

## TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of KUBOTA Tractor B1410, B1610. It is divided into two parts, "Mechanism" and "Servicing" for each section.

### ■ Mechanism

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

### ■ Servicing

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

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

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

March '99

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## SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and decals on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.

It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.



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



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



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

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

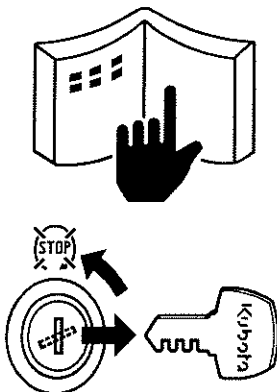
■ **NOTE** : Gives helpful information.

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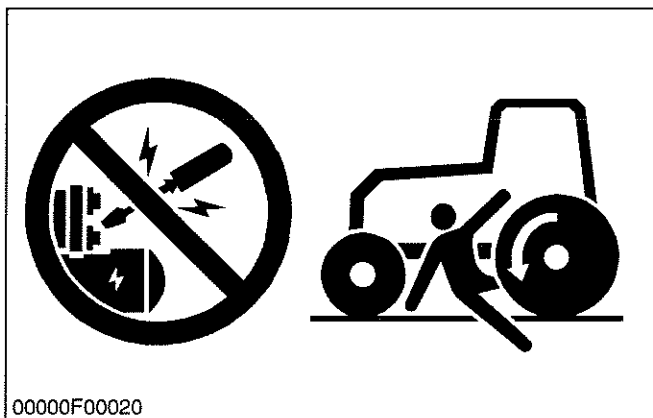
### BEFORE SERVICING AND REPAIRING

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

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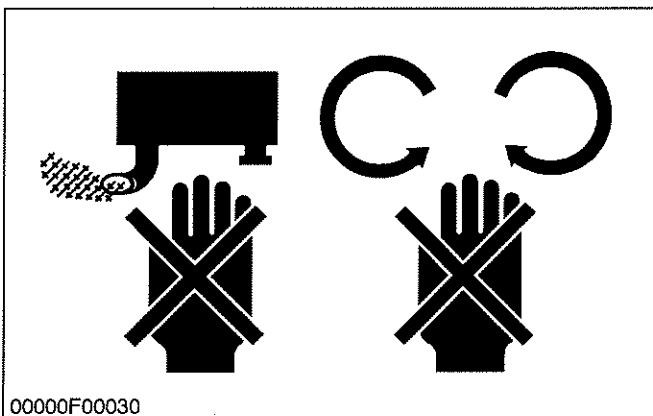


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## SAFETY STARTING

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

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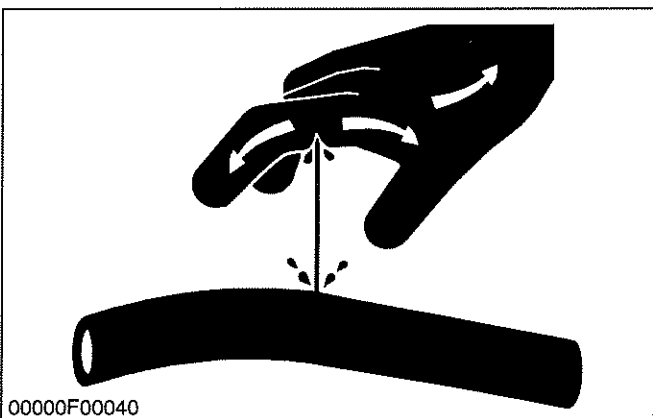


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## SAFETY WORKING

- (1) Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- (2) Wear close fitting clothing and safety equipment appropriate to the job.
- (3) Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
- (4) When servicing is performed together by two or more persons, take care to perform all work safely.
- (5) Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.
- (6) Do not touch the rotating or hot parts while the engine is running.
- (7) 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.
- (8) Escaping fluid (fuel or hydraulic oil) under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or fuel lines. Tighten all connections before applying pressure.

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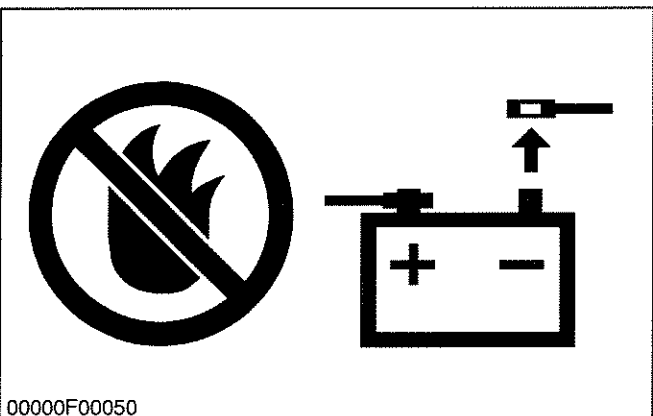


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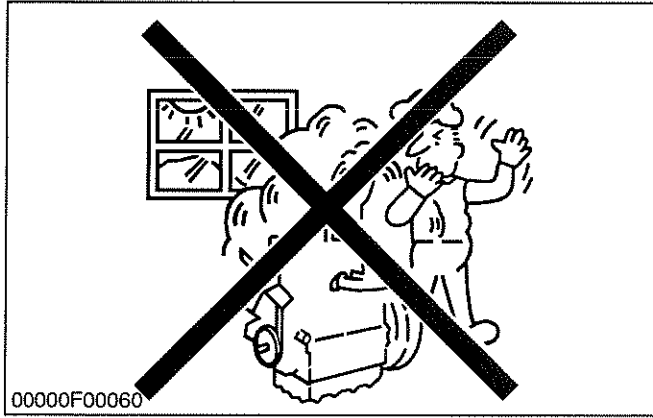
## AVOID FIRES

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

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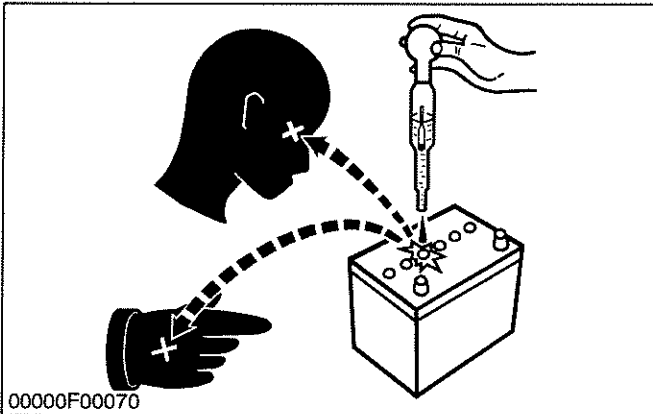


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**VENTILATE WORK AREA**

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

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**PREVENT ACID BURNS**

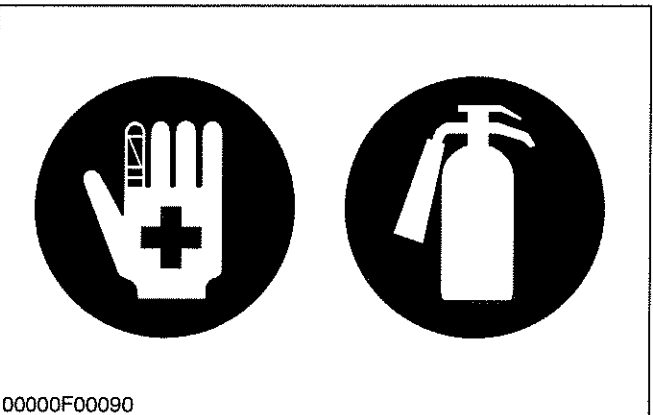
- (1) Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, clothing and cause blindness if splashed into eyes. Keep electrolyte away from eyes, hands and clothing. If you spill electrolyte on yourself, flush with water, and get medical attention immediately.

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**DISPOSE OF FLUIDS PROPERLY**

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

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**PREPARE FOR EMERGENCIES**

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

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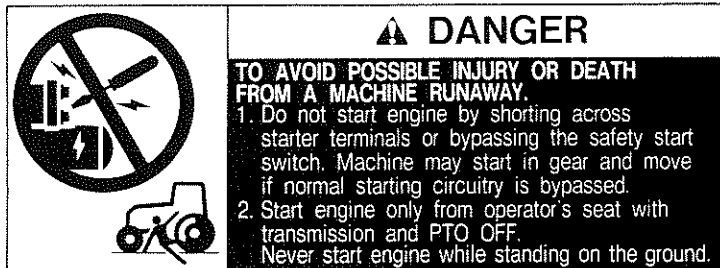


## SAFETY DECALS

- The following safety decals are installed on the machine.  
If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

### DANGER, WARNING AND CAUTION LABELS

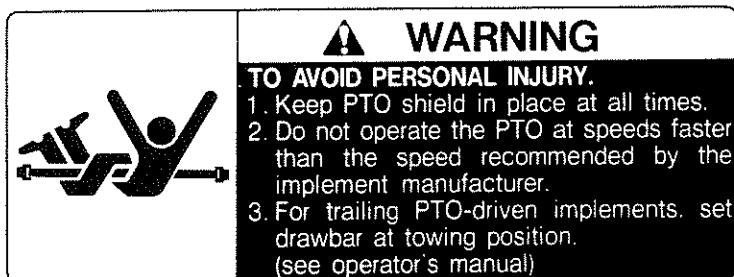
(1) Part No. TA040-4965-2



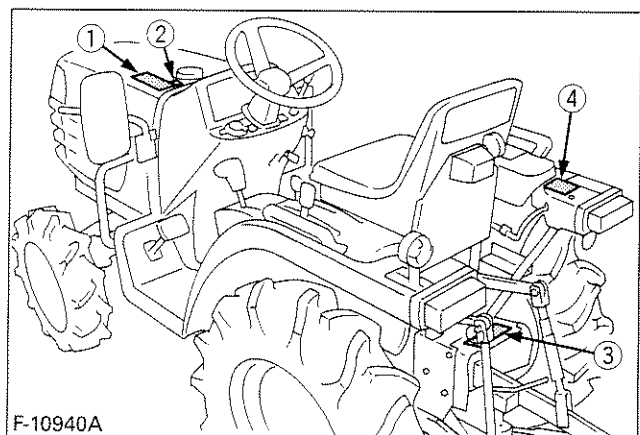
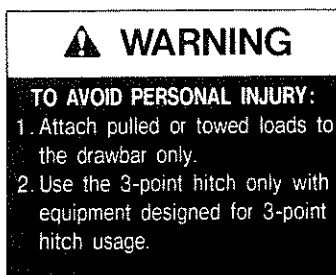
(2) Part No. 6C040-4741-2  
No fire



(3) Part No. TA040-4959-3



(4) Part No. TA040-4935-1



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

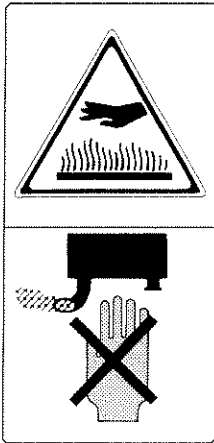
## ⚠ CAUTION

### 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. Lock the two brake pedals together before driving on the road.
8. Slow down for turns, or rough roads, or when applying individual brakes.
9. On public roads use SMV emblem and hazard lights, if required by local traffic and safety regulations.
10. Pull only from the drawbar.
11. Before dismounting lower the implement, set the parking brake, stop the engine and remove the key.

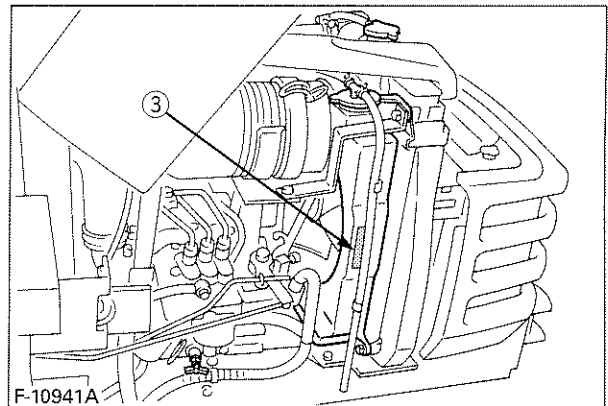
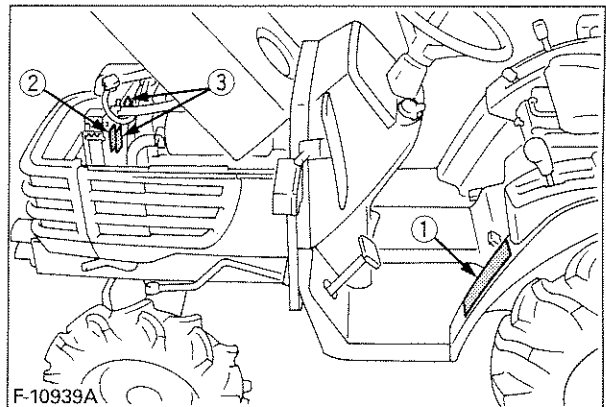
(2) Part No. 6C090-4959-1

Do not touch hot surface like muffler, etc



(3) Part No. 6C090-4958-2

Stay clear of engine fan and fanbelt.



### 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 Dealer.
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

Model			B1410	B1610
PTO power			8.1 kW (11.0 PS)	9.2 kW (12.5 PS)
Engine	Maker	KUBOTA		
	Model	D662-D14		
	Type	Indirect Injection. Vertical, water-cooled, 4-cycle diesel		
	Number of cylinders	3		
	Bore and stroke	64 × 68 mm (2.52 × 2.68 in.)		
	Total displacement	656 cm <sup>3</sup> (40.0 cu.in.)		
	Engine net power (DIN70020)	9.6 kW (13.0 PS)		
	Rated revolution min <sup>-1</sup> (rpm)	2800		
	Maximum torque	37.0 N·m (3.77 kgf·m)		
	Battery	12 V, RC : 71 min, CCA : 390 A		
	Starting system	Electric starting with cell starter 12 V, 0.85 kW		
	Lubricating system	Forced lubrication by trochoidal pump		
	Cooling system	Pressurized radiator, forced circulation with water pump		
	Fuel	Diesel fuel No. 2-D [above -10 °C (14 °F)], Diesel fuel No. 1 [below -10 °C (14 °F)]		
Capacities	Fuel tank	13 L (3.4 U.S.gals, 2.9 Imp.gal)		
	Engine crankcase (with filter)	2.4 L (2.5 U.S.qts, 2.1 Imp.qts)		
	Engine coolant (with recovery tank)	2.6 L (2.7 U.S.qts, 2.3 Imp.qts)		
	Transmission case	10.5 L (2.8 U.S.gals, 2.3 Imp.gals)		
	Front axle case	3.4 L (3.6 U.S.qts, 3.0 Imp.qts)		
Dimensions	Overall length (without 3P)	2035 mm (80.1 in.)		
	Overall width	932 to 1206 mm (36.7 to 47.5 in.)		
	Overall height (top of steering wheel)	*	1235 mm (48.6 in.)	1255 mm (49.4 in.)
		**	1175 mm (46.3 in.)	1195 mm (47.0 in.)
	Wheel base	1270 mm (50.0 in.)		
	Minimum ground clearance	250 mm (9.8 in.)		
	Tread	Front	778 mm (30.6 in.)	767 mm (30.2 in.)
			Rear	711 to 1031 mm (30.0 to 40.6 in.)
Weight (with ROPS)			510 kg (1125 lbs)	522 kg (1151 lbs)
Clutch			Dry single plate	
Travelling system	Tires	Front	4.50 - 10 (4PR)	5 - 12 (4PR)
		Rear	7 - 16 (4PR)	8 - 16 (4PR)
	Steering	Manual steering		
	Transmission	Gear-shift, 6 forward and 2 reverse		
	Brake	Wet disk type		
	Min. turning radius (with brake)	1.8 m (5.9 feet)		
	Differential	Bevel gear		
Hydraulic system	Hydraulic control system	Up and down type control valve		
	Pump capacity	14.1 L/min (3.7 U.S.GPM, 3.1 Imp.GPM)		
	Three point hitch	SAE Category I		
	Max. lift force (at lift point)	540 kg (1191 lbs)		
	Max. lift force (24 in, behind lift points)	410 kg (904 lbs)		
PTO system	Rear	PTO shaft	SAE 1-3/8, 6 splines	
		Revolution	2 speeds (540 min <sup>-1</sup> (rpm) at 2773 engine min <sup>-1</sup> (rpm)) (1000 min <sup>-1</sup> (rpm) at 2836 engine min <sup>-1</sup> (rpm))	
	Mid.	PTO shaft	USA No. 5 (KUBOTA 10-tooth) involute spline	
		Revolution	1 speed (2500 min <sup>-1</sup> (rpm) at 2750 engine min <sup>-1</sup> (rpm))	

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

\*\* Low profile type

# TRAVELLING SPEED

[At rated engine min<sup>-1</sup> (rpm)]

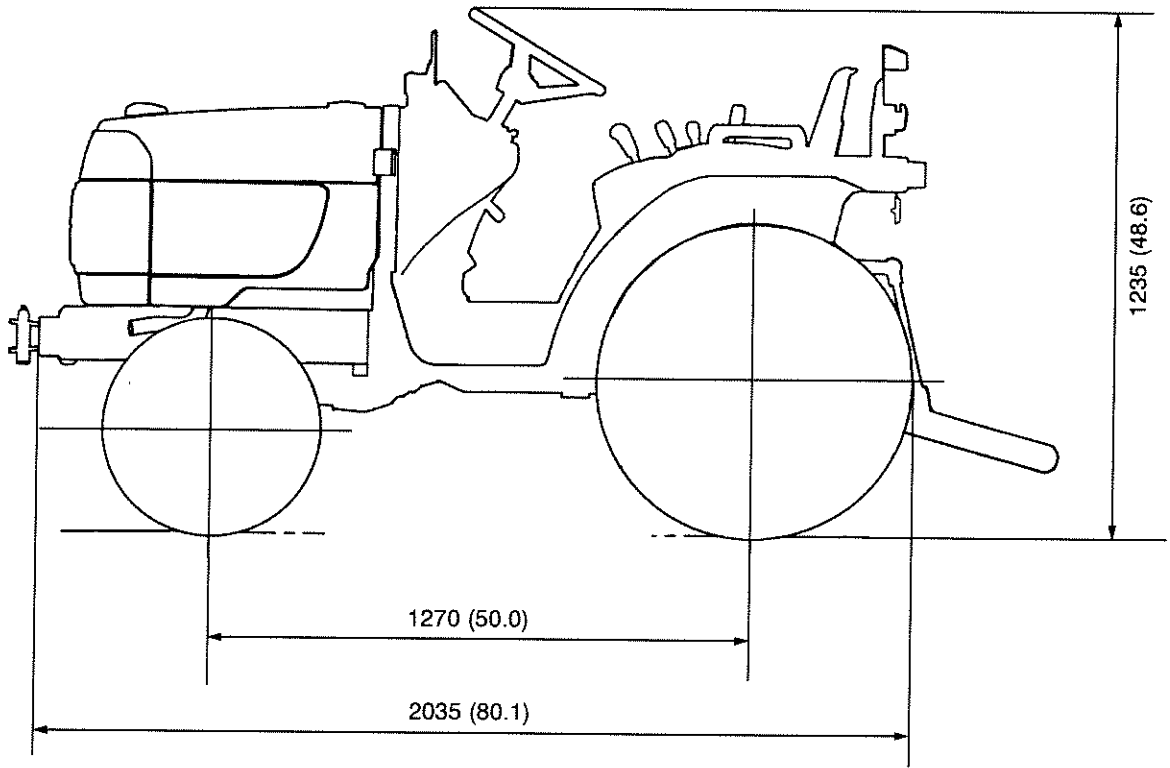
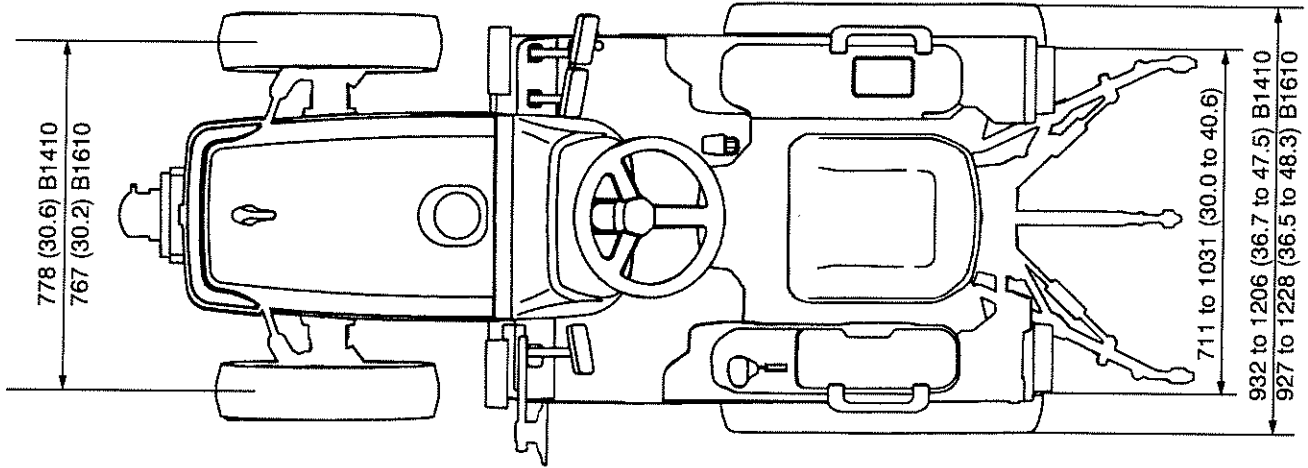
Model				B1410	B1610	B1410 / B1610
Tire size (Rear)				7 – 16	8 – 16	212/ 80D – 15
		Range gear shift lever	Main gear shift lever	km/h	km/h	km/h
Forward	1	Low	1	0.77	0.83	0.75
	2		2	1.40	1.49	1.36
	3		3	2.54	2.70	2.46
	4	High	1	4.32	4.61	4.19
	5		2	7.81	8.33	7.58
	6		3	14.14	15.08	13.73
	Max. speed (at 3000 engine rpm)			15.15	16.15	14.71
	Reverse	1	Low	R/AR	1.04	1.11
2		High	R/AR	5.79	6.17	5.62
		Max. speed (at 3000 engine rpm)			6.20	6.61

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

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DIMENSIONS

Unit mm (in.)



1

2

3

# GENERAL

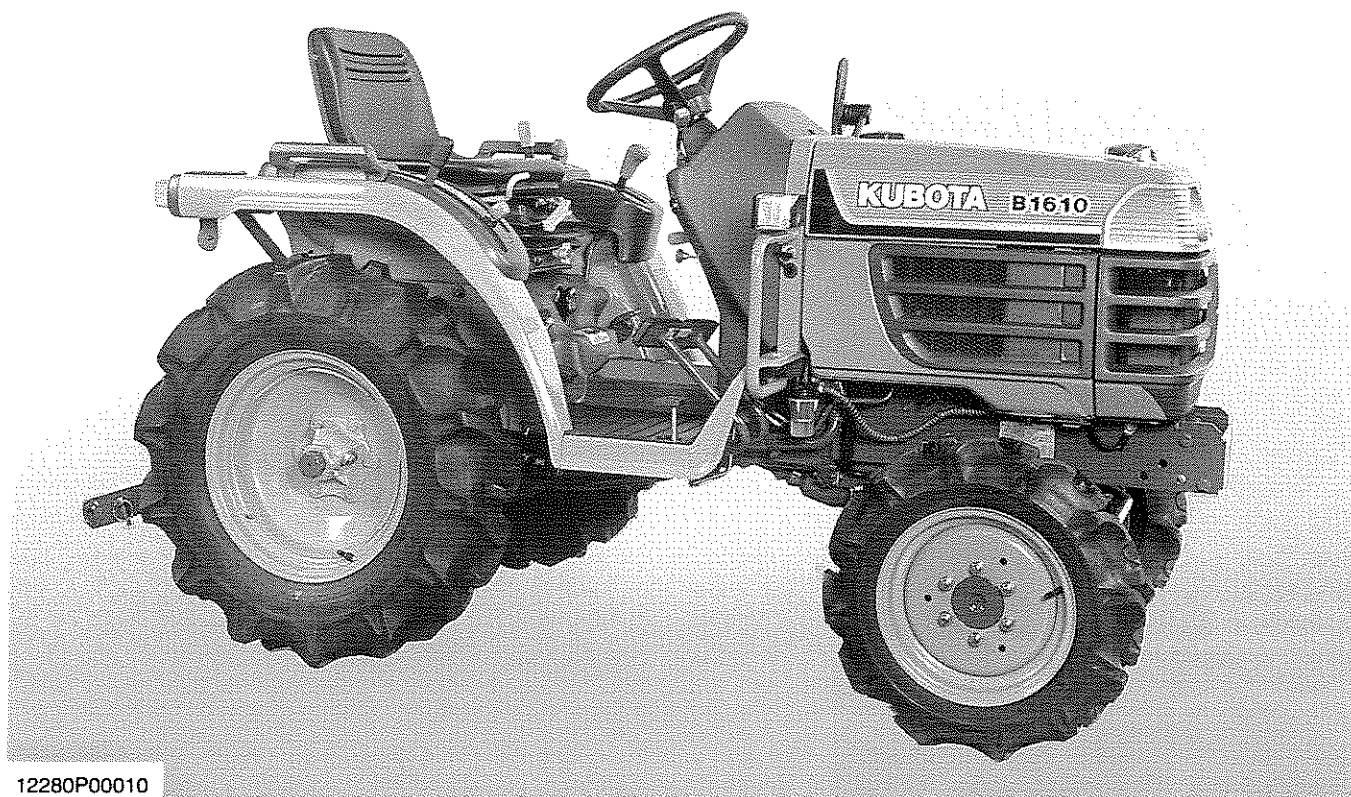
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## [1] FEATURES



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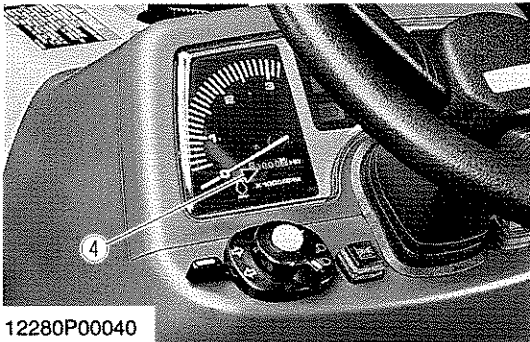
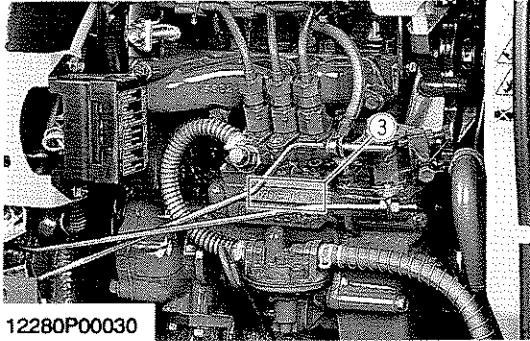
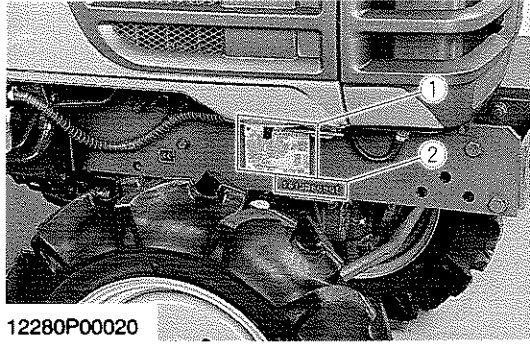
- |   |  |
|---|--|
| <p>(1) <b>Mid-PTO (If equipped)</b></p> <p>(2) <b>E-TVCS Diesel Engine</b></p> <p>(3) <b>Combination Panel of Easy Checker</b><br/>           (Indicators for charging system, engine oil pressure, glow plug indicator, hazard / turn signal indicator, high beam indicator, trailer indicator and hazard light indicator. And fuel gauge and coolant temperature gauge)</p> | <p>(4) <b>New Design</b></p> <p>(5) <b>Secondary Brake (If equipped)</b></p> <p>(6) <b>Wet Disc Brake</b></p> <p>(7) <b>Hydraulic Block Type Outlet</b><br/>           (Outlet has the delivery pipe for 3 point hitch)<br/>           (Rear outlet has the rear side of tractor, if equipped)</p> <p>(8) <b>Hydraulic Block Type Outlet (If equipped)</b></p> |
|---|--|

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## [2] TRACTOR IDENTIFICATION

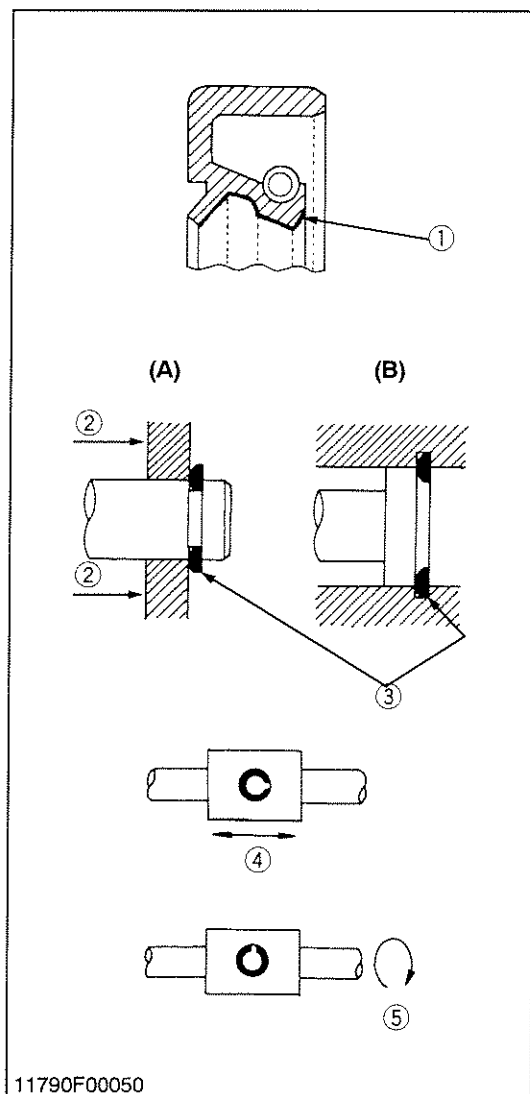
When contacting your local KUBOTA distributor, always specify engine serial number, tractor serial number and hour meter reading.

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



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### [3] GENERAL PRECAUTIONS



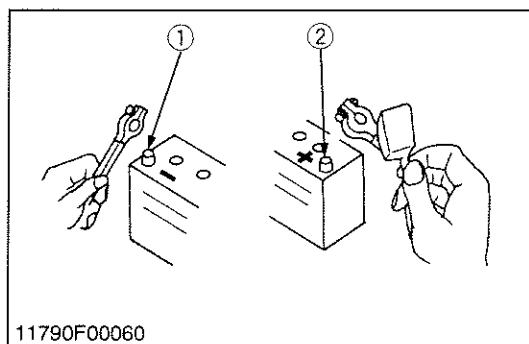
- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently used 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 tractor 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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### [4] HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



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

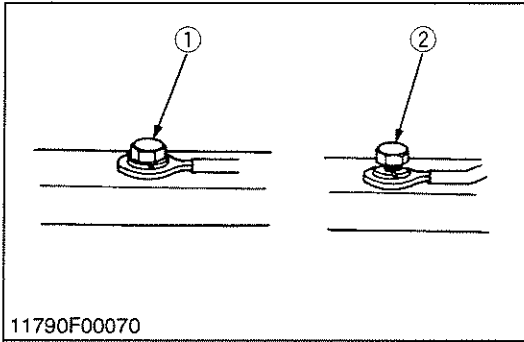
#### ■ IMPORTANT

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

- (1) Negative Terminal

- (2) Positive Terminal

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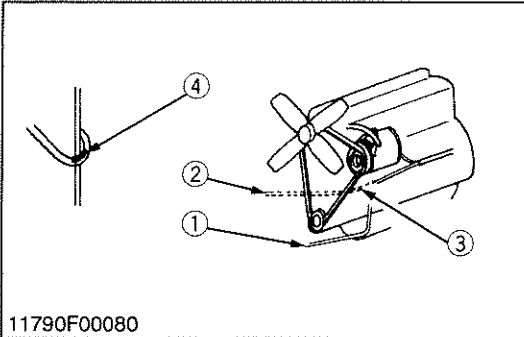
**(1) Wiring**

- Securely tighten wiring terminals.

(1) Correct  
(Securely Tighten)

(2) Incorrect  
(Loosening Leads to Faulty Contact)

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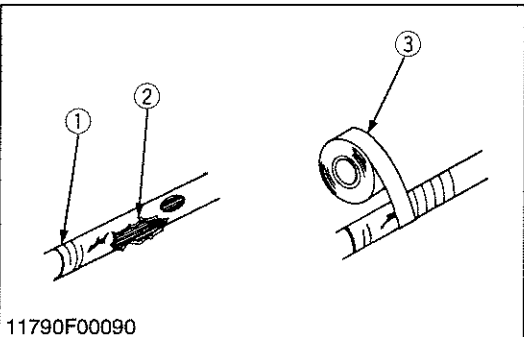


- Do not let wiring contact dangerous part.

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

(3) Dangerous Part  
(4) Dangerous Part

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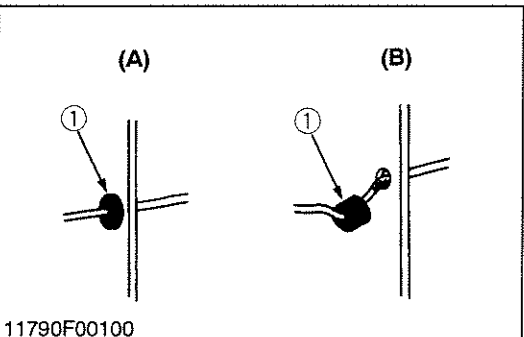


- Repair or change torn or aged wiring immediately.

(1) Aged  
(2) Torn

(3) Insulating Vinyl Tape

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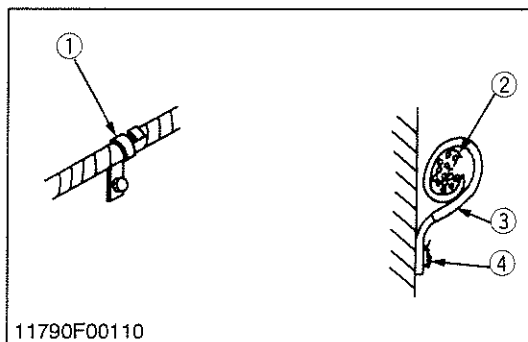


- Securely insert grommet.

(1) Grommet

(A) Correct  
(B) Incorrect

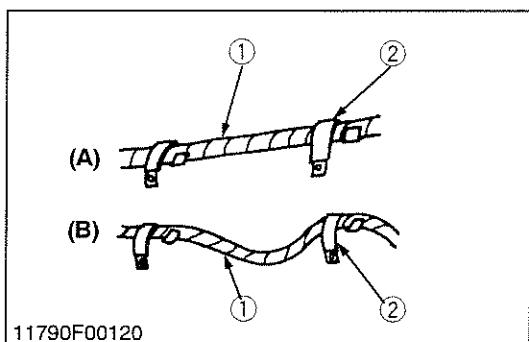
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- Securely clamp, being careful not to damage wiring.

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

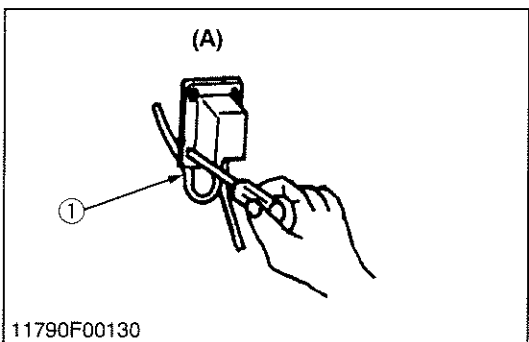
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- Clamp wiring so that there is no twist, unnecessary sag, or excessive tension, except for movable part, where sag be required.

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

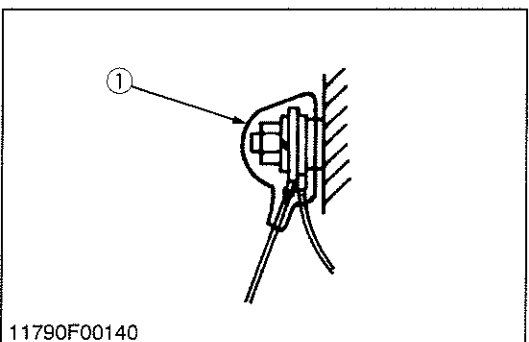
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- In installing a part, take care not to get wiring caught by it.

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

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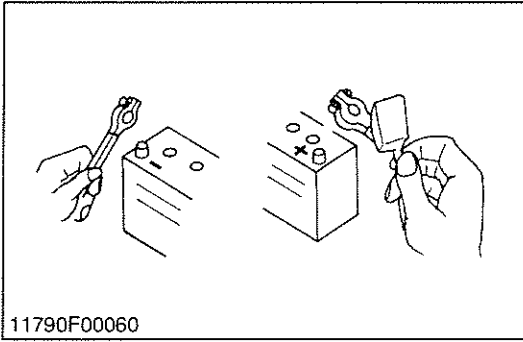


- After installing wiring, check protection of terminals and clamped condition of wiring, only then connect battery.

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

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## (2) Battery



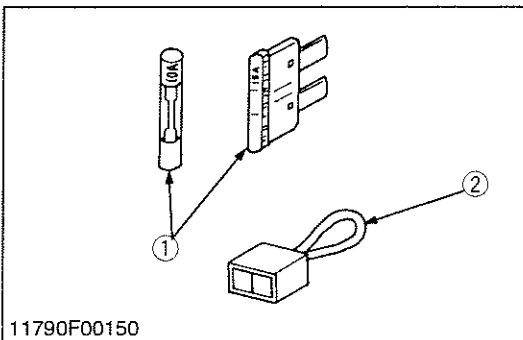
- Take care not to confuse positive and negative terminal posts.
- When removing battery cables, disconnect negative cable first. When installing battery cables, check for polarity and connect positive cable first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting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

11790G00131

## (3) Fuse



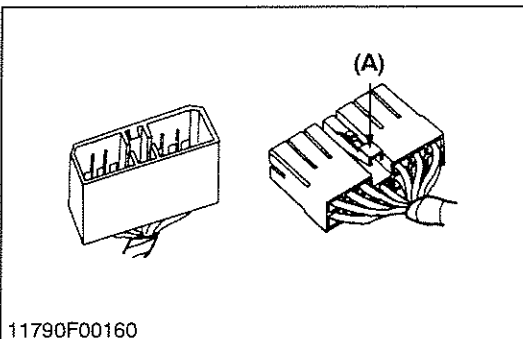
- Use fuses with specified capacity. Neither too large or small capacity fuse is acceptable.
- Never use steel or copper wire in place of fuse.
- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of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

(1) Fuse

(2) Fusible Link

11790G00140

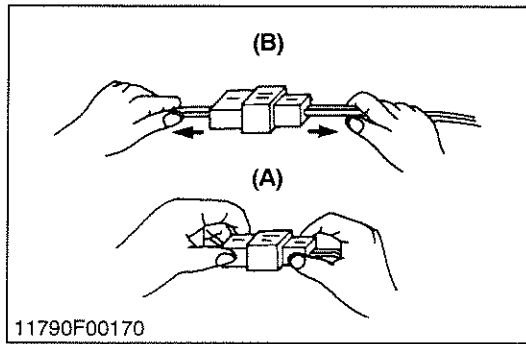
## (4) Connector



- For connector with lock, push lock to separate.

(A) Push

11790G00150

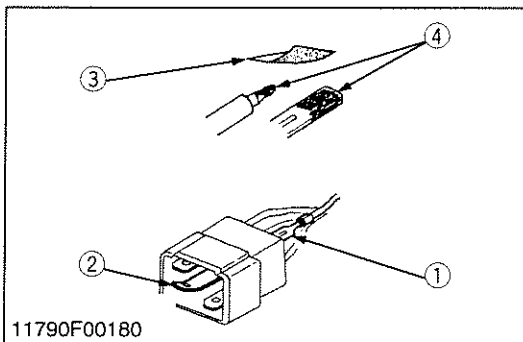


- In separating connectors, do not pull wire harnesses.
- Hold connector bodies to separate.

(A) Correct

(B) Incorrect

11790G00160



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

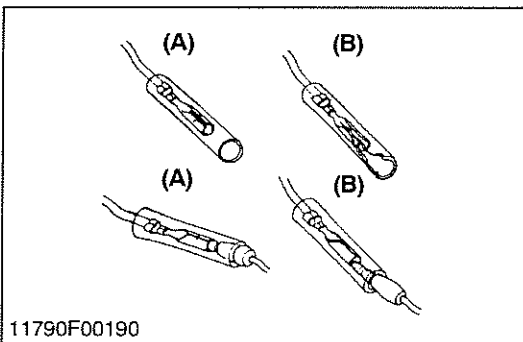
(1) Exposed Terminal

(3) Sandpaper

(2) Bend Terminal

(4) Rust

11790G00170

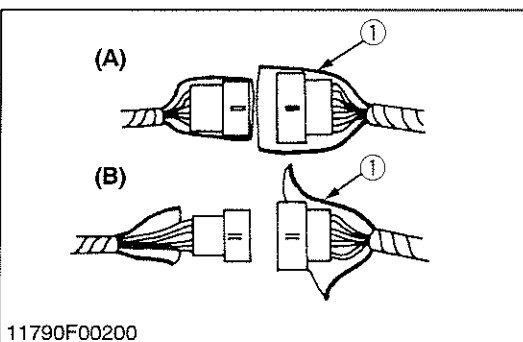


- Make certain that there is no female connector being too open.

(A) Correct

(B) Incorrect

11790G00180



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

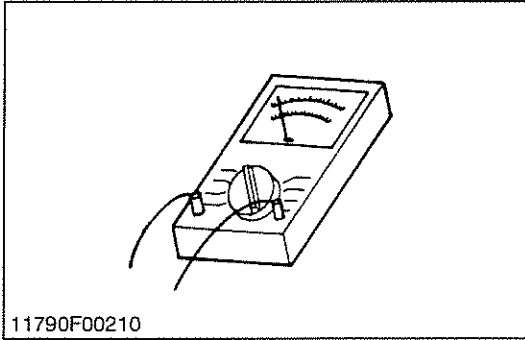
(1) Cover

(A) Correct

(B) Incorrect

11790G00190

### (5) Handling of Circuit Tester



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

11790G00200



## [5] LUBRICANTS, FUEL AND COOLING WATER

No.	Place	Capacity	Lubricants, fuel and cooling water	
		B1410 / B1610		
1	Fuel tank	13.0 L 3.4 U.S.gals. 2.9 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	2.6 L 2.7 U.S.qts. 2.3 Imp.qts.	Fresh clean water with anti-freeze	
3	Engine crankcase	2.4 L 2.5 U.S.qts. 2.1 Imp.qts	Engine oil : API Service CC or CD 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	10.5 L 2.77 U.S.gals. 2.31 Imp.gals.	KUBOTA SUPER UDT fluid *	
5	Front axle case	3.4 L 3.6 U.S.qts. 3.0 Imp.qts	KUBOTA SUPER UDT fluid * or SAE80, 90 gear oil	
6	Steering gear box	0.20 L 0.21 U.S.qts. 0.18 Imp.qts.		
Greasing				
No.	Place	No. of greasing point	Capacity	Type of grease
7	Brake pedal	1	Until grease overflows	Multipurpose type grease
	Clutch pedal	1		
	Brake pedal shaft	1		
	Secondary brake (If equipped)	1		
	Lift rod	1		
	Battery terminal	2	Moderate amount	




\* KUBOTA original transmission hydraulic fluid.

12280G00030

## [6] 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	 <b>No-grade or 4T</b>						 <b>7T</b>						 <b>9T</b>		
Material of bolt	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit Diameter	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M6 (6 mm, 0.24 in.)	7.85 to 9.31	0.80 to 0.95	5.79 to 6.87	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8 (8 mm, 0.31 in.)	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	16.7 to 19.6	1.7 to 2.0	12.3 to 14.4	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	29.5 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)	39.3 to 45.1	4.0 to 4.6	29.0 to 33.2	31.4 to 34.3	3.2 to 3.5	23.2 to 25.3	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5	60.9 to 70.6	6.2 to 7.2	44.9 to 52.0
M12 (12 mm, 0.47 in.)	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	/			77.5 to 90.2	7.9 to 9.2	57.2 to 66.5	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	103 to 117	10.5 to 12.0	76.0 to 86.7
M14 (14 mm, 0.55 in.)	108 to 125	11.0 to 12.8	79.6 to 92.5				124 to 147	12.6 to 15.0	91.2 to 108	/			167 to 196	17.0 to 20.0	123 to 144
M16 (16 mm, 0.63 in.)	167 to 191	17.0 to 19.5	123 to 141				197 to 225	20.0 to 23.0	145 to 166				260 to 304	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)	246 to 284	25.0 to 29.0	181 to 209				275 to 318	28.0 to 32.5	203 to 235				344 to 402	35.0 to 41.0	254 to 296
M20 (20 mm, 0.79 in.)	334 to 392	34.0 to 40.0	246 to 289	/			368 to 431	37.5 to 44.0	272 to 318	/			491 to 568	50.0 to 58.0	362 to 419

11790G00761

### (2) Stud Bolts

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

11790G00762

# [7] MAINTENANCE

No.	Period		Indication on hour meter																After purchase		Reference page
			50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1 year	2 years	
1	Engine oil	Change	★	☆	☆		☆		☆		☆		☆		☆		☆				G-13
2	Engine oil filter	Replace	★		☆				☆					☆			☆				G-13
3	Transmission fluid	Change	★					☆						☆							G-14
4	Transmission oil filter	Replace	★					☆						☆							G-14
5	Engine start system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆			G-16
6	Greasing	—	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆			G-15
7	Wheel bolt torque	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆			G-16
8	Battery condition	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆			G-17
9	Air cleaner element [Single type]	Clean		☆		☆		☆		☆		☆		☆		☆		☆			G-19
		Replace																	☆		G-19
10	Air cleaner element [Double type]	Primary element Clean*		☆		☆		☆		☆		☆		☆		☆		☆			G-19
		Replace																	☆		G-19
		Secondary element Replace																	☆		G-19
11	Fuel filter element	Clean		☆		☆		☆		☆		☆		☆		☆		☆			G-19
		Replace							☆									☆			G-19
12	Fan belt	Adjust		☆		☆		☆		☆		☆		☆		☆		☆			G-20
13	Clutch	Adjust		☆		☆		☆		☆		☆		☆		☆		☆			G-18
14	Brake	Adjust		☆		☆		☆		☆		☆		☆		☆		☆			G-21
15	Secondary brake (If equipped)	Check		☆		☆		☆		☆		☆		☆		☆		☆			5-S2
16	Fuel line	Check		☆		☆		☆		☆		☆		☆		☆		☆			G-20
		Replace																	☆		G-20
17	Radistor hose and clamp	Check				☆				☆				☆				☆			G-22
		Replace																	☆		G-22
18	Toe-in	Adjust				☆				☆				☆				☆			G-22
19	Front axle case oil	Change						☆						☆							G-23
20	Front axle pivot	Adjust								☆								☆			6-S2
21	Engine valve clearance	Adjust																☆			1-S17
22	Cooling system	Flush																		☆	G-24
23	Coolant	Change																		☆	G-24
24	Fuel system	Bleed																			G-25
25	Fuse	Replace																	Service as required		G-26
26	Light bulb	Replace																			G-26

## IMPORTANT :

The jobs indicated by ★ must be done after the first 50 hours of operation.

\* Air cleaner should be cleaned more often in dusty conditions than in normal conditions.

12280G00040

## [8] CHECK AND MAINTENANCE



### CAUTION

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

11790G00210

### (1) Daily Check

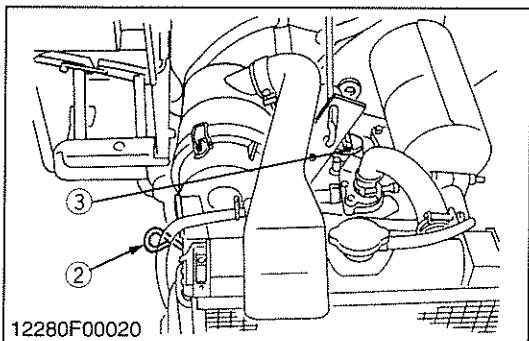
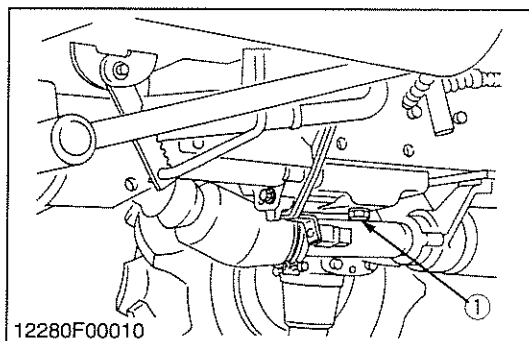
To prevent trouble from occurring, it is important to know the condition of the tractor. Check the following items before starting.

#### 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 and clean the radiator screen and grill.
  - 7) Check the bolts and nuts of the tires are tight.
  - 8) Care of danger, warning and caution labels.
  - 9) Clean around the exhaust manifold and the muffler of the engine.
- While sitting in the operator's seat.
- 1) Check the brake pedals and clutch pedal.
  - 2) Check the parking brake.
  - 3) Check the secondary brake pedal. (If equipped)
  - 4) 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.

12280G00050

## (2) Check Points of Initial 50 Hours



### Changing Engine Oil

#### ⚠ CAUTION

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

#### ■ IMPORTANT

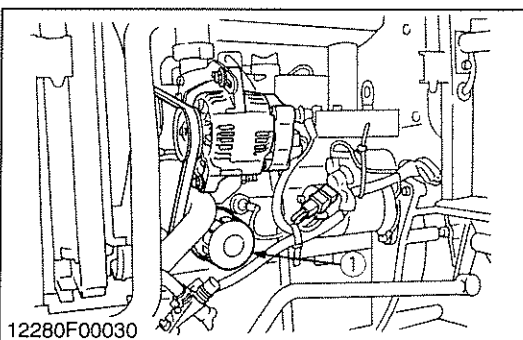
- **When using an oil of different manufacture or viscosity from the previous one, remove all of the old oil.**
- **Never mix two different types of oil.**
- **Use the proper SAE Engine Oil according to ambient temperatures.**
- **Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-9.)**

Engine oil capacity	2.4 L 2.5 U.S.qts 2.1 Imp.qts
---------------------	-------------------------------------

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

(A) Oil level is acceptable within this range.

12280G00060



### Replacing Engine Oil Filter Cartridge

#### ⚠ CAUTION

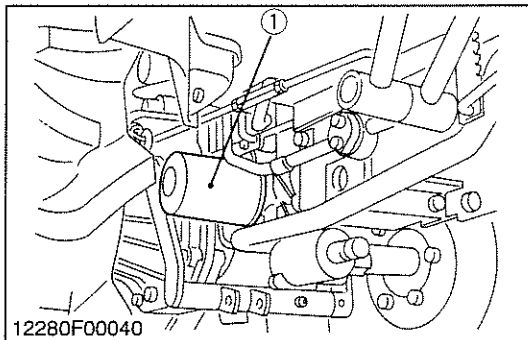
- **Be sure to stop the engine before changing oil filter cartridge.**
  1. Remove the oil filter cartridge with the filter wrench.
  2. Apply a slight coat of oil onto the cartridge gasket.
  3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.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

#### ■ IMPORTANT

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

- (1) Engine Oil Filter

12280G00070



### Replacing Hydraulic Oil Filter Cartridge

#### ⚠ CAUTION

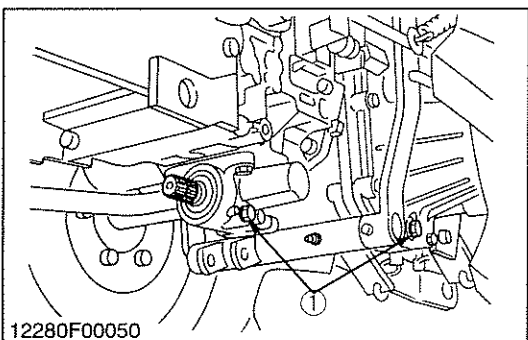
- **Be sure to stop the engine before changing the oil filters.**
1. Drain the transmission fluid.
  2. Remove the oil filter cartridge by using a filter wrench.
  3. Apply a slight coat of oil onto the cartridge gasket.
  4. To install the new cartridge, screw it in by hand. Over tightening may cause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

#### ■ IMPORTANT

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

(1) Hydraulic Oil Filter

12280G00080



### Changing Transmission Fluid

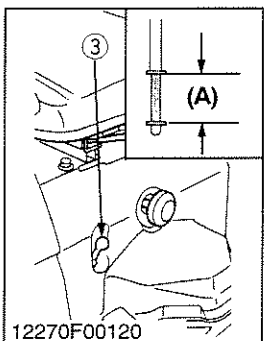
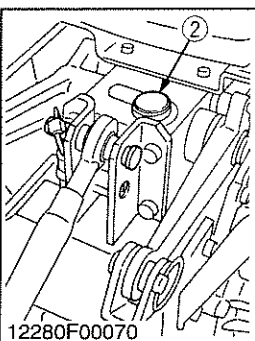
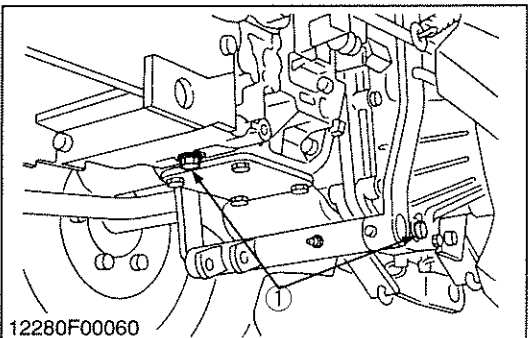
#### ⚠ CAUTION

- **Be sure to stop the engine checking and changing the transmission fluid.**

1. Place an oil pan under the tractor.
2. Remove the drain plugs (1) at the bottom of the rear axle cases.
3. Drain the transmission fluid.
4. After draining, screw in the three drain plugs.
5. Fill new oil from filling port after removing the filling plug (2) up to the upper notch on the dipstick.
6. After running the engine for a few minutes, stop it and check the oil level again, if low, add oil prescribed level.

#### ■ IMPORTANT

- **Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS AND FLUID" (See page G-9).**
- **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	10.5 L
	2.77 U.S.gals.
	2.31 Imp.gals.

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

(A) Oil level acceptable within this range.

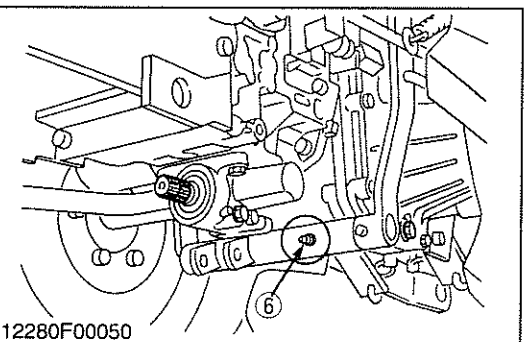
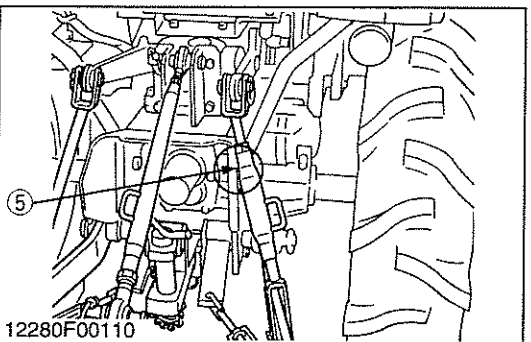
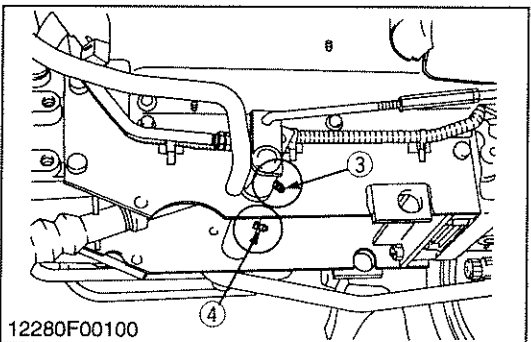
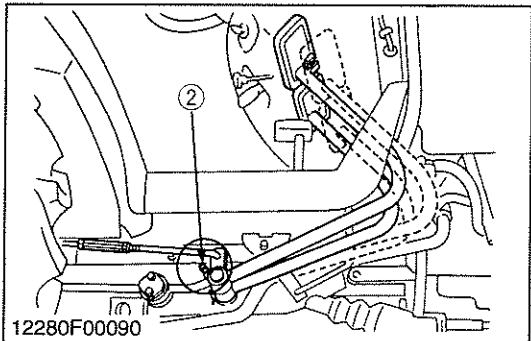
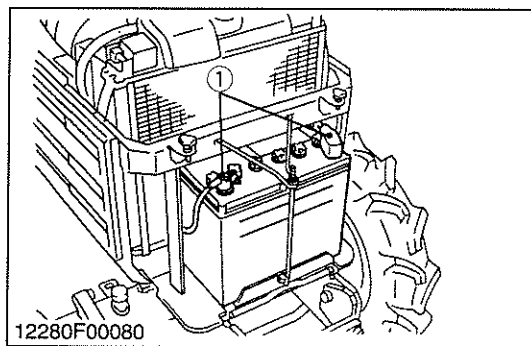
12280G00090

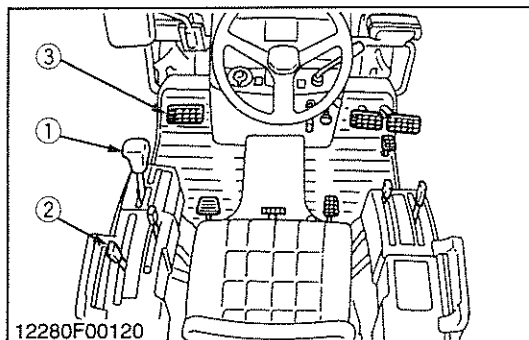
### (3) Check Points of Every 50 Hours

#### Greasing

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

- |                                   |                                      |
|-----------------------------------|--------------------------------------|
| (1) Battery Terminals             | (5) Grease Fitting (Lifting Rod RH)  |
| (2) Grease Fitting (Brake Pedal)  | (6) Grease Fitting (Secondary Brake) |
| (3) Grease Fitting (Clutch Pedal) | (If equipped)                        |
| (4) Grease Fitting (Pedal Shaft)  |                                      |





12280F00120

- (1) Main Gear Shift Lever (3) Clutch Pedal  
(2) PTO Gear Shift Lever

## 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 main gear shift lever in "NEUTRAL" position.
4. Shift the PTO gear shift lever to "OFF" position.
5. Fully depress the clutch pedal.

### ■ Test 1 : for safety switch on the main gear shift linkage

1. Fully depress the clutch pedal again.
2. Shift the main gear shift lever to "Desired" position.
3. Turn the key to "START" position.
4. The engine must not crank.

### ■ Test 2 : for safety switch on the PTO gear shift linkage

1. Shift the main gear shift lever to "NEUTRAL" position.
2. Shift the PTO gear shift lever to "Desired" position.
3. Turn the key to "START" position.
4. The engine must not crank.

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

When adjusting the safety switches keep the each linkage at condition indicated below.

1. Clutch pedal linkage → Fully depress the clutch pedal.
2. Main gear shift linkage → Shift the main gear shift lever to "NEUTRAL" position.
3. PTO gear shift linkage → Shift PTO gear shift lever to "OFF" position.

12280G00110

## Checking Wheel Mounting Screws and Nuts Tightening Torque

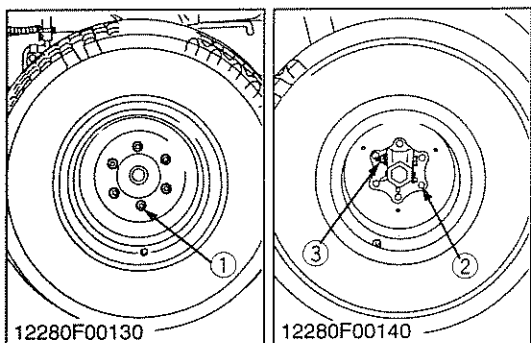


### CAUTION

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

Tightening torque	Front wheel mounting nuts	77 to 90 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Rear wheel hub mounting nuts	108 to 125 N·m 11.0 to 12.8 kgf·m 80 to 93 ft-lbs
	Cotter setting bolt and nut	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs

12280G00120

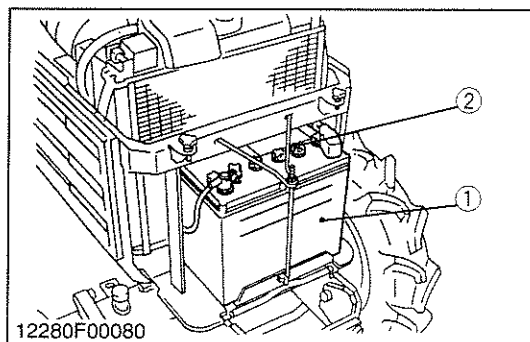


12280F00130

12280F00140

- (1) Front Wheel Mounting Nuts  
(2) Rear Wheel Mounting Nut  
(3) Cotter Setting Bolt and Nut





(1) Battery

(2) Vent Plug

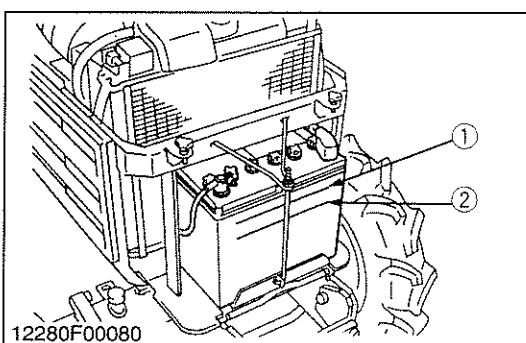


Table 1

Battery Type	Volts (V)	Capacity at 5H.R (A.H.)	Reserve Capacity (min.)	Cold Cranking Amps	Normal Charging Rate (A)
50B24L (S)-MF	12	36	71	390	4.5

## Checking Battery Condition

### ⚠ CAUTION

- Never remove the vent plugs while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately and get medical attention.
- Wear eye protection and rubber gloves when working around battery.

1. Mishandling the battery shortens the service life and adds to maintenance costs.
2. The original battery is maintenance free type battery, but need some servicing.  
If the battery is weak, the engine is difficult to start and the lights become dim. It is important check the battery periodically.

12280G00130

## ■ 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.

## ■ Direction for Storage

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

(1) Highest Level

(2) Lowest Level

12280G00140

## (4) Check Points of Every 100 Hours

### Changing Engine Oil

1. See page G-13.

12280G00370

### Checking Clutch Pedal Free Travel

#### CAUTION

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

1. Slightly depress the clutch pedal and measure stroke "A" at top of clutch pedal (5).
2. If the measurement is not within the factory specifications, loosen the lock nut (3) and adjust the clutch pedal rod (2) length.
3. After adjusting it, measure stroke "B" between clutch pedal (5) and step (7).
4. And at same time, check distance "C" between clutch pedal (5) and step (7).
5. If the measurement not within the factory specifications, adjust it with the clutch pedal stopper bolt (1).

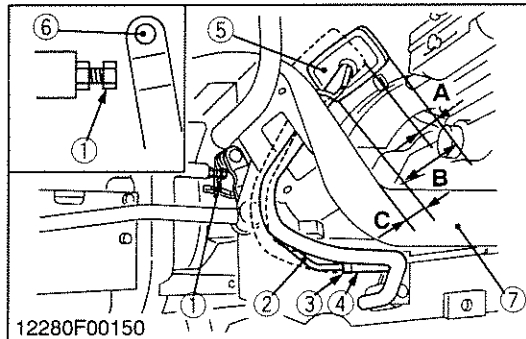
#### ■ NOTE

- After adjustment, sure the stopper bolt with the lock nut (3).

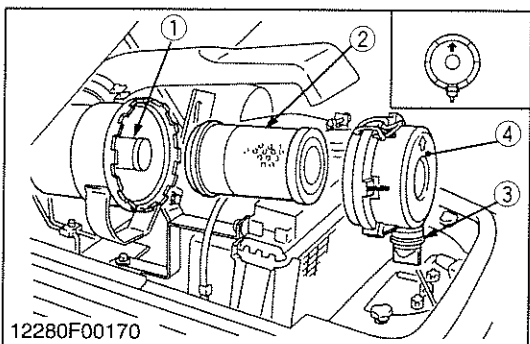
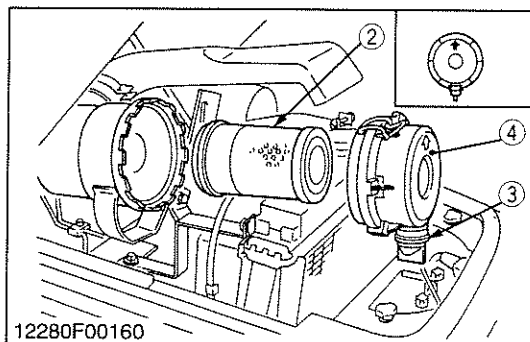
Clutch pedal free travel	Factory spec.	15 to 25 mm 0.59 to 0.98 in.
Clutch pedal stroke "B"	Factory spec.	80 mm 3.15 in.
Distance "C"	Factory spec.	10 to 15 mm 0.39 to 0.59 in.

- |                      |                  |
|----------------------|------------------|
| (1) Stopper Bolt     | (5) Clutch Pedal |
| (2) Clutch Pedal Rod | (6) Clutch Rod   |
| (3) Lock Nut         | (7) Step         |
| (4) Adjusting Nut    |                  |

12280G00150



12280F00150



### Cleaning Air Cleaner Element

1. Remove the air cleaner cover (4) and element (2).
2. Clean the primary 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 686 kPa (7 kgf/cm<sup>2</sup>, 99 psi).
  - When carbon or oil adheres to the element, soak the element in detergent for 15 minutes then wash it several times in water, rinse with clean water and dry it naturally. After element is fully dried, inspect inside of the element with a light and check if it is damaged or not.
3. When replacing the air cleaner element (2), replace the secondary element (1) as well :  
Once a year or after every six times of cleaning, whichever comes first.

#### ■ IMPORTANT

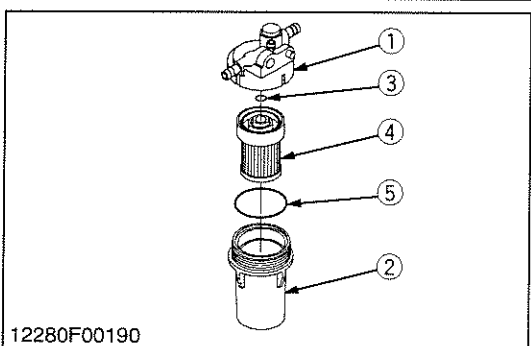
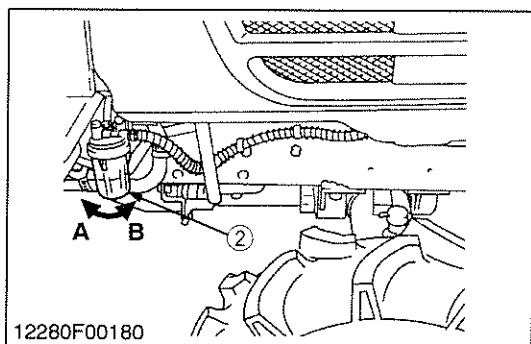
- The air cleaner uses a dry element, never apply oil.
- Do not run the engine with filter element removed.
- Be sure to refit the dust cup with the arrow ↑ (on the rear of cup) upright. If the dust cup is improperly fitted, evacuator valve will not function and dust will adhere to the element.
- Do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

#### ■ Evacuator Valve

Open the evacuator valve 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) Secondary (Safety) Element | (3) Evacuator Valve |
| (Double Element Type)          | (4) Cover           |
| (2) Element                    |                     |

12280G00160



### Cleaning Fuel Filter

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

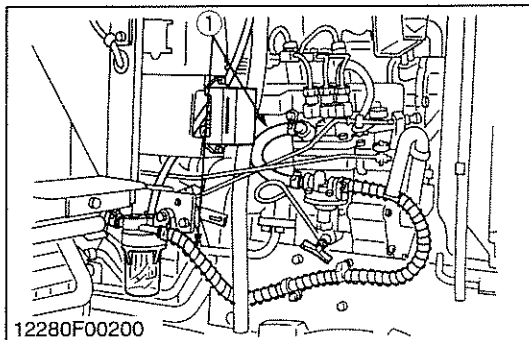
1. Loosen and remove the fuel filter bowl (2), and rinse the inside with kerosene.
2. Take out the filter element (4) and dip it in the kerosene to rinse.
3. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
4. Bleed the fuel system. (See page G-25.)

#### ■ NOTE

- When the fuel filter bowl has been removed, fuel stops flowing from the fuel tank. If the fuel tank is almost full, however, the fuel will flow back from the fuel return pipe to the fuel filter. Before the above checking, make sure the fuel tank is less than half-full.

- |                      |             |
|----------------------|-------------|
| (1) Filter Bracket   | (A) Loosen  |
| (2) Fuel Filter Bowl | (B) Tighten |
| (3) O-ring           |             |
| (4) Filter Element   |             |
| (5) O-ring           |             |

12280G00170



### Checking Fuel Line



#### CAUTION

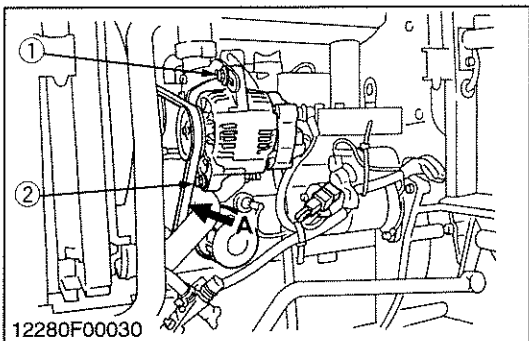
- Stop the engine when attempting the check and change prescribed below.
  - Remember to check the fuel line periodically. The fuel line is subject to wear and aging, fuel may leak out onto the running engine, causing a fire.
1. Check to see that all line and hose clamps are tight and not damaged.
  2. If hoses and clamps are found worn or damaged, replace or repair them at once.
  3. The fuel line is made of rubber and ages regardless of period of service. Replace the fuel pipe together with the clamp every two years and securely tighten.
  4. However if the fuel pipe and clamp are found damaged or deteriorated earlier than two years, then change or remedy.
  5. After the fuel line and clamp have been changed, bleed the fuel system.

#### IMPORTANT

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

(1) Fuel Hoses

12280G00180



### Checking Fan Belt Tension



#### CAUTION

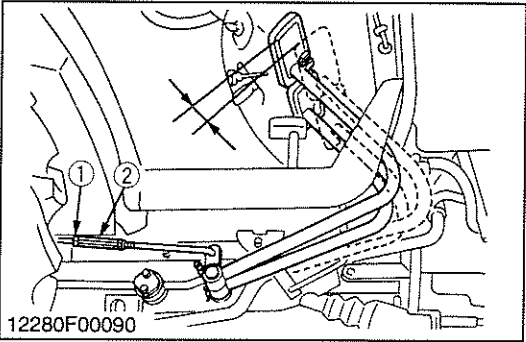
- Be sure to stop engine before checking belt tension.
1. Stop the engine and remove the key.
  2. Apply moderate thumb pressure to belt between pulleys.
  3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the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

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

- (1) Adjusting Screw  
(2) Tension Bolt

(A) Check the belt tension

12280G00190



**Checking Brake Pedal Free Travel**

**CAUTION**

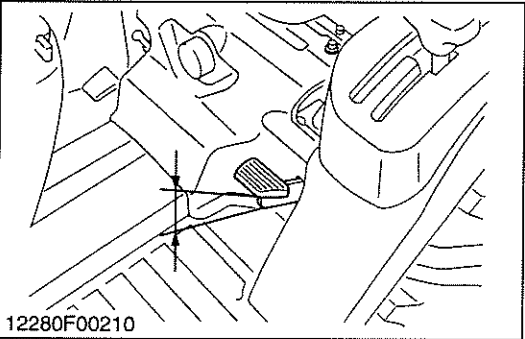
- Stop the engine and chock the wheels before checking brake pedal.
  - The difference between the right and left pedal plays must be less than 5.0 mm (0.20 in.).
1. Release the parking brake.
  2. Slightly depress the brake pedals and measure free travel at top of pedal stroke.
  3. If the measurement is not within the factory specifications, loosen the lock nut and turn the turnbuckle to adjust the brake rod length.
  4. Retighten the lock nut securely.
- Keep the free travel in the right and left brake pedals equal.

Brake pedal free travel	Factory spec.	30 to 40 mm 1.18 to 1.57 in.
-------------------------	---------------	---------------------------------

(1) Lock Nut

(2) Turnbuckle

12280G00200



**Checking Secondary Brake Pedal (If equipped)**

1. Check if the tractor stops on a steep hill by depressing the secondary brake pedal only.  
If not, see page 5-S2.

12280G00210

**(5) Check Points of Every 200 Hours**

**Replacing Engine Oil Filter Cartridge**

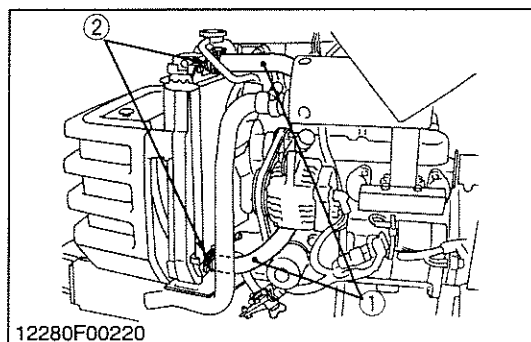
1. See page G-13.

12280G00380

**Replacing Hydraulic Oil Filter Cartridge**

1. See page G-14.

12280G00390



### 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

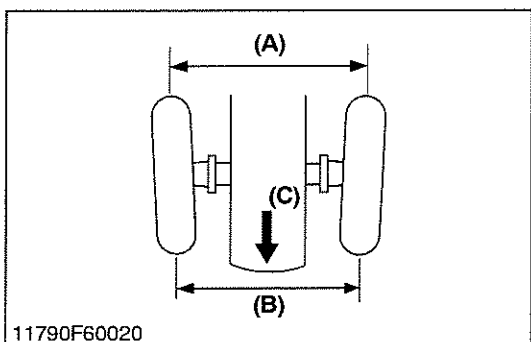
Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating".

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

12280G00220



### Adjusting Toe-in

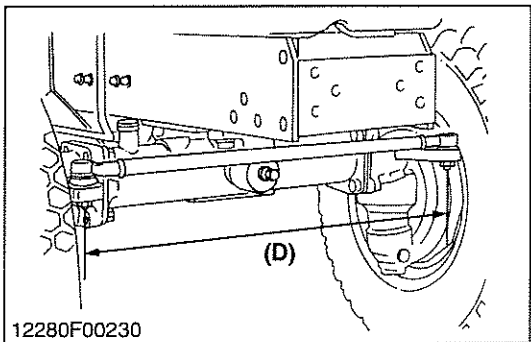
1. Park the tractor on the flat place.
2. Inflate the tires to the specified pressure.
3. Turn steering wheel so front wheels are in the straight ahead position.
4. Lower the implement, lock the parking brake and stop the engine.
5. Measure distance between tire beads at front of tire, hub height.
6. Measure distance between tire beads at rear of tire, hub height.
7. Front distance should be 0 to 20 mm (0 to 0.79 in.) less than rear distance.
8. If the measurement is not within the factory specifications, please correct the length (D) of tie rod and correct toe-in to be suitable for factory spec.

Toe-in (A – B)	Factory spec.	0 to 20 mm 0 to 0.79 in.
----------------	---------------	-----------------------------

(A) Wheel to Wheel Distance at rear

(B) Wheel to Wheel Distance at front

(C) Front



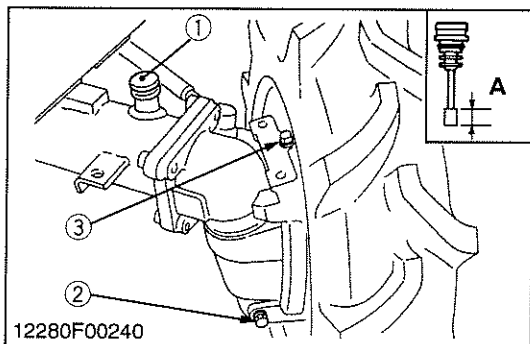
12280G00230

## (6) Check Points of Every 300 Hours

### Changing Transmission Fluid

1. See page G-14.

12280G00400



### Changing Front Axle Case Oil

1. Place the oil pans underneath the front axle case.
2. Remove the both right and left hand side drain plugs (1) and filling plug (2) to drain the oil.
3. After draining, reinstall the drain plugs (1).
4. Fill with new oil up to the upper notch on the dipstick.

#### ■ IMPORTANT

- After ten minutes, check the oil level again, add oil to prescribed level.
- Use KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-9.)

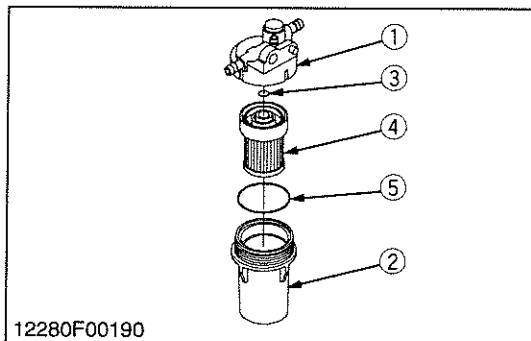
Front axle case oil capacity	3.4 L
	3.6 U.S.qts.
	3.0 Imp.qts.

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

(A) Oil level is acceptable within this range.

12280G00240

## (7) Check Points of Every 400 Hours



### Replacing Fuel Filter Element

1. The fuel filter element should be replaced every 400 hours. See page G-19.

- (1) Filter Bracket  
(2) Fuel Filter Bowl  
(3) O-ring  
(4) Filter Element  
(5) O-ring

12280G00250

### Checking Front Axle Rocking Force

1. See page 6-S2.

12280G00410

## (8) Check Points of Every 800 Hours

### Checking Valve Clearance

1. See page 1-S17.

12270G00420

## (9) Check Points of Every 1 Year

### Replacing Air Cleaner Element (Single Type)

1. See page G-19.

12280G00260

### Replacing Air Cleaner Element and Secondary Element (Double Type)

1. See page G-19.

12280G00270

(10) Check Points of Every 2 Years

Replacing Radiator Hose (Water Pipes)

1. Replace the hoses and clamps.  
Refer to “Checking Radiator Hose and Hose Clamp”. (See page G-22.)

12270G00400

Replacing Fuel Hose

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

12270G00410

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 plug (2) and drain cock (4), 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 (2) and drain cock (4).  
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.  
7. Start and operate the engine for few minutes.  
8. Stop the engine. Check coolant level and add coolant if necessary.  
9. Install the radiator cap securely.  
10. Check coolant level of recovery tank and coolant if necessary.

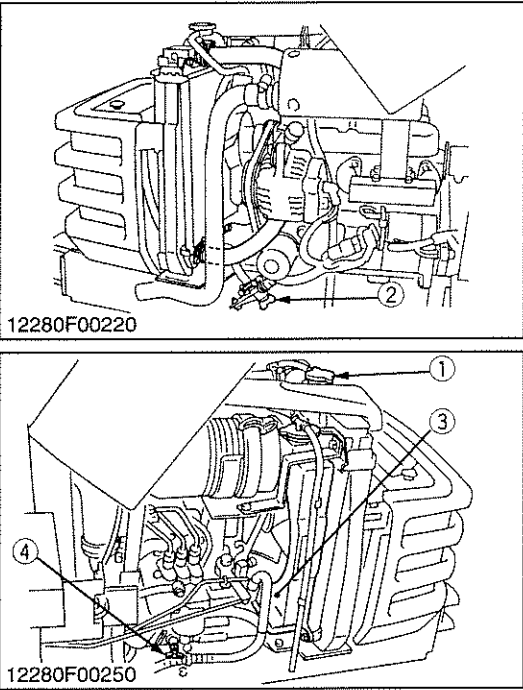
IMPORTANT

- 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)	2.6 L
	2.7 U.S.qts.
	2.3 Imp.qts.

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

12280G00280





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

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

1. There are two types of anti-freeze available; use the permanent type (PT) for this engine.
2. Before adding anti-freeze for the first time, clean the radiator interior by pouring fresh water and draining it a few times.
3. The procedure for mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature, basically it should be referred to SAE J1034 standard, more specifically also to SAE J19814c.
4. Mix the anti-freeze with water, and then fill in to the radiator.

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

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

**■ NOTE**

- The above data represent industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.
- When the cooling water 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 cooling water. (Anti-freeze contains an anti-corrosive agent, which will react with the radiator cleaning agent forming sludge which will affect the engine parts.)

12010G00400

**(11) Others****Bleeding Fuel System**

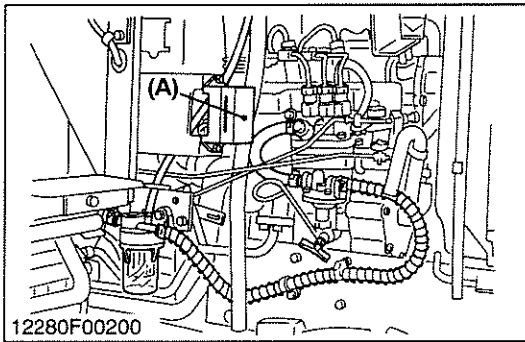
Air must be removed:

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

Bleeding procedure is as follows:

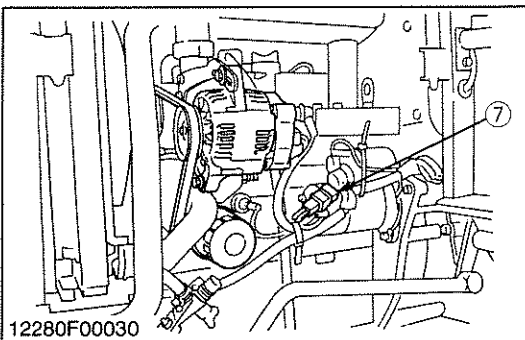
1. Fill the fuel tank with fuel.
2. Start the engine and run for about 30 seconds, and then stop the engine.

12280G00290



HEAD LIGHT, HORN	20A	①
BRAKE	10A	②
WORK LIGHT	15A	③
FLASHER, PANEL, ALTERNATOR	10A	④
PARKING	10A	⑤
HAZARD	15A	⑥

12280F00260



### Replacing Fuse

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

#### ■ IMPORTANT

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

#### ■ Protected Circuit

Fuse No.	Capacity (A)	Protected circuit
①	20	Head light, Horn
②	10	Brake
③	15	Work light
④	10	Flasher, Panel, Alternator
⑤	10	Parking
⑥	15	Hazard
⑦	Slow blow fuse (50 A)	Check circuit against wrong battery connection

(A) Fuse Box

12280G00300

### Replacing Light Bulb

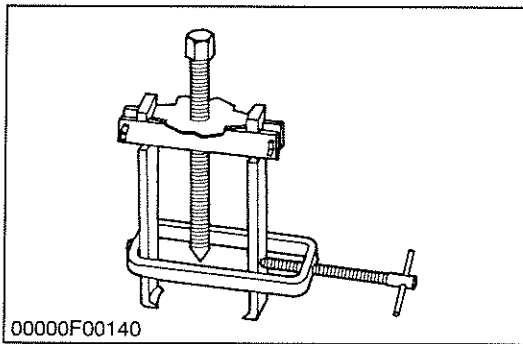
- Head lights.  
Take the bulb out of the light body and replace with a new one.
- Other lights  
Detach the lens and replace the bulb.

