

# WSM

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**WORKSHOP MANUAL  
TRACTOR**

**BX23**

**[LA210-1 FRONT LOADER]  
[BT600 BACKHOE]**

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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 KUBOTA Tractor BX23, KUBOTA Front Loader LA210-1 and KUBOTA Backhoe BT600. It is divided into two parts, "Mechanism" and "Servicing" for each section.

### ■ Mechanism

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

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

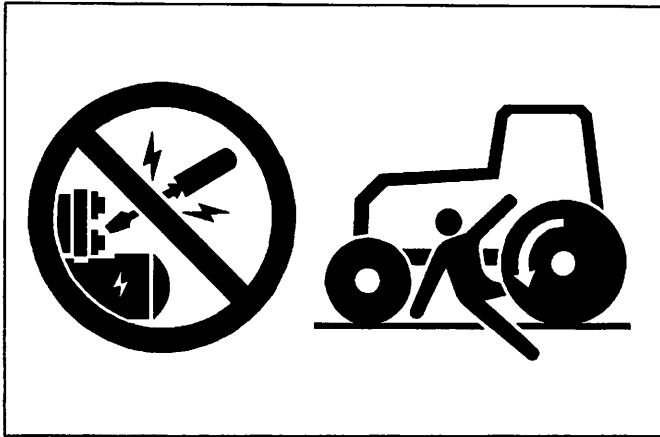
The heading "General" includes general precautions, check and maintenance and special tools. Other section, there are troubleshooting, servicing specification lists, checking and adjusting, disassembling and assembling, and servicing which cover procedures, precautions, factory specifications and allowable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

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

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

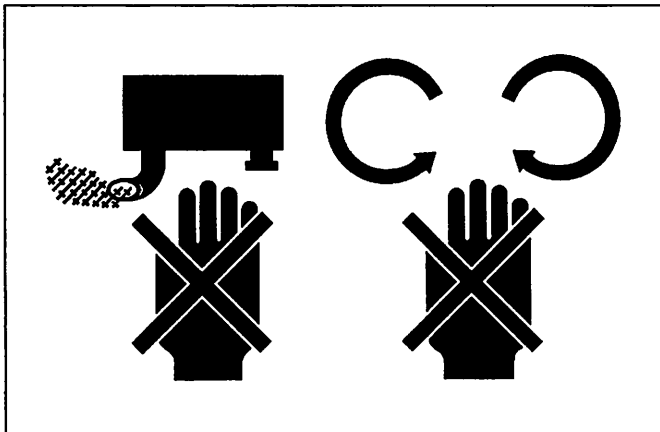
January 2004

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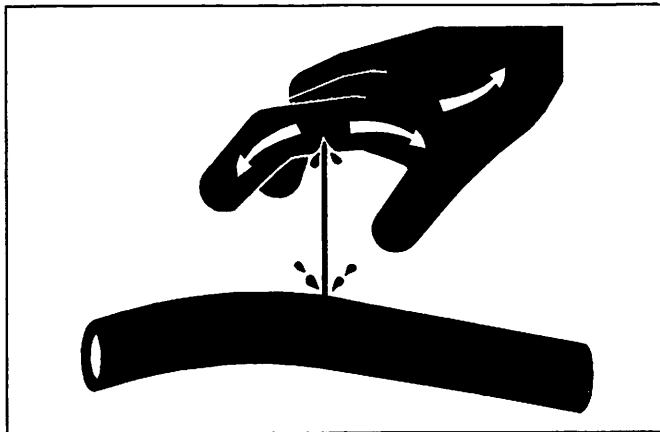
**SAFETY STARTING**

- 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.



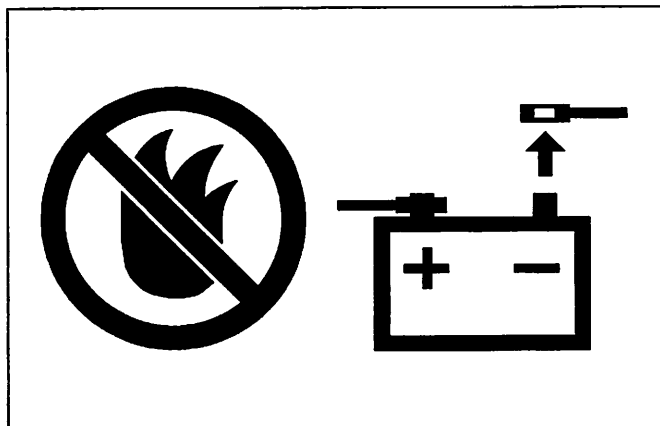
**SAFETY WORKING**

- 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.



**AVOID FIRES**

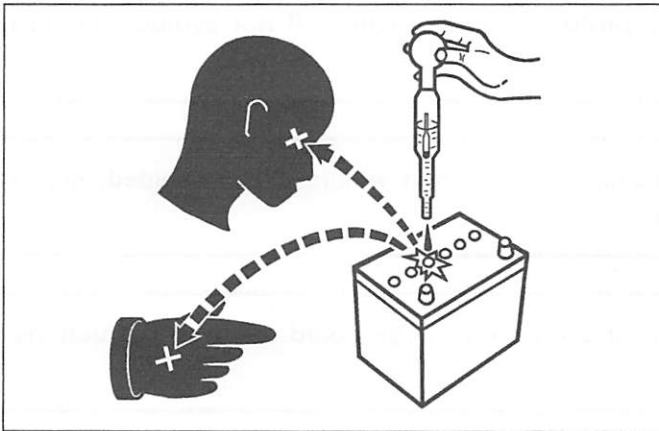
- Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
- To avoid sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- Battery gas can explode. Keep sparks and open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





**VENTILATE WORK AREA**

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



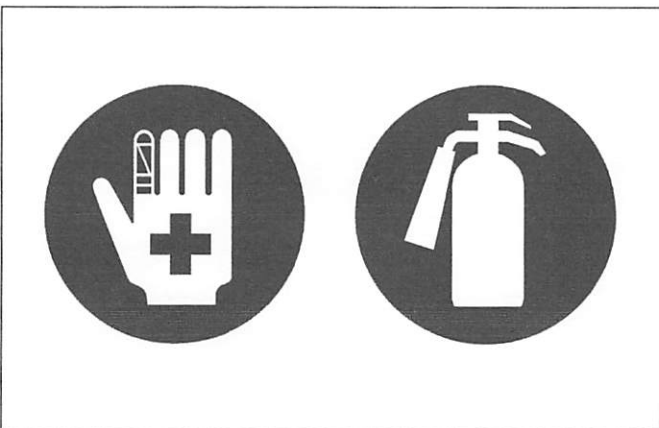
**PREVENT ACID BURNS**

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



**DISPOSE OF FLUIDS PROPERLY**

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



**PREPARE FOR EMERGENCIES**

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

# SAFETY 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.

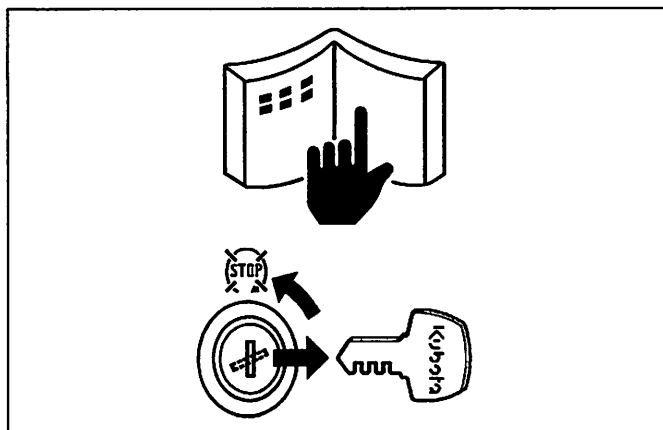
 **DANGER** : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **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.



## BEFORE SERVICING AND REPAIRING

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

# SAFETY 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. K2591-6564-1 (2) Part No. K2591-6557-1

**⚠ WARNING**

Never modify or repair a ROPS because welding, grinding, drilling or cutting any portion may weaken the structure.

**⚠ CAUTION**

**TO AVOID PERSONAL INJURY WHEN RAISING OR FOLDING ROPS:**

1. Set parking brake and stop engine.
2. Remove any obstruction that may prevent raising or folding of the ROPS.
3. Do not allow any bystanders.
4. Always perform function from a stable position at the rear of the tractor.
5. Hold the top of the ROPS securely when raising or folding.
6. Make sure all pins are installed and locked.

**⚠ WARNING**



**TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:**

1. Keep Roll-Over Protective Structures (ROPS) in the upright and locked position.
2. Fasten SEAT BELT before operating.



**THERE IS NO OPERATOR PROTECTION WHEN THE ROPS IS IN THE FOLDED POSITION.**

1. Check the operating area and fold the ROPS only when absolutely necessary.
2. Do not wear SEAT BELT if ROPS is folded.
3. Raise and lock ROPS as soon as vertical clearance allows.
4. Read ROPS related instruction and warnings.

- (3) Part No. K2561-6548-1

**⚠ 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. Slow down for turns, or rough roads.
8. On public roads use SMV emblem and hazard lights, if required by local traffic and safety regulations.
9. Pull only from the hitch.
10. Before dismounting lower the implement, set the parking brake, stop the engine and remove the key.

- (4) Part No. K2561-6556-1

**⚠ WARNING**

**TO AVOID PERSONAL INJURY:**

1. Attach pulled or towed loads to the hitch only.
2. Use the 3-point hitch only with equipment designed for 3-point hitch usage.

- (5) Part No. K2561-6552-2  
Do not put hands under the rear fender.

**⚠ WARNING**




**TO AVOID PERSONAL INJURY; KEEP HANDS AWAY FROM PINCH POINTS OF LIFT ARMS.**

- (7) Part No. K2561-6554-1

**⚠ WARNING**

**TO AVOID PERSONAL INJURY:**

1. Keep PTO shield in place at all times.
2. Do not operate the PTO at speeds faster than the speed recommended by the implement manufacturer.
3. For trailing PTO-driven implements, set hitch at towing position. (see operator's manual)



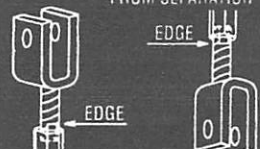
- (6) Part No. K2561-6549-1  
Diesel fuel only No fire



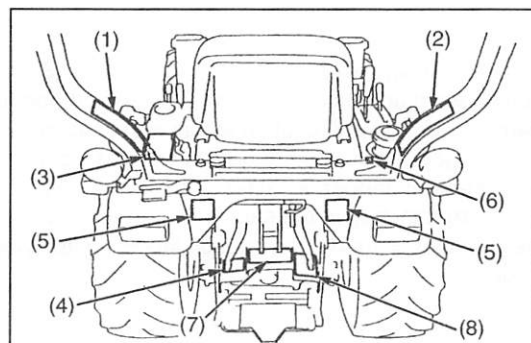
- (8) Part No. K2561-6555-1

**⚠ CAUTION**

**TO AVOID PERSONAL INJURY FROM SEPARATION**



**DO NOT EXTEND LIFT ROD BEYOND THE EDGE OF FLAT FACE ON THE THREADED ROD.**



(9) Part No. K2561-6541-1



**⚠ DANGER**

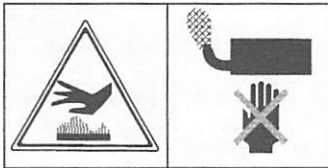
**TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.**

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

(10) Part No. K2561-6543-1  
Stay clear of engine fan and fanbelt.




(11) Part No. K2561-6542-1  
Do not touch hot surface like muffler, etc.



(12) Part No. K2561-6115-1

KEEP OUT OF THE REACH OF CHILDREN.  
DO NOT TIP. DO NOT OPEN BATTERY!

**FLUSH EYES IMMEDIATELY WITH WATER**

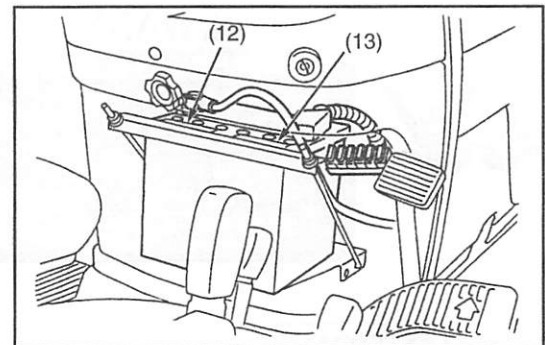
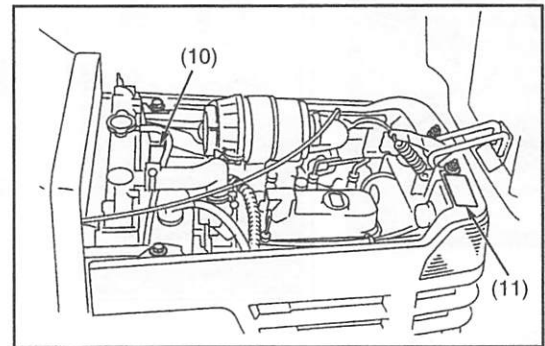
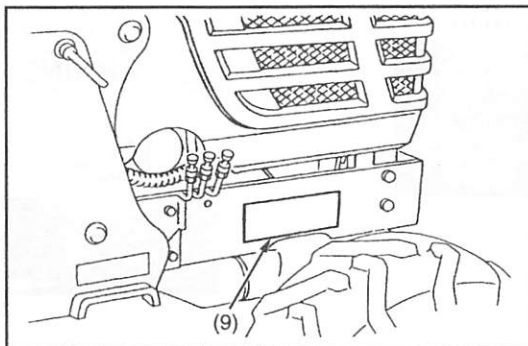


**GET MEDICAL HELP FAST**

(13) Part No. K2561-6116-1

**⚠ DANGER/POISON**

 <b>SHIELD EYES</b>	 <b>NO SPARKS, FLAMES, OR SMOKING</b>	 <b>SULFURIC ACID CAN CAUSE BLINDNESS OR SEVERE BURNS</b>
<b>EXPLOSIVE GASES CAN CAUSE BLINDNESS OR INJURY</b>		



**CARE OF DANGER, WARNING AND CAUTION LABELS**

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

3TVAAACCP002A

# SPECIFICATIONS

Model		BX23	
Rated power		12.4 kW (16.7 HP)*	
Engine	Maker	KUBOTA	
	Model	D905-E-BX	
	Type	Indirect Injection. Vertical, water-cooled, 4-cycle diesel	
	Number of cylinders	3	
	Bore and stroke	72 × 73.6 mm (2.83 × 2.90 in.)	
	Total displacement	898 cm <sup>3</sup> (54.8 cu.in.)	
	Engine gross power (DIN)	16.4 kW (22.0 HP)	
	Rated revolution	53.3 r/s [3200 min <sup>-1</sup> (rpm)]	
	Maximum torque	54.9 N·m (5.6 kgf·m, 40.5 ft·lbs) / 36.7 to 43.3 r/s [2200 to 2600 min <sup>-1</sup> (rpm)]	
	Battery	12 V, CCA : 535 A, RC : 80 min.	
	Starting system	Electric starter with cell starter, 12 V, 1.4 kW	
	Lubrication system	Forced lubrication by trochoid pump	
	Cooling system	Pressurized radiator, forced circulation with water pump	
	Fuel	Diesel fuel No. 1 [below -10 °C (14 °F)], Diesel fuel No. 2 [above -10 °C (14 °F)]	
Capacities	Fuel tank	21 L (5.5 U.S.gals, 4.6 Imp.gals.)	
	Engine crankcase (with filter)	2.5 L (2.64 U.S.qts., 2.20 Imp.qts.)	
	Engine coolant (with recovery tank)	3.5 L (3.70 U.S.qts., 3.08 Imp.qts.)	
	Transmission case	10.1 L (2.7 U.S.gals, 2.2 Imp.gals.)	
	Front axle case	4.7 L (4.97 U.S.qts., 4.14 Imp.qts.)	
Dimensions	Overall length (without 3P)	2025 mm (79.7 in.)	
	Overall width	1145 mm (45.1 in.)	
	Overall height (with ROPS)	2190 mm (86.2 in.)	
	Overall height (top of seat)	1250 mm (49.2 in.)	
	Overall height (with holded ROPS)	1610 mm (63.4 in.)	
	Wheel base	1400 mm (55.10 in.)	
	Minimum ground clearance (bottom of hitch basket)	170 mm (6.7 in.)	
	Tread	Front	910 mm (35.8 in.)
	Rear	820 mm (32.2 in.)	
Weight (with ROPS)		690 kg (1520 lbs)	
Travelling system	Tires	Front	18 × 8.50 – 8 (Bar)
		Rear	26 × 12.00 – 12 (Bar)
	Steering	Hydrostatic power steering	
	Transmission	Main-hydrostatic transmission, High-Low gear shift (2 forward and 2 reverse)	
	Brake	Wet disc type	
	Min. turning radius (without brake)	2.3 m (7.5 feet)	
Differential	Bevel gear		
Hydraulic system	Hydraulic control system	Directional control, auto-return lever system	
	Pump capacity	21.0 L/min. (5.5 U.S.gals./min., 4.6 Imp.gals./min.)	
	Three point hitch	SAE Category I	
	Max. lift force (24 in. behind lift points)	3040 N (310 kg, 684 lbs)	
PTO system	Clutch	Wet type, multiple disc	
	Mid	PTO shaft	USA No. 5 (KUBOTA 10-tooth) involute spline
		Revolution	41.7 r/s [2500 min <sup>-1</sup> (rpm)] / engine 52.1 r/s [3125 min <sup>-1</sup> (rpm)]
	Rear	PTO shaft	SAE 1-3/8, 6 splines
Revolution		9.0 r/s [540 min <sup>-1</sup> (rpm)] / engine 51.1 r/s [3068 min <sup>-1</sup> (rpm)]	

E: \* Manufacturer's estimate  
The company reserves the right to change the specifications without notice.

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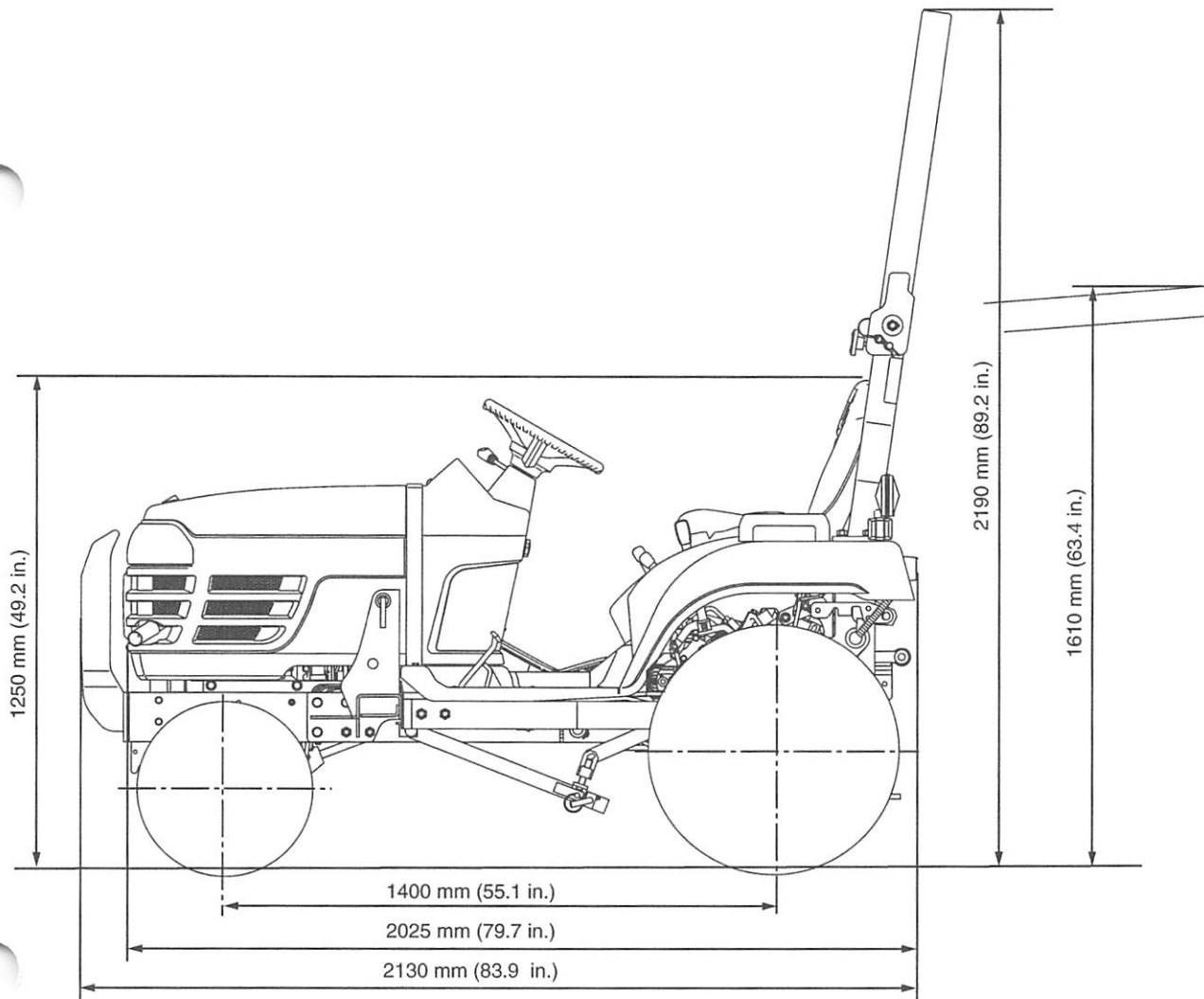
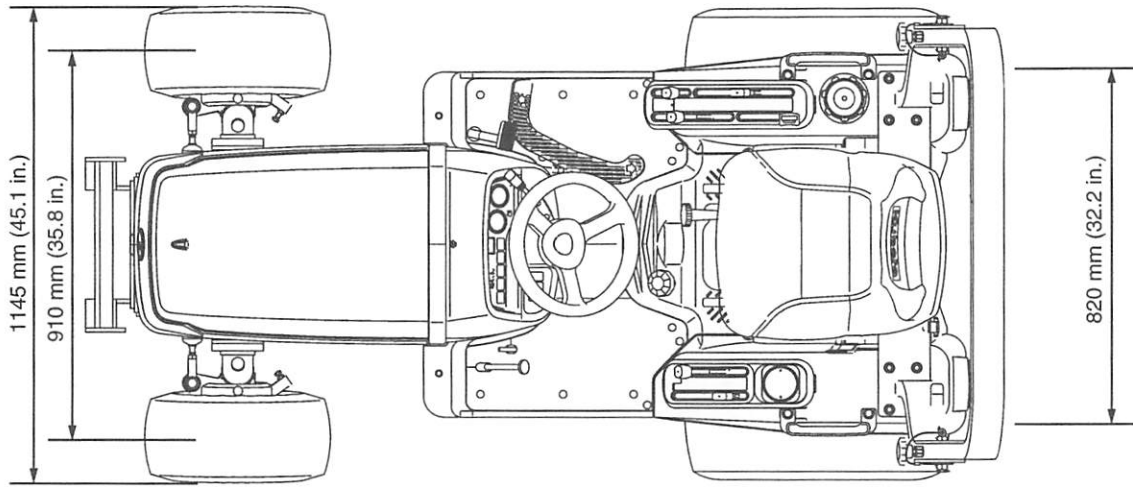
# TRAVELING SPEEDS

Model		BX23	
Tire size (Rear)		26 × 12.00 – 12	
	Range gear shift lever	km/h	mile/h
Forward (At rated engine rpm)	Low	0 to 5.9	0 to 3.7
	High	0 to 13.0	0 to 8.1
Reverse (At rated engine rpm)	Low	0 to 4.5	0 to 2.8
	High	0 to 10.0	0 to 6.2

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

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# DIMENSIONS



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# G GENERAL

# GENERAL

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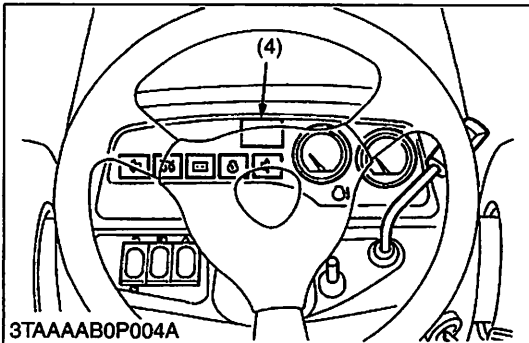
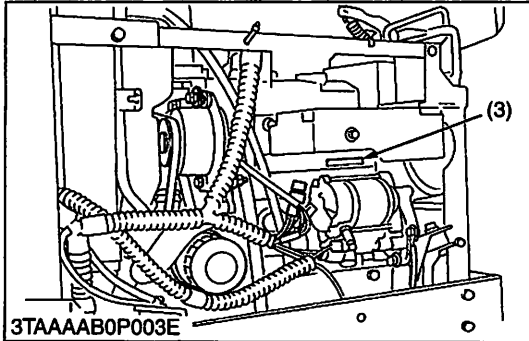
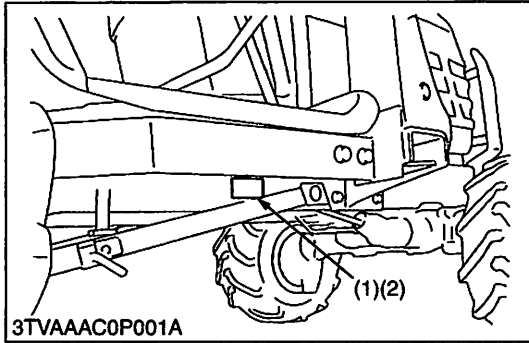
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# 1. TRACTOR IDENTIFICATION

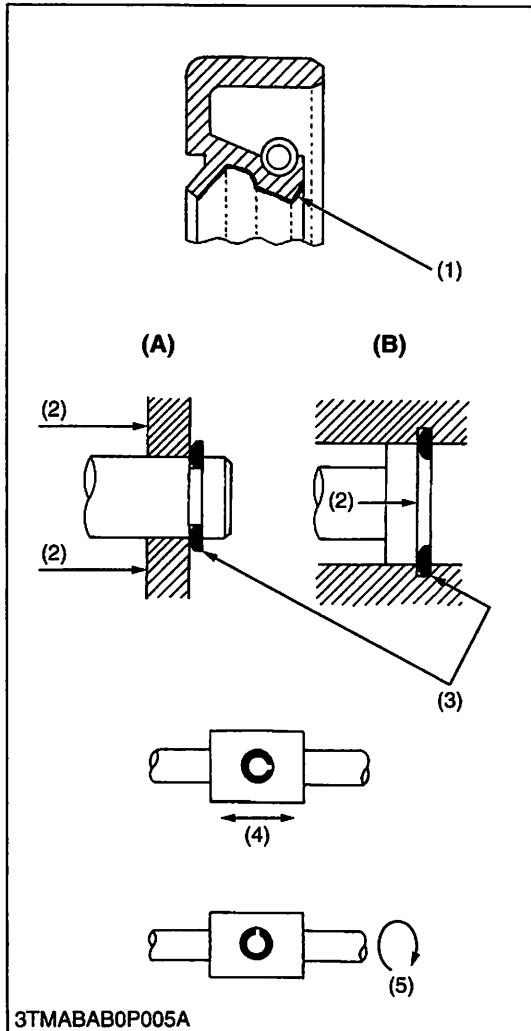
When contacting your local KUBOTA distributor, always specify engine serial number, tractor serial number and hour meter reading.

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

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## 2. GENERAL PRECAUTIONS



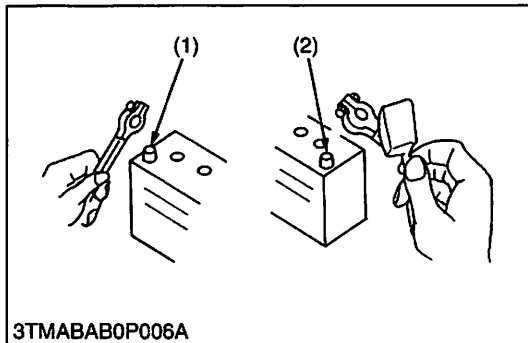
- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Screws, bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently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

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

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

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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.

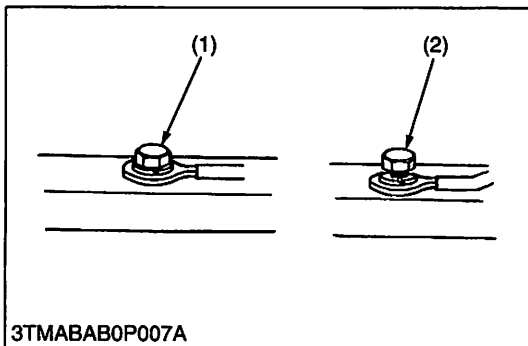
**■ IMPORTANT**

- 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

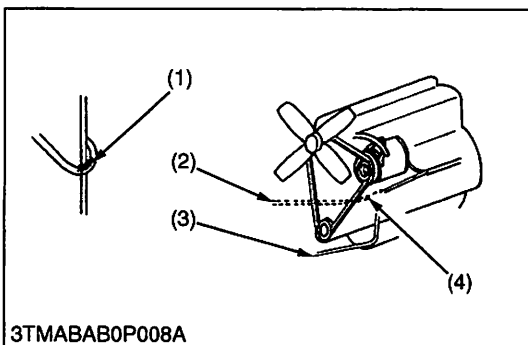


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- Securely tighten wiring terminals.

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

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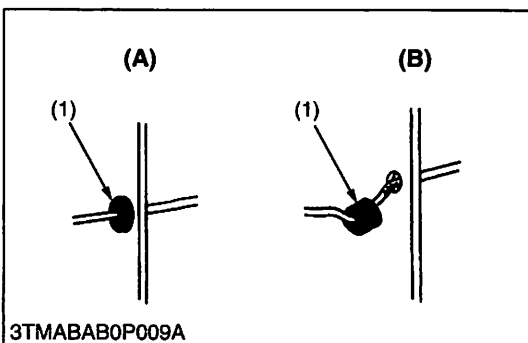


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- Do not let wiring contact dangerous part.

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

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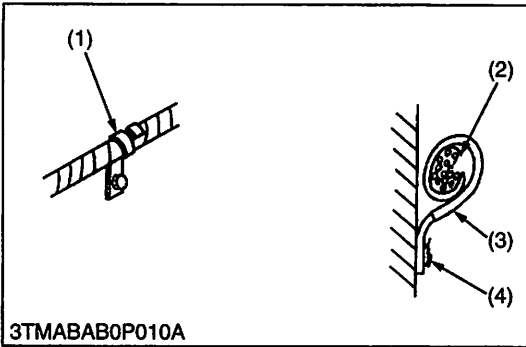


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- Securely insert grommet.

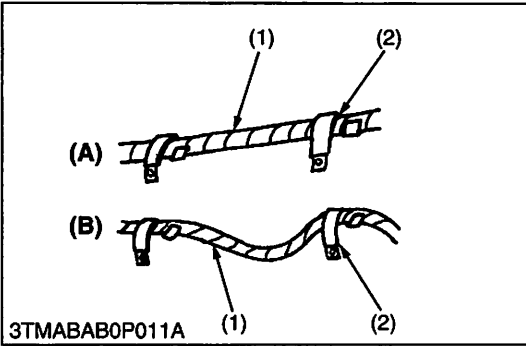
- (1) Grommet (A) Correct (B) Incorrect

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- Securely clamp, being careful not to damage wiring.
- |                       |                  |
|-----------------------|------------------|
| (1) Clamp             | (3) Clamp        |
| • Wind Clamp Spirally | (4) Welding Dent |
| (2) Wire Harness      |                  |

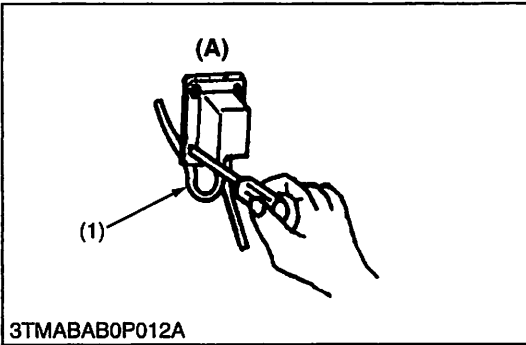
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- Clamp wiring so that there is no twist, unnecessary sag, or excessive tension, except for movable part, where sag be required.

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

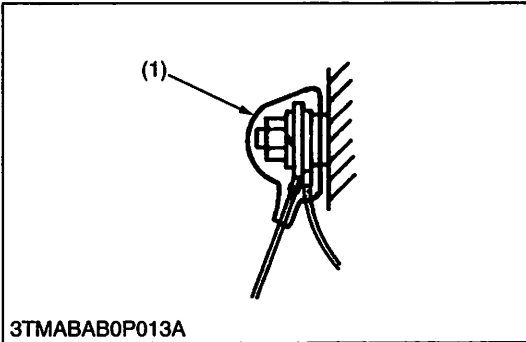
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- In installing a part, take care not to get wiring caught by it.

- |            |               |
|------------|---------------|
| (1) Wiring | (A) Incorrect |
|------------|---------------|

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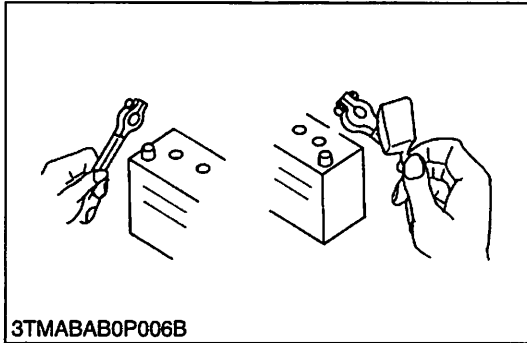
- After installing wiring, check protection of terminals and clamped condition of wiring, only connect battery.

- |           |                          |
|-----------|--------------------------|
| (1) Cover | • Securely Install Cover |
|-----------|--------------------------|

W10117350



## [2] BATTERY



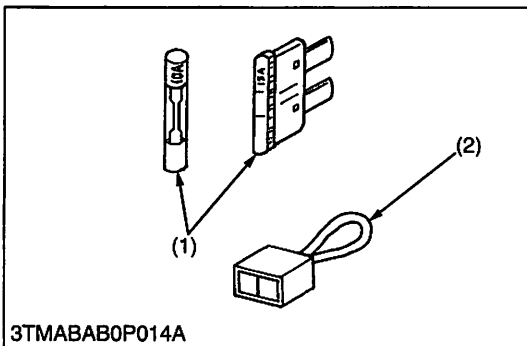
- Take care not to confuse positive and negative terminal posts.
- When removing battery cables, disconnect negative cable first. When installing battery cables, check for polarity and connect positive cable first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting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

### ⚠ CAUTION

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

W10118160

## [3] FUSE



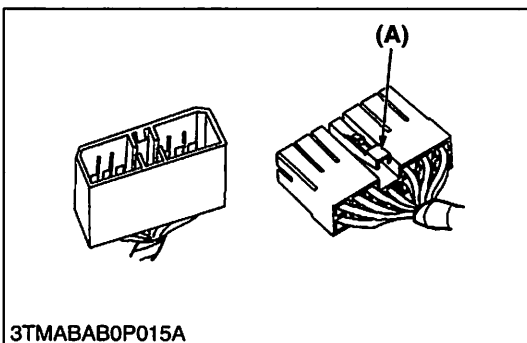
- Use fuses with specified capacity. Neither too large or small capacity fuse is acceptable.
- Never use steel or copper wire in place of fuse.
- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of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

(1) Fuse

(2) Slow Blow Fuse

W10120920

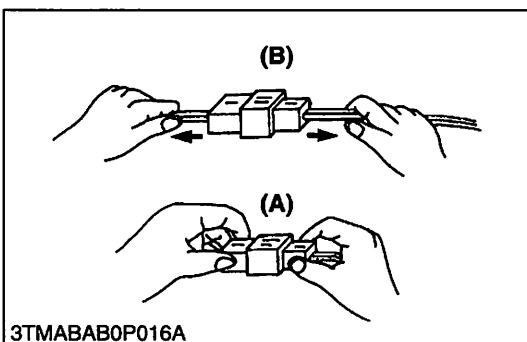
## [4] CONNECTOR



- For connector with lock, push lock to separate.

(A) Push

W10122110

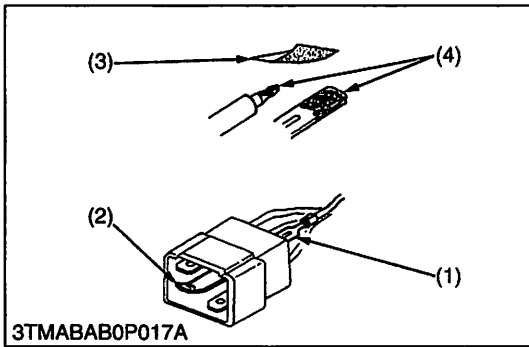


- In separating connectors, do not pull wire harnesses.
- Hold connector bodies to separate.

(A) Correct

(B) Incorrect

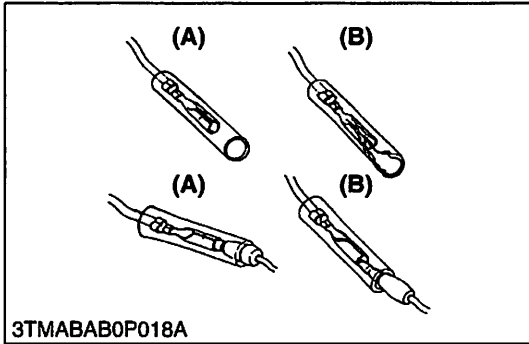
W10122720



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

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

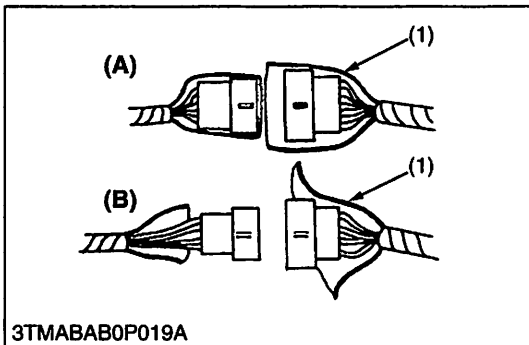
W10123460



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

(A) Correct (B) Incorrect

W10124300

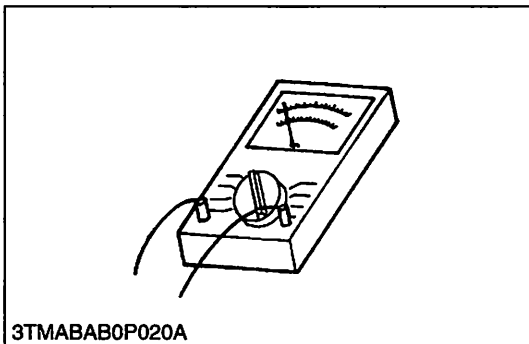


- Make certain plastic cover is large enough to cover whole connector.

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

W10125190

**[5] HANDLING OF CIRCUIT TESTER**



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

W10126840

## 4. LUBRICANTS FUEL AND COOLANT

No.	Place	Capacity		Lubricants, fuel and coolant
		BX23		
1	Fuel tank	21.0 L 5.5 U.S.gals. 4.6 Imp.gals.		No. 2-D diesel fuel No. 1-D diesel fuel if temperature is below -10 °C (14 °F)
2	Cooling system with recovery tank	3.5 L 3.70 U.S.qts. 3.08 Imp.qts.		Fresh clean water with anti-freeze
3	Engine crankcase	2.5 L 2.64 U.S.qts. 2.20 Imp.qts.		Engine oil : API Service CD, CE or CF 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	10.1 L 2.7 U.S.gals. 2.2 Imp.gals.		KUBOTA SUPER UDT fluid*
5	Front axle case	4.7 L 4.97 U.S.qts. 4.14 Imp.qts.		KUBOTA SUPER UDT fluid or SAE80, SAE90 gear oil
<b>Greasing</b>				
	Place	No. of greasing point	Capacity	Type of grease
6	Battery terminal	2	Moderate amount	Multipurpose type grease
7	Speed control pedal	1	Until grease overflows	

\* KUBOTA original transmission hydraulic fluid.

# 5. TIGHTENING TORQUES

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

Screws, bolts and nuts whose tightening torques 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	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
Diameter															
M6 (6 mm, 0.24 in.)	7.85	0.80	5.79	7.85	0.80	5.79	9.81	1.00	7.24	7.85	0.80	5.79	12.3	1.25	9.05
	to 9.31	to 0.95	to 6.87	to 8.82	to 0.90	to 6.50	to 11.2	to 1.15	to 8.31	to 8.82	to 0.90	to 6.50	to 14.2	to 1.45	to 10.4
M8 (8 mm, 0.31 in.)	17.7	1.8	13.1	16.7	1.7	12.3	23.6	2.4	17.4	17.7	1.8	13.1	29.5	3.0	21.7
	to 20.5	to 2.1	to 15.1	to 19.6	to 2.0	to 14.4	to 27.4	to 2.8	to 20.2	to 20.5	to 2.1	to 15.1	to 34.3	to 3.5	to 25.3
M10 (10 mm, 0.39 in.)	39.3	4.0	29.0	31.4	3.2	23.2	48.1	4.9	35.5	39.3	4.0	29.0	60.9	6.2	44.9
	to 45.1	to 4.6	to 33.2	to 34.3	to 3.5	to 25.3	to 55.8	to 5.7	to 41.2	to 44.1	to 4.5	to 32.5	to 70.6	to 7.2	to 52.0
M12 (12 mm, 0.47 in.)	62.8	6.4	46.3	-	-	-	77.5	7.9	57.2	62.8	6.4	46.3	103	10.5	76.0
	to 72.5	to 7.4	to 53.5				to 90.2	to 9.2	to 66.5	to 72.5	to 7.4	to 53.5	to 117	to 12.0	to 86.7
M14 (14 mm, 0.55 in.)	108	11.0	79.6	-	-	-	124	12.6	91.2	-	-	-	167	17.0	123
	to 125	to 12.8	to 92.5				to 147	to 15.0	to 108				to 196	to 20.0	to 144
M16 (16 mm, 0.63 in.)	167	17.0	123	-	-	-	197	20.0	145	-	-	-	260	26.5	192
	to 191	to 19.5	to 141				to 225	to 23.0	to 166				to 304	to 31.0	to 224
M18 (18 mm, 0.71 in.)	246	25.0	181	-	-	-	275	28.0	203	-	-	-	344	35.0	254
	to 284	to 29.0	to 209				to 318	to 32.5	to 235				to 402	to 41.0	to 296
M20 (20 mm, 0.79 in.)	334	34.0	246	-	-	-	368	37.5	272	-	-	-	491	50.0	362
	to 392	to 40.0	to 289				to 431	to 44.0	to 318				to 568	to 58.0	to 419



W1034542

## [2] STUD BOLTS

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

W10481390

### [3] AMERICAN STANDARD SCREWS, BOLTS AND NUTS WITH UNC OR UNF THREADS

Grade Unit Nominal Diameter	SAE GR.5 			SAE GR.8 		
	N-m	kgf-m	ft-lbs	N-m	kgf-m	ft-lbs
5/16	23.1 to 27.8	2.35 to 2.84	17.0 to 20.5	32.5 to 39.3	3.31 to 4.01	24.0 to 29.0
3/8	47.5 to 57.0	4.84 to 5.82	35.0 to 42.0	61.0 to 73.2	6.22 to 7.47	45.0 to 54.0
1/2	108.5 to 130.2	11.07 to 13.29	80.0 to 96.0	149.2 to 179.0	15.22 to 18.27	110.0 to 132.0
9/16	149.2 to 179.0	15.22 to 18.27	110.0 to 132.0	217.0 to 260.4	22.14 to 26.57	160.0 to 192.0
5/8	203.4 to 244.1	20.75 to 24.91	150.0 to 180.0	298.3 to 358.0	30.44 to 36.53	220.0 to 264.0

W1022485



## 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.

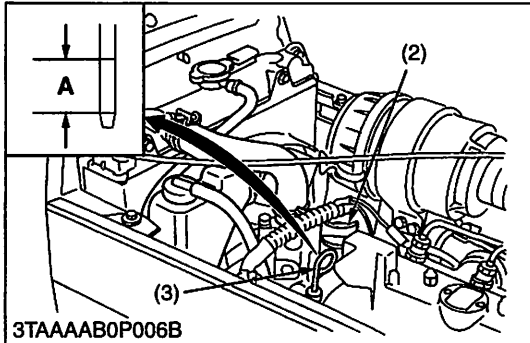
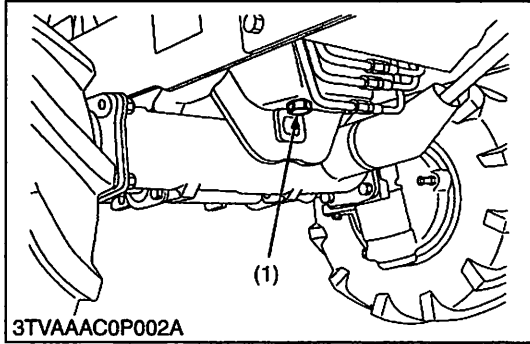
### [1] DAILY CHECK

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

#### Checking

- Check areas where previous trouble was experienced.
- Walk around the tractor.
  1. Check the tire pressure, and check for wear and damage.
  2. Check for oil and water leaks.
  3. Check the engine oil level.
  4. Check the transmission fluid level.
  5. Check the coolant level.
  6. Check the condition of seat belt and ROPS attaching hardware.
  7. Check and clean the radiator screen and grill.
  8. Check the screws and nuts of tires are tight.
  9. Check the number plate or SMV emblem for damage and cleaner replace as necessary if equipped.
  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.
  2. Check the parking brake.
  3. Check the steering wheel.
- Turning the key switch.
  1. Check the performance of the easy checker lights.
  2. Check head lights, tail lights and hazard lights. Clean if necessary.
  3. Check the performance of the meters and gauges.
- Starting the engine.
  1. Check to see that the lights on the Easy Checker go off.
  2. Check the color of the exhaust gas.
  3. Check the brakes for proper operation.

## [2] CHECK POINTS OF INITIAL 50 HOURS



### Changing Engine Oil

#### ⚠ CAUTION

- **Be sure to stop the engine before changing engine oil.**
- 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 (3).

#### ■ IMPORTANT

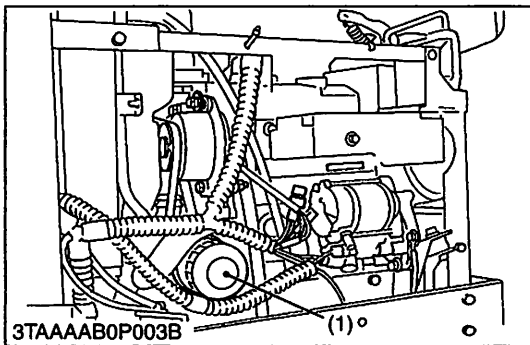
- **When using an oil of different manufacture or viscosity from the previous one, remove all of the old oil.**
- **Never mix two different types of oil.**
- **Use the proper SAE Engine Oil according to ambient temperatures.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-7.)**

Engine oil capacity	2.5 L 2.64 U.S.qts. 2.20 Imp.qts.
---------------------	---

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

A : Oil level is acceptable within this range.

W1014065



### Replacing Engine Oil Filter Cartridge

#### ⚠ CAUTION

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

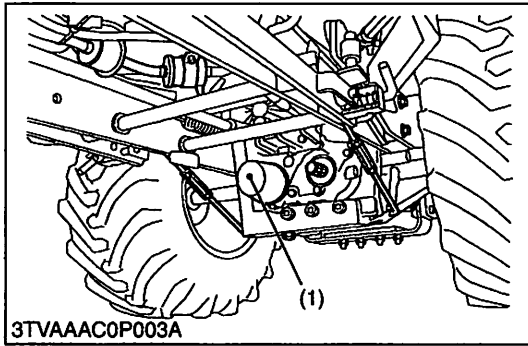
#### ■ IMPORTANT

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

- (1) Engine Oil Filter Cartridge

W1014316





**Replacing Transmission Oil Filter Cartridge**

**CAUTION**

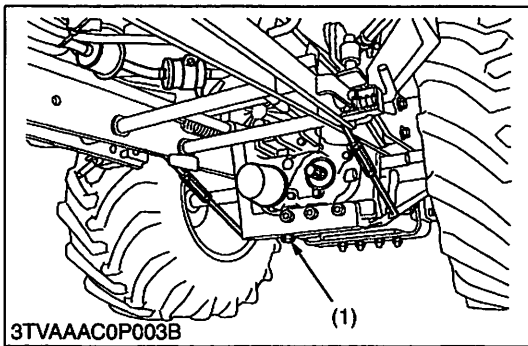
- **Be sure to stop the engine before changing the oil filters.**
- 1. Remove the oil filter cartridge by using a filter wrench.
- 2. Apply a slight coat of oil onto the cartridge gasket.
- 3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
- 4. After the new cartridge has been replaced, the 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 equivalent.**

(1) Transmission Oil Filter Cartridge

W1014458



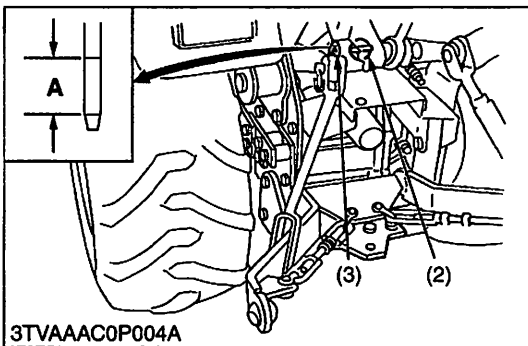
**Changing Transmission Fluid**

**CAUTION**

- **Be sure to stop the engine before changing the transmission fluid.**
- 1. Place an oil pan under the tractor.
- 2. Remove the drain plugs (1) at the bottom of the transmission case and drain the oil completely.
- 3. After draining, screw in the drain plug.
- 4. Fill new oil from filling port after removing the filling plug (2) up to the upper notch on the dipstick.
- 5. After running the engine for a few minutes, stop it and check the oil level again, if low, add oil to 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-7.)**
- **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.**



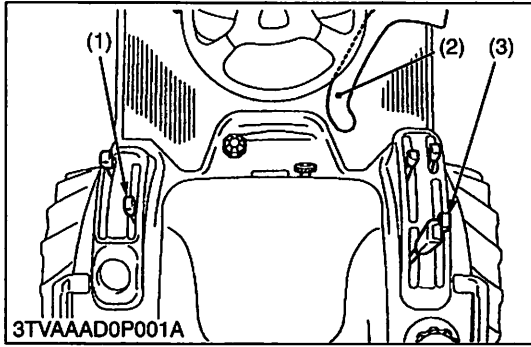
Transmission fluid capacity	10.1 L 2.7 U.S.qts. 2.2 Imp.qts.
-----------------------------	--

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

A : Oil level is acceptable within this range.

W1014665

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



#### Checking Engine Start System

##### **CAUTION**

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

##### ■ Preparation before testing.

1. Sit on operator's seat.
2. Set the parking brake and stop the engine.
3. Shift the range gear shift lever (3) to "NEUTRAL" position.
4. Shift the PTO clutch lever (1) to "OFF" position.

##### ■ Test 1 : Safety switch for the range gear shift linkage

1. Shift the range gear shift lever (3) to "LOW" or "HIGH" position.
2. Turn the key to "START" position.
3. The engine must not crank.

##### ■ Test 2 : Safety switch for the PTO clutch lever

1. Shift the range gear shift lever (3) to "NEUTRAL" position.
2. Shift the PTO clutch lever (1) to "ON" position.
3. Turn the key to "START" position.
4. The engine must not crank.

##### ■ Test 3 : Safety switch for the operator's seat and the speed control pedal

1. Sit on the operator's seat.
2. Start the engine.
3. Shift the range gear shift lever to "NEUTRAL" position and depress the speed control pedal (2).
4. Stand up. (Do not get off the machine.)
5. The engine must shut off after approximately 1 second.

##### ■ Test 4 : Safety switches for the operator's seat and the PTO clutch lever

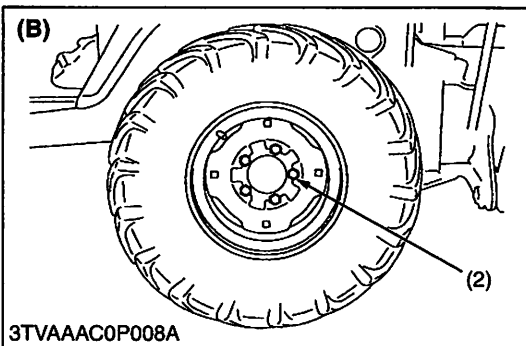
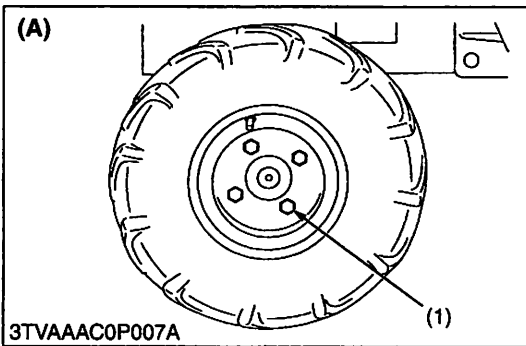
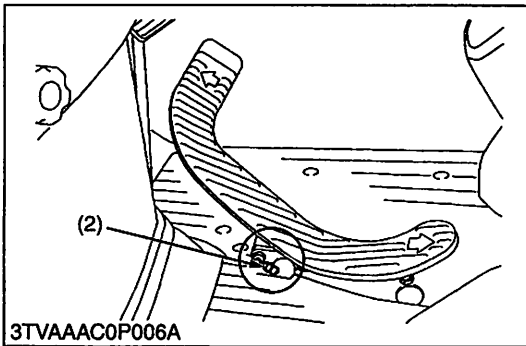
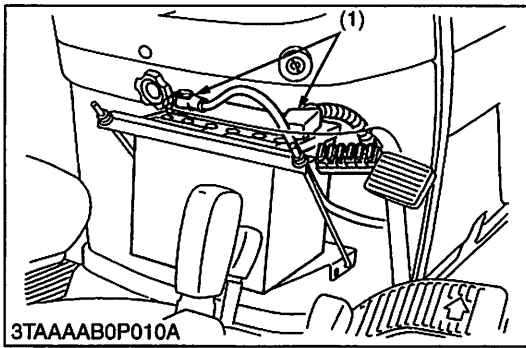
1. Sit on the operator's seat.
2. Start the engine.
3. Engage the PTO clutch lever (1).
4. Stand up. (Do not get off the machine.)
5. The engine must shut off after approximately 1 second.

(1) PTO Clutch Lever

(3) Range Gear Shift Lever

(2) Speed Control Pedal

W1014904



**Greasing**

1. Apply a small amount of multipurpose grease to the following points.

- (1) Battery Terminal
- (2) Speed Control Pedal

W1015242

**Checking Wheel Mounting Screws Tightening Torque**

**CAUTION**

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

Tightening torque	Front wheel mounting screws	149.2 to 179.0 N·m 15.2 to 18.3 kgf·m 110 to 132 ft·lbs
	Rear wheel mounting screws	108.5 to 130.2 N·m 11.1 to 13.3 kgf·m 80 to 96 ft·lbs

- (1) Front Wheel Mounting Screw      (A) Front
- (2) Rear Wheel Mounting Screw      (B) Rear

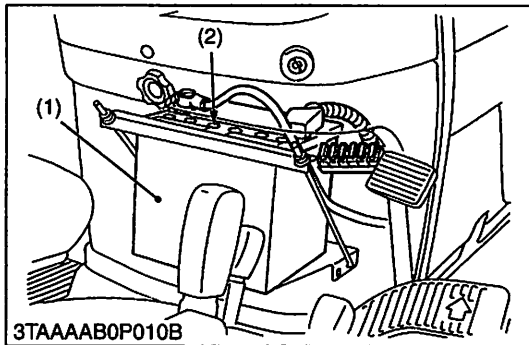
W1015311

## [4] CHECK POINTS OF EVERY 100 HOURS

### Changing Engine Oil

1. See page G-12.

W1015501



### Checking Battery Condition

#### **⚠ DANGER**

To avoid the possibility of battery explosion:

For the refillable type battery, follow the instructions below.

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

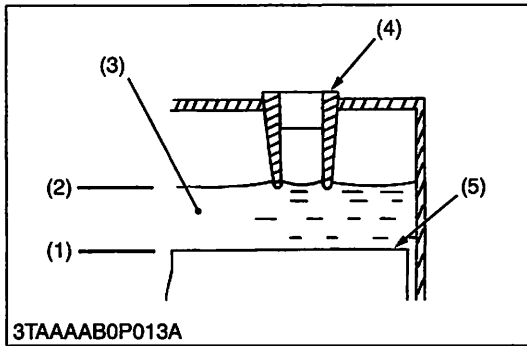
#### **⚠ CAUTION**

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

(1) Battery

(2) Vent Plug

W1015551



■ **Battery Charging**

**CAUTION**

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

**Use a voltmeter or hydrometer.**

1. Make sure each electrolyte level is to the bottom of vent wells, if necessary add distilled water in a well-ventilated area.
2. The water in the electrolyte evaporates during recharging. Liquid shortage damages the battery. Excessive liquid spills over and damages the tractor body.
3. 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.
4. A boost charge is only for emergencies. It will partially charges 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.
5. When the specific gravity of electrolyte become between 1.27 and 1.29 charge has completed.
6. When exchanging an old battery into new one, use battery of equal specification shown in table 1.

**Table 1**

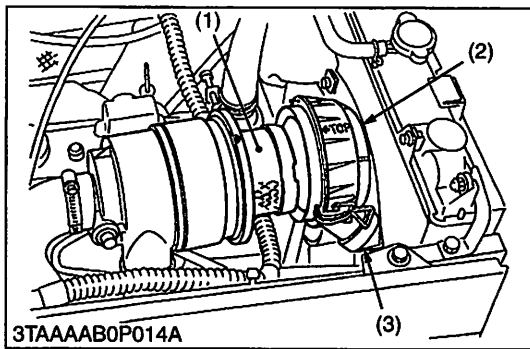
Tractor Type	Battery Type	Volts (V)	Reserve Capacity (min.)	Cold Cranking Amps
BX23	526RA	12	80	535

■ **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) Lowest Level
- (2) Highest Level
- (2) Electrolyte
- (4) Vent Well
- (5) Separator

W1019057



**Cleaning Air Cleaner Element**

1. Remove the air cleaner cover (2) and element (1).
2. Clean the element if:
  - 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. Replace the element (1) once a year or after every six times of cleaning, whichever comes first.

■ **IMPORTANT**

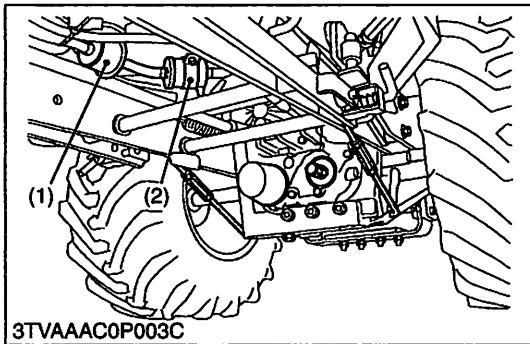
- The air cleaner uses a dry element, never apply oil.
- Do not run the engine with filter element removed.
- Be sure to refit the dust cup with the arrow ↑ upright. If the dust cup is improperly fitted, evacuator valve will not function and dust will adhere to the element.

■ **Evacuator Valve**

Open the evacuator valve 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 | (3) Evacuator Valve |
| (2) Cover   |                     |

W1017166



**Checking Fuel Lines and Fuel Filter**

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

■ **IMPORTANT**

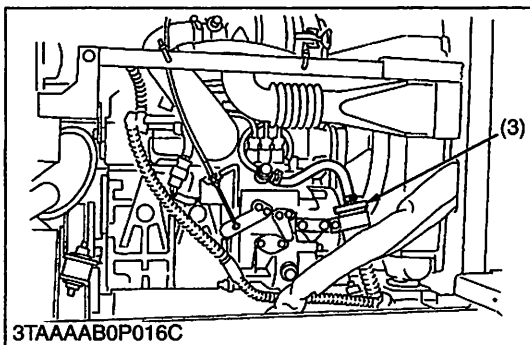
- When the fuel line is disconnected for maintenance or repair, plug both ends of the fuel line with a clean plug of suitable size to prevent dust and dirt from entering. Particular care must be taken not to admit dust and dirt into the fuel system. Entrance of dust and dirt causes malfunction of the fuel pump.

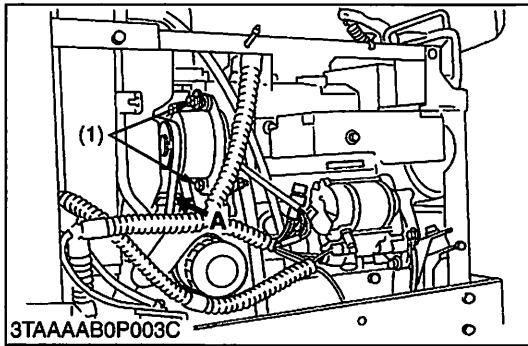
■ **NOTE**

- If the fuel line is removed, be sure to properly bleed the fuel system (see page G-25).

- |                 |                 |
|-----------------|-----------------|
| (1) Fuel Pump   | (3) Fuel Filter |
| (2) Fuel Filter |                 |

W1017546





**Checking Fan Belt Tension**

**CAUTION**

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

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

(1) Mounting Bolt

**A : Check the belt tension**

W1017708

**Adjusting HST Neutral Spring (Speed Control Pedal)**

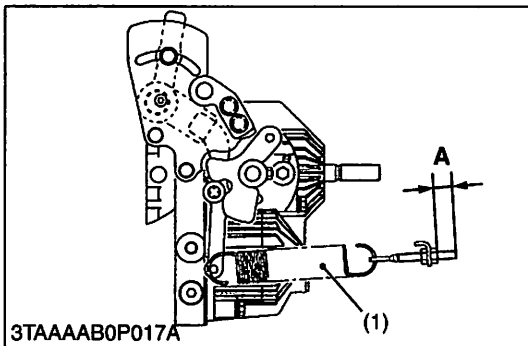
**CAUTION**

- **To avoid personal injury:**  
**Do not operate if tractor moves on level ground with foot off speed control pedal.**

1. Start the engine and set at low idle (approx. 1500 min<sup>-1</sup> (rpm)).
2. Shift the range gear shift lever to **HIGH** position.
3. Move the speed control pedal from forward or reverse position to neutral position to check the tractor movement. The tractor should comes to a complete stop.
4. If the speed control pedal is too slow in returning to neutral position, adjust the HST neutral spring setting.

**IMPORTANT**

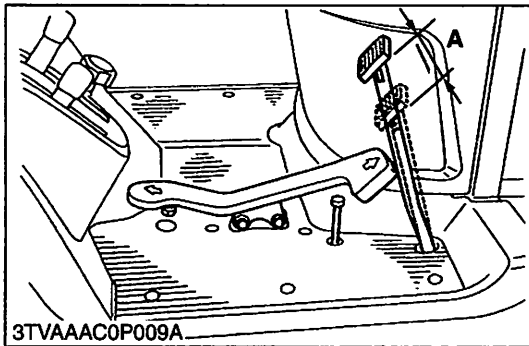
- **Do not set the length A more than 40 mm (1.57 in.)**



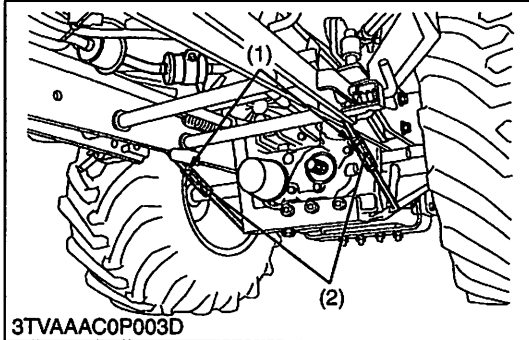
Length A	Factory spec.	5 to 40 mm 0.20 to 1.57 in.
----------	---------------	--------------------------------

(1) HST Neutral Spring

W1017963



3TVAAAC0P009A



3TVAAAC0P003D

**Adjusting Brake Pedal Free Travel**

**CAUTION**

- Stop the engine, remove the key, lower the implement to the ground, and chock the wheels before checking brake pedal.
- Even if the brake pedal free travel is within the limitation, adjust the brake pedal following the procedure below.

1. Release the parking brake.
2. Loosen the RH lock nut and extend the RH turnbuckle to the end of the thread.
3. Loosen the LH lock nut and turn the LH turnbuckle to adjust the LH rod length so that the brake pedal free travel is 20 mm (0.79 in.).
4. Retighten the LH lock nut.
5. Adjust the RH rod length so that the brake pedal free travel is 10 mm (0.39 in.).
6. Extend the RH turnbuckle one additional turn.
7. Retighten the RH lock nut.
8. Depress the brake pedal several times and make sure the brake pedal free travel is from 20 to 30 mm (0.79 to 1.18 in.).

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

- (1) Lock Nut
- (2) Turnbuckle

A : Free Travel

W1018144

**[5] CHECK POINTS OF EVERY 200 HOURS**

**Replacing Engine Oil Filter Cartridge**

1. See page G-12.

W1018516

**Checking Radiator Hose and Hose Clamp**

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

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

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

**Precaution at Overheating**

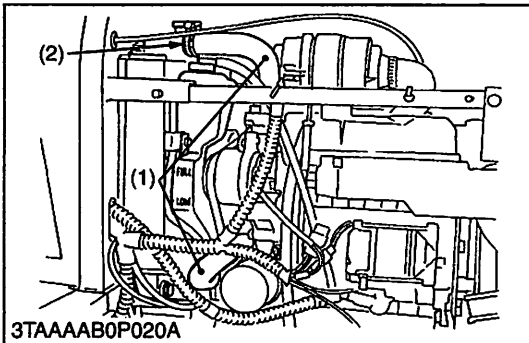
Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating".

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

- (1) Radiator Hose

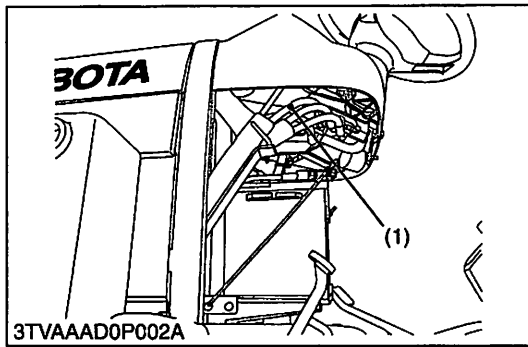
- (2) Clamp

W1018562



3TAAAB0P020A



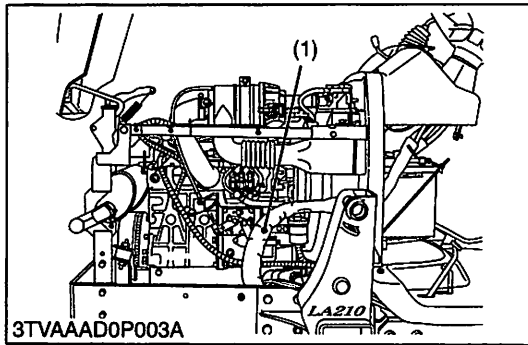


**Checking Power Steering Line**

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

(1) Power Steering Hose

W1018751

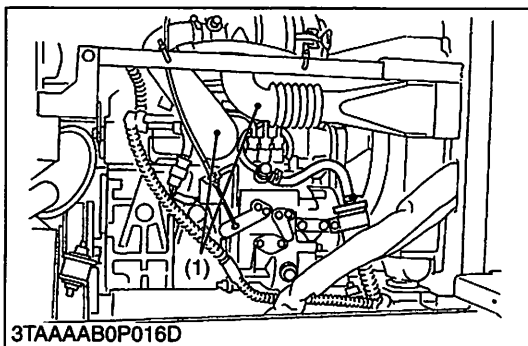


**Checking Intake Air Line**

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

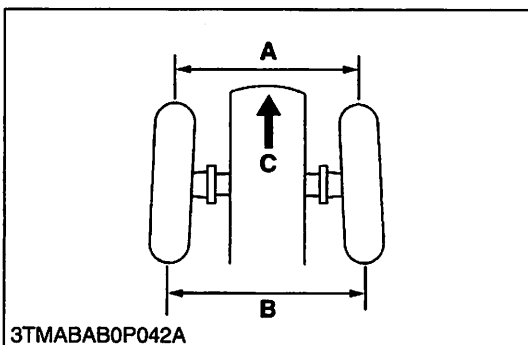
(1) Hose

W1018915



**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 1 to 10 mm (0.039 to 0.39 in.) less than rear distance.
8. If the measurement is not within the factory specifications, adjust by changing the steering tie-rod length.



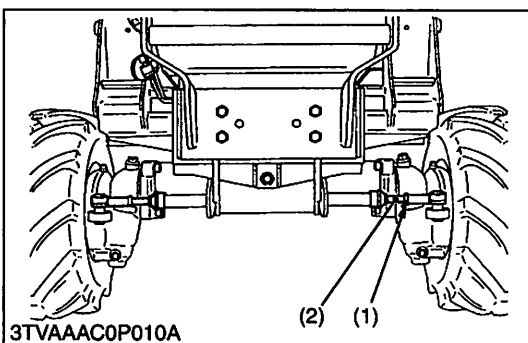
Toe-in (B - A)	Factory spec.	1 to 10 mm 0.039 to 0.39 in.
----------------	---------------	---------------------------------

**Adjusting**

1. Loosen the lock nuts and turn the steering tie-rod to adjust the rod length until the proper toe-in measurement is obtained.
2. Retighten the lock nuts.

(1) Lock Nut  
(2) Steering Tie-rod

(A) Wheel to Wheel Distance at Front  
(B) Wheel to Wheel Distance at Rear  
(C) Front



W1019009

## [6] CHECK POINTS OF EVERY 300 HOURS

### Replacing Transmission Oil Filter Cartridge

1. See page G-13.

W1019345

### Changing Transmission Fluid

1. See page G-13.

W1019295

### Cleaning Transmission Oil Strainer

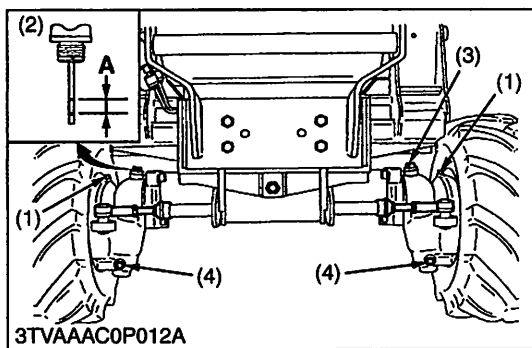
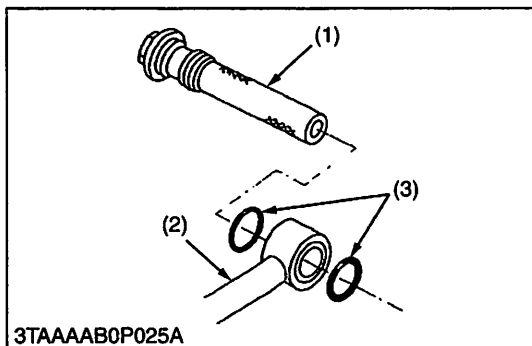
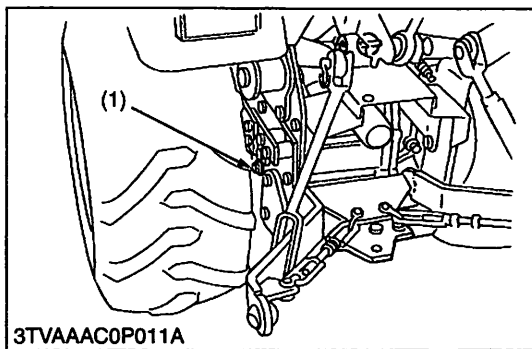
1. Remove the strainer and clean with nonflammable solvent.

■ **NOTE**

- When reassembling be careful not to damage the parts.
- Since the fine fillings in the oil can damage the precision component parts of the hydraulic system precision built to withstand high pressure, the end of the suction line is provided with an oil strainer.

- (1) Strainer (3) O-ring  
 (2) Suction Line

W1019390



### Changing Front Axle Case Oil

1. Park the machine on a firm, flat and level surface.
2. To drain the used oil, remove the right and left drain plugs and filling plug at the front axle case and drain the oil completely into the oil pan.
3. After draining reinstall the drain plugs.
4. Remove the right and left breather plugs.
5. Fill with new oil up to the upper notch on the dipstick.
6. After filling, reinstall the filling plug and breather plug.

■ **IMPORTANT**

- After ten minutes, check the oil level again; add oil to prescribed level.

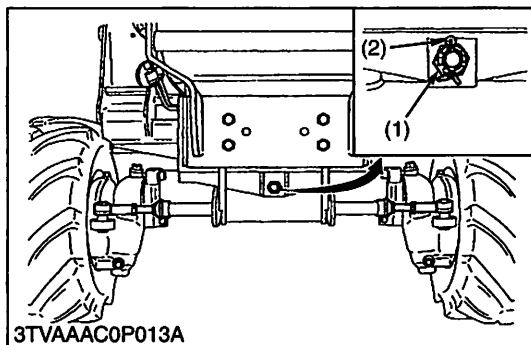
Front axle case oil capacity	4.7 L 4.97 U.S.qts. 4.14 Imp.qts.
------------------------------	---

- (1) Breather Pipe  
 (2) Filling Plug with Dipstick  
 (3) Filling Plug  
 (4) Drain Plug

A : Oil level is acceptable within this range.

W1019508

## [7] CHECK POINTS OF EVERY 400 HOURS



### Adjusting Front Axle Pivot

1. Remove the cotter pin (2) and tighten the adjusting nut (1) to the specified torque.
2. Make sure one of the nut slots aligns with the cotter pin hole, tighten the nut slightly if necessary to align.
3. Install the new cotter pin.

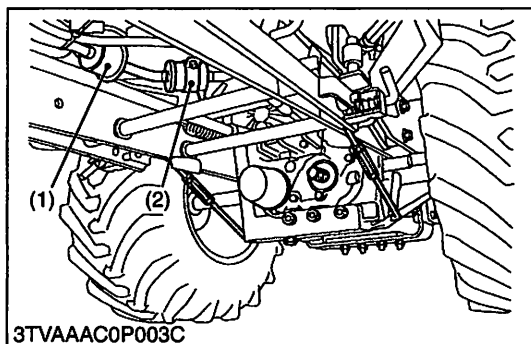
Tightening torque	Factory spec.	
		19.6 N·m 2.0 kgf·m 14.5 ft·lbs

(1) Adjusting Nut

(2) Cotter Pin

W1019713

## [8] CHECK POINTS OF EVERY 500 HOURS



### Replacing Fuel Filter

1. Disconnect the fuel hoses and replace the fuel filter (2).
2. Disconnect the fuel hoses and loosen the filter band to replace the fuel filter (3).

#### ■ NOTE

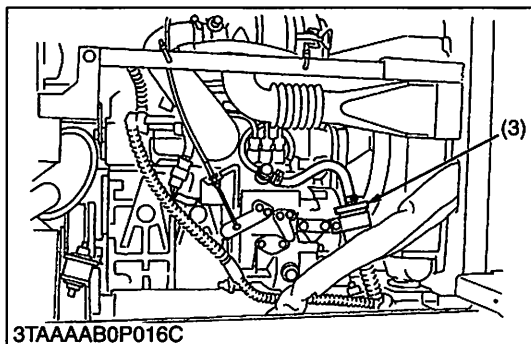
- If the fuel line is removed, be sure to properly bleed the fuel system (see page G-25).

(1) Fuel Pump

(3) Fuel Filter

(2) Fuel Filter

W1019858



## [9] CHECK POINTS OF EVERY 800 HOURS

### Adjusting Engine Valve Clearance

1. See page 1-S15.

W1019995

## [10] CHECK POINTS OF EVERY 1500 HOURS

### Checking Fuel Injection Nozzle Injection Pressure

1. See page 1-S48.

W1020203

## [11] CHECK POINTS OF EVERY 3000 HOURS

### Checking Injection Pump

1. See page 1-S21.

W1020260

## [12] CHECK POINTS OF EVERY 1 YEAR

### Replacing Air Cleaner Element

1. See page G-18.

W1020343

KiSC issued 07, 2006 A

**[13] 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-20.)

W1020468

**Replacing Power Steering Hose**

1. Replace the hoses.  
 Refer to "Checking Power Steering Line".  
 (See page G-21.)

W1020513

**Replacing Fuel Hose**

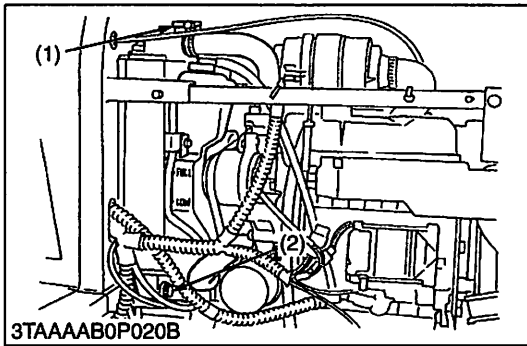
1. Replace the hoses and clamps.  
 Refer to "Checking Fuel Line and Fuel Filter".  
 (See page G-18.)

W1020558

**Replacing Intake Air Line**

1. Refer to "Checking Intake Air Line".  
 (See page G-21.)

W1020422



**Flush Cooling System and Changing Coolant**

**CAUTION**

- Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.
1. Stop the engine and let cool down.
  2. To drain the coolant, open the radiator drain cock, and remove radiator cap. The radiator cap must be removed to completely drain the coolant.
  3. After all coolant is drained, close the drain plug.
  4. Fill with clean water and cooling system cleaner.
  5. Follow directions of the cleaner instruction.
  6. After flushing, fill with clean water and anti-freeze until the coolant level is just below the port.  
Install the radiator cap securely.
  7. Fill with coolant up to “FULL” mark on the recovery tank.
  8. Start and operate the engine for few minutes.
  9. Stop the engine, remove the key and let cool.
  10. Check coolant level of recovery tank and add coolant if necessary.

**IMPORTANT**

- Do not start engine without coolant.
- Use clean, fresh water and anti-freeze to fill the radiator.
- When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50 %.
- Securely tighten radiator cap. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.

Coolant capacity (with recovery tank)	3.5 L
	3.70 U.S.qts.
	3.08 Imp.qts.

(1) Radiator Cap

(2) Drain Plug

W1021307

**Flash Cooling system and Changing Coolant (Continued)**

**■ Anti-Freeze**

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

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

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

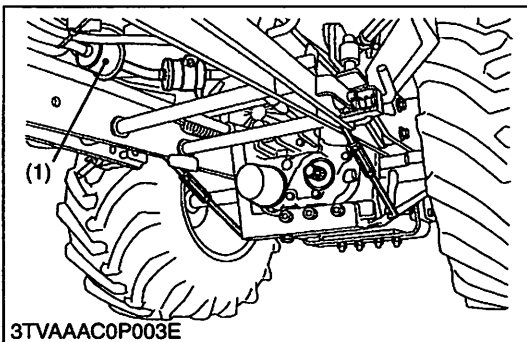
\* At 760 mmHg pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

**■ NOTE**

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

W1022492

**[14] OTHERS**



**Bleeding Fuel System**

Air must be removed:

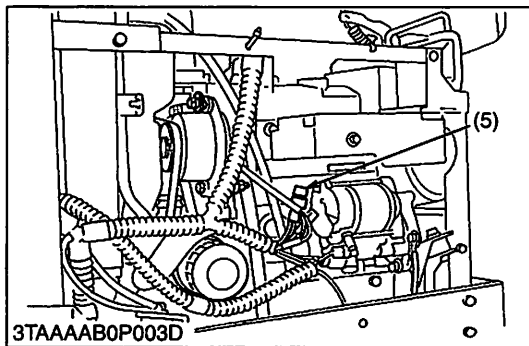
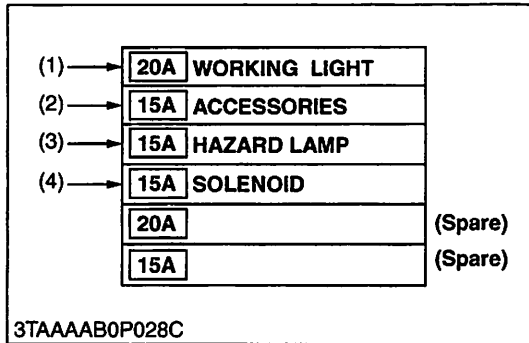
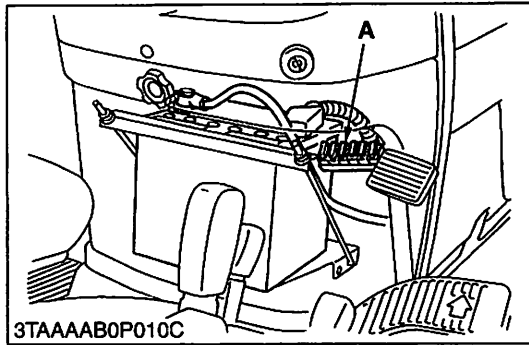
1. When the fuel filter or lines are removed.
2. When tank is completely empty.
3. After the tractor has not been used for a long period of time.

Bleeding procedure is as follows:

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

(1) Fuel Pump

W1021149



**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.

■ **Protected Circuit**

Fuse No.	Capacity (A)	Protected circuit
1	20	Working lights
2	15	Head lights
3	15	Hazard lights
4	15	Key stop
5	Slow blow fuse (30 A)	Check circuit against wrong battery connection

A : Fuse Box

W1023430

**Replacing Light Bulb**

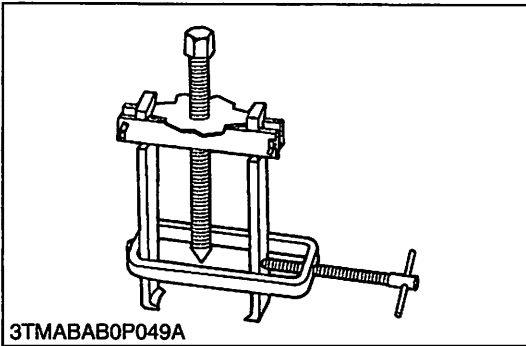
1. Head lights:  
Take the bulb out of the light body and replace with a new one.
2. Other lights:  
Detach the lens and replace the bulb.

Light	Capacity
Head light	24 W
Tail light	3 W
Hazard light	20 W
Additional turn signal lamps	20 W

W1023802

# 8. SPECIAL TOOLS

## [1] SPECIAL TOOLS FOR ENGINE

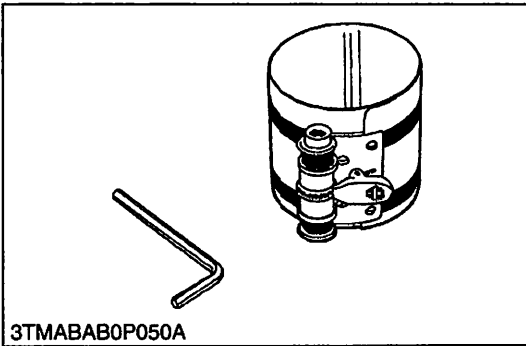


### Special Use Puller Set

Code No: 07916-09032

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

W1024050

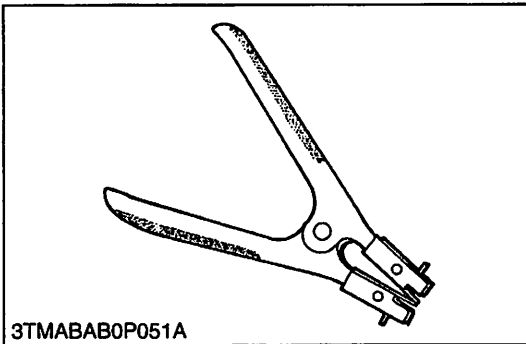


### Piston Ring Compressor

Code No: 07909-32111

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

W1024100

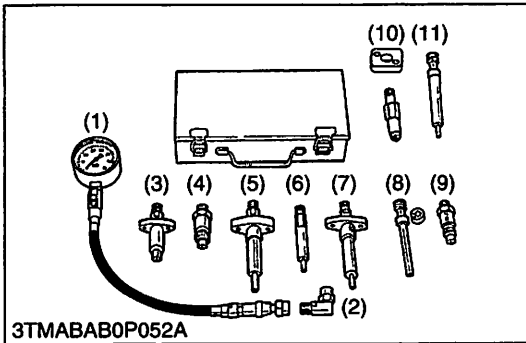


### Piston Ring Tool

Code No: 07909-32121

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

W1024150



### Diesel Engine Compression Tester (for Injection Nozzle)

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)

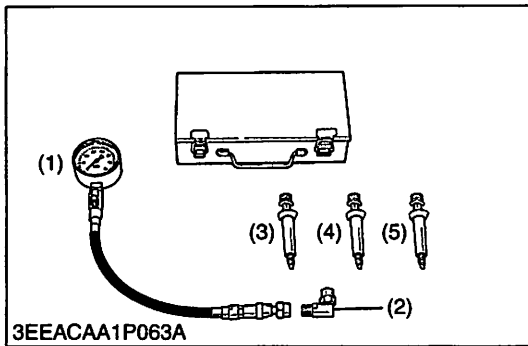
Application: Use to measure diesel engine compression and diagnostics of need for major overhaul.

- (1) Gauge
- (2) L Joint
- (3) Adaptor A
- (4) Adaptor B
- (5) Adaptor C
- (6) Adaptor E

- (7) Adaptor F
- (8) Adaptor G
- (9) Adaptor H
- (10) Adaptor I
- (11) Adaptor J

W1024200





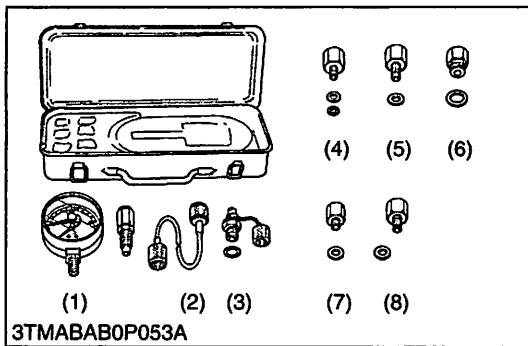
**Diesel Engine Compression Tester (for Glow Plug)**

Code No: 07909-39081 (Assembly) 07909-31301 (L)  
 07909-31291 (K) 07909-31311 (M)

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

- (1) Gauge
- (2) L Joint
- (3) Adaptor K
- (4) Adaptor L
- (5) Adaptor M

0000001398E



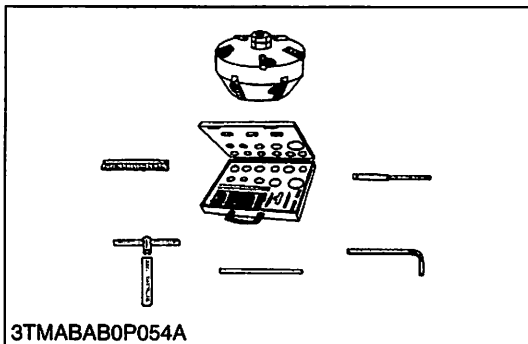
**Oil Pressure Tester**

Code No: 07916-32032

Application: Use to measure lubricating oil pressure.

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

W1024318



**Valve Seat Cutter**

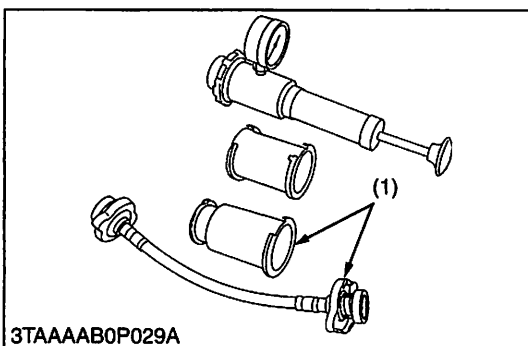
Code No: 07909-33102

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.)

W1024458



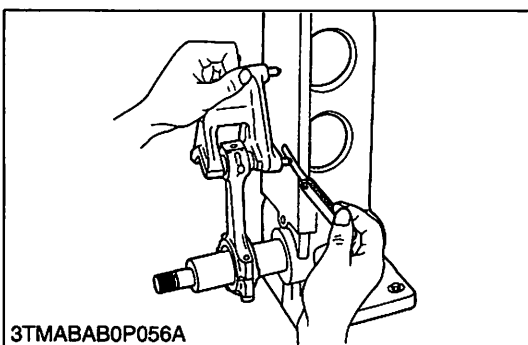
**Radiator Tester**

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

W1024532



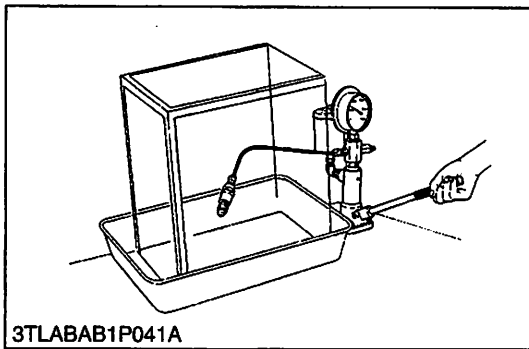
**Connecting Rod Alignment Tool**

Code No: 07909-31661

Application: Use to check the connecting rod alignment.

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

W1024583



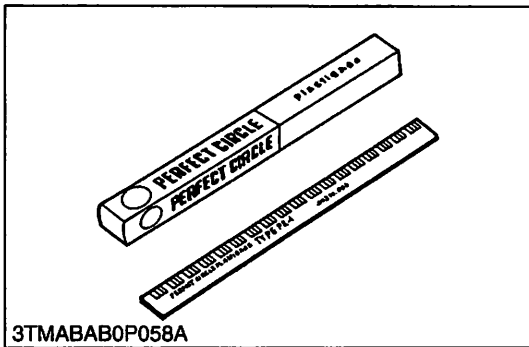
**Nozzle Tester**

Code No: 07909-31361

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

Measuring: 0 to 50 MPa  
range (0 to 500 kgf/cm<sup>2</sup>, 0 to 7000 psi)

W1024653



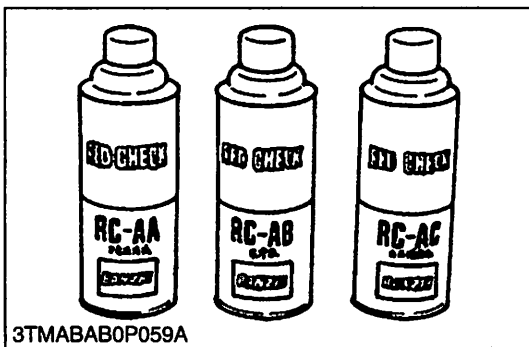
**Plastigage**

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.)  
Red..... 0.051 to 0.152 mm (0.002 to 0.006 in.)  
Blue ..... 0.102 to 0.229 mm (0.004 to 0.009 in.)

W1024719

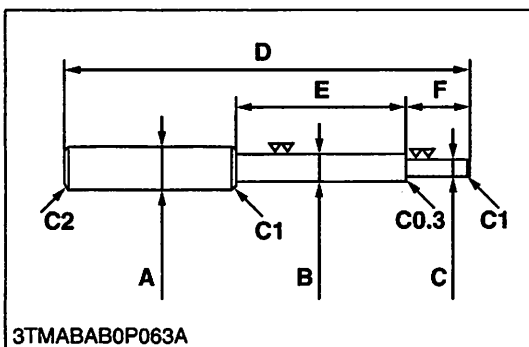


**Red Check**

Code No: 07909-31371

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

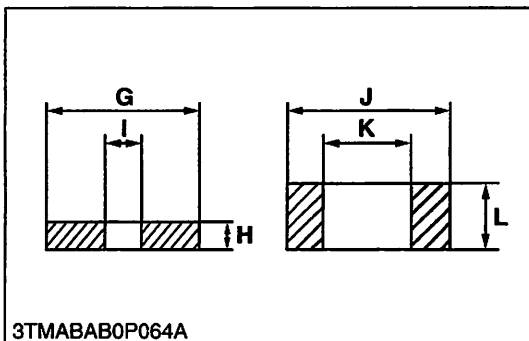
W1024909



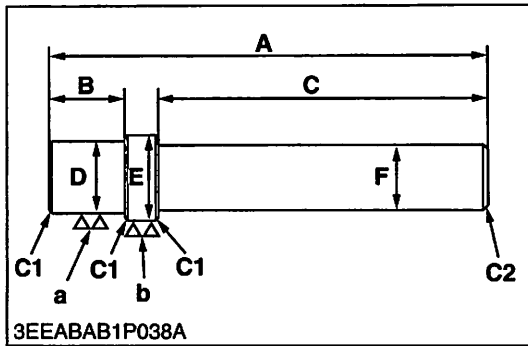
**Valve Guide Replacing Tool**

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

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



W1025017



**Bushing Replacing Tools**

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

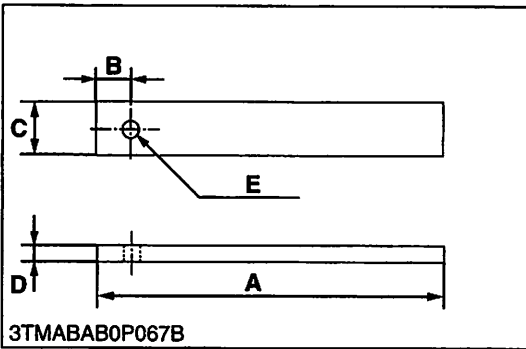
(1) For small end bushing

A	157 mm (6.1811 in.)
B	24 mm (0.9449 in.)
C	120 mm (4.7244 in.)
D	21.8 to 21.9 mm (0.8583 to 0.8622 in.)
E	24.8 to 24.9 mm dia. (0.9764 to 0.9803 in. dia.)
F	20 mm (0.7874 in.)
a	6.3 μm (250 μin.)
b	6.3 μm (250 μin.)

(2) For idle gear bushing

A	196 mm (7.7165 in.)
B	26 mm (1.0236 in.)
C	150 mm (5.9055 in.)
D	25.8 to 25.9 mm (1.0157 to 1.0197 in.)
E	28.8 to 28.9 mm dia. (1.1339 to 1.1378 in. dia.)
F	20 mm (0.7874 in.)
a	6.3 μm (250 μin.)
b	6.3 μm (250 μin.)

W1025500

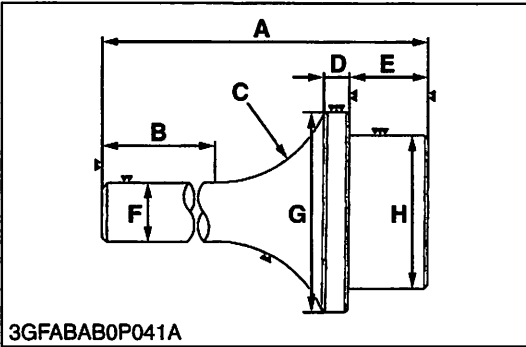


**Flywheel Stopper**

Application: Use to loosen and tighten the flywheel screw.

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

W1025948



**Crankshaft Bearing 1 Replacing Tool**

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

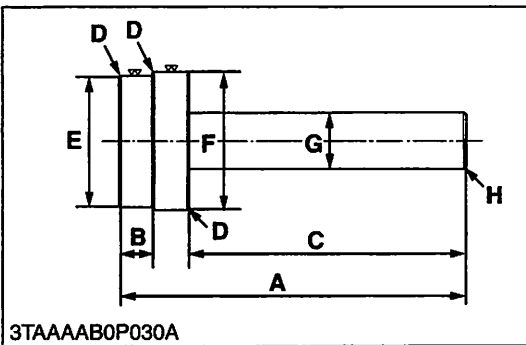
[Press Out]

A	135 mm (5.31 in.)
B	72 mm (2.83 in.)
C	40 mm radius (1.57 in. radius)
D	10 mm (0.39 in.)
E	20 mm (0.79 in.)
F	20 mm dia. (0.79 in. dia.)
G	56.80 to 56.90 mm dia. (2.2362 to 2.2402 in. dia.)
H	51.80 to 51.90 mm dia. (2.0393 to 2.0433 in. dia.)

[Press Fit]

A	130 mm (5.12 in.)
B	72 mm (2.83 in.)
C	1.57 rad. (40 °)
D	9 mm (0.35 in.)
E	24 mm (0.95 in.)
F	20 mm dia. (0.79 in. dia.)
G	68 mm dia. (2.68 in. dia.)
H	47.38 to 47.48 mm dia. (1.865 to 1.869 in. dia.)

W1026139



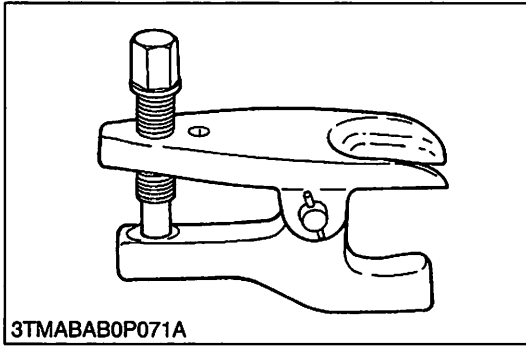
**Governor Gear Holder Bushing Replacing Tool**

Application: Use to press out and to press fit the governor gear holder bushing.

A	188 mm (7.4 in.)
B	18 mm (0.7 in.)
C	150 mm (5.9 in.)
D	C1 : Chamfer 1.0 mm (0.039 in.)
E	73.9 to 74.0 mm dia. (29.09 to 29.13 in. dia.)
F	69.8 to 69.9 mm (2.748 to 2.751 in. dia.)
G	30 mm dia. (1.181 in. dia.)
H	C2 : Chamfer 2.0 mm (0.079 in.)

W1023337

## [2] SPECIAL TOOLS FOR TRACTOR



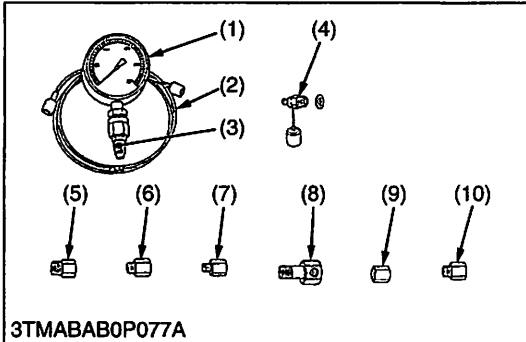
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### Tie-rod End Lifter

Code No: 07909-39051

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

W1026472



3TMABAB0P077A

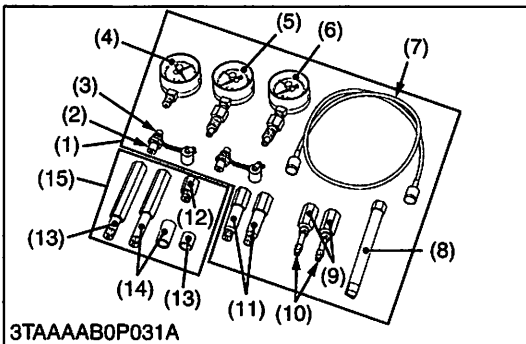
### Relief Valve Pressure Tester

Code No: 07916-50045

Application: This allows easy measurement of relief set pressure.

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

W1026741



3TAAAB0P031A

### Hydrostatic Transmission Tester and HST Adaptor Set

Code No: 07916-52040 (Hydrostatic Transmission Tester)  
07916-53072 (HST Adaptor Set)

Application: This allows easy measurement of hydrostatic transmission pressure.

- |  |  |
|--|--|
| (1) Hydrostatic Transmission Tester (07916-52040)                                      | (8) Valve Seat Driver (07916-60841)      |
| (2) Gasket (04714-00200)   | (9) Connector 1 (07916-60811)            |
| (3) Connector 3 (07916-51331)  | (10) Connector 2 (07916-60821)           |
| (4) Vacuum Gauge (07916-51331)   | (11) Long Connector (07916-60831)        |
| (5) Pressure Gauge (Low Pressure) (07916-51301)  | (12) Adaptor 1 (07916-52621)             |
| (6) Pressure Gauge (High Pressure) (in Relief Valve Set Pressure Tester) (07916-50321) | (13) Adaptor 2 with Collar (07916-52632) |
| (7) HN Tube (in Relief Valve Set Pressure Tester) (07916-50331)                        | (14) Adaptor 3 with Collar (07916-52642) |
|  | (15) HST Adaptor Set (07916-53072)       |

W1023682

# 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.

without Loader	Tire sizes	Inflation pressure
Front	18 × 8.50 – 8 Turf 18 × 8.50 – 8 Bar	150 kPa 1.5 kgf/cm <sup>2</sup> 22 psi
Rear	26 × 12.00 – 12 Turf 26 × 12.00 – 12 Bar	140 kPa 1.4 kgf/cm <sup>2</sup> 20 psi

with Loader	Tire sizes	Inflation pressure
Front	18 × 8.50 – 8 Turf 18 × 8.50 – 8 Bar	180 kPa 1.8 kgf/cm <sup>2</sup> 25.4 psi
Rear	26 × 12.00 – 12 Turf 26 × 12.00 – 12 Bar	140 kPa 1.4 kgf/cm <sup>2</sup> 20 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.

**■ NOTE**

- Maintain the maximum pressure in front tires, if using a front loader or when equipped with a full load of front weights.

## [2] TREAD

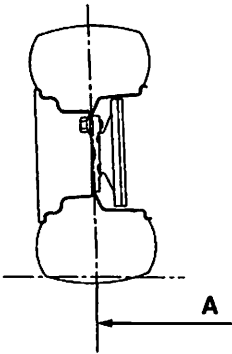
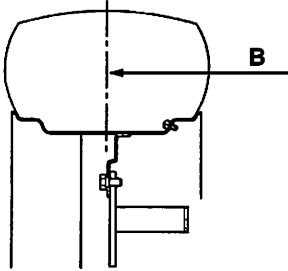
The tread can not be adjusted.

### ■ IMPORTANT

- Do not turn discs to obtain wider tread.
- Always attach tires as shown in the drawing.
- If not attached as illustrated, transmission parts may be damaged.

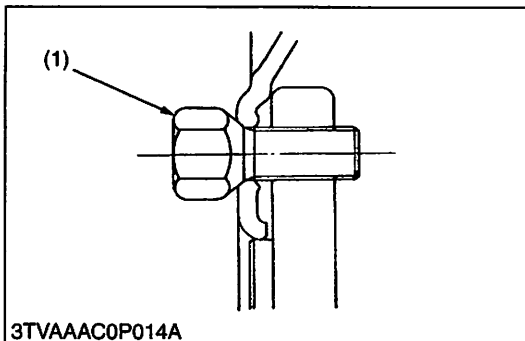
### ■ NOTE

- Use the tapered bolts for wheels with beveled or tapered holes.

Front	Rear
18 × 8.50 – 8 Turf, Bar	26 × 12.00 – 12 Turf, Bar
 <p>3TAAAAB0P032A</p>	 <p>3TAAAAB0P033A</p>

A : 910 mm (35.8 in.)

B : 820 mm (32.2 in.)



Tightening torque	Front wheel	149.2 to 179.0 N·m 15.2 to 18.3 kgf·m 110 to 132 ft-lbs
	Rear wheel	108.5 to 130.2 N·m 11.1 to 13.3 kgf·m 80 to 96 ft-lbs

(1) Wheel Mounting Screw

W1045824

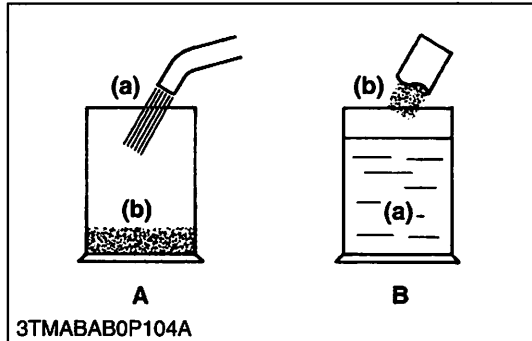
### [3] TIRE LIQUID INJECTION

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

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

**■ IMPORTANT**

- Do not fill the front tires with liquid.



#### Preparation of Calcium Chloride Solution

**⚠ CAUTION**

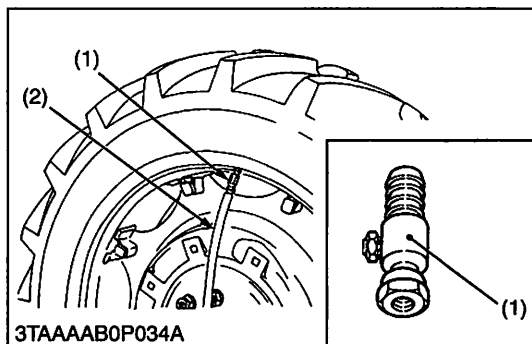
- When making a calcium chloride solution, do not pour water over calcium chloride since this results in chemical reaction which will cause high temperature. Instead add a small amount of calcium chloride to the water at a time until the desired solution is achieved.

Freezing temp.	Weight of CaCl <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)

W1033083



#### Attaching Injector

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

(1) Injector

(2) Hose

W1033331



Fig. 1

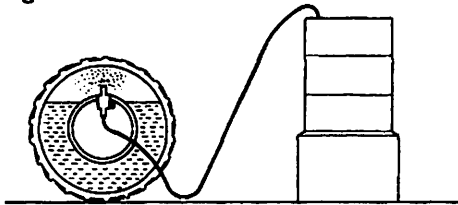


Fig. 2

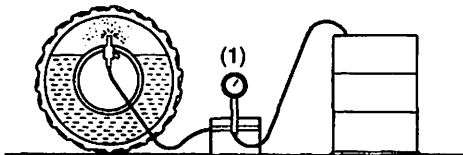
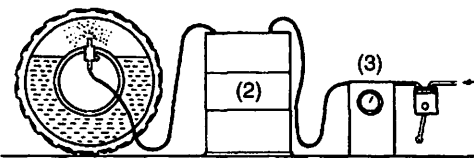
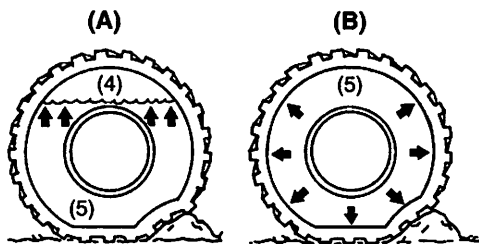


Fig. 3



3TMABAB0P111A



3TMABAB0P107A

**Injection**

**CAUTION**

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

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

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

**NOTE**

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

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

Tire sizes	26 x 12.00 - 12
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]	45 kg (99 lbs)
Slush free at -24 °C (-11 °F) Solid at -47 °C (-53 °F) [Approx. 1.5 kg (3.5 lbs.) CaCl <sub>2</sub> per 4 L (1 gal.) of water]	50 kg (110 lbs)
Slush free at -47 °C (-53 °F) Solid at -52 °C (-62 °F) [Approx. 2.25 kg (5 lbs.) CaCl <sub>2</sub> per 4 L (1 gal.) of water]	56 kg (123 lbs)

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

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

W1033435

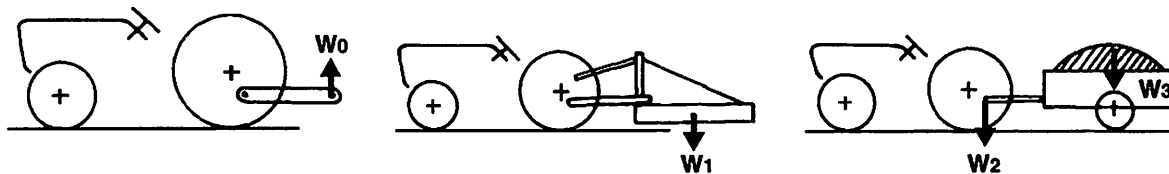
# 10. IMPLEMENT LIMITATIONS

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

	Tread (max. width) with farm tires		Lower link end max. loading weight $W_0$
	Front	Rear	
BX23	910 mm (35.8 in.)	820 mm (32.2 in.)	550 kg (1210 lbs.)

	Actual figures		
	Implement weight $W_1$ and / or size	Max. Drawbar Load $W_2$	Trailer loading weight $W_3$ Max. capacity
BX23	As in the following list (Shown on the next page)	250 kg (550 lbs)	800 kg (1765 lbs)

Lower link end max. hydraulic lifting capacity .....  $W_0$   
 Implement weight..... The implement's weight which can be put on the lower link :  $W_1$   
 Max. drawbar load .....  $W_2$   
 Trailer loading weight ..... The max. loading weight for trailer (without trailer's weight) :  $W_3$



3TMABAB0P109A

- **NOTE**
- Implement size may vary depending on soil operating conditions.

Implement		Remarks	BX23
Backhoe*		Max. Digging Depth	1840 mm (6 ft.)
		Max. Weight	262 kg (578 lbs) without Bucket
Front-end Loader**		Max. Lifting Capacity	210 kg (460 lbs)
		Max. Width	1220 mm (48 in.)
		Sub frame	Necessary
Mower	Mid-Mount	Max. Cutting Width	1520 mm (60 in.)
		Max. Weight	140 kg (300 lbs)
	Rotary-Cutter (1 Blade)	Max. Cutting Width	1070 mm (42 in.)
		Max. Weight	140 kg (300 lbs)
	Rear-Mount (2 or 3 Blade)	Max. Cutting Width	1520 mm (60 in.)
		Max. Weight	140 kg (300 lbs)
Flail Mower	Max. Cutting Width	1070 mm (42 in.)	
Sickle Bar	Max. Cutting Width	1220 mm (48 in.)	
Rotary Tiller		Max. Tilling Width	1070 mm (42 in.)
		Max. Weight	170 kg (375 lbs)
Bottom Plow		Max. Size	360 mm (14 in.) × 1
Disc Plow		Max. Size	560 mm (22 in.) × 1
Cultivator		Max. Width	1220 mm (48 in.) 1 Row
Disc Harrow		Max. Harrowing Width	1370 mm (54 in.)
		Max. Weight	140 kg (300 lbs)
Sprayer		Max. Tank Capacity	150 L (40 U.S.gals.)
Front Blade		Max. Cutting Width	1520 mm (60 in.)
		Sub Frame	Necessary
Rear Blade		Max. Cutting Width	1520 mm (60 in.)
		Max. Weight	160 kg (350 lbs)
Box Blade		Max. Cutting Width	1070 mm (42 in.)
		Max. Weight	170 kg (375 lbs)
Snow Blower (Front)		Max. Working Width	1270 mm (50 in.)
		Max. Weight	160 kg (350 lbs)
		Sub Frame	Necessary
Post Hole Digger		Digging Depth	1140 mm (45 in.)
Rotary Broom		Cleaning Width	1190 mm (47 in.)
Trailer		Max. Load Capacity	800 kg (1765 lbs)

\* KUBOTA provides BT600 Backhoe for BX23.

No other Backhoe installed by 3-points hitch is permitted for BX23.

\*\* KUBOTA provides LA210-1 Front-end Loader for BX23.

■ **NOTE**

- Implement size may vary depending on soil operating conditions.

W1012736

# 1 ENGINE

# MECHANISM

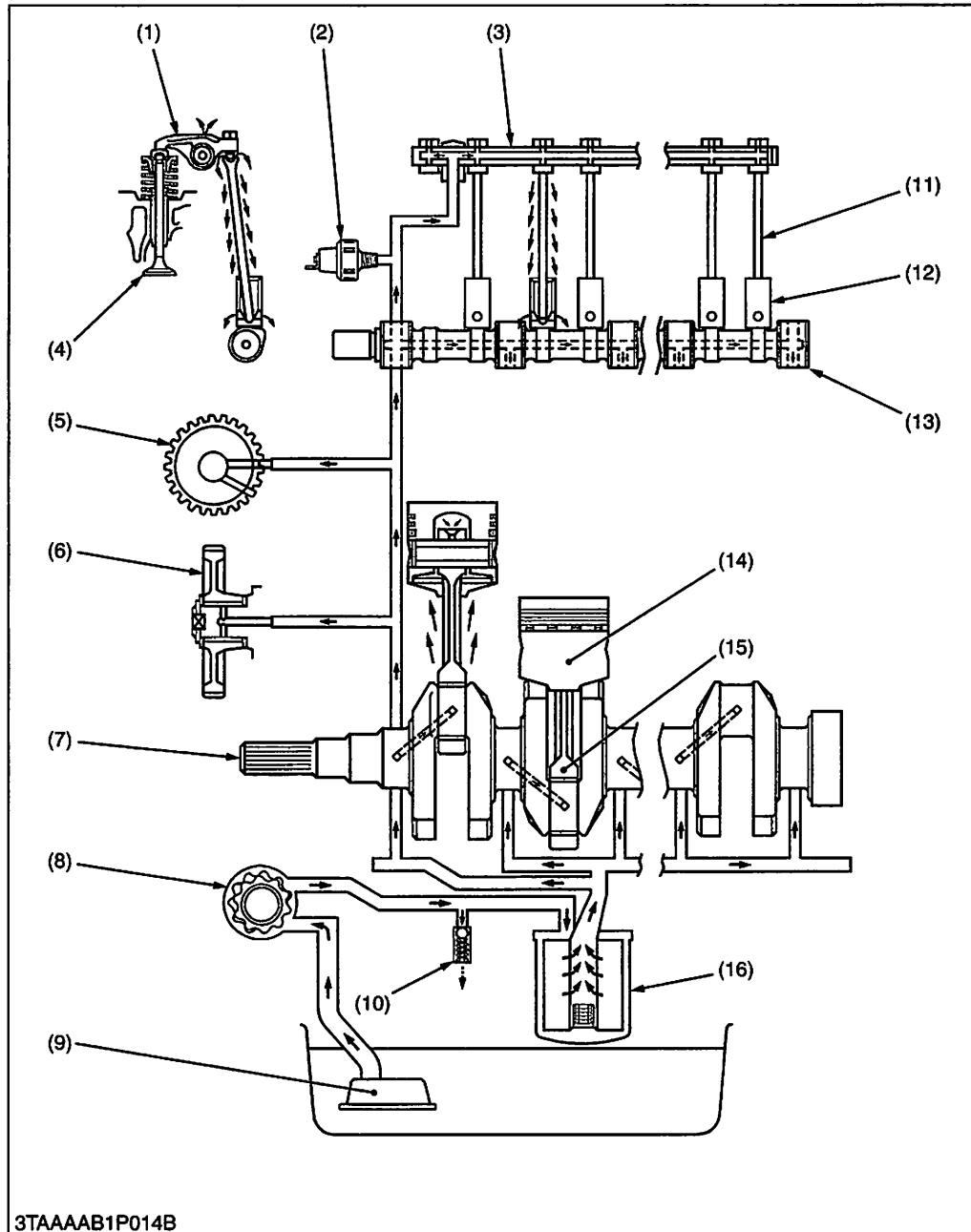
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2. COOLING SYSTEM .....	1-M2
3. FUEL SYSTEM .....	1-M3
[1] FUEL LINE .....	1-M3

## NOTICE

For not above-mentioned engine mechanism information, please refer ENGINE MECHANISM WSM (97897-01872).

# 1. LUBRICATING SYSTEM



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

W1012651

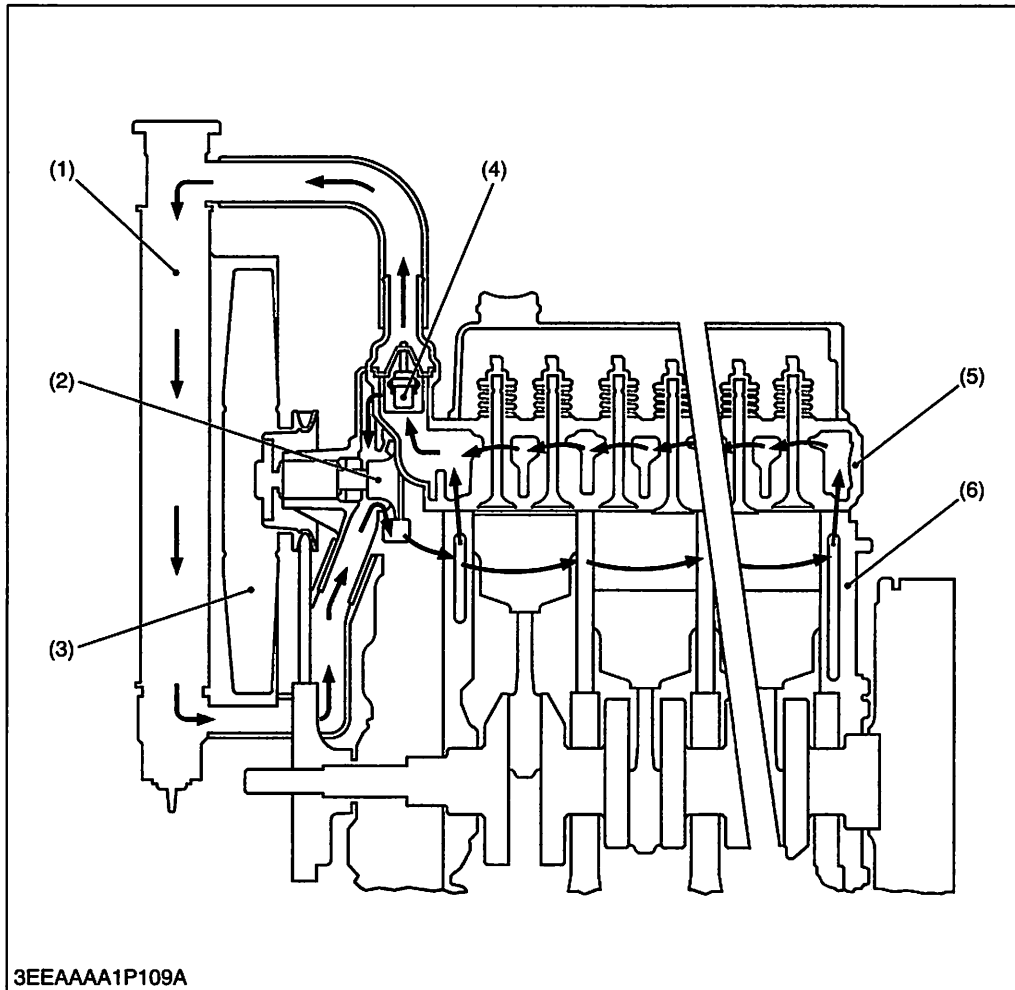
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This engine's lubricating system consists of oil strainer (9), oil pump (8), relief valve (10), oil filter cartridge (16) and oil pressure switch (2).

The oil pump sucks lubricating oil from the oil pan through the oil strainer and the oil flows down to the filter cartridge, where it is further filtered. Then the oil is forced to crankshaft (7), connecting rods (15), idle gear (6), governor shaft gear (5), camshaft (13) and rocker arm shaft (3) to lubricate each part.

Some part of oil, splashed by the crankshaft or leaking and dropping from gaps of each part, lubricates these parts: pistons (14), cylinders, small ends of connecting rods, tappets (12), push rods (11), inlet and exhaust valves (4) and timing gears.

## 2. COOLING SYSTEM



- (1) Radiator
- (2) Water Pump
- (3) Cooling Fan
- (4) Thermostat
- (5) Cylinder Head
- (6) Cylinder Block

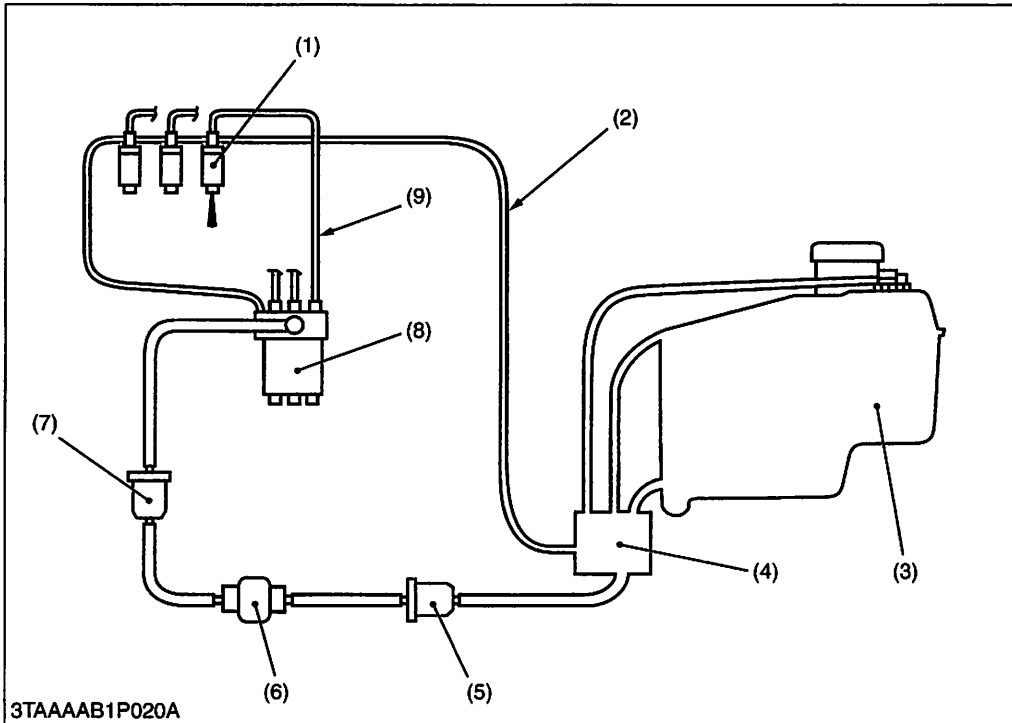
W10146560

3EEAAA1P109A

The cooling system consists of a radiator (1), a centrifugal water pump (2), a cooling fan (3) and a thermostat (4). The water is cooled as it flows through the radiator core, and the cooling air through the radiator core by cooling fan. The water pump receives water from the radiator or from the cylinder head and force it into the cylinder block. The thermostat opens or closes according to the water temperature. When the water temperature is high, the thermostat opens to allow the water to flow form the cylinder head to the radiator. When the water temperature is low, the thermostat close to flow the water only to the water pump. The opening temperature of the thermostat is approx. 82 °C (180 °F).

### 3. FUEL SYSTEM

#### [1] FUEL LINE



- (1) Injection Nozzle
- (2) Fuel Overflow Pipe
- (3) Fuel Tank
- (4) Fuel Tank 2
- (5) Fuel Filter
- (6) Fuel Feed Pump
- (7) Fuel Filter
- (8) Injection Pump
- (9) Injection Pipe

W1012995

Fuel from the fuel tank (3) passes through the fuel filter (5), and then enters the injection pump (8) after impurities such as dirt, water, etc. are removed.

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm<sup>2</sup>, 1991 to 2062 psi), of the injection nozzle (1) is injected into the combustion chamber.

Part of the fuel fed to the injection nozzle (1) lubricates the moving parts of the plunger inside the nozzle, then returns to the fuel tank through the fuel overflow pipe (2) from the upper part of the nozzle holder.



# SERVICING

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# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Engine Does Not Start</b>	<ul style="list-style-type: none"> <li>No fuel</li> <li>Air in the fuel system</li> <li>Water in the fuel system</li> </ul>	Replenish fuel Bleed Change fuel and repair or replace fuel system	G-7 G-26 G-18
	<ul style="list-style-type: none"> <li>Fuel pipe clogged</li> <li>Fuel filter clogged</li> <li>Excessively high viscosity of fuel or engine oil at low temperature</li> <li>Fuel with low cetane number</li> <li>Fuel leak due to loose injection pipe retaining nut</li> <li>Incorrect injection timing</li> <li>Fuel camshaft worn</li> <li>Injection nozzle clogged</li> <li>Injection pump malfunctioning</li> <li>Seizure of crankshaft, camshaft, piston, cylinder or bearing</li> <li>Compression leak from cylinder</li> </ul>	Clean Change Use specified fuel or engine oil Use specified fuel Tighten retaining nut Adjust Replace Clean Repair or replace Repair or replace Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	G-18 G-18 G-7 G-7 1-S16 1-S47 - 1-S49 - - 1-S13, S18
<b>(Starter Does Not Run)</b>	<ul style="list-style-type: none"> <li>Improper valve timing</li> <li>Piston ring and cylinder worn</li> <li>Excessive valve clearance</li> <li>Battery discharged</li> <li>Starter malfunctioning</li> <li>Main switch malfunctioning</li> <li>Safety switches malfunctioning</li> <li>Wiring disconnected</li> </ul>	Correct or replace timing gear Replace Adjust Charge Repair or replace Repair or replace Adjust or replace Connect	1-S23 1-S37 1-S15 G-17 G-14, 6-S15 - 6-S10 -
<b>Engine Revolution Is Not Smooth</b>	<ul style="list-style-type: none"> <li>Fuel filter clogged or dirty</li> <li>Air cleaner clogged</li> <li>Fuel leak due to loose injection pipe retaining nut</li> <li>Injection pump malfunctioning</li> <li>Incorrect nozzle injection pressure</li> <li>Injection nozzle stuck or clogged</li> <li>Governor malfunctioning</li> </ul>	Change Clean or replace Tighten retaining nut Repair or replace Adjust Repair or replace Repair	G-18 G-18 1-S16 - 1-S48 1-S49 -
<b>Either White or Blue Exhaust Gas Is Observed</b>	<ul style="list-style-type: none"> <li>Excessive engine oil</li> <li>Piston ring and cylinder worn or stuck</li> <li>Incorrect injection timing</li> <li>Deficient compression</li> </ul>	Reduce to specified level Repair or replace Adjust Adjust	G-12 1-S37 1-S47 1-S13

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Symptom	Probable Cause	Solution	Reference Page
<b>Either Black or Dark Gray Exhaust Gas Is Observed</b>	<ul style="list-style-type: none"> <li>• Overload</li> <li>• Low grade fuel used</li> <li>• Fuel filter clogged</li> <li>• Air cleaner clogged</li> <li>• Deficient nozzle injection</li> </ul>	Lesson load Use specified fuel Replace Clean or replace Repair or replace nozzle	– G-7 G-18 G-18 1-S47, S49
<b>Deficient Output</b>	<ul style="list-style-type: none"> <li>• Incorrect injection timing</li> <li>• Engine's moving parts seem to be seizing</li> <li>• Uneven fuel injection</li> <li>• Deficient nozzle injection</li> <li>• Compression leak</li> </ul>	Adjust Repair or replace Repair or replace injection pump Repair or replace nozzle Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S47 – – 1-S47, S49 1-S13, S18
<b>Excessive Lubricant Oil Consumption</b>	<ul style="list-style-type: none"> <li>• Piston ring's gap facing the same direction</li> <li>• Oil ring worn or stuck</li> <li>• Piston ring groove worn</li> <li>• Valve stem and valve guide worn</li> <li>• Oil leaking due to defective seals or packing</li> </ul>	Shift ring gap direction Replace Replace piston Replace Replace	1-S25 1-S37 1-S37 1-S18 –
<b>Fuel Mixed into Lubricant Oil</b>	<ul style="list-style-type: none"> <li>• Injection pump's plunger worn</li> <li>• Deficient nozzle injection</li> <li>• Injection pump broken</li> </ul>	Replace pump element or injection pump Repair or replace nozzle Replace	– 1-S47, S49 1-S21
<b>Water Mixed into Lubricant Oil</b>	<ul style="list-style-type: none"> <li>• Head gasket defective</li> <li>• Cylinder block or cylinder head flawed</li> </ul>	Replace Replace	– 1-S28
<b>Low Oil Pressure</b>	<ul style="list-style-type: none"> <li>• Engine oil insufficient</li> <li>• Oil strainer clogged</li> <li>• Oil filter clogged</li> <li>• Relief valve stuck with dirt</li> <li>• Relief valve spring weaken or broken</li> <li>• Excessive oil clearance of crankshaft bearing</li> <li>• Excessive oil clearance of crankpin bearing</li> <li>• Excessive oil clearance of rocker arm</li> <li>• Oil passage clogged</li> <li>• Different type of oil</li> <li>• Oil pump defective</li> </ul>	Replenish Clean Replace Clean Replace Replace Replace Replace Clean Use specified type of oil Repair or replace	– – G-12 – – 1-S40, S41 1-S39 1-S32 – G-7 1-S43, S44
<b>High Oil Pressure</b>	<ul style="list-style-type: none"> <li>• Different type of oil</li> <li>• Relief valve defective</li> </ul>	Use specified type of oil Replace	G-7 –

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Symptom	Probable Cause	Solution	Reference Page
<b>Engine Overheated</b>	<ul style="list-style-type: none"> <li>• Engine oil insufficient</li> <li>• Fan belt broken or tensioned improperly</li> </ul>	Replenish Replace or adjust	G-7 G-19, 1-S44
	<ul style="list-style-type: none"> <li>• Coolant insufficient</li> <li>• Radiator net and radiator fin clogged with dust</li> </ul>	Replenish Clean	G-7 -
	<ul style="list-style-type: none"> <li>• Inside of radiator corroded</li> </ul>	Clean or replace	G-25
	<ul style="list-style-type: none"> <li>• Coolant flow route corroded</li> </ul>	Clean or replace	G-20
	<ul style="list-style-type: none"> <li>• Radiator cap defective</li> </ul>	Replace	1-S45
	<ul style="list-style-type: none"> <li>• Radiator hose damaged</li> </ul>	Replace	G-20
	<ul style="list-style-type: none"> <li>• Overload running</li> </ul>	Lessen load	-
	<ul style="list-style-type: none"> <li>• Head gasket defective</li> </ul>	Replace	-
	<ul style="list-style-type: none"> <li>• Incorrect injection timing</li> </ul>	Adjust	1-S47
	<ul style="list-style-type: none"> <li>• Unsuitable fuel used</li> </ul>	Use specified fuel	G-7

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## 2. SERVICING SPECIFICATIONS

### ENGINE BODY

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	–	0.05 mm 0.0020 in.
Top Clearance		0.55 to 0.70 mm 0.0217 to 0.0276 in.	–
Compression Pressure (When Cranking with Starting Motor)		2.84 to 3.24 MPa 29 to 33 kgf/cm <sup>2</sup> 412 to 469 psi	2.26 MPa 23 kgf/cm <sup>2</sup> 327 psi
Difference among Cylinders		–	10 % or less
Valve Clearance (When Cold)		0.145 to 0.185 mm 0.00571 to 0.00728 in.	–
Valve Seat	Width	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 Recessing		–0.05 to 0.15 mm –0.0020 to 0.0059 in.	0.40 mm 0.0157 in.
Valve Stem to Valve Guide	Clearance	0.035 to 0.065 mm 0.00138 to 0.00256 in.	0.10 mm 0.0039 in.
Valve Stem	O.D.	6.960 to 6.975 mm 0.27402 to 0.27461 in.	–
Valve Guide	I.D.	7.010 to 7.025 mm 0.27598 to 0.27657 in.	–
Valve Timing (Intake Valve)	Open	0.24 rad. (14 °) before T.D.C.	–
	Close	0.52 rad. (30 °) after B.D.C.	–
Valve Timing (Exhaust Valve)	Open	0.96 rad. (55 °) before B.D.C.	–
	Close	0.24 rad. (14 °) after T.D.C.	–

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**ENGINE BODY (Continued)**

Item		Factory Specification	Allowable Limit
Valve Spring	Free Length	37.0 to 37.5 mm 1.457 to 1.476 in.	36.5 mm 1.437 in.
	Setting Load	117.6 N 12.0 kgf 26.4 lbs	100.0 N 10.2 kgf 22.5 lbs
	Setting Length	31.0 mm 1.220 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.	0.10 mm 0.0039 in.
Rocker Arm Shaft	O.D.	11.973 to 11.984 mm 0.47138 to 0.47181 in.	—
Rocker Arm	I.D.	12.000 to 12.018 mm 0.47244 to 0.47315 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.	19.959 to 19.980 mm 0.78579 to 0.78661 in.	—
Tappet Guide	I.D.	20.000 to 20.021 mm 0.78740 to 0.78823 in.	—
Camshaft	Side Clearance	0.07 to 0.22 mm 0.0028 to 0.0087 in.	0.30 mm 0.0118 in.
Camshaft	Alignment	—	0.01 mm 0.0004 in.
Cam Height	Intake	28.80 mm 1.1339 in.	28.75 mm 1.1319 in.
	Exhaust	29.00 mm 1.1417 in.	28.95 mm 1.1398 in.
Camshaft Journal to Cylinder Block Bore	Oil Clearance	0.050 to 0.091 mm 0.00197 to 0.00358 in.	0.15 mm 0.0059 in.
Camshaft Journal	O.D.	35.934 to 35.950 mm 1.41472 to 1.41535 in.	—
Cylinder Block Bore	I.D.	36.000 to 36.025 mm 1.41732 to 1.41831 in.	—

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**ENGINE BODY (Continued)**

Item		Factory Specification	Allowable Limit
Timing Gear	Crank Gear to Idle Gear	Backlash 0.032 to 0.115 mm 0.00126 to 0.00453 in.	0.15 mm 0.0059 in.
	Idle Gear to Cam Gear	Backlash 0.036 to 0.114 mm 0.00142 to 0.00449 in.	0.15 mm 0.0059 in.
	Idle Gear to Injection Pump Gear	Backlash 0.034 to 0.116 mm 0.00134 to 0.00457 in.	0.15 mm 0.0059 in.
	Injection Pump Gear to Governor Gear	Backlash 0.030 to 0.117 mm 0.00118 to 0.00461 in.	0.15 mm 0.0059 in.
Idle Gear	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.0200 in.	0.8 mm 0.0315 in.
Idle Gear Shaft to Idle Gear Bushing	Clearance	0.020 to 0.054 mm 0.00079 to 0.00213 in.	0.10 mm 0.0039 in.
Idle Gear Shaft	O.D.	25.967 to 25.980 mm 1.02232 to 1.02283 in.	—
Idle Gear Bushing	I.D.	26.000 to 26.021 mm 1.02362 to 1.02445 in.	—
Piston Pin Bore	I.D.	22.000 to 22.013 mm 0.86614 to 0.86675 in.	22.05 mm 0.8681 in.
Piston Ring Clearance	Second Ring	0.085 to 0.112 mm 0.00335 to 0.00441 in.	0.20 mm 0.0079 in.
	Oil Ring	0.020 to 0.055 mm 0.00079 to 0.00217 in.	0.15 mm 0.0059 in.
Piston Ring Gap	Top Ring and Second Ring	0.25 to 0.40 mm 0.0098 to 0.0157 in.	1.25 mm 0.0492 in.
	Oil Ring	0.25 to 0.45 mm 0.0098 to 0.0177 in.	1.25 mm 0.0492 in.
Connecting Rod	Alignment	—	0.05 mm 0.0020 in.
Piston Pin to Small End Bushing	Clearance	0.014 to 0.038 mm 0.00055 to 0.00150 in.	0.15 mm 0.0059 in.
Piston Pin	O.D.	22.002 to 22.011 mm 0.86622 to 0.86657 in.	—
Small End Bushing	I.D.	22.025 to 22.040 mm 0.86713 to 0.86771 in.	—
Crankshaft	Alignment	—	0.02 mm 0.0008 in.

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**ENGINE BODY (Continued)**

Item		Factory Specification	Allowable Limit
Crankshaft Journal to Crankshaft Bearing 1 (Front Side)		Oil Clearance 0.034 to 0.114 mm 0.00134 to 0.00449 in.	0.20 mm 0.0079 in.
Crankshaft Journal	O.D.	47.934 to 47.950 mm 1.88716 to 1.88779 in.	—
Crankshaft Bearing 1	I.D.	47.984 to 48.048 mm 1.88913 to 1.89165 in.	—
Crankshaft Journal to Crankshaft Bearing 2 (Rear Side)		Oil Clearance 0.034 to 0.095 mm 0.00134 to 0.00374 in.	0.20 mm 0.0079 in.
Crankshaft Journal	O.D.	47.934 to 47.950 mm 1.88716 to 1.88779 in.	—
Crankshaft Bearing 2	I.D.	47.984 to 48.029 mm 1.88913 to 1.89091 in.	—
Crankpin to Crankpin Bearing		Oil Clearance 0.029 to 0.091 mm 0.00114 to 0.00358 in.	0.20 mm 0.0079 in.
Crankpin	O.D.	39.959 to 39.975 mm 1.57319 to 1.57382 in.	—
Crankpin Bearing	I.D.	40.004 to 40.050 mm 1.57496 to 1.57677 in.	—
Crankshaft	Side Clearance	0.15 to 0.31 mm 0.0059 to 0.0122 in.	0.50 mm 0.0197 in.
Crankshaft Journal to Crankshaft Bearing 3 (Intermediate)		Oil Clearance 0.034 to 0.098 mm 0.00134 to 0.00386 in.	0.20 mm 0.0079 in.
Crankshaft Journal	O.D.	51.921 to 51.940 mm 2.04413 to 2.04488 in.	—
Crankshaft Bearing 3	I.D.	51.974 to 52.019 mm 2.04622 to 2.04799 in.	—
Cylinder [Standard]	I.D.	72.000 to 72.019 mm 2.83464 to 2.83539 in.	72.169 mm 2.84129 in.
Cylinder [Oversize : 0.5 mm (0.0197 in.)]	I.D.	72.500 to 72.519 mm 2.85433 to 2.85507 in.	72.669 mm 2.86098 in.

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**LUBRICATING SYSTEM**

Item		Factory Specification	Allowable Limit
Engine Oil Pressure	At Idle Speed	More than 49 kPa 0.5 kgf/cm <sup>2</sup> 7 psi	—
	At Rated Speed	196 to 441 kPa 2.0 to 4.5 kgf/cm <sup>2</sup> 36 to 64 psi	147 kPa 1.5 kgf/cm <sup>2</sup> 27 psi
Inner Rotor to Outer Rotor	Clearance	0.06 to 0.18 mm 0.0024 to 0.0071 in.	—
Outer Rotor to Pump Body	Clearance	0.10 to 0.18 mm 0.0039 to 0.0071 in.	—
Rotor to Cover	Clearance	0.030 to 0.085 mm 0.00118 to 0.00335 in.	—

W10139730

**COOLING SYSTEM**

Thermostat	Valve Opening Temperature (At Beginning)	80.5 to 83.5 °C 176.9 to 182.3 °F	—
	Valve Opening Temperature (Opened Completely)	95 °C 203 °F	—
Radiator	Water Leakage Test Pressure	No leaks at 137 kPa 1.4 kgf/cm <sup>2</sup> 20 psi	—
Radiator Cap	Pressure Falling Time	10 seconds or more for pressure falling from 88 to 59 kPa from 0.9 to 0.6 kgf/cm <sup>2</sup> from 13 to 9 psi	—
Fan Belt	Tension	7 to 9 mm (0.28 to 0.35 in.) deflection at 98 N (10 kgf, 22 lbs) of force	—

W10135990

**FUEL SYSTEM**

Injection Pump	Injection Timing	0.37 to 0.40 rad. 21 to 23 ° before T.D.C.	—
Injection Nozzle	Injection Pressure	13.71 to 14.71 MPa 140 to 150 kgf/cm <sup>2</sup> 1990 to 2130 psi	—
Injection Nozzle Valve Seat	Valve Seat Tightness	When the pressure is 12.7 MPa (130 kgf/cm <sup>2</sup> , 1850 psi), the valve seat must be fuel tightness.	—

W10139730

### 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-8.)

Item	N-m	kgf-m	ft-lbs
Cushion mounting nut	48.1	4.9	35.4
Engine mounting nut	48.1	4.9	35.4
Engine support screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Front coupling mounting screw	23.5 to 27.4	2.4 to 2.8	17.3 to 20.2
Under cover mounting bolt and nut	7.8 to 8.8	0.8 to 0.9	5.8 to 6.5

W10127360

Item	Size x Pitch	N-m	kgf-m	ft-lbs
Air cleaner stay nut	M10 × 1.25	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
* Bearing case cover screw	M6 × 1.0	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
Connecting rod screw	M8 × 1.0	41.2 to 46.1	4.2 to 4.7	30.3 to 33.9
* Cylinder head cover cap nut	M7 × 1.0	6.9 to 8.8	0.7 to 0.9	5.1 to 6.5
* Cylinder head screw	M10 × 1.25	63.7 to 68.6	6.5 to 7.0	47.0 to 50.6
* Fan drive pulley screw	M14 × 1.5	235.4 to 245.2	24.0 to 25.0	173.6 to 180.8
* Flywheel screw	M10 × 1.25	53.9 to 58.8	5.5 to 6.0	39.8 to 43.4
Glow plug	M8 × 1.0	7.8 to 14.7	0.8 to 1.5	5.8 to 10.8
* Idle gear shaft mounting screw	M6 × 1.0	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
Injection pipe retaining nut	M12 × 1.5	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3
* Main bearing case screw 1	M8 × 1.25	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
* Main bearing case screw 2	M9 × 1.25	49.0 to 53.9	5.0 to 5.5	36.2 to 39.8
Nozzle holder		34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Nozzle holder assembly	M20 × 1.5	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
* Oil pressure switch	PT 1/8	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Overflow pipe assembly retaining nut	M12 × 1.5	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
* Rocker arm bracket nut	M7 × 1.0	21.6 to 26.5	2.2 to 2.7	15.9 to 19.5

■ **NOTE**

- In removing and applying the bolts and nuts marked with “\*”, a pneumatic wrench or similar pneumatic tool, if employed, must be used with enough care not to get them seized.
- For \* marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.
- The letter “M” in Size x Pitch means that the screw, bolt or nut dimension stands for metric. The size is the nominal outside diameter in mm of the threads. The pitch is the nominal distance in mm between two threads.

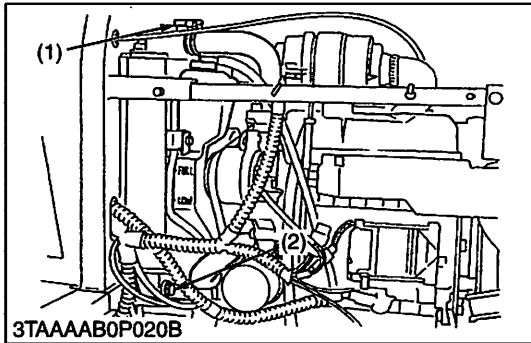
W10132360

# 4. CHECKING, DISASSEMBLING AND SERVICING

## [1] SEPARATE ENGINE

- Before proceeding this section disassembling the loader assembly. (Refer to Section 7.)

### (1) Draining Coolant and Engine Oil



#### Draining Coolant

#### ⚠ CAUTION

- **Never open the radiator cap while operating or immediately after stopping. Otherwise, hot water will spout out from the radiator. Wait for more than ten minutes to cool the radiator, before operating the cap.**

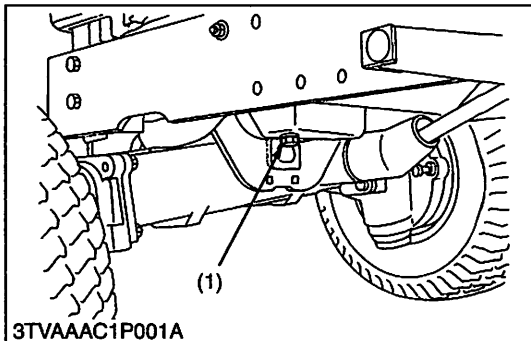
1. Open the radiator drain plug (2), and remove radiator cap (1) to completely drain the coolant.
2. After all coolant is drained, close the drain plug (2).

Coolant capacity	Radiator	3.1 L 3.28 U.S.qts. 2.73 Imp.qts.
	Recovery tank	0.4 L 0.42 U.S.qts. 0.35 Imp.qts.

(1) Radiator Cap

(2) Drain Plug

W1013828



#### Draining Engine Oil

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

#### (When refilling)

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

#### ■ IMPORTANT

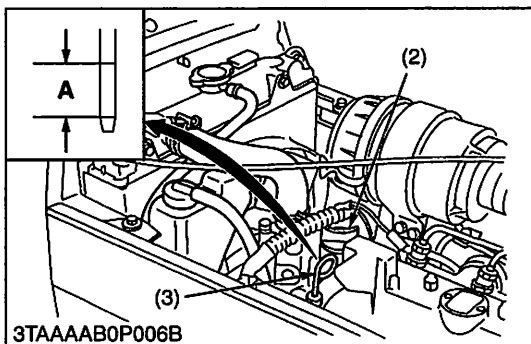
- **Never mix two different type of oil.**
- **Use the proper SAE Engine Oil according to ambient temperature.**

Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-7.)

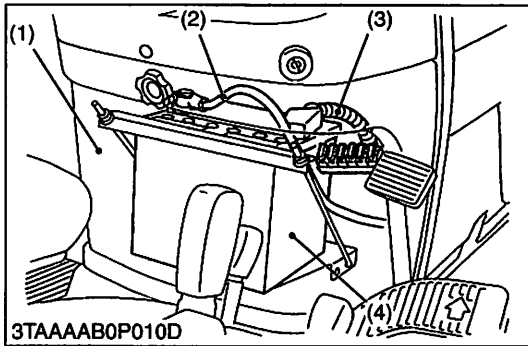
Engine oil capacity	2.5 L 2.64 U.S.qts. 2.20 Imp.qts.
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- (1) Drain Plug
- (2) Oil Inlet Plug
- (3) Dipstick

A : Oil level is acceptable within this range



W1014003



**Battery**

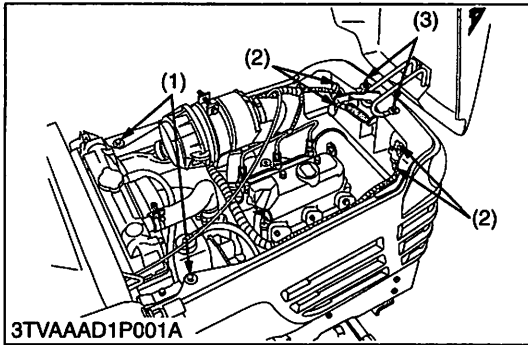
**CAUTION**

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

1. Remove the under panel (1).
2. Disconnect the negative cable (2) from the battery.
3. Disconnect the positive cable (3) from the battery and remove the battery (4).

- (1) Under Panel
- (2) Negative Cable
- (3) Positive Cable
- (4) Battery

W1014211



**Under Cover**

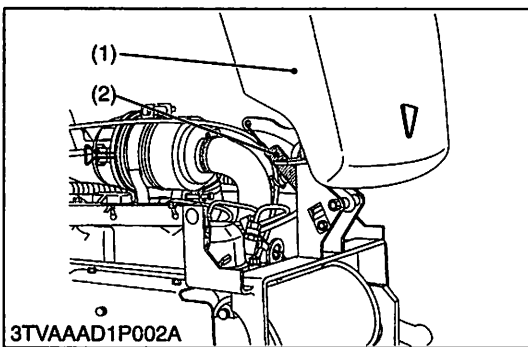
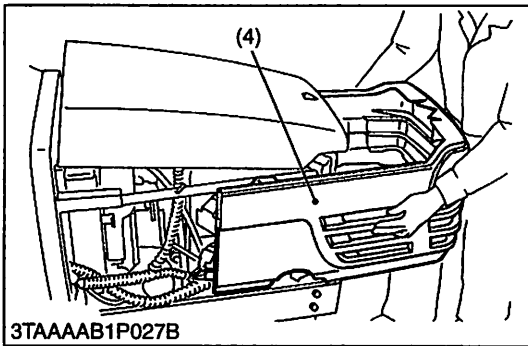
1. Remove the under cover mounting bolts (1), loosen the mounting nuts (3).
2. Disconnect the connectors (2) from the head lights.
3. Pull forward to remove the under cover (4).

**(When reassembling)**

Tightening torque	Under cover mounting bolt and nut	7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft·lbs
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- (1) Under Cover Mounting Bolt
- (2) Connector
- (3) Under Cover Mounting Nut
- (4) Under Cover

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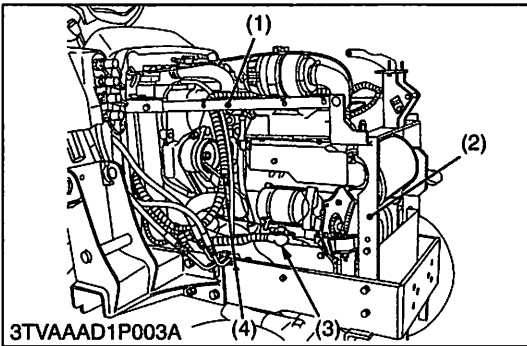


**Bonnet**

1. Remove the spring (2).
2. Remove the bonnet mounting bolt and nut, and remove the bonnet (1).

- (1) Bonnet
- (2) Spring

W1014501

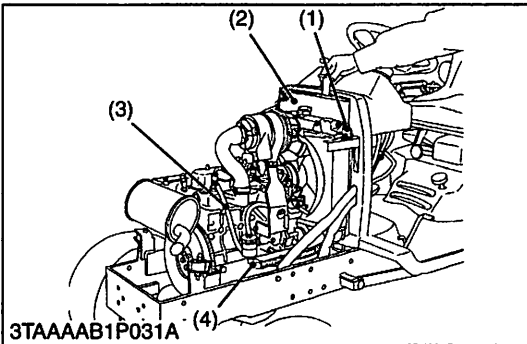
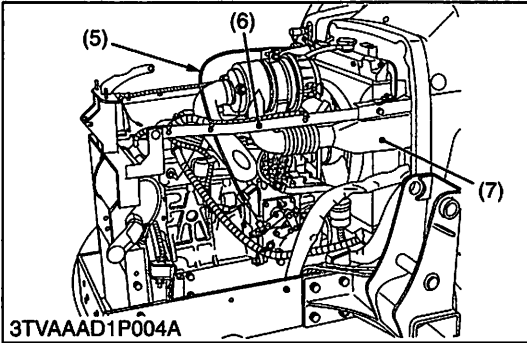


**Bonnet Post, Support and Others**

1. Disconnect the wire harness (4) and battery positive cable (3).
2. Disconnect the accelerator wire (5).
3. Remove the intake pipe (7).
4. Remove the supports (1), (6) and bonnet post (2).

- |                    |                      |
|--------------------|----------------------|
| (1) Support RH     | (5) Accelerator Wire |
| (2) Bonnet Post    | (6) Support LH       |
| (3) Positive Cable | (7) Intake Pipe      |
| (4) Wire Harness   |                      |

W1014587

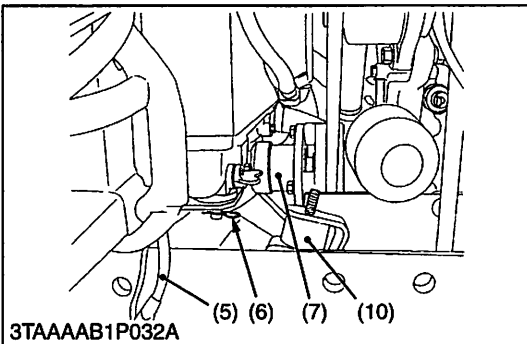


**Engine Assembly**

1. Disconnect the fuel hoses (3) and (4).
2. Remove the radiator net (2) and radiator stay (1).
3. Disconnect the battery negative cable (5), ground cable (9) and front coupling (7).
4. Remove the engine mounting nuts and radiator retaining snap pins (6).
5. Separate the engine assembly with radiator from the frame (8).

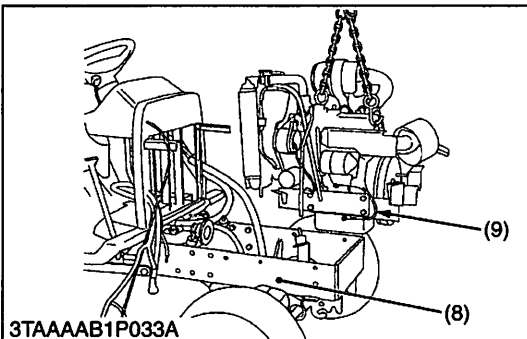
**(When reassembling)**

Tightening torque	Front coupling mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.3 to 20.2 ft-lbs
	Engine mounting nut	48.1 N·m 4.9 kgf·m 35.4 ft-lbs
	Cushion mounting nut	48.1 N·m 4.9 kgf·m 35.4 ft-lbs



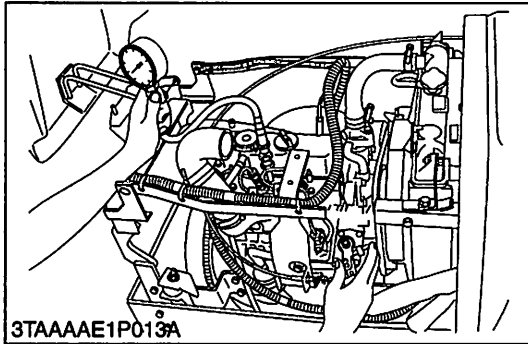
- |                            |                                 |
|----------------------------|---------------------------------|
| (1) Radiator Stay          | (6) Radiator Retaining Snap Pin |
| (2) Radiator Net           | (7) Front Coupling              |
| (3) Fuel Hose              | (8) Frame                       |
| (4) Fuel Hose              | (9) Ground Cable                |
| (5) Battery Negative Cable | (10) Cushion                    |

W1014832



## [2] ENGINE BODY

### (1) Checking and Adjusting



#### Compression Pressure

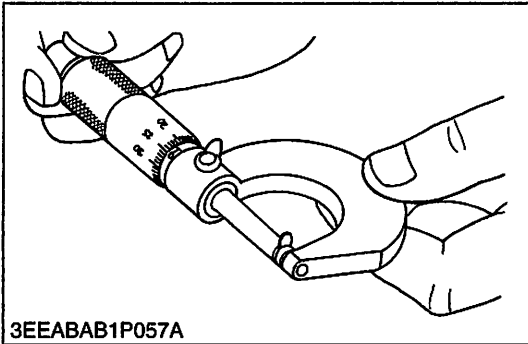
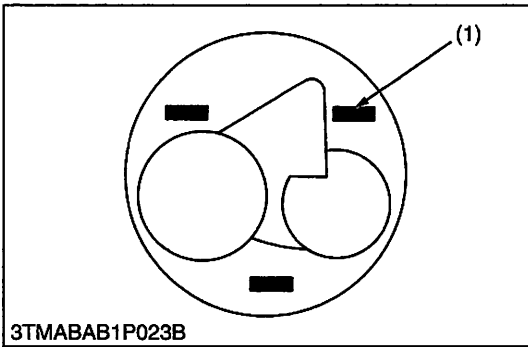
1. Run the engine until it is warmed up.
2. Stop the engine.
3. Disconnect the **2P** connector from the fuel pump.
4. Remove the air cleaner, the muffler and all injection nozzles.
5. Disconnect the accelerator wire.
6. Engage the parking brake.
7. Set a compression tester (Code No. 07909-30208) with the adaptor (Adaptor H, code No. 07909-31231) to the nozzle hole.
8. While cranking the engine with the starter, measure the compression pressure.
9. Repeat steps 7 and 8 for each cylinder.
10. 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.
11. If the compression pressure is still less than the allowable limit, check the top clearance, valve and cylinder head.
12. 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.	2.84 to 3.24 MPa 29 to 33 kgf/cm <sup>2</sup> 412 to 469 psi
	Allowable limit	2.26 MPa 23 kgf/cm <sup>2</sup> 327 psi

W10178940



**Top Clearance**

1. Remove the cylinder head. (Do not attempt to remove the cylinder head gasket.)
2. Move the piston up and stick a strip of fuse [1.5 mm dia. (0.059 in. dia.), 5 to 7 mm long (0.197 to 0.276 in. long)] on the piston head at three positions with grease so as to avoid the intake and exhaust valves and the combustion chamber ports.
3. Lower the piston and install the cylinder head and tighten the cylinder head screws to the specified torque.
4. Turn the flywheel until the piston exceeds its top dead center.
5. Remove the cylinder head, and measure the thickness of the squeezed fuses.
6. If the measurement is not within the factory specifications, check the oil clearance between the crankpin and crankpin bearing and between the piston pin and small end bushing.

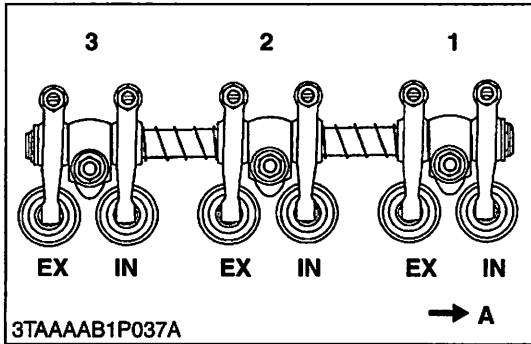
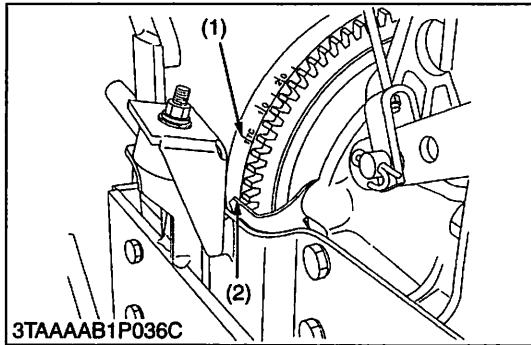
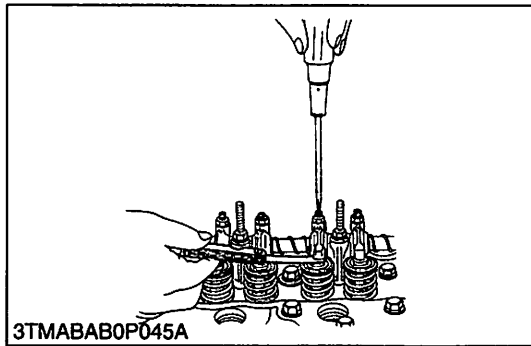
■ **NOTE**

- **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.
Tightening torque	Cylinder head screw	63.7 to 68.6 N·m 6.5 to 7.0 kgf·m 47.0 to 50.6 ft-lbs

(1) Fuse

W10201900



**Valve Clearance**

**■ IMPORTANT**

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

1. Remove the cylinder head cover and the glow plugs.
2. Align the “1TC” mark (1) on the flywheel and alignment mark (2) on the rear end plate so that the No. 1 piston comes to the compression top dead center.
3. Check the following valve clearance marked with “★” using a feeler gauge.

[When No. 1 piston comes to the compression top dead center position]

Cylinder No.	No.1	No.2	No.3
Intake valve	★		★
Exhaust valve	★	★	

4. If the clearance is not within the factory specifications, adjust with the adjusting screw.
5. Then turn the flywheel 6.28 rad. (360°), and align the “1TC” mark (1) on the flywheel and alignment mark (2) on the rear end plate so that the No.1 piston comes to the overlap position.
6. Check the following valve clearance marked with “☆” using a feeler gauge.

[When No. 1 piston comes to the overlap position]

Cylinder No.	No.1	No.2	No.3
Intake valve		☆	
Exhaust valve			☆

7. If the clearance is not within the factory specifications, adjust with the adjusting screw.

Intake and exhaust valve clearance (Cold)	Factory spec.	0.145 to 0.185 mm 0.00571 to 0.00728 in.
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**■ NOTE**

- The sequence of cylinder numbers is given as No.1, No.2 and No.3 starting from the gear case side.
- After adjusting the valve clearance, secure the adjusting screw with the lock nut.

- (1) “1TC” Mark  
(2) Alignment Mark

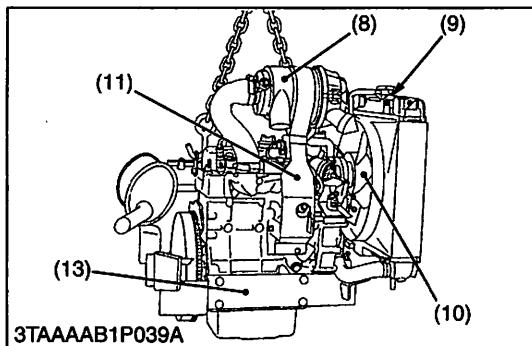
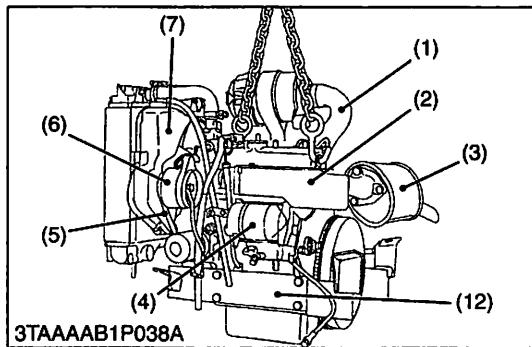
A : Gear Case Side

W10113200



## (2) Disassembling and Assembling

### (A) Cylinder Head and Valves



#### Alternator, Fan Belt and Muffler

1. Disconnect the radiator hoses and separate the radiator (9) with recovery tank (7) from engine assembly.
2. Remove the cooling fan (10) and fan pulley.
3. Remove the alternator (6) and fan belt (5).
4. Remove the muffler cover (2) and muffler (3).
5. Remove the starter (4).
6. Disconnect the inlet pipe (1), air cleaner (8) and air cleaner stay (11).
7. Remove the wire bracket.
8. Remove the engine support LH (12) and RH (13).

#### (When reassembling)

- Check to see that there are no cracks on the belt surface.

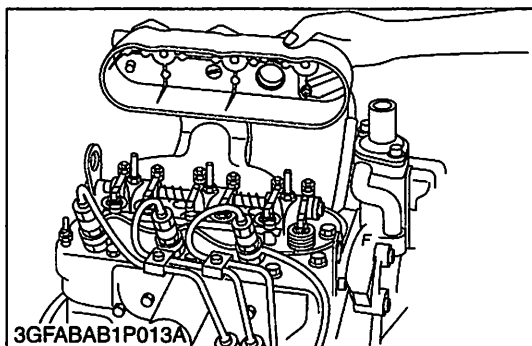
#### ■ IMPORTANT

- After reassembling the fan belt, be sure to adjust the fan belt tension.

Tightening torque	Air cleaner stay nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
	Engine support screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs

- |                   |                        |
|-------------------|------------------------|
| (1) Inlet Pipe    | (8) Air Cleaner        |
| (2) Muffler Cover | (9) Radiator           |
| (3) Muffler       | (10) Cooling Fan       |
| (4) Starter       | (11) Air Cleaner Stay  |
| (5) Fan Belt      | (12) Engine Support RH |
| (6) Alternator    | (13) Engine Support LH |
| (7) Recovery Tank |                        |

W10192100



#### Cylinder Head Cover

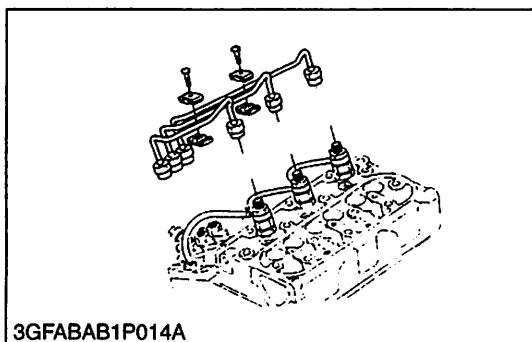
1. Remove the head cover cap nuts.
2. Remove the cylinder head cover.

#### (When reassembling)

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

Tightening torque	Cylinder head cover cap nut	6.9 to 8.8 N·m 0.7 to 0.9 kgf·m 5.1 to 6.5 ft-lbs
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W1017302



#### Injection Pipes

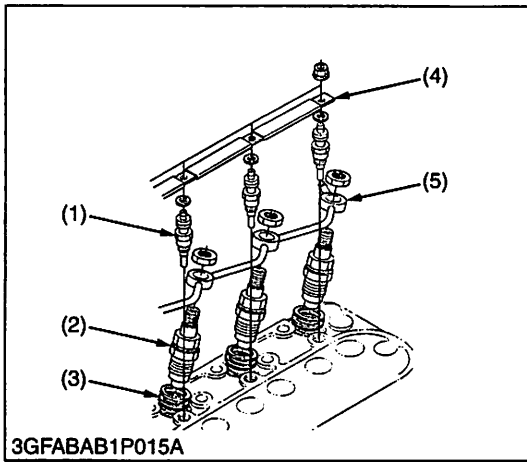
1. Loosen the screws on the pipe clamps.
2. Detach the injection pipes.

#### (When reassembling)

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

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

W1017424



**Nozzle Holder Assembly and Glow Plug**

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

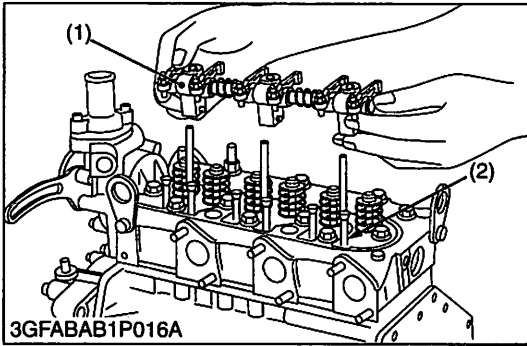
**(When reassembling)**

- 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	7.8 to 14.7 N-m 0.8 to 1.5 kgf-m 5.8 to 10.8 ft-lbs

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

W10198550



**Rocker Arm and Push Rod**

1. Remove the rocker arm bracket nuts.
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.

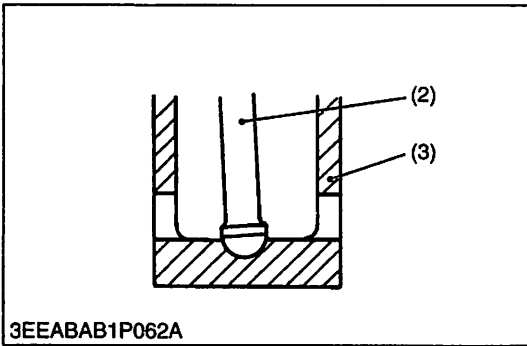
**■ IMPORTANT**

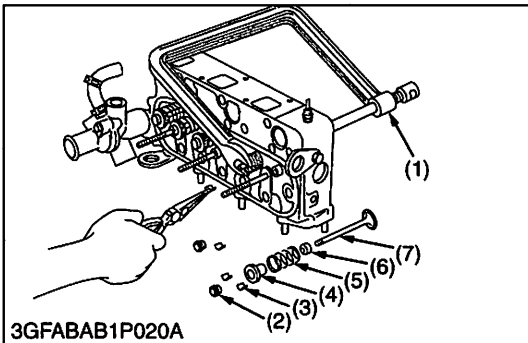
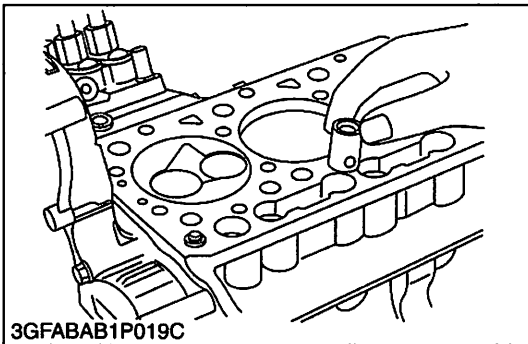
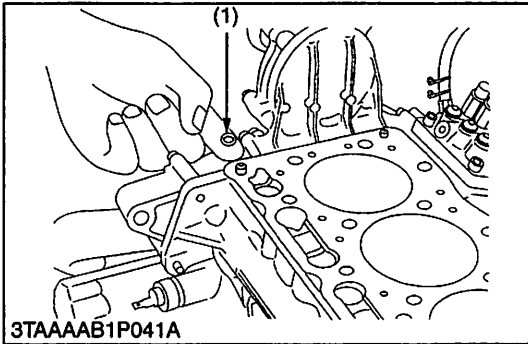
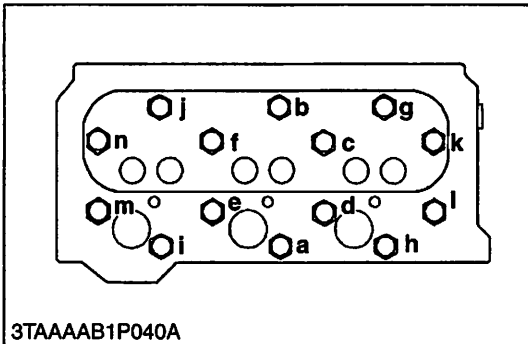
- **After installing the rocker arm, be sure to adjust the valve clearance.**

Tightening torque	Rocker arm bracket nut	21.6 to 26.5 N-m 2.2 to 2.7 kgf-m 15.9 to 19.5 ft-lbs
-------------------	------------------------	---

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

W10203230





**Cylinder Head**

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

**(When reassembling)**

- Replace the cylinder head gasket with a new one.
- Securely fit the O-ring (1) to the pipe pin.
- Tighten the cylinder head screws after applying sufficient oil.
- Tighten the cylinder head screws diagonal sequence starting from the center.
- Tighten them uniformly, or the head may deform in the long run.
- Retighten the cylinder head screws after running the engine for 30 minutes.

Tightening torque	Cylinder head screw	63.7 to 68.6 N·m 6.5 to 7.0 kgf·m 47.0 to 50.6 ft·lbs
-------------------	---------------------	---

(1) O-ring

(n) to (a) : To Loosen  
(a) to (n) : To Tighten

W10205250

**Tappets**

1. Remove the tappets from the crankcase.

**(When reassembling)**

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

**■ IMPORTANT**

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

W10209700

**Valves**

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

**(When reassembling)**

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

**■ IMPORTANT**

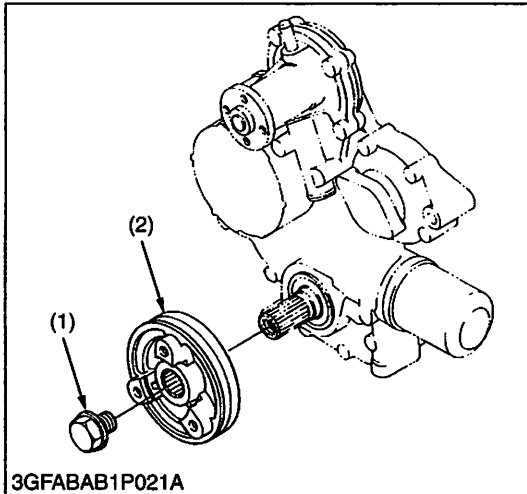
- **Don't change the combination of valve and valve guide.**

- (1) Valve Spring Replacer
- (2) Valve Cap
- (3) Valve Spring Collet
- (4) Valve Spring Retainer

- (5) Valve Spring
- (6) Valve Stem Seal
- (7) Valve

W10211070

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



**Fan Drive Pulley**

1. Set the stopper to the flywheel.
2. Remove the fan drive pulley screw (1).
3. Draw out the fan drive pulley (2) with a puller.

**(When reassembling)**

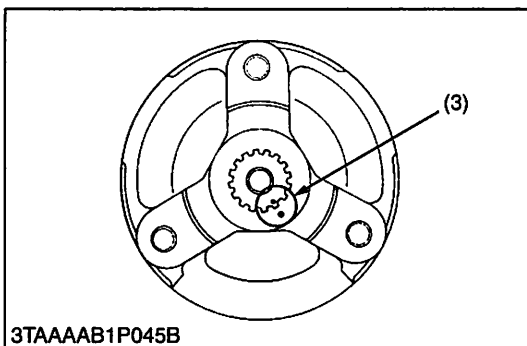
- Install the fan drive pulley to the crankshaft, aligning the marks (3) on them.

Tightening torque	Fan drive pulley screw	235.4 to 245.2 N·m 24.0 to 25.0 kgf·m 173.6 to 180.8 ft·lbs
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- (1) Fan Drive Pulley Screw
- (2) Fan Drive Pulley

(3) Aligning Mark

W10181950



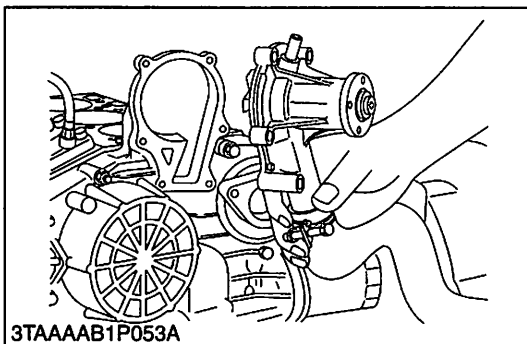
**Water Pump**

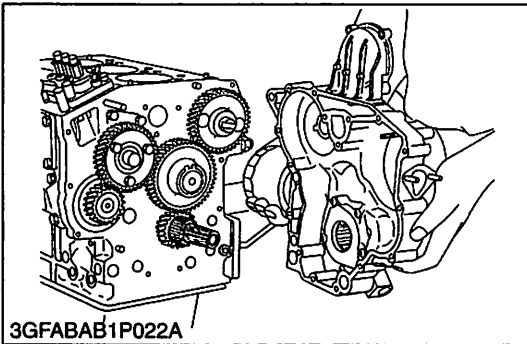
1. Remove the water pump flange.

**(When reassembling)**

- Before installing the water pump flange gasket, apply liquid gasket (Three Bond 1215 or equivalent) to the both side.

W1017530





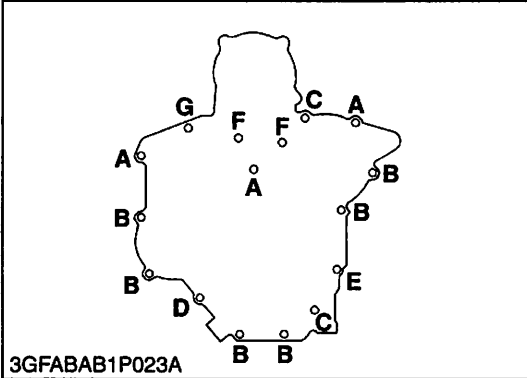
**Gear Case**

1. Remove the gear case.
2. Remove the crankshaft collar and O-rings.

**(When reassembling)**

- Replace the gear case gasket with a new one.
- Be sure to set four O-rings inside the gear case and the O-ring on the crankshaft.
- Apply a thin film of engine oil to the oil seal, and install it, noting the lip come off.
- Length of the gear case mounting screws. (Refer to the figure.)
  - A : 45 mm (1.77 in.)
  - B : 50 mm (1.97 in.)
  - C : 55 mm (2.17 in.)
  - D : 59 mm (2.32 in.)
  - E : 68 mm (2.68 in.)
  - F : 80 mm (3.15 in.)
  - G : Nut

W10220030



**Engine Stop Solenoid**

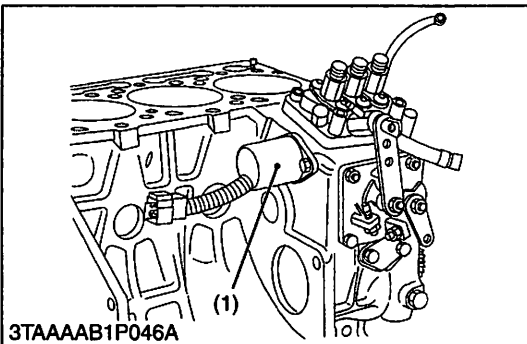
1. Remove the engine stop solenoid (1).

**(When reassembling)**

- Apply a thin coat of liquid type-gasket (Three bond 1215 or equivalent) to both surfaces of the solenoid's cover packing.
- Confirm the convex part of the flange of the engine stop solenoid has fitted into the hole, and then fasten the bolts.

(1) Engine Stop Solenoid

W1019085



**Speed Control Plate**

1. Remove the speed control plate and governor lever (1) from the governor springs 1 (2).

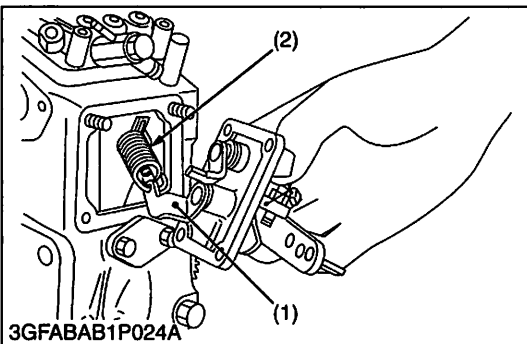
**(When reassembling)**

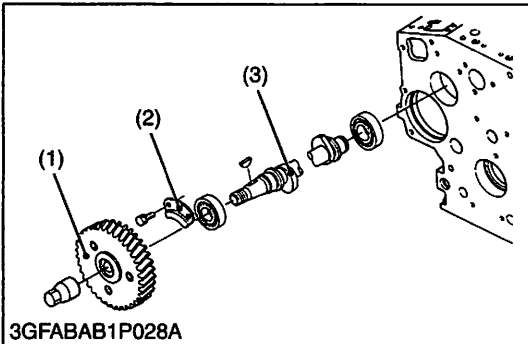
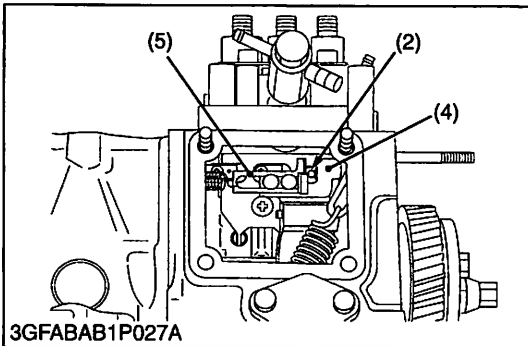
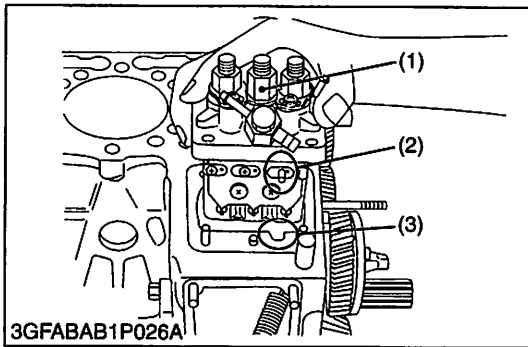
- Securely catch the governor spring 1 and 2 on the governor lever as shown in the figure.
- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the speed control plate gasket.

(1) Governor Lever

(2) Governor Spring 1

W1018974





**Injection Pump**

1. Remove the injection pump mounting screws and nuts.
2. Align the control rack pin (2) with the notch (3) on the crankcase, then remove the injection pump (1).
3. Remove the injection pump timing shims.
4. In principle, the injection pump should not be disassembled.

**(When reassembling)**

- Securely fit the control rack pin (2) to the grooves of the fork lever 1 (4) and thrust lever (5).
- The sealant is applied to both sides of the shim (soft metal gasket shim). The liquid gasket is not required for assembling.
- Addition or reduction of shims (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad. (0.5 °).
- In disassembling and replacing, be sure to use the same number of new shims with the same thickness.

- |                      |                  |
|----------------------|------------------|
| (1) Injection Pump   | (4) Fork Lever 1 |
| (2) Control Rack Pin | (5) Thrust Lever |
| (3) Notch            |                  |

W10223180

**Fuel Camshaft**

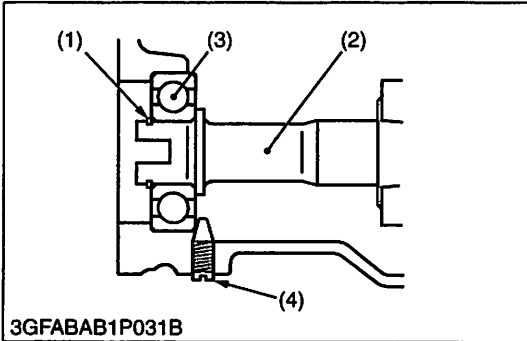
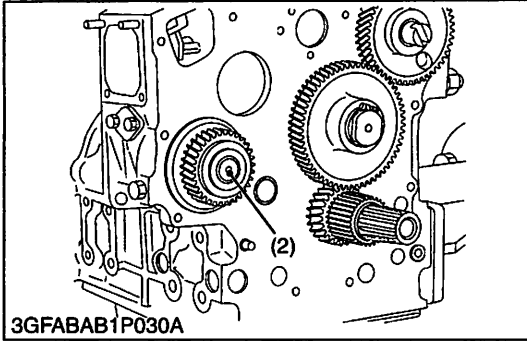
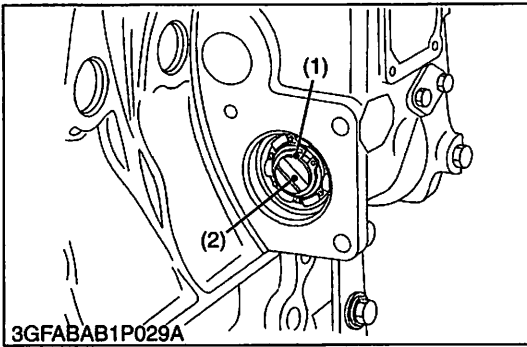
1. Remove the fuel camshaft stopper (2).
2. Draw out the fuel camshaft (3) and injection pump gear (1).

**(When reassembling)**

- Apply engine oil thinly to the fuel camshaft before installation.

- |                           |                   |
|---------------------------|-------------------|
| (1) Injection Pump Gear   | (3) Fuel Camshaft |
| (2) Fuel Camshaft Stopper |                   |

W1019366



**Governor Shaft**

1. Remove the pump cover.
2. Remove the external snap ring (1) from the governor shaft.
3. Pull out the governor shaft (2).

**(When reassembling)**

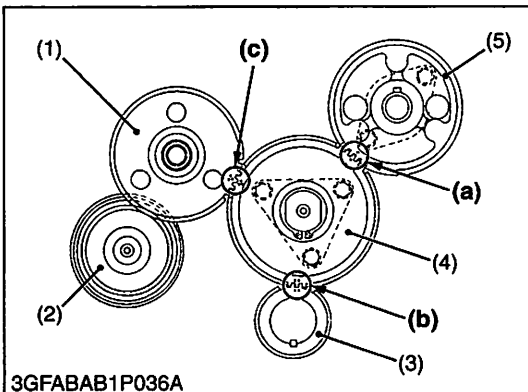
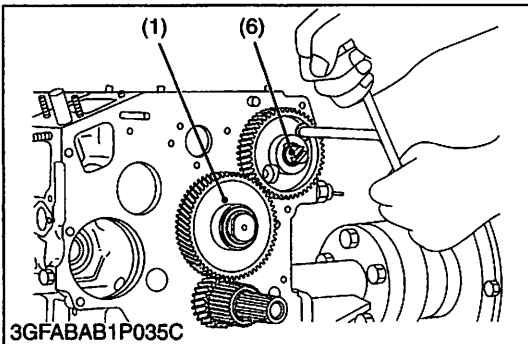
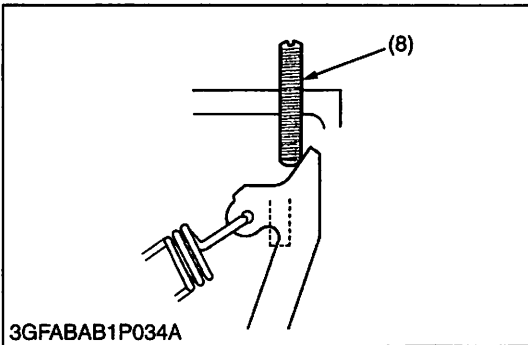
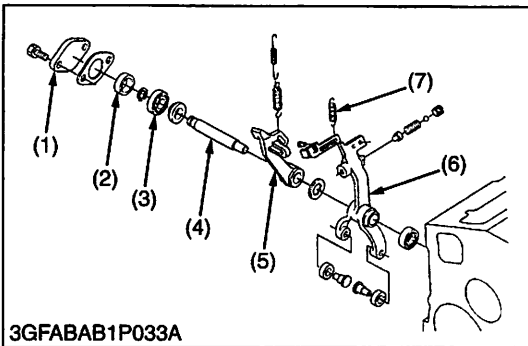
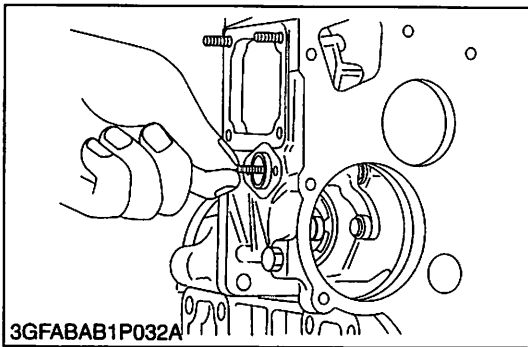
- Make sure assembling the external snap ring of the governor shaft.
- Check the governor shaft for smooth rotation.

■ **IMPORTANT**

- **When replacing the ball bearing of governor shaft, securely fit the ball bearing (3) to the crankcase, apply an adhesive (Three Bond 1324B or equivalent) to the set screw (4), and fasten the screw until its tapered part contacts the circumferential end of the ball bearing.**

- |                        |                  |
|------------------------|------------------|
| (1) External Snap Ring | (3) Ball Bearing |
| (2) Governor Shaft     | (4) Set Screw    |

W10228020



**Fork Lever**

1. Remove the start spring (7).
2. Remove the fork lever shaft cover (1).
3. Pull out the fork lever shaft (4), and remove the spacer (2), bearing (3), fork levers 1 (6) and 2 (5).

**(When reassembling)**

- Apply a liquid gasket (Three Bond 1215 or equivalent) to the both sides of the fork lever shaft cover, and fit the fork lever shaft cover with the “UP” mark facing upwards.
- Securely fit the start spring.

**■ IMPORTANT**

- Install the fork lever 2 (5) to position it on the right side of the maximum output limit bolt (8) as shown in the figure.

- |                            |                               |
|----------------------------|-------------------------------|
| (1) Fork Lever Shaft Cover | (5) Fork Lever 2              |
| (2) Spacer                 | (6) Fork Lever 1              |
| (3) Bearing                | (7) Start Spring              |
| (4) Fork Lever Shaft       | (8) Maximum Output Limit Bolt |

W10230800

**Camshaft and Idle Gear**

1. Remove the external snap ring, and then remove the idle gear (4).
2. Remove the camshaft stopper mounting screw, and pull out the camshaft (6).

**(When reassembling)**

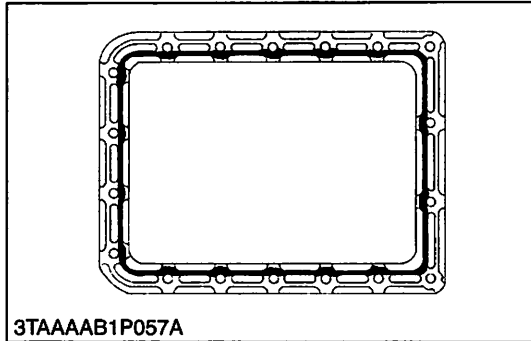
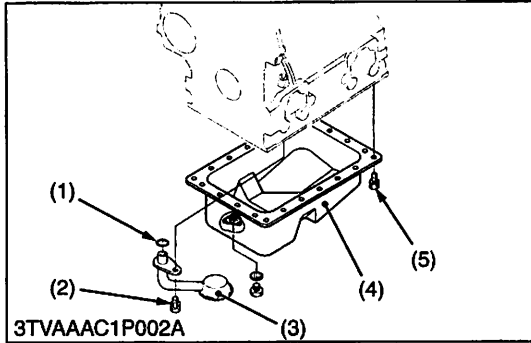
- When installing the idle gear 1, be sure to align the alignment marks (a), (b), (c) on the gears.
- Securely fit the external snap ring and stopper.

- |                         |   |
|-------------------------|---|
| (1) Injection Pump Gear | (a) Alignment Mark<br>(Idle Gear and Cam Gear)            |
| (2) Governor Gear       | (b) Alignment Mark<br>(Idle Gear and Crank Gear)          |
| (3) Crank Gear          | (c) Alignment Mark<br>(Idle Gear and Injection Pump Gear) |
| (4) Idle Gear           |   |
| (5) Cam Gear            |   |
| (6) Crank Gear          |   |

W10234470



**(C) Piston and Connecting Rod**



**Oil Pan and Oil Strainer**

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

**(When reassembling)**

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

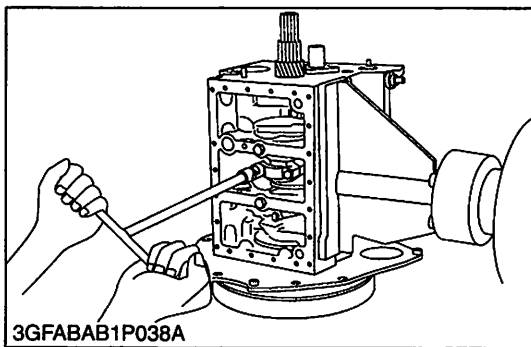
**■ IMPORTANT**

- **Scrape off the old adhesive completely. Wipe the sealing surface clean using waste cloth soaked with gasoline. Now apply new adhesive 3 to 5 mm (0.12 to 0.20 in.) thick all over the contact surface. Apply the adhesive also on the center of the flange as well as on the inner wall of each bolt hole.**
- **Cut the nozzle of the “liquid gasket” (Three Bond 1207D or equivalent) container at its second notch. Apply “liquid gasket” about 5 mm (0.20 in.) thick.**

**Within 20 minutes after the application of fluid sealant, reassemble the components. Wait then for about 30 minutes, and pour oil in the crankcase.**

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

W10236610



**Connecting Rod Cap**

1. Remove the connecting rod caps.

**(When reassembling)**

- Align the marks (a) with each other. (Face the marks toward the injection pump.)
- Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque.

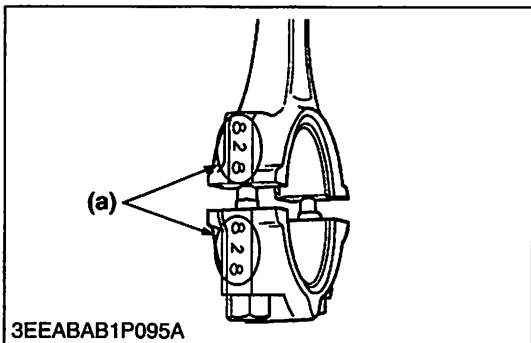
If the connecting rod screw won't be screwed in smoothly, clean the threads.

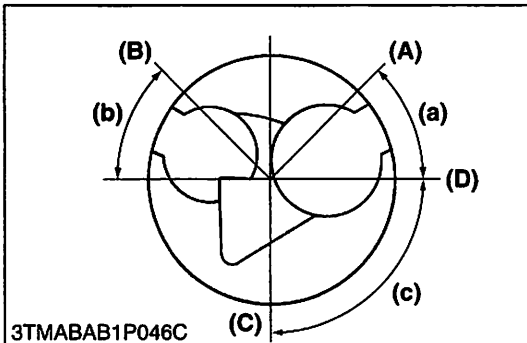
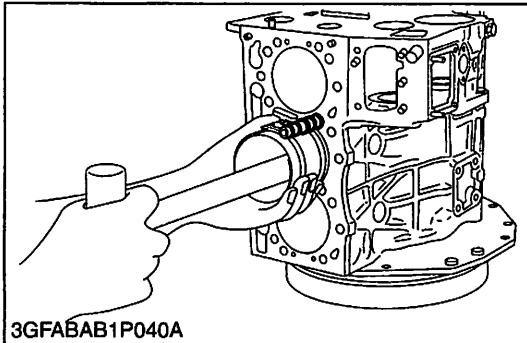
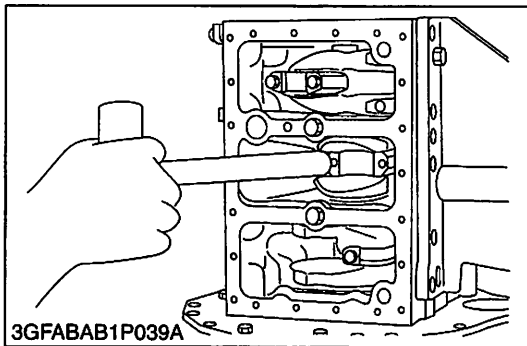
If the connecting rod screw is still hard to screw in, replace it.

Tightening torque	Connecting rod screw	41.2 to 46.1 N·m 4.2 to 4.7 kgf·m 30.3 to 33.9 ft·lbs
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(a) Mark

W10242740





**Pistons**

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

**(When reassembling)**

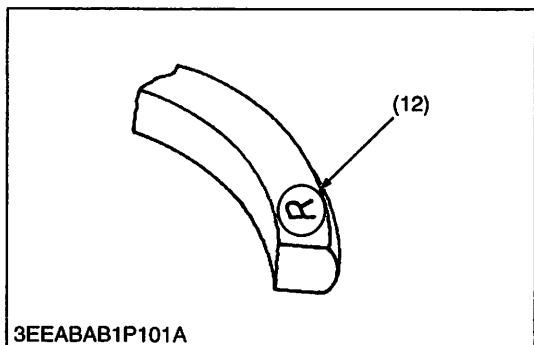
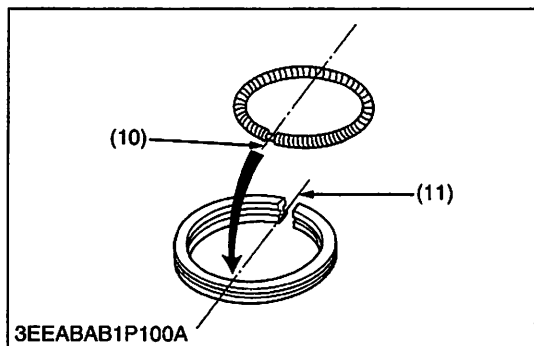
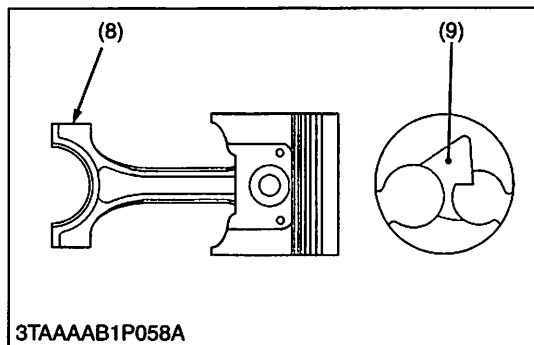
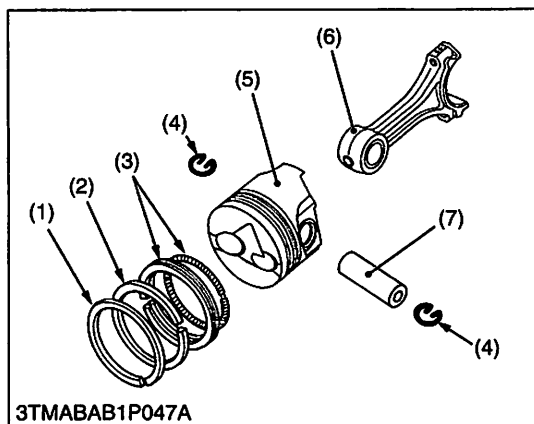
- Before inserting the piston into the cylinder, apply enough engine oil to the piston.
- When inserting the piston into the cylinder, face the mark on the connecting rod to the injection pump.

**■ 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.**
- **When installing the piston into the cylinder, place the gap of the compression ring 1 on the opposite side of the combustion chamber and stagger the gaps of the compression ring 2 and oil ring making a right angle from the gap of the compression ring 1.**
- **Carefully insert the pistons using a piston ring compressor. Otherwise, their chrome-plated section may be scratched, causing trouble inside the cylinder.**

- |                     |                     |
|---------------------|---------------------|
| (A) Top Ring Gap    | (a) 0.79 rad. (45°) |
| (B) Second Ring Gap | (b) 0.79 rad. (45°) |
| (C) Oil Ring Gap    | (c) 1.57 rad. (90°) |
| (D) Piston Pin Hole |                     |

W10277450



**Piston Ring and Connecting Rod**

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

**(When reassembling)**

- When installing the ring, assemble the rings so that the manufacturer's mark (12) near the gap faces the top of the piston.
- When installing the oil ring onto the piston, place the expander joint (10) on the opposite side of the oil ring gap (11).
- Apply engine oil to the piston pin.
- When installing the connecting rod to the piston, immerse the piston in 80 °C (176 °F) oil for 10 to 15 minutes and insert the piston pin to the piston.
- When installing the connecting rod to the piston, align the mark (8) on the connecting rod to the fan-shaped concave (9).

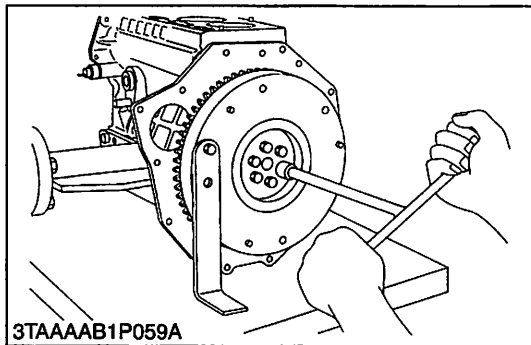
**NOTE**

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

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

W10281670

**(D) Crankshaft**



**Flywheel**

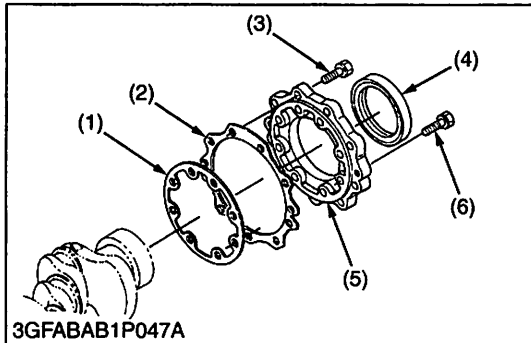
1. Fit the stopper to the flywheel.
2. Remove all flywheel screws and then remove the flywheel.

**(When reassembling)**

- Fit the flywheel giving care to the position of the knock pin.
- Apply engine oil to the threads and the undercut surface of the flywheel bolt and fit the bolt.

Tightening torque	Flywheel screw	53.9 to 58.8 N·m 5.5 to 6.0 kgf·m 39.8 to 43.4 ft·lbs
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W10290240



**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.

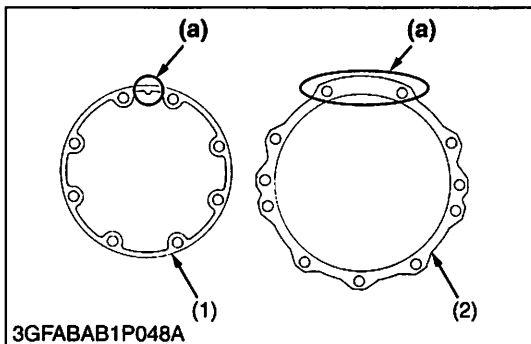
**■ IMPORTANT**

- The length of inside screws and outside screws are different. Do not take a mistake using inside screws and outside screws.

**(When reassembling)**

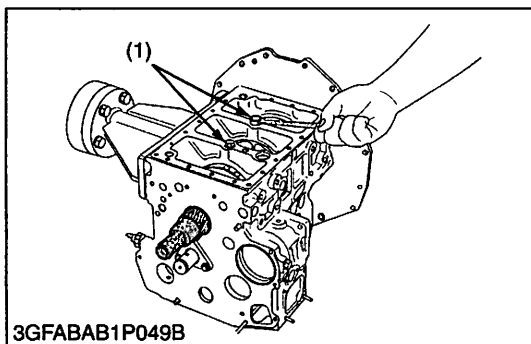
- Fit the bearing case gasket (1) and the bearing case cover gasket (2) with correct directions.
- Install the bearing case cover to position the casting mark "UP" on it upward.
- Apply engine oil to the oil seal lip and take care that it is not rolled when installing.
- Tighten the bearing case cover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

Tightening torque	Bearing case cover mounting screw	9.8 to 11.3 N·m 1.00 to 1.15 kgf·m 7.2 to 8.3 ft·lbs
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- (1) Bearing Case Gasket
- (2) Bearing Case Cover Gasket
- (3) Bearing Case Cover Mounting Screw
- (4) Oil Seal
- (5) Bearing Case Cover
- (6) Bearing Case Cover Mounting Screw
- (a) Upside

W10292140



**Crankshaft Assembly**

1. Remove the main bearing case screw 2 (1).
2. Pull out the crankshaft assembly.

**■ IMPORTANT**

- Take care to protect crankshaft bearing 1 from scratches, caused by the crank gear, etc.. (Wrap the gear in vinyl tape, etc.)

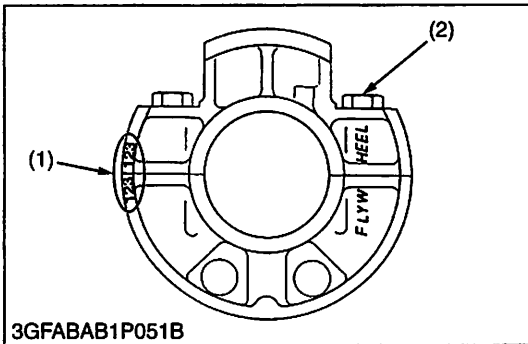
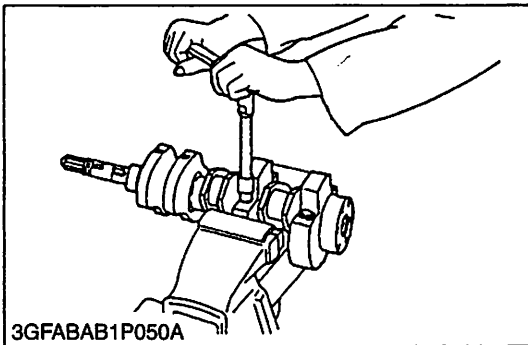
**(When reassembling)**

- Clean the oil passage of the crankshaft with compressed air.
- Apply oil to the main bearing case screw 2 (1).
- Install the crankshaft assembly, aligning the screw hole of main bearing case with the screw hole of crankcase.
- Clean the oil passage of the crankshaft with compressed air.

Tightening torque	Main bearing case screw 2	49.0 to 53.9 N·m 5.0 to 5.5 kgf·m 36.2 to 39.8 ft·lbs
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- (1) Main Bearing Case Screw 2

W10295750



**Main Bearing Case Assembly**

1. Remove the two main bearing case screws 1, and remove the main bearing case assembly, being careful with thrust bearing and crankshaft bearing 2.
2. Remove the main bearing case assembly 1 and 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) on the main bearing case.
- When installing the main bearing case 1 and 2, face the mark "FLYWHEEL" to the flywheel.
- Install the thrust bearing with its oil groove facing outward.
- Confirm that the main bearing case moves smoothly after tightening the main bearing case screw 1 to the specified torque.

Tightening torque	Main bearing case screw 1	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs
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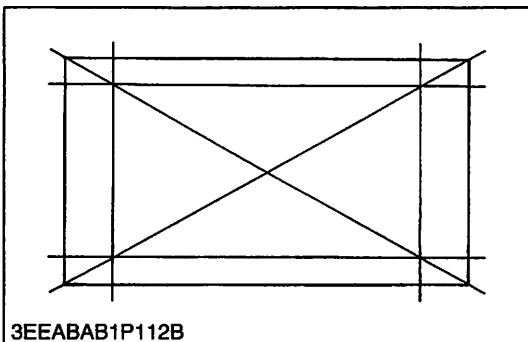
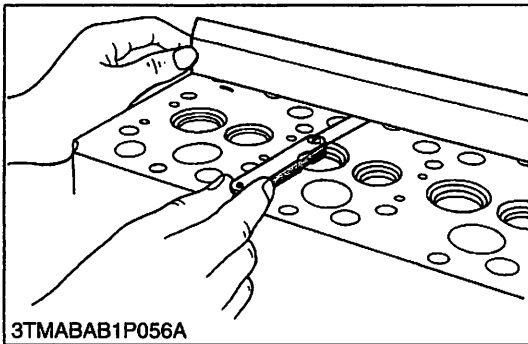
(1) Alignment Number

(2) Main Bearing Case Screw 1

W1021927

**(3) Servicing**

**(A) Cylinder Head and Valves**



**Cylinder Head Surface Flatness**

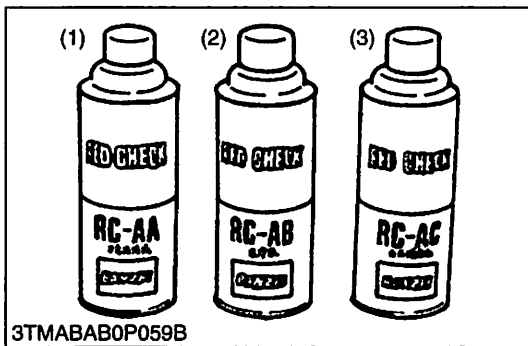
1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a feeler gauge.
4. If the measurement exceeds the allowable limit, correct it with a surface grinder.

**■ IMPORTANT**

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

Cylinder head surface flatness	Factory spec.	0.05 mm 0.0020 in.
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W10277370

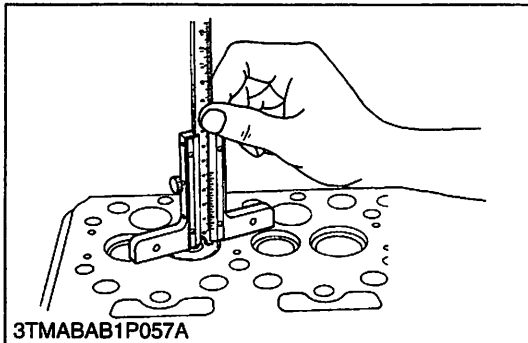


**Cylinder Head Flaw**

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

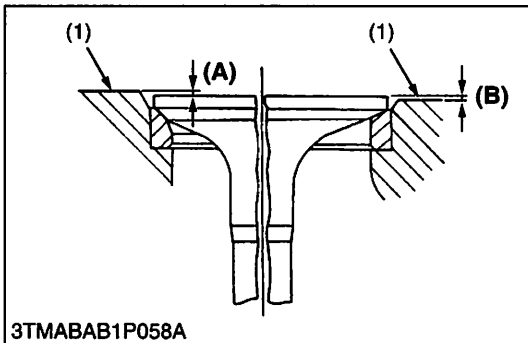
- (1) Red Permeative Liquid (3) White Developer  
 (2) Detergent

W10765420



**Valve Recessing**

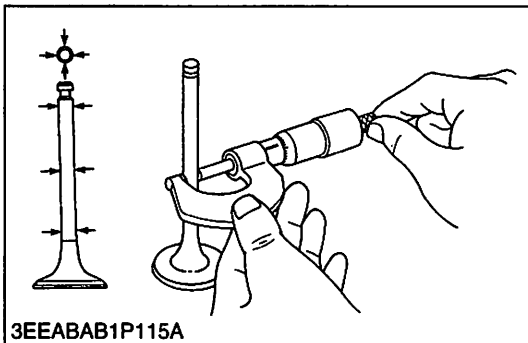
1. Clean the cylinder head surface, valve face and valve seat.
2. Insert the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measurement exceeds the allowable limit, replace the valve.
5. If it still exceeds the allowable limit after replacing the valve, correct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



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

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

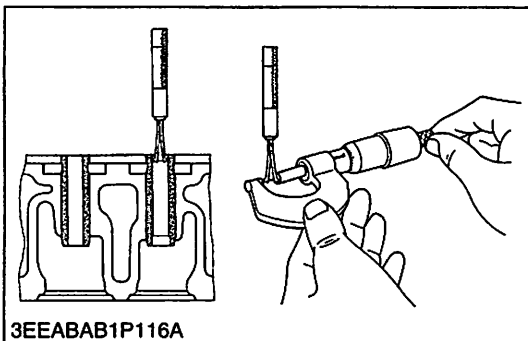
W10768800



**Clearance between Valve Stem and Valve Guide**

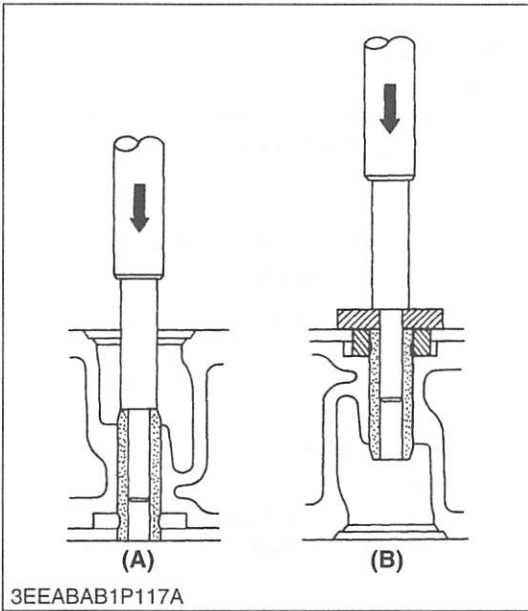
1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an outside micrometer.
3. Measure the valve guide I.D. with a small hole gauge, and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the valves. If it still exceeds the allowable limit,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

Clearance between valve stem and guide	Factory spec.	0.035 to 0.065 mm 0.00138 to 0.00256 in.
	Allowable limit	0.1 mm 0.0039 in.



Valve stem O.D.	Factory spec.	6.960 to 6.975 mm 0.27402 to 0.27461 in.
Valve guide I.D.	Factory spec.	7.010 to 7.025 mm 0.27598 to 0.27657 in.

W10774950



**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.	7.010 to 7.025 mm 0.27598 to 0.27657 in.
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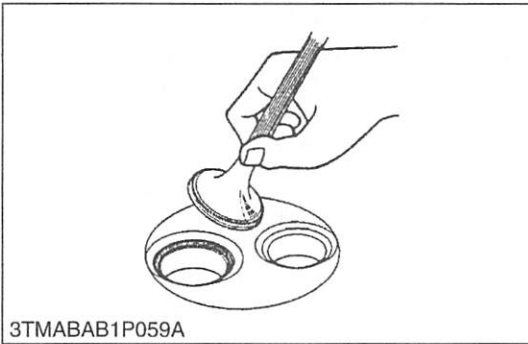
**■ IMPORTANT**

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

(A) When Removing

(B) When Installing

W10278890



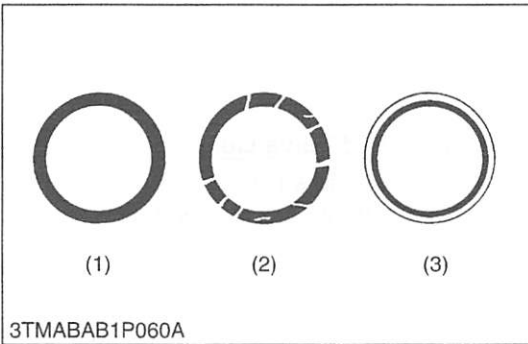
**Valve Seating**

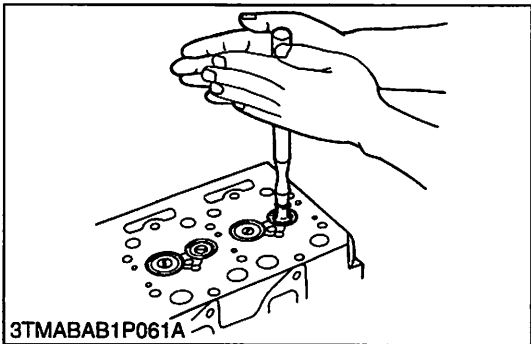
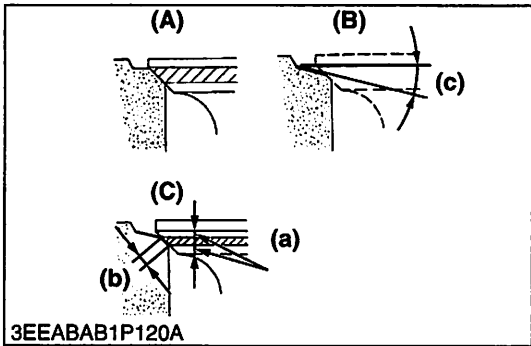
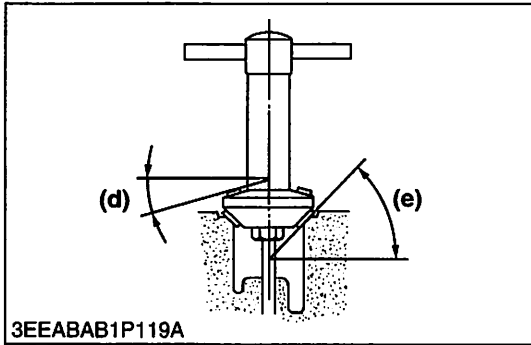
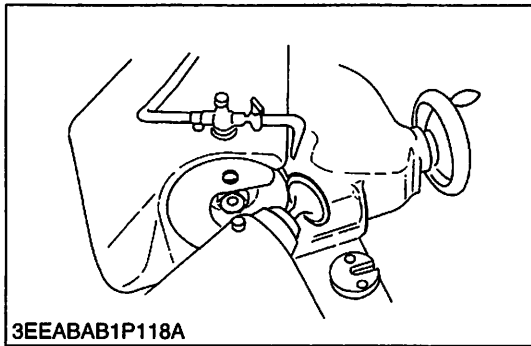
1. Coat the valve face lightly with prussian blue and put the valve on its seat to check the contact.
2. If the valve does not seat all the way around the valve seat or the valve contact is less than 70 %, correct the valve seating as follows.
3. If the valve contact does not comply with the reference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

- (1) Correct  
(2) Incorrect

(3) Incorrect

W10282190





**Correcting Valve and Valve Seat**

■ **NOTE**

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

1) **Correcting Valve**

1. Correct the valve with a valve refacer.

2) **Correcting Valve Seat**

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

- |  |                        |
|--|------------------------|
| (a) Identical Dimensions                   | (A) Check Correct      |
| (b) Valve Seat Width                       | (B) Correct Seat Width |
| (c) 0.523 rad. (30 °) or 0.262 rad. (15 °) | (C) Check Contact      |
| (d) 0.262 rad. (15 °) or 0.523 rad. (30 °) |                        |
| (e) 0.785 rad. (45 °) or 1.047 rad. (60 °) |                        |

W10283500

**Valve Lapping**

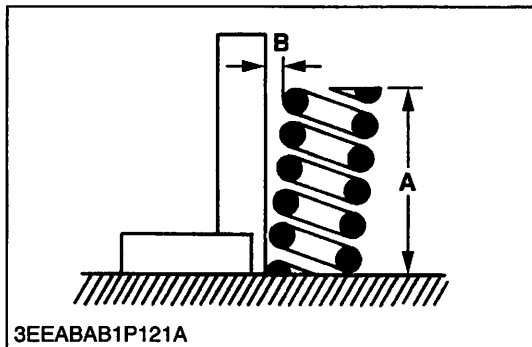
1. Apply compound evenly to the valve lapping surface.
2. Insert the valve into the valve guide. Lap the valve onto its seat with a valve flapper or screwdriver.
3. After lapping the valve, wash the compound away and apply oil, then repeat valve lapping with oil.
4. Apply prussian blue to the contact 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.

W10288140





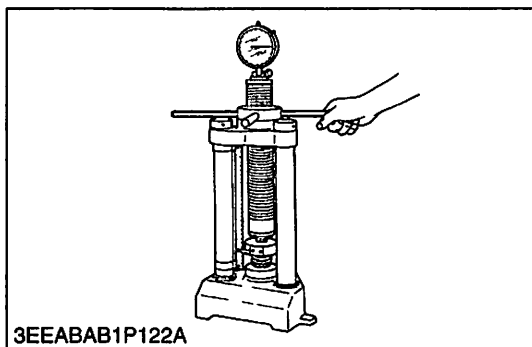
**Free Length and Tilt of Valve Spring**

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

Free length (A)	Factory spec.	37.0 to 37.5 mm 1.457 to 1.456 in.
	Allowable limit	36.5 mm 1.437 in.

Tilt (B)	Allowable limit	1.0 mm 0.039 in.
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W10289350

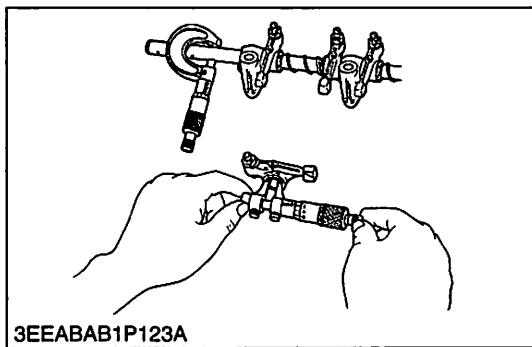


**Valve Spring Setting Load**

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

Setting load / Setting length	Factory spec.	117.6 N / 31.0 mm 12.0 kgf / 31.0 mm 26.4 lbs / 1.220 in.
	Allowable limit	100.0 N / 31.0 mm 10.2 kgf / 31.0 mm 22.5 lbs / 1.220 in.

W10784360



**Oil Clearance between Rocker Arm and Rocker Arm Shaft**

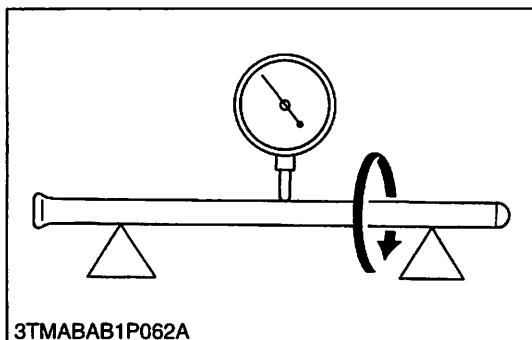
1. Measure the rocker arm shaft O.D. with an outside micrometer.
2. Measure the rocker arm I.D. with an inside micrometer, and then calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the rocker arm and measure the oil clearance again. If it still exceeds the allowable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

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

Rocker arm shaft O.D.	Factory spec.	11.973 to 11.984 mm 0.47138 to 0.47181 in.
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Rocker arm I.D.	Factory spec.	12.000 to 12.018 mm 0.47244 to 0.47315 in.
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W10291500

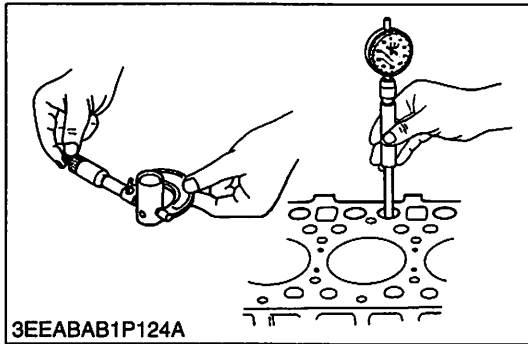


**Push Rod Alignment**

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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W10292900



**Oil Clearance between Tappet and Tappet Guide Bore**

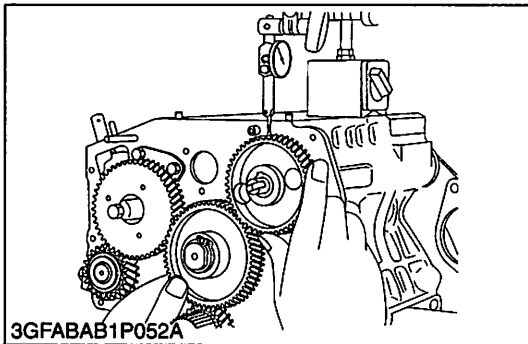
1. Measure the tappet O.D. with an outside micrometer.
2. Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

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.	19.959 to 19.980 mm 0.78579 to 0.78661 in.
Tappet guide bore I.D.	Factory spec.	20.000 to 20.021 mm 0.78740 to 0.78823 in.

W10293660

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



**Timing Gear Backlash**

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

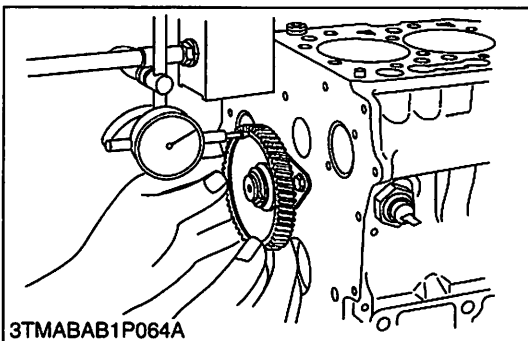
Backlash between idle gear and crank gear	Factory spec.	0.032 to 0.115 mm 0.00126 to 0.00453 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear and cam gear	Factory spec.	0.036 to 0.114 mm 0.00142 to 0.00449 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear and injection pump gear	Factory spec.	0.034 to 0.116 mm 0.00134 to 0.00457 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between injection pump gear and governor gear	Factory spec.	0.030 to 0.117 mm 0.00118 to 0.00461 in.
	Allowable limit	0.15 mm 0.0059 in.

W10280630

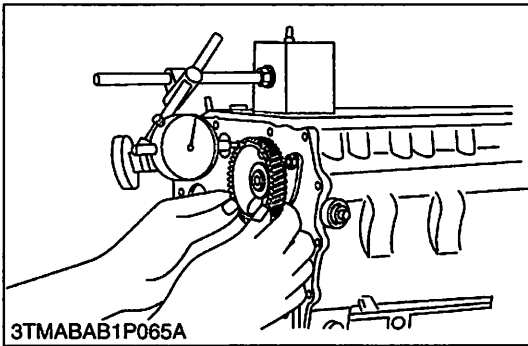


**Idle Gear Side Clearance**

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

Idle gear side clearance	Factory spec.	0.20 to 0.51 mm 0.0079 to 0.0200 in.
	Allowable limit	0.80 mm 0.0315 in.

W10285590

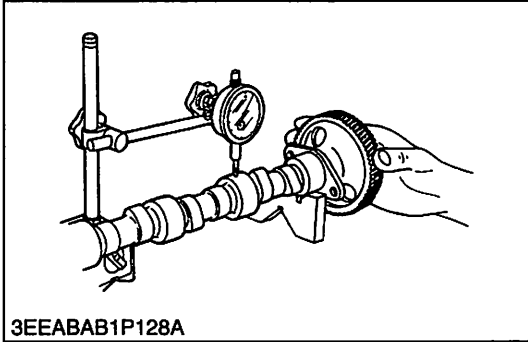


**Camshaft Side Clearance**

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

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

W10295630

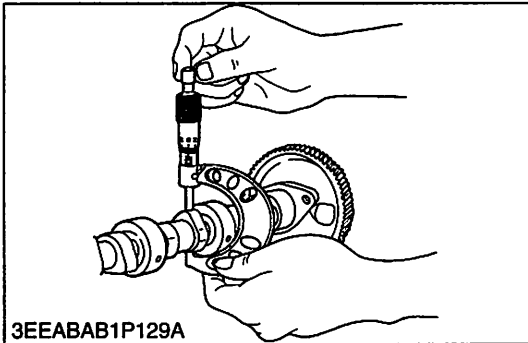


**Camshaft Alignment**

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

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.
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W10296710



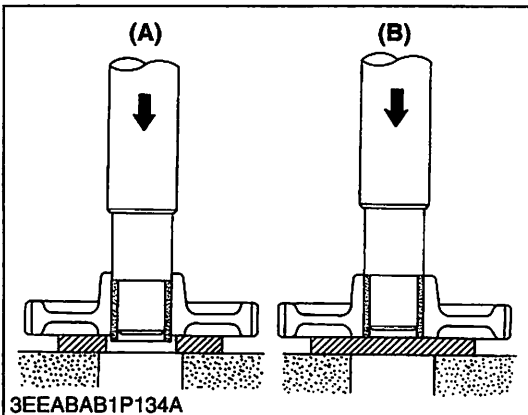
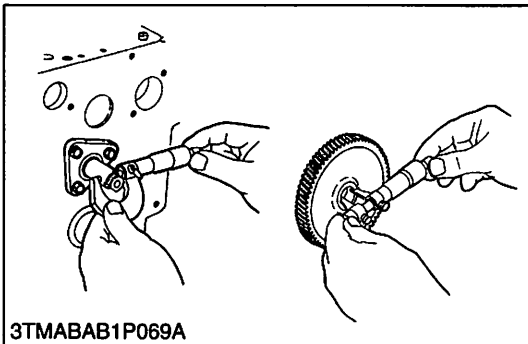
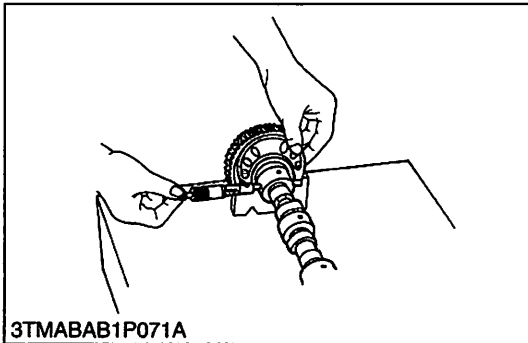
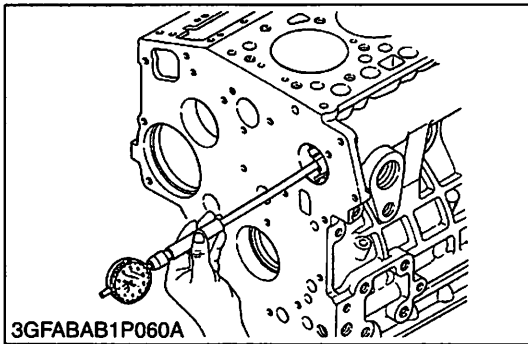
**Cam Height**

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

Cam height of intake	Factory spec.	28.80 mm 1.1339 in.
	Allowable limit	28.75 mm 1.1319 in.

Cam height of exhaust	Factory spec.	29.00 mm 1.1417 in.
	Allowable limit	28.95 mm 1.1398 in.

W10297880



**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.	35.934 to 35.950 mm 1.41472 to 1.41535 in.
Cylinder block bore I.D.	Factory spec.	36.000 to 36.025 mm 1.41732 to 1.41831 in.

W10299330

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

Oil clearance between idle gear shaft and idle gear bushing	Factory spec.	0.020 to 0.054 mm 0.00079 to 0.00213 in.
	Allowable limit	0.10 mm 0.0039 in.

Idle gear shaft O.D.	Factory spec.	25.967 to 25.980 mm 1.02232 to 1.02283 in.
Idle gear bushing I.D.	Factory spec.	26.000 to 26.021 mm 1.02362 to 1.02445 in.

W10301050

**Replacing Idle Gear Bushing**

**(When removing)**

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

**(When installing)**

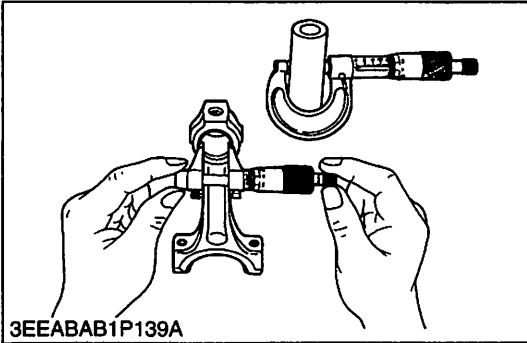
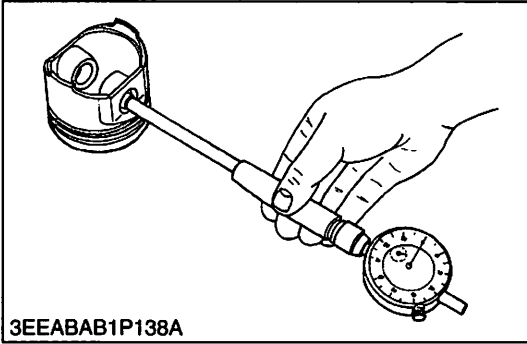
1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Press in a new bushing using an idle gear bushing replacing tool, until it is flush with the end of the idle gear.

(A) When Removing

(B) When Installing

W10302410

**(C) Piston and Connecting Rod**



**Piston Pin Bore I.D.**

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

Piston pin bore I.D.	Factory spec.	22.000 to 22.013 mm 0.86614 to 0.86665 in.
	Allowable limit	22.05 mm 0.8681 in.

W10304770

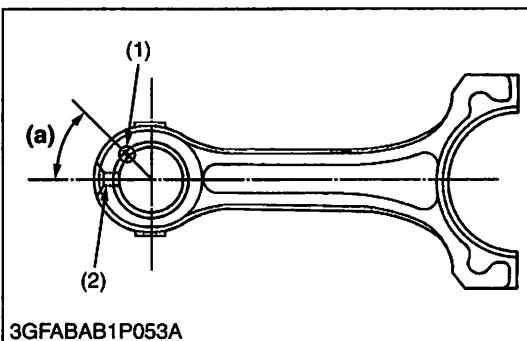
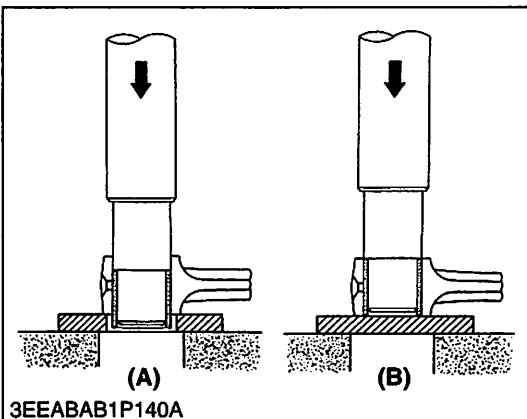
**Oil Clearance between Piston Pin and Small End Bushing**

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.	22.002 to 22.011 mm 0.86622 to 0.86657 in.
Small end bushing I.D.	Factory spec.	22.025 to 22.040 mm 0.86713 to 0.86771 in.

W10305740



**Replacing Small End Bushing**

**(When removing)**

1. Press out the used bushing using a small end bushing replacing tool.

**(When installing)**

1. Clean a new small end bushing and bore, and apply engine oil to them.
2. Insert a new bushing onto the tool and press-fit with a press so that the seam (1) of bushing positions as shown in the figure, until it is flush with the connecting rod.
3. Drill a hole to the bushing with aligning the oil hole (2) of connecting rod using 4.0 mm dia. (0.157 in. dia.) drill.

**NOTE**

- Be sure to chamfer the oil hole circumference with an oil stone.

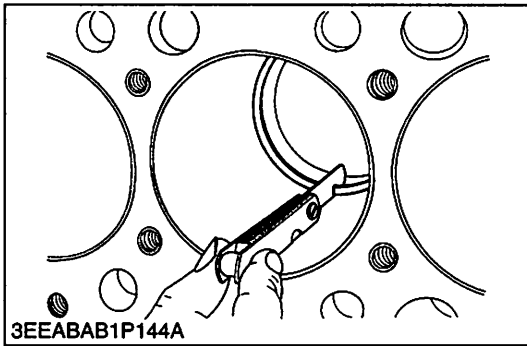
Oil clearance between piston pin and small end bushing (Spare parts)	Factory spec.	0.015 to 0.075 mm 0.00059 to 0.00295 in.
	Allowable limit	0.15 mm 0.0059 in.

Small end bushing I.D. (Spare parts)	Factory spec.	22.026 to 22.077 mm 0.86716 to 0.86917 in.
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- (1) Seam
- (2) Oil Hole

- (A) When Removing
- (B) When Installing
- (a) 0.79 rad. (45 °)

W10307120

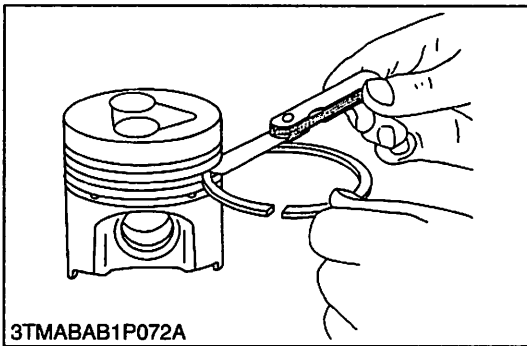


**Piston Ring Gap**

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

Piston ring gap	Top ring	Second ring	Factory spec.	0.25 to 0.40 mm 0.0098 to 0.0157 in.
			Allowable limit	1.25 mm 0.0492 in.
	Oil ring	Factory spec.	0.25 to 0.45 mm 0.0098 to 0.0177 in.	
		Allowable limit	1.25 mm 0.0492 in.	

W10310120

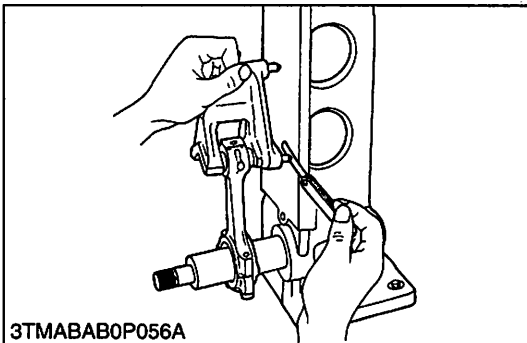


**Clearance between Piston ring and Piston Ring Groove**

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

Clearance between piston ring and piston ring groove	Second ring	Factory spec.	0.085 to 0.112 mm 0.00335 to 0.00441 in.
		Allowable limit	0.20 mm 0.0079 in.
	Oil ring	Factory spec.	0.020 to 0.055 mm 0.00079 to 0.00217 in.
		Allowable limit	0.15 mm 0.0059 in.

W10312390



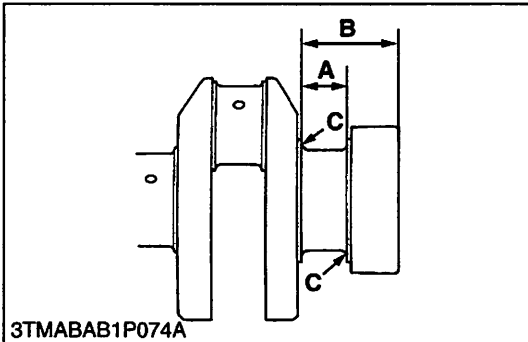
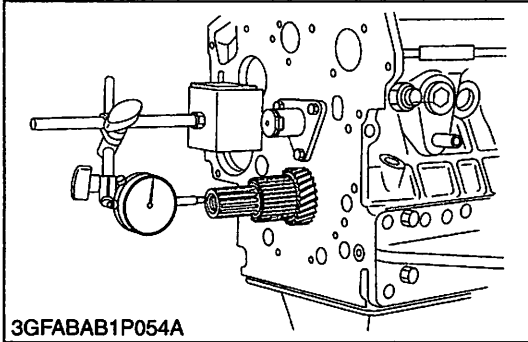
**Connecting Rod Alignment**

1. Remove the crankpin bearing, and install the connecting rod cap.
2. Install the piston pin in the connecting rod.
3. Install the connecting rod on the connecting rod alignment tool (Code No. 07909-31661).
4. Put a gauge over the piston pin, and move it against the face plate.
5. If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and the face plate.
6. If the measurement exceeds the allowable limit, replace the connecting rod.

Space between gauge pin and face plate	Allowable limit	0.05 mm 0.0020 in.
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W10314620

**(D) Crankshaft**



**Crankshaft Side Clearance**

1. Set a dial indicator with its tip on the end of the crankshaft.
2. Measure the side clearance by moving the crankshaft to the front and rear.
3. If the measurement exceeds the allowable limit, replace the thrust bearings.
4. If the same size bearing is useless because of the crankshaft journal wear, replace it with an oversize one referring to the table and figure.

Crankshaft side clearance	Factory spec.	0.15 to 0.31 mm 0.0059 to 0.0122 in.
	Allowable limit	0.50 mm 0.0197 in.

**(Reference)**

- Oversize thrust bearing

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

- Oversize dimensions of crankshaft journal

Oversize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	28.20 to 28.25 mm 1.1102 to 1.1122 in.	28.40 to 28.45 mm 1.1181 to 1.1201 in.
Dimension B	51.5 to 51.7 mm 2.028 to 2.035 in.	51.6 to 51.8 mm 2.031 to 2.039 in.
Dimension C	2.3 to 2.7 mm radius 0.091 to 0.106 in. radius	2.3 to 3.7 mm radius 0.091 to 0.106 in. radius

(0.8-S)

The crankshaft journal must be fine-finished to higher than VVVV

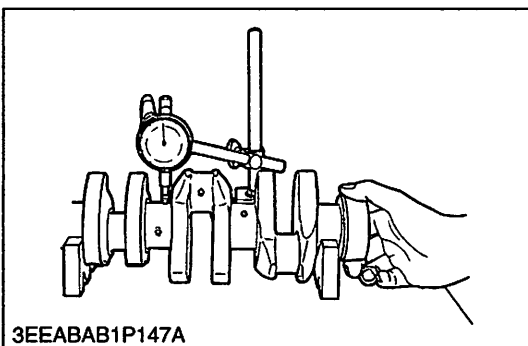
W10317070

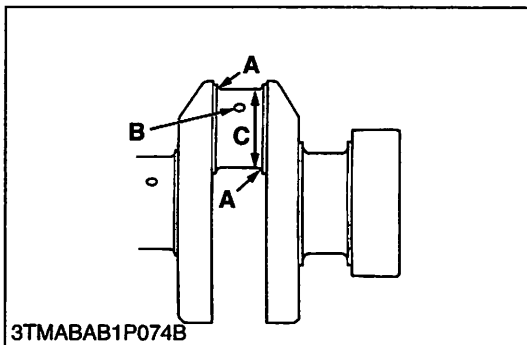
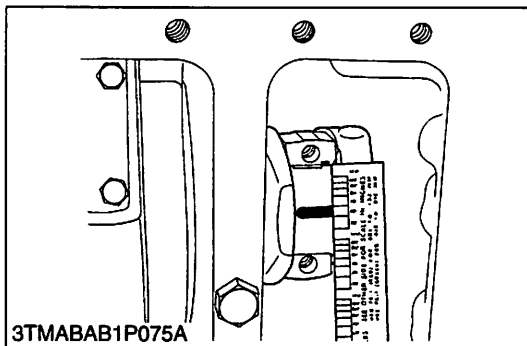
**Crankshaft Alignment**

1. Support the crankshaft 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 crankshaft alignment.
4. If the measurement exceeds the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.0008 in.
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W10330010





**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.
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.	0.029 to 0.091 mm 0.00114 to 0.00358 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankpin O.D.	Factory spec.	39.959 to 39.975 mm 1.57319 to 1.57382 in.
Crankpin bearing I.D.	Factory spec.	40.004 to 40.050 mm 1.57496 to 1.57677 in.