Light	Capacity
Head light	40 W / 45 W
Tail light	10 W
Position light	5 W
Turn signal / Hazard light	21 W
Brake stop light	21 W
Number plate light	10 W

12280G00310

## [9] SPECIAL TOOLS

### (1) Special Tools for Engine

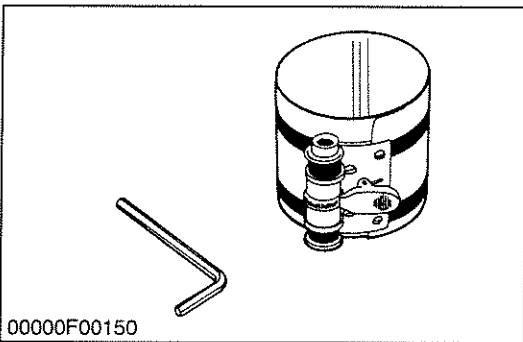


#### Special Use Puller Set

Code No : 07916-09032

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

00000G00010

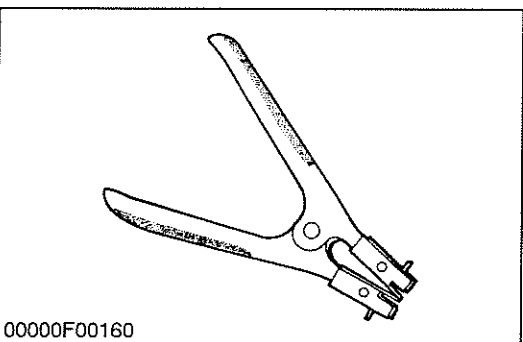


#### Piston Ring Compressor

Code No : 07909-32111

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

00000G00020

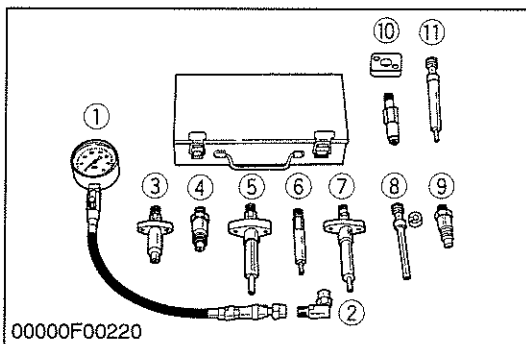


#### Piston Ring Tool

Code No : 07909-32121

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

00000G00030



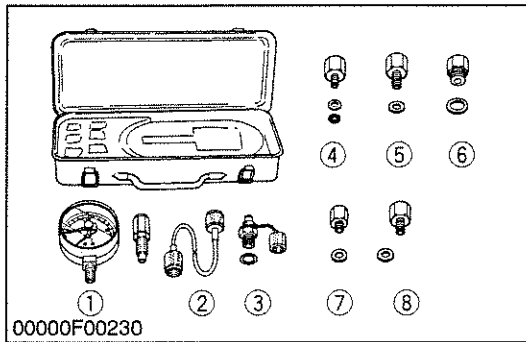
#### Diesel Engine Compression Tester

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

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

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

00000G00070

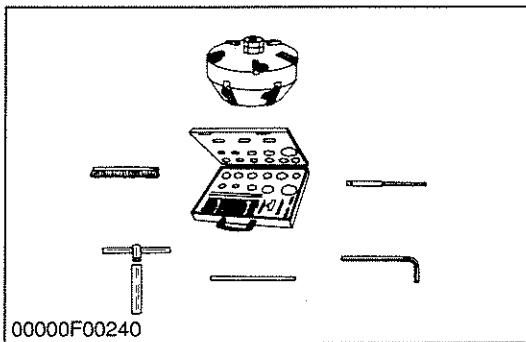
**Oil Pressure Tester**

Code No : 07916-32032

Application : Use to measure lubricating oil pressure.

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

00000G00080

**Valve Seat Cutter**

Code No : 07909-33102

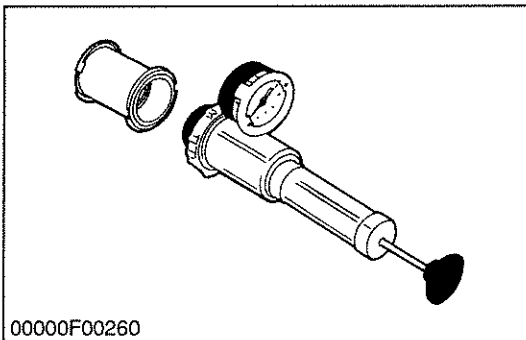
Application : Use to reseal valves.

Angle : 0.785 rad. (45°)

0.262 rad. (15°)

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

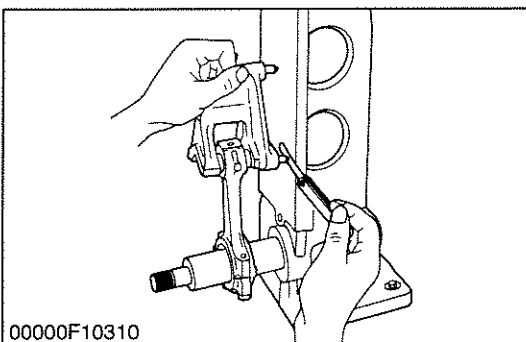
00000G00090

**Radiator Tester**

Code No : 07909-31551

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

00000G00130

**Connecting Rod Alignment Tool**

Code No : 07909-31661

Application : Use to check the connecting rod alignment.

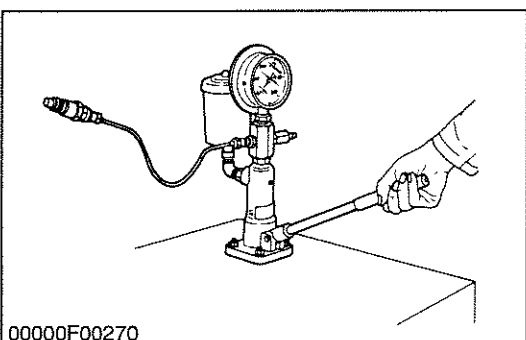
Applicable : Connecting rod big end I.D.

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.)

00000G00110

**Nozzle Tester**

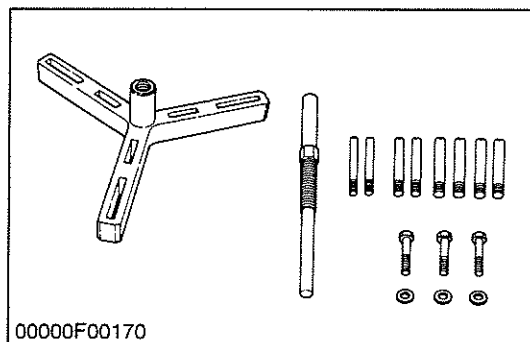
Code No : 07909-31361

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)

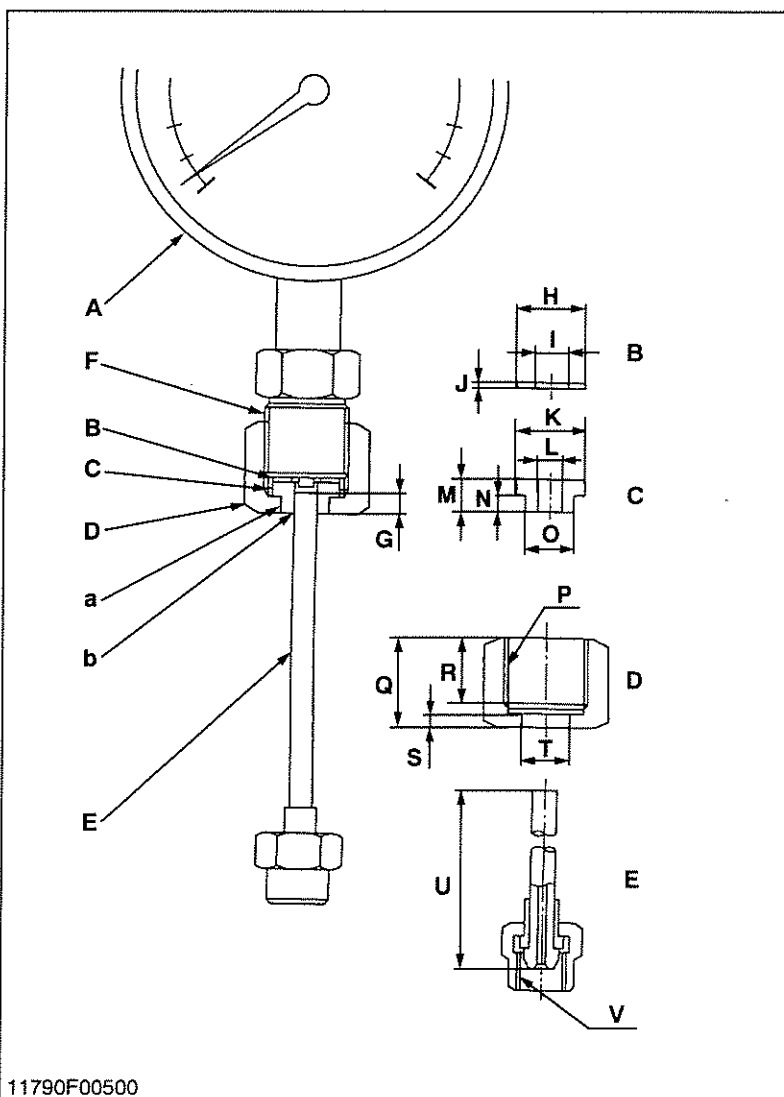
00000G00140

**Flywheel Puller**

Code No : 07916-32011

Application: Use exclusively for removing the flywheel with ease.

00000G00040

**Injection Pump Pressure Tester**

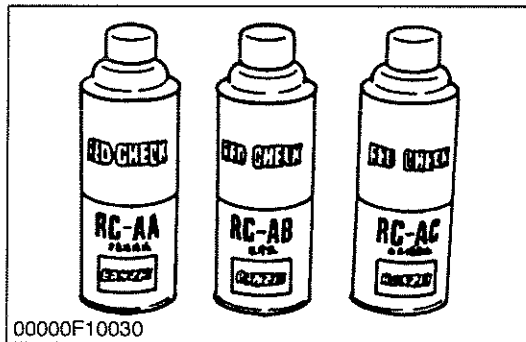
Application: Use to check fuel tightness of injection pumps.

**NOTE**

- This special tool is not provided, so make it referring to the figure.

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

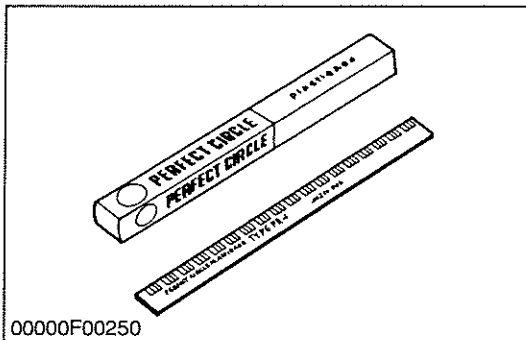
11790G00810

**Red Check**

Code No : 07909-31371

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

00000G00120

**Plastigage**

Code No : 07909-30241

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

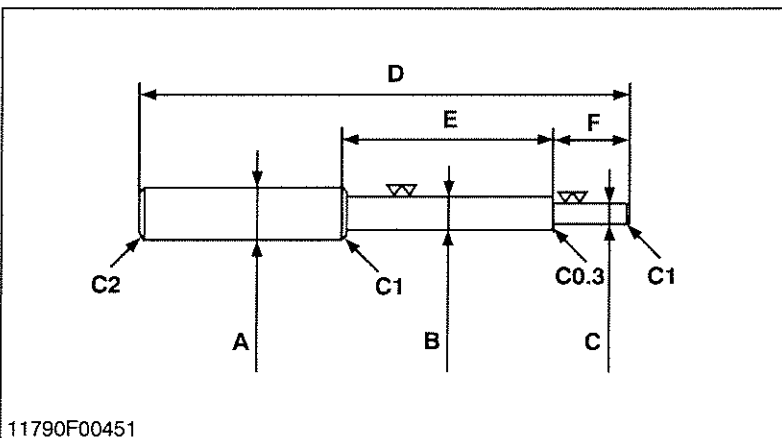
Measuring : Green .....0.025 to 0.076 mm (0.001 to 0.003 in.)  
 range Red .....0.051 to 0.152 mm (0.002 to 0.006 in.)  
 Blue .....0.102 to 0.229 mm (0.004 to 0.009 in.)

00000G00100

**NOTE**

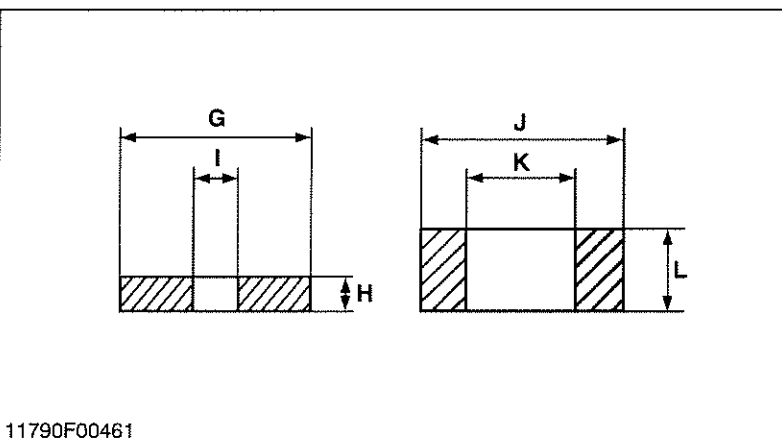
- The following special tools are not provided, so make them referring to the figure.

01640S10910

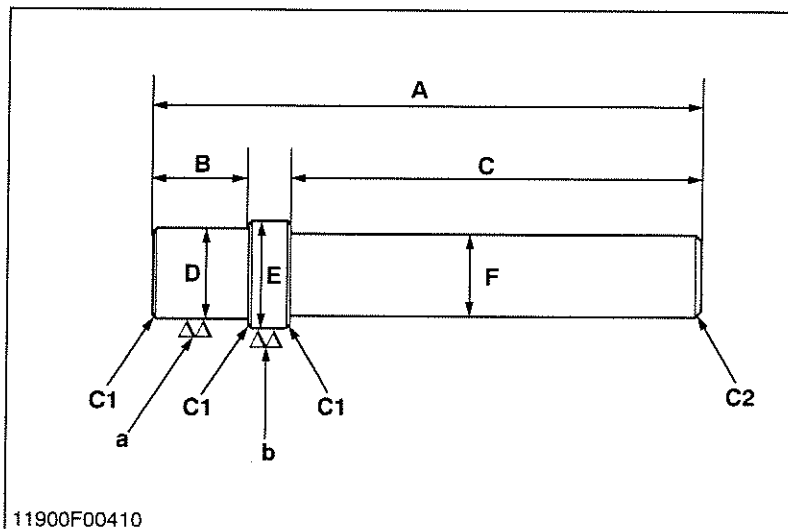
**Valve Guide Replacing Tool**

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

A	20 mm dia. (0.79 in. dia.)
B	9.96 to 9.98 mm dia. 0.3921 to 0.3929 in. dia.
C	5.5 to 5.7 mm dia. 0.2165 to 0.2244 in. dia.
D	200 mm (7.87 in.)
E	80 mm (3.15 in.)
F	40 mm (1.58 in.)
G	15 mm (0.59 in.)
H	5 mm (0.197 in.)
I	6.0 to 6.1 mm dia. (0.236 to 0.240 in. dia.)
J	18 mm dia. (0.71 in. dia.)
K	10.6 to 10.7 mm dia. (0.417 to 0.421 in. dia.)
L	7 mm (0.276 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.)



11790G00623



### Bushing Replacing Tool

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

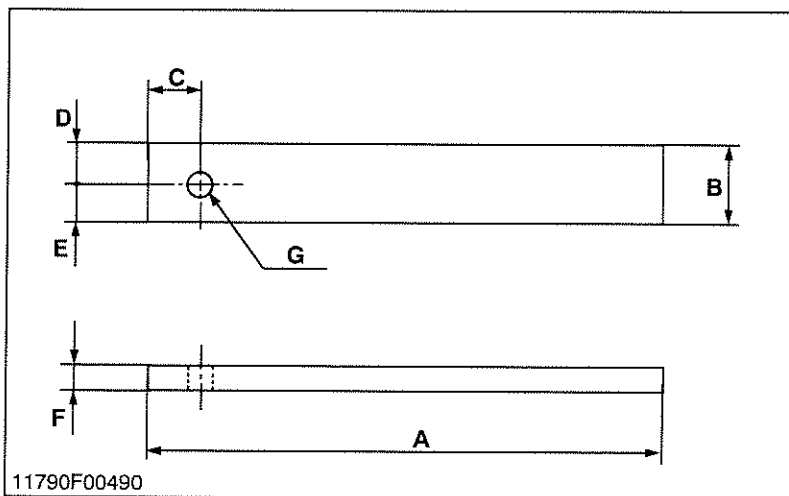
#### 1. For small end bushing

A	145 mm (5.71 in.)
B	20 mm (0.79 in.)
C	100 mm (3.94 in.)
D	19.90 to 19.95 mm (0.7835 to 0.7854 in.)
E	21.90 to 21.95 mm (0.8622 to 0.8642 in.) DIA.
F	25 mm (0.98 in.)
a	6.3 $\mu$ m (250 $\mu$ in.)
b	6.3 $\mu$ m (250 $\mu$ in.)

#### 2. For idle gear bushing

A	150 mm (5.91 in.)
B	20 mm (0.79 in.)
C	100 mm (3.94 in.)
D	19.90 to 19.95 mm (0.7835 to 0.7854 in.)
E	21.90 to 21.95 mm (0.8622 to 0.8642 in.) DIA.
F	25 mm (0.98 in.)
a	6.3 $\mu$ m (250 $\mu$ in.)
b	6.3 $\mu$ m (250 $\mu$ in.)

11900G00442

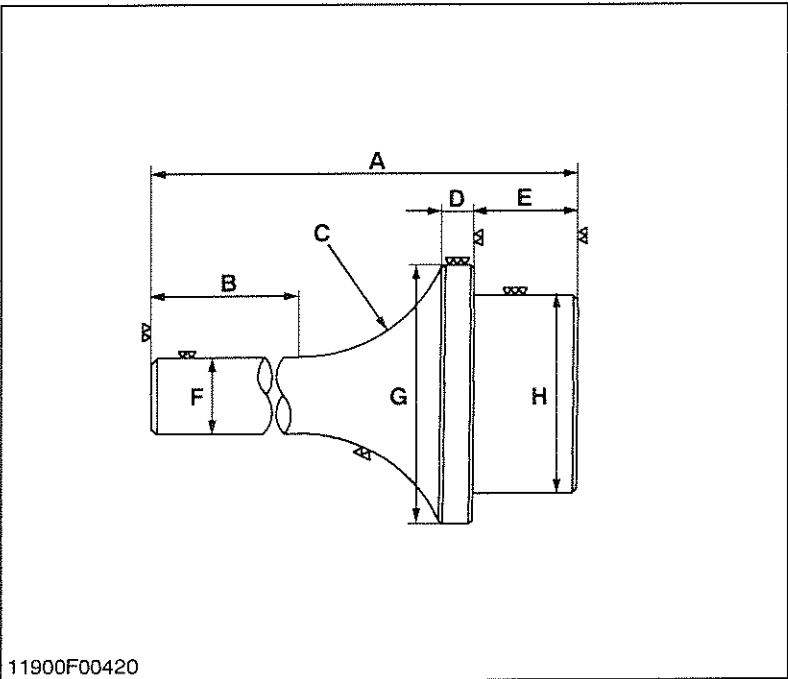


### Flywheel Stopper

Application: Use to loosen and tighten the flywheel screw.

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

11790G00801



**Crankshaft Bearing 1 Replacing Tool**

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

**[Press Out]**

A	135 mm (5.31 in.)
B	72 mm (2.83 in.)
C	40° (1.57 rad.)
D	10 mm (0.39 in.)
E	22 mm (0.87 in.)
F	20 mm (0.79 in.)
G	48.90 to 48.95 mm dia. 1.9251 to 1.9271 in. dia.
H	43.90 to 43.95 mm dia. 1.7283 to 1.7303 in. dia.

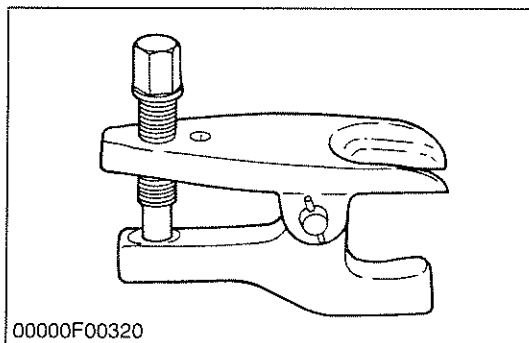
**[Press Fit]**

A	130 mm (5.12 in.)
B	72 mm (2.83 in.)
C	40° (1.57 rad.)
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	39.90 to 39.95 mm dia. 1.5709 to 1.5728 in. dia.

11900G00452



## (2) Special Tools for Tractor

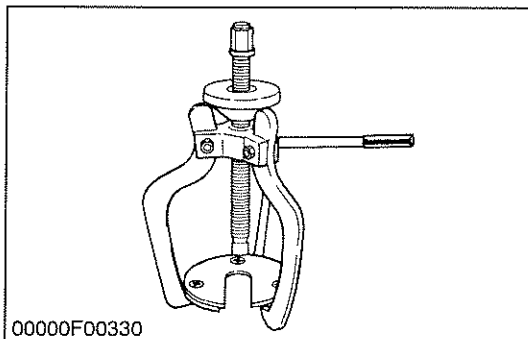


### Tie-rod End Lifter

Code No : 07909-39051

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

00000G00190

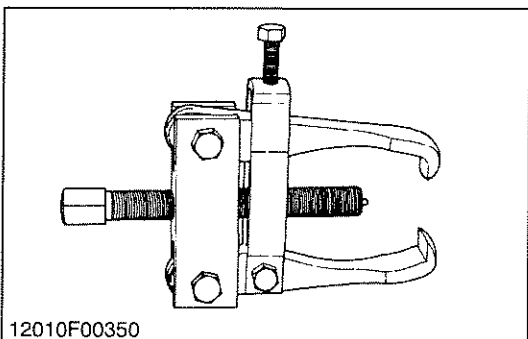


### Steering Wheel Puller

Code No : 07916-51090

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

00000G00200

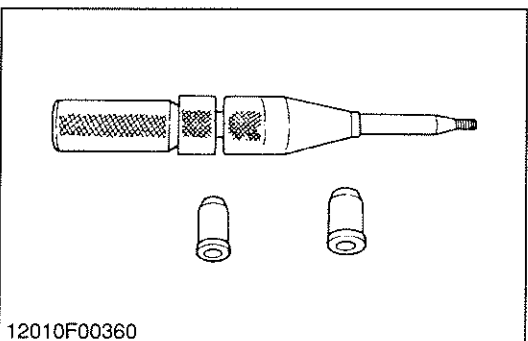


### Pitman Arm Puller

Code No : 07909-39011

Application : Use for pulling out pitman arm from tractor.

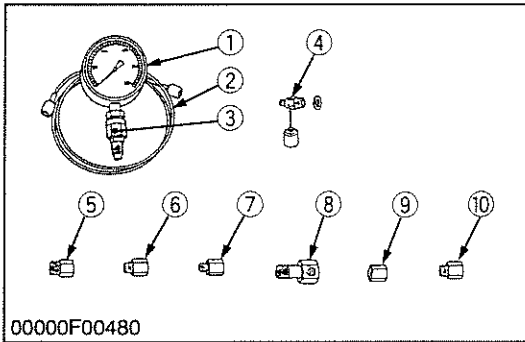
12010G00440



### Clutch Center Tool (For B and L Series Tractors)

Application : The clutch center tool can be used for all **B** and **L** series tractors with a diaphragm clutch by changing tip guides. Center piece diameter is 14 mm (0.55 in.)

12010G00450



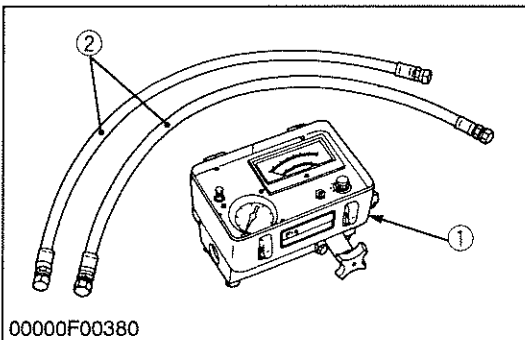
### Relief Valve Pressure Tester

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 58 (PT1/4) (07916-52391) |

00000G00351



### Flow Meter

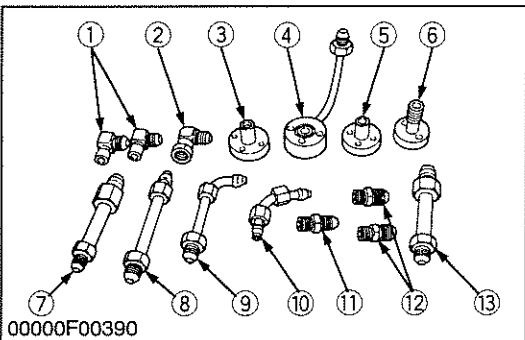
Code No : 07916-52791 (Flow Meter)

07916-52651 (Hydraulic Test Hose)

Application : This allows easy testing of hydraulic system.

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

00000G00250



### Adaptor Set for Flow Meter

Code No : 07916-54031

Application : Use for testing the hydraulic system.

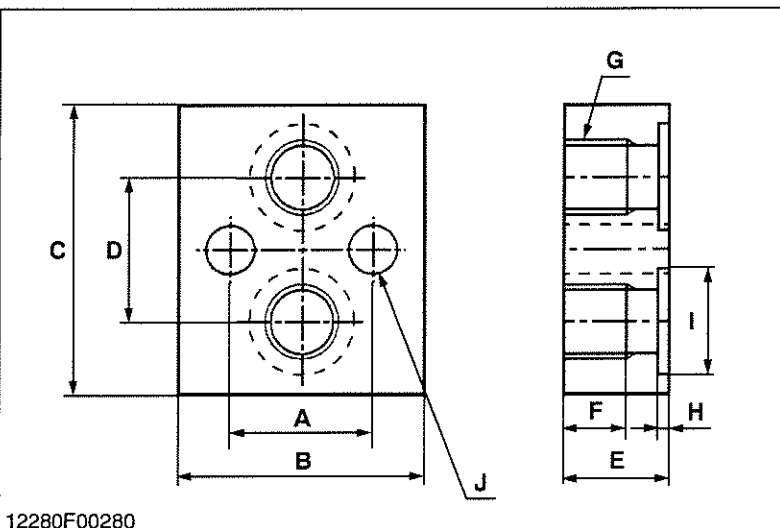
- |                |                          |
|----------------|--------------------------|
| (1) Adaptor 52 | (8) Adaptor 65           |
| (2) Adaptor 53 | (9) Adaptor 66           |
| (3) Adaptor 54 | (10) Adaptor 67          |
| (4) Adaptor 61 | (11) Adaptor 68          |
| (5) Adaptor 62 | (12)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

00000G00260

### NOTE

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

01640S10910



### Hydraulic Outlet

Application: Use for testing the hydraulic system.

A	25.603 to 26.213 mm (1.008 to 1.032 in.)
B	44.45 mm (1 3/4 in.)
C	51.82 mm (2.04 in.)
D	25.603 to 26.203 mm (1.008 to 1.032 in.)
E	19.05 mm (3/4 in.)
F	11.43 mm (0.45 in.)
G	M16 × P1.5
H	1.88 mm (0.074 in.)
I	19.177 to 18.999 mm (0.748 to 0.755 in.)
J	8.73 mm dia. (11/32 in. dia.)

### (Reference)

- O-ring nominal size : 9/16 × 3/3 × 3/32

12280G00420

## [10] TIRES

### (1) Tire Pressure

#### CAUTION

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

#### IMPORTANT

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

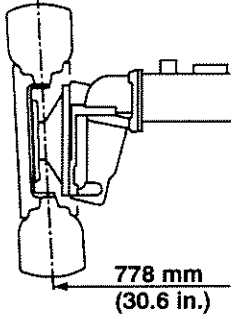
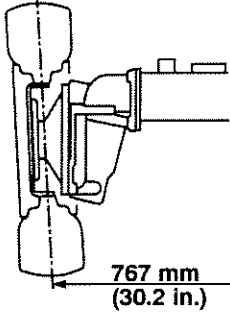
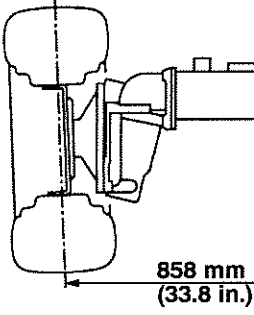
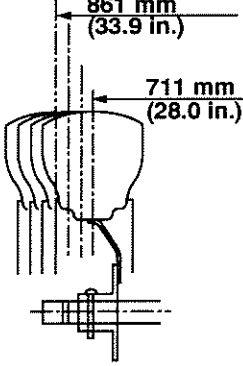
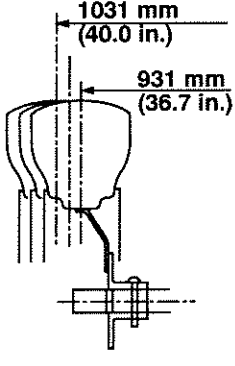
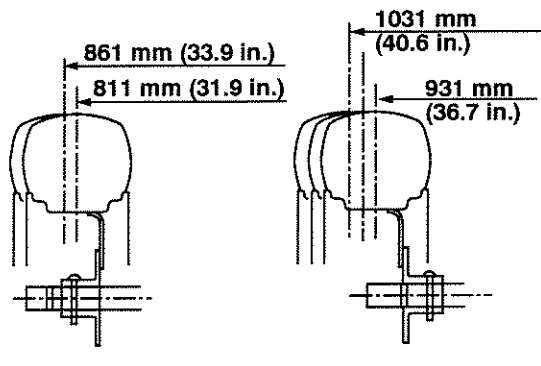
Type		Tire sizes	Inflation pressure
Farm	Front	4.50 – 10 4PR	220 kPa 2.2 kgf/cm <sup>2</sup> 31.3 psi
		5 – 12 4PR	240 kPa 2.4 kgf/cm <sup>2</sup> 34.2 psi
	Rear	7 – 16 4PR	180 kPa 1.8 kgf/cm <sup>2</sup> 25.6 psi
		8 – 16 4PR	160 kPa 1.6 kgf/cm <sup>2</sup> 22.8 psi
Turf	Front	20 × 8.00 – 10 4PR	160 kPa 1.6 kgf/cm <sup>2</sup> 22.8 psi
	Rear	212/80D – 15 4PR	160 kPa 1.6 kgf/cm <sup>2</sup> 22.8 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.

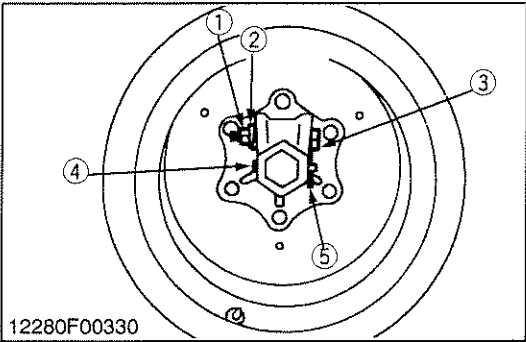
12280G00320

(2) Tread

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

Models	B1410		B1610	B1410 / B1610	
Front Tires	4.5 – 10 Farm		5 – 10 Farm	20 × 8.00 – 10 Turf	
Tread	835 mm (32.9 in.)			940 mm (37.0 in.)	
	 778 mm (30.6 in.) 12280F00290	 767 mm (30.2 in.) 12280F00290		 858 mm (33.8 in.) 12280F00300	
Models	B1410		B1610	B1410 / B1610	
Rear Tires	7 – 16 Farm		8 – 16 Farm	212 / 80D – 15 Turf	
Tread	711 to 861 mm (28.0 to 33.9 in.)		931 to 1031 mm (36.7 to 40.0 in.)	811 to 1031 mm (31.9 to 40.6 in.)	
	 861 mm (33.9 in.) 711 mm (28.0 in.) 12280F00270	 1031 mm (40.0 in.) 931 mm (36.7 in.) 12280F00310		 1031 mm (40.6 in.) 861 mm (33.9 in.) 811 mm (31.9 in.) 931 mm (36.7 in.) 12280F00320	

(2)-1 Rear Wheels



- (1) Nut
- (2) Spring Lock Washer
- (3) Bolt
- (4) Wheel Hub Pin
- (5) Snap Pin

**CAUTION**

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

**IMPORTANT**

- Always attach tires as shown in the drawings below.
- If not attached as illustrated, transmission parts may be damaged.
- Do not use tires larger than specified.
- When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service.

(When adjusting tread)

Tightening torque	Cotter setting bolt and nut	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
	Wheel hub mounting nut	108 to 125 N·m 11.0 to 12.8 kgf·m 80 to 93 ft-lbs

12280G00340

## [11] IMPLEMENT LIMITATIONS

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

Tread (max. width)		Lower link end max. loading weight $W_0$
Front	Rear	
858 mm (33.8 in.)	1031 mm (40.0 in.)	300 kg (660 lbs.)

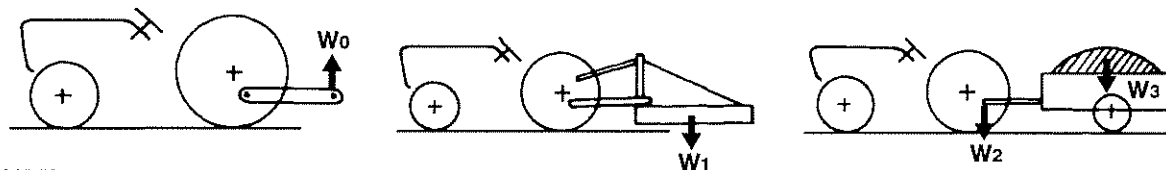
Actual figures		
Implement weight $W_1$ and / or size	Max. Drawbar Load $W_2$	Trailer loading weight $W_3$ Max. capacity
As in the following list (Shown on the next page)	330 kg (728 lbs.)	1000 kg (2200 lbs.)

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) :  $W_3$



11790F00750

### NOTE :

- Implement size may vary depending on soil operating conditions.

12280G00350

Implement		Remarks	B1410 · B1610
Mower	Mid-Mount	Max. cutting width	1220 mm (48 in.)
		Max. weight	140 kg (308 lbs.)
	Rotary-Cutter (1 Blade)	Max. cutting width	1070 mm (42 in.)
		Max. weight	140 kg (308 lbs.)
	Rear-Mount (2 or 3 Blade)	Max. cutting width	1220 mm (48 in.)
		Max. weight	140 kg (308 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	300 mm (12 in.)
Disc Plow		Max. size	560 mm (22 in.)
Cultivator		Max. size	1220 mm (48 in.) 1 Row
Disc Harrow		Max. harrowing width	1220 mm (48 in.)
		Max. weight	120 kg (265 lbs.)
Sprayer		Max. tank capacity	150 L (40 U.S.gals.)
Front Blade		Max. cutting width	1220 mm (48 in.)
		Sub frame	Necessary
Rear Blade		Max. cutting width	1520 mm (60 in.)
		Max. weight	160 kg (353 lbs.)
Front Loader		Max. lifting capacity	200 kg (441 lbs.)
		Max. width	1100 mm (43 in.)
		Sub frame	Necessary
Box Blade		Max. cutting width	1070 mm (42 in.)
		Max. weight	170 kg (375 lbs.)
Back Hoe		Max. digging depth	1830 mm (72 in.)
		Max. weight	270 kg (595 lbs.)
		Sub frame	Necessary
Snow Blower		Max. working width	1070 mm (42 in.)
		Max. weight	160 kg (353 lbs.)
		Sub frame	Necessary
Trailer		Max. load capacity	1000 kg (2205 lbs.)

**NOTE :**

- Implement size may vary depending on soil and operating conditions.

12280G00360





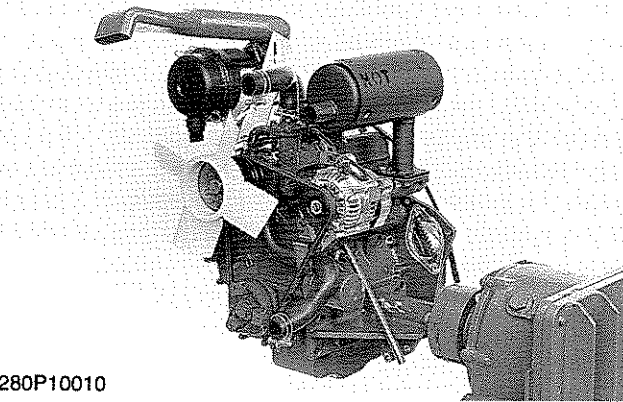
# MECHANISM

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## [1] FEATURES



12280P10010

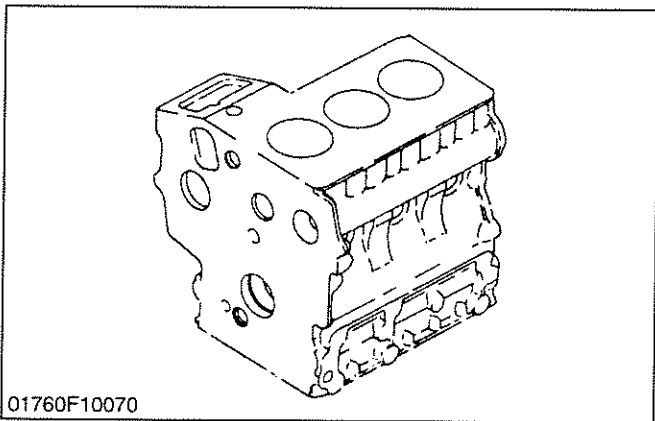
The D662 / D722-D14 is vertical, water-cooled, 4 cycle diesel engines.

It is incorporated KUBOTA's foremost technologies. With KUBOTA's E-TVCS (Three Vortex Combustion System), well-known Bosch MD type injection pump and the well-balanced designs, they give greater power, low fuel consumption, little vibration and quiet operation.

12280M10010

## [2] ENGINE BODY

### (1) Cylinder Block



01760F10070

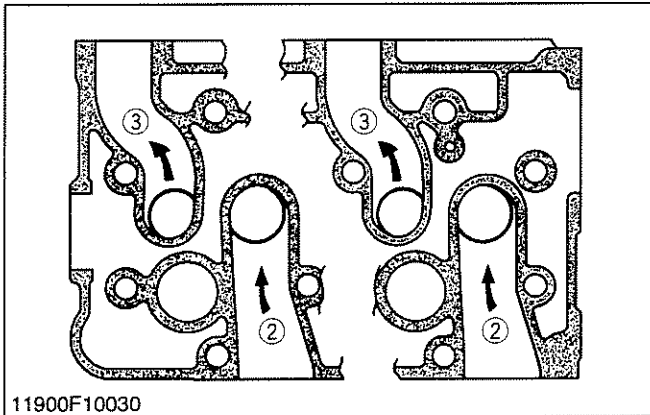
The engine has a high durability tunnel-type cylinder block in which the crank bearing component is a constructed body.

Furthermore, liner less type, allow effective cooling, less distortion, and greater wear-resistance.

The noise level is reduced to a minimum because each cylinder has its own chamber.

01760M10020

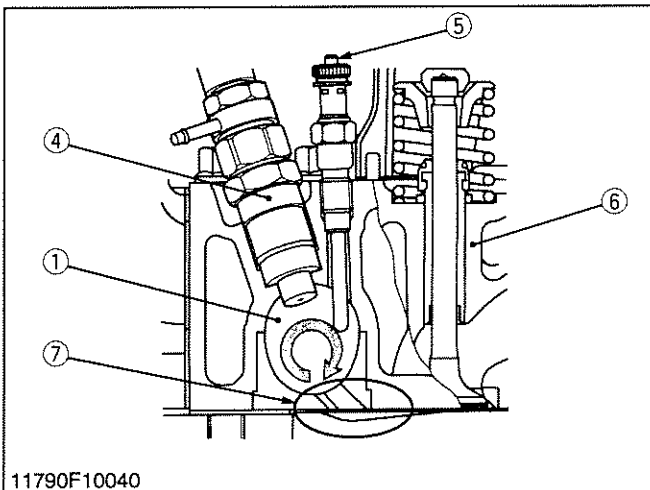
## (2) Cylinder Head



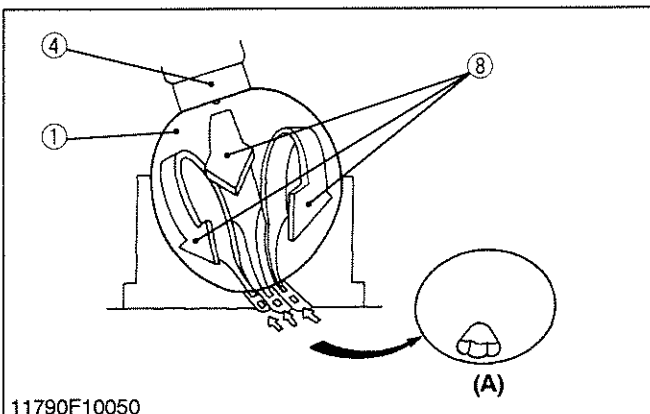
The cross-flow type intake / exhaust ports in this engine have their openings at both sides of the cylinder head. Because overlaps of intake / exhaust ports are smaller than in ports of other types which have openings on one side, the suction air can be protected from being heated and expanded by heated exhaust air. The cool, high density suction air has high volume efficiency and raises the power of the engine. Furthermore, distortion of the cylinder head by heated exhaust gas is reduced because intake ports are arranged alternately.

The combustion chamber is of KUBOTA's exclusive E-TVCS combustion chamber type. Suction air is swirled to be mixed effectively with fuel, prompting combustion and reducing fuel consumption.

In the combustion chamber are installed throttle type injection nozzle and rapid heating sheathed type glow plug. This glow plug assures easier than ever engine starts even at  $-15^{\circ}\text{C}$  ( $5^{\circ}\text{F}$ ).

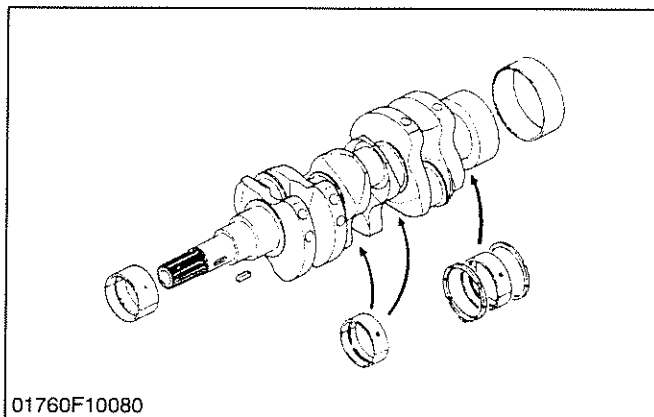


- |                        |                                   |
|------------------------|-----------------------------------|
| (1) Combustion Chamber | (7) Depression                    |
| (2) Intake Port        | (8) Compressed Air                |
| (3) Exhaust Port       |                                   |
| (4) Nozzle Assembly    | (A) Connect to Combustion Chamber |
| (5) Glow Plug          |                                   |
| (6) Cylinder Head      |                                   |



11900M10032

### (3) Crankshaft



The crankshaft with the connecting rod converts the reciprocating motion of the piston into the rotating motion.

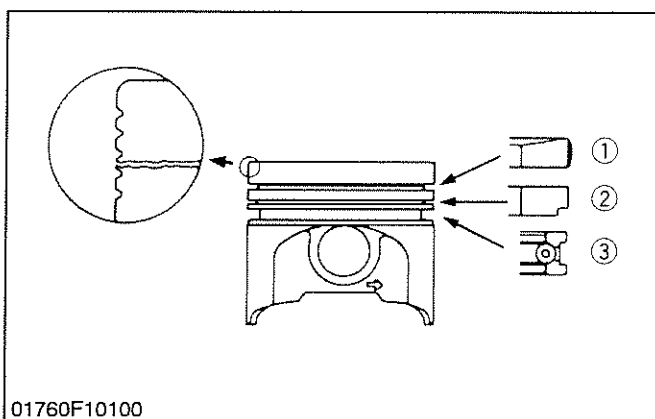
The crankshaft is made of tough special alloy steel, and the journals, pins and oil seal sliding portions are induction hardened to increase the hardness for higher wear resistance.

The front journal is supported by a solid type bearing, the intermediate journal by a split type, and the rear journal by a split type with thrust bearings.

The crankshaft is provided with an oil gallery, through which engine oil is fed to the crankpin portion, and lubricates it.

01760M10030

### (4) Piston and Piston Rings



The piston has a slightly oval shape when cold (in consideration of thermal expansion) and a concave head.

Three rings are installed in grooves in the piston.

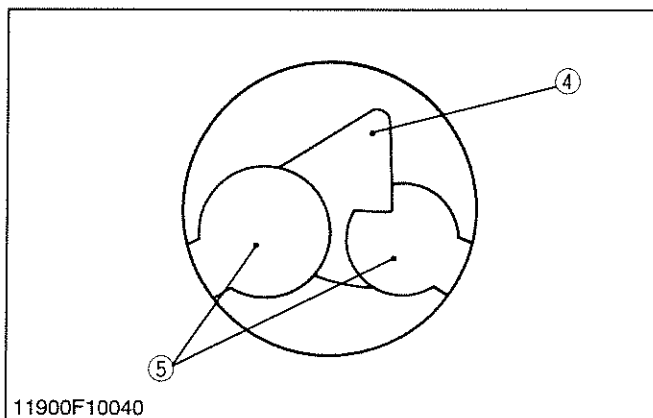
The top ring (1) is a keystone type, which can stand against heavy loads, and the barrel face on the ring fits well to the cylinder wall.

The second ring (2) is an undercut type, which effectively prevents the oil from being carried up.

The third oil ring (3) has chamfered contact faces and an expander ring, which increase the pressure of the oil ring against the cylinder wall.

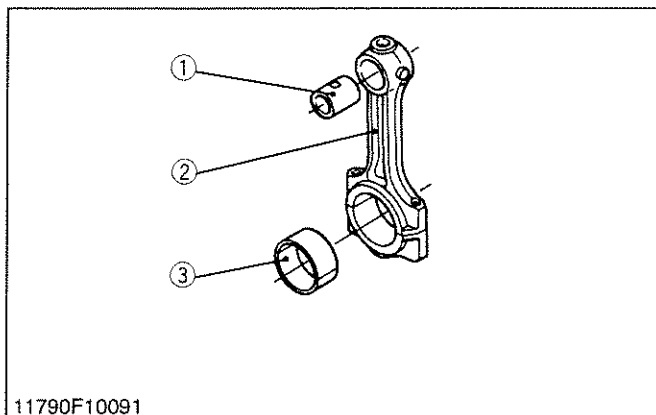
Several grooves are cut on the top land to help heat dissipate and to prevent scuffing.

- |                 |                  |
|-----------------|------------------|
| (1) Top Ring    | (4) Depression   |
| (2) Second Ring | (5) Valve Recess |
| (3) Oil Ring    |                  |



12280M10020

## (5) Connecting Rod



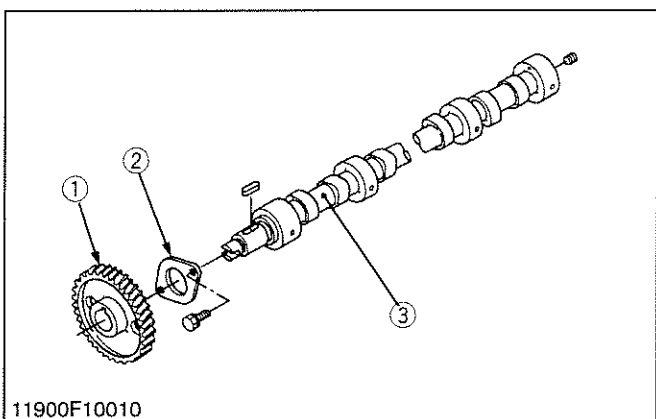
The connecting rod (2) is used to connect the piston with the crankshaft.

The big end of the connecting rod has a crankpin bearing (3) (split type) and the small end has a small end bushing (1) (solid type).

- |                       |                      |
|-----------------------|----------------------|
| (1) Small End Bushing | (3) Crankpin Bearing |
| (2) Connecting Rod    |                      |

11790M10061

## (6) IN. and EX. Camshaft



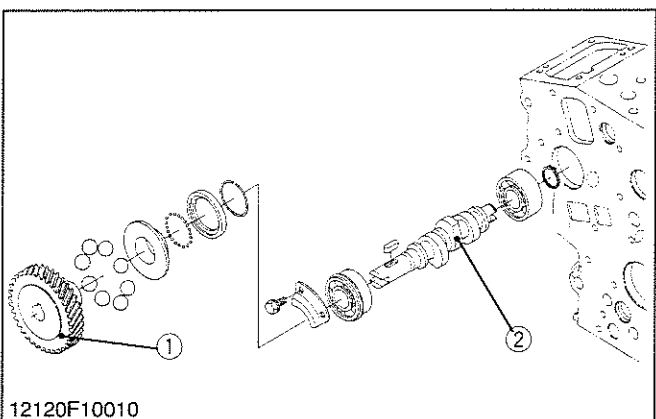
The camshaft (3) is made of special cast iron, and the journal and camshaft sections are chilled to resist wear.

The journal sections are force-lubricated.

- |                      |              |
|----------------------|--------------|
| (1) Cam Gear         | (3) Camshaft |
| (2) Camshaft Stopper |              |

11900M10051

## (7) Fuel Camshaft



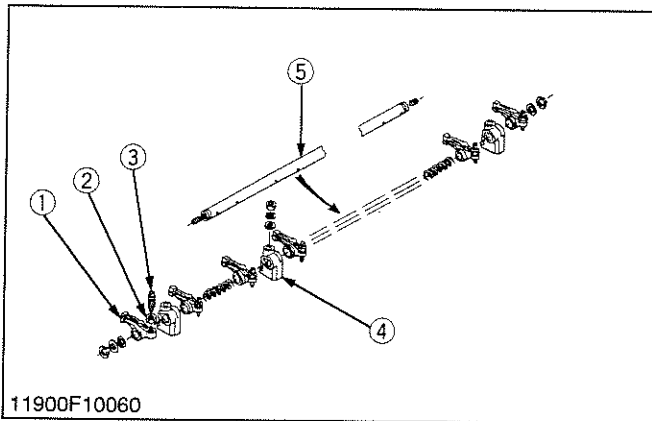
The fuel camshaft (2) controls the reciprocating movement of the injection pump.

The fuel camshaft is made of carbon steel and the cam sections are quenched and tempered to provide greater wear resistance.

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

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## (8) Rocker Arm



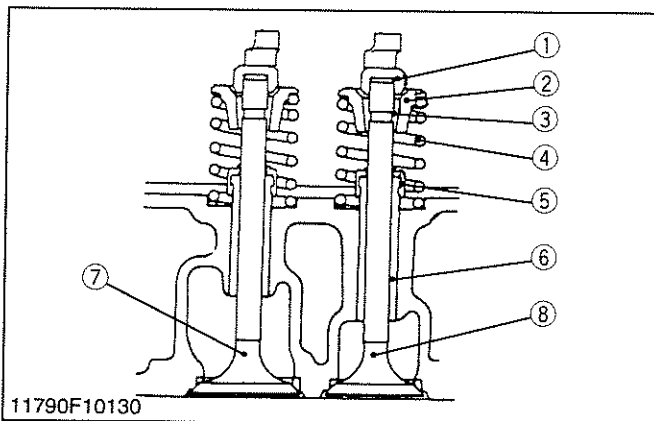
The rocker arm assembly includes the rocker arms (1), rocker arm brackets (4) and rocker arm shaft (5), and converts the reciprocating movement of the push rods to an open / close movement of the intake and exhaust valves.

Lubricating oil pressurized through the bracket to the rocker arm shaft, which serves as a fulcrum so that the rocker arm and the entire system are lubricated sufficiently.

- |                     |                        |
|---------------------|------------------------|
| (1) Rocker Arm      | (4) Rocker Arm Bracket |
| (2) Lock Nut        | (5) Rocker Arm Shaft   |
| (3) Adjusting Screw |                        |

11900M10070

## (9) Intake and Exhaust Valve

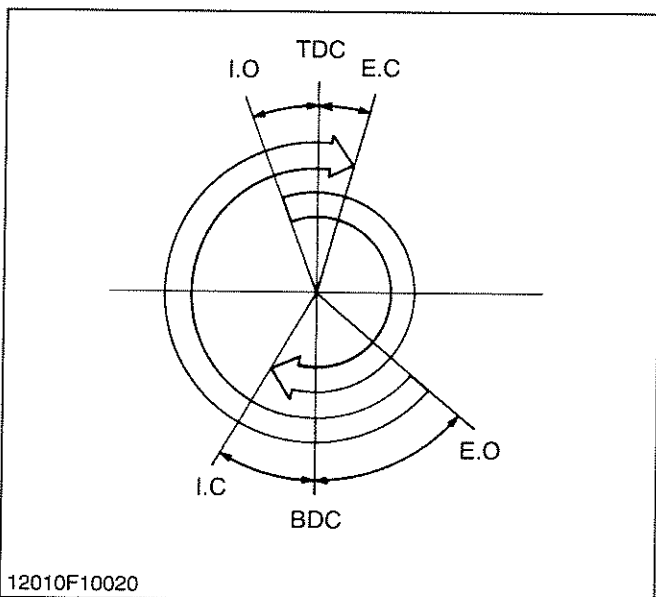


The intake and exhaust valves (7), (8) and their guides (6) are different from each other. Other parts, such as valve springs (4), valve spring retainers (2), valve spring collets (3), valve stem seals (5) and valve caps (1) are the same for both the inlet and exhaust valves. All contact or sliding parts are quenched and tempered to resist wear.

- |                           |                     |
|---------------------------|---------------------|
| (1) Valve Cap             | (5) Valve Stem Seal |
| (2) Valve Spring Retainer | (6) Valve Guide     |
| (3) Valve Spring Collet   | (7) Intake Valve    |
| (4) Valve Spring          | (8) Exhaust Valve   |

11790M10100

## (10) Valve Timing

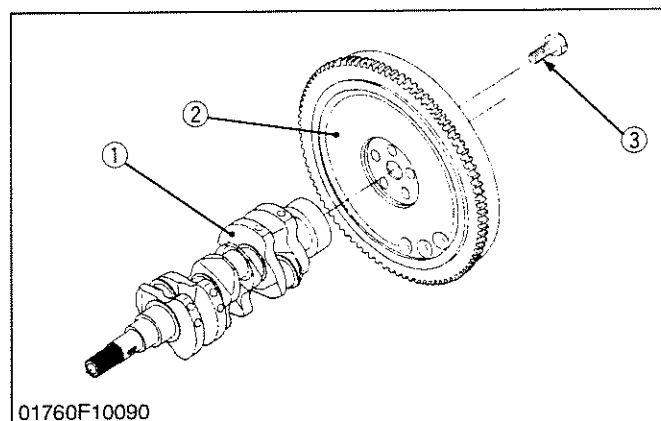


The valve opening and closing timing is extremely important for effectively intaking air into the cylinder and sufficiently exhaust gas. An appropriate timing can be obtained by aligning the alignment marks on the crank gear and cam gear.

Inlet valve open (I.O)	0.35 rad. (20°) before T.D.C.
Inlet valve close (I.C)	0.79 rad. (45°) after B.D.C.
Exhaust valve open (E.O)	0.89 rad. (50°) Before B.D.C.
Exhaust valve close (E.C)	0.26 rad. (15°) after T.D.C.

12120M10030

## (11) Flywheel



The flywheel is installed on the rear end of the crankshaft. Its inertia keeps the flywheel turning at a constant speed, while the crankshaft tends to speed up during the power stroke and to slow down during other strokes.

The flywheel has a ring gear, which mesh with the drive pinion of the starter.

The flywheel has also marks **TC** and fuel injection timing lines on its outer rim. The lines of fuel injection timing shows the fuel injection timing and the mark **TC** shows the piston's top dead center, when they are aligned with the alignment mark on the rear end plate.

(1) Crankshaft

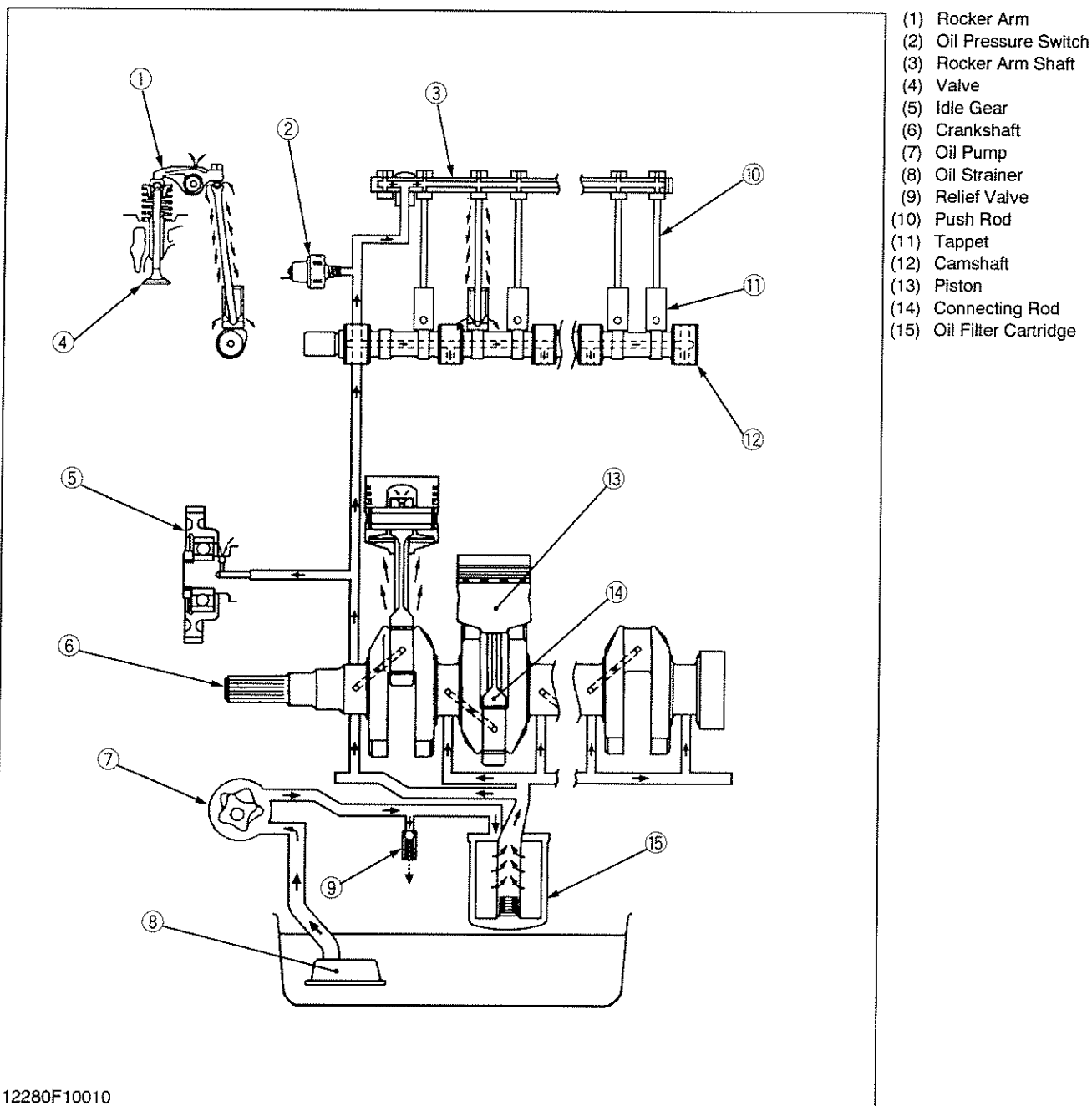
(2) Flywheel

(3) Flywheel Screw

12280M10030



### [3] LUBRICATING SYSTEM



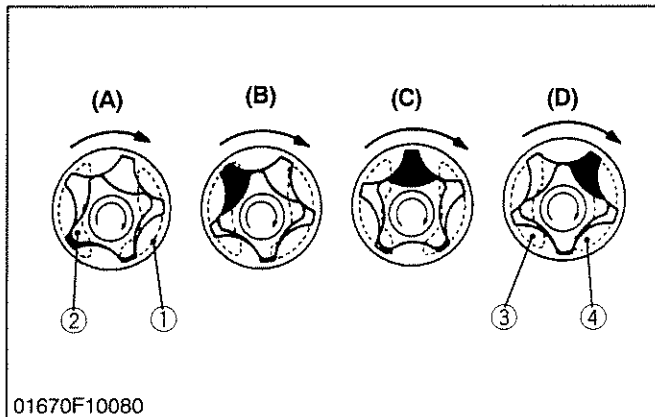
This engine's lubricating system consists of oil strainer (8), oil pump (7), relief valve (9), oil filter cartridge (15) and oil pressure switch (2).

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 (6), connecting rods (14), camshaft

(12) 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 (13), cylinders, small ends of connecting rods, tappets (11), push rods (10), inlet and exhaust valves (4) and timing gears.

## (1) Oil Pump



The oil pump is a trochoid pump.

Inside the pump body, the 4 lobe inner rotor (2) is eccentrically engaged with the 5 lobe outer rotor (1). The inner rotor is driven by the crankshaft, which in turn rotate the outer rotor.

When the inner rotor rotates, the outer rotor also rotates in the same direction. The two rotors have differences in lobe number and center, which generates space between lobes as shown in the figure.

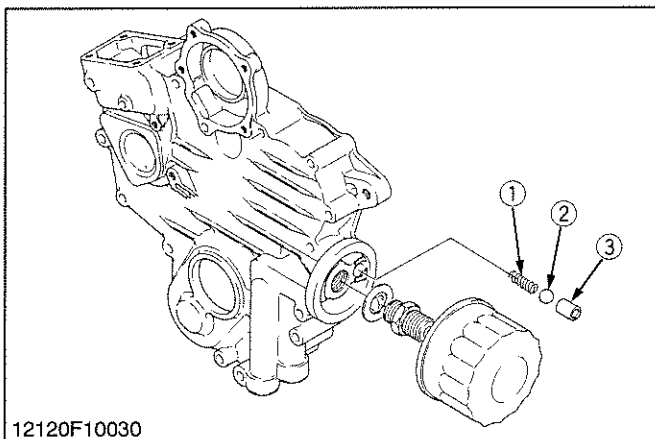
At position (A), there is little space between lobes in the inlet port. As the rotor rotates towards position (B), the space between the lobes becomes larger, creating a negative pressure which sucks in oil.

Outside the inlet port, as shown in position (C), the space between the lobes becomes gradually smaller, and oil pressure increases. At position (D), oil is discharged from the outlet port.

- |                 |                 |
|-----------------|-----------------|
| (1) Outer Rotor | (3) Inlet Port  |
| (2) Inner Rotor | (4) Outlet Port |

12120M10050

## (2) Relief Valve



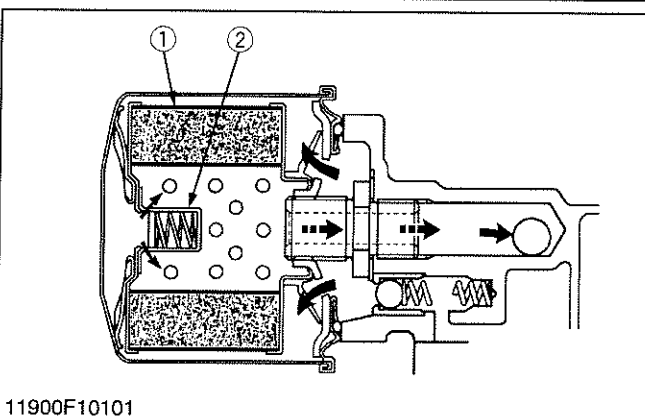
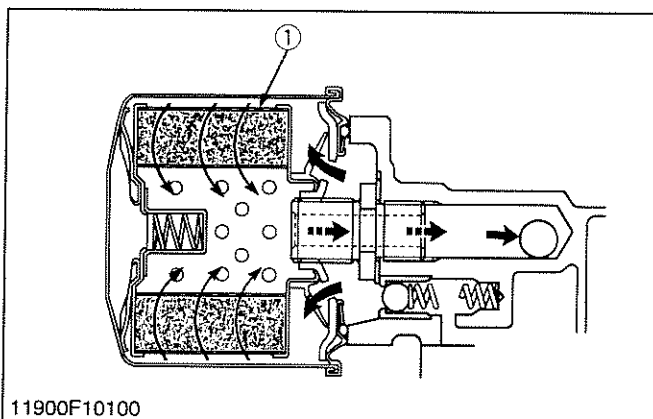
The relief valve prevents the damage of the lubricating system due to high oil pressure. This relief valve is a ball type direct acting relief valve, and is best suited for low pressures.

When oil pressure exceeds the upper limit, the ball (2) is pushed back by the oil pressure and the oil escapes.

- |            |                |
|------------|----------------|
| (1) Spring | (3) Valve Seat |
| (2) Ball   |                |

12120M10060

### (3) Oil Filter Cartridge



Impurities in engine oil can cause to wear and seize components as well as impairing the physical and chemical properties of the oil itself. Impurities contained in force-fed engine oil are absorbed on the filter paper for removal as they pass through the filter element (1).

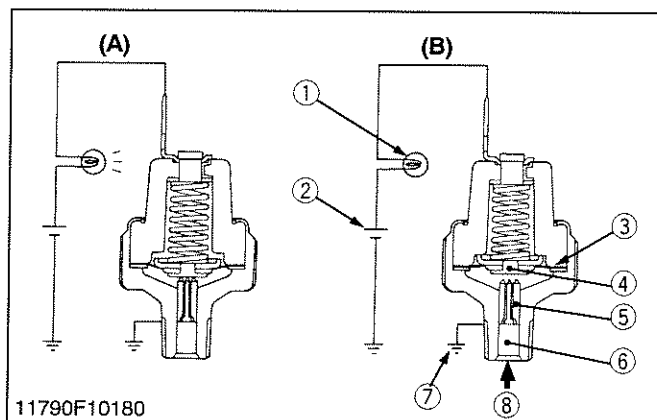
When the filter element is clogged and the oil pressure in inlet line builds up by 98 kPa (1.0 kgf/cm<sup>2</sup>, 14 psi) more than the outlet line, the bypass valve (2) opens and the oil flows from inlet to outlet bypassing the filter element.

(1) Filter Element

(2) Bypass Valve

11900M10120

### (4) Oil Pressure Switch



The oil pressure switch is mounted on the cylinder block, to warn the operator that the lubricating oil pressure is poor.

If the oil pressure falls below the specified value, the oil warning lamp will light up, warning the operator. In this case, stop the engine immediately and check the cause of pressure drop.

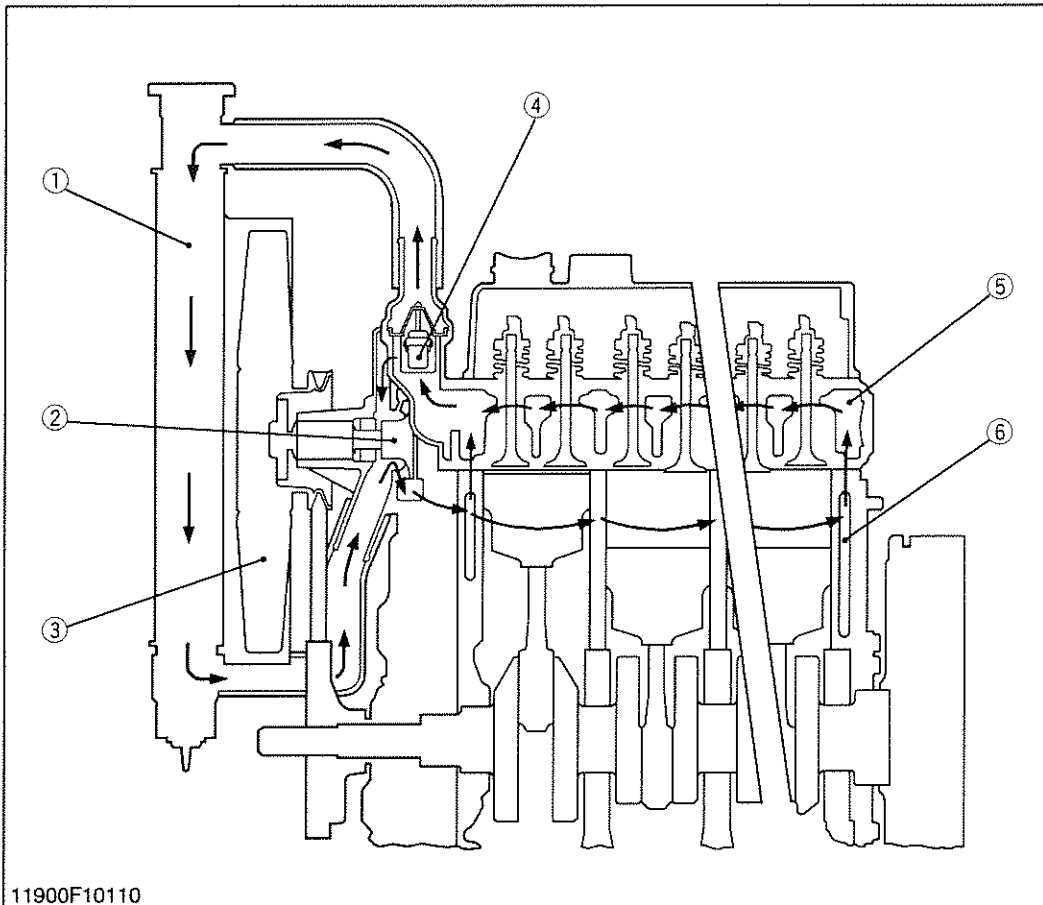
- (1) Warning Lamp
- (2) Battery
- (3) Rubber Gasket
- (4) Contact Rivet
- (5) Contact
- (6) Oil Passage
- (7) Cylinder Block
- (8) Oil

(A) At Lower Oil Pressure  
(49 kPa, 0.5 kgf/cm<sup>2</sup>, 7 psi or less)

(B) At Proper Oil Pressure

11790M10151

## [4] COOLING SYSTEM



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

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.

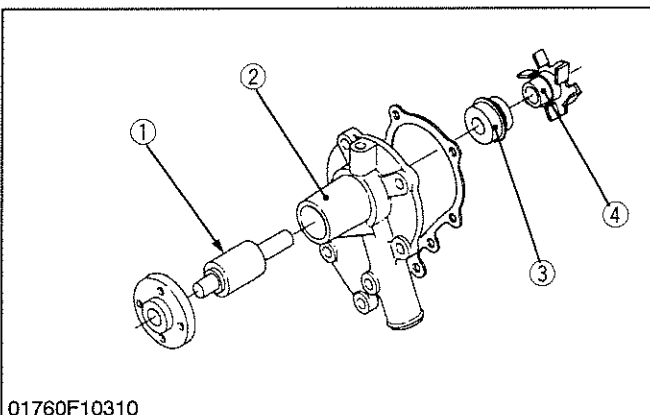
The water pump receives water from the radiator or from the cylinder head and force it into the cylinder block.

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 from the cylinder head to the radiator. When the water temperature is low, the thermostat closes to flow the water only to the water pump.

The opening temperature of the thermostat is approx. 82 °C (180 °F).

11900M10133

### (1) Water Pump



The water pump is driven with the fan drive pulley, which is on the water pump shaft and driven by the crankshaft with a belt.

The rotating impeller (4) in the water pump receives cool water from the bottom of the radiator and the water jacket of cylinder head, and sends it into the water jacket in the cylinder block.

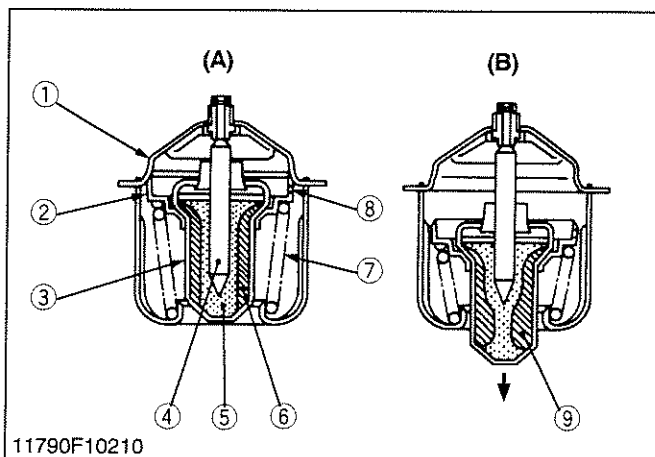
The mechanical seal (3) prevents the water from entering the bearing (1).

- (1) Bearing Unit
- (2) Water Pump Body
- (3) Mechanical Seal
- (4) Water Pump Impeller

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12280M10050

## (2) Thermostat



The thermostat maintains the cooling water at correct temperature. KUBOTA's engine uses a wax pellet type thermostat. Wax is enclosed in the pellet. The wax is solid at low temperatures, but turns liquid at high temperatures, its volume expands and as a result the valve is opened.

### (A) At low temperature (lower than 82 °C, 180 °F)

As the thermostat is closed, cooling water circulates in the engine through the water return pipe without running to the radiator.

Air in the water jacket escapes to the radiator side through leak hole (8) of the thermostat.

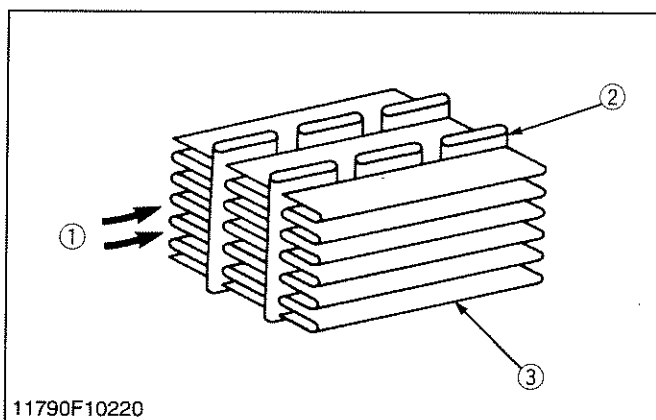
### (B) At high temperature (higher than 82 °C, 180 °F)

When the temperature of cooling water exceeds 82 °C (180 °F), wax in the pellet turns liquid and expands. Because the spindle (4) is fixed, the pellet (3) is lowered, the valve (2) is separated from the seat (1), and then cooling water is sent to the radiator.

- |                      |                  |
|----------------------|------------------|
| (1) Seat             | (6) Wax (Solid)  |
| (2) Valve            | (7) Spring       |
| (3) Pellet           | (8) Leak Hole    |
| (4) Spindle          | (9) Wax (Liquid) |
| (5) Synthetic Rubber |                  |

11790M10183

## (3) Radiator



The radiator core consists of water carrying tubes (2) with fins (3) at a right angle to it.

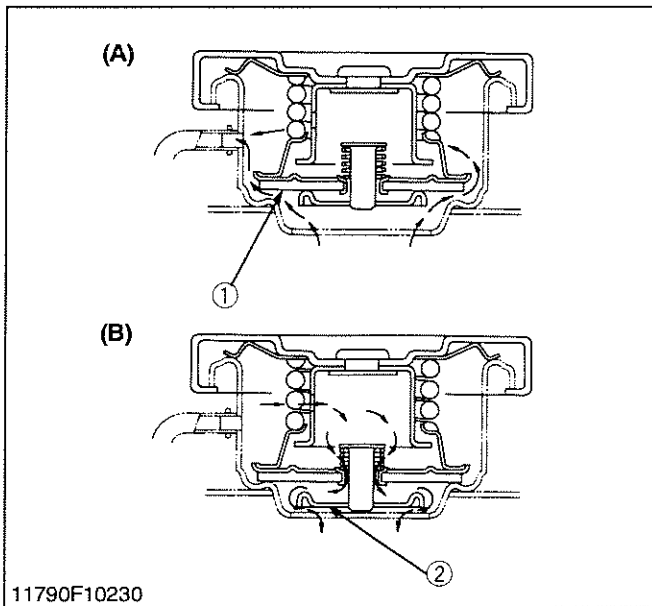
The water in the radiator is cooled by the air flowing through between the tube wall and the fin.

The louverless corrugated fins are light in weight, high in heat exchange ratio and less in clogging by the dust.

- |                 |         |
|-----------------|---------|
| (1) Cooling Air | (3) Fin |
| (2) Tube        |         |

11790M10190

## (4) Radiator Cap



The pressure type cap is installed on the radiator, which prevents the pressure difference between the inside and the outside of the radiator from deforming the radiator.

### (A) At high pressure

(higher than 88 kPa, 0.9 kgf/cm<sup>2</sup>, 13 psi)

When the water temperature rises and the pressure in the radiator increase above the specified pressure, the pressure valve (1) opens to reduce the internal pressure.

### (B) At negative pressure

When the water temperature falls and a vacuum is formed in the radiator, the vacuum valve (2) opens to allow the air to enter the radiator.

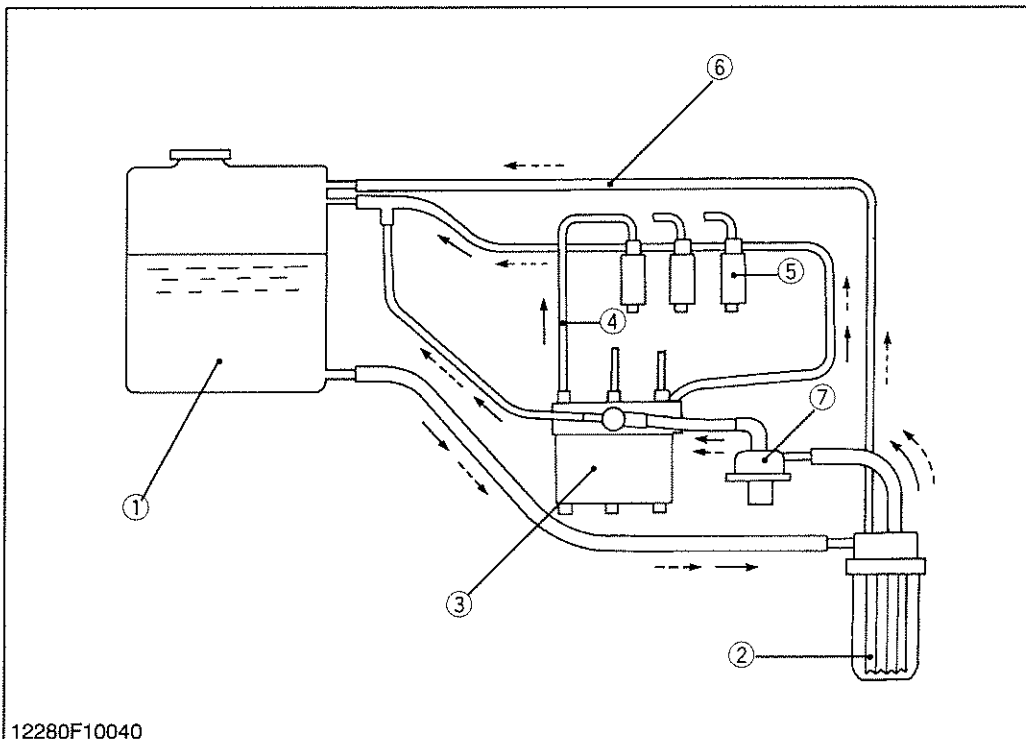
(1) Pressure Valve

(2) Vacuum Valve

11790M10200

## [5] FUEL SYSTEM

### (1) Fuel Line



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

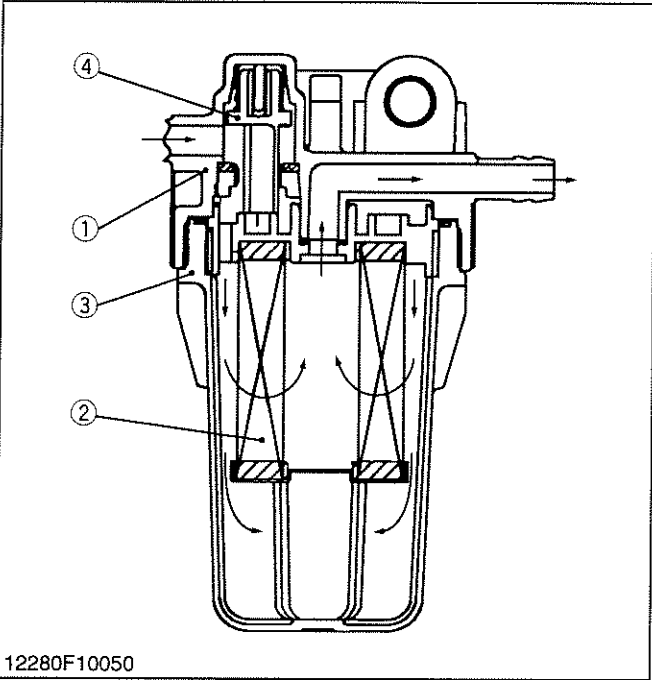
Fuel from the fuel tank (1) passes through the fuel filter (2), and then enters the injection pump (3) after impurities such as dirt, water, etc. are removed.

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 (5) is injected into the combustion chamber.

Part of the fuel fed to the injection nozzle (5) lubricates the moving parts of the plunger inside the nozzle, then returns to the fuel tank through the fuel overflow pipe (6) from the upper part of the nozzle holder.

12280M10060

(2) Fuel Filter



The fuel filter is installed between the fuel tank and fuel lift pump, and serves to remove dirt and impurities from the fuel.

Fuel from the fuel tank enters the outside of the filter element (2) and passes through the filter element under its own pressure. As it passes through, the dirt and impurities in the fuel are filtered out, allowing only clean fuel to enter the interior of the filter element. The fuel exits from the outlet of the filter bracket (1) and is sent to the fuel lift pump.

And to prevent the fuel from flowing out when the element was removed, the valve (4) is installed in this filter.