**(Reference)**

- Undersize crankpin bearing

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankpin bearing 02	16241-22970	020 US
0.4 mm 0.016 in.	Crankpin bearing 04	16241-22980	040 US

- Undersize dimensions of crankpin

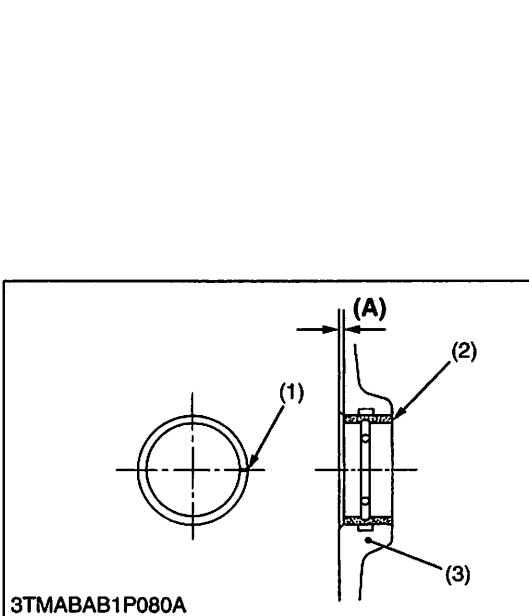
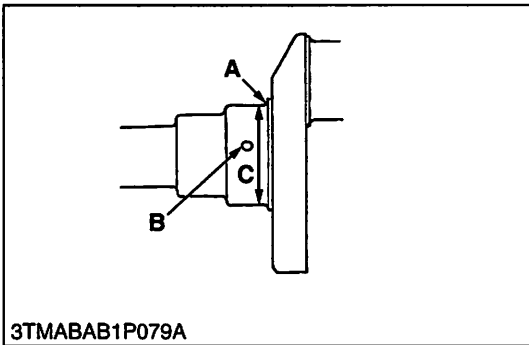
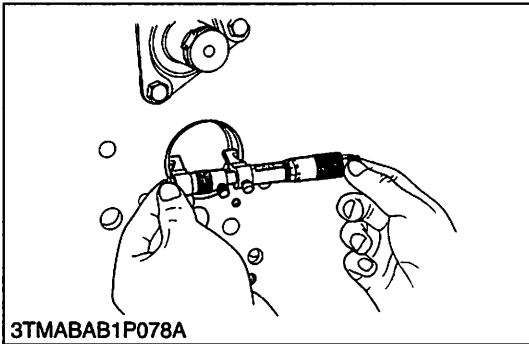
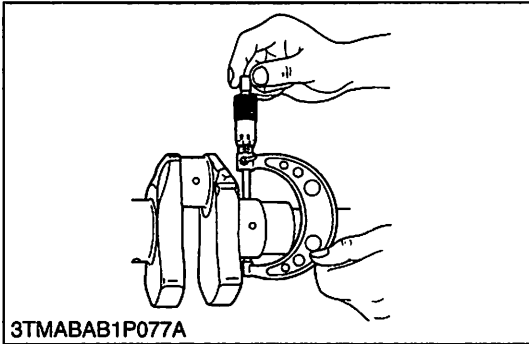
Undersize Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
	<b>A</b>	2.8 to 3.2 mm radius 0.1102 to 0.1260 in. radius
<b>B</b>	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius
<b>C</b>	39.759 to 39.775 mm 1.56531 to 1.56594 in.	39.559 to 39.575 mm 1.55744 to 1.55807 in.

(0.8-S)

The crankpin must be fine-finished to higher than ∇∇∇∇

W10331060





**Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1**

1. Measure the O.D. of the crankshaft front journal with an outside micrometer.
2. Measure the I.D. of the crankshaft bearing 1 with an inside micrometer, and calculate the 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.	0.034 to 0.114 mm 0.00134 to 0.00449 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D.	Factory spec.	47.934 to 47.950 mm 1.88716 to 1.88779 in.
Crankshaft bearing 1 I.D.	Factory spec.	47.984 to 48.048 mm 1.88913 to 1.89165 in.

**(Reference)**

- Undersize crankshaft bearing 1

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 1 02	16241-23910	020 US
0.4 mm 0.016 in.	Crankshaft bearing 1 04	16241-23920	040 US

- Undersize dimensions of crankshaft journal

Undersize Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
	<b>A</b>	2.3 to 2.7 mm radius 0.0906 to 0.1063 in. radius
<b>B</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
<b>C</b>	47.734 to 47.750 mm 1.87929 to 1.87992 in.	47.534 to 47.550 mm 1.87142 to 1.87204 in.
(0.8-S) The crankshaft journal must be fine-finished to higher than ∇∇∇∇		

W10337170

**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. (See figure.)

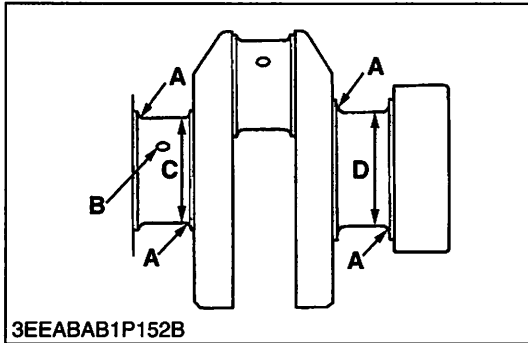
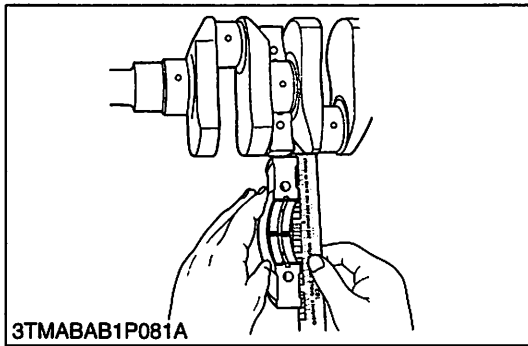
Dimension (A)	Factory spec.	0 to 0.3 mm 0 to 0.0118 in.
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(1) Seam

(3) Cylinder Block

(2) Crankshaft Bearing 1

W10339460



**Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2 (Crankshaft Bearing 3)**

1. Put a strip of plastigage (Code No. 07909-30241) on the center of the journal.
2. Install the bearing case and tighten the bearing case screws 1 to the specified torque, and remove the bearing case again.
3. Measure the amount of the flattening with the scale and get the oil clearance.
4. If the clearance exceeds the allowable limit, replace the crankshaft bearing 2 (crankshaft bearing 3).
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 journal and crankshaft bearing 2	Factory spec.	0.034 to 0.095 mm 0.00134 to 0.00374 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D. (Intermediate)	Factory spec.	47.934 to 47.950 mm 1.88716 to 1.88779 in.
Crankshaft bearing 2 I.D.	Factory spec.	47.984 to 48.029 mm 1.88913 to 1.89091 in.

Oil clearance between crankshaft journal and crankshaft bearing 3	Factory spec.	0.034 to 0.098 mm 0.00134 to 0.00386 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D. (Flywheel side)	Factory spec.	51.921 to 51.940 mm 2.04413 to 2.04488 in.
Crankshaft bearing 3 I.D.	Factory spec.	51.974 to 52.019 mm 2.04622 to 2.04799 in.

**(Reference)**

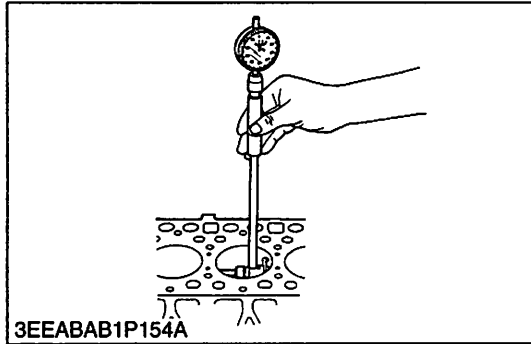
- Undersize crankshaft bearing 2 and 3

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 2 02	16241-23930	020 US
	Crankshaft bearing 3 02	16241-23860	020 US
0.4 mm 0.016 in.	Crankshaft bearing 2 04	16241-23940	040 US
	Crankshaft bearing 3 04	16241-23870	040 US

- Undersize dimensions of crankshaft journal

Dimension \ Undersize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
	<b>A</b>	2.3 to 2.7 mm radius 0.0906 to 0.1063 in. radius
<b>B</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
<b>C</b>	47.734 to 47.750 mm 1.87929 to 1.87992 in.	47.534 to 47.550 mm 1.87142 to 1.87204 in.
<b>D</b>	51.721 to 51.740 mm 2.03626 to 2.03700 in.	51.521 to 51.540 mm 2.02838 to 2.02913 in.
(0.8-S) The crankshaft journal must be fine-finished to higher than ∇∇∇∇		

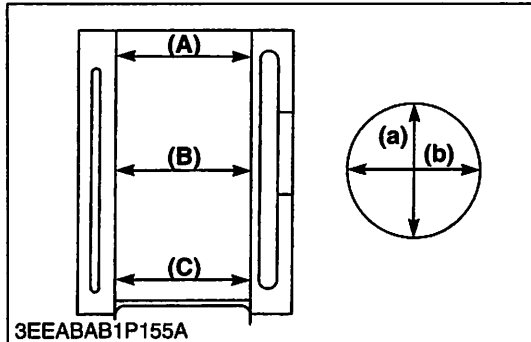
**(E) Cylinder**



**Cylinder Wear**

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

Cylinder liner I.D.	Factory spec.	72.000 to 72.019 mm 2.83464 to 2.83539 in.
	Allowable limit	72.169 mm 2.84129 in.



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

W10343890

**Correcting Cylinder**

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

Oversized cylinder liner I.D.	Factory spec.	72.500 to 72.519 mm 2.85433 to 2.85507 in.
	Allowable limit	72.669 mm 2.86098 in.
Finishing	Hone to 1.2 to 2.0 mm $\mu$ R max. ▽▽▽ (0.000047 to 0.000079 in. $\mu$ R max.)	

2. Replace the piston and piston rings with oversize ones.

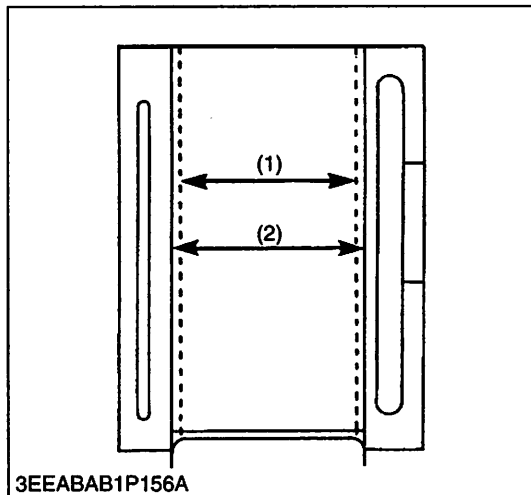
Oversize	Part Name	Code Number	Marking
0.5 mm	Piston 05	16221-21910	05 OS
0.0197 in.	Piston ring 05 assembly	15901-21090	05 OS

**NOTE**

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

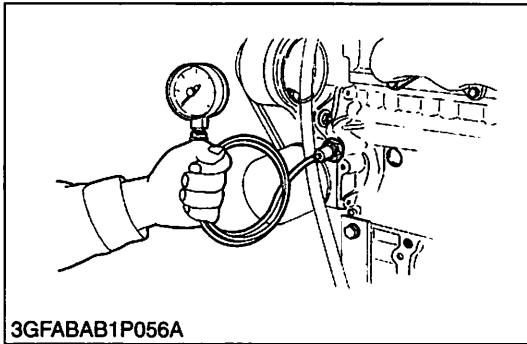
(1) Cylinder I.D. (Before Correction)      (2) Oversize Cylinder I.D.

W10344480



### [3] LUBRICATING SYSTEM

#### (1) Checking



#### Engine Oil Pressure

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

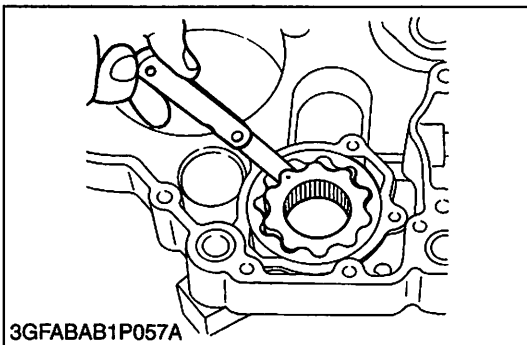
Engine oil pressure	At idle speed	Factory spec.	More than 49 kPa 0.5 kgf/cm <sup>2</sup> 7 psi
	At rated speed	Factory spec.	196 to 441 kPa 2.0 to 4.5 kgf/cm <sup>2</sup> 36 to 64 psi
		Allowable limit	147 kPa 1.5 kgf/cm <sup>2</sup> 27 psi

#### (When reassembling)

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

W10349520

#### (2) Servicing

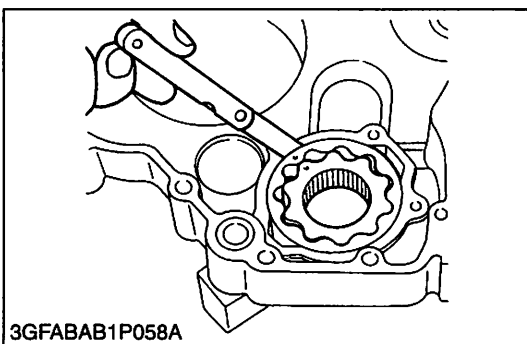


#### Rotor Lobe Clearance

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

Rotor lobe clearance	Factory spec.	0.06 to 0.18 mm 0.0024 to 0.0071 in.
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W10355630

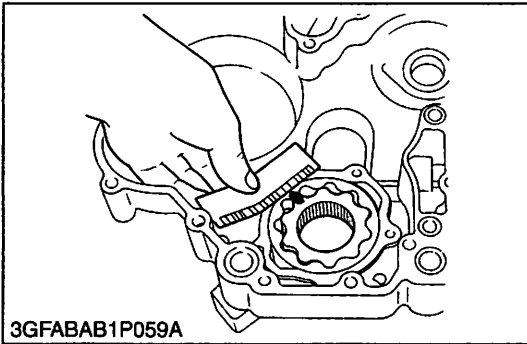


#### Clearance between Outer Rotor and Pump Body

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

Clearance between outer rotor and pump body	Factory spec.	0.10 to 0.18 mm 0.0039 to 0.0071 in.
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**Clearance between Rotor and Cover**

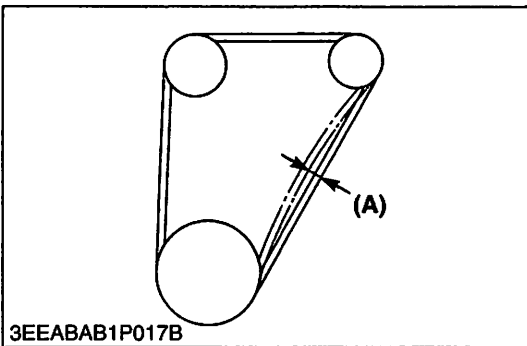
1. Put a strip of plastigage (Code No. 07909-30241) onto the rotor face with grease.
2. Install the cover and tighten the screws.
3. Remove the cover carefully, and measure the amount of the flattening with the scale and get the clearance.
4. If the clearance exceeds the factory specifications, replace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

Clearance between rotor and cover	Factory spec.	0.030 to 0.085 mm 0.00118 to 0.00335 in.
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**[4] COOLING SYSTEM**

**(1) Checking and Adjusting**

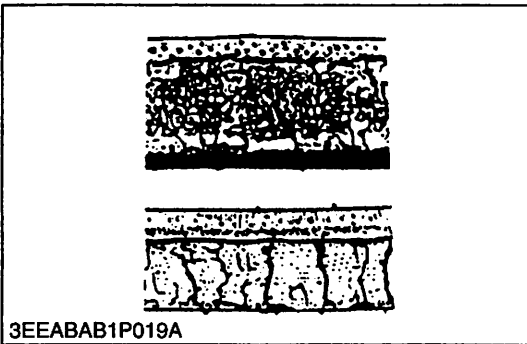


**Fan Belt Tension**

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

Deflection (A)	Factory spec.	7 to 9 mm 0.28 to 0.35 in.
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W10356670



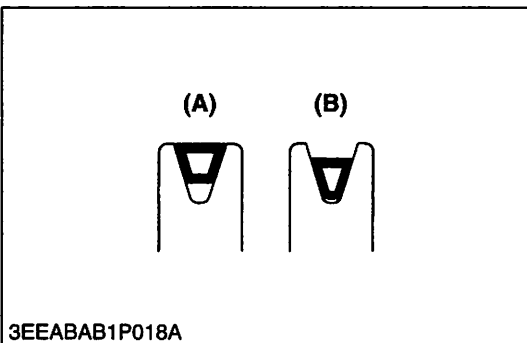
**Fan Belt Damage and Wear**

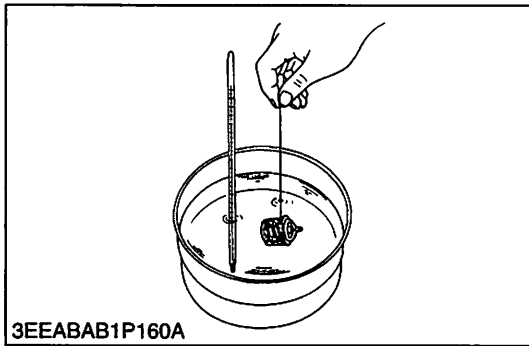
1. Check the fan belt for damage.
2. If the fan belt is damaged, replace it.
3. Check if the fan belt is worn and sunk in the pulley groove.
4. If the fan belt is nearly worn out and deeply sunk in the pulley groove, replace it.

(A) Good

(B) Bad

W10357580





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**Thermostat Valve Opening Temperature**

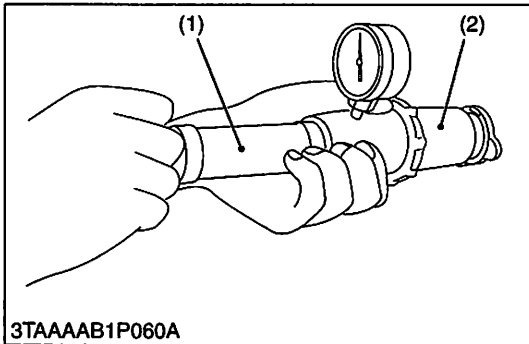
1. Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
2. Heating the water gradually, read the temperature when the valve opens and leaves the string.
3. Continue heating and read the temperature when the valve opens approx. 6 mm (0.236 in.).
4. If the measurement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

Thermostat's valve opening temperature	Factory spec.	80.5 to 83.5 °C 176.9 to 182.3 °F
Temperature at which thermostat completely opens	Factory spec.	95 °C 203 °F

W10358490

**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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**Radiator Cap Air Leakage**

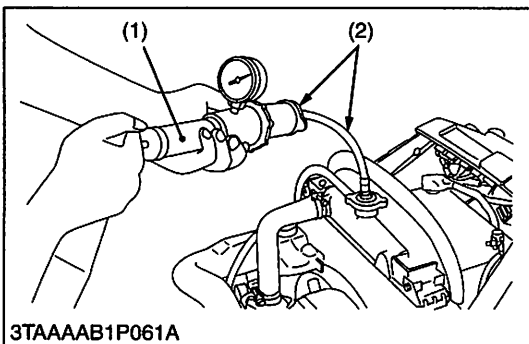
1. Set a radiator tester (1) and adaptor (2) (BANZAI Code No.: RCT-2A-30S) on the radiator cap.
2. Apply the specified pressure (88 kPa, 0.9 kgf/cm<sup>2</sup>, 13 psi), and measure the time for the pressure to fall to 59 kPa (0.6 kgf/cm<sup>2</sup>, 9 psi).
3. If the measurement is less than the factory 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)
-----------------------	---------------	---

(1) Radiator Tester

(2) Adaptor

W10360900



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**Radiator Water Leakage**

1. Pour a specified amount of water into the radiator.
2. Set a radiator tester (1) (Code No. 07909-31551) and an adaptor (2) (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, repair with the radiator cement. When water leak is excessive, replace the radiator.

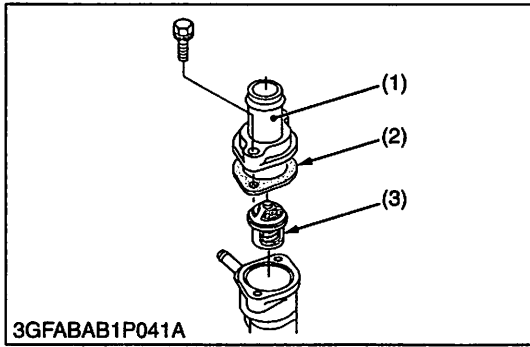
Radiator water leakage test pressure	Factory spec.	137 kPa 1.4 kgf/cm <sup>2</sup> 20 psi
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(1) Radiator Tester

(2) Adaptor

W10361840

**(2) Disassembling and Assembling**



**Thermostat Assembly**

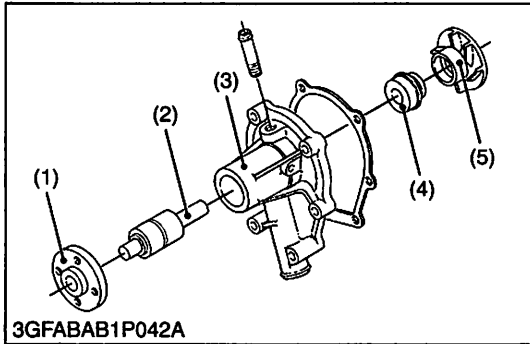
1. Remove the thermostat cover mounting screws, and remove the thermostat cover (1).
2. Remove the thermostat assembly (3).

**(When reassembling)**

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

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

W10363950



**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.
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.

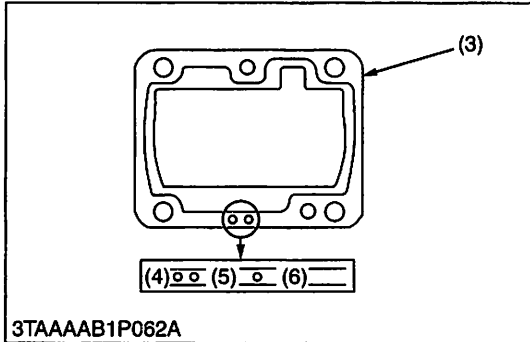
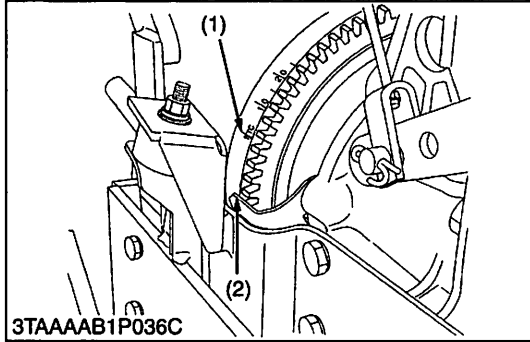
- |                       |                     |
|-----------------------|---------------------|
| (1) Water Pump Flange | (4) Mechanical Seal |
| (2) Water Pump Shaft  | (5) Impeller        |
| (3) Water Pump Body   |                     |

W10365080

## [5] FUEL SYSTEM

### (1) Checking and Adjusting

#### (A) Injection Pump



#### Injection Timing

1. Remove the injection pipes.
2. Remove the engine stop solenoid.
3. Turn the flywheel counterclockwise (facing the flywheel) until fuel flows from the delivery valve holder.
4. Continue to turn the flywheel slowly, and stop it as soon as the fuel level at the tip of the delivery valve holder begins to increase.
5. Check to see if the timing angle lines on the flywheel is aligned with the alignment mark (2).
6. If the injection timing is out of adjustment, readjust the timing with shims.

Injection timing	Factory spec.	0.37 to 0.40 rad. (21 to 23 °) before T.D.C.
------------------	---------------	--

#### NOTE

- The sealant is applied to both sides of the shim (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.
- Addition or reduction of shim (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad. (0.5 °).
- In disassembling and replacing the injection pump, be sure to use the same number of new shims with the same thickness.
- Refer to figure below to check the thickness of the shims.

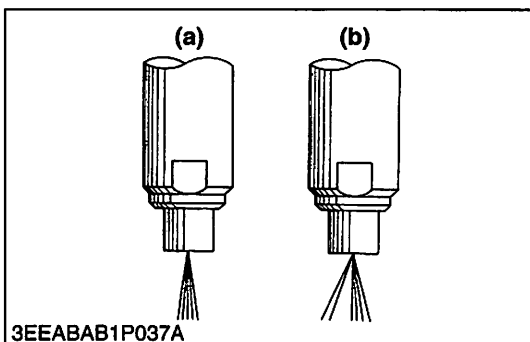
- |                                   |   |
|-----------------------------------|---|
| (1) Timing Line                   | (4) Two-holes : 0.20 mm (0.0079 in.)    |
| (2) Alignment Mark                | (5) One-hole : 0.25 mm (0.0098 in.)     |
| (3) Shim (Soft Metal Gasket Shim) | (6) Without hole : 0.30 mm (0.0118 in.) |

W10369450

#### (B) Injection Nozzle

#### 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.



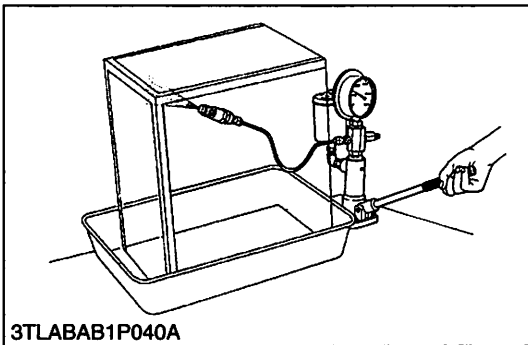
#### Nozzle Spraying Condition

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

- |          |         |
|----------|---------|
| (a) Good | (b) Bad |
|----------|---------|

W10411400





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**Fuel Injection Pressure**

1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
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.

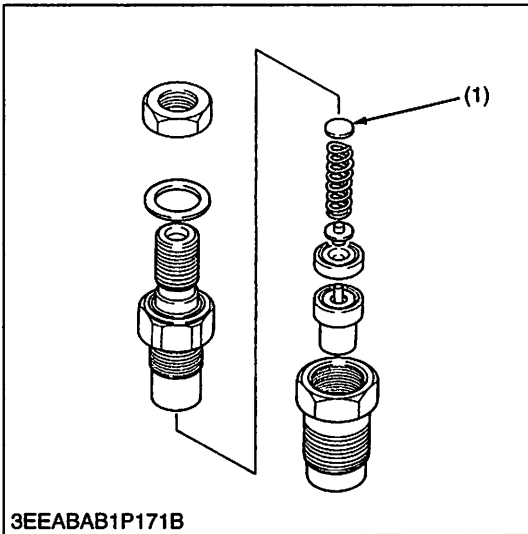
Fuel injection pressure	Factory spec.	13.71 to 14.71 MPa 140 to 150 kgf/cm <sup>2</sup> 1990 to 2130 psi
-------------------------	---------------	--

**(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

W10408820



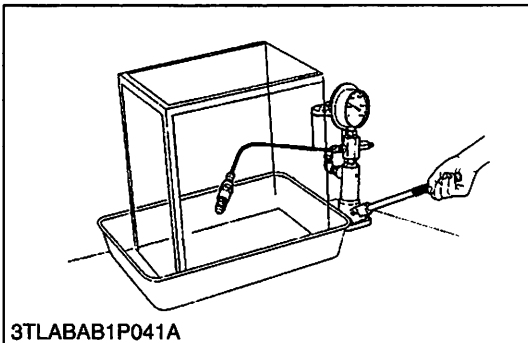
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**Valve Seat Tightness**

1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Raise the fuel pressure, and keep at 12.7 MPa (130 kgf/cm<sup>2</sup>, 1850 psi) for 10 seconds.
3. If any fuel leak is found, replace the nozzle piece.

Valve seat tightness	Factory spec.	No fuel leak at 12.7 MPa 130 kgf/cm <sup>2</sup> 1850 psi
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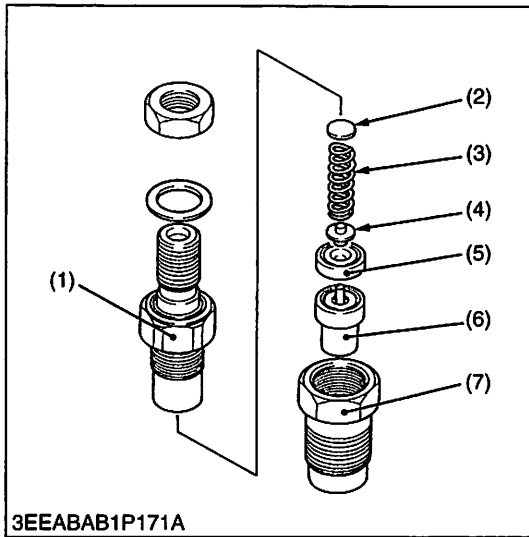
W10412730



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**(2) Disassembling and Assembling**

**(A) Injection Nozzle**



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**Nozzle Holder**

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

**(When reassembling)**

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

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

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

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

W10415210

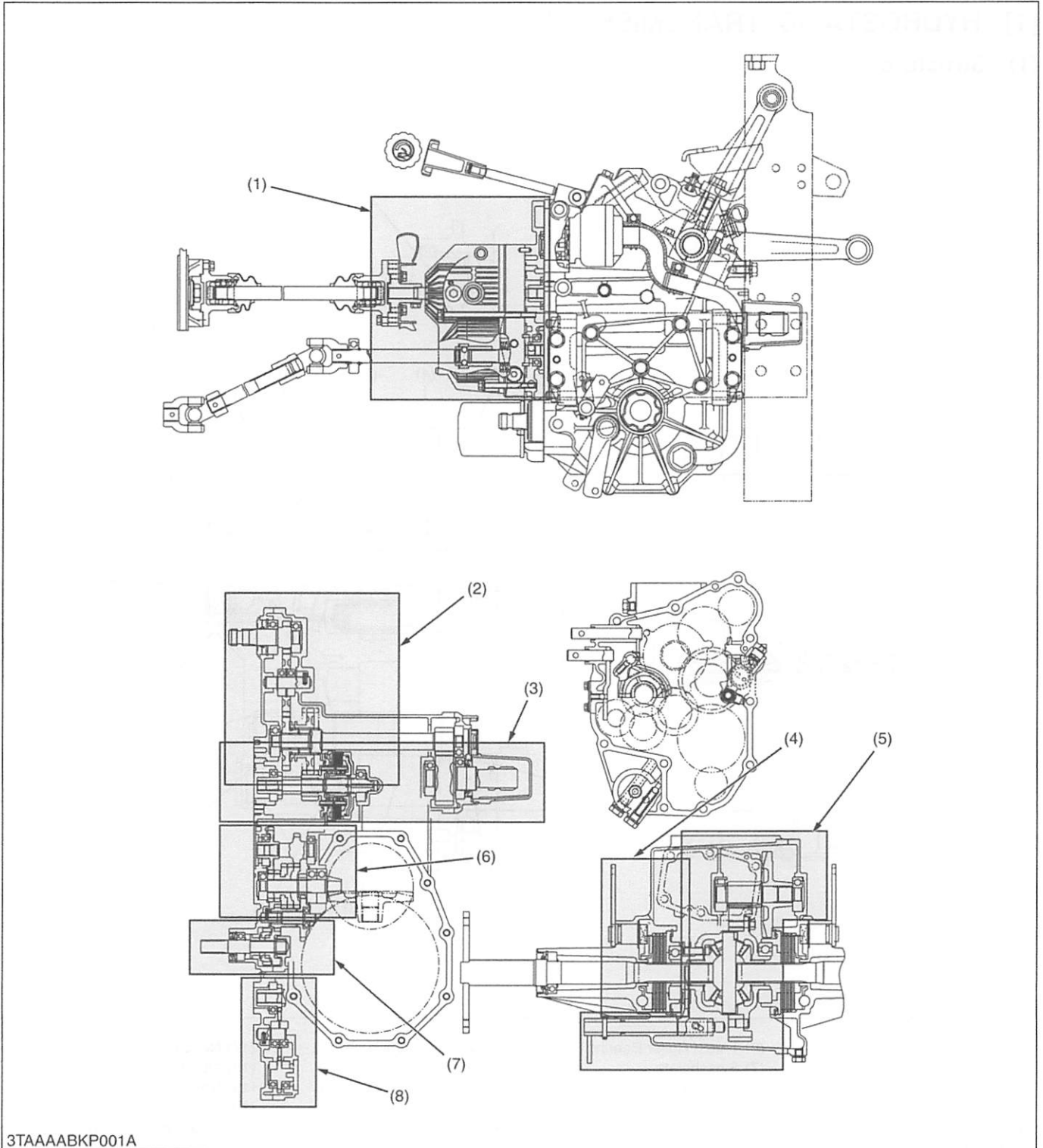
# 2 TRANSAXLE

# MECHANISM

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# 1. STRUCTURE



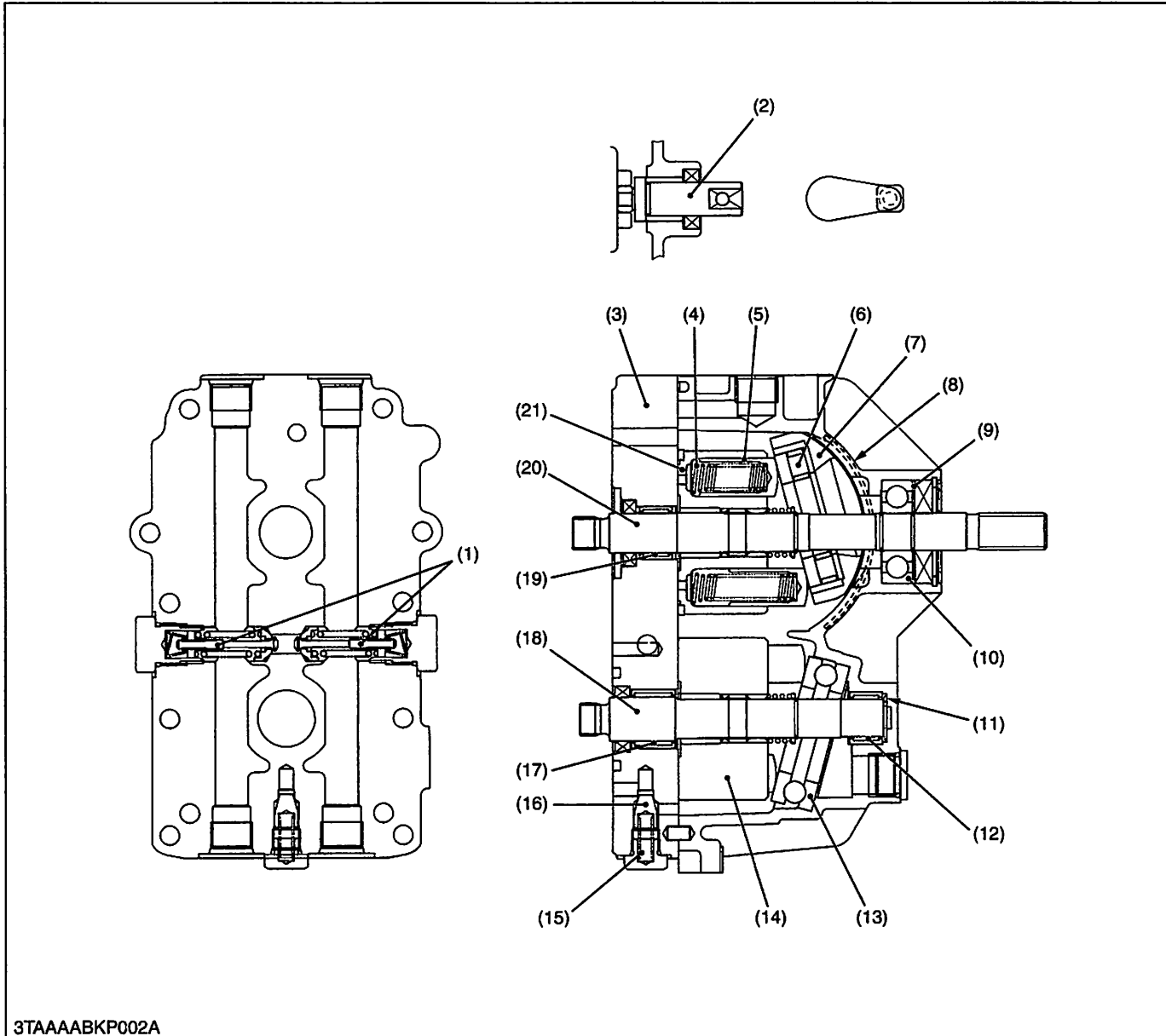
3TAAAABKP001A

- (1) Hydrostatic Transmission
- (2) Mid-PTO Section
- (3) Rear PTO Section
- (4) Brake Section
- (5) Differential Gear Section
- (6) Range Gear Shift Section
- (7) Front Wheel Drive Gear Section
- (8) Hydraulic Pump Drive Gear Section

## 2. TRAVELLING SYSTEM

### [1] HYDROSTATIC TRANSMISSION

#### (1) Structure

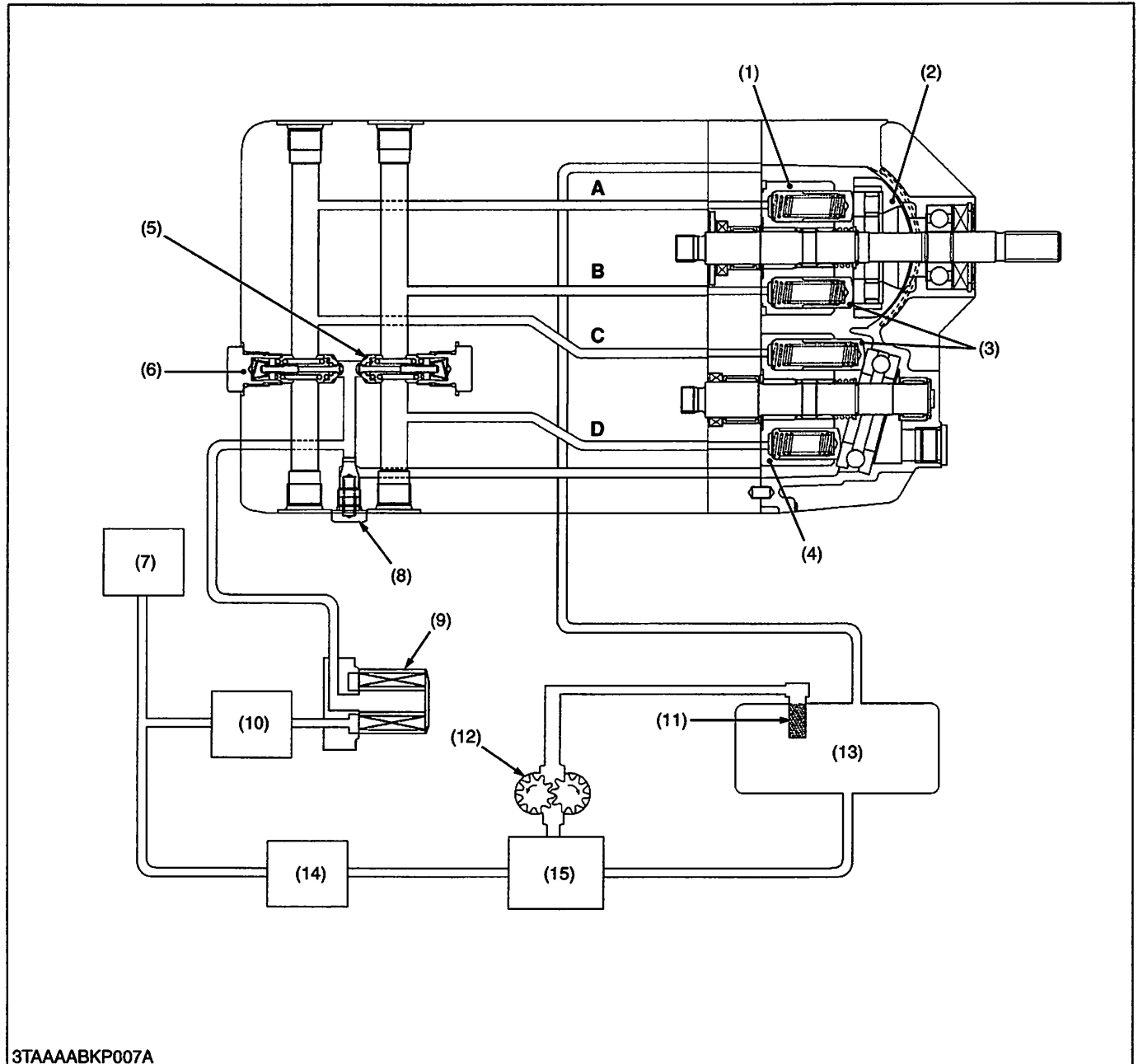


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- |  |                           |                             |                            |
|--|---------------------------|-----------------------------|----------------------------|
| (1) Check and High Pressure Relief Valve | (6) Thrust Roller Bearing | (12) Needle Bearing         | (17) Needle Bearing        |
| (2) Trunnion Arm                         | (7) Swashplate            | (13) Thrust Ball Bearing    | (18) Motor Shaft           |
| (3) Center Section                       | (8) Cradle Bearing        | (14) Cylinder Block (Motor) | (19) Needle Bearing        |
| (4) Piston Spring                        | (9) Spacer                | (15) Charge Relief Spring   | (20) Pump Shaft            |
| (5) Piston                               | (10) Ball Bearing         | (16) Charge Relief Valve    | (21) Cylinder Block (Pump) |
|  | (11) Thrust Washer        |                             |                            |

The hydrostatic transmission consists of variable displacement piston pump, fixed displacement piston motor and valve system.

(2) Oil Flow



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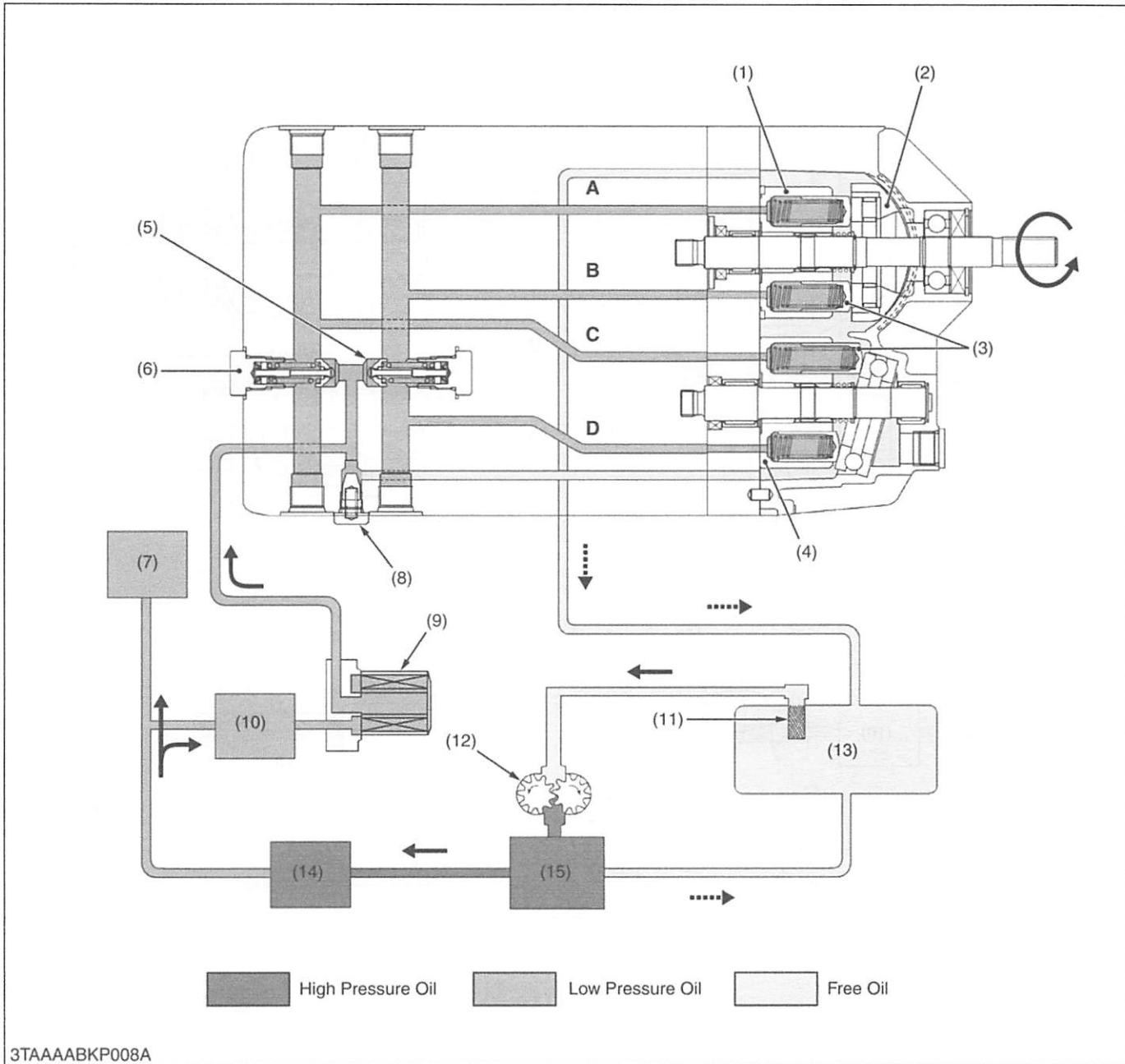
- |  |  |  |                   |
|--|--|--|-------------------|
| (1) Cylinder Block (Pump)                          | (6) Check and High Pressure Relief Valve (Forward) | (11) Oil Strainer                                  | <b>A : A Port</b> |
| (2) Swashplate                                     | (7) PTO Clutch Valve                               | (12) Hydraulic Pump                                | <b>B : B Port</b> |
| (3) Piston   | (8) Charge Relief Valve                            | (13) Transmission Case                             | <b>C : C Port</b> |
| (4) Cylinder Block (Motor)                         | (9) Oil Filter Cartridge                           | (14) Power Steering                                | <b>D : D Port</b> |
| (5) Check and High Pressure Relief Valve (Reverse) | (10) PTO Relief Valve                              | (15) Flow Priority Valve (Hydraulic Control Valve) |                   |

The pump and motor 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. Then oil in the main oil circuit of the HST needs to be supplied a want.

The oil from the power steering circuit flows into the HST for charging.

The charge oil aids smooth operation of pistons for pump and motor. The charge oil passes through the oil filter cartridge to charge relief valve port. The rest of oil passes through the charge relief valve into the HST housing. And overflow oil from HST housing return to the transmission case.

■ Neutral



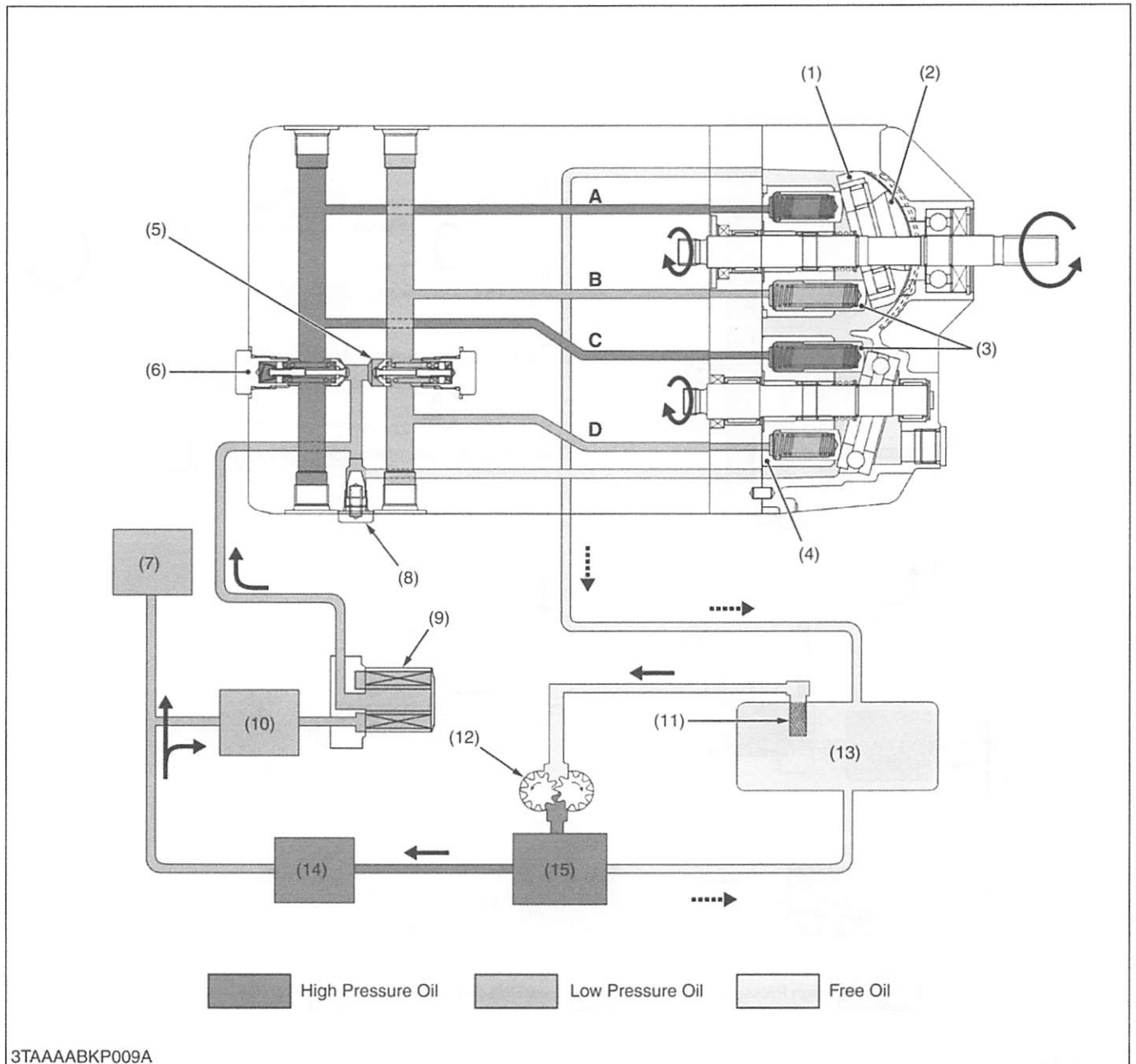
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- |  |  |  |                   |
|--|--|--|-------------------|
| (1) Cylinder Block (Pump)                          | (6) Check and High Pressure Relief Valve (Forward) | (11) Oil Strainer                                  | <b>A : A Port</b> |
| (2) Swashplate                                     | (7) PTO Clutch Valve                               | (12) Hydraulic Pump                                | <b>B : B Port</b> |
| (3) Piston   | (8) Charge Relief Valve                            | (13) Transmission Case                             | <b>C : C Port</b> |
| (4) Cylinder Block (Motor)                         | (9) Oil Filter Cartridge                           | (14) Power Steering                                | <b>D : D Port</b> |
| (5) Check and High Pressure Relief Valve (Reverse) | (10) PTO Relief Valve                              | (15) Flow Priority Valve (Hydraulic Control Valve) |                   |

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



■ Forward



3TAAAABKP009A

- |  |  |  |                   |
|--|--|--|-------------------|
| (1) Cylinder Block (Pump)                          | (6) Check and High Pressure Relief Valve (Forward) | (11) Oil Strainer                                  | <b>A : A Port</b> |
| (2) Swashplate                                     | (7) PTO Clutch Valve                               | (12) Hydraulic Pump                                | <b>B : B Port</b> |
| (3) Piston   | (8) Charge Relief Valve                            | (13) Transmission Case                             | <b>C : C Port</b> |
| (4) Cylinder Block (Motor)                         | (9) Oil Filter Cartridge                           | (14) Power Steering                                | <b>D : D Port</b> |
| (5) Check and High Pressure Relief Valve (Reverse) | (10) PTO Relief Valve                              | (15) Flow Priority Valve (Hydraulic Control Valve) |                   |

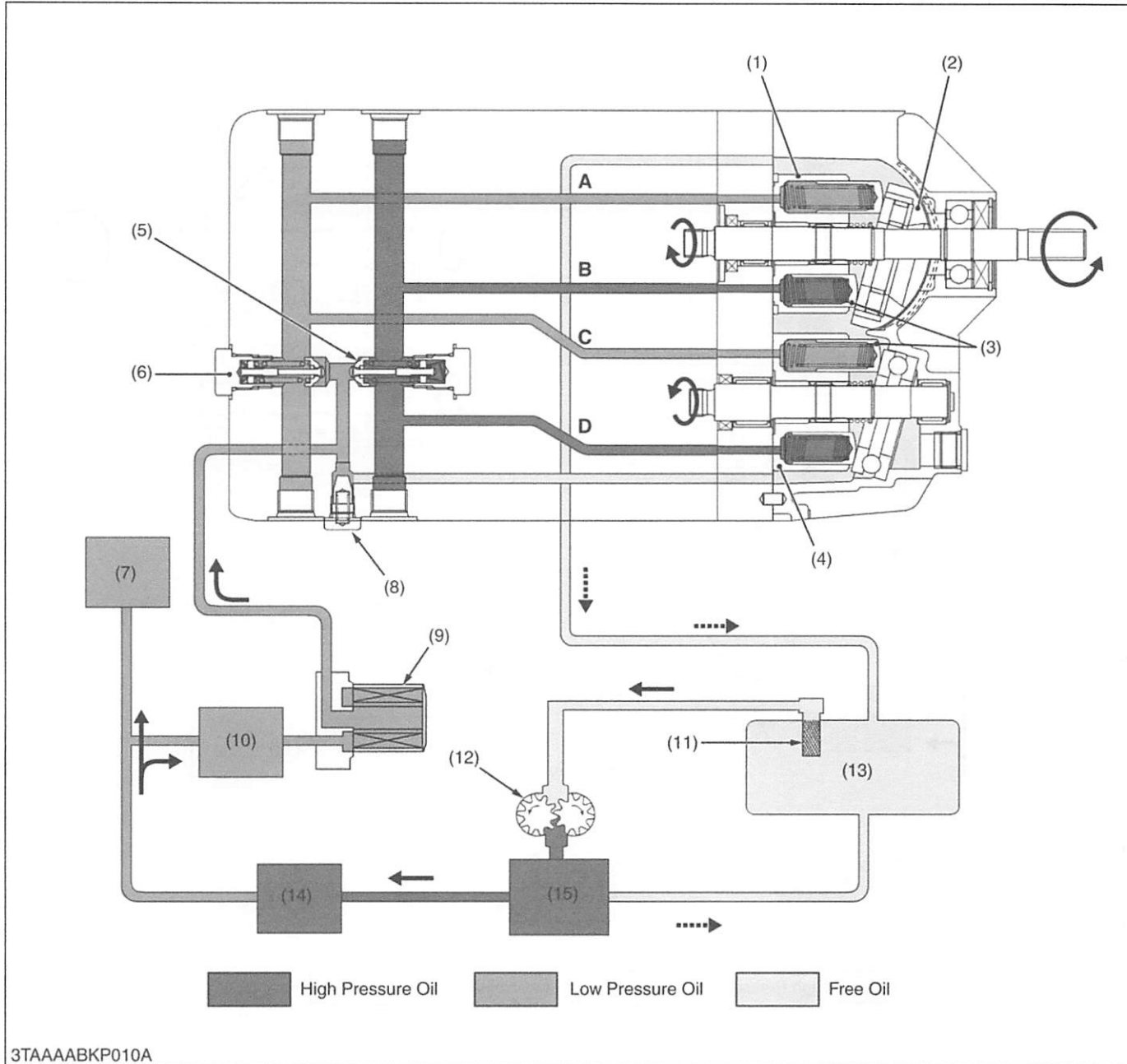
When the speed control pedal is stepped on and in forward, the variable swashplate is tilted as shown in figure above.

As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **A** at high pressure. As pressure oil enters motor port **C**, the pistons, which align with port **C**, are pushed against the swashplate and slide down the inclined surface.

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

As the motor cylinder block continues to rotate, oil is forced out of motor port **D** at low pressure and returns to the pump.

■ Reverse



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- |  |  |  |                   |
|--|--|--|-------------------|
| (1) Cylinder Block (Pump)                          | (6) Check and High Pressure Relief Valve (Forward) | (11) Oil Strainer                                  | <b>A : A Port</b> |
| (2) Swashplate                                     | (7) PTO Clutch Valve                               | (12) Hydraulic Pump                                | <b>B : B Port</b> |
| (3) Piston   | (8) Charge Relief Valve                            | (13) Transmission Case                             | <b>C : C Port</b> |
| (4) Cylinder Block (Motor)                         | (9) Oil Filter Cartridge                           | (14) Power Steering                                | <b>D : D Port</b> |
| (5) Check and High Pressure Relief Valve (Reverse) | (10) PTO Relief Valve                              | (15) Flow Priority Valve (Hydraulic Control Valve) |                   |

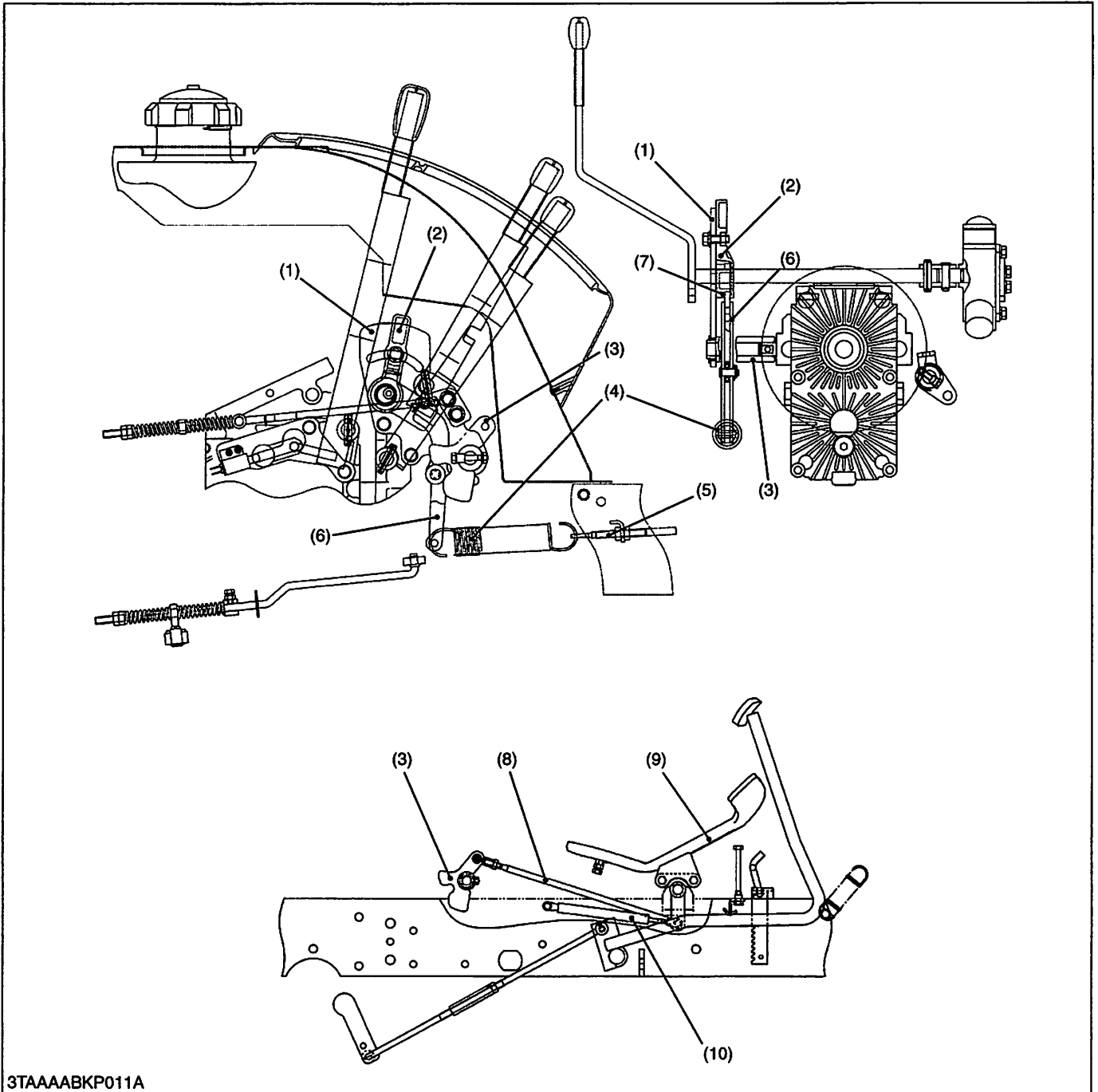
When the speed control pedal is stepped on and in reverse, the variable swashplate is tilted as shown in figure above.

As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **B** at high pressure. As pressure oil enters motor port **D**, the pistons, which align with port **D**, are pushed against the swashplate and slide down the inclined surface.

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

As the motor cylinder block continues to rotate, oil is forced out of motor port **C** at low pressure and returns to the pump.

**(3) Control Linkage**



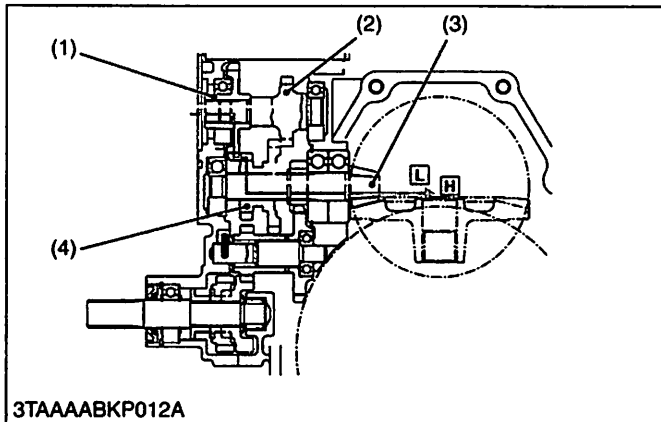
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- |                          |                    |                       |                         |
|--------------------------|--------------------|-----------------------|-------------------------|
| (1) Neutral Plate        | (4) Neutral Spring | (7) Collar            | (9) Speed Control Pedal |
| (2) Neutral Adjust Lever | (5) Adjust Rod     | (8) Speed Control Rod | (10) Damper             |
| (3) Trunnion Arm         | (6) Neutral Arm    |                       |                         |

The speed control pedal (9) and the trunnion shaft of variable swashplate are linked with the speed control rod (8) and the trunnion arm (3). As the front of the pedal is depressed, the swashplate rotates and forward travelling speed increases. Depressing the rear end increases reverse speed.

The trunnion arm (3) is return to neutral position by the neutral arm (6) and the tension of neutral spring (4). At the same time, the swashplate is returned to neutral, when the pedal is released. The damper (10) connected to the speed control pedal restricts the movement of the linkage to prevent abrupt operation or reversing.

## [2] RANGE GEAR SHIFT SECTION



Two kinds of power flow are selected by operating the range gear shift lever to shift the 16T-24T shifter gear (4) on the spiral bevel gear shaft (3).

■ **Low Range**

17T Gear Shaft (2) → Shifter Gear (24T) (4) → Spiral Bevel Pinion Shaft (3).

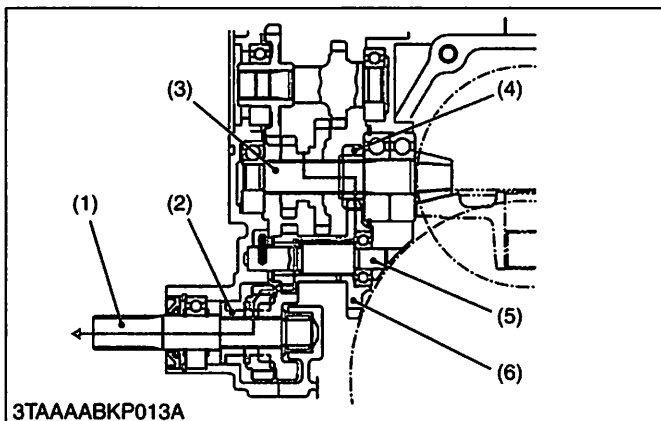
■ **High Range**

25T Gear (1) → Shifter Gear (16T) (4) → Spiral Bevel Pinion Shaft (3).

- |                    |                               |
|--------------------|-------------------------------|
| (1) 25T Gear       | (3) Spiral Bevel Pinion Shaft |
| (2) 17T Gear Shaft | (4) 16T-24T Shifter Gear      |

W1014705

## [3] FRONT WHEEL DRIVE SECTION



2-wheel drive or 4-wheel drive is selected by changing the position of 19T shifter gear (2) with the front wheel drive lever.

When the front wheel drive lever is set to “**Disengaged**” position, the 19T shifter gear (2) is neutral and power is not transmitted to the front wheel drive shaft (1).

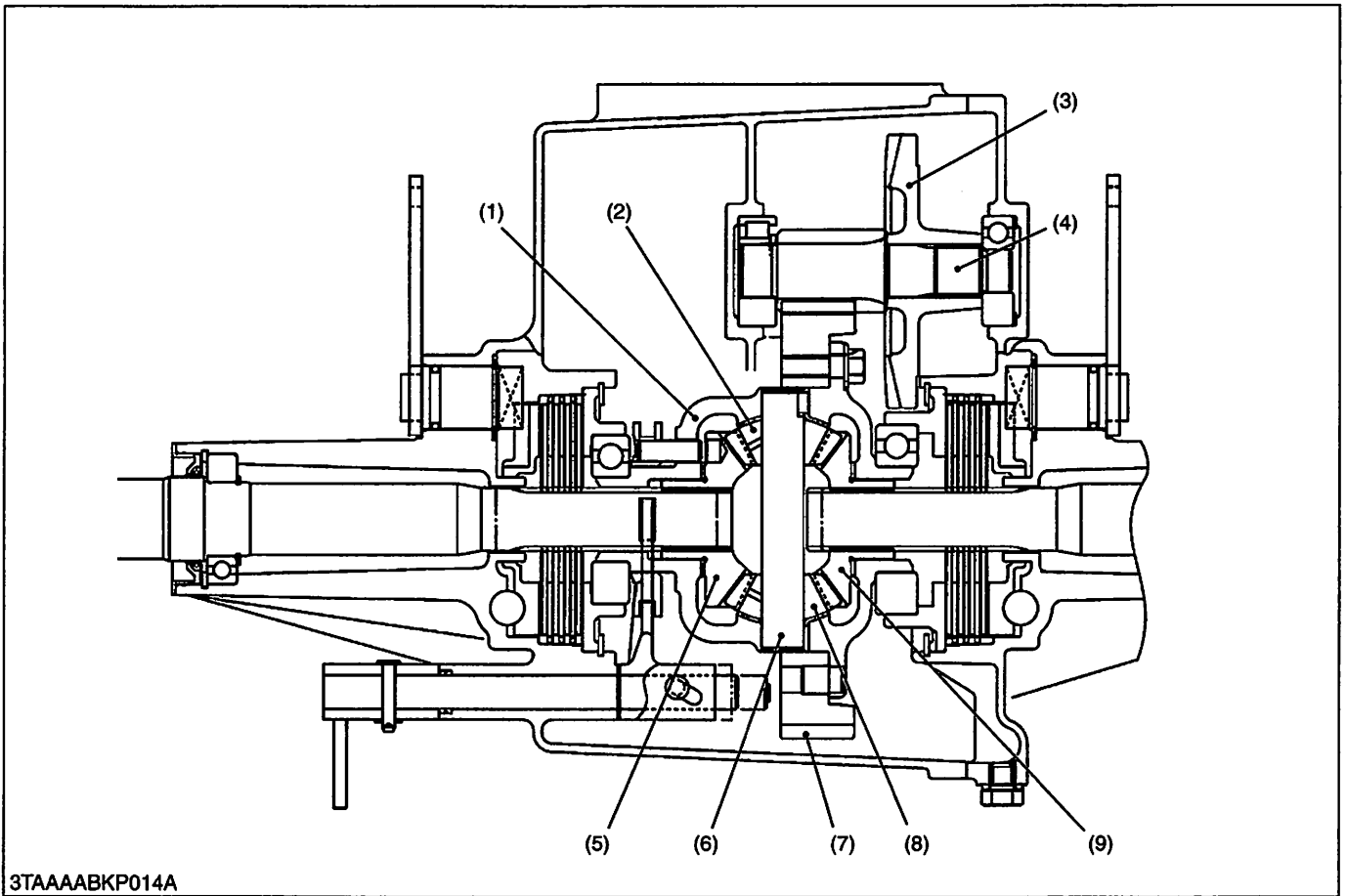
When the front wheel drive lever is set to “**Engaged**” position, the 19T shifter gear (2) slides to the right to engage with 13T-25T gear (6) on the front wheel drive idle shaft (5). Therefore, the power from spiral bevel pinion shaft (3) is transmitted to the front wheel drive shaft (1) through the gears.

- |                               |                                  |
|-------------------------------|----------------------------------|
| (1) Front Wheel Drive Shaft   | (4) 12T Gear                     |
| (2) 19T Shifter Gear          | (5) Front Wheel Drive Idle Shaft |
| (3) Spiral Bevel Pinion Shaft | (6) 13T-25T Gear                 |

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## [4] DIFFERENTIAL GEAR SECTION

### (1) Differential Gears



3TAAAABKP014A

- |                           |                            |                               |                            |
|---------------------------|----------------------------|-------------------------------|----------------------------|
| (1) Differential Case     | (4) 10T Final Gear Shaft   | (6) Differential Pinion Shaft | (8) Differential Pinion    |
| (2) Differential Pinion   | (5) Differential Side Gear | (7) 66T Final Gear            | (9) Differential Side Gear |
| (3) 37T Spiral Bevel Gear |                            |                               |                            |

#### 1. During Straight Running

Rotation of the spiral bevel pinion is transmitted to the 37T spiral bevel gear (3), 10T final gear shaft (4), 66T final gear (7) and differential case (1).

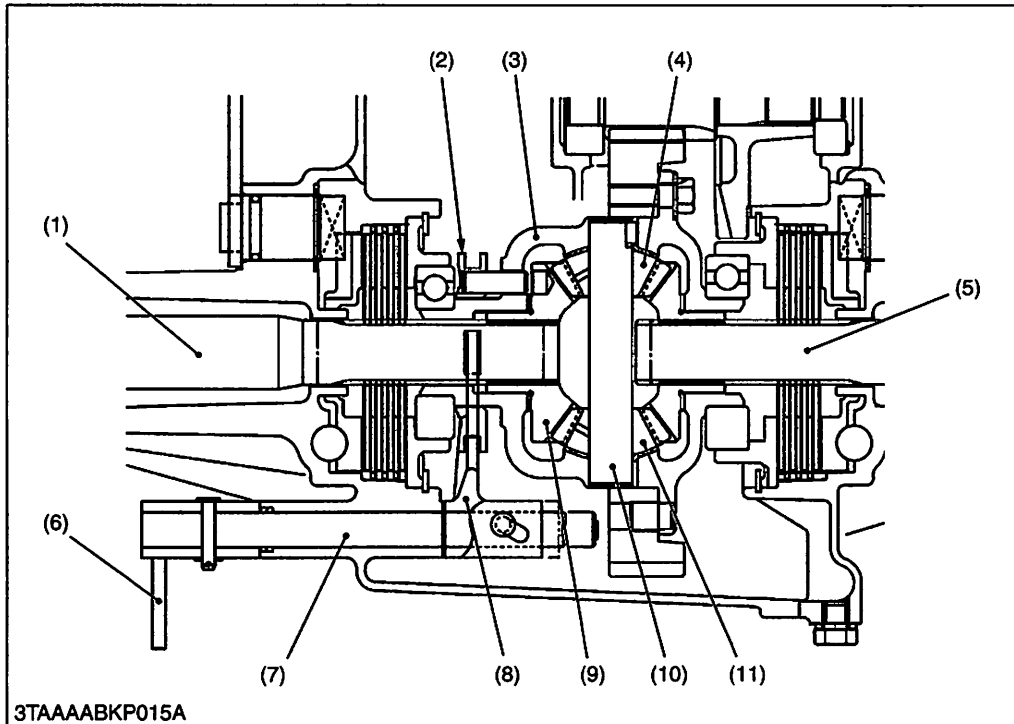
When road resistance to the right and left wheels are equal, differential pinions (2), (8) and differential side gears (5), (9) are all rotate as a unit. Both rear axles received equal input, and both wheels turn at the same speed, allowing the tractor to go straight ahead.

At this time, differential pinions (2), (8) do not rotate around the differential pinion shaft (6).

#### 2. During Turning

When the tractor turns, the road resistance to the inside tire increases. In other words, if one of tires slows down, revolution difference is generated in the differential side gears (5), (9). When rotation of one differential side gear becomes lower than the other, differential pinions (2), (8) begin rotating around differential pinion shaft (6). The other differential side gear is increased in speed by the speed increment of differential pinion shaft (6). This means that rotation of one rear axle is slowed down and that of the other rear axle is increased. Thus, the tractor turn smoothly without power loss.

The combined number of revolutions of the right and left differential side gears is always twice that of the spiral bevel gear (3). When spiral bevel gear revolution is  $100 \text{ min}^{-1}$  (rpm), and if one of the differential side gears stops moving, the revolution of the other differential side gear becomes  $200 \text{ min}^{-1}$  (rpm) and if one rotates at  $50 \text{ min}^{-1}$  (rpm), the other rotates at  $150 \text{ min}^{-1}$  (rpm).

**(2) Differential Lock**

- (1) Rear Axle
- (2) Differential Lock Shifter
- (3) Differential Case
- (4) Differential Pinion
- (5) Rear Axle
- (6) Differential Lock Arm
- (7) Differential Lock Shaft
- (8) Differential Lock Shift Fork
- (9) Differential Side Gear
- (10) Differential Pinion Shaft
- (11) Differential Pinion

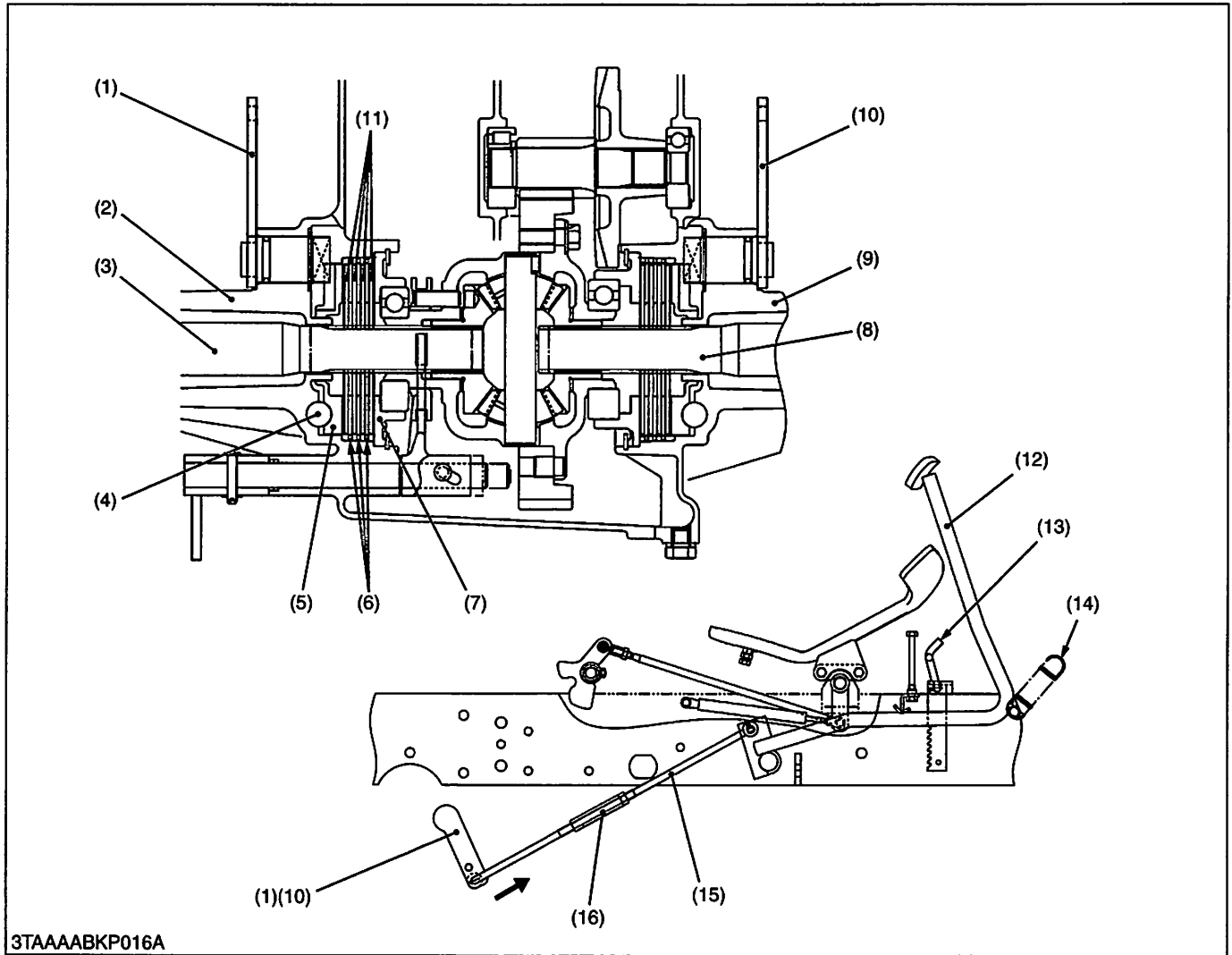
W1015160

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

When the differential lock pedal is stepped on, it causes the differential lock arm (6) and differential lock shaft (7) to rotate, which will move the differential lock shift fork (8) and the differential lock shifter (2) toward the differential side gear (9). The pins on the differential lock shifter (2) go into the holes in the differential case (3) to cause the differential case (3), differential lock shifter (2) and differential side gear (9) to rotate as a unit.

Therefore, differential pinions (4), (11) are unable to rotate around differential pinion shaft (10) and identical revolutions are transmitted to the right and left rear axle (1), (5).

[5] BRAKE SECTION



3TAAAABKP016A

- |                        |                       |                         |                               |
|------------------------|-----------------------|-------------------------|-------------------------------|
| (1) Brake Cam Lever LH | (5) Cam Plate LH      | (9) Axle Cover          | (13) Parking Brake Lock Pedal |
| (2) Transmission Case  | (6) Friction Plate    | (10) Brake Cam Lever RH | (14) Spring                   |
| (3) Rear Axle LH       | (7) Bearing Holder LH | (11) Brake Disc         | (15) Brake Rod                |
| (4) Steel Ball         | (8) Rear Axle RH      | (12) Brake Pedal        | (16) Turnbuckle               |

The mechanical wet disc brakes are used for right and left travelling brakes. They are operated by the brake pedal (12) through the mechanical linkages and provide stable braking and require little adjustment.

The brake body is incorporated in the transmission case (2) and axle cover (9) filled with transmission oil.

For greater braking force, four brake discs (11) are provided at the right and left sides respectively, and the friction plates (6) fixed to the transmission case (2) and axle cover (9) are arranged between the brake discs (11).

■ Travelling Brake

When the brake pedal (12) is depressed, the linkage causes the brake cam levers (1), (10) to turn into the direction of arrow shown in the above figure.

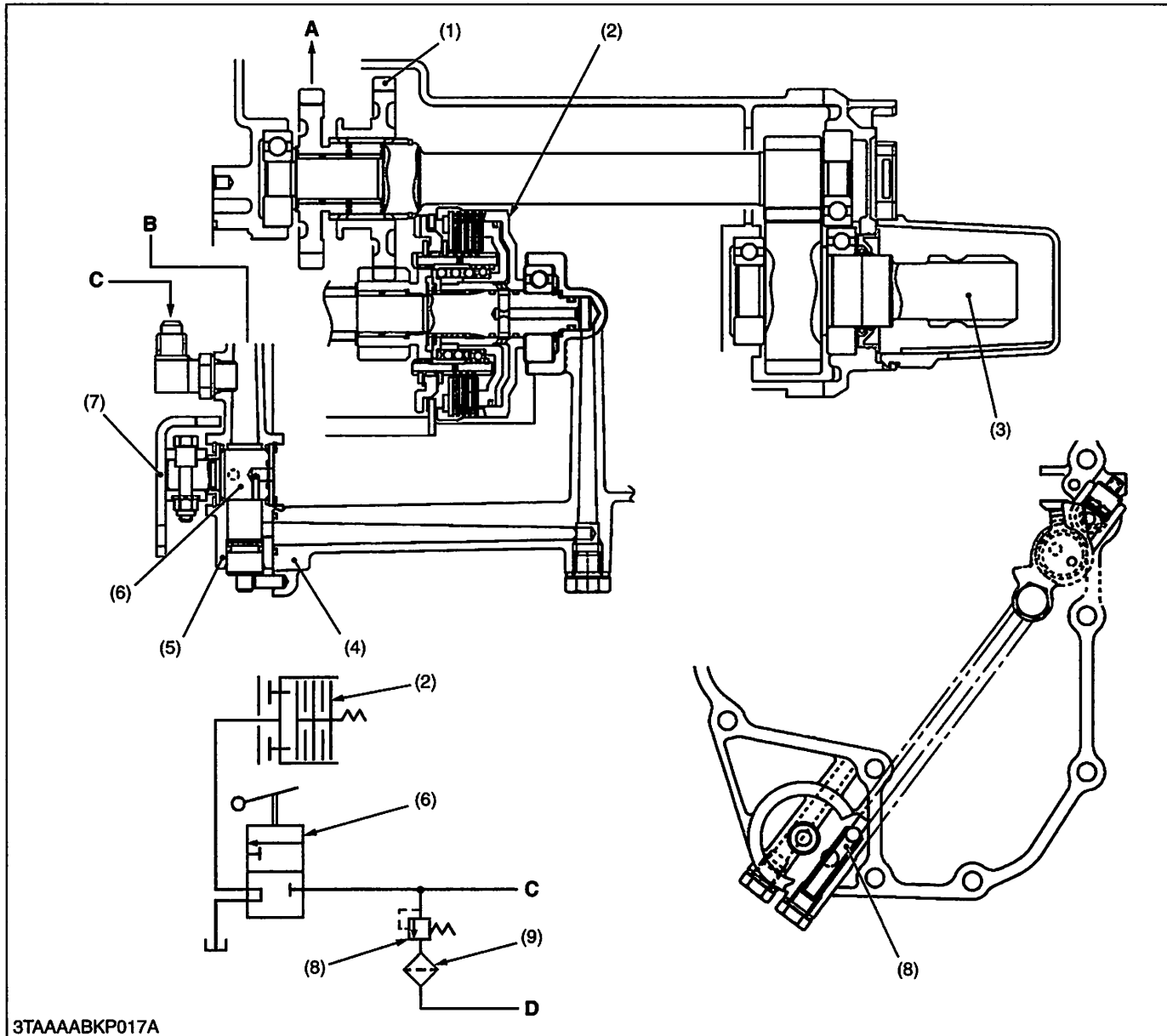
Therefore, the cam plates also moves and rides on the steel balls set in the grooves of the transmission case (2) and axle cover (9) to press the brake disc, the rear axle (3), (8) are braked by the frictional force generated by the cam plate and brake disc.

■ Parking Brake

When the parking brake is applied, the brake pedal (12) locked by the parking brake lock pedal (13) to actuate the brake mechanism same as a travelling brake.

### 3. PTO SYSTEM

#### [1] PTO CLUTCH AND VALVE



3TAAAABKP017A

- |                       |                      |  |  |
|-----------------------|----------------------|--|--|
| (1) PTO Select Gear   | (5) Front Cover      | (9) Oil Filter Cartridge                 | <b>C : From Power Steering Controller</b>    |
| (2) PTO Clutch Pack   | (6) PTO Clutch Valve | <b>A : To Mid-PTO Shaft</b>              | <b>D : To Hydrostatic Transmission Valve</b> |
| (3) Rear PTO Shaft    | (7) PTO Clutch Arm   | <b>B : Connected to PTO Relief Valve</b> |  |
| (4) Transmission Case | (8) PTO Relief Valve |  |  |

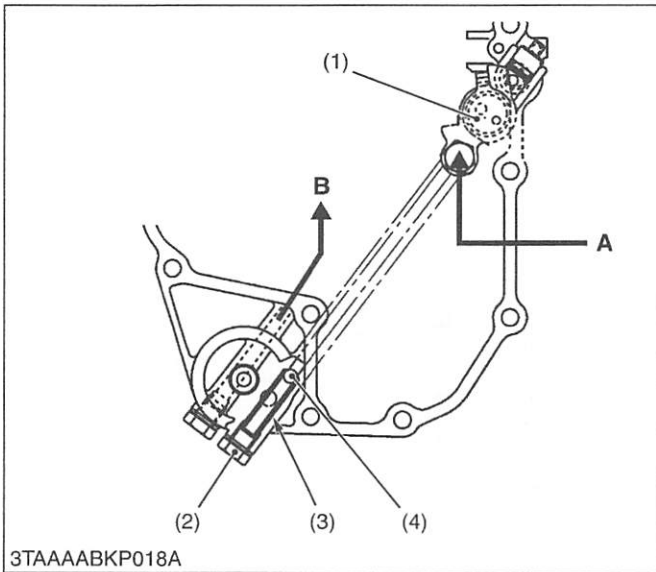
The BX series equipped with hydraulic independent PTO clutch (wet multi-plates type). Therefore, the engine power could engage or disengage to the PTO shafts without stopping the tractor movement.

The PTO clutch pack (2) has four clutch discs, four drive plates, pressure plate, clutch piston and so on.

The clutch piston is actuated by hydraulic oil flow from the power steering controller.

The PTO clutch valve (6) controls the hydraulic oil flow from power steering controller to the PTO clutch pack (2) by operating the PTO clutch lever through linkage.





■ **PTO Relief Valve**

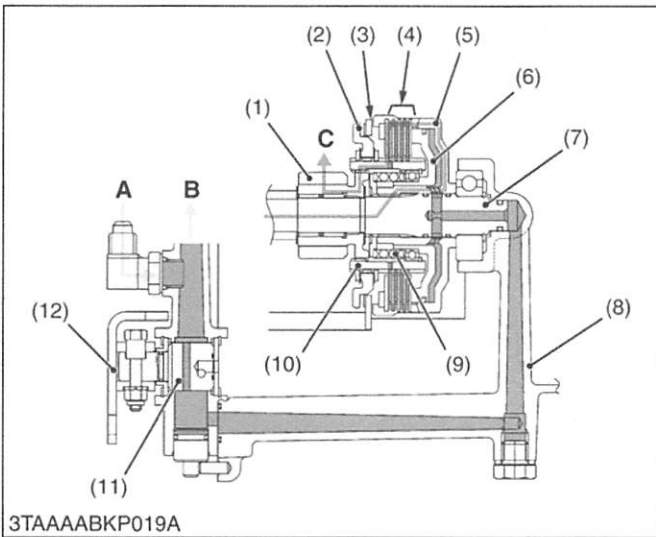
The PTO relief valve is provided to control the PTO operating pressure. When the oil pressure exceed the relief valve setting pressure, relief valve opens and the oil flows into PTO clutch and hydrostatic transmission.

(Reference)

- Relief valve setting pressure : 471 kPa  
4.8 kgf/cm<sup>2</sup>  
68.3 psi

- |                      |   |
|----------------------|---|
| (1) PTO Clutch Valve | <b>A : From Power Steering Controller</b> |
| (2) Plug             | <b>B : To Hydrostatic Transmission</b>    |
| (3) Spring           |   |
| (4) Steel Ball       |   |

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■ **PTO Clutch "Engaged"**

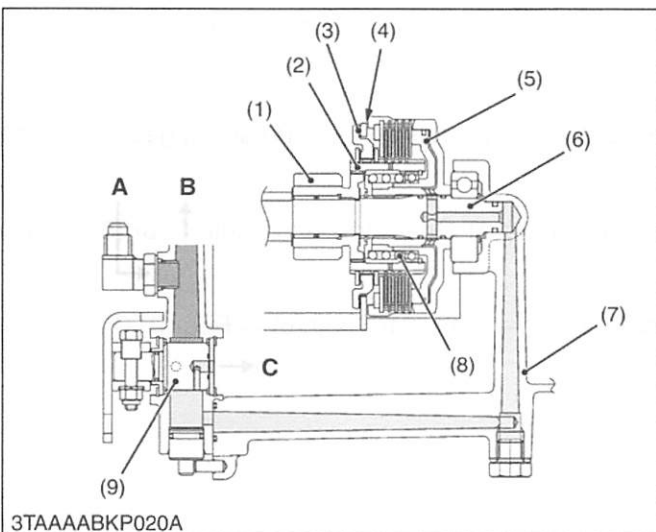
The oil from power steering controller flows into the PTO clutch valve (11).

When the PTO clutch lever is set at the "Engaged" position, the PTO clutch valve (11) rotates and from the oil line to the PTO clutch pack.

Oil entering the clutch pack pushes the clutch piston (6) to engage the clutch pack.

- |                                    |   |
|------------------------------------|---|
| (1) 12T Gear Clutch                | (9) Spring                                |
| (2) Brake Pressure Plate           | (10) Clutch Spline Boss                   |
| (3) Brake Disc                     | (11) PTO Clutch Valve                     |
| (4) Clutch Disc and Pressure Plate | (12) PTO Clutch Arm                       |
| (5) Clutch Case                    | <b>A : From Power Steering Controller</b> |
| (6) Clutch Piston                  | <b>B : To Hydrostatic Transmission</b>    |
| (7) Clutch Shaft                   | <b>C : To Mid and Rear PTO Shaft</b>      |
| (8) Transmission Case              |   |

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■ **PTO Clutch "Disengaged"**

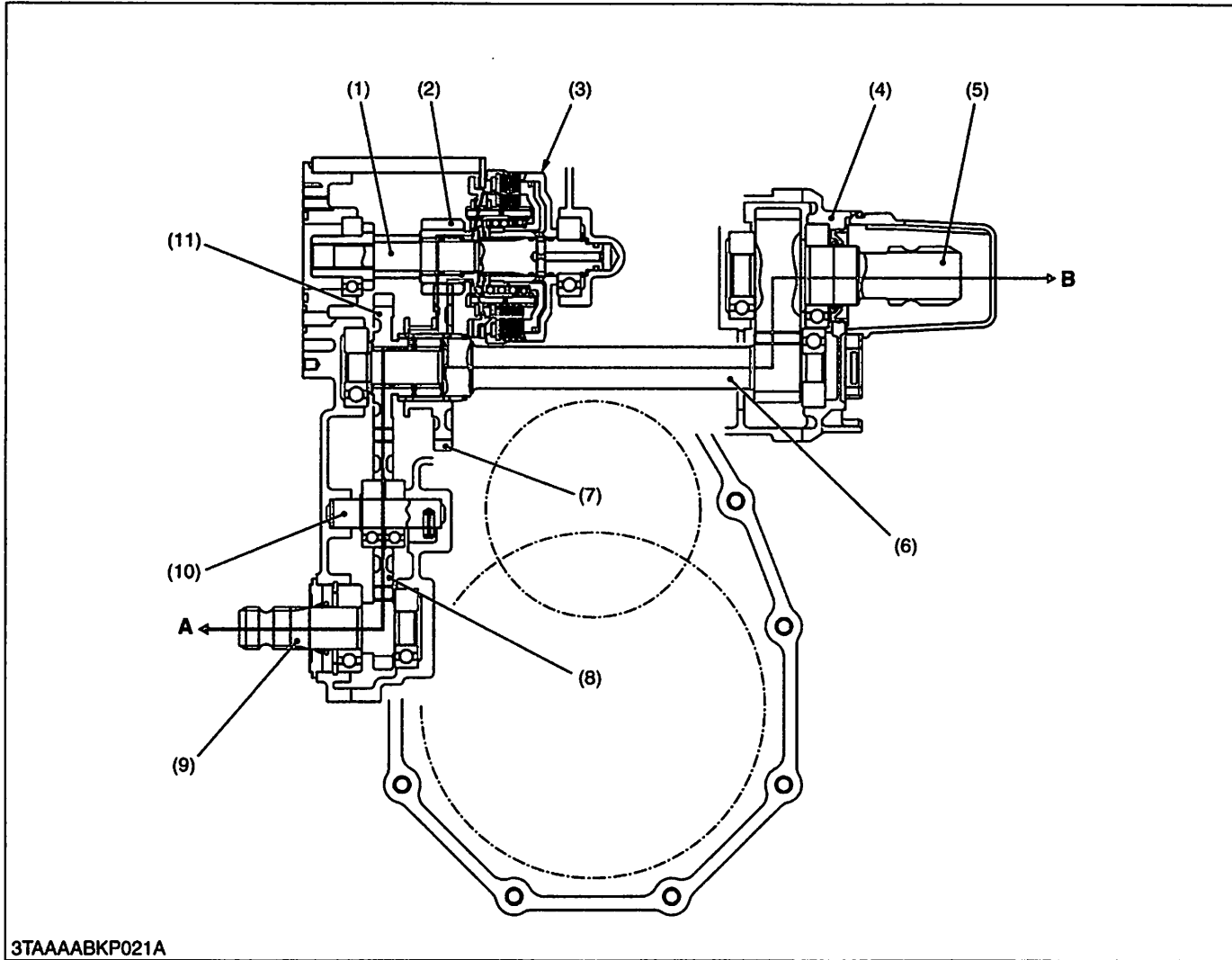
When the PTO clutch lever is set at the "Disengaged" position, the PTO clutch valve (9) rotates and close the oil passage to the PTO clutch pack. The oil in the PTO clutch pack drained into the transmission case (7). Thus the clutch piston (5) is pushed back by the spring (8).

When the clutch piston (5) is pushed back, the brake pressure plate (3) is also moved to contract the brake disc (4) so as to stop the rotation and drag of the PTO shafts.

- |                          |   |
|--------------------------|---|
| (1) 12T Gear Clutch      | <b>A : From Power Steering Controller</b> |
| (2) Clutch Spline Boss   | <b>B : To Hydrostatic Transmission</b>    |
| (3) Brake Pressure Plate | <b>C : To Transmission Case</b>           |
| (4) Brake Disc           |   |
| (5) Clutch Piston        |   |
| (6) Clutch Shaft         |   |
| (7) Transmission Case    |   |
| (8) Spring               |   |
| (9) PTO Clutch Valve     |   |

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## [2] MID AND REAR PTO SECTION



3TAAAABKP021A

- |                     |                    |                     |                 |
|---------------------|--------------------|---------------------|-----------------|
| (1) Clutch Shaft    | (4) Rear Cover     | (7) PTO Select Gear | (10) Idle Shaft |
| (2) 12T Gear Clutch | (5) Rear PTO Shaft | (8) 26T Idle Gear   | (11) 22T Gear   |
| (3) PTO Clutch Pack | (6) 11T Gear Shaft | (9) Mid-PTO Shaft   |                 |

Three kinds of power flow are selected by operating the PTO select lever to shift the PTO select gear (7) on the 11T gear shaft (6).

### ■ Mid-PTO Position (A)

PTO Clutch Pack (3) → 12T Gear Clutch → PTO Select Gear (7) → 22T Gear (11) → 26T Idle Gear (8) → Mid-PTO Shaft (9).

### ■ Rear PTO Position (B)

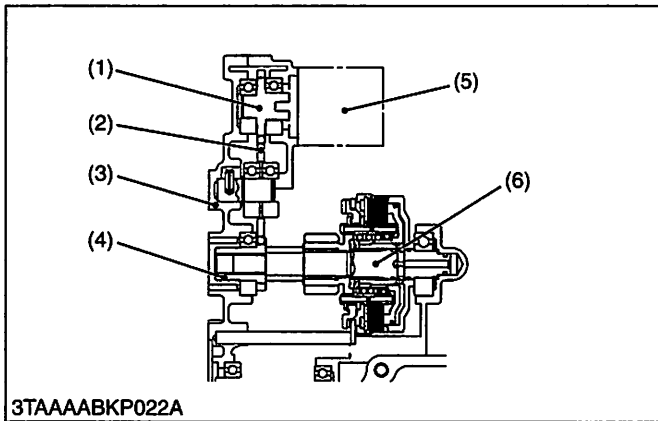
PTO Clutch Pack (3) → 12T Gear Clutch (2) → PTO Select Gear (7) → 11T Gear Shaft (6) → Rear PTO Shaft (5).

### ■ Mid and Rear PTO Position

A and B at the same time.

## 4. OTHERS

### [1] HYDRAULIC PUMP DRIVE GEAR SECTION



The hydraulic pump (5) is mounted to front cover (3) of the transmission case and driven by 13T gear (4) on the clutch shaft (6).

- |                    |                    |
|--------------------|--------------------|
| (1) 19T Gear Shaft | (4) 13T Gear       |
| (2) 29T Idle Gear  | (5) Hydraulic Pump |
| (3) Front Cover    | (6) Clutch Shaft   |

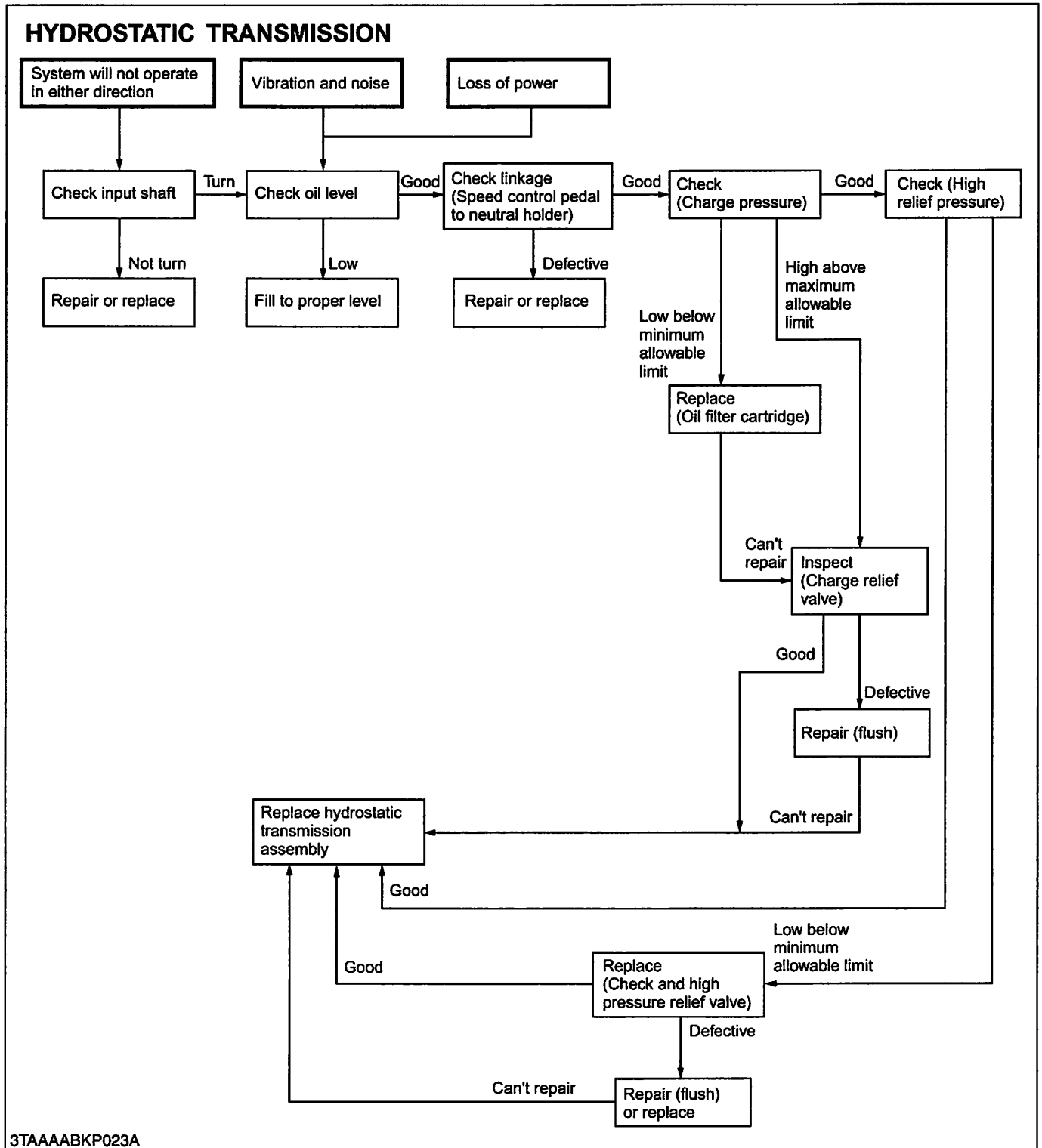
W1016433

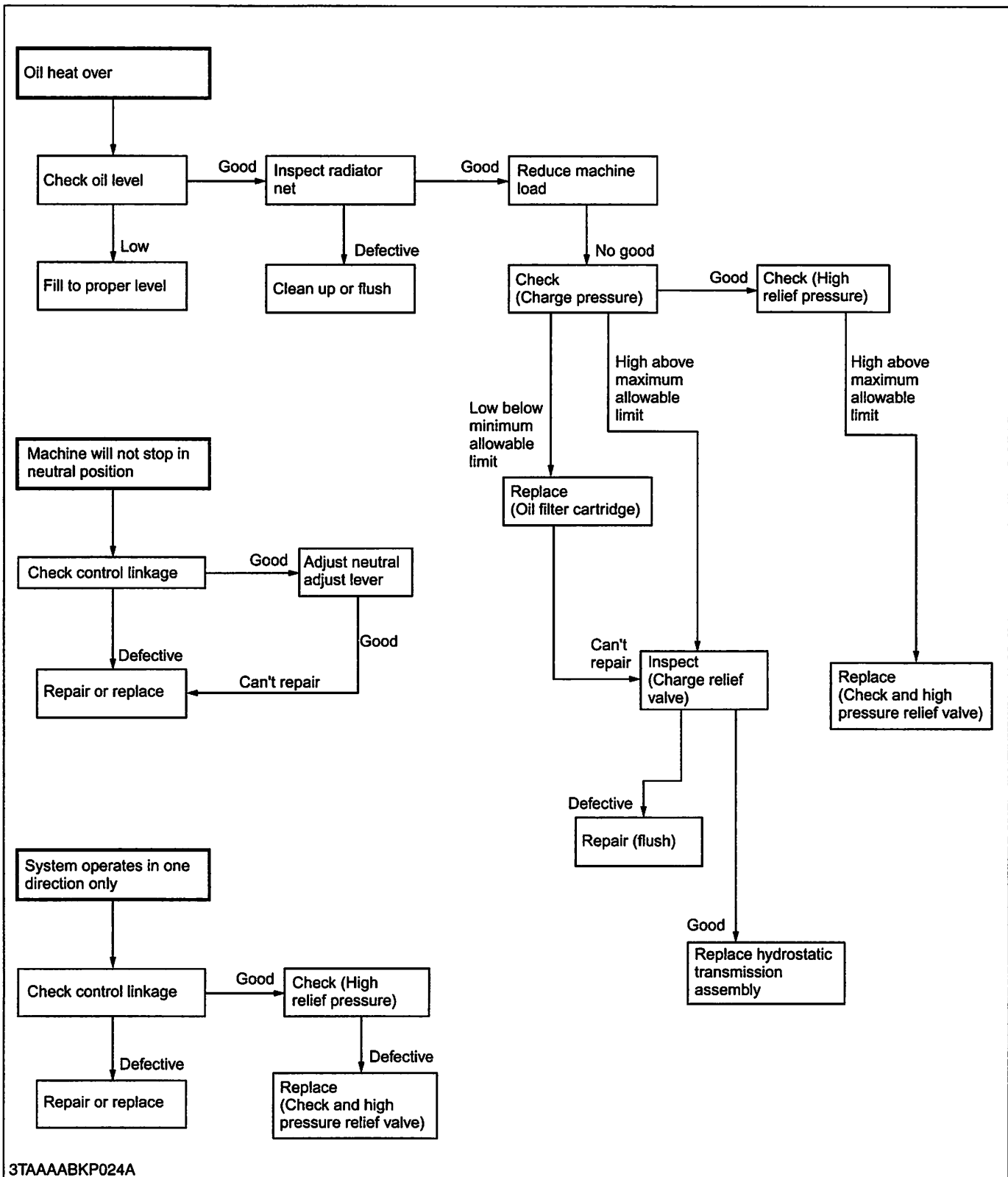
# SERVICING

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# 1. TROUBLESHOOTING





**TRAVELLING GEAR SHIFT SECTION**

Symptom	Probable Cause	Solution	Reference Page
<b>Noise from Transmission</b>	• Transmission oil insufficient	Refill	2-S13
	• Gear worn or broken	Replace	–
	• Bearings worn	Replace	–
<b>Gear Slip Out of Mesh</b>	• Shift fork spring tension insufficient	Replace	2-S25
	• Shift fork or shifter worn	Replace	2-S25
	• Shift fork bent	Replace	2-S25

W1013580

**DIFFERENTIAL GEAR SECTION**

<b>Excessive or Unusual Noise at All Time</b>	• Improper backlash between spiral bevel pinion and bevel gear	Adjust	2-S36
	• Improper backlash between differential pinion and differential side gear	Adjust	2-S35
	• Bearing worn	Replace	–
	• Insufficient or improper type of transmission fluid used	Replenish or change	G-7, 2-S13
<b>Noise while Turning</b>	• Differential pinions or differential side gears worn or damaged	Replace	2-S28
	• Differential lock binding (does not disengage)	Replace	2-S28
	• Bearing worn	Replace	–
<b>Differential Lock Can Not Be Set</b>	• Differential lock shift fork damaged	Replace	2-S28
	• Differential lock shifter mounting pin damaged	Replace	2-S28
	• Differential lock pin damaged	Replace	2-S28
<b>Differential Lock Pedal Does Not Return</b>	• Differential lock pedal return spring weaken or damaged	Replace	2-S19
	• Differential lock fork shaft rusted	Repair	2-S28

W1013718

**BRAKE SECTION**

<b>Uneven Braking Force</b>	• Brake rod unevenly adjusted	Adjust	G-20
	• Brake disc worn	Replace	2-S29
	• Actuator warped	Replace	2-S29
<b>Brake Drags</b>	• Brake pedal free travel too small	Adjust	G-20
	• Ball holes of actuator for uneven wear	Replace	2-S29
	• Brake pedal return spring weaken or broken	Replace	2-S20
	• Brake cam rusted	Replace	2-S29
<b>Poor Braking Force</b>	• Brake pedal free travel excessive	Adjust	G-20
	• Brake disc worn	Replace	2-S29
	• Actuator warped	Replace	2-S29
	• Brake cam or lever damaged	Replace	2-S29
	• Transmission fluid improper	Change	2-S13

W1010878

**PTO SECTION**

Symptom	Probable Cause	Solution	Reference Page
<b>PTO Clutch Slip</b>	<ul style="list-style-type: none"> <li>• Operating pressure is low</li> <li>• PTO clutch valve malfunctioning</li> <li>• Clutch disc or drive plate excessively worn</li> <li>• Deformation of clutch piston</li> </ul>	Check Repair or replace Replace Replace	2-S12 2-S25 2-S33 2-S33
<b>PTO Shaft Does Not Rotate</b>	<ul style="list-style-type: none"> <li>• PTO clutch malfunctioning</li> </ul>	Repair or replace Engage	2-S27
<b>PTO Clutch Operating Pressure is Low</b>	<ul style="list-style-type: none"> <li>• Transmission oil improper or insufficient</li> <li>• Relief valve malfunctioning</li> </ul>	Replenish or change Check or replace	2-S13 2-S12, S27
<b>PTO Clutch Drags</b>	<ul style="list-style-type: none"> <li>• Brake plate excessive worn</li> <li>• Clutch spring weaken or broken</li> <li>• Deformation of pressure plate or steel plate</li> </ul>	Replace Replace Replace	2-S34 2-S34 2-S27

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## 2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Charge Relief Valve	Setting Pressure	294.2 to 490.4 kPa 3.0 to 5.0 kgf/cm <sup>2</sup> 42.7 to 71.1 psi	—
Check and High Pressure Relief Valve	Setting Pressure	13.73 MPa 140 kgf/cm <sup>2</sup> 1991.2 psi	—
PTO Clutch	Operating Pressure	Above 961 kPa 9.8 kgf/cm <sup>2</sup> 139.4 psi	—
Shift Fork to Shifter Gear Groove	Clearance	0.03 to 0.48 mm 0.0012 to 0.019 in.	0.7 mm 0.028 in.
13T-25T Gear to Front Wheel Drive Idle Shaft	Clearance	0.007 to 0.043 mm 0.0003 to 0.0017 in.	0.10 mm 0.0039 in.
13T-25T Gear	I.D.	19.007 to 19.020 mm 0.7483 to 0.7488 in.	—
Front Wheel Drive Idle Shaft	O.D.	13.989 to 14.000 mm 0.5507 to 0.5512 in.	—
Needle	O.D.	2.494 to 2.500 mm 0.0982 to 0.0984 in.	—
22T Gear to 11T Gear Shaft	Clearance	0.007 to 0.039 mm 0.0003 to 0.0015 in.	0.10 mm 0.0039 in.
22T Gear	I.D.	24.007 to 24.020 mm 0.9452 to 0.9457 in.	—
11T Gear Shaft	O.D.	19.987 to 20.000 mm 0.7869 to 0.7874 in.	—
Needle	O.D.	1.997 to 2.000 mm 0.0786 to 0.0787 in.	—
12T Gear Clutch to Clutch Shaft	Clearance	0.007 to 0.037 mm 0.0003 to 0.0015 in.	0.10 mm 0.0039 in.
12T Gear Clutch	I.D.	22.007 to 22.020 mm 0.8664 to 0.8669 in.	—
Clutch Shaft	O.D.	17.989 to 18.000 mm 0.7082 to 0.7087 in.	—
Needle	O.D.	1.997 to 2.000 mm 0.0786 to 0.0787 in.	—

W1013874

Item		Factory Specification	Allowable Limit
PTO Clutch Disc	Thickness	1.70 to 1.90 mm 0.067 to 0.075 in.	1.55 mm 0.061 in.
Pressure Plate	Thickness	1.95 to 2.05 mm 0.077 to 0.081 in.	1.80 mm 0.071 in.
Steel Plate	Thickness	1.15 to 1.25 mm 0.045 to 0.049 in.	1.10 mm 0.043 in.
Clutch Piston	Flatness	–	0.15 mm 0.0059 in.
Pressure Plate and Steel Plate	Flatness	–	0.20 mm 0.0079 in.
Clutch Spring	Free Length	37.3 to 37.7 mm 1.47 to 1.48 in.	34.5 mm 1.36 in.
PTO Brake Disc	Thickness	3.20 to 3.40 mm 0.126 to 0.134 in.	3.00 mm 0.118 in.
Differential Case to Differential Side Gear	Clearance	0.050 to 0.151 mm 0.0020 to 0.0059 in.	0.30 mm 0.0118 in.
Differential Case	I.D.	38.000 to 38.062 mm 1.4961 to 1.4985 in.	–
Differential Side Gear	O.D.	37.911 to 37.950 mm 1.4926 to 1.4941 in.	–
Differential Pinion Shaft to Differential Pinion	Clearance	0.080 to 0.122 mm 0.0031 to 0.0048 in.	0.30 mm 0.0118 in.
Differential Pinion	I.D.	20.060 to 20.081 mm 0.7898 to 0.7906 in.	–
Differential Pinion Shaft	O.D.	19.959 to 19.980 mm 0.7858 to 0.7866 in.	–
Differential Pinion to Differential Side Gear	Backlash	0.15 to 0.30 mm 0.0059 to 0.0118 in.	0.40 mm 0.0157 in.
Spiral Bevel Pinion Shaft	Side Clearance	0.1 to 0.3 mm 0.0039 to 0.0118 in.	–
Spiral Bevel Pinion Shaft to Spiral Bevel Gear	Backlash	0.1 to 0.3 mm 0.0039 to 0.0118 in.	–
Actuator and Bearing Holder	Flatness	–	0.30 mm 0.0118 in.
Cam Plate and Ball	Height	22.89 to 22.99 mm 0.9012 to 0.9051 in.	22.40 mm 0.8819 in.
Brake Disc	Thickness	3.3 to 3.5 mm 0.130 to 0.138 in.	3.0 mm 0.118 in.
Friction Plate	Thickness	1.92 to 2.08 mm 0.0756 to 0.0819 in.	1.52 mm 0.0598 in.

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### 3. TIGHTENING TORQUES

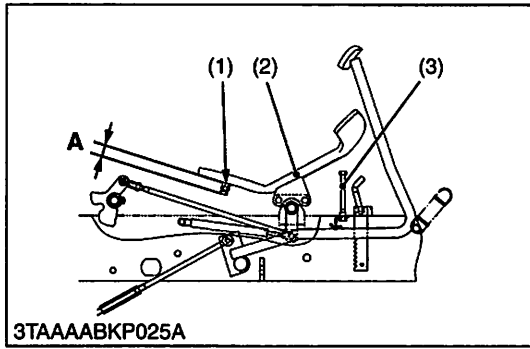
Tightening torques of screws, bolts and nuts on the table below are especially specified.  
 (For general use screws, bolts and nuts : See page G-8.)

Item	N·m	kgf·m	ft-lbs
Charge relief valve checking plug	21.58 to 25.50	2.2 to 2.6	15.91 to 18.81
Hexagon socket head plug (P1 and P2 port)	40.70 to 94.93	4.15 to 9.68	30.02 to 70.02
PTO clutch operating pressure plug	21.58 to 25.50	2.2 to 2.6	15.91 to 18.81
ROPS mounting nut	124 to 147	12.6 to 15.0	91.2 to 108
Rear wheel mounting screw	108.5 to 130.2	11.1 to 13.3	80 to 96
Fuel tank stay mounting bolt and nut	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Sub frame mounting bolt and nut (M14)	147	15.0	108.5
(M16)	196	20.0	147
PTO cover RH and LH mounting bolt and nut	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Rear support mounting screw (M12)	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Hitch plate mounting bolt and nut	124 to 147	12.6 to 15.0	91.2 to 108
Fender bracket mounting bolt and nut	124 to 147	12.6 to 15.0	91.2 to 108
Fender center stay mounting screw	124 to 147	12.6 to 15.0	91.2 to 108
Transaxle assembly mounting screw (M12)	62.8 to 72.6	6.4 to 7.4	46.3 to 53.5
Transaxle assembly mounting screw (M14)	124 to 147	12.6 to 15.0	91.2 to 108
Rear coupling mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Front coupling mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
HST fan mounting screw	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
Tie-rod mounting screw	124 to 147	12.6 to 15.0	91.2 to 108
Hydraulic control lever mounting bolt and nut	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Trunnion arm mounting bolt and nut	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
Hydrostatic transmission mounting screw	15.7 to 20.6	1.6 to 2.1	11.6 to 15.2
Center section mounting hex. head socket screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Charge relief valve plug	14.22 to 23.54	1.45 to 2.40	10.49 to 17.36
Check and high pressure relief valve plug	40.70 to 94.93	4.15 to 9.68	30.02 to 70.02
Delivery pipe	28.4 to 30.0	2.9 to 3.1	20.9 to 22.1
PTO safety switch mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Hydraulic cylinder mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Front cover mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
PTO clutch arm mounting bolt and nut	9.8 to 14.7	1.00 to 1.15	7.2 to 10.8
PTO relief valve plug	21.58 to 25.50	2.2 to 2.6	15.91 to 18.81
Rear cover mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
PTO select bolt	21.6 to 25.5	2.2 to 2.6	15.9 to 18.8
Bracket mounting nut	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Axle cover mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
66T final gear mounting screw	60.8 to 70.6	6.2 to 7.2	44.8 to 52.1

W1012736

2

# 4. CHECKING



## Adjusting Maximum Speed

### ■ Forward

1. Depress the speed control pedal (2) all the way and lengthen the stopper bolt (3) until it touches the bottom surface of the speed control pedal (2).
2. Release the speed control pedal (2) to the neutral, lengthen the stopper bolt (3) half turn and lock it.

### ■ Reverse

1. Adjust the stopper bolt (1) length "A" to 30 mm (1.18 in.) and lock it securely.

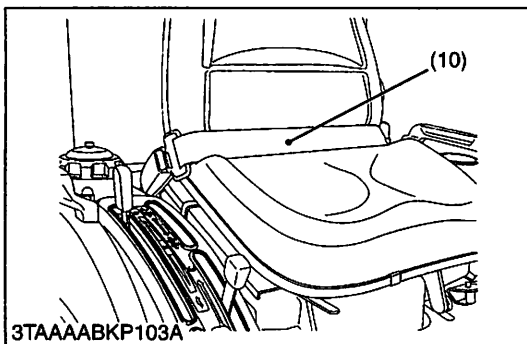
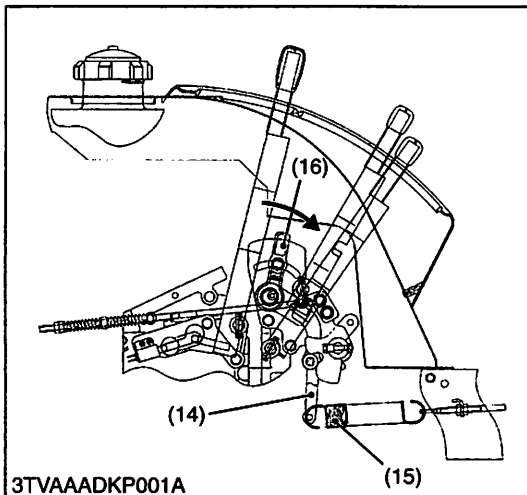
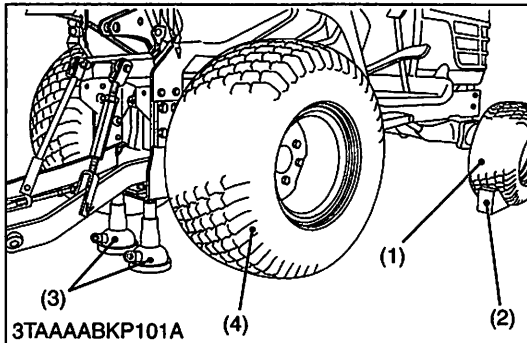
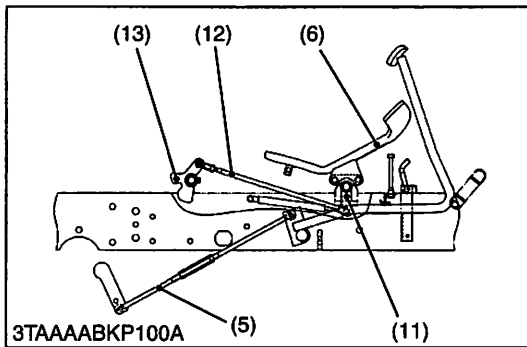
### (Reference)

Maximum speed	Reference	Forward	13.0 to 14.0 km/h 8.1 to 8.8 mph
		Reverse	10.0 to 11.0 km/h 6.3 to 6.9 mph

- (1) Stopper Bolt (Reverse)  
(2) Speed Control Pedal

- (3) Stopper Bolt (Forward)

W1012590

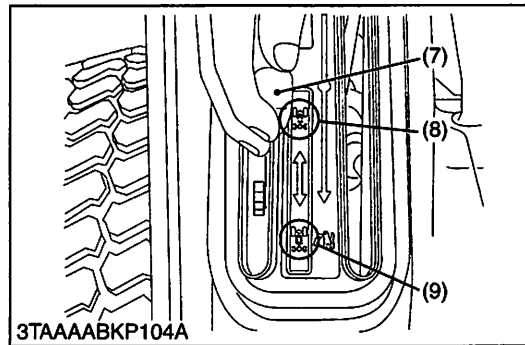


**Preparation before HST Adjustment**

**CAUTION**

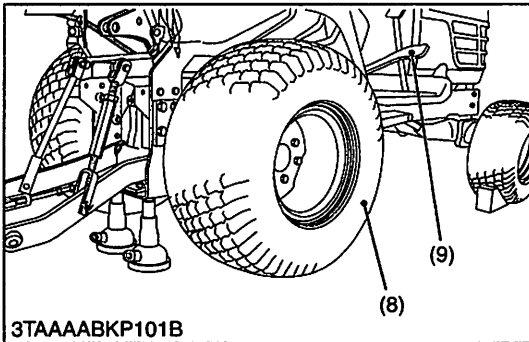
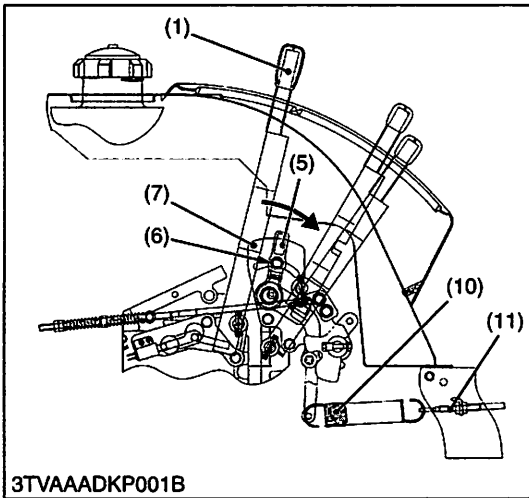
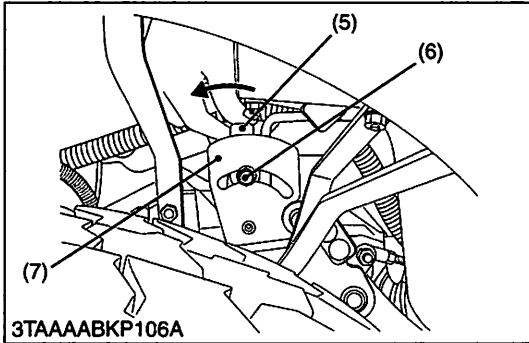
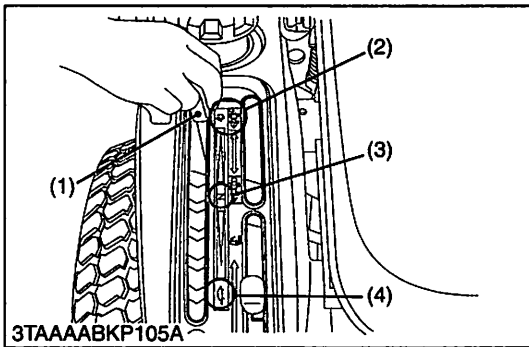
- **Park the machine on a firm and level ground.**
- 1. Place the wooden blocks (2) at F and R side of wheels not to move the tractor.
- 2. Measure the speed control pedal (6) control force with a push-pull gauge before starting the engine.
- 3. Remove the brake rod (5) because improper brake rod adjustment will cause the HST neutral adjustment unexpectedly.
- 4. Remove the neutral spring (15) from the neutral arm (14). Move the neutral arm (14) by hand. Check that the neutral arm (14) moves smoothly around the neutral adjust lever (16). If the neutral arm (14) does not move smoothly around neutral adjust lever (16), apply spray grease to neutral arm fulcrum contacted to the neutral arm (14). Check it again. If the neutral arm (14) still does not move smoothly, change the neutral arm (14) with a new one. Reinstall the neutral spring (15) to the original position.
- 5. Lift up the rear wheels (4) with safely by the hydraulic jacks (3).
- 6. Shift the front wheel drive lever (7) to "OFF" position (8).
- 7. To avoid the engine stopping in adjusting neutral and to contact the operator's seat switch, fasten firmly seat belt (10) on the operator's seat as shown in the figure. (for only model equipped Operator's Presence Control System.)