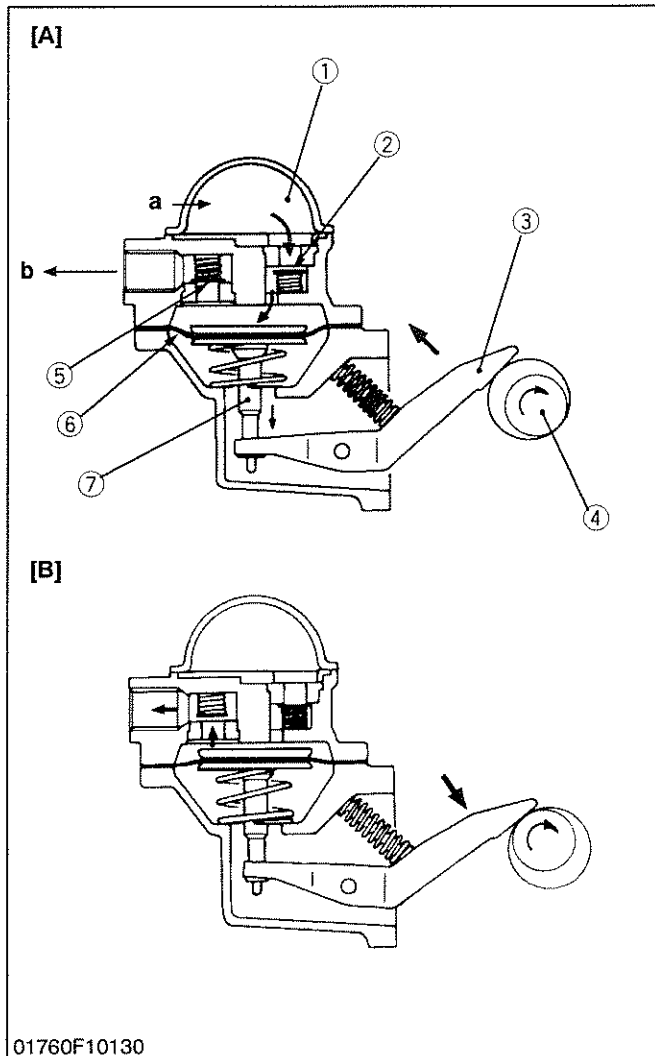
Type of filter element	According-pleated paper type
Filter mesh	20 to 40 $\mu\text{m}$ 0.00079 to 0.00157 in.

- (1) Filter Bracket  
(2) Filter Element

- (3) Filter Cap  
(4) Valve

12280M10070

### (3) Fuel Feed Pump



The filtered fuel is fed to the injection pump by the fuel feed pump.

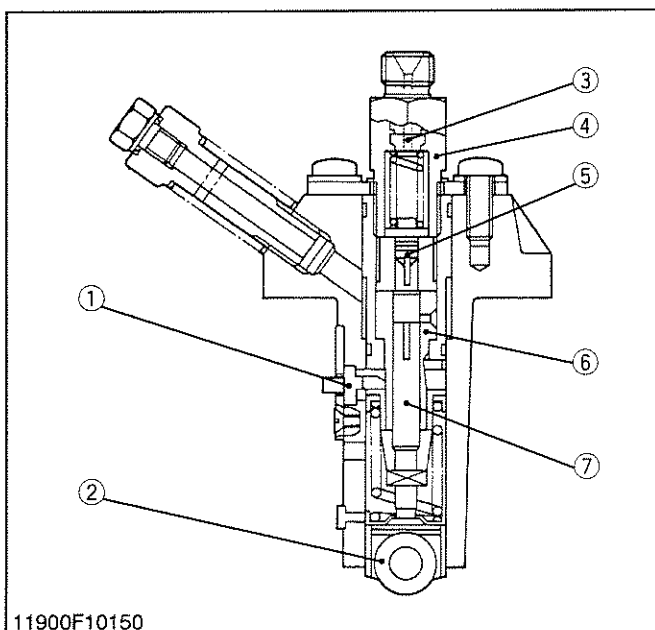
The chamber (1) is enclosed with the inlet valve (2), the outlet valve (5) and the diaphragm (6), which is linked to the rocker arm with the pull rod (7). The rocker arm is swung by the eccentric cam on the fuel camshaft (4).

When the diaphragm is pulled down, vacuum in the chamber (1) causes the outlet valve (5) to close and the atmospheric pressure in the fuel tank to force the fuel into the chamber, opening the inlet valve (2).

When the diaphragm is pushed up by the cam, the pressure in the chamber causes the inlet valve to close and forces out the fuel, opening the outlet valve.

- |                   |                       |
|-------------------|-----------------------|
| (1) Chamber       | (a) From Fuel Filter  |
| (2) Inlet Valve   | (b) To Injection Pump |
| (3) Rocker Arm    |                       |
| (4) Fuel Camshaft | (A) Inlet Stroke      |
| (5) Outlet Valve  | (B) Discharge Stroke  |
| (6) Diaphragm     |                       |
| (7) Pull Rod      |                       |

### (4) Injection Pump



A Bosch MD type mini pump is used for the injection pump. It is small, lightweight and easy to handle.

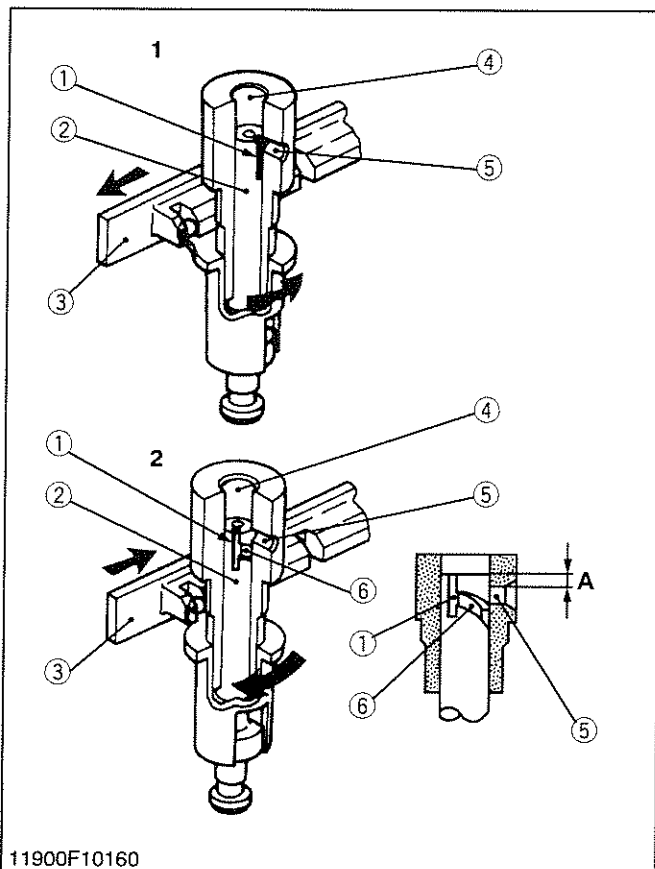
The plunger (7) with a left-hand lead reciprocates via the tappet roller (2) by means of the fuel camshaft, causing the fuel to be delivered into the injection nozzle.

- |                           |                    |
|---------------------------|--------------------|
| (1) Control Rack          | (5) Delivery Valve |
| (2) Tappet Roller         | (6) Cylinder       |
| (3) Dumping Valve         | (7) Plunger        |
| (4) Delivery Valve Holder |                    |

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11900M10170





## ■ Injection Control

### 1. No fuel delivery (Engine stop)

At the engine stop position of the control rack (3), the lengthwise slot (1) on the plunger (2) aligns with the feed hole (5). And the delivery chamber (4) is led to the feed hole during the entire stroke of the plunger.

The pressure in the delivery chamber does not build up and no fuel can be forced to the injection nozzle.

### 2. Fuel delivery

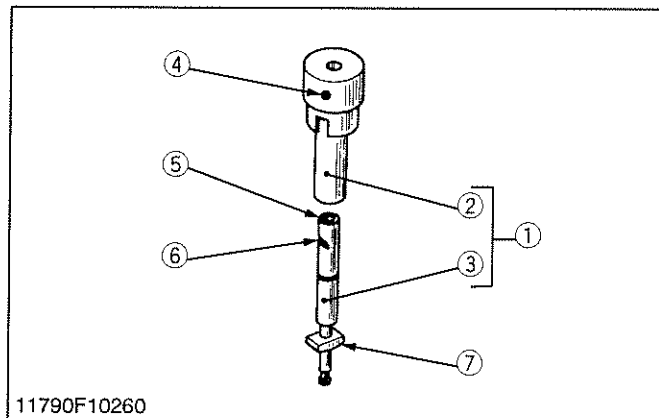
The plunger (2) is rotated (see figure) by the control rack (3).

When the plunger is pushed up, the feed hole (5) is closed. The pressure in the delivery chamber (4) builds up and forcefeeds the fuel to the injection nozzle until the control groove (6) meets the feed hole (5).

The amount of the fuel corresponds to the distance "A".

- |                  |                      |
|------------------|----------------------|
| (1) Slot         | (4) Delivery Chamber |
| (2) Plunger      | (5) Feed Hole        |
| (3) Control Rack | (6) Control Groove   |

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## ■ Pump Element

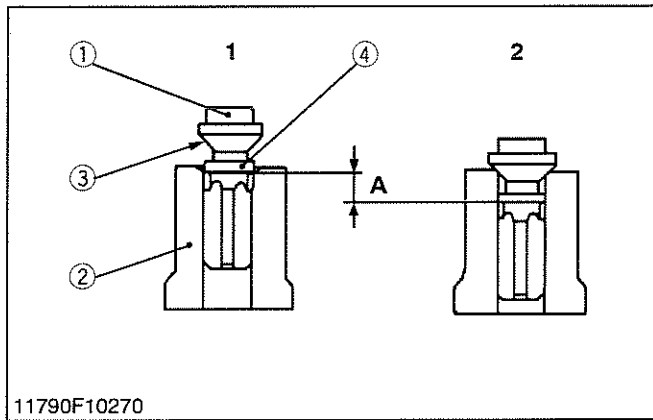
The pump element (1) is consist of the plunger (3) and cylinder (2).

The sliding surfaces are super-precision machined to maintain injection pressure at engine low speeds. Since the driving face (7) fits in the control sleeve, the plunger (3) is rotated by the movement of the control rack to increase or decrease of fuel delivery.

As described above, the plunger (3) is machined to have the slot (5) and the control groove (6).

- |                  |                    |
|------------------|--------------------|
| (1) Pump Element | (5) Slot           |
| (2) Cylinder     | (6) Control Groove |
| (3) Plunger      | (7) Driving Face   |
| (4) Feed Hole    |                    |

11790M10230



### ■ Delivery Valve

The delivery valve consists of the delivery valve (1) and delivery valve seat (2).

The delivery valve performs the following functions.

#### 1. Reverse flow preventing function

If the fuel flow reverse from the injection nozzle side when the plunger lowers, the time lag between the next delivery start and the nozzle injection start increases. To avoid this, the delivery chamber to injection pipe interruption by delivery valve (1) prevents this reverse flow, thus keeping fuel always filled in the nozzle and pipe.

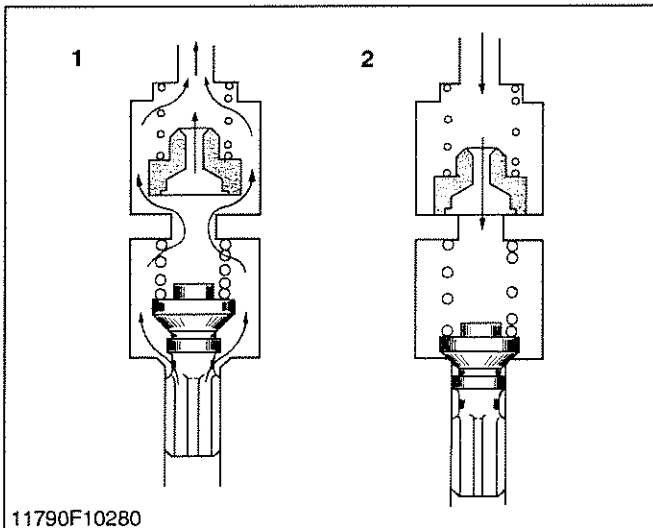
#### 2. Suck-back function

After completing the fuel delivery, the delivery valve lowers, and the relief plunger (4) end contacts the delivery valve seat (2). The valve further lowers until its seat surface (3) seats firmly the delivery valve seat. During this time, the amount of fuel corresponding to (A) is sucked back from inside the injection pipe, the pressure inside the pipe is reduced, thus leading to an improved injection shut off and preventing after leakage dribbling.

- (1) Delivery Valve  
(2) Delivery Valve Seat

- (3) Seat Surface  
(4) Relief Plunger

11790M10240



### ■ Dumping Valve

#### 1. At fuel injection

Since dumping valve is pushed up to press the spring, fuel is pressure-fed to injection nozzle the same as without dumping valve.

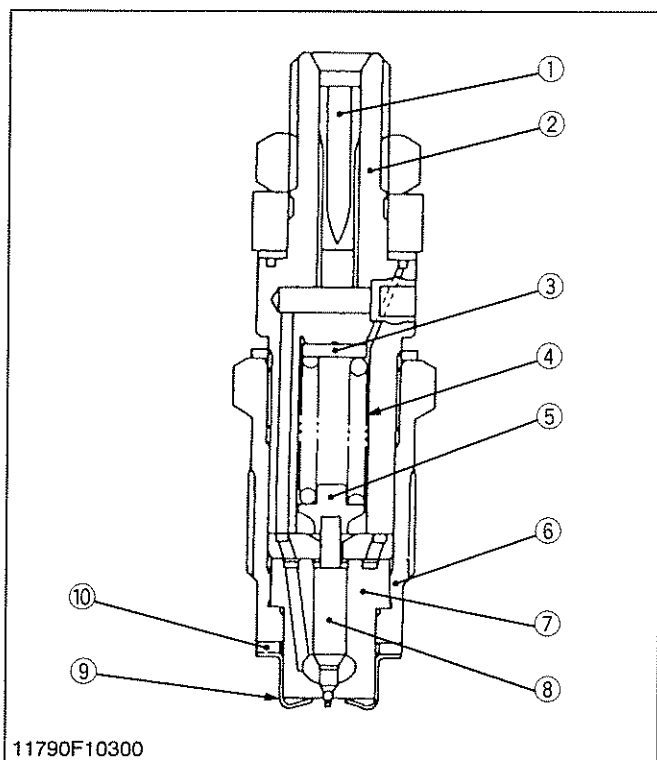
#### 2. At suck-back

At suck-back by delivery valve after fuel injection fuel returns through dumping valve orifice. Generally second injection is apt to occur by reflex pressure due to reaction of sudden pressure drop when changing into suck-back by delivery valve from high injection pressure.

As a result of preventing this second injection perfectly by dumping valve and dissolving nozzle clogging, durability of injection nozzle is improved.

11790M10250

## (5) Injection Nozzle



This nozzle is of a flat cut provided double throttle type. This type of nozzle is designed to control the injection quantity when the lift rate is low at start of the injection, and to cut down on the knocking sound caused by excessive fuel injection by giving the needle valve section more taper than before to prevent the rapid increase in the injection quantity when the initial injection turns into the full-force injection.

Also, employed to prevent the injection quantity loss in the throttle section caused by carbon, the flat cut provided at the needle valve section helps the throttle withstand long use and reduce as much knocking sound as when it was new.

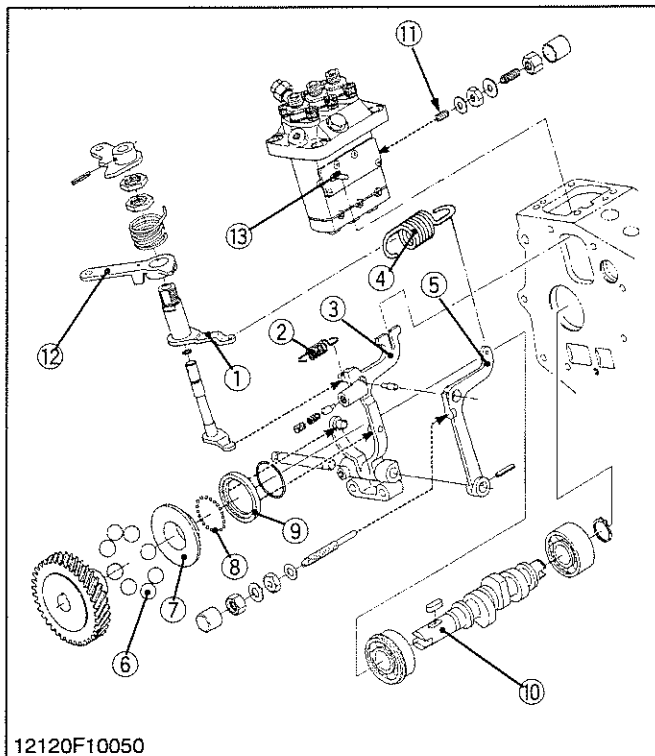
The heat seal is employed to improve the durability and reliability of the nozzle.

The injection pressure is 13.73 to 14.71 MPa (140 to 150 kgf/cm<sup>2</sup>, 1991 to 2133 psi), and is adjusted with adjusting washers (3).

- |                        |                   |
|------------------------|-------------------|
| (1) Bar Filter         | (6) Retaining Nut |
| (2) Nozzle Holder Body | (7) Nozzle Body   |
| (3) Adjusting Washer   | (8) Needle Valve  |
| (4) Nozzle Spring      | (9) Heat Seal     |
| (5) Push Rod           | (10) Gasket       |

11790M10271

## (6) Governor



The governor controls the amount of the fuel to be fed in the entire speed range to prevent the engine from changing its speed according to the load.

The fork lever 1 (3) is held where two forces on it are balanced. One is the force that fork lever 2 pushes, which is caused by the tension of the governor spring (4) between the governor lever (1) and fork lever 2 (5). Another is the component of the centrifugal force produced by the steel balls (6) which are rotated by the fuel camshaft (10).

### ■ At start

The steel ball (6) has no centrifugal force.

Fork lever 1 (3) is pulled by the start spring (2) and the control rod (13) moves to the maximum injection position for easy starting.

### ■ At idling

When the speed control lever (12) is set at the idling position, the governor spring (4) is pulled slightly.

As the camshaft rotates, the steel ball (6) increase their centrifugal force and push the governor sleeve (7). Fork lever 1 (3) pushed by the governor sleeve, pushes the control rod (13) and the control rod compresses the idling adjust spring (11).

The control rod is kept at a position where the centrifugal force is balanced with the spring tensions on the control rod, providing stable idling.

- |                     |                           |
|---------------------|---------------------------|
| (1) Governor Lever  | (8) Steel Ball            |
| (2) Start Spring    | (9) Governor Ball Case    |
| (3) Fork Lever 1    | (10) Fuel Camshaft        |
| (4) Governor Spring | (11) Idling Adjust Spring |
| (5) Fork Lever 2    | (12) Speed Control Lever  |
| (6) Steel Ball      | (13) Control Rod          |
| (7) Governor Sleeve |                           |

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### ■ At medium or high speed running

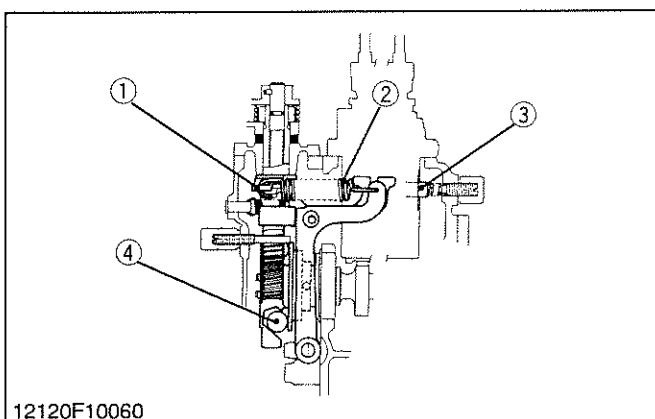
When the speed control lever (1) is turned further, the governor spring (2) increases the tension and the control rod (3) is pulled to increase the engine speed.

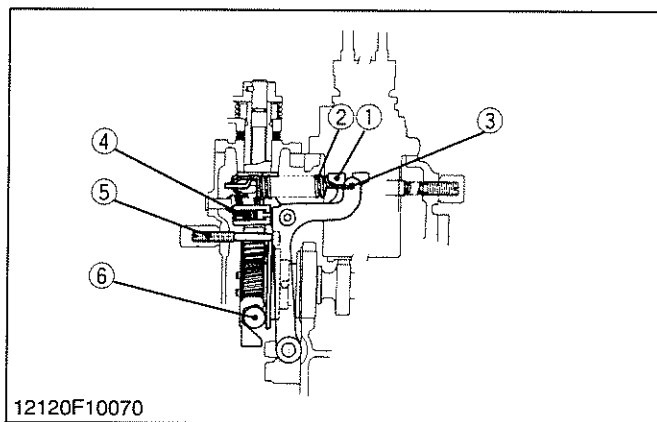
The steel ball (4) increase their centrifugal force and the control rod is pushed, decreasing the engine speed, until the centrifugal force and the spring tension are balanced.

When the engine speed is dropped with the increase of the load, the centrifugal force of the steel ball decreases and the control rod is pulled. The amount of the fuel to the injection nozzle is increased to produce a higher engine torque required for the load.

- |                         |                 |
|-------------------------|-----------------|
| (1) Speed Control Lever | (3) Control Rod |
| (2) Governor Spring     | (4) Steel Ball  |

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### ■ At maximum speed running with an overload

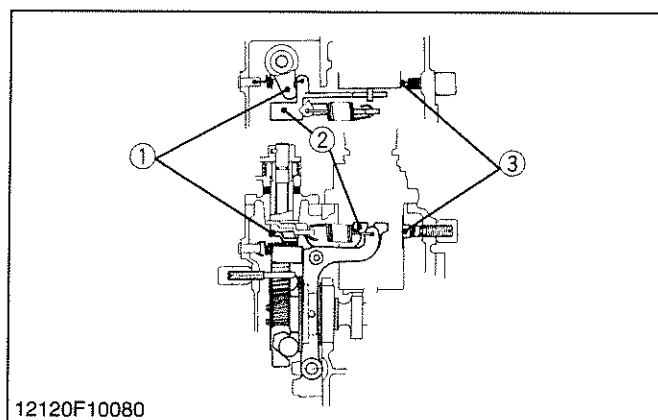
When the engine is overloaded at the high speeds and the engine speed drops, the centrifugal force of the steel ball (6) decreases and the governor spring (2) pulls fork lever 1 (1) and 2 (3).

When fork lever 2 contacts the adjusting screw (5), the spring (4) which is built in fork lever 1 begins to push the fork lever 1 to pull the control rod.

The fuel to the injection nozzle is increased to run the engine at high speed and torque.

- |                     |                     |
|---------------------|---------------------|
| (1) Fork Lever 1    | (4) Spring          |
| (2) Governor Spring | (5) Adjusting Screw |
| (3) Fork Lever 2    | (6) Steel Ball      |

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### ■ To stop the engine

When the stop lever (1) is moved to the stop position, fork lever 1 (2) is pushed and the control rod (3) is moved to stop the fuel injection.

- |                  |                 |
|------------------|-----------------|
| (1) Stop Lever   | (3) Control Rod |
| (2) Fork Lever 1 |                 |

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# SERVICING

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# 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 Clean	— — — —
	<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>	Replace 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 Correct or replace timing gear	G-23 G-9 G-9 1-S18 1-S48 1-S23 1-S51 1-S21 1-S24, S25 1-S26 1-S19, S20 1-S23
<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> </ul>	Replace Adjust	1-S26 1-S17
<b>Engine Revolution Is Not Smooth</b>	<ul style="list-style-type: none"> <li>• Battery discharged</li> <li>• Starter malfunctioning</li> <li>• Main switch malfunctioning</li> <li>• Safty switch defective</li> <li>• Wiring disconnected</li> </ul>	Charge Repair or replace Repair or replace Replace Connect	G-17 8-S9 8-S6 8-S10 —
	<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>	Replace Clean or replace Tighten retaining nut Repair or replace Adjust Repair or replace Repair	G-23 G-19 1-S18 1-S21 1-S50 1-S51 1-S23
<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 top clearance	1-S11 1-S26 1-S48 1-S16

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>	Lessen load Use specified fuel Replace Clean or replace Repair or replace nozzle	— — G-23 G-19 1-S50, S51
<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-S48 — 1-S21 1-S50, S51 1-S19, S20
<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-S26 1-S25 1-S21, S31 —
<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-S21 1-S50, S51 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-S20 —
<b>Low Oil Pressure</b>	<ul style="list-style-type: none"> <li>• Engine oil insufficient</li> <li>• Oil strainer 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 Clean Replace Replace Replace Replace Clean Use specified type of oil Repair or replace	1-S11 1-S24 1-M9 1-M9 1-S28 1-S28 1-S20 — G-9 1-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-9 1-M9

Symptom	Probable Cause	Solution	Reference Page
<b>Engine Overheated</b>	• Engine oil insufficient	Replenish	1-S11
	• Fan belt broken or elongated	Replace or adjust	G-20
	• Cooling water insufficient	Replenish	G-9
	• Radiator net and radiator fin clogged with dust	Clean	—
	• Inside of radiator corroded	Clean or replace	G-24
	• Cooling water flow route corroded	Clean or replace	G-24
	• Radiator cap defective	Replace	1-S46
	• Overload running	Loosen load	—
	• Head gasket defective	Replace	1-S20
	• Incorrect injection timing	Adjust	1-S48
	• Unsuitable fuel used	Use specified fuel	G-9

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# SERVICING SPECIFICATIONS

## [1] ENGINE BODY

### Cylinder Head

Item	Factory Specification	Allowable Limit
Cylinder Head Surface Flatness	—	0.05 mm 0.0020 in.
Top Clearance	0.50 to 0.70 mm 0.0197 to 0.0276 in.	—
Compression Pressure	2.84 to 3.24 MPa 29.0 to 33.0 kgf/cm <sup>2</sup> 412 to 469 psi	2.26 MPa 23 kgf/cm <sup>2</sup> 327 psi
Variance Among Cylinders	—	10 % or less

### Valves

Valve Clearance (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	0.785 rad. 45°	—
Valve Face Angle	0.785 rad. 45°	—
Valve Recessing	— 0.10 to 0.10 mm — 0.0039 to 0.0039 in.	0.3 mm 0.0118 in.
Clearance between Valve Stem and Valve Guide	0.030 to 0.057 mm 0.00118 to 0.00224 in.	0.1 mm 0.0039 in.
Valve Stem O.D.	5.968 to 5.980 mm 0.23496 to 0.23543 in.	—
Valve Guide I.D.	6.010 to 6.025 mm 0.23661 to 0.23720 in.	—

### Valve Timing

Intake Valve	Open	0.35 rad. (20°) before T.D.C.	—
	Close	0.79 rad. (45°) after B.D.C.	—
Exhaust Valve	Open	0.89 rad. (50°) before B.D.C.	—
	Close	0.26 rad. (15°) after T.D.C.	—

**Valve Spring**

Item	Factory Specification	Allowable Limit
Free Length	31.3 to 31.8 mm 1.232 to 1.252 in.	28.4 mm 1.118 in.
Setting Load / Setting Length	64.7 N / 27 mm 6.6 kgf / 27 mm 14.6 lbs / 1.063 in.	54.9 N / 27 mm 5.6 kgf / 27 mm 12.3 lbs / 1.063 in.
Tilt	—	1.2 mm 0.047 in.

**Rocker Arm**

Clearance between Rocker Arm Shaft and Rocker Arm	0.016 to 0.045 mm 0.00063 to 0.00177 in.	0.15 mm 0.0059 in.
Rocker Arm Shaft O.D.	10.473 to 10.484 mm 0.41232 to 0.41276 in.	—
Rocker Arm I.D.	10.500 to 10.518 mm 0.41339 to 0.41410 in.	—

**Push Rod**

Push Rod Runout	—	0.50 mm 0.0196 in.
-----------------	---	-----------------------

**Tappet**

Clearance between Tappet and Guide	0.016 to 0.052 mm 0.00063 to 0.00205 in.	0.10 mm 0.0039 in.
Tappet O.D.	17.966 to 17.984 mm 0.70732 to 0.70803 in.	—
Tappet Guide I.D.	18.000 to 18.018 mm 0.70866 to 0.70937 in.	—

**Camshaft**

Camshaft Side Clearance	0.15 to 0.31 mm 0.0059 to 0.0122 in.	0.5 mm 0.02 in.
Camshaft Runout	—	0.02 mm 0.0008 in.
Cam Height of Intake and Exhaust	26.88 mm 1.0583 in.	26.83 mm 1.0563 in.
Oil Clearance of Camshaft	0.050 to 0.091 mm 0.00197 to 0.00358 in.	0.15 mm 0.0059 in.
Camshaft Journal O.D.	32.934 to 32.950 mm 1.29661 to 1.29724 mm	—
Camshaft Bearing I.D.	33.000 to 33.025 mm 1.29921 to 1.30020 in.	—

**Timing Gear**

Item	Factory Specification	Allowable Limit
Timing Gear Backlash Crank Gear-Idle Gear	0.043 to 0.124 mm 0.00169 to 0.00488 in.	0.15 mm 0.0059 in.
Idle Gear-Cam Gear	0.047 to 0.123 mm 0.00185 to 0.00484 in.	0.15 mm 0.0059 in.
Idle Gear-Injection Pump Gear	0.046 to 0.124 mm 0.00181 to 0.00488 in.	0.15 mm 0.0059 in.
Crank Gear-Oil Pump Drive Gear	0.041 to 0.123 mm 0.00161 to 0.00484 in.	0.15 mm 0.0059 in.
Idle Gear Side Clearance	0.13 to 0.49 mm 0.0051 to 0.0199 in.	0.60 mm 0.0236 in.

**Piston • Piston Ring**

Piston Pin Hole I.D.		20.000 to 20.013 mm 0.78740 to 0.78791 in.	20.05 mm 0.7894 in.
Piston Ring Clearance	Second Ring	0.090 to 0.120 mm 0.00354 to 0.00472 in.	0.15 mm 0.0059 in.
	Oil Ring	0.04 to 0.08 mm 0.0016 to 0.0031 in.	0.15 mm 0.0059 in.
Ring Gap	Top Ring Second Ring	0.25 to 0.40 mm 0.0098 to 0.0157 in.	1.25 mm 0.0492 in.
	Oil Ring	0.15 to 0.30 mm 0.0059 to 0.0118 in.	1.25 mm 0.0492 in.
Oversize of Piston Rings		+0.25 mm +0.0098 in.	—

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**Connecting Rod**

Item	Factory Specification	Allowable Limit
Connecting Rod Alignment	—	0.05 mm 0.0020 in.
Clearance between Piston Pin and Small End Bushing	0.014 to 0.038 mm 0.00055 to 0.00150 in.	0.10 mm 0.0039 in.
Piston Pin O.D.	20.002 to 20.011 mm 0.78748 to 0.78783 in.	—
Small End Bushing I.D.	20.025 to 20.040 mm 0.78839 to 0.78897 in.	—

**Crankshaft**

Crankshaft Runout	—	0.04 mm 0.0016 in.
Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1	0.034 to 0.106 mm 0.00134 to 0.00417 in.	0.20 mm 0.0079 in.
Crankshaft Journal O.D.	39.934 to 39.950 mm 1.57221 to 1.57284 in.	—
Crankshaft Bearing 1 I.D.	39.984 to 40.040 mm 1.57417 to 1.57638 in.	—
Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2 (Flywheel Side)	0.028 to 0.059 mm 0.0014 to 0.00232 in.	0.20 mm 0.0079 in.
Crankshaft Journal O.D.	43.978 to 43.993 mm 1.73142 to 1.73201 in.	—
Crankshaft Bearing 2 I.D.	43.984 to 44.026 mm 1.73177 to 1.73331 in.	—
Oil Clearance between Crankshaft Journal and Crankshaft Bearing 3 (Intermediate)	0.028 to 0.059 mm 0.0014 to 0.00232 in.	0.20 mm 0.0079 in.
Crankshaft Journal O.D.	39.934 to 39.950 mm 1.57221 to 1.57284 in.	—
Crank bearing 3 I.D.	39.978 to 39.993 mm 1.57394 to 1.57453 in.	—
Oil Clearance between Crankpin and Crankpin Bearing	0.020 to 0.051 mm 0.0008 to 0.0020 in.	0.15 mm 0.0059 in.
Crankpin O.D.	33.959 to 33.975 mm 1.33697 to 1.33760 in.	—
Crankpin Bearing I.D.	33.995 to 34.010 mm 1.33839 to 1.33898 in.	—
Crankshaft Side Clearance	0.15 to 0.31 mm 0.0059 to 0.0122 in.	0.50 mm 0.0197 in.

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**Cylinder Liner**

Item		Factory Specification	Allowable Limit
Cylinder Liner I.D.	D662-D14	64.000 to 64.019 mm 2.51968 to 2.52043 in.	+ 0.15 mm 0.0059 in.
	D722-D14	67.000 to 67.019 mm 2.63779 to 2.63854 in.	+ 0.15 mm 0.0059 in.
Oversized Cylinder Liner I.D.	D662-D14	64.250 to 64.269 mm 2.52953 to 2.53028 in.	+ 0.15 mm 0.0059 in.
	D722-D14	67.250 to 67.269 mm 2.64764 to 2.64839 in.	+ 0.15 mm 0.0059 in.

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**[2] LUBRICATING SYSTEM****Oil Pump**

Engine Oil Pressure At Idle Speed	69 kPa 0.7 kgf/cm <sup>2</sup> 10 psi	—
At Rated Speed	245 to 392 kPa 2.5 to 4.0 kgf/cm <sup>2</sup> 35.0 to 56.0 psi	98 kPa 1.0 kgf/cm <sup>2</sup> 14 psi
Clearance between Inner Rotor and Outer Rotor	0.03 to 0.14 mm 0.0012 to 0.0055 in.	—
Clearance between Outer Rotor and Pump Body	0.07 to 0.15 mm 0.0028 to 0.0059 in.	—
End Clearance between Inner Rotor and Cover	0.075 to 0.135 mm 0.00295 to 0.00531 in.	—

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**[3] COOLING SYSTEM****Thermostat**

Thermostat's Valve Opening Temperature	80.5 to 83.5 °C 176.9 to 182.3 °F	—
Temperature at Which Thermostat Completely Opens	95 °C 203 °F	—

**Radiator**

Radiator Water Tightness	Water tightness at specified pressure 147 kPa 1.5 kgf/cm <sup>2</sup> , 21 psi	—
Radiator Cap Air Leakage	10 seconds or more 88 → 59 kPa 0.9 → 0.6 kgf/cm <sup>2</sup> 13 → 9 psi	—
Fan Belt Tension	7 to 9 mm / 10 kgf 0.28 to 0.35 in. / 10 kgf (22 lbs.)	—

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**[4] FUEL SYSTEM****Injection Pump**

Item	Factory specification	Allowable Limit
Injection Timing	0.31 to 0.34 rad. (17.5 to 19.5°) Before T.D.C.	—
Fuel Tightness of Pump Element	—	14.7 MPa 150 kgf/cm <sup>2</sup> 2133 psi
Fuel Tightness of Delivery Valve	—	5 seconds 14.7 → 13.7 MPa 150 → 140 kgf/cm <sup>2</sup> 2133 → 1990 psi

**Injection Nozzle**

Fuel Injection Pressure	13.73 to 14.71 MPa 140 to 150 kgf/cm <sup>2</sup> 1991 to 2133 psi	—
Fuel Tightness of Nozzle Valve Seat	When the pressure is 12.75 MPa (130 kgf/cm <sup>2</sup> , 1849 psi), the valve seat must be fuel tightness	—

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# 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-10.)

Item	Size × Pitch	N·m	kgf·m	ft-lbs
Steering wheel mounting nut		29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Engine mounting M8 screw		17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Clutch cover mounting screw		23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
* Cylinder head cover cap nut	M6 × 1.0	3.9 to 5.9	0.4 to 0.6	2.9 to 4.3
Cylinder head bolt	M8 × 1.25	37.2 to 42.1	3.8 to 4.3	28.0 to 31.7
Injection pump retaining nut		9.8 to 11.3	1.00 to 1.15	7.23 to 7.32
* Main bearing case screw 1	M6 × 1.0	12.7 to 15.7	1.3 to 1.6	9.4 to 11.6
* Main bearing case screw 2	M7 × 1.0	26.5 to 30.4	2.7 to 3.1	19.5 to 22.4
* Flywheel mounting screw	M10 × 1.25	53.9 to 58.8	5.5 to 6.0	39.8 to 43.4
* Connecting rod screw	M7 × 0.75	26.5 to 30.4	2.7 to 3.1	19.5 to 22.4
* Rocker arm bracket nut	M6 × 1.0	9.8 to 11.3	1.01 to 1.15	7.2 to 8.3
* Idle gear retaining nut	M20 × 1.0	78.4 to 88.2	8.0 to 9.0	59.0 to 66.4
* Idle gear shaft mounting nut	M6 × 1.0	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
* Fan drive pulley retaining bolt (Crankshaft screw)	M12 × 1.5	98.0 to 107.8	10.0 to 11.0	73.8 to 81.2
Glow plug	M8 × 1.0	7.8 to 14.7	0.8 to 1.5	5.8 to 10.8
Nozzle holder assembly	M20 × 1.5	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Overflow pipe assembly retaining nut (nozzle)	M12 × 1.5	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Oil pressure switch	PT 1/8	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Injection pipe retaining nut	M12 × 1.5	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3
Nozzle holder		34.3 to 39.2	3.5 to 4.0	25.3 to 28.9

## NOTE

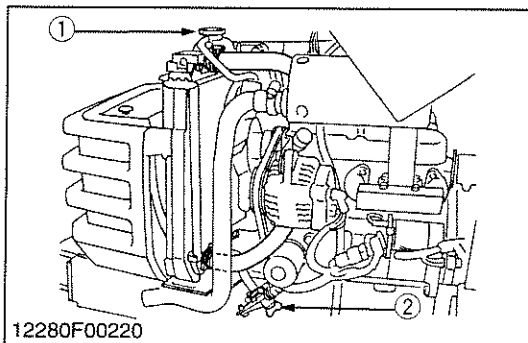
- In removing and applying the bolts and nuts marked with "\*", a pneumatic wrench or similar pneumatic tool, if employed, must be used with enough care not to get them seized.
- For \* marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.
- The letter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

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# CHECKING, DISASSEMBLING AND SERVICING

## [1] SEPARATING ENGINE

### (1) Draining Coolant, Engine Oil and Transmission Fluid



#### Draining Cooling Water



#### 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 opening the cap.**

1. Loosen the drain cock (2) from the radiator hose to drain cooling water.
2. Remove the radiator cap (1) to drain cooling water completely.

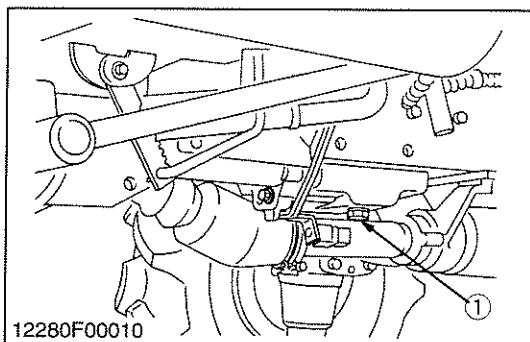
Coolant capacity  
(with recovery tank)

2.7 L  
2.9 U.S.qts.  
2.1 Imp.qts.

(1) Radiator Cap

(2) Drain Cock

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#### 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. Screw in the drain plug (1).

#### (When refilling)

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

#### ■ IMPORTANT

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

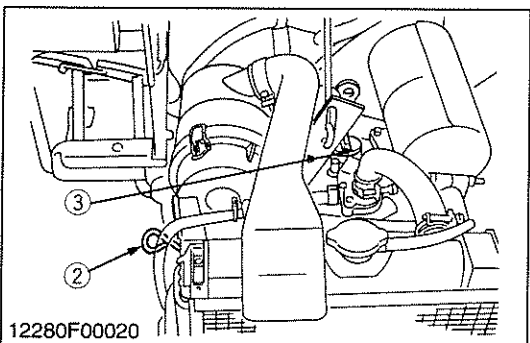
Engine oil capacity

2.4 L  
2.5 U.S.qts.  
2.1 Imp.qts.

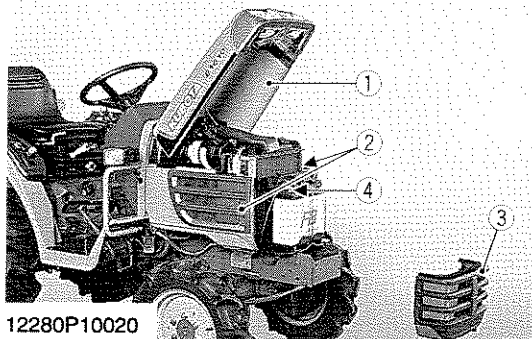
(1) Drain Plug

(3) Oil Inlet Plug

(2) Dipstick



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#### Hood, Side Cover and Battery Cord

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

#### ■ NOTE

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

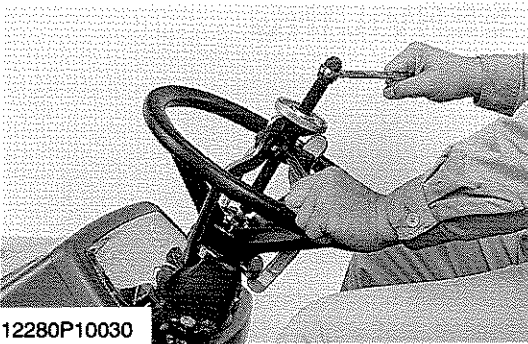
(1) Hood

(3) Front Grille

(2) Side Cover

(4) Battery Cord

12280S10110



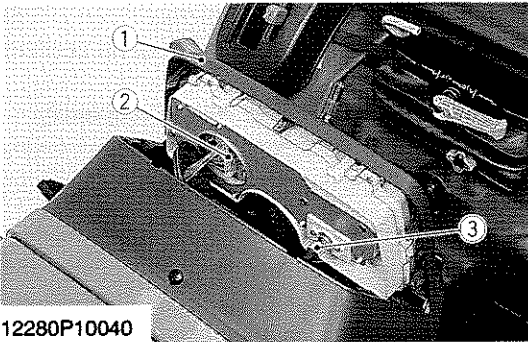
**Steering Wheel**

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

**(When reassembling)**

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs
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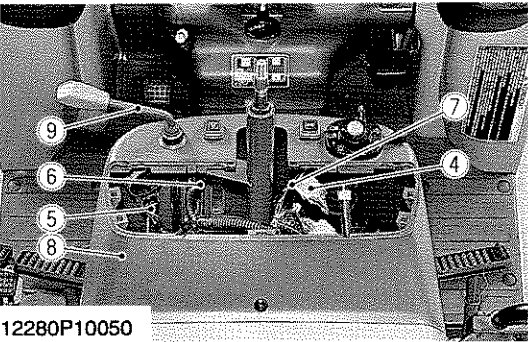
12280S10120



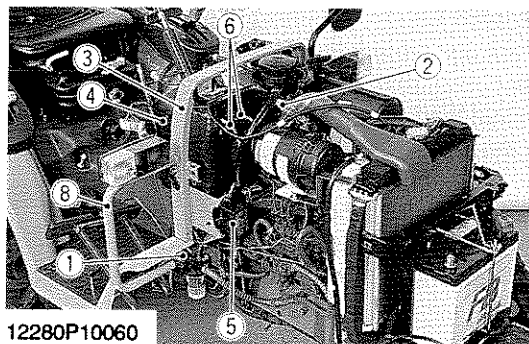
**Meter Panel and Panel Under Cover**

- 1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
- 2. Disconnect the combination switch connector (4), main switch connector (5), hazard switch connector (6) and parking light switch connector (7).
- 3. Tap out the spring pin and remove the hand accelerator lever (9).
- 4. Remove the panel under cover (8).

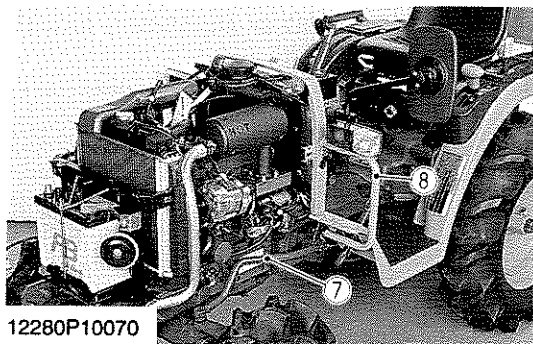
- |                                  |                                    |
|----------------------------------|------------------------------------|
| (1) Meter Panel                  | (6) Hazard Switch Connector        |
| (2) Meter Panel Connector        | (7) Parking Light Switch Connector |
| (3) Hour-meter Cable             | (8) Panel Under Cover              |
| (4) Combination Switch Connector | (9) Hand Accelerator Lever         |
| (5) Main Switch Connector        |                                    |



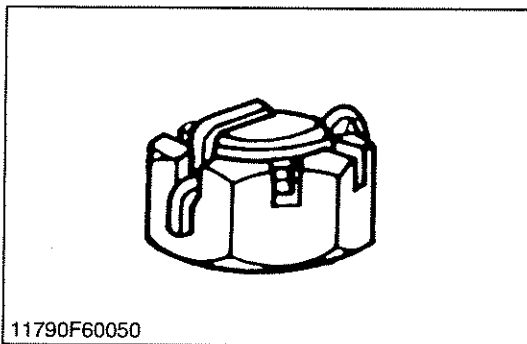
12280S10130



12280P10060



12280P10070



11790F60050

### Fuel Tank and Drag Link

1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the fuel tank frame stay (2).
3. Disconnect the hazard unit, starter relay and remove the lead wire for fuel gauge.
4. Remove the fuse box (5).
5. Disconnect the overflow hoses (6) of fuel line.
6. Remove the front lamp stay (8).
7. Remove the tank frame (3) with fuel tank (4).
8. Remove the cotter pin and loosen the slotted nut.
9. Disconnect the drag link (7) with a pitman arm puller from the knuckle arm.

#### (When reassembling)

#### ■ IMPORTANT

- Do not loosen the slotted nut to align the hole.
- Install the cotter pin as shown in the figure

#### (Reference)

Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13 to 25.3 ft-lbs
-------------------	-------------	---

- |                          |                     |
|--------------------------|---------------------|
| (1) Fuel Hose            | (5) Fuse Box        |
| (2) Fuel Tank Frame Stay | (6) Overflow Hose   |
| (3) Fuel Tank Frame      | (7) Drag Link       |
| (4) Fuel Tank            | (8) Front Lamp Stay |

12280S10140

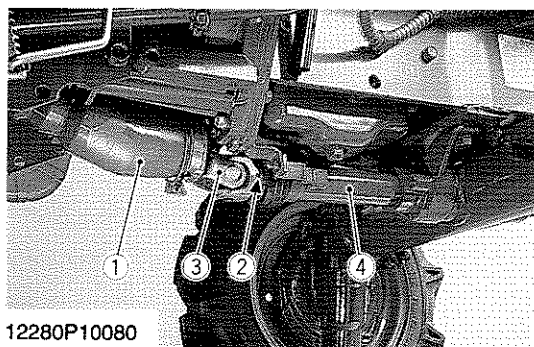
### Universal Joint and Propeller Shaft Cover

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

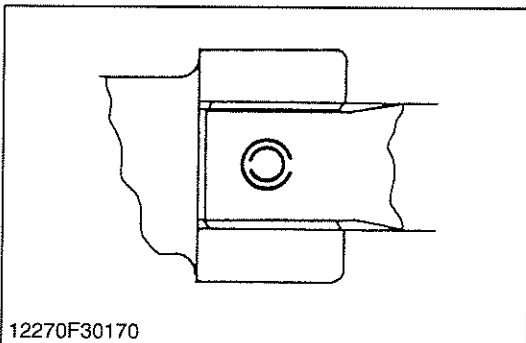
#### (When reassembling)

- 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 Cover | (3) Universal Joint       |
| (2) Spring Pin            | (4) Propeller Shaft Cover |

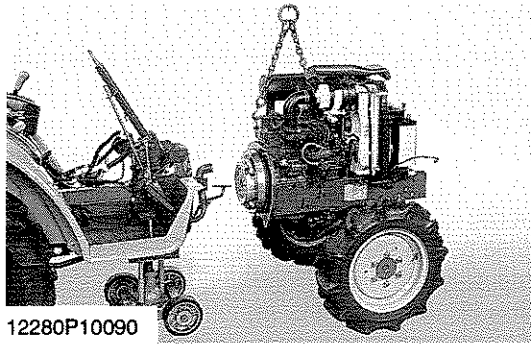


12280P10080



12270F30170

12280S10150



12280P10090

### **Separating the Engine from Clutch Housing**

1. Loosen the clamp, then disconnect the three point hitch delivery pipe and suction hose.
2. Disconnect the glow plug lead wire and thermo sensor lead wire. And then disconnect the connector for dynamo and starter motor lead wire.
3. Place the jack under the center frame.
4. Hoist the engine by the chain at the engine hook.
5. Remove the engine mounting screws and separate the engine from the clutch housing.

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

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

Tightening torque	Engine mounting M8 screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft·lbs
-------------------	--------------------------	---

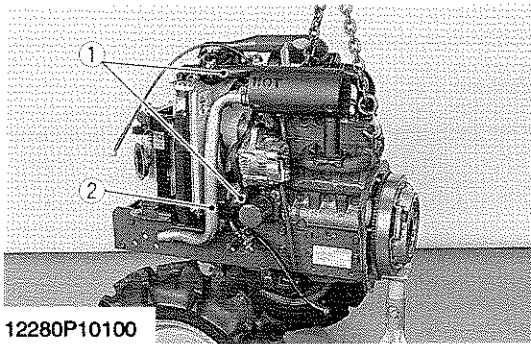
12280S10160

### **Separating Front Axle Assembly**

1. Disconnect the radiator hoses (1).
2. Remove the muffler pipe (2).
3. Hoist the engine by the chain at the engine hook.
4. Remove the front axle frame mounting screws and separate the front axle assembly from the engine.

(1) Radiator Hose

(2) Muffler Pipe

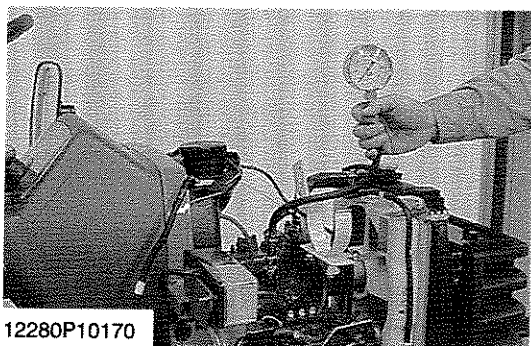


12280P10100

12280S10170

## [2] ENGINE BODY

### CHECKING AND ADJUSTING



12280P10170

#### Compression Pressure

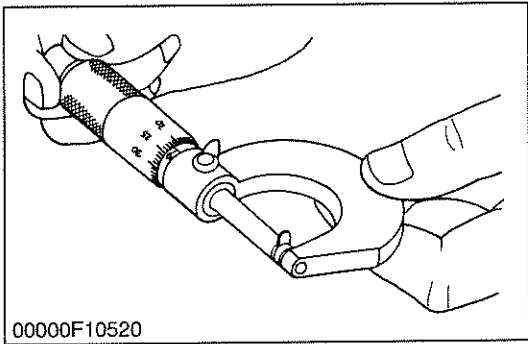
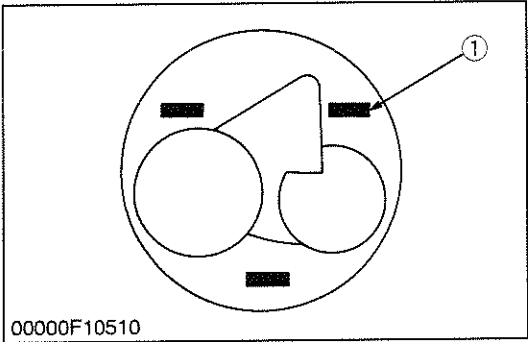
1. Run the engine until it is warmed up.
2. Stop the engine, and then remove the air cleaner and muffler.
3. Remove the injection nozzles from all cylinders, and set a compression tester (Code No. 07909-30208) with the adaptor (Adaptor H, Code No. 07909-31231) to the nozzle hole.
4. Keep the engine stop lever at "**Stop Position**".
5. While cranking the engine with cell starter, measure the compression pressure.
6. Repeat steps 3 through 5 for each cylinder.
7. If the measurement does not reach the allowable limit, apply a small amount of oil to the cylinder wall through the nozzle hole and measure the compression pressure again.
8. If the compression pressure is still less than the allowable limit, check the top clearance, valve and cylinder head.
9. If the compression pressure increases after applying oil, check the cylinder wall and piston rings.

#### ■ NOTE

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

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

12280S10180



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 crankshaft 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

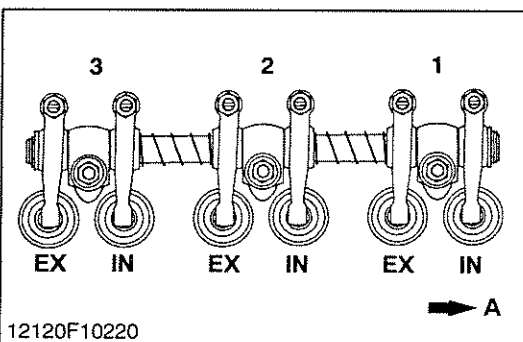
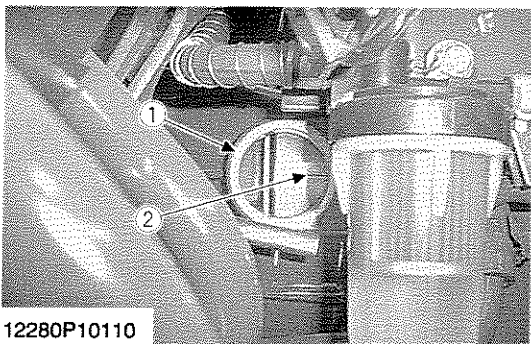
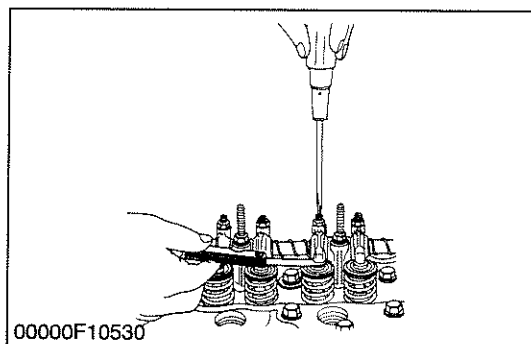
- After checking the top clearance, be sure to assemble the cylinder head with a new cylinder head gasket.

Top clearance	Factory spec.	0.50 to 0.70 mm 0.0197 to 0.0276 in.
Tightening torque	Cylinder head bolt	37.2 to 42.1 N·m 3.8 to 4.3 kgf·m 28.0 to 31.7 ft·lbs

(1) Fuse

12120S10220





## 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 on the flywheel and timing window cover on the clutch housing 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 is 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 on the flywheel and center of timing window so that the No. 1 piston comes to the compression or overlap top dead center.
6. Check the following valve clearance marked with "☆" using a feeler gauge.

[When No. 1 piston is 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.
---	---------------	---

### ■ 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) Timing Window

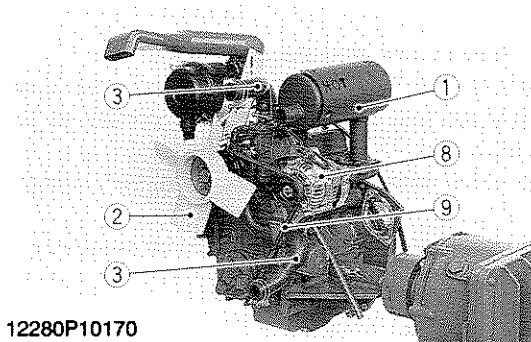
(2) TC Mark Line

(A) Gear Case Side

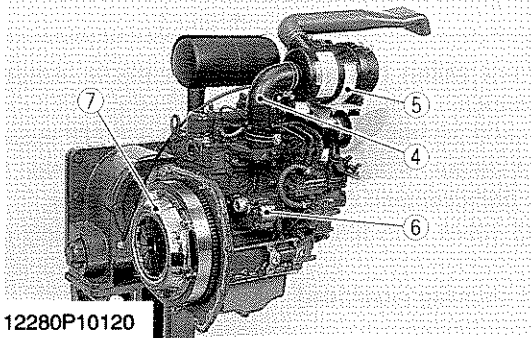
12280S10190

## DISASSEMBLING AND ASSEMBLING

### (1) Cylinder Head and Valves



12280P10170



12280P10120

#### External Components

1. Remove the air cleaner assembly (4) and air cleaner stay (5).
2. Remove the hydraulic pump (6).
3. Remove the clutch assembly (7).
4. Remove the alternator (8) and fan belt (9).
5. Remove the cooling fan (2) and fan pulley.
6. Remove the radiator hose (3).
7. Remove the muffler (1).

#### (When reassembling)

- Direct the shorter end of the clutch disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Insert the pressure plate noting the position of straight pins.

#### ■ IMPORTANT

- After reassembling the fan belt, be sure to adjust the fan belt tension.
- Be sure to align the center of disc and flywheel by inserting the clutch center tool.

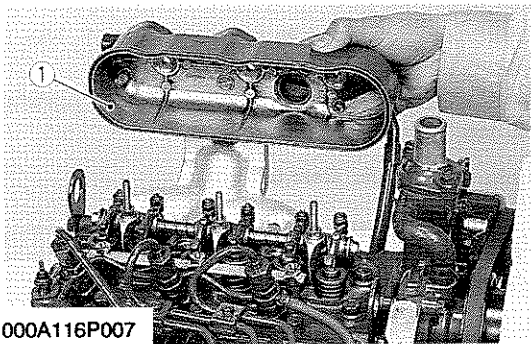
#### ■ NOTE

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

Tightening torque	Clutch cover mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
-------------------	-----------------------------	---

- |                          |                     |
|--------------------------|---------------------|
| (1) Muffler              | (6) Hydraulic Pump  |
| (2) Cooling Fan          | (7) Clutch Assembly |
| (3) Radiator Hose        | (8) Alternator      |
| (4) Air Cleaner Assembly | (9) Fan Belt        |
| (5) Air Cleaner Stay     |                     |

12280S10200



000A116P007

#### Cylinder Head Cover

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

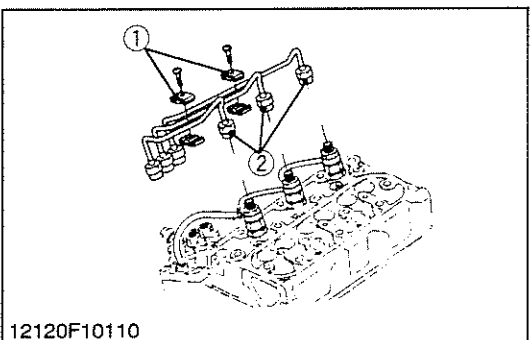
#### (When reassembling)

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

Tightening torque	Cylinder head cover cap nut	3.9 to 5.9 N·m 0.4 to 0.6 kgf·m 2.9 to 4.3 ft-lbs
-------------------	-----------------------------	---

- (1) Head Cover

01760S10050



12120F10110

#### Injection Pipes

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

#### (When reassembling)

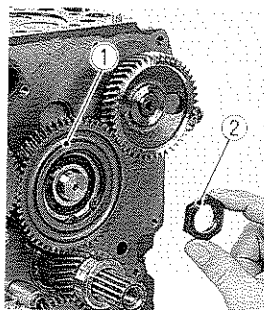
- Blow out dust from the pipes with compressed air. Then, reassemble the pipes in the reverse order.

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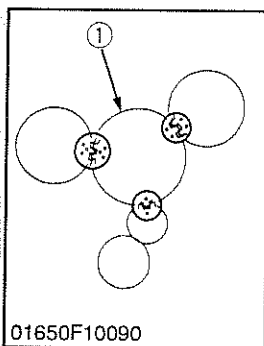
- (1) Pipe Clamp

- (2) Injection Pipe

12120S10260



12280P10140



01650F10090

### Idle Gear

1. Remove the idle gear retaining nut (2) and the idle gear (1).
2. Remove the idle gear shaft mounting screws.
3. Remove the idle gear shaft.

### (When reassembling)

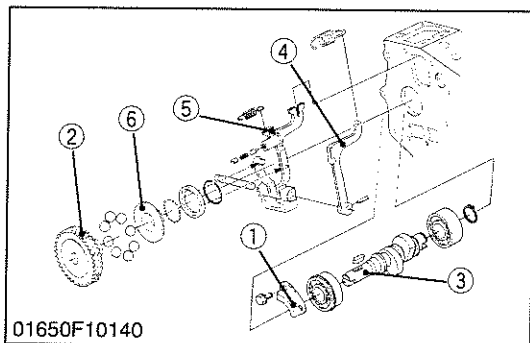
- Assemble the idle gear shaft, face the oil hole to fuel camshaft.
- Install the idle gear, aligning the mark on the gears referring to the figure.
- When tighten the idle gear retaining nut (2), face the finishing side to the idle gear bearing.
- Apply engine oil to the seat and thread of idle gear retaining nut (2).

Tightening torque	Idle gear shaft mounting nut	9.8 to 11.3 N·m 1.00 to 1.15 kgf·m 7.2 to 8.3 ft-lbs
	Idle gear retaining nut	78.4 to 88.2 N·m 8.0 to 9.0 kgf·m 59.0 to 66.4 ft-lbs

(1) Idle Gear

(2) Idle Gear Retaining Nut

12280S10240



01650F10140

### Fuel Camshaft

1. Remove the screws and draw out the camshaft with the gear on it.
2. Remove the retaining plate (1).
3. Remove the screws, then draw out the injection pump gear (2) and fuel camshaft (3) with the governor fork assembly.

### (When reassembling)

- Hook the spring to the fork lever 2 (4) as shown in the figure before installing the fork lever assembly to the crankcase.

(1) Retaining Plate

(4) Fork Lever 2

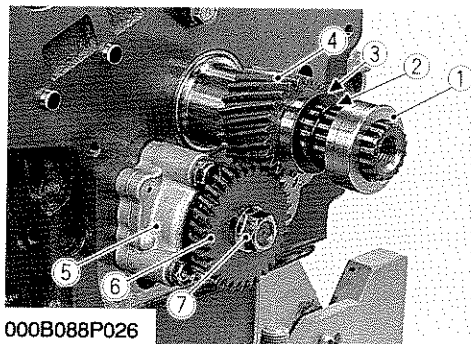
(2) Injection Pump Gear

(5) Fork Lever 1

(3) Fuel Camshaft

(6) Governor Sleeve

01650S10340



000B088P026

### Oil Pump and Crankshaft Gear

1. Unscrew the flange nut (7) and remove the oil pump gear (6).
2. Unscrew the retaining screws and remove the oil pump (5).
3. Remove the collar (1), O-ring (2) and oil slinger (3).
4. Remove the crankshaft gear (4) with a puller.

### (When reassembling)

- Install the collar after aligning the marks on the gears. (See the figure at "Idle Gear".)

(1) Crankshaft Collar

(5) Oil Pump

(2) O-ring

(6) Oil Pump Gear

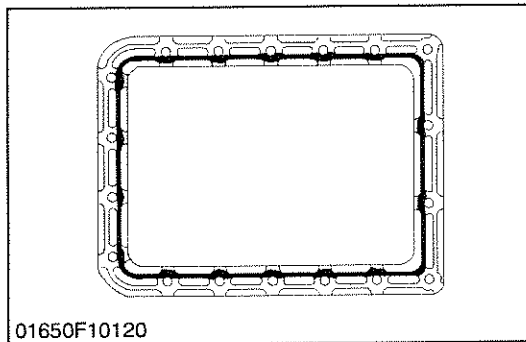
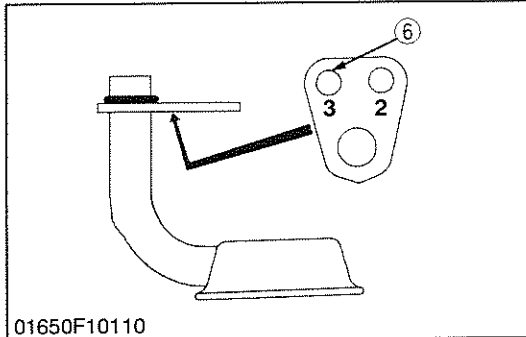
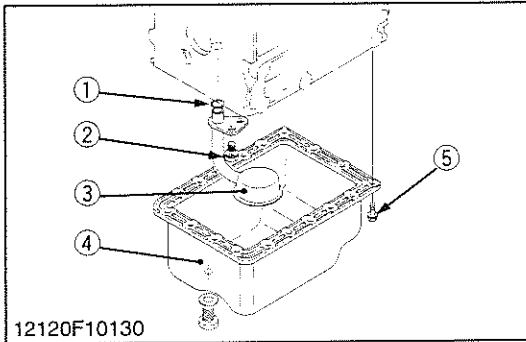
(3) Crankshaft Oil Slinger

(7) Flange Nut

(4) Crankshaft Gear

01760S10730

### (3) Connecting Rod and Piston



#### Oil Pan and Oil Strainer

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

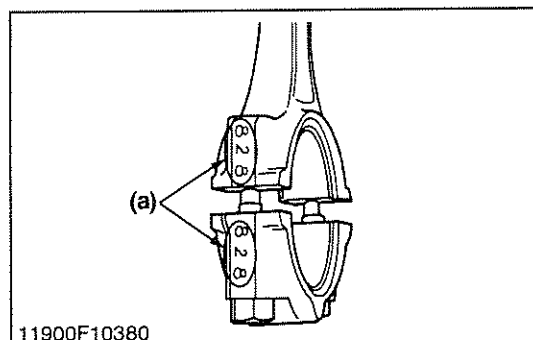
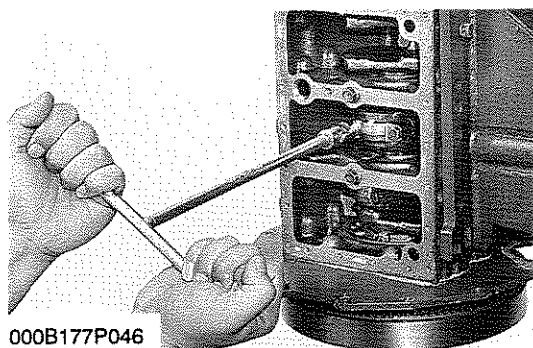
#### (When reassembling)

- Install the oil strainer, using care not to damage the O-ring (1).
- Using the hole (6) numbered "3", install the oil strainer by mounting screw.
- Apply liquid gasket (Three Bond 1270D or 1270C) to the oil pan as shown in the figure.

#### ■ IMPORTANT

- Scape off the oil adhesive completely. Wipe the sealing surface clean using waste cloth soaked with gasoline. Now apply new adhesive 3 ~ 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 "fluid sealant" container at its second notch. Apply "fluid sealant" 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 | (6) Hole                    |



#### Connecting Rod Cap

1. Remove the connecting rod screws from connecting rod cap.
2. Remove the connecting rod caps.

#### (When reassembling)

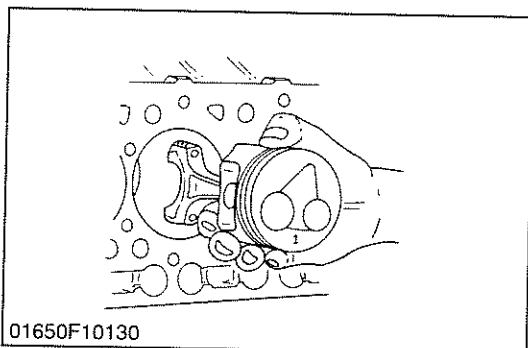
- Align the marks (a) with each other. (Face the marks toward the injection pump.)
- Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque.  
If the connecting rod screw won't be screwed in smoothly, clean the threads.  
If the connecting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

Tightening torque	Connecting rod screw	26.5 to 30.4 N·m 2.7 to 3.1 kgf·m 19.5 to 22.4 ft·lbs
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(a) Mark

12120S10330

01760S10110



### Piston

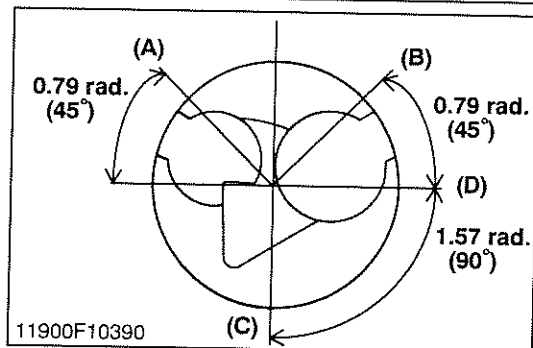
1. Turn the flywheel and bring the No. 1 piston to the top dead center.
2. Pull out the piston upward by lightly tapping it from the bottom of the crankcase with the grip of a hammer.

#### (When reassembling)

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

#### ■ IMPORTANT

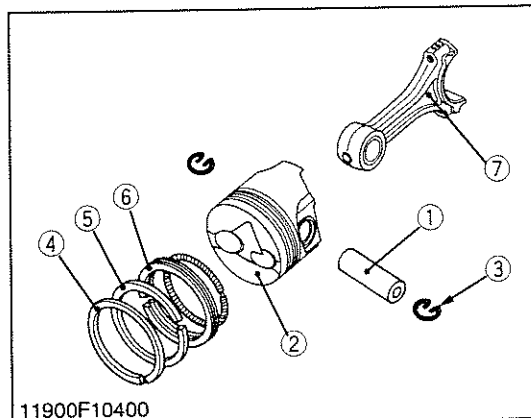
- Do not change the combination of cylinder and piston. Make sure of the position of each piston by marking. For example, mark "1" on the No.1 piston.
- When inserting the piston into the cylinder, place the gap of the compression ring 1 on the opposite side of the combustion chamber and stagger the 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 liner.



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

- (C) Oil Ring Gap  
(D) Piston Pin Hole

01760S10120



### Piston Ring and Connecting Rod

1. Remove the piston rings using a piston ring tool.
2. Put the casting mark (1) (8) on the piston as shown in figure.
3. Remove the piston pin (1), and separate the connecting rod (7) from the piston (2).

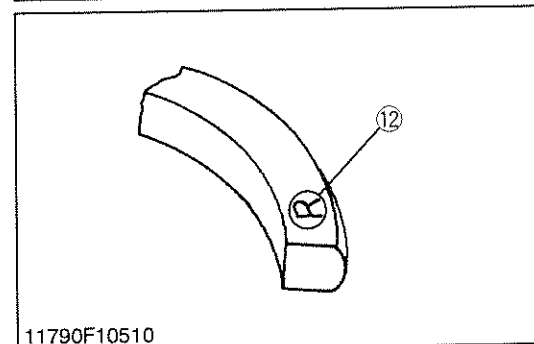
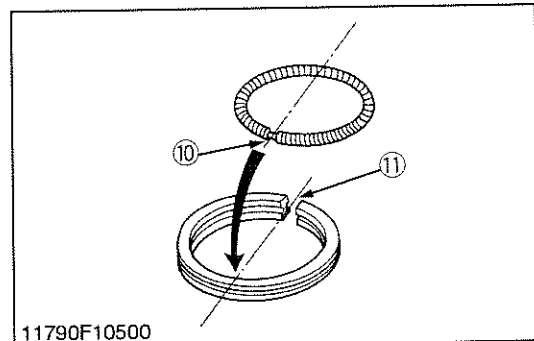
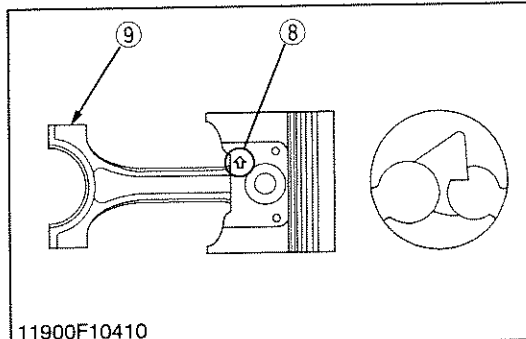
#### (When reassembling)

- When installing the rings, assemble the rings so that the manufacturer's mark (12) near the gap faces the top of the piston.
- 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 piston pin, 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 (9) on the connecting rod to the casting mark (8).

#### ■ IMPORTANT

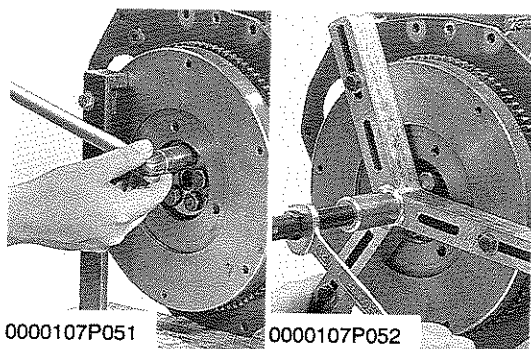
- **Mark the same number on the connecting rod and the piston so as not to change the combination.**

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



11900S10212

## (4) Crankshaft



### Flywheel

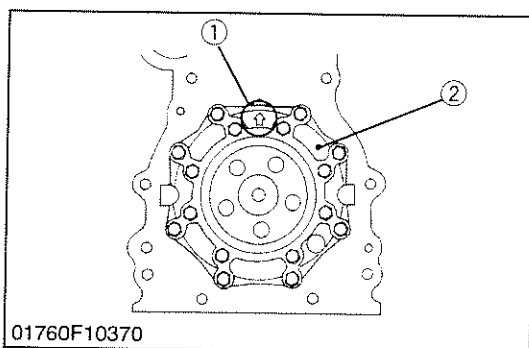
1. Lock the flywheel not to turn using the flywheel stopper.
2. Remove the flywheel screws, except for two which must be loosened and left as they are.
3. Set a flywheel puller (Code No: 07916-32011), and remove the flywheel.

### (When reassembling)

- Apply engine oil to the flywheel screws.

Tightening torque	Flywheel mounting 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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### Bearing Case Cover

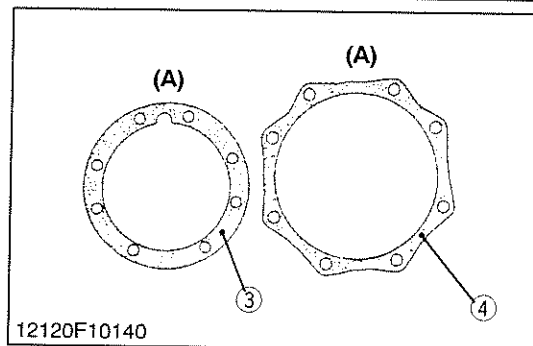
1. Remove the bearing case cover mounting screws. First, remove inside screws and then outside screws.
2. Remove the main bearing case cover (2).

### (When reassembling)

- Fit the bearing case gasket (3) and the bearing case cover gasket (4) with correct directions.
- Apply liquid-type gasket (Three Bond 1215 or its equivalent) to both sides of a new bearing case cover gasket.
- Install the bearing case cover to position the casting mark "↑" (1) 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.

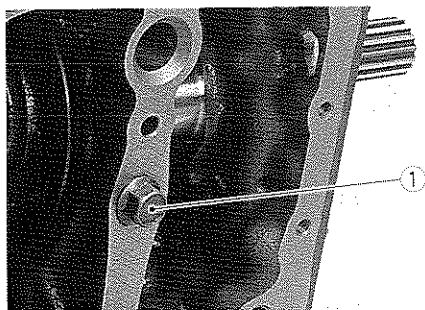
- (1) Mark
- (2) Main Bearing Case Cover
- (3) Bearing Case Gasket
- (4) Bearing Case Cover Gasket

(A) Upside

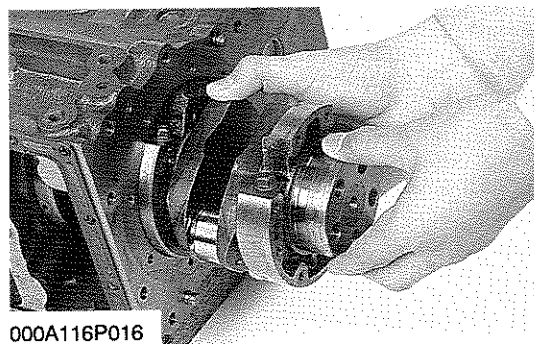


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### Crankshaft

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

#### (When reassembling)

- Install the crankshaft sub assembly, aligning the screw hole of main bearing case 2 with the screw hole of cylinder block.
- Apply engine oil to the seat and thread of main bearing case screw 2. And tighten it.

Tightening torque	Main bearing case screw 2	26.5 to 30.4 N·m 2.7 to 3.1 kgf·m 19.5 to 22.4 ft·lbs
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(1) Main Bearing Case Screw 2

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### Main Bearing Case Assembly

1. Remove the two main bearing case screws 1 (4), and remove the main bearing case assembly 1 (3), being careful with the thrust bearing (2) and crankshaft bearing 2.
2. Remove the main bearing case assembly 2 (1) and 3 (5) as above.

#### (When reassembling)

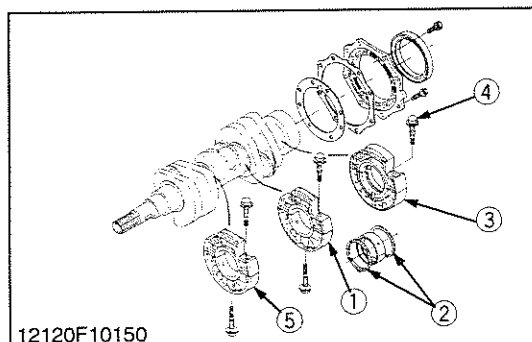
- Clean the oil passage in the main bearing case.
- Apply clean engine oil on the bearings.
- Install the main bearing case assemblies in the original positions. Since diameters of main bearing case vary, install them in order of makings (1, 2) from the gear case side.
- Match the alignment numbers (1 or 2) on the main bearing case.
- When installing the main bearing case 2, and 3, 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	Bearing case screw 1	12.7 to 15.7 N·m 1.3 to 1.6 kgf·m 9.4 to 11.6 ft·lbs
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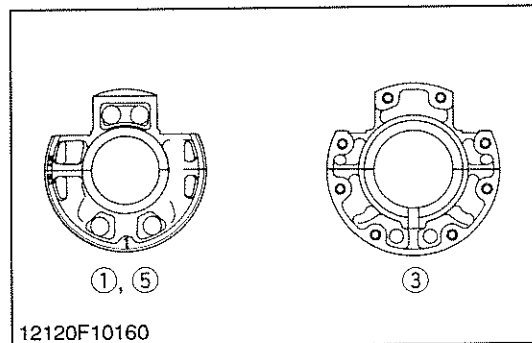
- (1) Main Bearing Case Assembly 2  
(2) Thrust Bearing  
(3) Main Bearing Case Assembly 1

- (4) Main Bearing Case Screw 1  
(5) Main Bearing Case Assembly 3

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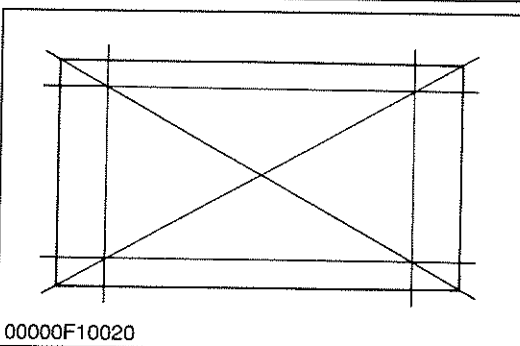
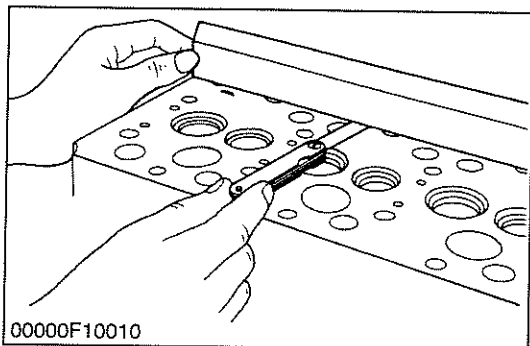


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## SERVICING

### (1) Cylinder Head and Valves



#### Cylinder Head Surface Flatness

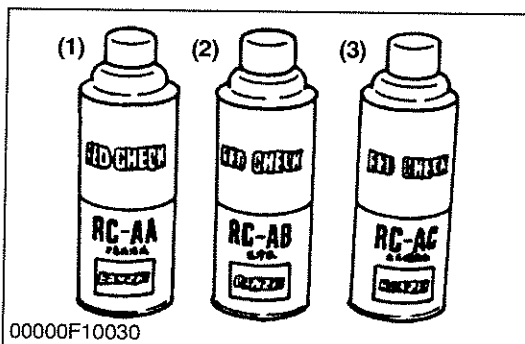
1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a feeler gauge.
4. If the measurement exceeds the allowable limit, correct it with a surface grinder.

#### ■ IMPORTANT

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

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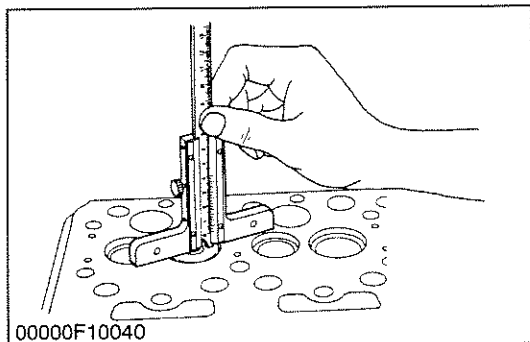
#### Cylinder Head Flaw

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

- (1) Red Permeative Liquid  
(2) Detergent

- (3) White Developer

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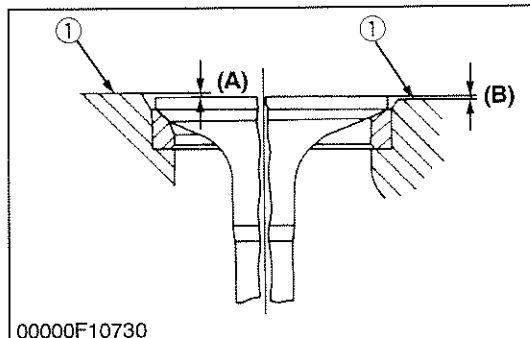
### Valve Recessing

1. Clean the cylinder head surface, valve face and valve seat.
2. Insert the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measurement exceeds the allowable limit, replace the valve.
5. If it still exceeds the allowable limit after replacing the valve, 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.	0.10 (protrusion) to 0.10 (recessing) mm 0.0039 (protrusion) to 0.0039 (recessing) in.
	Allowable limit	0.30 (recessing) mm 0.0118 (recessing) in.

(1) Cylinder Head Surface

(A) Recessing  
(B) Protrusion



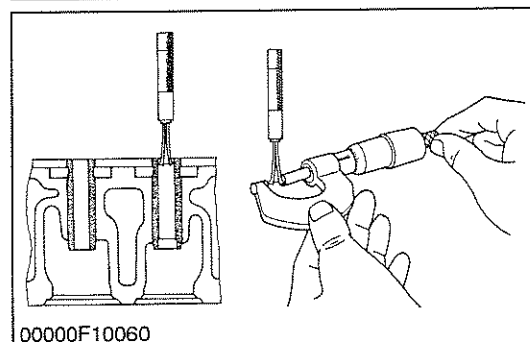
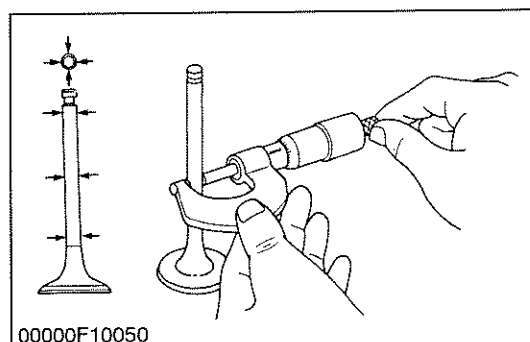
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### Clearance between Valve Stem and Valve Guide

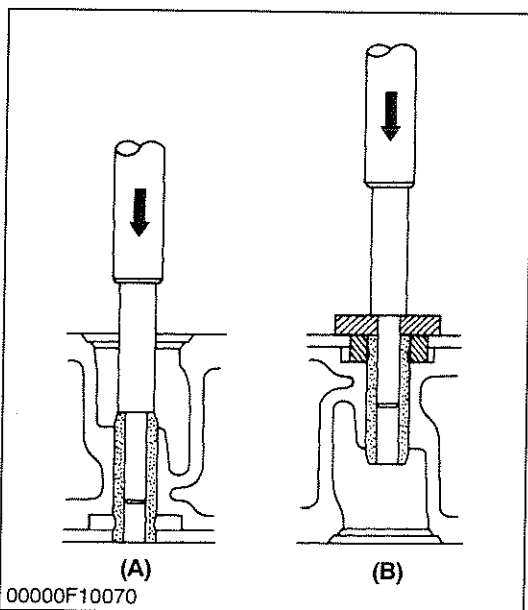
1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an outside micrometer.
3. Measure the valve guide I.D. with a small hole gauge, and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the valves. If it still exceeds the allowable limit,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

Clearance between valve stem and valve guide	Factory spec.	0.030 to 0.057 mm 0.00118 to 0.00224 in.
	Allowable limit	0.10 mm 0.0039 in.