Speed control pedal control force (forward side pedal)	Factory spec.	60 to 100 N 6.1 to 10.2 kgf 13.5 to 22.8 lbs
Speed control pedal control force (reverse side pedal)	Factory spec.	40 to 80 N 4.1 to 8.2 kgf 9.0 to 18.0 lbs



- (1) Front Wheel
- (2) Wooden Block
- (3) Hydraulic Jack
- (4) Rear Wheel
- (5) Brake Rod
- (6) Speed Control Pedal
- (7) Front Wheel Drive Lever
- (8) 4WD "OFF" Position
- (9) 4WD "ON" Position
- (10) Seat Belt
- (11) Speed Control Pedal Link
- (12) Speed Control Rod
- (13) Trunnion Arm
- (14) Neutral Arm
- (15) Neutral Spring
- (16) Neutral Adjust Lever

W1047776

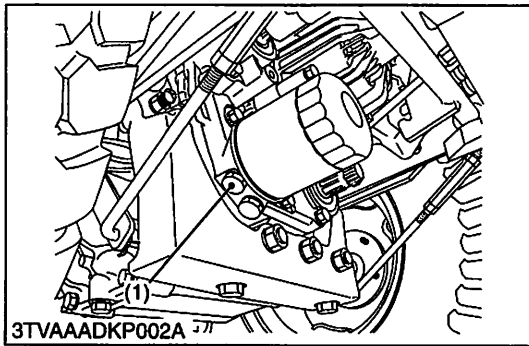


**Adjustment of HST Neutral Position**

1. Start the engine.
2. Shift the range gear shift lever (1) to “**Hi**” position (2).
3. Loosen the locking screw (6). And push the neutral adjust lever (5) toward the tractor rear side as shown in the figure until the rear wheels (4) begin to rotate forward.
4. Push the neutral adjust lever (5) toward tractor front side until the rear wheels (4) stop rotating.
5. When the rear wheels (4) stop rotating, lock the neutral adjust lever (5) with the locking screw (6).
6. Depress the speed control pedal (9) forward to rotate the rear wheels (8), release the foot from the speed control pedal (9) and check that the rear wheels (8) stop rotating.
7. Depress the speed control pedal (9) reverse to rotate the rear wheels (8), release the foot from the speed control pedal (9) and check that the rear wheels (8) stop rotating.  
If the rear wheels (8) do not stop rotating, repeat the above mentioned procedure 3 to 5 again and check that the rear wheels (8) stop rotating at the neutral position of the speed control pedal (9).
8. Shift the range gear shift lever (1) to “**LOW**” position. Check that the rear wheels (8) stop rotating at the neutral position of the speed control pedal (9).
9. Reinstall the brake rod to the original position.
10. Remove the hydraulic jacks.
11. Disconnect the safety belt to return the operator’s seat switch to the original condition. (for only model equipped Operator’s Presence Control System.)
12. Check the HST proper operation on the usual jobs.

- |                            |                         |
|----------------------------|-------------------------|
| (1) Range Gear Shift Lever | (7) Neutral Plate       |
| (2) “Hi” Position          | (8) Rear Wheel          |
| (3) “NEUTRAL” Position     | (9) Speed Control Pedal |
| (4) “Lo” Position          | (10) Neutral Spring     |
| (5) Neutral Adjust Lever   | (11) Adjust Rod         |
| (6) Locking Screw          |                         |

W1056688



**Charge Relief Pressure**

**CAUTION**

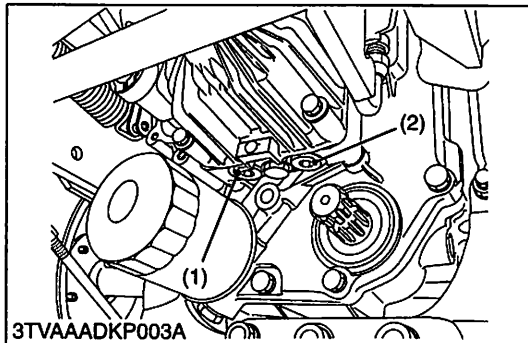
- **When checking, park the tractor on flat ground, apply the parking brake.**
1. Remove the plug (M14, Pitch 1.5 mm) (1) from the front cover, then install the adaptor, cable and pressure gauge.
  2. Set the range gear shift lever to **Neutral** position.
  3. Start the engine and run it at the maximum speed.
  4. Read the pressure gauge to measure the charge relief pressure.
  5. If the measurement is not within the factory specifications, check the charge relief valve and related hydraulic components.

Charge relief pressure	Factory spec. (Oil temperature at 50 °C, 122 °F)	294.2 to 490.4 kPa 3.0 to 5.0 kgf/cm <sup>2</sup> 42.7 to 71.1 psi
------------------------	--	--

Tightening torque	Plug	21.58 to 25.50 N-m 2.2 to 2.6 kgf-m 15.91 to 18.81 ft-lbs
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(1) Plug

W1013009



**High Relief Pressure**

**CAUTION**

- **When checking, park the tractor on flat ground, apply the parking brake.**
1. Remove the hexagon socket head plug (3/4-16 UNF-2A) from P1 (1) or P2 (2), then install the adaptor, cable and pressure gauge.
  2. Start the engine and run it at maximum speed.
  3. Set the range gear shift lever to **High** position.
  4. Depress the speed control pedal to **forward** or **reverse**, and read the pressure gauge to measure the high relief pressure.
  5. If the measurement is not same as factory specification, check the high pressure relief valve and related hydraulic components.

High relief pressure	Factory spec. (Oil temperature at 50 °C, 122 °F)	13.73 MPa 140 kgf/cm <sup>2</sup> 1991.2 psi
----------------------	--	--

Tightening torque	Hexagon socket head plug (P1 and P2 port)	40.70 to 94.93 N-m 4.15 to 9.68 kgf-m 30.02 to 70.02 ft-lbs
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**IMPORTANT**

- **Measure quickly so that the high pressure relief valve may not be in operation more than 10 seconds.**

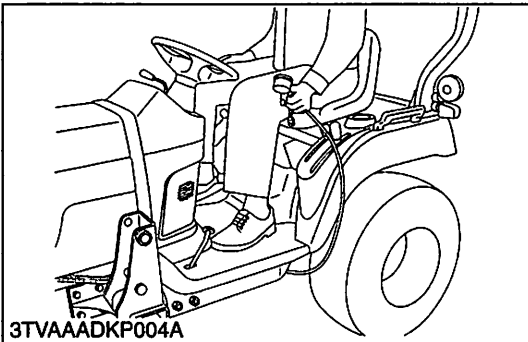
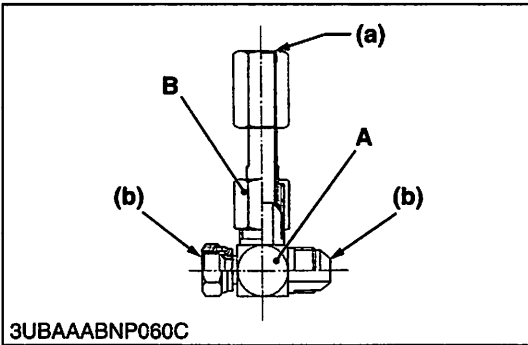
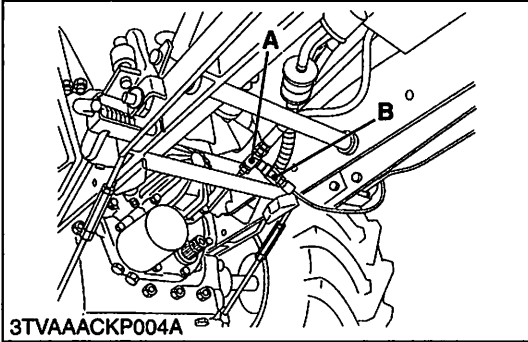
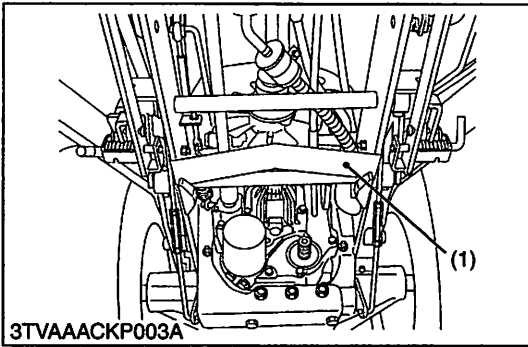
**NOTE**

- **When reinstall the hexagon socket head plug, take care not to damage the O-ring.**

(1) P1 Port (Reverse)

(2) P2 Port (Forward)

W1013275



**PTO Clutch Operating Pressure**

**CAUTION**

- When checking, park the tractor on flat ground, apply the parking brake.
  - Do not engage PTO while measuring it.
1. Remove the cover (1).
  2. Connect the adaptor of A between the power steering hoses, then connect the adaptor B and the pressure gauge with adaptor A.
  3. Start the engine and set at maximum speed.
  4. Measure the pressure.
  5. If the measurement is not same as factory specifications, check the PTO relief valve and related hydraulic components.

PTO clutch operating pressure	Factory spec.	Above 961 kPa 9.8 kgf/cm <sup>2</sup> 139.4 psi
-------------------------------	---------------	---

**Condition**

- Engine speed : Maximum
- Oil temperature : 45 to 55 °C  
113 to 131 °F

(1) Cover

- A : Adaptor Tee, Swivel (9/16-18)
- B : Adaptor B
- (a) Connect pressure gauge
- (b) Connect power steering hose

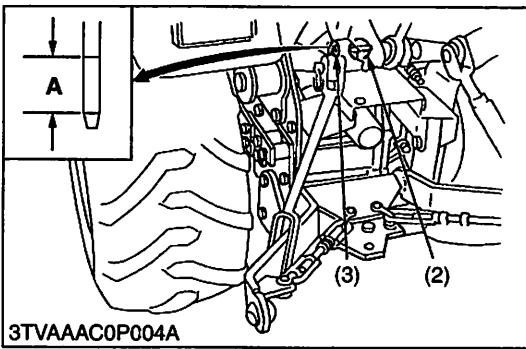
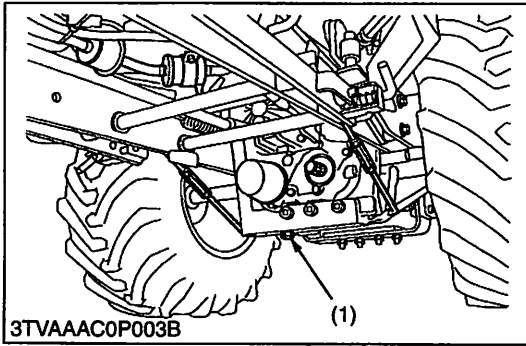
W1013552



# 5. DISASSEMBLING AND ASSEMBLING

- Before proceeding this section, disassembling the Loader Assembly and Backhoe. (Refer to section 7 and 8.)

## [1] SEPARATE TRANSAXLE



### Draining Transmission Fluid

#### ⚠ CAUTION

- Be sure to stop the engine before checking and changing the transmission fluid.
1. Place oil pan under the tractor.
  2. Remove the drain plugs (1) at the bottom of the transmission case.
  3. Drain the transmission fluid and reinstall the drain plug.

#### (When refilling)

- 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 to 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-7.)
- 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	10.1 L 2.7 U.S.gals. 2.2 Imp.gals.
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- (1) Drain Plug
- (2) Filling Plug
- (3) Dipstick

A : Oil level is acceptable within this range

W1014039

### Battery

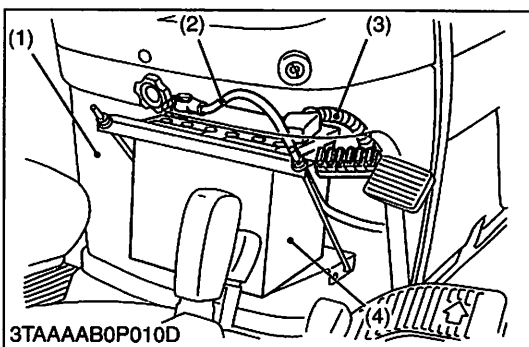
#### ⚠ CAUTION

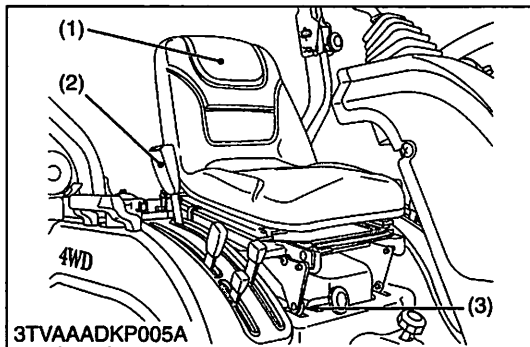
- When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.
1. Remove the under panel (1).
  2. Disconnect the negative cable (2) from the battery.
  3. Disconnect the positive cable (3) from the battery and remove the battery (4).

- (1) Under Panel
- (2) Negative Cable

- (3) Positive Cable
- (4) Battery

W1032888



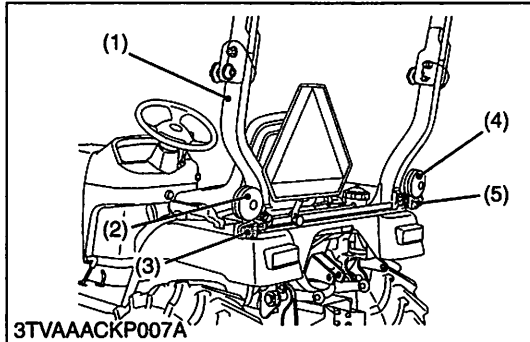


**Seat**

1. Remove the snap pin (3) to remove the seat (1).
2. Remove the seat belt RH (2).

- (1) Seat
- (2) Seat Belt RH
- (3) Snap Pin

W1014409



**Roll-Over Protective Structures (ROPS)**

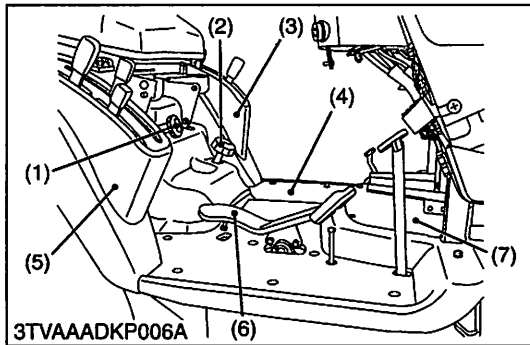
1. Disconnect the lead wires from the hazard lights (2), (4), and turn signal lamp (3), (5).
2. Remove the ROPS mounting nuts and remove the ROPS (1).

**(When reassembling)**

Tightening torque	ROPS mounting nut	124 to 147 N-m 12.6 to 15.0 kgf-m 91.2 to 108 ft-lbs
-------------------	-------------------	--

- (1) ROPS
- (2) Hazard Light LH
- (3) Turn Signal Lamp LH
- (4) Hazard Light RH
- (5) Turn Signal Lamp RH

W1014508

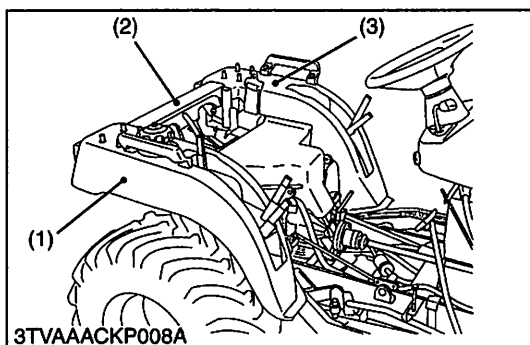


**Speed Control Pedal, Lever Guides and Step**

1. Remove the lever grips.
2. Remove the lowering speed adjusting knob (1) and cutting height adjusting dial knob (2).
3. Remove the step plate (7), speed control pedal (6) and lever guides (3), (5).
4. Remove the step (4).

- (1) Lowering Speed Adjusting Knob
- (2) Cutting Height Adjusting Dial Knob
- (3) Lever Guide LH
- (4) Step
- (5) Lever Guide RH
- (6) Speed Control Pedal
- (7) Step Plate

W1014726

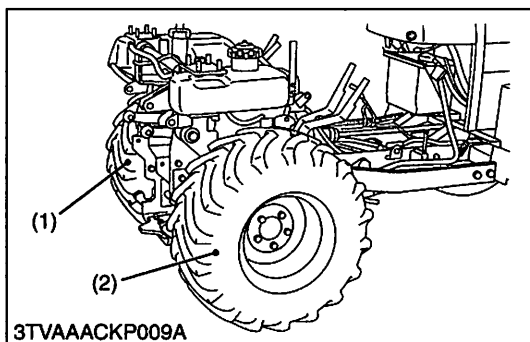


**Fenders**

1. Disconnect the lead wires from the tail lights.
2. Remove the fenders (1), (3) and (2) as a unit.

- (1) Fender RH
- (2) Rear Fender
- (3) Fender LH

W1014865



**Rear Wheel**

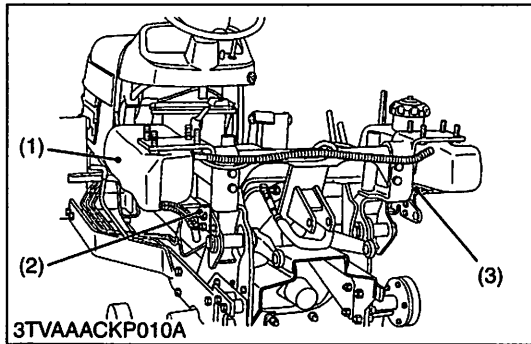
1. Remove the rear wheels (1) and (2).

**(When reassembling)**

Tightening torque	Rear wheel mounting screw	108.5 to 130.2 N-m 11.1 to 13.3 kgf-m 80 to 96 ft-lbs
-------------------	---------------------------	---

- (1) Rear Wheel LH
- (2) Rear Wheel RH

W1014976



**Fuel Tank**

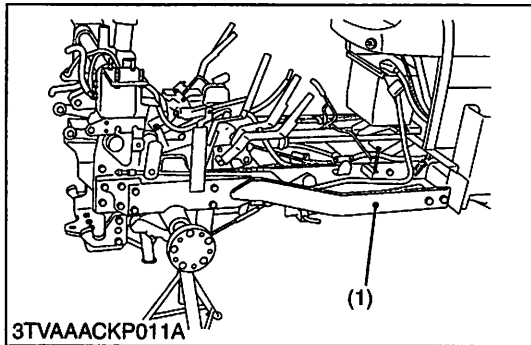
1. Drain the fuel.
2. Disconnect the lead wire from fuel level sensor and fuel hoses from the fuel tank (1).
3. Remove the fuel tank stays (2), (3) and cushions, then remove the fuel tank (1).

**(When reassembling)**

Tightening torque	Fuel tank stay mounting bolt and 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) Fuel Tank (3) Fuel Tank Stay RH  
(2) Fuel Tank Stay LH

W1015094



**Sub Frame**

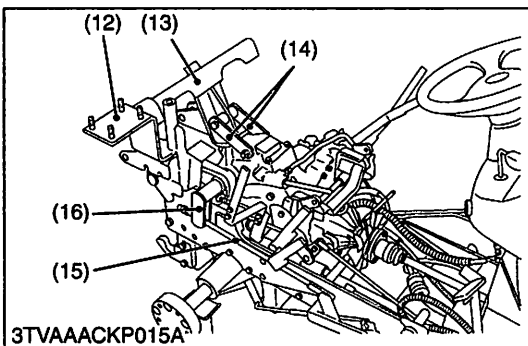
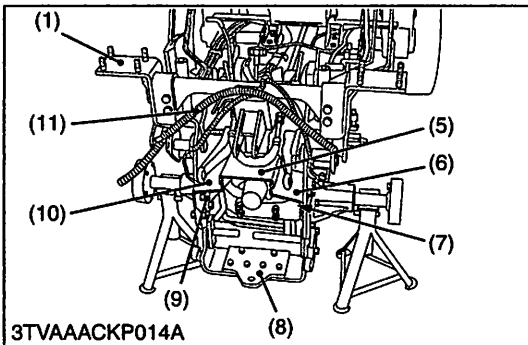
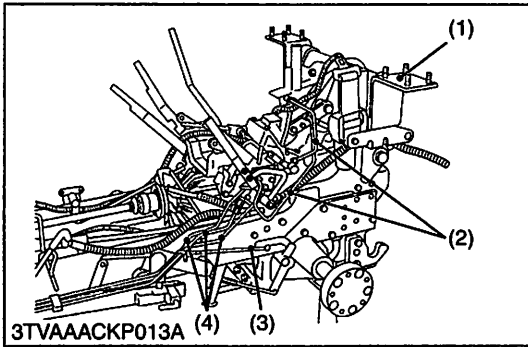
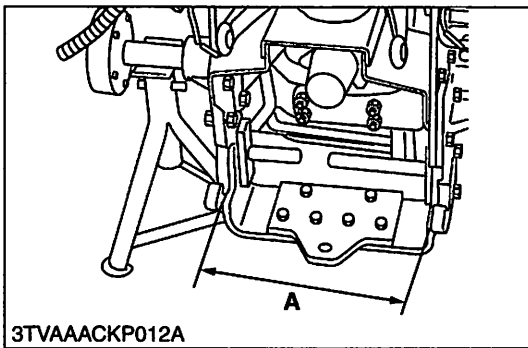
1. Remove the sub frame (1).

**(When reassembling)**

Tightening torque	Sub frame mounting bolt and nut	M14	147 N·m 15.0 kgf·m 108.5 ft·lbs
		M16	196 N·m 20.0 kgf·m 147 ft·lbs

- (1) Sub Frame

W1034997



**Fender Bracket, Hitch Plate and Others**

■ **NOTE**

• **Measure it before disassembling length A to make reassembly smooth.**

1. Remove the differential rod (3).
2. Remove the delivery pipe and return pipe (2) of backhoe.
3. Disconnect the pipes (4) of front loader.
4. Remove the PTO covers (5), (6) and (10).
5. Remove the hitch plate (8) and rear supports (7), (9).
6. Remove the fender bracket LH (1).
7. Disconnect the wire harness (11).
8. Remove the nuts from the lift link (15).
9. Remove the mower lift arm (16).
10. Remove the fender bracket RH (12).
11. Remove the center stay supports (14) and fender center stay (13).

**(When reassembling)**

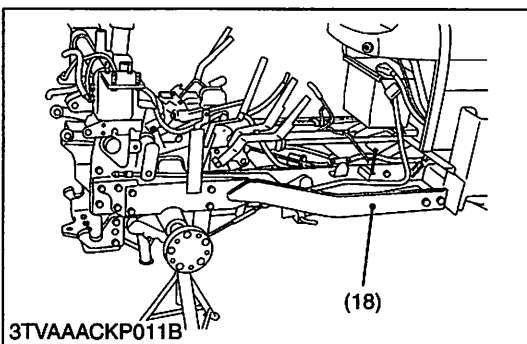
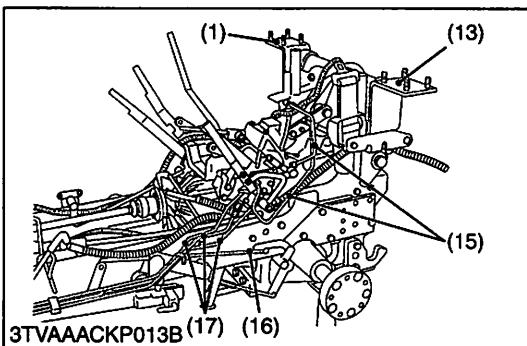
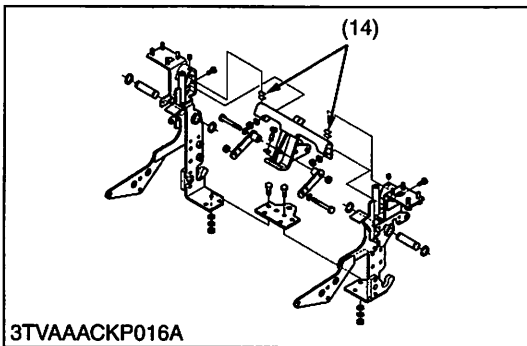
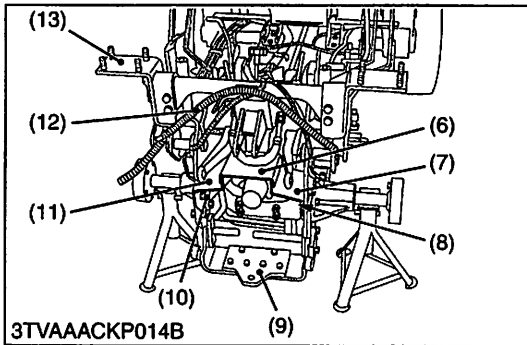
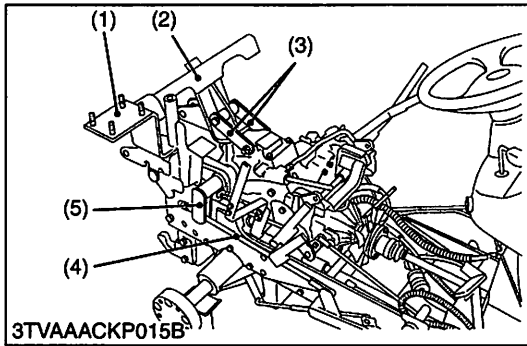
• Refer to the page 2-S17.

**(Reference)**

• Length A : 326 mm (12.8 in.)

- |                       |                          |
|-----------------------|--------------------------|
| (1) Fender Bracket LH | (9) Rear Support LH      |
| (2) Pipe              | (10) PTO Cover LH        |
| (3) Differential Rod  | (11) Wire Harness        |
| (4) Pipe              | (12) Fender Bracket RH   |
| (5) Upper PTO Cover   | (13) Fender Center Stay  |
| (6) PTO Cover RH      | (14) Center Stay Support |
| (7) Rear Support RH   | (15) Lift Link           |
| (8) Hitch Plate       | (16) Mower Lift Arm      |

W1036739



**Assembling Fender Bracket, Hitch Plate and Others**

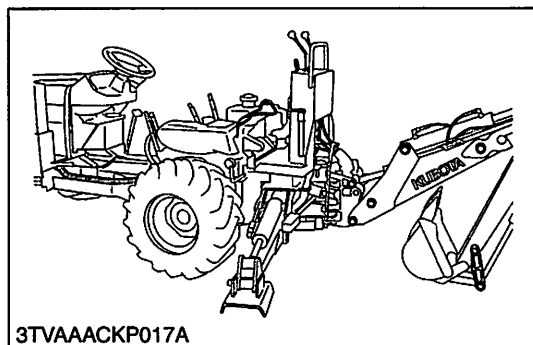
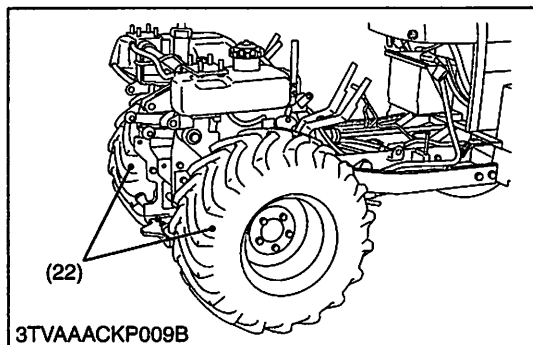
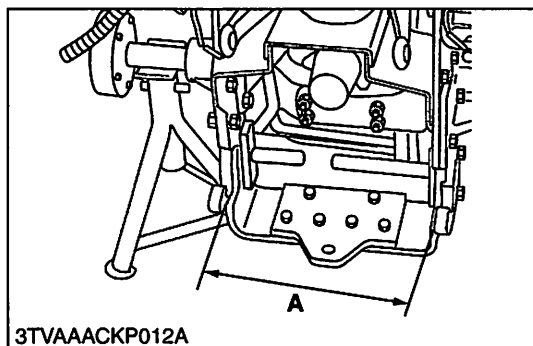
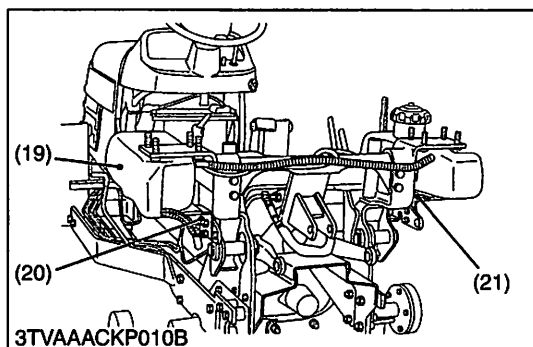
■ **IMPORTANT**

- After confirming the backhoe mounting to the tractor tighten all the bolt and nuts with specified torque.
- When tightening the upper PTO cover (6) mounting bolts and nuts. Adjust the operating force to 29.4 to 49.0 N (3.0 to 5.0 kgf, 6.6 to 11.0 lbs).

1. Install the fender bracket LH (13), fender bracket RH (1) and fender center stay (2).
2. After the all screws, bolt and nuts are tighten to the specified torque. Install and secure the shim (14) with hexagonal socket head screw between fender brackets (1), (13) and fender center stay (2).
3. Install the center stay support (3), mower lift arm (5) and lift link (4) with nuts.
4. Connect the wire harness (12).
5. Install the hitch plate (9) and rear supports (8), (10).
6. Install the PTO cover (6), (7) and (11).
7. Connect the pipes (17) of front loader.
8. Install the pipe (15) of backhoe.
9. Install the differential rod (16).
10. Install the sub frame (18).

- |                         |                        |
|-------------------------|------------------------|
| (1) Fender Bracket RH   | (10) Rear Support LH   |
| (2) Fender Center Stay  | (11) PTO Cover LH      |
| (3) Center Stay Support | (12) Wire Harness      |
| (4) Lift Link           | (13) Fender Bracket LH |
| (5) Lift Arm            | (14) Shim              |
| (6) Upper PTO Cover     | (15) Pipe              |
| (7) PTO Cover RH        | (16) Differential Rod  |
| (8) Rear Support RH     | (17) Pipe              |
| (9) Hitch Plate         | (18) Sub Frame         |

W1038901



**Assembling Fender Bracket, Hitch Plate and Others (Continued)**

11. Install the fuel tank stays (20), (21) with cushions and fuel tank (19).
12. Connect the fuel hoses and fuel lever sensor.
13. Confirm and adjust length A.
14. Install the rear wheel (22).
15. Confirm backhoe can surely be mounted on the tractor.

■ **NOTE**

- Refer to section 8 for the mounting of backhoe.

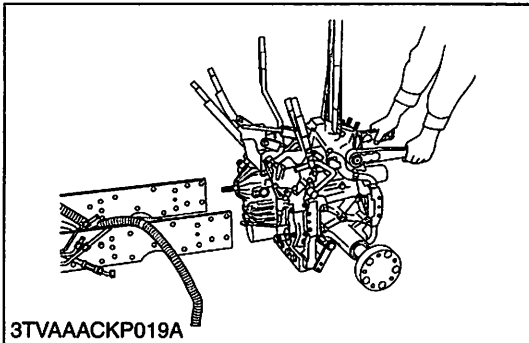
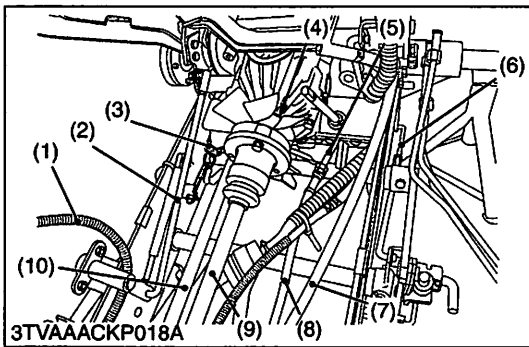
Tightening torque	PTO cover RH and LH mounting bolt and nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
	Rear support mounting screw (M12)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Hitch plate mounting bolt and nut	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs
	Fender bracket mounting bolt and nut (M14)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs
	Fender center stay mounting screw (M14)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs
	Sub frame mounting bolt and nut (M16)	196 to 225 N·m 20.0 to 23.0 kgf·m 145 to 166 ft-lbs

**(Reference)**

- Length A : 326 mm (12.8 in.)
- Thickness of shim (14) : 1.2 mm (0.047 in.)  
1.5 mm (0.059 in.)  
1.9 mm (0.075 in.)

- |                         |                           |
|-------------------------|---------------------------|
| (1) Fender Bracket RH   | (12) Wire Harness         |
| (2) Fender Center Stay  | (13) Fender Bracket LH    |
| (3) Center Stay Support | (14) Shim                 |
| (4) Lift Link           | (15) Pipe                 |
| (5) Mower Lift Arm      | (16) Differential Rod     |
| (6) Upper PTO Cover     | (17) Pipe                 |
| (7) PTO Cover RH        | (18) Sub Frame            |
| (8) Rear Support RH     | (19) Fuel Tank            |
| (9) Hitch Plate         | (20) Fuel Tank Support LH |
| (10) Rear Support LH    | (21) Fuel Tank Support RH |
| (11) PTO Cover LH       | (22) Rear Wheel           |

W1040733



**Transaxle Assembly**

1. Disconnect the speed control rod (2) and brake rod (6).
2. Disconnect the propeller shaft (9) from the transaxle.
3. Remove the rear coupling mounting bolt (4) and spring (3).
4. Remove the wire harness (1) clamps.
5. Disconnect the power steering delivery hose (7) and return hose (8).
6. Remove the bearing holder of front wheel drive shaft (10).

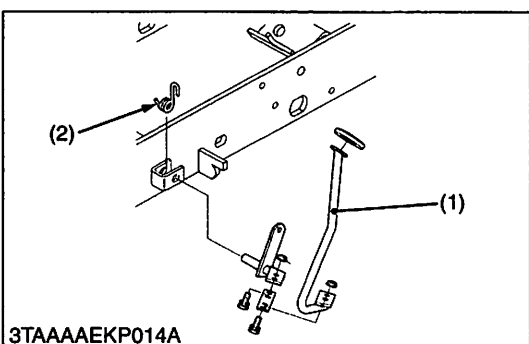
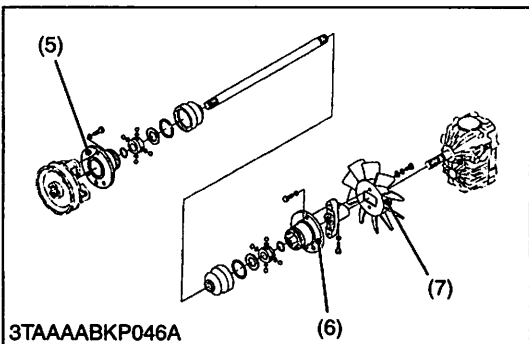
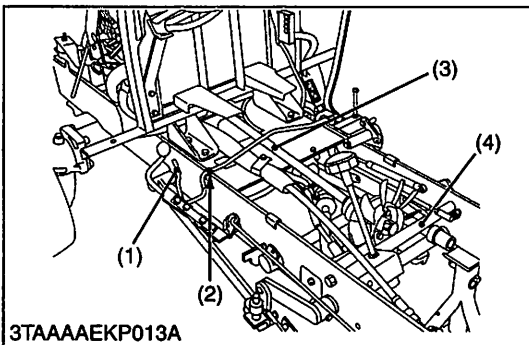
**(When reassembling)**

- Tighten the smaller screws (M12) first.

Tightening torque	Transaxle assembly mounting screw (M12)	62.8 to 72.6 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft·lbs
	Transaxle assembly mounting screw (M14)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft·lbs
	Rear coupling mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs

- |                                 |                     |
|---------------------------------|---------------------|
| (1) Wire Harness                | (6) Brake Rod       |
| (2) Speed Control Rod           | (7) Delivery Hose   |
| (3) Spring                      | (8) Return Hose     |
| (4) Rear Coupling Mounting Bolt | (9) Propeller Shaft |
| (5) Pipe                        | (10) Drive Shaft    |

W1016000



**Parking Pedal, Propeller Shaft Assembly and Tie-rod**

1. Unhook the spring (1) and remove the parking pedal (2).
2. Disconnect the front coupling (5) and remove the propeller shaft assembly (3).
3. Remove the HST fan (7) from propeller shaft assembly (3).
4. Remove the tie-rod (4).

**(When reassembling)**

- Apply grease to inside of the front coupling and rear coupling.

Tightening torque	Front coupling mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs
	HST fan mounting screw	9.8 to 11.3 N·m 1.00 to 1.15 kgf·m 7.2 to 8.3 ft·lbs
	Tie-rod mounting screw	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft·lbs

- |                              |                    |
|------------------------------|--------------------|
| (1) Spring                   | (5) Front Coupling |
| (2) Parking Pedal            | (6) Rear Coupling  |
| (3) Propeller Shaft Assembly | (7) HST Fan        |
| (4) Tie-rod                  |                    |

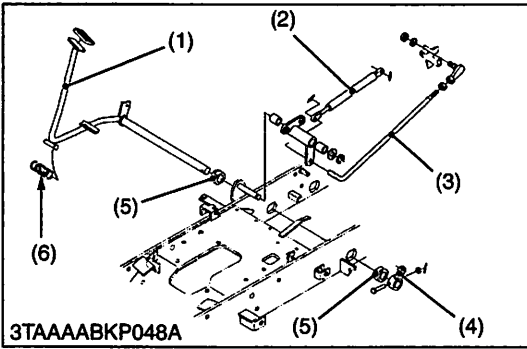
W1016476

**Differential Lock Pedal**

1. Unhook the spring (2) and remove the differential lock pedal (1).

- |                             |            |
|-----------------------------|------------|
| (1) Differential Lock Pedal | (2) Spring |
|-----------------------------|------------|

W1016728



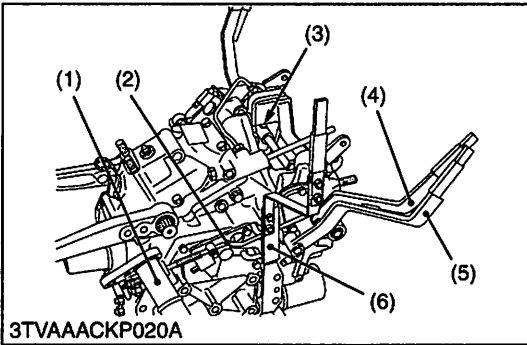
**Brake Pedal, Speed Change Rod and HST Damper**

1. Remove the cotter pin and clevis pin, then remove the brake arm (4).
2. Remove the spring (6), brake pedal (1) and bushes (5).
3. Remove the rue rings, then remove the HST damper (2) and speed change rod (3).

- |                      |               |
|----------------------|---------------|
| (1) Brake Pedal      | (4) Brake Arm |
| (2) HST Damper       | (5) Bush      |
| (3) Speed Change Rod | (6) Spring    |

W1016858

**[2] HYDROSTATIC TRANSMISSION**



**Levers and Mower Lift Arm**

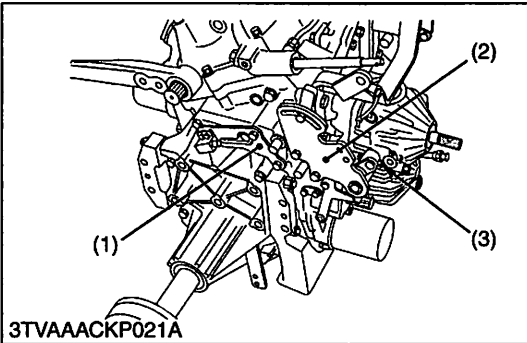
1. Tap out the spring pin from the range gear shift lever (6) and front wheel drive lever (5), then remove the both levers.
2. Remove the mower lift arm (1) with feedback rod (2).
3. Remove the rue ring (3) and hydraulic control lever mounting bolt and nut, then remove the hydraulic control lever (4).

**(When reassembling)**

Tightening torque	Hydraulic control lever mounting bolt and nut	17.7 to 20.6 N-m 1.8 to 2.1 kgf-m 13.0 to 15.2 ft-lbs
-------------------	---	---

- |                    |                             |
|--------------------|-----------------------------|
| (1) Mower Lift Arm | (4) Hydraulic Control Lever |
| (2) Feedback Rod   | (5) Front Wheel Drive Lever |
| (3) Rue Ring       | (6) Range Gear Shift Lever  |

W1017118



**Neutral Plate and Neutral Switch Stay**

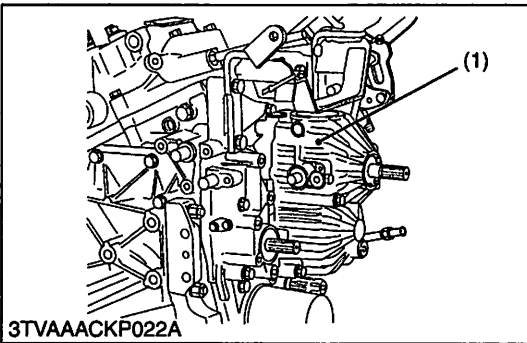
1. Remove the trunnion arm mounting bolt and nut (3).
2. Remove the neutral plate mounting screws, then remove the neutral plate (2).
3. Remove the neutral switch stay (1).

**(When reassembling)**

Tightening torque	Trunnion arm mounting bolt and nut	9.8 to 11.3 N-m 1.00 to 1.15 kgf-m 7.2 to 8.3 ft-lbs
-------------------	------------------------------------	--

- |                         |  |
|-------------------------|--|
| (1) Neutral Switch Stay | (3) Trunnion Arm Mounting Bolt and Nut |
| (2) Neutral Plate       |  |

W1017287



**Hydrostatic Transmission Assembly**

1. Remove the hydrostatic transmission assembly (1) from transmission case.

**(When reassembling)**

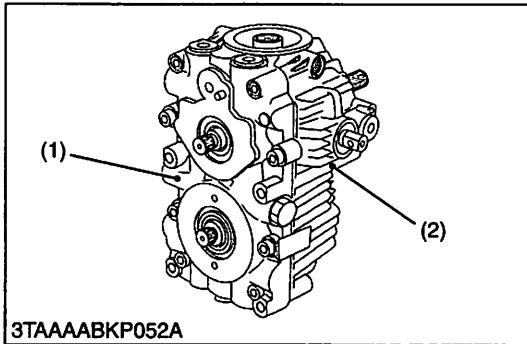
- Apply oil to the O-rings and take care not to damage them.
- Apply liquid lock (Three Bond 1324 or its equivalent) to the thread of hydrostatic transmission mounting screws.

Tightening torque	Hydrostatic transmission mounting screw	15.7 to 20.6 N-m 1.6 to 2.1 kgf-m 11.6 to 15.2 ft-lbs
-------------------	---	---

- |                                       |
|---------------------------------------|
| (1) Hydrostatic Transmission Assembly |
|---------------------------------------|

W1017437





**Center Section**

1. Remove the center section mounting hex. socket head screw.
2. Tap the center section (1) with soft hammer and separate the center section (1) from the HST housing (2).

**(When reassembling)**

- Cover the splines of each shaft with thin tape to protect the sealing lip of the oil seals.
- Place a new gasket on the HST housing.

**NOTE**

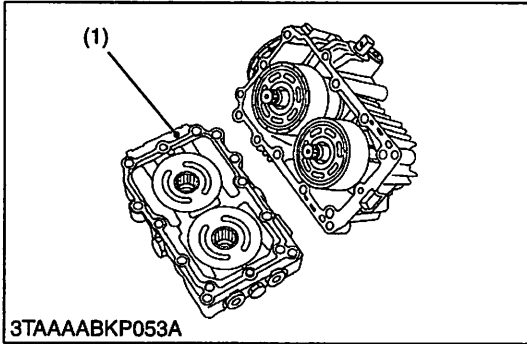
- Take care not to damage the surface of cylinder blocks, pistons and center section.

Tightening torque	Center section mounting hex. socket head screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft·lbs
-------------------	--	---

(1) Center Section

(2) HST Housing

W1022048



**Charge Relief Valve**

1. Remove the plug (3) and draw out the spring (2) and charge relief cone (1).

**(When reassembling)**

- Take care not to damage the O-ring on the plug.

**NOTE**

- If the shims are placed at the bottom of the relief valve plug bore, place them as they are.

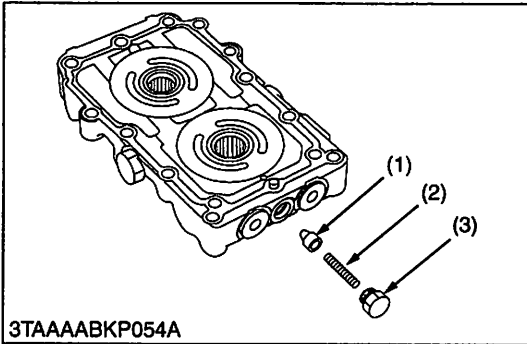
Tightening torque	Charge relief valve plug	14.22 to 23.54 N·m 1.45 to 2.40 kgf·m 10.49 to 17.36 ft·lbs
-------------------	--------------------------	---

(1) Charge Relief Cone

(3) Plug

(2) Spring

W1022241



**Check and High Pressure Relief Valve**

1. Remove the plug (1) and draw out the spring (2) and check and high pressure relief valve assembly (3), (4).

**(When reassembling)**

- Take care not to damage the O-ring on the plug.

Tightening torque	Check and high pressure relief valve plug	40.70 to 94.93 N·m 4.15 to 9.68 kgf·m 30.02 to 70.02 ft·lbs
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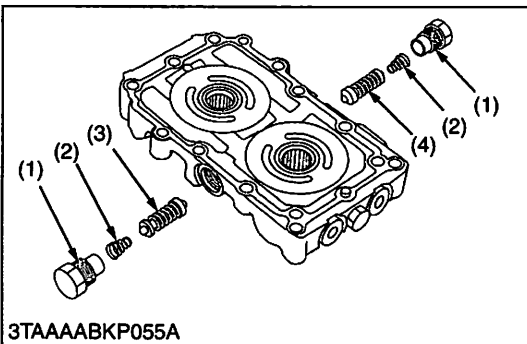
(1) Plug

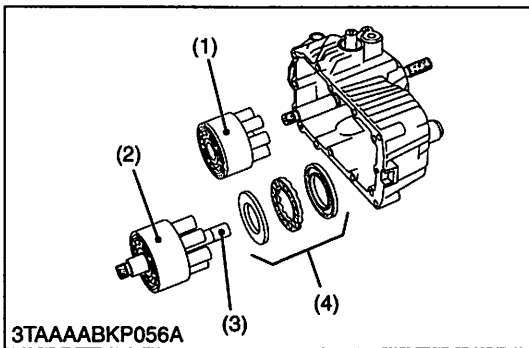
(4) Check and High Pressure Relief Valve Assembly (Reverse)

(2) Spring

(3) Check and High Pressure Relief Valve Assembly (Forward)

W1022380





3TAAAABKP056A

**Cylinder Block Assembly and Thrust Ball Bearing**

1. Remove the cylinder block assembly (pump side) (1).
2. Remove the cylinder block assembly (motor side) (2) with the motor shaft (3).
3. Remove the thrust ball bearing (4).

**(When reassembling)**

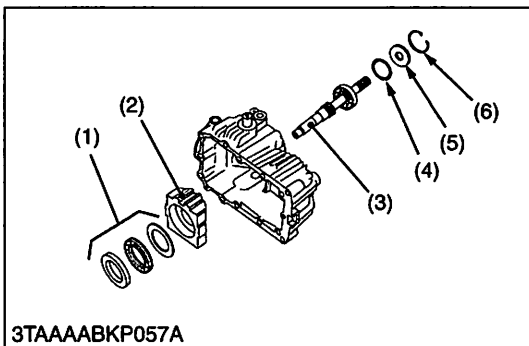
- Apply clean transmission oil to thrust ball bearing, cylinder block and piston.

**■ NOTE**

- Take care not to damage the surface of cylinder blocks and pistons.

- |  |                         |
|--|-------------------------|
| (1) Cylinder Block Assembly (Pump Side)  | (3) Motor Shaft         |
| (2) Cylinder Block Assembly (Motor Side) | (4) Thrust Ball Bearing |

W1022614



3TAAAABKP057A

**Swashplate and Pump Shaft**

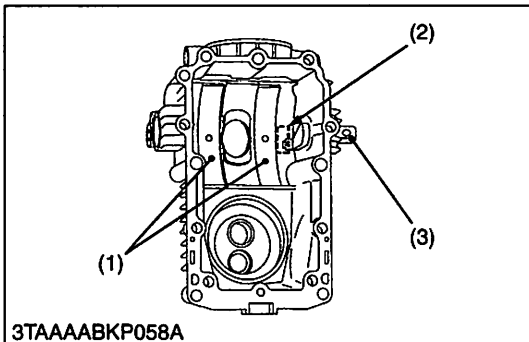
1. Remove the swashplate and thrust roller bearing (1) from the HST housing.
2. Remove the internal snap ring (6) and tap out the pump shaft (3), spacer (4) and oil seal (5).

**(When reassembling)**

- Apply clean transmission oil to the thrust roller bearing.

- |                           |                        |
|---------------------------|------------------------|
| (1) Thrust Roller Bearing | (4) Spacer             |
| (2) Swashplate            | (5) Oil Seal           |
| (3) Pump Shaft            | (6) Internal Snap Ring |

W1022771



3TAAAABKP058A

**Cradle Bearing, Slot Guide and Trunnion Arm**

1. Remove the slot guide (2) and trunnion arm (3).
2. Remove the cradle bearing (1) from the HST housing.

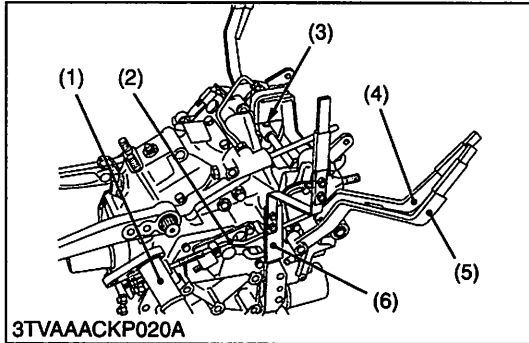
**(When reassembling)**

- Apply clean transmission oil to the cradle bearing and trunnion arm.
- Fasten down the cradle bearing to the HST housing.

- |                    |                  |
|--------------------|------------------|
| (1) Cradle Bearing | (3) Trunnion Arm |
| (2) Slot Guide     |                  |

W1022902

### [3] TRANSMISSION CASE



#### Levers and Mower Lift Arm

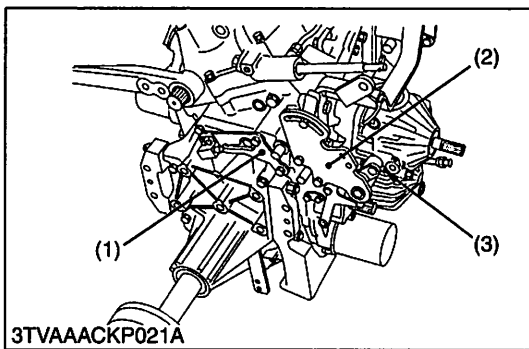
1. Tap out the spring pin from the range gear shift lever (6) and front wheel drive lever (5), then remove the both levers.
2. Remove the mower lift arm (1) with feedback rod (2).
3. Remove the rue ring (3) and hydraulic control lever mounting bolt and nut, then remove the hydraulic control lever (4).

#### (When reassembling)

Tightening torque	Hydraulic control lever mounting bolt and nut	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft·lbs
-------------------	---	---

- |                    |                             |
|--------------------|-----------------------------|
| (1) Mower Lift Arm | (4) Hydraulic Control Lever |
| (2) Feedback Rod   | (5) Front Wheel Drive Lever |
| (3) Rue Ring       | (6) Range Gear Shift Lever  |

W1023064



#### Neutral Plate and Neutral Switch Stay

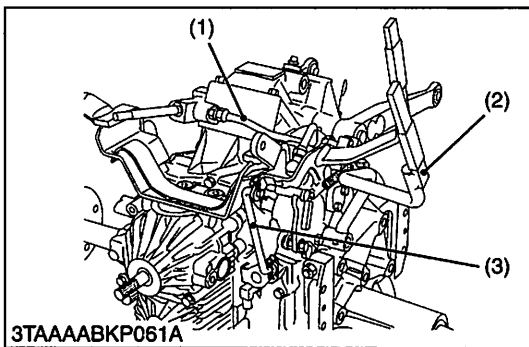
1. Remove the trunnion arm mounting bolt and nut (3).
2. Remove the neutral plate mounting screws, then remove the neutral plate (2).
3. Remove the neutral switch stay (1).

#### (When reassembling)

Tightening torque	Trunnion arm mounting bolt and nut	9.8 to 11.3 N·m 1.00 to 1.15 kgf·m 7.2 to 8.3 ft·lbs
-------------------	------------------------------------	--

- |                         |  |
|-------------------------|--|
| (1) Neutral Switch Stay | (3) Trunnion Arm Mounting Bolt and Nut |
| (2) Neutral Plate       |  |

W1023204



#### PTO Select Lever and Control Valve

1. Remove the delivery pipe (1) and PTO clutch rod (3).
2. Tap out the spring pin and remove the PTO select lever (2).
3. Remove the control valve (5) with PTO safety switch stay.

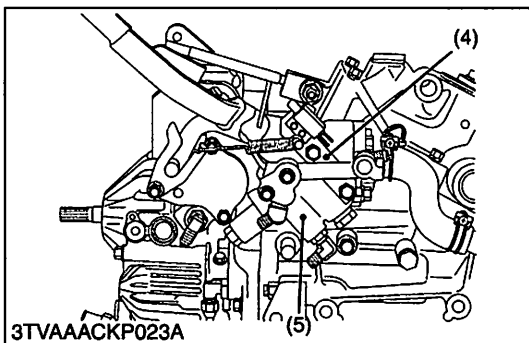
#### (When reassembling)

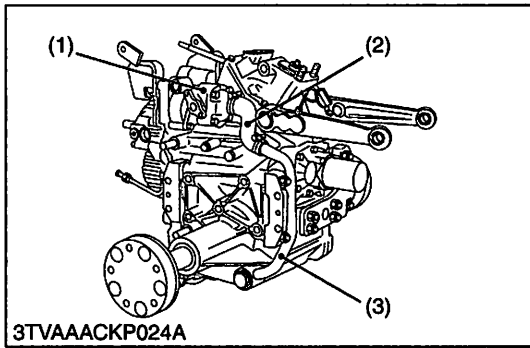
- Apply oil to the O-rings and take care not to damage them.

Tightening torque	Delivery pipe	28.4 to 30.0 N·m 2.9 to 3.1 kgf·m 20.9 to 22.1 ft·lbs
	PTO safety switch mounting screw (with control valve)	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft·lbs

- |                      |                            |
|----------------------|----------------------------|
| (1) Delivery Pipe    | (4) PTO Safety Switch Stay |
| (2) PTO Select Lever | (5) Control Valve          |
| (3) PTO Clutch Rod   |                            |

W1023043





**Hydraulic Pump and Suction Pipe**

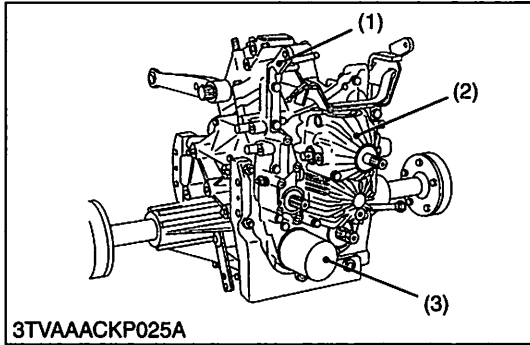
1. Remove the hydraulic pump (1) and suction pipe (3) from the transmission case.

**(When reassembling)**

- Do not twist the suction hose (2).
- Take care not to damage the O-rings.

- (1) Hydraulic Pump (3) Suction Pipe  
 (2) Suction Hose

W1023493



**Seal Rail Front Stay and Hydrostatic Transmission Assembly**

1. Remove the seat rail front stay (1).  
 2. Remove the hydrostatic transmission assembly (2) and oil filter cartridge (3).

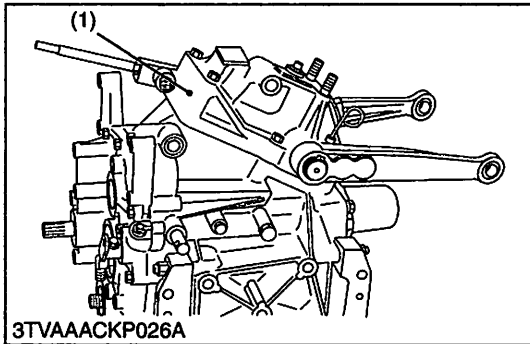
**(When reassembling)**

- Apply oil to the O-rings and take care not to damage them.
- Apply liquid lock (Three Bond 1324 or equivalent) to the thread of hydrostatic transmission mounting screws.

Tightening torque	Hydrostatic transmission mounting screw	15.7 to 20.6 N-m 1.6 to 2.1 kgf-m 11.6 to 15.2 ft-lbs
-------------------	---	---

- (1) Seat Rail Front Stay (3) Oil Filter Cartridge  
 (2) Hydrostatic Transmission Assembly

W1023679



**Hydraulic Cylinder**

1. Remove the hydraulic cylinder mounting screws and dismount the hydraulic cylinder (1).

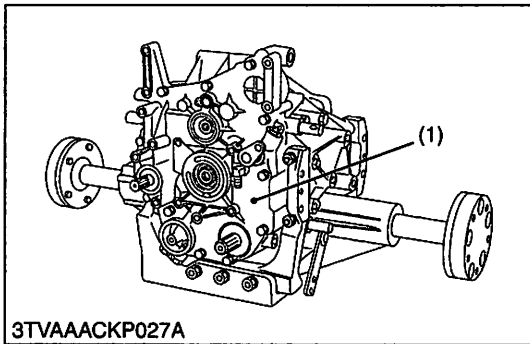
**(When reassembling)**

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

Tightening torque	Hydraulic cylinder mounting screw	39.2 to 44.1 N-m 4.0 to 4.5 kgf-m 28.9 to 32.5 ft-lbs
-------------------	-----------------------------------	---

- (1) Hydraulic Cylinder

W1023836



**Front Cover**

1. Remove the front cover mounting screws and separate the front cover (1).

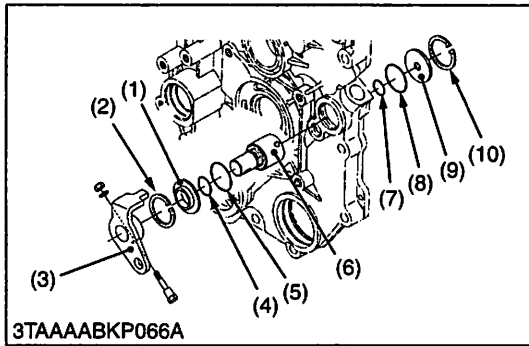
**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the transmission case to front cover.
- The spring pin on the front wheel drive idle shaft and gear pump idle shaft should face upper side.
- Apply grease to the collar on the front wheel drive shaft.
- Take care not to damage the O-ring.

Tightening torque	Front 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) Front Cover

W1023957



**PTO Clutch Valve**

1. Remove the PTO clutch arm (3).
2. Remove the internal snap ring (10), then draw out the PTO clutch collar (9) and PTO clutch valve (6).
3. Remove the internal snap ring (10) and draw out the PTO clutch sleeve (1).

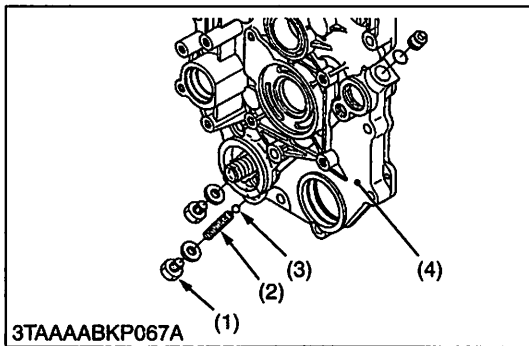
**(When reassembling)**

- Take care not to damage the O-rings.

Tightening torque	PTO clutch arm mounting bolt and nut	9.8 to 14.7 N·m 1.00 to 1.15 kgf·m 7.2 to 10.8 ft-lbs
-------------------	--------------------------------------	---

- |                        |                         |
|------------------------|-------------------------|
| (1) PTO Clutch Sleeve  | (6) PTO Clutch Valve    |
| (2) Internal Snap Ring | (7) O-ring              |
| (3) PTO Clutch Arm     | (8) O-ring              |
| (4) O-ring             | (9) PTO Clutch Collar   |
| (5) O-ring             | (10) Internal Snap Ring |

W1024111



**PTO Relief Valve**

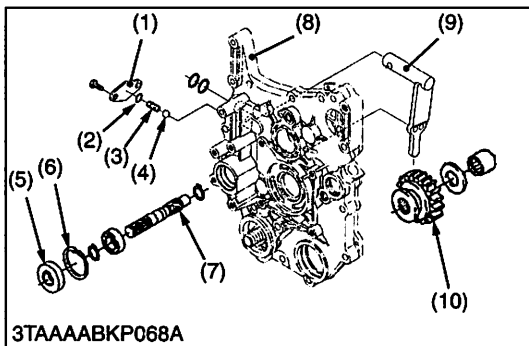
1. Remove the PTO relief valve plug (1), then draw out the spring (2) and steel ball (3).

**(When reassembling)**

Tightening torque	PTO relief valve plug	21.58 to 25.50 N·m 2.2 to 2.6 kgf·m 15.91 to 18.81 ft-lbs
-------------------	-----------------------	---

- |                           |                 |
|---------------------------|-----------------|
| (1) PTO Relief Valve Plug | (3) Steel Ball  |
| (2) Spring                | (4) Front Cover |

W1024483



**Front Wheel Drive Shaft and Shift Fork**

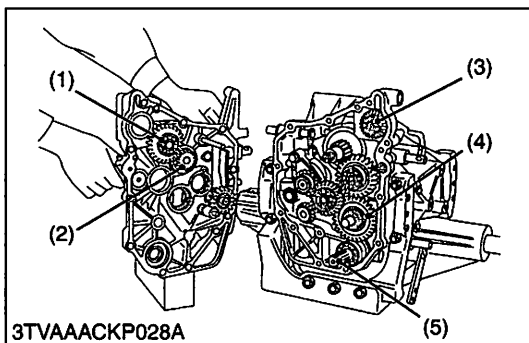
1. Remove the plate (1), then draw out the spring (3) and steel ball (4).
2. Remove the oil seal (5) and internal snap ring (6).
3. Tap out the front wheel drive shaft (7) to the front.
4. Remove the 19T shifter gear (10) and front wheel drive shift fork (9).

**(When reassembling)**

- Take care not to damage the O-ring.
- Replace the oil seal (5) with new one.

- |                |                                  |
|----------------|----------------------------------|
| (1) Plate      | (6) Internal Snap Ring           |
| (2) O-ring     | (7) Front Wheel Drive Shaft      |
| (3) Spring     | (8) Front Cover                  |
| (4) Steel Ball | (9) Front Wheel Drive Shift Fork |
| (5) Oil Seal   | (10) 19T Shifter Gear            |

W1024622

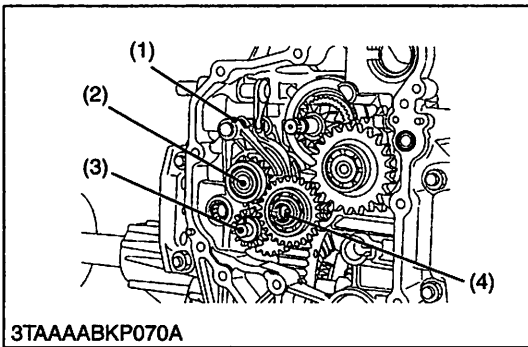


**13T Gear, 19T Gear Shaft, Hydraulic Pump Idle Shaft, Mid-PTO Shaft and Mid-PTO Idle Shaft**

1. Remove the 13T gear assembly (2), 19T gear shaft assembly (3) and hydraulic pump idle shaft assembly (1).
2. Remove the mid-PTO shaft assembly (5) and mid-PTO idle shaft assembly (4).

- |  |                                 |
|--|---------------------------------|
| (1) Hydraulic Pump Idle Shaft Assembly | (4) Mid-PTO Idle Shaft Assembly |
| (2) 13T Gear Assembly                  | (5) Mid-PTO Shaft Assembly      |
| (3) 19T Gear Shaft Assembly            |                                 |

W1024846



3TAAAABKP070A

**Spiral Bevel Gear Shaft, 17T-25T Gear Shaft and Front Wheel Drive Idle Shaft**

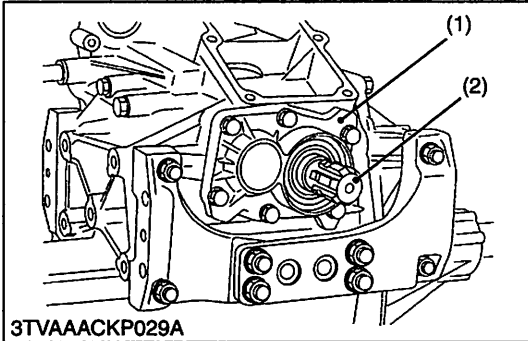
1. Remove the front wheel drive idle shaft assembly (3) and 17T-25T gear shaft assembly (4).
2. Remove the spiral bevel gear shaft assembly (2) together with range gear shift fork (1).

**(When reassembling)**

- Install all of the above mentioned parts, simultaneously.

- |                                      |   |
|--------------------------------------|---|
| (1) Range Gear Shift Fork            | (3) Front Wheel Drive Idle Shaft Assembly |
| (2) Spiral Bevel Gear Shaft Assembly | (4) 17T-25T Gear Shaft Assembly           |

W1024950



3TVAAACKP029A

**Rear Cover, Rear PTO Shaft and Rear PTO Drive Shaft**

1. Remove the rear cover (1) and rear PTO shaft assembly (2).
2. Remove the PTO select bolt (3) and draw out the spring and steel ball.
3. Remove the rear PTO drive shaft assembly (4).

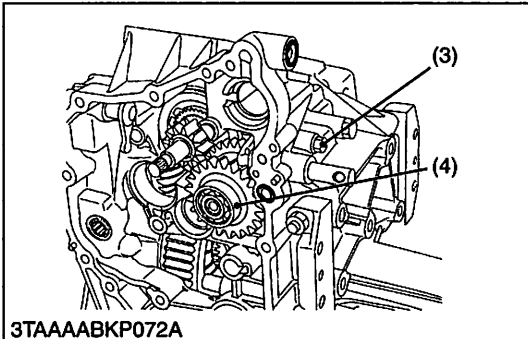
**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the transmission case to rear cover.
- Apply grease to the lip of oil seal.

Tightening torque	Rear cover mounting screw	39.2 to 44.1 N-m 4.0 to 4.5 kgf-m 28.9 to 32.5 ft-lbs
	PTO select bolt	21.6 to 25.5 N-m 2.2 to 2.6 kgf-m 15.9 to 18.8 ft-lbs

- |                             |                                   |
|-----------------------------|-----------------------------------|
| (1) Rear Cover              | (3) PTO Select Bolt               |
| (2) Rear PTO Shaft Assembly | (4) Rear PTO Drive Shaft Assembly |

W1025166



3TAAAABKP072A

**PTO Clutch Assembly**

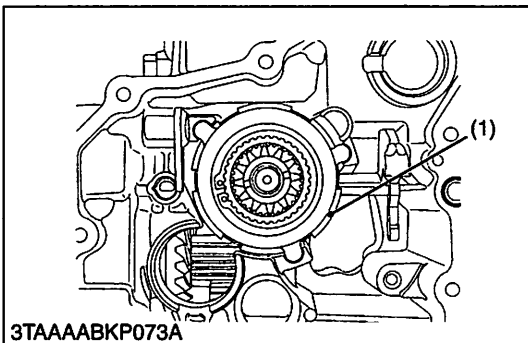
1. Remove the PTO clutch assembly (1) from transmission case.

**(When reassembling)**

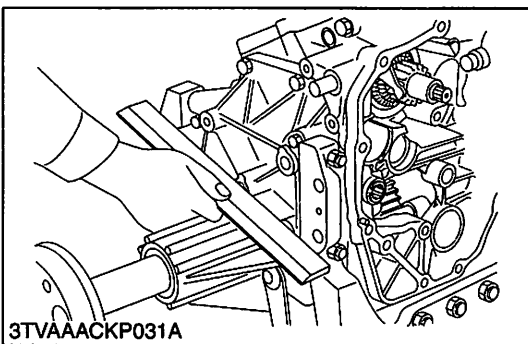
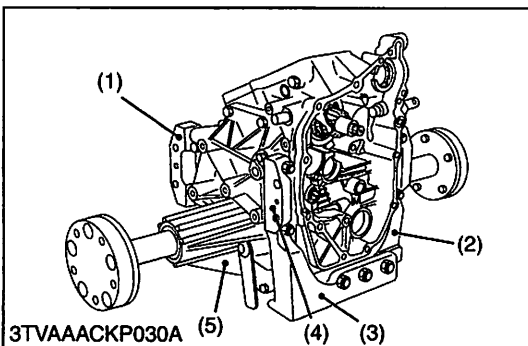
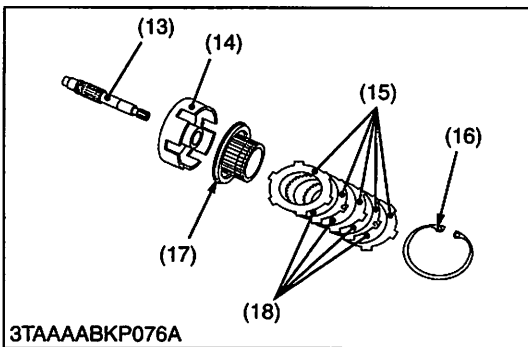
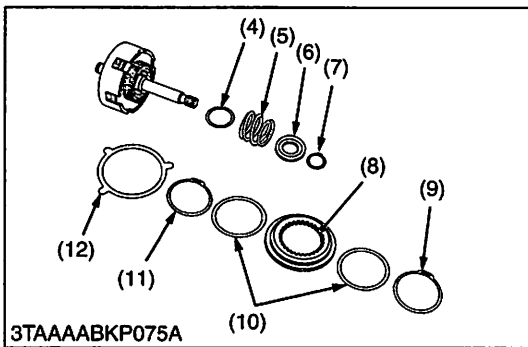
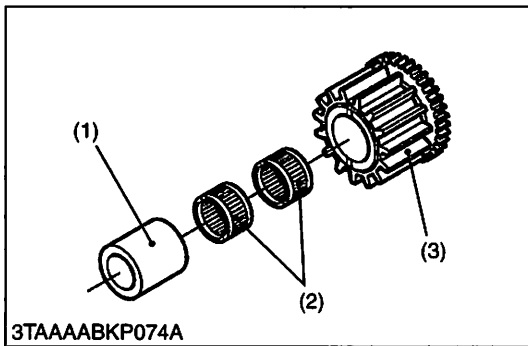
- Apply transmission oil to the seal ring on the clutch shaft.

- |                         |
|-------------------------|
| (1) PTO Clutch Assembly |
|-------------------------|

W1025392



3TAAAABKP073A



**Disassembling PTO Clutch Assembly**

1. Remove the collar (1), needle bearings (2) and 12T gear clutch (3).
2. Remove the external snap ring (9), then remove the shims (10), brake pressure plate (8) and brake disc (12).
3. Remove the external snap rings (11) and (7).
4. Remove the spring collar (6), clutch spring (5) and bearing collar (4).
5. Remove the internal snap ring (16), then draw out the pressure plates (15) and clutch discs (18).
6. Tap out the clutch shaft (13) and remove the clutch piston (17) from clutch case (14).

**(When reassembling)**

- Apply transmission oil to the O-rings, D-ring and seal ring, and take care not to damage it.

- |                          |                         |
|--------------------------|-------------------------|
| (1) Collar               | (10) Shim               |
| (2) Needle Bearing       | (11) External Snap Ring |
| (3) 12T Gear Clutch      | (12) Brake Disc         |
| (4) Bearing Collar       | (13) Clutch Shaft       |
| (5) Clutch Spring        | (14) Clutch Case        |
| (6) Spring Collar        | (15) Pressure Plate     |
| (7) External Snap Ring   | (16) Internal Snap Ring |
| (8) Brake Pressure Plate | (17) Clutch Piston      |
| (9) External Snap Ring   | (18) Clutch Disc        |

W1025482

**Axle Cover**

1. Remove the rear bracket (1) and front bracket (4).
2. Remove the bracket RH (3) and bracket LH (2).
3. Remove the axle cover (5) from transmission case.

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the transmission case to axle cover.
- Align the mounting surface of the front bracket, rear bracket and axle cover to the transmission case before tightening the bracket mounting nut.

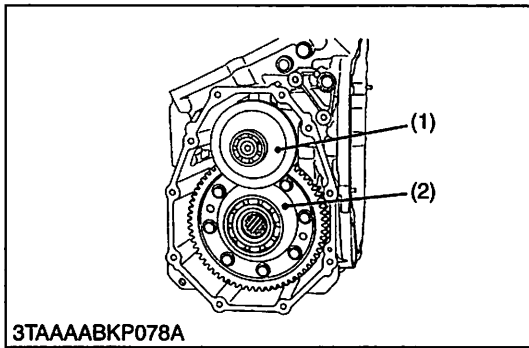
**NOTE**

- Confirm bracket in the rear (1) and front (4) is parallel.

Tightening torque	Bracket mounting nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Axle 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) Rear Bracket | (4) Front Bracket |
| (2) Bracket RH   | (5) Axle Cover    |
| (3) Bracket LH   |                   |

W1026073



**Final Gear Shaft and Differential Gear Assembly**

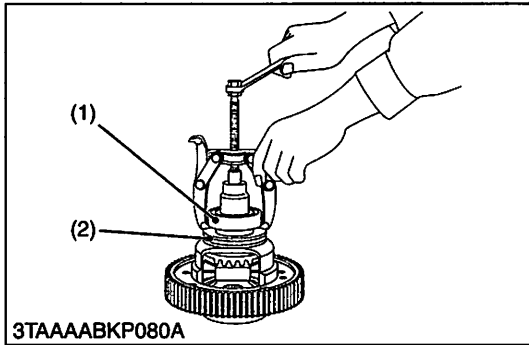
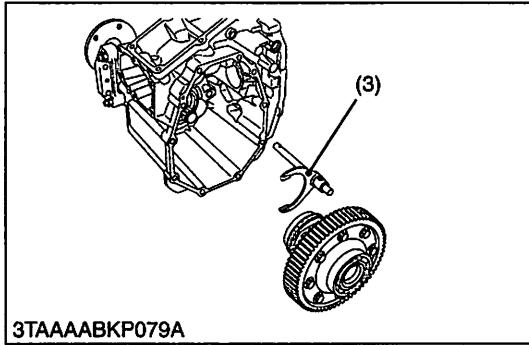
1. Draw out the final gear shaft assembly (1), differential gear assembly (2) and differential lock shift fork (3).

**(When reassembling)**

- Take care not to damage the O-ring.

- |                                |                                  |
|--------------------------------|----------------------------------|
| (1) Final Gear Shaft Assembly  | (3) Differential Lock Shift Fork |
| (2) Differential Gear Assembly |                                  |

W1026307

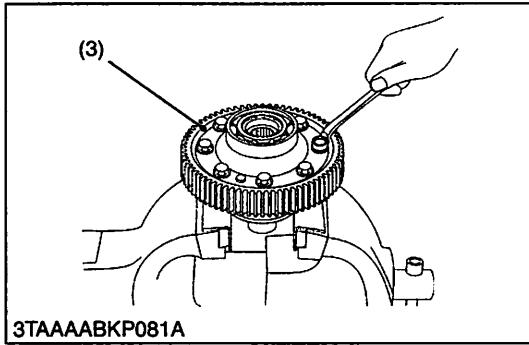


**Disassembling Differential Gear Assembly**

1. Remove the bearing (1), differential lock shifter (2) and 66T final gear (3).
2. Put parting marks on the differential pinions (9), (13) and the differential side gears (6), (11).
3. Tap out the differential pinion shaft (5).
4. Remove the differential pinions (9), (13), differential pinion washers (10), (14), differential side gears (6), (11) and differential side gear washers (7), (12).

**(When reassembling)**

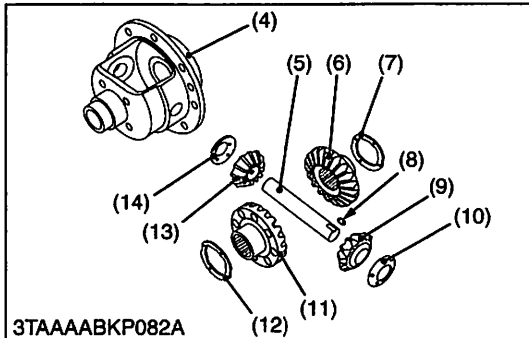
- Install the differential pinion and differential side gear, aligning the parting marks.
- Lock the differential pinion shaft (5) by setting the key (8).



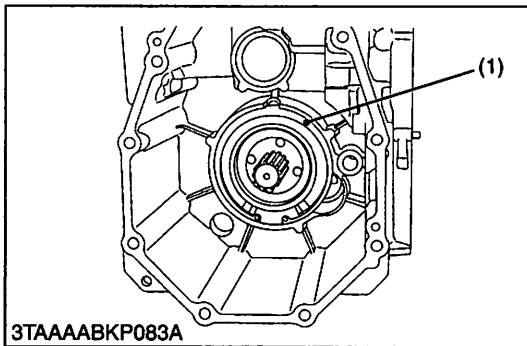
Tightening torque	66T final gear mounting screw	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft·lbs
-------------------	-------------------------------	---

- |                                   |                                    |
|-----------------------------------|------------------------------------|
| (1) Bearing                       | (8) Key                            |
| (2) Differential Lock Shifter     | (9) Differential Pinion            |
| (3) 66T Final Gear                | (10) Differential Pinion Washer    |
| (4) Differential Case             | (11) Differential Side Gear        |
| (5) Differential Pinion Shaft     | (12) Differential Side Gear Washer |
| (6) Differential Side Gear        | (13) Differential Pinion           |
| (7) Differential Side Gear Washer | (14) Differential Pinion Washer    |

W1026489







**Brake Disc and Friction Plate**

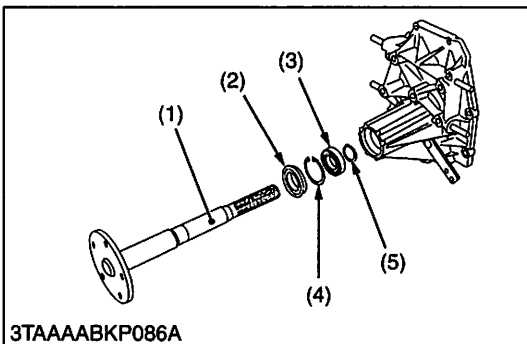
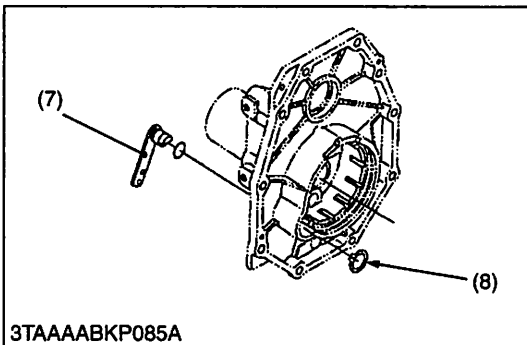
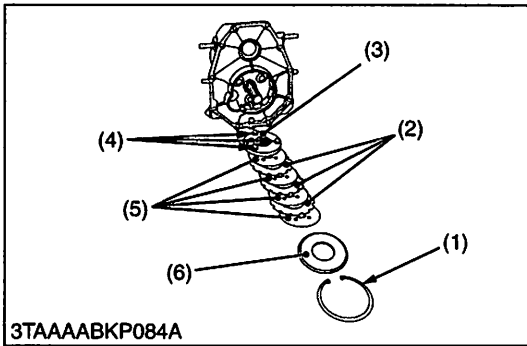
1. Remove the internal snap ring (1).
2. Remove the bearing holder (6), brake discs (5), friction plates (2), actuator (3) and steel balls (4).
3. Remove the external snap ring (8), then remove the cam lever (7).

**(When reassembling)**

- Apply grease to the steel balls.
- Install the brake discs with their holes deviation at less than 1/3 of the total hole area.
- When installing the bearing holder, do not forget to install the straight pin.
- Install the internal snap ring (1) as shown in the figure. (Open end of the snap ring should place bottom side.)
- Take care not to damage the O-ring.

- |                        |                        |
|------------------------|------------------------|
| (1) Internal Snap Ring | (5) Brake Disc         |
| (2) Friction Plate     | (6) Bearing Holder     |
| (3) Actuator           | (7) Cam Lever          |
| (4) Steel Ball         | (8) External Snap Ring |

W1026785



**Rear Axle**

1. Remove the oil seal (2), then remove the internal snap ring (4).
2. Tap out the rear axle (1) from transmission case or rear axle cover.

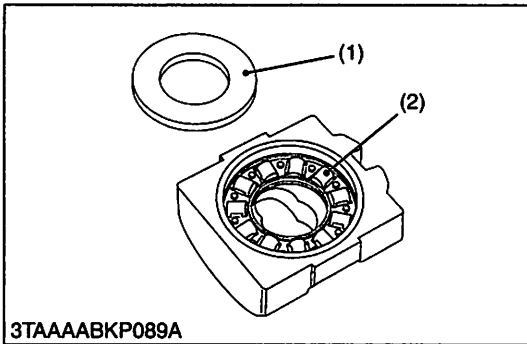
**(When reassembling)**

- Do not apply oil to the outer circumference of the oil seal.

- |               |                        |
|---------------|------------------------|
| (1) Rear Axle | (4) Internal Snap Ring |
| (2) Oil Seal  | (5) External Snap Ring |
| (3) Bearing   |                        |

W1027164





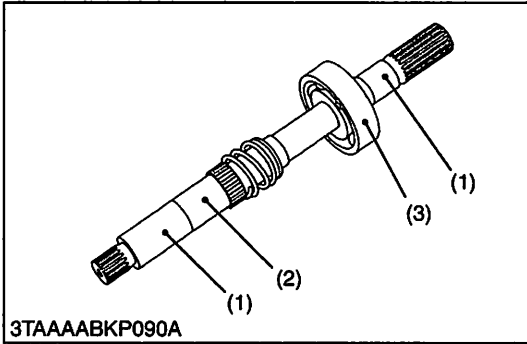
3TAAAABKP089A

**Thrust Washer, Thrust Roller Bearing and Thrust Plate**

1. Check the thrust roller bearing (2) for scratches and excessive wear.
2. If worn, replace.
3. Check the thrust plate (1) for scratches and excessive wear.
4. If worn or scored, replace.

(1) Thrust Plate (2) Thrust Roller Bearing

W1027775



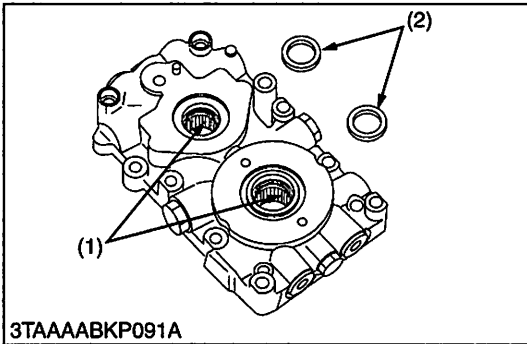
3TAAAABKP090A

**Pump Shaft**

1. Check the seal surface (1), the bearing surface (2) and the ball bearing (3).
2. If the shaft is rough or grooved, replace it.
3. If the ball bearing is worn, replace it.

(1) Seal Surface (2) Bearing Surface (3) Ball Bearing

W1027972



3TAAAABKP091A

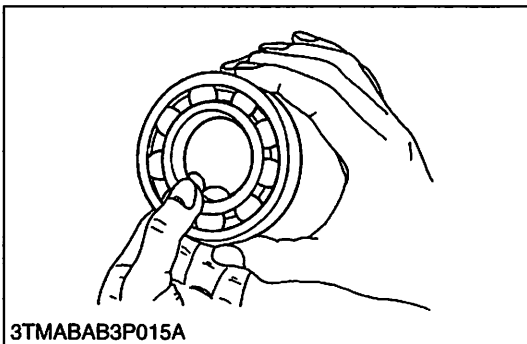
**Needle Bearing and Oil Seal**

1. Check the oil seals (2) for damage.
2. Check the needle bearings (1) for wear.
3. If the oil seals and needle bearings are worn or damaged, replace them.

(1) Needle Bearing (2) Oil Seal

W1028196

**[2] TRANSMISSION CASE**

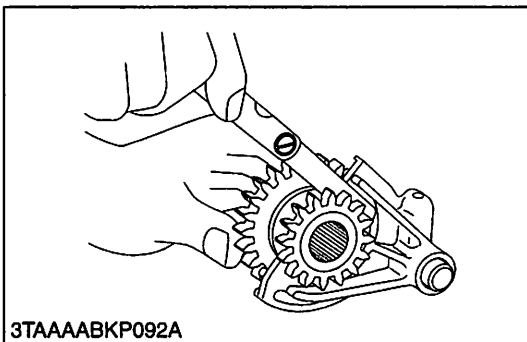


3TMABAB3P015A

**Checking Bearing**

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.

W10260490



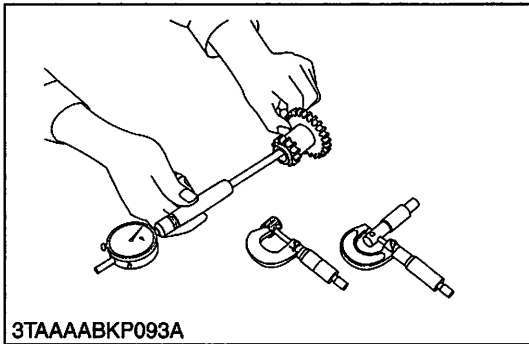
3TAAAABKP092A

**Clearance between Shift Fork and Shifter Gear Groove (Range Gear Shift)**

1. Insert the shift fork into the shifter gear groove and measure the clearance with a feeler gauge.
2. If the clearance exceeds the allowable limit, replace it.

Clearance between shift fork and shifter gear groove	Factory spec.	0.03 to 0.48 mm 0.0012 to 0.019 in.
	Allowable limit	0.7 mm 0.028 in.

W1028380



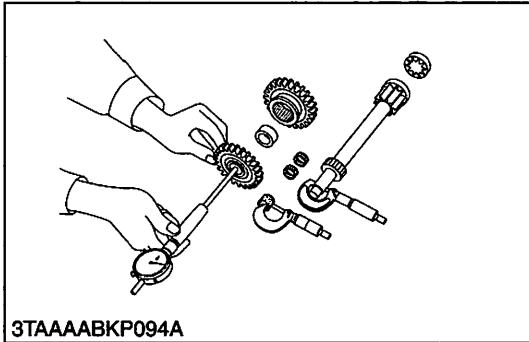
**Clearance between 13T-25T Gear and Front Wheel Drive Idle Gear**

1. Measure the 13T-25T gear I.D. with a cylinder gauge, and then front wheel drive idle shaft O.D. with an outside micrometer.
2. Measure the O.D. of two needles in the needle bearing with an outside micrometer.
3. Clearance is the difference between the gear I.D. and the sum of shaft O.D. and two needle O.D..
4. If the clearance exceeds the allowable limit, replace it.

Clearance between 13T-25T gear and front wheel drive idle gear	Factory spec.	0.007 to 0.043 mm 0.0003 to 0.0017 in.
	Allowable limit	0.10 mm 0.0039 in.

13T-25T gear I.D.	Factory spec.	19.007 to 19.020 mm 0.7483 to 0.7488 in.
Front wheel drive idle shaft O.D.	Factory spec.	13.989 to 14.000 mm 0.5507 to 0.5512 in.
Needle O.D.	Factory spec.	2.494 to 2.500 mm 0.0982 to 0.0984 in.

W1028475



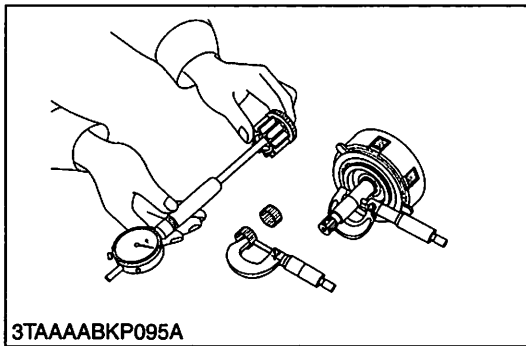
**Clearance between 22T Gear and 11T Gear Shaft**

1. Measure the 22T gear I.D. with a cylinder gauge, and then 11T gear shaft O.D. with an outside micrometer.
2. Measure the O.D. of two needles in the needle bearing with an outside micrometer.
3. Clearance is the difference between the gear I.D. and the sum of shaft O.D. and two needle O.D..
4. If the clearance exceeds the allowable limit, replace it.

Clearance between 22T gear and 11T gear shaft	Factory spec.	0.007 to 0.039 mm 0.0003 to 0.0015 in.
	Allowable limit	0.10 mm 0.0039 in.

22T gear I.D.	Factory spec.	24.007 to 24.020 mm 0.9452 to 0.9457 in.
11T gear shaft O.D.	Factory spec.	19.987 to 20.000 mm 0.7869 to 0.7874 in.
Needle O.D.	Factory spec.	1.997 to 2.000 mm 0.0786 to 0.0787 in.

W1028725



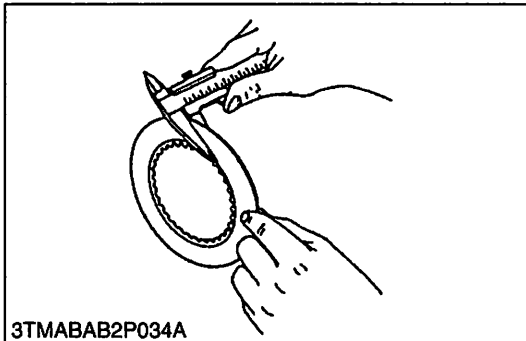
**Clearance between 12T Gear Clutch and Clutch Shaft**

1. Measure the 12T gear clutch I.D. with a cylinder gauge, and then clutch shaft O.D. with an outside micrometer.
2. Measure the O.D. of two needles in the needle bearing with an outside micrometer.
3. Clearance is the difference between the gear clutch I.D. and the sum of shaft O.D. and two needle O.D..
4. If the clearance exceeds the allowable limit, replace it.

Clearance between 12T gear clutch and clutch shaft	Factory spec.	0.007 to 0.037 mm 0.0003 to 0.0015 in.
	Allowable limit	0.10 mm 0.0039 in.

12T gear clutch I.D.	Factory spec.	22.007 to 22.020 mm 0.8664 to 0.8669 in.
Clutch shaft O.D.	Factory spec.	17.989 to 18.000 mm 0.7082 to 0.7087 in.
Needle O.D.	Factory spec.	1.997 to 2.000 mm 0.0786 to 0.0787 in.

W1028898

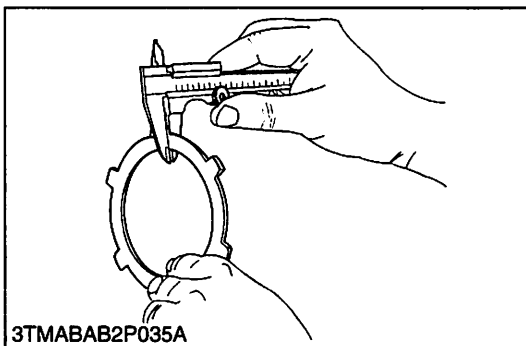


**Clutch Disc Wear**

1. Measure the thickness of PTO clutch disc with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Clutch disc wear	Factory spec.	1.70 to 1.90 mm 0.067 to 0.075 in.
	Allowable limit	1.55 mm 0.061 in.

W1024320



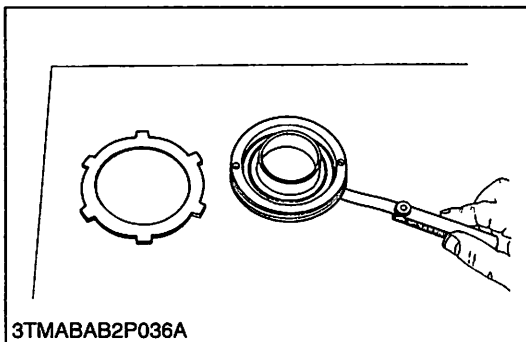
**Pressure Plate and Steel Plate Wear**

1. Measure the thickness of pressure plate and steel plate with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Thickness of pressure plate	Factory spec.	1.95 to 2.05 mm 0.077 to 0.081 in.
	Allowable limit	1.80 mm 0.071 in.

Thickness of steel plate	Factory spec.	1.15 to 1.25 mm 0.045 to 0.049 in.
	Allowable limit	1.10 mm 0.043 in.

W1017226



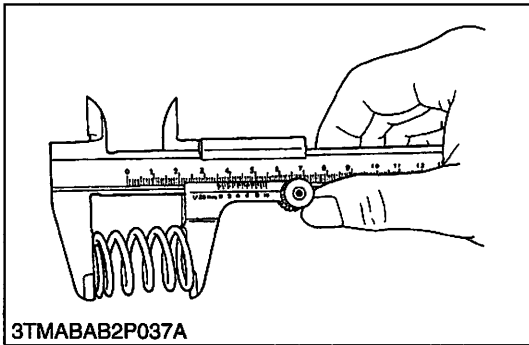
**Flatness of Clutch Piston, Pressure Plate and Steel Plate**

1. Place the part on a surface plate.
2. Check it unable to insert a feeler gauge (allowable limit size) underneath it at least four points.
3. If the gauge can be inserted, replace it.

Flatness of clutch piston	Allowable limit	0.15 mm 0.0059 in.
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Flatness of pressure plate and steel plate	Allowable limit	0.20 mm 0.0079 in.
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W1017358

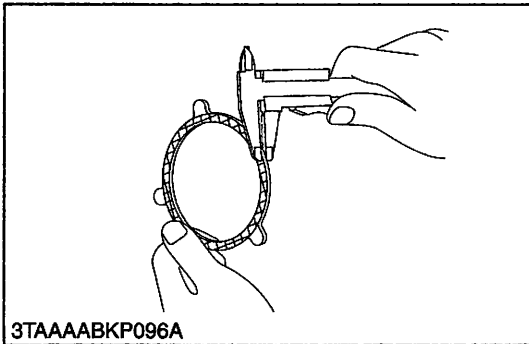


**Clutch Spring Free Length**

1. Measure the free length of spring with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

Clutch spring free length	Factory spec.	37.3 to 37.7 mm 1.47 to 1.48 in.
	Allowable limit	34.5 mm 1.36 in.

W1017533

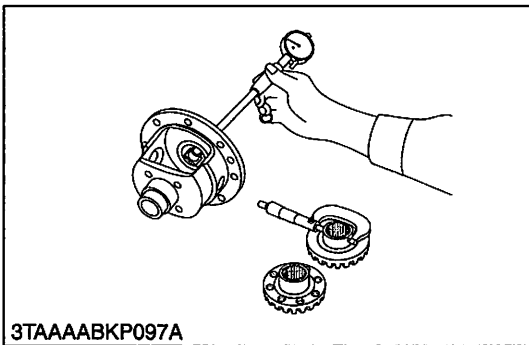


**PTO Brake Disc Wear**

1. Measure the PTO brake disc thickness with a vernier caliper.
2. If the thickness is less than allowable limit, replace it.

PTO brake disc thickness	Factory spec.	3.20 to 3.40 mm 0.126 to 0.134 in.
	Allowable limit	3.00 mm 0.118 in.

W1029590



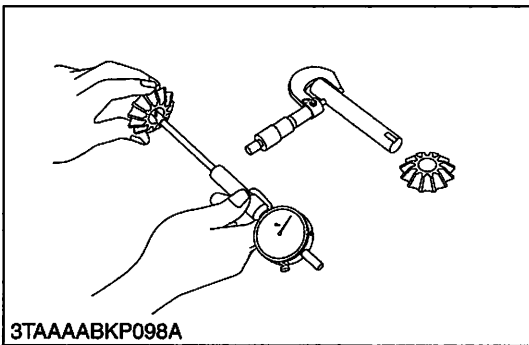
**Clearance between Differential Case and Differential Side Gear**

1. Measure the differential side gear boss O.D. with an outside micrometer.
2. Measure the differential case I.D. with a cylinder gauge 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.	0.050 to 0.151 mm 0.0020 to 0.0059 in.
	Allowable limit	0.30 mm 0.0118 in.

Differential case I.D.	Factory spec.	38.000 to 38.062 mm 1.4961 to 1.4985 in.
Differential side gear O.D.	Factory spec.	37.911 to 37.950 mm 1.4926 to 1.4941 in.

W1029693



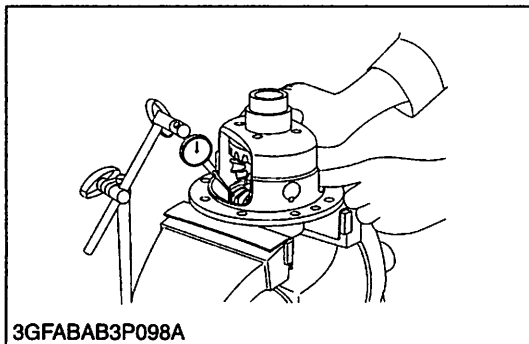
**Clearance between Differential Pinion Shaft and Differential Pinion**

1. Measure the differential pinion shaft O.D. with an outside micrometer.
2. Measure the differential pinion I.D. with a cylinder gauge, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential pinion shaft and differential pinion	Factory spec.	0.080 to 0.122 mm 0.0031 to 0.0048 in.
	Allowable limit	0.30 mm 0.0118 in.

Differential pinion I.D.	Factory spec.	20.060 to 20.081 mm 0.7898 to 0.7906 in.
Differential pinion shaft O.D.	Factory spec.	19.959 to 19.980 mm 0.7858 to 0.7866 in.

W1029832



3GFABAB3P098A

**Backlash between Differential Pinion and Differential Side Gear**

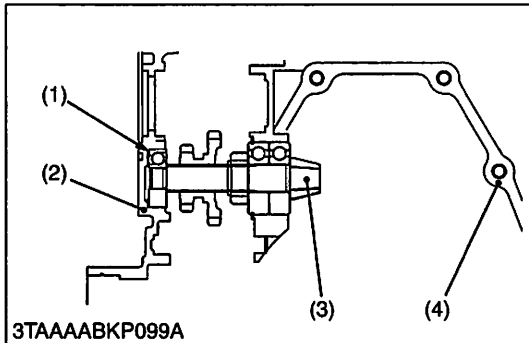
1. Secure the differential case with a vise.
2. Set the dial indicator (lever type) with its finger on the tooth of the differential side gear.
3. Press differential pinion and side gear against the differential case.
4. Hold the differential pinion and move the differential side gear to measure the backlash.
5. If the backlash exceeds the allowable limit, adjust with differential side gear shims.

Backlash between differential pinion and differential side gear	Factory spec.	0.15 to 0.30 mm 0.0059 to 0.0118 in.
	Allowable limit	0.40 mm 0.0157 in.

**(Reference)**

- Thickness of shims :  
1.5 mm (0.0591 in.), 1.6 mm (0.0630 in.), 1.7 mm (0.0669 in.)

W1029971



3TAAABKP099A

**Side Clearance of Spiral Bevel Pinion Shaft**

1. Temporary assemble the spiral bevel pinion shaft (3) and front cover (2) to the transmission case (4).
2. Set the dial indicator (lever type) with its finger on the end of spiral bevel pinion shaft (3).
3. Move the spiral bevel pinion shaft (3) back and forth to each end and measure the side clearance.
4. If the side clearance exceeds the factory specifications, adjust with the shim (1) at front end of spiral bevel pinion shaft (3).

Side clearance of spiral bevel pinion shaft	Factory spec.	0.1 to 0.3 mm 0.0039 to 0.0118 in.
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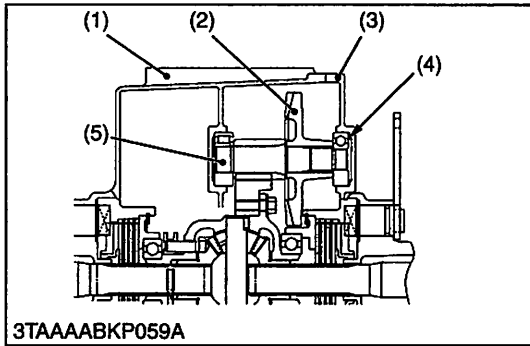
**(Reference)**

- Thickness of shims :  
0.2 mm (0.0079 in.), 0.5 mm (0.0197 in.)

- (1) Shim
- (2) Front Cover

- (3) Spiral Bevel Pinion Shaft
- (4) Transmission Case

W1030223



**Backlash between Spiral Bevel Pinion Shaft and Spiral Bevel Gear**

1. Temporary assemble the spiral bevel pinion shaft, and properly adjust the side clearance.
2. Place fuses between spiral bevel pinion shaft and spiral bevel gear (2). (Several points on the circumferential)
3. Assemble the axle cover assembly, and turn the rear axle.
4. Remove the axle cover assembly, and take out the fuses.
5. Measure the thickness of fuses with an outside micrometer. (Backlash equal thickness of fuse.)
6. If the measurement is not within the factory specifications, adjust with shims (4).

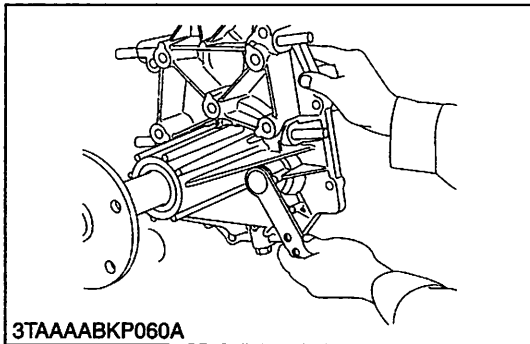
Backlash between spiral bevel pinion shaft and spiral bevel gear	Factory spec.	0.1 to 0.3 mm 0.0039 to 0.0118 in.
--	---------------	---------------------------------------

**(Reference)**

- Thickness of shims:  
0.3 mm (0.0118 in.), 0.6 mm (0.0236 in.), 0.8 mm (0.0315 in.)  
1.0 mm (0.0394 in.), 1.2 mm (0.0472 in.), 1.4 mm (0.0551 in.)

- (1) Transmission Case
- (2) Spiral Bevel Gear
- (3) Axle Cover
- (4) Shim
- (5) Final Gear Shaft

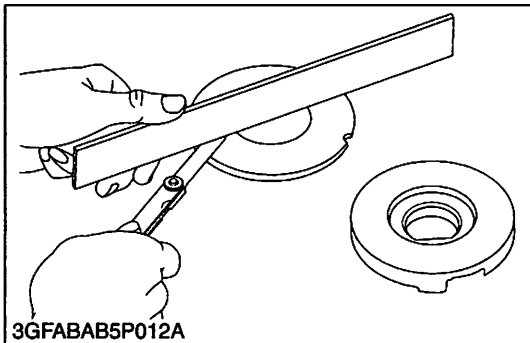
W1030394



**Brake Cam Lever Movement**

1. Move the brake cam lever by hand to check the movement.
2. If the movement is heavy, refine the brake cam with emery paper.

W1030594

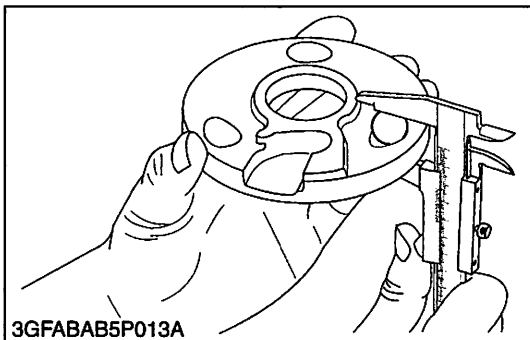


**Flatness of Actuator and Bearing Holder**

1. Place a straightedge of 150 mm (5.91 in.) or more in length on the contacting surface of the actuator and the bearing holder.
2. Inspect the friction surface of the actuator and the bearing holder with the straightedge, and determine if a 0.30 mm (0.0118 in.) feeler gauge will fit on the part of wear.
3. If it will fit, resurface.

Flatness of actuator and bearing holder	Allowable limit	0.30 mm 0.0118 in.
---	-----------------	-----------------------

W1030671



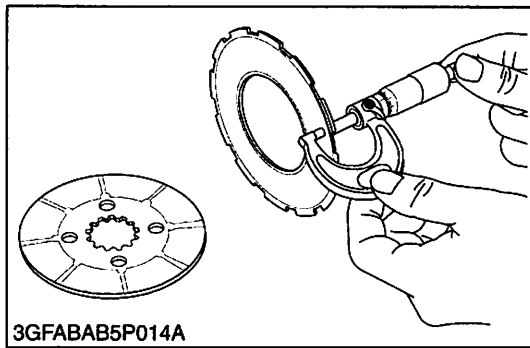
**Height of Cam Plate and Ball**

1. Measure the height 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.
4. If the uneven wear is found, replace it.

Height of cam plate and ball	Factory spec.	22.89 to 22.99 mm 0.9012 to 0.9051 in.
	Allowable limit	22.40 mm 0.8819 in.

W1030769





**Brake Disc and Friction Plate Wear**

1. Measure the brake disc thickness and the friction plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

Brake disc thickness	Factory spec.	3.3 to 3.5 mm 0.130 to 0.138 in.
	Allowable limit	3.0 mm 0.118 in.
Friction plate thickness	Factory spec.	1.92 to 2.08 mm 0.0756 to 0.0819 in.
	Allowable limit	1.52 mm 0.0598 in.

W1030890

2

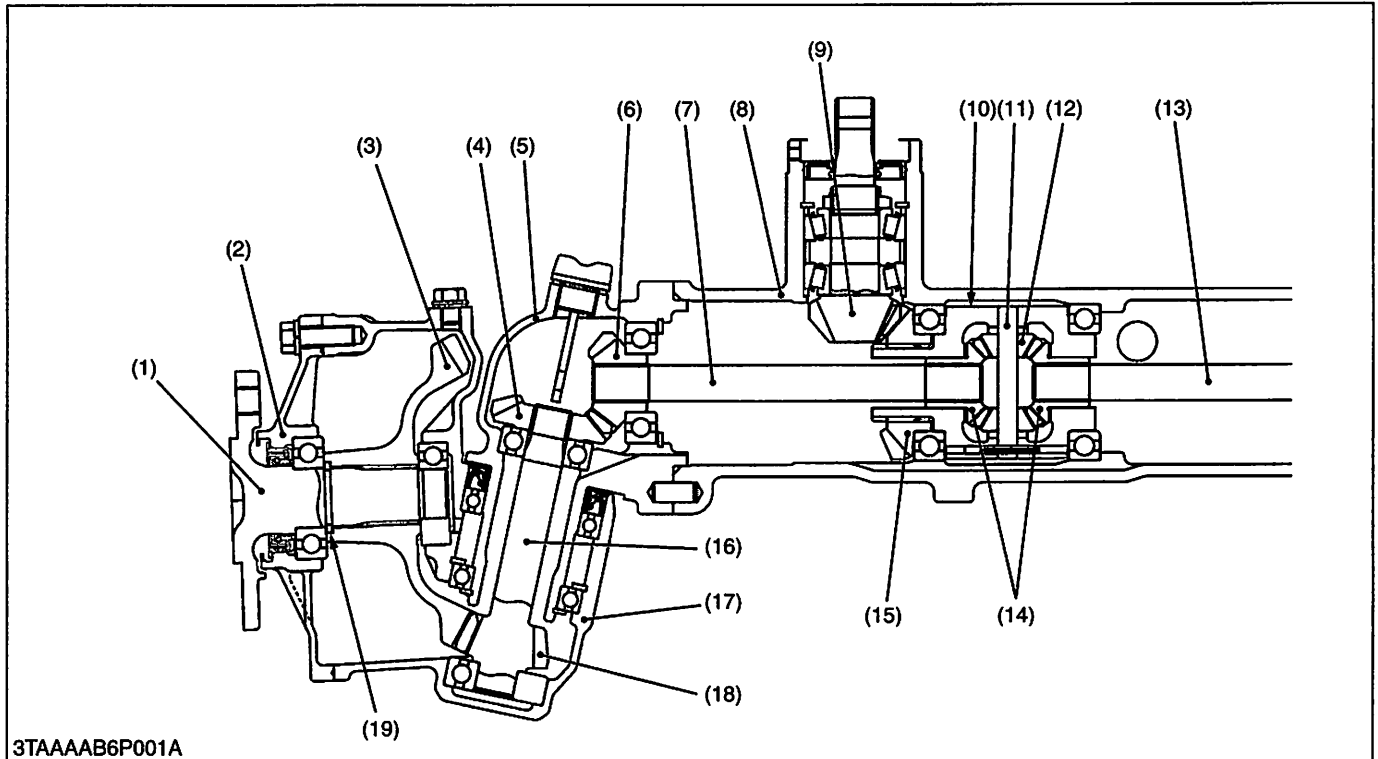
# 3 FRONT AXLE

# MECHANISM

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1. STRUCTURE .....	3-M1
--------------------	------

# 1. STRUCTURE



3TAAAAB6P001A

- |                     |                                 |                                  |                       |
|---------------------|---------------------------------|----------------------------------|-----------------------|
| (1) Axle            | (6) Bevel Gear                  | (11) Differential Pinion Shaft   | (16) Bevel Gear Shaft |
| (2) Axle Flange     | (7) Differential Yoke Shaft, RH | (12) Differential Pinion Gear    | (17) Front Gear Case  |
| (3) Bevel Gear      | (8) Front Axle Case             | (13) Differential Yoke Shaft, LH | (18) Bevel Gear       |
| (4) Bevel Gear      | (9) Spiral Bevel Pinion Shaft   | (14) Differential Side Gear      | (19) Collar           |
| (5) Bevel Gear Case | (10) Differential Gear Assembly | (15) Spiral Bevel Gear           |                       |

The front axle of the 4WD is constructed as shown above. Power is transmitted from the transmission through the propeller shaft to the spiral bevel pinion shaft (9), then to the spiral bevel gear (15) and to the differential side gear (14).

The power through the differential side gear is transmitted to the differential yoke shaft (7), (13), and to the bevel gear shaft (16) through the bevel gears (4), (6) in the bevel gear case (5).

The revolution is greatly reduced by the bevel gears (18), (3), then the power is transmitted to the axle (1).

The differential system allows each wheel to rotate at a different speed to make turning easier.

# SERVICING

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1. TROUBLESHOOTING .....	3-S1
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[2] DISASSEMBLING AND ASSEMBLING.....	3-S5
(1) Separating Front Axle Assembly.....	3-S5
(2) Disassembling Front Axle Assembly.....	3-S8
[3] SERVICING .....	3-S12

# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Front Wheels Wander to Right or Left</b>	• Tire pressure uneven	Adjust	G-34
	• Improper toe-in adjustment (improper alignment)	Adjust	G-21, 3-S4
	• Clearance between center pin and shaft support bushing excessive	Replace	3-S14
	• Front axle rocking force too small	Adjust	3-S4
	• Tie-rod end loose	Tighten	3-S8
	• Air sucked in power steering circuit	Bleed	–
<b>Front Wheels Can Not Be Driven</b>	• Front wheel driving gears in front axle gear case broken	Replace	3-S8
	• Universal joint broken	Replace	3-S7
	• Front wheel drive gears in transmission broken	Replace	–
	• Front differential gear broken	Replace	3-S11
<b>Noise</b>	• Gear backlash excessive	Adjust or replace	3-S13
	• Oil insufficient	Replenish	3-S5
	• Bearings damaged or broken	Replace	–
	• Gears damaged or broken	Replace	–
	• Spiral bevel pinion shaft turning force improper	Adjust	3-S13

W1014322

## 2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	1 to 10 mm 0.04 to 0.39 in.	—
Front Axle	Rocking Force	49.0 to 117.7 N 5.0 to 12.0 kgf 11.0 to 26.5 lbs	—
Differential Case to Differential Side Gear	Clearance	0.040 to 0.082 mm 0.00157 to 0.00323 in.	0.17 mm 0.0067 in.
Differential Case	I.D.	26.000 to 26.021 mm 1.02362 to 1.02445 in.	—
Differential Side Gear	O.D.	25.939 to 25.960 mm 1.02122 to 1.02205 in.	—
Differential Pinion Shaft to Differential Pinion	Clearance	0.025 to 0.055 mm 0.00098 to 0.00217 in.	0.25 mm 0.0096 in.
Differential Pinion Shaft	O.D.	9.960 to 9.975 mm 0.39212 to 0.39272 in.	—
Differential Pinion	I.D.	10.000 to 10.015 mm 0.39370 to 0.39429 in.	—
Differential Pinion to Differential Side Gear	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	—
Bevel Pinion Shaft	Turning Torque	0.8 to 1.0 N·m 0.08 to 0.10 kgf·m 0.59 to 0.73 ft-lbs	—
Bevel Pinion Shaft to Bevel Gear	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	—
12T Bevel Gear to 15T Bevel Gear	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	—
Center Pin to Pin Support Bush	Clearance	0 to 0.231 mm 0 to 0.00909 in.	0.70 mm 0.0276 in.
Center Pin	O.D.	19.850 to 20.000 mm 0.78149 to 0.78740 in.	—
Bush	I.D.	20.000 to 20.081 mm 0.78740 to 0.79059 in.	—

W1013874

### 3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.  
 (For general use screws, bolts and nuts : See page G-8.)

Item	N·m	kgf·m	ft-lbs
Under cover mounting bolt and nut	7.8 to 8.8	0.8 to 0.9	5.8 to 6.5
Power steering cylinder hose	28.4 to 30.0	2.9 to 3.1	20.9 to 22.1
Front wheel mounting screw	149.2 to 179.0	15.2 to 18.3	110 to 132
Center pin slotted nut	19.6	2.0	14.5
Tie-rod slotted nut	17.7 to 34.3	1.8 to 3.5	13.0 to 25.3
Bevel gear case mounting screw	77.5 to 90.1	7.9 to 9.2	57.1 to 66.5
Front gear case cover mounting screw	77.5 to 90.1	7.9 to 9.2	57.1 to 66.5

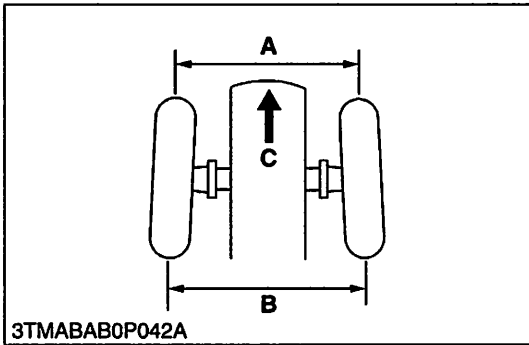
W1012736



# 4. CHECKING, DISASSEMBLING AND SERVICING

- Before proceeding this section, disassembling the Loader Assembly and Frames. (Refer to Section 7.)

## [1] CHECKING AND ADJUSTING



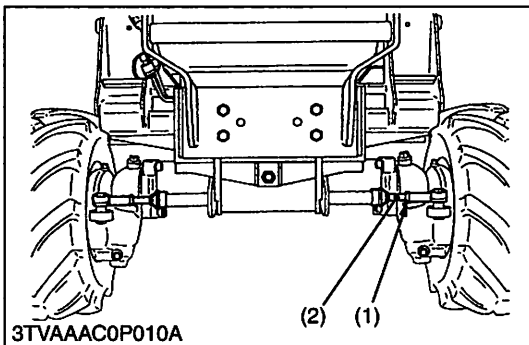
### Toe-in

1. Inflate the tires to the specified pressure.
2. Turn the front wheels straight ahead.
3. Measure the toe-in (B-A).
4. If the measurement is not within the factory specifications, adjust the tie-rod length.