Valve stem O.D.	Factory spec.	5.968 to 5.980 mm 0.23496 to 0.23543 in.
Valve guide I.D.	Factory spec.	6.010 to 6.025 mm 0.23661 to 0.23720 in.



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### Replacing Valve Guide

#### (When removing)

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

#### (When installing)

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

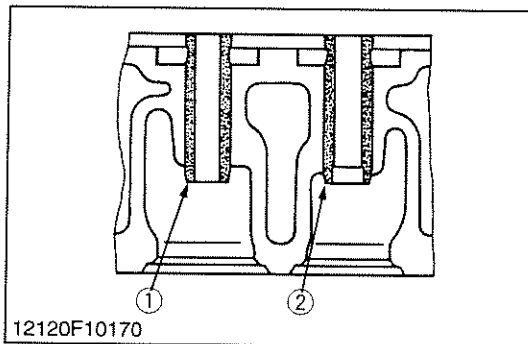
Valve guide I.D. (Intake and exhaust)	Factory spec.	6.010 to 6.025 mm 0.23661 to 0.23720 in.
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#### ■ IMPORTANT

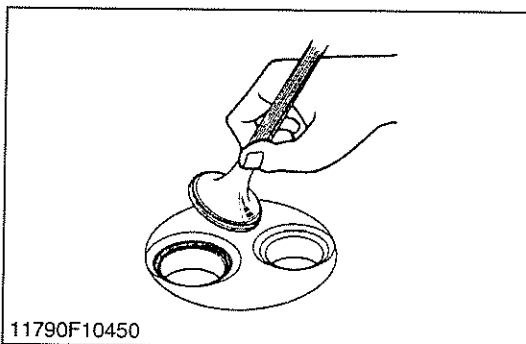
- Do not hit the valve guide with a hammer during replacement.

- (1) Intake Valve Guide  
(2) Exhaust Valve Guide

- (A) When Removing  
(B) When Installing



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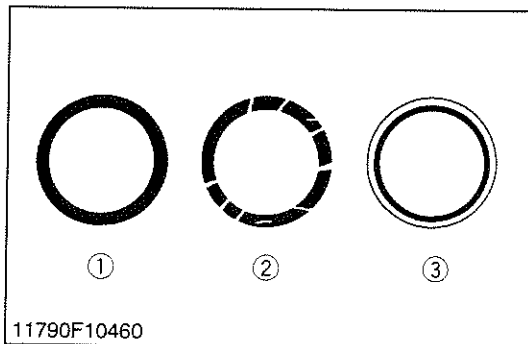


### Valve Seating

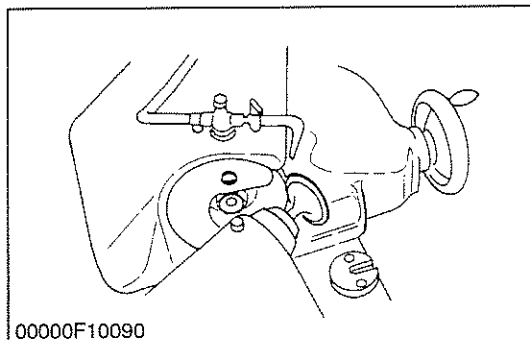
1. Coat the valve face lightly with prussian blue and put the valve on its seat to check the contact.
2. If the valve does not seat all the way around the valve seat or the valve contact is less than 70 %, correct the valve seating as follows.
3. If the valve contact does not comply with the reference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

- (1) Correct  
(2) Incorrect

- (3) Incorrect



11790S10230



### Correcting Valve and Valve Seat

#### NOTE

- Before correcting the valve and seat, check the valve stem and the I.D. of the 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.

Valve face angle	Factory spec.	0.785 rad. 45.0°
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#### 2) Correcting Valve Seat

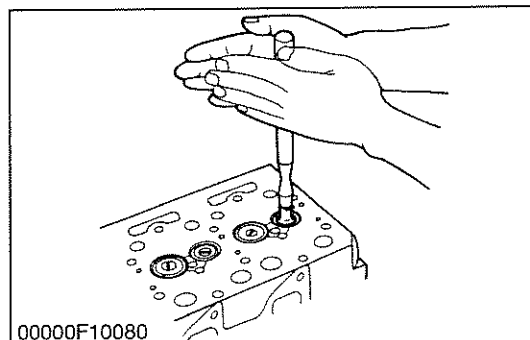
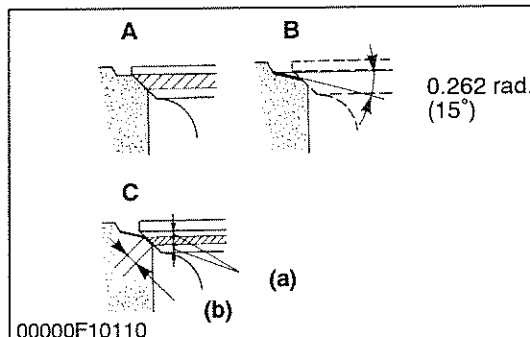
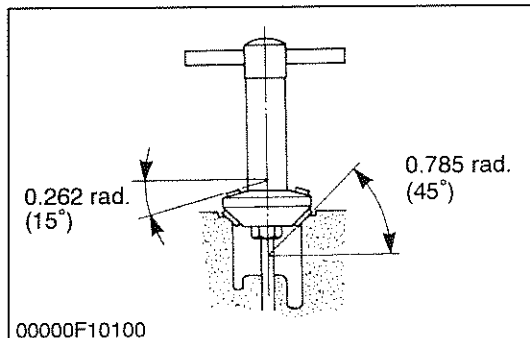
1. Slightly correct the seat surface with a 0.79 rad. (45°) valve seat cutter (Code No. 07909-33102).
2. Fitting the valve, check the contact position of the valve face and seat surface with red lead. (Visual check) [If the valve has been used for a long period, the seat tends to come in contact with the upper side of the valve face.]
3. Grind the upper surface of the valve seat with a 0.26 rad. (15°) valve seat cutter until the valve seat touches to the center of the valve face (so that  $a$  equals  $b$  as shown in the figure).
4. Grind the seat with a 0.79 rad. (45°) valve seat cutter again, and visually recheck the contact between the valve and seat.
5. Repeat steps 3 and 4 until the correct contact is achieved.
6. Continue lapping until the seated rate becomes more than 70 % of the total contact area.

Valve seat angle	Factory spec.	0.785 rad. 45.0°
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- (a) Identical Dimensions  
(b) Valve Seat Width

- (A) Check Contact  
(B) Correct Seat Width  
(C) Check Contact

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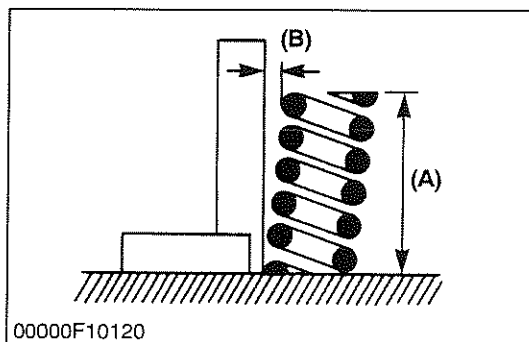
### Valve Lapping

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

#### IMPORTANT

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

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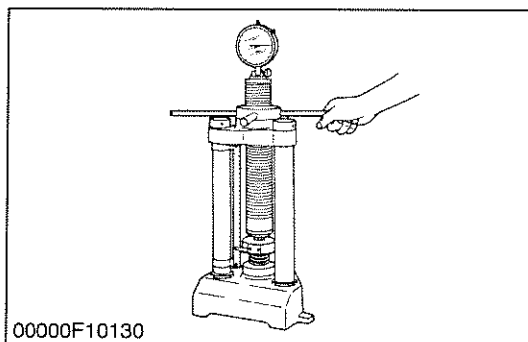


### Free Length and Tilt of Valve Spring

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

Free length (A)	Factory spec.	31.3 to 31.8 mm 1.232 to 1.252 in.
	Allowable limit	28.2 mm 1.118 in.
Tilt (B)	Allowable limit	1.2 mm 0.047 in.

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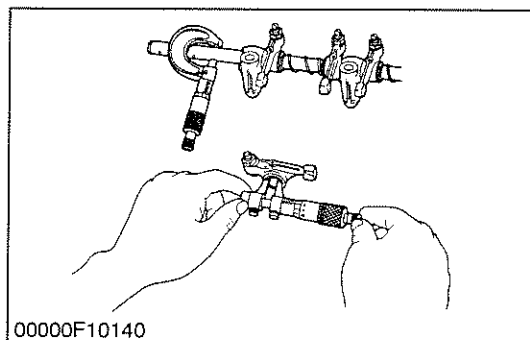


### Valve Spring Setting Load

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

Setting load / Setting length	Factory spec.	64.7 N / 27.0 mm 6.6 kgf / 27.0 mm 14.6 lbs / 1.063 in.
	Allowable limit	54.9 N / 27.0 mm 5.6 kgf / 27.0 mm 12.3 lbs / 1.063 in.

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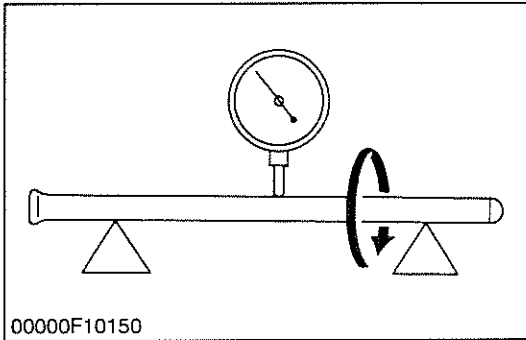
### Oil Clearance between Rocker Arm and Rocker Arm Shaft

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

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	0.15 mm 0.0059 in.

Rocker arm shaft O.D.	Factory spec.	10.473 to 10.484 mm 0.41232 to 0.41276 in.
Rocker arm I.D.	Factory spec.	10.500 to 10.518 mm 0.41339 to 0.41410 in.

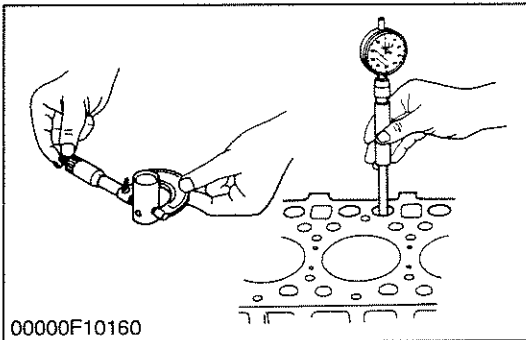
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**Push Rod Runout**

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

Push rod runout	Allowable limit	0.50 mm 0.0196 in.
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**Oil Clearance between Tappet and Tappet Guide Bore**

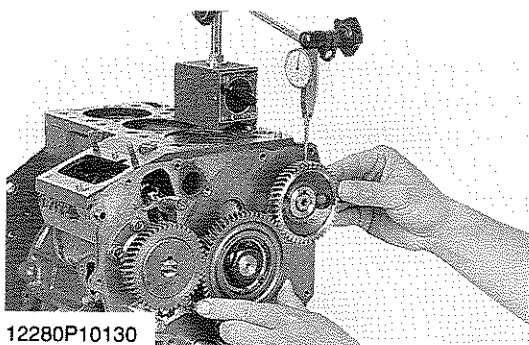
1. Measure the tappet O.D. with an outside micrometer.
2. Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

Oil Clearance between tappet and tappet guide bore	Factory spec.	0.016 to 0.052 mm 0.00063 to 0.00205 in.
	Allowable limit	0.10 mm 0.0039 in.

Tappet O.D.	Factory spec.	17.966 to 17.984 mm 0.70732 to 0.70803 in.
Tappet guide bore I.D.	Factory spec.	18.000 to 18.018 mm 0.70866 to 0.70937 in.

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



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### Timing Gear Backlash

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

Backlash between idle gear and crank gear	Factory spec.	0.043 to 0.124 mm 0.00169 to 0.00488 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear and cam gear	Factory spec.	0.047 to 0.123 mm 0.00185 to 0.00484 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear and injection pump gear	Factory spec.	0.046 to 0.124 mm 0.00181 to 0.00488 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between oil pump gear and crank gear	Factory spec.	0.041 to 0.123 mm 0.00161 to 0.00484 in.
	Allowable limit	0.15 mm 0.0059 in.

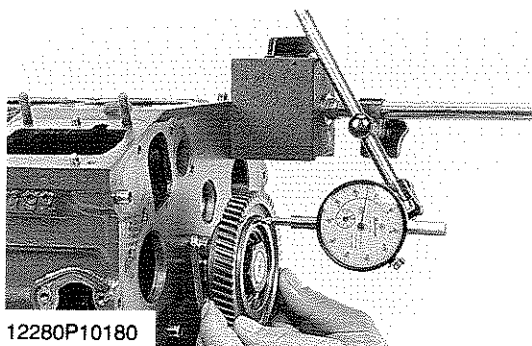
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### Idle Gear Side Clearance

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

Idle gear side clearance	Factory spec.	0.13 to 0.49 mm 0.0051 to 0.0199 in.
	Allowable limit	0.60 mm 0.0236 in.

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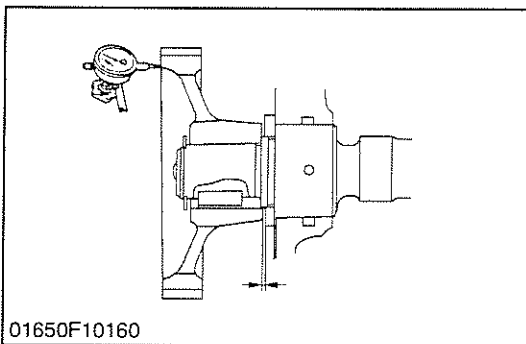
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### Camshaft Side Clearance

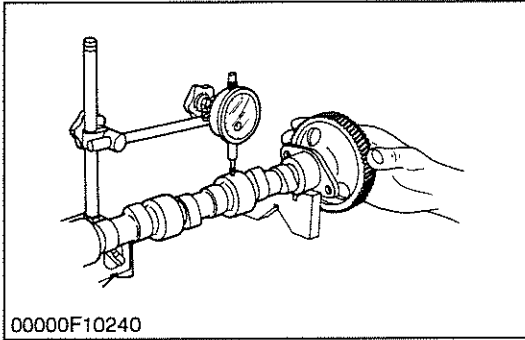
1. Set a dial indicator with its tip on the camshaft.
2. Measure the side clearance by moving the cam gear to the front and rear.
3. If the measurement exceeds the allowable limit, replace the camshaft stopper.

Camshaft side clearance	Factory spec.	0.15 to 0.31 mm 0.0059 to 0.0122 in.
	Allowable limit	0.50 mm 0.020 in.

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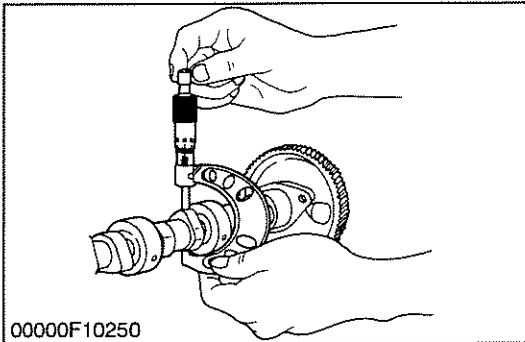


### Camshaft Runout

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 runout.
4. If the measurement exceeds the allowable limit, replace the camshaft.

Camshaft runout	Allowable limit	0.02 mm 0.0008 in.
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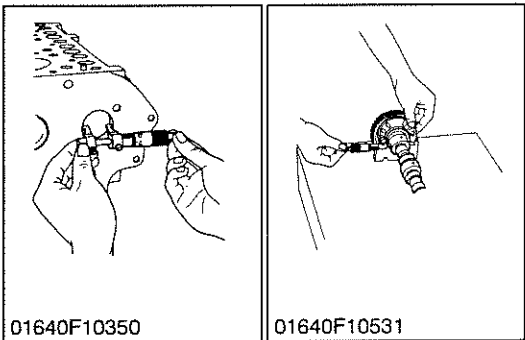


### Cam Height

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

Cam height of intake and exhaust	Factory spec.	26.88 mm 1.0583 in.
	Allowable limit	26.83 mm 1.0563 in.

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### Oil Clearance of Camshaft Journal

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

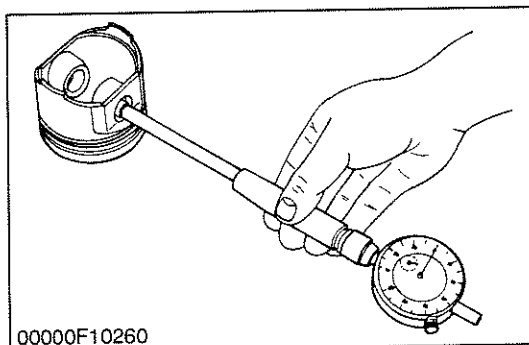
Oil clearance of camshaft journal	Factory spec.	0.050 to 0.091 mm 0.00197 to 0.00358 in.
	Allowable limit	0.15 mm 0.0059 in.

Camshaft journal O.D.	Factory spec.	32.934 to 32.950 mm 1.29661 to 1.29724 in.
Cylinder block bore I.D.	Factory spec.	33.000 to 33.025 mm 1.29921 to 1.30020 in.

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### (3) Piston and Connecting Rod

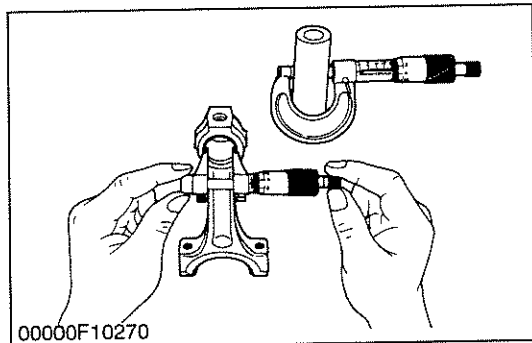


#### Piston Pin Bore I.D.

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.	20.000 to 20.013 mm 0.78740 to 0.78791 in.
	Allowable limit	20.05 mm 0.78940 in.

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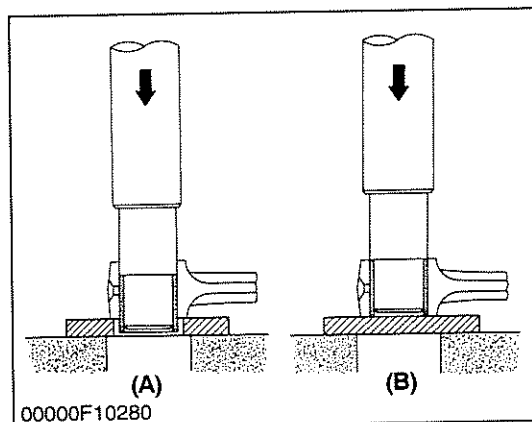
#### Oil Clearance between Piston Pin and Small End Bushing

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

Oil clearance between piston pin and small end bushing	Factory spec.	0.014 to 0.038 mm 0.00055 to 0.00150 in.
	Allowable limit	0.10 mm 0.0039 in.

Piston pin O.D.	Factory spec.	20.002 to 20.011 mm 0.78748 to 0.78783 in.
Small end bushing I.D.	Factory spec.	20.025 to 20.040 mm 0.78839 to 0.78897 in.

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#### Replacing Small End Bushing

##### (When removing)

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

##### (When installing)

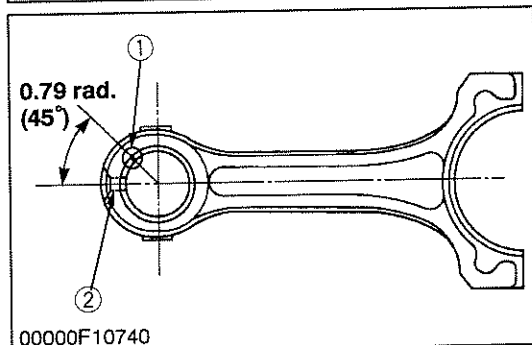
1. Clean a new small end bushing and bore, and apply engine oil to them.
2. Insert a new bushing onto the tool and press-fit it with a press so that the seam (1) of bushing positions as shown in the figure, until it is flush with the connecting rod.
3. Drill a hole to the bushing with aligning the oil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

#### ■ NOTE

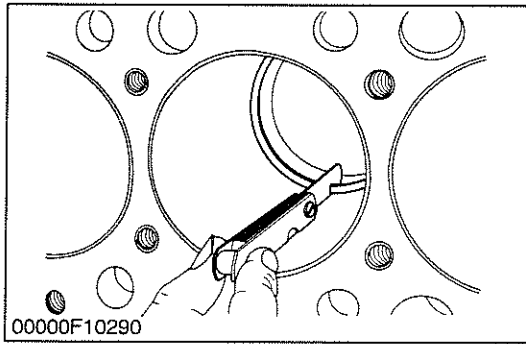
- Be sure to chamfer the oil hole circumference with an oil stone.

- (1) Seam  
(2) Oil Hole

- (A) When Removing  
(B) When Installing



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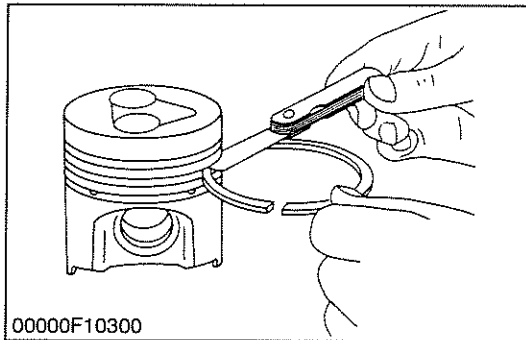


### Piston Ring Gap

1. Insert the piston ring into the lower part of the 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.	0.15 to 0.30 mm 0.0059 to 0.0118 in.
		Allowable limit	1.25 mm 0.0492 in.

12280S10290

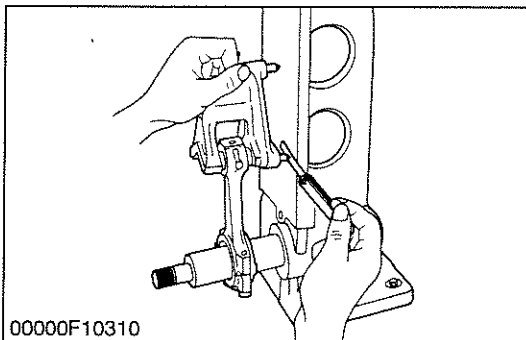


### Clearance between Piston Ring and Piston Ring Groove

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.	0.090 to 0.120 mm 0.00354 to 0.00472 in.
		Allowable limit	0.15 mm 0.0059 in.
	Oil ring	Factory spec.	0.04 to 0.08 mm 0.0016 to 0.0031 in.
		Allowable limit	0.15 mm 0.0059 in.

12280S10300



### Connecting Rod Alignment

#### ■ NOTE

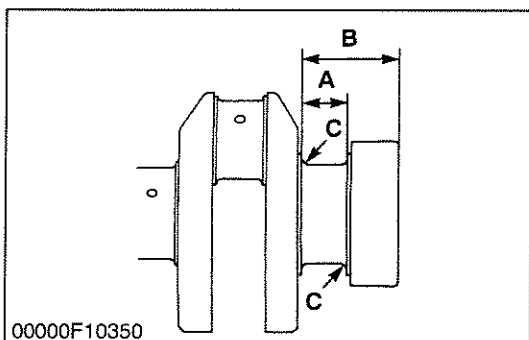
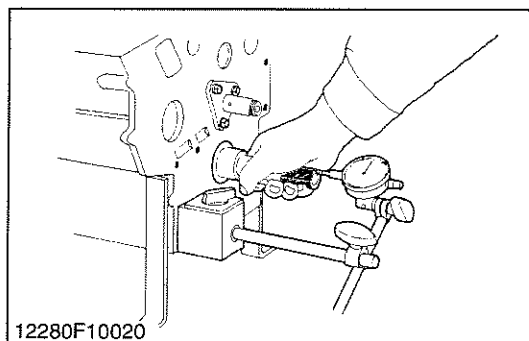
- Since the I.D. of the connecting rod small end bushing is the basis of this check, check the bushing for wear beforehand.

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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12120S10570

## (4) 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 main bearing case assembly.
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 main bearing case assembly

Oversize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Thrust bearing 1 02	15261-23951	020 OS
	Thrust bearing 2 02	15261-23971	020 OS
0.4 mm 0.016 in.	Thrust bearing 1 04	15261-23961	040 OS
	Thrust bearing 2 04	15261-23981	040 OS

- Oversize dimensions of crankshaft journal

Oversize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	23.40 to 23.45 mm 0.9134 to 0.9154 in.	23.80 to 23.85 mm 0.9213 to 0.9232 in.
Dimension B	46.1 to 46.3 mm 1.815 to 1.823 in.	46.3 to 46.5 mm 1.823 to 1.831 in.
Dimension C	1.8 to 2.2 mm radius 0.071 to 0.087 in. radius	1.8 to 2.2 mm radius 0.071 to 0.087 in. radius
The crankshaft journal must be fine-finished to higher than $\sqrt[0.8]{S}$ .		

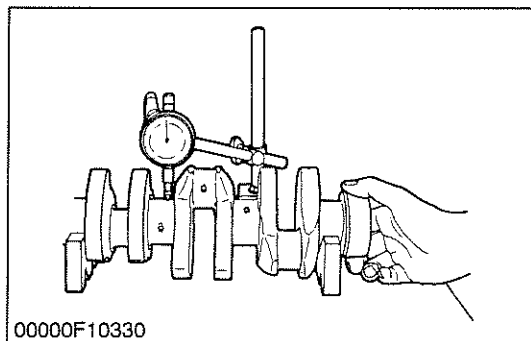
12280S10310

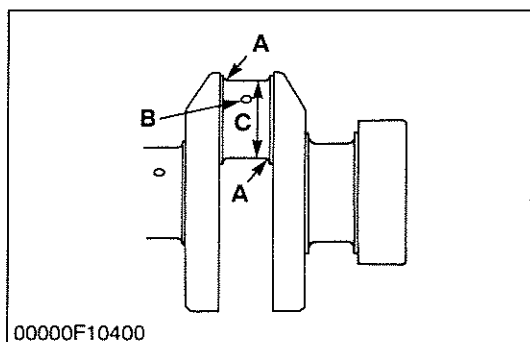
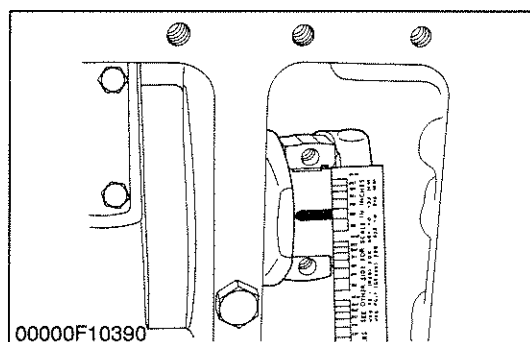
### Crankshaft Runout

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 runout.
4. If the measurement exceeds the allowable limit, replace the crankshaft.

Crankshaft runout	Allowable limit	0.04 mm 0.0016 in.
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00000S10280





### 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.	0.020 to 0.051 mm 0.0008 to 0.0020 in.
	Allowable limit	0.15 mm 0.0059 in.
Crankpin O.D.	Factory spec.	33.959 to 33.975 mm 1.33697 to 1.33760 in.
Crankpin bearing I.D.	Factory spec.	33.995 to 34.010 mm 1.33839 to 1.33898 in.

**(Reference)**

- Undersize crankpin bearing

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankpin bearing 02	15861-22971	020 US
0.4 mm 0.016 in.	Crankpin bearing 04	15861-22981	040 US

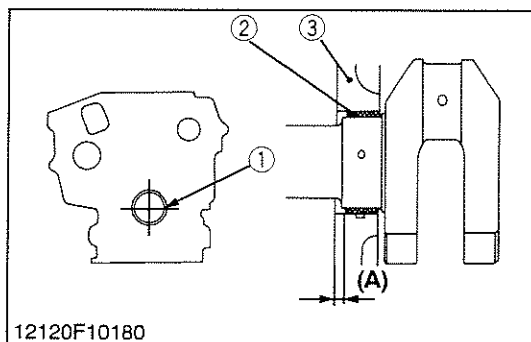
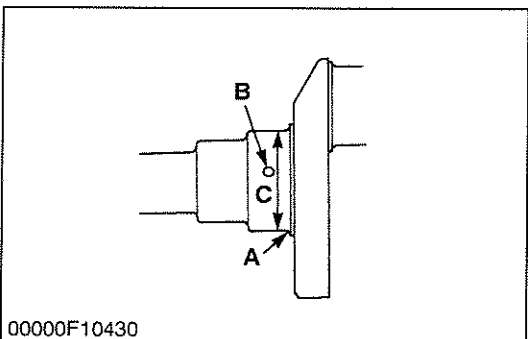
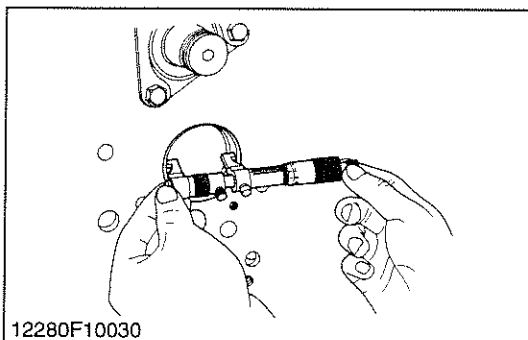
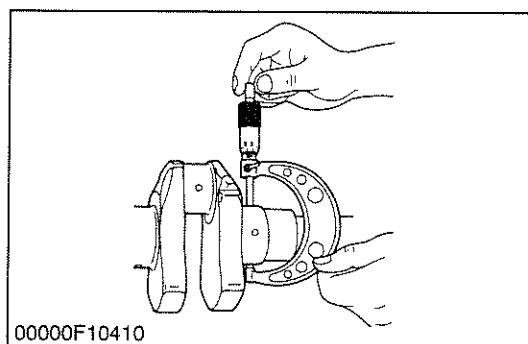
- Undersize dimensions of crankpin

<div style="text-align: center;">Undersize Dimension</div>	0.2 mm 0.008 in.	0.4 mm 0.016 in.
A	2.3 to 2.7 mm radius 0.091 to 0.106 in. radius	2.3 to 2.7 mm radius 0.091 to 0.106 in. radius
B	4 mm radius 0.16 in. radius	4 mm radius 0.16 in. radius
C	33.759 to 33.775 mm 1.32910 to 1.32973 in.	33.559 to 33.575 mm 1.32122 to 1.32185 in.

(0.8-S)

The crankpin must be fine-finished to higher than VVVV .

12120S10590



### 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 oil 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 0.106 mm 0.00134 to 0.00417 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D.	Factory spec.	39.934 to 39.950 mm 1.57221 to 1.57284 in.
Crankshaft bearing 1 I.D.	Factory spec.	39.984 to 40.040 mm 1.57417 to 1.57638 in.

**(Reference)**

- Undersize crankshaft bearing 1

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 1 02	15861-23911	020 US
0.4 mm 0.016 in.	Crankshaft bearing 1 04	15861-23921	040 US

- Undersize dimensions of crankshaft journal

Undersize Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
A	1.8 to 2.2 mm radius 0.071 to 0.087 in. radius	1.8 to 2.2 mm radius 0.071 to 0.087 in. radius
B	5 mm dia. 0.20 in. dia.	5 mm dia. 0.20 in. dia.
C	39.734 to 39.750 mm 1.56433 to 1.56496 in.	39.534 to 39.550 mm 1.55646 to 1.55709 in.
(0.8-S) The crankshaft journal must be fine-finished to higher than VVVV.		

12280S10320

## Replacing Crankshaft Bearing 1

**(When removing)**

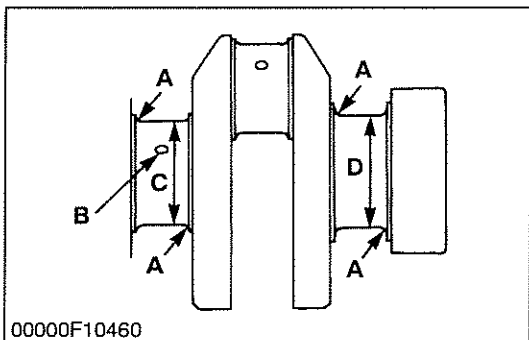
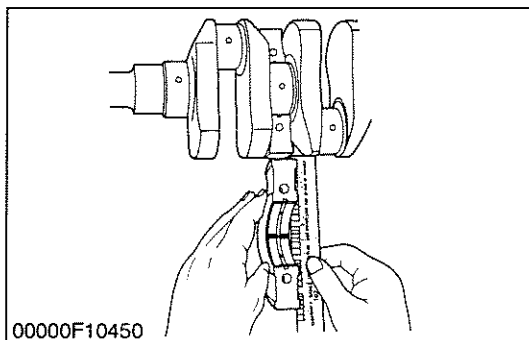
1. Press out the used crankshaft bearing 1 using a crankshaft bearing 1 replacing tool.

**(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



### Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2 and 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 oil clearance exceeds the allowable limit, replace the crankshaft bearing 2 or 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 and crankshaft bearing 3	Factory spec.	0.028 to 0.059 mm 0.0014 to 0.00232 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D. (Intermediate)	Factory spec.	39.934 to 39.950 mm 1.57221 to 1.57284 in.
Crankshaft bearing 3 I.D.	Factory spec.	39.978 to 39.993 mm 1.57394 to 1.57453 in.

Crankshaft journal O.D. (Flywheel side)	Factory spec.	43.978 to 43.993 mm 1.73142 to 1.73201 in.
Crankshaft bearing 2 I.D.	Factory spec.	43.984 to 44.026 mm 1.73177 to 1.73331 in.

#### (Reference)

- Undersize crankshaft bearing 2 and 3

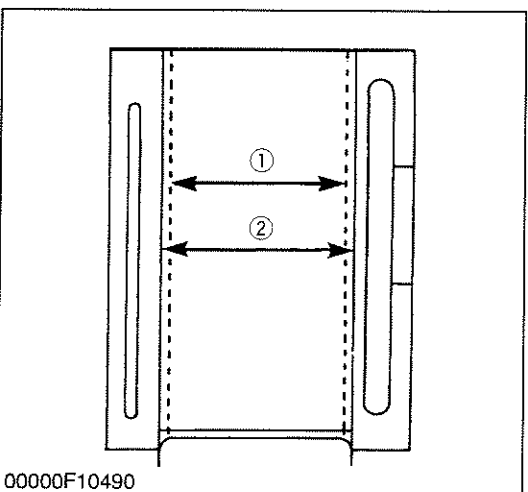
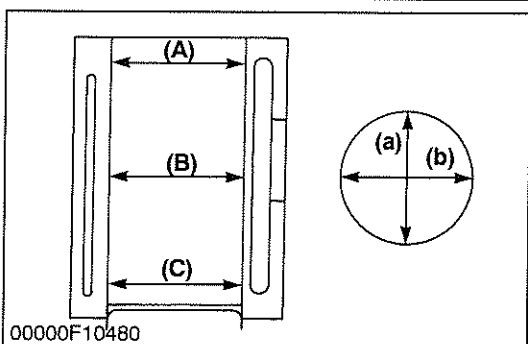
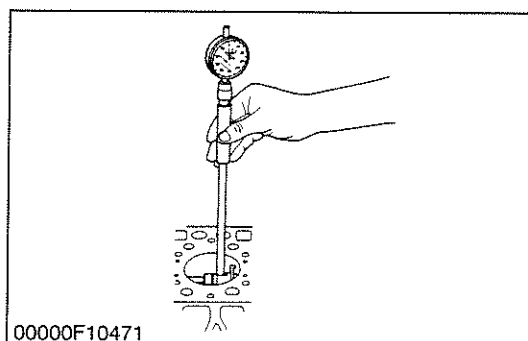
Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 2 02	15694-23931	020 US
	Crankshaft bearing 3 02	15861-23861	020 US
0.4 mm 0.016 in.	Crankshaft bearing 2 04	15694-23941	040 US
	Crankshaft bearing 3 04	15861-23871	040 US

- Undersize dimensions of crankshaft journal

Undersize Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
A	1.8 to 2.2 mm radius 0.071 to 0.087 in. radius	1.8 to 2.2 mm radius 0.071 to 0.087 in. radius
B	3 mm dia 0.12 in. dia	3 mm dia 0.12 in. dia
C	39.734 to 39.750 mm 1.56433 to 1.56496 in.	39.534 to 39.550 mm 1.55646 to 1.55709 in.
D	43.734 to 43.750 mm 1.72181 to 1.72244 in.	43.534 to 43.550 mm 1.71394 to 1.71457 in.
• The crankpin journal must be fine-finished to higher than $\nabla\nabla\nabla\nabla$ (0.8 S).		

12280S10330

## (5) 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 I.D.	Factory spec.	D662	64.000 to 64.019 mm 2.51968 to 2.52043 in.
		D722	67.000 to 67.019 mm 2.63779 to 2.63854 in.
Maximum wear	Allowable limit		0.15 mm 0.0059 in.

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

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

12280S10340

### Correcting Cylinder

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

Oversize cylinder I.D.	Factory spec.	D662	64.250 to 64.269 mm 2.52953 to 2.53028 in.
		D722	67.250 to 67.269 mm 2.64764 to 2.64839 in.
Maximum wear	Allowable limit		0.15 mm 0.0059 in.
Finishing	Hone to 1.2 to 2.0 mR max. ▽▽▽ (0.000047 to 0.0079 in.R max.)		

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

Oversize	Engine Model	Part Name	Code Number	Marking
0.25 mm 0.0098 in.	D662	Piston	16861-21900	0.25 OS
		Piston ring assembly	16861-21090	0.25 OS
	D722	Piston	16851-21900	0.25 OS
		Piston ring assembly	16851-21090	0.25 OS

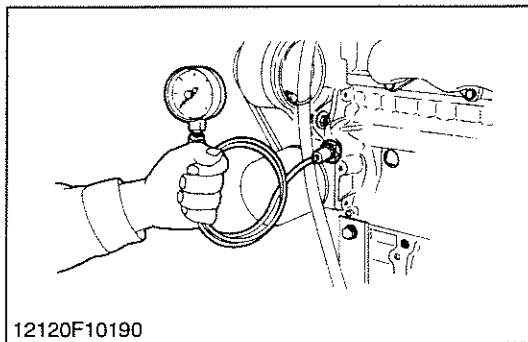
### NOTE

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

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

12280S10350

### [3] LUBRICATING SYSTEM CHECKING



#### Engine Oil Pressure

1. Remove the engine oil pressure switch, and set a oil pressure tester (Code No. 07916-32032). (Adaptor screw size : PT 1/8)
2. Start the engine. After warming up, measure the oil pressure of both idling and rated speeds.
3. If the oil pressure is less than the allowable limit, check the following.
  - Engine oil insufficient
  - Oil pump defective
  - Oil strainer clogged
  - Oil filter cartridge clogged
  - Oil gallery clogged
  - Excessive oil clearance
  - Foreign matter in the relief valve

Engine oil pressure	At idle speed	Factory spec.	More than 69 kPa 0.7 kgf/cm <sup>2</sup> 10 psi
	At rated speed	Factory spec.	245 to 392 kPa 2.5 to 4.0 kgf/cm <sup>2</sup> 35 to 56 psi
		Allowable limit	98 kPa 1.0 kgf/cm <sup>2</sup> 14 psi

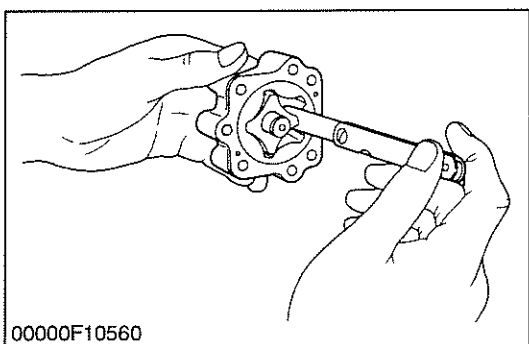
#### (When reassembling)

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

Tightening torque	Oil pressure switch	14.7 to 19.6 N·m 1.5 to 2.0 kgf·m 10.8 to 14.5 ft·lbs
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12280S10360

### SERVICING



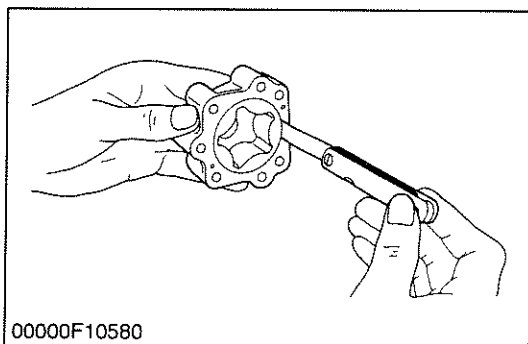
#### Rotor Lobe Clearance

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.	0.03 to 0.14 mm 0.0012 to 0.0055 in.
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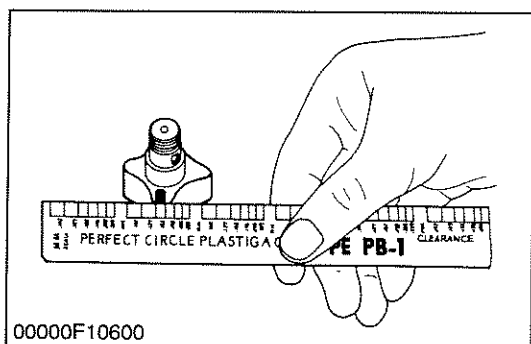


### Clearance between Outer Rotor and Pump Body

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.	0.07 to 0.15 mm 0.0028 to 0.0059 in.
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### Clearance between Rotor and Cover

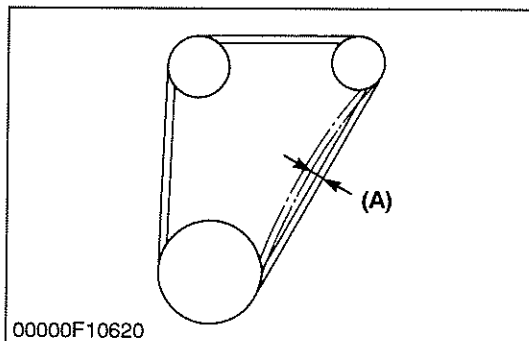
1. Put a strip of plastigage (Code No. 07909-30241) onto the rotor face with grease.
2. Install the cover and tighten the screws.
3. Remove the cover carefully, and measure the amount of the flattening with the scale and get the clearance.
4. If the clearance exceeds the factory specifications, replace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

Clearance between rotor and cover	Factory spec.	0.075 to 0.135 mm 0.00295 to 0.00531 in.
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12120S10680

## [4] COOLING SYSTEM CHECKING AND ADJUSTING

### (1) Fan Belt

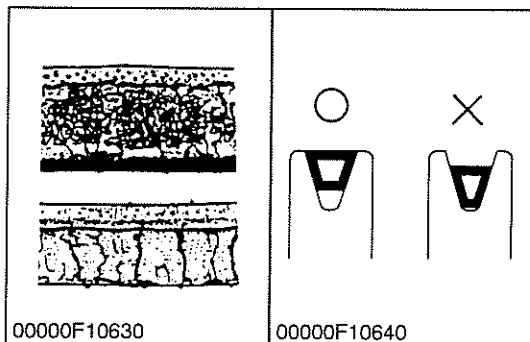


### Fan Belt Tension

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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### Fan Belt Damage and Wear

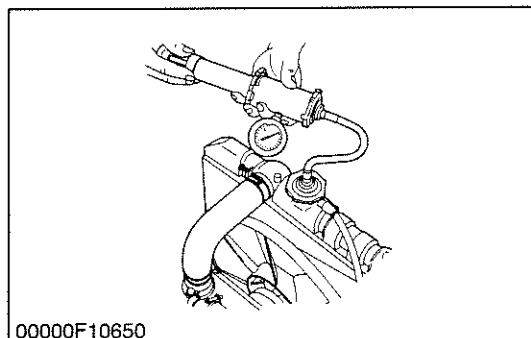
1. Check the fan belt for damage.
2. If the fan belt is damaged, replace it.
3. Check if the fan belt is worn and sunk in the pulley groove.
4. If the fan belt is nearly worn out and deeply sunk in the pulley groove, replace it.

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**(2) Radiator****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.

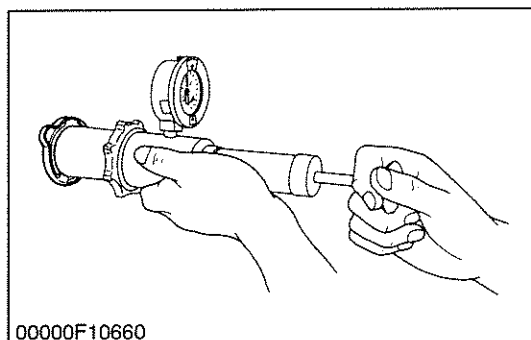
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**Radiator Water Leakage**

1. Pour a specified amount of water into the radiator.
2. Set a radiator tester 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.	147 kPa 1.5 kgf/cm <sup>2</sup> 21 psi
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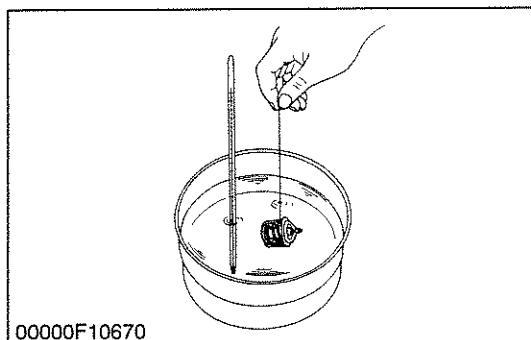
12120S10690

**Radiator Cap Air Leakage**

1. Set a radiator tester on the radiator cap.
2. Apply the specified pressure (88 kPa, 0.9 kgf/cm<sup>2</sup>, 13 psi), and measure the time for the pressure to fall to 59 kPa (0.6 kgf/cm<sup>2</sup>, 9 psi).
3. If the measurement is less than the factory specification, replace the radiator cap.

Pressure falling time	Factory spec.	More than 10 seconds for pressure fall from 88 to 59 kPa (from 0.9 to 0.6 kgf/cm <sup>2</sup> , from 13 to 9 psi)
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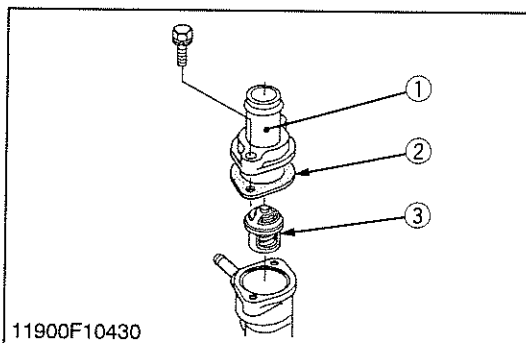
**(3) Thermostat****Thermostat Valve Opening Temperature**

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

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## DISASSEMBLING AND ASSEMBLING



### Thermostat Assembly

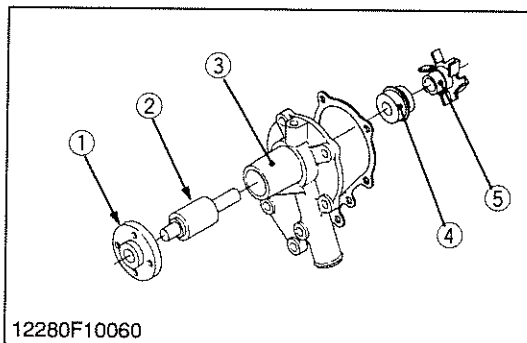
1. Remove the thermostat cover mounting screws, and remove the thermostat cover (1).
2. Remove the thermostat assembly (3).

#### (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 |                         |

11900S10270



### 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)

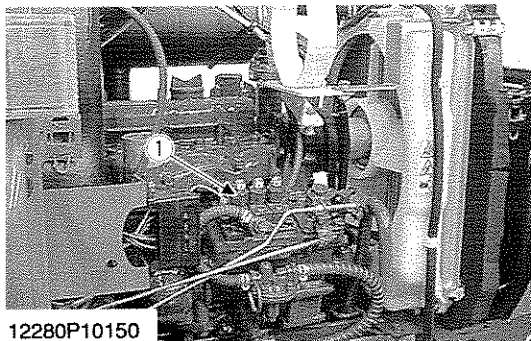
- Apply a liquid gasket (Three Bond 1215 or equivalent) to the both sides of gasket.
- Replace the mechanical seal with new one.

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

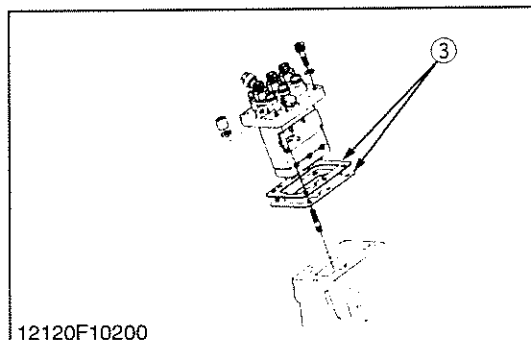
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## [5] FUEL SYSTEM CHECKING AND ADJUSTING

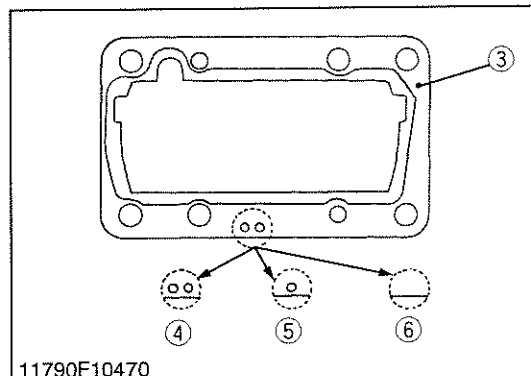
### (1) Injection Pump



12280P10150



12120F10200



11790F10470

#### Injection Timing

1. Remove the bonnet and air cleaner.
2. Remove the muffler.
3. Remove the injection pipes and glow plugs.
4. Engage the parking brake.
5. Set the throttle lever to the maximum engine speed.
6. Turn the flywheel counterclockwise (facing the flywheel) until fuel flows from the delivery valve holder (1).
7. 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.
8. Check to see if the timing angle line on the flywheel is aligned with the alignment mark (2).
9. If the injection timing is out of adjustment, readjust the timing with shims (3).

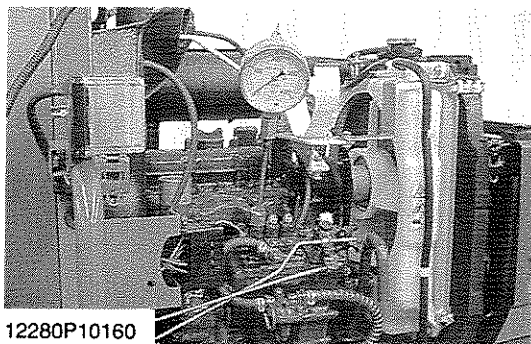
Injection timing	Factory spec.	0.31 to 0.34 rad. (17.5 to 19.5°) before T.D.C.
------------------	---------------	---

#### 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 left to check the thickness of the shims.

- |   |  |
|---|--|
| (1) Delivery Valve Holder                         | (5) Shim with One-hole : 0.25 mm<br>(0.0098 in.) |
| (2) Alignment Mark                                |  |
| (3) Shim  | (6) Shim with No-hole : 0.30 mm<br>(0.0118 in.)  |
| (4) Shim with Two-holes : 0.20 mm<br>(0.0079 in.) |  |

12280S10380



12280P10160

### Fuel Tightness of Pump Element

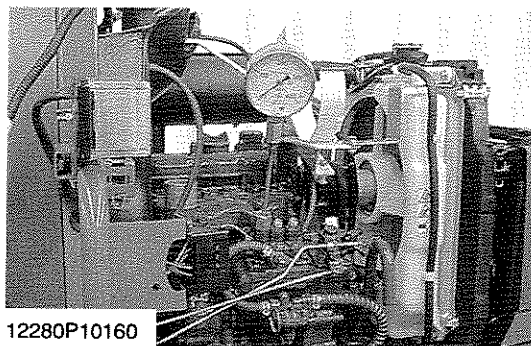
1. Remove the bonnet and air cleaner.
2. Remove the muffler.
3. Remove the injection pipes and glow plugs.
4. Install the injection pump pressure tester to the injection pump.
5. Engage the parking brake.
6. Set the throttle lever to the maximum engine speed.
7. Turn the flywheel to increase the pressure.
8. If the pressure can not reach the allowable limit, replace the pump element or injection pump assembly.

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

### ■ NOTE

- Bleed the air completely out of all the pipes up to the ignition pump pressure tester.

12280S10390



12280P10160

### Fuel Tightness of Delivery Valve

1. Remove the bonnet and air cleaner.
2. Remove the muffler.
3. Remove the injection pipes and glow plugs.
4. Install the injection pump pressure tester to the injection pump.
5. Engage the parking brake.
6. Set the throttle lever to the maximum engine speed.
7. Turn the flywheel and raise the pressure to approx. 14.7 MPa (150 kgf/cm<sup>2</sup>, 2133 psi).
8. Now turn the flywheel back about half a turn (to keep the plunger free). Maintain the flywheel at this position and clock the time taken for the pressure to drop from 14.7 to 13.7 MPa (from 150 to 140 kgf/cm<sup>2</sup>, 2133 to 1990 psi).
9. Measure the time needed to decrease the pressure from 14.7 to 13.7 MPa (from 150 to 140 kgf/cm<sup>2</sup>, 2133 to 1990 psi).
10. If the measurement is less than allowable limit, replace the delivery valve.

Fuel tightness of delivery valve	Allowable limit	5 seconds 14.7 → 13.7 MPa 150 → 140 kgf/cm <sup>2</sup> 2133 → 1990 psi
----------------------------------	-----------------	--

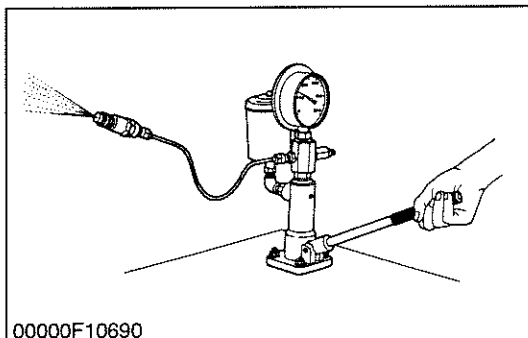
12280S10400

## (2) 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.

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### Fuel Injection Pressure

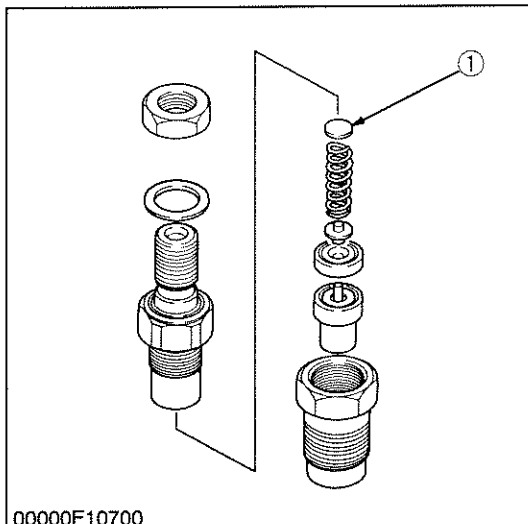
1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.
3. If the measurement is not within the factory specifications, replace the adjusting washer (1) in the nozzle holder to adjust it.

Fuel injection pressure	Factory spec.	13.73 to 14.71 MPa 140 to 150 kgf/cm <sup>2</sup> 1991 to 2133 psi
-------------------------	---------------	--

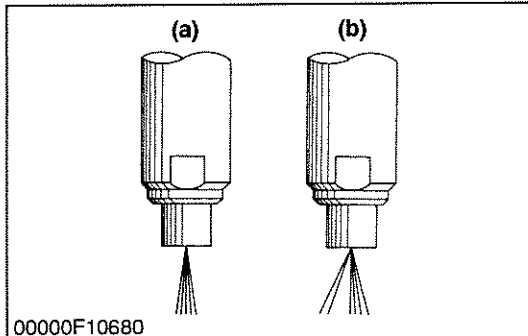
### (Reference)

- Pressure variation with 0.025 mm (0.001 in.) difference of adjusting washer thickness.  
Approx. 59 kPa (0.6 kgf/cm<sup>2</sup>, 8.5 psi)

(1) Adjusting Washer



12120S10720



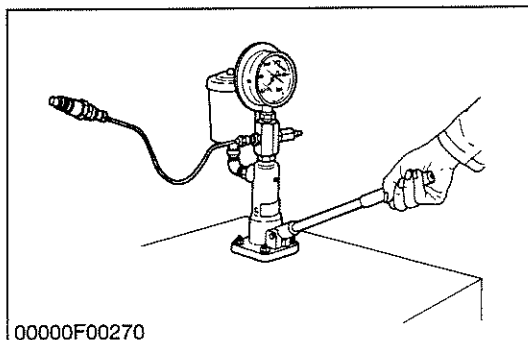
### Nozzle Spraying Condition

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

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### Valve Seat Tightness

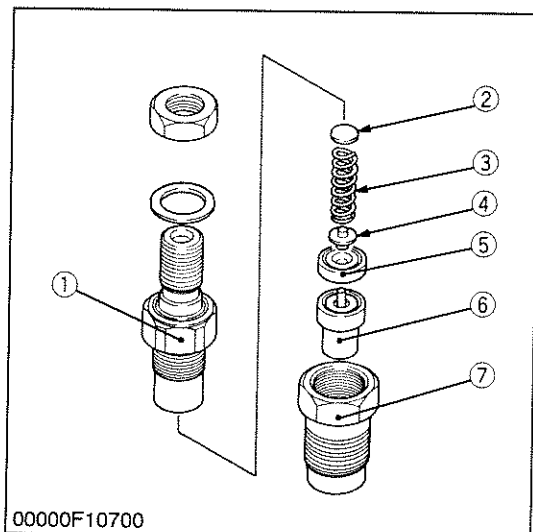
1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Raise the fuel pressure, and keep at 12.75 MPa (130 kgf/cm<sup>2</sup>, 1849 psi) for 10 seconds.
3. If any fuel leak is found, replace the nozzle piece.

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

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## DISASSEMBLING AND ASSEMBLING

### (1) Injection Nozzle



#### Nozzle Holder

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

#### (When reassembling)

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

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

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

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

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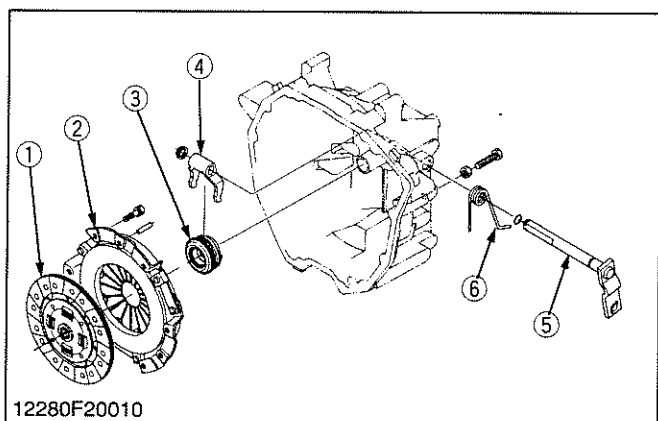
# MECHANISM

## CONTENTS

[1] FEATURES .....	2-M1
[2] LINKAGE MECHANISM .....	2-M1
[3] OPERATION .....	2-M2



## [1] FEATURES



This tractor is used dry single plate type clutch.

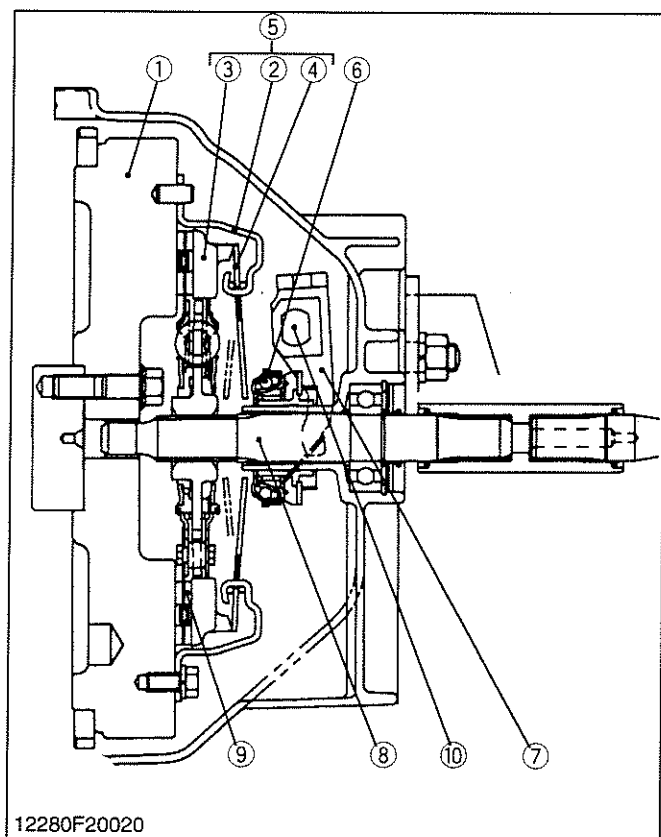
The clutch is located between the engine and transmission and is operated by stepping on the clutch pedal.

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

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

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## [2] LINKAGE MECHANISM



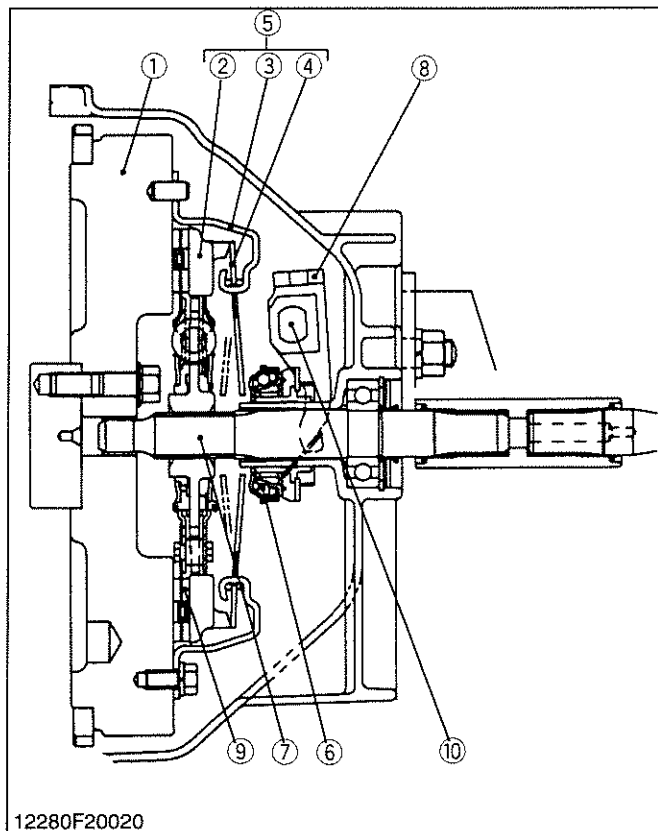
Engine torque is transmitted to the pressure plate assembly (5) via the flywheel (1) which is connected to the engine crankshaft. Therefore, the clutch cover constantly runs with engine. The clutch disc (9) is located between the flywheel (1) and the pressure plate (3) of pressure plate assembly. Torque is transmitted to the clutch disc (9) by the pressure created by diaphragm spring (4) installed in pressure plate assembly. Then, the torque is transmitted to the transmission via the clutch shaft (8).

When the pedal is depressed, the clutch release bearing (6) move towards the flywheel and push the fingers of the diaphragm spring (4). In other words, this movement pulls the pressure plate (3) up and disengages the clutch.

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

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### [3] OPERATION



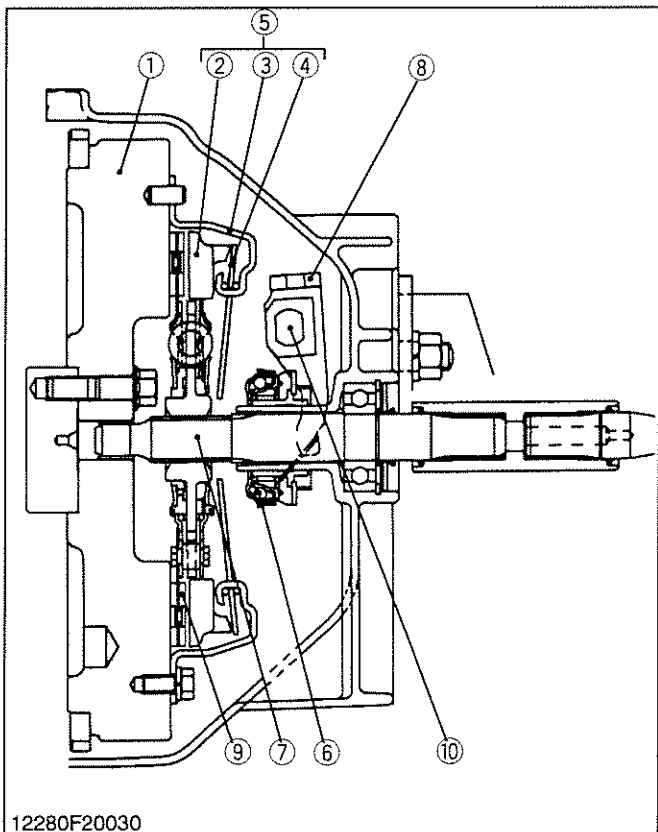
#### ■ Clutch "Engaged"

When the clutch pedal is not depressed, the clutch release bearing (6) and the fingers of diaphragm spring (4) are not connected to each other.

Accordingly, the pressure plate (2) is tightly pressed against the flywheel (1) by the diaphragm spring (4). As a result, rotation of the flywheel (1) is transmitted to the transmission through the clutch shaft (7) due to the frictional force among the flywheel (1), clutch disc (9) and pressure plate (2).

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

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#### ■ Clutch "Disengaged"

When the clutch pedal is depressed, the clutch rod is pulled to move the clutch lever (10). then, the release fork (8) pushes the release bearing (6) toward the flywheel. Simultaneously, the release bearing (6) pushes the diaphragm spring (4).

As the pressure plate (2) is pulled by the diaphragm spring (4), the frictional force among the flywheel (1), clutch disc (9) and pressure plate (2) disappears.

Therefore, rotation of the flywheel (1) is not transmitted to the clutch disc (9), and then the rotation of the clutch shaft (7) stops.

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

12280M20040

# SERVICING

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# TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Clutch Drags</b>	<ul style="list-style-type: none"> <li>• Clutch pedal free travel excessive</li> <li>• Dust on clutch disc generated from clutch disc facing</li> <li>• Release fork broken</li> <li>• Clutch disc or pressure plate warped</li> <li>• Wire ring of the pressure plate worn or broken</li> </ul>	Adjust Remove rust  Replace Replace Replace (Pressure plate assembly)	2-S3 2-S6  2-S6 2-S6 2-S6
<b>Clutch Slips</b>	<ul style="list-style-type: none"> <li>• Clutch pedal free travel too small</li> <li>• Clutch disc excessively worn</li> <li>• Grease or oil on clutch disc facing</li> <li>• Clutch disc or pressure plate warped</li> <li>• Diaphragm spring weaken or broken</li> <li>• Wire ring of the pressure plate worn or broken</li> </ul>	Adjust Replace Replace Replace Replace Replace (Pressure plate assembly)	2-S3 2-S6 2-S6 2-S6 2-S6 2-S6
<b>Chattering</b>	<ul style="list-style-type: none"> <li>• Grease or oil on clutch disc facing</li> <li>• Clutch disc or pressure plate warped</li> <li>• Clutch disc boss spline worn or rusted</li> <li>• Clutch shaft bent</li> <li>• Pressure plate or flywheel face cracked or scored</li> <li>• Clutch disc boss spline and clutch shaft spline worn</li> <li>• Diaphragm spring strength uneven or diaphragm spring broken</li> </ul>	Replace Replace Replace or remove rust Replace Replace  Replace  Replace	2-S6 2-S6 2-S6  3-S8 1-S2, 2-S6  2-S6, 3-S8  2-S6
<b>Rattle During Running</b>	<ul style="list-style-type: none"> <li>• Clutch disc boss spline worn</li> <li>• Replace bearing worn or sticking</li> </ul>	Replace Replace	2-S6 2-S6
<b>Clutch Squeaks</b>	<ul style="list-style-type: none"> <li>• Replace bearing sticking or dry</li> <li>• Clutch disc excessively worn</li> </ul>	Replace Replace	2-S6 2-S6
<b>Vibration</b>	<ul style="list-style-type: none"> <li>• Clutch shaft bent</li> <li>• Clutch disc rivet worn or broken</li> <li>• Clutch parts broken</li> </ul>	Replace Replace Replace	3-S8 2-S6 —

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## SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Clutch Pedal	Free travel on Clutch Pedal	15 to 25 mm 0.59 to 0.98 in.	—
Clutch Disc	Disc Surface to Rivet Top (Depth)	—	0.3 mm 0.012 in.
Clutch Disc Boss to Gear Shaft	Backlash (Displacement Around Disc Edge)	—	2.0 mm 0.079 in.
Pressure Plate	Flatness	—	0.2 mm 0.008 in.
Diaphragm Spring	Mutual Difference	—	0.5 mm 0.020 in.

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## 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-10.)

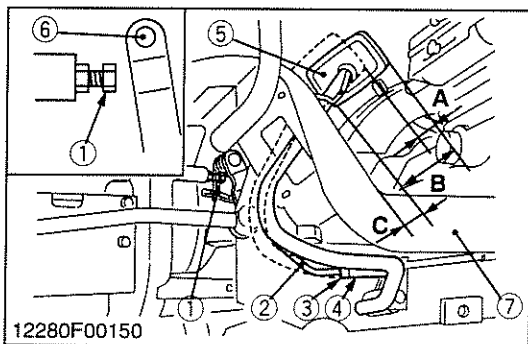
Item		N·m	kgf·m	ft-lbs
Steering wheel mounting nut	M8	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Clutch housing and engine mounting screw		17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Clutch cover mounting screw		23.5 to 27.5	2.4 to 2.8	17.4 to 20.2

12280S20030



# CHECKING, DISASSEMBLING AND SERVICING

## CHECKING AND ADJUSTING



### Clutch Pedal Free Travel

#### CAUTION

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

- Slightly depress the clutch pedal and measure stroke "A" at top of clutch pedal (5).
- If the measurement is not within the factory specifications, loosen the lock nut (3) and adjust the clutch pedal rod (2) length.
- After adjusting it, measure stroke "B" between clutch pedal (5) and step (7).
- And at same time, check distance "C" between clutch pedal (5) and step (7).
- If the measurement not within the factory specifications, adjust it with the clutch pedal stopper bolt (1).

#### NOTE

- After adjustment, sure the stopper bolt with the lock nut (3).

Clutch pedal free travel	Factory spec.	15 to 25 mm 0.59 to 0.98 in.
Clutch pedal stroke "B"	Factory spec.	80 mm 3.15 in.
Distance "C"	Factory spec.	10 to 15 mm 0.39 to 0.59 in.

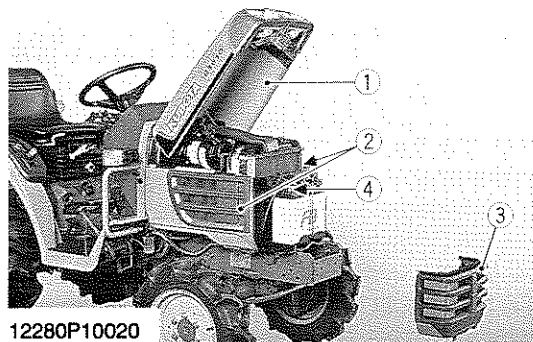
- (1) Stopper Bolt
- (2) Clutch Pedal Rod
- (3) Lock Nut
- (4) Adjusting Nut

- (5) Clutch Pedal
- (6) Clutch Rod
- (7) Step

12280S20040

## DISASSEMBLING AND ASSEMBLING

### [1] SEPARATING ENGINE FROM CLUTCH HOUSING



#### Hood, Side Cover and Battery Cord

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

#### ■ NOTE

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

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

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#### Steering Wheel

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

#### (When reassembling)

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft·lbs
-------------------	-----------------------------	---

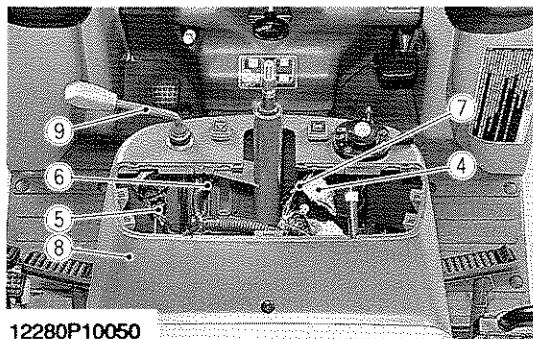
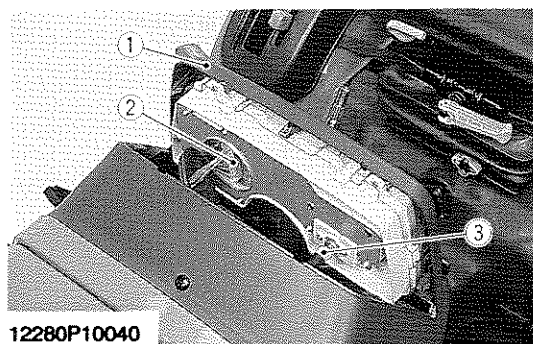
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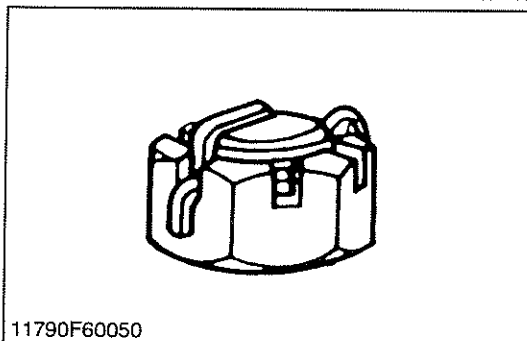
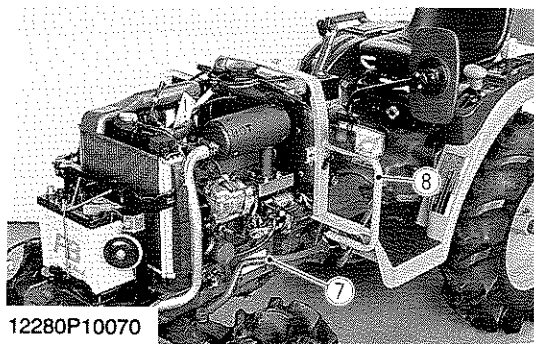
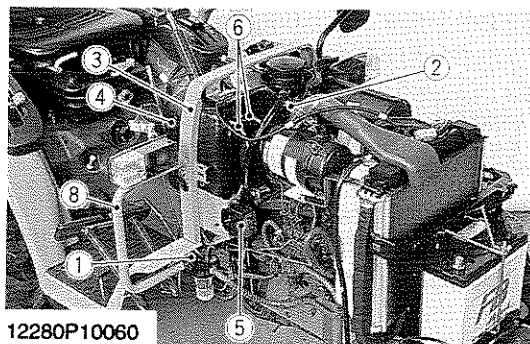
#### Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Disconnect the combination switch connector (4), main switch connector (5), hazard switch connector (6) and parking light switch connector (7).
3. Tap out the spring pin and remove the hand accelerator lever (9).
4. Remove the panel under cover (8).

- |                                  |                                    |
|----------------------------------|------------------------------------|
| (1) Meter Panel                  | (6) Hazard Switch Connector        |
| (2) Meter Panel Connector        | (7) Parking Light Switch Connector |
| (3) Hour-meter Cable             | (8) Panel Under Cover              |
| (4) Combination Switch Connector | (9) Hand Accelerator Lever         |
| (5) Main Switch Connector        |                                    |



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### Fuel Tank and Drag Link

1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the fuel tank frame stay (2).
3. Disconnect the hazard unit, starter relay and remove the lead wire for fuel gauge.
4. Remove the fuse box (5).
5. Disconnect the overflow hoses (6) of fuel line.
6. Remove the front lamp stay (8).
7. Remove the tank frame (3) with fuel tank (4).
8. Remove the cotter pin and loosen the slotted nut.
9. Disconnect the drag link (7) with a pitman arm puller from the knuckle arm.

#### (When reassembling)

#### ■ IMPORTANT

- Do not loosen the slotted nut to align the hole.
- Install the cotter pin as shown in the figure

#### (Reference)

Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13 to 25.3 ft·lbs
-------------------	-------------	---

- |                          |                     |
|--------------------------|---------------------|
| (1) Fuel Hose            | (5) Fuse Box        |
| (2) Fuel Tank Frame Stay | (6) Overflow Hose   |
| (3) Fuel Tank Frame      | (7) Drag Link       |
| (4) Fuel Tank            | (8) Front Lamp Stay |

12280S10140

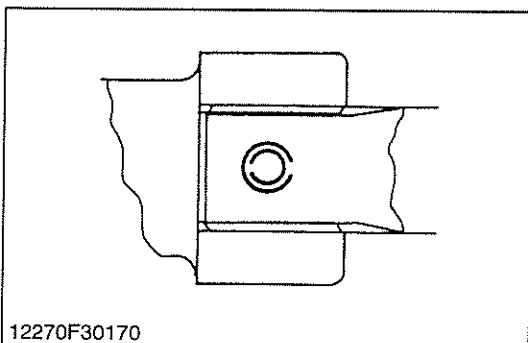
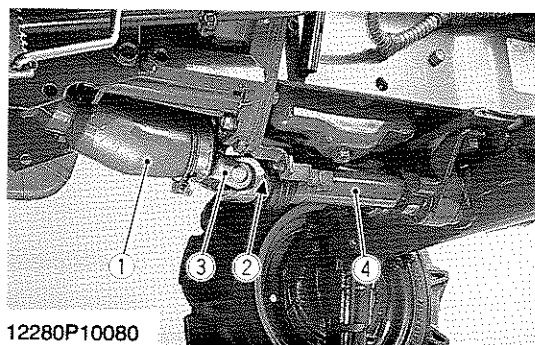
### Universal Joint and Propeller Shaft Cover

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

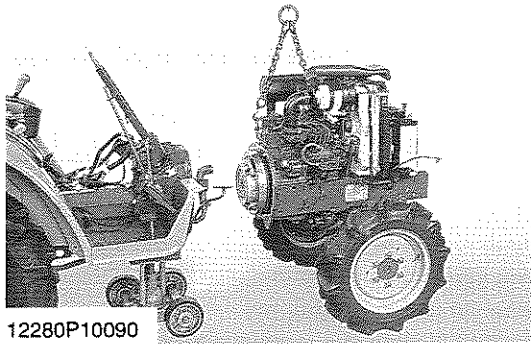
#### (When reassembling)

- 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 Cover | (3) Universal Joint       |
| (2) Spring Pin            | (4) Propeller Shaft Cover |



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### Separating the Engine from Clutch Housing

1. Loosen the clamp, then disconnect the three point hitch delivery pipe and suction hose.
2. Disconnect the glow plug lead wire and thermo sensor lead wire. And then disconnect the connector for dynamo and starter motor lead wire.
3. Place the jack under the center frame.
4. Hoist the engine by the chain at the engine hook.
5. Remove the engine mounting screws and separate the engine from the clutch housing.

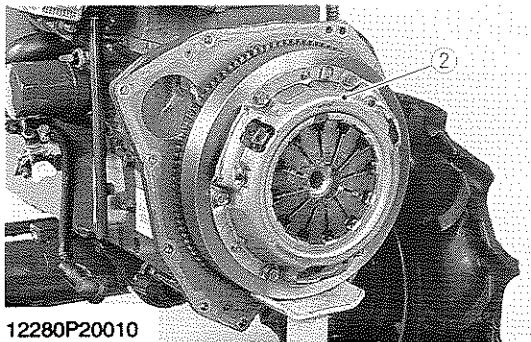
#### (When reassembling)

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

Tightening torque	Engine mounting M8 screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft·lbs
-------------------	--------------------------	---

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## [2] SEPARATING CLUTCH ASSEMBLY



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### Separating the Clutch Assembly

1. Remove the clutch assembly (2) from the flywheel.

#### (When reassembling)

- Direct the shorter end of the clutch disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Install the pressure plate, noting the position of straight pins.

#### ■ IMPORTANT

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

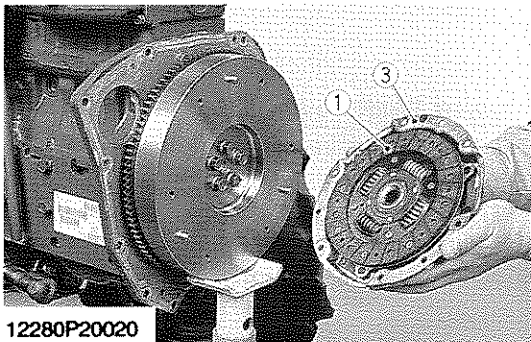
#### ■ NOTE

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

Tightening torque	Clutch mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft·lbs
-------------------	-----------------------	---

- (1) Clutch Disc  
(2) Clutch Assembly

- (3) Clutch Cover



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12280S20050

### Clutch Rod and Clutch Release Fork

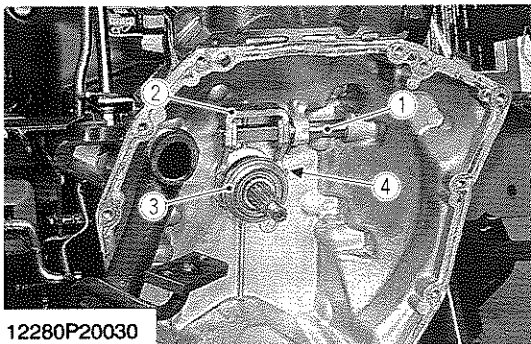
1. Remove the step LH and disconnect the clutch pedal rod.
2. Remove the clutch rod (1).
3. Remove the external snap ring at the end of clutch rod (1) and remove the clutch release fork (2) and release bearing (3) with release hub.

#### (When reassembling)

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

- (1) Clutch Rod  
(2) Clutch Release Fork

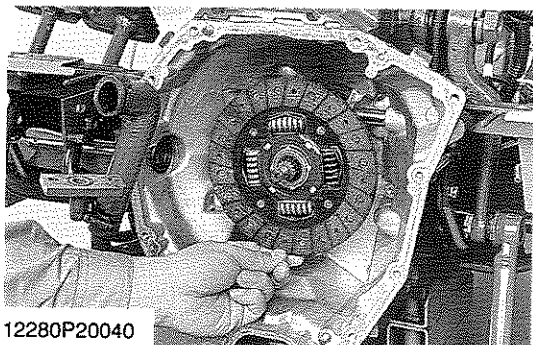
- (3) Release Bearing  
(4) Set Spring



12280P20030

12280S20060

## SERVICING



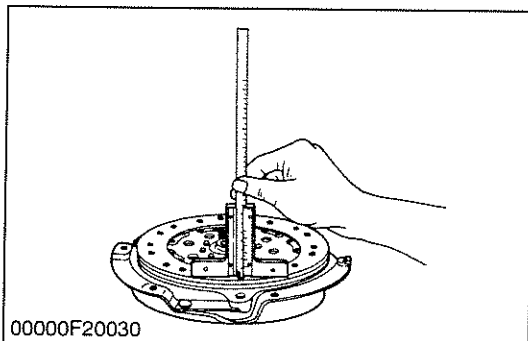
12280P20040

### Backlash between Clutch Disc and Clutch Shaft

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

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

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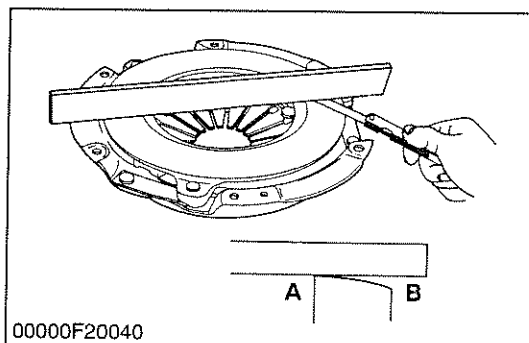
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### Clutch Disc Wear

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

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

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### Pressure Plate Flatness

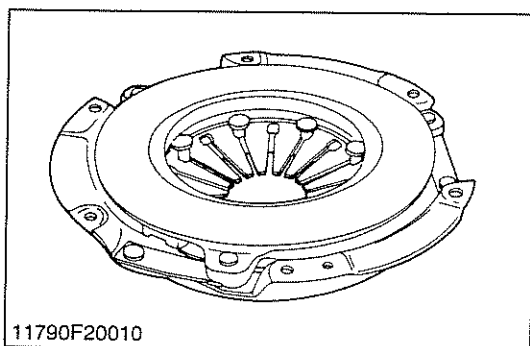
1. Place a straightedge on the pressure plate and measure clearance with a feeler gauge at several points.
2. If the clearance exceeds the allowable limit, replace it.
3. When the pressure plate is worn around its outside and its inside surface only is in contact with the straightedge, replace even if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

Clearance between pressure plate and straightedge	Allowable limit	0.2 mm 0.008 in.
---	-----------------	---------------------

(A) Inside

(B) Outside

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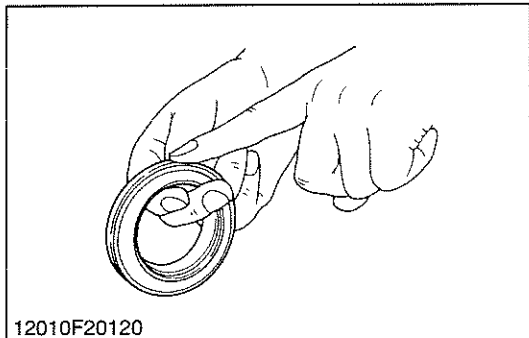


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### Checking Pressure Plate and Diaphragm

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

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**Checking Clutch Release Bearing**

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

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# MECHANISM

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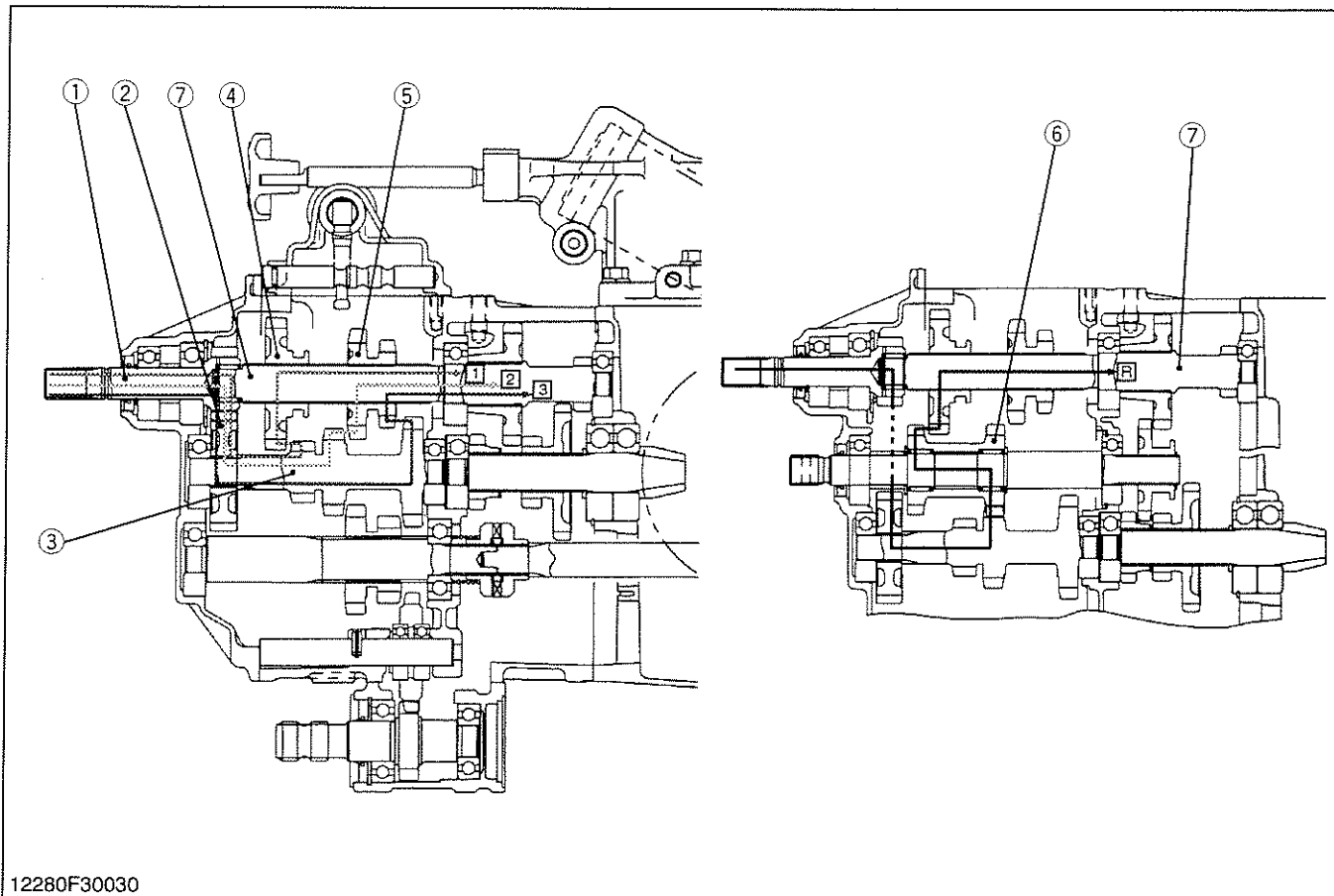
### [3] POWER TRAIN

The transmission consists of a series of gears shown previously. It offers the most suitable speed for travelling and operation by combination of these gears.

It transmits power to the front or rear axles and the PTO shaft, which are classified respectively as the travelling system and PTO system.

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#### (1) Main Gear Shift Section



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(1) 1st Gear Shaft with 15T Gear (2) 27T Gear  
(3) 2nd Gear Shaft with 11T-13T-18T Gear

(4) 26T Shifter Gear  
(5) 17T-13T Shifter Gear

(6) 15T-17T Idle Gear  
(7) 4th Gear Shaft

Besides neutral, four kinds of power flow (from clutch shaft to 4th shaft) are available by operating the main gear shift lever to shift positions on the 26T shifter gear (4) and 17T-13T shifter gear (5) on the 4th gear shaft (7).

#### ■ 1st Position

1st Gear Shaft with 15T Gear (1) → 27T Gear (2) → 2nd Gear Shaft with 11T Gear (3) → 26T Shifter Gear (4) → 4th Gear Shaft (7)

#### ■ 2nd Position

1st Gear Shaft with 15T Gear (1) → 27T Gear (2) →

2nd Gear Shaft with 13T Gear (3) → 17T-(13T) Shifter Gear (5) → 4th Gear Shaft (7)

#### ■ 3rd Position

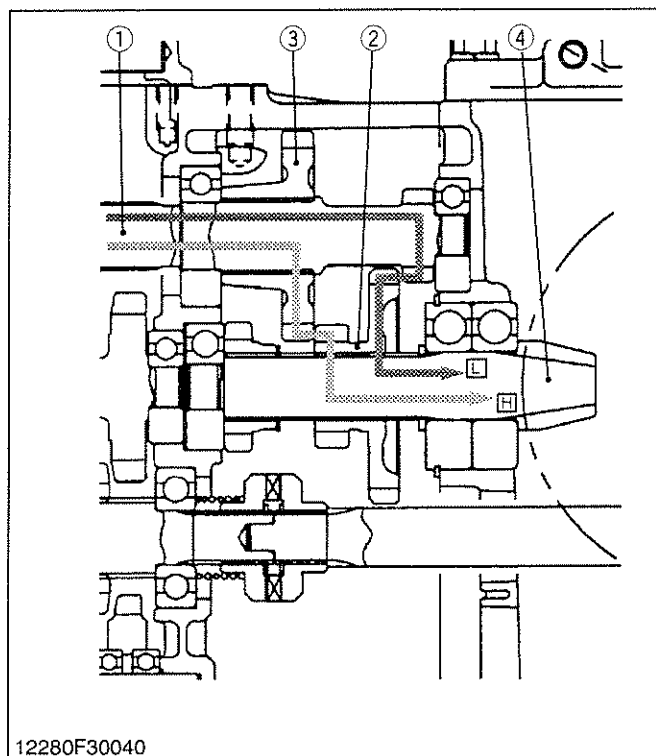
1st Gear Shaft with 15T Gear (1) → 27T Gear (2) → 2nd Gear Shaft with 18T Gear (3) → (17T)-13T Shifter Gear (5) → 4th Gear Shaft (7)

#### ■ Reverse Position

1st Gear Shaft with 15T Gear (1) → 27T Gear (2) → 2nd Gear Shaft with 13T Gear (3) → 15T-17T Idle Gear (6) → 26T Shifter Gear (4) → 4th Gear Shaft (7).

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## (2) Hi-Lo Gear Shift Section



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Two kinds of power flow (from 4th shaft to spiral bevel pinion shaft) are available by operating the high-low gear shift lever to shift the gear (2) on the spiral bevel pinion shaft (4).

### ■ Low Position

4th Gear Shaft with 11T Gear (1) → (12T)-32T Shifter Gear (2) → Spiral Bevel Pinion Shaft (4)

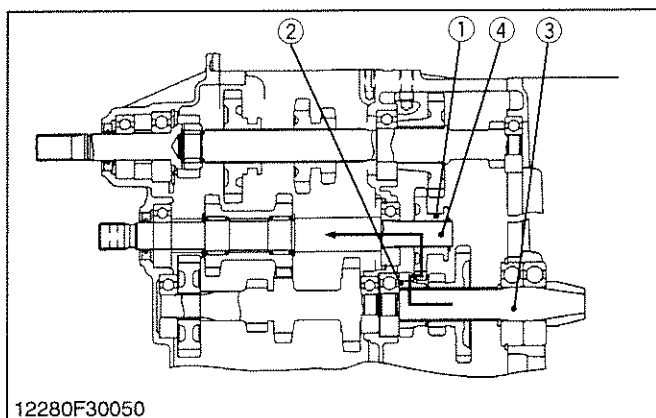
### ■ High Position

4th Gear Shaft with 11T Gear (1) → 23T Gear (3) → 12T-(32T) Shifter Gear (2) → Spiral Bevel Pinion Shaft (4)

- |                                  |                               |
|----------------------------------|-------------------------------|
| (1) 4th Gear Shaft with 11T Gear | (3) 23T Gear                  |
| (2) 12T-32T Shifter Gear         | (4) Spiral Bevel Pinion Shaft |

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## (3) Front Wheel Drive Section



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2-wheel drive or 4-wheel drive is selected by changing the position of 20T shift gear (1) with the front wheel drive lever. When the front wheel drive lever is set to "Disengaged", the 20T shift gear (1) is neutral and power is not transmitted to the front wheel drive shaft (4).

When the front wheel drive lever is set to "Engaged", the 20T shift gear (1) slides to the right to engage with 13T gear (2) on the spiral bevel pinion shaft (3). Therefore, the front drive shaft is actuated to drive the front wheels.

- |                    |                               |
|--------------------|-------------------------------|
| (1) 20T Shift Gear | (3) Spiral Bevel Pinion Shaft |
| (2) 13T Gear       | (4) Front Wheel Drive Shaft   |

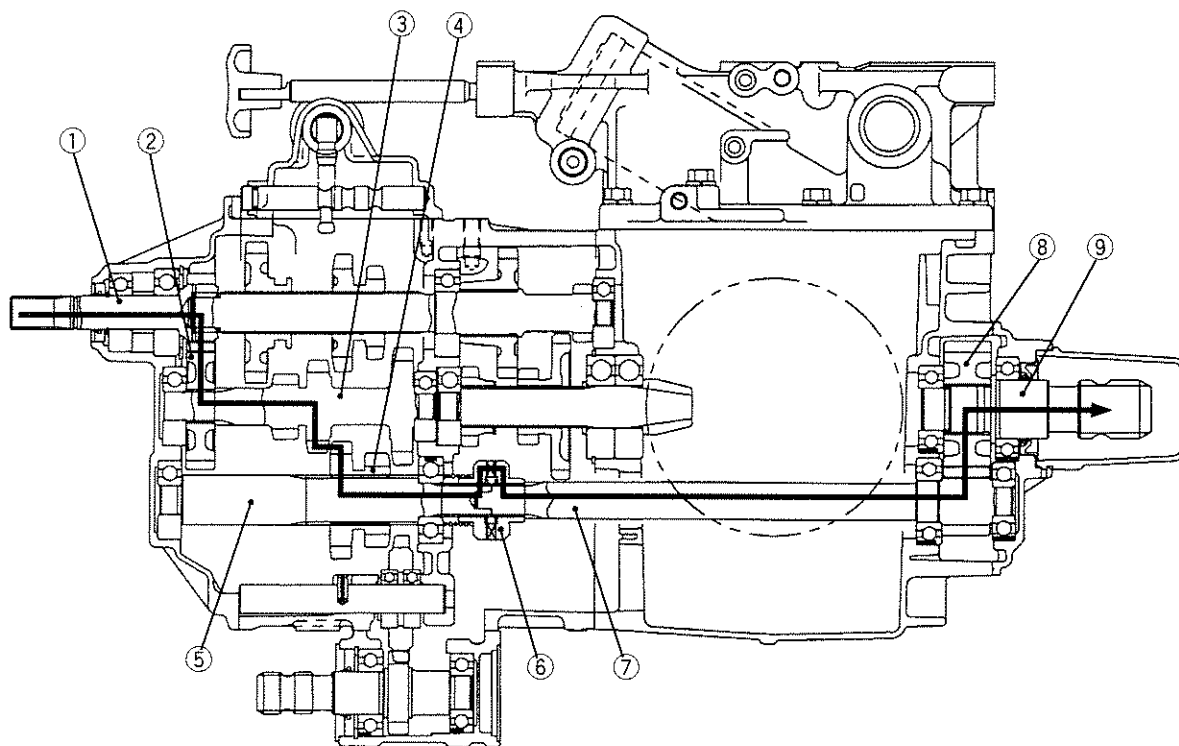
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## [4] PTO SYSTEM

### (1) Rear PTO Shift Section

Besides neutral, one kind of power flow are available 13T shifter gear (4) for rear PTO.  
by operating the PTO shift lever to shift positions of 17T-

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- |                                  |  |                                  |                    |
|----------------------------------|--|----------------------------------|--------------------|
| (1) 1st Gear Shaft with 15T Gear | (3) 2nd Gear Shaft with 11T-13T-18T Gear | (5) 3rd Shaft                    | (8) 24T Gear       |
| (2) 27T Gear                     | (4) 17T-13T Shifter Gear                 | (6) One-way Clutch               | (9) Rear PTO Shaft |
|                                  |  | (7) 5th Gear Shaft with 11T Gear |                    |

#### ■ PTO Gear Shift Lever in Rear PTO ON Position

1st Gear Shaft with 15T Gear (1) → 27T Gear (2) →  
2nd Gear Shaft with 13T Gear (3) → 17T-(13T) Shifter

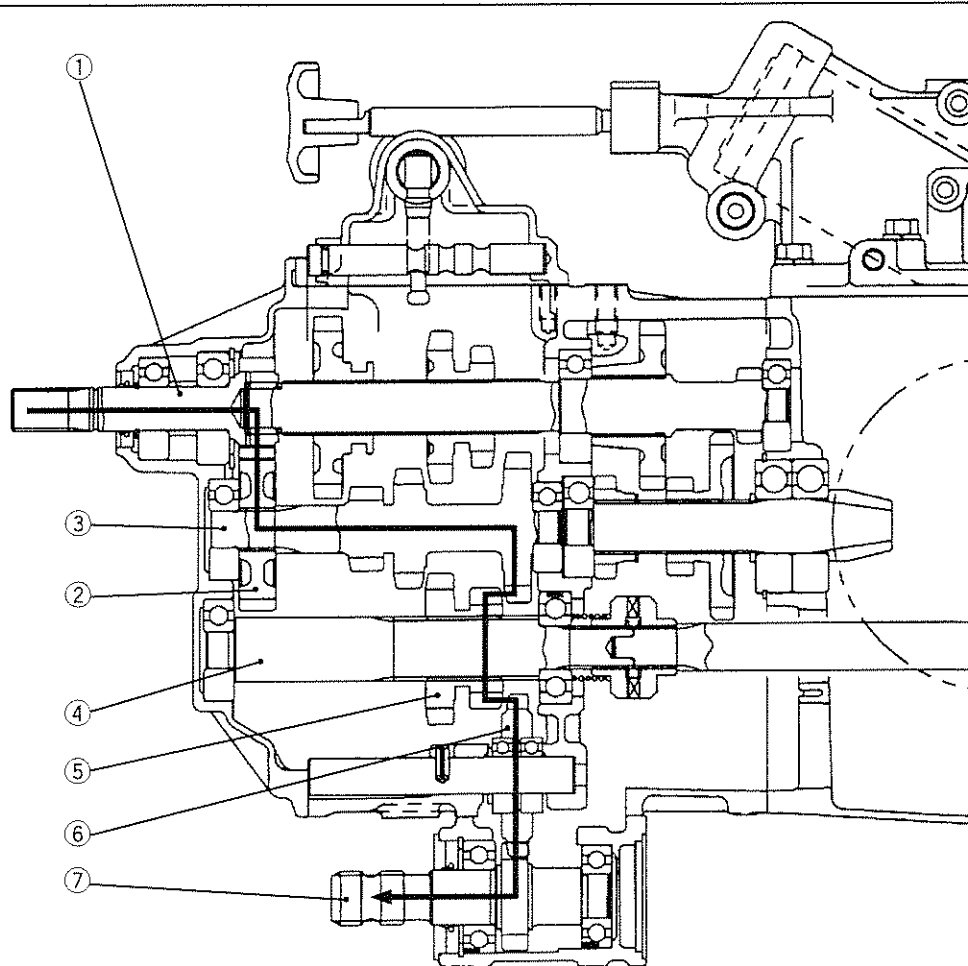
Gear (4) → 3rd Shaft (5) → One-way Clutch (6) → 5th  
Gear Shaft with 11T Gear (7) → 24T Gear (8) → Rear  
PTO Shaft (9)

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**(2) Mid-PTO Shift Section (If equipped)**

Besides neutral, one kind of power flow are available 13T shifter gear (5) for mid-PTO.  
by operating the PTO shift lever to shift positions of 17T-

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- |                                  |  |                          |                                 |
|----------------------------------|--|--------------------------|---------------------------------|
| (1) 1st Gear Shaft with 15T Gear | (3) 2nd Gear Shaft with 11T-13T-18T Gear | (4) 3rd Shaft            | (6) 19T Gear                    |
| (2) 27T Gear                     |  | (5) 17T-13T Shifter Gear | (7) Mid-PTO Shaft with 11T Gear |

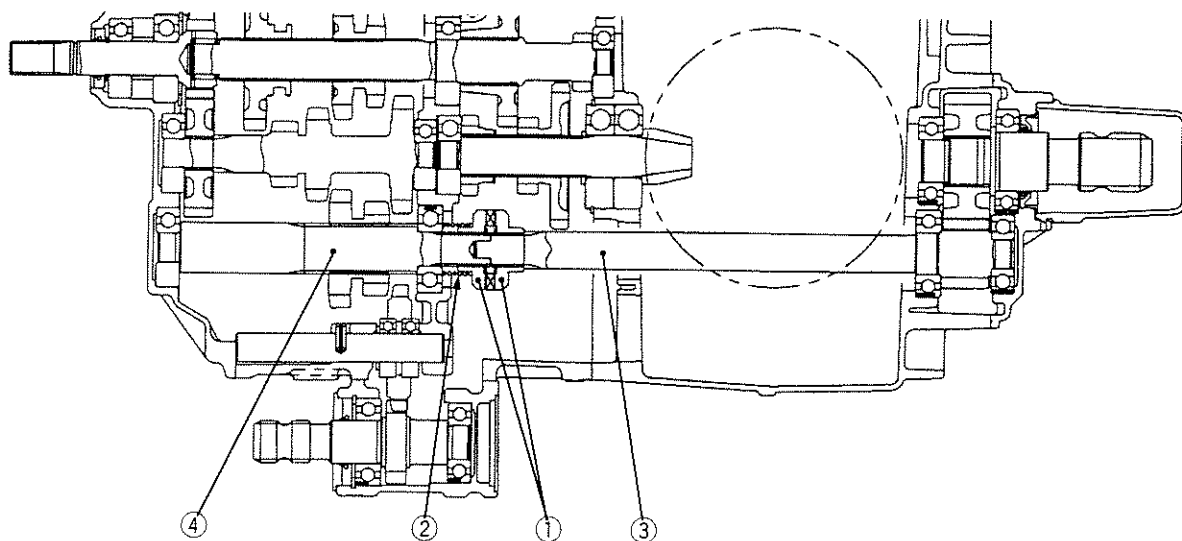
**■ PTO Gear Shift Lever in Mid-PTO ON Position**

1st Gear Shaft with 15T Gear (1) → 27T Gear (2) →  
2nd Gear Shaft with 18T Gear (3) → (17T)-13T Shifter

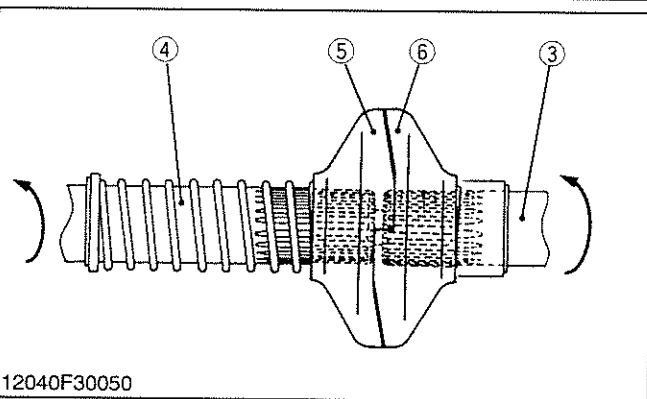
Gear (5) → 19T Gear (6) → Mid-PTO Shaft with 11T Gear (7)

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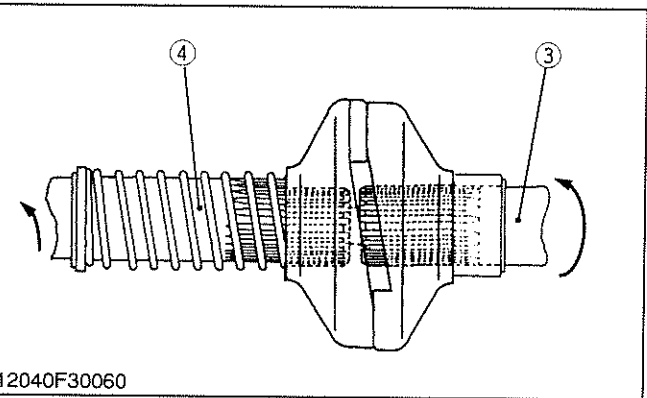
### (3) One-way Clutch Cam Section



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The one-way clutch cam is also called an overrunning clutch. It is composed of a pair of clutch cams (5), (6) and a cam spring (2). One of the clutch cam is splined to the shaft (4), and the other is splined to the shaft (3).

These two clutch cam (1) is engaged with each other by the force of the cam spring. As long as the shaft (4) is rotating faster than the shaft (3) these two clutch cams (5), (6) will remain engaged, and the shaft (3) is driven.

But, if the PTO shaft drives a rotary mower as an implement, for example, and the source of power is stopped by pressing the clutch pedal, or if the engine speed is lowered, the clutch cam (5) will overrun as shown in the figure. This overrunning is caused by the inertia of the mower blades. Then, engagement will not take place until the shaft (4) is running faster than the shaft (3).

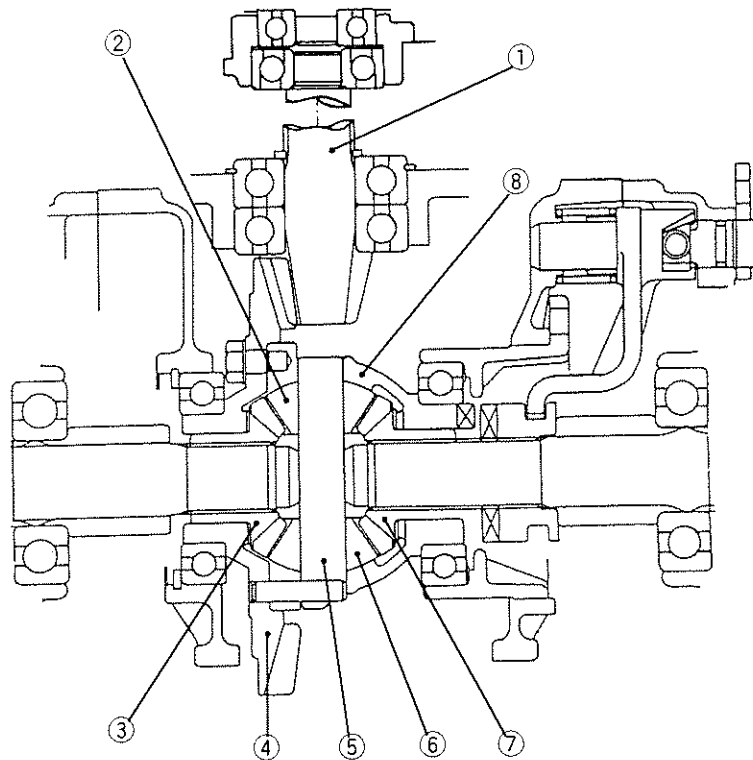
In this way, the one-way clutch cam protects the transmission and engine power train against damage, by allowing the PTO shaft and the shaft (3) to overrun if PTO shaft overspeeds.

- |                                  |               |
|----------------------------------|---------------|
| (1) Clutch Cam                   | (4) 3rd Shaft |
| (2) Clutch Cam Spring            | (5) Slant Cam |
| (3) 5th Gear Shaft with 11T Gear | (6) Slant Cam |

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## [5] DIFFERENTIAL GEAR SYSTEM

### (1) Differential Function



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

#### 1. During Straight Running

Rotation of the spiral bevel pinion (1) is transmitted to the spiral bevel gear (4) and differential case (8).

When road resistance to the right and left wheels are equal, differential pinions (2), (6) and differential side gears (3), (7) 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.

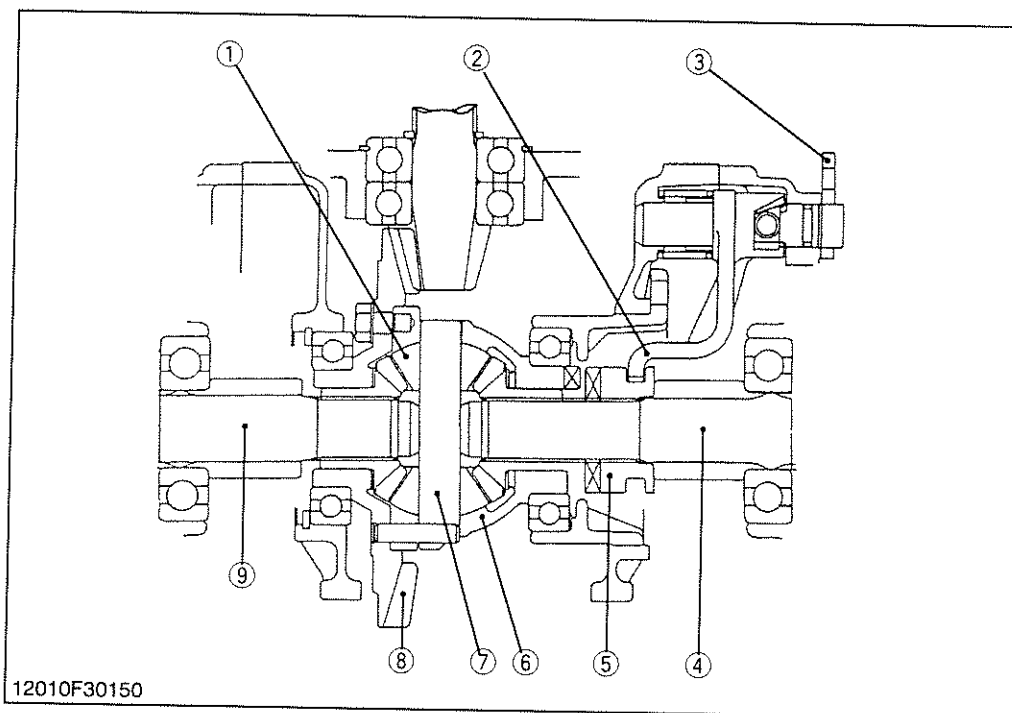
At this time, differential pinions (2), (6) do not rotate around the differential pinion shaft (5).

#### 2. During Turning

When the tractor turns, the road resistance to the inside tire increases (as if braking is applied to that side only). In other words, if one of tires slows down, revolution difference is generated in the differential side gears (3), (7). When rotation of one differential side gear becomes lower than the other, differential pinions (2), (6) begin rotating around differential pinion shaft (5). The other differential side gear is increased in speed by the speed increment of differential pinion shaft (5). 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 (4). When spiral bevel gear revolution is 100 rpm, and if one of the differential side gears stops moving, the revolution of the other differential side gear becomes 200 rpm and if one rotates at 50 rpm, the other rotates at 150 rpm.

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**(2) Differential Lock**

- (1) Differential Pinions
- (2) Shift Fork
- (3) Differential Lock Levere
- (4) Differential Gear Shaft
- (5) Differential Lock Clutch
- (6) Differential Case
- (7) Differential Pinion Shaft
- (8) Spiral Bevel Gear
- (9) Differential Gear Shaft

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 lever (3) to rotate, which will move the shift fork (2) and the differential lock clutch (5)

toward the spiral bevel gear (8). The differential lock clutch (5) engaged with the teeth of the differential case (6) to cause the differential case (6) and the differential lock clutch (5) to rotate as a unit.

Therefore, differential pinions (1) are unable to rotate around differential pinion shaft (7) and identical revolutions are transmitted to the right and left differential gear shaft (4), (9).

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1

2

3



# SERVICING

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# TROUBLESHOOTING

## CLUTCH HOUSING

Symptom	Probable Cause	Solution	Reference Page
Noise from Clutch Housing	<ul style="list-style-type: none"> <li>• Bearing worn</li> </ul>	Replace	3-S7

## TRANSMISSION CASE SECTION

Noise from Transmission	<ul style="list-style-type: none"> <li>• Transmission oil insufficient</li> <li>• Gear worn or broken</li> <li>• Improper backlash between spiral bevel pinion and bevel gear</li> <li>• Improper backlash between differential pinion and differential side gear</li> <li>• Bearings worn</li> </ul>	Refill Replace Adjust Adjust Replace	3-S4 — 3-S19 3-S18 —
Gear Slip out of Mesh	<ul style="list-style-type: none"> <li>• Shift fork spring tension insufficient</li> <li>• Shift fork or shifter worn</li> <li>• Shift fork bent</li> </ul>	Replace Replace Replace	3-S13, S14 3-S13, S14 3-S13, S14

## DIFFERENTIAL CASE SECTION

Excessive or Unusual Noise At All Time	<ul style="list-style-type: none"> <li>• Improper backlash between spiral bevel pinion and bevel gear</li> <li>• Improper backlash between differential pinion and differential side gear</li> <li>• Bearing worn</li> <li>• Insufficient or improper type of transmission fluid used</li> </ul>	Adjust Adjust Replace Replenish or Replace	3-S19 3-S18 — G-9
Noise while Turning	<ul style="list-style-type: none"> <li>• Differential pinions or differential side gears worn or damaged</li> <li>• Bearings worn</li> </ul>	Replace Replace	3-S15 —
Differential Lock Can Not Be Set	<ul style="list-style-type: none"> <li>• Differential lock shift fork damaged</li> <li>• Differential lock shifter mounting pin damaged</li> <li>• Differential lock clutch damaged</li> </ul>	Replace Replace Replace	3-S11 3-S11 3-S11
Differential Lock Pedal Does Not Return	<ul style="list-style-type: none"> <li>• Differential lock pedal return spring weaken or damaged</li> <li>• Differential lock fork shaft rusted</li> </ul>	Replace Repair	3-S9 3-S11

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# SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Gears	Backlash	0.10 to 0.20 mm 0.004 to 0.008 in.	0.4 mm 0.016 in.
Gear to Spline	Clearance	0.03 to 0.08 mm 0.0012 to 0.0031 in.	0.20 mm 0.0079 in.
Shift Fork to Shift Gear Groove	Clearance	0.10 to 0.35 mm 0.004 to 0.014 in.	0.50 mm 0.020 in.
Gear to Shaft	Clearance	0.007 to 0.046 mm 0.0003 to 0.0018 in.	0.10 mm 0.0039 in.
Ring Gear to Spiral Bevel Pinion Shaft	Backlash	0.10 to 0.20 mm 0.004 to 0.008 in.	0.4 mm 0.016 in.
Adjusting Shim	Thickness	0.2 mm (0.008 in.) 0.5 mm (0.020 in.)	—
Differential Pinion to Differential Side Gear	Backlash	0.10 to 0.30 mm 0.004 to 0.012 in.	0.4 mm 0.016 in.
Adjusting Shim	Thickness	0.8 mm (0.0315 in.) 1.0 mm (0.0394 in.) 1.2 mm (0.0472 in.)	—
Differential Case to Differential Side Gear	Clearance	0.025 to 0.066 mm 0.0010 to 0.0026 in.	0.30 mm 0.0118 in.
Differential Case	I.D.	32.000 to 32.025 mm 1.2598 to 1.2608 in.	—
Spiral Bevel Gear	I.D.	32.000 to 32.025 mm 1.2598 to 1.2608 in.	—
Differential Side Gear	O.D.	31.959 to 31.975 mm 1.2582 to 1.2589 in.	—
Differential Pinion Shaft to Differential Pinion	Clearance	0.016 to 0.045 mm 0.0006 to 0.0018 in.	0.30 mm 0.0118 in.
Differential Pinion Shaft	O.D.	15.973 to 15.984 mm 0.6289 to 0.6293 in.	—
Differential Pinion	I.D.	16.000 to 16.018 mm 0.6299 to 0.6306 in.	—

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## TIGHTENING TORQUES

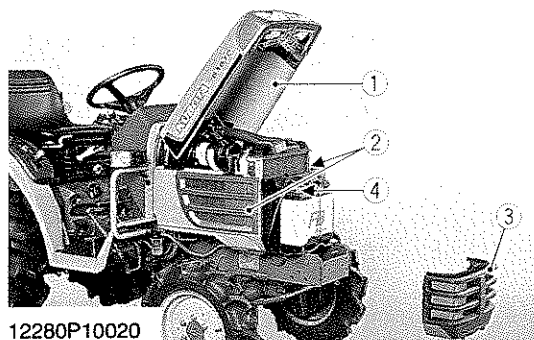
Tightening torques of screws, bolts and nuts on the table below are especially specified.  
(For general use screws, bolts and nuts : See page G-10.)

Item	N·m	kgf·m	ft-lbs
Steering wheel mounting nut	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Pitman arm mounting nut	98.0 to 118.0	10.0 to 12.0	72.3 to 87.0
Steering assembly mounting screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Clutch housing mounting screw to engine			
M8 screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Center frame mounting screw and nut to transmission case	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5
Main shift cover mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Mission case front cover mounting screw and nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Connecting plate mounting screw and nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Transmission case to differential case mounting screw and nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Top link bracket mounting screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Hydraulic cylinder to differential case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Mid-PTO case to transmission case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Rear PTO cover mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Rear axle case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Differential bearing holder mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Spiral bevel gear mounting screw	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
3-Point hitch shaft setting screw	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
3-point hitch shaft setting screw lock nut	43.0 to 47.0	4.4 to 4.8	31.7 to 35.4
Drawbar frame mounting screw	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5
Cotter setting bolt and nut	123 to 147	12.6 to 15.0	91 to 108
Joint bolt for delivery pipe of 3-point hitch	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4

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# DISASSEMBLING AND ASSEMBLING

## [1] SEPARATING ENGINE FROM CLUTCH HOUSING



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### Hood, Side Cover and Battery Cord

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

### NOTE

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

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

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### Steering Wheel

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

### (When reassembling)

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs
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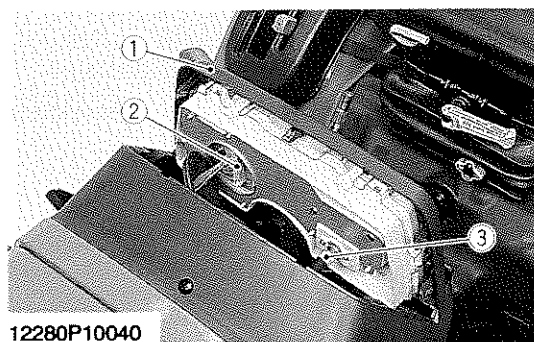


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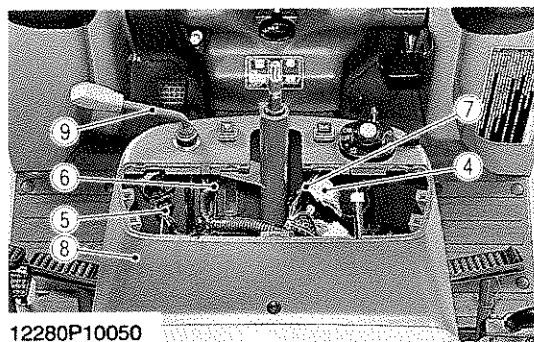
### Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Disconnect the combination switch connector (4), main switch connector (5), hazard switch connector (6) and parking light switch connector (7).
3. Tap out the spring pin and remove the hand accelerator lever (9).
4. Remove the panel under cover (8).

- |                                  |                                    |
|----------------------------------|------------------------------------|
| (1) Meter Panel                  | (6) Hazard Switch Connector        |
| (2) Meter Panel Connector        | (7) Parking Light Switch Connector |
| (3) Hour-meter Cable             | (8) Panel Under Cover              |
| (4) Combination Switch Connector | (9) Hand Accelerator Lever         |
| (5) Main Switch Connector        |                                    |

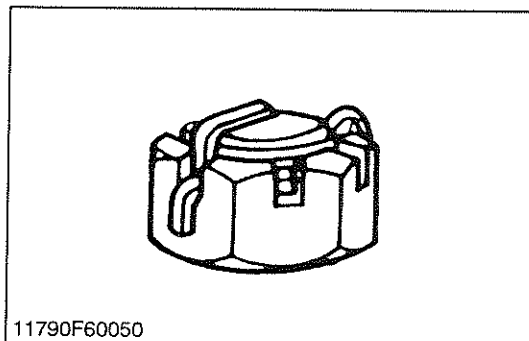
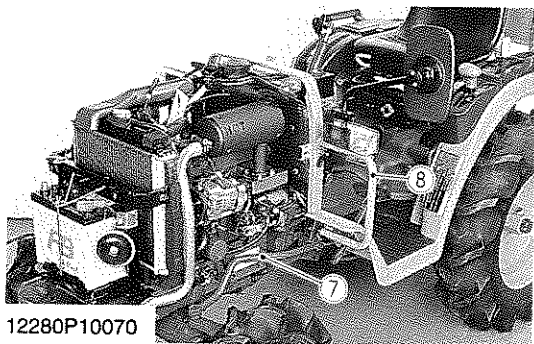
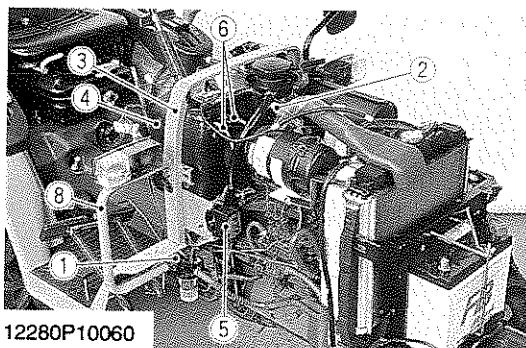


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### Fuel Tank and Drag Link

1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the fuel tank frame stay (2).
3. Disconnect the hazard unit, starter relay and remove the lead wire for fuel gauge.
4. Remove the fuse box (5).
5. Disconnect the overflow hoses (6) of fuel line.
6. Remove the front lamp stay (8).
7. Remove the tank frame (3) with fuel tank (4).
8. Remove the cotter pin and loosen the slotted nut.
9. Disconnect the drag link (7) with a pitman arm puller from the knuckle arm.

(When reassembling)

#### ■ IMPORTANT

- Do not loosen the slotted nut to align the hole.
- Install the cotter pin as shown in the figure

(Reference)

Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13 to 25.3 ft·lbs
-------------------	-------------	---

- |                          |                     |
|--------------------------|---------------------|
| (1) Fuel Hose            | (5) Fuse Box        |
| (2) Fuel Tank Frame Stay | (6) Overflow Hose   |
| (3) Fuel Tank Frame      | (7) Drag Link       |
| (4) Fuel Tank            | (8) Front Lamp Stay |

12280S10140

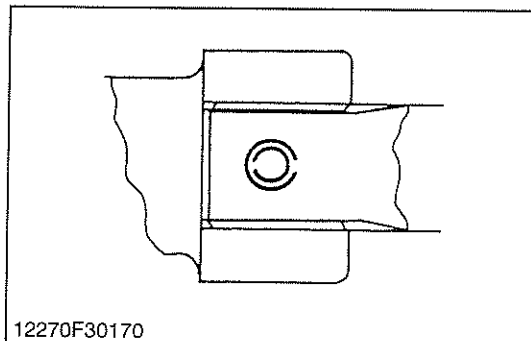
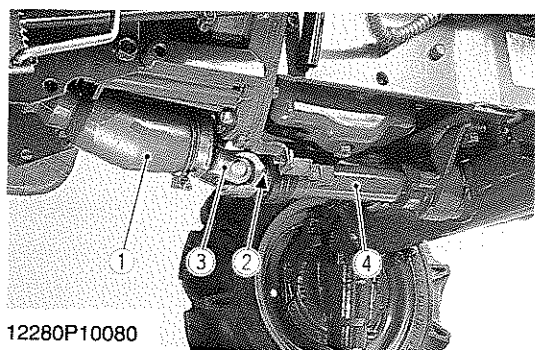
### Universal Joint and Propeller Shaft Cover

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

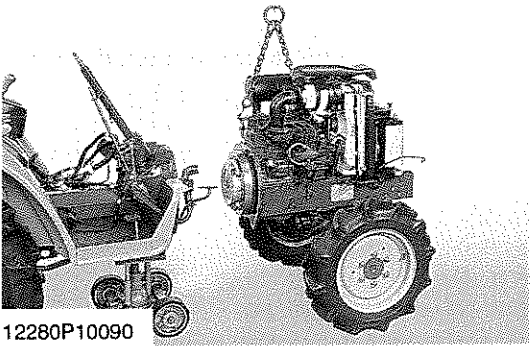
(When reassembling)

- 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 Cover | (3) Universal Joint       |
| (2) Spring Pin            | (4) Propeller Shaft Cover |



12280S10150



**Separating the Engine from Clutch Housing**

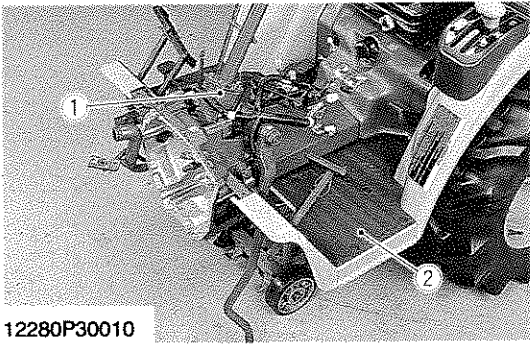
1. Loosen the clamp, then disconnect the three point hitch delivery pipe and suction hose.
2. Disconnect the glow plug lead wire and thermo sensor lead wire. And then disconnect the connector for dynamo and starter motor lead wire.
3. Place the jack under the center frame.
4. Hoist the engine by the chain at the engine hook.
5. Remove the engine mounting screws and separate the engine from the clutch housing.

**(When reassembling)**

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

Tightening torque	Engine mounting M8 screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft·lbs
-------------------	--------------------------	---

12280S10160



**Separating Clutch Housing**

1. Remove the steering gear box assembly (1).
2. Remove the step LH (2).
3. Remove the step bracket RH (3).
4. Disconnect the clutch pedal rod.
5. Separate the clutch housing from center frame.

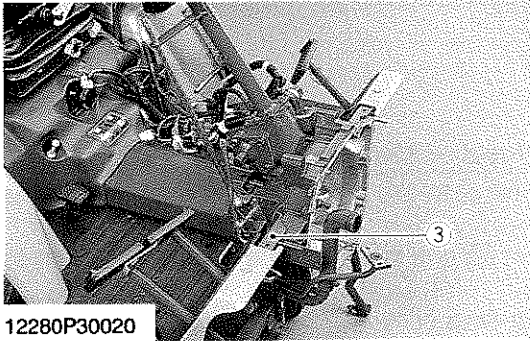
**(When reassembling)**

- Apply grease to the spline of clutch shaft and coupling.

Tightening torque	Clutch housing mounting screw and nut	62.8 to 77.6 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft·lbs
	Steering gear box mounting screw and nut	62.8 to 77.6 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft·lbs

- (1) Steering Gear Box Assembly  
(2) Step LH

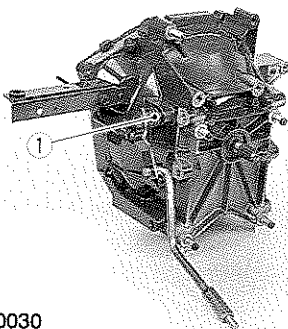
- (3) Step Bracket RH



12280S30050



## [2] DISASSEMBLING CLUTCH HOUSING

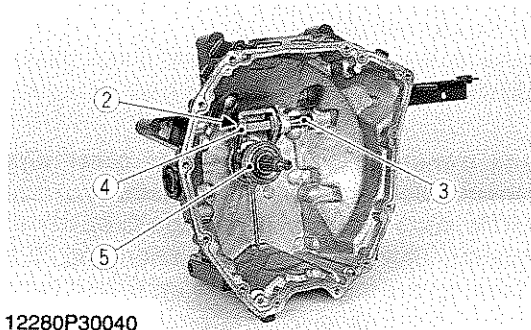


12280P30030

### Clutch Rod and Release Fork

1. Remove the clutch rod return spring (1).
2. Remove the external snap ring (2).
3. Draw out the clutch rod (3) and remove the clutch release fork (4).
4. Take out the release hub with release bearing (5).

- |                        |                         |
|------------------------|-------------------------|
| (1) Return Spring      | (4) Clutch Release Fork |
| (2) External Snap Ring | (5) Release Bearing     |
| (3) Clutch Rod         |                         |



12280P30040

12280S30060

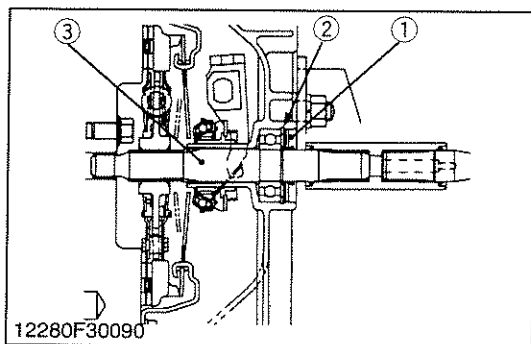
### Clutch Shaft

1. Remove the oil seal (1).
2. Remove the internal snap ring (2).
3. Pull out the clutch shaft assembly (3).

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

- Apply small amount of the grease to the oil seal (1).

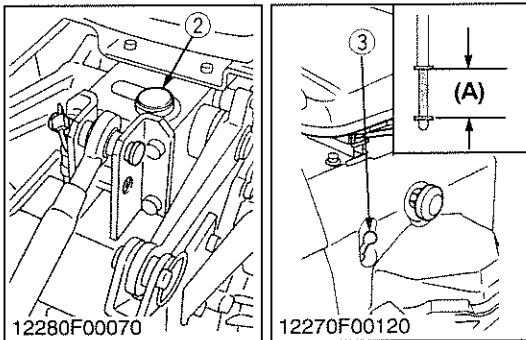
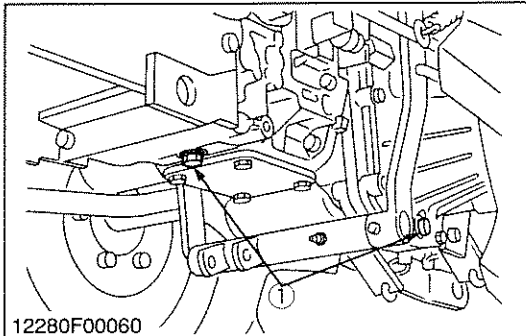
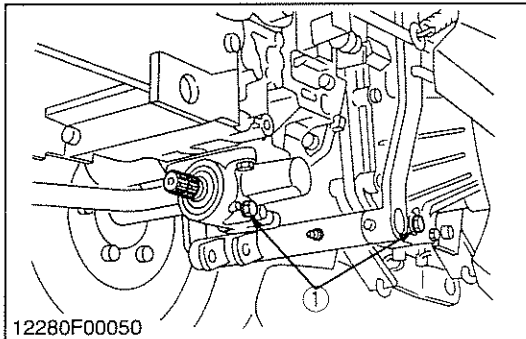
- |                        |                           |
|------------------------|---------------------------|
| (1) Oil Seal           | (3) Clutch Shaft Assembly |
| (2) Internal Snap Ring |                           |



12280F30090

12280S30070

### [3] SEPARATING CENTER FRAME AND TRANSMISSION CASE



12270F00120

#### 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 rear axle case and oil tank.
3. Drain the transmission fluid and reinstall the drain plugs.

##### (When refilling)

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

##### IMPORTANT

- Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS AND FLUID" (See page G-9).
- 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	10.5 L 2.77 U.S.gals. 2.31 Imp.gals.
-----------------------------	--

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

(A) Oil level is acceptable within this range

12280S30040

#### Battery Connector

1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).

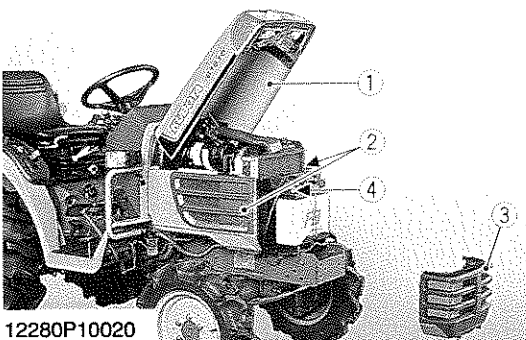
##### NOTE

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

- (1) Hood
- (2) Side Cover

- (3) Front Grille
- (4) Battery Cord

12280S30080



12280P10020

#### Steering Wheel

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

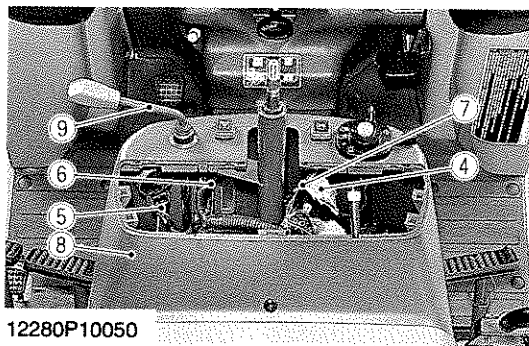
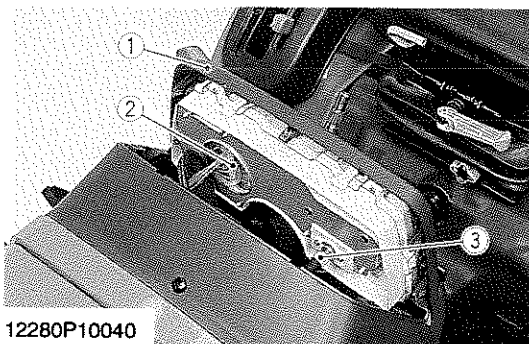
##### (When reassembling)

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft·lbs
-------------------	-----------------------------	---



12280P10030

12280S10120



### Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Disconnect the combination switch connector (4), main switch connector (5), hazard switch connector (6) and parking light switch connector (7).
3. Tap out the spring pin and remove the hand accelerator lever (9).
4. Remove the panel under cover (8).

- |                                  |                                    |
|----------------------------------|------------------------------------|
| (1) Meter Panel                  | (6) Hazard Switch Connector        |
| (2) Meter Panel Connector        | (7) Parking Light Switch Connector |
| (3) Hour-meter Cable             | (8) Panel Under Cover              |
| (4) Combination Switch Connector | (9) Hand Accelerator Lever         |
| (5) Main Switch Connector        |                                    |

12280S10130



### Seat, Tire, Step, Fender and Others

1. Place the jack under the transmission case and center frame.
2. Remove the both sides rear wheel.
3. Remove the seat and seat under cover.
4. Remove the both sides tail lamp and lamp frame.
5. Remove the main gear shift lever and hydraulic control lever.
6. Remove the each lever grip and lever guide.
7. Remove the differential lock pedal and differential lock rod.
8. Remove the both sides rubber mat and step.

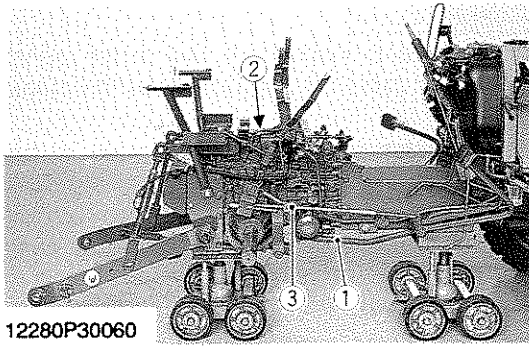
### ■ IMPORTANT

- When refitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service.

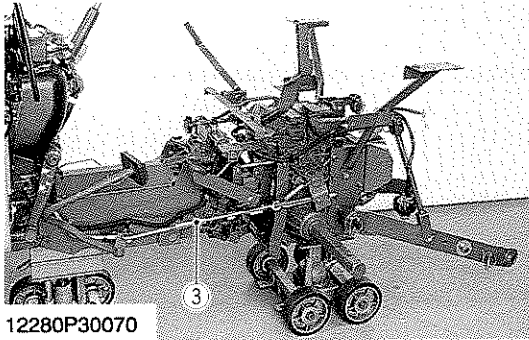
(When reassembling)

Tightening torque	Rear wheel setting cotter bolt and nut	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
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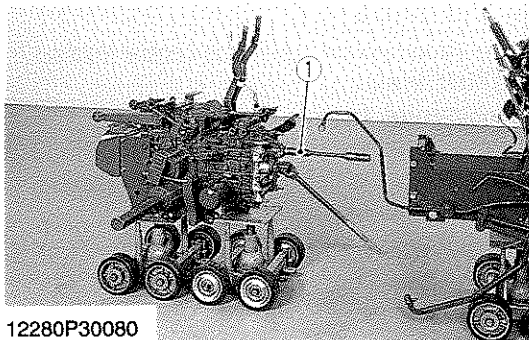
12280S30090



12280P30060



12280P30070



12280P30080

### **Suction Pipe, Delivery Pipe, Brake Rod and Others**

1. Remove the 3-point hitch shaft and lower link.
2. Remove the both sides fender stay.
3. Remove the both sides brake rod (3).
4. Remove the front wheel drive lever with front fender stay.
5. Remove the joint bolt for 3-point hitch delivery pipe (2)
6. Remove the pipe clamp and disconnect the suction pipe (1).
7. Move the wiring harness to front.

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

Tightening torque	3-Point hitch shaft setting screw	14.7 to 19.6 N·m 1.5 to 2.0 kgf·m 10.8 to 14.5 ft-lbs
	3-Point hitch shaft setting screw lock nut	43.0 to 47.0 N·m 4.4 to 4.8 kgf·m 31.7 to 35.4 ft-lbs
	Joint bolt for 3-point hitch delivery pipe	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs

- (1) Suction Pipe  
(2) Delivery Pipe

- (3) Brake Rod

12280S30100

### **Separating Transmission Case from Center Frame**

1. Separate the transmission case and center frame.
2. Remove the propeller shaft (1).

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

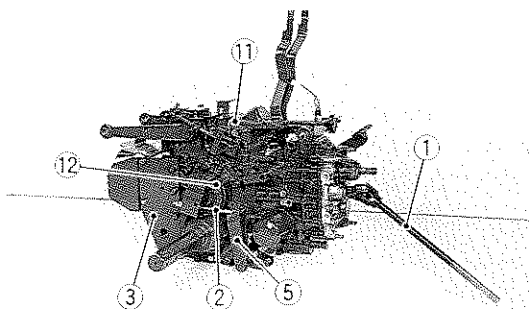
- Apply grease to the spline of propeller shaft and coupling.

Tightening torque	Transmission case mounting screw and nut	62.8 to 72.6 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft-lbs
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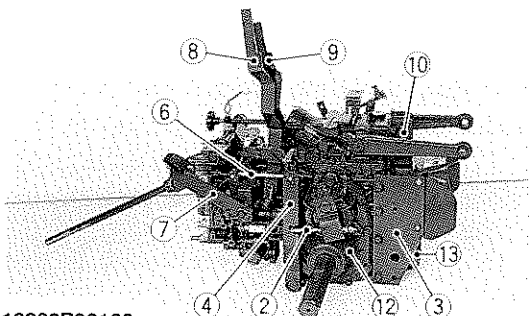
- (1) Propeller Shaft

12280S30110

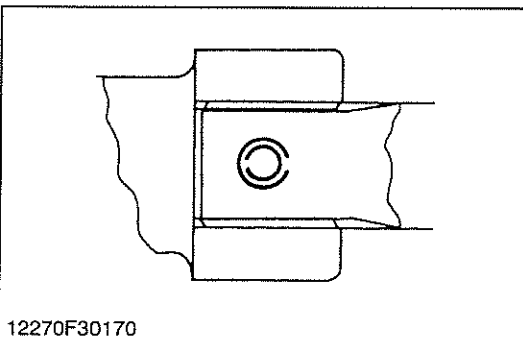
## [4] DISASSEMBLING TRANSMISSION CASE



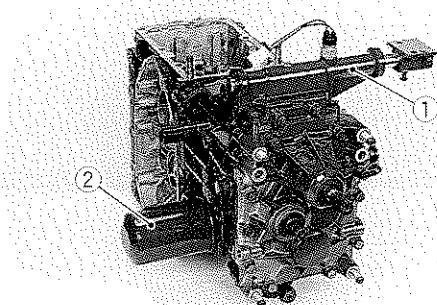
12280P30090



12280P30100



12270F30170



12280P30110

### Hydraulic Cylinder, Rear Axle Case and Others

1. Remove the front wheel drive shaft (1).
2. Remove the both sides secondary brake rod (2) (If equipped).
3. Remove the PTO shaft cover and both sides lower link stay (3).
4. Remove the secondary brake lever (4) and secondary brake shaft (5) (If equipped).
5. Remove the secondary brake pedal rod (6) (If equipped).
6. Remove the secondary brake pedal assembly (7) (If equipped).
7. Remove the range gear shift lever (8) and PTO shift lever (9) with rod.
8. Remove the top link bracket LH (10) and remove the hydraulic cylinder (11).
9. Remove the both sides rear axle case (12) and drawbar frame (13).

### (When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the differential case to hydraulic cylinder and rear axle cases.

### ■ IMPORTANT

- After reassembling the secondary brake rod (2), check and adjust the secondary brake pedal free play.

Tightening torque	Hydraulic cylinder mounting screw and nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft·lbs
	Rear axle case 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 Wheel Drive Shaft   | (8) Range Gear Shift Lever |
| (2) Secondary Brake Rod       | (9) PTO Shift Lever        |
| (3) Lower Link Stay           | (10) Top Link Bracket LH   |
| (4) Secondary Brake Lever     | (11) Hydraulic Cylinder    |
| (5) Secondary Brake Shaft     | (12) Rear Axle Case        |
| (6) Secondary Brake Pedal Rod | (13) Drawbar Frame         |
| (7) Secondary Brake Pedal     |                            |

12280S30120

### Main Shift Cover and Transmission Oil Filter

1. Remove the main shift cover (1).
2. Remove the transmission oil filter (2) (If necessary).

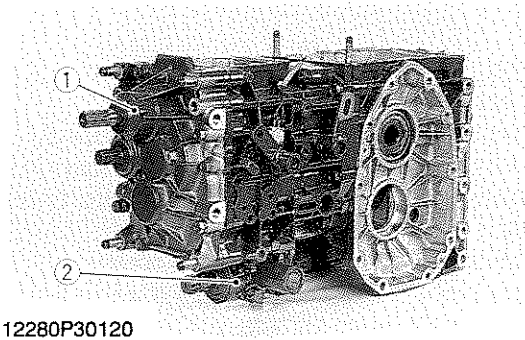
### (When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the main shift cover.

Tightening torque	Main shift cover mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft·lbs
-------------------	---------------------------------	---

- |                      |                             |
|----------------------|-----------------------------|
| (1) Main Shift Cover | (2) Transmission Oil Filter |
|----------------------|-----------------------------|

12280S30130



12280P30120

**Front Cover and Mid-PTO Case (If equipped)**

- 1. Remove the front cover (1).
- 2. Remove the mid-PTO case (2).

**(When reassembling)**

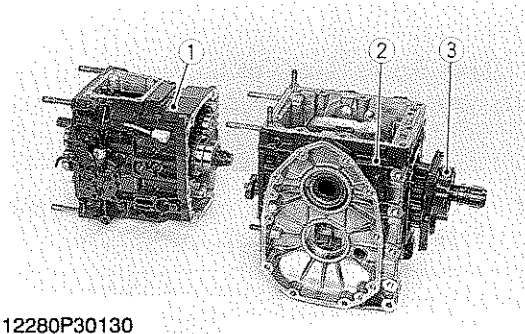
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the front cover and mid-PTO case.

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
	Mid-PTO case 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

(2) Mid-PTO Case

12280S30140



12280P30130

**Separating Transmission Case and Differential Case**

- 1. Separate the transmission case (1) and differential case (2).

**(When reassembling)**

- Remove the rear PTO cover, then assemble the transmission case and differential case first.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the transmission case and rear PTO cover (3).

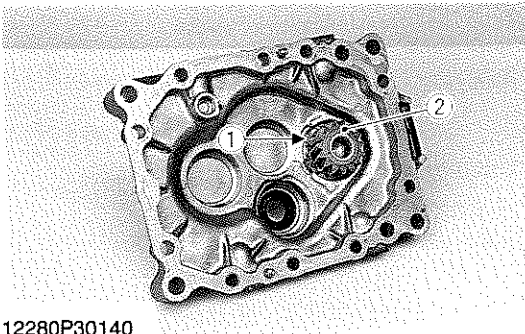
Tightening torque	Transmission case mounting screw and nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Rear PTO cover mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

(1) Transmission Case

(3) Rear PTO Cover

(2) Differential Case

12280S30150



12280P30140

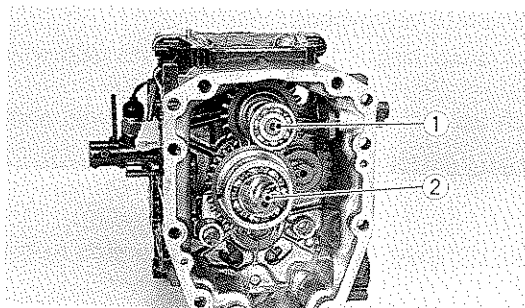
**1st Gear Shaft**

- 1. Remove the internal snap ring (1).
- 2. Remove the 1st gear shaft (2) to the rear.

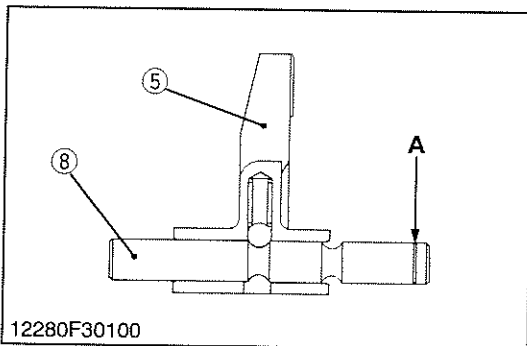
(1) Internal Snap Ring

(2) 1st Gear Shaft

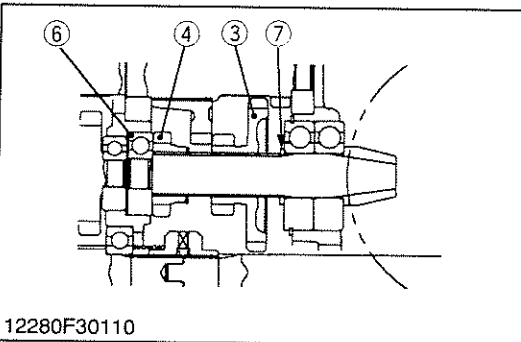
12280S30160



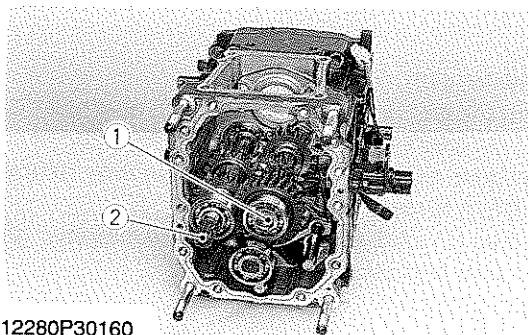
12280P30150



12280F30100



12280F30110



12280P30160

#### 4th Gear Shaft and Spiral Bevel Pinion Shaft

1. Remove the 26T shifter gear and 17T-13T shifter gear.
2. Remove the spiral bevel pinion shaft (2) with 12T-32T shifter gear (3), 13T gear (4) and shift fork (5).
3. Remove the 4th gear shaft (1) with 23T gear.

#### (When reassembling)

- When installing the spiral bevel pinion shaft, be sure to install the shims (6).

#### ■ IMPORTANT

- When disassembling the spiral bevel pinion shaft (2), be sure to replace the external snap ring (7) with new one.
- When set the shift fork (5) and fork rod (8) chamfer side of shift fork in distinction mark (A) and the opposite direction (shown in figure).

- (1) 4th Gear Shaft
- (2) Spiral Bevel Pinion Shaft
- (3) 12T-32T Shifter Gear
- (4) 13T Gear
- (5) Shift Fork
- (6) Shim
- (7) External Snap Ring
- (8) Fork Rod

A : Distinction Mark

12280S30170

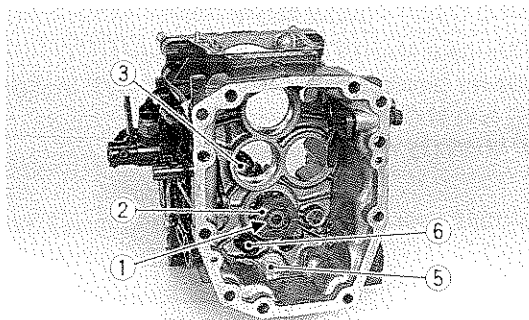
#### Front Wheel Drive Shaft and 2nd Gear Shaft

1. Remove the external snap ring on the front wheel drive shaft (2).
2. Remove the front wheel drive shaft (2) with 17T-13T gear to the front.
3. Remove the 2nd gear shaft (1).

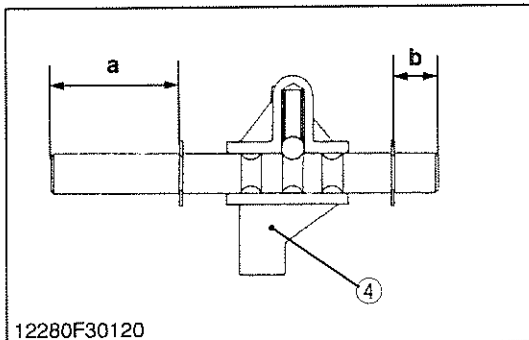
(1) 2nd Gear Shaft

(2) Front Wheel Drive Shaft

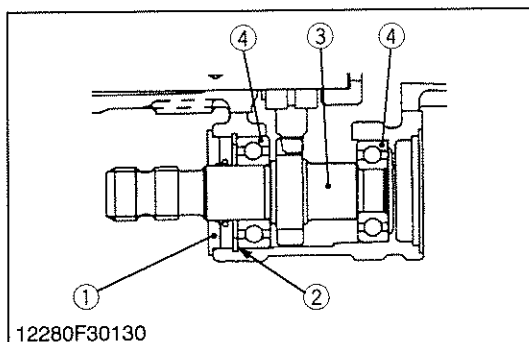
12280S30180



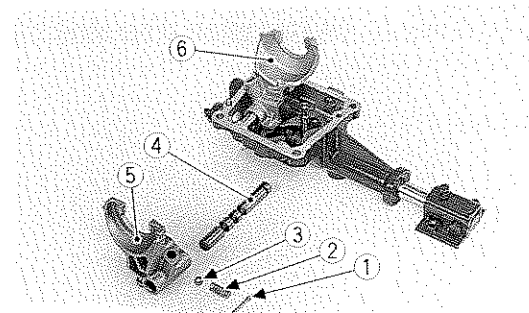
12280P30170



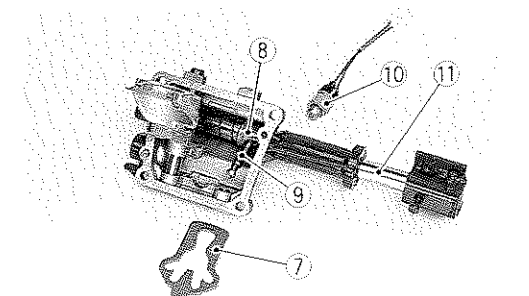
12280F30120



12280F30130



12280P30180



12280P30190

### 3rd Shaft and Middle Shaft (If equipped)

1. Remove the external snap ring (1) and remove the one-way clutch cam (2).
2. Remove the 3rd shaft assembly (3) and shift fork (4) with shift rod.
3. Remove the middle shaft (5) and 19T gear with bearing.

#### (When reassembling)

- When assembling the 19T gear (6), face the chamfer side to the rear.

- (1) External Snap Ring
- (2) One-way Clutch Cam
- (3) 3rd Shaft Assembly
- (4) Shift Fork
- (5) Middle Shaft
- (6) 19T Gear

a : Front  
b : Rear

12280S30190

### Mid-PTO Shaft (If equipped)

1. Remove the oil seal (1) and internal snap ring (2).
2. Remove the mid-PTO shaft (3) with bearings (4).

#### (When reassembling)

- Apply grease to lip and outer of oil seal.

- (1) Oil Seal
- (2) Internal Snap Ring
- (3) Mid-PTO Shaft
- (4) Bearing

12280S30200

### Main Gear Shift Fork

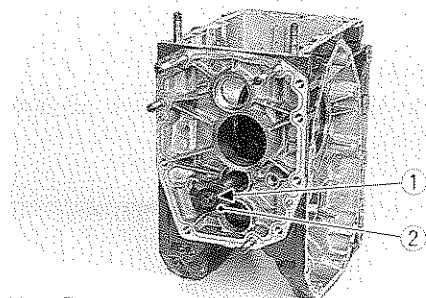
1. Remove the safety switch (10).
2. Remove the cotter pin (1) and remove the spring (2) and ball (3).
3. Remove the shift rod (4) and 1st-reverse gear shift fork (5).
4. Remove the 2nd-3rd gear shift fork (6), in the same way as the 1st-reverse gear shift fork removing procedure.
5. Remove the interlocker (7) and slide the shift arm stopper (8) and then remove the shift arm (9).
6. Remove the shift shaft (11).

- (1) Cotter Pin
- (2) Spring
- (3) Ball
- (4) Shift Rod
- (5) 1st-Reverse Gear Shift Fork
- (6) 2nd-3rd Gear Shift Fork
- (7) Interlocker
- (8) Shift Arm Stopper
- (9) Shift Arm
- (10) Safety Switch
- (11) Shift Shaft

12280S30210



## [5] DISASSEMBLING DIFFERENTIAL GEAR CASE



12280P30200

### 5th Gear Shaft and Rear PTO Shaft

1. Remove the external snap ring (1) and one-way clutch cam (2).
2. Remove the rear PTO cover assembly.

#### (When reassembling)

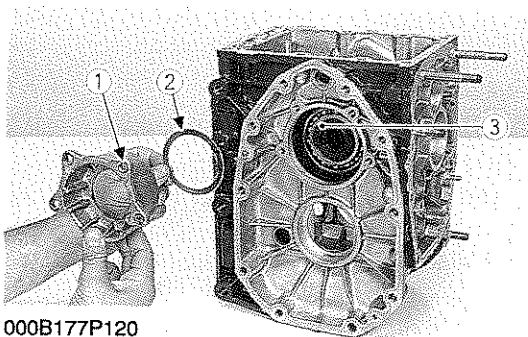
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of differential gear case and rear PTO cover.

Tightening torque	Rear PTO 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) External Snap Ring

(2) One-way Clutch Cam

12280S30220



000B177P120

### Differential Gear Assembly

1. Remove the bearing holder mounting screws and remove the bearing holder (1).
2. Take out the differential gear assembly (3).

#### (When reassembling)

- Install the differential gear assembly, noting the number of shims (2) in the differential case left side and bearing holder side.

Tightening torque	Differential gears bearing holder mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
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(1) Bearing Holder

(3) Differential Gear Assembly

(2) Adjusting Shim

12280S30230

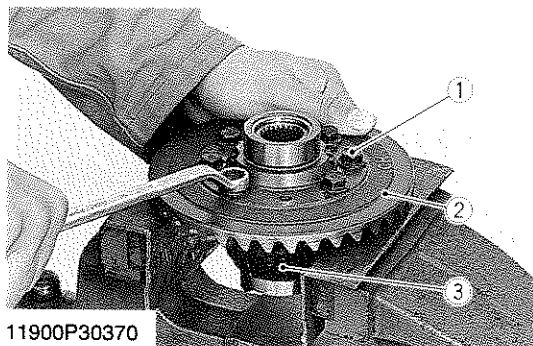


11900P30360

### Bearings

1. Remove the right and left bearings from the differential case.

11900S30490



11900P30370

### Spiral Bevel Gear

1. Remove the spiral bevel gear UBS screws (1).
2. Remove the spiral bevel gear (2) from differential case (3).

#### (When reassembling)

- Apply liquid lock (Three Bond 1324B or its equivalent) to the spiral bevel gear UBS screws.

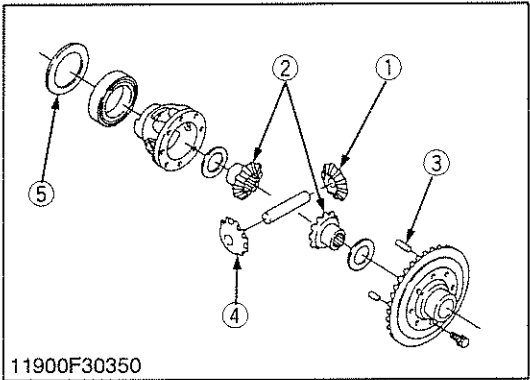
Tightening torque	Spiral bevel gear UBS screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs
-------------------	-----------------------------	---

(1) Spiral Bevel Gear UBS Screw

(3) Differential Case

(2) Spiral Bevel Gear

11900S30500



**Differential Side Gear and Differential Pinion**

1. Put parting marks on the differential pinion (1) and the differential side gear (2).
2. Tap out the dowel pin (3).
3. Remove the differential pinion shaft.
4. Remove the differential pinion (4), differential side gear (2) and shim (5).

**(When reassembling)**

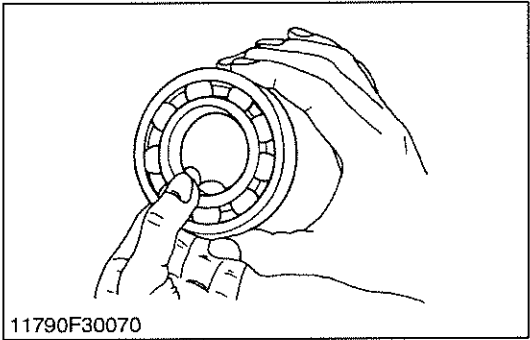
- Install the differential pinion and differential side gear, aligning the parting marks.

- |                            |                         |
|----------------------------|-------------------------|
| (1) Differential Pinion    | (4) Differential Pinion |
| (2) Differential Side Gear | (5) Shim                |
| (3) Dowel Pin              |                         |

11900S30510

**SERVICING**

**[1] CLUTCH HOUSING**

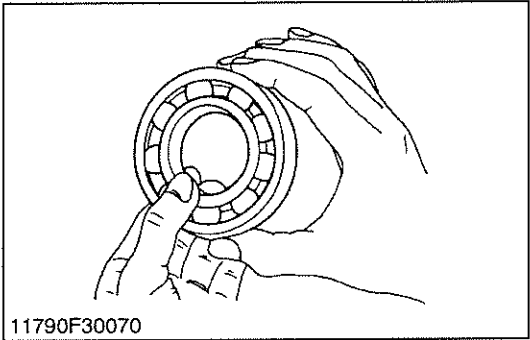


**Checking Bearing**

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.

11790S30180

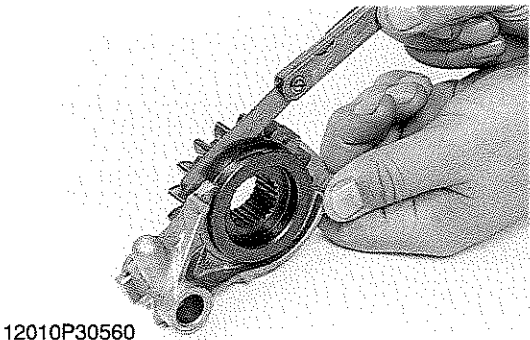
**[2] TRANSMISSION CASE**



**Checking Bearing**

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

11790S30180

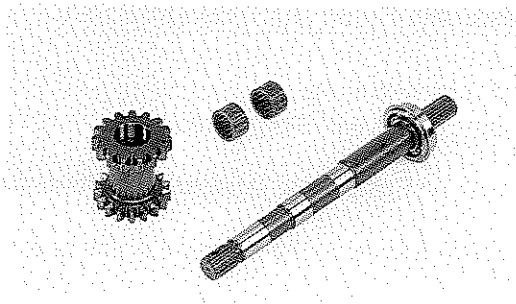


**Clearance between Shift Fork and Shift Gear Groove**

1. Insert the fork into the shift 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 shift gear groove	Factory spec.	0.10 to 0.35 mm 0.004 to 0.014 in.
	Allowable limit	0.5 mm 0.020 in.

12010S30510



12280P30210

### Clearance between Gear and Shaft

1. Measure the gear I.D. with an inside micrometer, and then 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.

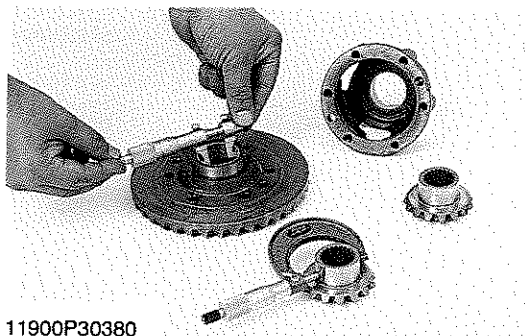
#### ■ IMPORTANT

- Check to see if the needle bearing, inside of gear and surface of shaft do not change relative roughness.

Clearance between gear and shaft	Factory spec.	0.007 to 0.046 mm 0.0003 to 0.0018 in.
	Allowable limit	0.10 mm 0.0039 in.

12280S30240

## [3] DIFFERENTIAL GEAR



11900P30380

### Clearance between Differential Case (Spiral Bevel Gear) and Differential Side Gear

1. Measure the differential side gear boss O.D. with an outside micrometer.
2. Measure the differential case I.D. and the spiral bevel gear I.D. with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential case (spiral bevel gear) and differential side gear	Factory spec.	0.025 to 0.066 mm 0.0010 to 0.0026 in.
	Allowable limit	0.30 mm 0.0118 in.

Differential case I.D.	Factory spec.	32.000 to 32.025 mm 1.2598 to 1.2608 in.
Spiral bevel gear I.D.	Factory spec.	32.000 to 32.025 mm 1.2598 to 1.2608 in.
Differential side gear O.D.	Factory spec.	31.959 to 31.975 mm 1.2582 to 1.2589 in.

11900S30520

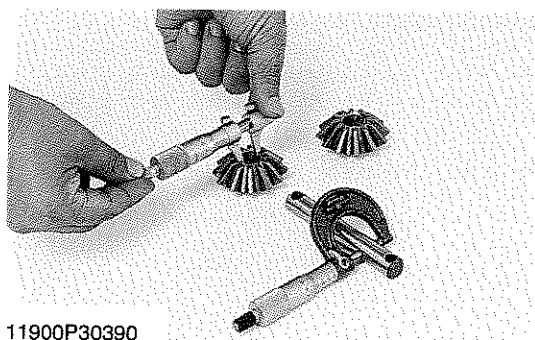
### Clearance between Differential Pinion Shaft and Differential Pinion

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

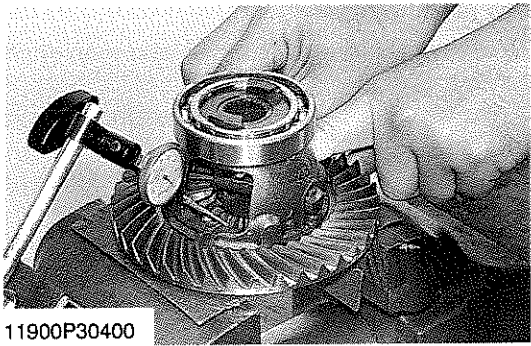
Clearance between differential pinion shaft and differential pinion	Factory spec.	0.016 to 0.045 mm 0.0006 to 0.0018 in.
	Allowable limit	0.30 mm 0.0118 in.