Toe-in (B-A)	Factory spec.	1 to 10 mm 0.04 to 0.39 in.
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- (A) Wheel to Wheel Distance at front (C) Front  
(B) Wheel to Wheel Distance at rear

W1011333

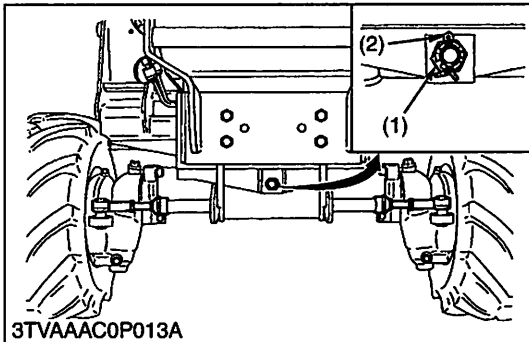


### Toe-in Adjusting

1. Loosen the lock nuts (1).
2. Turn the tie-rod (2) until to be factory specification.
3. Tighten the lock nuts (1).

- (1) Lock Nut (2) Tie-rod

W1011497



### Front Axle Rocking Force

1. Jack up the front side of tractor and remove the front wheel.
2. Set a spring balance to the front gear case cover.
3. Measure the front axle rocking force.
4. If the measurement is not within the factory specifications, adjust as following.

#### ■ Adjusting procedure

1. Remove the cotter pin (2).
2. Tighten or loosen the adjusting nut (1) so that the measurement of rocking force comes to factory specifications.
3. If the slot and pin hole do not meet, align the nut until they do meet within factory specifications.
4. Install the new cotter pin.

#### (When reassembling)

- Be sure to split the cotter pin like an anchor.

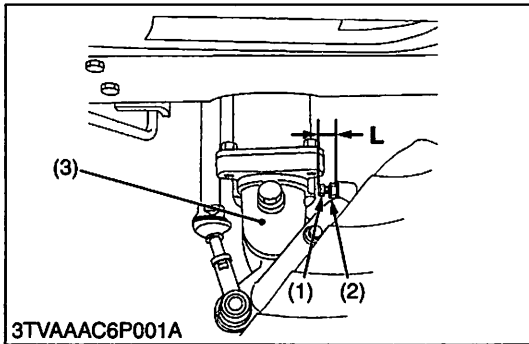
#### (Reference)

- Tightening torque of adjusting nut:  
19.6 N·m (2.0 kgf·m, 14.5 ft·lbs)

Front axle rocking force	Factory spec.	49.0 to 177.7 N 5.0 to 12.0 kgf 11.0 to 26.5 lbs
--------------------------	---------------	--

- (1) Adjusting Nut (2) Cotter Pin

W1011602



**Front Wheel Steering Angle**

1. Inflate the tires to the specified pressure.
2. Loosen the lock nut and shorten the length of stopper bolt LH (1).
3. Steer the wheels to the extreme left.
4. Lengthen the length of stopper bolt (1) until the stopper bolt contacts with the bevel gear case (3).
5. Return the steering wheel to straight ahead and lengthen the stopper bolt half turn from above position further.
6. Lock the stopper bolt by lock nut (2).
7. For adjusting the right steering angle, perform the same procedure as mentioned in left steering angle.

**(Reference)**

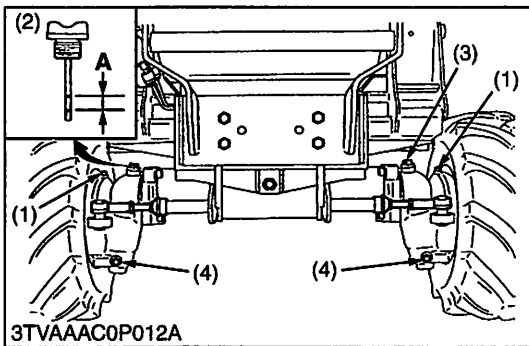
- Length of adjusting bolt L : Right side 25 mm (0.98 in.)  
Left side 20 mm (0.79 in.)
- Steering angle : Right side 0.84 to 0.87 rad. (48 to 50 °)  
Left side 0.92 to 0.96 rad. (53 to 55 °)

- (1) Stopper Bolt LH (2) Lock Nut (3) Bevel Gear Case

W1011846

**[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 (4) and filling plug (3) to drain the oil.
3. After draining, reinstall the drain plugs (4).

**(When reassembling)**

- When re-filling, remove the right and left breather plugs (1).

**■ IMPORTANT**

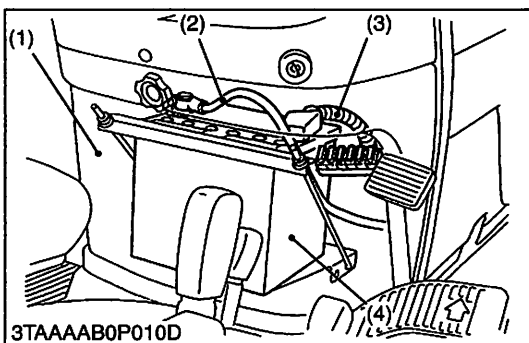
- After ten minutes, check the oil level again, add oil to prescribed level.
- Use KUBOTA SUPER UDT fluid or SAE80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-7.)

Front axle case oil capacity	4.7 L 4.97 U.S.qts. 4.14 Imp.qts.
------------------------------	---

- (1) Breather Plug (2) Filling Plug with Dipstick (3) Filling Plug (4) Drain Plug

A : Oil level is acceptable within this range.

W1012192



**Battery**

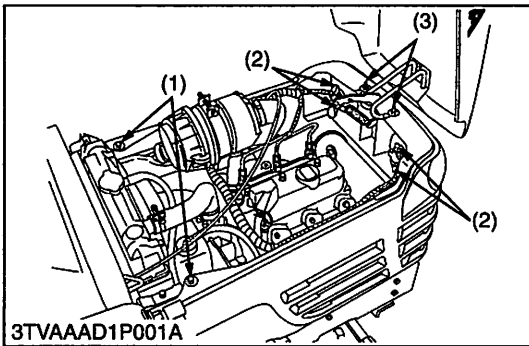
**⚠ CAUTION**

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

1. Remove the under panel (1).
2. Disconnect the negative cable (2) from the battery.
3. Disconnect the positive cable (3) from the battery and remove the battery (4).

- (1) Under Panel (2) Negative Cable (3) Positive Cable (4) Battery

W1012394



**Under Cover**

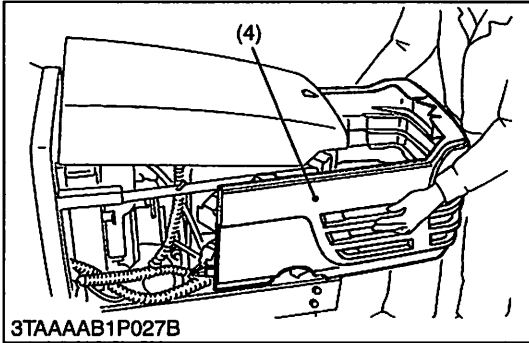
1. Remove the under cover mounting bolts (1), loosen the mounting nuts (3).
2. Disconnect the connectors (2) from the head lights.
3. Pull forward to remove the under cover (4).

**(When reassembling)**

Tightening torque	Under cover mounting bolt and nut	7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft-lbs
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- (1) Under Cover Mounting Bolt                      (3) Under Cover Mounting Nut  
(2) Connector    (4) Under Cover

W1014643

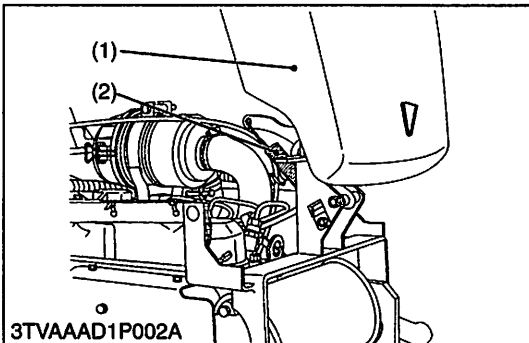


**Bonnet**

1. Remove the spring (2).
2. Remove the bonnet mounting bolt and nut, and remove the bonnet (1).

- (1) Bonnet    (2) Spring

W1014962



**Flywheel Cover and Power Steering Hose**

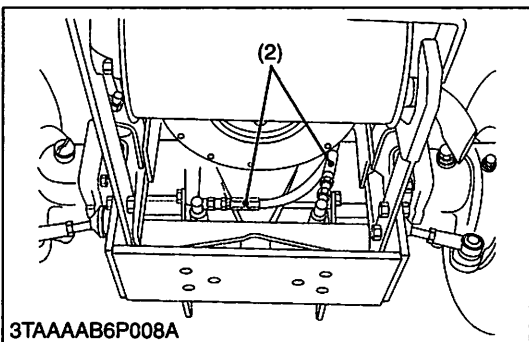
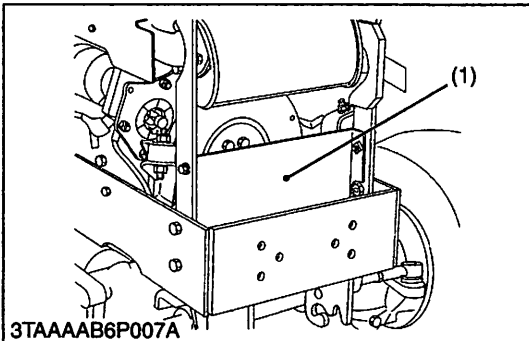
1. Remove the flywheel cover (1).
2. Disconnect the power steering cylinder hoses (2).

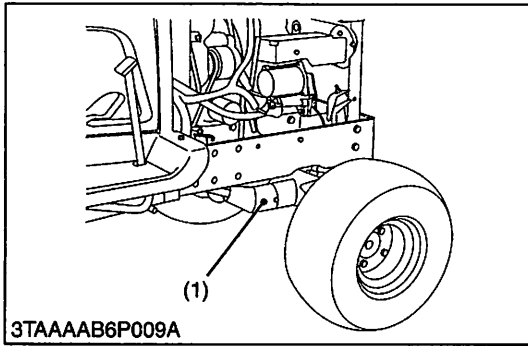
**(When reassembling)**

Tightening torque	Power steering cylinder hose	28.4 to 30.0 N·m 2.9 to 3.1 kgf·m 20.9 to 22.1 ft-lbs
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- (1) Flywheel Cover                                      (2) Power Steering Cylinder Hose

W1012698





**Front Wheel and Propeller Shaft Cover**

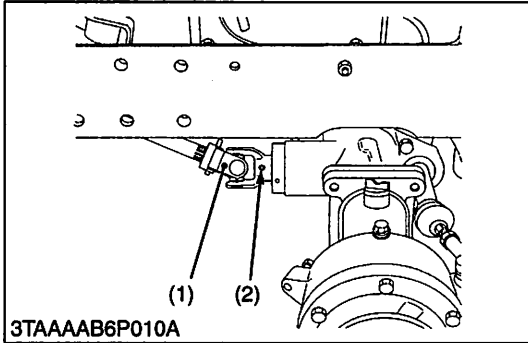
1. Lift up the front side of tractor and place the disassembling stand under the front axle frame.
2. Remove the front wheels.
3. Remove the propeller shaft cover mounting bolt and slide the propeller shaft cover (1).

**(When reassembling)**

Tightening torque	Front wheel mounting screw	149.2 to 179.0 N-m 15.2 to 18.3 kgf-m 110 to 132 ft-lbs
-------------------	----------------------------	---

(1) Propeller Shaft Cover

W1012838



**Disconnecting Propeller Shaft**

1. Tap out the spring pins (2) and disconnect the universal joint (1) and spiral bevel pinion shaft.

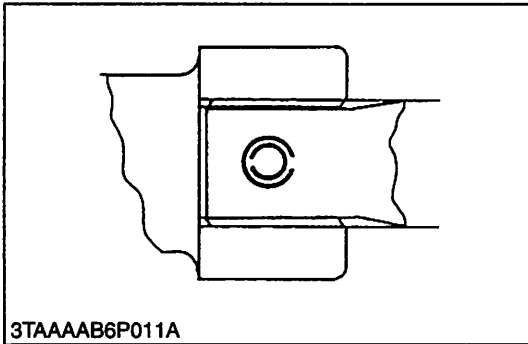
**(When reassembling)**

- Apply grease to the splines of the propeller shaft and universal joint.
- When inserting the spring pins (2), face their splits in the direction parallel to the universal joint as shown in the figure.

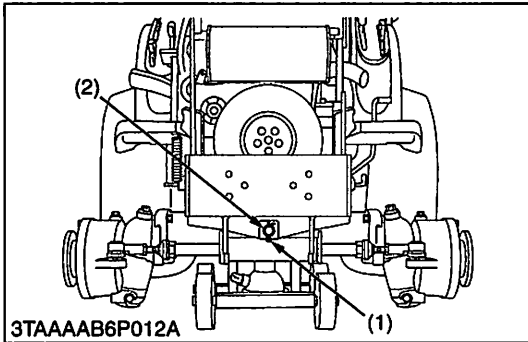
(1) Universal Joint

(2) Spring Pin

W1013075



3TAAAB6P011A



3TAAAB6P012A

**Front Axle Assembly**

1. Place the disassembling stand under the front axle.
2. Remove the cotter pin (1).
3. Remove the slotted nut (2) of center pin and separate the front axle from the frame.

**(When reassembling)**

- After mounting the front axle assembly to the frame, be sure to adjust the front axle rocking force. (See page 3-S4.)
- Installing the cotter pin and be sure to split the cotter pin like an anchor.

Tightening torque	Center pin slotted nut	19.6 N-m 2.0 kgf-m 14.5 ft-lbs
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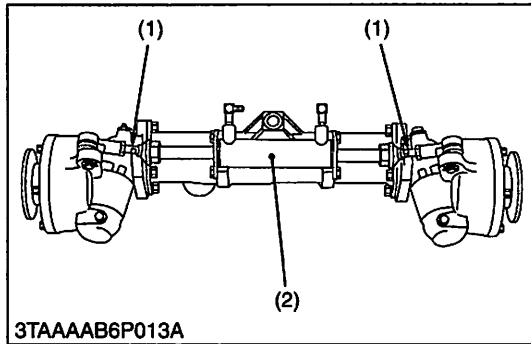
(1) Cotter Pin

(2) Slotted Nut (Adjusting nut for front axle rocking force)

W1013203

3

## (2) Disassembling Front Axle Assembly



### Power Steering Cylinder

1. Remove the cotter pin and remove the slotted nut for tie-rod (1).
2. Remove the power steering cylinder mounting screws and remove the power steering cylinder (2) with tie-rod.

#### (When reassembling)

#### ■ NOTE

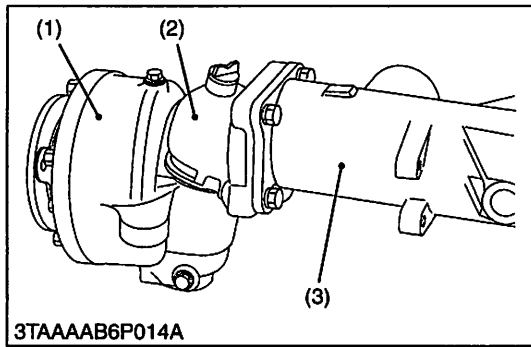
- Tighten the slotted nut to 17.7 N-m (1.8 kgf-m, 13 ft-lbs). If the slot and pin hole do not meet, tighten the nut until they do meet, and install the cotter pin.
- Be sure to split the cotter pin like an anchor.

Tightening torque	Tie-rod slotted nut	17.7 to 34.3 N-m 1.8 to 3.5 kgf-m 13.0 to 25.3 ft-lbs
-------------------	---------------------	---

(1) Tie-rod

(2) Power Steering Cylinder

W1013368



### Bevel Gear Case and Front Gear Case

1. Remove the bevel gear case mounting screws.
2. Remove the bevel gear case (2) and front gear case (1) as a unit from the front axle case (3).

#### (When reassembling)

- Apply grease to the O-ring and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies and right and left gear case assemblies.

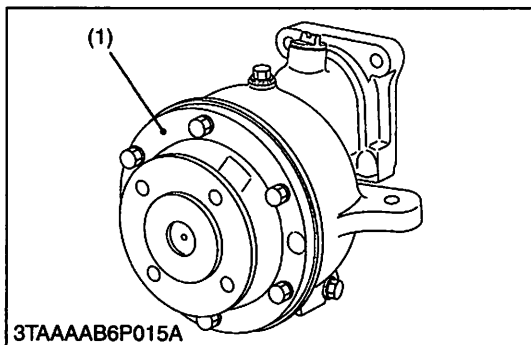
Tightening torque	Bevel gear case mounting screw	77.5 to 90.1 N-m 7.9 to 9.2 kgf-m 57.1 to 66.5 ft-lbs
-------------------	--------------------------------	---

(1) Front Gear Case

(3) Front Axle Case

(2) Bevel Gear Case

W1013787



### Front Gear Case Cover

1. Remove the front gear case mounting screws and remove the front gear case cover (1) with bevel gear (2).

#### (When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the gear case cover (1) and front gear case (3) after eliminate the water, oil and stuck liquid gasket.

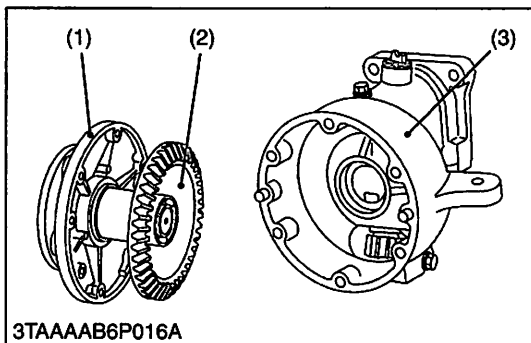
Tightening torque	Front gear case cover mounting screw	77.5 to 90.1 N-m 7.9 to 9.2 kgf-m 57.1 to 66.5 ft-lbs
-------------------	--------------------------------------	---

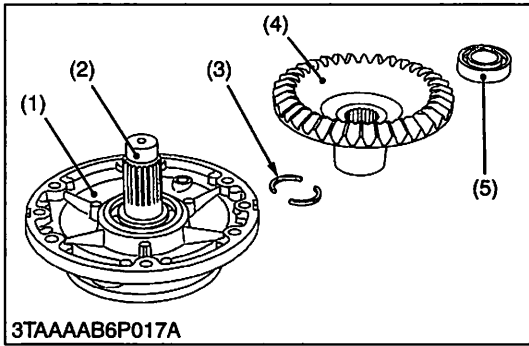
(1) Front Gear Case Cover

(3) Front Gear Case

(2) Bevel Gear

W1013952





**36T Bevel Gear and Front Axle Shaft**

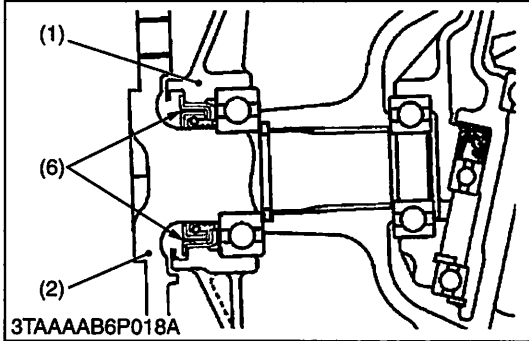
1. Remove the bearing (5).
2. Take out the 36T bevel gear (4).
3. Take out the collar (3).
4. Tap out the axle shaft (2).

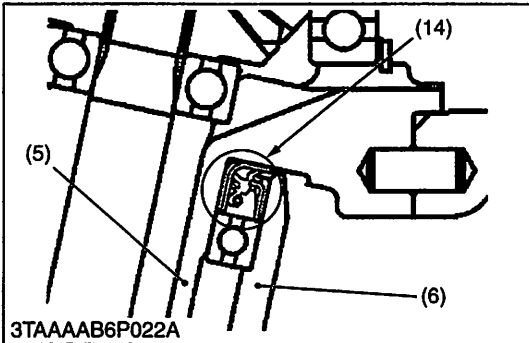
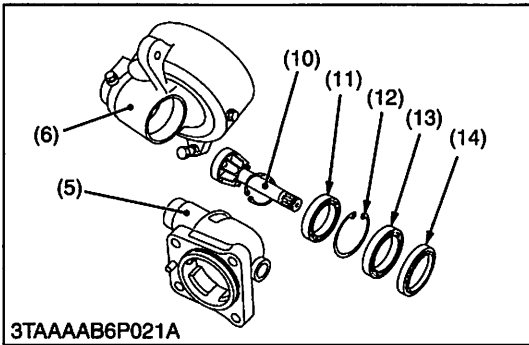
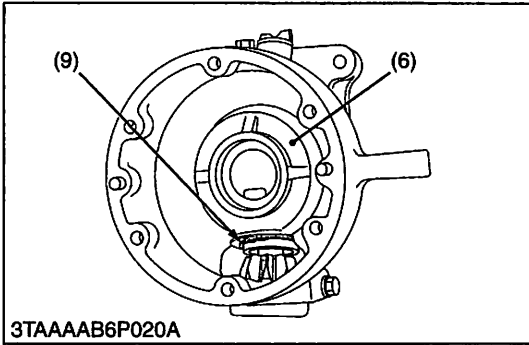
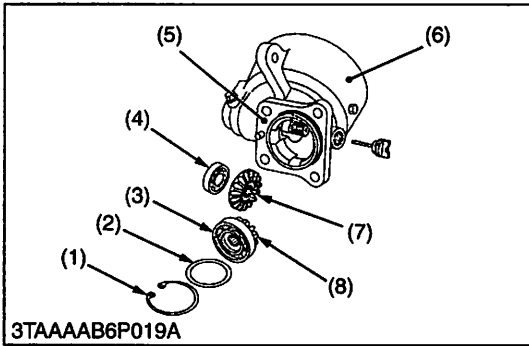
**(When reassembling)**

- Install the oil seal (6) of front gear case cover (1), noting its direction as shown in the figure.

- |                           |                    |
|---------------------------|--------------------|
| (1) Front Gear Case Cover | (4) 36T Bevel Gear |
| (2) Axle Shaft            | (5) Ball Bearing   |
| (3) Collar                | (6) Oil Seal       |

W1014087





**Front Gear Case and Bevel Gear Case**

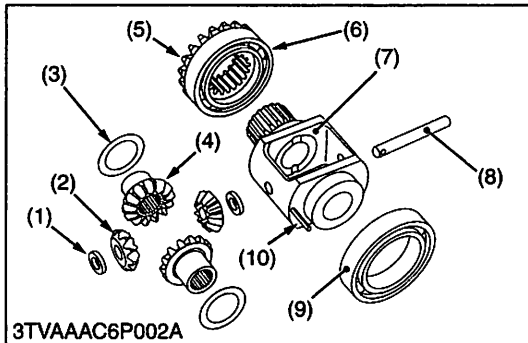
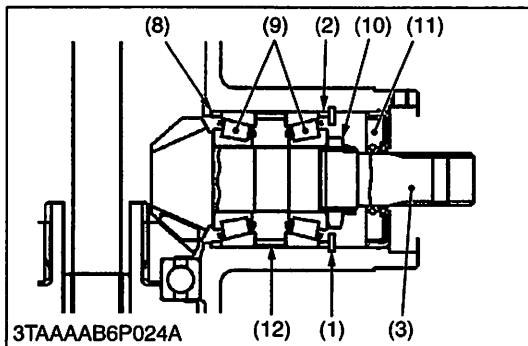
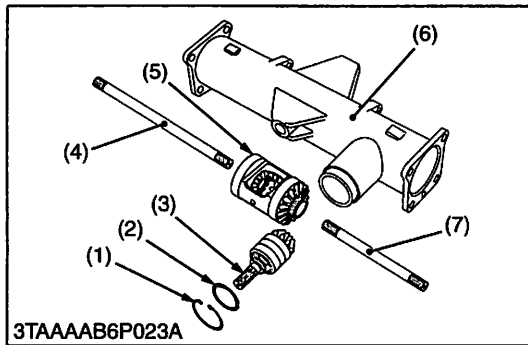
1. Remove the internal snap ring (1).
2. Remove the 12T bevel gear (8) with ball bearing (3) and shim (2).
3. Remove the 15T bevel gear (7) and ball bearing (4).
4. Remove the external snap ring (9).
5. Remove the bevel gear case (5) from front gear case (6).
6. Remove the oil seal (14) and the ball bearing (13).
7. Remove the internal snap ring (12) and remove the ball bearing (11).
8. Remove the bevel gear shaft (10) with ball bearing.

**(When reassembling)**

- Install the oil seal (14) of bevel gear case, noting its direction as shown in the figure.
- Install the adjusting shims (2) to their original position.

- |                        |                         |
|------------------------|-------------------------|
| (1) Internal Snap Ring | (8) 12T Bevel Gear      |
| (2) Shim               | (9) External Snap Ring  |
| (3) Ball Bearing       | (10) Bevel Gear Shaft   |
| (4) Ball Bearing       | (11) Ball Bearing       |
| (5) Bevel Gear Case    | (12) Internal Snap Ring |
| (6) Front Gear Case    | (13) Ball Bearing       |
| (7) 15T Bevel Gear     | (14) Oil Seal           |

W1014354



**Bevel Pinion Shaft and Differential Gear Assembly**

1. Take out the differential yoke shaft (4), (7).
2. Remove the oil seal (11).
3. Remove the internal snap ring (1).
4. Pull out the bevel pinion shaft (3).
5. Take out the differential gear assembly (5), from right side of front axle case (6).
6. Remove the stake of lock nut (10), and then remove the lock nut (10).
7. Remove the taper roller bearings (9).

**(When reassembling)**

- Apply gear oil to the taper roller bearings (9) and install them correctly, noting their direction.
- Replace the lock nut (10) and oil seal (11) with new ones.
- After tighten the lock nut (10) to the specified torque, stake it firmly.
- Install the adjusting collars (2), (8) to their original position.

- |                                |                                |
|--------------------------------|--------------------------------|
| (1) Internal Snap Ring         | (7) Differential Yoke Shaft RH |
| (2) Adjusting Collar           | (8) Adjusting Collar           |
| (3) Bevel Pinion Shaft         | (9) Taper Roller Bearing       |
| (4) Differential Yoke Shaft LH | (10) Lock Nut                  |
| (5) Differential Gear Assembly | (11) Oil Seal                  |
| (6) Front Axle Case            | (12) Collar                    |

W1014794

**Differential Gear**

1. Remove the bevel gear (5) with bearing (6) and bearing (9) by puller.
2. Tap out the spring pin (10) from bevel gear side.
3. Remove the differential pinion shaft (8).
4. Remove the differential pinions (2), differential side gears (4) and shims (1), (3).

■ **NOTE**

- **Arrange the parts to know their original position.**

**(When reassembling)**

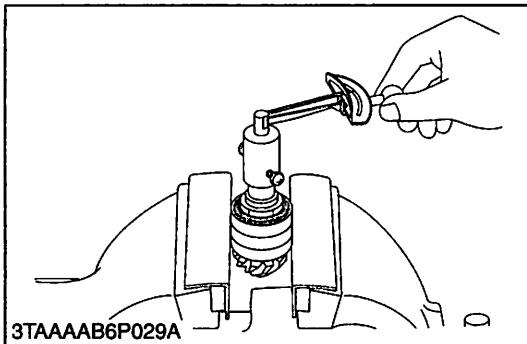
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears, differential pinions and shims.

- |                            |                               |
|----------------------------|-------------------------------|
| (1) Shim                   | (6) Ball Bearing              |
| (2) Differential Pinion    | (7) Differential Gear Case    |
| (3) Shim                   | (8) Differential Pinion Shaft |
| (4) Differential Side Gear | (9) Ball Bearing              |
| (5) Bevel Gear             | (10) Spring Pin               |

W1015222







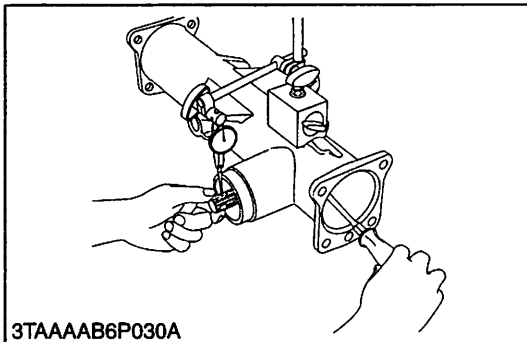
**Turning Torque of Bevel Pinion Shaft**

1. Cramp the 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 torque is not within the factory specifications, adjust with the lock nut.

Turning torque	Factory spec.	0.8 to 1.0 N·m 0.08 to 0.10 kgf·m 0.59 to 0.73 ft-lbs
----------------	---------------	---

■ **NOTE**

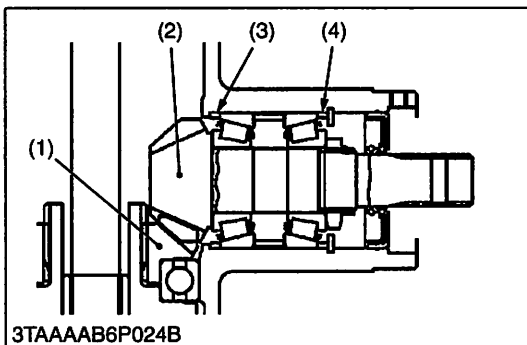
- After turning force adjustment, be sure to stake the lock nut. W10206520



**Backlash between Bevel Pinion Shaft and Bevel Gear**

1. Set a dial gauge (lever type) with its finger on the spline of bevel pinion shaft.
2. Fix the bevel gear and measure the backlash by moving the bevel pinion shaft by hand lightly.
3. If the backlash is not within the factory specifications, change the adjusting collars (3), (4). For example 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.

Backlash between bevel pinion shaft and bevel gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
--	---------------	-------------------------------------



**(Reference)**

- Above factory specification should be measured on the tooth of bevel pinion. When measuring the backlash on the spline of its shaft, factory specification will be 0.0571 to 0.1714 mm (0.00225 to 0.00675 in.).
- 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.)

- |                        |                      |
|------------------------|----------------------|
| (1) Bevel Gear         | (3) Adjusting Collar |
| (2) Bevel Pinion Shaft | (4) Adjusting Collar |

W10207820





# 4 STEERING

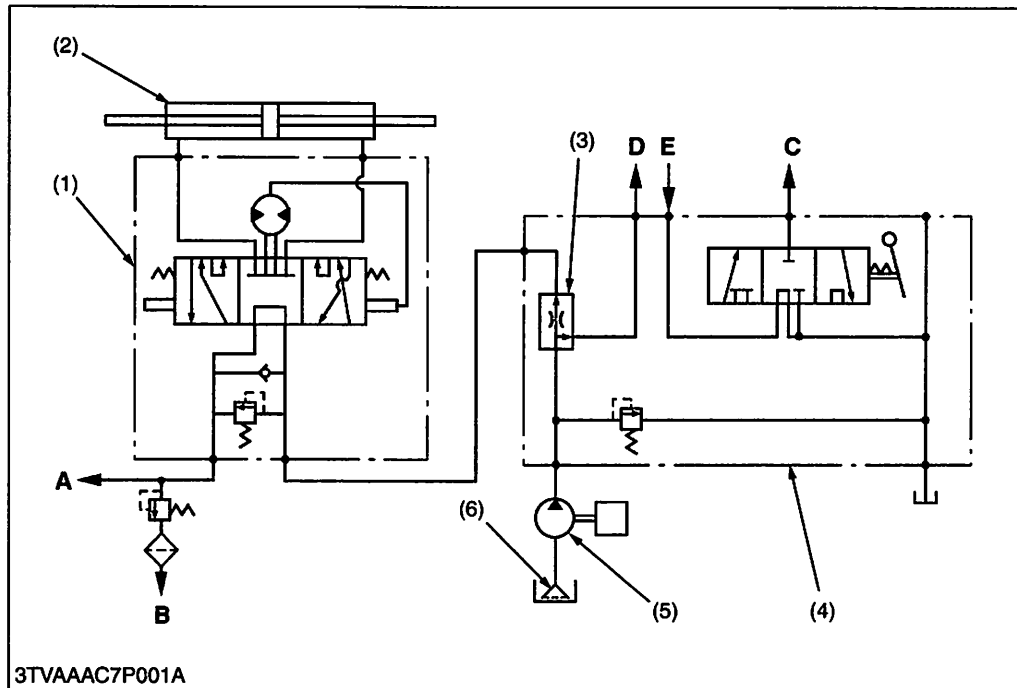


# MECHANISM

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1. HYDRAULIC CIRCUIT.....	4-M1
---------------------------	------

# 1. HYDRAULIC CIRCUIT



- (1) Steering Controller
  - (2) Steering Cylinder
  - (3) Flow Priority Valve
  - (4) Hydraulic Control Valve Assembly
  - (5) Hydraulic Pump
  - (6) Oil Strainer
- A : To PTO Clutch Valve
  - B : To HST
  - C : To Hydraulic Cylinder
  - D : To Implement
  - E : From Implement

W1012655

This model is provided with a full hydrostatic power steering.

In the full hydrostatic power steering, the steering controller is connected to the steering cylinder with only the hydraulic piping. Accordingly, it does not have mechanical transmitting parts such as steering gear, pitman arm, drag link, etc.. Therefore, it is simple in construction. This steering system consists of the oil strainer (6), hydraulic pump (5), flow priority valve (3), steering controller (1), steering cylinder (2), etc..

Flow priority valve (3) which located in the hydraulic control valve assembly (4) divides the oil into two direction. One is the control flow to power steering (constantly 7 L/min., 1.8 U.S.gals./min., 1.5 Imp.gals./min.), and the other is excessive flow to control valve of implement lift control.

By operating the power steering body, the required amount of oil is fed to the steering cylinder (2).

# SERVICING

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[3] SERVICING .....	4-S8

# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Cannot Be Steered</b>	<ul style="list-style-type: none"> <li>Steering controller malfunctioning</li> <li>Pipe broken</li> </ul>	Replace Replace	4-S5 4-S5
<b>Hard Steering</b>	<ul style="list-style-type: none"> <li>Power steering oil improper</li> <li>Hydraulic pump malfunctioning</li> <li>Flow priority valve malfunctioning</li> <li>Steering controller malfunctioning</li> </ul>	Change with specified oil Replace Repair or replace Replace	G-21 5-S14 5-S15 4-S5
<b>Steering Force Fluctuates</b>	<ul style="list-style-type: none"> <li>Steering controller malfunctioning</li> <li>Flow priority valve malfunctioning</li> <li>Air sucked in pump due to lack of oil</li> <li>Air sucked in pump from suction circuit</li> </ul>	Replace Replace Replenish Repair	4-S5 5-S15 G-13 -
<b>Steering Wheel Turns Spontaneously When Released</b>	<ul style="list-style-type: none"> <li>Steering controller malfunctioning</li> </ul>	Replace	4-S5
<b>Front Wheels Wander to Right and Left</b>	<ul style="list-style-type: none"> <li>Steering controller malfunctioning</li> <li>Air sucked in pump due to lack of oil</li> <li>Air sucked in pump from suction circuit</li> <li>Insufficient bleeding</li> <li>Cylinder malfunctioning</li> <li>Improper toe-in adjustment</li> <li>Tire pressure uneven</li> </ul>	Replace Replenish Repair Bleed Repair or replace Adjust Inflate	4-S5 G-13 - - 4-S7 3-S4 G-34
<b>Wheels Are Turned to a Direction Opposite to Steering Direction</b>	<ul style="list-style-type: none"> <li>Cylinder piping connected in reverse</li> </ul>	Repair	4-S6
<b>Steering Wheel Turns Idle in Manual Steering</b>	<ul style="list-style-type: none"> <li>Insufficient bleeding</li> <li>Air sucked in due to lack of oil</li> </ul>	Bleed Replenish	- G-13
<b>Noise</b>	<ul style="list-style-type: none"> <li>Air sucked in pump due to lack of oil</li> <li>Air sucked in pump from suction circuit</li> <li>Pipe deformed</li> </ul>	Replenish Repair Replace	G-13 - -
<b>Oil Temperature Increases Rapidly</b>	<ul style="list-style-type: none"> <li>Steering controller (relief valve) malfunctioning</li> </ul>	Replace	4-S5

W1014322



## 2. SERVICING SPECIFICATIONS

### POWER STEERING BODY

Item		Factory Specification	Allowable Limit
Relief Valve	Operating Pressure	9.30 to 9.79 MPa 94.8 to 99.8 kgf/cm <sup>2</sup> 1348 to 1419 psi	—

W1013874

### STEERING CYLINDER

Steering Cylinder	I.D.	40.000 to 40.062 mm 1.57480 to 1.57724 in.	40.100 mm 1.57874 in.
Piston Rod to Guide	Clearance	0.020 to 0.070 mm 0.00079 to 0.00276 in.	0.200 mm 0.00787 in.

W1013973

### 3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.  
 (For general use screws, bolts and nuts : See page G-8.)

Item	N·m	kgf·m	ft-lbs
Steering wheel mounting nut	20 to 25	2.0 to 2.6	14.8 to 18.4
Power steering hose mounting nut	28.4 to 30.0	2.9 to 3.1	20.9 to 22.1
Under cover mounting bolt and nut	7.8 to 8.8	0.8 to 0.9	5.8 to 6.5
Power steering cylinder hose	28.4 to 30.0	2.9 to 3.1	20.9 to 22.1
Tie-rod slotted nut	17.7 to 34.3	1.8 to 3.5	13.0 to 25.3
Tie-rod screw	74 to 84	7.5 to 8.6	54.6 to 61.9

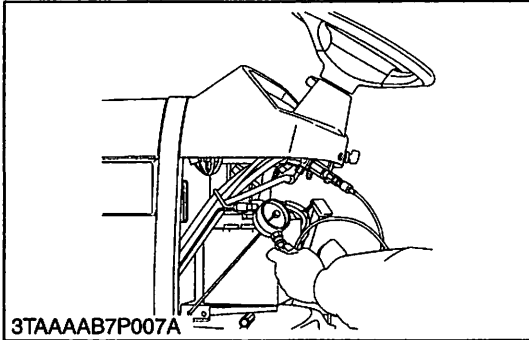
W1012736

## 4. CHECKING, DISASSEMBLING AND SERVICING

- Before proceeding this section, disassembling the Loader Assembly. (Refer to Section 7.)

### [1] CHECKING

#### (1) Relief Valve



#### Relief Valve Operating Pressure

1. Disconnect the power steering hose L (or R) from steering controller, and set a pressure gauge and cable.

#### **(Reference)**

- Hose and adaptor size : 9/16-18UNF, 37 ° flare
2. Start the engine and set at maximum speed.
  3. Fully turn the steering wheel to the left (or right) to check the feeling which the steering wheel lightly locks. Read the relief valve operating pressure when the steering wheel to the above-mentioned lock position by operation force at approximately 9.8 N (1 kgf, 2.2 lbs) of outer.

#### ■ NOTE

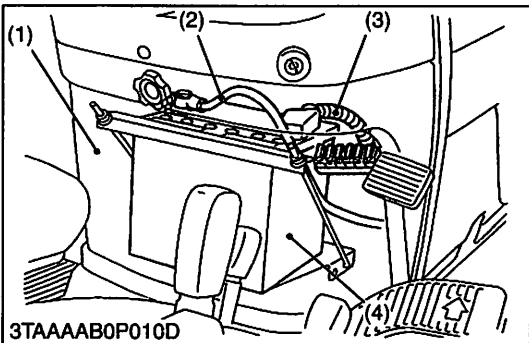
- After set a pressure gauge, be sure to bleed air.
- Note that the pressure value changes by the pump action of the power steering controller when the steering operation is continued after the steering wheel is lightly locked and accurate relief valve pressure cannot be measured.

Relief valve operating pressure	Factory spec.	9.30 to 9.79 MPa 94.8 to 99.8 kgf/cm <sup>2</sup> 1348 to 1419 psi
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W1011481

### [2] DISASSEMBLING AND ASSEMBLING

#### (1) Separating Power Steering Controller



#### Battery

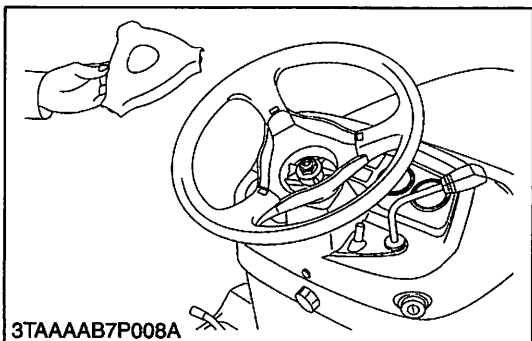
#### ⚠ CAUTION

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

1. Remove the under panel (1).
2. Disconnect the negative cable (2) from the battery.
3. Disconnect the positive cable (3) from the battery and remove the battery (4).

- |                    |                    |
|--------------------|--------------------|
| (1) Under Panel    | (3) Positive Cable |
| (2) Negative Cable | (4) Battery        |

W1011659



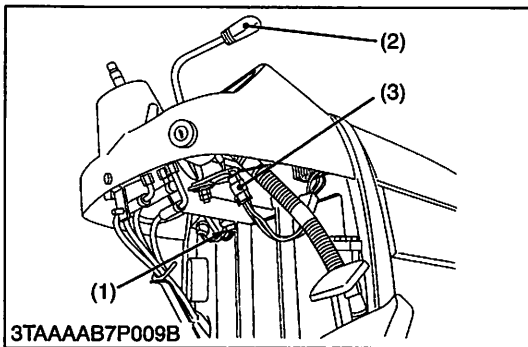
#### Steering Wheel

1. Remove the steering wheel cap.
2. Remove the steering wheel mounting nut and remove the steering wheel.

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

Tightening torque	Steering wheel mounting nut	20 to 25 N·m 2.0 to 2.6 kgf·m 14.8 to 18.4 ft-lbs
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W1011793



3TAAAB7P009B

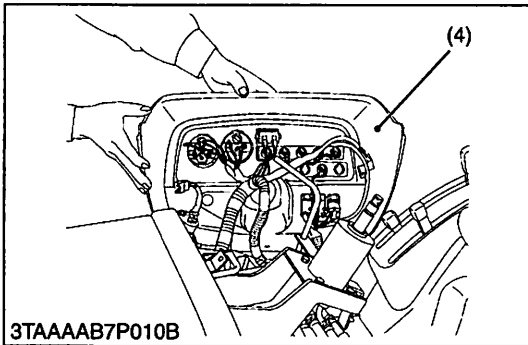
**Meter Panel**

1. Remove the hand accelerator lever grip (2).
2. Disconnect the connector for main switch (3) and flasher unit (1).
3. Remove the panel mounting screws and dismount the meter panel (4).
4. Disconnect the all connectors from panel and remove the meter panel (4).

- (1) Connector for Flasher Unit
- (2) Accelerator Lever Grip

- (3) Connector for Main Switch
- (4) Meter Panel

W1011901



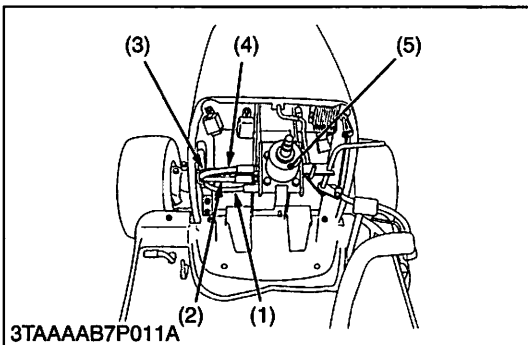
3TAAAB7P010B

**Steering Controller**

1. Disconnect the power steering hoses (1), (2), (3), (4).
2. Remove the steering controller mounting screws and remove the steering controller (5).

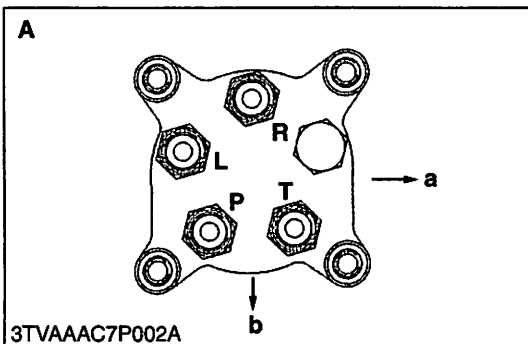
**(When reassembling)**

- Be sure to connect the power steering hoses to their original position, and tighten them to the specified torque.



3TAAAB7P011A

Tightening torque	Power steering hose mounting nut	28.4 to 30.0 N·m 2.9 to 3.1 kgf·m 20.9 to 22.1 ft·lbs
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3TVAAAC7P002A

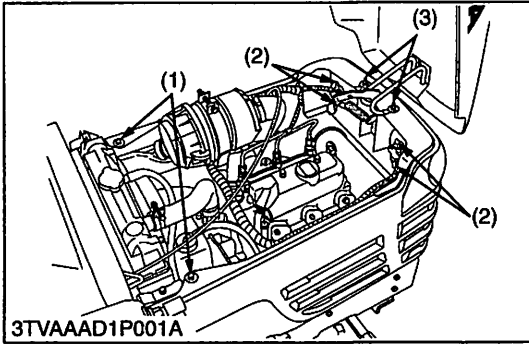
- (1) Cylinder Hose RH
- (2) Cylinder Hose LH
- (3) Return Hose
- (4) Delivery Hose
- (5) Steering Controller

- A : Bottom View**
- P : Pump Port**  
(Connect to Delivery Hose)
- T : Tank Port**  
(Connect to Return Hose)
- L : L Port**  
(Connect to Cylinder LH Hose)
- R : R Port**  
(Connect to Cylinder RH Hose)
- a : Right**
- b : Front**

W1012133



## (2) Separating Power Steering Cylinder



### Under Cover

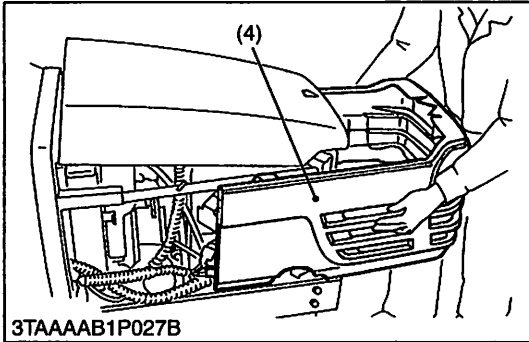
1. Remove the under cover mounting bolts (1), loosen the mounting nuts (3).
2. Disconnect the connectors (2) from the head lights.
3. Pull forward to remove the under cover (4).

### (When reassembling)

Tightening torque	Under cover mounting bolt and nut	7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft·lbs
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- (1) Under Cover Mounting Bolt                      (3) Under Cover Mounting Nut  
(2) Connector    (4) Under Cover

W1012879

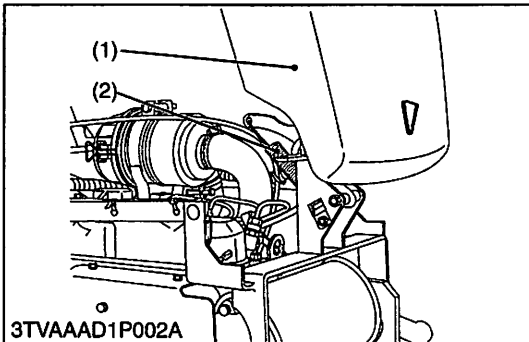


### Bonnet

1. Remove the spring (2).
2. Remove the bonnet mounting bolt and nut, and remove the bonnet (1).

- (1) Bonnet    (2) Spring

W1013021



### Power Steering Cylinder

1. Remove the flywheel cover (1).
2. Disconnect the power steering cylinder hoses (3), (4).
3. Remove the cotter pin and remove the slotted nut for tie-rod (2).
4. Remove the power steering cylinder mounting screws and remove the power steering cylinder with tie-rod.

### (When reassembling)

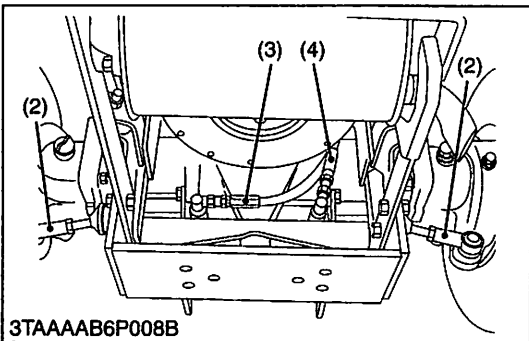
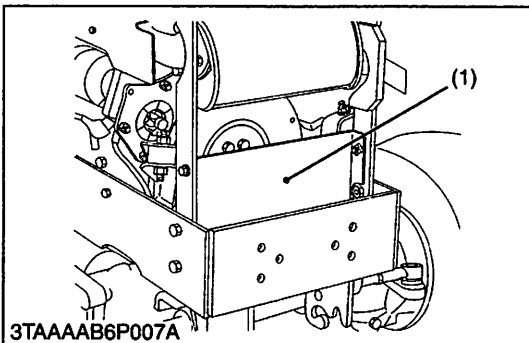
#### ■ NOTE

- Tighten the slotted nut to 17.7 N·m (1.8 kgf·m, 13 ft·lbs). If the slot and pin hole do not meet, tighten the nut until they do meet, and install cotter pin.
- Be sure to split the cotter pin like an anchor.

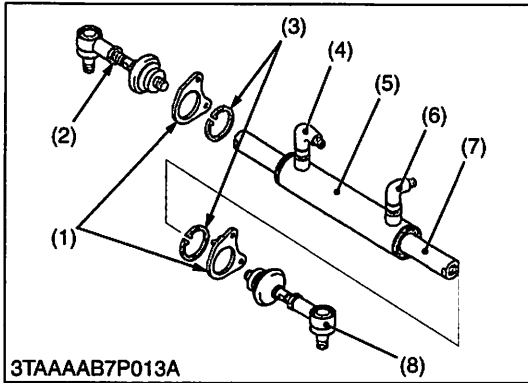
Tightening torque	Power steering cylinder hose	28.4 to 30.0 N·m 2.9 to 3.1 kgf·m 20.9 to 22.1 ft·lbs
	Tie-rod slotted nut	17.7 to 34.3 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft·lbs

- (1) Flywheel Cover                                      (3) Cylinder Hose RH  
(2) Tie-rod    (4) Cylinder Hose LH

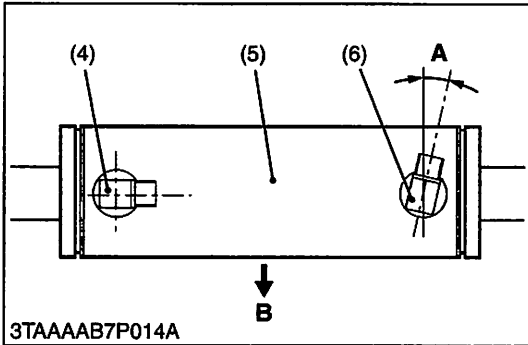
W1012658



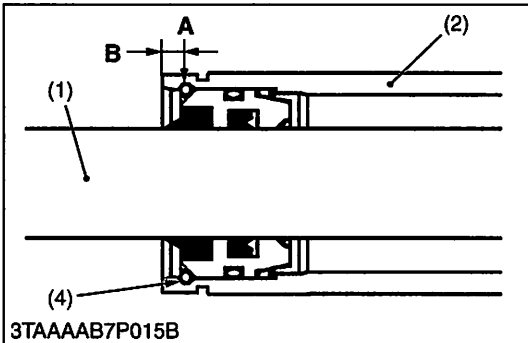
### (3) Disassembling Power Steering Cylinder



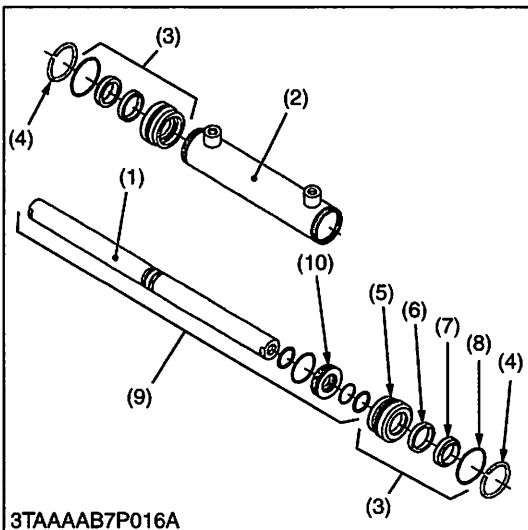
3TAAAAB7P013A



3TAAAAB7P014A



3TAAAAB7P015B



3TAAAAB7P016A

#### Adaptor and Tie-rod

1. Remove the cylinder hose adaptors (4), (6).
2. Remove the tie-rods (2), (8) from piston rod (7).
3. Remove the cylinder holder (1) and internal snap ring (3).

#### (When reassembling)

- Be sure to install the hose adaptors (4), (6) as shown figure left.
- After reassembling the tie-rod, be sure to adjust the toe-in. (Refer to 3-S4.)

Tightening torque	Tie-rod screw	74 to 84 N·m 7.5 to 8.6 kgf·m 54.6 to 61.9 ft·lbs
-------------------	---------------	---

- |                        |                             |
|------------------------|-----------------------------|
| (1) Cylinder Holder    | (7) Piston Rod              |
| (2) Tie-rod RH         | (8) Tie-rod LH              |
| (3) Internal Snap Ring |                             |
| (4) Hose Adaptor RH    | <b>A : 0.26 rad. (15 °)</b> |
| (5) Cylinder           | <b>B : Front</b>            |
| (6) Hose Adaptor LH    |                             |

W1012941

#### Steering Cylinder

1. Carefully clamp the cylinder in a vise.
2. Push one of the guide assembly (3) to inside of cylinder tube (2).
3. Drill a hole (2.5 mm dia., 0.1 in. dia.) on the cylinder tube (2) just over the snap ring (4) as shown figure left.
4. Take a little screwdriver and lift off the snap ring (4) from its groove. Simultaneousness support this action by pushing from the outside of the cylinder tube with another little screwdriver or another tool.
5. Push out the piston rod assembly (9) and take off the guide assembly (3).

#### (When reassembling)

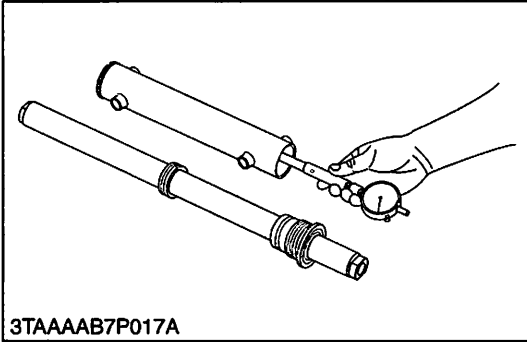
##### ■ NOTE

- **Seals must be exchanged after disassembling.**
- Apply transmission fluid to the exchanged seals.
- Enter the piston rod and block the guide assemblies with the snap rings.

- |                    |                                |
|--------------------|--------------------------------|
| (1) Piston Rod     | (8) O-ring                     |
| (2) Cylinder Tube  | (9) Piston Rod Assembly        |
| (3) Guide Assembly | (10) Center Piston             |
| (4) Snap Ring      |                                |
| (5) Guide          | <b>A : Drill a Hole</b>        |
| (6) Seal Ring      | <b>B : 5.25 mm (0.267 in.)</b> |
| (7) Wiper Ring     |                                |

W1013441

### [3] SERVICING

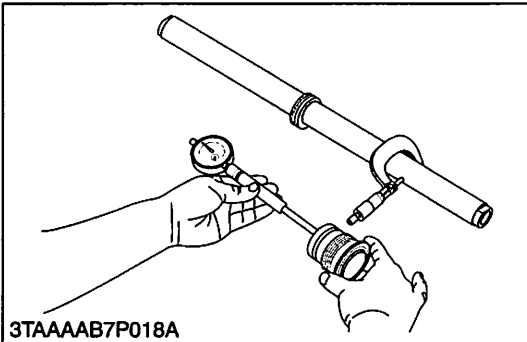


#### Steering Cylinder I.D.

1. Measure the steering cylinder I.D. with a cylinder gauge.
2. If the cylinder I.D. exceed the allowable limit, replace the cylinder barrel.

Steering cylinder I.D.	Factory spec.	40.000 to 40.062 mm 1.57480 to 1.57724 in.
	Allowable limit	40.100 mm 1.57874 in.

W1013872



#### Clearance between Rod and Guide

1. Measure the rod guide I.D. with a cylinder gauge.
2. Measure the rod O.D. with an outside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace as a unit.

Clearance between rod and guide	Factory spec.	0.020 to 0.070 mm 0.00079 to 0.00276 in.
	Allowable limit	0.200 mm 0.00787 in.

W1013777

# 5 HYDRAULIC SYSTEM

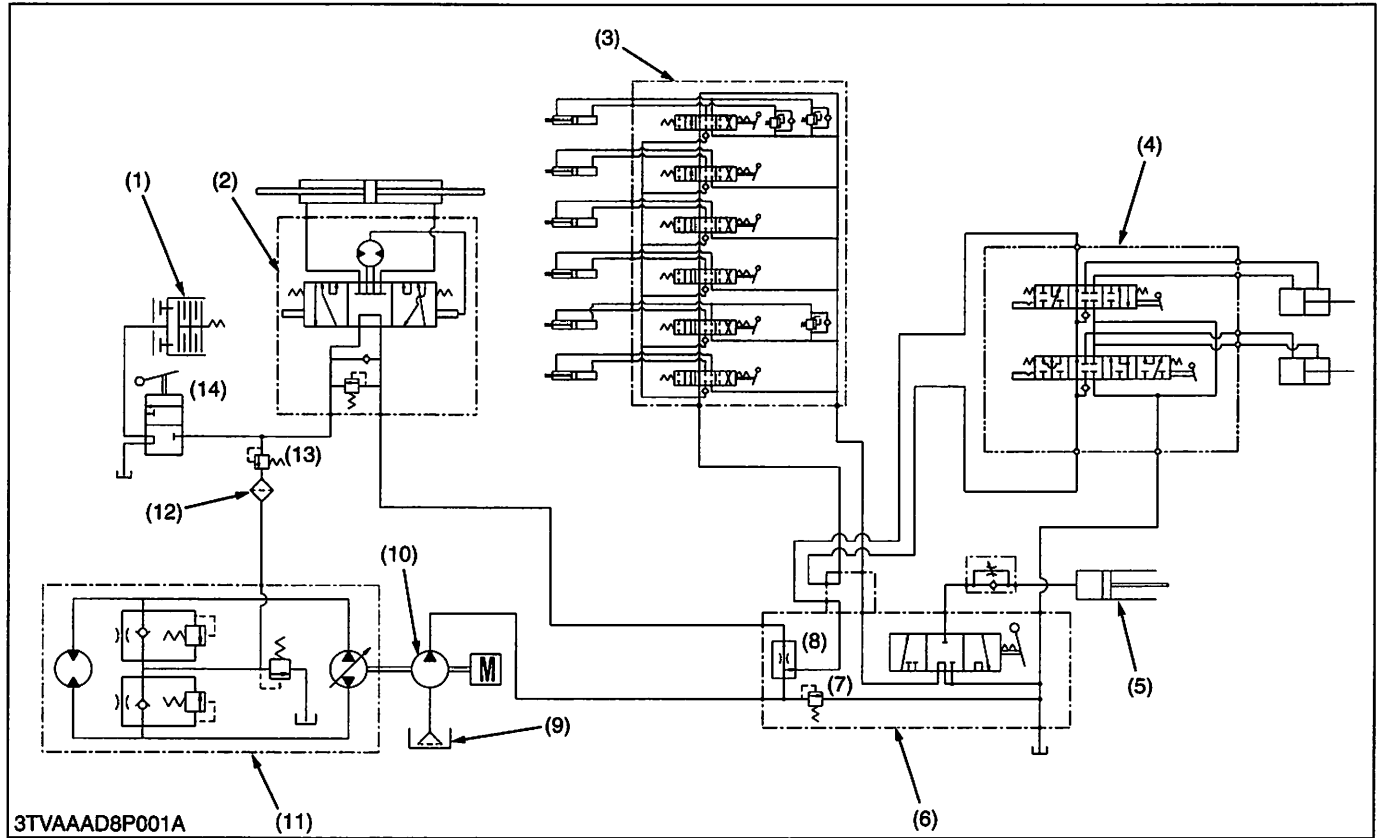


# MECHANISM

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# 1. HYDRAULIC CIRCUIT



3TVAAAD8P001A

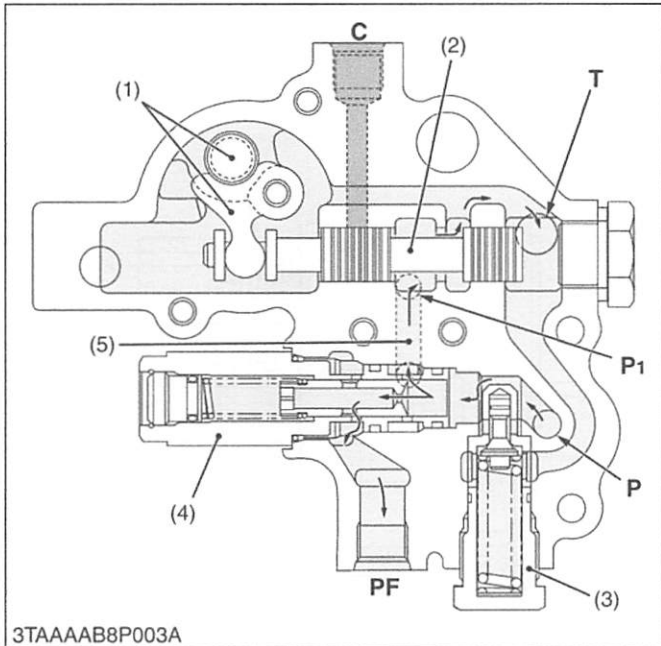
- |                                    |   |                         |                               |
|------------------------------------|---|-------------------------|-------------------------------|
| (1) PTO Clutch                     | (4) Front Loader Control Valve Assembly | (7) Relief Valve        | (11) Hydrostatic Transmission |
| (2) Power Steering Controller      | (5) Hydraulic Cylinder                  | (8) Flow Priority Valve | (12) Oil Filter               |
| (3) Backhoe Control Valve Assembly | (6) Hydraulic Control Valve Assembly    | (9) Oil Strainer        | (13) PTO Relief Valve         |
| (14) PTO Clutch Valve              |   | (10) Hydraulic Pump     |                               |

The hydraulic system of this tractor is composed of a hydraulic pump (10), hydraulic block type outlet, control valve (6), hydraulic cylinder (5) and other components.

This system has the following functions.

1. Oil is supplied by hydraulic pump (10) which is driven by pump drive shaft in the transmission case. As the pump drive shaft is connected to the propeller shaft, hydraulic pump starts running when engine is started.
2. The hydraulic pump forces out the oil to control valve (6) for 3 point hitch system, power steering controller (2), PTO clutch valve and hydrostatic transmission after dividing oil flow by flow priority valve (8).
3. Hydraulic power take off from the hydraulic block type outlet to operate the implements such as a front loader and etc.

## 2. HYDRAULIC CONTROL VALVE



Hydraulic control valve assembly is composed of control valve, flow priority valve (4) and relief valve (3). Oil from hydraulic pump is divided by flow priority valve (4) and forced into the control valve through passage (5) of hydraulic block type outlet. The spool (2) is moved by control arm (1) which is connected to hydraulic lever and oil from pump is changed flow direction by spool movement.

### ■ Neutral

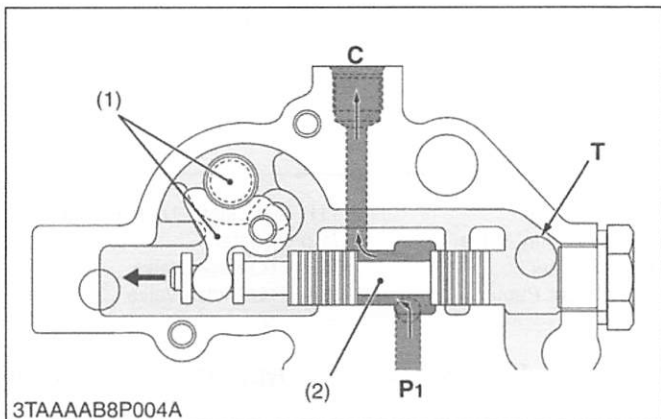
Oil forced into the control valve through **P1** port and returns to the transmission case through **T** port.

Also, **C** port is closed by spool (2), oil in the hydraulic cylinder does not flow to the transmission case.

Thus, the implement remains at its fixed position.

- |                               |   |
|-------------------------------|---|
| (1) Control Arm               | <b>P, P1</b> : Pump Port                        |
| (2) Spool (for Control Valve) | <b>C</b> : Cylinder Port                        |
| (3) Relief Valve              | <b>T</b> : Tank Port                            |
| (4) Flow Priority Valve       | <b>PF</b> : PF Port (to power steering circuit) |
| (5) Passage                   |   |

W1013049



### ■ Lift

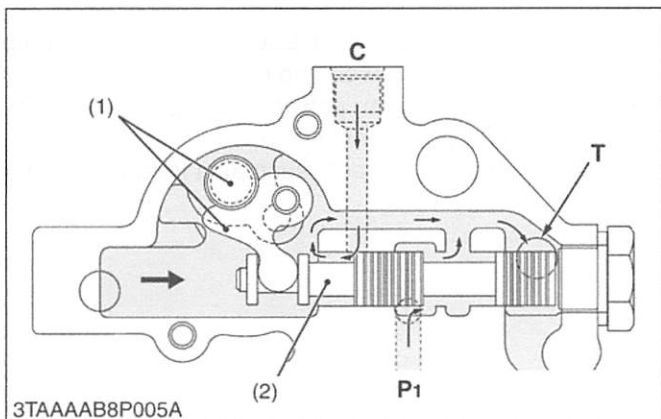
When the control lever is set to the “**LIFT**” position, the spool (2) is moved to the left.

The oil forced into the control valve through **P1** port flows to **C** port.

The oil pushes and flow into the hydraulic cylinder through the **C** port to lift the implement.

- |                 |                          |
|-----------------|--------------------------|
| (1) Control Arm | <b>P1</b> : Pump Port    |
| (2) Spool       | <b>C</b> : Cylinder Port |
|                 | <b>T</b> : Tank Port     |

W1013268



### ■ Down

When the control lever is moved to “**Down**” position, the spool (2) is moved to the right.

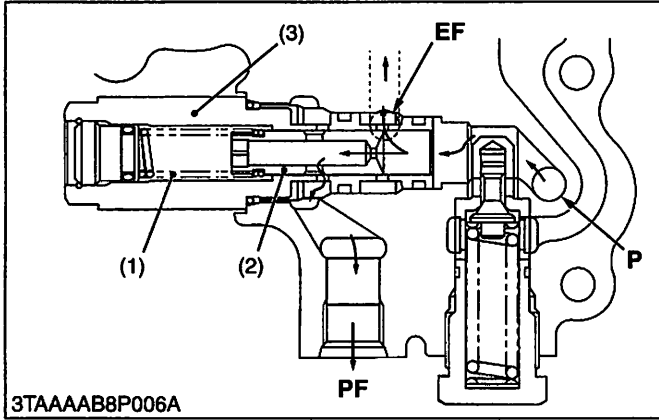
Oil in the hydraulic cylinder is forced out to the transmission case through gap of spool and **T** port by the weight of the implement, causing the implement to lower.

Oil forced into the control valve through the **P1** port and returns to the transmission case through the **T** port.

- |                 |                          |
|-----------------|--------------------------|
| (1) Control Arm | <b>P1</b> : Pump Port    |
| (2) Spool       | <b>C</b> : Cylinder Port |
|                 | <b>T</b> : Tank Port     |

W1013211

### 3. FLOW PRIORITY VALVE



The flow priority valve is a flow divider that divides the flow from single hydraulic source (hydraulic pump) to actuates two circuits simultaneously.

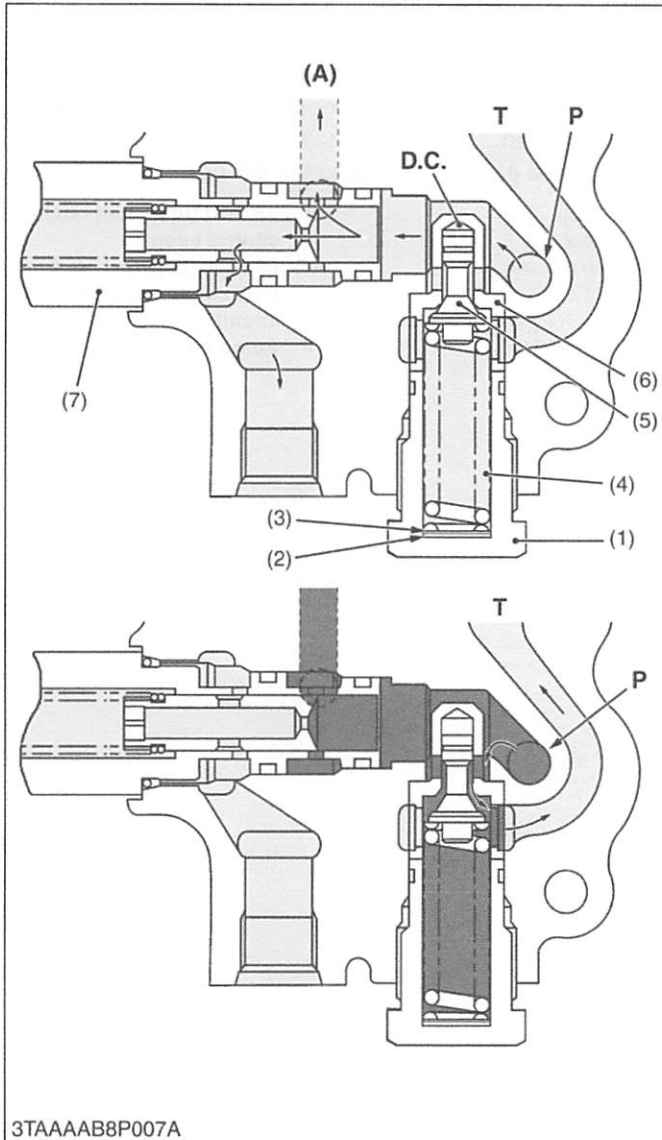
This valve feeds fixedly controlled flow (7 L/min., 1.8 U.S.gals./min., 1.5 Imp.gals./min.) to the PF port with priority and excessive flow to the EF port.

- (1) Spring
- (2) Spool
- (3) Valve Body

- EF : EF Port (to 3 point hitch control circuit)
- PF : PF Port (to power steering PTO clutch and HST circuit)
- P : Pump Port

W1013500

# 4. RELIEF VALVE



The implement control system circuit has a relief valve to restrict the maximum pressure in the circuit. The relief valve is located in the hydraulic control valve assembly.

The relief valve is of the guide piston type with damping effect.

Among direct acting relief valves, this type is suited to higher pressure and has large capacity. Furthermore, this type is free from unstable operation, such as chattering, which occurs often in direct acting relief valves.

As shown in the figure, the guide is attached to the poppet (5) and a valve chamber **D.C.** (called the damping chamber) is formed at the top of the guide piston. The inlet of the valve leads to the chamber via a clearance between the sliding portion of the guide and the seat (6), minimizing valve vibration with the damping effect of the chamber.

When the oil pressure in the circuit is lower than the setting pressure of the relief valve, the relief valve is not operated and the oil fed to the relief valve from the hydraulic pump flows into the implement control valve.

As the oil pressure in the circuit increases, so does the pressure in the damping chamber **D.C.**. When the pressure rises above the valve setting and overcomes the spring force, the valve opens. Oil then flows out to the transmission case through **T** port, preventing any further rise in pressure. The valve closes again when enough oil is released to drop pressure below the valve setting.

**(Reference)**

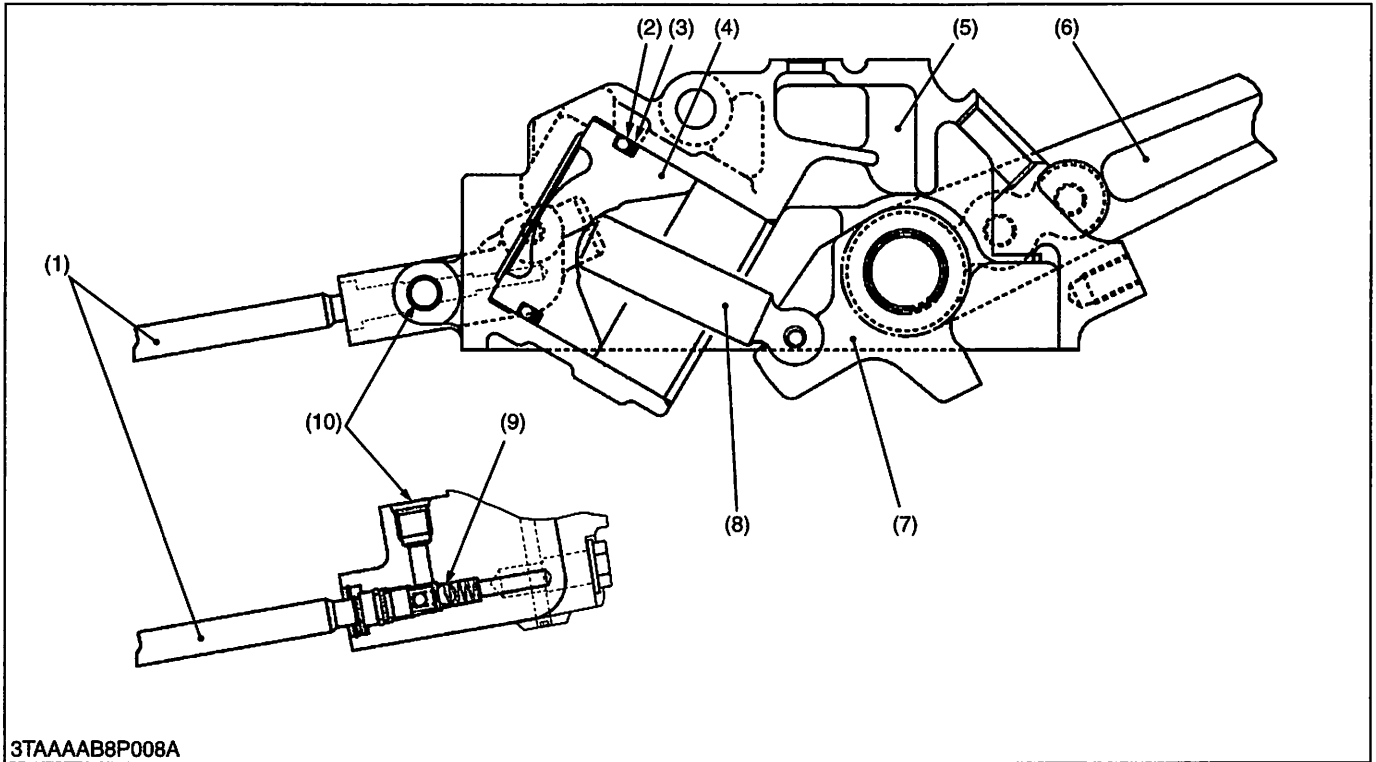
- Relief valve setting pressure : 12.3 to 12.7 MPa  
125 to 130 kgf/cm<sup>2</sup>  
1778 to 1849 psi
- Engine speed : Maximum
- Oil temperature : 40 to 50 °C  
104 to 122 °F

- (1) Plug
- (2) Washer
- (3) Shim
- (4) Spring
- (5) Poppet
- (6) Seat
- (7) Flow Priority Valve

- D.C.** : Damping Chamber
- P** : Pump Port
- T** : Tank Port
- (A)** To Hydraulic Control Valve

W1013612

## 5. HYDRAULIC CYLINDER



3TAAAAB8P008A

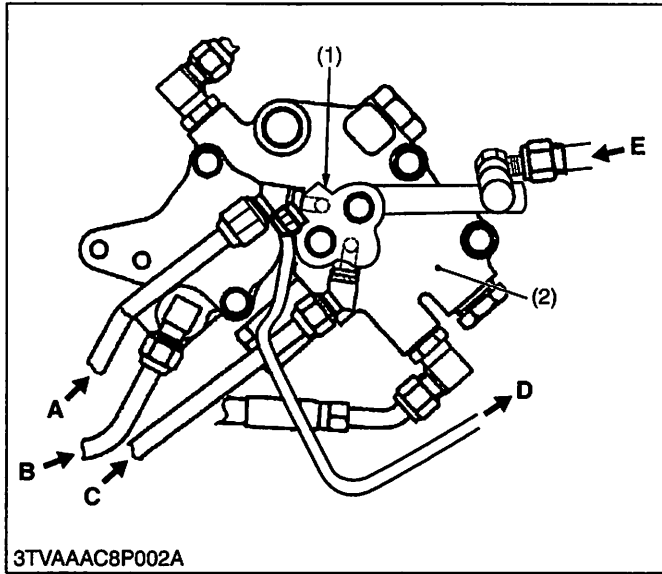
- |                                    |                        |                   |   |
|------------------------------------|------------------------|-------------------|---|
| (1) Lowering Speed Adjusting Shaft | (3) Back-up Ring       | (6) Lift Arm      | (9) Ball  |
| (2) O-ring                         | (4) Piston             | (7) Hydraulic Arm | (10) Cylinder Port (Connected to Control Valve) |
|                                    | (5) Hydraulic Cylinder | (8) Hydraulic Rod |   |

The main components of the hydraulic cylinder are shown in the figure above.

While the lift arm (6) is rising, oil from the hydraulic pump flows into the hydraulic cylinder through the hydraulic control valve and cylinder port (10). Then oil pushes out the piston (4).

While the lift arm (6) is lowering, oil in the hydraulic cylinder is discharged to the transmission case through the hydraulic control valve by the weight of the implement. At this time, the lowering speed of the implement can be controlled by the ball (9) attached to the hydraulic cylinder (5). Turning the lowering speed adjusting knob clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve is completely closed, the lift arm (6) is held at its position since oil in the hydraulic cylinder is sealed between the piston (4) and ball (9).

## 6. HYDRAULIC BLOCK TYPE OUTLET



The hydraulic block type outlet is located on the control valve assembly.

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, backhoe and so on.

- (1) Block Outlet Cover
- (2) Hydraulic Control Valve Assembly

**A : To Front Loader (Outlet)**  
**Max. flow 14 L/min.**  
**(3.7 U.S.gals./min,**  
**3.1 Imp.gals./min.)**

**B : Return Port**

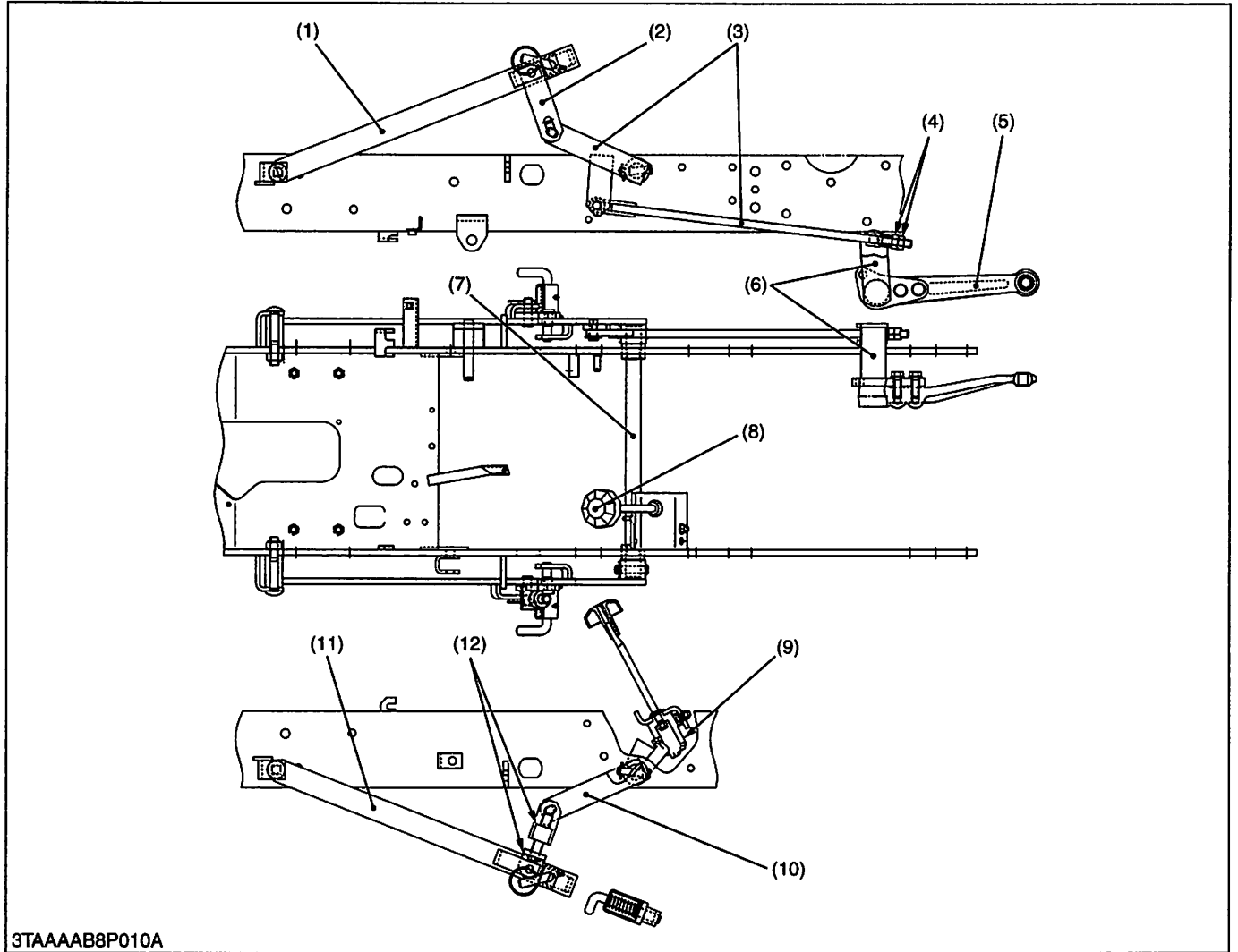
**C : From Front Loader (Inlet)**

**D : To Backhoe (Outlet)**

**E : From Backhoe (Inlet)**

W1013966

# 7. MOWER LINKAGE



3TAAAAB8P010A

- |                        |                        |                                   |                         |
|------------------------|------------------------|-----------------------------------|-------------------------|
| (1) Mower Rear Link RH | (4) Link Adjusting Nut | (7) Lift Link Shaft               | (10) Lift Link Rear LH  |
| (2) Lift Link RH       | (5) Lift Arm RH        | (8) Cutting Height Adjusting Dial | (11) Mower Rear Link LH |
| (3) Lift Link Rear RH  | (6) Mower Lift Arm     | (9) Adjusting Cam                 | (12) Lift Link LH       |

The mower rear link (1), (11) and lift arm RH (5) are linked with lift link (2), (12), lift link rear (3), (10) lift link shaft (7) and mower lift arm (6).

As the hydraulic control lever moves to up position, lift arm (5) is raised and mower lift arm (6) is rotated to pull the lift links to the rearward. As a result, mower rear link (1), (11) are lifted.

The cutting height adjusting dial (8) is adjusts cutting height of mower by rotating the adjusting cam (9). The position of mower rear link (1), (11) are adjusted by changing the rod of lift link rear RH (3).



# SERVICING

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# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Implement Does Not Rise (No Noise)</b>	<ul style="list-style-type: none"> <li>Control valve broken</li> <li>Control valve improperly assembled</li> <li>Relief valve spring damaged</li> <li>Spool sticks</li> <li>Piston O-ring or cylinder damaged</li> </ul>	Replace Repair Replace Repair Replace	5-S15 5-S15 5-S15 5-S15 5-S17
	<b>(Noise)</b>	<ul style="list-style-type: none"> <li>Oil filter cartridge clogged</li> <li>Suction pipe loosen or broken</li> <li>Suction pipe connecting hose loosen or broken</li> <li>Suction pipe O-ring broken</li> <li>Insufficient transmission oil</li> <li>Relief valve setting pressure too low</li> <li>Hydraulic pump broken</li> </ul>	Replace Repair or replace Repair or replace Replace Refill Adjust or replace Replace
<b>Implement Does Not Reach Maximum Height</b>	<ul style="list-style-type: none"> <li>Feedback rod improperly adjusted</li> </ul>	Adjust	5-S7
<b>Implement Does Not Lower</b>	<ul style="list-style-type: none"> <li>Control valve malfunctioning</li> </ul>	Repair or replace	5-S14
<b>Implement Drops by Its Weight</b>	<ul style="list-style-type: none"> <li>Hydraulic cylinder worn or damaged</li> <li>Piston O-ring worn or damaged</li> <li>Control valve malfunctioning</li> </ul>	Replace Replace Replace	- 5-S17 5-S14

W1014322

## 2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
<b>[Hydraulic Pump]</b> Condition <ul style="list-style-type: none"> <li>• Engine speed : Maximum</li> <li>• Oil Temperature : 50 °C, 122 °F</li> </ul>	at no pressure	21.0 L/min. 5.5 U.S.gals./min. 4.6 Imp.gals./min.	–
	at 12.7 MPa 130 kgf/cm <sup>2</sup> 1849 psi	18.0 L/min. 4.8 U.S.gals./min. 4.0 Imp.gals./min.	16.0 L/min. 4.2 U.S.gals./min. 3.5 Imp.gals./min.
Gear to Casing	Clearance	–	0.15 mm 0.0059 in.
Gear Shaft to Bushing	Clearance	0.020 to 0.091 mm 0.0008 to 0.0036 in.	0.12 mm 0.0047 in.
Gear Shaft	O.D.	14.970 to 14.980 mm 0.5894 to 0.5898 in.	–
Bushing	I.D.	15.000 to 15.061 mm 0.5906 to 0.5930 in.	–
Side Plate	Thickness	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.
Relief Valve	Setting Pressure	12.3 to 12.7 MPa 125 to 130 kgf/cm <sup>2</sup> 1778 to 1849 psi	–
Lift Arm	Free Play	5 to 10 mm 0.20 to 0.40 in.	–
Hydraulic Cylinder	I.D.	80.05 to 80.15 mm 3.1516 to 3.1555 in.	80.2 mm 3.1575 in.

W1013874

### 3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.  
 (For general use screws, bolts and nuts : See page G-8.)

Item	N-m	kgf-m	ft-lbs
ROPS mounting nut	124 to 147	12.6 to 15.0	91.2 to 108
Rear wheel mounting screw	108.5 to 130.2	11.1 to 13.3	80 to 96
Fuel tank stay mounting bolt and nut	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Sub frame mounting bolt and nut (M14)	147	15.0	108.5
(M16)	196	20.0	147
PTO cover RH and LH mounting bolt and nut	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Rear support mounting screw (M12)	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Hitch plate mounting bolt and nut (M14)	124 to 147	12.6 to 15.0	91.2 to 108
Fender bracket mounting bolt and nut (M14)	124 to 147	12.6 to 15.0	91.2 to 108
Fender center stay mounting screw (M14)	124 to 147	12.6 to 15.0	91.2 to 108
Control valve and PTO safety switch stay mounting screw	17.8 to 20.6	1.8 to 2.1	13.0 to 15.2
Delivery pipe	28.4 to 30.0	2.9 to 3.1	20.9 to 22.1
Power steering delivery hose	28.4 to 30.0	2.9 to 3.1	20.9 to 22.1
Mower lift arm mounting screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Mower rear link mounting bolt and nut	124 to 147	12.6 to 15.0	91.2 to 108
Hydraulic cylinder mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Relief valve plug	39.2 to 58.8	4.0 to 6.0	28.9 to 43.4
Flow priority valve	39.2 to 58.8	4.0 to 6.0	28.9 to 43.4
Control valve plug	39.2 to 58.8	4.0 to 6.0	28.9 to 43.4
Pump cover mounting screw	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9

W1012736

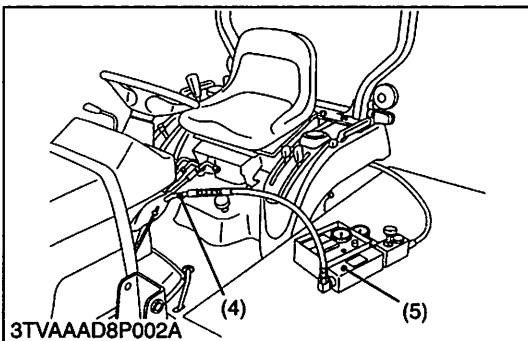
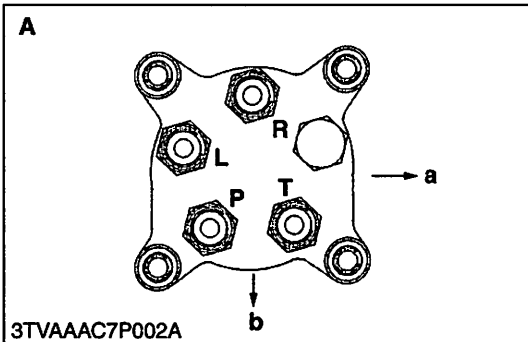
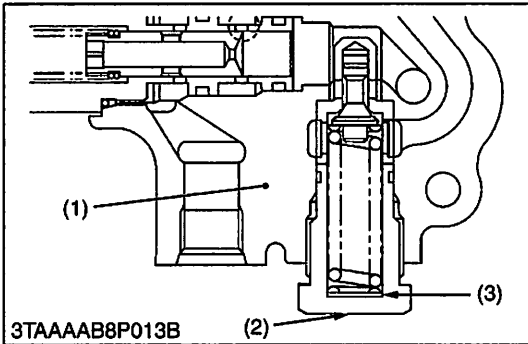
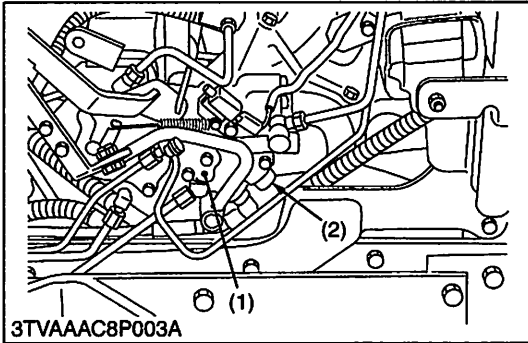
# 4. CHECKING, DISASSEMBLING AND SERVICING

## [1] HYDRAULIC PUMP

### (1) Checking

■ **NOTE**

- Two kinds of flowing quantity from the pump divides.
- Measure flowing quantity in two places and put out the total flow.



### Flowmeter Connecting and Test Preparation 1

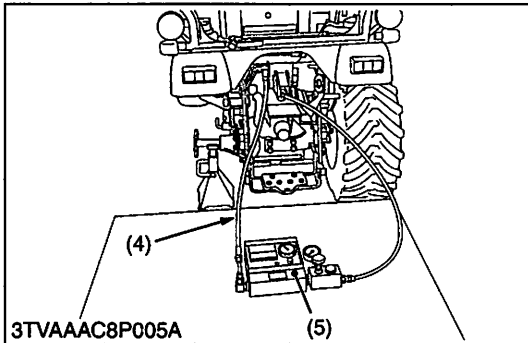
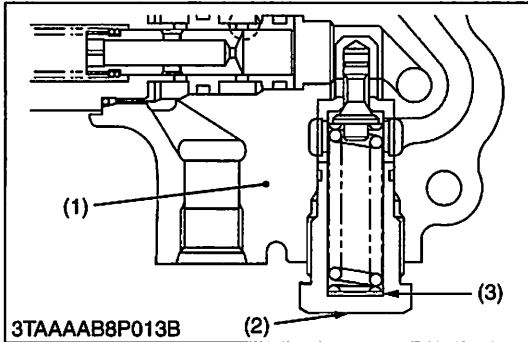
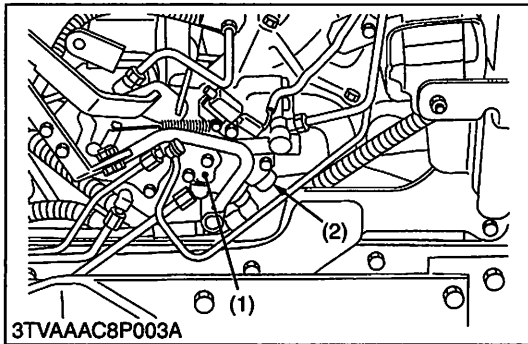
■ **IMPORTANT**

- Use the instruction with the flowmeter when you use the flowmeter.
  - While testing, do not close the flowmeter loading valve completely.
  - Added shim is a thing removed after it measures it.
1. Remove the rear wheel LH.
  2. Add shim to the relief valve 0.4 mm (0.0157 in.).
  3. Remove the under panel.
  4. Disconnect the power steering hoses.
  5. Connect the power steering hose (4) (**From pump**) and flowmeter inlet port.
  6. Connect the another hydraulic test hose to flowmeter outlet port and transmission oil filling port.
  7. Open the flowmeter loading valve completely. (Turn counterclockwise.)
  8. Start the engine and set the **Maximum engine speed**.
  9. Slowly close the loading valve to generate the pressure **approx. 12.7 MPa (130 kgf/cm<sup>2</sup>, 1849 psi)**.
  10. Hold in this condition until oil temperature reaches approx. 50 °C (122 °F).

- (1) Control Valve
- (2) Relief Valve
- (3) Shim
- (4) Power Steering Hose (From Pump)
- (5) Flowmeter

- A : Bottom View**
- a : Right**
- b : Front**

W1020855



**Flowmeter Connecting and Test Preparation 2**

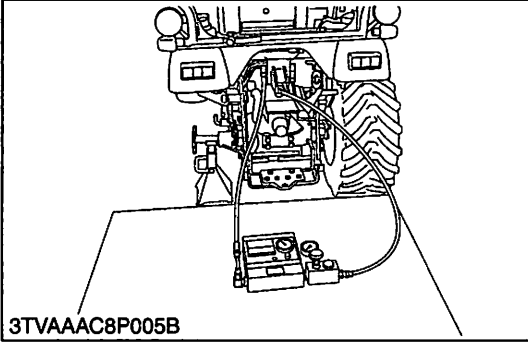
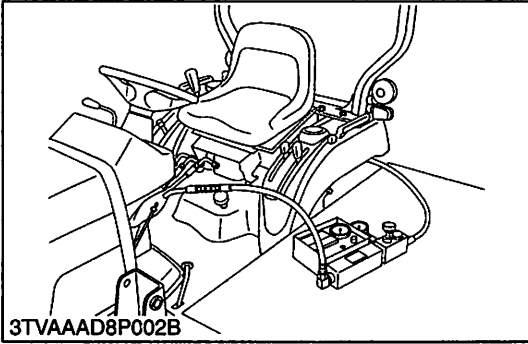
■ **IMPORTANT**

- Use the instruction with the flowmeter when you use the flowmeter.
  - While testing, do not close the flowmeter loading valve completely.
  - Added shim is a thing removed after it measures it.
1. Remove the rear wheel LH.
  2. Add shim to the relief valve 0.4 mm (0.0157 in.).
  3. Disconnect the power steering hose of backhoe inlet hose.
  4. Connect the power steering hose (4) and flowmeter inlet port.
  5. Connect the another hydraulic test hose to flowmeter outlet port and transmission oil filling port.
  6. Open the flowmeter loading valve completely. (Turn counterclockwise.)
  7. Start the engine and set the **Maximum engine speed**.
  8. Slowly close the loading valve to generate the pressure **approx. 12.7 MPa (130 kgf/cm<sup>2</sup>, 1849 psi)**.
  9. Hold in this condition until oil temperature reaches approx. 50 °C (122 °F).

- (1) Control Valve
- (2) Relief Valve
- (3) Shim

- (4) Power Steering Hose (From Pump)
- (5) Flowmeter

W1024500



**Pump Test**

■ **NOTE**

- Before pump testing, perform the flowmeter connecting and test preparation 1 and 2.

1. Open the loading valve completely.
2. Start the engine and set ant maximum engine speed.
3. Read and note the pump delivery at no pressure.
4. Slowly close the loading valve to increase pressure approx. 12.7 MPa (130 kgf/cm<sup>2</sup>, 1849 psi).
5. Read and note the pump flow at rated pressure.
6. Open the loading valve and stop the engine.

**Condition**

- Engine speed : Maximum
- Rated pressure : 12.7 MPa  
130 kgf/cm<sup>2</sup>  
1849 psi
- Oil temperature : 50 °C  
122 °F

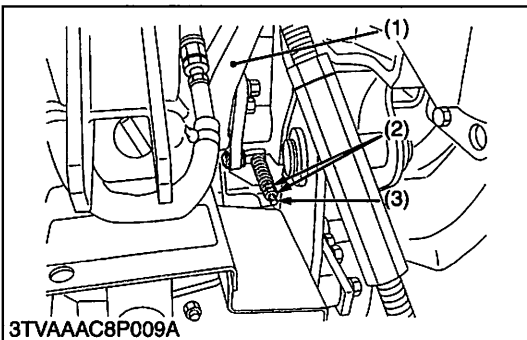
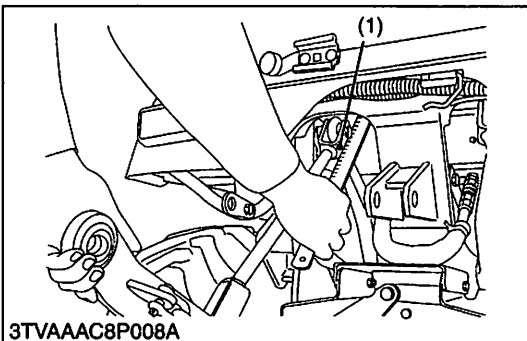
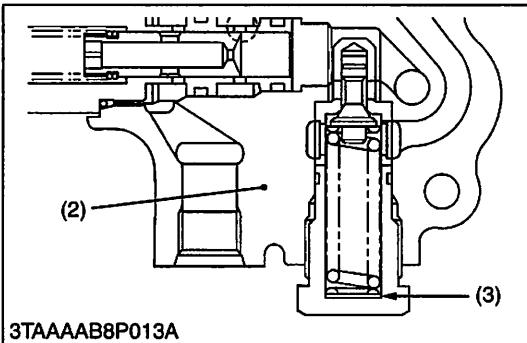
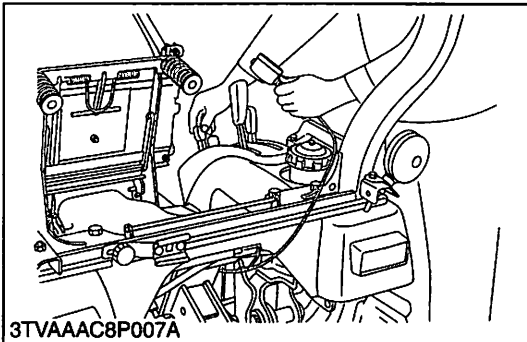
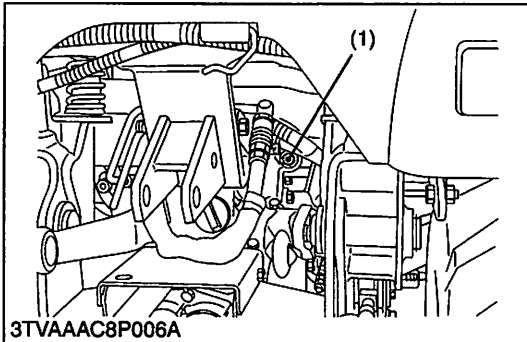
**(Reference)**

Hydraulic pump delivery at not pressure	Factory spec.	21.0 L/min. 5.5 U.S.gals./min. 4.6 Imp.gals./min.
Hydraulic pump delivery at rated pressure	Factory spec.	18.0 L/min. 4.8 U.S.gals./min. 4.0 Imp.gals./min.

W1025600

## [2] HYDRAULIC CONTROL VALVE, PUMP AND CYLINDER

### (1) Checking and Adjusting



#### Relief Valve Setting Pressure

1. Remove the plug (1) (G1/4) from rear of hydraulic cylinder body.
2. Install the adaptor, cable and pressure gauge.
3. Lengthen the feedback rod for relief valve activation.
4. Start the engine and set at maximum speed.
5. Move the control lever all way up to operate the relief valve and read the gauge.
6. If the pressure is not within the factory specifications, adjust with the adjusting shims (3).
7. After checking, reset the feedback rod correctly.

Relief valve setting pressure	Factory spec.	12.3 to 12.7 MPa 125 to 130 kgf/cm <sup>2</sup> 1778 to 1849 psi
-------------------------------	---------------	--

#### Condition

- Engine speed : Maximum
- Oil temperature : 45 to 55 °C  
113 to 131 °F

#### (Reference)

- Thickness of shims (3) :  
0.1 mm (0.0039 in.), 0.2 mm (0.0079 in.), 0.4 mm (0.0157 in.)
- 0.27 MPa (2.74 kgf/cm<sup>2</sup>, 39.0 psi) pressure is increased whenever the thickness of adjusting shim is increased by 0.1 mm (0.0039 in.).

- (1) Plug (3) Shim  
(2) Control Valve Assembly

W1011231

#### Lift Arm Free Play

1. Set the hydraulic control lever to the lowest position.
2. Start the engine, and set at the idling speed.
3. Move the hydraulic control lever to Lift position until the lift arm (1) moves to the uppermost position.
4. Move the lift arm (1) to the upper end by hand and measure the free play.
5. If the measurement is not within the factory specifications, adjust the free play by changing the set position of feedback rod rock nuts (2).

Lift arm free play	Factory spec.	5 to 10 mm 0.20 to 0.40 in.
--------------------	---------------	--------------------------------

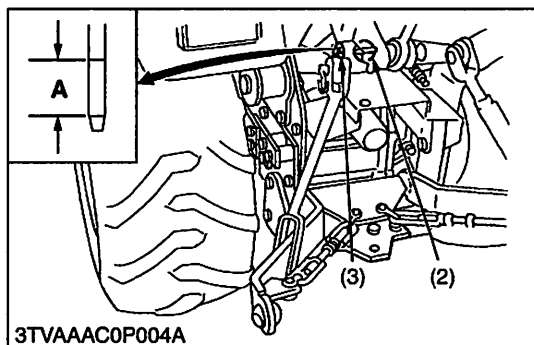
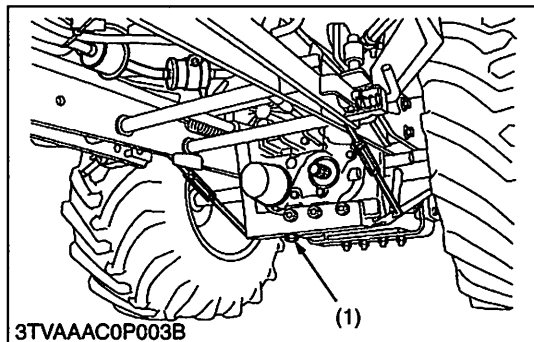
- (1) Lift Arm (3) Feedback Rod  
(2) Rock Nut

W1011520



**(2) Disassembling and Assembling**

**(A) Separating Hydraulic Control Valve, Pump and Cylinder**



**Draining Transmission Fluid**

**CAUTION**

• Be sure to stop the engine before checking and changing the transmission fluid.

1. Place oil pan under the tractor.
2. Remove the drain plugs (1) at the bottom of the transmission case.
3. Drain the transmission fluid and reinstall the drain plug.

**(When refilling)**

- 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 to prescribed level.

**IMPORTANT**

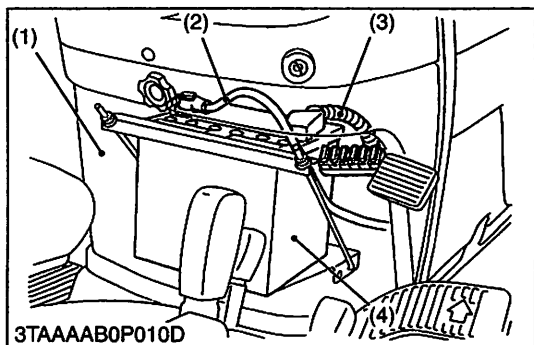
- Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-7.)
- Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.
- Do not mix different brands oil together.

Transmission fluid capacity	10.1 L 2.7 U.S.gals. 2.2 Imp.gals.
-----------------------------	--

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

A : Oil level is acceptable within this range

W1030763



**Battery**

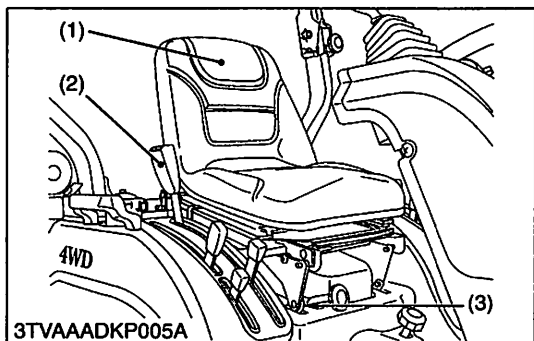
**CAUTION**

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

1. Remove the under panel (1).
2. Disconnect the negative cable (2) from the battery.
3. Disconnect the positive cable (3) from the battery and remove the battery (4).

- (1) Under Panel
- (2) Negative Cable
- (3) Positive Cable
- (4) Battery

W1011994

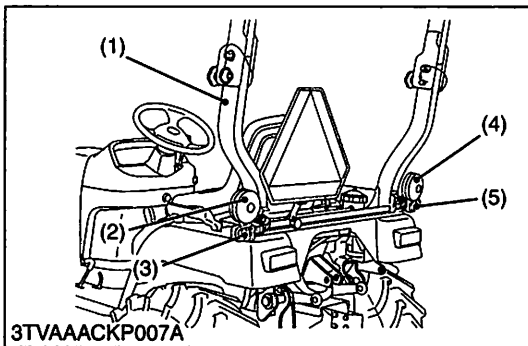


**Seat**

1. Remove the snap pin (3) to remove the seat (1).
2. Remove the seat belt RH (2).

- (1) Seat
- (2) Seat Belt RH
- (3) Snap Pin

W1031755



**Roll-Over Protective Structures (ROPS)**

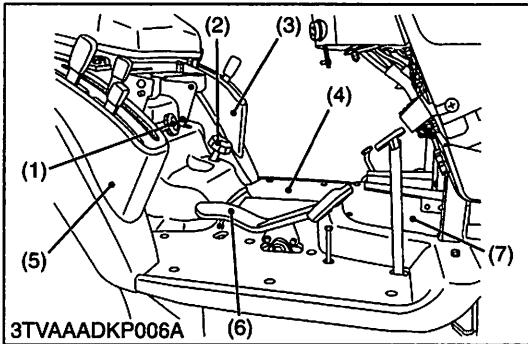
1. Disconnect the lead wires from the hazard lights (2), (4), and turn signal lamp (3), (5).
2. Remove the ROPS mounting nuts and remove the ROPS (1).

**(When reassembling)**

Tightening torque	ROPS mounting nut	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft·lbs
-------------------	-------------------	--

- (1) ROPS
- (2) Hazard Light LH
- (3) Turn Signal Lamp LH
- (4) Hazard Light RH
- (5) Turn Signal Lamp RH

W1031820

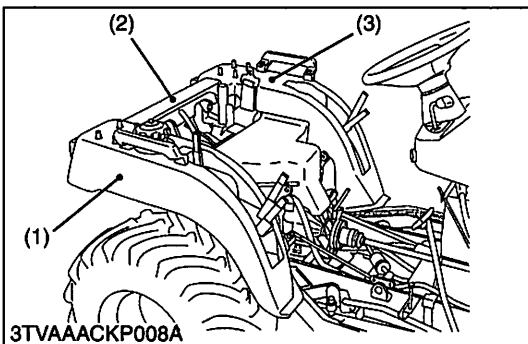


**Speed Control Pedal, Lever Guides and Step**

1. Remove the lever grips.
2. Remove the lowering speed adjusting knob (1) and cutting height adjusting dial knob (2).
3. Remove the step plate (7), speed control pedal (6) and lever guides (3), (5).
4. Remove the step (4).

- (1) Lowering Speed Adjusting Knob
- (2) Cutting Height Adjusting Dial Knob
- (3) Lever Guide LH
- (4) Step
- (5) Lever Guide RH
- (6) Speed Control Pedal
- (7) Step Plate

W1014726

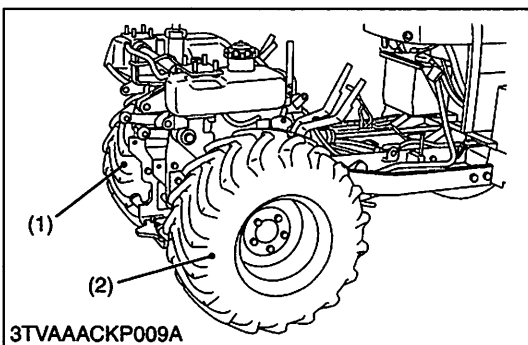


**Fenders**

1. Disconnect the lead wires from the tail lights.
2. Remove the fenders (1), (3) and (2) as a unit.

- (1) Fender RH
- (2) Rear Fender
- (3) Fender LH

W1031415



**Rear Wheel**

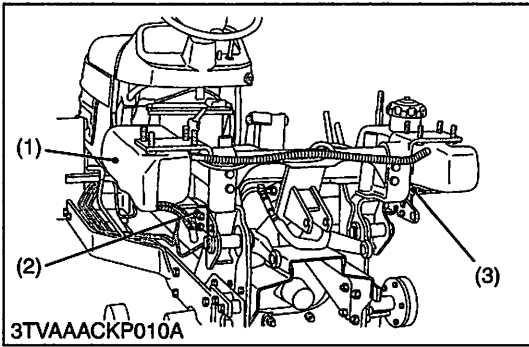
1. Remove the rear wheels (1) and (2).

**(When reassembling)**

Tightening torque	Rear wheel mounting screw	108.5 to 130.2 N·m 11.1 to 13.3 kgf·m 80 to 96 ft·lbs
-------------------	---------------------------	---

- (1) Rear Wheel LH
- (2) Rear Wheel RH

W1033482



**Fuel Tank**

1. Drain the fuel.
2. Disconnect the lead wire from fuel level sensor and fuel hoses from the fuel tank (1).
3. Remove the fuel tank stays (2), (3) and cushions, then remove the fuel tank (1).

**(When reassembling)**

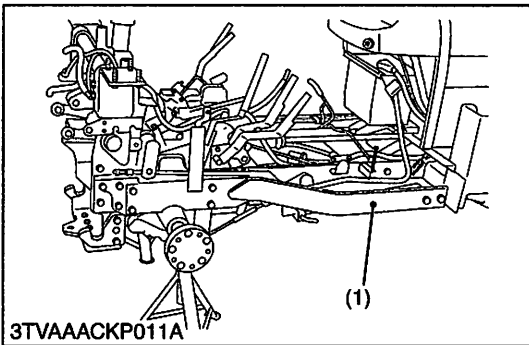
Tightening torque	Fuel tank stay mounting bolt and nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
-------------------	--------------------------------------	---

(1) Fuel Tank

(3) Fuel Tank Stay RH

(2) Fuel Tank Stay LH

W1033616



**Sub Frame**

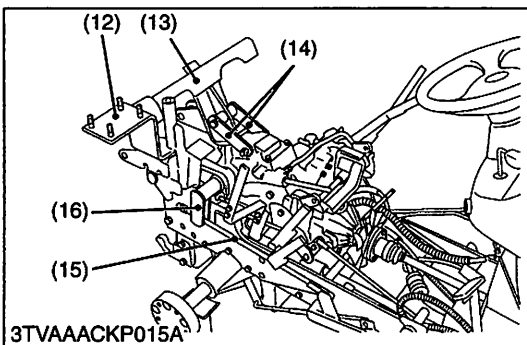
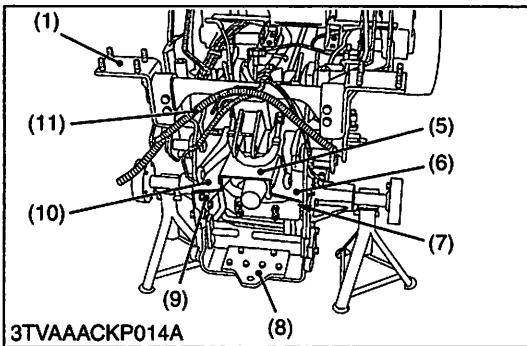
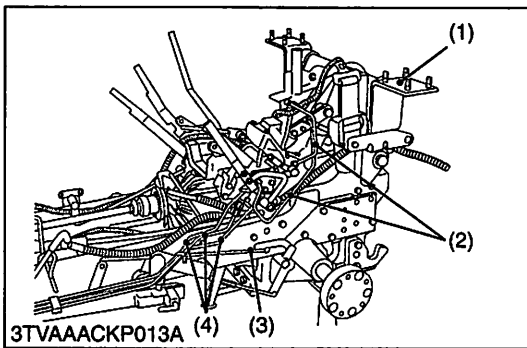
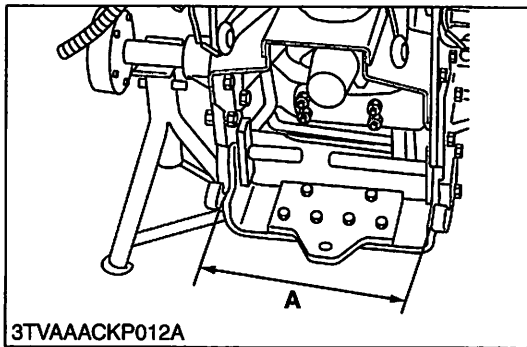
1. Remove the sub frame (1).

**(When reassembling)**

Tightening torque	Sub frame mounting bolt and nut	M14	147 N·m 15.0 kgf·m 108.5 ft·lbs
		M16	196 N·m 20.0 kgf·m 147 ft·lbs

(1) Sub Frame

W1034114



### Fender Bracket, Hitch Plate and Others

■ **NOTE**

• Measure it before disassembling length A to make reassembly smooth.

1. Remove the differential rod (3).
2. Remove the pipes (2) of backhoe.
3. Disconnect the pipes (4) of front loader.
4. Remove the PTO covers (5), (6) and (10).
5. Remove the hitch plate (8) and rear supports (7), (9).
6. Remove the fender bracket LH (1).
7. Disconnect the wire harness (11).
8. Remove the nuts from the lift link (15).
9. Remove the mower lift arm (16).
10. Remove the fender bracket RH (12).
11. Remove the center stay supports (14) and fender center stay (13).

**(When reassembling)**

• Refer to the page 2-S17.

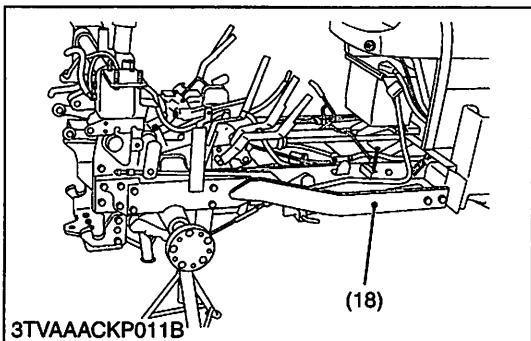
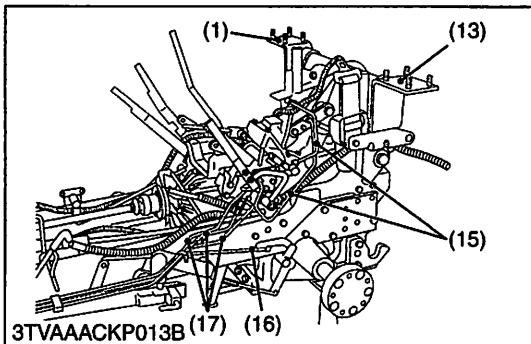
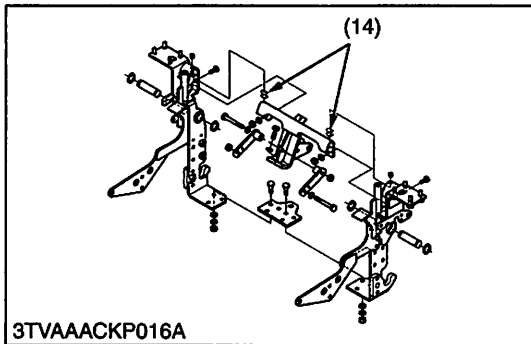
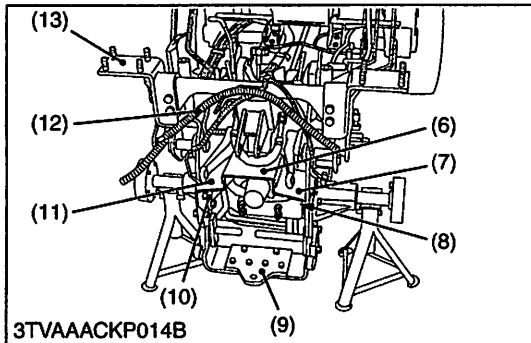
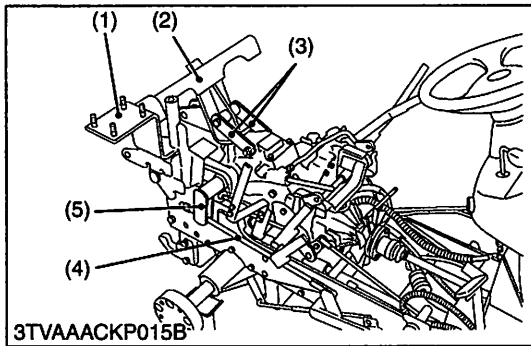
**(Reference)**

• Length A : 326 mm (12.8 in.)

- |                       |                          |
|-----------------------|--------------------------|
| (1) Fender Bracket LH | (9) Rear Support LH      |
| (2) Pipe              | (10) PTO Cover LH        |
| (3) Differential Rod  | (11) Wire Harness        |
| (4) Pipe              | (12) Fender Bracket RH   |
| (5) Upper PTO Cover   | (13) Fender Center Stay  |
| (6) PTO Cover RH      | (14) Center Stay Support |
| (7) Rear Support RH   | (15) Lift Link           |
| (8) Hitch Plate       | (16) Mower Lift Arm      |

W1036739

5



**Assembling Fender Bracket, Hitch Plate and Others**

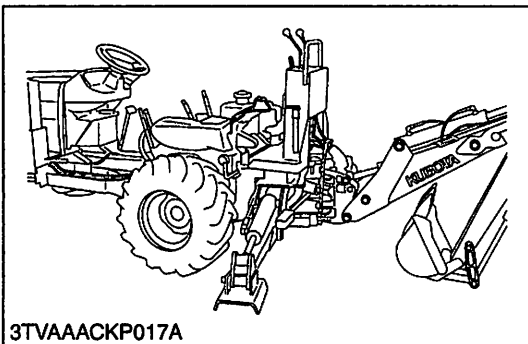
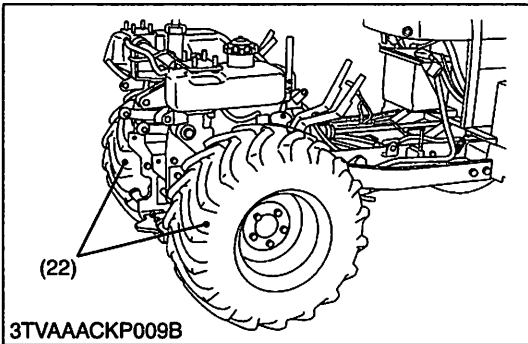
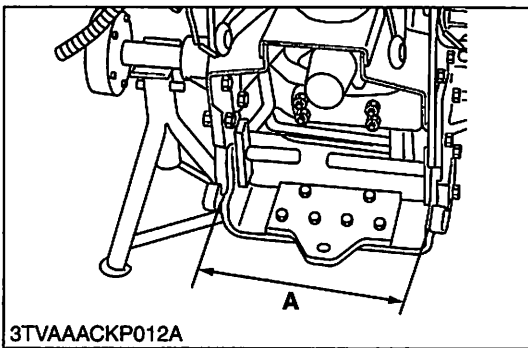
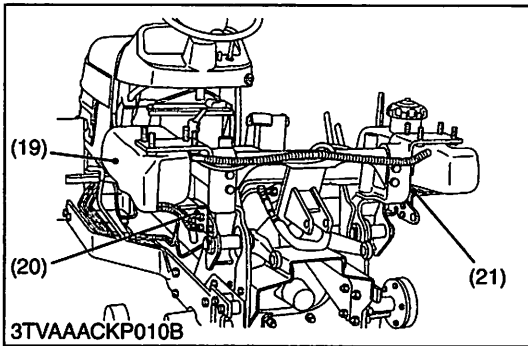
**■ IMPORTANT**

- After confirming the backhoe mounting to the tractor tighten all the bolt and nuts with specified torque.
- When tightening the upper PTO cover (6) mounting bolts and nuts. Adjust the operating force to 29.4 to 49.0 N (3.0 to 5.0 kgf, 6.6 to 11.0 lbs).