Differential pinion I.D.	Factory spec.	16.000 to 16.018 mm 0.6299 to 0.6306 in.
Differential pinion shaft O.D.	Factory spec.	15.973 to 15.984 mm 0.6289 to 0.6293 in.

11900S30530



11900P30390



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

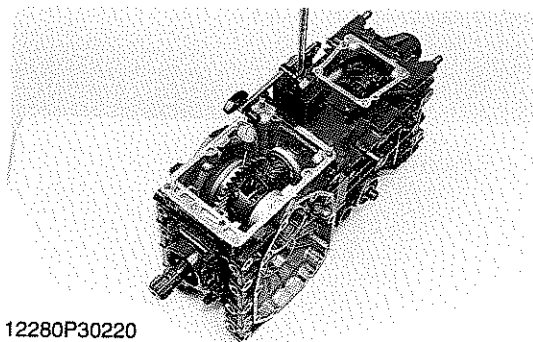
- 1. Secure the differential case with a vise.
- 2. Set the dial indicator (lever type) with its finger on the tooth of the differential side gear.
- 3. Press differential pinion and side gear against the differential case.
- 4. Hold the differential pinion and move the differential side gear to measure 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.	0.1 to 0.3 mm 0.004 to 0.012 in.
	Allowable limit	0.4 mm 0.016 in.

**NOTE**

- Thickness of shims :  
0.8 mm (0.0315 in.), 1.0 mm (0.0394 in.), 1.2 mm (0.0472 in.)

11900S30540



12280P30220

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

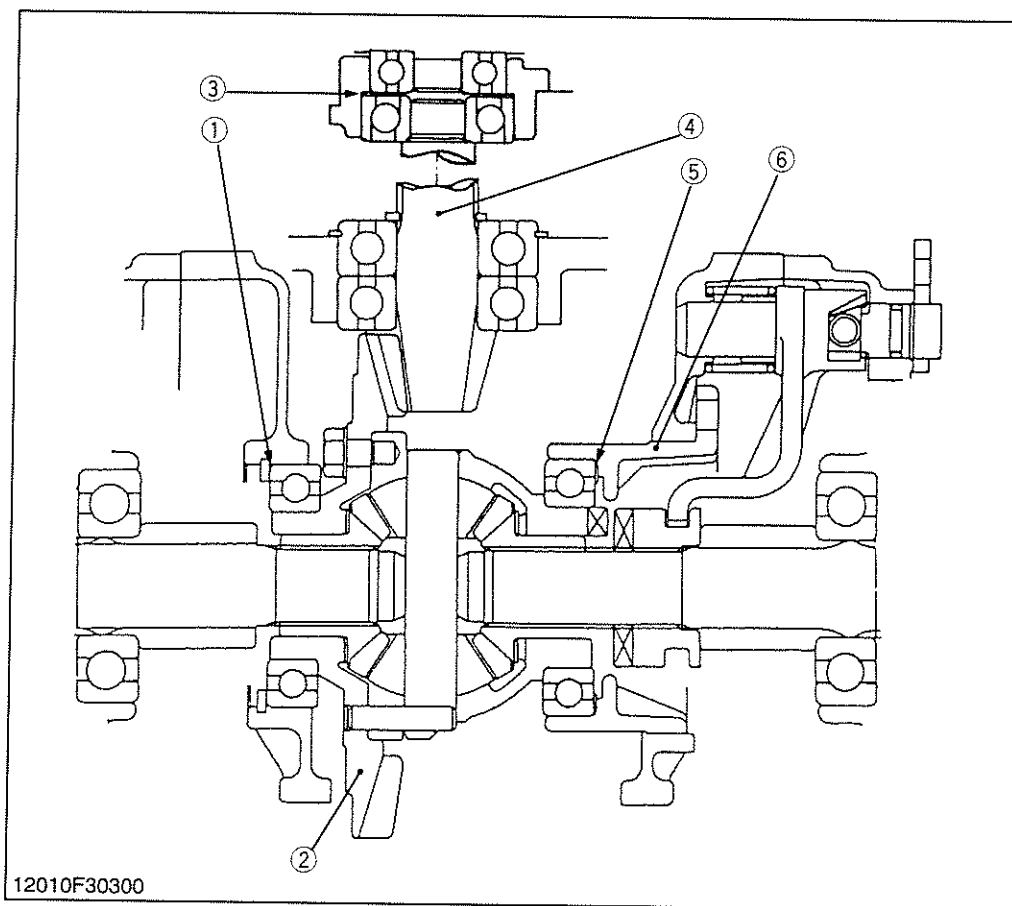
1. Set the dial indicator (lever type) with its finger on the end of spiral bevel pinion (4).
2. Move the spiral bevel pinion back and forth to each end and measure the side clearance.
3. If the side clearance exceeds the factory specifications, adjust with the shims (3) at front end of spiral bevel pinion.
4. Set the dial indicator (lever type) with its finger on the tooth surface of bevel gear.
5. Measure the backlash by fixing the spiral bevel pinion (4) and moving bevel gear (2) by hand.
6. If the backlash exceeds the factory specifications, adjust with the shims (1), (5) at bearing holder (6) and differential case.
7. Adjust the backlash properly by repeating the above procedures.

#### **(When adjusting)**

Side clearance of spiral bevel pinion	Factory spec.	Less than 0.15 mm 0.0059 in.
Backlash between spiral bevel pinion and spiral bevel gear	Factory spec.	0.10 to 0.20 mm 0.0039 to 0.0079 in.

#### **(Reference)**

- Thickness of shims (1), (5) :  
0.2 mm (0.008 in.)      0.5 mm (0.020 in.)
- Thickness of shims (3) :  
0.2 mm (0.008 in.)      1.4 mm (0.055 in.)  
1.8 mm (0.071 in.)



12010F30300

- (1) Shim
- (2) Bevel Gear
- (3) Shim
- (4) Spiral Bevel Pinion
- (5) Shim
- (6) Bearing Holder

12280S30250



# MECHANISM

## CONTENTS

[1] FEATURES .....4-M1





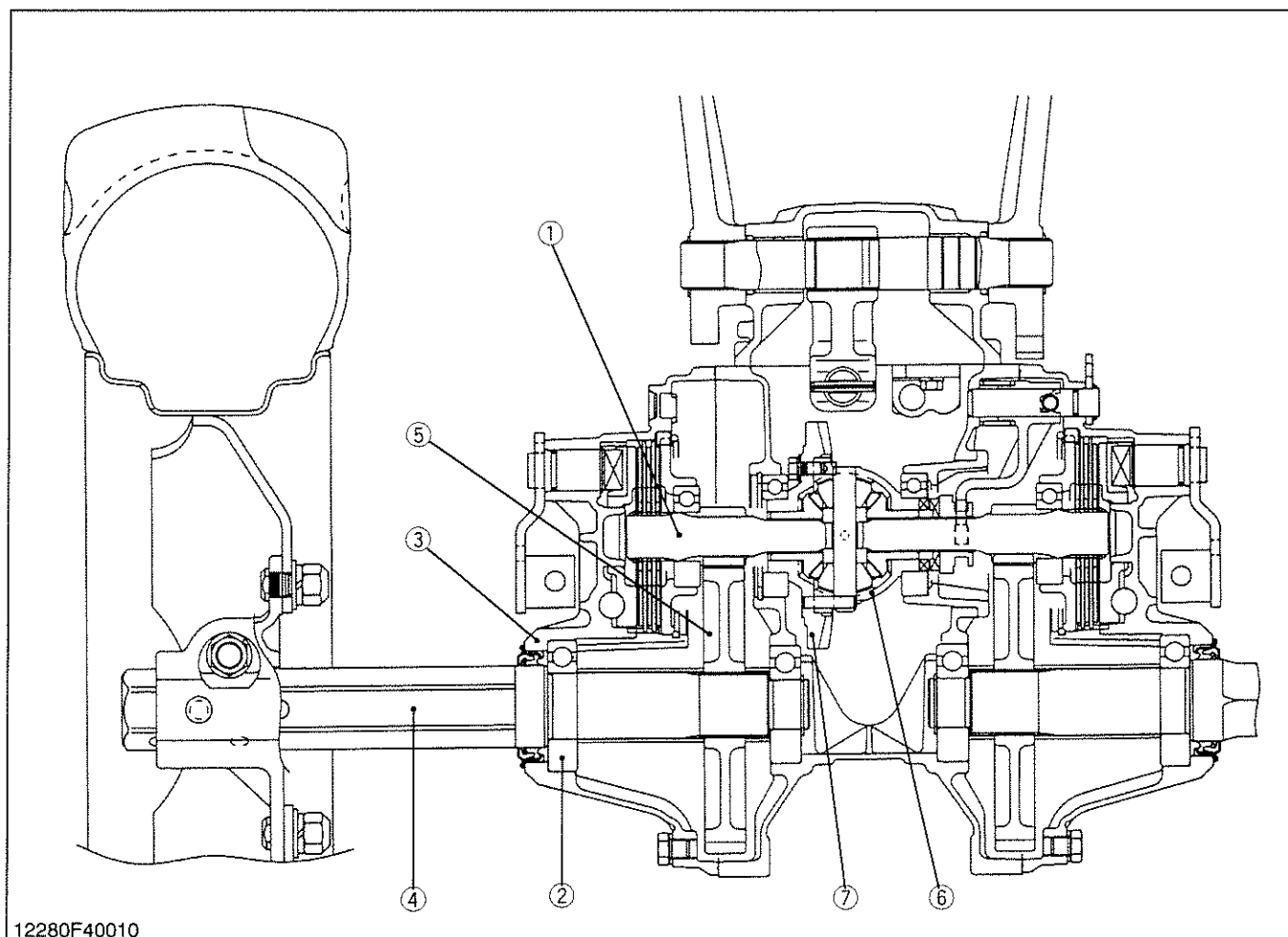
# SERVICING

## CONTENTS

<b>TIGHTENING TORQUES</b> .....	4-S1
<b>CHECKING, DISASSEMBLING</b> .....	4-S1
<b>[1] SEPARATING REAR AXLE CASE</b> .....	4-S1
(1) Draining Transmission Fluid .....	4-S1
(2) Separating Rear Axle Case from Differential Gear Case .....	4-S2
<b>[2] DISASSEMBLING REAR AXLE CASE</b> .....	4-S2



## [1] FEATURES



(1) Differential Gear Shaft

(3) Rear Axle Case

(5) Spur Gear

(7) Spiral Bevel Gear

(2) Ball Bearing

(4) Rear Axle

(6) Differential

The rear axles are the semifloating type with ball bearings (2) between the rear axle (4) and the rear axle case (3), which supports the rear wheel load as well as transmitting power to the rear wheels.

The differential (6) automatically controls the revolution of right and left wheels when the rear wheels encounter unequal road resistance during turning.

12280M40010



## 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-10.)

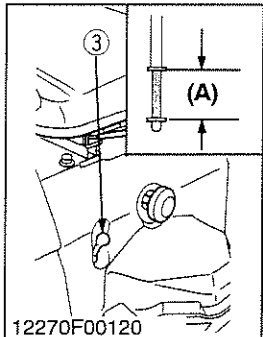
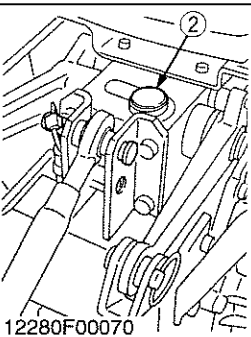
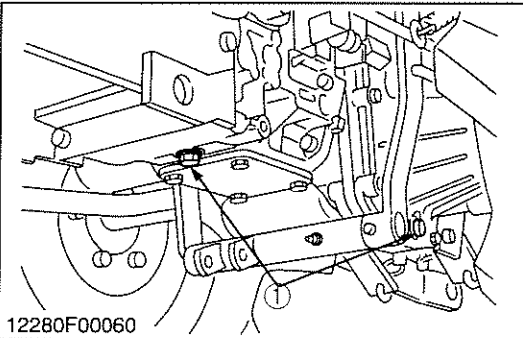
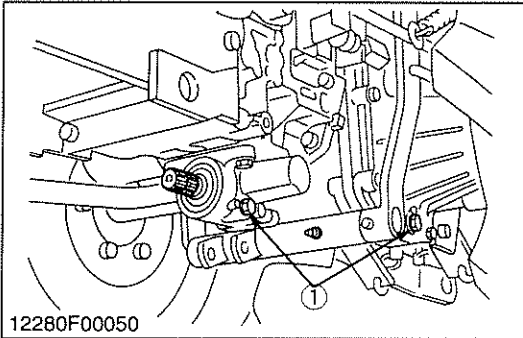
Item	N·m	kgf·m	ft·lbs
Rear wheel cotter setting bolt and nut	123 to 147	12.6 to 15.0	91 to 108
Rear axle case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5

12280S40010

## CHECKING, DISASSEMBLING

### [1] SEPARATING REAR AXLE CASE

#### (1) Draining Transmission Fluid



#### 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 rear axle case and oil tank.
3. Drain the transmission fluid and reinstall the drain plugs.

##### (When refilling)

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

##### ■ IMPORTANT

- Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS AND FLUID" (See page G-9).
- 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.

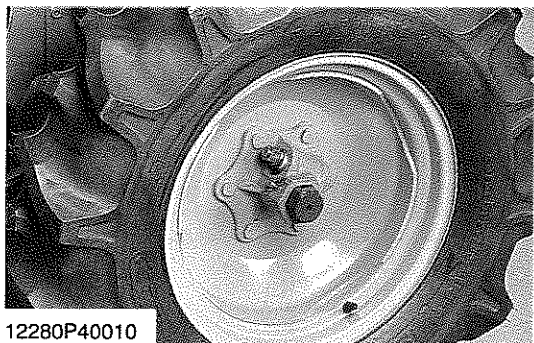
Transmission fluid capacity	10.5 L 2.77 U.S.gals. 2.31 Imp.gals.
-----------------------------	--

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

(A) Oil level is acceptable within this range

12280S30040

## (2) Separating Rear Axle Case from Differential Gear Case



12280P40010

### Rear Wheels

1. Place hydraulic jack under the transmission case.
2. Remove the tires.
3. Remove the hydraulic jack and place rear side of tractor body on the ground.

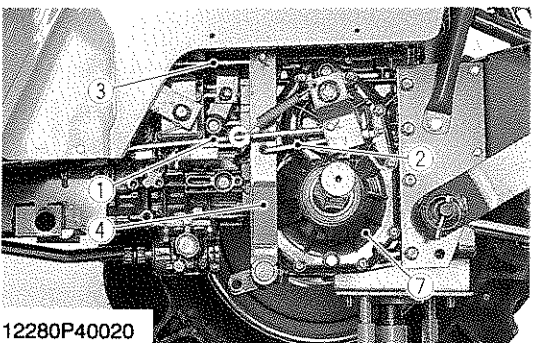
### ■ IMPORTANT

- When refitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service.

(When reassembling)

Tightening torque	Rear wheel setting cotter bolt and nut	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
-------------------	--	--

12280S40020



12280P40020

### Rear Axle Case

1. Remove the brake rod (1).
2. Remove the secondary brake rod (2) (If equipped).
3. Remove the secondary brake pedal rod (3) (If equipped).
4. Remove the clevis pin and the remove the secondary brake lever (4) or secondary brake shaft (5) (If equipped).
5. Disconnect the differential lock rod (6).
6. Remove the rear axle case mounting screws and nuts and separate the rear axle case (7) from the differential case.

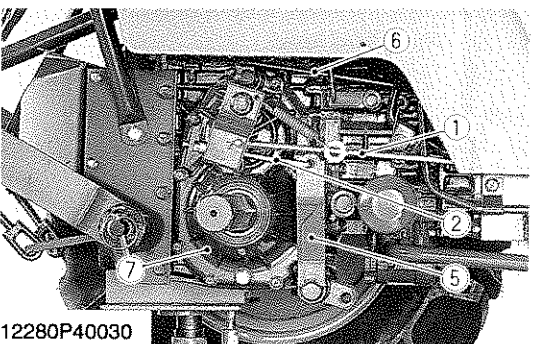
(When reassembling)

- Apply liquid gasket (Three Bond 1208 or equivalent) to joint face of the rear axle case and differential gear case after eliminating the water, oil and stuck liquid gasket.

### ■ IMPORTANT

- After reassembling the secondary brake rod (2) adjust the secondary brake free play.

Tightening torque	Rear axle case mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
-------------------	-------------------------------	---

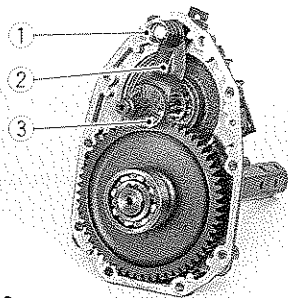


12280P40030

- |   |   |
|---|---|
| (1) Brake Rod                               | (4) Secondary Brake Lever (If equipped) |
| (2) Secondary Brake Rod (If equipped)       | (5) Secondary Brake Shaft (If equipped) |
| (3) Secondary Brake Pedal Rod (If equipped) | (6) Differential Rod                    |
|   | (7) Rear Axle Case                      |

12280S40030

## [2] DISASSEMBLING REAR AXLE CASE



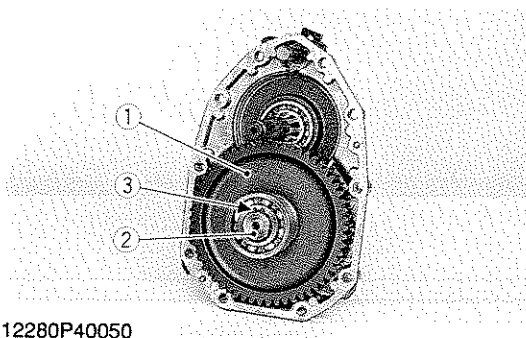
12280P40040

### Differential Lock Shift Fork, Differential Lock Clutch

1. Remove the spring (1).
2. Draw out the differential lock shift fork (2) and differential lock clutch (3).

- |                                  |                              |
|----------------------------------|------------------------------|
| (1) Spring                       | (3) Differential Lock Clutch |
| (2) Differential Lock Shift Fork |                              |

12280S40040

**57T Gear and Rear Axle**

1. Remove the 57T gear (1) and rear axle (2) as a unit.
2. Remove the external snap ring (3) and then remove the bearing and 57T gear.

**(When reassembling)**

- Apply grease to lip of oil seal.

- (1) 57T Gear  
(2) Rear Axle

- (3) External Snap Ring

12280S40050



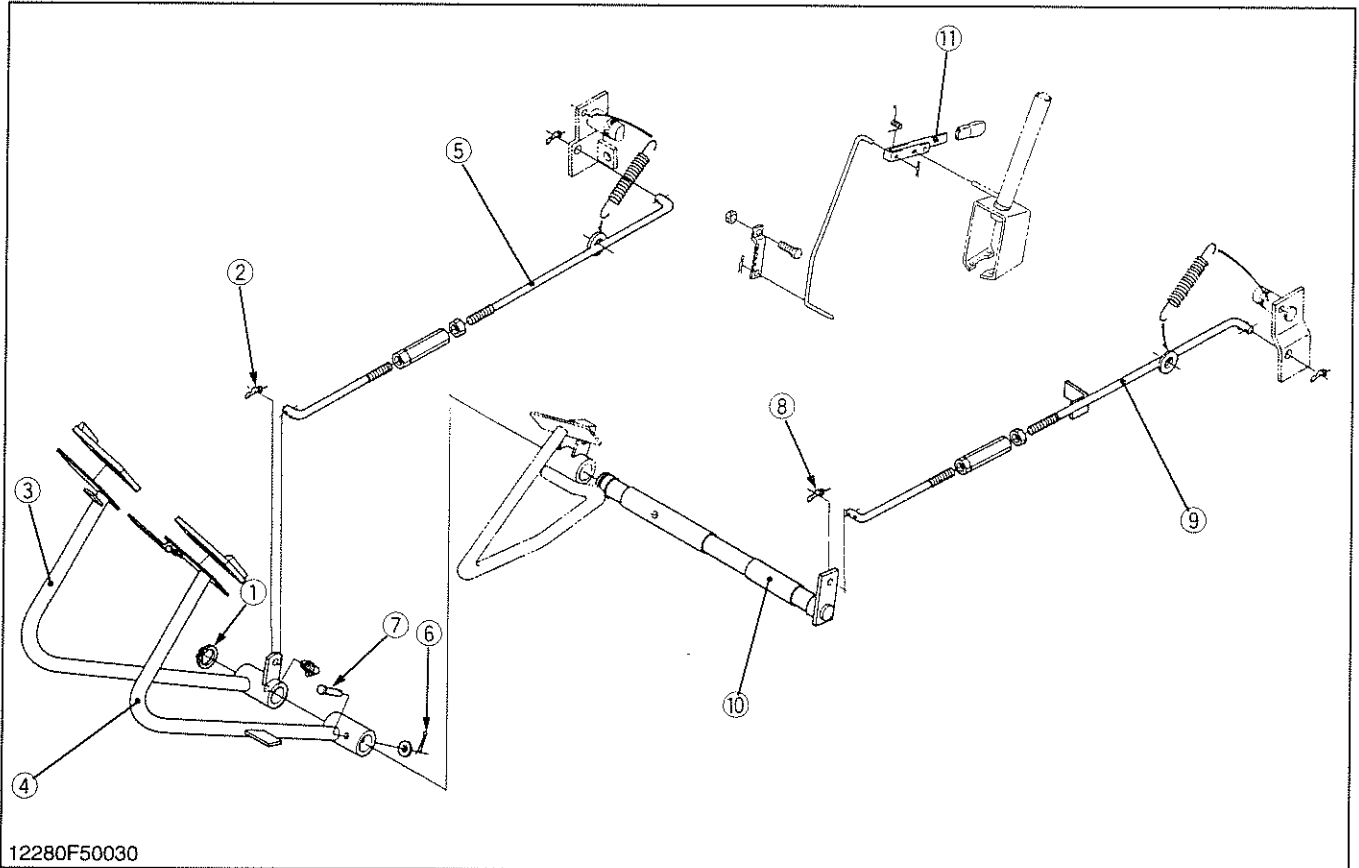


# MECHANISM

## CONTENTS

[1] FEATURES .....	5-M1
[2] OPERATION .....	5-M2



**Separating Brake Pedal**

12280F50030

- |                        |                    |                     |                          |
|------------------------|--------------------|---------------------|--------------------------|
| (1) External Snap Ring | (4) Brake Pedal LH | (7) Clevis Pin      | (10) Brake Pedal Shaft   |
| (2) Spring Lock Pin    | (5) Brake Rod RH   | (8) Spring Lock Pin | (11) Parking Brake Lever |
| (3) Brake Pedal RH     | (6) Cotter Pin     | (9) Brake Rod LH    |                          |

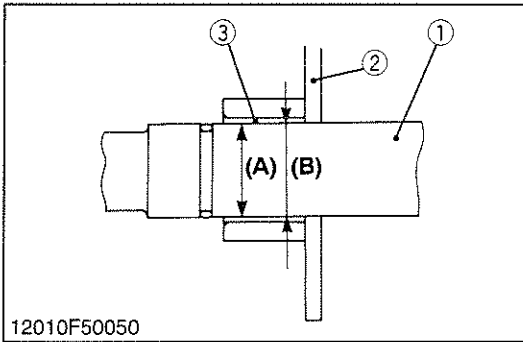
1. Remove the spring lock pin (2) of brake rod (9) and pull out the brake rod (5).
2. Remove the external snap ring (1) at the end of the brake pedal shaft (10).
3. Remove the brake pedal RH (3).
4. Remove the cotter pin (6) and clevis pin (7) of the brake pedal LH (4).
5. Remove the brake pedal LH (4) from the brake pedal shaft (10).

6. Remove the brake pedal shaft (10) with the clutch pedal to the left.

**(When reassembling)**

- Apply grease to the brake pedal shaft.
- When inserting the spring pin, face its split in the direction at right angle to the brake pedal shaft.

12280S50040

**Clearance between Brake Pedal Shaft and Center Frame Bush**

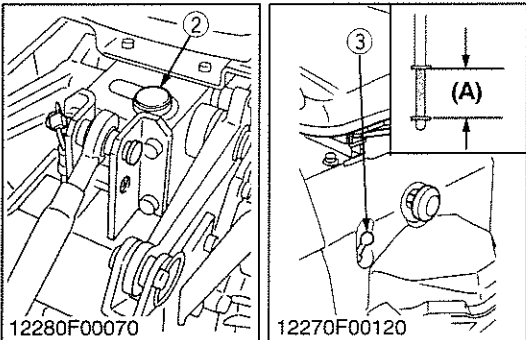
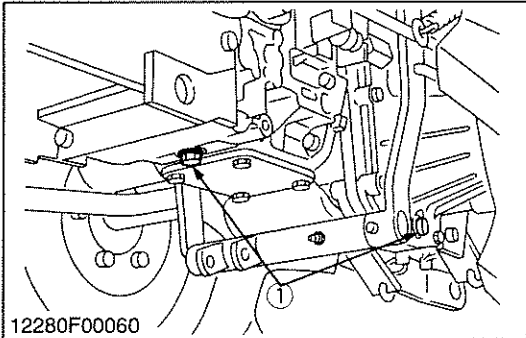
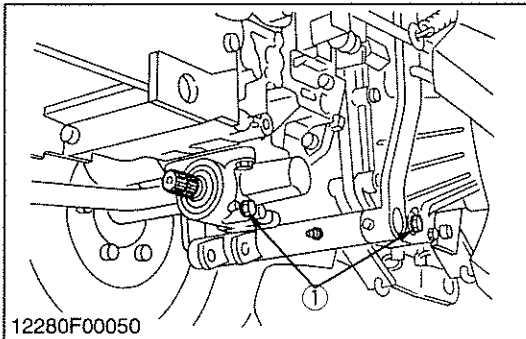
1. Measure the brake pedal shaft O.D. with an outside micrometer.
2. Measure the bush (3) I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between brake pedal shaft and center frame bush	Factory spec.	0 to 0.165 mm 0 to 0.00649 in.
	Allowable limit	1.0 mm 0.039 in.
Brake pedal shaft O.D.	Factory spec.	24.916 to 25.030 mm 0.98094 to 0.98543 in.
Center frame bush I.D.	Factory spec.	25.030 to 25.081 mm 0.98543 to 0.98744 in.

- (1) Brake Pedal Shaft  
(2) Center Frame  
(3) Bush

- (A) Bush I.D.  
(B) Brake Pedal Shaft O.D.

12010S50050

**DISASSEMBLING AND ASSEMBLING****[1] SEPARATING REAR AXLE CASE WITH BRAKE ASSEMBLY**

12270F00120

**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 rear axle case and oil tank.
3. Drain the transmission fluid and reinstall the drain plugs.

**(When refilling)**

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

**IMPORTANT**

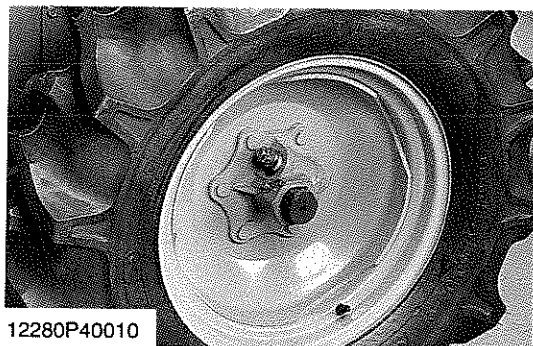
- Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS AND FLUID" (See page G-9).
- Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.
- Do not mix different brands oil together.

Transmission fluid capacity	10.5 L 2.77 U.S.gals. 2.31 Imp.gals.
-----------------------------	--

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

- (A) Oil level is acceptable within this range

12280S30040



12280P40010

### Rear Wheels

1. Place hydraulic jack under the transmission case.
2. Remove the tires.
3. Remove the hydraulic jack and place rear side of tractor body on the ground.

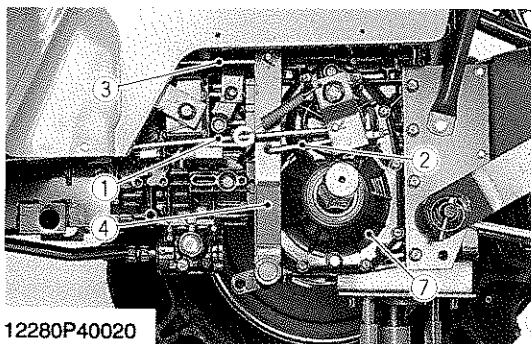
### ■ IMPORTANT

- When refitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service.

(When reassembling)

Tightening torque	Rear wheel setting cotter bolt and nut	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
-------------------	--	--

12280S40020



12280P40020

### Rear Axle Case

1. Remove the brake rod (1).
2. Remove the secondary brake rod (2) (If equipped).
3. Remove the secondary brake pedal rod (3) (If equipped).
4. Remove the clevis pin and the remove the secondary brake lever (4) or secondary brake shaft (5) (If equipped).
5. Disconnect the differential lock rod (6).
6. Remove the rear axle case mounting screws and nuts and separate the rear axle case (7) from the differential case.

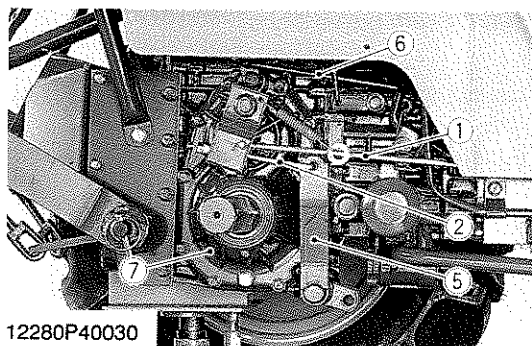
(When reassembling)

- Apply liquid gasket (Three Bond 1208 or equivalent) to joint face of the rear axle case and differential gear case after eliminating the water, oil and stuck liquid gasket.

### ■ IMPORTANT

- After reassembling the secondary brake rod (2) adjust the secondary brake free play.

Tightening torque	Rear axle case mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
-------------------	-------------------------------	---



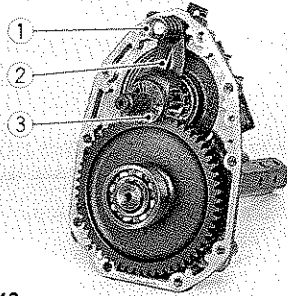
12280P40030

- |   |   |
|---|---|
| (1) Brake Rod                               | (4) Secondary Brake Lever (If equipped) |
| (2) Secondary Brake Rod (If equipped)       | (5) Secondary Brake Shaft (If equipped) |
| (3) Secondary Brake Pedal Rod (If equipped) | (6) Differential Rod                    |
|   | (7) Rear Axle Case                      |

12280S40030

## [2] DISASSEMBLING BRAKE ASSEMBLY

### Differential Lock Shift Fork, Differential Lock Clutch (Right Side Only), 57T Gear and Rear Axle



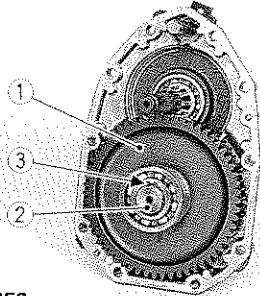
12280P40040

1. Remove the spring (1).
2. Draw out the differential lock shift fork (2) and differential lock clutch (3).
3. Remove the 57T gear (4) and rear axle (5) as a unit.

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

- Apply grease to lip of oil seal.

- |                                  |               |
|----------------------------------|---------------|
| (1) Spring                       | (4) 57T Gear  |
| (2) Differential Lock Shift Fork | (5) Rear Axle |
| (3) Differential Lock Clutch     |               |



12280P40050

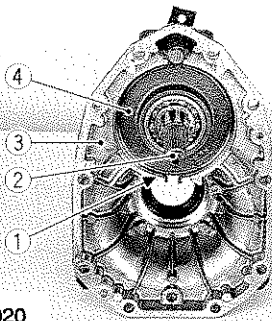
12280S50050

### Brake Assembly

1. Remove the internal snap ring (1).
2. Remove the brake shaft (2) with brake discs.

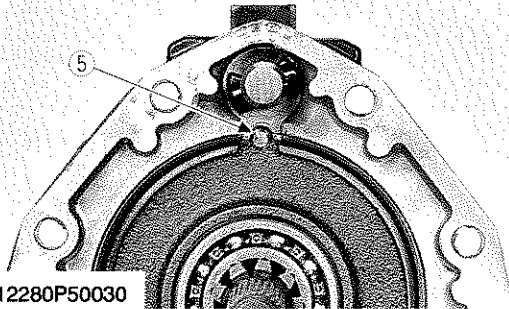
#### **(When reassembling)**

- When installing the internal snap ring (1) to rear axle case (3) as shown in the photo.
- When installing the bearing holder (4) to the rear axle case (3), do not forget to install the straight pin (5).



12280P50020

- |                        |                    |
|------------------------|--------------------|
| (1) Internal Snap Ring | (4) Bearing Holder |
| (2) Brake Shaft        | (5) Straight Pin   |
| (3) Rear Axle Case     |                    |



12280P50030

12280S50060

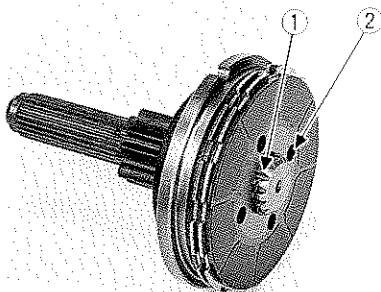
### Brake Discs and Friction Plate

1. Remove the external snap ring (1), and remove the brake discs and friction plate.
2. Remove the cam plate and balls.
3. Remove the external snap ring and pull out the brake cam lever.

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

- Install the brake discs with their holes (2) deviation at less than 1/3 of the total hole area.

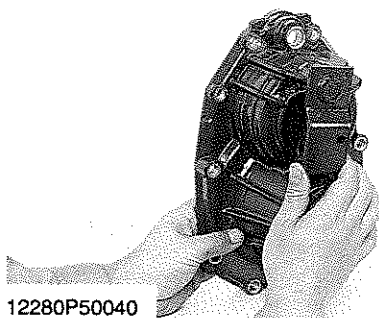
- |                        |          |
|------------------------|----------|
| (1) External Snap Ring | (2) Hole |
|------------------------|----------|



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12280S50080

## SERVICING

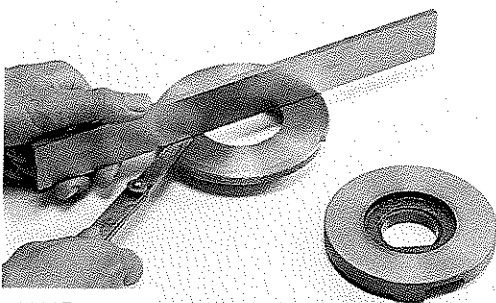


12280P50040

### 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.

12280S50070



11900P50050

### Cam Plate Flatness and Bearing Holder Wear

1. Place a straightedge of 150 mm (5.91 in.) or more in length on the contacting surface of the cam plate and the bearing holder.
2. Inspect the friction surface of the cam plate 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.

11900S50110



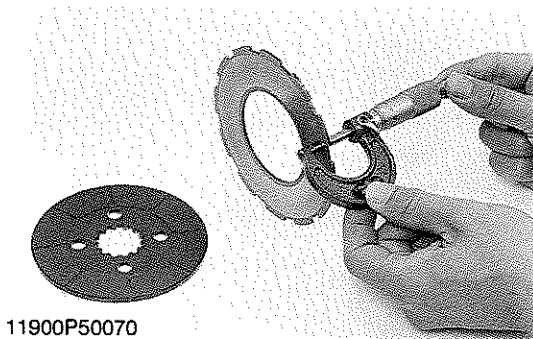
11900P50060

### Height of Cam Plate and Ball

1. Measure the dimensions of the cam plate with the ball installed.
2. If the measurement is less than the allowable limit, replace the cam plate and balls.
3. Inspect the ball holes of cam plate for uneven wear.
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.

11900S50120



11900P50070

### 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.

11900S50130





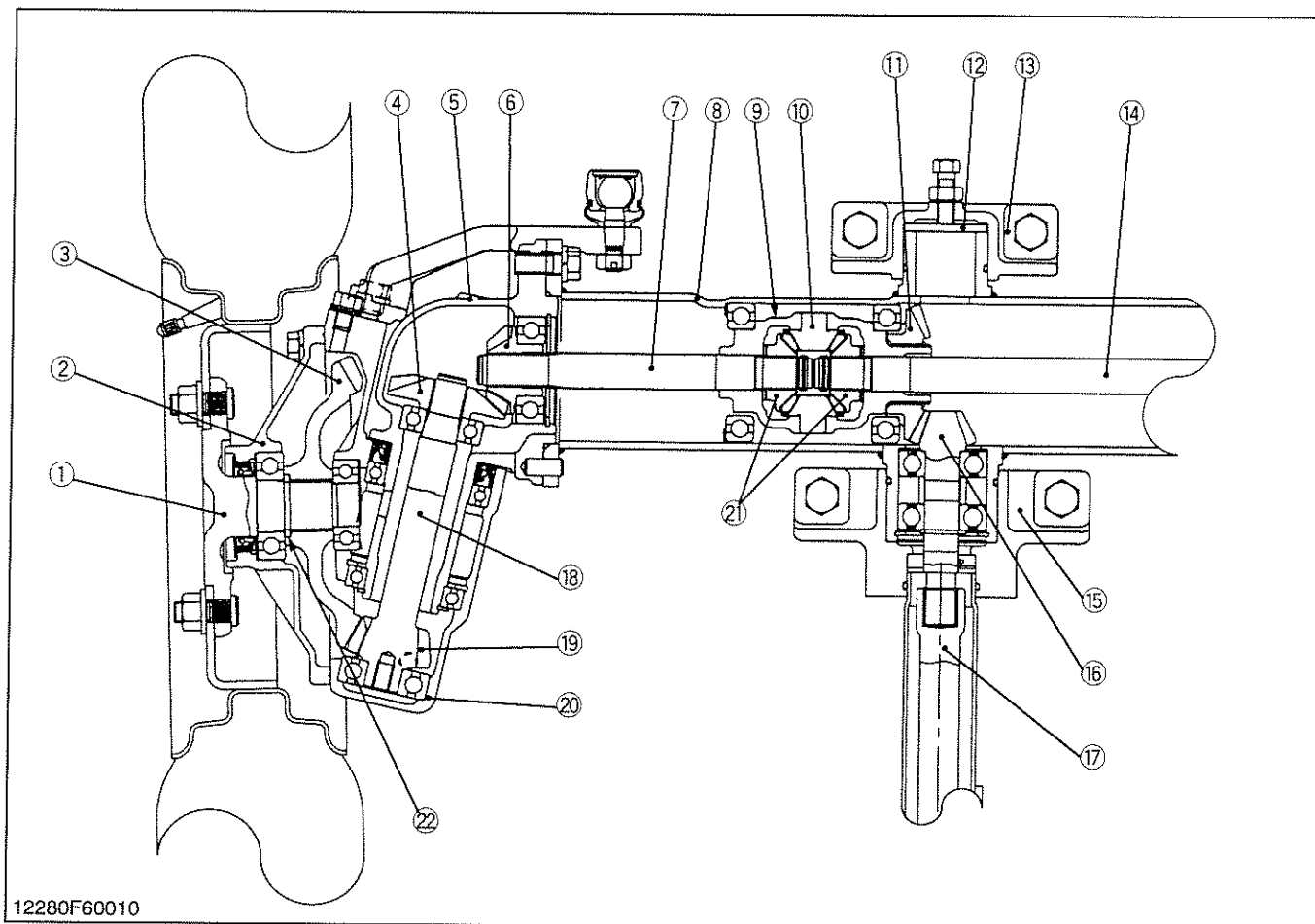
# MECHANISM

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[1] STRUCTURE.....	6-M1
[2] FRONT WHEEL ALIGNMENT .....	6-M2



# [1] STRUCTURE



12280F60010

- |                     |                                 |                                  |                             |
|---------------------|---------------------------------|----------------------------------|-----------------------------|
| (1) Axle            | (7) Differential Yoke Shaft, LH | (13) Front Axle Bracket, Front   | (18) Bevel Gear Shaft       |
| (2) Axle Flange     | (8) Front Axle Case             | (14) Differential Yoke Shaft, RH | (19) Bevel Gear             |
| (3) Bevel Gear      | (9) Differential Gear Assembly  | (15) Front Axle Bracket, Rear    | (20) Front Gear Case        |
| (4) Bevel Gear      | (10) Differential Pinion Gear   | (16) Spiral Bevel Pinion Shaft   | (21) Differential Side Gear |
| (5) Bevel Gear Case | (11) Spiral Bevel Gear          | (17) Propeller Shaft             | (22) Collar                 |
| (6) Bevel Gear      | (12) Collar                     |                                  |                             |

The front axle of the 4WD is constructed as shown above. Power is transmitted from the transmission through the propeller shaft (17) to the spiral bevel pinion shaft (16), then to the spiral bevel gear (11) and to the differential side gear (21).

The power through the differential side gear is transmitted to the differential yoke shaft (7), (14), and to the bevel gear shaft (18) through the bevel gears (4), (6) in the bevel gear case (5).

The revolution is greatly reduced by the bevel gears (19), (3), then the power is transmitted to the axle (1).

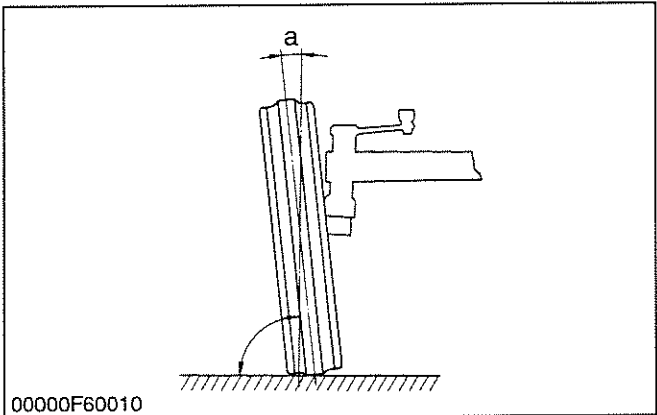
The differential system allows each wheel to rotate at a different speed to make turning easier.

12280M60010

[2] FRONT WHEEL ALIGNMENT

To assure smooth mobility or maneuverability and enhance stable and straight running, the front wheels are mounted at an angle to the right, left and forward

directions.  
This arrangement is referred to as the Front Wheel Alignment.



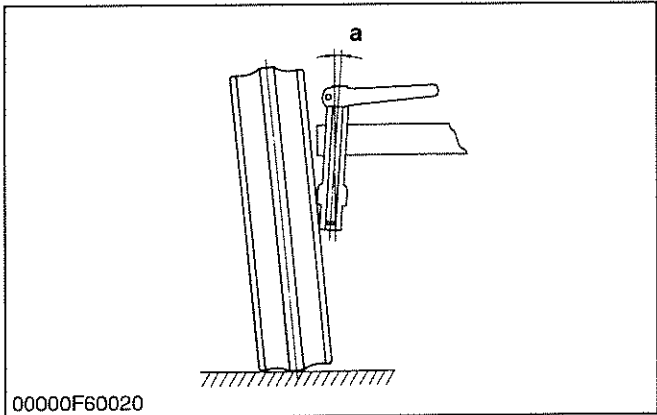
■ Camber

The front wheels are tilted from the vertical as viewed from the front, upper wheels are spreader than lower ones.

This inclination is called camber (a). Camber reduces bending or twisting of the front axle caused by vertical load or running resistance, and also maintains the stability in running.

Camber	0.035 rad. 2°
--------	------------------

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■ Kingpin Angle

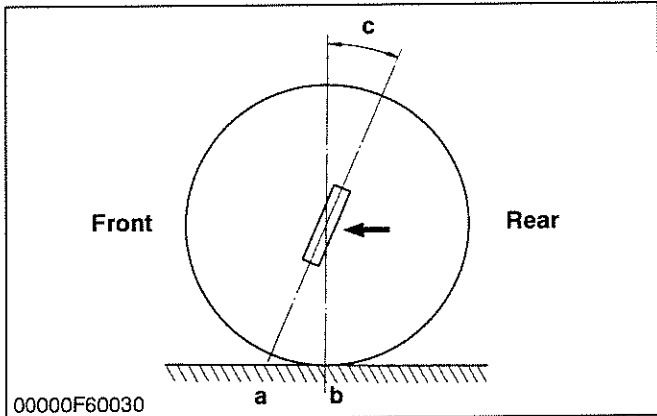
The kingpin is tilted from the vertical as viewed from the front.

This angle is called kingpin angle (a). As with the camber, kingpin angle reduces rolling resistance of the wheels, and prevents any shimmy motion of the steering wheel.

It also reduces steering effort.

Kingpin angle	0.209 rad. 12°
---------------	-------------------

12270M60030



■ Caster

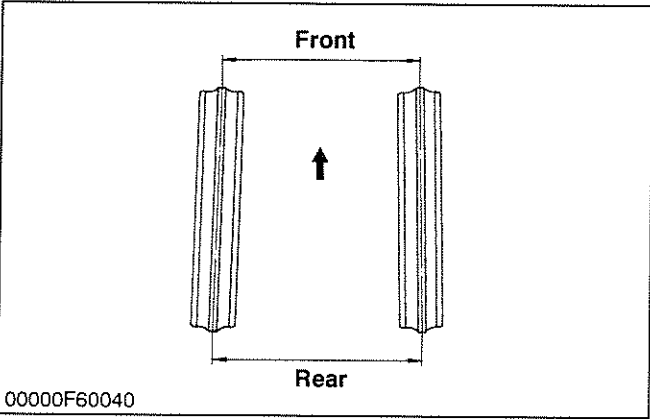
The kingpin is tilted forward as viewed from the side. The point (b) of the wheel center line is behind the point (a) of the kingpin shaft center line.

This inclination is called caster (c). Caster helps provide steering stability.

As with the kingpin inclination, caster reduces steering effort.

Caster	0 rad. 0°
--------	--------------

12270M60040



■ **Toe-in**

Viewing the front wheels from above reveals that the distance between the toes of the front wheels is smaller than that between the heels.

It is called toe-in. The front wheels tend to roll outward due to the camber, but toe-in offsets it and ensures parallel rolling of the front wheels. Another purpose of toe-in is to prevent excessive and uneven wear of tires.

Toe-in	0 to 20 mm 0 to 0.79 in.
--------	-----------------------------

12280M60020



# SERVICING

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TROUBLESHOOTING .....	6-S1
SERVICING SPECIFICATIONS.....	6-S1
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CHECKING AND ADJUSTING.....	6-S2
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[2] DISASSEMBLING FRONT AXLE ASSEMBLY.....	6-S5
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## TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Front Wheels Wander to Right or Left</b>	<ul style="list-style-type: none"> <li>• Tire pressure uneven</li> <li>• Toe-in incorrect</li> <li>• Front axle rocking force too small</li> </ul>	Adjust Correct or Replace Adjust	G-35 6-S2, S5 6-S3
<b>Front Wheels Can Not Be Driven</b>	<ul style="list-style-type: none"> <li>• Front wheel driving gears in front axle gear case broken</li> <li>• Universal joint broken</li> <li>• Front wheel drive gears in transmission broken</li> <li>• Front differential gear broken</li> </ul>	Replace  Replace Replace Replace	6-S6  6-S4 3-S14 6-S8
<b>Noise</b>	<ul style="list-style-type: none"> <li>• Gear backlash excessive</li> <li>• Oil insufficient</li> <li>• Bearings damaged or broken</li> <li>• Gears damaged or broken</li> </ul>	Adjust or replace Replenish Replace Replace	6-S9, S10 6-S3 — —

12280S60010

## SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	0 to 20 mm 0 to 0.79 in.	—
Front Axle	Rocking Force	49.0 to 98.1 N 5.0 to 10.0 kgf 11.0 to 22.1 lbs	—
Differential Case and Differential Side Gear			
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.	—
Spiral Bevel Pinion Shaft to Spiral Bevel Gear	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	—
10T Bevel Gear to 16T Bevel Gear	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	—
38T Bevel Gear to 9T Bevel Gear Shaft	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	—

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## TIGHTENING TORQUES

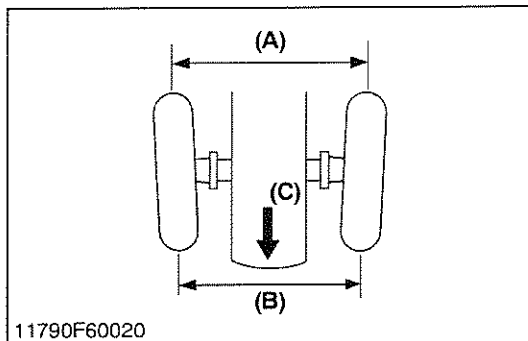
Tightening torques of screws, bolts and nuts on the table below are especially specified.  
(For general use screws, bolts and nuts : See page G-10.)

Item	N·m	kgf·m	ft-lbs
Front wheel mounting nut	77.5 to 90.1	7.9 to 9.2	57.1 to 66.5
Front axle bracket mounting screw	124 to 147	12.6 to 15.0	91.2 to 108.0
Bevel gear case mounting screw	77.5 to 90.1	7.9 to 9.2	57.1 to 66.5
Knuckle arm mounting screw	77.5 to 90.1	7.9 to 9.2	57.1 to 66.5
Axle flange mounting screw	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Differential case cover mounting screw	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3

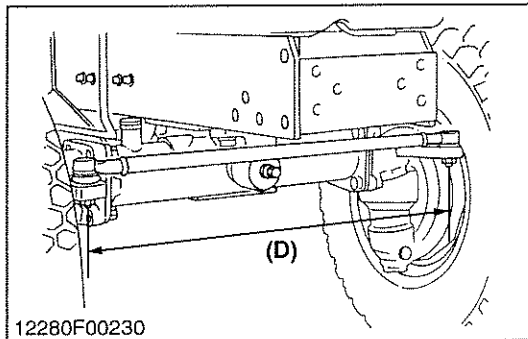
12280S60030

## CHECKING, DISASSEMBLING AND SERVICING

### CHECKING AND ADJUSTING



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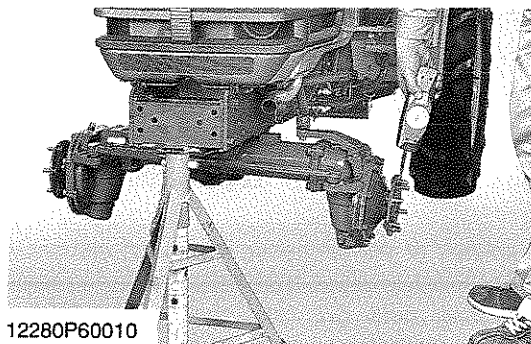
#### Adjusting Toe-in

1. Park the tractor on the flat place.
2. Inflate the tires to the specified pressure.
3. Turn 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 0 to 20 mm (0 to 0.79 in.) less than rear distance.
8. If the measurement is not within the factory specifications, please correct the length (D) of tie rod and correct toe-in to be suitable for factory spec.

Toe-in (A - B)	Factory spec.	0 to 20 mm 0 to 0.79 in.
----------------	---------------	-----------------------------

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

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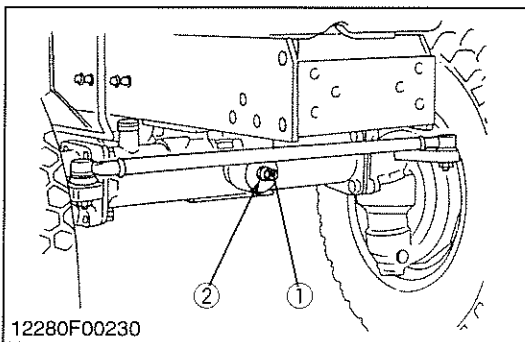
### Front Axle Rocking Force

1. Jack up the front side of tractor.
2. Set a spring balance to the front axle flange.
3. Measure the front axle rocking force.
4. If the measurement is not within the factory specifications, adjust with the adjusting screw (1).
5. Tighten the lock nut (2) firmly.

Front axle rocking force	Factory spec.	49.0 to 98.1 N 5.0 to 10.0 kgf 11.0 to 22.1 lbs
--------------------------	---------------	---

(1) Adjusting Screw

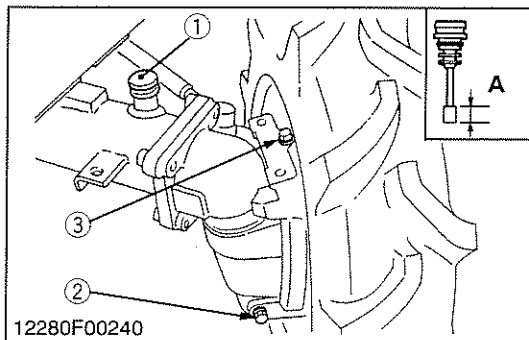
(2) Lock Nut



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12280S60060

## [1] SEPARATING FRONT AXLE ASSEMBLY



12280F00240

### Draining Front Axle Case Oil

1. Place the oil pans underneath the front axle case.
2. Remove the both right and left hand side breather plugs (3), drain plugs (2) and filling plug (1) to drain the oil.
3. After draining, reinstall the drain plugs (2).
4. Fill with new oil up to the upper notch on the dipstick.

#### ■ IMPORTANT

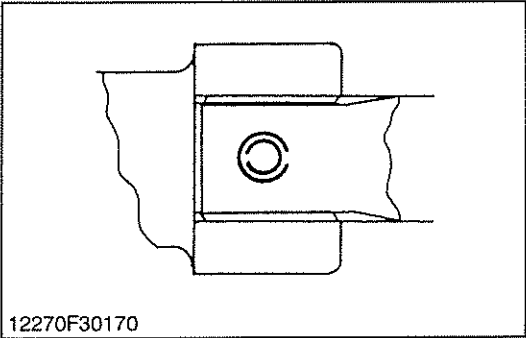
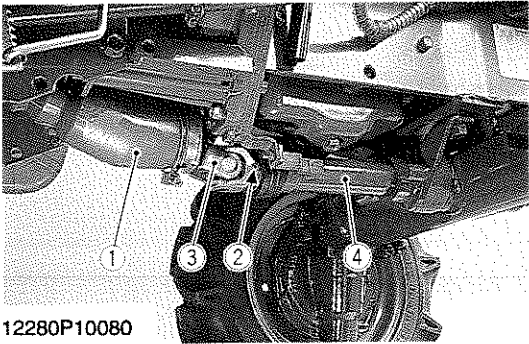
- After ten minutes, check the oil level again, add oil to prescribed level.
- Use KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-9.)

Front axle case oil capacity	3.4 L 3.6 U.S.qts. 3.0 Imp.qts.
------------------------------	---------------------------------------

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

(A) Oil level is acceptable within this range.

12280S60070



**Universal Joint and Propeller Shaft Cover**

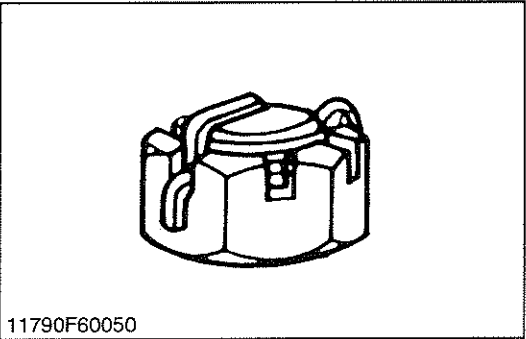
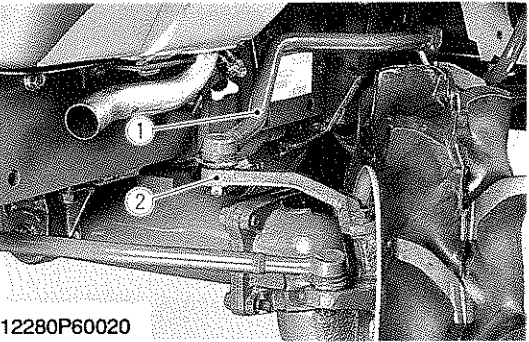
- 1. Loosen the clamp and slide the universal joint cover (1) to the rear.
- 2. Tap out the spring pin (2) and then slide the universal joint (3) to the rear.
- 3. Remove the propeller shaft cover (4) with propeller shaft.

**(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 Cover
- (2) Spring Pin
- (3) Universal Joint
- (4) Propeller Shaft Cover

12280S10150



**Drag Link**

- 1. Remove the cotter pin and loosen the slotted nut.
- 2. Disconnect the drag link (1) with a pitman arm puller from the knuckle arm (2).

**(When reassembling)**

**■ IMPORTANT**

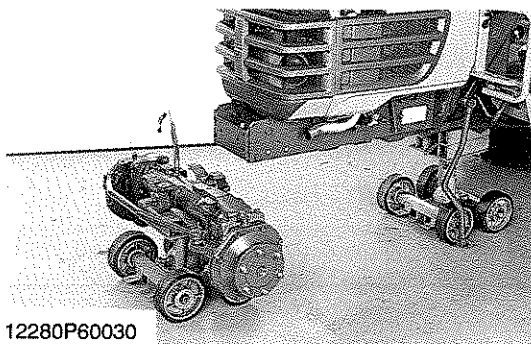
- Do not loosen the slotted nut to align the hole.
- Install the cotter pin as shown in the figure

**(Reference)**

Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13 to 25.3 ft·lbs
-------------------	-------------	---

- (1) Drag Link
- (2) Knuckle Arm

12280S60080



12280P60030

### Front Axle Assembly

1. Lift up the front side of tractor and place the disassembling stand under the front axle frame.
2. Remove the front wheels.
3. Place the disassembling stand under the front axle.
4. Remove the front axle brackets (Front and Rear) mounting screws.
5. Separate the front axle from the front axle frame.

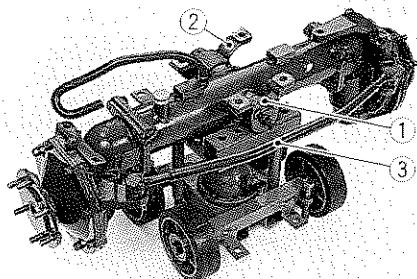
#### (When reassembling)

- After mounting the front axle assembly to the front axle frame, be sure to adjust the front axle rocking force. (See page 6-S3)

Tightening torque	Front wheel mounting nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Front axle bracket mounting screw	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108.0 ft-lbs

12280S60090

## [2] DISASSEMBLING FRONT AXLE ASSEMBLY



12280P60040

### Tie-rod and Axle Bracket

1. Remove the slotted nut and remove the tie-rod (3).
2. Remove the front axle brackets (1), (2).

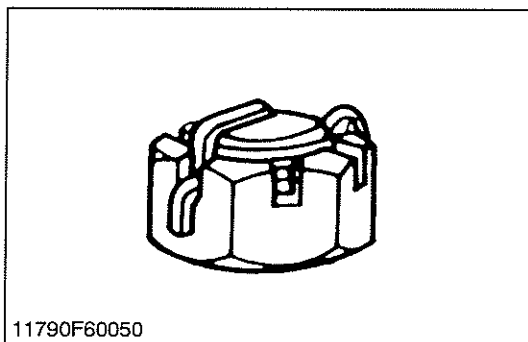
#### (When reassembling)

- Apply grease to the thrust collar of front axle bracket.
- Apply grease to the O-ring and take care not to damage it.
- After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.

(1) Front Axle Bracket (Front)

(3) Tie-rod

(2) Front Axle Bracket (Rear)



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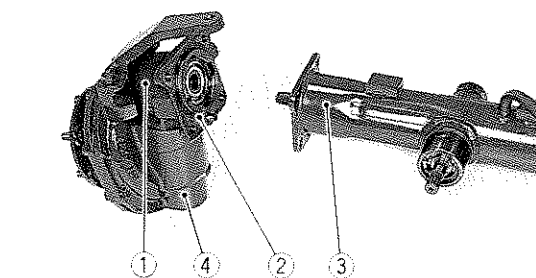
12280S60100

### Bevel Gear Case and Front Gear Case

1. Remove the bevel gear case mounting screws.
2. Remove the bevel gear case (1) and front gear case (4) as a unit from the front axle case (3).

#### (When reassembling)

- Apply grease to the O-ring (2) and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies and right and left gear case assemblies.



12280P60050

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
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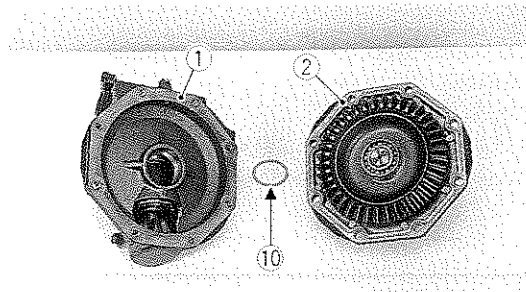
(1) Bevel Gear Case

(3) Front Axle Case

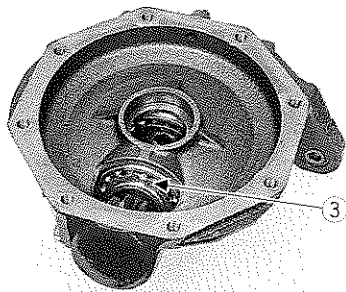
(2) O-ring

(4) Front Gear Case

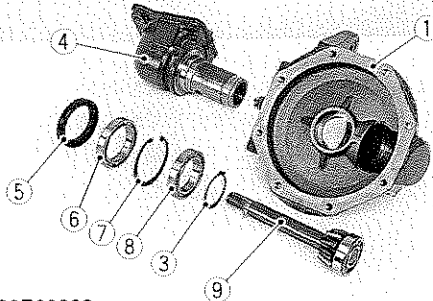
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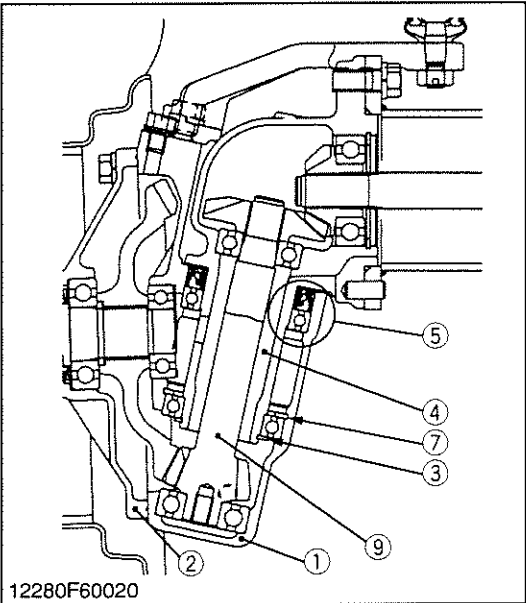
12280P60060



12280P60070



12280P60080



12280F60020

**Front Gear Case**

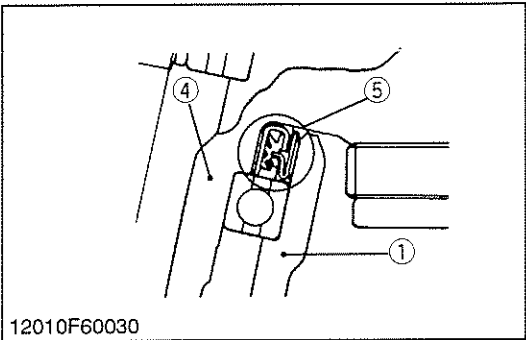
1. Remove the knuckle arm (Left side only).
2. Remove the axle flange (2).
3. Remove the external snap ring (3).
4. Remove the bevel gear case (4) from front gear case (1).
5. Remove the oil seal (5).
6. Remove the ball bearing 1 (6).
7. Remove the internal snap ring (7) and remove the ball bearing 2 (8).
8. Remove the bevel gear shaft (9) with ball bearing.

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the axle flange (2) and front gear case (1) after eliminate the water, oil and stuck liquid gasket.
- Install the shims (10) to their original position.
- Tighten the axle flange mounting screws and nuts diagonally in several steps.
- Install the oil seal (5) of bevel gear case, noting its direction as shown in the figure.

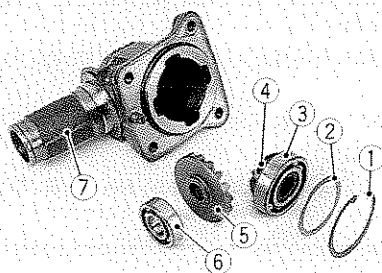
Tightening torque	Knuckle arm mounting screw	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft·lbs
	Axle flange mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs

- |                        |                        |
|------------------------|------------------------|
| (1) Front Gear Case    | (6) Ball Bearing 1     |
| (2) Axle Flange        | (7) Internal Snap Ring |
| (3) External Snap Ring | (8) Ball Bearing 2     |
| (4) Bevel Gear Case    | (9) Bevel Gear Shaft   |
| (5) Oil Seal           | (10) Shim              |



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### Bevel Gear Case Gears

1. Remove the internal snap ring (1).
2. Take out the bevel gears (4), (5) with ball bearings (3), (6) and shims (2).

#### (When reassembling)

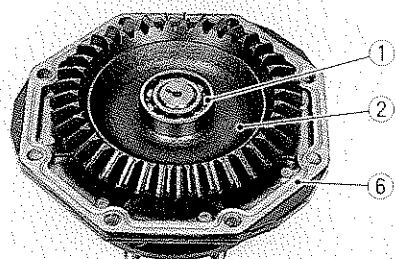
- Install the shims (2) to their original position.

#### (Reference)

- Thickness of adjusting shims :  
 0.8 mm (0.031 in.)      1.2 mm (0.047 in.)  
 1.0 mm (0.039 in.)

- |                        |                     |
|------------------------|---------------------|
| (1) Internal Snap Ring | (5) Bevel Gear      |
| (2) Shim               | (6) Ball Bearing    |
| (3) Ball Bearing       | (7) Bevel Gear Case |
| (4) Bevel Gear         |                     |

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12280P60100

### Axle

1. Remove the bearing (1).
2. Take out the bevel gear (2).
3. Take out the collar (3).
4. Tap out the axle (7).

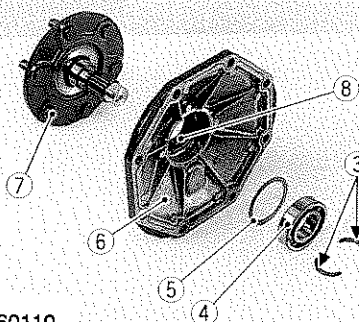
#### (When reassembling)

- Install the oil seal (8) of axle flange (6), noting its direction as shown in the figure.
- Install the shims (5) to their original position.

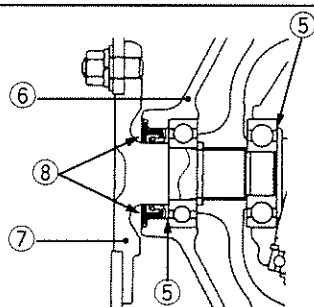
#### (Reference)

- Thickness of adjusting shims :  
 0.2 mm (0.008 in.)      0.3 mm (0.012 in.)

- |                  |                 |
|------------------|-----------------|
| (1) Ball Bearing | (5) Shim        |
| (2) Bevel Gear   | (6) Axle Flange |
| (3) Collar       | (7) Axle        |
| (4) Ball Bearing | (8) Oil Seal    |

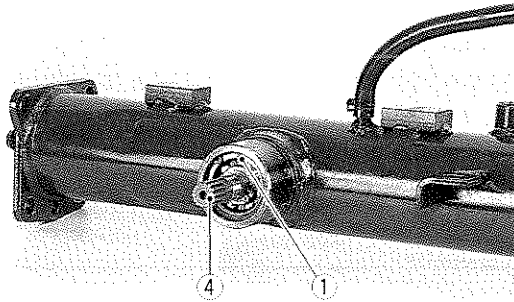


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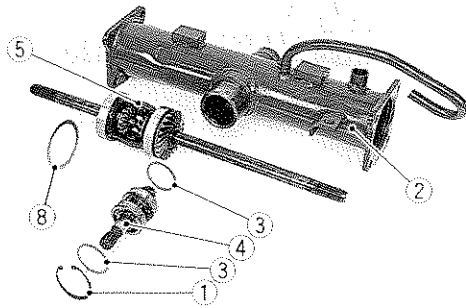


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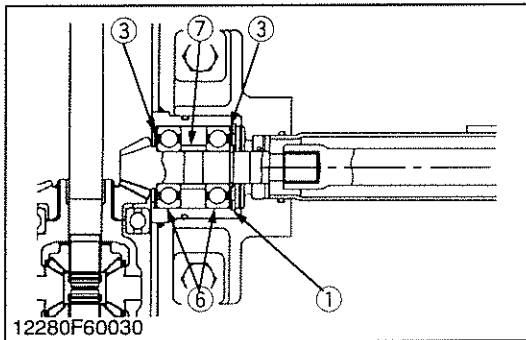
12280S60140



12280P60120



12280P60130



12280F60030

### **Spiral Bevel Pinion Shaft and Differential Gear Assembly**

1. Remove the internal snap ring (1).
2. Tap out the spiral bevel pinion shaft (4) by the brass rod and hammer.
3. Remove the yoke shaft with differential gear assembly (5), from right side of front axle case (2).
4. Remove the external snap ring and then remove the ball bearings (6).

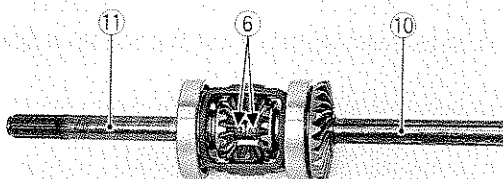
#### **(When reassembling)**

- Install the adjusting shims (3) to their original position.

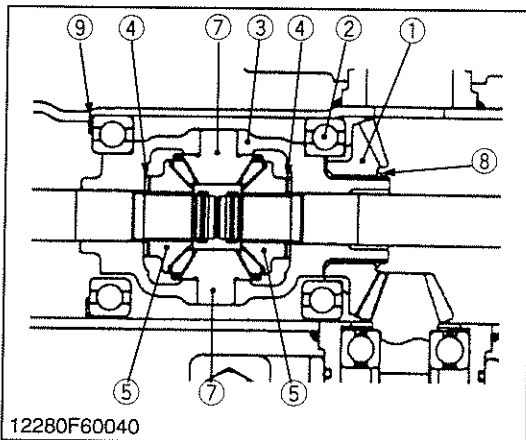
- |                               |                                |
|-------------------------------|--------------------------------|
| (1) Internal Snap Ring        | (5) Differential Gear Assembly |
| (2) Front Axle Case           | (6) Ball Bearing               |
| (3) Adjusting Shim (A)        | (7) Collar                     |
| (4) Spiral Bevel Pinion Shaft | (8) Adjusting Shim (B)         |

12280S60150





12280P60140



12280F60040

### Differential Gear

1. Tap out the spring pin (6) and then remove the yoke shaft (10).
2. Remove the differential side gear (5) and differential pinion (7).
3. Remove the external snap ring (8) and spiral bevel gear (1).

#### NOTE

- Arrange the parts to know their original position.

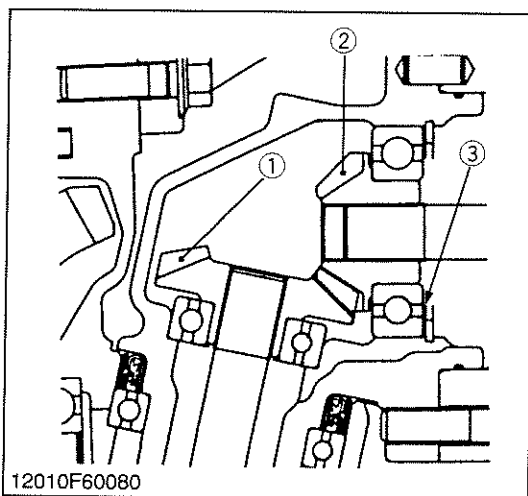
#### (When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the thrust collars (4), differential side gears (5) and differential pinions (7).

- |                            |                         |
|----------------------------|-------------------------|
| (1) Spiral Bevel Gear      | (7) Differential Pinion |
| (2) Ball Bearing           | (8) External Snap Ring  |
| (3) Differential Case      | (9) Shim (B)            |
| (4) Thrust Collar          | (10) Yoke Shaft (RH)    |
| (5) Differential Side Gear | (11) Yoke Shaft (LH)    |
| (6) Spring Pin             |                         |

12280S60160

## SERVICING



12010F60080

### Backlash between 10T Bevel Gear and 16T Bevel Gear

1. Stick a strip of fuse to three spots on the 16T bevel gear (1) with grease.
2. Fix the front axle case, bevel gear case and front gear case.
3. Turn the axle.
4. Remove the bevel gear case from front axle case and measure the thickness of the fuses with an outside micrometer.
5. If the backlash is not within the factory specifications, adjust with shim (3).

Backlash between 10T bevel gear and 16T bevel gear	Factory spec.	0.10 to 0.30 mm 0.004 to 0.012 in.
--	---------------	---------------------------------------

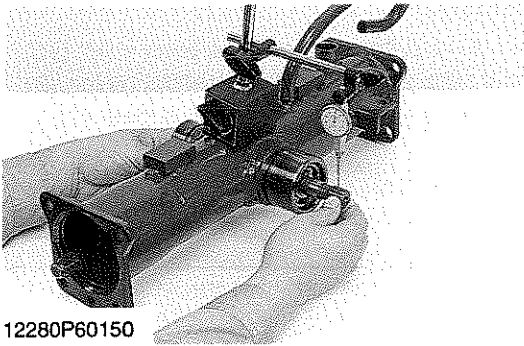
#### (Reference)

- Thickness of adjusting shims (3) :
 

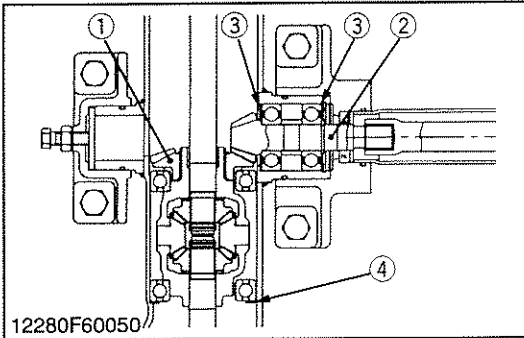
0.8 mm (0.031 in.)	1.2 mm (0.047 in.)
1.0 mm (0.039 in.)	1.4 mm (0.055 in.)
- Tooth contact : More than 35 %

- |                    |          |
|--------------------|----------|
| (1) 16T Bevel Gear | (3) Shim |
| (2) 10T Bevel Gear |          |

12280S60190



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- (1) Spiral Bevel Gear      (3) Adjusting Shim A  
(2) Spiral Bevel Pinion Shaft      (4) Adjusting Shim B

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

1. Set a dial gauge (lever type) with its finger on the spline of spiral bevel pinion shaft.
2. Measure the backlash by moving the spiral bevel pinion shaft by hand lightly.
3. If the backlash is not within the factory specifications, select the adjusting shim (A) and (B).
4. Adjust the backlash properly by repeating the above procedures.
5. Apply read lead lightly over several teeth at three positions equally spaced on the spiral bevel gear.
6. Turn the spiral bevel pinion shaft.
7. Check the tooth contact. If not proper, adjust the adjusting shim (A) and (B).
8. Repeat above until the proper tooth contact and backlash are achieved.

Backlash between spiral  
bevel pinion shaft and  
spiral bevel gear

Factory spec.

0.1 to 0.3 mm  
0.004 to 0.012 in.

#### (Reference)

- Above factory specification should be measured on the tooth of spiral 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:
 

A: 0.6 mm (0.024 in.)	B: 0.6 mm (0.024 in.)
0.8 mm (0.031 in.)	0.8 mm (0.031 in.)
1.2 mm (0.047 in.)	1.0 mm (0.039 in.)
1.4 mm (0.055 in.)	1.2 mm (0.047 in.)
1.6 mm (0.063 in.)	1.4 mm (0.055 in.)
	1.6 mm (0.063 in.)

#### [Proper Contact]



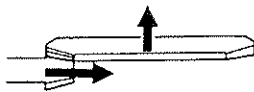
11790F30160

More than 35 % red lead contact area on the gear tooth surface.

#### [Shallow Contact]



#### [Heel Contact]



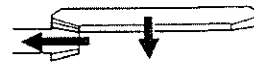
11790F30170

Replace adjusting shim (A) with thicker one to move the spiral bevel pinion shaft backward.  
And place the adjusting shim (B) change to the thinner one.

#### [Deep Contact]



#### [Toe Contact]



11790F30180

Replace adjusting shim (A) with thinner one to move the spiral bevel pinion shaft forward.  
And place the adjusting shim (B) change to the thinner one.

12280S60180

# MECHANISM

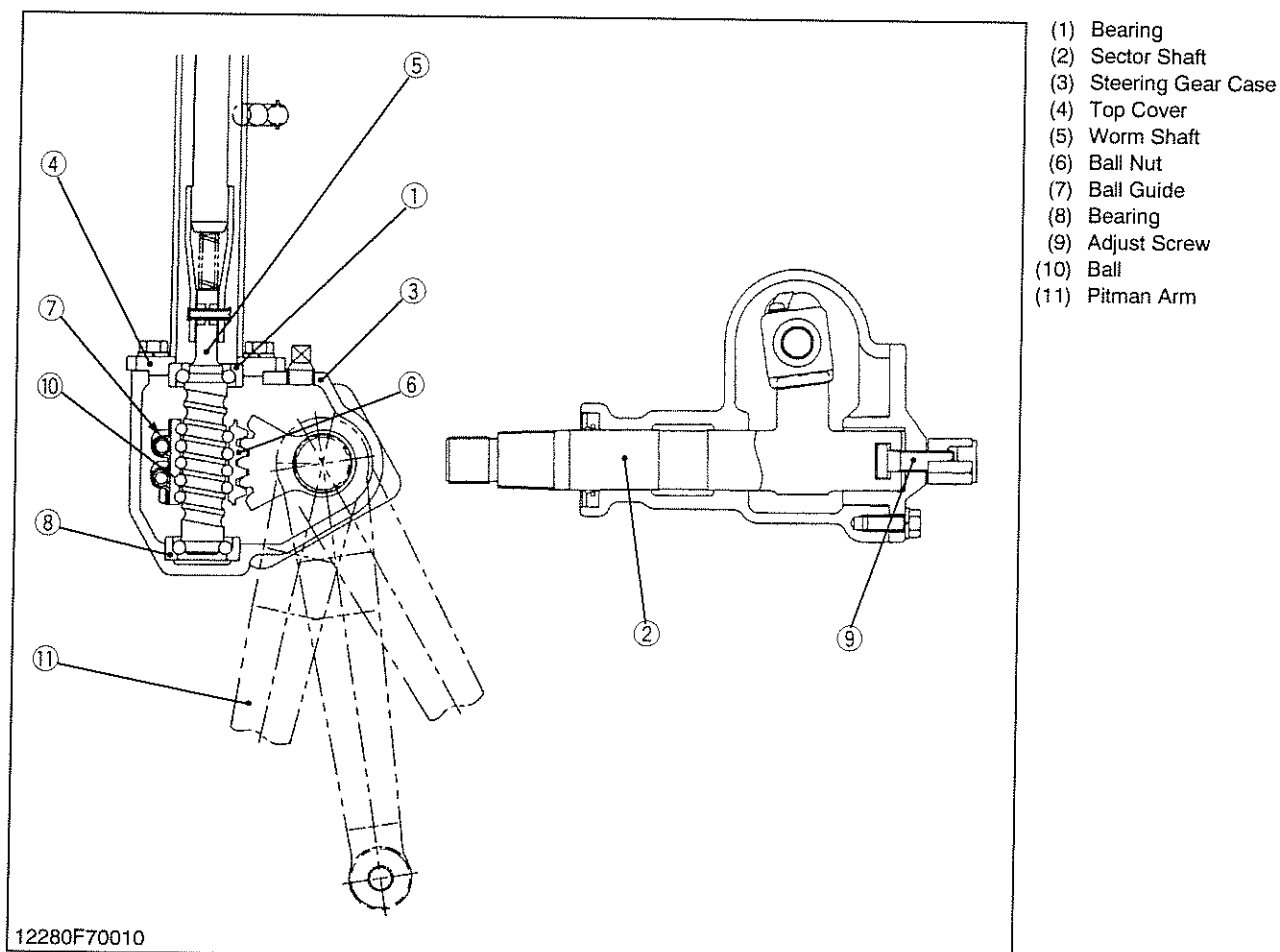
## CONTENTS

<b>[1] STRUCTURE</b> .....	7-M1
(1) Manual Steering System.....	7-M1



## [1] STRUCTURE

### (1) Manual Steering System



- (1) Bearing
- (2) Sector Shaft
- (3) Steering Gear Case
- (4) Top Cover
- (5) Worm Shaft
- (6) Ball Nut
- (7) Ball Guide
- (8) Bearing
- (9) Adjust Screw
- (10) Ball
- (11) Pitman Arm

The steering is of the recirculating ball bearing, ball nut type. Ball nut (6) is thread over the worm portion of worm shaft (5) and they have grooves corresponding to each other. These grooves are filled with steel balls (10) and ball nut (6) is provided with ball guides (7) to make up circuits of recirculating balls.

Worm shaft (5) is supported by two bearings (1), (8). One is at the bottom of top cover (4) and the other is in the bottom of steering gear case (3). The gear teeth on ball nut (6) mesh with the gear on sector shaft (2).

Turning the steering wheel clockwise, ball nut (6) is moved upward by the steering worm shaft (5). Sector shaft (2), which meshes with ball nut (6), rotates and pitman arm (11) pulls the drag link. Then wheels turn to the right.

Turning the steering wheel counterclockwise, ball nut (6) is moved downward by the worm shaft (5). Sector shaft (2), which meshes with ball nut (6), rotates and pitman arm (11) pushes the drag link. Then wheels turn to the left.

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# SERVICING

## CONTENTS

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## TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Excessive Steering Wheel Play</b>	• Backlash between sector gear shaft and ball nut too large	Adjust	7-S6
	• Steering linkage worn	Replace	—
	• Sector gear shaft worn	Replace	7-S4
<b>Tractor Pulls to Right or Left</b>	• Tire pressure uneven	Adjust	G-35
	• Steering wheel play too small	Adjust	7-S6
	• Toe-in incorrect	Correct or Replace	6-S2, S5
<b>Front Wheels Vibration</b>	• Steering linkage worn	Replace	—
	• Toe-in incorrect	Correct or Replace	6-S2, S5

12280S70010

## SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Steering Wheel	Play	5.0 to 30.0 mm 0.20 to 1.18 in.	—
Worm Shaft and Sector Shaft	Total Turning Torque	0.45 to 1.0 N·m 0.05 to 0.10 kgf·m 0.33 to 0.74 ft-lbs	—

12280S70020

## TIGHTENING TORQUES

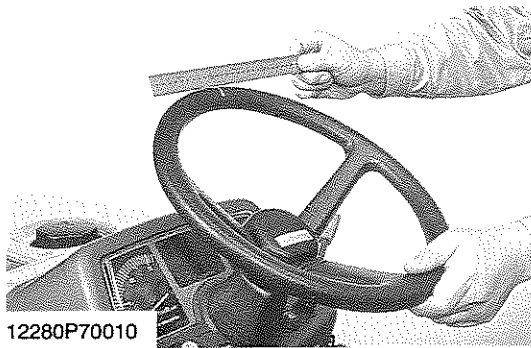
Tightening torques of screws, bolts and nuts on the table below are especially specified.  
(For general use screws, bolts and nuts : See page G-10.)