1. Install the fender bracket LH (13), fender bracket RH (1) and fender center stay (2).
2. After the all screws, bolt and nuts are tighten to the specified torque. Install and secure the shim (14) with hexagonal socket head screw between fender brackets (1), (13) and fender center stay (2).
3. Install the center stay support (3), mower lift arm (5) and lift link (4) with nuts.
4. Connect the wire harness (12).
5. Install the hitch plate (9) and rear supports (8), (10).
6. Install the PTO cover (6), (7) and (11).
7. Connect the pipes (17) of front loader.
8. Install the pipe (15) of backhoe.
9. Install the differential rod (16).
10. Install the sub frame (18).

- |                         |                        |
|-------------------------|------------------------|
| (1) Fender Bracket RH   | (10) Rear Support LH   |
| (2) Fender Center Stay  | (11) PTO Cover LH      |
| (3) Center Stay Support | (12) Wire Harness      |
| (4) Lift Link           | (13) Fender Bracket LH |
| (5) Mower Lift Arm      | (14) Shim              |
| (6) Upper PTO Cover     | (15) Pipe              |
| (7) PTO Cover RH        | (16) Differential Rod  |
| (8) Rear Support RH     | (17) Pipe              |
| (9) Hitch Plate         | (18) Sub Frame         |

W1038901



**Assembling Fender Bracket, Hitch Plate and Others (Continued)**

- 11. Install the fuel tank stays (20), (21) with cushions and fuel tank (19).
- 12. Connect the fuel hoses and fuel lever sensor.
- 13. Confirm and adjust length A.
- 14. Install the rear wheel (22).
- 15. Confirm backhoe can surely be mounted on the tractor.

**NOTE**

- Refer to section 8 for the mounting of backhoe.

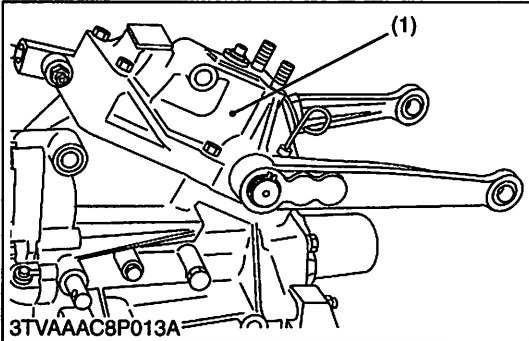
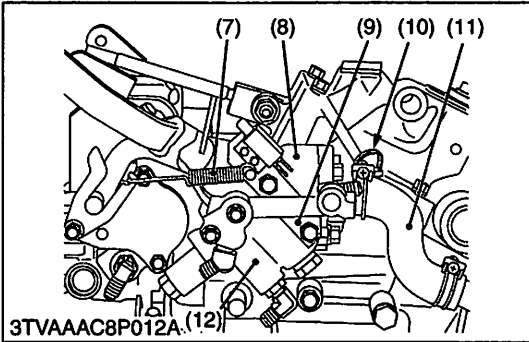
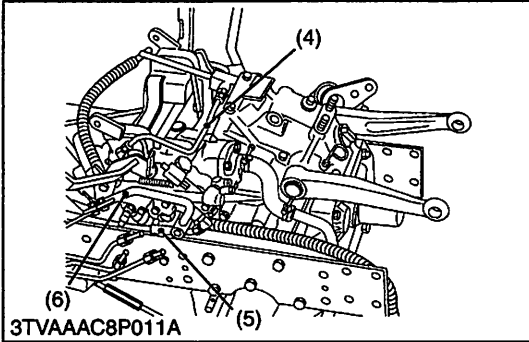
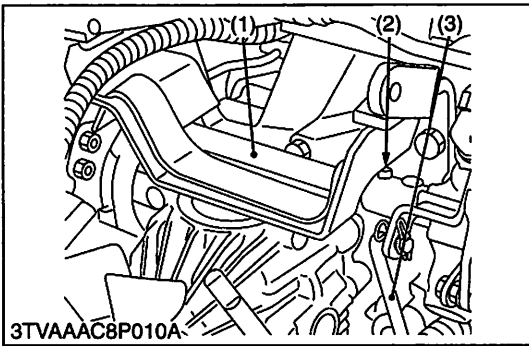
Tightening torque	PTO cover RH and LH mounting bolt and nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
	Rear support mounting screw (M12)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Hitch plate mounting bolt and nut	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs
	Fender bracket mounting bolt and nut (M14)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs
	Fender center stay mounting screw (M14)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs
	Sub frame mounting bolt and nut (M16)	196 to 225 N·m 20.0 to 23.0 kgf·m 145 to 166 ft-lbs

**(Reference)**

- Length A : 326 mm (12.8 in.)
- Thickness of shim (14) : 1.2 mm (0.047 in.)  
1.5 mm (0.059 in.)  
1.9 mm (0.075 in.)

- |                         |                           |
|-------------------------|---------------------------|
| (1) Fender Bracket RH   | (12) Wire Harness         |
| (2) Fender Center Stay  | (13) Fender Bracket LH    |
| (3) Center Stay Support | (14) Shim                 |
| (4) Lift Link           | (15) Pipe                 |
| (5) Mower Lift Arm      | (16) Differential Rod     |
| (6) Upper PTO Cover     | (17) Pipe                 |
| (7) PTO Cover RH        | (18) Sub Frame            |
| (8) Rear Support RH     | (19) Fuel Tank            |
| (9) Hitch Plate         | (20) Fuel Tank Support LH |
| (10) Rear Support LH    | (21) Fuel Tank Support RH |
| (11) PTO Cover LH       | (22) Rear Wheel           |

W1043546



**Hydraulic Control Valve and Hydraulic Pump**

1. Tap out the spring pin and remove the PTO select lever (6).
2. Disconnect the PTO clutch lever rod (3).
3. Remove the delivery pipe (4).
4. Disconnect the power steering delivery hose (5).
5. Remove the delivery pipe.
6. Remove the rue ring cotter and remove the clevis pin (2) for hydraulic control lever shaft (1).
7. Remove the spring (7) and separate the hydraulic control valve assembly (12) and PTO safety switch stay (9).
8. Loosen the hose clamp (10) and disconnect the suction hose (11).
9. Remove the hydraulic pump (8).

**(When reassembling)**

- Be sure to install the O-ring and take care not to damage the O-ring.

Tightening torque	Control valve and PTO safety switch stay mounting screw	17.8 to 20.6 N-m 1.8 to 2.1 kgf-m 13.0 to 15.2 ft-lbs
	Delivery pipe	28.4 to 30.0 N-m 2.9 to 3.1 kgf-m 20.9 to 22.1 ft-lbs
	Power steering delivery hose	28.4 to 30.0 N-m 2.9 to 3.1 kgf-m 20.9 to 22.1 ft-lbs

- |                                   |                             |
|-----------------------------------|-----------------------------|
| (1) Hydraulic Control Lever Shaft | (7) Spring                  |
| (2) Clevis Pin                    | (8) Hydraulic Pump          |
| (3) PTO Clutch Lever Rod          | (9) PTO Safety Switch Stay  |
| (4) Delivery Pipe                 | (10) Hose Clamp             |
| (5) Power Steering Delivery Hose  | (11) Suction Hose           |
| (6) PTO Select Lever              | (12) Control Valve Assembly |

W1013072

**Hydraulic Cylinder**

1. Remove the hydraulic cylinder mounting screws and dismount the hydraulic cylinder (1).

**(When reassembling)**

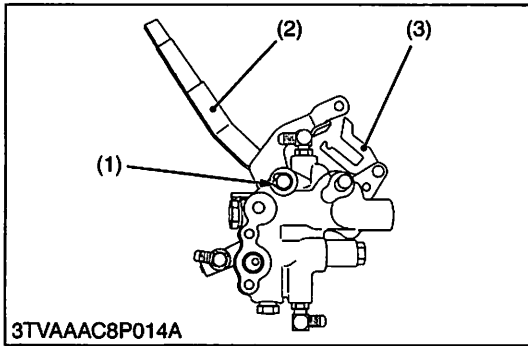
- Take care not to damage the O-ring for hydraulic pump.
- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of transmission case to hydraulic cylinder.

Tightening torque	Mower lift arm mounting screw	77.5 to 90.2 N-m 7.9 to 9.2 kgf-m 57.1 to 66.5 ft-lbs
	Hydraulic cylinder mounting screw	39.2 to 44.1 N-m 4.0 to 4.5 kgf-m 28.9 to 32.5 ft-lbs

- (1) Hydraulic Cylinder

W1013457

**(B) Disassembling Control Valve Assembly**



**PTO Clutch Lever and PTO Clutch Cam**

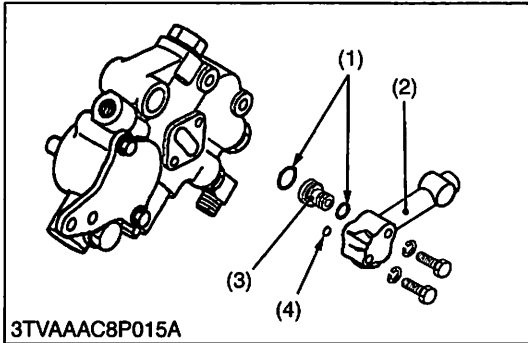
1. Remove the external snap ring (1) and remove the PTO clutch lever (2).
2. Remove the PTO clutch cam (3).

**(When reassembling)**

- Apply grease to the PTO clutch cam.

- |                        |                    |
|------------------------|--------------------|
| (1) External Snap Ring | (3) PTO Clutch Cam |
| (2) PTO Clutch Lever   |                    |

W1013717



**Hydraulic Block Type Outlet**

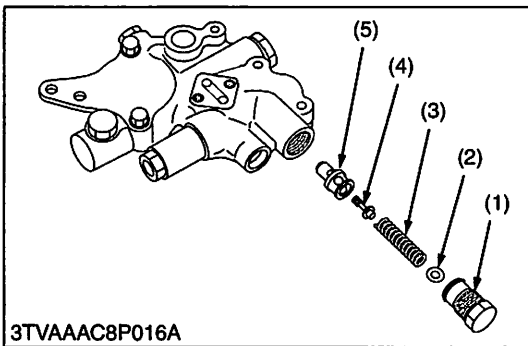
1. Remove the hydraulic block type outlet (2).

**(When reassembling)**

- Be sure to install the O-rings and take care not to damage the O-rings.

- |                                 |            |
|---------------------------------|------------|
| (1) O-ring                      | (3) Collar |
| (2) Hydraulic Block Type Outlet | (4) O-ring |

W1037100



**Relief Valve**

1. Remove the plug (1), and draw out the shim (2), spring (3), poppet (4) and the valve seat (5).

**(When reassembling)**

- Take care not to damage the O-ring.

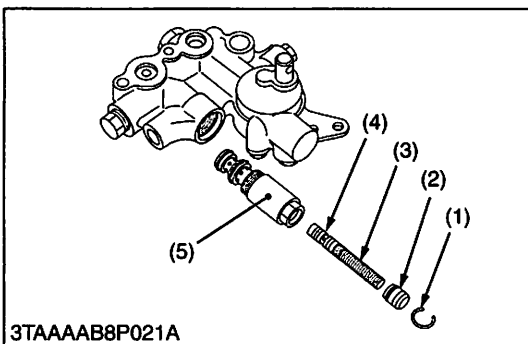
Tightening torque	Relief valve plug	39.2 to 58.8 N·m 4.0 to 6.0 kgf·m 28.9 to 43.4 ft·lbs
-------------------	-------------------	---

**■ IMPORTANT**

- After disassembling and assembling the relief valve, be sure to adjust the relief valve setting pressure. (See page 5-S7.)

- |            |                |
|------------|----------------|
| (1) Plug   | (4) Poppet     |
| (2) Shim   | (5) Valve Seat |
| (3) Spring |                |

W1013981



**Flow Priority Valve**

1. Remove the flow priority valve assembly.
2. Remove the stopper ring (1) while pressing the plug (2).
3. Remove the spool (4) with spring (3).

**(When reassembling)**

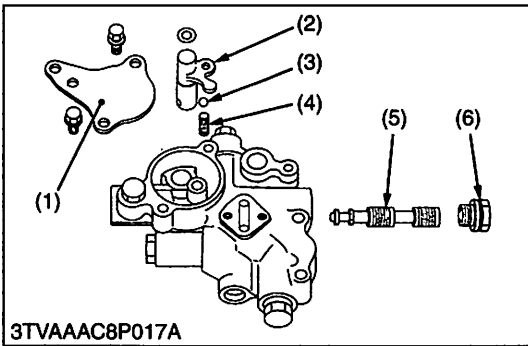
- Take care not to damage the O-rings.

Tightening torque	Flow priority valve	39.2 to 58.8 N·m 4.0 to 6.0 kgf·m 28.9 to 43.4 ft·lbs
-------------------	---------------------	---

- |                  |           |
|------------------|-----------|
| (1) Stopper Ring | (4) Spool |
| (2) Plug         | (5) Body  |
| (3) Spring       |           |

W1014148





3TVAAAC8P017A

**Control Valve Spool and Control Arm**

1. Remove the valve cover (1).
2. Remove the control arm (2), ball (3) and spring (4).
3. Remove the control valve plug (6) and draw out the spool (5).

**(When reassembling)**

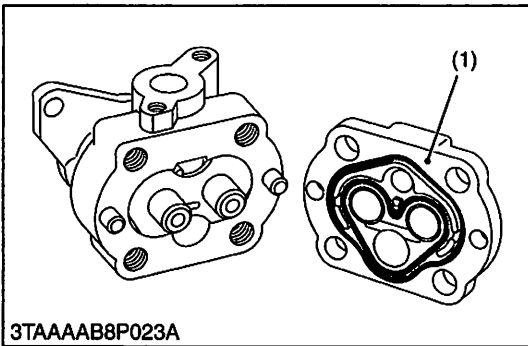
- Take care not to damage the O-rings.

Tightening torque	Control valve plug (6)	39.2 to 58.8 N·m 4.0 to 6.0 kgf·m 28.9 to 43.4 ft-lbs
-------------------	------------------------	---

- |                 |                        |
|-----------------|------------------------|
| (1) Valve Cover | (4) Spring             |
| (2) Control Arm | (5) Spool              |
| (3) Ball        | (6) Control Valve Plug |

W1014310

**(C) Disassembling Hydraulic Pump**



3TAAAB8P023A

**Pump Cover**

1. Secure the hydraulic pump with a vise, and remove the pump cover (1).

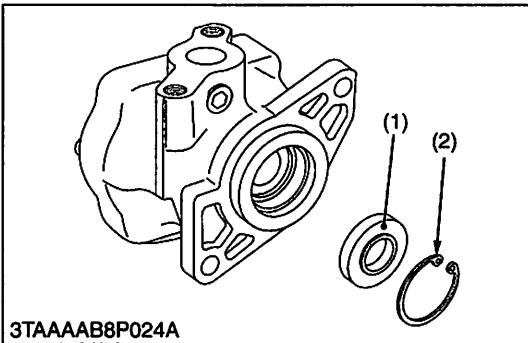
**(When reassembling)**

- Take care not to damage the O-ring.
- Align the holes of the cover and casing.

Tightening torque	Pump cover mounting screw	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
-------------------	---------------------------	---

- (1) Pump Cover

W1014503



3TAAAB8P024A

**Oil Seal**

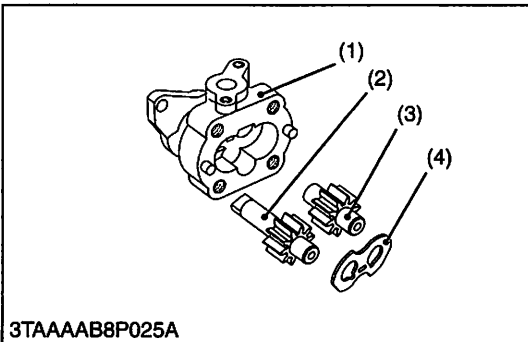
1. Remove the internal snap ring (2), and remove the oil seal (1).

**(When reassembling)**

- If the oil seal is defective, worn or scratched, replace it.

- |              |                        |
|--------------|------------------------|
| (1) Oil Seal | (2) Internal Snap Ring |
|--------------|------------------------|

W1014788



3TAAAB8P025A

**Side Plate and Gear**

1. Remove the side plate (4).
2. Remove the drive gear (2) and driven gear (3) from the casing (1).

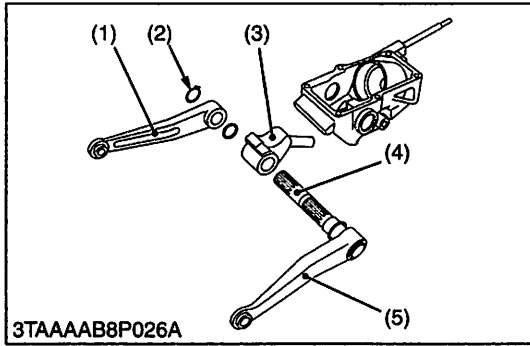
**(When reassembling)**

- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

- |                |                 |
|----------------|-----------------|
| (1) Casing     | (3) Driven Gear |
| (2) Drive Gear | (4) Side Plate  |

W1014898

**(D) Disassembling Hydraulic Cylinder**



**Lift Arm, Hydraulic Arm Shaft and Hydraulic Arm**

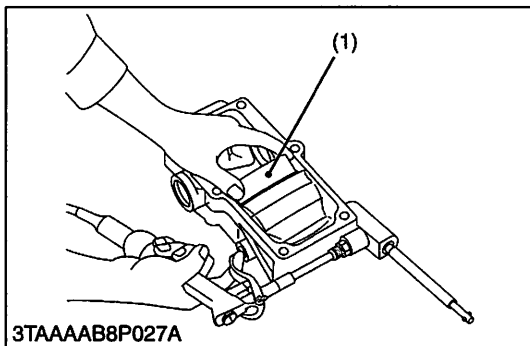
1. Remove the external snap ring (2), and remove the lift arm RH (1).
2. Draw out the hydraulic arm shaft (4) and lift arm LH (5) as a unit.

**(When reassembling)**

- Align the alignment marks of the hydraulic arm (3) and hydraulic arm shaft (4).
- Align the alignment marks of the lift arm RH (1) and hydraulic arm shaft (4).
- Apply grease to the right and left bushings and O-rings.
- Take care not to damage the O-ring.

- |                        |                         |
|------------------------|-------------------------|
| (1) Lift Arm RH        | (4) Hydraulic Arm Shaft |
| (2) External Snap Ring | (5) Lift Arm LH         |
| (3) Hydraulic Arm      |                         |

W1015040



**Hydraulic Piston**

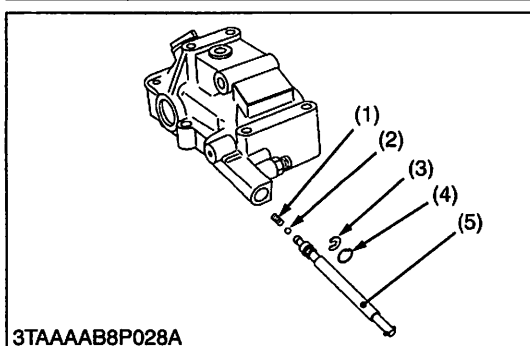
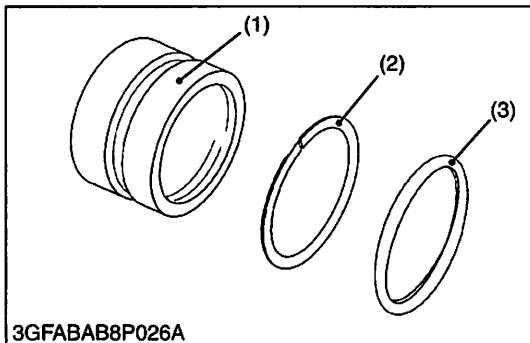
1. Inject the compressed air into the hydraulic cylinder, and take out the hydraulic piston (1).

**(When reassembling)**

- Take care not to damage the O-ring (3) and backup ring (2).
- Apply transmission fluid to the O-ring.
- Replace the O-ring if it is defective, worn or scratched, which may cause oil leakage.

- |                      |            |
|----------------------|------------|
| (1) Hydraulic Piston | (3) O-ring |
| (2) Backup Ring      |            |

W1015387



**Lowering Speed Adjusting Valve**

1. Remove the internal snap ring (4) and the remove the lowering speed adjusting shaft (5).
2. Remove the ball (2) and spring (1).

**(When reassembling)**

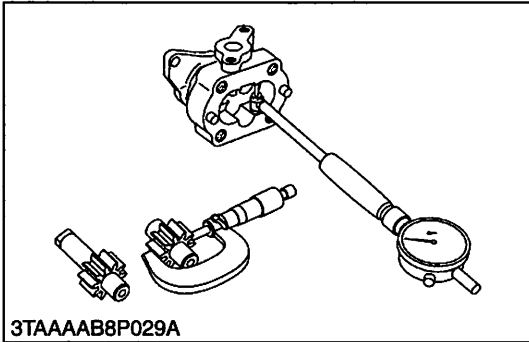
- Take care not to damage the O-rings.

- |             |                                    |
|-------------|------------------------------------|
| (1) Spring  | (4) Internal Snap Ring             |
| (2) Ball    | (5) Lowering Speed Adjusting Shaft |
| (3) Stopper |                                    |

W1015612

**(3) Servicing**

**(A) Hydraulic Pump**

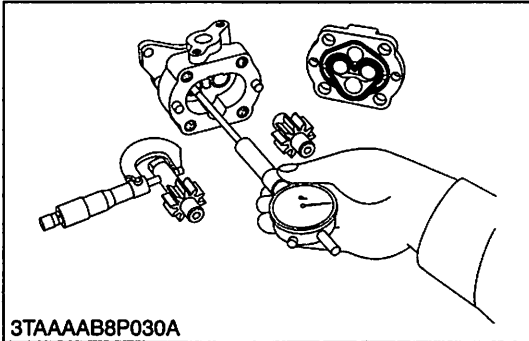


**Clearance between Tip of Gear Tooth and Casing**

1. Measure the gear O.D. with an outside micrometer.
2. Measure the casing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace the assembly.

Clearance between tip of gear tooth and casing	Allowable limit	0.15 mm 0.0059 in.
--	-----------------	-----------------------

W1015764



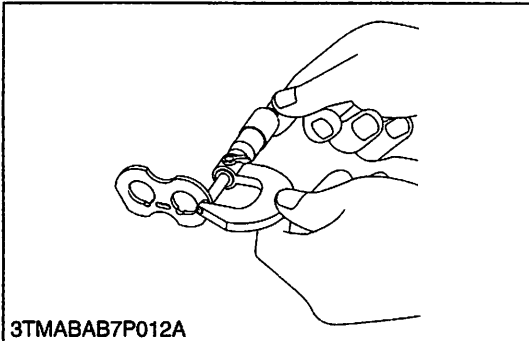
**Clearance between Bushing and Gear Shaft**

1. Measure the gear shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between bushing and gear shaft	Factory spec.	0.020 to 0.091 mm 0.0008 to 0.0036 in.
	Allowable limit	0.12 mm 0.0047 in.

Gear shaft O.D.	Factory spec.	14.970 to 14.980 mm 0.5894 to 0.5898 in.
Bushing I.D.	Factory spec.	15.000 to 15.061 mm 0.5906 to 0.5930 in.

W1015972



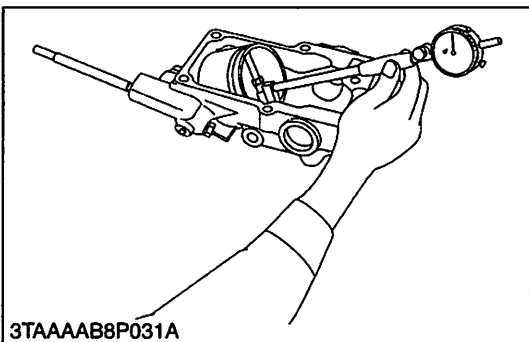
**Side Plate Thickness**

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.

W1016194

**(B) Hydraulic Cylinder**

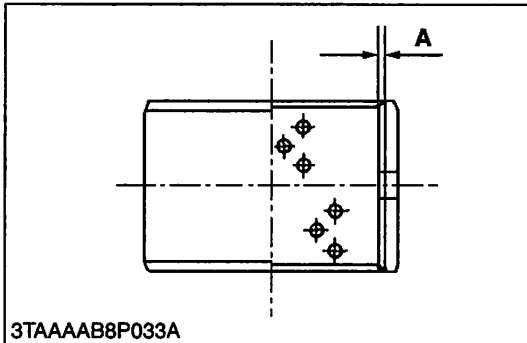
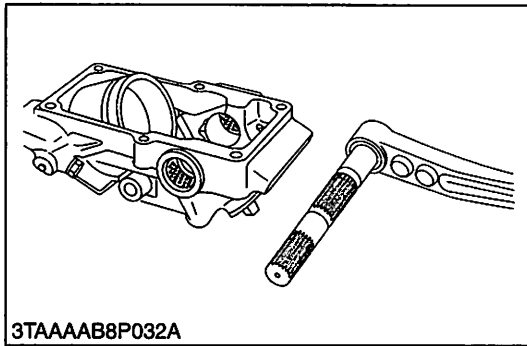


**Hydraulic Cylinder Bore**

1. Check the cylinder internal surface for scoring or damage.
2. Measure the cylinder I.D. with a cylinder gauge.
3. If the measurement exceeds the allowable limit, replace the hydraulic cylinder block.

Hydraulic cylinder I.D.	Factory spec.	80.05 to 80.10 mm 3.1516 to 3.1555 in.
	Allowable limit	80.2 mm 3.1575 in.

W10171300



**Hydraulic Arm Shaft Bushing**

1. Visually inspect the DX bushings for signs of wear or damage. (The DX bushing tends show concentrated wear.)
2. If the DX bushing is worn beyond the alloy thickness (**A**), replace it.

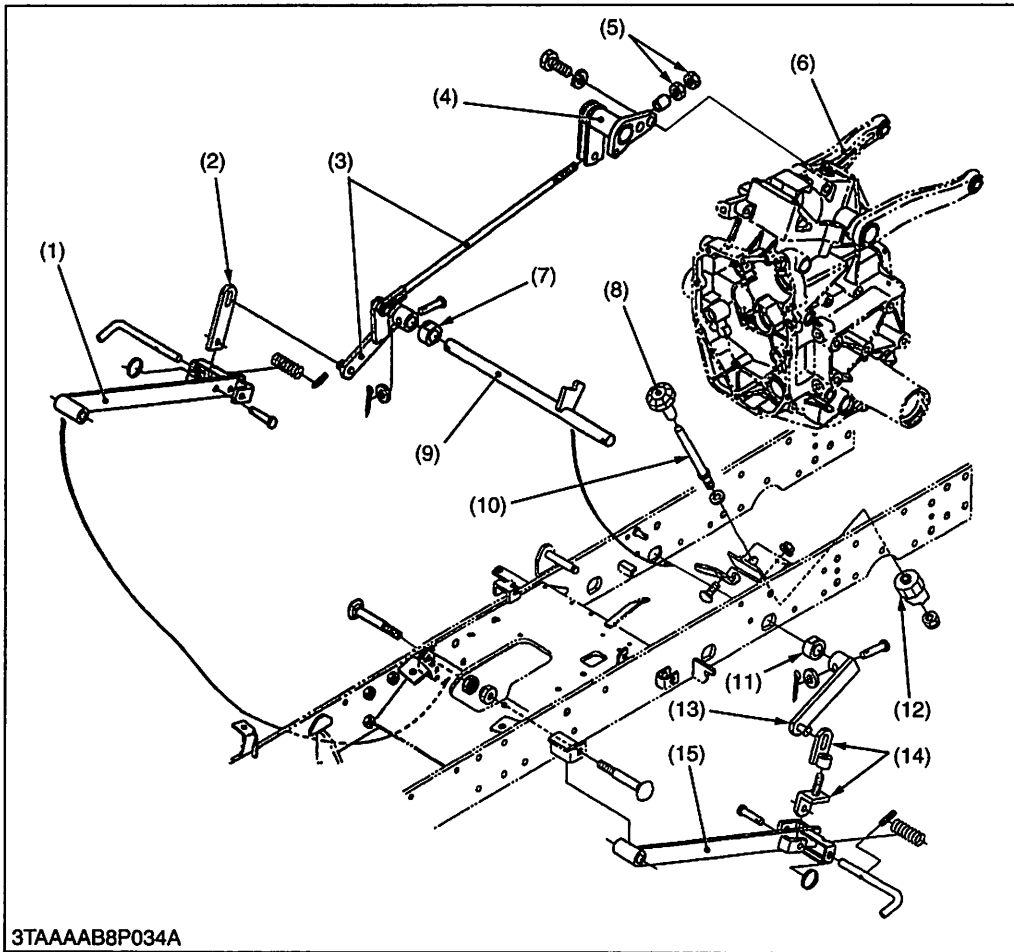
**(Reference)**

Hydraulic arm shaft bushing	Alloy thickness (A)	0.57 mm 0.0224 in.
Hydraulic arm shaft	LH	O.D. 31.925 to 31.950 mm 1.2569 to 1.2579 in.
	RH	O.D. 29.925 to 29.950 mm 1.1781 to 1.1791 in.

W1016329

### [3] MOWER LIFT LINKAGE

#### Disassembling Mower Linkage



- (1) Mower Rear Link RH
- (2) Lift Link RH
- (3) Lift Link Rear RH
- (4) Mower Lift Arm
- (5) Link Adjusting Nut
- (6) Lift Arm RH
- (7) Bush
- (8) Cutting Height Adjusting Dial Knob
- (9) Rear Lift Link Shaft
- (10) Cutting Height Adjusting Rod
- (11) Bush
- (12) Adjusting Cam
- (13) Lift Link Rear LH
- (14) Lift Link LH
- (15) Mower Rear Link LH

W1016616

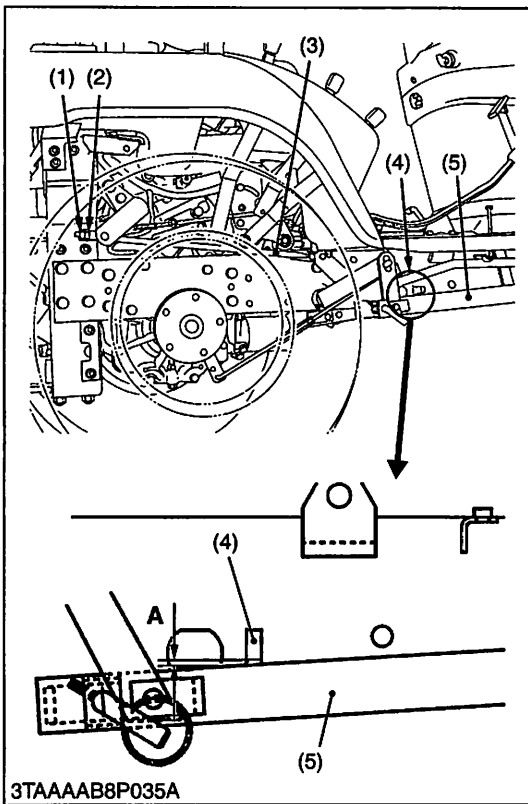
3TAAAAB8P034A

1. Remove the clevis pin and remove the mower rear link (1), (15) and lift link (2), (14).
2. Remove the clevis pin and remove the lift link rear LH (13).
3. Remove the clevis pin and mower lift arm mounting screws, and remove the lift link rear RH (3) with mower lift arm (4) as a unit.
4. Remove the both side of bushes (7), (11) and remove the rear lift link shaft (9).
5. Remove the cutting height adjusting dial knob (8).
6. Remove the nut and remove the adjusting cam (12) and cutting height adjusting rod (10).

**(When reassembling)**

Tightening torque	Mower lift arm mounting screw	77.5 to 90.2 N-m 7.9 to 9.2 kgf-m 57.1 to 66.5 ft-lbs
	Mower rear link mounting bolt and nut	124 to 147 N-m 12.6 to 15.0 kgf-m 91.2 to 108 ft-lbs

W1016794



**Adjusting Mower Lift Linkage**

After reassembling, be sure to adjust the mower lift linkages as follows.

1. Adjust the lift arm free play. (See page 5-S7.)
2. Loosen the adjusting nut (1), (2) and start the engine.
3. Move the hydraulic control lever to **Lift** position until the relief valve operating (**Uppermost** position).
4. Tighten the adjusting nut (2) until the clearance between stopper (4) and mower rear link RH (5) gets 0 to 1.0 mm (0 to 0.04 in.).
5. Secure the lock nut (1).

- (1) Lock Nut
- (2) Adjusting Nut
- (3) Adjusting Rod (Lift Link Rear RH)
- (4) Stopper
- (5) Mower Rear Link RH

**A : Clearance between stopper and mower rear link LH**

W1016972

# 6 ELECTRICAL SYSTEM

6

# MECHANISM

## CONTENTS

1. WIRING DIAGRAM .....	6-M1
2. STARTING SYSTEM .....	6-M4
[1] SAFETY SWITCH.....	6-M4
3. LIGHTING SYSTEM .....	6-M5
[1] HEAD LIGHT.....	6-M5
[2] TURN SIGNAL LIGHT .....	6-M5
[3] HAZARD LIGHT.....	6-M6
[4] EASY CHECKER.....	6-M6



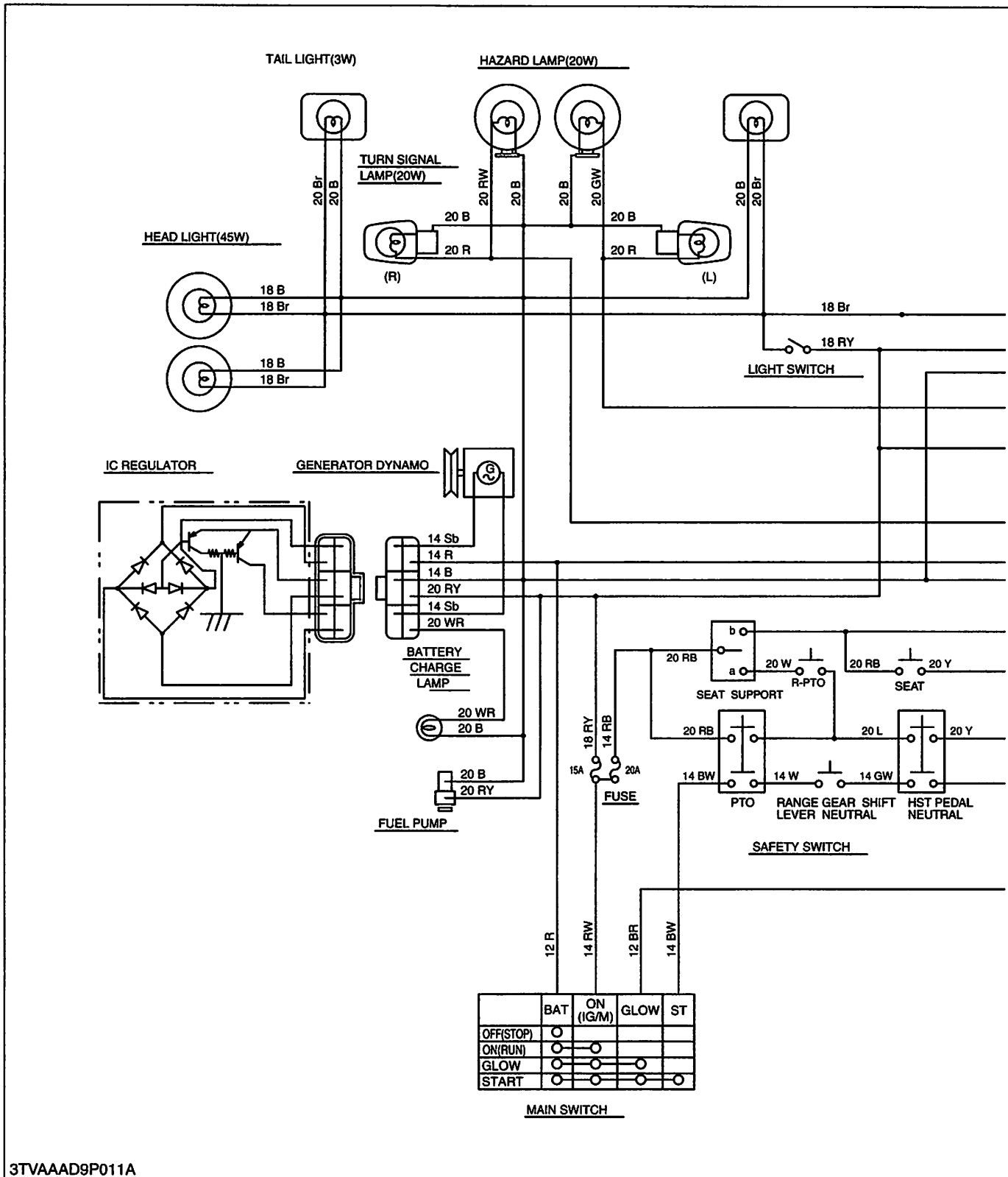
# 1. WIRING DIAGRAM

## Color of Wiring

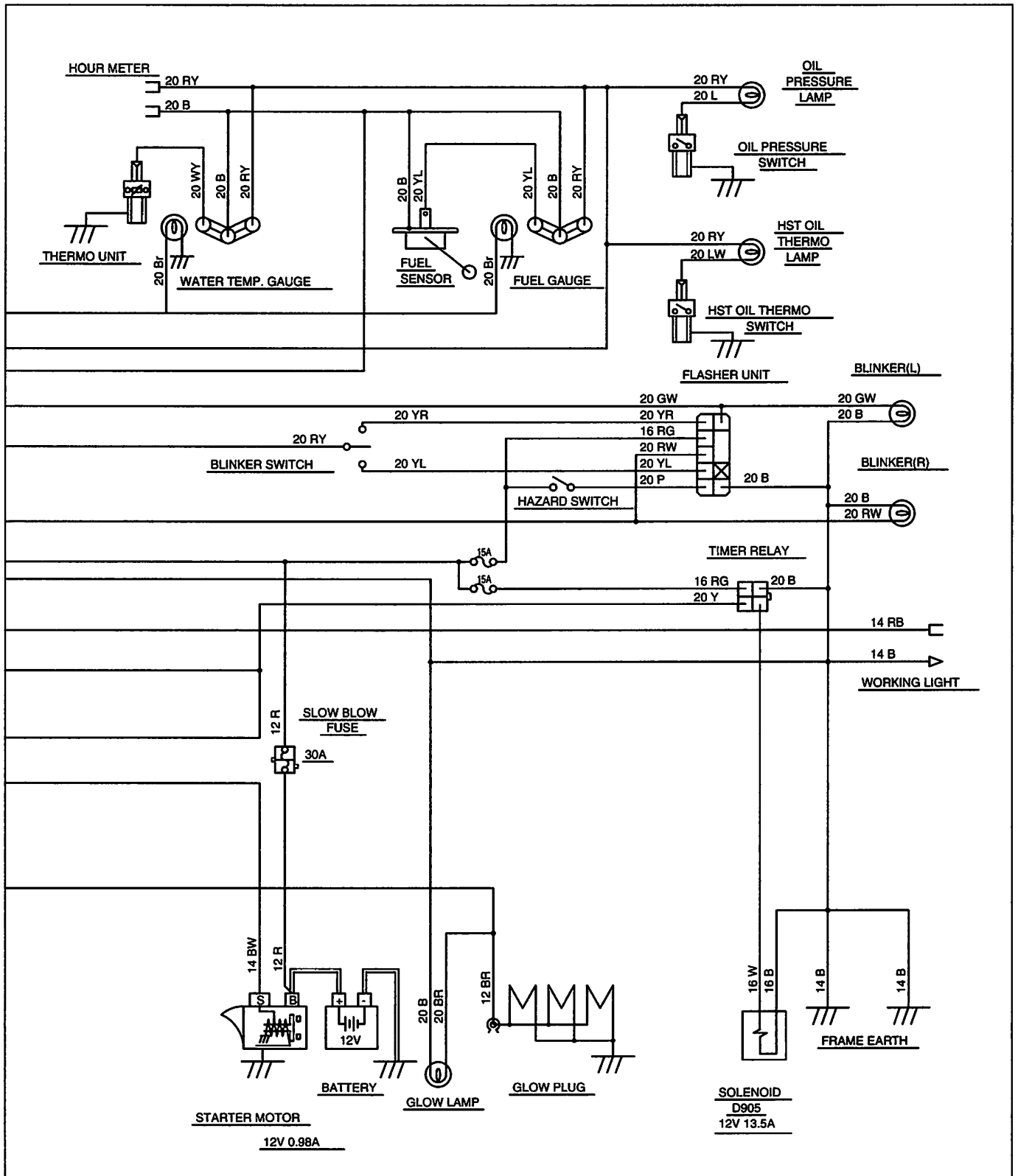
W ..... White	WR ..... White / Red	BW ..... Black / White
R ..... Red	WY ..... White / Yellow	BR ..... Black / Red
L ..... Blue	RB ..... Red / Black	GW ..... Green / White
P ..... Pink	RW ..... Red / White	YR ..... Yellow / Red
B ..... Black	RG ..... Red / Green	YL ..... Yellow / Blue
Br ..... Brown	RY ..... Red / Yellow	LW ..... Blue / White
Sb ..... Sky Blue		

W1019456



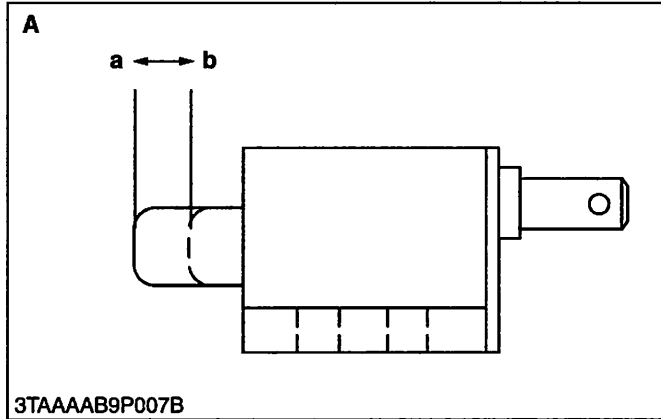


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## 2. STARTING SYSTEM

### [1] SAFETY SWITCH



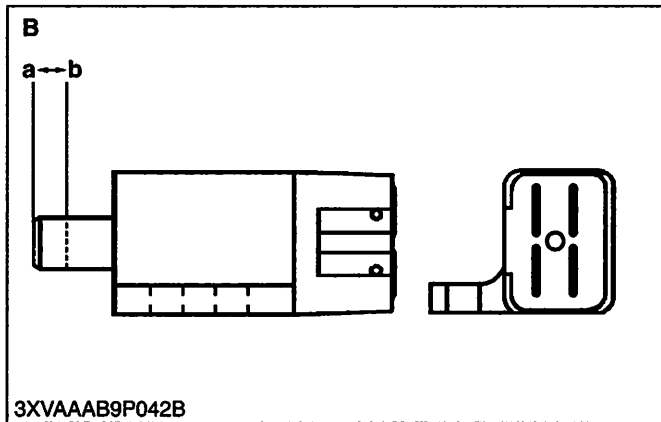
The safety switch prevents current from flowing to the starter when the safety switches are not depressed. This is to ensure safe starting.

The safety switches of single pole (**A**) are located two (range gear shift lever and PTO select lever) different position.

The safety switches of double pole (**B**) are located two (HST trunnion and PTO clutch lever) different position.

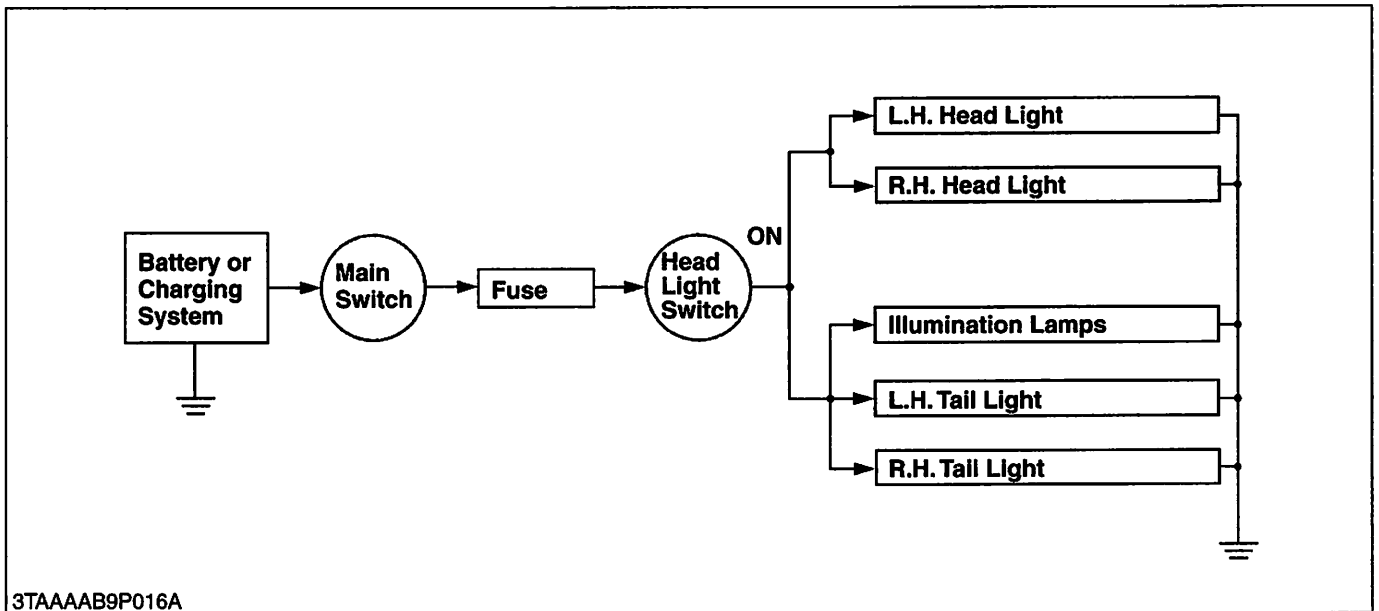
- |   |                |
|---|----------------|
| <b>A : Safety Switch of Single Pole</b> | <b>a : OFF</b> |
|   | <b>b : ON</b>  |
| <b>B : Safety Switch of Double Pole</b> |                |
|   |                |

W1013107



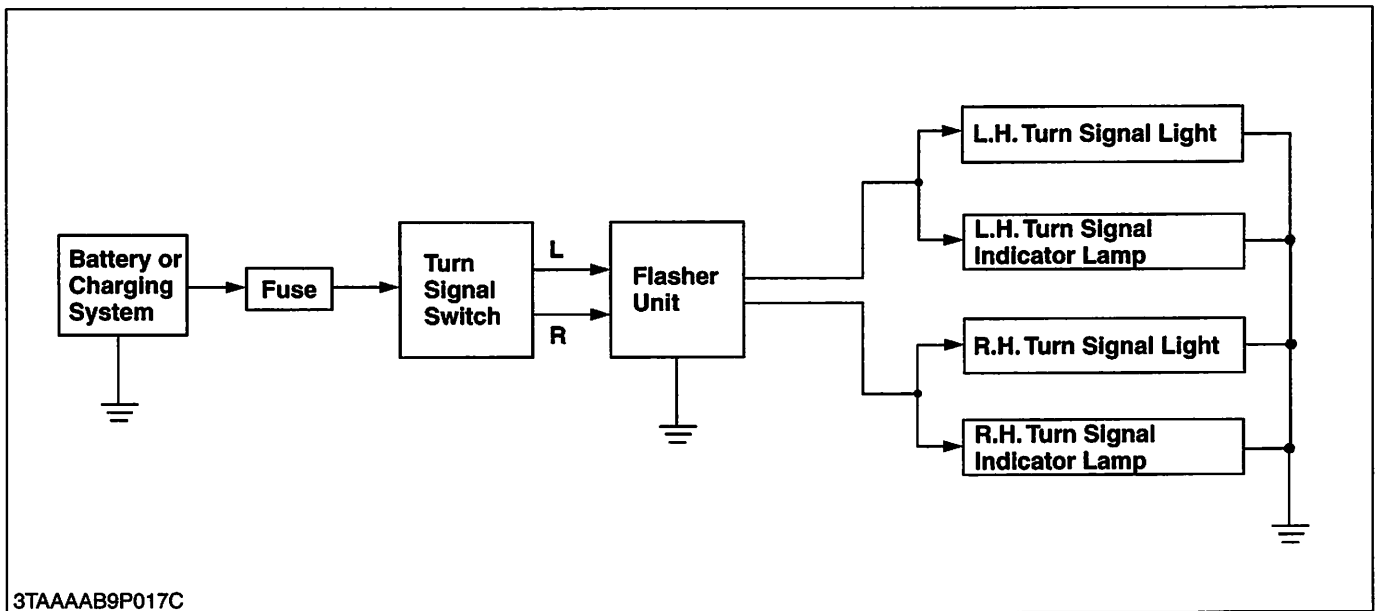
### 3. LIGHTING SYSTEM

#### [1] HEAD LIGHT



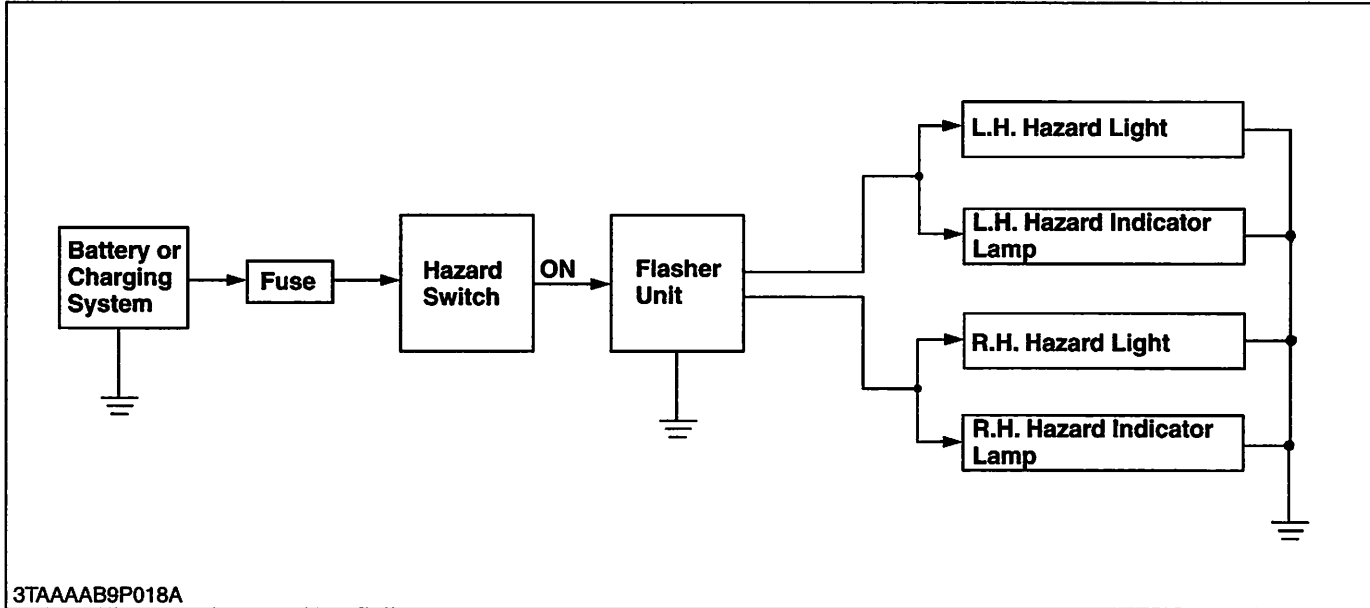
The head light switch has two positions; **OFF** and **ON**.  
 Current passes through the light circuit as shown in the figure above.

#### [2] TURN SIGNAL LIGHT



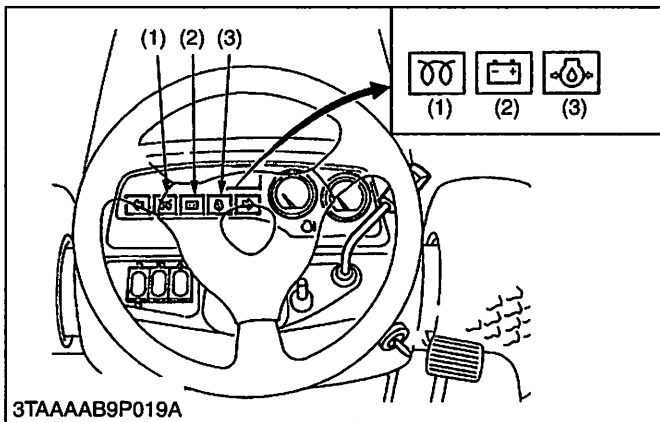
The turn signal switch has three positions; **OFF**, **L** and **R**. When using turn signal switch, turn signal only one side light and other one stays on.

### [3] HAZARD LIGHT



Hazard switch has two positions; **ON** and **OFF**. Blinking the hazard lights and indicator lamps as shown in the figure above.

### [4] EASY CHECKER



#### ■ Indication Items

##### (1) Pre-heat Indicator Lamp

When the key switch is in the "Pre-heat" position, the pre-heat indicator lamp illuminates.

##### (2) Charge Lamp

When the charging system is not functioning properly, this lamp illuminates.

##### (3) Oil Pressure Lamp

When the engine oil pressure is low, this lamp illuminates.

W1013386

# SERVICING

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1. TROUBLESHOOTING .....	6-S1
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3. TIGHTENING TORQUES .....	6-S5
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[1] BATTERY.....	6-S6
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(1) Checking.....	6-S22

# 1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>All Electrical Equipment Do Not Operate</b>	• Battery discharged or defective	Recharge or Replace	G-17, 1-S11
	• Battery positive cable disconnected or improperly connected	Repair or Replace	–
	• Battery negative cable disconnected or improperly connected	Repair or Replace	–
	• Slow blow fuse blown	Replace	–
<b>Fuse Blown Frequently</b>	• Short-circuited	Repair or Replace	–

W10143220

## BATTERY

<b>Battery Discharges Too Quickly</b>	• Battery defective	Replace	1-S11
	• Dynamo defective	Repair or Replace	6-S18, S19
	• IC Regulator defective	Replace	–
	• Wiring harness disconnected or improperly connected (between battery positive terminal and regulator <b>B</b> terminal)	Repair or Replace	–
	• Cooling fan belt slipping	Adjust tension	G-19

W10137180

## STARTING SYSTEM

<b>Starter Motor Does Not Operate</b>	• Battery discharged or defective	Recharge or Replace	G-17, 1-S11
	• Slow blow fuse blown	Replace	–
	• Safety switch improperly adjusted or defective	Repair or Replace	6-S10
	• Wiring harness disconnected or improperly connected (between main switch <b>50</b> terminal and safety switches, between safety switches and starter motor, between battery positive terminal and starter motor)	Repair or Replace	–
	• Starter motor defective • Main switch defective	Repair or Replace Replace	6-S15 6-S8
<b>Engine Does Not Stop When Main Switch is Turned OFF</b>	• Fuse blown (20 A)	Replace	G-27
	• Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and engine stop solenoid)	Repair or Replace	–
	• Engine stop solenoid defective	Replace	6-S14
<b>Engine Does Not Start</b>	• Engine stop solenoid defective	Replace	6-S14

W10137180



**CHARGING SYSTEM**

Symptom	Probable Cause	Solution	Reference Page
<b>Charge Lamp Does Not Light when Main Switch is Turned ON</b>	<ul style="list-style-type: none"> <li>Fuse blown (15 A)</li> <li>Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and panel board, between panel board and dynamo)</li> </ul>	Replace Repair or Replace	G-27 -
	<ul style="list-style-type: none"> <li>Dynamo defective</li> <li>Regulator defective</li> </ul>	Repair or Replace Replace	6-S18, S19 -
<b>Charge Lamp Does Not Go Off When Engine is Running</b>	<ul style="list-style-type: none"> <li>Wiring harness disconnected or improperly connected (between main switch <b>30</b> terminal and dynamo, between panel board and dynamo)</li> </ul>	Repair or Replace	-
	<ul style="list-style-type: none"> <li>Dynamo defective</li> <li>Regulator defective</li> </ul>	Repair or Replace Replace	6-S15 -

W10135800

**LIGHTING SYSTEM**

<b>Head Light Does Not Light</b>	<ul style="list-style-type: none"> <li>Fuse blown (15 A)</li> <li>Bulb blown</li> <li>Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and head light switch, between head light switch and head light)</li> </ul>	Replace Replace Repair or Replace	G-27 G-27 -
<b>Tail Light Does Not Light</b>	<ul style="list-style-type: none"> <li>Fuse blown (15 A)</li> <li>Bulb blown</li> <li>Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and head light switch, between head light switch and tail light)</li> </ul>	Replace Replace Repair or Replace	G-27 G-27 -
<b>Illumination Light Does Not Light</b>	<ul style="list-style-type: none"> <li>Fuse blown (15 A)</li> <li>Bulb blown</li> <li>Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and head light switch, between head light switch and illumination light)</li> </ul>	Replace Replace Repair or Replace	G-27 G-27 -
<b>Hazard Light Does Not Light</b>	<ul style="list-style-type: none"> <li>Fuse blown (15 A)</li> <li>Bulb blown</li> <li>Wiring harness disconnected or improperly connected</li> </ul>	Replace Replace Repair or Replace	G-27 G-27 -
	<ul style="list-style-type: none"> <li>Flasher unit defective</li> <li>Hazard switch defective</li> </ul>	Replace Replace	6-S20 6-S20
<b>Hazard Indicator Lamp Does Not Light</b>	<ul style="list-style-type: none"> <li>Bulb blown</li> <li>Wiring harness disconnected or improperly connected</li> </ul>	Replace Repair or Replace	- -
<b>Hazard Light Does Not Flicker</b>	<ul style="list-style-type: none"> <li>Flasher unit defective</li> </ul>	Replace	6-S20

W10137180

**LIGHTING SYSTEM (Continued)**

Symptom	Probable Cause	Solution	Reference Page
<b>Turn Signal Light Does Not Light</b>	<ul style="list-style-type: none"> <li>• Fuse blown (15 A)</li> <li>• Bulb blown</li> <li>• Wiring harness disconnected or improperly connected</li> <li>• Flasher unit defective</li> <li>• Turn signal switch defective</li> </ul>	Replace Replace Repair or Replace  Replace Replace	G-27 G-27 –  6-S20 6-S20
<b>Turn Signal Light Indicator Lamp Does Not Light</b>	<ul style="list-style-type: none"> <li>• Bulb blown</li> <li>• Wiring harness disconnected or improperly connected (turn signal switch and indicator lamp)</li> </ul>	Replace Repair or Replace	– –
<b>Turn Signal Light Does Not Flicker</b>	<ul style="list-style-type: none"> <li>• Flasher unit defective</li> <li>• Turn signal switch defective</li> </ul>	Replace Replace	6-S20 6-S19
<b>Pre-heat Indicator Lamp Does Not Light When Main Switch Is in Pre-heat Position</b>	<ul style="list-style-type: none"> <li>• Battery discharged or defective</li> <li>• Slow blow fuse blown</li> <li>• Wiring harness disconnected or improperly connected (between main switch 19 terminal and pre-heat indicator, between pre-heat indicator and glow plugs)</li> <li>• Main switch defective</li> <li>• Pre-heat indicator defective</li> </ul>	Recharge or Replace  Replace Repair or Replace  Replace Replace	G-17, 1-S11 – –  – –
<b>Oil Pressure Lamp Lights Up When Engine Is Running</b>	<ul style="list-style-type: none"> <li>• Engine oil pressure too low</li> <li>• Engine oil insufficient</li> <li>• Engine oil pressure switch defective</li> <li>• Short circuit between engine oil pressure switch lead and chassis</li> </ul>	Repair engine Replenish Replace Repair	– G-12 6-S21 –
<b>Oil Pressure Lamp Does Not Light When Main Switch Is Turned ON and Engine Is Not Running</b>	<ul style="list-style-type: none"> <li>• Bulb blown</li> <li>• Engine oil pressure switch defective</li> <li>• Wiring harness disconnected or improperly connected (between panel board and engine oil pressure switch)</li> </ul>	Replace Replace Repair or Replace	– 6-S21 –

W10135800

**GAUGES**

<b>Fuel Gauge Does Not Function</b>	<ul style="list-style-type: none"> <li>• Fuel gauge defective</li> <li>• Fuel level sensor defective</li> <li>• Wiring harness disconnected or improperly connected (between fuel gauge and fuel level sensor)</li> </ul>	Replace Replace Repair or Replace	6-S22 6-S22 –
<b>Coolant Temperature Gauge Does Not Function</b>	<ul style="list-style-type: none"> <li>• Coolant temperature gauge defective</li> <li>• Coolant temperature sensor defective</li> <li>• Wiring harness disconnected or improperly connected (between coolant temperature gauge and coolant temperature sensor)</li> </ul>	Replace Replace Repair or Replace	6-S22 6-S22 –

W10137180

## 2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Battery	Voltage	More than 12 V	—
	Potential Difference	Less than 0.1 V	—
Safety Switch	Distance	7.0 mm 0.276 in.	—
OPC Switch	Distance	12 mm 0.472 in.	—
Glow Plug	Resistance	Approx. 0.9 Ω	—
Starter	Commutator	O.D.	30.0 mm 1.181 in.
		Difference of O.D.'s	Less than 0.02 mm 0.0008 in.
	Mica	Under Cut	0.50 to 0.80 mm 0.0197 to 0.0315 in.
	Brush	Length	14.0 mm 0.551 in.
AC Dynamo	Charging Current / Dynamo Speed	14 to 15 A / 5200 min <sup>-1</sup> (rpm)	—
	Charging Voltage / Dynamo Speed	14 to 15 A / 5200 min <sup>-1</sup> (rpm)	—
Head Light Switch	Resistance <b>OFF</b>	Infinity	—
	<b>ON</b>	0 Ω	—
Turn Signal Switch	Resistance <b>OFF</b>	Infinity	—
	<b>R</b>	0 Ω	—
	<b>L</b>	0 Ω	—
Hazard Light Switch	Resistance <b>OFF</b>	Infinity	—
	<b>ON</b>	0 Ω	—

W10138740

### 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-8.)

Item	N·m	kgf·m	ft-lbs
Starter B terminal nut	5.9 to 11.8	0.6 to 1.2	4.3 to 8.7
AC Dynamo Stator nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5

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## 4. CHECKING, DISASSEMBLING AND SERVICING

### CAUTION

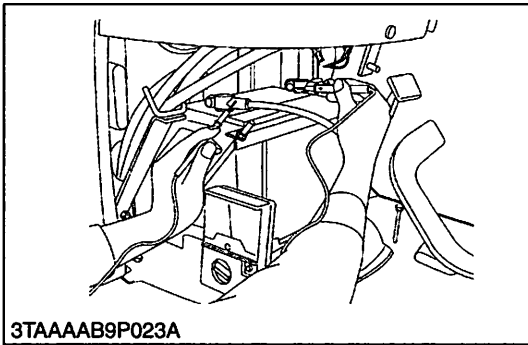
- To avoid accidental short circuit, be sure to attach the positive cable to the positive terminal before the negative cable is attached to the negative terminal.
- Never remove the battery cap while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are splattered with 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.

## [1] BATTERY

### (1) Checking

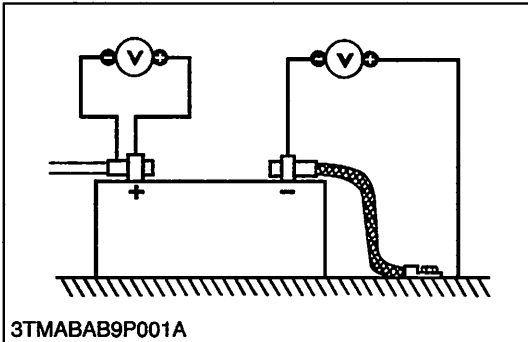


#### Battery Voltage

1. Stop the engine and turn the main switch off.
2. Connect the COM (-) lead of the voltmeter to the battery's negative terminal post and the (+) lead to the positive terminal post, and measure the battery voltage.
3. If the battery voltage is less than the factory specification, check the battery specific gravity and recharge the battery.

Battery voltage	Factory spec.	More than 12 V
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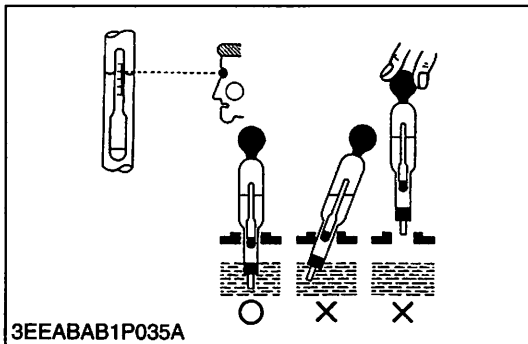
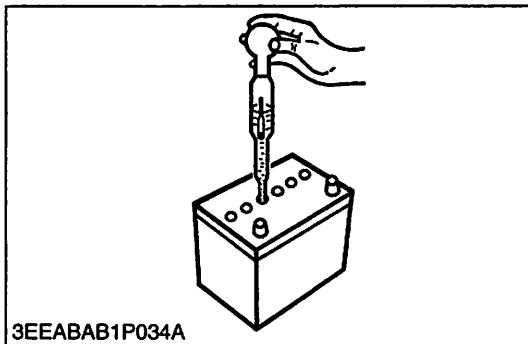


#### Battery Terminal Connection

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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**Battery Specific Gravity**

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

■ **NOTE**

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

**(Reference)**

- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1 °C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with a decreases of 1 °C (0.0004 with a decrease of 1 °F).

Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula :

- Specific gravity at 20 °C = Measured value + 0.0007 × (electrolyte temperature – 20 °C)
- Specific gravity at 68 °F = Measured value + 0.0004 × (electrolyte temperature – 68 °F)

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

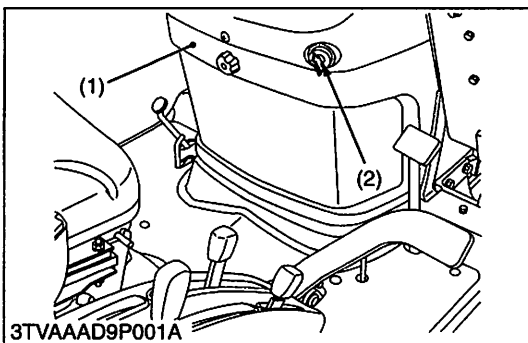
At an electrolyte temperature of 20 °C (68 °F)

W10127630

**[2] STARTING SYSTEM**

**(1) Checking**

**(A) Main Switch**



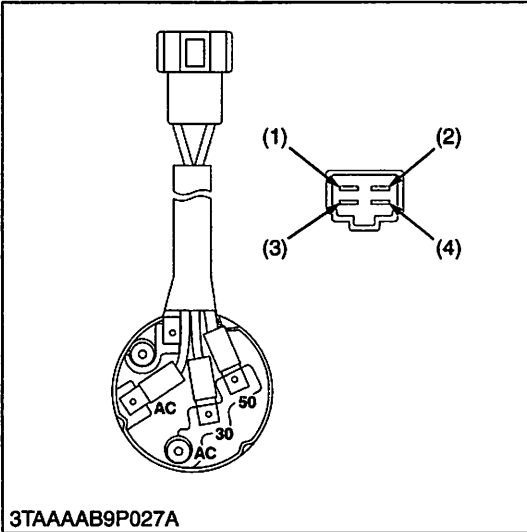
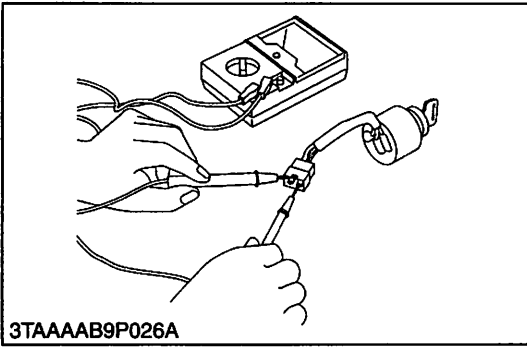
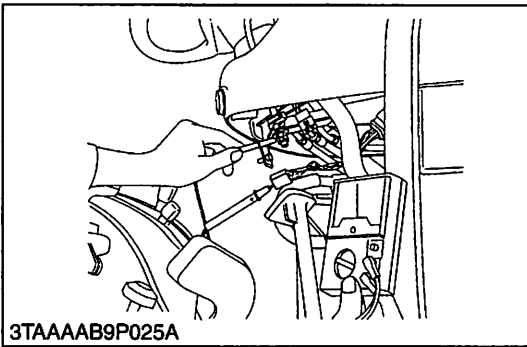
**Main Switch**

1. Remove the under panel (1).
2. Disconnect the 4P connector and remove the main switch (2).
3. Perform the following checks.

(1) Under Panel

(2) Main Switch

W10134520



**Connector Voltage**

1. Measure the voltage with a voltmeter across the connector **30** (red) terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), the wiring harness is faulty.

Voltage	Connector <b>30</b> terminal – chassis	Approx. battery voltage
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W10135530

**Main Switch Continuity**

**1) Main Switch Key at OFF Position**

1. Set the main switch **OFF** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **AC** terminal, **30** terminal and **50** terminal, **30** terminal and **19** terminal.
3. If infinity is not indicated, the contacts of the main switch are faulty.

Resistance	30 terminal – AC terminal	Infinity
	30 terminal – 50 terminal	
	30 terminal – 19 terminal	

**2) Main Switch Key at ON Position**

1. Set the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, the **30 – AC** contact of the main switch are faulty.

Resistance	30 terminal – AC terminal	0 Ω
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**3) Main Switch Key at PREHEAT Position**

1. Set and hold the main switch key at the **PREHEAT** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, and measure the resistance across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

Resistance	30 terminal – 19 terminal	0 Ω
	30 terminal – AC terminal	

**4) Main Switch Key at START Position**

1. Set and hold the main switch key at the **START** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, across the **30** terminal and the **50** terminal, and across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

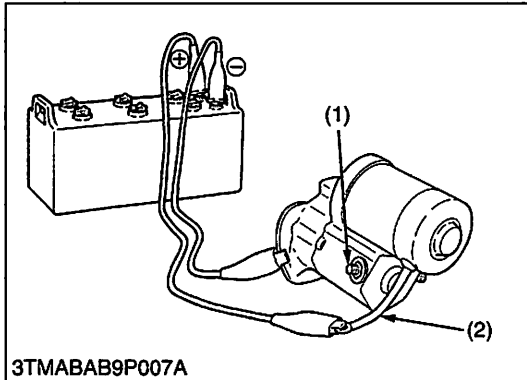
Resistance	30 terminal – 19 terminal	0 Ω
	30 terminal – 50 terminal	
	30 terminal – AC terminal	

(1) 19 Terminal (Black / Red)  
 (2) AC Terminal (Red / White)

(3) 50 Terminal (Black / White)  
 (4) 30 Terminal (Red)

W10136580

**(B) Starter**



**Motor Test**

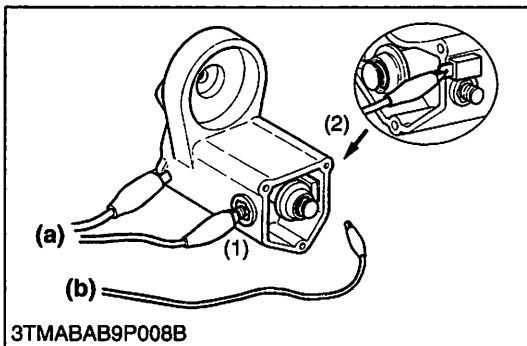
**⚠ CAUTION**

• **Secure the starter to prevent it from jumping up and down while testing the motor.**

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter.
3. Remove the starter from the engine.
4. Disconnect the connecting lead (2) from the starter C terminal (1).
5. Connect a jumper lead from the connecting lead (2) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter motor housing and the battery negative terminal post.
7. If the motor does not run, check the motor.

(1) C Terminal (2) Connecting Lead

W10142670



**Magnet Switch Test (Pull-in, Holding Coils)**

1. Remove the motor from the starter housing.
2. Prepare a 6 V battery for the test.
3. Connect jumper leads from the battery negative terminal to the housing and the starter C terminal (1).
4. The plunger should be attracted and the pinion gear should pop out when a jumper lead is connected from the battery positive terminal to the S terminal (2). It's a correct.
5. Disconnect the jumper lead to the starter C terminal (1). Then the pinion gear should remain popped out. It's a correct.

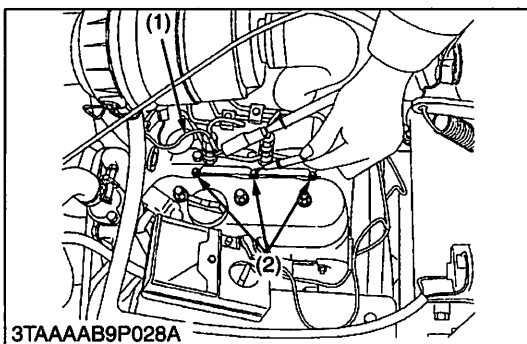
**■ IMPORTANT**

• **Testing time must be 3 to 5 sec..**

(1) C Terminal (a) To Negative Terminal  
 (2) S Terminal (b) To Positive Terminal

W1015210

**(C) Glow Plug**



**Lead Terminal Voltage**

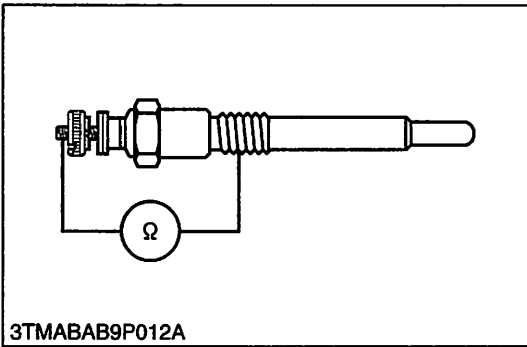
1. Disconnect the wiring lead (1) from the glow plug (2) after turning the main switch off.
2. Turn the main switch key to the "PREHEAT" position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the "START" position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage (Lead terminal – Chassis)	Main switch key at "PREHEAT"	Approx. battery voltage
	Main switch key at "START"	Approx. battery voltage

(1) Wiring Lead (Positive) (2) Glow Plug

W10149130





3TMABAB9P012A

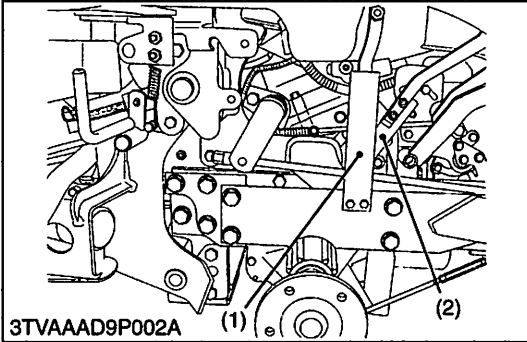
**Glow Plug Continuity**

1. Disconnect the lead from the glow plugs.
2. Measure the resistance with an ohmmeter between the glow plug terminal and the chassis.
3. If 0 ohm is indicated, the screw at the tip of the glow plug and the housing are short-circuited.
4. If the factory specification is not indicated, the glow plug is faulty.

Glow plug resistance	Factory spec.	Approx. 0.9 Ω
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W10151150

**(D) Safety Switch**

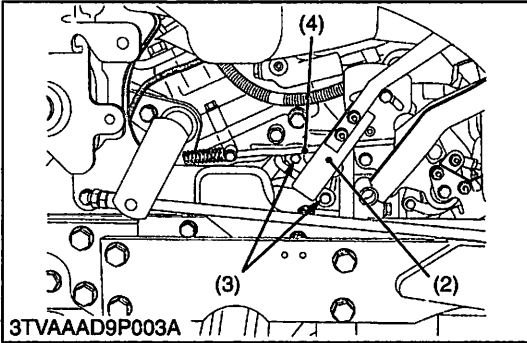


3TVAAAD9P002A

**Safety Switch Continuity**

**1) Range Gear Shift Lever Switch**

1. Remove the rear wheel RH.
2. Remove the seat belt stay RH (1).
3. Remove the range gear shift lever (2).
4. Disconnect the feed back rod (4) from the hydraulic control lever.
5. Remove the safety switch stay mounting bolts (3).
6. Remove the safety switch (6) while installed in the safety switch stay (7).
7. Measure the resistance with an ohmmeter across the safety switch terminals (5).
8. If the safety switch is defective, replace it.

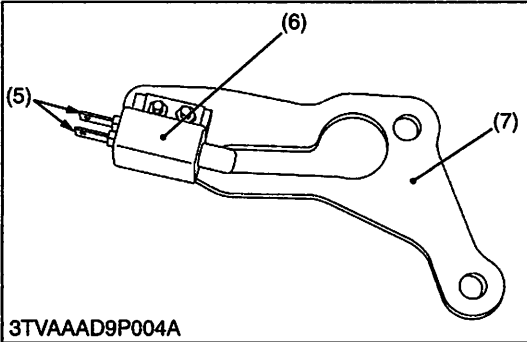


3TVAAAD9P003A

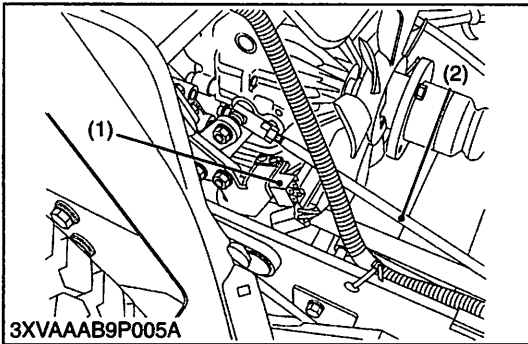
Resistance (Across switch terminal)	When switch push is pushed	0 Ω
	When switch push is released	Infinity

- |                                      |  |
|--------------------------------------|--|
| (1) Seat Belt Stay RH                | (5) Safety Switch Terminal                   |
| (2) Range Gear Shift Lever           | (6) Safety Switch for Range Gear Shift Lever |
| (3) Safety Switch Stay Mounting Bolt | (7) Safety Switch Stay                       |
| (4) Feed Back Rod                    |  |

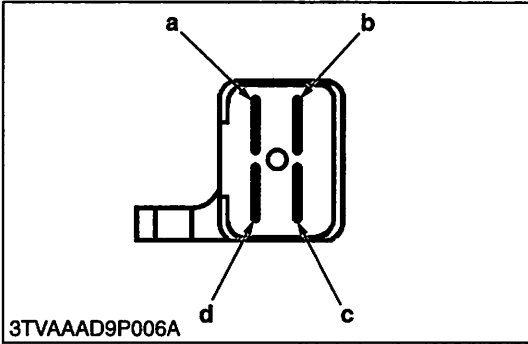
W10158610



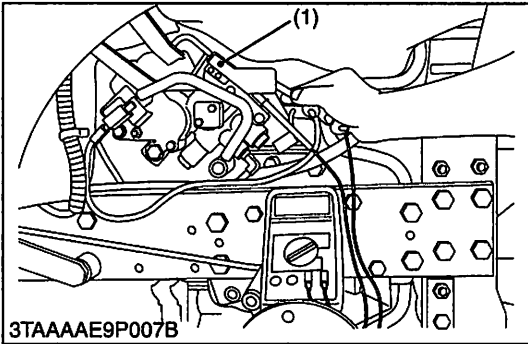
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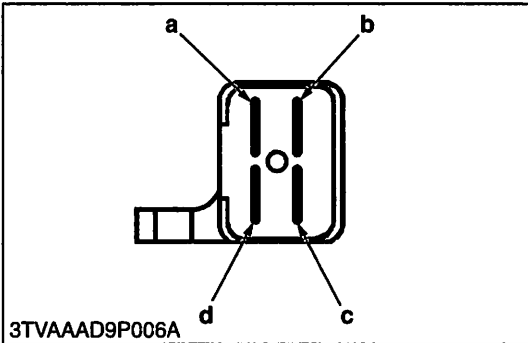
3XVAAAB9P005A



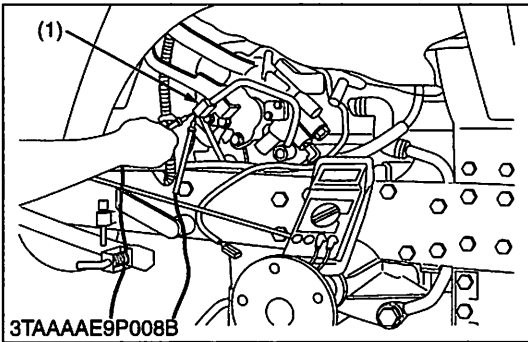
3TVAAAD9P006A



3TAAAAE9P007B



3TVAAAD9P006A



3TAAAAE9P008B

**2) HST Trunnion Switch**

1. Remove the battery. (See page 2-S13.)
2. Remove the seat. (See page 2-S14.)
3. Remove the speed control pedal, lever guides and step. (See page 2-S14.)
4. Remove the safety switch (1) lead.
5. Measure the resistance between terminal **a** and terminal **b**, and the resistance between terminal **c** and terminal **d** with an ohmmeter.
6. If the safety switch is defective, replace it.

Resistance (between terminal <b>a</b> and <b>b</b> )	When switch push is pushed	0 Ω
	When switch push is released	Infinity
Resistance (between terminal <b>c</b> and <b>d</b> )	When switch push is pushed	0 Ω
	When switch push is released	Infinity

- (1) Safety Switch for HST Trunnion      **a to d** :Safety Switch Terminal  
 (2) Speed Control Rod

W10198720

**3) PTO Clutch Lever Switch**

1. Remove the rear wheel LH.
2. Remove the safety switch lead.
3. Measure the resistance between terminal **a** and terminal **b**, and the resistance between terminal **c** and terminal **d** with an ohmmeter.
4. If the safety switch is defective, replace it.

Resistance (between terminal <b>a</b> and <b>b</b> )	When switch push is pushed	0 Ω
	When switch push is released	Infinity
Resistance (between terminal <b>c</b> and <b>d</b> )	When switch push is pushed	0 Ω
	When switch push is released	Infinity

- (1) Safety Switch for PTO Clutch Lever      **a to d** :Safety Switch Terminal

W10211170

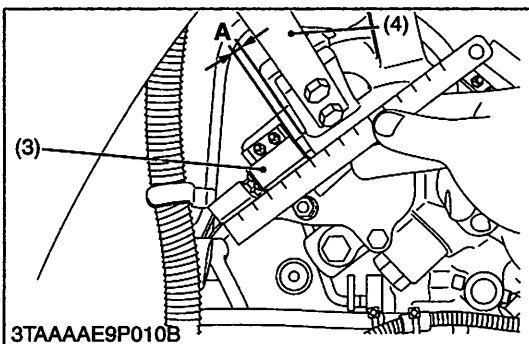
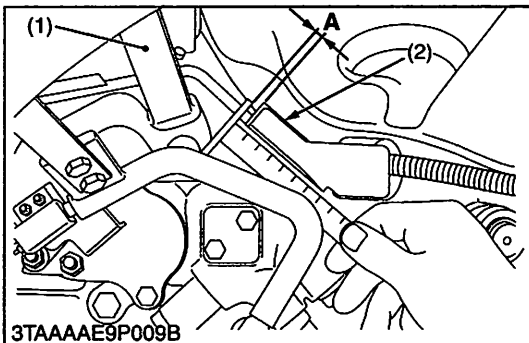
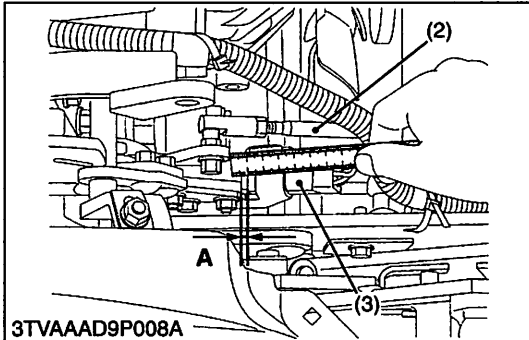
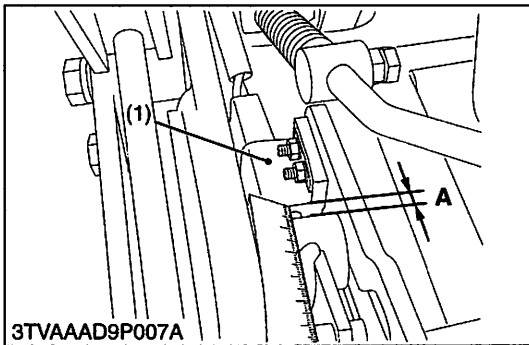
**4) PTO Select Lever Switch**

1. Remove the rear wheel LH.
2. Remove the safety switch lead.
3. Measure the resistance with an ohmmeter across the safety switch terminals (as shown the figure).
4. If the safety switch is defective, replace it.

Resistance (Across switch terminals)	When switch push is pushed	0 Ω
	When switch push is released	Infinity

- (1) Safety Switch for PTO Select Lever

W10213340



**Safety Switch Distance**

**1) Range Gear Shift Lever Switch and HST Trunnion Switch**

1. Remove the battery. (See page 2-S13.)
2. Remove the seat and the ROPS. (See page 2-S14.)
3. Remove the speed control pedal, lever guides and step. (See page 2-S14.)
4. Remove the fender RH.
5. After removing the step, reinstall the speed control pedal.
6. Set the range gear shift lever and speed control pedal to **“Neutral”** position.
7. Measure the distance **A**.
8. If the measurement is not same as the factory specification, adjust the distance **A** by moving the safety switch mounting location.

Safety switch distance “A”	Factory spec.	7 mm 0.276 in.
----------------------------	---------------	-------------------

- (1) Safety Switch for Range Gear Shift Lever
- (2) Speed Control Rod
- (3) Safety Switch for HST Trunnion

W1015919

**2) PTO Clutch Lever Switch and PTO Select Lever Switch**

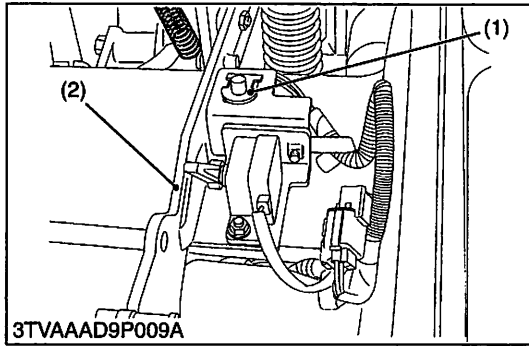
1. Remove the rear wheel LH.
2. Set the PTO clutch lever to **“Disengaged”** position and the PTO select lever to **“Neutral”** position.
3. Measure the distance **A**.
4. If the measure is not same as the factory specification, adjust the distance **A** by moving the safety switch mounting location.

Safety switch distance “A”	Factory spec.	7 mm 0.276 in.
----------------------------	---------------	-------------------

- (1) PTO Clutch Lever
- (2) Safety Switch for PTO Clutch Lever
- (3) Safety Switch for PTO Select Lever
- (4) PTO Select Lever

W1024743

**(E) Operator Presence Control (OPC) Switch**



**OPC Switch (Seat Switch) Continuity**

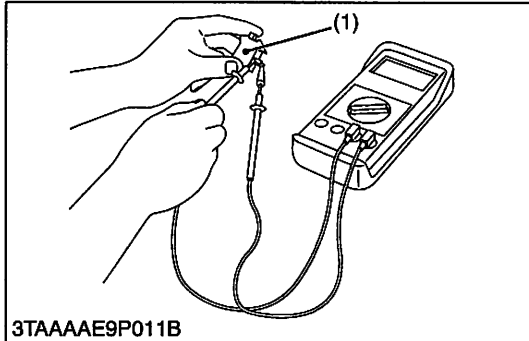
1. Remove the OPC switch (1).
2. Measure the resistance with an ohmmeter across the OPC switch terminals.
3. If the OPC switch (1) is defective, replace it.

Resistance (Across switch terminal)	When switch push is pushed	0 Ω
	When switch push is released	Infinity

(1) OPC Switch (Seat Switch)

(2) Seat Support

W1025909



**OPC Switch (Seat Switch) Distance**

1. Measure the distance **A** when the seat is vacant.
2. If the measurement is not same as the factory specification, adjust the distance **A** by moving the seat switch bracket location.

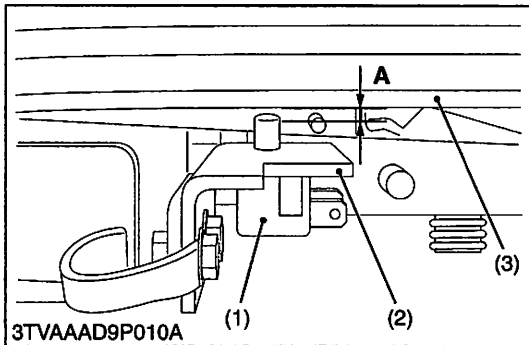
Distance "A"	Factory spec.	12 mm 0.472 in.
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(1) OPC Switch (Seat Switch)

**A : Distance**

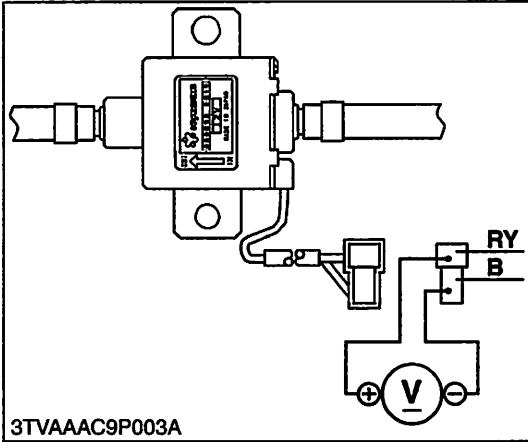
(2) Seat Switch Stay

(3) Seat Rail



W1027139

**(F) Fuel Pump**

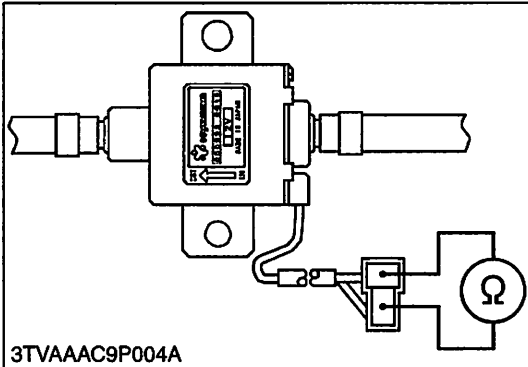


**Connector Voltage**

1. Disconnect the **2P** connector from the fuel pump.
2. Turn the main switch key to the “**ON**” position, and measure the voltage with a voltmeter between the connector terminals.
3. If the voltage differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage	Between connector terminal	Approx. battery voltage
---------	----------------------------	-------------------------

W1016341

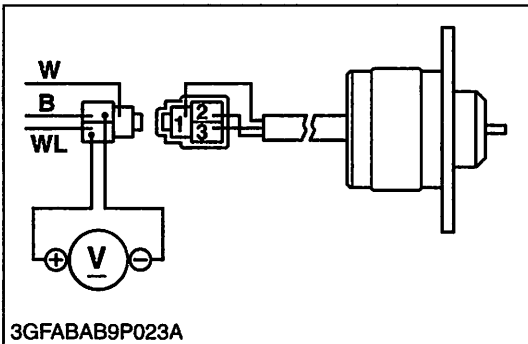


**Fuel Pump Continuity**

1. Disconnect the **2P** connector from the fuel pump.
2. Check the continuity between the connector terminals with an ohmmeter.
3. If it does not conduct, the fuel pump is faulty.

W1016134

**(G) Engine Stop Solenoid**

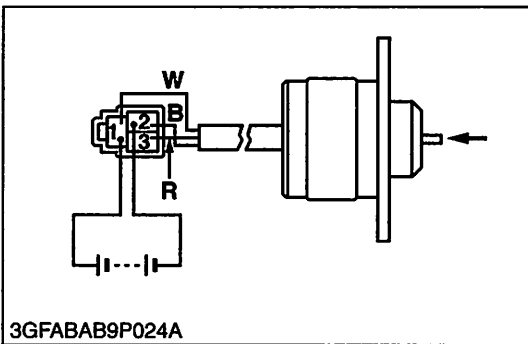


**Connector Voltage**

1. Disconnect the **3P** connector from the engine stop solenoid.
2. Turn the main switch key to the “**ON**” position, and measure the voltage with a voltmeter between the terminal **3** (Red / Black) and the terminal **2** (Black).
3. If the voltage differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage	Terminal <b>3</b> - Terminal <b>2</b>	Approx. battery voltage
---------	---------------------------------------	-------------------------

W1016508

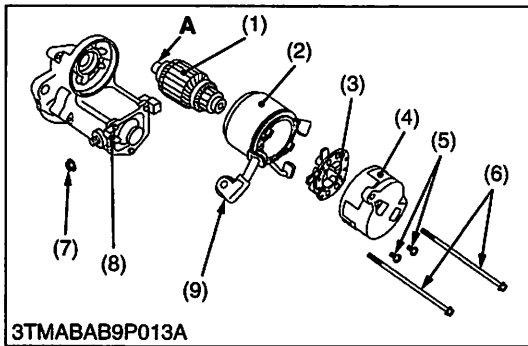


**Engine Stop Solenoid Test**

1. Disconnect the **3P** connector from the engine stop solenoid.
2. Remove the engine stop solenoid from the engine.
3. Connect the jumper leads from the battery positive terminal to the terminal **1** (White), and from the battery negative terminal to the terminal **2** (Black).
4. If the solenoid plunger is not attracted, the engine stop solenoid is faulty.
5. Connect the jumper leads from the battery positive terminal to the terminal **3** (Red), and from the battery negative terminal to the terminal **2** (Black). Push the solenoid plunger in by your finger, and then release it.
6. If the solenoid plunger is not held, the engine stop solenoid is faulty.

W1016653

## (2) Disassembling and Assembling



### Disassembling Motor

1. Disconnect the connecting lead (9) from the magnet switch (8).
2. Remove the screws (6), and then separate the end frame (4), yoke (2) and armature (1).
3. Remove the two screws (5), and then take out the brush holder (3) from the end frame (4).

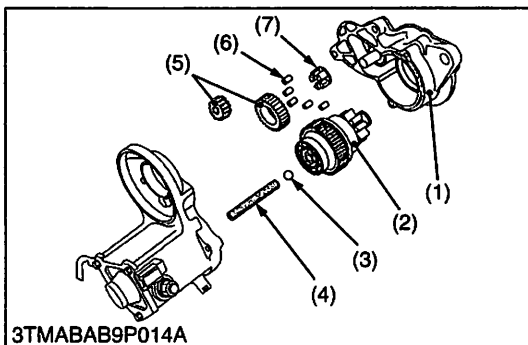
### (When reassembling)

- Apply grease to the spline teeth (A) of the armature (1).

Tightening torque	Nut (7)	5.9 to 11.8 N·m 0.6 to 1.2 kgf·m 4.3 to 8.7 ft·lbs
-------------------	---------	--

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

W1016288



### Disassembling Magnet Switch

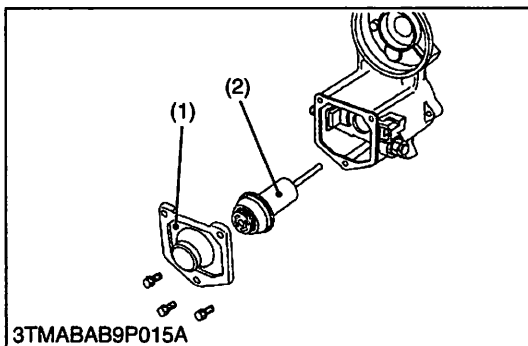
1. Remove the drive end frame (1) mounting screws.
2. Take out the overrunning clutch (2), ball (3), spring (4), gears (5), rollers (6) and retainer (7).

### (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             |              |

W1016728



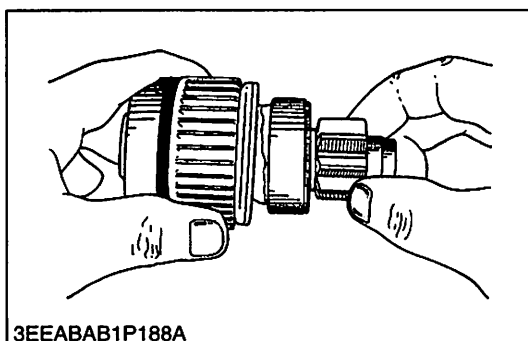
### Plunger

1. Remove the end cover (1).
2. Take out the plunger (2).

- |               |             |
|---------------|-------------|
| (1) End Cover | (2) Plunger |
|---------------|-------------|

W1016883

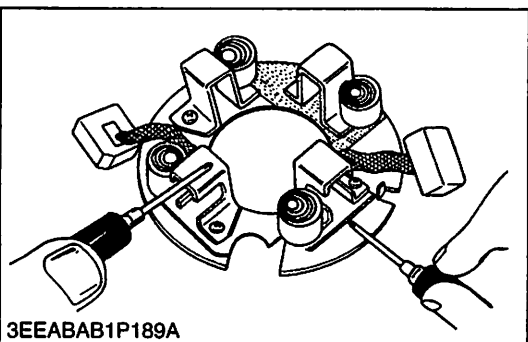
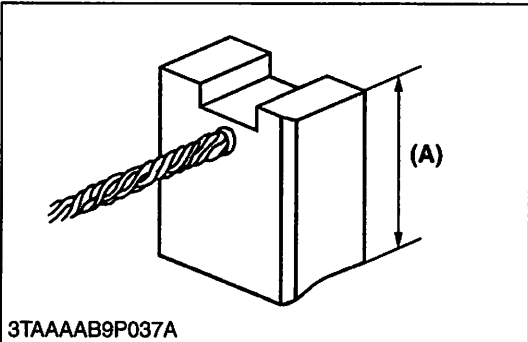
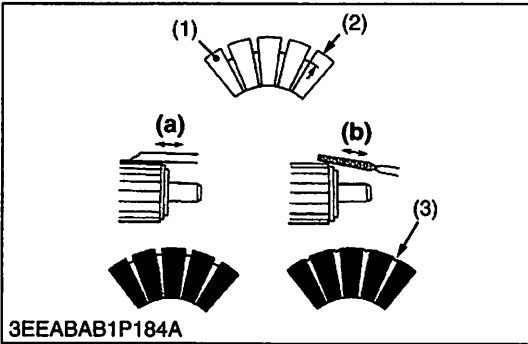
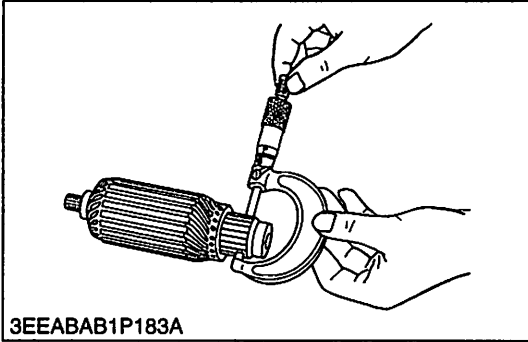
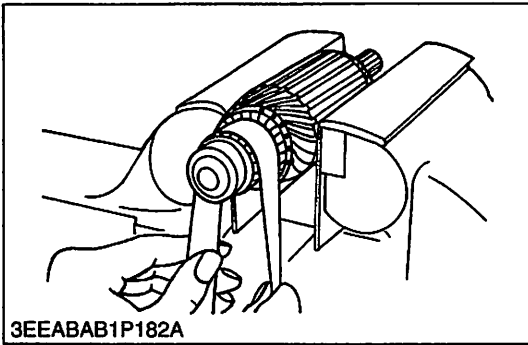
## (3) Servicing



### Overrunning Clutch

1. Inspect the pinion for wear or damage.
2. If there is any defect, replace the overrunning clutch assembly.
3. Check that the pinion turns freely and smoothly in the overrunning direction and does not slip in the cranking direction.
4. If the pinion slips or does not rotate in the both directions, replace the overrunning clutch assembly.

W1016990



**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.

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.

- (1) Segment
- (2) Undercut
- (3) Mica
- (a) Correct
- (b) Incorrect

W1017092

**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.	14.0 mm 0.551 in.
	Allowable limit	9.0 mm 0.354 in.

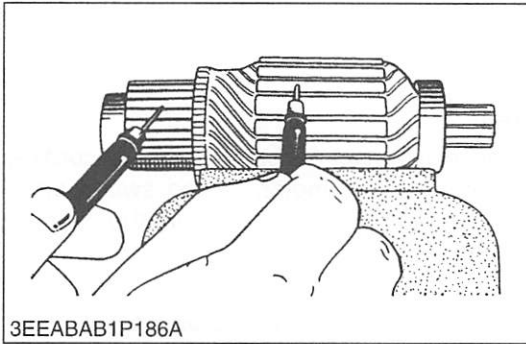
W1017544

**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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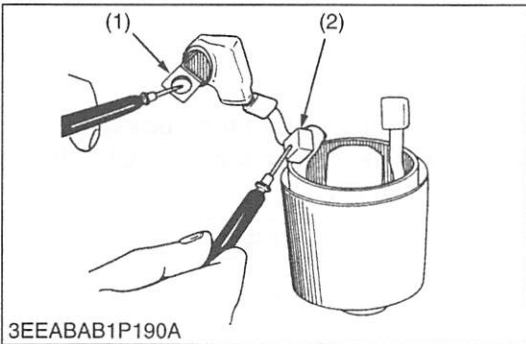
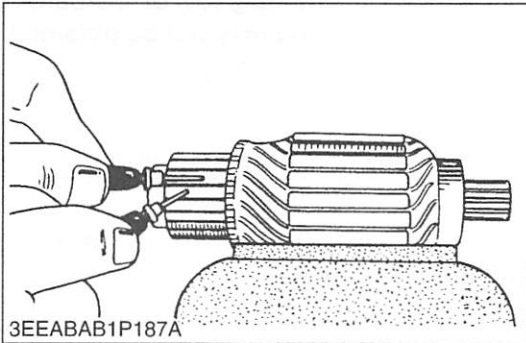
W1017672



**Armature Coil**

1. Check the continuity across the commutator and armature coil core with an ohmmeter.
2. If it conducts, replace the armature.
3. Check the continuity across the segments of the commutator with an ohmmeter.
4. If it does not conduct, replace the armature.

W1017767

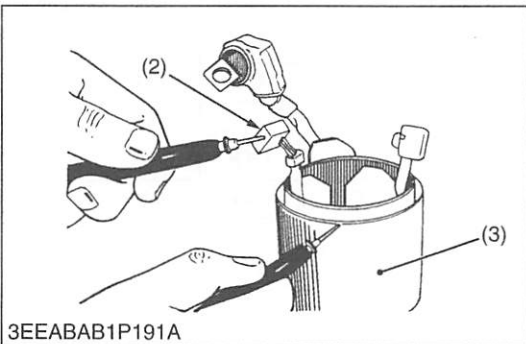


**Field Coil**

1. Check the continuity across the lead (1) and brush (2) with an ohmmeter.
2. If it does not conduct, replace the yoke assembly.
3. Check the continuity across the brush (2) and yoke (3) with an ohmmeter.
4. If it conducts, replace the yoke assembly.

- (1) Lead
- (2) Brush
- (3) Yoke

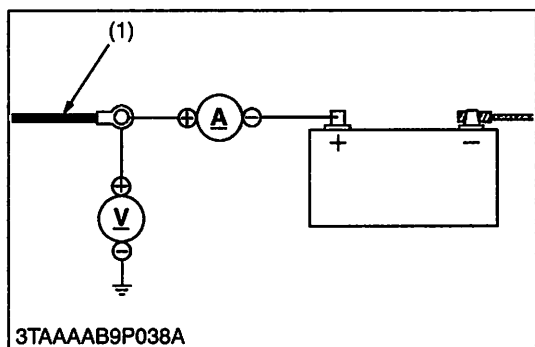
W1018015





### [3] CHARGINE SYSTEM

#### (1) Checking



#### Battery Charging Current

1. After starting the engine, disconnect the battery positive cord (+), and connect an ammeter and voltmeter. Then switch on all electrical loads (such as head lights) and measure the charging current.

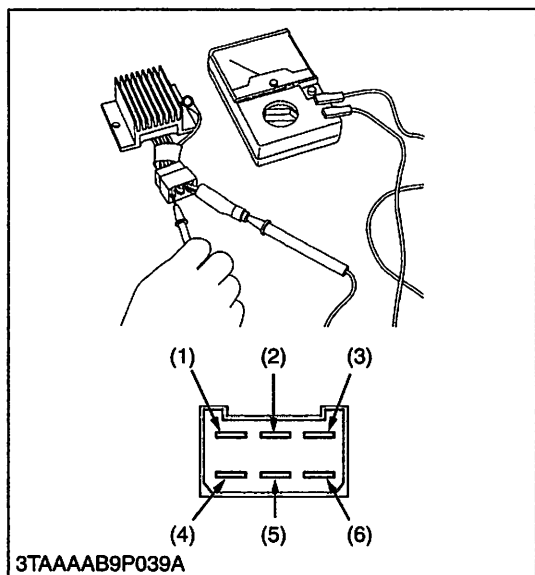
#### NOTE

- Connect an ammeter only after starting the engine.
- When the electrical loads is considerably low or the battery is fully charged, the specified reading may not be obtained.

Factory spec.	Current	14 to 15 V
	Voltage	14 to 15 V
	Dynamo speed	5200 min <sup>-1</sup> (rpm)

(1) Battery Positive Cord

W1018053



#### Continuity across Regulator's Terminals

1. Remove the regulator coupler.
2. Check with a tester whether the regulator is in optimum condition or not.

#### Check Table

#### NOTE

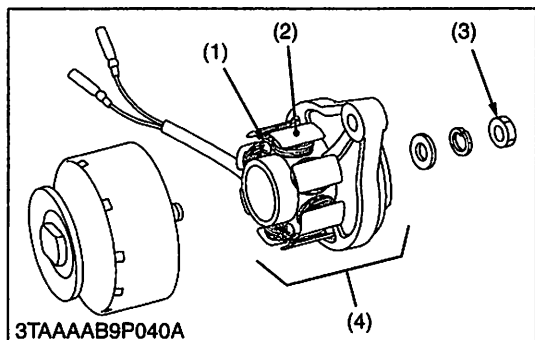
- Type to use a high-resistance tester as far as possible.
- The judgement should be as below table. "ON" if the indicator moves, otherwise "OFF".

Tester + terminal	Cord colors					
	Blue	Black	Blue	Green	Yellow	Red
Tester - terminal						
Cord colors	Blue	OFF	ON	ON	ON	ON
	Black	ON	OFF	ON	ON	ON
	Blue	ON	OFF	ON	ON	ON
	Green	OFF	OFF	OFF	OFF	OFF
	Yellow	OFF	OFF	OFF	OFF	OFF
	Red	ON	OFF	ON	ON	ON

- |           |            |
|-----------|------------|
| (1) Blue  | (4) Green  |
| (2) Black | (5) Yellow |
| (3) Blue  | (6) Red    |

W1018232

#### (2) Disassembling and Assembling



#### Stator

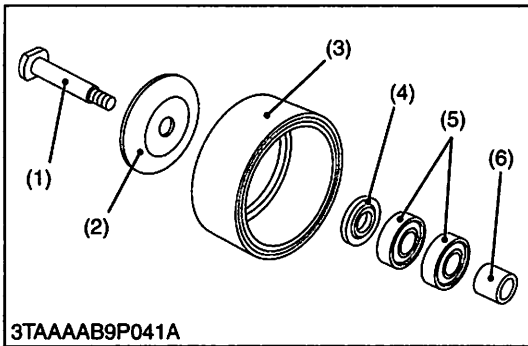
1. Remove the nut (3) and separate the stator comp. (4).
2. Unscrew the screws (1) and remove the stator (2).

#### (When reassembling)

Tightening torque	Nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft·lbs
-------------------	-----	---

- |            |                  |
|------------|------------------|
| (1) Screw  | (3) Nut          |
| (2) Stator | (4) Stator Comp. |

W1018872



**Rotor**

1. Tap out the shaft (1) from the rotor (3).

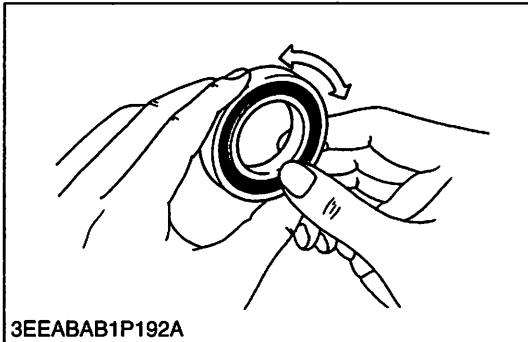
**(When reassembling)**

- Take care the direction of the collar (4), the flat side should face to the pulley (2) side.

- |            |              |
|------------|--------------|
| (1) Shaft  | (4) Collar   |
| (2) Pulley | (5) Bearings |
| (3) Rotor  | (6) Collar   |

W1019015

**(3) Servicing**



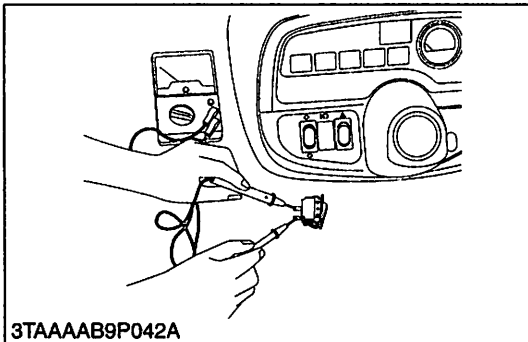
**Bearing**

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

W1019790

**[4] LIGHTING SYSTEM**

**(1) Checking**

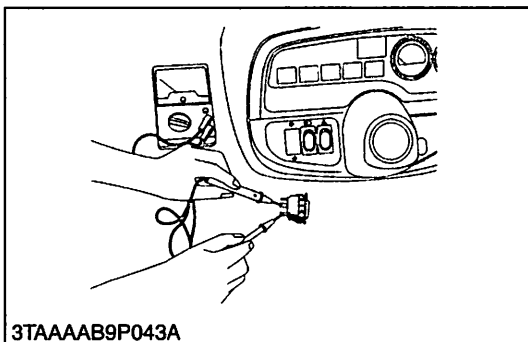


**Head Light Switch Continuity**

1. Remove the under panel.
2. Disconnect the wiring leads from head light switch and remove it.
3. Measure the resistance with an ohmmeter across the head light switch terminals in each position.
4. If the resistance differs from the factory specifications, the head light switch is faulty.

Resistance	Factory spec.	OFF	Infinity
		ON	0 Ω

W1019360

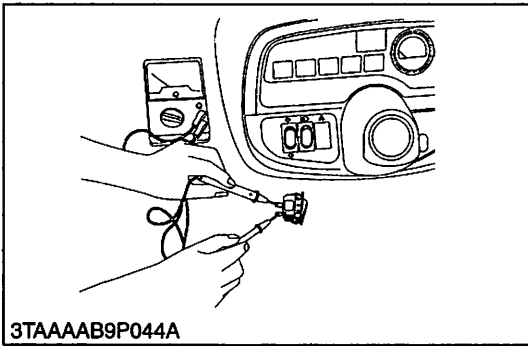


**Turn Signal Switch Continuity**

1. Remove the under panel.
2. Disconnect the connector from turn signal switch and remove it.
3. Measure the resistance with an ohmmeter across the center terminal and terminal R or L.
4. If the resistance differs from the factory specifications, the turn signal switch is faulty.

Resistance	Factory spec.	OFF	Infinity
		R	0 Ω
		L	0 Ω

W1019512

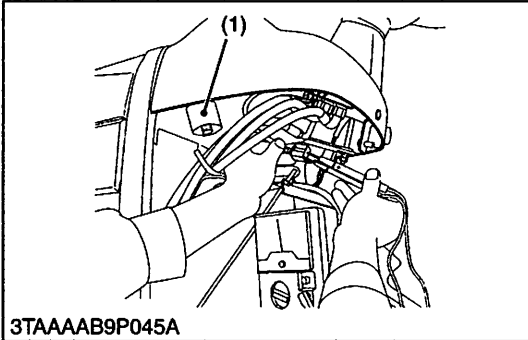


**Hazard Light Switch Continuity**

1. Remove the under panel.
2. Disconnect the wiring leads from hazard light switch and remove it.
3. Measure the resistance with an ohmmeter across the hazard light switch terminals in each position.
4. If the resistance differs from the factory specifications, the hazard light switch is faulty.

Resistance	Factory spec.	OFF	Infinity
		ON	0 Ω

W1019697



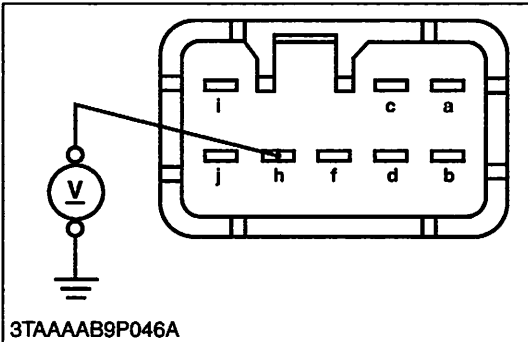
**Flasher Unit**

1. Remove the under panel.
2. Disconnect the coupler from flasher unit.
3. Measure the voltage with a voltmeter across the terminal **h** and terminal **c** or chassis.
4. If the voltage differ from the battery voltage, the wiring harness is faulty.

Voltage	Terminal <b>h</b> – Terminal <b>c</b> or Chassis	Approx. battery voltage
---------	--	-------------------------

(1) Flasher Unit

W1019868



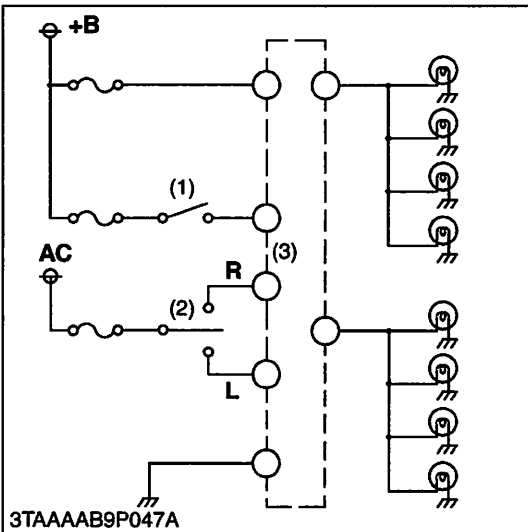
**Flasher Unit Actuation Test**

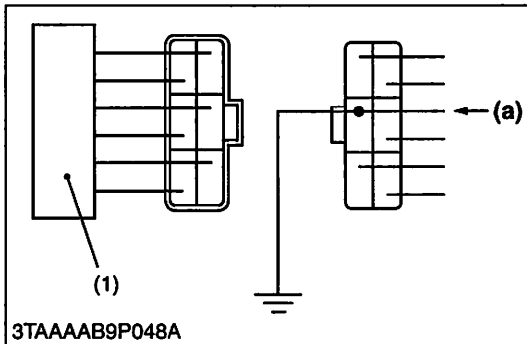
1. Set the hazard switch to the **ON** position, and make sure the hazard light gives 60 to 85 flashes for a minute.
2. With the main switch and the hazard switch at the **ACC** and **ON** positions, respectively, move the turn signal switch to the left. Make sure that the right-hand light stays on and the left-hand light gives flashes earlier (by about 20 flashes) than when the hazard lamp is activated. Then move the turn signal switch to the right and make sure the corresponding actions take place.
3. Now set the main switch to the **ACC** position and move the turn signal switch alone. Make sure the same actions as above result.
4. If both the hazard switch and the turn signal switch function but the above actions do not take place, replace the flasher unit with new one.

(1) Hazard Switch  
(2) Turn Signal Switch

(3) Flasher Unit

W1020049





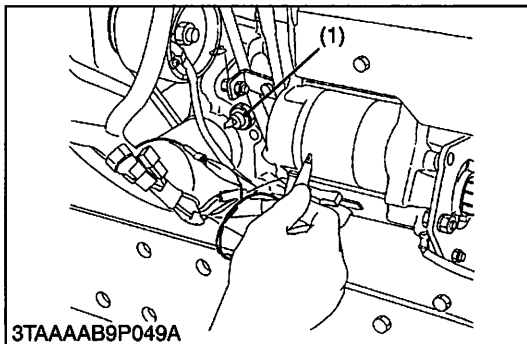
**Charge Lamp (Charging Circuit)**

1. Remove the under panel.
2. Disconnect the **6P** connector from the regulator after turning the main switch **OFF**.
3. Turn the main switch **ON** and connect a jumper lead from the wiring harness connector terminal (Black) to the chassis.
4. If the charge lamp does not light, the wiring harness or fuse is faulty.

(1) Regulator

(a) From Charge Lamp

W1020208



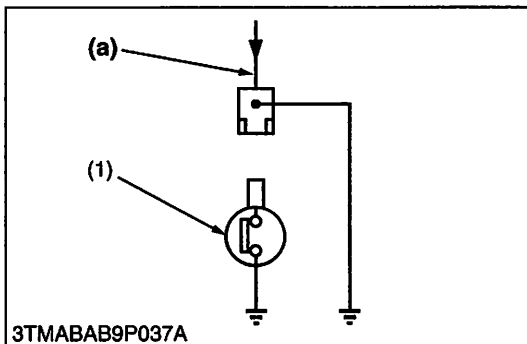
**Engine Oil Pressure Lamp**

1. Disconnect the lead 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 wiring harness is faulty.

(1) Engine Oil Pressure Switch

(a) From Oil Pressure Lamp

W1025954



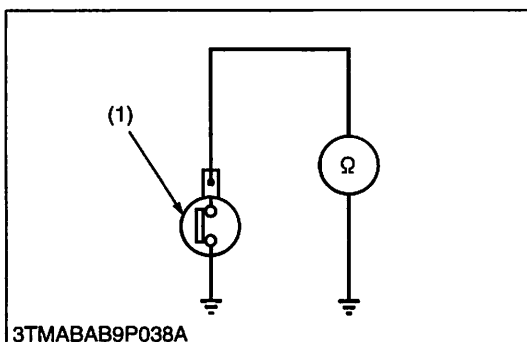
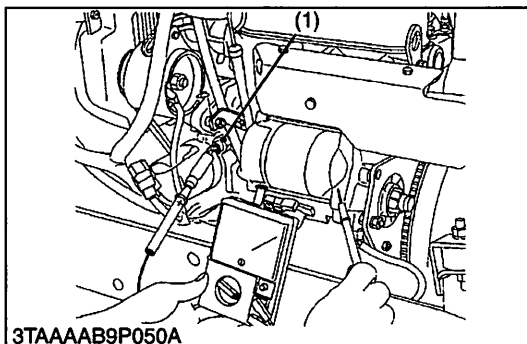
**Engine Oil Pressure Switch Continuity**

1. Measure the resistance with an ohmmeter across the switch terminal and the chassis.
2. If 0 ohm is not indicated in the normal state, the switch is faulty.
3. If infinity is not indicated at pressure over 4.9 kPa (0.5 kgf/cm<sup>2</sup>, 7 psi), the switch is faulty.