Item	N·m	kgf·m	ft-lbs
Pitman arm mounting nut	60 to 110	6.1 to 11.2	44.3 to 81.1
Steering gear box mounting screw	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5
Steering wheel mounting nut	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Top cover mounting nut	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Side cover mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3

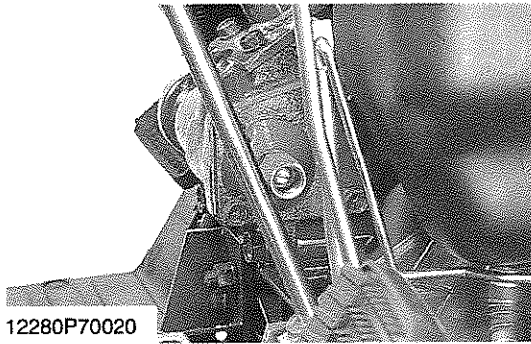
12280S70030

# CHECKING, DISASSEMBLING AND SERVICING

## CHECKING AND ADJUSTING



12280P70010



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### Steering Wheel Play

1. Turn the front wheels straight ahead.
2. Move the steering wheel back and forth until slight movement of pitman arm is seen. Measure maximum play of steering wheel at outer rim.
3. If the play is not within the factory specifications, turn the adjusting screw to adjust.

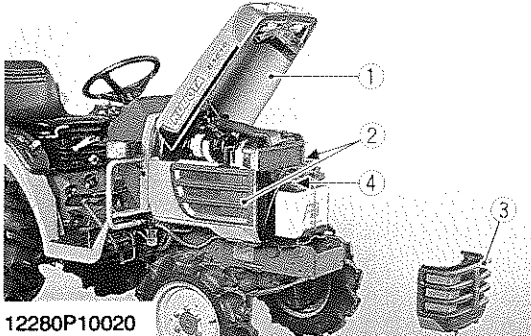
Steering wheel play	Factory spec.	5 to 30 mm 0.20 to 1.18 in.
---------------------	---------------	--------------------------------

### (Adjusting)

1. Remove the steering wheel.
2. Remove the meter panel and panel under cover.
3. Install the steering wheel.
4. Loosen the lock nut and turn the adjusting screw with a screwdriver to adjust the play.  
When the adjusting screw is turned clockwise, the play decreases.
5. After adjustment, fix it with the lock nut while holding the adjusting screw.

12280S70040

## [1] SEPARATING STEERING GEAR BOX



12280P10020

### Hood, Side Cover and Battery Cord

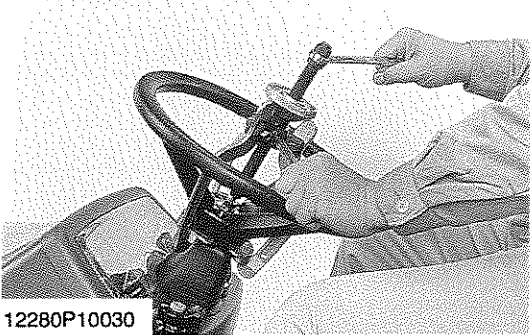
1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).
3. Disconnect the head light connectors and remove the hood and side covers (2).

### NOTE

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

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

12280S10110



12280P10030

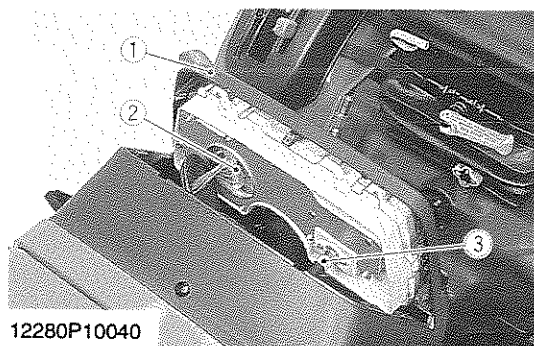
### Steering Wheel

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

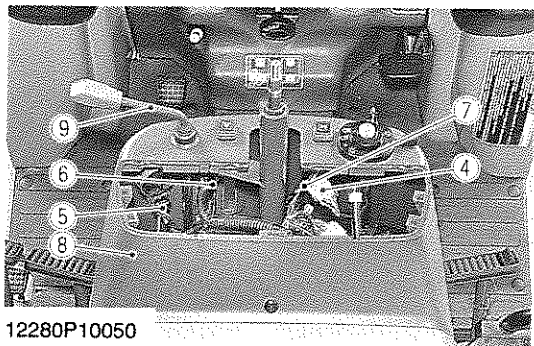
### (When reassembling)

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft·lbs
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12280P10040



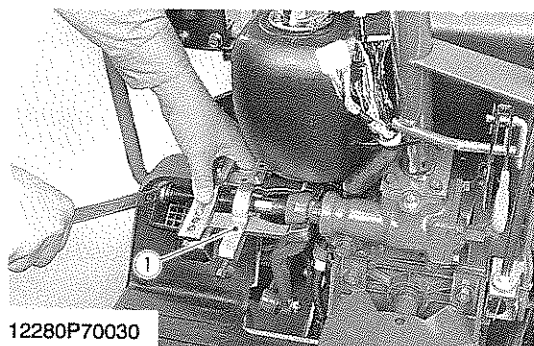
12280P10050

### Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Disconnect the combination switch connector (4), main switch connector (5), hazard switch connector (6) and parking light switch connector (7).
3. Tap out the spring pin and remove the hand accelerator lever (9).
4. Remove the panel under cover (8).

- |                                  |                                    |
|----------------------------------|------------------------------------|
| (1) Meter Panel                  | (6) Hazard Switch Connector        |
| (2) Meter Panel Connector        | (7) Parking Light Switch Connector |
| (3) Hour-meter Cable             | (8) Panel Under Cover              |
| (4) Combination Switch Connector | (9) Hand Accelerator Lever         |
| (5) Main Switch Connector        |                                    |

12280S10130



12280P70030

### Pitman Arm

1. Use a pitman arm puller (1) or similar puller to remove the pitman arm.

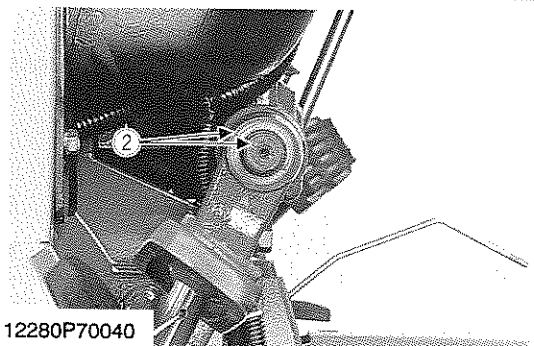
#### ■ IMPORTANT

- When removing pitman arm, do not strike the end of cross shaft or pulley. Damage to gear box could occur.
- Install the pitman arm to the sector gear shaft so that their marks (2) align.

Tightening torque	Pitman arm mounting nut	60 to 110 N·m 6.1 to 11.2 kgf·m 44.3 to 81.1 ft·lbs
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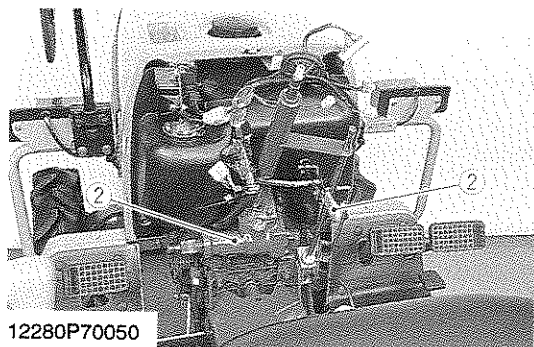
(1) Pitman Arm Puller

(2) Mark



12280P70040

12280S70050



12280P70050

### Steering Gear Box Assembly

1. Remove the parking brake lever (1).
2. Remove the steering gear box assembly (2) from the clutch housing.

Tightening torque	Steering gear box mounting screw	62.8 to 72.5 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft·lbs
-------------------	----------------------------------	---

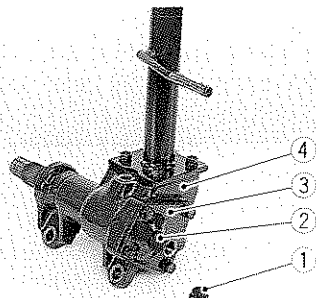
(1) Parking Brake Lever

(2) Steering Gear Box Assembly

12280S70060

## [2] STEERING GEAR BOX ASSEMBLY

### DISASSEMBLING AND ASSEMBLING



12280P70060

#### Side Cover

1. Drain the steering gear box oil.
2. Remove the cap (1) and lock nut (2).
3. Remove the side cover mounting screws.
4. Adjusting the screw in, to remove the side cover (3).

#### (When reassembling)

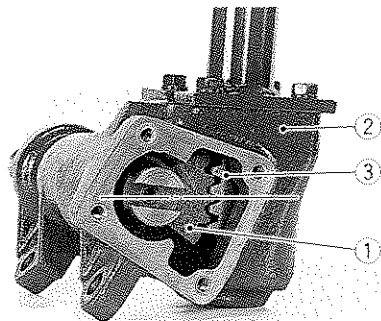
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of side cover (3) and steering gear box (4).
- Use KUBOTA SUPER FLUID OR SAE 80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-9).

Steering gear box oil capacity	0.17 L 0.18 U.S.gals. 0.15 Imp.gals.
--------------------------------	--

Tightening torque	Side cover mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
-------------------	---------------------------	---

- (1) Cap (3) Side Cover  
(2) Lock Nut (4) Steering Gear Box

12280S70070



12280P70070

#### Sector Shaft

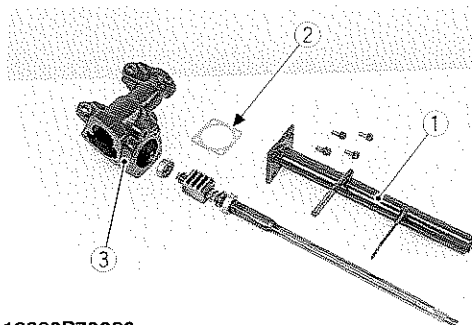
1. Turn the worm shaft so that sector shaft (1) teeth are aligned with wider opening in steering gear box (2).
2. Remove the sector shaft (1).

#### (When reassembling)

- Turn the worm shaft so that the ball nut (3) is centered in its travel. Then, install the sector shaft (1) to center tooth engage the center of the ball nut (3).

- (1) Sector Shaft (3) Ball Nut  
(2) Steering Gear Box

12280S70080



12280P70080

#### Top Cover (Steering Column) and Ball Nut Assembly

1. Remove the top cover (steering column) mounting screws.
2. Pull the worm shaft with ball nut from the steering gear box.

#### (When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of top cover (1), steering gear box (2), and shims (3).

#### NOTE

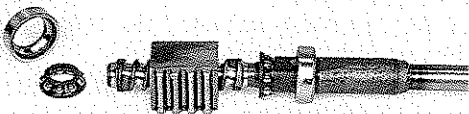
- Be sure to check the number of shims used between top cover and steering gear box.

Tightening torque	Top cover mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
-------------------	--------------------------	---

- (1) Top Cover (Steering Column) (3) Shims  
(2) Steering Gear Box

12280S70090

## SERVICING

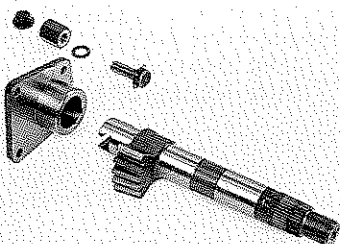


12280P70090

### Bearing and Bearing to Worm Shaft Contact Area

1. Inspect the lower and upper ball bearing and race for roughness or pitting. If damaged, replace bearing and race.
2. Inspect the lower and upper bearing to worm shaft contact area for pitting or roughness. Replace parts as necessary.

12280S70100



12280P70100

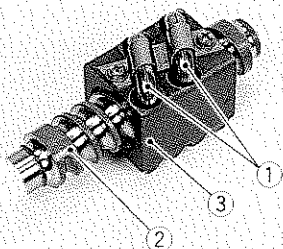
### Sector Shaft

1. Inspect the sector shaft to steering gear box and side cover contact areas for wear or scoring.
2. Inspect the teeth area and pitman arm spline for cracks, chipping or excessive wear. Replace the sector shaft as necessary.
3. Check the side cover for cracks or damage. Replace the side cover if necessary.

- (1) Sector Shaft  
(2) Adjusting Screw

- (3) Shim  
(4) Side Cover

12280S70110



000B203P075

### Ball Nut

1. Thoroughly clean the worm shaft (2) and ball nut (3). Turn the ball nut on the shaft, feeling for roughness, binding or sticking. Inspect the worm path for pitting or flaking.
2. Check the return guide (1) for damage.
3. Inspect the ball nut teeth for excessive wear or roughness.

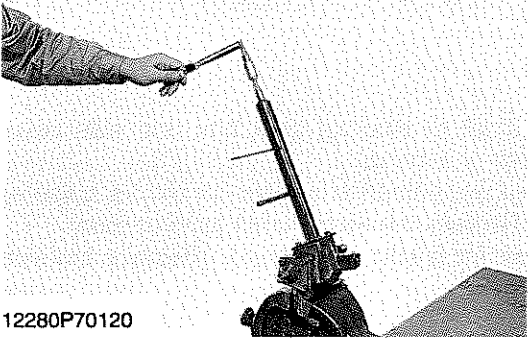
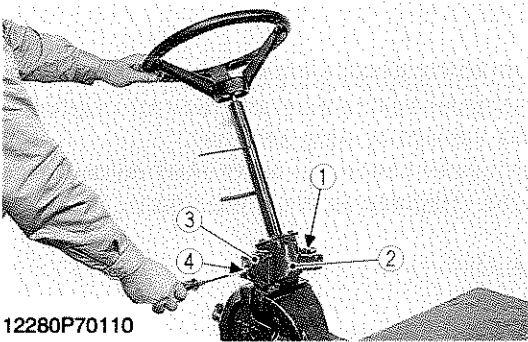
#### NOTE

- Do not remove the ball nut from the worm shaft. The two parts are replaced as a unit only.

- (1) Return Guide  
(2) Worm Shaft

- (3) Ball Nut

12280S70120



**Total Turning Torque of Worm Shaft and Sector Shaft**

1. Install the sector shaft (1) to steering gear box (2) as shown.
2. Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of side cover and steering gear box.
3. Install the side cover (3) by adjusting screw (4) through cover.
4. Tighten the side cover mounting screw. Be sure to keep adjusting screw loosen when tightening.
5. Install the seal washer and lock nut to adjusting screw and adjust the steering wheel play (backlash between sector shaft teeth and ball nut teeth).
6. Then, measure the total turning torque required to initial turning.

Steering wheel play	Factory spec.	5 to 30 mm 0.20 to 1.18 in.
Total turning torque of worm shaft and sector shaft	Factory spec.	0.45 to 1.0 N·m 0.05 to 0.10 kgf·m 0.33 to 0.74 ft·lbs

- (1) Sector Shaft

(2) Steering Gear Box
- (3) Side Cover

(4) Adjusting Screw

12280S70130

# MECHANISM

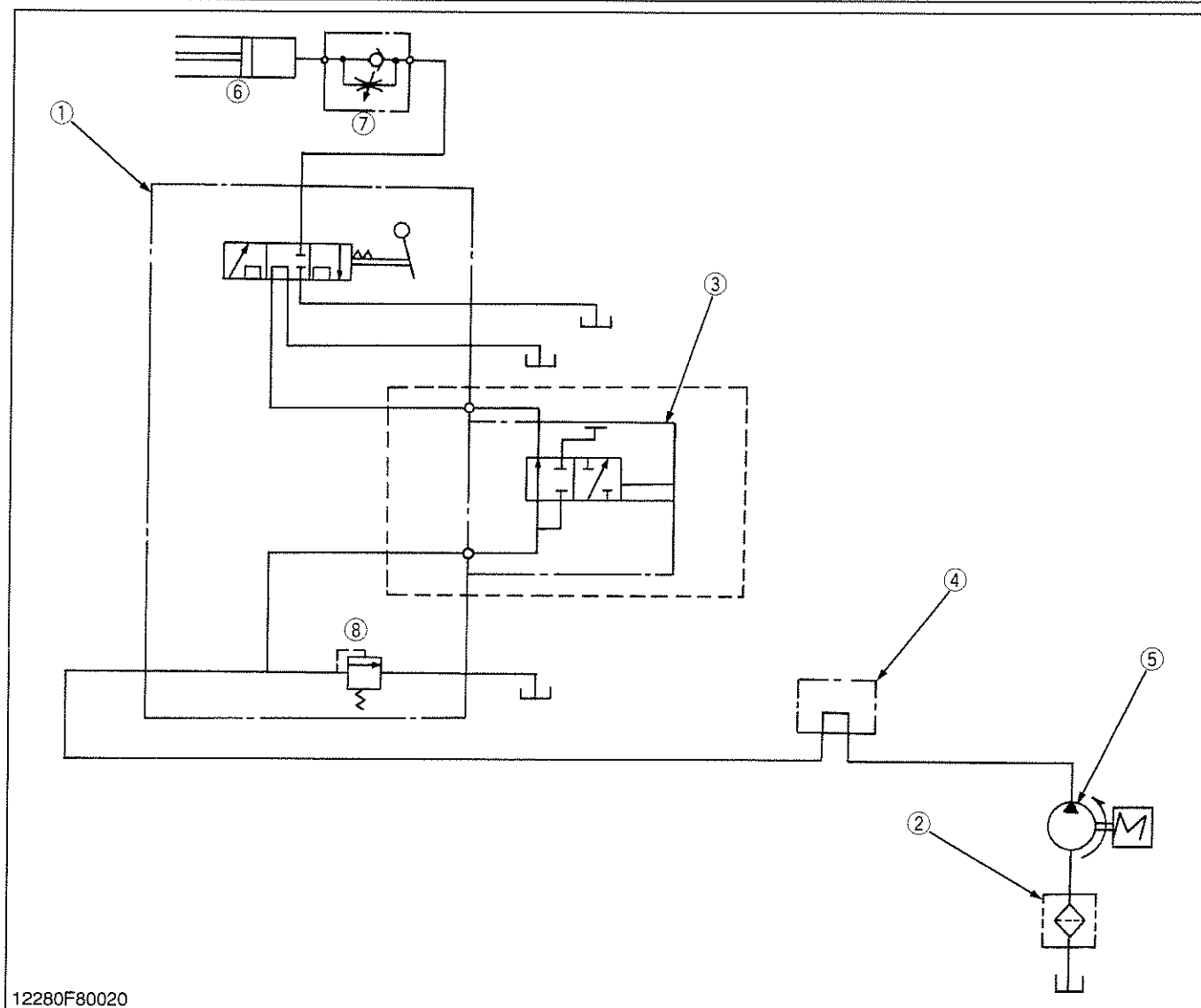
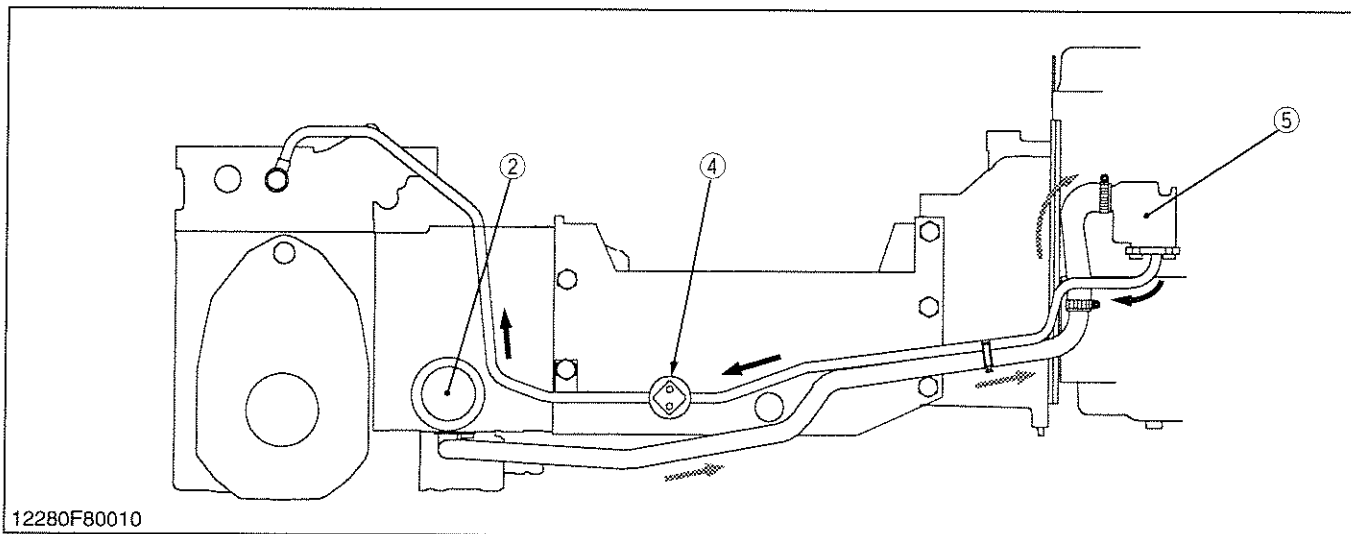
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[3] HYDRAULIC CONTROL VALVE.....	8-M3
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[5] RELIEF VALVE .....	8-M5
[6] HYDRAULIC CYLINDER .....	8-M6
[7] HYDRAULIC BLOCK TYPE OUTLET .....	8-M7
[8] REAR HYDRAULIC OUTLET .....	8-M7





## [1] HYDRAULIC CIRCUIT



(1) Hydraulic Control Valve  
(2) Oil Filter Cartridge

(3) Rear Hydraulic Outlet  
(If equipped)  
(4) Hydraulic Block Type Outlet

(5) Hydraulic Pump  
(6) Hydraulic Cylinder

(7) Lowering Speed Adjusting  
Valve  
(8) Relief Valve

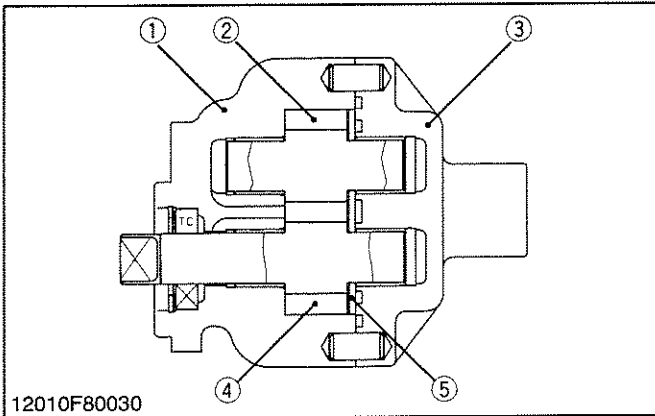
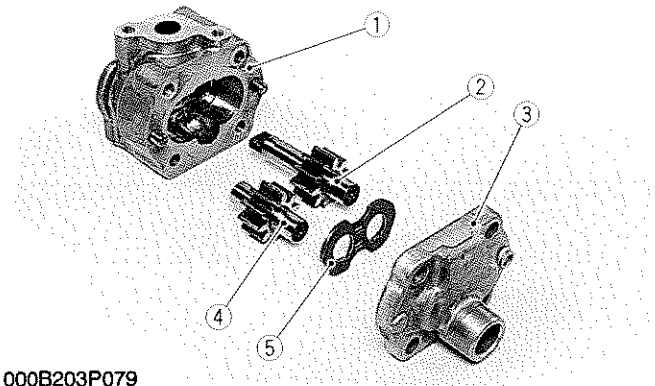
■ Hydraulic System

The hydraulic system of this tractor is composed of a hydraulic pump, hydraulic block type outlet, control valve, hydraulic cylinder, hydraulic oil filter and other components.

This system has the following function.

- 1. Hydraulic power take off from the hydraulic block type outlet to operate the implements such as a front loader, front blade and etc.

[2] HYDRAULIC PUMP



- Oil is supplied by a hydraulic pump connected to the engine. When a engine is started, a hydraulic pump starts running, sucks oil from a transmission case. The hydraulic pump forces out the oil to hydraulic block type outlet, control valve, hydraulic cylinder and hydrostatic transmission.

12280M80030

The hydraulic pump is composed of the casing (1), cover (3), side plate (5), and two spur gears (drive gear (4) and driven gear (2)) that are in mesh.

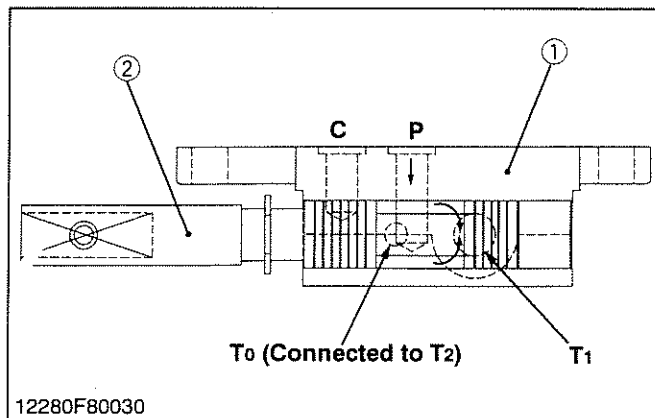
Hydraulic pump is driven by the fuel camshaft.  
Maximum displacement is as follows.

Displacement	Engine speed	Condition
14.1 L/min. 3.7 U.S.gal/min. 3.1 Imp.gal/min.	At 2900 rpm	at no load

- (1) Casing
- (2) Driven Gear
- (3) Cover
- (4) Drive Gear
- (5) Side Plate

12280M80020

### [3] HYDRAULIC CONTROL VALVE



#### ■ Neutral

Oil forced into the control valve (1) through **P** port and returns to the transmission case through **T1** port.

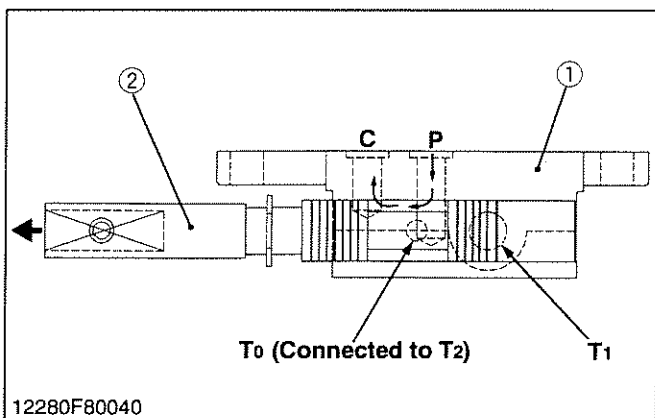
Also, **C** port is closed by spool (2), oil in the hydraulic cylinder does not flow to the transmission case.

Thus, the implement remains at its fixed position.

- (1) Control Valve
- (2) Spool

**P : Pump Port**  
**C : Cylinder Port**  
**T0, T1, T2 : Tank Port**

12280M80040



#### ■ Lift

When the control lever is set to the "**LIFT**" position, the spool (2) is moved to the left.

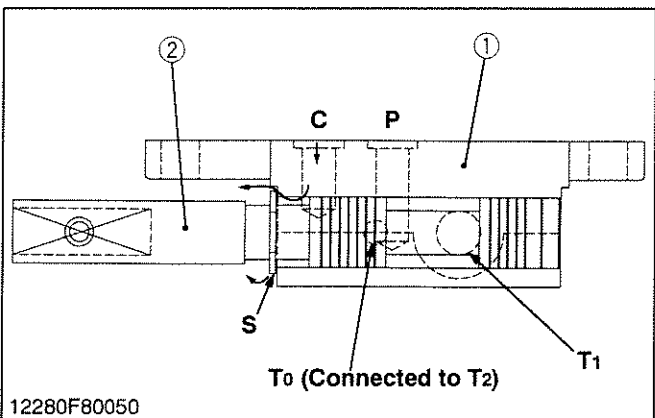
The oil forced into the control valve (1) through **P** port flows to **C** port.

The oil pushes and flow into the hydraulic cylinder through the **C** port to lift the implement.

- (1) Control Valve
- (2) Spool

**P : Pump Port**  
**C : Cylinder Port**  
**T0, T1, T2 : Tank Port**

12280M80050



#### ■ 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 the spool "**S**" by the weight of the implement, causing the implement to lower.

Oil forced into the control valve (1) through the **P** port and returns to the transmission case through the **T1** port.

- (1) Control Valve
- (2) Spool

**P : Pump Port**  
**C : Cylinder Port**  
**T1, T2 : Tank Port**

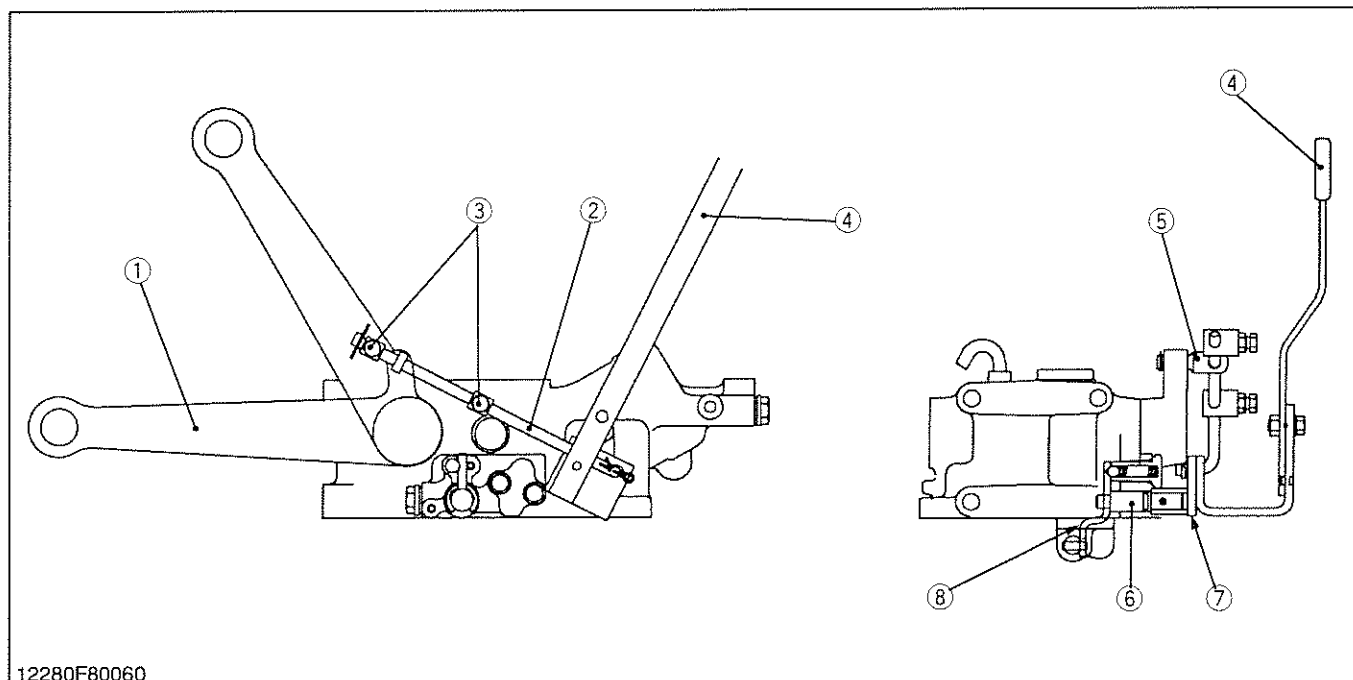
12280M80060

#### ■ NOTE

- The **T0** port is connected to **T2** through the relief valve. When the relief valve opens, pressurized oil is released to the transmission case through **T2** ports.

12280M80070

## [4] FEEDBACK LINKAGE FOR POSITION CONTROL



12280F80060

(1) Lift Arm RH  
(2) Feedback Rod

(3) Interlocker  
(4) Hydraulic Control Lever

(5) Feedback Pin  
(6) Control Lever Shaft

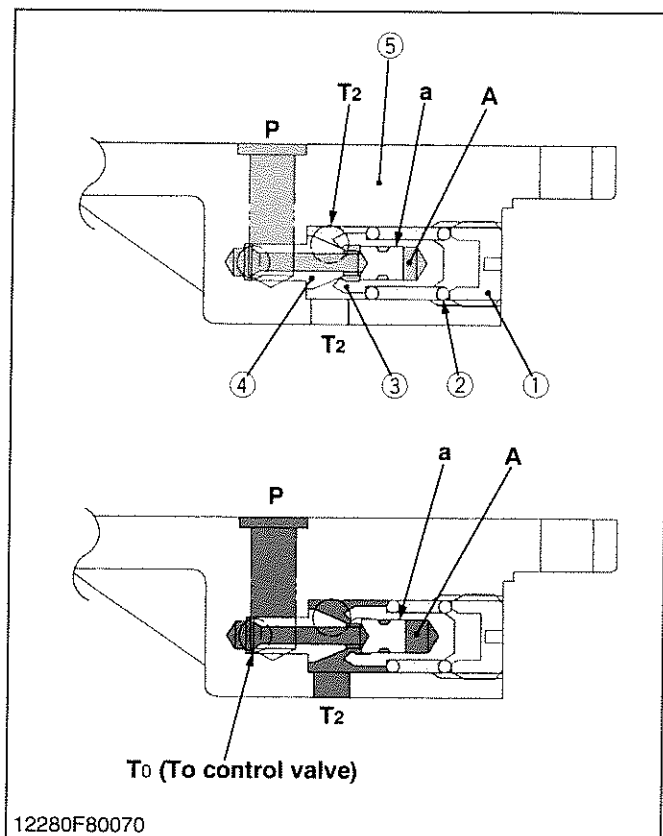
(7) Feedback Arm  
(8) Control Lever Arm

When the hydraulic control lever (4) moved to rearward to lift the implement, the spool of the control valve is pulled out to form a raising circuit by the motions of feedback arm (7), control lever shaft (6) and control lever arm (8). And after the lift arm (1) moves upward,

the spool is pushed in and returned to form a neutral circuit by the motions of interlocker (3), feedback rod (2), feedback arm (7), control lever shaft (6) and control lever arm (8).

12280M80080

## [5] RELIEF VALVE



The three point hydraulic system circuit has a relief valve to restrict the maximum pressure in the circuit. The relief valve is located in control valve body.

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.

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 position control valve.

When the pressure rises above the relief valve setting pressure, the oil reaches the room **A** through the clearance "**a**" of the valve seat (4), then the poppet (3) is pushed against the spring (2) force. This mechanism relieves the shock of this hydraulic system. Finally, oil flows out to the transmission case through **T2** ports, preventing any further rise in pressure. The poppet closes again when enough oil is released to drop pressure below the valve setting.

### (Reference)

- Relief valve setting pressure : 11.3 to 11.8 MPa  
115 to 120 kgf/cm<sup>2</sup>  
1636 to 1707 psi
- Engine speed : Maximum
- Oil temperature : 45 to 55 °C  
113 to 131 °F

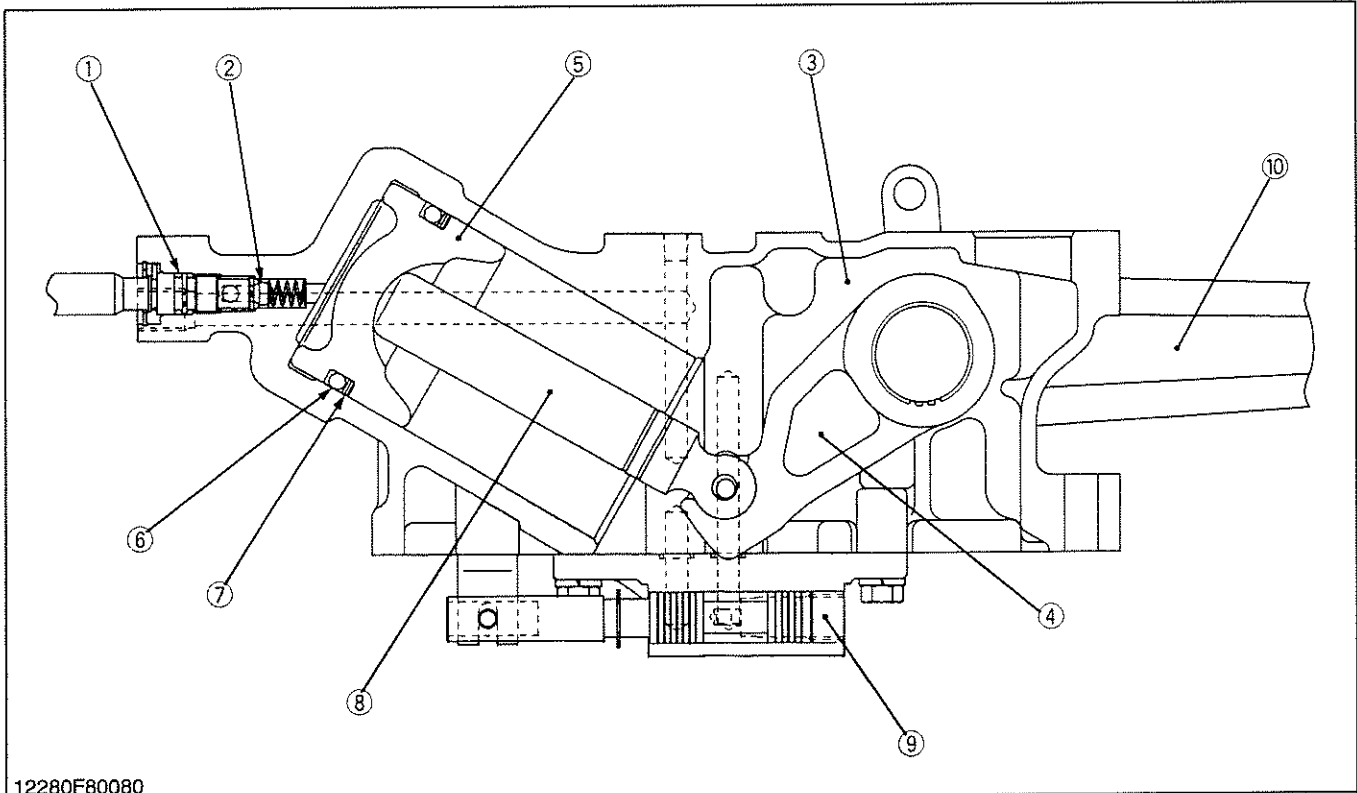
### NOTE

- **Right side of valve seat (4) is connected with left side of valve seat (4).**

- |                        |                                 |
|------------------------|---------------------------------|
| (1) Adjusting Plug     | <b>P : Pump Port</b>            |
| (2) Spring             | <b>A : Room</b>                 |
| (3) Poppet             | <b>T2 : Tank Port</b>           |
| (4) Valve Seat         | <b>a : Clearance (Oil Path)</b> |
| (5) Control Valve Body |                                 |

12280M80090

## [6] HYDRAULIC CYLINDER



12280F80080

- |                                    |                        |                   |                             |
|------------------------------------|------------------------|-------------------|-----------------------------|
| (1) Lowering Speed Adjusting Shaft | (3) Hydraulic Cylinder | (6) O-ring        | (9) Hydraulic Control Valve |
| (2) Ball                           | (4) Hydraulic Arm      | (7) Back-up Ring  | (10) Lift Arm               |
|                                    | (5) Piston             | (8) Hydraulic Rod |                             |

The main components of the hydraulic cylinder are shown in the figure above.

While the lift arm (10) is rising, oil from the hydraulic pump flows into the hydraulic cylinder through the hydraulic control valve (9). Then oil pushes out the piston (5).

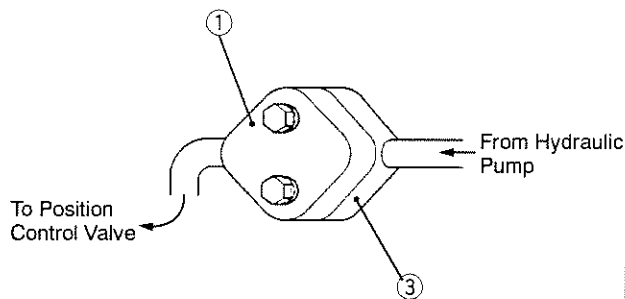
While the lift arm (10) is lowering, oil in the hydraulic cylinder is discharged to the transmission case through the hydraulic control valve (9) by the weight of the

implement. At this time, the lowering speed of the implement can be controlled by the ball (2) attached to the hydraulic cylinder (3). Turning the lowering speed adjusting knob clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve (2) is completely closed, the lift arm (10) is held at its position since oil in the hydraulic cylinder is sealed between the piston (5) and ball (2).

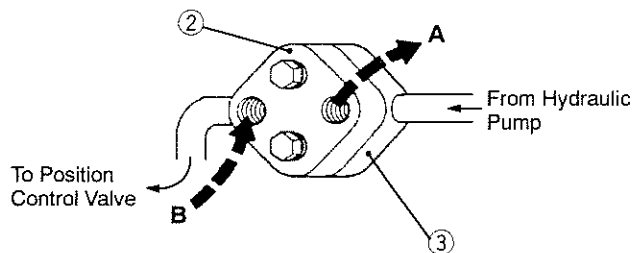
12280M80100

## [7] HYDRAULIC BLOCK TYPE OUTLET

### When implement is not attached



### When implement is attached



12270F80080

The hydraulic block type outlet is located at the right hand side of the engine.

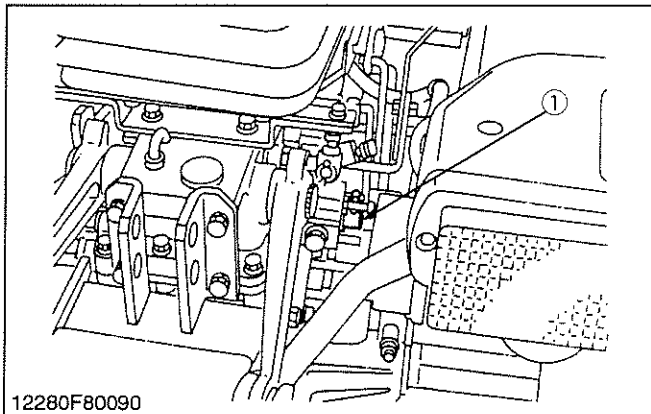
This hydraulic block type outlet is provided to take power out from the tractor to operate the hydraulic cylinders on the implement, such as front end loader, front blade and so on.

- (1) Block Cover
- (2) Block Outlet Cover (Option)
- (3) Hydraulic Block

- (A) To implement (Inlet)  
Max. flow 14.1 L/min.  
(3.7 U.S.gal/min.,  
3.1 Imp.gal/min.)  
No relief valve in the  
hydraulic block.
- (B) From implement (Outlet)

12280M80110

## [8] REAR HYDRAULIC OUTLET



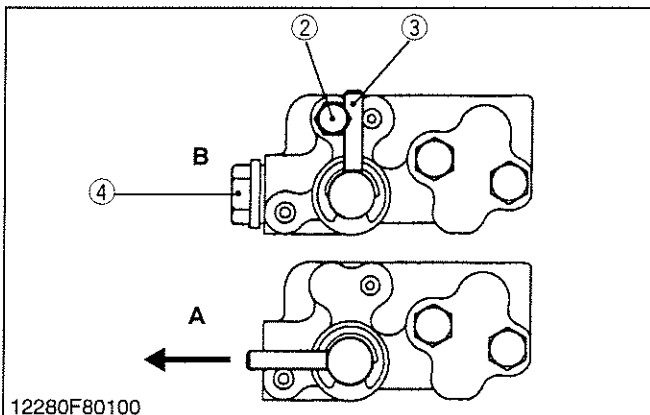
12280F80090

The rear hydraulic outlet is located at the right hand side of the hydraulic cylinder body.

This rear hydraulic outlet is provided to take power out from the tractor to operate the hydraulic cylinder on the implement such as damp trailer so on.

- (1) Hydraulic Outlet
- (2) Restricting Bolt
- (3) Lever
- (4) Plug

- (A) For implement  
Max. flow 14.1 L/min.  
(3.7 U.S.gal/min.,  
3.1 Imp.gal/min.)
- (B) 3-Point Hitch Operation



12280F80100

12280M80120





# SERVICING

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# TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Implement Does Not Rise (No Noise)</b>  <b>(Noise)</b>	<ul style="list-style-type: none"> <li>Hydraulic Control valve broken</li> <li>Relief valve spring damaged</li> <li>Spool sticks</li> <li>Piston O-ring or cylinder damaged</li> </ul>	Replace Replace Repair Replace	8-S8 8-S10 8-S10 8-S9
	<ul style="list-style-type: none"> <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>	Repair or Replace Repair or Replace  Replace Refill Adjust or Replace Replace	— —  — G-9 8-S6 8-S4
<b>Implement Does Not Reach Maximum Height</b>	<ul style="list-style-type: none"> <li>Feedback rod interlock improperly adjust</li> </ul>	Adjust	8-S7
<b>Implement Does Not Lower</b>	<ul style="list-style-type: none"> <li>Hydraulic linkage malfunctioning</li> </ul>	Repair	8-S7
<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>Hydraulic control valve malfunctioning</li> </ul>	Replace Replace Replace	8-S8 8-S9 8-S8

12280S80010

# SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
<b>[Hydraulic Pump]</b> Pump Delivery at Engine 2900 rpm, Oil Temperature 50°C, 122°F			
	at no pressure	14.1 L/min. 3.7 U.S.gal/min. 3.1 Imp.gal/min.	—
	at 11.8 MPa 120 kgf/cm <sup>2</sup> 1707 psi	13.4 L/min. 3.5 U.S.gal/min. 2.9 Imp.gal/min.	—
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.
Gear to Casing	Clearance	—	0.15 mm 0.0059 in.
Lift Arm	Free Play	5 to 25 mm 0.20 to 0.98 in.	—
Relief Valve	Setting Pressure	11.3 to 11.8 MPa 115 to 120 kgf/cm <sup>2</sup> 1636 to 1707 psi	—
Hydraulic Cylinder	I.D.	65.05 to 65.10 mm 2.5610 to 2.5629 in.	65.15 mm 2.5650 in.
Hydraulic Arm Shaft to Bushing			
Hydraulic Arm Shaft, Left	O.D.	31.925 to 31.950 mm 1.2569 to 1.2579 in.	—
Hydraulic Arm Shaft, Right	O.D.	29.925 to 29.950 mm 1.1781 to 1.1791 in.	—
Bushing, Left	I.D.	31.970 to 32.035 mm 1.2589 to 1.2612 in.	—
Bushing, Right	I.D.	29.975 to 30.035 mm 1.1801 to 1.1825 in.	—

12280S80020

## 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-10.)

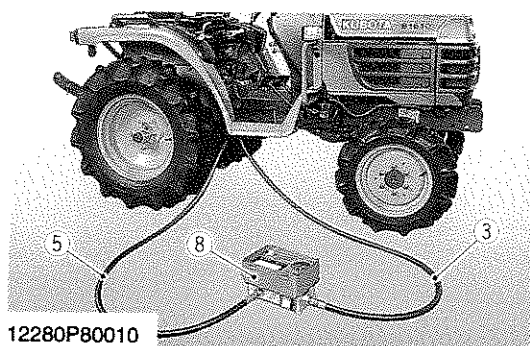
Item	N·m	kgf·m	ft-lbs
Delivery pipe joint bolt	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Hydraulic pump mounting screw	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Top link bracket mounting screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Hydraulic cylinder assembly mounting screw and nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Hydraulic control valve mounting screw	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2

12280S80030

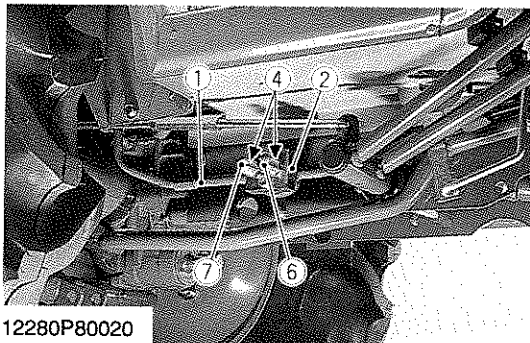
## CHECKING, DISASSEMBLING AND SERVICING

### [1] HYDRAULIC PUMP

#### CHECKING AND ADJUSTING



12280P80010



12280P80020

#### Flowmeter Connecting and Test Preparation

##### ■ IMPORTANT

- When using a flowmeter other than KUBOTA specified flowmeter (Code No: 07916-52792), be sure to use the instructions with that flowmeter.
- In this hook-up, there is no relief valve. Therefore while testing, do not close the flowmeter loading valve completely.

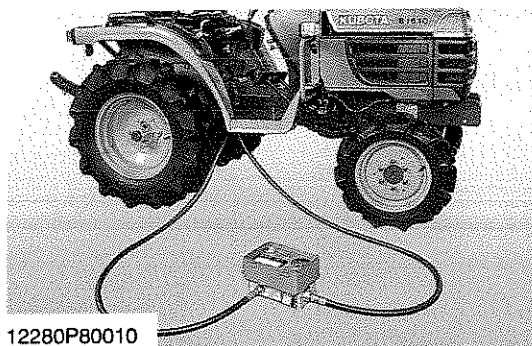
- Remove the hydraulic block outlet cover.
- Attach the hydraulic block (2) with adaptor **69** (4) for hydraulic pump testing to hydraulic block outlet.
- Connect the hydraulic test hose (3) (Code No: 07916-52651) to the adaptor **69** (pump port) (6) and flowmeter (8) (Code No: 07916-52791) inlet port.
- Connect the another hydraulic test hose (3) to flowmeter outlet port and adaptor **69** (power beyond port) (7).
- Open the flowmeter loading valve completely. (Turn counterclockwise)
- Start the engine and set the engine speed at **2900 rpm**.
- Slowly close the loading valve to generate the pressure **approx. 11.8 MPa (120 kgf/cm<sup>2</sup>, 1707 psi)**.
- Hold in this condition until oil temperature reaches approx. 50 °C (122 °F).

##### (Reference)

- Adaptor is included in the adaptor set (Code No: 07916-54031).
- When testing the hydraulic pump, use the hydraulic block. (Refer to G-34)

- |   |                         |
|---|-------------------------|
| (1) Hydraulic Delivery Pipe for 3-Point Hitch | (5) Hydraulic Test Hose |
| (2) Hydraulic Block                           | (6) Pump Port           |
| (3) Hydraulic Test Hose                       | (7) Power Beyond Port   |
| (4) Adaptor <b>69</b>                         | (8) Flowmeter           |

12280S80040



### Pump Test

#### NOTE

- Before pump testing, perform the flowmeter connecting and test preparation. (See page 8-S3.)
1. Open the loading valve completely.
  2. Start the engine and set at approx. 2900 rpm.
  3. Read and note the pump delivery at no pressure.
  4. Slowly close the loading valve to increase pressure approx. 11.8 MPa (120 kgf/cm<sup>2</sup>, 1707 psi).
  5. Read and note the pump flow at rated pressure.
  6. Open the loading valve and stop the engine.

#### (Reference)

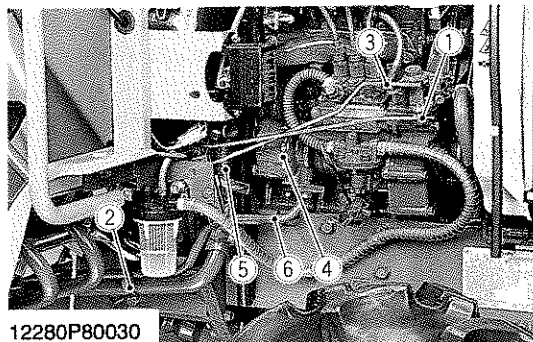
Hydraulic pump delivery at no pressure	Factory spec.	Above 14.1 L/min. 3.7 U.S.gal/min. 3.1 Imp.gal/min.
Hydraulic pump delivery at rated pressure	Factory spec.	Above 13.4 L/min. 3.5 U.S.gal/min. 2.9 Imp.gal/min.

#### Condition

- Engine speed .....Approx. 2900 rpm
- Rated pressure .....11.8 MPa  
120 kgf/cm<sup>2</sup>  
1707 psi
- Oil temperature .....50 °C  
122 °F

12280S80050

## DISASSEMBLING AND ASSEMBLING



12280P80030

### Removing Hydraulic Pump

1. Open the bonnet then remove the grille side cover (RH).
2. Disconnect the connector of the engine stop rod (3) and accelerator rod (1).
3. Loosen the pipe clamp (2) and remove the 3-point hitch delivery pipe (6).
4. Disconnect the suction hose (5) and remove the hydraulic pump (4).

#### (When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to engine stop solenoid.

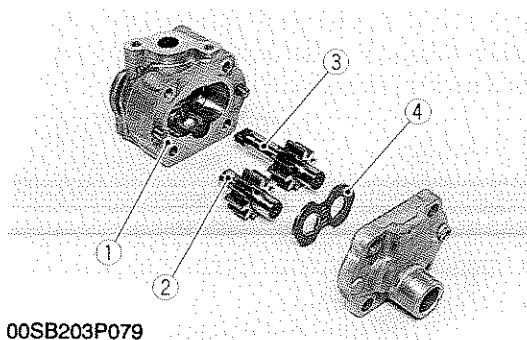
#### NOTE

- For fastening hydraulic pipe nut, use two wrenches. Hold the fitting with a wrench, turn the pipe nut another wrench to avoid damage at fitting installed part.

- (1) Accelerator Rod  
(2) Pipe Clamp  
(3) Engine Stop Rod

- (4) Hydraulic Pump  
(5) Suction Hose  
(6) 3-Point Hitch Delivery Pipe

12280S80060



00SB203P079

**Cover, Side Plate and Gear**

1. Secure the hydraulic pump with a vise, and remove the cover.
2. Remove the side plate (4).
3. Remove the drive gear (3) and driven gear (2) from the casing (1).

**(When reassembling)**

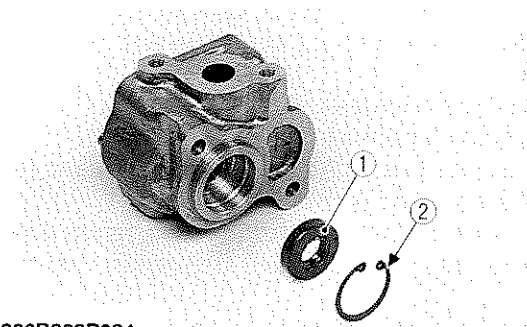
- Take care not to damage the O-ring.
- Align the holes of the cover and casing.
- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

Tightening torque	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) Casing  
(2) Driven Gear

- (3) Drive Gear  
(4) Side Plate

12280S80070



000B203P084

**Oil Seal**

1. Remove the internal snap ring (2), and remove the oil seal (1).

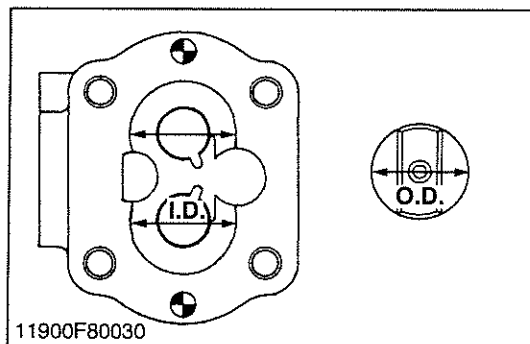
**(When reassembling)**

- If the oil seal is defective, worn or scratched, replace it.

- (1) Oil Seal

- (2) Internal Snap Ring

12280S80080

**SERVICING**

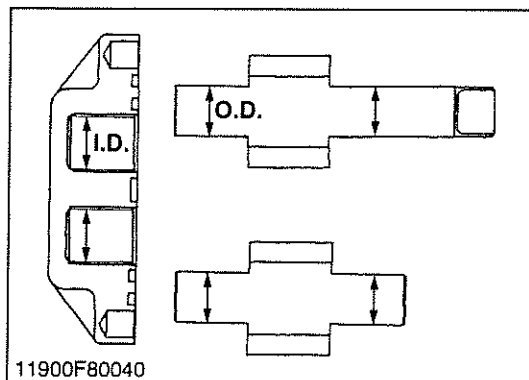
11900F80030

**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.
--	-----------------	-----------------------

12280S80200



11900F80040

**Clearance between Bushing and Shaft**

1. Measure the 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 shaft	Factory spec.	0.020 to 0.091 mm 0.0008 to 0.0036 in.
	Allowable limit	0.12 mm 0.0047 in.

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.

12280S80210



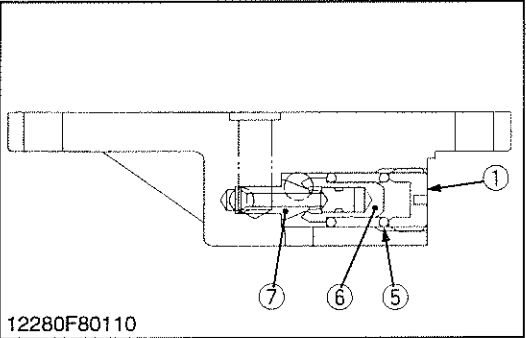
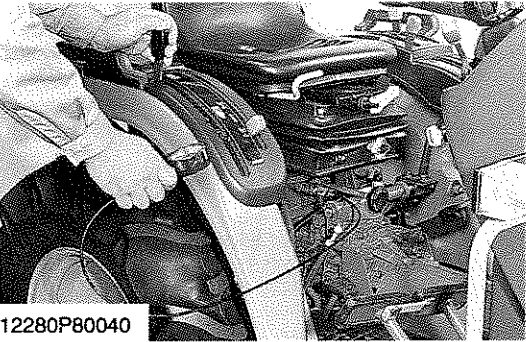
**Side Plate Thickness**

- 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.

11900S80110

**[2] HYDRAULIC CYLINDER ASSEMBLY AND HYDRAULIC BLOCK CHECKING AND ADJUSTING**



**Relief Valve Setting Pressure**

- 1. Remove the seat under cover.
- 2. Remove the plug (1) from front of hydraulic cylinder body.
- 3. Install the adaptor 58. Then connect the cable and pressure gauge to adaptor 58.
- 4. Lengthen the feedback rod interlocker (3).
- 5. Start the engine and set at maximum speed.
- 6. Move the hydraulic control lever (2) all way up to operate the relief valve and read the gauge.
- 7. If the pressure is not within the factory specifications, remove the hydraulic cylinder assembly (refer to 8-S8) and adjust with the adjusting plug (4).
- 8. Reinstall the hydraulic cylinder assembly. After checking the pressure, be sure to stake the adjusting plug and control valve body with a punch and reinstall the feedback rod interlocker (3) correctly.

Relief valve setting pressure	Factory spec.	11.3 to 11.8 MPa 115 to 120 kgf/cm <sup>2</sup> 1636 to 1707 psi
-------------------------------	---------------	--

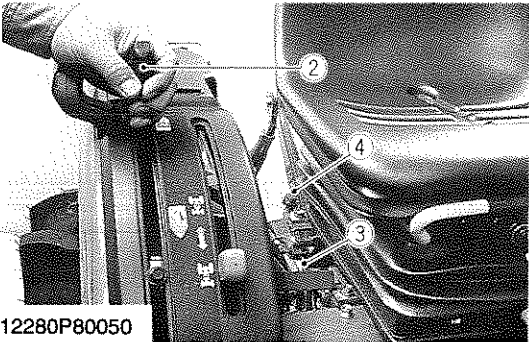
**Condition**

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

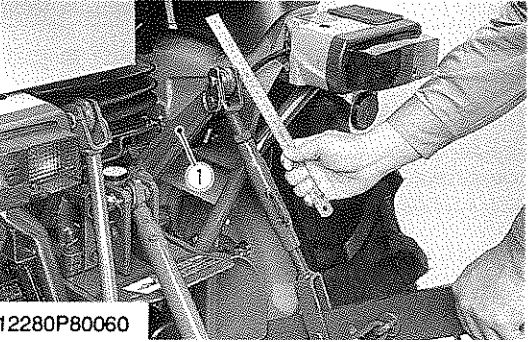
- |                              |                |
|------------------------------|----------------|
| (1) Plug                     | (5) Spring     |
| (2) Hydraulic Control Lever  | (6) Poppet     |
| (3) Feedback Rod Interlocker | (7) Valve Seat |
| (4) Adjusting Plug           |                |

12280S80090





12280P80050



12280P80060

**Lift Arm Free Play**

1. Set the hydraulic control lever (2) to the lowest position.
2. Start the engine, and set at the idling speed.
3. Move the hydraulic control lever (2) 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 interlocker (4).

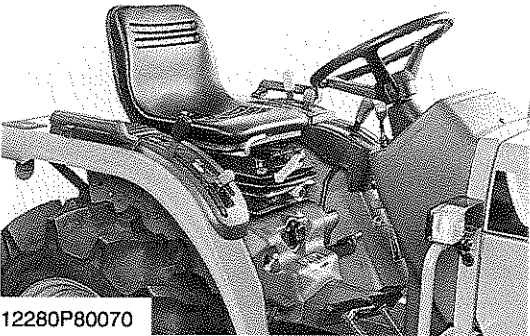
Lift arm free play	Factory spec.	5 to 25 mm 0.20 to 0.98 in.
--------------------	---------------	--------------------------------

- |                             |                              |
|-----------------------------|------------------------------|
| (1) Lift Arm                | (3) Feedback Rod             |
| (2) Hydraulic Control Lever | (4) Feedback Rod Interlocker |

12280S80100

**DISASSEMBLING AND ASSEMBLING**

**(1) Separating Hydraulic Cylinder Assembly**

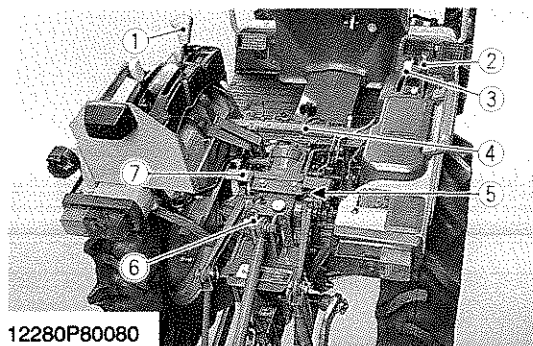


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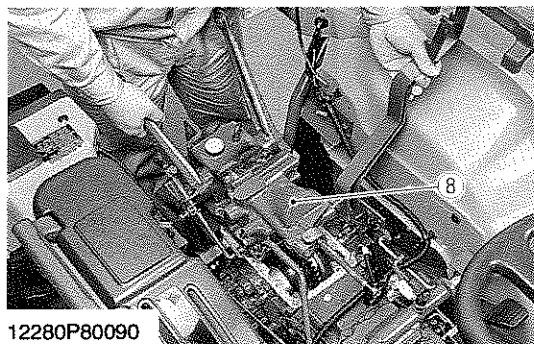
**Seat and Seat Stay**

1. Disconnect the battery grounding cord.
2. Remove the seat.
3. Remove the dipstick and seat under cover.

12280S80110



12280P80080



12280P80090

### Hydraulic Cylinder Assembly

1. Remove the top link and disconnect the lift rods.
2. Remove the main gear shift lever (1) and hydraulic control lever (2).
3. Remove the each lever grips and lever guide (LH).
4. Disconnect the front wheel drive rod (3) and remove the fender stay (4).
5. Remove the seat stay (7) and disconnect the delivery pipe for 3-point hitch (5).
6. Remove the left hand side top link bracket (6) mounting screws.
7. Remove the hydraulic cylinder assembly (8).

#### (When reassembling)

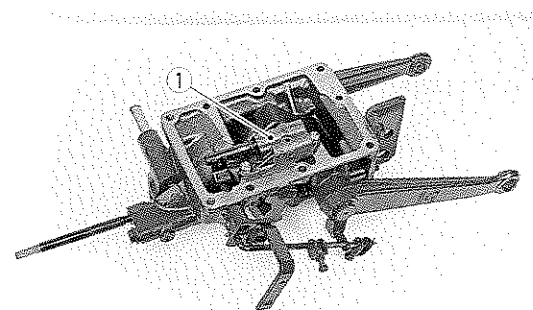
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the differential case and the hydraulic cylinder.

Tightening torque	Hydraulic cylinder mounting screw and nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Delivery pipe joint bolt	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs

- |                             |                                     |
|-----------------------------|-------------------------------------|
| (1) Main Gear Shift Lever   | (5) Delivery Pipe for 3-Point Hitch |
| (2) Hydraulic Control Lever | (6) Top Link Bracket LH             |
| (3) Front Wheel Drive Rod   | (7) Seat Stay                       |
| (4) Fender Stay             | (8) Hydraulic Cylinder              |

12280S80120

## (2) Disassembling Hydraulic Cylinder Assembly



12280P80100

### Hydraulic Control Valve

1. Remove the hydraulic control valve mounting screws, and remove the hydraulic control valve (1).

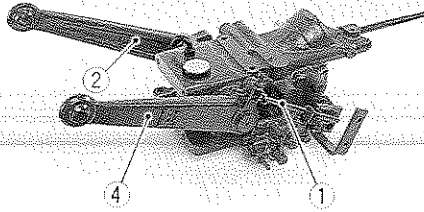
#### (When reassembling)

- Take care not to damage the O-rings.

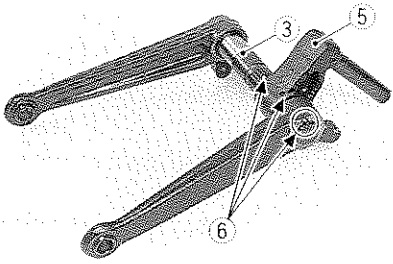
Tightening torque	Hydraulic control valve mounting screws	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
-------------------	---	---

- (1) Hydraulic Control Valve

12280S80130



12280P80110



12280P80120

### Lift Arm, Hydraulic Arm Shaft and Hydraulic Arm

1. Remove the feedback rod (1).
2. Remove the lift arm LH (2).
3. Remove the hydraulic arm shaft (3) and lift arm RH (4) as a unit.

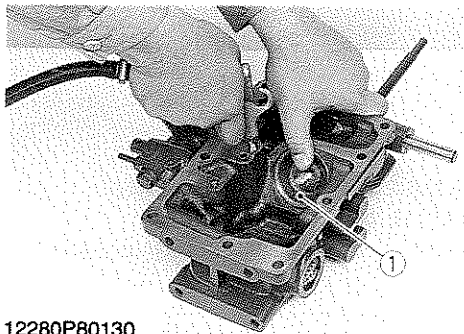
#### **(When reassembling)**

- Align the alignment marks (6) of the hydraulic arm (5) and hydraulic arm shaft (3).
- Align the alignment marks (6) of the lift arm LH and hydraulic arm shaft (3).
- Apply grease to the right and left bushings and O-rings.
- Take care not to damage the O-rings.

- (1) Feedback Rod  
(2) Lift Arm LH  
(3) Hydraulic Arm Shaft

- (4) Lift Arm RH  
(5) Hydraulic Arm  
(6) Alignment Marks

12280S80140



12280P80130

### Hydraulic Piston

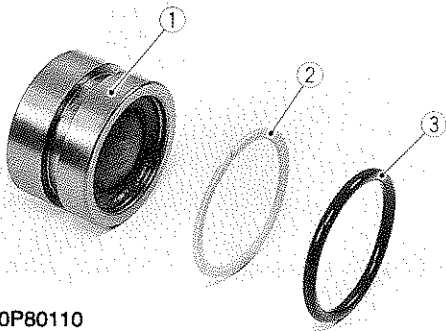
1. Inject the compressed air into the hydraulic cylinder, and take out the hydraulic piston (1).

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

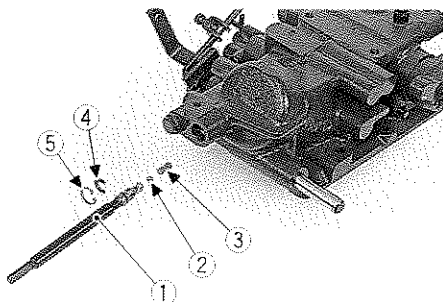
- Take care not to damage the O-ring (3) and backup ring (2).
- Apply transmission fluid to the O-ring.
- Replace the O-ring if it is defective, worn or scratched, which may cause oil leakage.

- (1) Hydraulic Piston  
(2) Backup Ring

- (3) O-ring



11900P80110



12280P80140

### Lowering Speed Adjusting Valve

1. Remove the internal snap ring (5) and the remove the lowering speed adjusting shaft (1).
2. Remove the ball (2) and spring (3).

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

- Take care not to damage the O-rings.

- (1) Lowering Speed Adjusting Shaft  
(2) Ball  
(3) Spring

- (4) Stopper  
(5) Internal Snap Ring

12280S80220

12280S80150

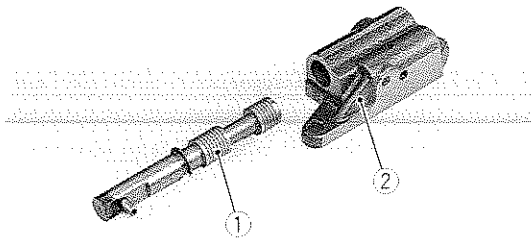
### (3) Disassembling Hydraulic Control Valve

#### Spool

1. Remove the spool (1).

(1) Spool

(2) Valve Body



000B203P095

12280S80160

#### Relief Valve

1. Remove the adjusting plug (1), spring (2) and poppet (3).

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

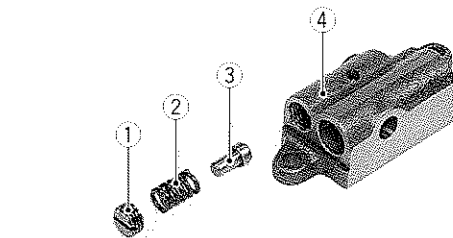
- Recutting the threads of adjusting plug and control valve inner thread.
- After adjusting the pressure, be sure to stake the adjusting plug and control valve body.

(1) Adjusting Plug

(3) Poppet

(2) Spring

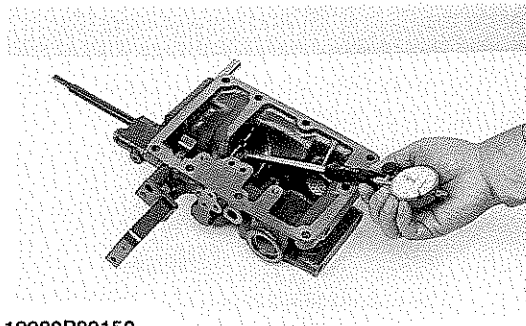
(4) Valve Body



000B203P096

12280S80170

## SERVICING



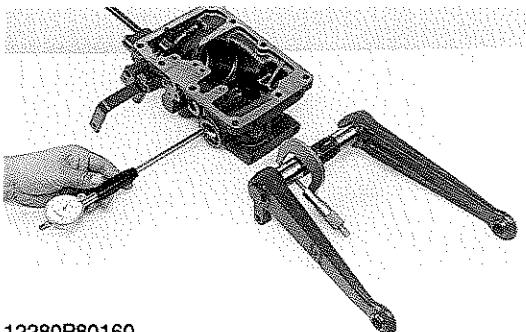
12280P80150

#### Hydraulic Cylinder Bore

1. Check the cylinder internal surface for spring 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.

Cylinder I.D.	Factory spec.	65.05 to 65.10 mm 2.5610 to 2.5629 in.
	Allowable limit	65.15 mm 2.5650 in.

12280S80180



12280P80160

#### Hydraulic Arm Shaft and Bushing

1. Measure the hydraulic arm shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge, and calculate the clearance.

Hydraulic arm shaft O.D.	Left	Factory spec.	31.925 to 31.950 mm 1.2569 to 1.2579 in.
	Right	Factory spec.	29.925 to 29.950 mm 1.1781 to 1.1791 in.
Bushing I.D. (after press fitted)	Left	Factory spec.	31.970 to 32.035 mm 1.2589 to 1.2612 in.
	Right	Factory spec.	29.975 to 30.035 mm 1.1801 to 1.1825 in.

12280S80190

# MECHANISM

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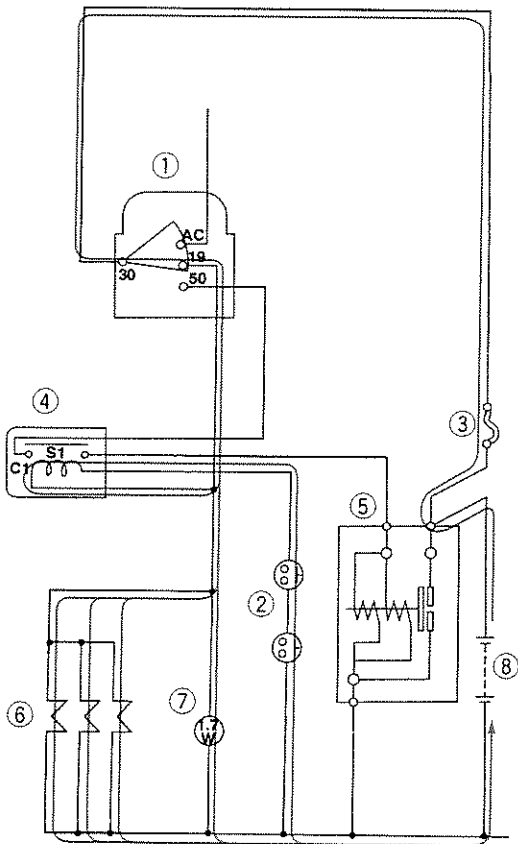
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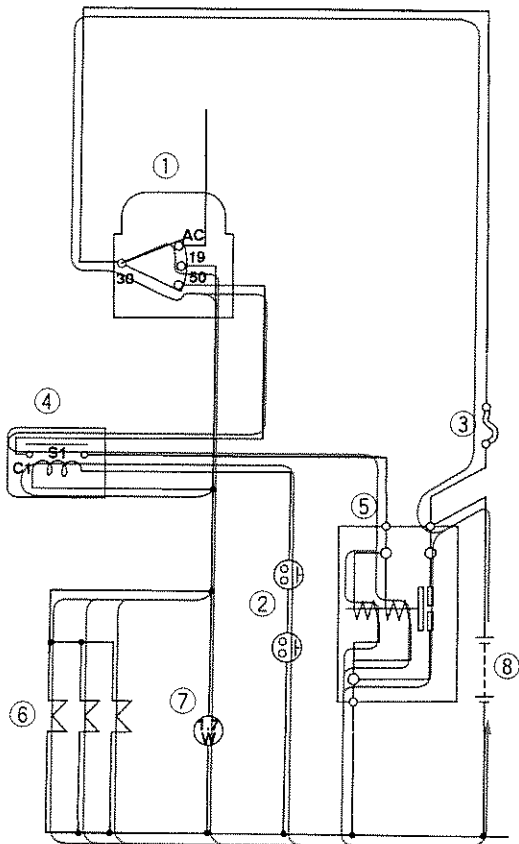
[2] STARTING SYSTEM

Main Switch Table				
Key Position \ Terminal	30	AC	19	50
OFF	●			
ON	●	●		
PREHEAT	●	●	●	
START	●	●	●	●

At the "PREHEAT" position



At the "START" position



12280F90030

- (1) Main Switch
- (2) Safety Switches
- (3) Slow Blow Fuse
- (4) Starter Relay
- (5) Starter Motor
- (6) Glow Plugs
- (7) Pre-heat Indicator Lamp
- (8) Battery

When the main switch (1) is turned to the **PREHEAT** position, the terminal **30** is connected to the terminals **19** and **AC**. The glow plugs (6) become red-hot, and at the same time, the pre-heat indicator lamp (7) also lights on.

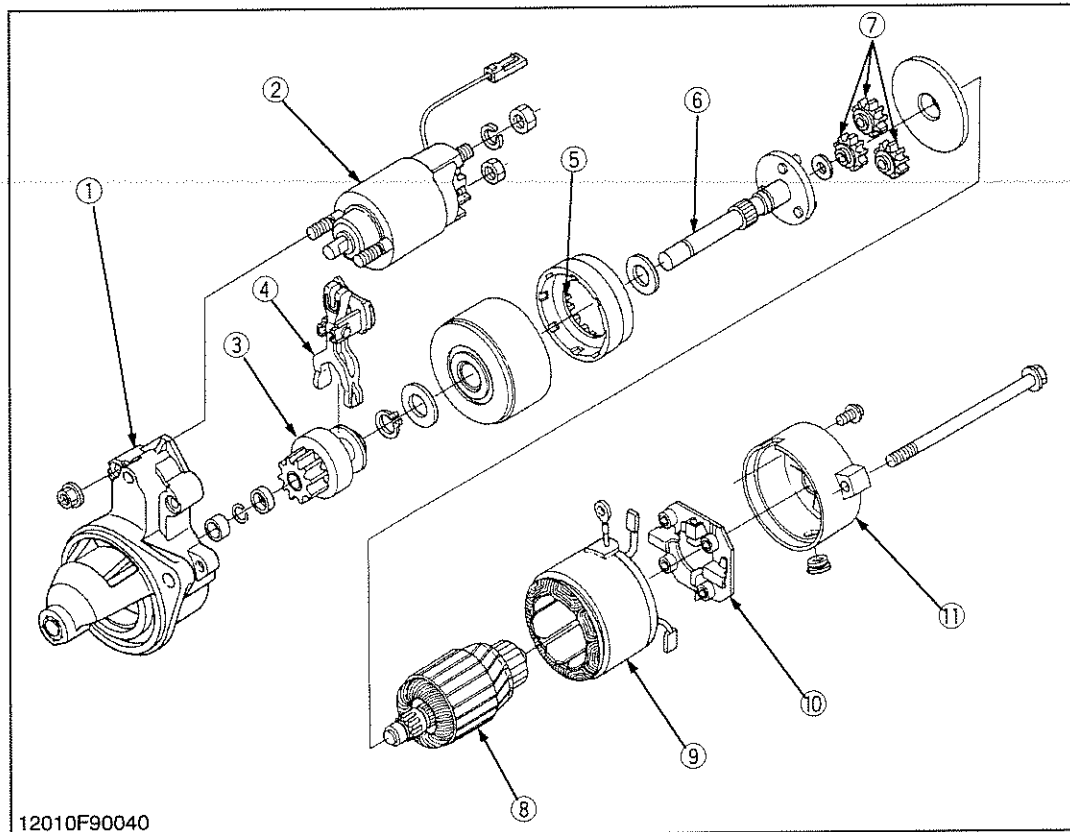
When the main switch is then turned to the **START** position with the safety switches (2) on, the terminal **30** is connected to the terminals **50** and **AC**. Consequently, battery current flows to the coil **C1** of the starter relay (4),

and relay contact point **S1** is turned on.

This actuates starter motor (5) and the glow plugs are kept red-hot.

The main switch automatically returns to the **ON** position, the terminal **30** is connected only to the terminal **AC**, thereby causing the starting circuit to be opened, stopping the starter motor.

12280M90010

**(1) Starter**

12010F90040

- (1) Housing
- (2) Magnetic Switch
- (3) Overrunning Clutch
- (4) Drive Lever
- (5) Internal Gear
- (6) Gear Shaft
- (7) Planetary Gear
- (8) Armature Shaft
- (9) Yoke
- (10) Brush Holder
- (11) Rear End Frame

The starter is a reduction type.

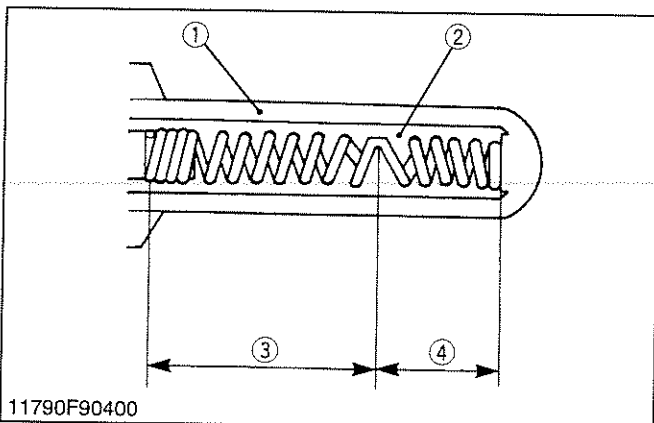
The reduction system is used planetary gears, and

the speed of gear shaft (6) is reduced to approximately one fifth of the armature shaft (8).

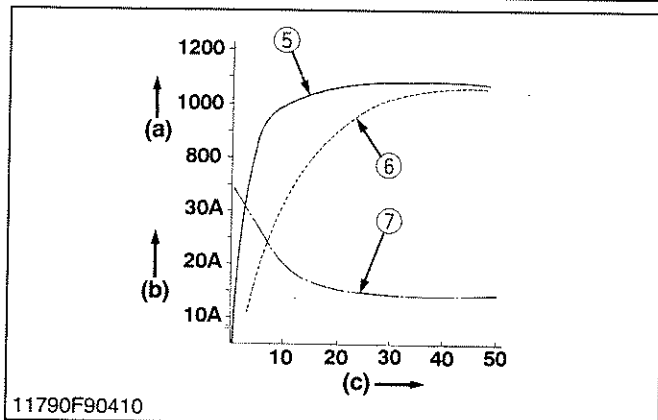
12010M90020



## (2) Glow Plug



11790F90400



11790F90410

This plug is a two-material type QGS (Quick Glow System) for quick temperature rise, and has self-controlling function as well as excellent durability.

The heater (4) connected in series to the heater (3), which also functions as the resistor, is incorporated in the sheath tube (1) of the super glow plug.

The resistance of this heater (3) cum resistor is small when the temperature is low, while the resistance becomes large when the temperature rises.

Therefore, because sufficient current is flown to the heater (4) during the initial period of energization, the temperature rises quickly and the resistance grows with the rise in the temperature of the resistor, the flowing current is reduced to prevent the heater (4) from being heated.

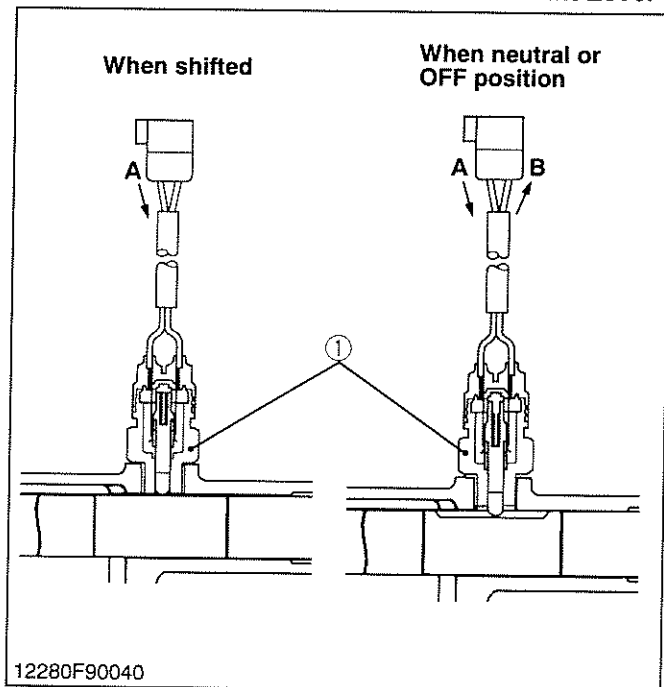
The ignition point is in the area of 2 to 3 mm (0.079 to 0.118 in.) from the tip of the plug in order to reduce its projection into the combustion chamber.