Resistance (Switch terminal – Chassis)	In normal state	0 Ω
	At pressure over approx. 4.9 kPa (0.5 kgf/cm <sup>2</sup> , 7 psi)	Infinity

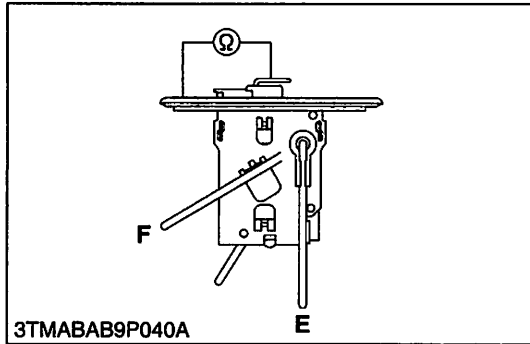
(1) Engine Oil Pressure Switch

W1026084



## [5] GAUGES

### (1) Checking



#### Fuel Level Sensor

##### 1) Sensor Continuity

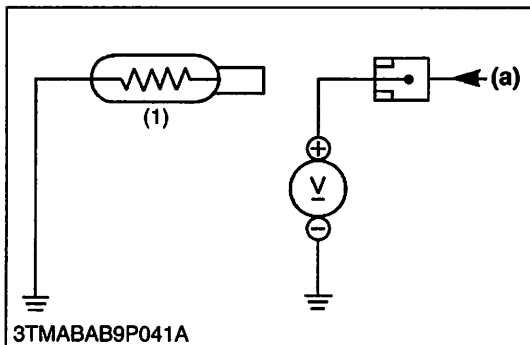
1. Remove the fuel level sensor from the fuel tank.
2. Measure the resistance with an ohmmeter across the sensor terminal and its body.
3. If the reference value are not indicated, the sensor is faulty.

Resistance (Sensor terminal – its body)	Reference value	Float at upper-most position	1 to 5 Ω
		Float at lower-most position	103 to 117 Ω

E : Empty

F : Full

W1024865



#### Coolant Temperature Sensor

##### 1) Lead Terminal Voltage

1. Disconnect the lead from the coolant temperature sensor after turning the main switch off.
2. Turn the main switch on and measure the voltage with a voltmeter across the lead terminal and the chassis.  
If the voltage differs from the battery voltage, the wiring harness, fuse or coolant temperature gauge is faulty.

Voltage	Lead terminal – Chassis	Approx. battery voltage
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##### 2) Sensor Continuity

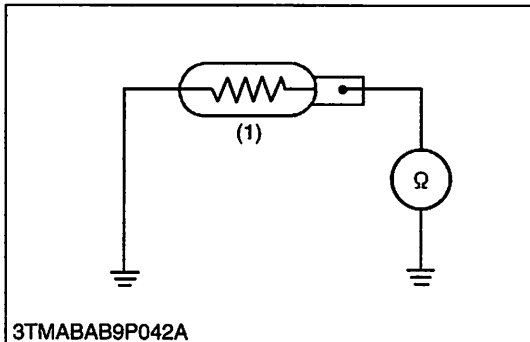
1. Measure the resistances with an ohmmeter across the sensor terminal and the chassis.
2. If the reference value is not indicated, the sensor is faulty.

Resistance (Sensor terminal – Chassis)	Reference value	Approx. 16.1 Ω at 120 °C (248 °F) Approx. 27.4 Ω at 100 °C (212 °F) Approx. 51.9 Ω at 80 °C (176 °F) Approx. 153.9 Ω at 50 °C (122 °F)
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(1) Coolant Temperature Sensor

(a) From Temperature Gauge

W1025104



#### Fuel Gauge and Coolant Temperature Gauge Operation

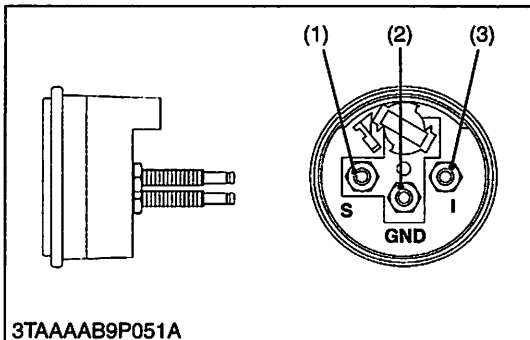
1. Remove the under panel.
2. Turn the main switch to **ON** position. Measure the voltage with a voltmeter across the I terminal (3) and **GND** terminal (2) of the gauge.
3. If approx. battery voltage is indicated, the ignition and ground lead connections are good.
4. Turn the main switch to **OFF**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

(1) S Terminal

(3) I Terminal

(2) GND Terminal

W1027205



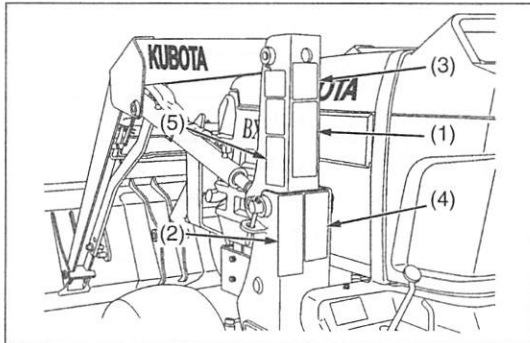
# 7 FRONT LOADER



# 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. 7J246-5643-1

**⚠ DANGER**

**TO AVOID SERIOUS INJURY OR DEATH CAUSED BY FALLING LOADS :**

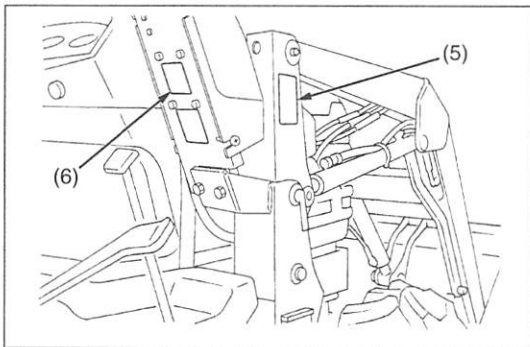
1. Load on raised bucket or fork can fall or roll back onto operator causing serious injury or death.
2. Use approved clamping and / or guard attachments for handling large, loose or shiftable loads such as bales, posts, sheets of plywood etc.
3. Carry loads as low as possible.

(2) Part No. 7J246-5641-1

**⚠ DANGER**

**TO AVOID SERIOUS INJURY OR DEATH CAUSED BY ROLLOVERS :**

1. ROPS and a fastened seat belt are strongly recommended in almost all applications. Foldable ROPS should be in upright and locked position if equipped.
2. Adjust rear wheels to the widest setting that is suitable for the work.
3. Add recommended wheel ballast and rear weight for stability.
4. DO NOT drive on steep slopes or unstable surfaces.
5. Carry loader arms at low position during transport. Move and turn tractor at slow speeds.



(4) Part No. 7J246-5645-1

**⚠ CAUTION**

**TO AVOID PERSONAL INJURY :**

1. Observe safety precautions in loader and tractor Operator's Manual.
2. Operate the loader from tractor seat only.
3. Keep children, others and livestock away when operating loader and tractor.
4. Avoid holes, loose ground, and rocks which may cause tractor / loader to tip.
5. Make sure approved bucket is attached before removing loader from tractor.
6. When parking or storing, choose flat and hard ground. Lower the bucket to the ground, set brakes and remove key before leaving tractor.
7. Before disconnecting hydraulic lines, relieve all hydraulic pressure.

(6) Part No. 7J266-5649-2

**⚠ CAUTION**

**TO AVOID INJURY FROM CRUSHING :**

1. Do not utilize the valve lock for machine maintenance or repair.
2. The valve lock is to prevent accidental actuation when implement is not in use or during transport.

(3) Part No. 7J246-5642-1

**⚠ DANGER**

**TO AVOID SERIOUS INJURY OR DEATH CAUSED BY CONTACT WITH ELECTRIC LINES:**

- Check overhead clearance.

(5) Part No. 7J246-5644-2  
(Both sides)

**⚠ WARNING**

**TO AVOID INJURY FROM FALLS OR BEING CRUSHED :**

1. DO NOT stand or work under raised loader or bucket.
2. DO NOT use loader as jack for servicing.
3. DO NOT use loader as a work platform.
4. NEVER connect chain, cable or rope to loader bucket while operating loader.

## CARE OF DANGER, WARNING AND CAUTION LABELS

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

# SPECIFICATIONS

## [1] LOADER SPECIFICATIONS

Item		LA210-1
ASAE Rated Lift Capacity		210 kg (460 lbs)
ASAE Rated Brakeout Force		4200 N (950 lbs)
Boom Cylinder	Bore	38 mm (1.50 in.)
	Stroke	325 mm (12.77 in.)
Bucket Cylinder	Bore	57 mm (2.25 in.)
	Stroke	200 mm (7.96 in.)
Control Valve	4 Position Bucket Control Valve Type	One Detent Float Position, Two Stage Bucket Dump, Power Beyond Circuit
Relief Valve Setting Pressure		133.5 to 140 kg/cm <sup>2</sup> (1900 to 2000 psi)
Net Weight (Approx.)		195 kg (430 lbs)

W1027852

## [2] BUCKET SPECIFICATIONS

Item		LA210-1
Type		Square 48
Width		1220 mm (48.0 in.)
Length		495 mm (19.5 in.)
Height		465 mm (18.2 in.)
Capacity	Struck	0.14 m <sup>3</sup> (5.0 cu.ft.)
	Heaped	0.17 m <sup>3</sup> (6.1 cu.ft.)
Weight		60 kg (132 lbs)

W1013973

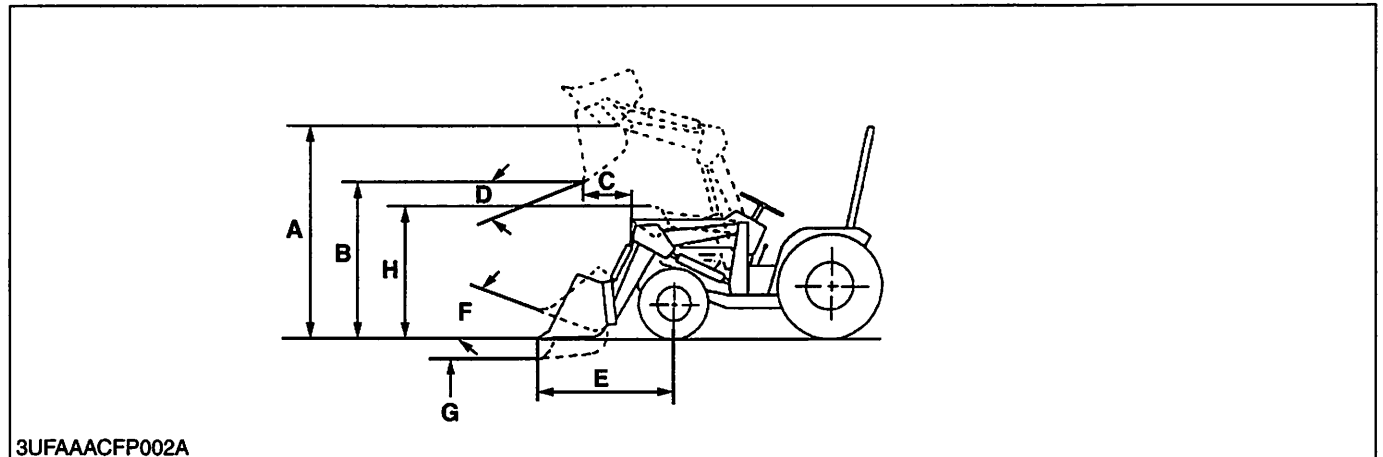


# OPERATING DIMENSIONS

Item	LA210-1
	BX23
Maximum Lifting Height (A)	1810 mm (71.3 in.)
Clearance with Bucket Dumped (B)	1300 mm (51.2 in.)
Reach at Maximum Height (C)	686 mm (27.0 in.)
Maximum Dump Angle (D)	45 deg.
Reach with Bucket on Ground (E)	1310 mm (51.6 in.)
Bucket Roll-back Angle (F)	25 deg.
Digging Depth (G)	120 mm (4.7 in.)
Overall Height in Carrying Position (H)	1070 mm (42.1 in.)

BX23 with 18 × 18.50-8 Front Tires and 26 × 12.00-12 Rear Tires.

W1028404



7

# PERFORMANCE RATINGS (NO LOAD)

Item	LA210-1
Raise to Full Height	2.9 sec.
Lowering Time	2.9 sec.
Attachment Roll-back Time	1.5 sec.
Attachment Dump Time	1.4 sec.

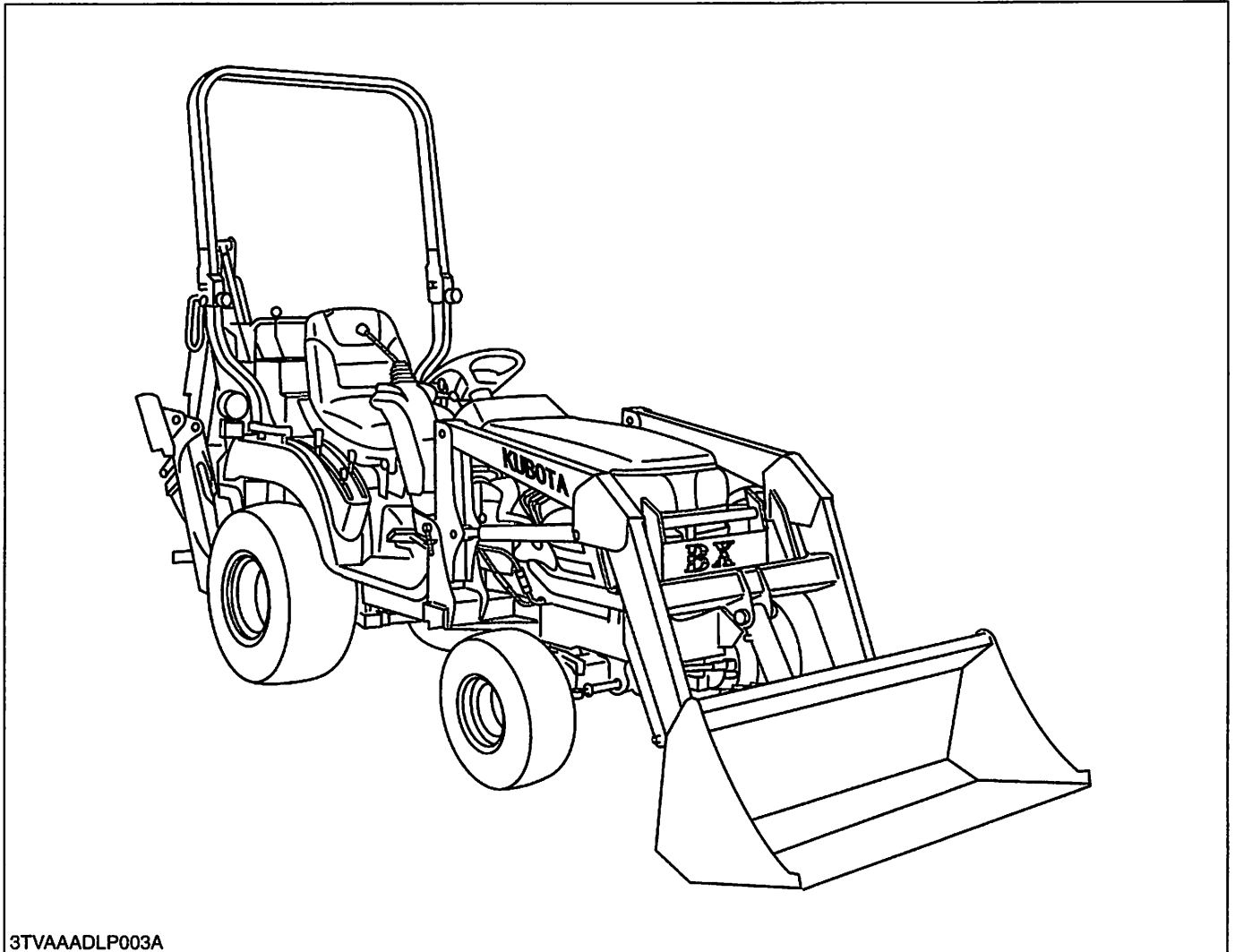
W1028712

# MECHANISM

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- 1. FEATURES ..... 7-M1
- 2. HYDRAULIC CIRCUIT ..... 7-M2
- 3. BOOM CYLINDER AND BUCKET CYLINDER ..... 7-M3

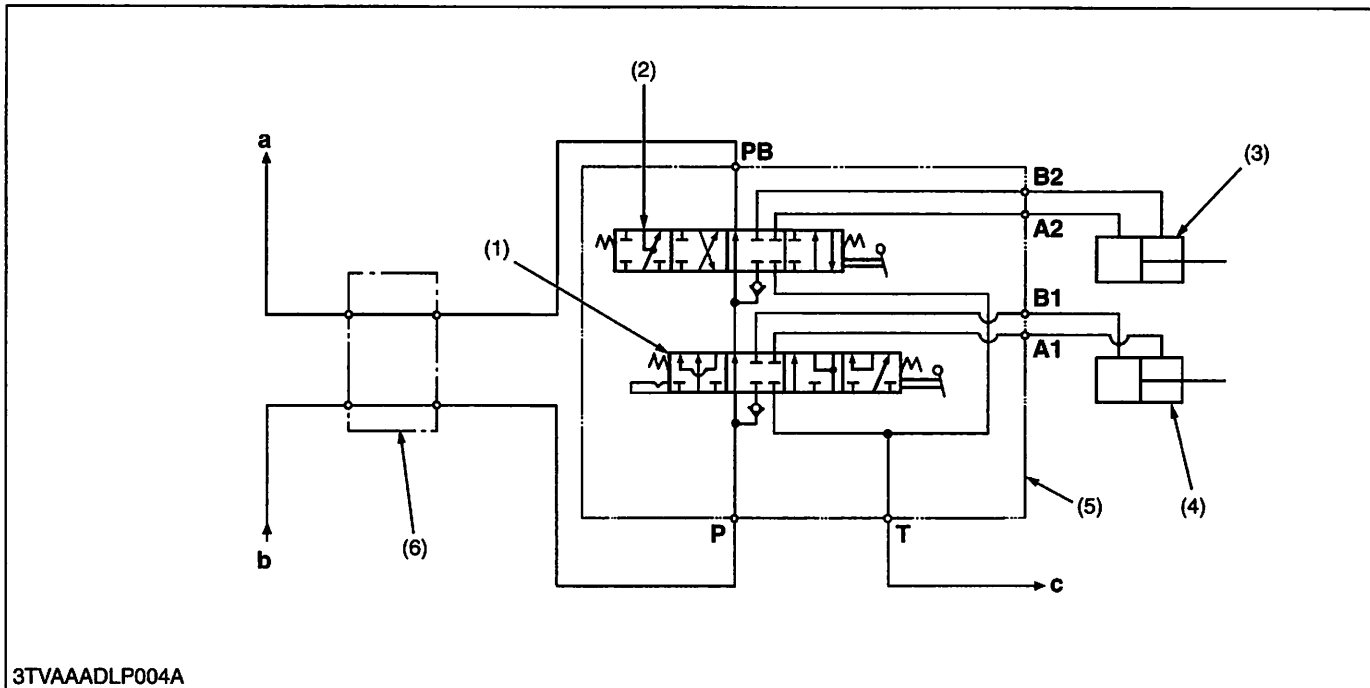
# 1. FEATURES



3TVAAADLP003A

1. Huge Hoisting and Scooping Power
2. Fast Cycle Time
3. One-Lever Operation
4. Heavy Duty Bucket
5. Long Arm Reach
6. Series Circuit Hydraulic Control Valve

## 2. HYDRAULIC CIRCUIT



3TVAAADLP004A

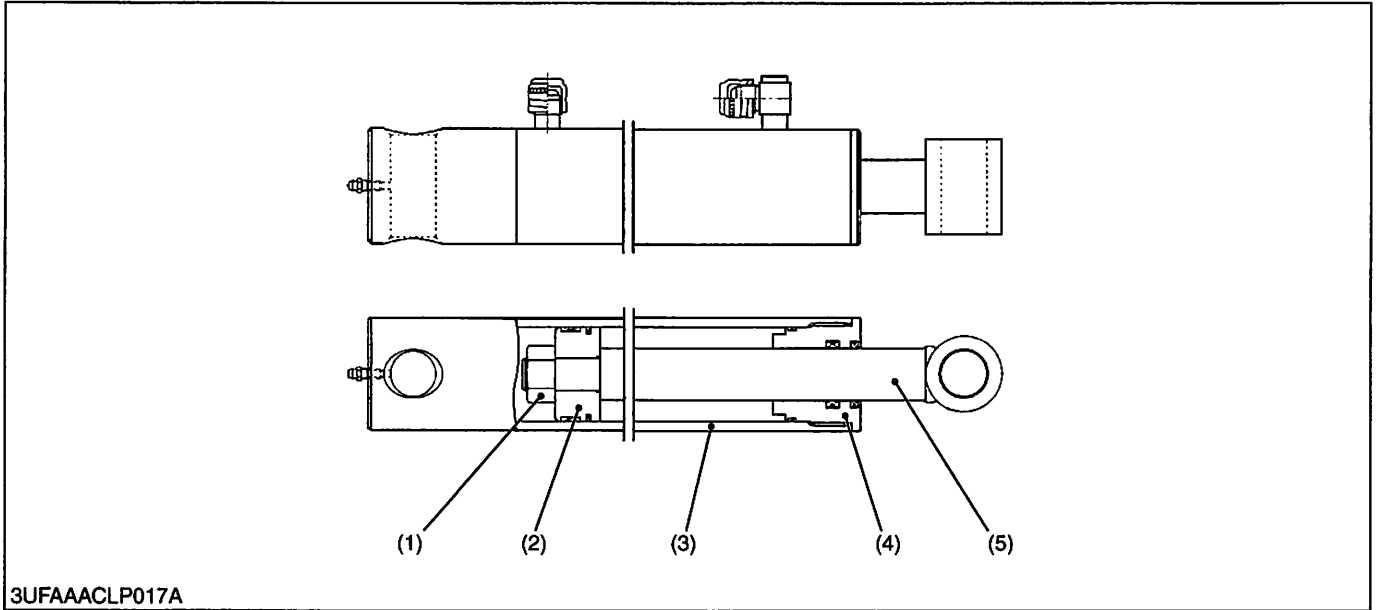
- (1) Boom Control Valve
- (2) Bucket Control Valve
- (3) Bucket Cylinder

- (4) Boom Cylinder
- (5) Control Valve Assembly
- (6) Hydraulic Block

**A : 4 Position Bucket Control**

- a : To 3-Point Hydraulic System**
- b : From Hydraulic Pump**
- c : To Transmission Case**

### 3. BOOM CYLINDER AND BUCKET CYLINDER



3UFAAACL017A

- (1) Nut
- (2) Piston
- (3) Cylinder Tube
- (4) Head
- (5) Piston Rod

Both boom cylinder and bucket cylinder consists of a head (4), cylinder tube (3), piston rod (5), piston (2), and other parts as shown in the figure above. They are single-rod double acting cylinder in which the reciprocating motion, of the piston is controlled by hydraulic force applied to both of its ends.

#### Cylinder Specifications

		LA210-1
Boom Cylinder	Cylinder I.D.	38 mm (1.50 in.)
	Rod O.D.	25.4 mm (1.00 in.)
	Stroke	325 mm (12.77 in.)
Bucket Cylinder	Cylinder I.D.	57 mm (2.25 in.)
	Rod O.D.	32 mm (1.25 in.)
	Stroke	200 mm (7.96 in.)

W1025274

7

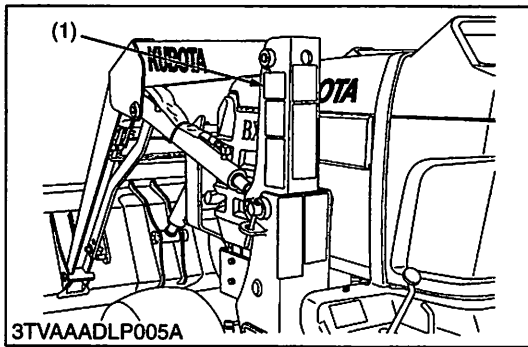
# SERVICING

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[3] SIDE FRAMES, FRONT GUARD, HYDRAULIC TUBES AND MAIN FRAMES .....	7-S14
(1) Disassembling and Assembling .....	7-S14

# 1. GENERAL

## [1] IDENTIFICATION

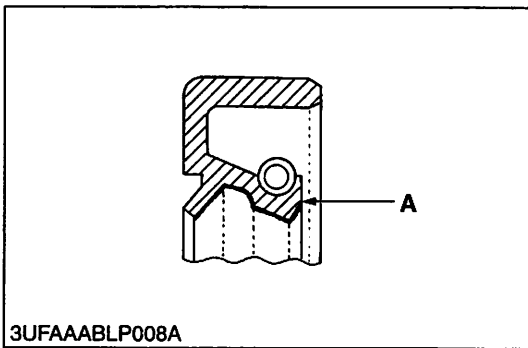


When contacting your local KUBOTA distributor, always specify front loader model and serial number.

(1) Model / Serial Number

W1010468

## [2] GENERAL PRECAUTION



- During disassembly, carefully arrange removed parts in a clean area to prevent later confusion. Screws, bolts and nuts should be replaced in their original positions to prevent reassembly errors.
- When special tools are required, use genuine KUBOTA tools. Special tools which are not used frequently should be made according to the drawings provided.
- Clean parts before measuring them.
- Use only genuine KUBOTA parts for parts replacement to maintain loader performance and to assure safety.
- O-ring and oil seals must be replaced during reassembly. Apply grease to new O-rings or oil seals before reassembling.

A : Grease

W1010531



### [3] LUBRICANTS

To prevent serious damage to hydraulic system, use only specified fluid or its equivalent.

Place	Capacities	Lubricants
Transmission Case	10.1 L 2.7 U.S.gals 2.2 Imp.gals	KUBOTA SUPER UDT Fluid *
Grease fitting	Until grease overflows	Moly Ep Type grease

**NOTE**

- \* KUBOTA SUPER UDT Fluid.....KUBOTA original transmission hydraulic fluid

W1010650

### [4] MAINTENANCE CHECK LIST

To keep the machine working in good condition as well as to avoid any accident and trouble, carry out periodic inspection and maintenance. Check the following points before use.

Service Interval	Check Points	Reference Page
Daily (Each use)	<ul style="list-style-type: none"> <li>• Check the transmission fluid level</li> <li>• Check the hydraulic hoses</li> </ul>	7-S2 7-S2
Every 10 hours	<ul style="list-style-type: none"> <li>• Grease all grease fitting</li> <li>• Lubricate joints of control lever linkage</li> </ul>	7-S3 7-S3

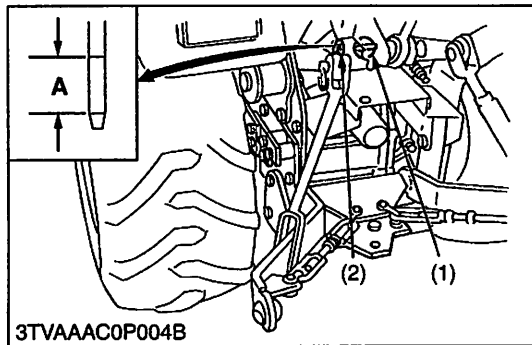
W1010764

### [5] CHECK AND MAINTENANCE

**CAUTION**

- When checking and repairing, park the tractor on flat ground and apply the parking brake.
- When checking and repairing, lower the bucket and stop the engine.

#### (1) Check Points of Each Use or Daily



#### Checking Transmission Fluid Level

1. Check the oil level at the dipstick (2).
2. If the level is too low, add new oil to the prescribed level at the oil inlet.

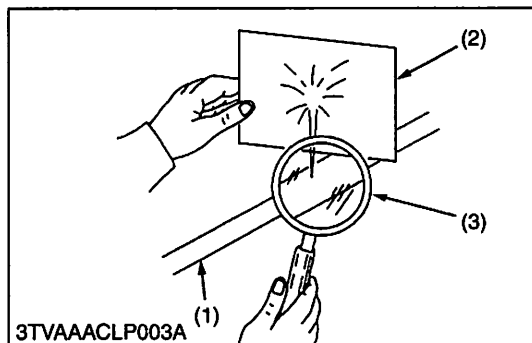
**IMPORTANT**

- If oil level is low, do not run engine.

- (1) Oil Filling Plug
- (2) Dipstick

A : Oil level is acceptable within this range.

W1010960



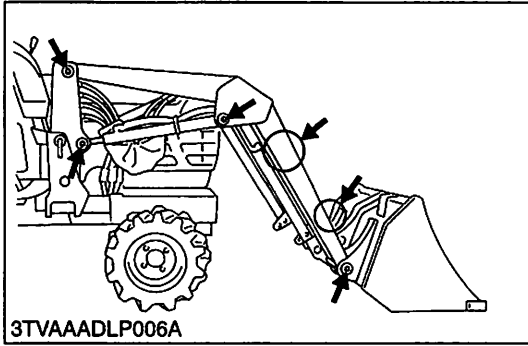
#### Checking Hydraulic Hoses

1. Checking all hydraulic hoses for cuts or wear.
2. If defects are found, replace them.

- (1) Hydraulic Hose
- (2) Cardboard
- (3) Magnifying Glass

W1011064

## (2) Check Points of Every 10 Hours



### Greasing

1. Inject grease in all grease fitting with a hand grease gun.

W1011132

### Lubricating

1. Lubricate joints of control lever linkage.

W1011274

7

## 2. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Boom Does Not Rise</b>	• Control valve malfunctioning	Repair or replace	7-S8
	• Boom cylinder defective	Repair or replace	7-S11
	• Control lever linkage defective	Repair or replace	—
	• Hydraulic pump malfunctioning	Repair or replace	—
	• Oil filter clogged	Clean or replace	—
	• Hydraulic hose damaged	Replace	—
<b>Boom Does Not Lower</b>	• Control valve malfunctioning	Repair or replace	7-S8
<b>Insufficient Boom Speed</b>	• Boom cylinder tube worn or damaged	Replace	7-S12
	• Boom cylinder piston ring (piston seal and O-ring) worn or damaged	Replace	7-S13
	• Oil leaks from tube joints	Repair	—
	• Relief valve setting pressure too low	Adjust	7-S8
	• Insufficient transmission fluid	Refill	7-S2
	• Dirty relief valve	Clean	—
<b>Bucket Does Not Move</b>	• Control valve malfunctioning	Repair or replace	7-S8
	• Bucket cylinder defective	Repair or replace	7-S11
	• Control lever linkage defective	Repair or replace	—
	• Hydraulic pump malfunctioning	Repair or replace	—
	• Oil filter clogged	Clean or replace	—
	• Relief valve spring damaged	Replace	—
	• Hydraulic hose damaged	Replace	—
	• Dirty relief valve	Clean	—
<b>Insufficient Bucket Speed</b>	• Bucket cylinder tube worn or damaged	Replace	7-S12
	• Bucket cylinder piston ring (piston seal and O-ring) worn or damaged	Replace	7-S13
	• Oil leaks from tube joints	Repair	—
	• Insufficient transmission fluid	Refill	—
<b>Front End Loader Drops by its Weight</b>	• Boom cylinder tube worn or damaged	Replace	7-S12
	• Boom cylinder piston ring (piston seal and O-ring) worn or damaged	Replace	7-S13
	• Oil leaks from tube joints	Repair	—
	• Control valve malfunctioning	Repair or replace	—

W1014322

### 3. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Piston Rod	Bend	—	0.25 mm 0.0098 in.

W1013874



## 4. TIGHTENING TORQUES

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

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

American standard cap screws with UNC or UNF Threads				Metric cap screws			
Grade	SAE 5 or 8			Grade	Property class 8.8 (Approx. SAE grade 5)		
Unit	N-m	kgf-m	ft-lbs	Unit	N-m	kgf-m	ft-lbs
Size				Size			
1/4	9.8 to 11.7	1.0 to 1.2	7.2 to 8.6	M6	9.8 to 11.2	1.0 to 1.1	7.2 to 8.3
5/16	19.0 to 23.1	1.9 to 2.4	14 to 17	M8	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
3/8	33.9 to 40.7	3.5 to 4.2	25 to 30	M10	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
1/2	88.1 to 105.8	9.0 to 10.8	65 to 78	M12	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
9/16	122.0 to 146.4	12.4 to 14.9	90 to 108	M14	124 to 147	12.6 to 15.0	91.2 to 108
5/8	176.3 to 211.5	18.0 to 21.6	130 to 156	M16	196 to 225	20.0 to 23.0	145 to 166
-	-	-	-	M18	275 to 318	28.0 to 32.5	203 to 235

W1012507

### [2] HYDRAULIC FITTINGS

Item	Thread size	Tightening torque		
		N-m	kgf-m	ft-lbs
Adjustable elbow and adapter	9/16	37 to 44	3.7 to 4.6	27 to 33
	3/4	47 to 54	4.8 to 5.5	35 to 40
Hose fitting and flare nut	9/16	22 to 25	2.2 to 2.6	16 to 19
	3/4	35 to 41	3.6 to 4.1	26 to 30
	7/8	65 to 71	6.6 to 7.2	48 to 52
Adapter (NPT)	1/4	30 to 35	3.1 to 3.6	22 to 26
	3/8	39 to 44	3.9 to 4.4	28 to 32
	1/2	49 to 58	5.0 to 5.9	36 to 43

■ **NOTE**

- When connecting a hose with flare nut, after tightening the nut with specified torque, return it approximately 45 degrees and re-tighten it to specified torque.

W1013389

### [3] TIGHTENING TORQUES OF SCREWS, BOLTS AND NUTS ON THE TABLE BELOW ARE ESPECIALLY SPECIFIED

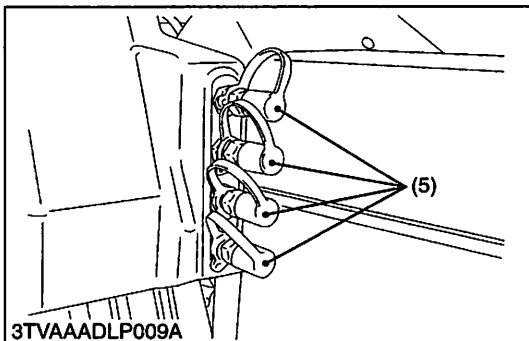
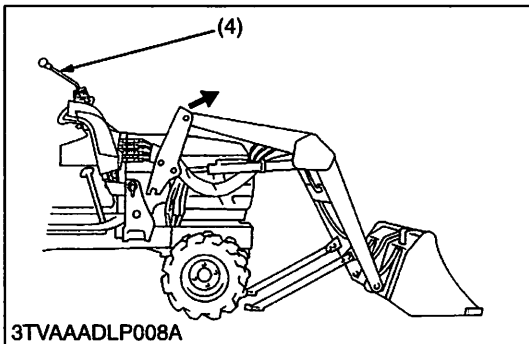
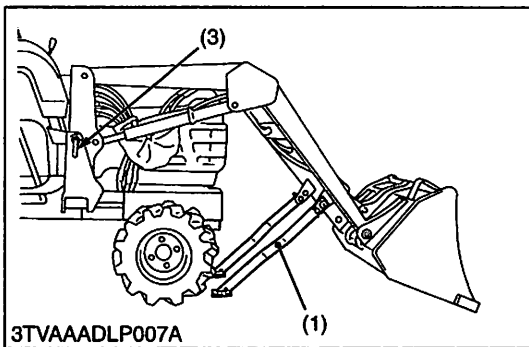
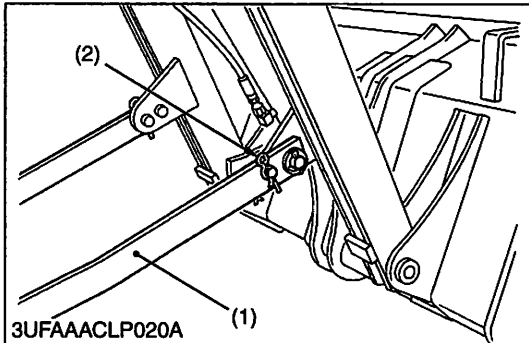
Item	N-m	kgf-m	ft-lbs
Control valve stay mounting bolt	90.1	9.2	66.5
Hydraulic block mounting bolt	47.5 to 54.2	4.8 to 5.5	35 to 40
Control valve adaptor and elbow	47.5 to 54.2	4.8 to 5.5	35 to 40
Boom cylinder piston mounting nut	170 to 183	17.3 to 18.6	125 to 135
Bucket cylinder piston mounting nut	170 to 183	17.3 to 18.6	125 to 135
Main frame mounting bolt (M14)	147	15.0	108

W1012736

# 5. DISMOUNTING FRONT LOADER FROM TRACTOR

**■ IMPORTANT**

- When dismounting the loader, park the tractor on flat and hard ground, apply the parking brake.
- When starting the engine or using the hydraulic control valve, always sit in the operator's seat.



**Side Frame**

1. Raise the boom until the stands (1) can be rotated.
2. Stop the engine.
3. Remove the spring pins (2) holding the stands (1) to the boom.
4. Slide the stands (1) outward and rotate them until the hole in the stand and pin on the boom are aligned. Then slide the stands (1) inward and insert the spring pin (2) as shown.
5. Start the engine.
6. Dump the bucket approximately 20 degrees.
7. Lower the boom and raise the front wheels slightly.
8. Stop the engine.
9. Remove the mounting pins (3) from the loader side frames.
10. Start the engine and run at idle. Slowly move the hydraulic control lever (4) to rollback position to raise the loader side frames up and out of the receives of the main frames as shown.
11. Stop the engine.
12. Slowly release all hydraulic pressure by moving the hydraulic control lever (4) in all directions.
13. Disconnect the four hoses with quick couplers at the control valve and place them on the right side of the boom.
14. Place the protective caps and plugs (5) on the quick coupler ends.

**■ IMPORTANT**

- Before starting the engine, make sure hose 4 is securely connected to the pump port.
15. Start the engine and slowly back the tractor away from the loader.

- (1) Stand
- (2) Spring Pin
- (3) Loader Mounting Pin
- (4) Hydraulic Control Lever
- (5) Protective Plug

W1012789

# 6. CHECKING, DISASSEMBLING AND SERVICING

## [1] CONTROL VALVE

### (1) Checking and Adjusting

#### Relief Valve Setting Pressure

■ **NOTE**

- The relief valve is not installed on this model. However the relief valve of the tractor hydraulic system is used as the relief valve of the front loader. Refer to hydraulic section.

(Reference)

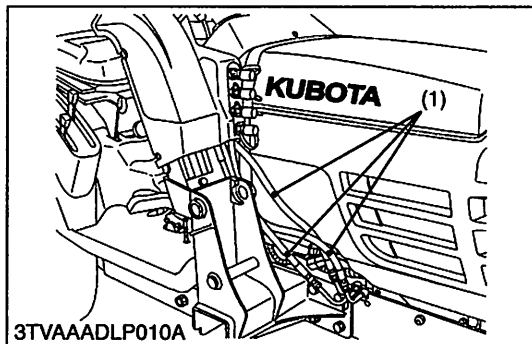
Relief valve setting pressure	Factory spec.	12.3 to 12.7 MPa 125 to 130 kgf/cm <sup>2</sup> 1778 to 1849 psi
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#### **Condition**

- Engine speed..... Maximum
- Oil temperature..... 45 to 55 °C  
113 to 131 °F

W1014688

### (2) Disassembling and Assembling



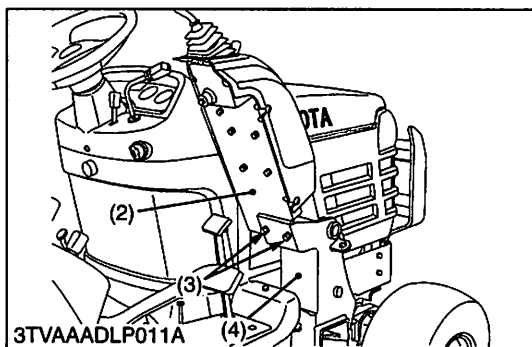
#### Control Valve Stay

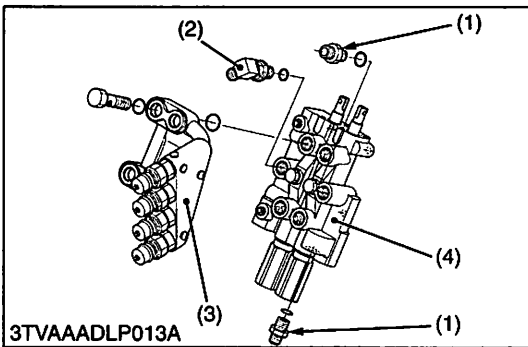
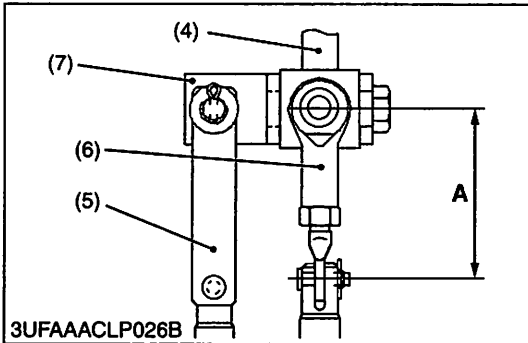
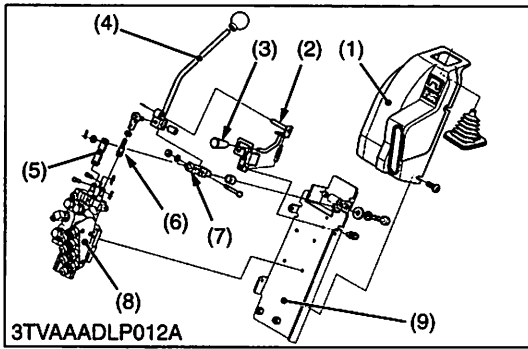
1. Disconnect the hydraulic hoses (1) from the tractor.
2. Remove the control valve stay (2) from the frame RH (4).

Tightening torque	Control valve stay mounting bolt	90.1 N-m 9.2 kgf-m 66.5 ft-lbs
-------------------	----------------------------------	--------------------------------------

- (1) Hydraulic Hose
- (2) Control Valve Stay
- (3) Control Valve Stay Mounting Bolt
- (4) Frame RH

W1013376





**Control Valve**

1. Remove the lock lever grip (3), then remove the control valve cover (1) from the control valve stay (9).
2. Disconnect the hydraulic hoses from adaptors and elbow.
3. Disconnect the control lever (4), lock lever (2) and lever (7).
4. Disconnect the control lever rod 1 (6) and rod 2 (5) at the control valve spools.
5. Remove the control valve (8) from the control valve stay (9).

**(Reference)**

- The length "A" of rod 1 (6) should be adjusted as follows.  
LA210-1 : 61.5 to 62.5 mm (2.42 to 2.46 in.)

- |                         |                        |
|-------------------------|------------------------|
| (1) Control Valve Cover | (6) Rod 1              |
| (2) Lock Lever          | (7) Lever              |
| (3) Lock Lever Grip     | (8) Control Valve      |
| (4) Control Lever       | (9) Control Valve Stay |
| (5) Rod 2               |                        |

W1013522

**Hydraulic Block, Adaptor and Elbow**

1. Remove the hydraulic block (3) from the control valve (4).
2. Remove the adaptors (1) and elbow (2) from the control valve (4).

**(When reassembling)**

- Take care not to damage the O-ring.

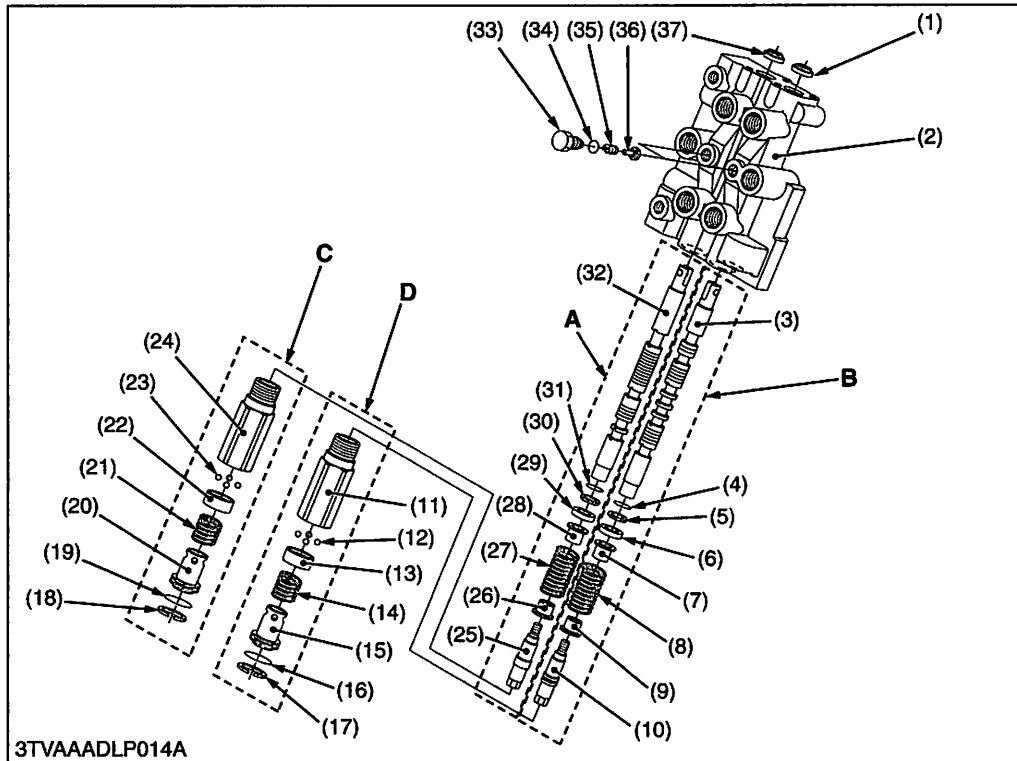
Tightening torque	Hydraulic block mounting bolt	47.5 to 54.2 N·m 4.8 to 5.5 kgf·m 35 to 40 ft-lbs
	Adaptor and elbow	47.5 to 54.2 N·m 4.8 to 5.5 kgf·m 35 to 40 ft-lbs

- |             |                     |
|-------------|---------------------|
| (1) Adaptor | (3) Hydraulic Block |
| (2) Elbow   | (4) Control Valve   |

W1013894



**Disassembling Control Valve**



- (1) Dust Seal
- (2) Valve Body
- (3) Spool
- (4) O-ring
- (5) Back-up Ring
- (6) Collar
- (7) Spring Holder
- (8) Spring
- (9) Spring Holder
- (10) Bolt
- (11) Plug
- (12) Ball
- (13) Seat
- (14) Spring
- (15) Stopper
- (16) O-ring
- (17) Ring
- (18) Ring
- (19) O-ring
- (20) Stopper
- (21) Spring
- (22) Seat
- (23) Ball
- (24) Plug
- (25) Bolt
- (26) Spring Holder
- (27) Spring
- (28) Spring Holder
- (29) Collar
- (30) Back-up Ring
- (31) O-ring
- (32) Spool
- (33) Plug
- (34) O-ring
- (35) Spring
- (36) Load Check Valve
- (37) Dust Seal

**A, C : Bucket Control Section**  
**B, D : Boom Control Section**

W1016062

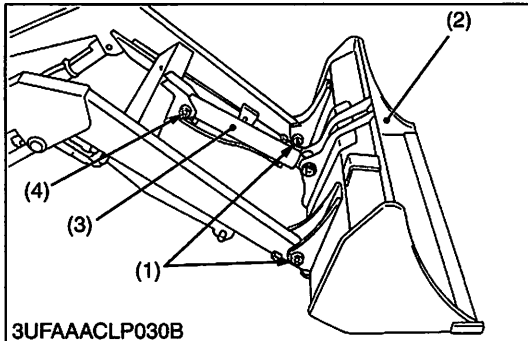
1. Remove the plugs (33) and take out the spring (35) and load check valve (36).
2. Remove the seal plates (11), (24) with other parts inside plug (C), (D).
3. Draw out the spools (3), (32) with other component parts (A), (B) from the valve body (2).

**(When reassembling)**

- Clean all parts with a suitable solvent, and dry with a lint-free cloth or air.
- Visually inspect all parts for damage
- Install the spools to the valve body, using care not to damage the O-ring.

## [2] BUCKET, BOOM AND HYDRAULIC CYLINDERS

### (1) Disassembling and Assembling



#### Bucket and Bucket Cylinder

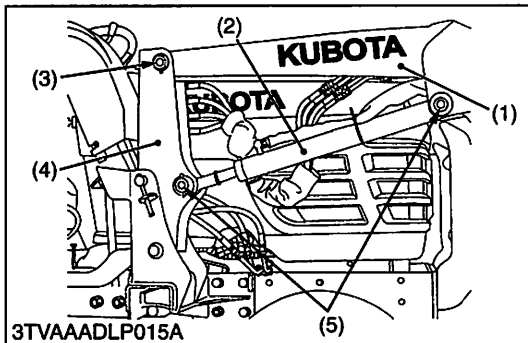
1. Remove the pins (1) and remove the bucket (2).
2. Disconnect the hydraulic hoses from the bucket cylinder (3).
3. Remove the pin (4) and remove the bucket cylinder (3).

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

- When installing the bucket cylinder (3), the hydraulic port should face inside and be careful of the direction of grease fittings.

- |            |                     |
|------------|---------------------|
| (1) Pin    | (3) Bucket Cylinder |
| (2) Bucket | (4) Pin             |

W1016780



#### Boom and Hydraulic Cylinders

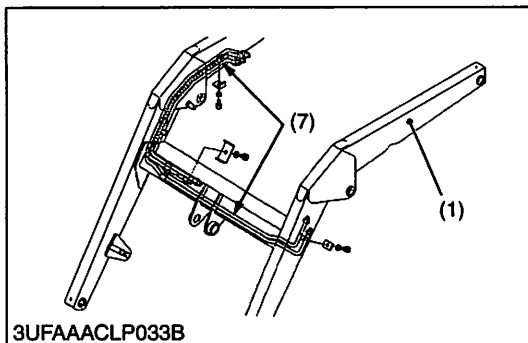
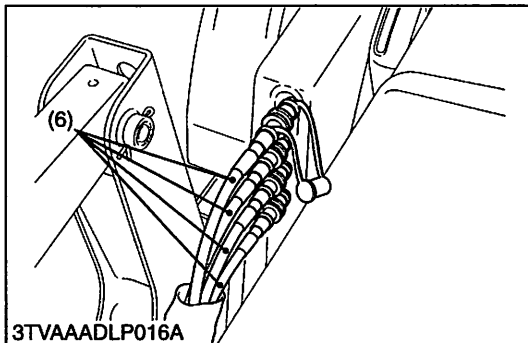
1. Disconnect the hydraulic hoses from the boom cylinders (2).
2. Remove the pins (5) and remove the boom cylinders (2).
3. Disconnect the hydraulic hoses (6) with quick couplers at the control valve.
4. Remove the pins (3) and remove the boom (1) from the side frame (4).
5. Remove the hydraulic tubes (7) from the boom (1).

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

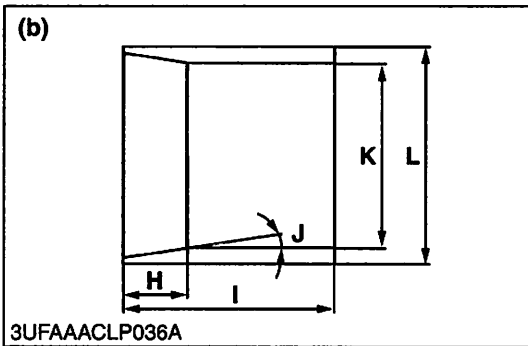
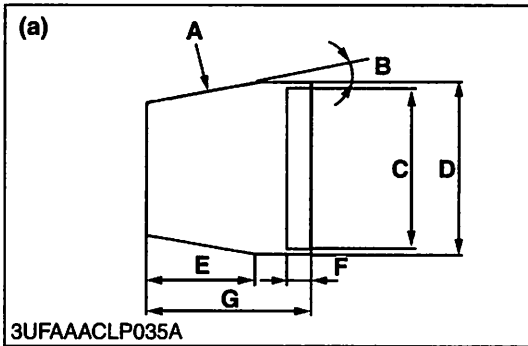
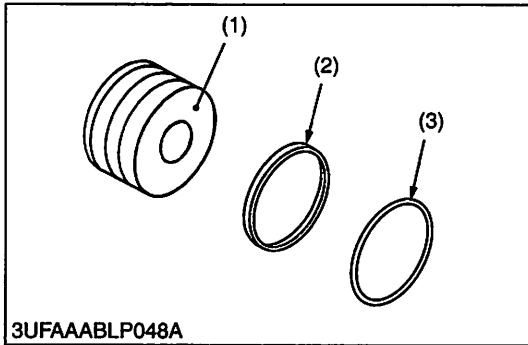
- When installing the boom cylinders (2), the hydraulic port should face inside and be careful of the direction of grease fittings.

- |                   |                    |
|-------------------|--------------------|
| (1) Boom          | (5) Pin            |
| (2) Boom Cylinder | (6) Hydraulic Hose |
| (3) Pin           | (7) Hydraulic Tube |
| (4) Side Frame    |                    |

W1016879







**Piston Seal and O-ring**

1. Remove the piston seal (2) and O-ring (3) from the piston (1).

■ **IMPORTANT**

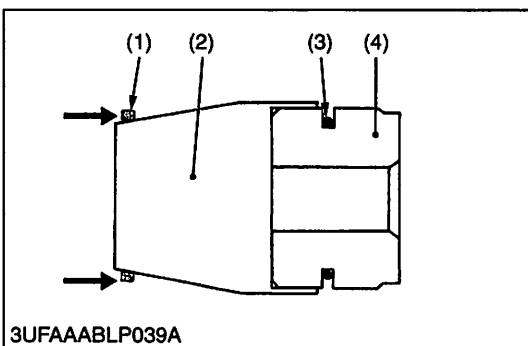
- When installing the O-ring (3) and piston seal (2) to the piston (1), use the slide jig and correcting jig as shown in the figure.

LA210-1	
A	80 √
B	0.0523 rad 3°
C	37.46 mm dia. 1.475 in. dia.
D	39.46 mm dia. 1.554 in. dia.
E	76.0 mm 2.992 in.
F	14.0 mm 0.551 in.
G	100.0 mm 3.937 in.
H	70.0 mm 2.756 in.
I	110.0 mm 4.331 in.
J	0.0523 rad 3°
K	38.1 mm dia. 1.5 in. dia.
L	47.63 mm dia. 1.875 in. dia.

- (1) Piston
- (2) Piston Seal
- (3) O-ring

- (a) : Slide Jig
- (b) : Correcting Jig

W1017590



**Installing O-ring and Piston Seal**

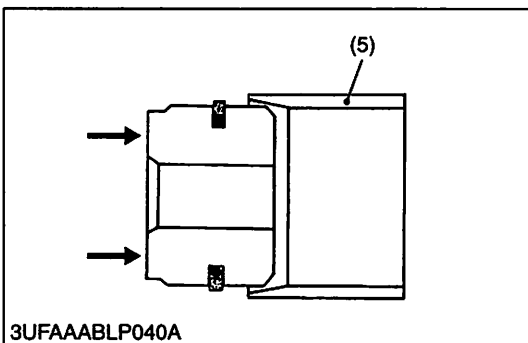
1. Place the slide jig (2) on the piston (4).
2. Install the O-ring (3) to the piston using the slide jig.
3. Install the piston seal (1) over the O-ring using the slide jig.
4. Compress the piston seal to the correct size by installing the piston into the correcting jig (5).

■ **NOTE**

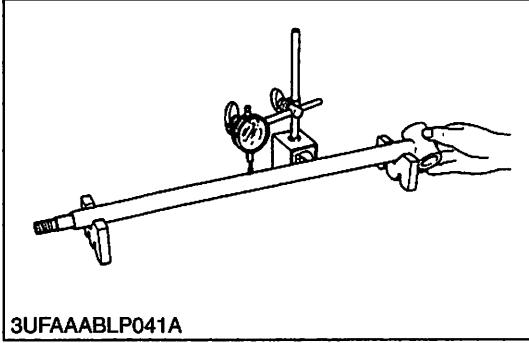
- Do not turn (roll) the piston seal as you install it.

- (1) Piston Seal
- (2) Slide Jig
- (3) O-ring
- (4) Piston
- (5) Correcting Jig

W1018156



**(2) Servicing**



**Piston Rod Bend**

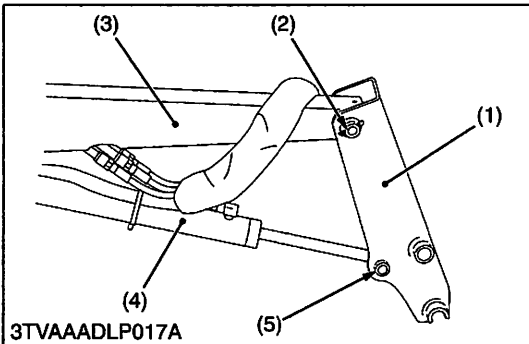
1. Place piston rod on V blocks.
2. Set a dial indicator on the center of the rod.
3. Turn the piston rod and read the dial indicator.
4. If the measurement exceeds the allowable limit, replace it.

Piston rod bend	Allowable limit	0.25 mm 0.0098 in.
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W1018329

**[3] SIDE FRAMES, FRONT GUARD, HYDRAULIC TUBES AND MAIN FRAMES**

**(1) Disassembling and Assembling**

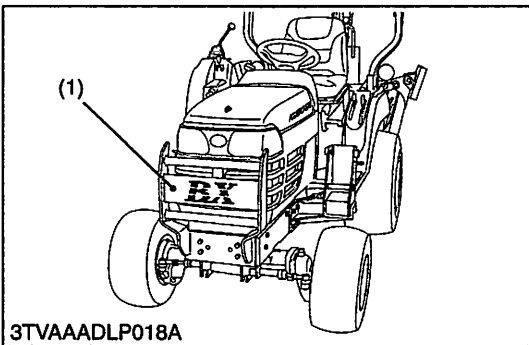


**Side Frames**

1. Remove the pins (2), (5).
2. Remove the side frames (1) from the boom assembly (3) and the boom cylinder (4).

- (1) Side Frame
- (2) Pin
- (3) Boom Assembly
- (4) Boom Cylinder
- (5) Pin

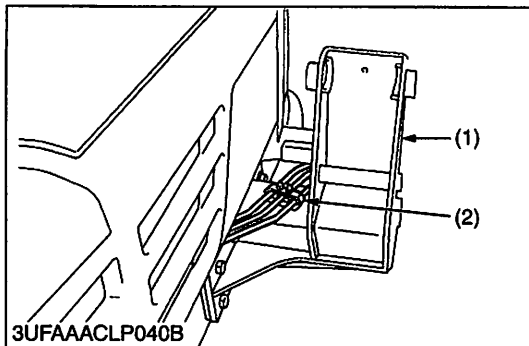
W1015835



**Front Guard**

1. Remove the front guard (1).
- (1) Front Guard

W1015954



**Main Frames**

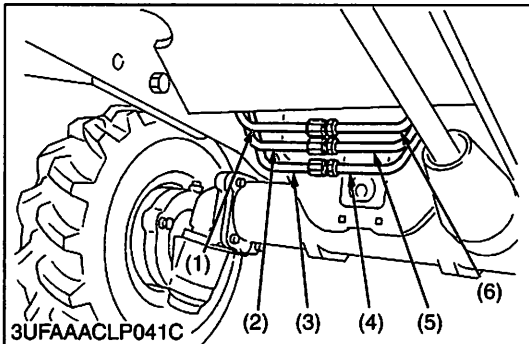
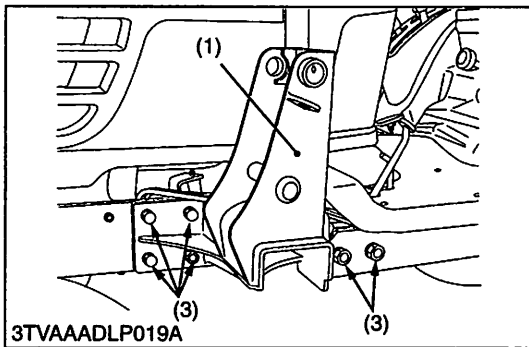
1. Remove the tube clamp (2).
2. Remove the main frame mounting bolts and nuts (3) from the tractor body.
3. Remove the main frame (1).

Tightening torque	Main frame mounting bolt and nut	147 N·m 15.0 kgf·m 108 ft·lbs
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- (1) Main Frame  
(2) Tube Clamp

- (3) Main Frame Mounting Bolt and Nut

W1016042



**Hydraulic Tubes**

1. Remove the tube clamp.
2. Disconnect the return tube 2 (4) with the male coupler from the return tube 1 (3) as shown.
3. Disconnect the pump tube 2 (5) with the male coupler from the pump tube 1 (2) as shown.
4. Disconnect the delivery tube 2 (6) with the male coupler from the delivery tube 1 (1) as shown.

- (1) Delivery Tube 1  
(2) Pump Tube 2  
(3) Return Tube 1

- (4) Return Tube 2  
(5) Pump Tube 2  
(6) Delivery Tube 2



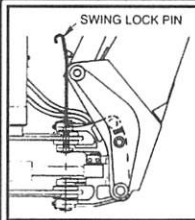
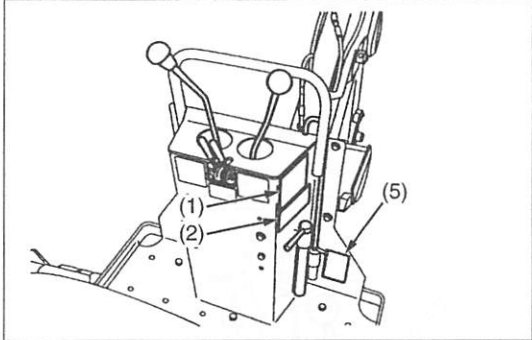

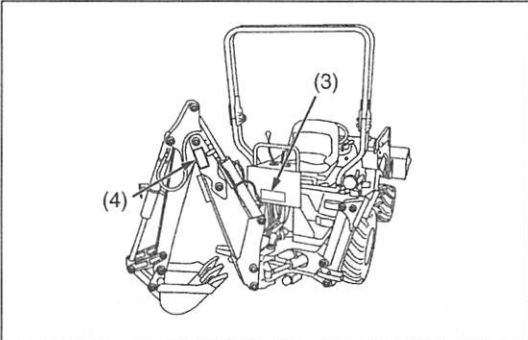
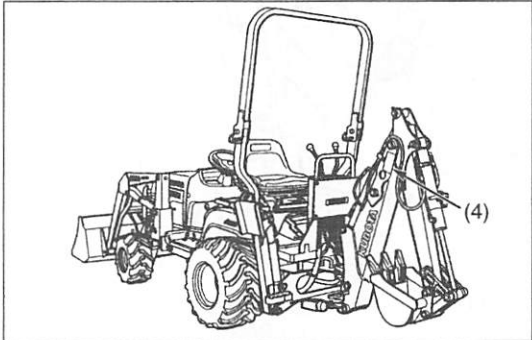
W1016403

# 8 BACKHOE

# 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.

<p>(1) Part No. 75597-7528-1</p> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>TO AVOID PERSONAL INJURY: WHEN MOUNTING AND DISMOUNTING THE BACKHOE.</b></p> <ol style="list-style-type: none"> <li>1. When starting the engine, always sit in the operator's seat.</li> <li>2. When getting off the tractor, make sure that PTO lever is off and range gear shift lever is in neutral. Then set the parking brake.</li> <li>3. Keep hands, feet and body from between tractor and backhoe. Never allow any part of body under the machine.</li> </ol> </div>	<p>(4) Part No. 75595-7517-2</p> <div style="border: 1px solid black; padding: 5px;">  <div style="float: right; border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; padding: 5px;"> <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>TO AVOID PERSONAL INJURY</b> STAY CLEAR OR OPERATING AREA OF THE BACKHOE.</p> </div> </div>	<p>(5) Part No. 75595-7524-2</p> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;"><b>⚠ WARNING</b></p>  <div style="border-top: 1px solid black; border-right: 1px solid black; border-left: 1px solid black; padding: 5px;"> <p><b>TO AVOID PERSONAL INJURY:</b> KEEP BOTH FEET ON FOOT PLATFORM AND AWAY FROM STABILIZER.</p> </div> </div>
<p>(2) Part No. 75595-7529-3</p> <div style="border: 1px solid black; padding: 5px;">  <div style="float: right; border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; padding: 5px;"> <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>TO AVOID PERSONAL INJURY:</b> SET THE SWING LOCK PIN, AND LOWER THE BOOM TO THE GROUND WHEN LEAVING THE OPERATOR'S SEAT.</p> </div> </div>		
<p>(3) Part No. 75597-7517-2</p> <div style="border: 1px solid black; padding: 5px;">  <div style="float: right; border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; padding: 5px;"> <p style="text-align: center;"><b>⚠ DANGER</b></p> <p><b>TO AVOID SERIOUS CRUSHING INJURY OR DEATH:</b> MAKE SURE BOOM SWING LOCK PIN IS INSTALLED FROM OPERATOR'S SEAT BEFORE ENTERING THIS AREA.</p> </div> </div>		
		

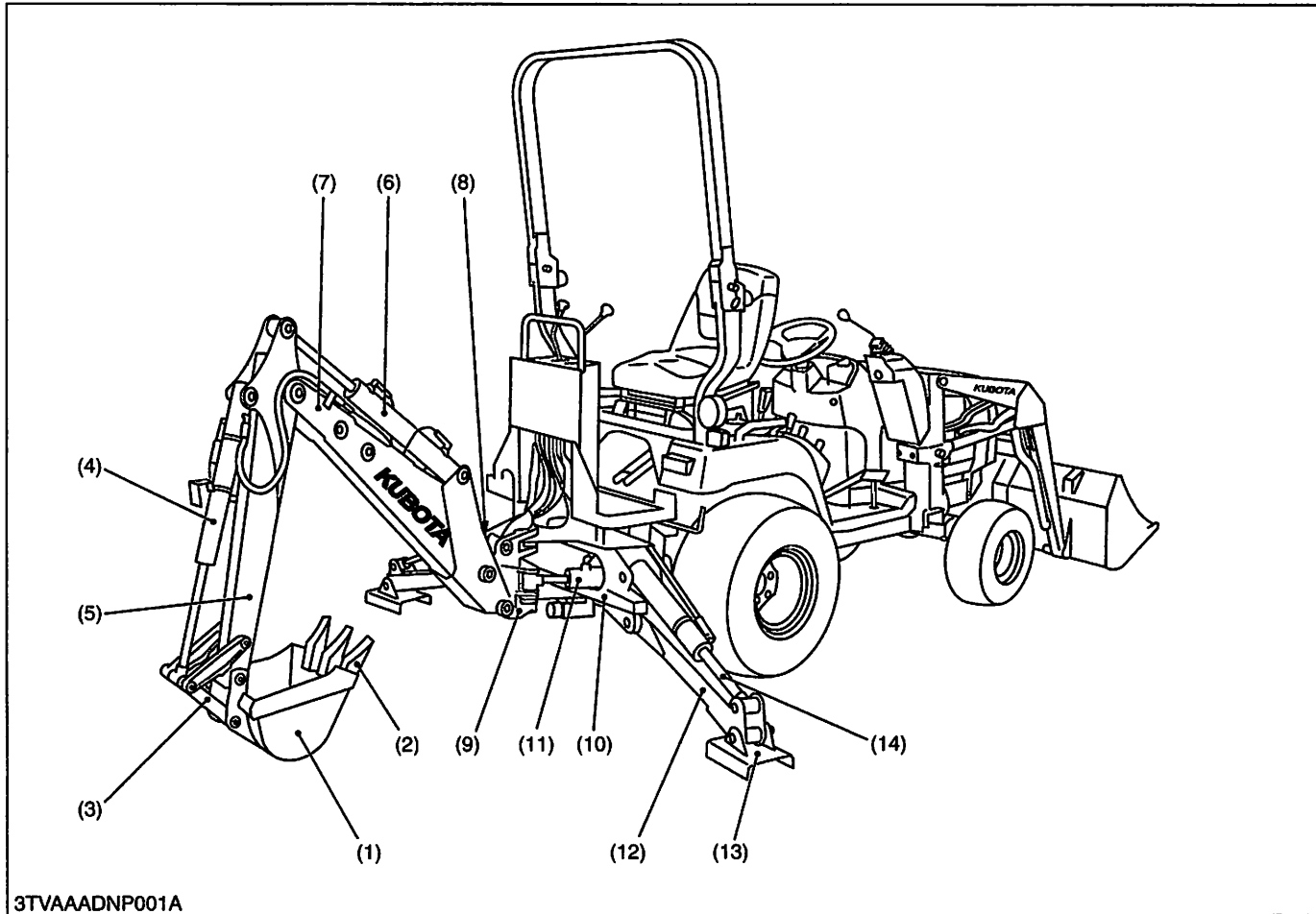
**CARE OF DANGER, WARNING AND CAUTION LABELS**

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

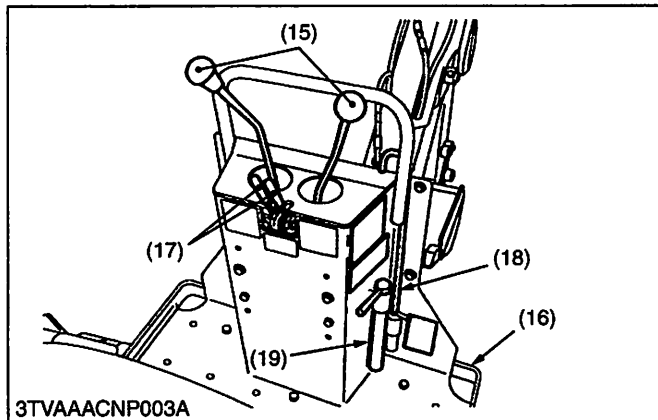
3TVAAACNP001A



# BACKHOE TERMINONOLOGY



3TVAAADNP001A

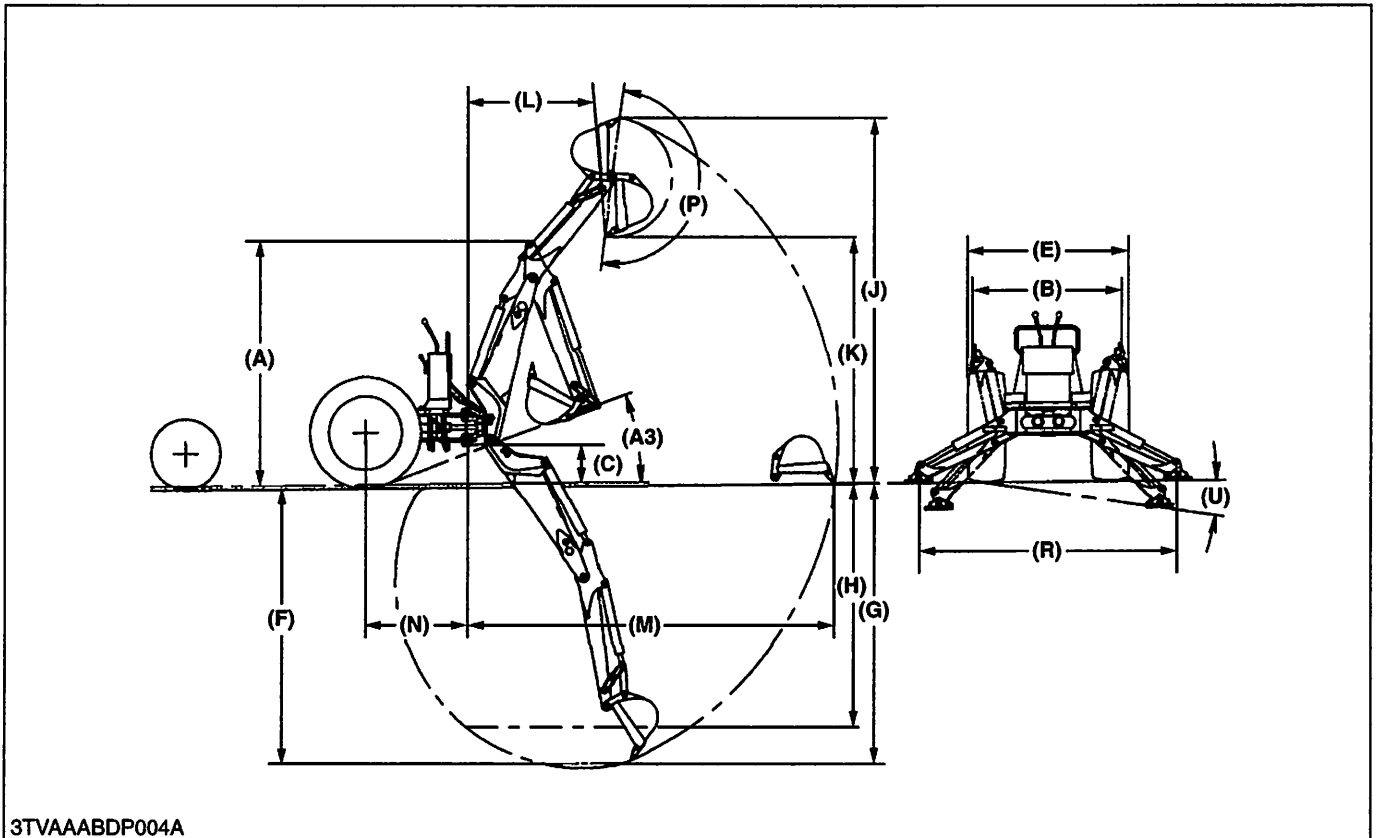


3TVAAACNP003A

- |                     |                          |                          |                               |
|---------------------|--------------------------|--------------------------|-------------------------------|
| (1) Backhoe Bucket  | (6) Dipperstick Cylinder | (11) Swing Cylinder      | (16) Step                     |
| (2) Bucket Teeth    | (7) Boom                 | (12) Stabilizer          | (17) Stabilizer Control Lever |
| (3) Bucket Link     | (8) Boom Cylinder        | (13) Stabilizer Pad      | (18) Swing Lock Pin           |
| (4) Bucket Cylinder | (9) Swing Frame          | (14) Stabilizer Cylinder | (19) Boom Lock Pin            |
| (5) Dipperstick     | (10) Main Frame          | (15) Joystick Control    |                               |

# SPECIFICATIONS

## ■ Operating Dimensions



3TVAAABDP004A

Model		BT600
(A)	Transport Height	1572 mm (61.9 in.)
(B)	Stabilizer Spread Transport	1360 mm (53.51 in.)
(C)	Ground Clearance	228 mm (9.0 in.)
(E)	Overall Width	1128 mm (44.4 in.)
(F)	Maximum Digging Depth	1882 mm (74.1 in.)
(G)	Digging Depth 2 ft., Flat Bottom	1840 mm (72.4 in.)
(H)	Digging Depth 8 ft., Flat Bottom	1095 mm (43.1 in.)
(J)	Operating Height Fully Raised	2456 mm (96.7 in.)
(K)	Loading Height	1636 mm (64.4 in.)
(L)	Loading Reach	894 mm (35.2 in.)
(M)	Reach from Swing Pivot	2484 mm (97.8 in.)
(N)	Swing Pivot to Rear Axle Center Line	726 mm (28.6 in.)
(P)	Bucket Rotation	180 deg.
(R)	Stabilizer Spread-Operation	1990 mm (78.3 in.)
(A3)	Angle of Departure per SAE J1234	18.3 deg.
(U)	Leveling Angle	9.6 deg.
	Swing Arc	140 deg.

NOTE: The specifications are taken with KUBOTA BX22 tractor. (Tire size : Front 18 × 18.5-8, Rear 26 × 12.00-12)

W1028417

■ Digging Force (Per SAE J49)

Model	BT600
With bucket cylinder	8610 N (1936 lbs)
With dipperstick cylinder	5057 N (1137 lbs)

W1027852

■ Cycle Time (Seconds)

Boom cylinder, extend	4.7
Boom cylinder, retract	3.7
Swing cylinder, from 70 ° to center	1.6
Dipperstick cylinder, extend	4.0
Dipperstick cylinder, retract	3.0
Bucket cylinder, extend	3.1
Bucket cylinder, retract	2.2
Stabilizer cylinders, max. height to ground	2.8
Stabilizer cylinders, ground to max. height	2.2

W1028902

■ Hydraulic Cylinders

	Boom cm (in.)	Dipperstick cm (in.)	Bucket mm (in.)	Stabilizer cm (in.)	Swing cm (in.)
Rod diameter	3.0 (1.18)	3.0 (1.18)	3.0 (1.18)	3.0 (1.18)	3.0 (1.18)
Cylinder bore	6.0 (2.36)	6.0 (2.36)	5.0 (1.97)	6.0 (2.36)	6.0 (2.36)

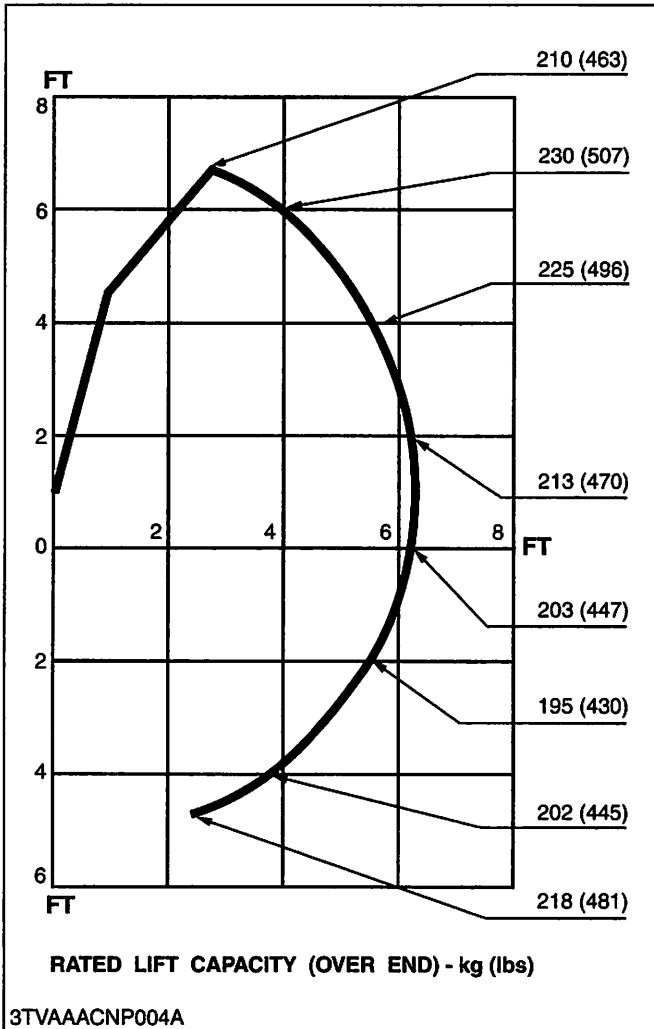
W1028958

■ Bucket Sizes

	Width cm (in.)	SAE Struck Capacity m <sup>3</sup> (cu-ft)	SAE Heaped Capacity m <sup>3</sup> (cu-ft)	Number of Teeth	Weight kg (lbs)
Trenching 10"	25.4 (10)	0.013 (0.459)	0.018 (0.636)	3	17 (37)
Trenching 12"	30.5 (12)	0.016 (0.565)	0.022 (0.777)	3	18 (40)

W1029014

■ Lift Capacity (Per SAE J31)



Lift capacities shown are 87 % of maximum lift force, according to SAE definition.

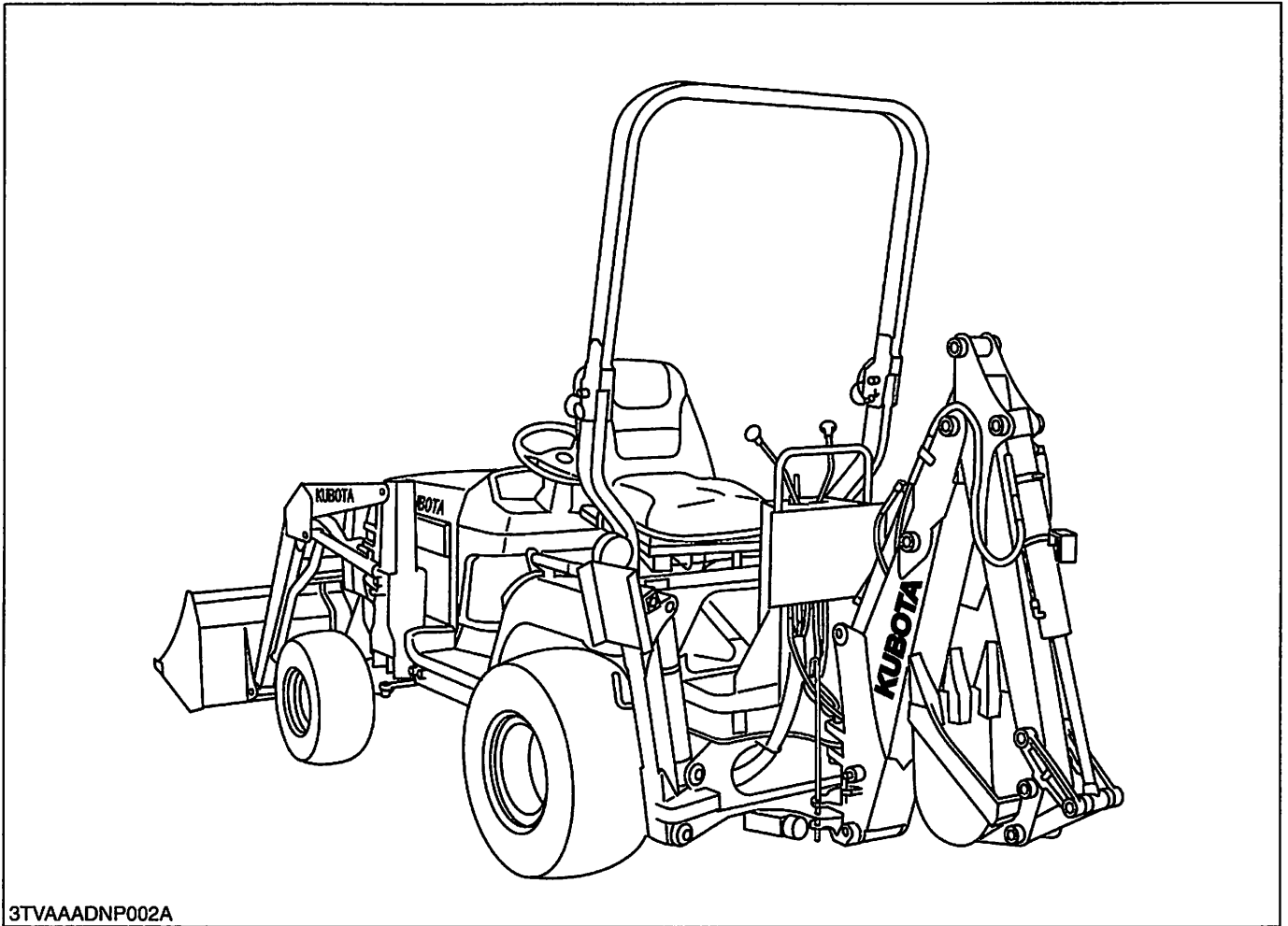
W1029646

# MECHANISM

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# 1. FEATURES

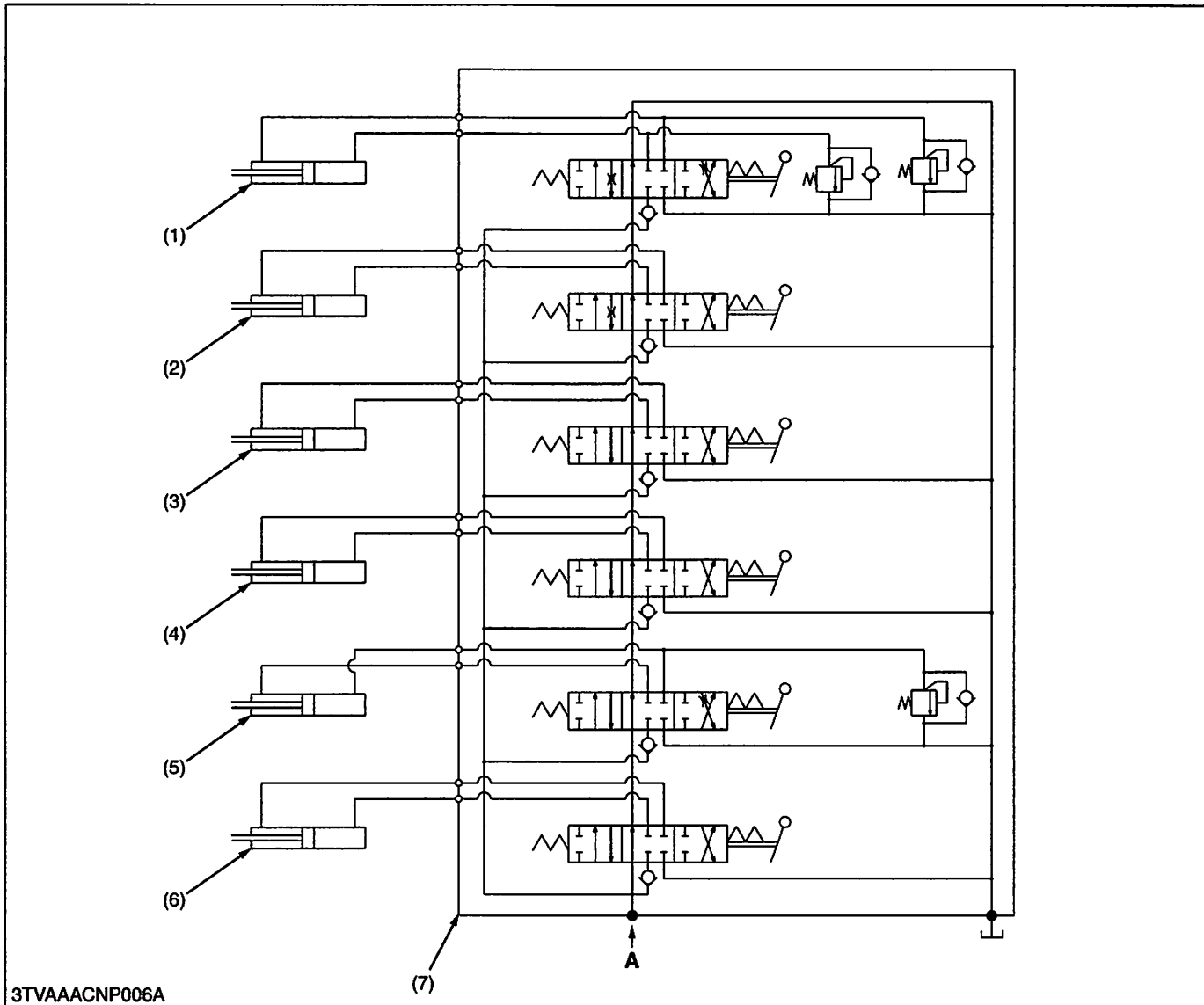


3TVAAADNP002A

1. Backhoe Quick-Attach, Easy-ON and Easy-OFF
2. A Maximum Digging Depth of 6 feet
3. Reversible Stabilizer Flip Pads (Option)
4. Improved Operator Comfort
5. Safety During Transportation

# 2. HYDRAULIC SYSTEM

## [1] HYDRAULIC CIRCUIT



3TVAAACNP006A

- (1) Swing Cylinder
- (2) Boom Cylinder
- (3) Stabilizer Cylinder LH

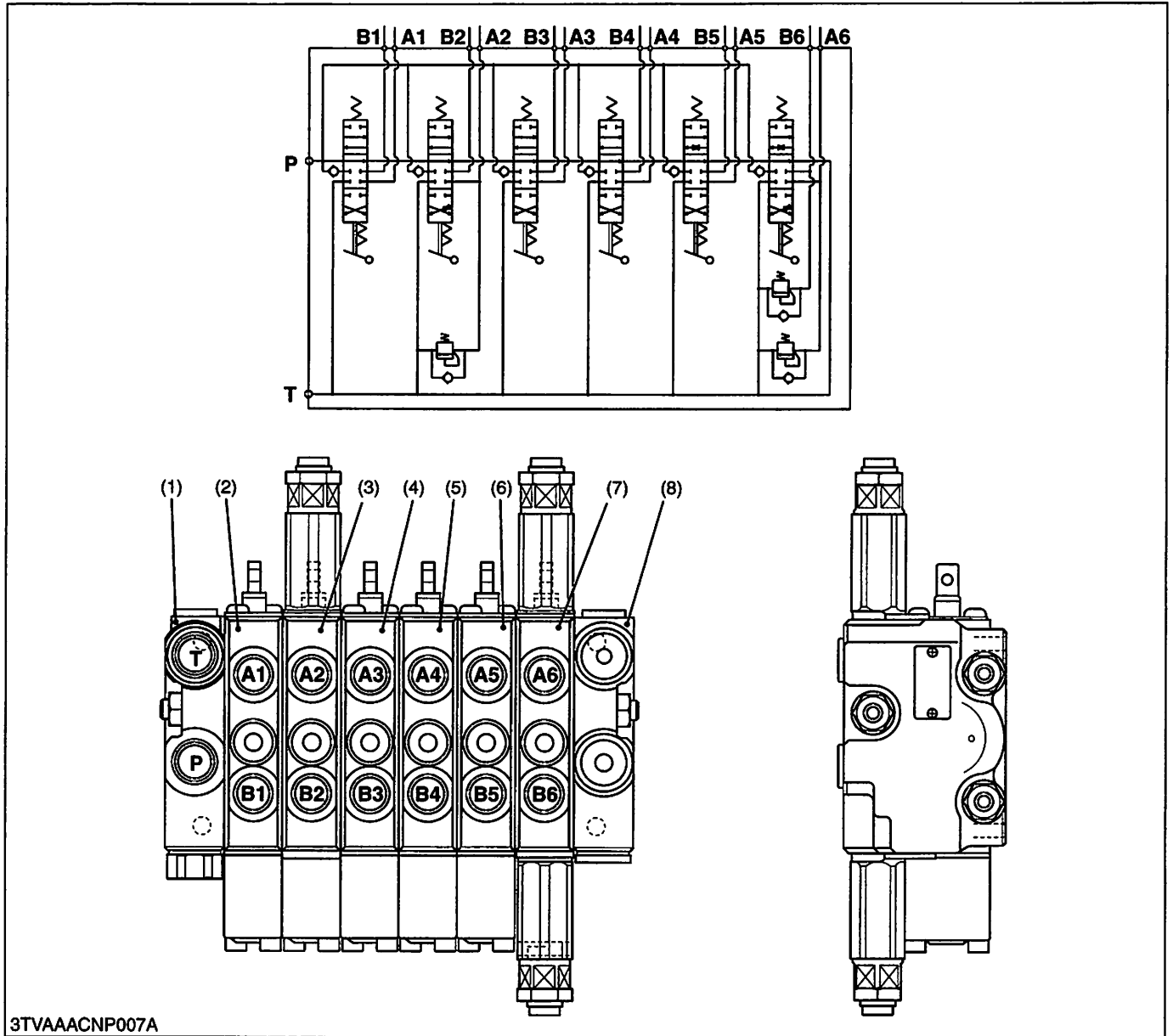
- (4) Stabilizer Cylinder RH
- (5) Dipperstick Cylinder

- (6) Bucket Cylinder
- (7) Backhoe Control Valve

**A : From Hydraulic Pump**  
 (Approx. 14.7 L/min.,  
 3.7 U.S.gals./min.,  
 3.08 Imp.gals./min.)

## [2] CONTROL VALVE

### (1) Structure



3TVAAACNP007A

(1) Inlet Section

(2) Bucket Control Valve

(3) Dipperstick Control Valve

(4) Stabilizer RH Control Valve

(5) Stabilizer LH Control Valve

(6) Boom Control Valve

(7) Swing Control Valve

(8) Outlet Section

P : Pump Port

T : Tank Port

A1 : A1 Port

A2 : A2 Port

A3 : A3 Port

A4 : A4 Port

A5 : A5 Port

A6 : A6 Port

B1 : B1 Port

B2 : B2 Port

B3 : B3 Port

B4 : B4 Port

B5 : B5 Port

B6 : B6 Port

#### (1) Inlet / Outlet Section

This section has P and T ports.

The P port is connected to the **OUTLET** port of tractor connected by the quick coupler.

The T port is connected to the **RETURN** port of tractor connected by the quick coupler.

#### (2) Control Valve Section

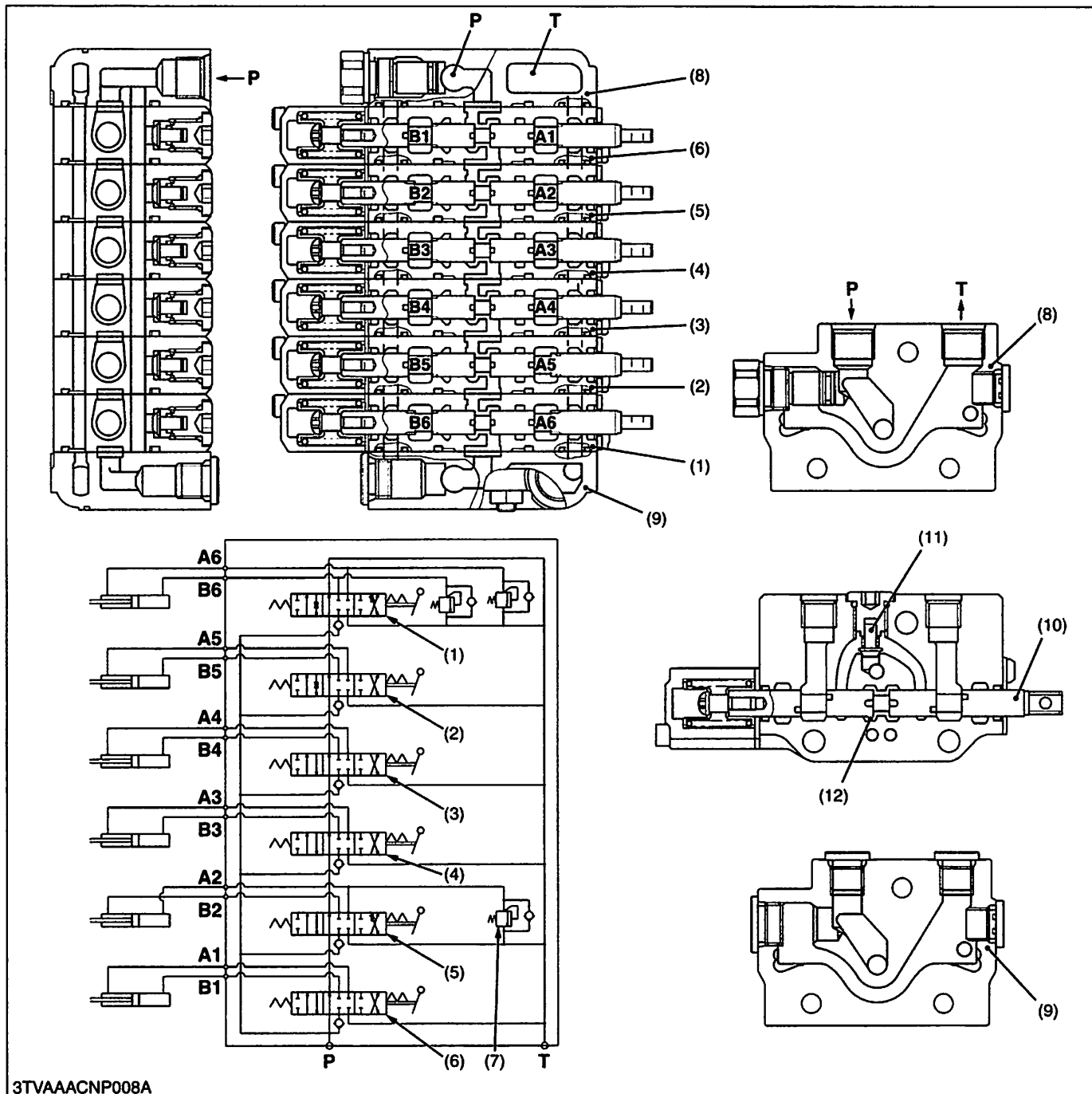
The control valves are of 3 positions, 6 connections, no detent, spring center type. These valves have A and B ports and control oil flow to each cylinders.

These are consisting of a valve housing, spool, load check valve, overload relief valve, etc..



## (2) Operation

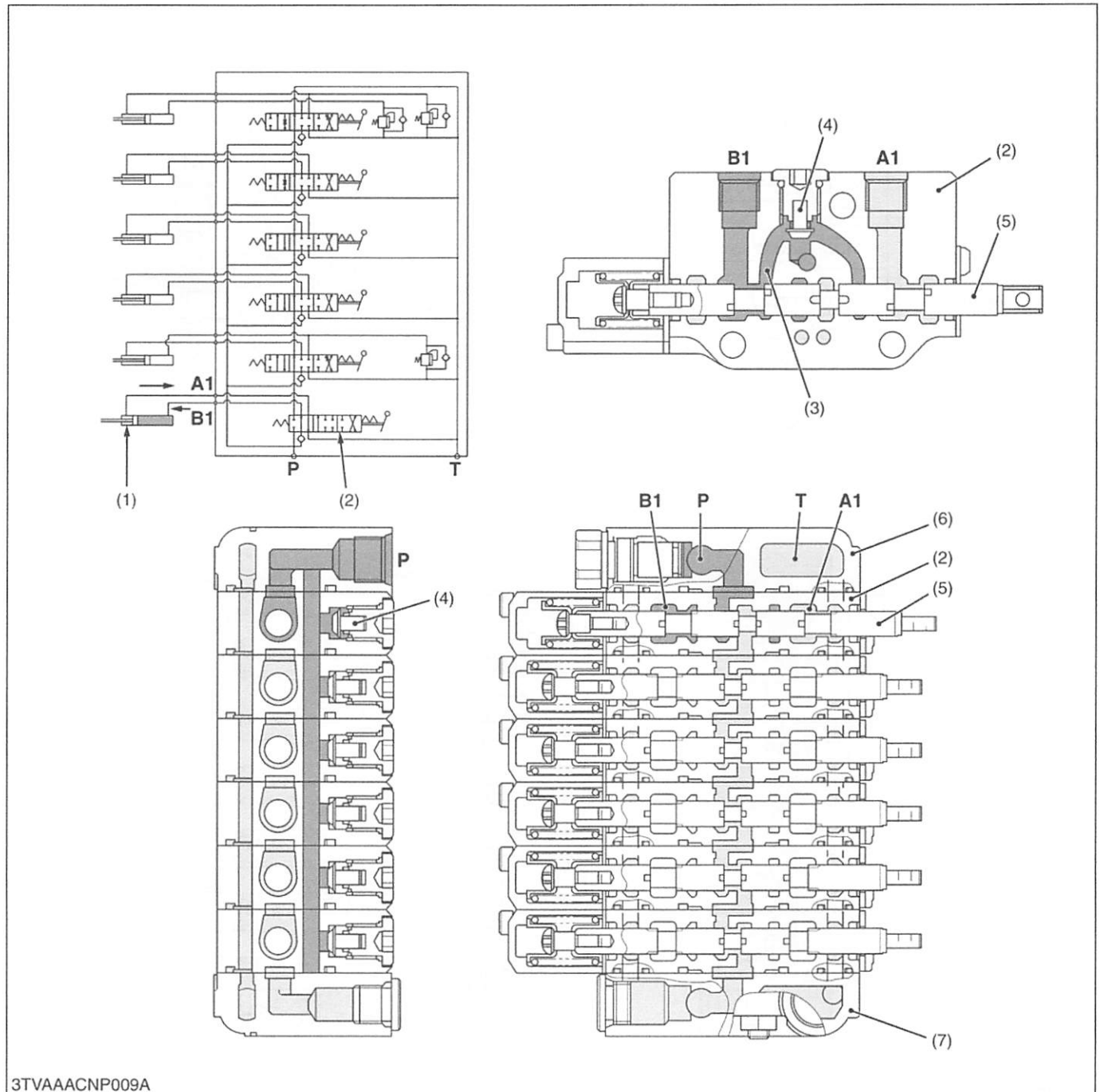
### ■ Neutral



- |                                 |   |                      |                     |
|---------------------------------|---|----------------------|---------------------|
| (1) Swing Control Valve         | (7) Overload Relief Valve (Port Relief Valve) | <b>P : Pump Port</b> | <b>B1 : B1 Port</b> |
| (2) Boom Control Valve          | (8) Inlet Section                             | <b>T : Tank Port</b> | <b>B2 : B2 Port</b> |
| (3) Stabilizer LH Control Valve | (9) Outlet Section                            | <b>A1 : A1 Port</b>  | <b>B3 : B3 Port</b> |
| (4) Stabilizer RH Control Valve | (10) Spool                                    | <b>A2 : A2 Port</b>  | <b>B4 : B4 Port</b> |
| (5) Dipperstick Control Valve   | (11) Load Check Valve                         | <b>A3 : A3 Port</b>  | <b>B5 : B5 Port</b> |
| (6) Bucket Control Valve        | (12) Neutral Passage                          | <b>A4 : A4 Port</b>  | <b>B6 : B6 Port</b> |
|                                 |   | <b>A5 : A5 Port</b>  |                     |
|                                 |   | <b>A6 : A6 Port</b>  |                     |

Pressure-fed oil from the hydraulic pumps are delivered into **P** port in the inlet section (8).  
 As the load check valves (11) are kept closed in the neutral position, oil flows along the notched section of the spools (10) to the **T** port through the neutral passage (12).  
 Then the oil is fed to the transmission case via the return hose and pipe from the **T** port.

■ Bucket (Roll-back)

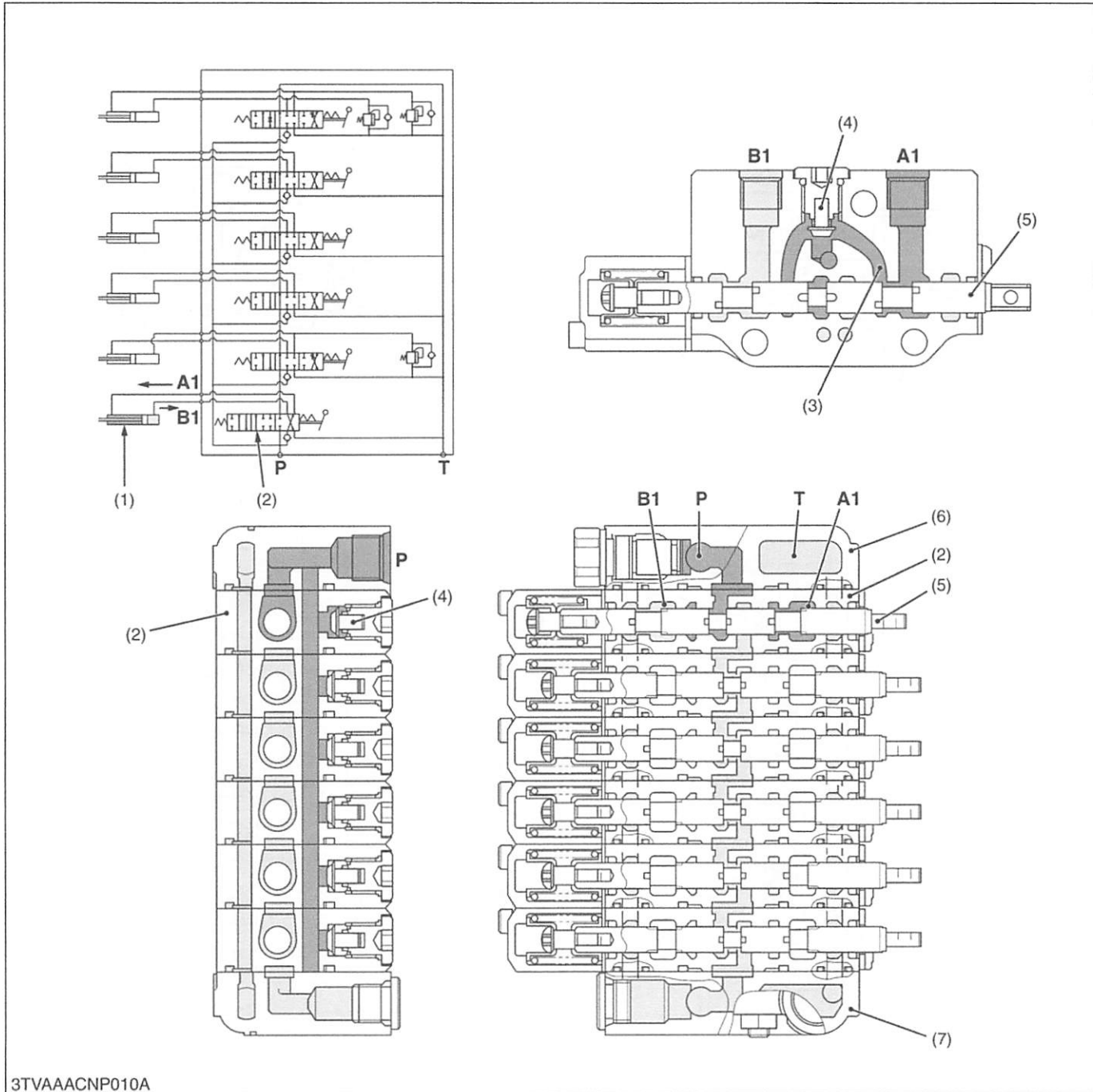


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- |                          |                    |                   |                               |
|--------------------------|--------------------|-------------------|-------------------------------|
| (1) Bucket Cylinder      | (5) Spool          | <b>P : P Port</b> | <b>A1 : A1 Port</b>           |
| (2) Bucket Control Valve | (6) Inlet Section  | <b>T : T Port</b> | <b>(From Bucket Cylinder)</b> |
| (3) Bridge Passage       | (7) Outlet Section |                   | <b>B1 : B1 Port</b>           |
| (4) Load Check Valve     |                    |                   | <b>(To Bucket Cylinder)</b>   |

1. When the dipperstick and bucket lever is moved to the left to set to the “**ROLL-BACK**” position, the spool (5) of the bucket control valve (2) moves to the right, which forms oil passage between bridge passage (3) and **B1** port, and between **A1** port and **T** port.
2. The pressure-fed oil from the **P** port opens the load check valve (4) and flows to **B1** port to extend the bucket cylinder (1).
3. Return oil from the bucket cylinder (1) returns to the transmission case through the **A1** port, low pressure passage and **T** port.

■ Bucket (Dump)

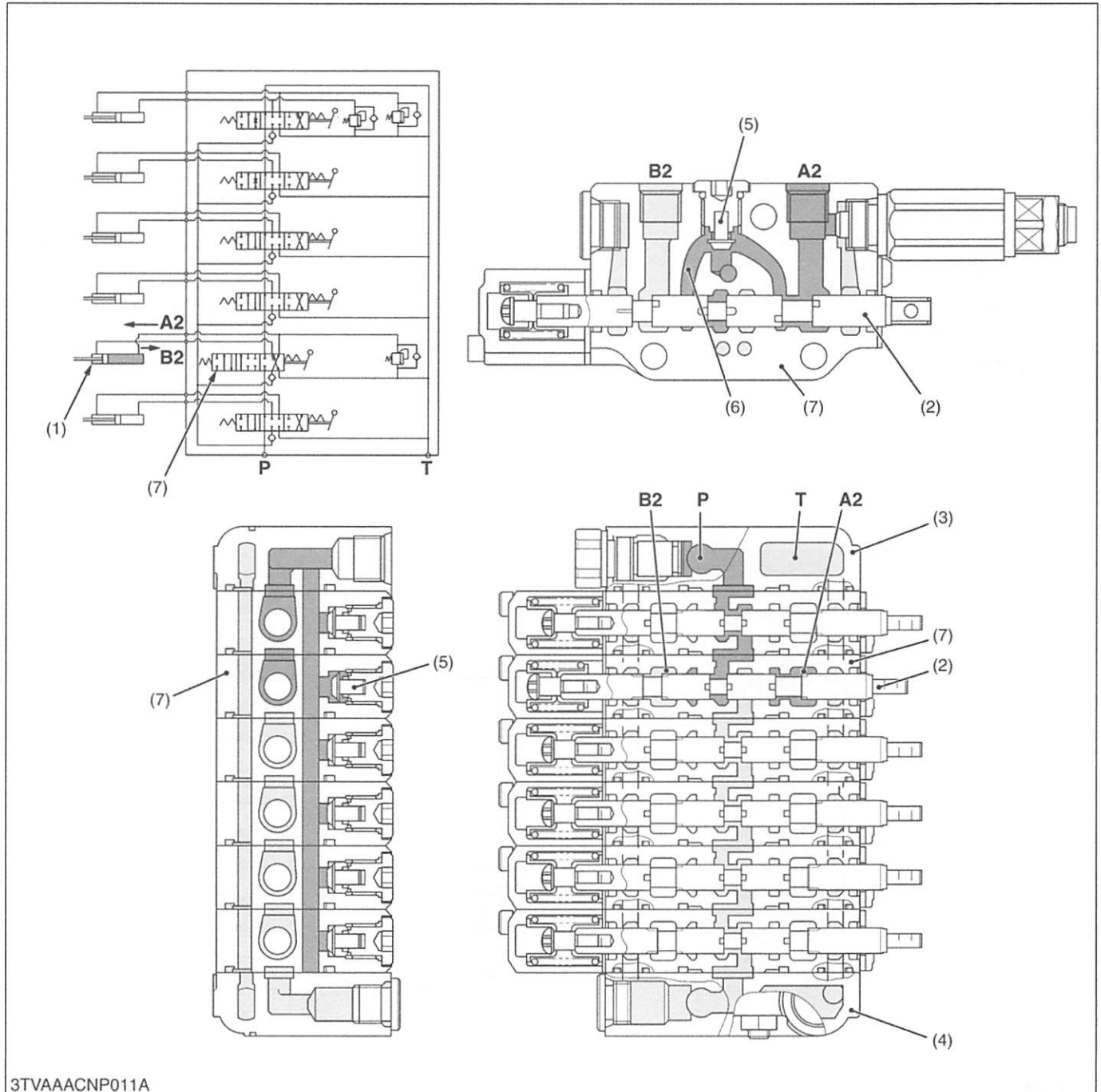


3TVAAACNP010A

- |                          |                    |                   |                               |
|--------------------------|--------------------|-------------------|-------------------------------|
| (1) Bucket Cylinder      | (5) Spool          | <b>P : P Port</b> | <b>A1 : A1 Port</b>           |
| (2) Bucket Control Valve | (6) Inlet Section  | <b>T : T Port</b> | <b>(To Bucket Cylinder)</b>   |
| (3) Bridge Passage       | (7) Outlet Section |                   | <b>B1 : B1 Port</b>           |
| (4) Load Check Valve     |                    |                   | <b>(From Bucket Cylinder)</b> |

- When the dipperstick and bucket lever is moved to the right to set to the “DUMP” position, the spool (5) of the bucket control valve (2) moves to the left, which forms oil passage between bridge passage (3) and A1 port, and between B1 port and T port.
- The pressure-fed oil from the P port opens the load check valve (4) and flows to A1 port to retract the bucket cylinder.
- Return oil from the bucket cylinder returns to the transmission case through the B1 port, low pressure passage and T port.

■ Dipperstick (Crowd)

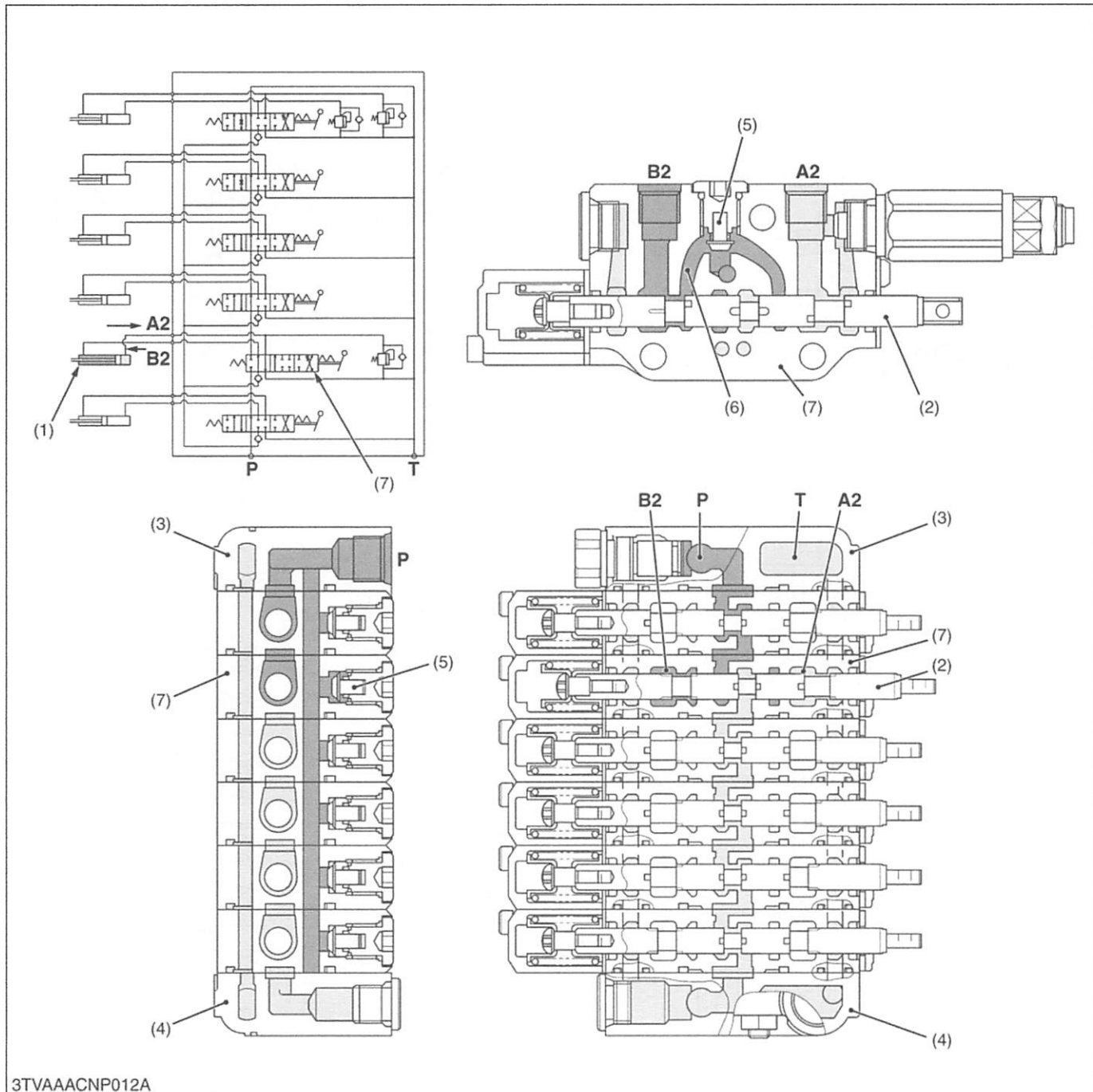


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- |                          |                               |                   |                                    |
|--------------------------|-------------------------------|-------------------|------------------------------------|
| (1) Dipperstick Cylinder | (5) Load Check Valve          | <b>P : P Port</b> | <b>A2 : A2 Port</b>                |
| (2) Spool                | (6) Bridge Passage            | <b>T : T Port</b> | <b>(From Dipperstick Cylinder)</b> |
| (3) Inlet Section        | (7) Dipperstick Control Valve |                   | <b>B2 : B2 Port</b>                |
| (4) Outlet Section       |                               |                   | <b>(To Dipperstick Cylinder)</b>   |

1. When the dipperstick and bucket lever is pulled to the backward to set to the “**CROWD**” position, the spool (2) of the dipperstick control valve (7) moves to the left, which forms oil passage between bridge passage (6) and **B2** port, and between **A2** port and **T** port.
2. The pressure-fed oil from the **P** port opens the load check valve (5) and flows to **B2** port to extend the dipperstick cylinder.
3. Return oil from the dipperstick cylinder returns to the transmission case through the **A2** port, low pressure passage and **T** port.

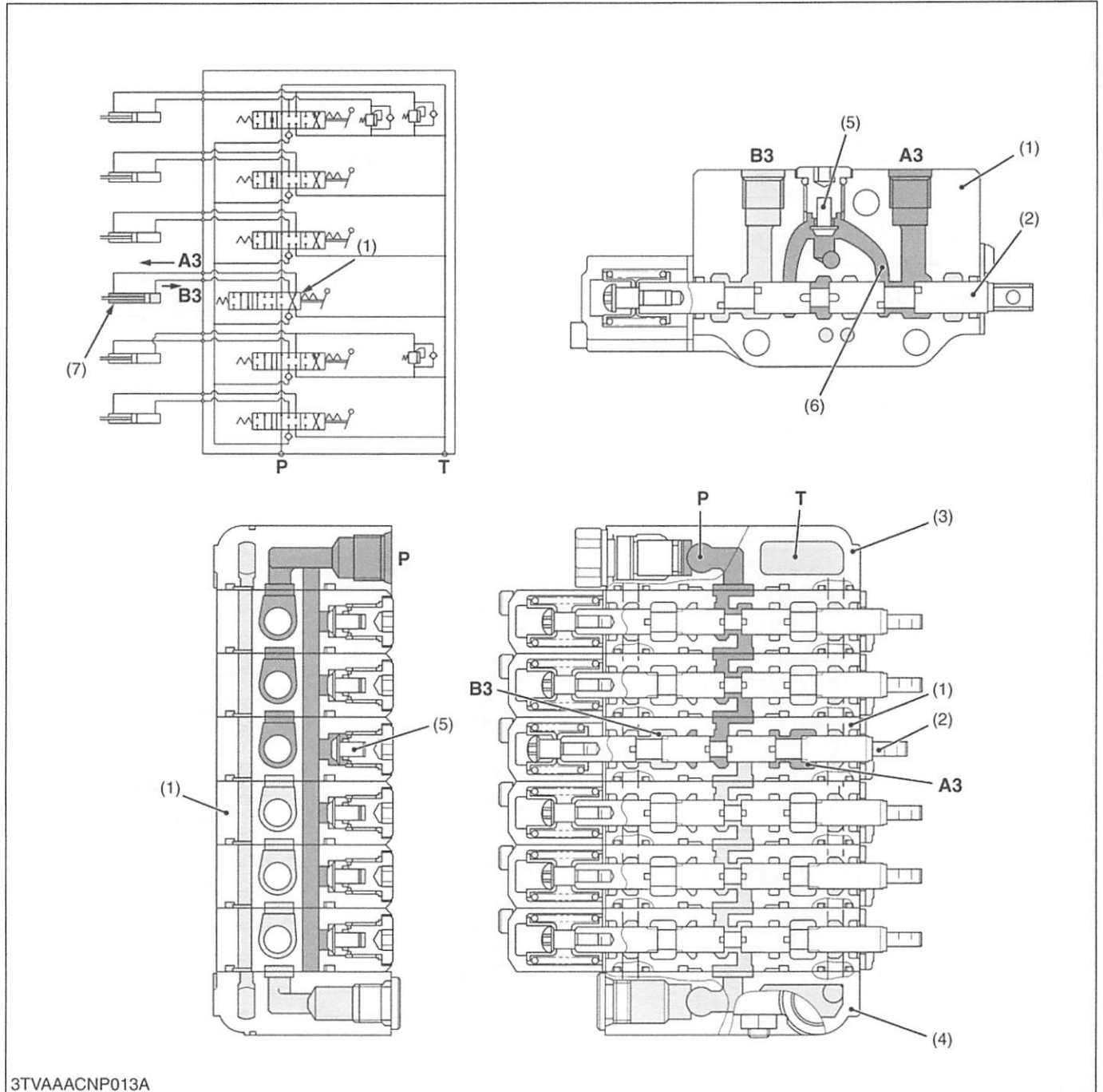
■ Dipperstick (Extend)



- |                          |                               |                   |                                    |
|--------------------------|-------------------------------|-------------------|------------------------------------|
| (1) Dipperstick Cylinder | (5) Load Check Valve          | <b>P : P Port</b> | <b>A2 : A2 Port</b>                |
| (2) Spool                | (6) Bridge Passage            | <b>T : T Port</b> | <b>(To Dipperstick Cylinder)</b>   |
| (3) Inlet Section        | (7) Dipperstick Control Valve |                   | <b>B2 : B2 Port</b>                |
| (4) Outlet Section       |                               |                   | <b>(From Dipperstick Cylinder)</b> |

- When the dipperstick and bucket lever is pushed to the forward to set to the “**EXTEND**” position, the spool (2) of the dipperstick control valve (7) moves to the right, which forms oil passage between bridge passage (6) and **A2** port, and between **B2** port and **T** port.
- The pressure-fed oil from the **P** port opens the load check valve (5) and flows to **A2** port to retract the dipperstick cylinder.
- Return oil from the dipperstick cylinder returns to the transmission case through the **B2** port, low pressure passage and **T** port.

■ Stabilizer RH (Shrink)

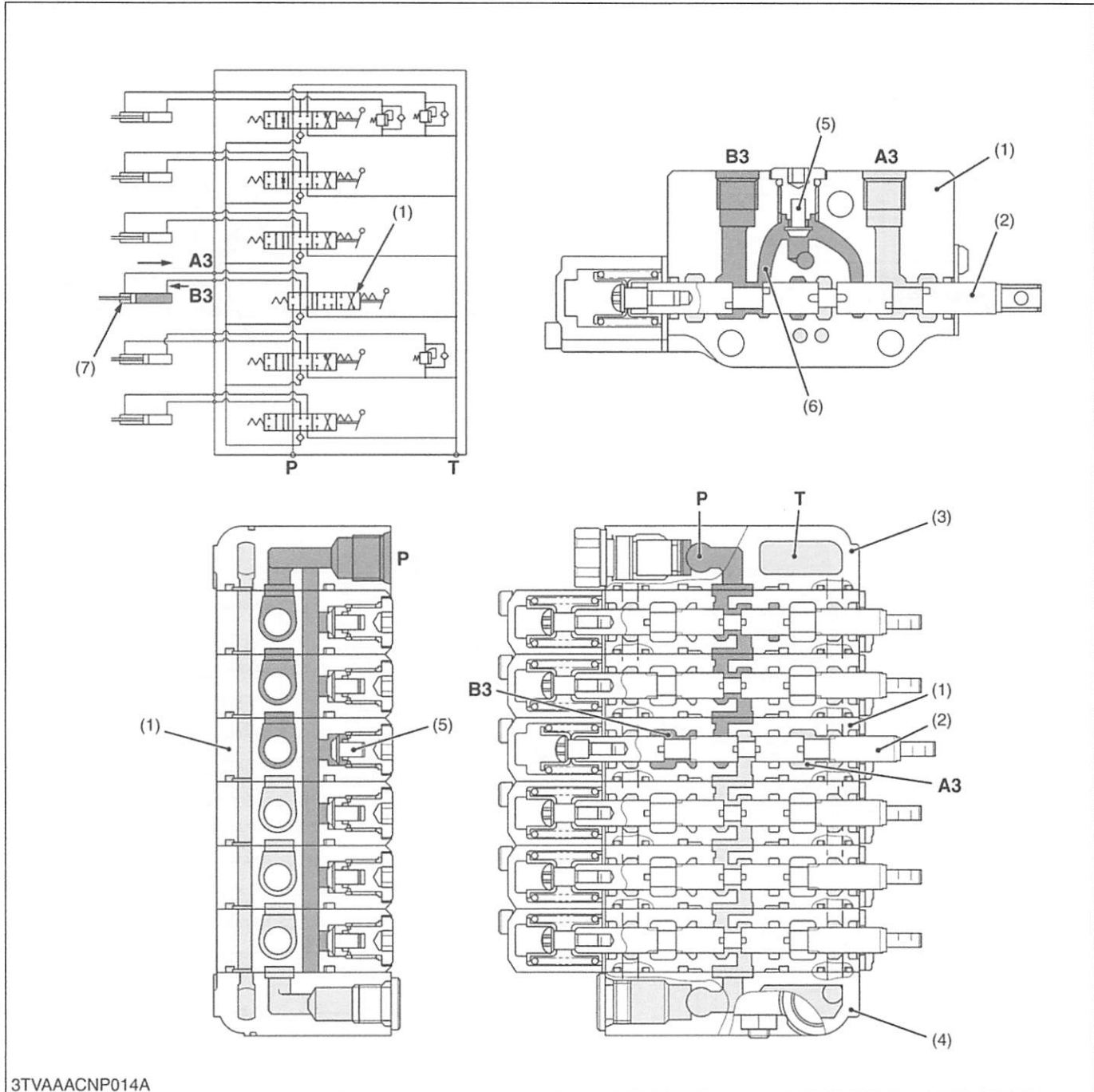


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- |                                 |                            |                   |   |
|---------------------------------|----------------------------|-------------------|---|
| (1) Stabilizer RH Control Valve | (5) Load Check Valve       | <b>P</b> : P Port | <b>A3</b> : A3 Port (From Stabilizer RH Cylinder) |
| (2) Spool                       | (6) Bridge Passage         | <b>T</b> : T Port | <b>B3</b> : B3 Port (To Stabilizer RH Cylinder)   |
| (3) Inlet Section               | (7) Stabilizer Cylinder RH |                   |   |
| (4) Outlet Section              |                            |                   |   |

1. When the right stabilizer control lever is pushed to the forward to set to the “**SHRINK**” position, the spool (2) of the stabilizer RH control valve (1) moves to the left, which forms oil passage between bridge passage (6) and **B3** port, and between **A3** port and **T** port.
2. The pressure-fed oil from the **P** port opens the load check valve (5), and flows to **B3** port to retract the right stabilizer cylinder.
3. Return oil from the right stabilizer cylinder returns to the transmission case through the **A3** port, low pressure passage and **T** port.

■ Stabilizer RH (Extend)

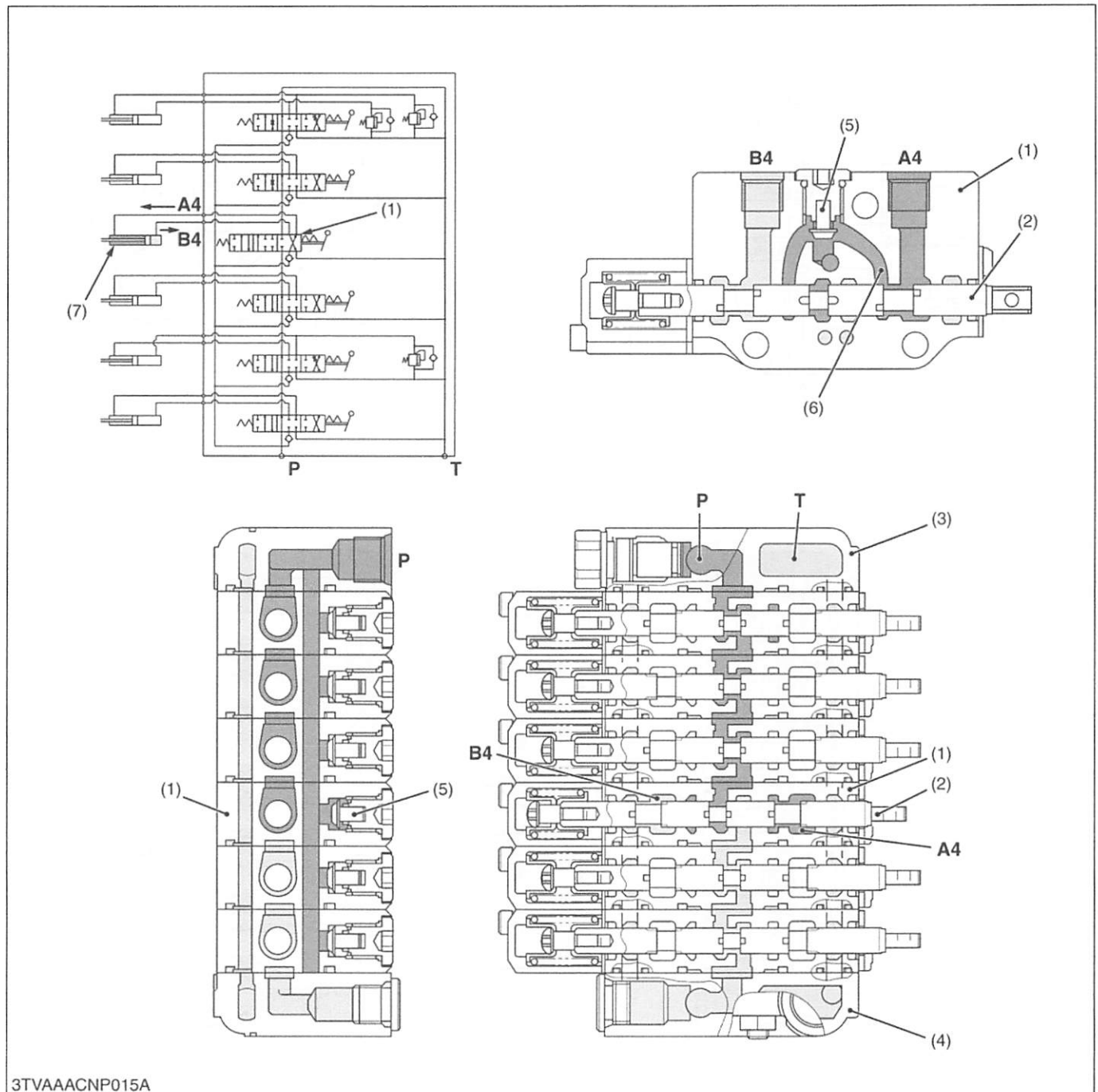


3TVAAACNP014A

- |                                 |                            |                   |   |
|---------------------------------|----------------------------|-------------------|---|
| (1) Stabilizer RH Control Valve | (5) Load Check Valve       | <b>P</b> : P Port | <b>A3</b> : A3 Port                               |
| (2) Spool                       | (6) Bridge Passage         | <b>T</b> : T Port | (To Stabilizer RH Cylinder)                       |
| (3) Inlet Section               | (7) Stabilizer Cylinder RH |                   | <b>B3</b> : B3 Port (From Stabilizer RH Cylinder) |
| (4) Outlet Section              |                            |                   |   |

1. When the right stabilizer control lever is pulled to the downward to set to the “**EXTEND**” position, the spool (2) of the stabilizer RH control valve (1) moves to the right, which forms oil passage between bridge passage (6) and **A3** port, and between **B3** port and **T** port.
2. The pressure-fed oil from the **P** port opens the load check valve (5), and flows to **A3** port to extend the right stabilizer cylinder.
3. Return oil from the right stabilizer cylinder returns to the transmission case through the **B3** port, low pressure passage and **T** port.

■ Stabilizer LH (Shrink)



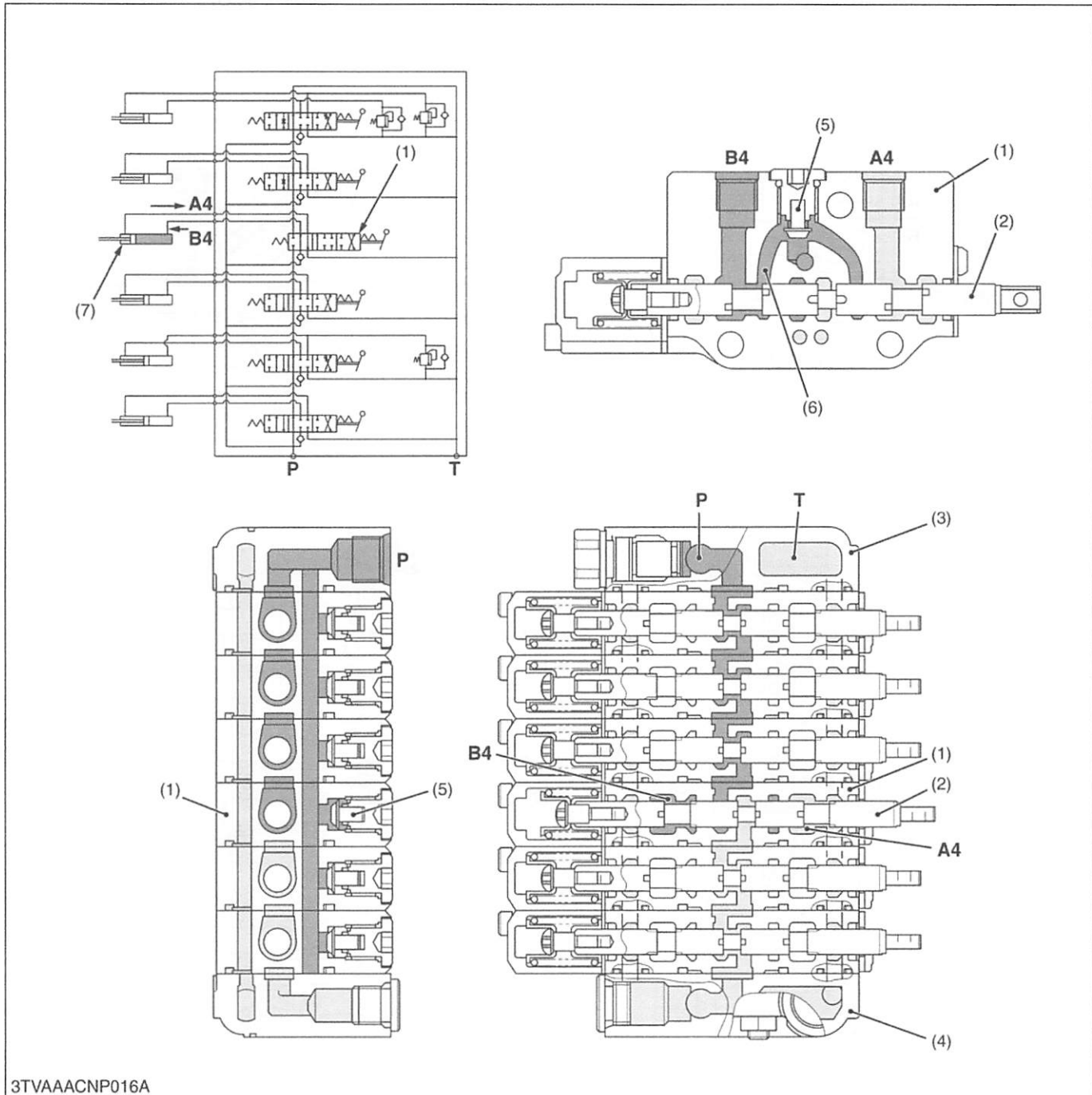
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- |                                 |                            |                   |   |
|---------------------------------|----------------------------|-------------------|---|
| (1) Stabilizer LH Control Valve | (5) Load Check Valve       | <b>P</b> : P Port | <b>A4</b> : A4 Port (From Stabilizer LH Cylinder) |
| (2) Spool                       | (6) Bridge Passage         | <b>T</b> : T Port | <b>B4</b> : B4 Port (To Stabilizer LH Cylinder)   |
| (3) Inlet Section               | (7) Stabilizer Cylinder LH |                   |   |
| (4) Outlet Section              |                            |                   |   |

1. When the right stabilizer control lever is pushed to the forward to set to the “**SHRINK**” position, the spool (2) of the stabilizer LH control valve (1) moves to the left, which forms oil passage between bridge passage (6) and **B4** port, and between **A4** port and **T** port.
2. The pressure-fed oil from the **P** port opens the load check valve (5), and flows to **B4** port to retract the left stabilizer cylinder.
3. Return oil from the left stabilizer cylinder returns to the transmission case through the **A4** port, low pressure passage and **T** port.



■ Stabilizer LH (Extend)

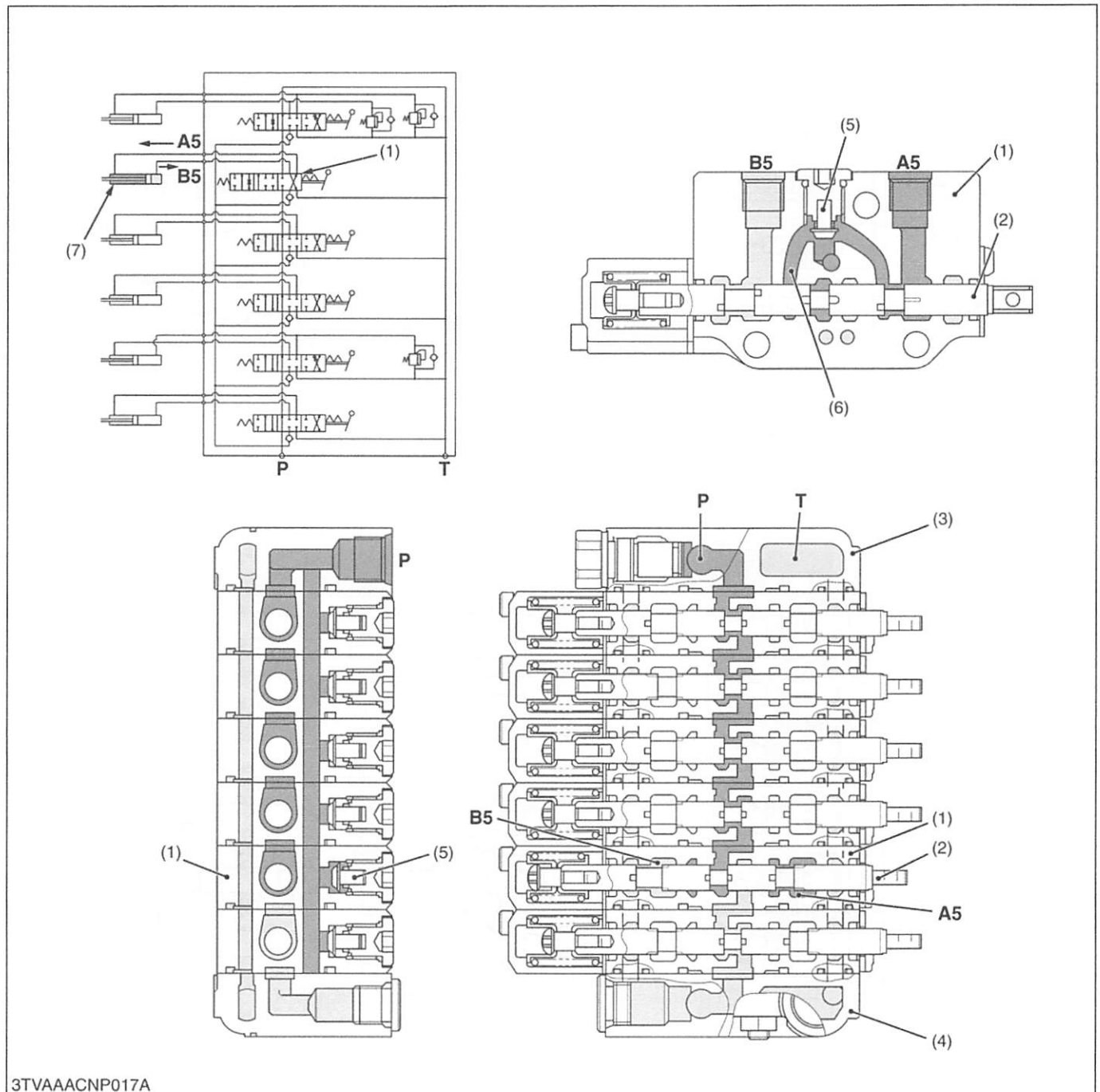


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- |                                 |                            |                   |   |
|---------------------------------|----------------------------|-------------------|---|
| (1) Stabilizer LH Control Valve | (5) Load Check Valve       | <b>P</b> : P Port | <b>A4</b> : A4 Port                               |
| (2) Spool                       | (6) Bridge Passage         | <b>T</b> : T Port | (To Stabilizer LH Cylinder)                       |
| (3) Inlet Section               | (7) Stabilizer Cylinder LH |                   | <b>B4</b> : B4 Port (From Stabilizer LH Cylinder) |
| (4) Outlet Section              |                            |                   |   |

- When the right stabilizer control lever is pulled to the downward to set to the “**EXTEND**” position, the spool (2) of the stabilizer LH control valve (1) moves to the right, which forms oil passage between bridge passage (6) and **A4** port, and between **B4** port and **T** port.
- The pressure-fed oil from the **P** port opens the load check valve (5), and flows to **A4** port to retract the left stabilizer cylinder.
- Return oil from the left stabilizer cylinder returns to the transmission case through the **B4** port, low pressure passage and **T** port.

■ Boom (Up)



3TVAAACNP017A

- (1) Boom Control Valve
- (2) Spool
- (3) Inlet Section
- (4) Outlet Section

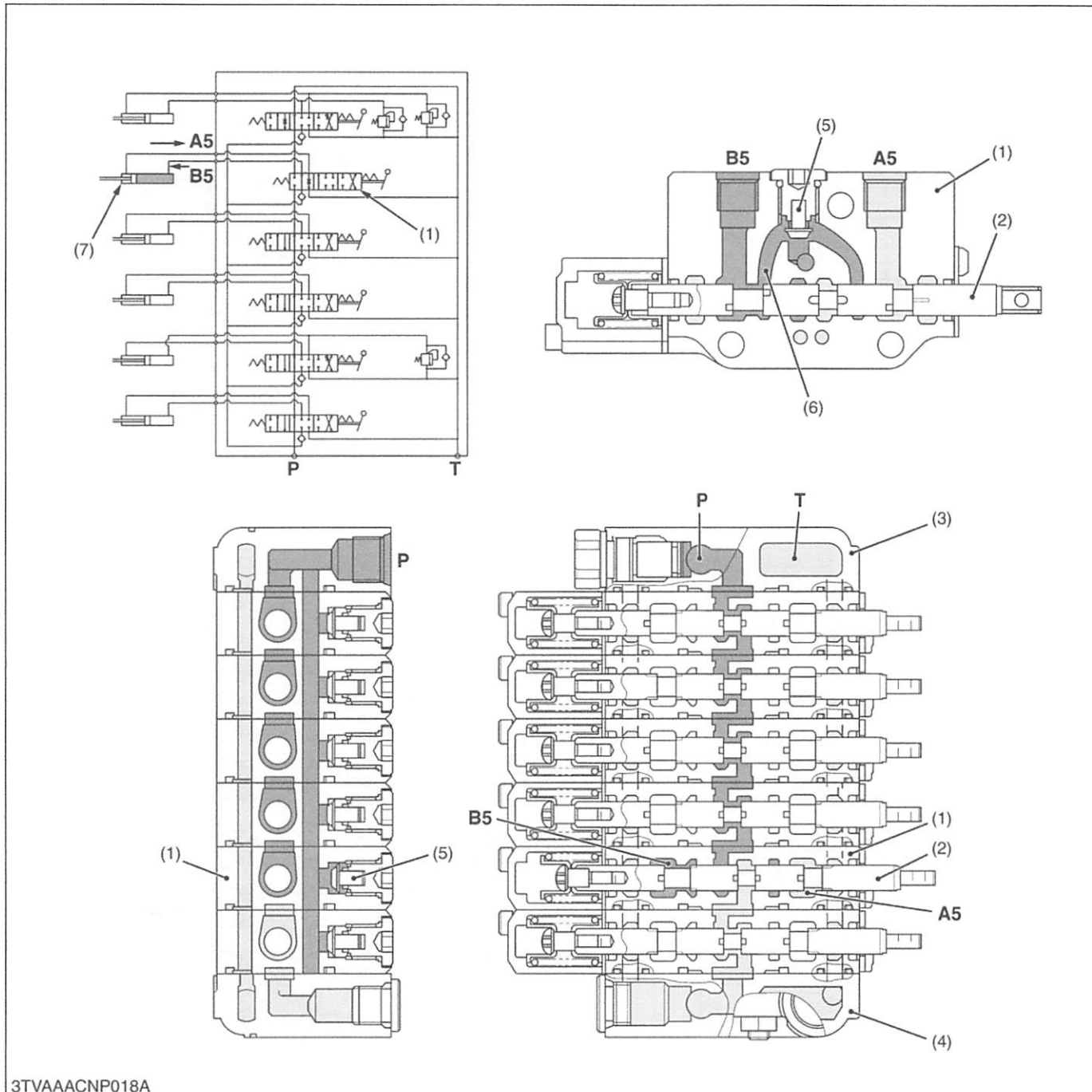
- (5) Load Check Valve
- (6) Bridge Passage
- (7) Boom Cylinder

P : P Port  
T : T Port

A5 : A5 Port  
(From Boom Cylinder)  
B5 : B5 Port  
(To Boom Cylinder)

1. When the boom and swing lever is pulled to the backward to set to the “UP” position, the spool (2) of the boom control valve (1) moves to the left, which forms oil passage between bridge passage (6) and B5 port, and between A5 port and T port.
2. The pressure-fed oil from the P port opens the load check valve (5) and flows to B5 port to retract the boom cylinder.
3. Return oil from the boom cylinder returns to the transmission case through the A5 port, low pressure passage and T port.

■ Boom (Down)

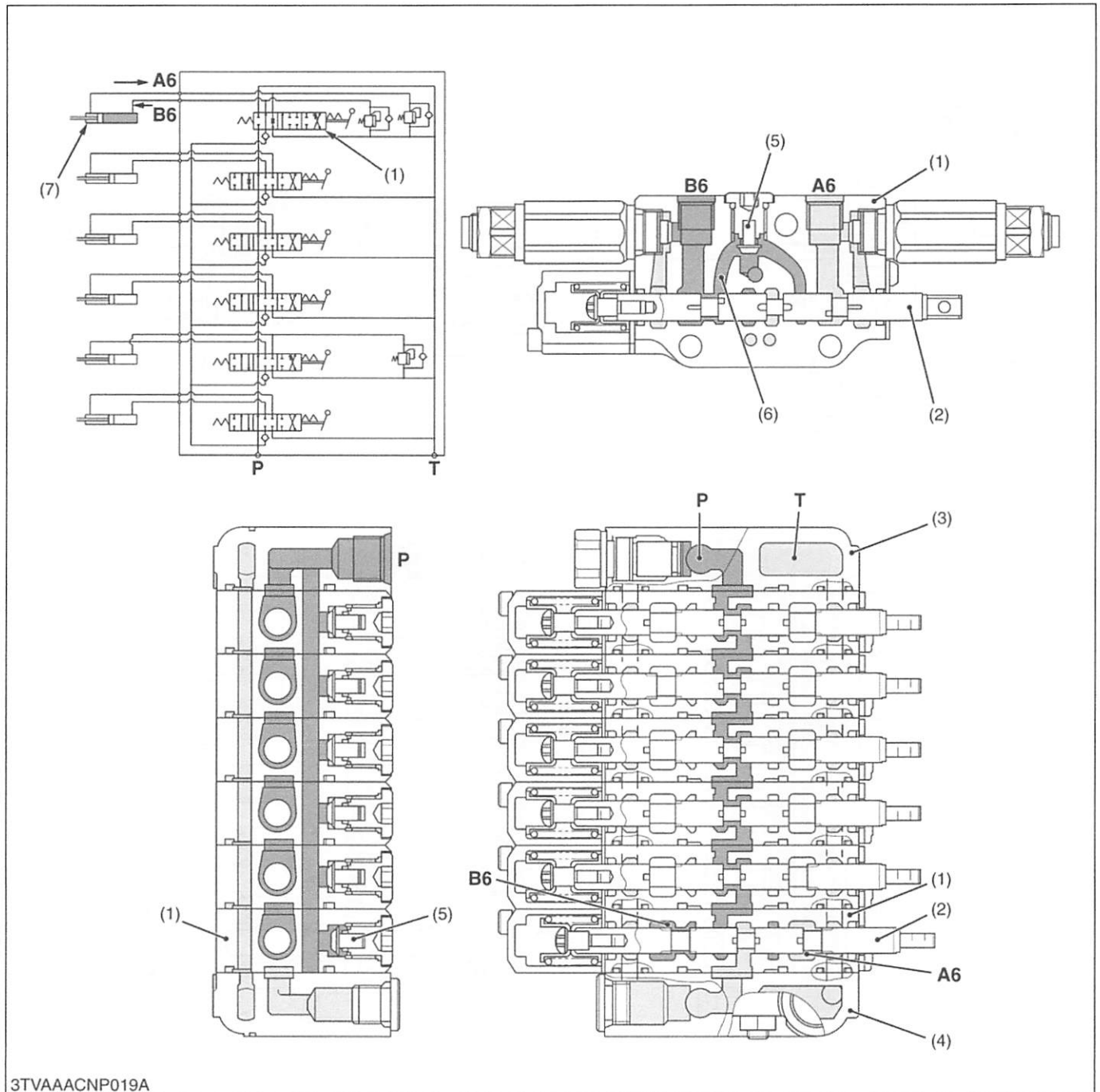


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- |                        |                      |                   |                             |
|------------------------|----------------------|-------------------|-----------------------------|
| (1) Boom Control Valve | (5) Load Check Valve | <b>P : P Port</b> | <b>A5 : A5 Port</b>         |
| (2) Spool              | (6) Bridge Passage   | <b>T : T Port</b> | <b>(To Boom Cylinder)</b>   |
| (3) Inlet Section      | (7) Boom Cylinder    |                   | <b>B5 : B5 Port</b>         |
| (4) Outlet Section     |                      |                   | <b>(From Boom Cylinder)</b> |

1. When the boom and swing lever is pulled to the forward to set to the "DOWN" position, the spool (2) of the boom control valve (1) moves to the right, which forms oil passage between bridge passage (6) and A5 port, and between B5 port and T port.
2. The pressure-fed oil from the P port opens the load check valve (5) and flows to A5 port to extend the boom cylinder.
3. Return oil from the boom cylinder returns to the transmission case through the B5 port, low pressure passage and T port.

■ Swing (Right)

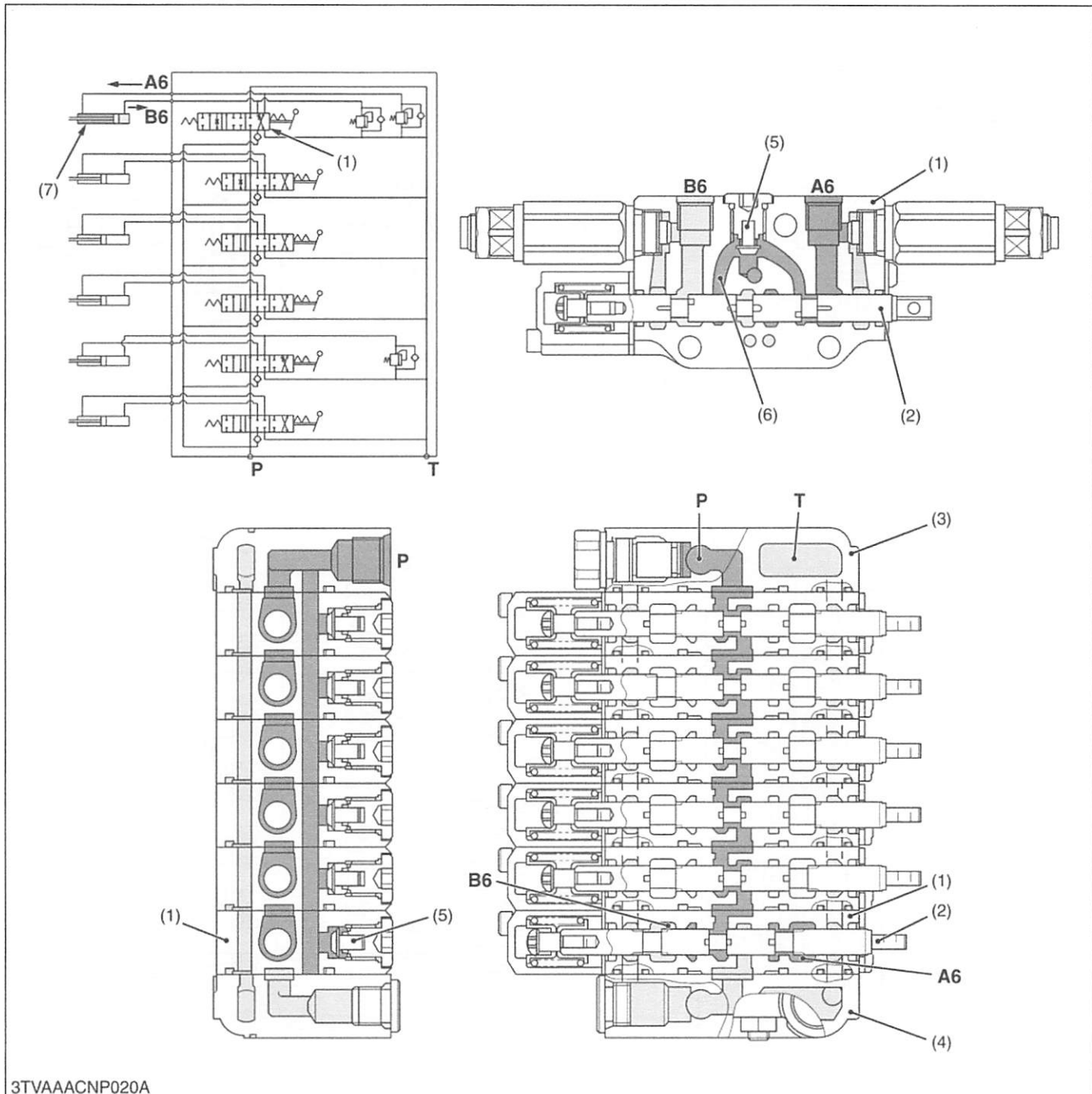


3TVAAACNP019A

- |                         |                      |                   |                       |
|-------------------------|----------------------|-------------------|-----------------------|
| (1) Swing Control Valve | (5) Load Check Valve | <b>P</b> : P Port | <b>A6</b> : A6 Port   |
| (2) Spool               | (6) Bridge Passage   | <b>T</b> : T Port | (To Swing Cylinder)   |
| (3) Inlet Section       | (7) Swing Cylinder   |                   | <b>B6</b> : B6 Port   |
| (4) Outlet Section      |                      |                   | (From Swing Cylinder) |

1. When the boom and swing lever is moved to the right to set to the “**RIGHT**” position, the spool (2) of the swing control valve (1) moves to the right, which forms oil passage between bridge passage (6) and **A6** port, and between **B6** port and **T** port.
2. The pressure-fed oil from the **P** port opens the load check valve (5) and flows to **B6** port to extend the swing cylinder.
3. Return oil from the swing cylinders return to the transmission case through the **A6** port, low pressure passage and **T** port.

■ Swing (Left)

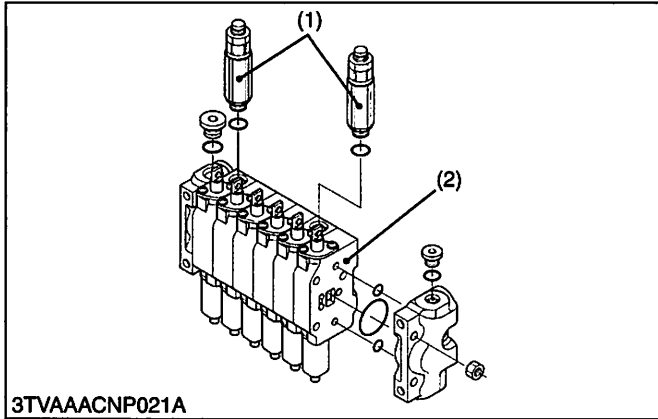


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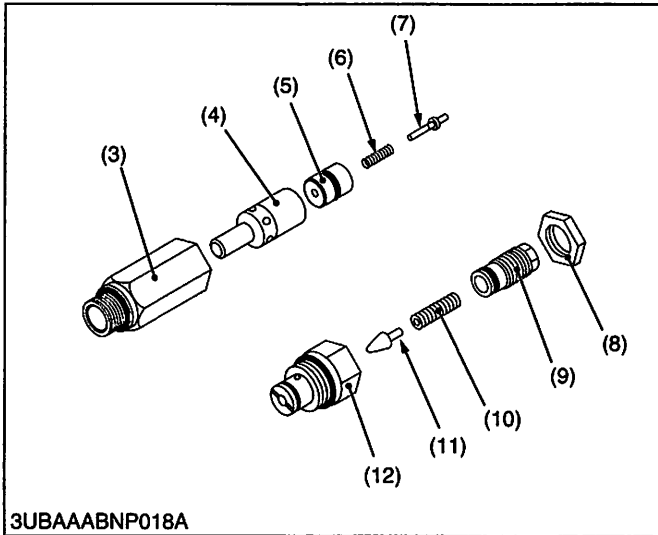
- |                         |                      |                   |                              |
|-------------------------|----------------------|-------------------|------------------------------|
| (1) Swing Control Valve | (5) Load Check Valve | <b>P : P Port</b> | <b>A6 : A6 Port</b>          |
| (2) Spool               | (6) Bridge Passage   | <b>T : T Port</b> | <b>(From Swing Cylinder)</b> |
| (3) Inlet Section       | (7) Swing Cylinder   |                   | <b>B6 : B6 Port</b>          |
| (4) Outlet Section      |                      |                   | <b>(To Swing Cylinder)</b>   |

1. When the boom and swing lever is moved to the left to set to the "LEFT" position, the spool (2) of the swing control valve (1) moves to the left, which forms oil passage between bridge (6) and A6 port, and between B6 port and T port.
2. The pressure-fed oil from the P port opens the load check valve (5) and flows to A6 port to shrink the swing cylinder.
3. Return oil from the swing cylinders return to the transmission case through the B6 port, low pressure passage and T port.

### (3) Overload Relief Valve

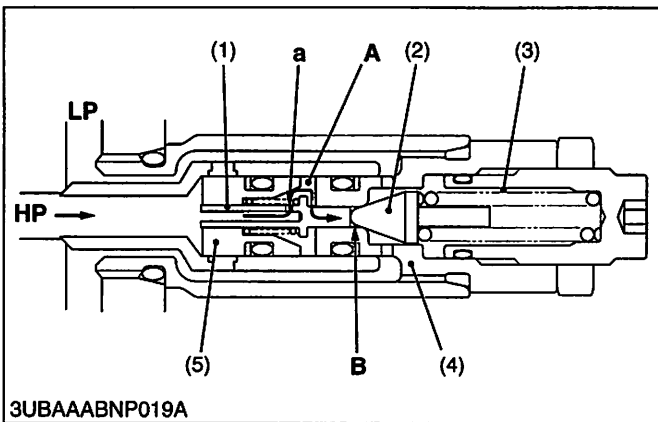


3TVAAACNP021A



3UBAAABNP018A

#### ■ Relief Operation



3UBAAABNP019A

Overload relief valve in this control valve is a combination valve combining a relief operation and anti-cavitation operation.

#### ■ Relief Operation

When the control valve is in the neutral position, both cylinder ports of control valve are blocked by the spool. If an external load is imposed on the cylinder, pressure builds in the circuit.

When the pressure exceeds the set level of the overload relief valve, the relief valve opens and the oil returns to tank. In this way, the hydraulic circuit and actuator are protected from excessive pressures.

#### ■ Anti-cavitation Operation

Overload relief valve also has anti-void function. If a negative pressure takes place in the circuit, the oil is fed from the tank to eliminate the negative pressure.

- |                           |                     |
|---------------------------|---------------------|
| (1) Overload Relief Valve | (7) Piston Poppet   |
| (2) Control Valve         | (8) Lock Nut        |
| (3) Housing               | (9) Adjusting Screw |
| (4) Check Valve Poppet    | (10) Pilot Spring   |
| (5) Relief Valve Poppet   | (11) Pilot Poppet   |
| (6) Piston Spring         | (12) Pilot Section  |

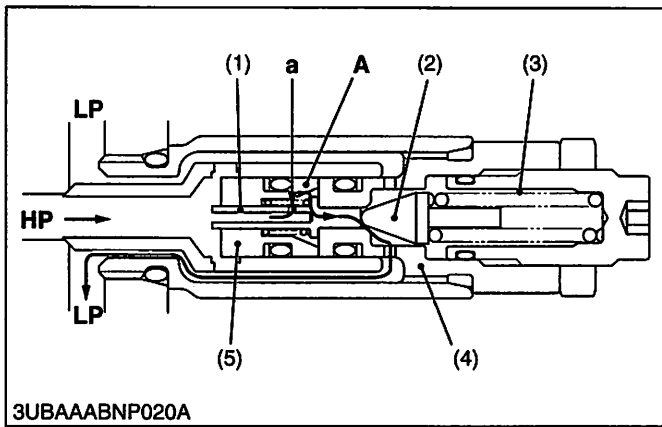
W1023498

#### [When the actuator port pressure is lower than the setting]

The cylinder port HP is applied to the seat B in the following route : first through the throttle a of the piston poppet (1) built in the relief valve poppet (5), second through the spring chamber A, and then through the circular clearance between the adjusting screw (9) and the piston poppet (1). This cylinder port HP works to open the pilot poppet (2). Because the piston spring (3) has not reached the set pressure, however, the valve stays shut. In this way the seat remains intact and the relief valve poppet (5) stays shut.

- |                         |                   |
|-------------------------|-------------------|
| (1) Piston Poppet       | HP :High Pressure |
| (2) Pilot Poppet        | LP :Low Pressure  |
| (3) Piston Spring       | A : Chamber       |
| (4) Adjusting Screw     | B : Seat          |
| (5) Relief Valve Poppet | a : Throttle      |

W1024073



**[When the actuator port pressure is higher than the setting]**

When the cylinder port **HP** has reached the set pressure of the piston spring (5), the pressure oil in the spring chamber **A** opens the pilot poppet (4) and flows through the drain passage into the tank passage. This lowers the pressure in the spring chamber **A**, and the pressure difference across the throttle **a** moves the relief valve poppet (1) to the right. Now the seat of the relief valve poppet (1) gets open. The pressure oil flows then from this seat into the tank, and the circuit pressure is kept at the pressure level set by the overload relief valve.

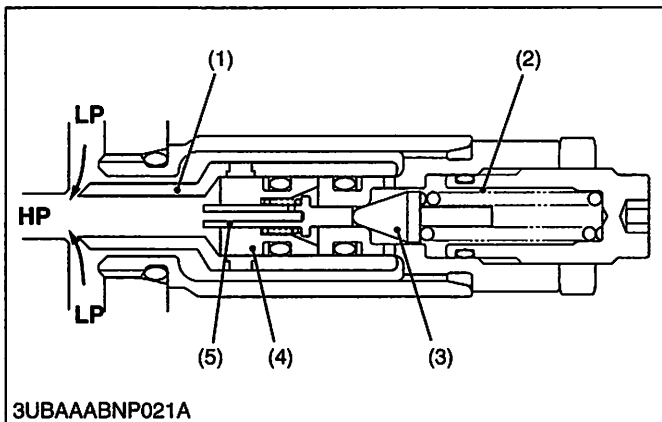
	Relief valve setting pressure
Dipperstick	17.20 to 17.69 MPa 175 to 180 kgf/cm <sup>2</sup> 2489 to 2560 psi
Swing	13.7 to 14.1 MPa 140 to 145 kgf/cm <sup>2</sup> 1991 to 2062 psi

- Oil temperature : 45 to 55 °C  
113 to 131 °F

- |                         |                          |
|-------------------------|--------------------------|
| (1) Piston Poppet       | <b>HP :High Pressure</b> |
| (2) Pilot Poppet        | <b>LP :Low Pressure</b>  |
| (3) Piston Spring       | <b>A : Chamber</b>       |
| (4) Adjusting Screw     | <b>a : Throttle</b>      |
| (5) Relief Valve Poppet |                          |

W1024163

**■ Anti-cavitation Operation**



This valve, in operation, prevents a condition – so called cavitation – that arises in the cylinder port **HP** where fluid is not entirely filling out.

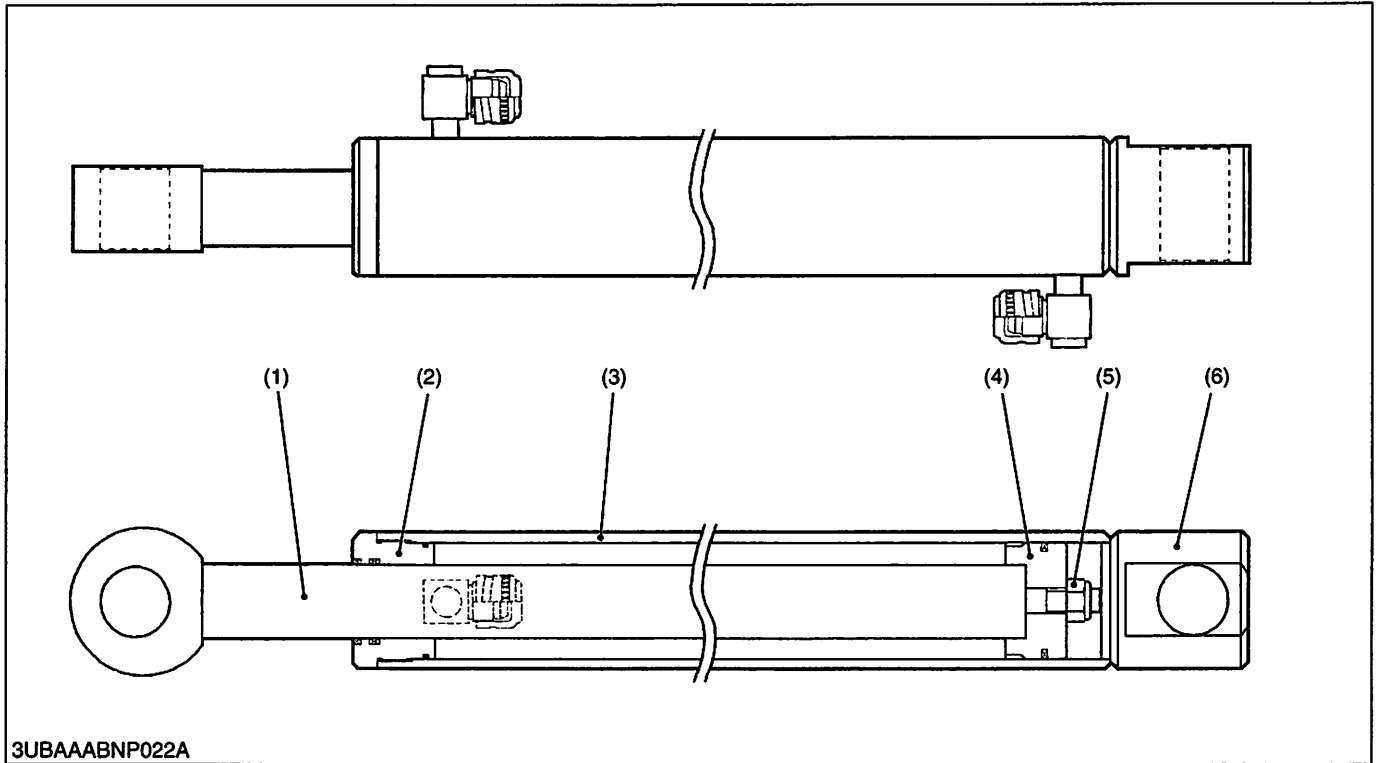
That is, this relief valve is combined an anti-cavitation functions supplying oil.

The pressure oil at the tank port **LH** opens the check valve poppet, allowing oil to flow through the tank port to prevent negative pressure from being generated in the cylinder.

- |                        |                         |
|------------------------|-------------------------|
| (1) Check Valve Poppet | (4) Relief Valve Poppet |
| (2) Piston Spring      | (5) Piston Poppet       |
| (3) Pilot Poppet       |                         |

W1024467

### [3] HYDRAULIC CYLINDER



3UBAAABNP022A

- (1) Rod
- (2) Head
- (3) Cylinder Tube
- (4) Piston
- (5) Nut
- (6) Tube End

Bucket, dipperstick, boom, swing, and stabilizer cylinder consists of cylinder head (2), piston rod (1), cylinder tube (3), piston (4) and other parts as shown in the figure above.

They are single-rod double acting cylinders in which the reciprocating motion of the piston is controlled by hydraulic force applied to both of its ends.

**Cylinder Specifications**

	Bucket Cylinder mm (in.)	Dipperstick Cylinder mm (in.)	Boom Cylinder mm (in.)	Stabilizer Cylinder mm (in.)	Swing Cylinder mm (in.)
Cylinder I.D.	30.0 (1.18)	30.0 (1.18)	30.0 (1.18)	30.0 (1.18)	30.0 (1.18)
Rod O.D.	60.0 (2.36)	60.0 (2.36)	50.0 (1.97)	60.0 (2.36)	60.0 (2.36)
Stroke	364 (14.33)	330 (12.99)	356 (14.02)	272 (10.71)	175 (6.89)

W1025274



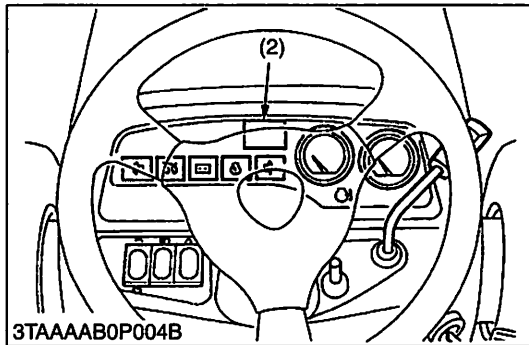
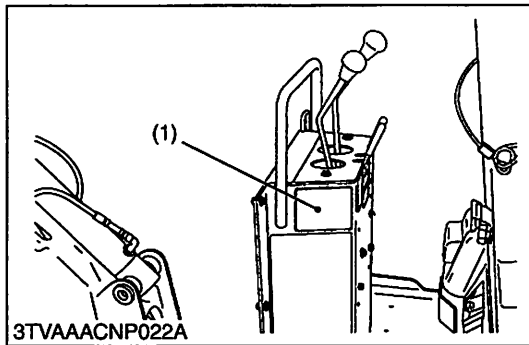
# SERVICING

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# 1. GENERAL

## [1] BACKHOE IDENTIFICATION



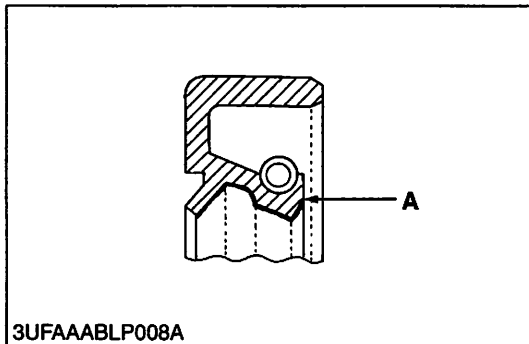
When contacting your local KUBOTA distributor, always specify backhoe serial number and hour meter reading.

(1) Serial Number

(2) Hour Meter

W1010477

## [2] GENERAL PRECAUTION



- During disassembly, carefully arrange removed parts in a clean area to prevent later confusion. Screws, bolts and nuts should be replaced in their original positions to prevent reassembly errors.
- When special tools are required, use genuine KUBOTA tools. Special tools which are not used frequently should be made according to the drawings provided.
- Clean parts before measuring them.
- Use only genuine KUBOTA parts for parts replacement to maintain backhoe performance and to assure safety.
- O-rings and oil seals must be replaced during reassembly. Apply grease to new O-rings or oil seals before reassembling.
- Nipples must be tightened to the specified torque. Excessive torque may cause damages hydraulic units or nipples, and insufficient torque will result in oil leaks.
- When using a new hose or pipe, tighten nuts to the specified torque once, then loosen them (approx. by 45 °) to allow hose or pipe to settle before retightening to the specified torque (except seal taped parts).
- When removing both ends of a pipe, remove the lower end first.
- Use two pliers in removal and reinstallation; one to hold the static side, and the other to turn the side being removed to avoid twisting.
- Check to see that sleeves of flareless connectors and tapered sections of hoses are free of dust and scratches.
- After tightening nipples, clean the joint and apply the maximum working pressure 2 to 3 times to check for oil leak.

A : Grease

W1010572

### [3] LUBRICANTS

To prevent serious damage to hydraulic systems, use only specified fluid or its equivalent.

Place	Capacity	Lubricants
Transmission case	10.1 L 2.7 U.S.gals. 2.2 Imp.gals.	KUBOTA SUPER UDT fluid*
Grease nipples	Until grease overflows	Moly Ep Type grease

\* KUBOTA original transmission hydraulic fluid

### [4] MAINTENANCE CHECK LIST

To keep the machine working in good condition as well as to avoid any accident and trouble, carry out periodic inspection and maintenance. Check the following points before use.

Service Interval	Check Points	Reference page
Daily (Each use)	<ul style="list-style-type: none"> <li>• Check the transmission fluid level</li> <li>• Retighten the backhoe hardware to torque value</li> <li>• Check the hydraulic hoses</li> </ul>	8-S2 8-S2 8-S2
Every 10 hours	<ul style="list-style-type: none"> <li>• Grease all grease nipples</li> </ul>	8-S3

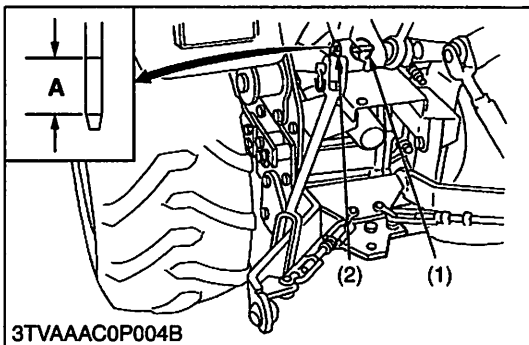
W1013874

### [5] CHECK AND MAINTENANCE

#### ⚠ CAUTION

- When checking and repairing, park the tractor on flat ground and apply the parking brake.
- When checking and repairing, lower the bucket and stabilizers, and stop the engine.

#### (1) Check Points of Each Use or Daily



#### Checking Transmission Fluid Level

1. Check that the tractor hydraulic fluid level.
2. To check the oil level, remove the dipstick (2), wipe it clean, replace it, and remove it again.  
Check that the oil level is between the two notches.
3. If the level is too low, replenish new oil.

#### ■ IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS".

- (1) Oil Filling Port  
(2) Dipstick

A : Oil level acceptable within this range.

W1011494

#### Retightening Backhoe Hardware

1. Check all hardware before daily operation.
2. If the screws, bolts and nuts are loosen, retighten them to the specified torque.

W1011636

#### Checking Hydraulic Hoses

1. Check all hydraulic hoses for cuts or wear.
2. If defects are found, replace them.

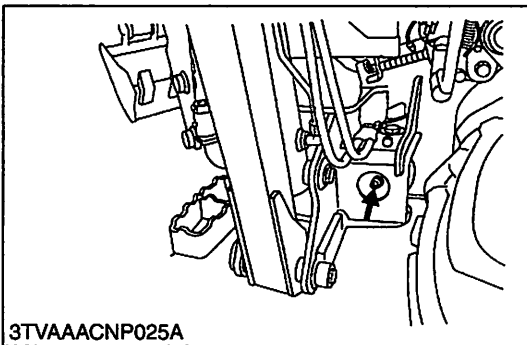
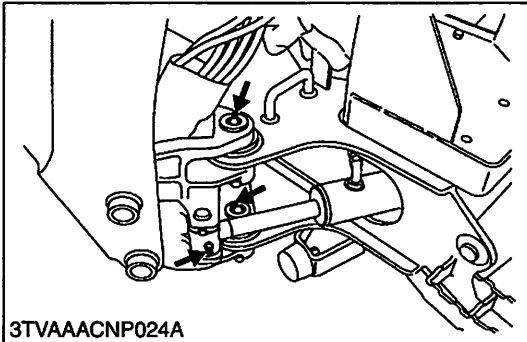
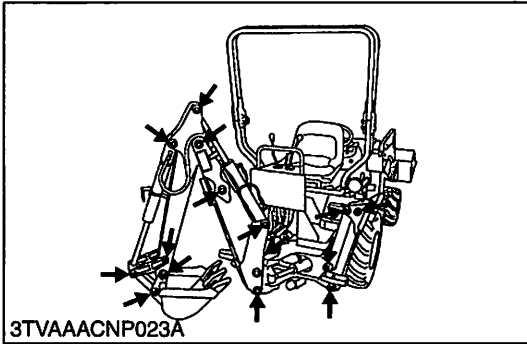
W1011703

## (2) Check Points of Every 10 Hours

### Greasing

1. Inject grease all grease nipples with a hand grease gun.

W1011760



## 2. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>All Functions Inoperative (Front Loader Is OK)</b>	<ul style="list-style-type: none"> <li>• Quick coupler disconnected</li> </ul>	Reconnect	–
<b>All Functions Including Front Loader, Are Inoperative</b>	<ul style="list-style-type: none"> <li>• Insufficient transmission fluid</li> <li>• Relief valve spring damaged</li> <li>• Hydraulic pump malfunctioning</li> <li>• Oil filter clogged</li> </ul>	Replenish Replace Repair or replace Replace	8-S2 5-S15 5-S14 G-13
<b>Hydraulic Oil Overheats</b>	<ul style="list-style-type: none"> <li>• Continuous operation against relief</li> <li>• Transmission fluid improper brand and viscosity</li> <li>• Relief valve misadjusted</li> <li>• Insufficient transmission fluid</li> <li>• Oil filter clogged</li> </ul>	Operate properly Use proper fluid  Readjust Replenish Replace	– G-7  5-S15 8-S2 G-13
<b>Individual Cylinder Circuit Weak or Inoperative (Others OK)</b>	<ul style="list-style-type: none"> <li>• Valve spool not moving fully</li> <li>• Valve spool stick (especially when warm)</li> <li>• Overload relief valve misadjusted</li> <li>• Piston seal ring worn or damaged</li> <li>• Cylinder tube worn or damaged</li> <li>• Oil leaks from joint</li> <li>• Hydraulic hose damaged</li> <li>• Dust in overload relief valve</li> </ul>	Adjust linkage Repair or replace Readjust Replace Replace Repair or replace Replace Flush hydraulic line	– 8-S17 – 8-S21 8-S19 – – –
<b>Excessive Cylinder Movement</b>	<ul style="list-style-type: none"> <li>• Piston seal ring worn or damage</li> <li>• Excessive valve spool to bore tolerance</li> <li>• Hydraulic hose or fitting damaged</li> <li>• Hydraulic hose or fitting loose</li> <li>• Cylinder tube worn or damaged</li> </ul>	Replace Replace Replace Retighten Replace	8-S21 8-S17 – – 8-S21
<b>Insufficient Cylinder Speed</b>	<ul style="list-style-type: none"> <li>• Engine rpm too low</li> <li>• Hydraulic pump malfunctioning</li> <li>• Relief valve pressure too low</li> <li>• Insufficient transmission fluid</li> </ul>	Adjust rpm Repair or replace Readjust Replenish	– 5-S14 5-S15 8-S2

W1014322

### 3. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Main Frame Fulcrum Pin to Bushing	Clearance	0.076 to 0.132 mm 0.003 to 0.005 in.	0.5 mm 0.0197 in.
	Main Frame Fulcrum Pin O.D.	39.97 to 40.00 mm 1.574 to 1.575 in.	—
	Bushing I.D.	40.081 to 40.110 mm 1.578 to 1.579 in.	—
Swing Cylinder Rod Pin to Bushing	Clearance	0.108 to 0.259 mm 0.004 to 0.010 in.	1.0 mm 0.0394 in.
	Pin O.D.	24.816 to 25.000 mm 0.977 to 0.984 in.	—
	Bushing I.D.	25.000 to 25.209 mm 0.984 to 0.992 in.	—
Boom Support, Dipperstick Fulcrum Pin to Bushing	Clearance	0.140 to 0.180 mm 0.006 to 0.007 in.	1.0 mm 0.0394 in.
	Pin O.D.	29.820 to 30.000 mm 1.174 to 1.181 in.	—
	Bushing I.D.	30.000 to 30.251 mm 1.181 to 1.191 in.	—
Boom Cylinder Rod Pin to Cylinder Bushing	Clearance	0.139 to 0.281 mm 0.005 to 0.011 in.	1.0 mm 0.0394 in.
	Pin O.D.	29.820 to 30.000 mm 1.174 to 1.181 in.	—
	Bushing I.D.	30.000 to 30.251 mm 1.181 to 1.191 in.	—
Dipperstick Cylinder Rod Pin to Cylinder Bushing	Clearance	0.178 to 0.309 mm 0.007 to 0.012 in.	1.0 mm 0.0394 in.
	Pin O.D.	24.816 to 25.000 mm 0.977 to 0.984 in.	—
	Bushing I.D.	25.000 to 25.209 mm 0.984 to 0.992 in.	—
Bucket Cylinder Rod Pin to Cylinder Bushing	Clearance	0.262 to 0.393 mm 0.010 to 0.015 in.	1.0 mm 0.0394 in.
	Pin O.D.	24.816 to 25.000 mm 0.977 to 0.984 in.	—
	Bushing I.D.	25.000 to 25.209 mm 0.984 to 0.992 in.	—

W1013874

Item		Factory Specification	Allowable Limit	
Pin to Guide Link, Stabilizer Arm, Bucket Fulcrum or Bucket Link Bushing	Clearance	0.149 to 0.184 mm 0.006 to 0.007 in.	1.0 mm 0.0394 in.	
	Pin	O.D.	24.816 to 25.000 mm 0.9777 to 0.984 in.	–
	Bushing	I.D.	25.000 to 25.209 mm 0.984 to 0.992 in.	–
Stabilizer Cylinder Rod Pin to Cylinder Bushing	Clearance	0.127 to 0.253 mm 0.005 to 0.010 in.	1.0 mm 0.0394 in.	
	Pin	O.D.	24.816 to 25.000 mm 0.977 to 0.984 in.	–
	Bushing	I.D.	25.000 to 25.209 mm 0.984 to 0.992 in.	–

W1013089

## 4. TIGHTENING TORQUES

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

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

American standard cap screws with UNC or UNF threads				Metric cap screws					
Grade		SAE grade 5 or 8		Grade		Grade 8.8 (Approx. SAE grade 5)			
Size	Unit	N-m	kgf-m	ft-lbs	Size	Unit	N-m	kgf-m	ft-lbs
1/4		9.8 to 11.7	1.0 to 1.2	7.2 to 8.6	M6		9.8 to 11.2	1.0 to 1.1	7.2 to 8.3
5/16		19.0 to 23.1	1.9 to 2.4	14 to 17	M8		23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
3/8		33.9 to 40.7	3.5 to 4.2	25 to 30	M10		48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
1/2		88.1 to 105.8	9.0 to 10.8	65 to 78	M12		77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
9/16		122.0 to 146.4	12.4 to 14.9	90 to 108	M14		124 to 147	12.6 to 15.0	91.2 to 108
5/8		176.3 to 211.5	18.0 to 21.6	130 to 156	M16		196 to 225	20.0 to 23.0	145 to 166

W1012507

### [2] HYDRAULIC HOSES FITTING AND FLARE PIPES

Item	Thread size	Tightening torque		
		N-m	kgf-m	ft-lbs
Adjustable elbow and adapter	9/16	37 to 44	3.7 to 4.6	27 to 33
	3/4	47 to 54	4.8 to 5.5	35 to 40
	7/8	77 to 85	7.9 to 8.7	57 to 63
Hose fitting and flare nut	9/16	22 to 25	2.2 to 2.6	16 to 19
	3/4	47 to 54	4.8 to 5.5	35 to 40
	7/8	43 to 50	4.4 to 5.1	32 to 37
Adapter (NPT)	3/8	39 to 44	3.9 to 4.4	28 to 32
	1/2	49 to 58	5.0 to 5.9	36 to 43
Adapter G (PF) [Equivalent for NPSF]	1/4	25 to 29	2.6 to 2.9	19 to 21
	3/8	49 to 54	5.0 to 5.5	36 to 39

■ **NOTE**

- When connecting a hose with flare nut, after tightening the nut with specified torque, return it approximately 45 degrees and re-tighten it to specified torque.

W1013389

### [3] TIGHTENING TORQUES OF SCREWS, BOLT AND NUTS ON THE TABLE BELOW ARE ESPECIALLY SPECIFIED

Item	N-m	kgf-m	ft-lbs
Holder plate mounting screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Cylinder head	245 to 275	25.0 to 28.0	181 to 203
Cylinder piston mounting nut (Boom, stabilizer, dipperstick, bucket)	157 to 196	16.0 to 20.0	116 to 145
Cylinder piston mounting nut (Swing)	216 to 245	22.0 to 25.0	159 to 181

W1012736



# 5. DISMOUNTING AND MOUNTING

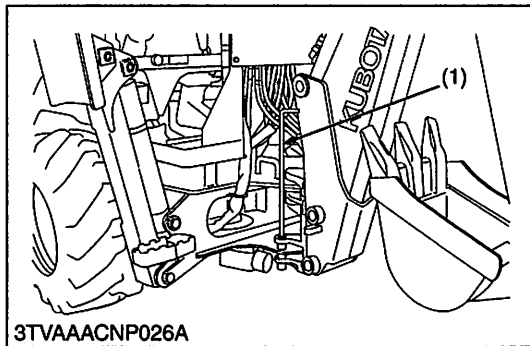
## [1] DISMOUNTING THE BACKHOE

### ⚠ CAUTION

- When starting the engine, always sit in the operator's seat.
- When getting off the tractor, make sure that PTO lever is off and range gear shift lever is in neutral. Then set the parking brake.
- Keep hands, feet and body from between tractor and backhoe. Never allow any part of body under the machine.
- When leaving the operator's seat, fully lower the boom to the ground.
- When removing the backhoe set the swing lock pin.

### ■ IMPORTANT

- When removing the backhoe, set the engine speed slightly above idle.
- For removing the backhoe, locate the tractor / loader / backhoe on a flat and hard surface, preferably concrete. If the ground surface is soft, place a board on the ground for the contact parts of backhoe such as stabilizer pad, bucket, boom etc.



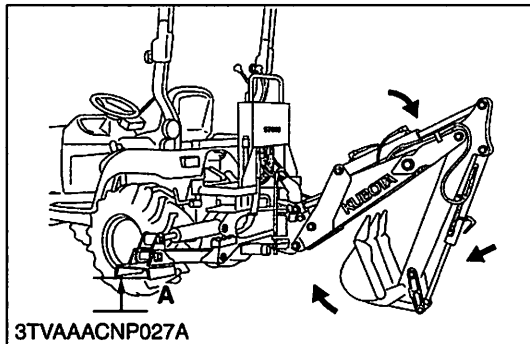
### Preparation

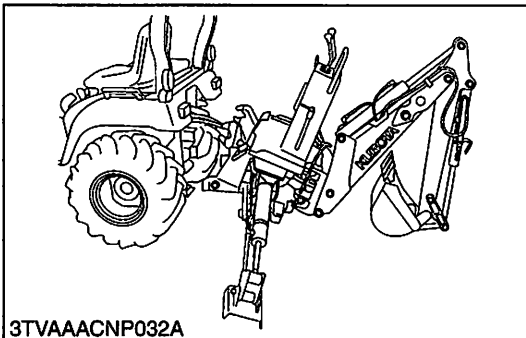
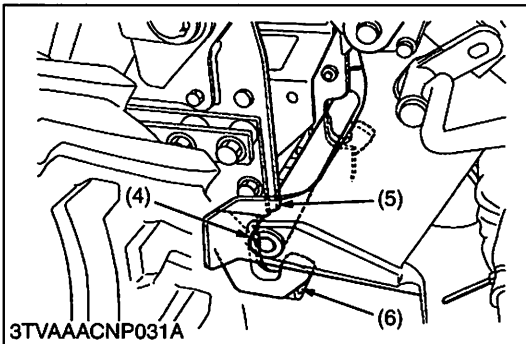
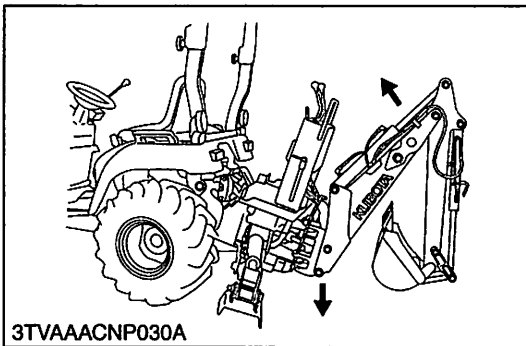
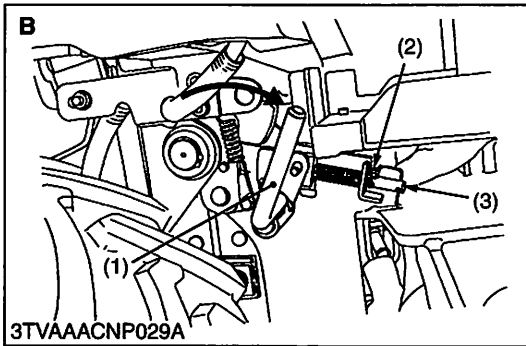
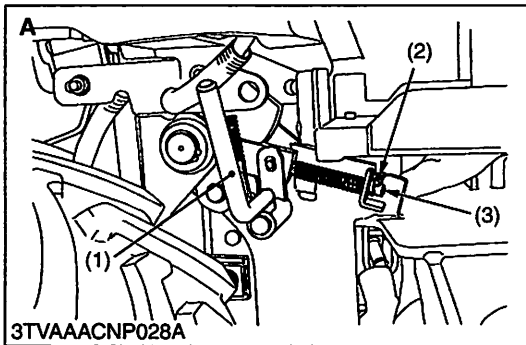
1. Start the engine and lower the front loader to the ground.
2. Set the swing lock pin to prevent the pivoting of the boom before removing the backhoe.
3. Stand beside the rear tire, fully close the dipperstick, curl the bucket and lower the boom until the back of bucket contacts the ground.
4. Keep the stabilizer pads at about 15 inches high.
5. Raise the rear wheels slightly with the boom.

(1) Swing Lock Pin

A : 380 mm (15 in.)

W1014290





**Mount Lever**

1. Remove the snap ring (2) from the set pins (3). Release the set pins (3) with the mount levers (1). Reinstall the snap pins (2) in the release position.
2. Slowly raise the boom and hold at full height (approx. 5 seconds) to disengage the mount holder from the tractor mount pins.
3. Raise the backhoe by operating the stabilizers to the lowering direction until the mount bars (4) hit to the guide stopper (5) on the support hooks (6).
4. Move the tractor forward from the backhoe about 200 mm (8 in.).

**■ IMPORTANT**

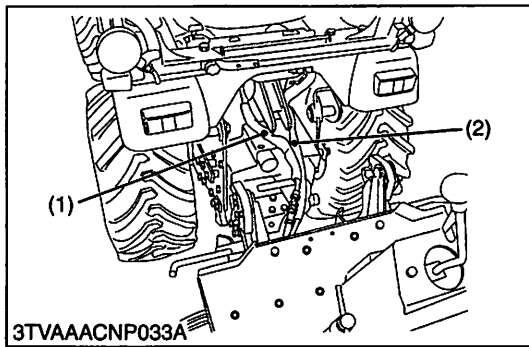
- **Be careful not to damage or break the hoses when moving the tractor.**
5. Lower the main frame and swing frame onto the ground by operating the boom and stabilizer control levers.
  6. Lift up the both sides of stabilizers (if necessary).
  7. Lower the front loader and shut off the engine.

- (1) Mount Lever
- (2) Snap Pin
- (3) Set Pin
- (4) Mount Bar
- (5) Guide Stopper
- (6) Support Hook

- A : Mount Position**
- B : Release Position**

W1013686





**Hydraulic Hoses**

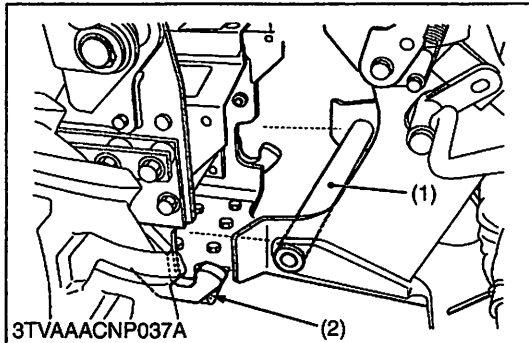
1. Start the engine and move the tractor backward slowly, centering to the backhoe main frame. Step the tractor 254 to 305 mm (10 to 12 in.) away from the backhoe.
2. Lower the front loader and shut off the engine, then apply parking brake.
3. Connect the hydraulic hoses (1), (2).

■ **IMPORTANT**

- **Make sure both hoses are firmly connected before starting the engine.**

(1) Inlet Hose (2) Return Hose

W1014766



**Mount Lever and Mounting Backhoe**

1. Start the engine and lower the both sides of stabilizer until stabilizer pads contact to the ground slightly. (If the stabilizer had been at up position)
2. Slowly move the boom to raising position until the mount bar (1) on the backhoe main frame are slightly higher than the tractor frame support hooks (2).

⚠ **CAUTION**

- **Do not move the joystick control lever to the swing position.**

■ **NOTE**

- **If the support hooks (2) are not parallel to the mount bars, stabilizer is adjusted by lowering so that the support hooks and the mount bars may become parallel.**

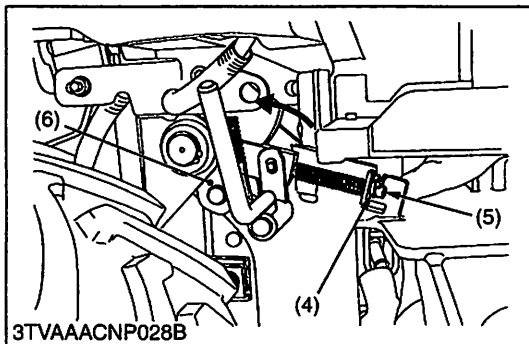
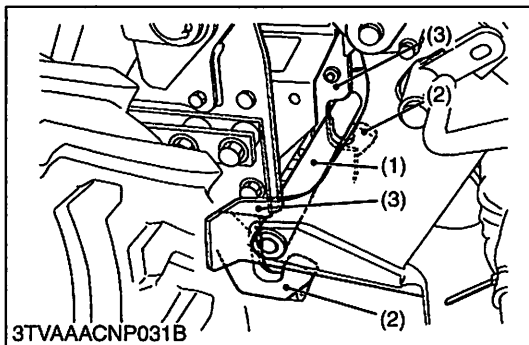
3. Move the tractor backward until the support hooks (2) on the tractor main frame are just beneath the mount bar (1) on the backhoe main frame.
4. Lower the mount bar (1) onto the support hooks (2) by operating the stabilizer and boom control lever.
5. Remove the snap pins (4) on the set pins (5).
6. Move the boom slowly to the lowering direction to engage the mount holders (6) on the backhoe with the tractor mount pins. Set pin (5) are locked automatically. Set the snap pins (4) to the mounted position.

■ **IMPORTANT**

- **Be careful not to catch the hydraulic hoses between backhoe frame and tractor while mounting the backhoe.**

■ **NOTE**

- **Move the tractor / loader / backhoe to an open area and cycle all backhoe functions.**
- **If the backhoe has been stored for long period, check and maintain the backhoe.**



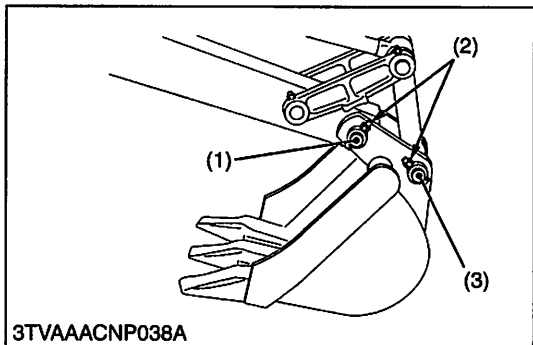
(1) Mount Bar (4) Snap Pin  
 (2) Support Hook (5) Set Pin  
 (3) Guide Step (6) Mount Pin Holder

W1015409

### [3] DISASSEMBLING THE BACKHOE

**■ IMPORTANT**

- When reassembling the pins, bushings and inner rings, apply slight coat of grease to them.
- When tightening the hydraulic hoses, refer to “HYDRAULIC HOSES FITTING AND FLARE PIPES” (Page 8-S7.)



**Bucket**

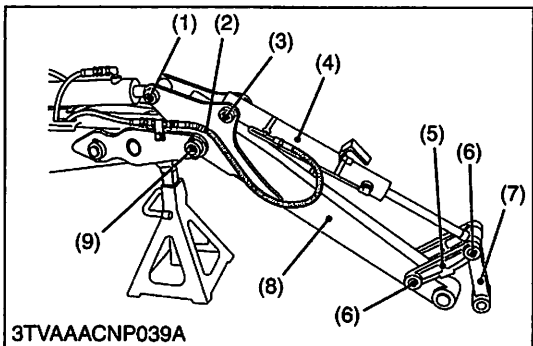
1. Remove the bucket from the dipper stick.

**(When reassembling)**

- Install locking nuts (2) to setting bolts at position where the setting bolt may still be rotated.

- (1) Pin (0.98 × 6.17)
- (2) Locking Nut
- (3) Pin (0.98 × 6.17)

W1015866



**Dipperstick and Bucket Cylinder**

1. Remove the pins (6) and remove the bucket link (7) and guide link (5).
2. Disconnect the hydraulic hoses (2) and remove the bucket cylinder (4).
3. Remove the pins (1), (9) and remove the dipperstick (8).

**■ NOTE**

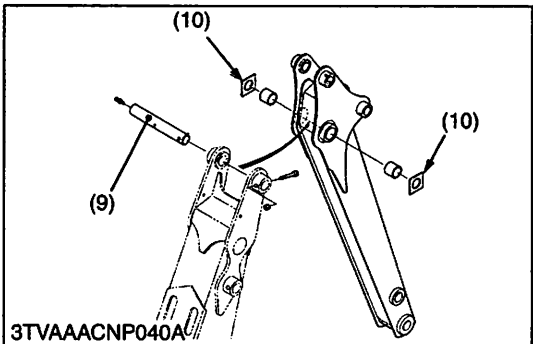
- To prevent from the damage of hydraulic tubes, set the wooden block etc. between dipperstick cylinder and boom.

**(When reassembling)**

- Lock the locking nuts to setting bolts at position where the setting bolt may still be rotated.
- Replace the spacers (10) at their original position.

- (1) Pin (0.98 × 5.39)
- (2) Hydraulic Hose
- (3) Pin (0.98 × 5.39)
- (4) Bucket Cylinder
- (5) Guide Link
- (6) Pin (0.98 × 6.68)
- (7) Bucket Link
- (8) Dipperstick
- (9) Pin (1.18 × 7.96)
- (10) Spacer

W1016036

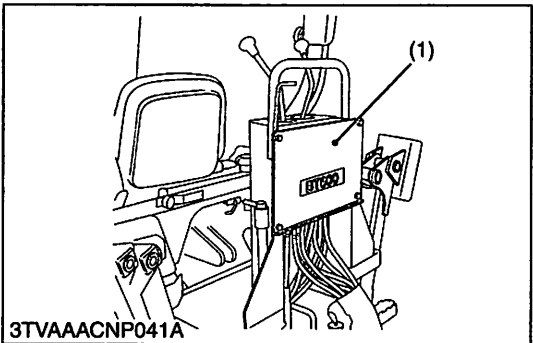


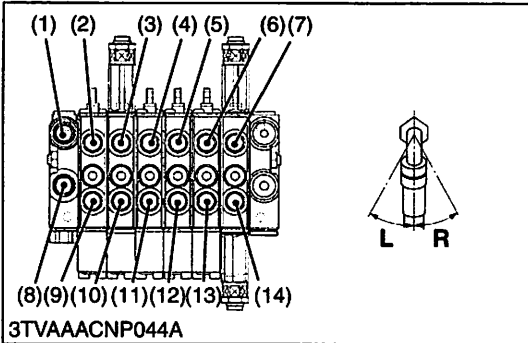
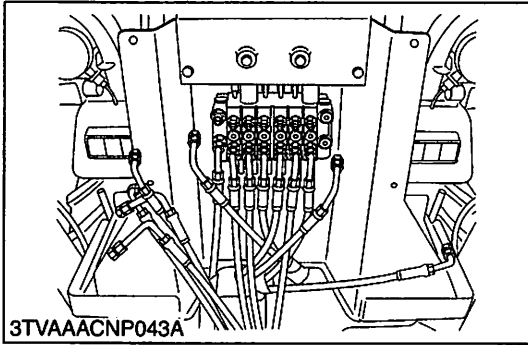
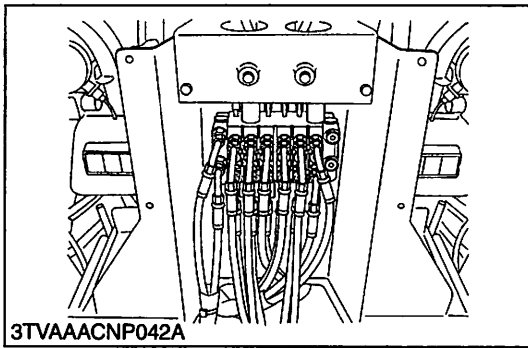
**Valve Cover**

1. Remove the valve cover (1).

- (1) Valve Cover

W1016537





**Hydraulic Hoses**

1. Disconnect the hydraulic hoses from the control valve.

**(When reassembling)**

- Connect the hydraulic hoses at their original positions and be sure to connect the hose angle as indicated table below.

Port	Angle of Bent Tube
T	L 0.227 rad. (L 13 °)
A6	L 0.227 rad. (R 13 °)

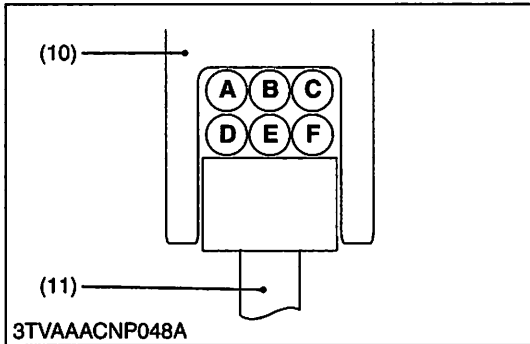
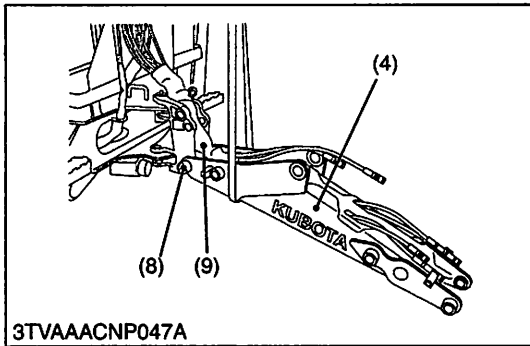
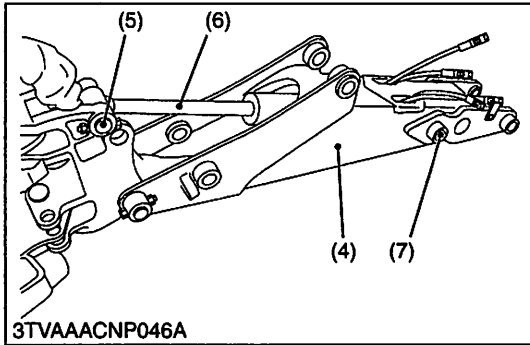
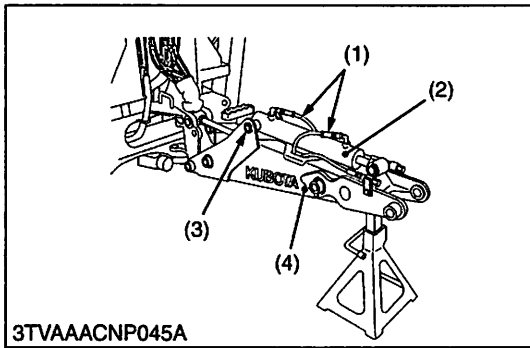
**(Reference)**

- Color or tape

	Color
P	Blue
A1, B1	Red
A2, B2	Orange
A3, B3	Green
A4, B4	White
A5, B5	Yellow
A6	Light Blue

- |                                 |                                  |
|---------------------------------|----------------------------------|
| (1) T Port (Return)             | (10) B2 Port (for Dipperstick)   |
| (2) A1 Port (for Bucket)        | (11) B3 Port (for Stabilizer RH) |
| (3) A2 Port (for Dipperstick)   | (12) B4 Port (for Stabilizer LH) |
| (4) A3 Port (for Stabilizer RH) | (13) B5 Port (for Boom)          |
| (5) A4 Port (for Stabilizer LH) | (14) B6 Port (for Swing)         |
| (6) A5 Port (for Boom)          |                                  |
| (7) A6 Port (for Swing)         |                                  |
| (8) P Port (Pump)               | <b>L : Installation Angle</b>    |
| (9) B1 Port (for Bucket)        | <b>R : Installation Angle</b>    |

W1016658



**Dipperstick Cylinder, Boom and Boom Cylinder**

1. Disconnect the hydraulic hoses (1) and remove the dipperstick cylinder (2).
2. Remove the pins (5), (7) and remove the boom cylinder (6).
3. Remove the pin (8) and remove the boom (4).
4. Remove the hydraulic hoses (9).

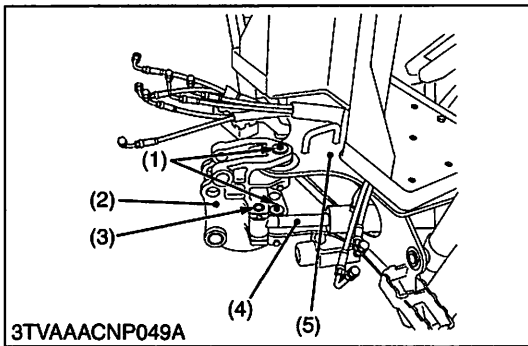
**(When reassembling)**

- Connect the hydraulic hoses at their original positions.
- Lock the locking nuts to setting bolts at position where the mounting bolt may still be rotated.

- (1) Hydraulic Hose
- (2) Dipperstick Cylinder
- (3) Pin (0.98 × 6.22)
- (4) Boom
- (5) Pin (1.18 × 4.72)
- (6) Boom Cylinder
- (7) Pin (1.18 × 7.96)
- (8) Pin (1.18 × 7.96)
- (9) Hose
- (10) Swing Frame
- (11) Boom Cylinder Rod

- Position of Hose**
- A : Bucket Bottom Hose
  - B : Dipper Rod Hose
  - C : Boom Bottom Hose
  - D : Bucket Rod Hose
  - E : Dipper Bottom Hose
  - F : Boom Bottom Hose

W1016286



**Swing Frame**

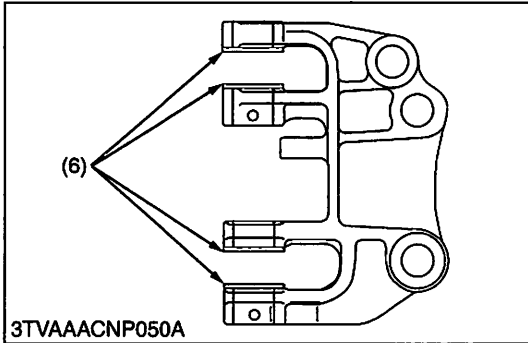
1. Disconnect the swing cylinder rods (4) from swing frame (2).
2. Remove the swing frame (2) from main frame (5).

**(When reassembling)**

- Lock the locking nuts to setting bolts at position where the setting bolt may still be rotated.
- Reinstall the thrust washers (6) at their original positions.

- |                       |                        |
|-----------------------|------------------------|
| (1) Pin (1.57 × 4.29) | (4) Swing Cylinder Rod |
| (2) Swing Frame       | (5) Main Frame         |
| (3) Pin (0.98 × 4.21) | (6) Thrust Washer      |

W1017110

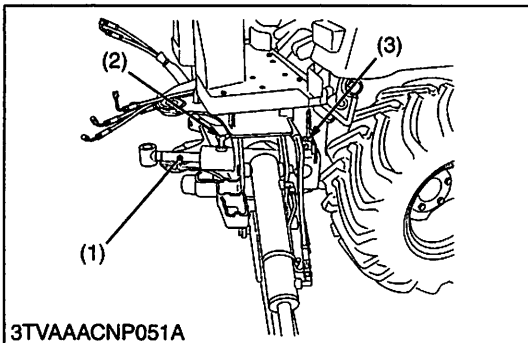


**Swing Cylinder**

1. Remove the swing cylinder bottom pin (3).
2. Disconnect the hydraulic hoses (2).
3. Remove the swing cylinder (1).

- |                    |                       |
|--------------------|-----------------------|
| (1) Swing Cylinder | (3) Pin (0.98 × 6.18) |
| (2) Hydraulic Hose |                       |

W1017745



**Stabilizers and Stabilizer Cylinder**

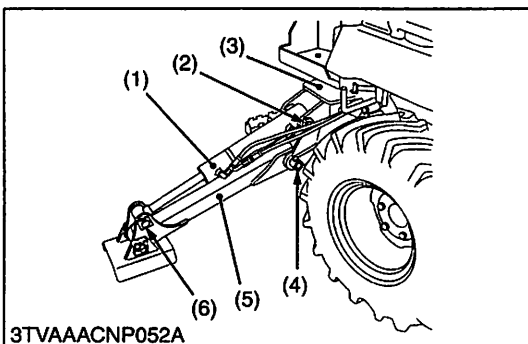
1. Remove the pins (2) (6) and remove the stabilizer cylinder (1) with hydraulic hoses.
2. Remove the pin (4) and remove the stabilizer (5).

**(When reassembling)**

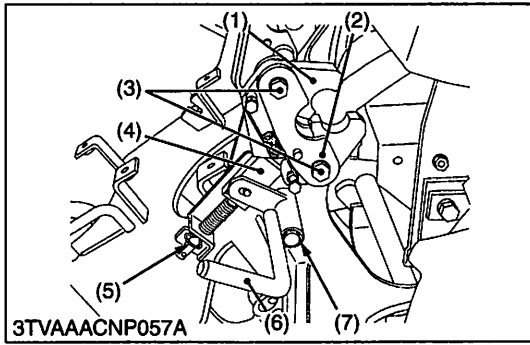
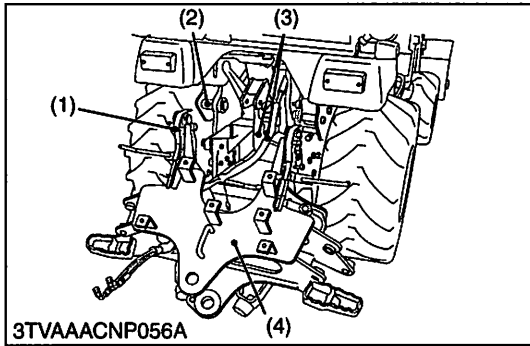
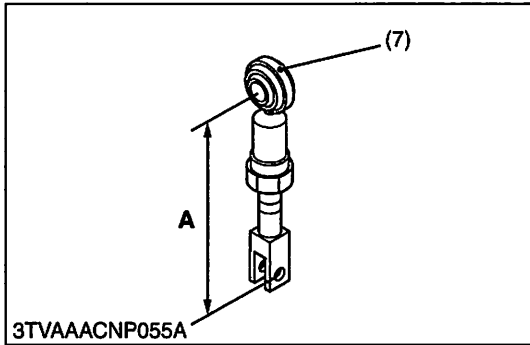
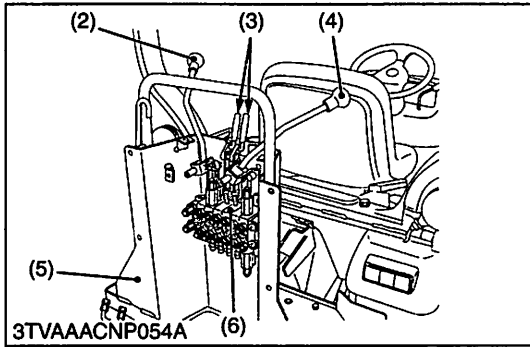
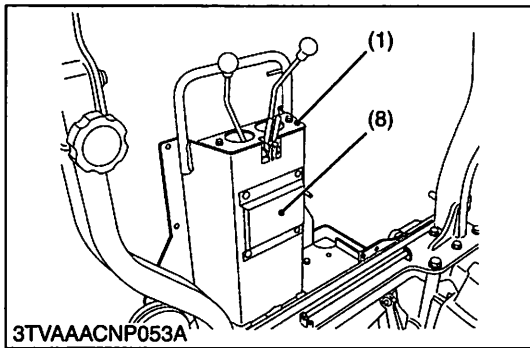
- Lock the locking nuts to setting bolts at position where the setting bolt may still be rotated.

- |                         |                       |
|-------------------------|-----------------------|
| (1) Stabilizer Cylinder | (4) Pin (0.98 × 6.93) |
| (2) Pin (0.98 × 6.06)   | (5) Stabilizer        |
| (3) Backhoe Main Frame  | (6) Pin (0.98 × 3.90) |

W1017254







**Control Valve and Step**

1. Remove the cover (8).
2. Remove the lever support (1).
3. Remove the control levers (2), (3), (4) from the control valve (6).
4. Remove the control valve (6) from the step (5).
5. Remove the step (5) from the backhoe main frame.

**(When reassembling)**

■ **NOTE**

- **Do not change the length of control lever rods (7). If the length of rod have been changed or replace them adjust the length as below.**

**(Reference)**

- Length of control lever rod A : 72.5 to 73.5 mm  
2.85 to 2.89 in.

- |  |                                |
|--|--------------------------------|
| (1) Lever Support                            | (5) Step                       |
| (2) Control Lever for Bucket and Dipperstick | (6) Control Valve              |
| (3) Control Lever for Stabilizer             | (7) Control Lever Rod Assembly |
| (4) Control Lever for Boom and Swing         | (8) Cover                      |

W1017535

**Backhoe Main Frame and Hydraulic Hose**

1. Hoist the backhoe main frame (4) and disconnect the mount holders (1) from mount pins (2).
2. Remove the three hydraulic hoses (3).
3. Separate the main frame (4) from the tractor frame.

- |                  |                        |
|------------------|------------------------|
| (1) Mount Holder | (3) Hydraulic Hose     |
| (2) Mount Pin    | (4) Backhoe Main Frame |

W1017875

**Holder Plate, Mount Holder and Mount Lever**

1. Remove the holder plate (2) and mount holder (1).
2. Remove the snap pin (5) and external cir-clip (7).
3. Remove the mount lever (6) and set pin (4).

**(When reassembling)**

Tightening torque	Holder plate mounting screw	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft·lbs
-------------------	-----------------------------	---

- |                  |                       |
|------------------|-----------------------|
| (1) Mount Holder | (5) Snap Pin          |
| (2) Holder Plate | (6) Mount Lever       |
| (3) Screw        | (7) External Cir-clip |
| (4) Set Pin      |                       |

W1018402

## 6. CHECKING, DISASSEMBLING AND SERVICING

### [1] CONTROL VALVE

#### (1) Checking and Adjusting

#### Relief Valve Setting Pressure

■ **NOTE**

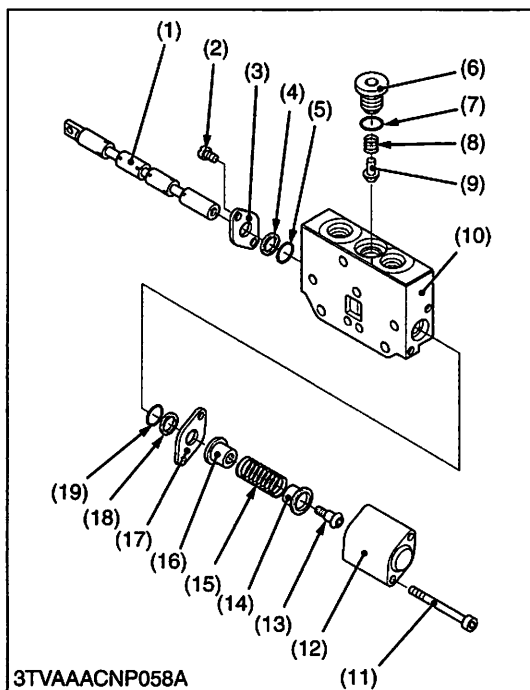
- The relief valve of the tractor hydraulic system is used as a relief valve of the backhoe hydraulic system.

(Reference)

Relief valve pressure	Factory spec.	12.3 to 12.7 MPa 125 to 130 kgf/cm <sup>2</sup> 1778 to 1849 psi
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W1019092

#### (2) Disassembling and Assembling



#### Disassembling Control Valve

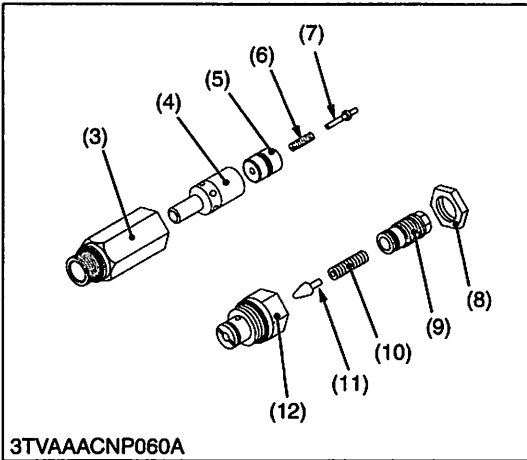
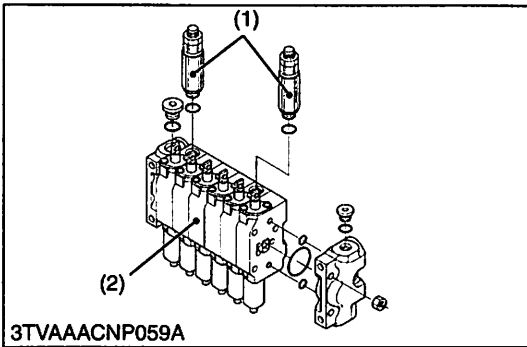
1. Remove the spring and load check valve.
2. Remove the seal plate and wiper ring from valve housing.
3. Remove the cap, seal plate and wiper ring, and draw out the spool from the valve housing.

(When reassembling)

- Clean all parts with a suitable solvent, and dry with a lint-free cloth or air.
- Visually inspect all parts for signs of scoring or damage.
- Install the spool and seal plate to the valve housing, taking care not to damage the O-rings.

- |                      |                    |
|----------------------|--------------------|
| (1) Spool            | (11) Screw         |
| (2) Screw            | (12) Cap           |
| (3) Seal Plate       | (13) Cap Screw     |
| (4) Wiper Ring       | (14) Spring Seat   |
| (5) O-ring           | (15) Return Spring |
| (6) Plug             | (16) Spring Seat   |
| (7) O-ring           | (17) Seal Plate    |
| (8) Spring           | (18) Wiper Ring    |
| (9) Load Check Valve | (19) O-ring        |
| (10) Valve Housing   |                    |

W1036061



**Disassembling Overload Valve (Port Relief Valve)**

1. Remove the overload relief valve (1) from the valve housing (3).
2. Separate the all component parts.

**(When reassembling)**

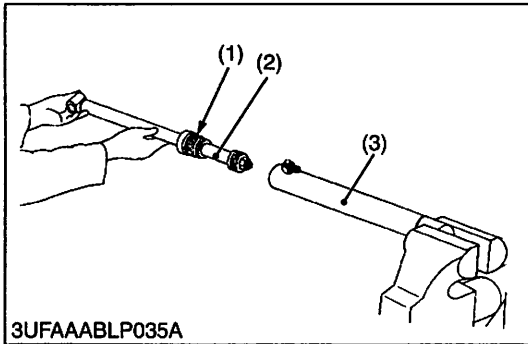
- Clean all parts with a suitable solvent, and dry with a lint-free cloth or air.
- Visually inspect all parts for signs of scoring or damage.
- Install the overload relief valve assembly to the valve housing, using care not to damage the O-ring.

- |                           |                     |
|---------------------------|---------------------|
| (1) Overload Relief Valve | (7) Piston Poppet   |
| (2) Control Valve         | (8) Lock Nut        |
| (3) Housing               | (9) Adjusting Screw |
| (4) Check Valve Poppet    | (10) Pilot Spring   |
| (5) Relief Valve Poppet   | (11) Pilot Poppet   |
| (6) Piston Spring         | (12) Pilot Section  |

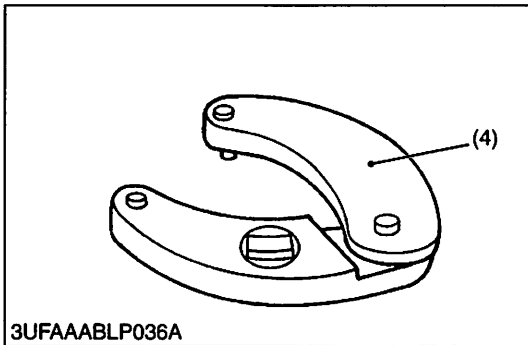
W1021194

## [2] BOOM, DIPPERSTICK, BUCKET, SWING AND STABILIZER CYLINDER

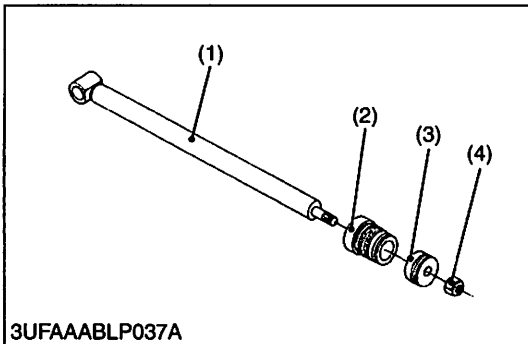
### (1) Disassembling and Assembling



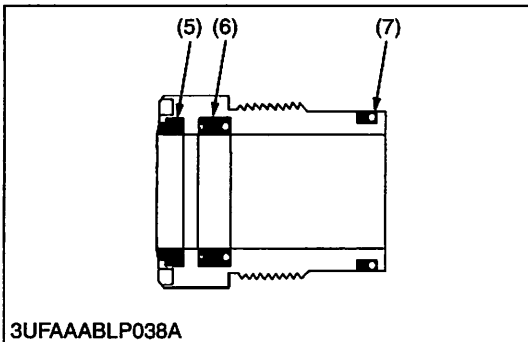
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3UFAAABL036A



3UFAAABL037A



3UFAAABL038A

#### Cylinder Rod Assembly

1. Drain hydraulic oil from the cylinder, and secure the tube end of the cylinder in a vise.
2. Unscrew the cylinder head (1) with the adjustable gland nut wrench (4).
3. Pull out the piston rod assembly (2) from the cylinder tube (3).

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

- Visually inspect the cylinder tube for signs of scoring or damage.
- Insert the piston rod assembly to the cylinder tube, using care not to damage the piston seal on the piston.
- Install the cylinder head to the cylinder tube, using care not to damage the O-ring on the cylinder head.

Tightening torque	Cylinder head	245 to 275 N-m 25.0 to 28.0 kgf-m 181 to 203 ft-lbs
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- (1) Cylinder Head (3) Cylinder Tube  
(2) Piston Rod Assembly (4) Adjustable Gland Wrench

W1021758

#### Cylinder Head, Piston and Nut

1. Secure the rod end in a vise.
2. Unscrew the nut (4), and remove the piston (3) and cylinder head (2) from the piston rod (1).

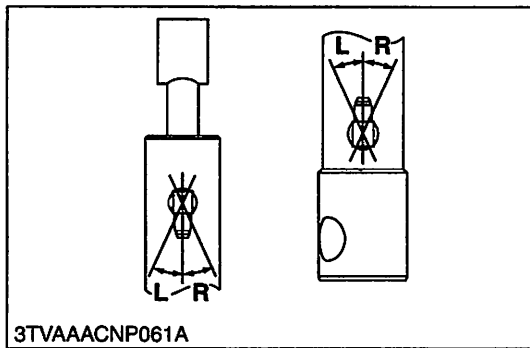
#### **(When reassembling)**

- Visually inspect all parts for signs of scoring or damage.
- Insert the piston rod to the cylinder head, using care not to damage the wiper seal (5) and oil seal (6).

Tightening torque	Bucket cylinder, boom cylinder, stabilizer cylinder and dipperstick cylinder, piston mounting nut	157 to 196 N-m 16.0 to 20.0 kgf-m 116 to 145 ft-lbs
	Swing cylinder piston mounting nut	216 to 245 N-m 22.0 to 25.0 kgf-m 159 to 181 ft-lbs

- (1) Piston Rod (5) Wiper Seal  
(2) Cylinder Head (6) Oil Seal  
(3) Piston (7) O-ring  
(4) Nut

W1021908

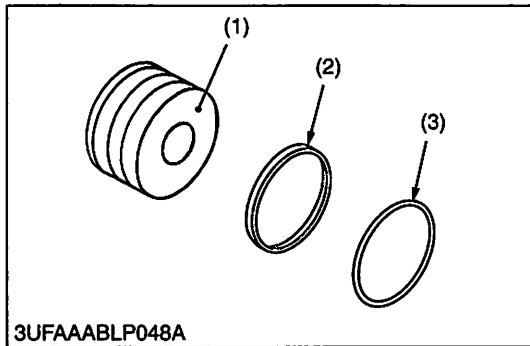


**Cylinder Adaptor Angle**

- Connect the cylinder adaptor at their original positions and be sure to connect the adaptor angle as indicated table below.

Cylinder	Rod Side	Bottom Side
Swing	R70 ±1 (deg.)	R75 ±1 (deg.)
Boom	0 ±1	0 ±1
Dipperstick	R25 ±1	L 25 ±1
Bucket	0 ±1	0 ±1
Stabilizer (LH)	R20 ±1	0 ±1
Stabilizer (RH)	L20 ±1	0 ±1

W1022523

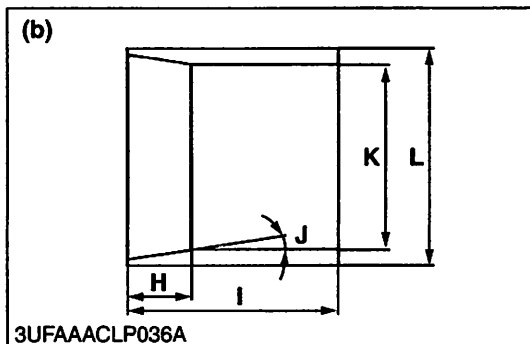
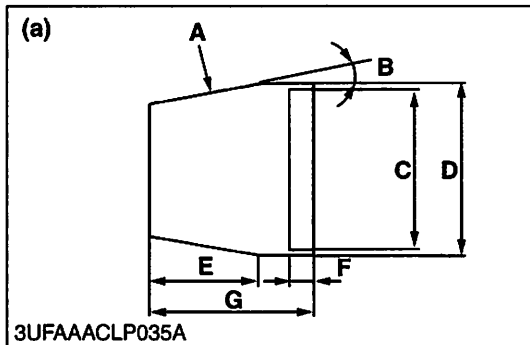


**Piston Seal and O-ring**

1. Remove the piston seal (2) and O-ring (3) from the piston (1).

**■ IMPORTANT**

- When installing the O-ring (3) and piston seal (2) to the piston (1), use the slide jig and correcting jig as shown in the figure.

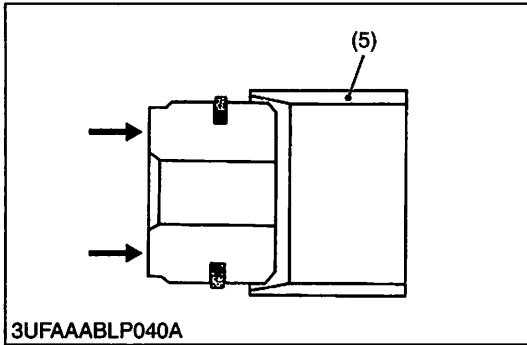
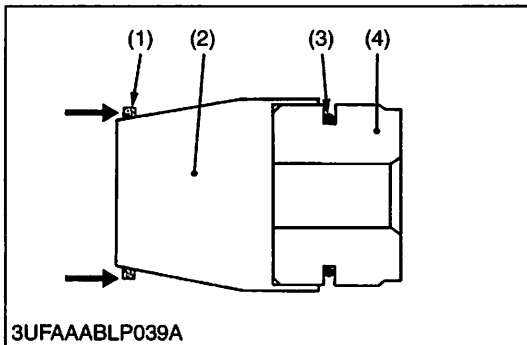


	Bucket, Dipperstick, Swing, Stabilizer Cylinder	Boom Cylinder
A	80 √	80 √
B	0.157 rad. 9°	0.157 rad. 9°
C	60.18 mm 2.369 in.	50.18 mm 1.976 in.
D	61.18 mm 2.409 in.	51.18 mm 2.015 in.
E	42.00 mm 1.654 in.	42.00 mm 1.654 in.
F	10.00 mm 0.394 in.	10.00 mm 0.394 in.
G	58.40 mm 2.299 in.	58.40 mm 2.299 in.
H	14.00 mm 0.551 in.	14.0 mm 0.551 in.
I	35.00 mm 1.378 in.	35.00 mm 1.378 in.
J	0.122 rad. 7°	0.122 rad. 7°
K	60.2 mm 2.370 in.	50.2 mm 1.976 in.
L	69.00 mm 2.717 in.	59.00 mm 2.323 in.

- (1) Piston
- (2) Piston Seal
- (3) O-ring

- (a) Slide Jig
- (b) Correcting Jig

W1022090



**Installing O-ring and Piston Seal**

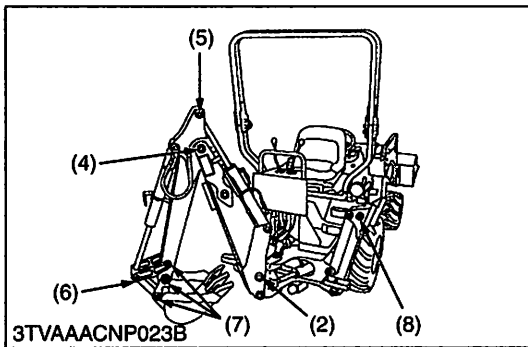
1. Place the slide jig (2) on the piston (4).
2. Install the O-ring (3) on the piston using the slide jig.
3. Install the piston seal (1) over the O-ring using the slide jig.
4. Compress the piston seal to the correct size by installing the piston into the correcting jig (5).

■ **NOTE**

- **Do not turn (roll) the piston seal as you install it.**

- |                 |                    |
|-----------------|--------------------|
| (1) Piston Seal | (4) Piston         |
| (2) Slide Jig   | (5) Correcting Jig |
| (3) O-ring      |                    |

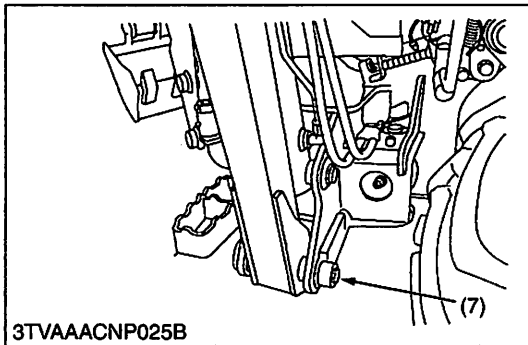
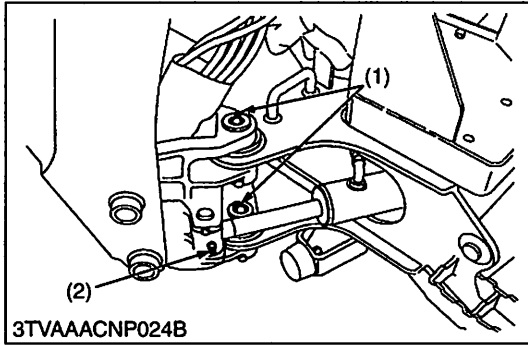
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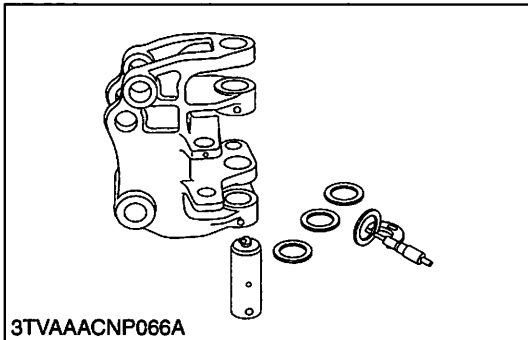
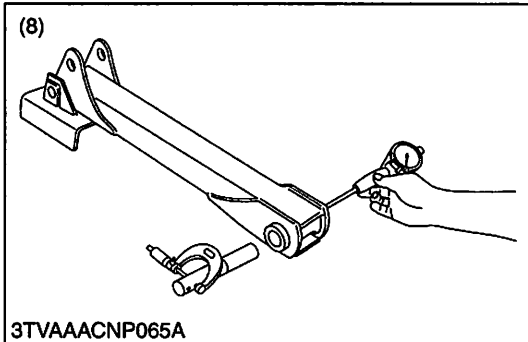
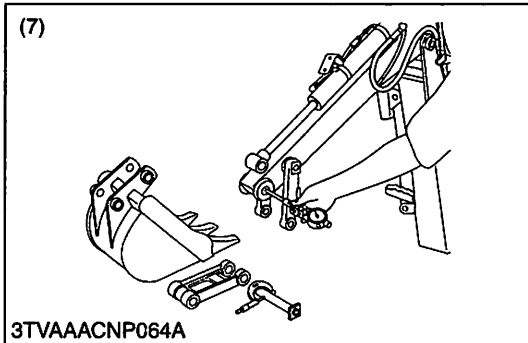
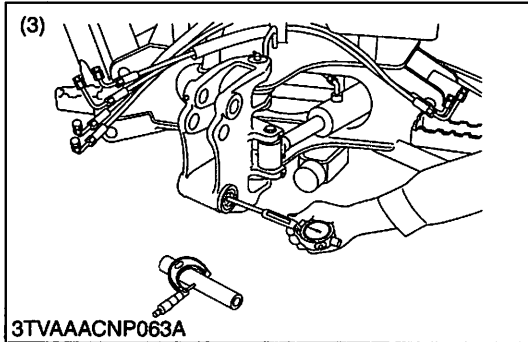
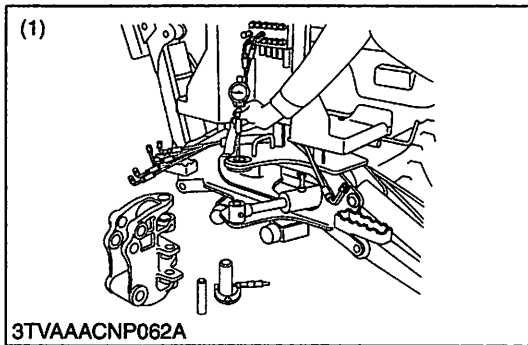


**Clearance between Pin and Bushing**

1. Measure the pins O.D. with an outside micrometer.
2. Measure the bushings I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace pin or bushing.

W1023439





**Clearance between Pin and Bushing (Continued)**

	Clearance	Factory spec.	Allowable limit
(1)	Main frame fulcrum pin and bushing	0.076 to 0.132 mm 0.003 to 0.005 in.	0.5 mm 0.0197 in.
(2)	Swing cylinder rod pin and cylinder bushing	0.108 to 0.259 mm 0.004 to 0.010 in.	1.0 mm 0.0394 in.
(3)	Boom support pin and bushing, dipperstick fulcrum pin and bushing	0.140 to 0.180 mm 0.006 to 0.007 in.	1.0 mm 0.0394 in.
(4)	Boom cylinder rod pin and cylinder bushing	0.139 to 0.281 mm 0.005 to 0.011 in.	1.0 mm 0.0394 in.
(5)	Dipperstick cylinder rod pin and cylinder bushing	0.178 to 0.309 mm 0.007 to 0.012 in.	1.0 mm 0.0394 in.
(6)	Bucket cylinder rod pin and cylinder bushing	0.262 to 0.393 mm 0.010 to 0.015 in.	1.0 mm 0.0394 in.
(7)	Guide link pin / stabilizer arm pin / bucket fulcrum / bucket link pins and bushing	0.149 to 0.184 mm 0.006 to 0.007 in.	1.0 mm 0.0394 in.
(8)	Stabilizer cylinder rod pin and cylinder bushing	0.127 to 0.253 mm 0.005 to 0.010 in.	1.0 mm 0.0394 in.

Main frame fulcrum pin O.D.	Factory spec.	39.97 to 40.00 mm 1.574 to 1.575 in.
Cylinder pins (swing / bucket / dipperstick / stabilizer), bucket fulcrum / guide link pins and stabilizer arm pins O.D.		24.816 to 25.000 mm 0.977 to 0.984 in.
Cylinder pins (boom), boom support pin and dipperstick fulcrum pin O.D.		29.820 to 30.000 mm 1.174 to 1.181 in.
Main frame fulcrum bushing I.D.		40.081 to 40.110 mm 1.578 to 1.579 in.
Cylinder bushing (swing / bucket / dipperstick / stabilizer), bucket fulcrum / guide link bushing and stabilizer arm bushing I.D.		25.000 to 25.209 mm 0.984 to 0.992 in.
Cylinder bushing (boom), boom support bushing and dipperstick bushing I.D.		30.000 to 30.251 mm 1.181 to 1.191 in.

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**Thrust Washer Wear**

1. Measure the thickness of thrust washer with an outside micrometer.
2. If the wear exceeds the allowable limit, replace it.

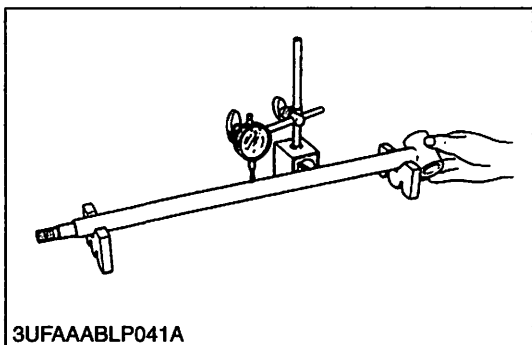
■ **NOTE**

- Visually inspect the thrust washer for signs of scoring or damage not only on the thrust washer but also on the main frame and swing frame contact surface.

Thrust washer thickness	Factory spec.	2.45 to 2.82 mm 0.0966 to 0.1126 in.
	Allowable limit	1.8 mm 0.0709 in.

W1025818





**Piston Rod Bend**

1. Place piston rod on V blocks.
2. Set a dial indicator on the center of the rod.
3. Turn the piston rod and read the dial indicator.
4. If the measurement exceeds the allowable limit, replace it.

Piston rod bend	Allowable limit	0.25 mm 0.0098 in.
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W1026026

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