- |   |                                |
|---|--------------------------------|
| (1) Sheath Tube                               | (a) Glow Plug Temperature (°C) |
| (2) Insulation Powder                         | (b) Current (A)                |
| (3) Heater also functioning as a Resistor     | (c) Time (Sec.)                |
| (4) Heater                                    |                                |
| (5) Super Glow Plug                           |                                |
| (6) Conventional Quick-heating type Glow Plug |                                |
| (7) Glow Plug Current                         |                                |

12010M90030

## (3) Safety Switch

### ■ Main Gear Shift Lever and PTO Gear Shift Lever



12280F90040

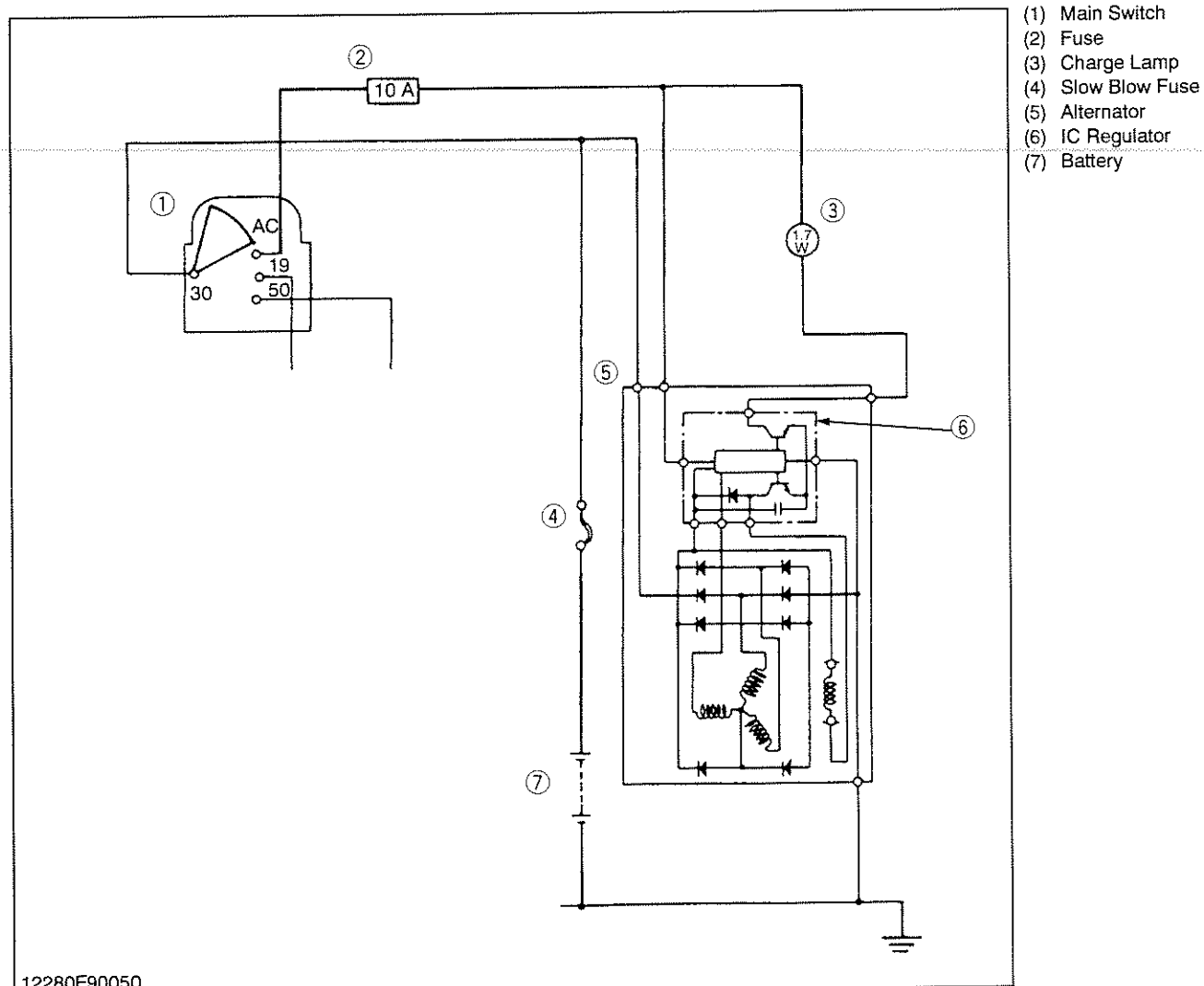
The safety switch prevents current from flowing to the starter when the safety switches are released. This is to ensure safe starting.

The safety switches are located two (PTO gear shift lever and main gear shift lever) different position.

- |                   |                      |
|-------------------|----------------------|
| (1) Safety Switch | (A) From Main Switch |
|                   | (B) To Starter       |

12280M90020

### [3] CHARGING SYSTEM

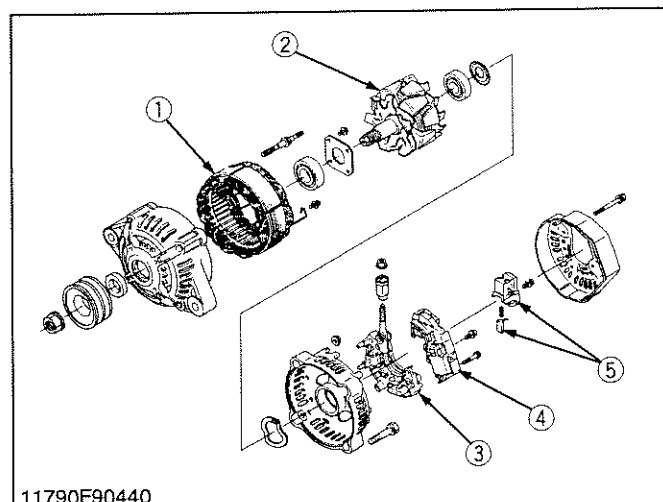


12280F90050

The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs. This alternator has IC regulator.

12280M90030

#### (1) Alternator



11790F90440

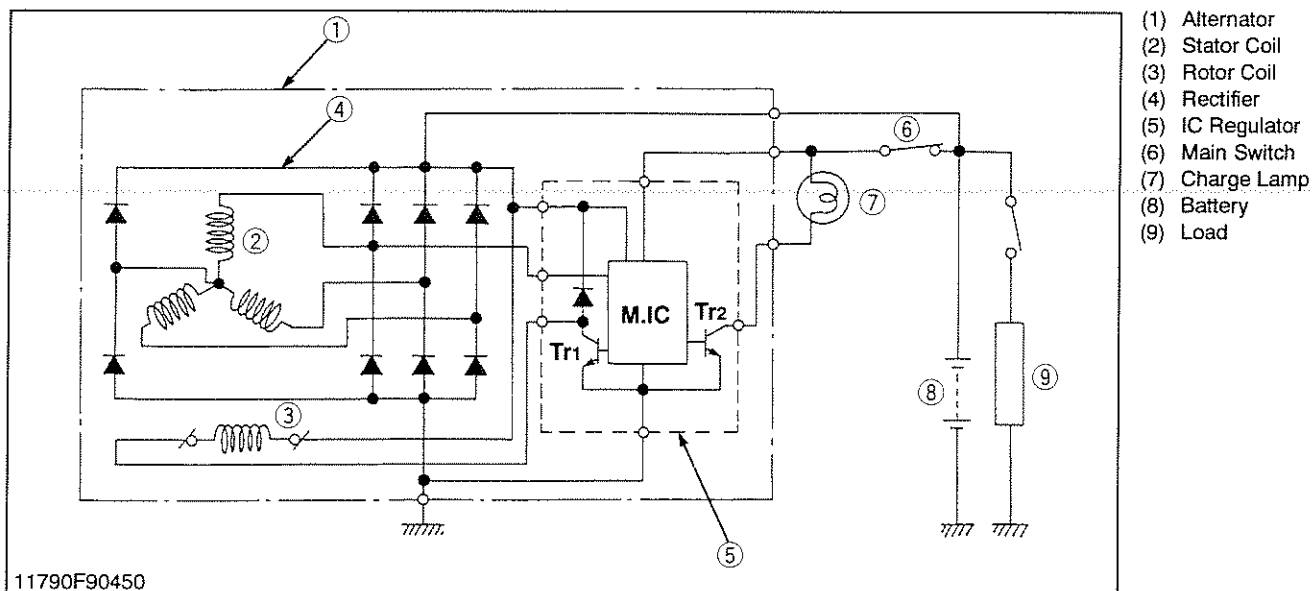
A compact alternator with an IC regulator is used, having the following characteristics :

- Approximately 26 % lighter and 17 % smaller than a standard alternator.
- Cooling performance and safety have been improved by combining the cooling fan with the rotor and incorporating the fan / rotor unit inside the alternator.
- IC regulator is fitted inside the alternator.
- The rectifier, IC regulator and similar components are easy to remove, making it easier to service the alternator.

- (1) Stator  
(2) Rotor  
(3) Rectifier  
(4) IC Regulator  
(5) Brush Holder

11790M90120

## (2) IC Regulator



- (1) Alternator
- (2) Stator Coil
- (3) Rotor Coil
- (4) Rectifier
- (5) IC Regulator
- (6) Main Switch
- (7) Charge Lamp
- (8) Battery
- (9) Load

An IC regulator uses solid state transistors, chips or other semiconductor elements instead of the relays in a conventional regulator. Stable characteristics are achieved by cutting off the field current.

IC regulators have the following characteristics :

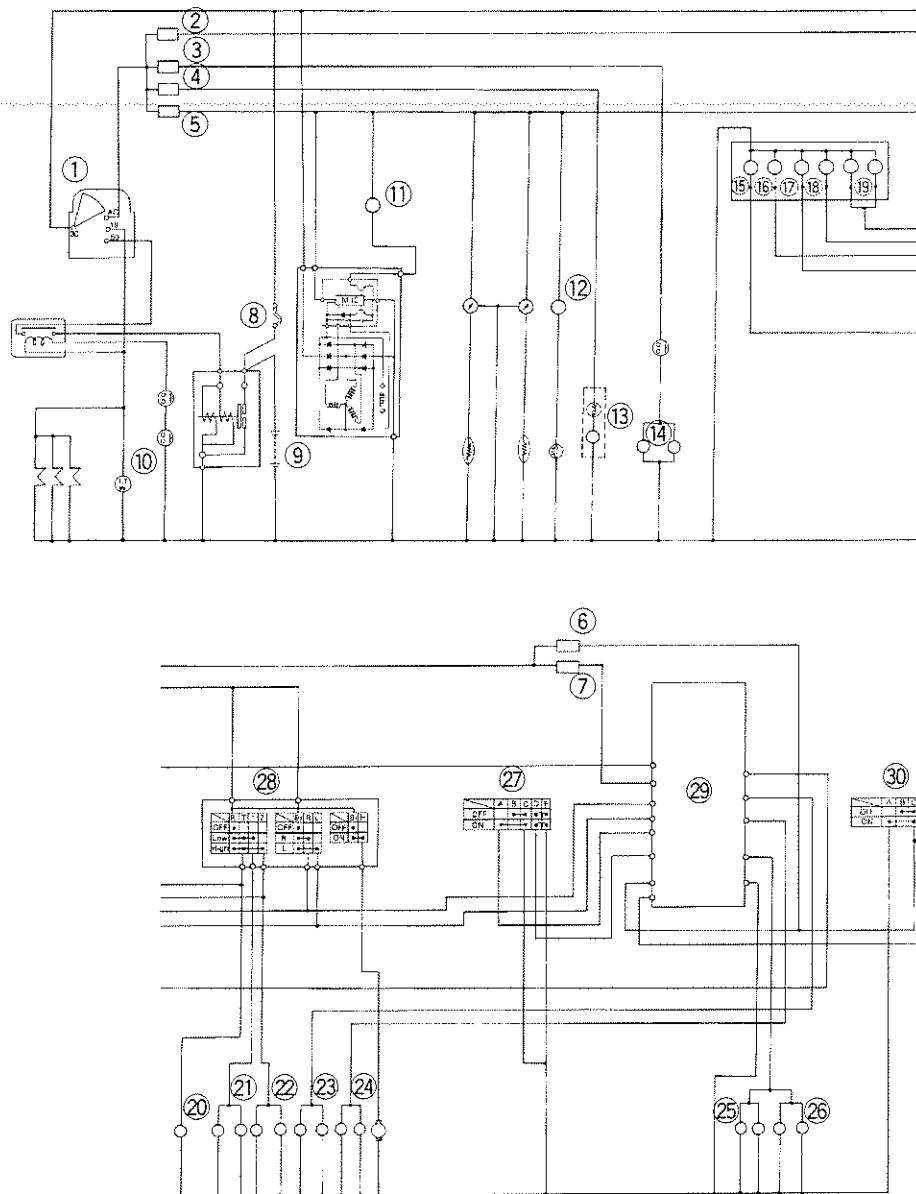
- The control voltage does not change over time, so the need for readjustment is eliminated. Since there are no moving parts, IC regulators are extremely durable and resistant to vibration.
- The overheat compensation characteristics ensure that the control voltage is reduced as the temperature rises, so the battery is charged at just the right level.

The internal circuitry of the IC regulator is shown in the diagram. It consists of a hybrid IC incorporating a monolithic IC. (The internal circuitry of the monolithic IC is extremely complex, so it is shown as simply "**M.IC circuit**")

**Tr1** acts as the contacts controlling the field current, and **Tr2** acts as the charge lamp relay controlling the flashing of the charge lamp.

The **M.IC** circuit controls **Tr1** and **Tr2**, and monitors the alternator output voltage, and detects any drop in **L** terminal voltage or breaks in the rotor coil.

11790M90130

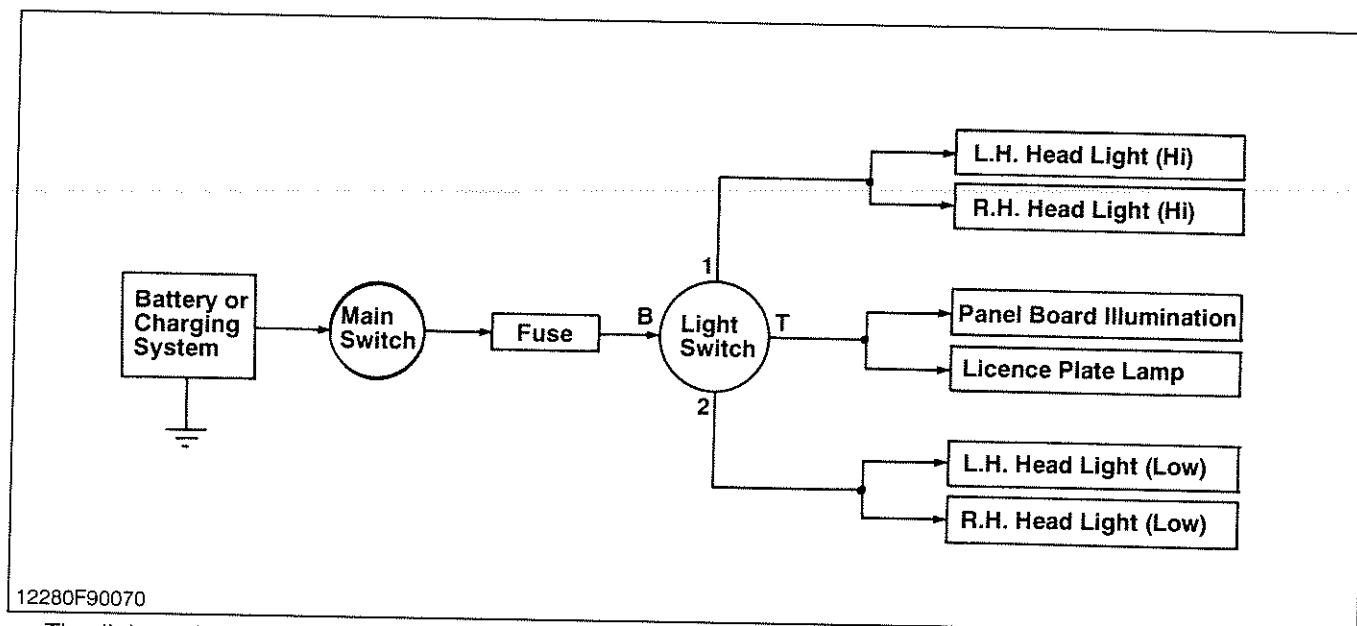
**[4] LIGHTING SYSTEM**

12280F90060

- |                    |  |  |                             |
|--------------------|--|--|-----------------------------|
| (1) Main Switch    | (9) Battery                              | (17) Hazard / Turn Signal Indicator Lamp | (24) Turn Signal Light (LH) |
| (2) Fuse           | (10) Pre-heat Indicator Lamp             | (18) Head Light Hi Beam Indicator        | (25) Parking Light (RH)     |
| (3) Fuse           | (11) Charge Lamp                         | (19) Illumination Lamp                   | (26) Parking Light (LH)     |
| (4) Fuse           | (12) Oil Pressure Indicator Lamp         | (20) Licence Plate Lamp                  | (27) Hazard Switch          |
| (5) Fuse           | (13) Working Light (Optional)            | (21) Head Light Low Beam                 | (28) Combination Switch     |
| (6) Fuse           | (14) Brake Lamp                          | (22) Head Light Hi Beam                  | (29) Flasher Unit           |
| (7) Fuse           | (15) Trailer Indicator                   | (23) Turn Signal Light (RH)              | (30) Position Switch        |
| (8) Slow Blow Fuse | (16) Hazard / Turn Signal Indicator Lamp |  |                             |

The lighting system consists of combination switch (light switch and turn signal light switch), head lights, parking lights, hazard lights, flasher unit, etc.

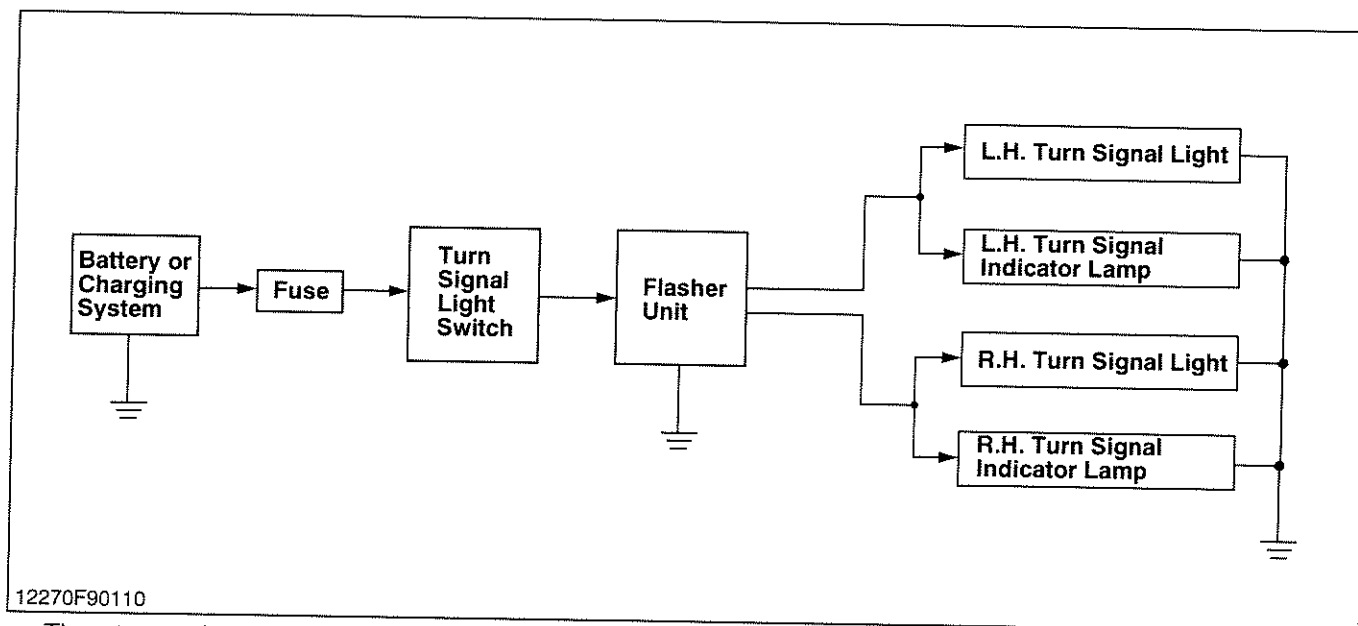
12280M90040

**(1) Head Light**

The light switch, which forms a combination switch with the hazard switch, has two positions; **OFF** and **ON**.

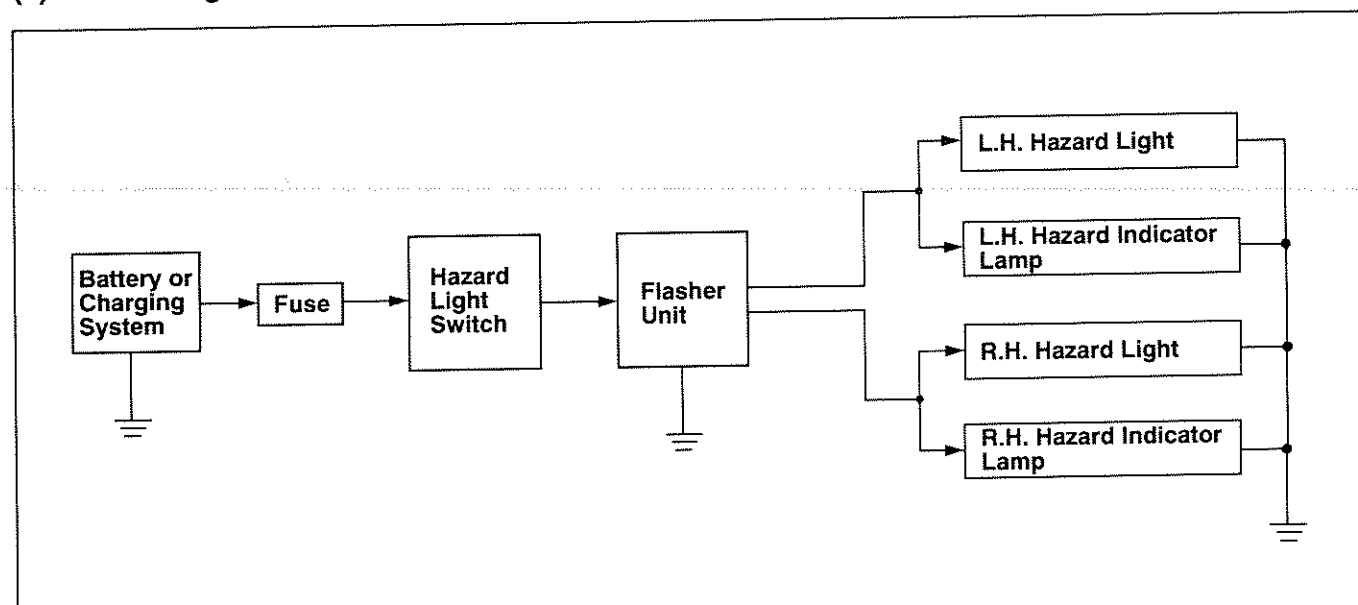
Current passes through the light circuit as shown in the figure above.

12280M90050

**(2) Turn Signal Light**

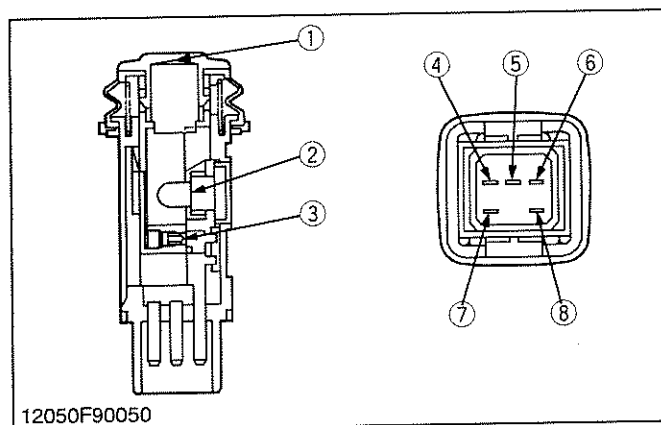
The turn signal light switch, which forms a combination switch with the light switch, has three positions; **OFF**, **1**, **2**. When using turn signal light switch, blinks only one side light and other one stays off.

12280M90130

**(3) Hazard Light**

Hazard switch has two positions; **ON** and **OFF**. in the figure above.  
Blinking the hazard lights and indicator lamps as shown

12270M90120

**■ Hazard Switch**

This is a pushing type switch to turn on the hazard lamps. The lamp (2) in the switch is lighted up by the current from out side of the switch, when the switch is "ON". The circuit in the switch is shown below.

Terminal	a	b	c	d	e
ON		●	●	●	Lamp — ●
OFF	●		●	●	Lamp — ●

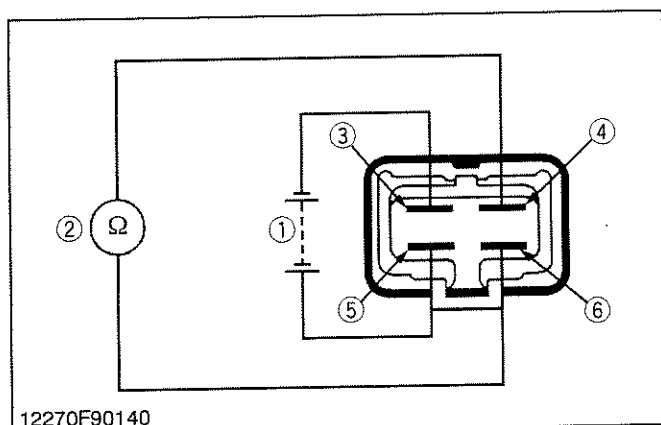
- (1) Lens
- (2) Lamp
- (3) Contact Portion
- (4) Terminal a
- (5) Terminal b
- (6) Terminal d
- (7) Terminal c
- (8) Terminal e

12050M90040

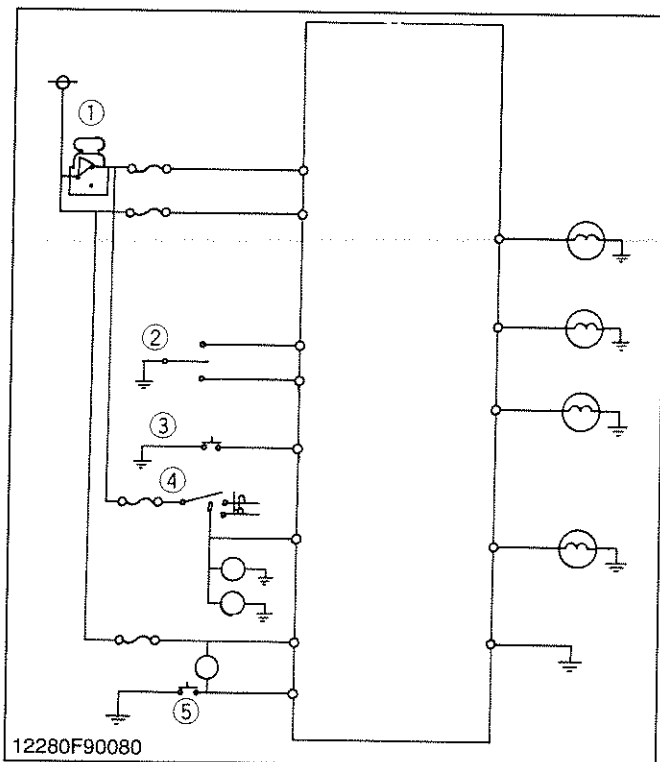
**■ Starter Relay**

The starter relay is used in the hazard light circuit. The circuit in the relay is shown figure left.

- (1) Battery
- (2) Ohmmeter
- (3) Terminal Coil
- (4) Terminal COM.
- (5) Terminal Coil
- (6) Terminal NO



12270M90140



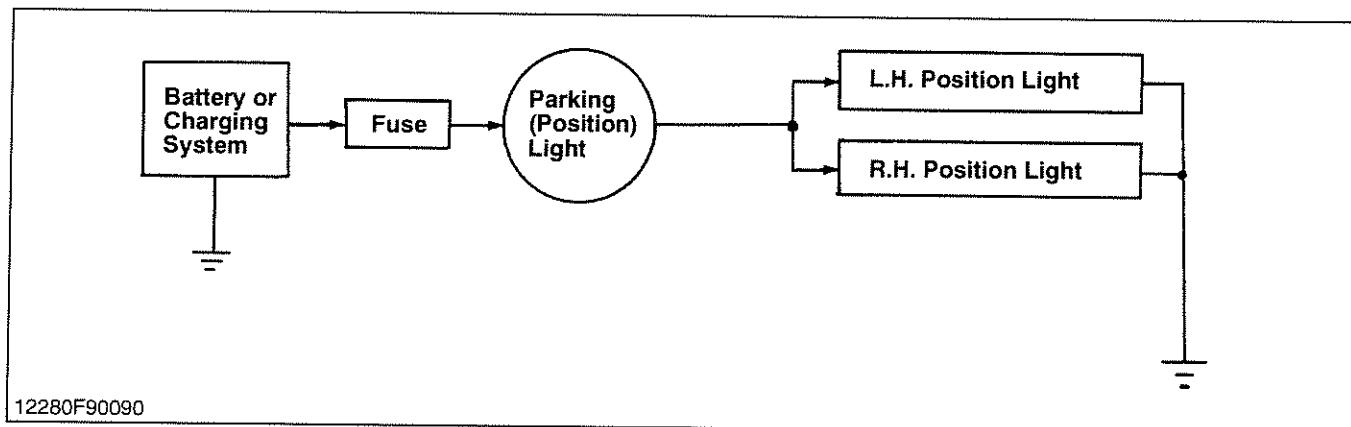
### Flasher Unit

This flasher unit is a summary to one as for past hazard / flasher unit, hazard relay, and charge relay.

- (1) Main Switch
- (2) Turn Signal Switch
- (3) Hazard Switch
- (4) Light Switch
- (5) Parking Light Switch

12280M90060

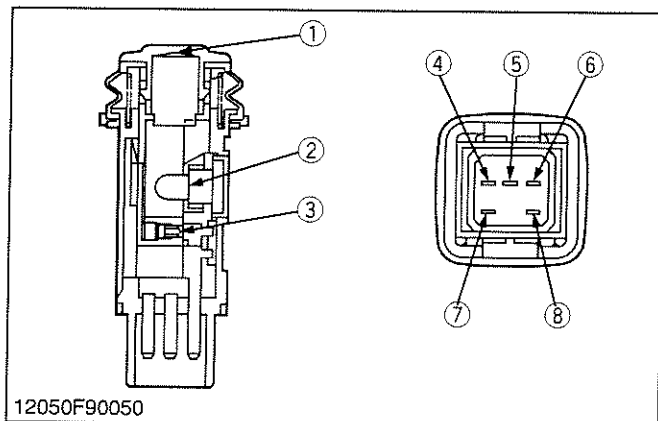
### (4) Parking (Position) Light



The parking (position) switch has two position, **ON** and **OFF**.

Current passes through the light circuit as shown in the figure above.

12280M90070



### Parking (Position) Light Switch

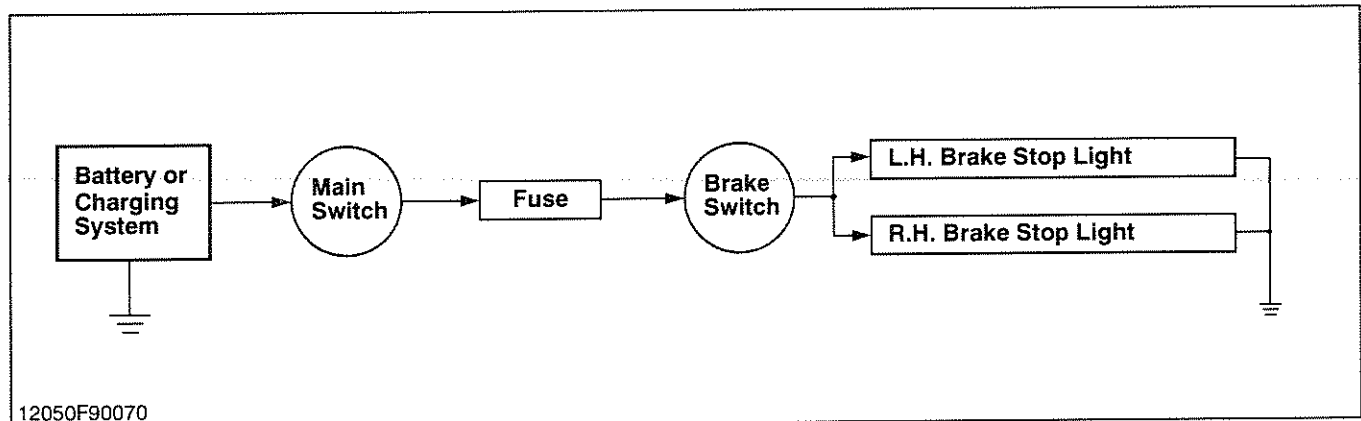
This is a pushing type switch to turn on the position lamps. The lamp (2) in the switch is lighted up by the current from out side of the switch, when the switch is **"ON"**. The circuit in the switch is shown below.

Terminal	a	b	c	d	e
ON		●	●	●	Lamp
OFF	●		●	●	Lamp

- (1) Lens
- (2) Lamp
- (3) Contact Portion
- (4) Terminal a
- (5) Terminal b
- (6) Terminal d
- (7) Terminal c
- (8) Terminal e

12280M90080

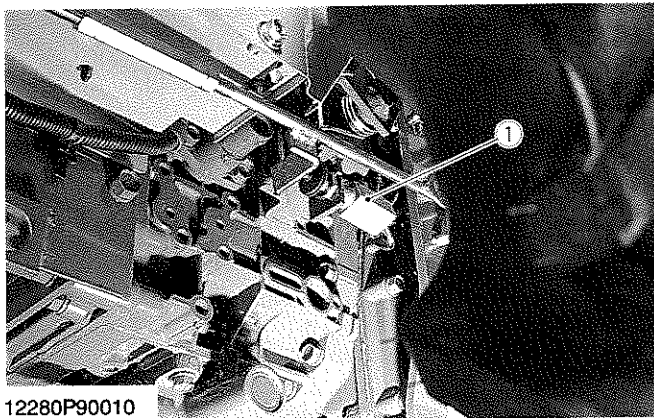
## (5) Brake Stop Light



The brake stop lights are lighted up by stop switch.

Current passes the circuit as shown in the figure above.

12280M90090



### ■ Brake Switch

Brake switch is turned on by pushing a brake pedal and turned off by releasing it.

(1) Brake Switch

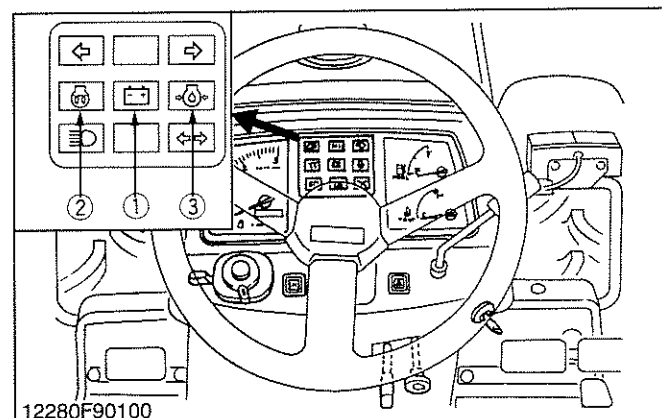
12280M90100

## [6] EASY CHECKER

To check the conditions of tractor easily before and during operation, easy checker combination of lamps on the easy checker board is provided.

12010M90100

### (1) Indication Items



#### (1) Charge Lamp

When the charging system is not functioning properly, this lamp illuminates.

#### (2) Pre-heat Indicator Lamp

When the key switch is in the "Pre-heat" position, the pre-heat indicator lamp illuminates.

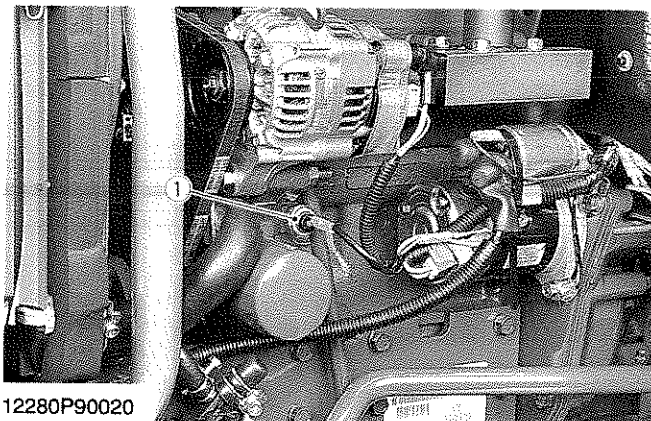
#### (3) Oil Pressure Lamp

When the engine oil pressure is low, this lamp illuminates.

12280M90110



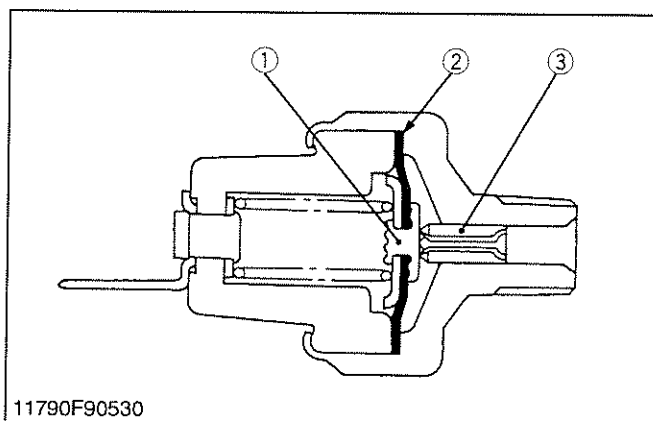
## (2) Engine Oil Pressure Alarm



When the engine oil pressure has dropped, the engine oil pressure switch is activated to let the current flow from the main switch and to light up the lamp.

(1) Oil Pressure Switch

12280M90120



### ■ Engine Oil Pressure Switch

While oil pressure is high and the force applied to the diaphragm (2) is larger than the spring tension, the terminal contact (1) is open separated from the body contact (3). If the pressure drops below approx. 49 kPa (0.5 kgf/cm<sup>2</sup>, 7.1 psi), the contact closes.

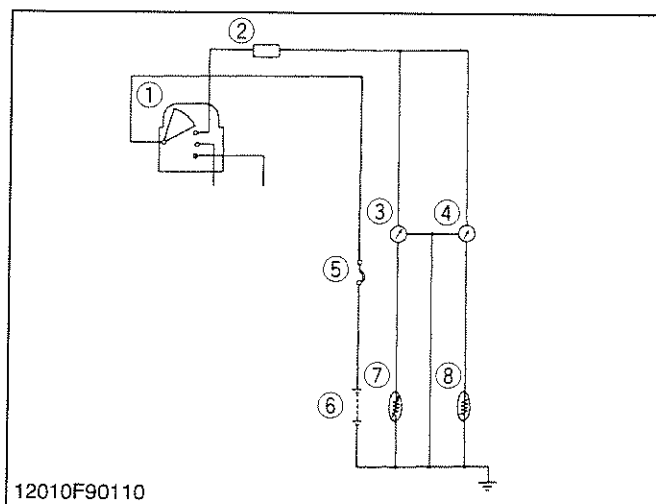
(1) Terminal Contact

(3) Body Contact

(2) Diaphragm

12010M90130

## [7] GAUGE



The fuel quantity and coolant temperature are indicated by the ammeters. The ammeters indicate each amperate flowing through the fuel level sensor (7) for the fuel quantity detection and through the coolant temperature sensor (8) for the coolant temperature detection.

(1) Main Switch

(5) Slow Blow Fuse

(2) Fuse (10 A)

(6) Battery

(3) Fuel Gauge

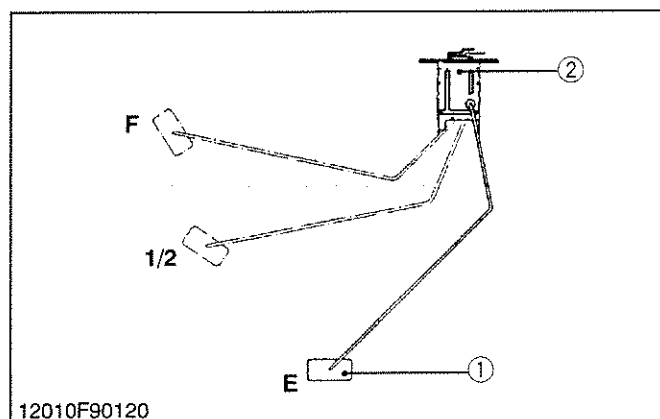
(7) Fuel Level Sensor

(4) Water Temperature Gauge

(8) Water Temperature Sensor

12010M90140

## (1) Fuel Quantity



### ■ Fuel Level Sensor

The remaining fuel quantity is detected by the fuel level sensor installed in the fuel tank and indicated on the fuel gauge. For detection, a float and a resistor are used.

As the float (1) lowers, the resistance of the variable resistor (2) varies. The relation between the amount of fuel and the resistance is as follows.

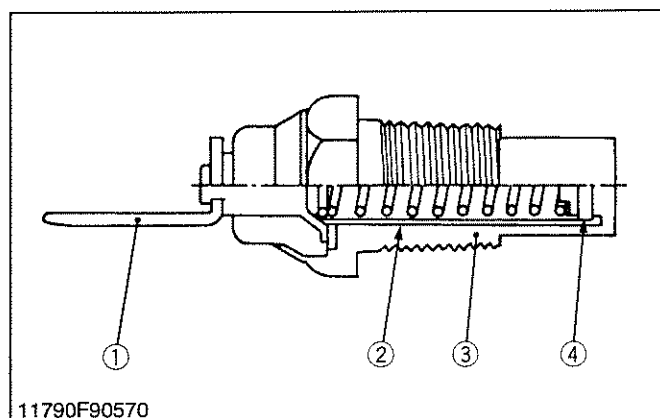
F	1/2	E (Remaining fuel of approx. 3.0 L, 0.79 U.S.gal, 0.66 Imp.gal.)
1 to 5 $\Omega$	28.5 to 36.5 $\Omega$	103 to 117 $\Omega$

(1) Float

(2) Variable Resistor

12010M90150

## (2) Coolant Temperature



### ■ Coolant Temperature Sensor

The coolant temperature sensor is installed to the cylinder head of engine, and its tip is in touch with the coolant. It contains a thermistor (4) whose electrical resistance decreases as the temperature increases.

Current varies with changes in the coolant temperature, and the increases or decreases in the current move the pointer of gauge.

Characteristics of Thermistor	
Temperature	Resistance
50 °C (122 °F)	148.8 $\Omega$
80 °C (176 °F)	50.3 $\Omega$
120 °C (248 °F)	16.0 $\Omega$
170 °C (338 °F)	5.6 $\Omega$

(1) Terminal

(2) Insulator

(3) Body

(4) Thermistor

11790M90310

# SERVICING

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(1) Main Switch .....	9-S6
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CHECKING .....	9-S26

.....



# TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>All Electrical Equipments Do Not Operate</b>	• Battery discharged or defective	Recharge or Replace	9-S5
	• Battery positive cable disconnected or improperly connected	Repair or Replace	9-S5
	• Battery negative cable disconnected or improperly connected	Repair or Replace	9-S5
	• Slow blow fuse blown	Replace	—
<b>Fuse Blown Frequently</b>	• Short-circuited	Repair or Replace	—

## BATTERY

<b>Battery Discharges Too Quickly</b>	• Battery defective	Recharge or Replace	9-S5
	• Alternator defective	Repair or Replace	9-S15
	• IC Regulator defective	Replace	9-S15
	• Wiring harness disconnected or improperly connected (between battery positive terminal and alternator <b>B</b> terminal)	Repair or Replace	9-S14
	• Cooling fan belt slipping	Adjust tension	G-20

## STARTING SYSTEM

<b>Starter Motor Does Not Operate</b>	• Battery discharged or defective	Recharge or Replace	9-S5
	• Slow blow fuse blown	Replace	—
	• Safety switch defective	Replace	9-S10
	• Wiring harness disconnected or improperly connected (between main switch 50 terminal and safety switches, between safety switches and starter motor, between battery positive terminal and starter motor)	Repair or Replace	9-S6
	• Starter relay defective	Replace	9-S9
	• Starter motor defective	Repair or Replace	9-S8
<b>Pre-heat Indicator Lamp Does Not Light When Main Switch Is in Pre-heat Position</b>	• Main switch defective	Replace	9-S6
	• Battery discharged or defective	Recharge or Replace	9-S5
	• Slow blow fuse blown	Replace	—
	• Wiring harness disconnected or improperly connected (between main switch 19 terminal and pre-heat indicator, between pre-heat indicator and glow plugs)	Repair or Replace	9-S6
	• Pre-heat indicator defective	Replace	9-S24

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**CHARGING SYSTEM**

Symptom	Probable Cause	Solution	Reference Page
<b>Charging Lamp Does Not Light when Main Switch Is Turned ON</b>	<ul style="list-style-type: none"> <li>• Fuse blown (10 A)</li> <li>• Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and panel board, between panel board and alternator)</li> </ul>	Replace Repair or Replace	— 9-S15
	<ul style="list-style-type: none"> <li>• Alternator defective</li> </ul>	Repair or Replace	9-S15
<b>Charging 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 alternator, between panel board and alternator)</li> </ul>	Repair or Replace	9-S6
	<ul style="list-style-type: none"> <li>• Alternator defective</li> </ul>	Repair or Replace	9-S15

**LIGHTING SYSTEM**

<b>Head Light Does Not Light</b>	<ul style="list-style-type: none"> <li>• Fuse blown (10 A)</li> <li>• Bulb blown</li> <li>• Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and combination switch <b>B1</b> terminal, between combination switch <b>1</b> terminal and headlight, between combination switch <b>2</b> terminal and head light)</li> </ul>	Replace Replace Repair or Replace	— — 9-S19
<b>Licence Plate Light Does Not Light</b>	<ul style="list-style-type: none"> <li>• Fuse blown (10 A)</li> <li>• Bulb blown</li> <li>• Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and combination switch <b>B1</b> terminal, between combination switch <b>T</b> terminal and tail light)</li> </ul>	Replace Replace Repair or Replace	— — 9-S19
<b>Illumination Light Does Not Light</b>	<ul style="list-style-type: none"> <li>• Fuse blown (10 A)</li> <li>• Bulb blown</li> <li>• Wiring harness disconnected or improperly connected (between main switch <b>AC</b> terminal and combination switch <b>B1</b> terminal, between combination switch <b>T</b> terminal and panel board)</li> </ul>	Replace Replace Repair or Replace	— — 9-S19
<b>Hazard Light Does Not Light</b>	<ul style="list-style-type: none"> <li>• Fuse blown (10 A)</li> <li>• Bulb blown</li> <li>• Wiring harness disconnected or improperly connected</li> <li>• Flasher unit defective</li> <li>• Hazard switch defective</li> </ul>	Replace Replace Repair or Replace  Replace Replace	— — —  9-S21 9-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	— 9-S25
<b>Hazard Light Does Not Flicker</b>	<ul style="list-style-type: none"> <li>• Flasher unit defective</li> </ul>	Replace	9-S20

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**LIGHTING SYSTEM (Continued)**

Symptom	Probable Cause	Solution	Reference Page
<b>Parking (Position) Light Does Not Light</b>	<ul style="list-style-type: none"> <li>• Fuse blown (10 A)</li> <li>• Bulb blown</li> <li>• Parking (position) light switch defective</li> <li>• Wiring harness disconnected (between parking (position) light switch and parking (position) light)</li> </ul>	Replace Replace Repair or Replace Repair or Replace	— — 9-S22 9-S22
<b>Turn Signal Light Does Not Light</b>	<ul style="list-style-type: none"> <li>• Fuse blown (10 A)</li> <li>• Bulb blown</li> <li>• Wiring harness disconnected or improperly connected</li> <li>• Flasher unit defective</li> <li>• Combination switch defective</li> </ul>	Replace Replace Repair or Replace  Replace Replace	— — 9-S19  9-S21 9-S19
<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 (between combination switch <b>R</b> or <b>L</b> terminal and panel board)</li> </ul>	Replace Repair or Replace	9-S24 9-S19
<b>Turn Signal Light Does Not Flicker</b>	<ul style="list-style-type: none"> <li>• Flasher unit defective</li> <li>• Combination switch defective</li> </ul>	Replace Replace	9-S21 9-S19

**HORN**

<b>Horn Does Not Sound When Horn Button Is Pushed</b>	<ul style="list-style-type: none"> <li>• Combination switch defective</li> <li>• Horn defective</li> <li>• Wiring harness disconnected or improperly connected (between combination switch terminal and horn)</li> </ul>	Replace Replace Repair or Replace	9-S19 — 9-S19
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**EASY CHECKER**

<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>• Oil pressure switch defective</li> <li>• Short circuit between oil pressure switch lead and chassis</li> <li>• Circuit in panel board defective</li> </ul>	Repair engine Replenish Replace Repair  Replace	— G-9 9-S23 — 9-S24
<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>• Oil pressure switch defective</li> <li>• Wiring harness disconnected or improperly connected (between panel board and oil pressure switch)</li> <li>• Circuit in panel board defective</li> </ul>	Replace Replace Repair or Replace  Replace	9-S24 9-S23 9-S25  9-S25

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**GAUGES**

Symptom	Probable Cause	Solution	Reference Page
<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 panel board and fuel level sensor)</li> </ul>	Replace Replace Repair or Replace	9-S26 9-S26 9-S25
	<ul style="list-style-type: none"> <li>Circuit in panel board defective</li> </ul>	Replace	9-S25
<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 panel board and coolant temperature sensor)</li> </ul>	Replace Replace Repair or Replace	9-S26 9-S26 9-S25
	<ul style="list-style-type: none"> <li>Circuit in panel board defective</li> </ul>	Replace	9-S25

12280S90040

**SERVICING SPECIFICATIONS****STARTER**

Item		Factory Specification	Allowable Limit
Commutator	O.D.	28.0 mm 1.102 in.	27.0 mm 1.063 in.
	Difference of O.D.'s	Less than 0.02 mm 0.0008 in.	0.05 mm 0.0020 in.
Mica	Undercut	0.60 mm 0.0236 in.	0.20 mm 0.0079 in.
Brush	Length	14.0 mm 0.551 in.	9.0 mm 0.354 in.

**ALTERNATOR**

Brush	Length	10.5 mm 0.413 in.	8.4 mm 0.331 in.
Slip Ring	O.D.	14.4 mm 0.567 in.	12.8 mm 0.504 in.

**GLOW PLUG**

Glow Plug	Resistance	Approx. 0.9 ohms	—
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## 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-10.)

Item	N·m	kgf·m	ft-lbs
Starter			
• M terminal nut	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7
• C terminal nut	7.9 to 11.8	0.8 to 1.2	5.8 to 8.7
• Magnetic switch mounting nut	5.9 to 10.8	0.6 to 1.1	4.4 to 7.9
• Through bolt	4.42 to 7.35	0.45 to 0.75	3.26 to 5.42
Alternator			
• Pulley nut	58.3 to 78.9	5.95 to 8.05	43.0 to 58.2

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## CHECKING, DISASSEMBLING AND SERVICING



### CAUTION

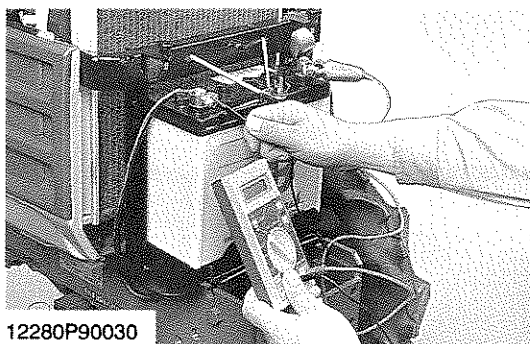
- To avoid accidental short circuit, be sure to attach the positive cable to the positive terminal before the negative cable is attached to the negative terminal.
- Never remove the battery cap while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately.
- Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.

### IMPORTANT

- If the machine is to be operated for a short time without battery (using a slave battery for starting), use additional current (lights) while engine is running and insulate terminal of battery. If this advice is disregarded, damage to alternator and regulator may result.

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## [1] BATTERY CHECKING



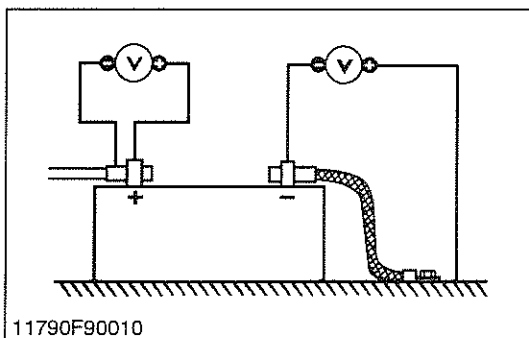
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### Battery Voltage

1. Stop the engine and turn the main switch off.
2. Connect the COM (-) lead of the voltmeter to the battery's negative terminal post and the (+) lead to the positive terminal post, and measure the battery voltage.
3. If the battery voltage is less than the factory specification, check the battery specific gravity and recharge the battery.

Battery voltage	Factory spec.	More than 12 V
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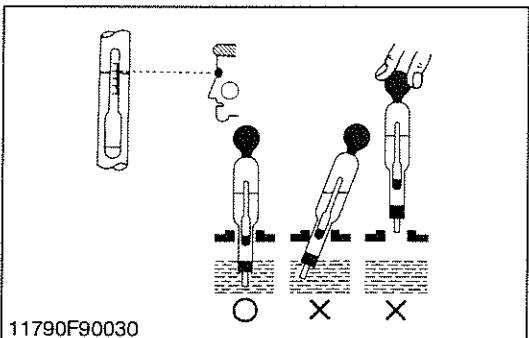
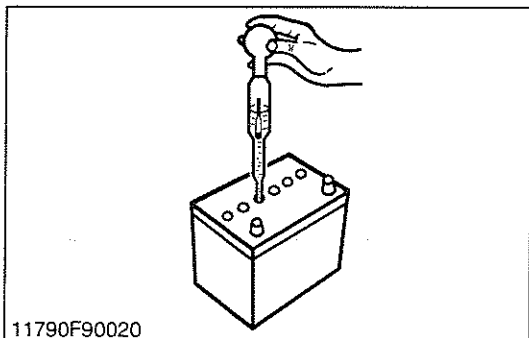
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### Battery Terminal Connection

1. Turn the main switch on, and turn on the head light.
2. Measure the voltage with a voltmeter across the battery's positive terminal post and the cable terminal, and the voltage across the battery's negative terminal post and the chassis.
3. If the measurement exceeds the factory specification, clean the battery terminal posts and cable clamps, and tighten them firmly.

Potential difference	Factory spec.	Less than 0.1 V
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11790S90030



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)

### 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).

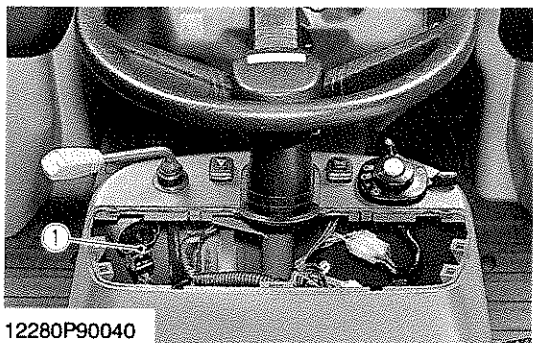
Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula :

- 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)

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## [2] STARTING SYSTEM CHECKING

### (1) Main Switch

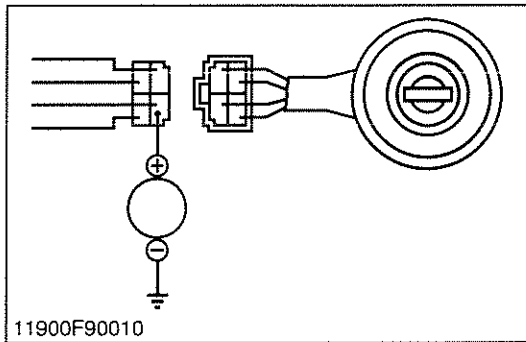


### Main Switch

1. Remove the panel board.
2. Disconnect the **4P** connector and remove the main switch (1).
3. Perform the following checks.

- (1) Main Switch

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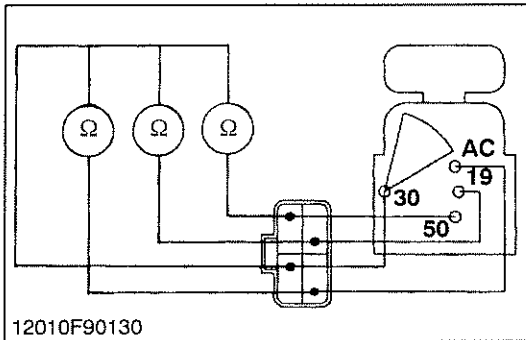


### Connector Voltage

1. Measure the voltage with a voltmeter across the connector **30** 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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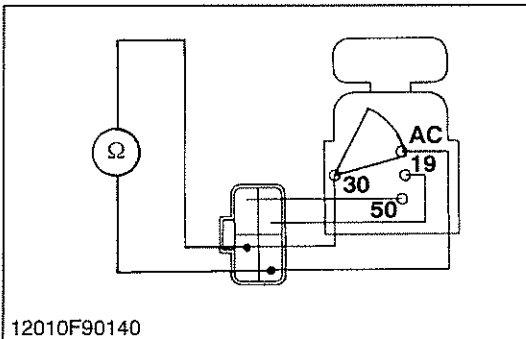
### Main Switch Continuity

#### 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	

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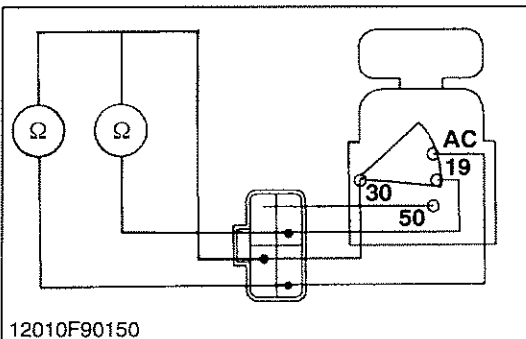


#### 2) Main Switch Key at ON Position

1. Set the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **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 ohm
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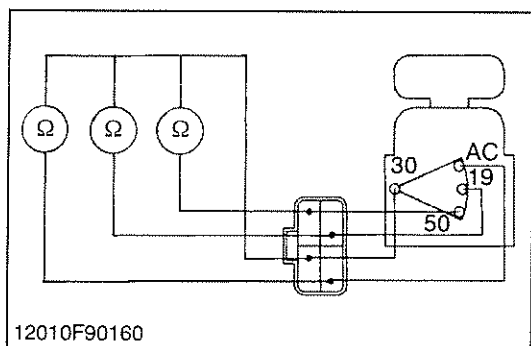


#### 3) Main Switch Key at PREHEAT Position

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 ohm
	30 terminal – AC terminal	

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#### 4) Main Switch Key at START Position

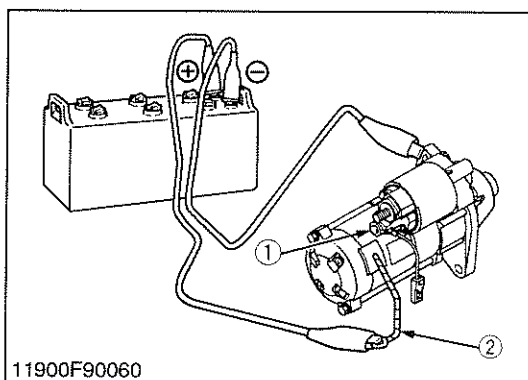
1. Set and hold the main switch key at the **START** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, across the **30** terminal and the **50** terminal, and across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

Resistance	30 terminal – 19 terminal		0 ohm
	30 terminal – 50 terminal		
	30 terminal – AC terminal		

Terminal Key position	30	AC	19	50
OFF	●			
ON	●	●		
PREHEAT	●	●	●	
START	●	●	●	●

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### (2) Starter



(1) C Terminal

(2) Connecting Lead

#### Motor Test

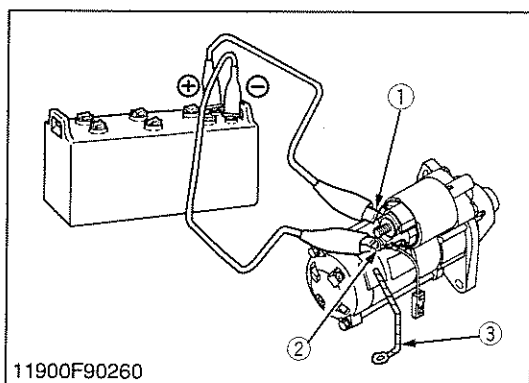


#### CAUTION

- **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 **M** terminal.
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.

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(1) S Terminal

(2) C Terminal

(3) Connecting Lead

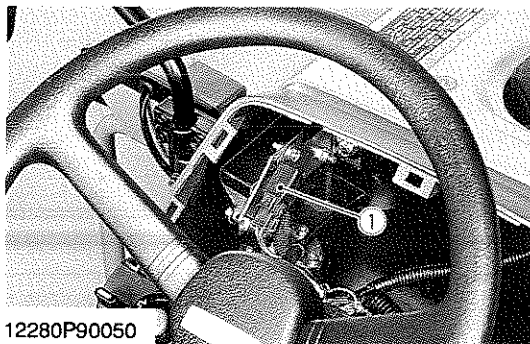
#### Magnetic Switch Test

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter **M** terminal.
3. Remove the starter from the engine.
4. Disconnect the connecting lead (3) from the starter **C** terminal (2).
5. Connect a jumper lead from the starter **S** terminal (1) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter **C** terminal (2) and the battery negative terminal post.
7. If the pinion gear does not pop out, check the magnetic switch.

#### NOTE

- **This test should be carried out for a short time, about 3 to 5 seconds.**

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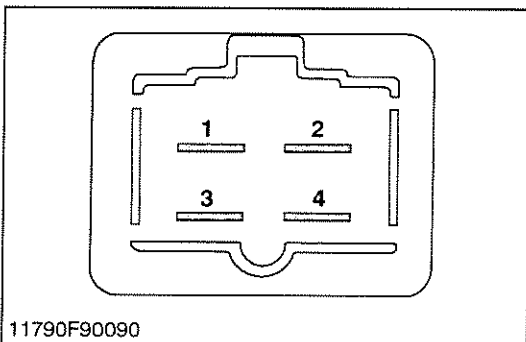
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### Starter Relay

1. Open the panel board and remove out the starter relay.
2. Apply battery voltage across terminal **2** and **4**, and check for continuity across terminal **1** and **3**.
3. If 0 ohm is not indicated, renew the starter relay.

Resistance	2 – 4	Battery voltage is applied 1 – 3	0 ohm
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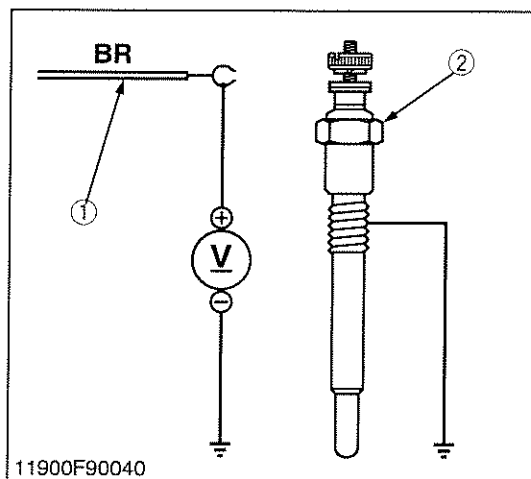
(1) Starter Relay



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### (3) Glow Plug



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### Lead Terminal Voltage

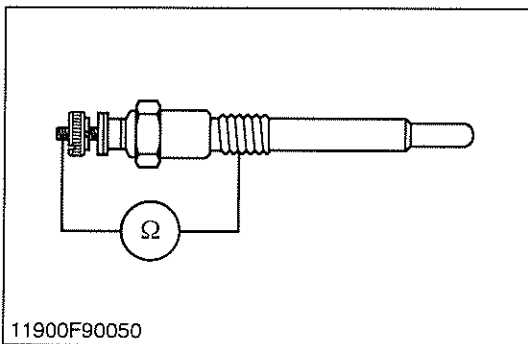
1. Disconnect the wiring lead (1) from the glow plug (2) after turning the main switch off.
2. Turn the main switch key to the **"PREHEAT"** position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the **"START"** position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage (Lead terminal – Chassis)	Main switch key at <b>"PREHEAT"</b>	Approx. battery voltage
	Main switch key at <b>"START"</b>	Approx. battery voltage

(1) Wiring Lead

(2) Glow Plug

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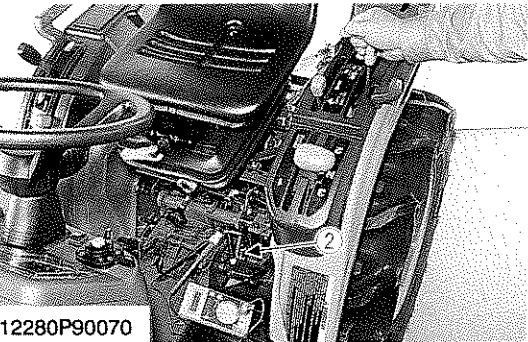
### Glow Plug Continuity

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 ohms
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(4) Safety Switch



Safety Switch Continuity

- 1. Remove the safety switch leads.
- 2. Connect the circuit tester to the safety switch leads.
- 3. Measure the resistance between leads.
- 4. If the safety switch is defective, replace it.

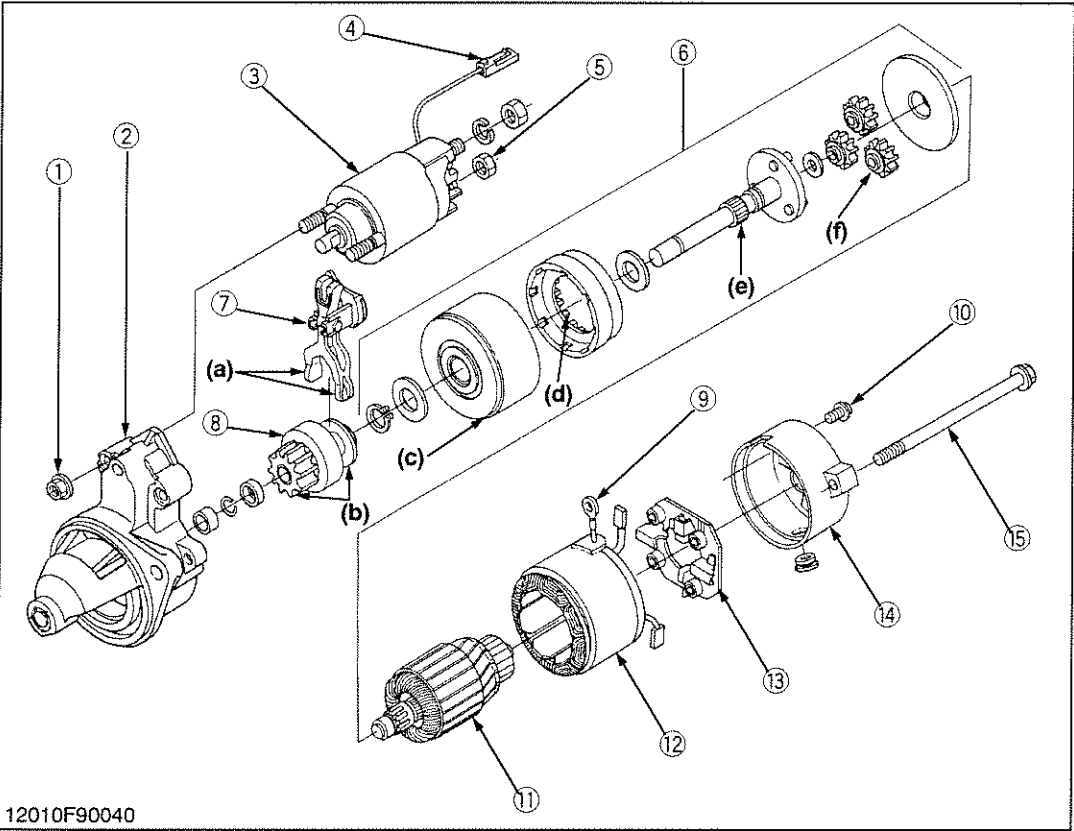
Resistance (Across switch terminal)	When you move the gear shift lever	Infinity
	When you return the gear shift lever	0 ohm

- (1) Safety Switch for Main Gear Shift Lever
- (2) Safety Switch for PTO Gear Shift Lever

12280S90080

DISASSEMBLING AND ASSEMBLING

Disassembling Starter



- (1) Magnetic Switch Mounting Nut
- (2) Housing
- (3) Magnetic Switch
- (4) Connecting Lead
- (5) C Terminal Nut
- (6) Shaft Assembly
- (7) Drive Lever
- (8) Overrunning Clutch
- (9) Connecting Lead
- (10) Mounting Screw
- (11) Armature
- (12) Yoke
- (13) Brush Holder
- (14) Rear End Frame
- (15) Through Bolt

- 1. Unscrew the C terminal nut (5), and disconnect the connecting leads (4), (9).
- 2. Unscrew the magnetic switch mounting nuts (1), and remove the magnetic switch (3) from the housing (2).
- 3. Unscrew the through bolts (15) and mounting screws (10), and remove the rear end frame (14).
- 4. Remove the brush from the brush holder while holding the spring up.
- 5. Remove the brush holder (13).
- 6. Draw out the armature (11) and yoke (12) from the housing.
- 7. Draw out the shaft assembly (6) with the drive lever (7) and overrunning clutch (8) from the the housing.

NOTE

- Do not damage to the brush and commutator.

(When reassembling)

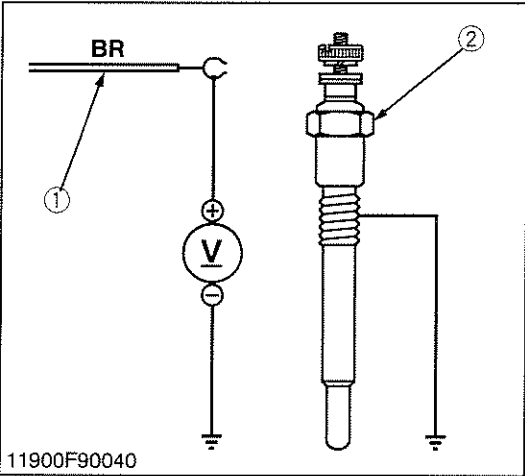
- Apply grease (NIPPONDENSO No.50 or equivalent) to the parts indicated in the figure.

- (a) Drive lever
- (b) Teeth of pinion gear
- (c) Center bearing
- (d) Internal gear
- (e) Shaft
- (f) Planetary gear

Tightening torque	C terminal nut (5)	7.9 to 11.8 N·m 0.8 to 1.2 kgf·m 5.8 to 8.7 ft·lbs
	Magnetic switch mounting nut (1)	5.9 to 10.8 N·m 0.6 to 1.1 kgf·m 4.4 to 7.9 ft·lbs
	Through bolt (15)	4.42 to 7.35 N·m 0.45 to 0.75 kgf·m 3.26 to 5.42 ft·lbs

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SERVICING



Lead Terminal Voltage

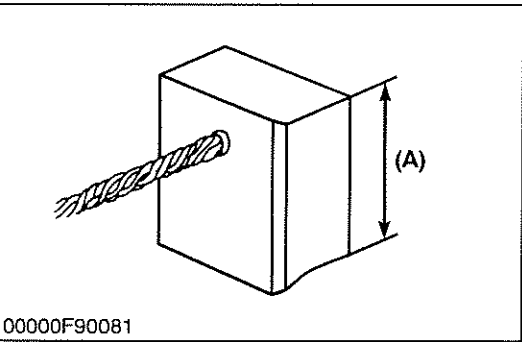
1. Disconnect the wiring lead (1) from the glow plug (2) after turning the main switch off.
2. Turn the main switch key to the “PREHEAT” position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the “START” position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage (Lead terminal – Chassis)	Main switch key at “PREHEAT”	Approx. battery voltage
	Main switch key at “START”	Approx. battery voltage

(1) Wiring Lead

(2) Glow Plug

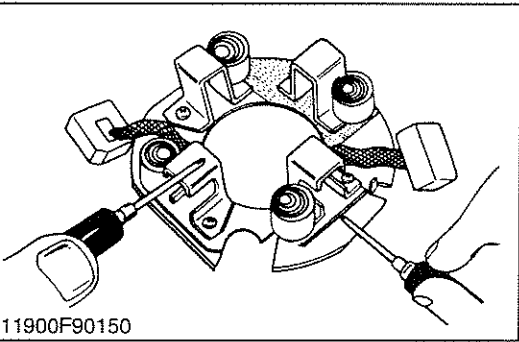
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Brush Wear

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.

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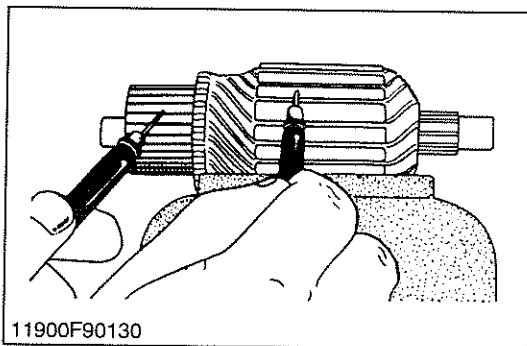


Brush Holder

1. Check the continuity between the brush holder and the holder support with an ohmmeter.
2. If it conducts, replace the brush holder.

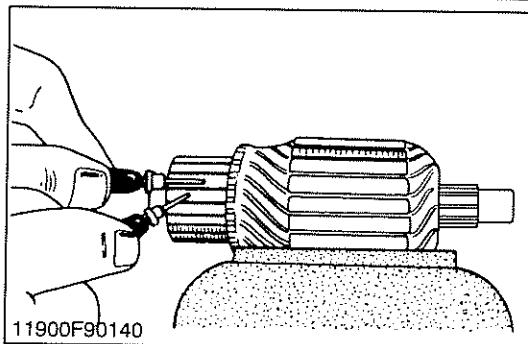
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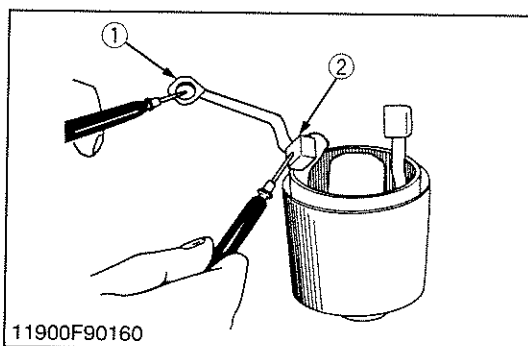


### Armature Coil

1. Check the continuity between the commutator and armature coil core with an ohmmeter.
2. If it conducts, replace the armature.
3. Check the continuity between the segments of the commutator with an ohmmeter.
4. If it does not conduct, replace the armature.



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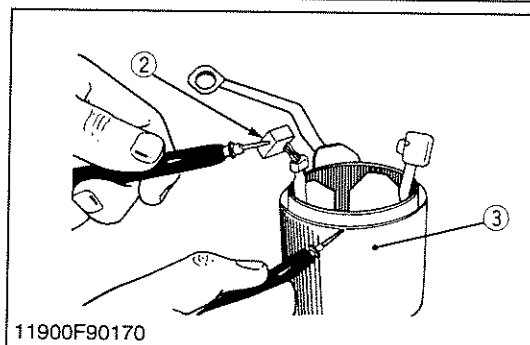


### Field Coil

1. Check the continuity between the connecting lead (1) and the brush (2) with an ohmmeter.
2. If it does not conduct, replace the yoke assembly.
3. Check the continuity between the brush (2) and the yoke (3) with an ohmmeter.
4. If it conducts, replace the yoke assembly.

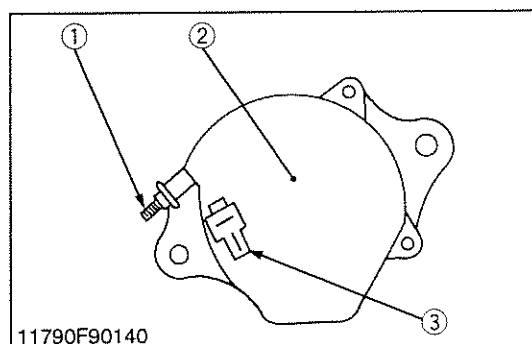
(1) Connecting Lead  
(2) Brush

(3) Yoke



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## [3] CHARGING SYSTEM CHECKING

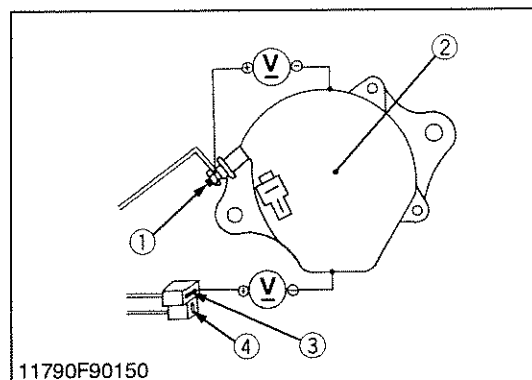


### Alternator

1. Disconnect the **2P** connector (3) from alternator after turning the main switch **OFF**.
2. Perform the following checkings.

- (1) **B** Terminal (3) **2P** Connector  
(2) Alternator

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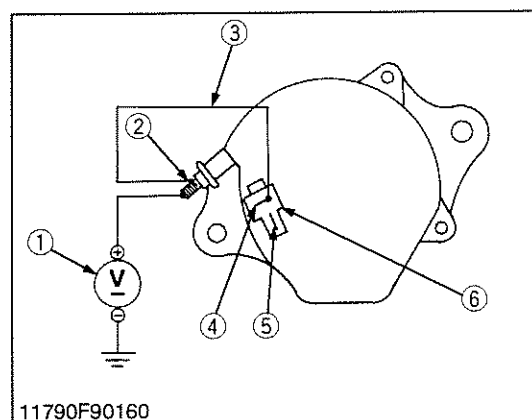
### Connector Voltage

1. Turn the main switch **OFF**. Measure the voltage between the **B** terminal (1) and the chassis.
2. Turn the main switch **ON**. Measure the voltage between the **IG** terminal (3) and the chassis.

Voltage (Main switch at <b>OFF</b> )	<b>B</b> terminal - Chassis	Approx. battery voltage
Voltage (Main switch at <b>ON</b> )	<b>IG</b> terminal - Chassis	Approx. battery voltage

- (1) **B** Terminal (3) **IG** Terminal  
(2) Alternator (4) **L** Terminal

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### No-Load Test

1. Connect the **2P** connector (6) to previous positions of the alternator after turning the main switch **OFF**.
2. Connect the jumper lead (3) between **IG** terminal (4) and **B** terminal (2).
3. Start the engine and then set the idling speed.
4. Disconnect the negative cable from the battery.
5. Measure the voltage between the **B** terminal (2) and the chassis.
6. If the measurement is less than the factory specification, disassemble the alternator and check the IC regulator.

Voltage	Factory spec.	More than 14 V
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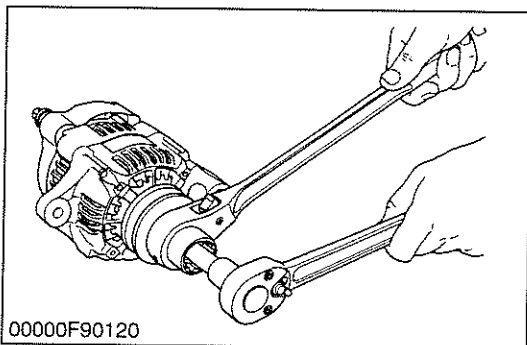
### (Reference)

- Once the engine has started, the alternator temperature rises quickly up to an ambient temperature of 70 to 90 °C (158 to 194 °F). As the temperature goes higher than 50 °C (122 °F), the alternator voltage slowly drops ; at higher than 100 °C (212 °F), it drops by about 1 V.

- (1) Voltmeter (4) **IG** Terminal  
(2) **B** Terminal (5) **L** Terminal  
(3) Jumper Lead (6) **2P** Connector

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## DISASSEMBLING AND ASSEMBLING



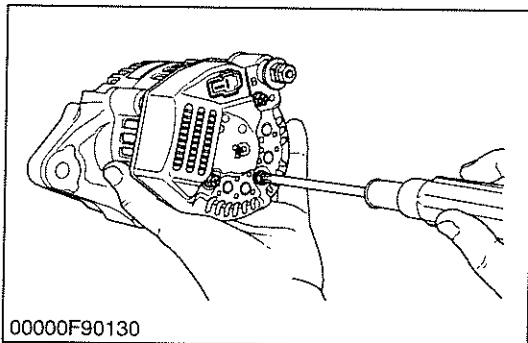
### Pulley

1. Secure the hexagonal end of the pulley shaft with a double-ended ratchet wrench as shown in the figure, loosen the pulley nut with a socket wrench and remove it.

(When reassembling)

Tightening torque	Pulley nut	58.3 to 78.9 N·m 5.95 to 8.05 kgf·m 43.0 to 58.2 ft·lbs
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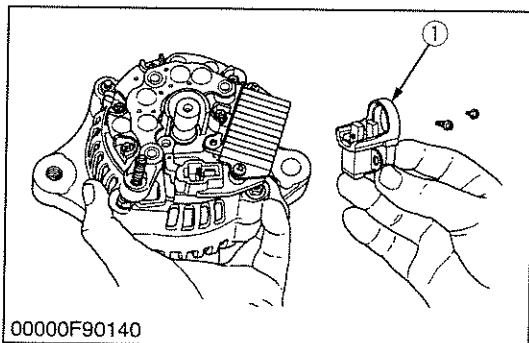
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### Rear End Cover

1. Unscrew the three rear end cover screws and the **B** terminal nut, and remove the rear end cover.

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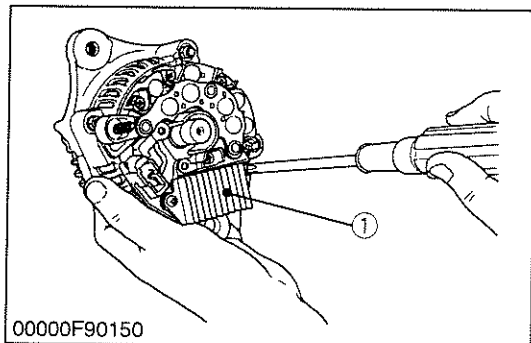


### Brush Holder

1. Unscrew the two screws holding the brush holder, and remove the brush holder (1).

(1) Brush Holder

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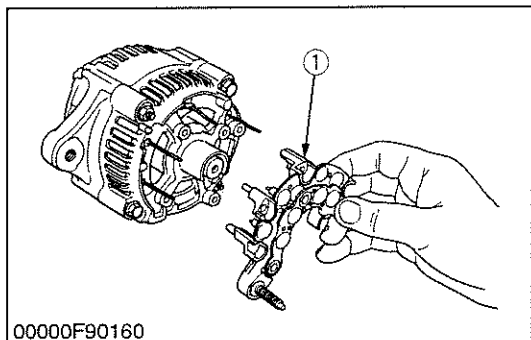


### IC Regulator

1. Unscrew the three screws holding the IC regulator, and remove the IC regulator (1).

(1) IC Regulator

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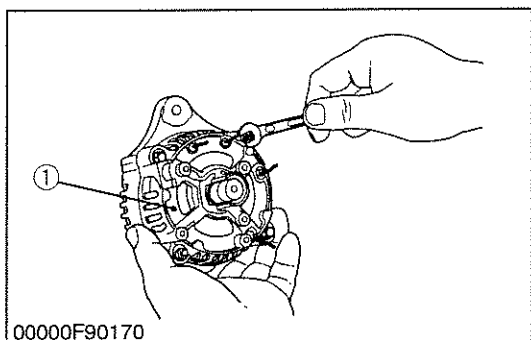
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**Rectifier**

1. Remove the four screws holding the rectifier and the stator lead wires.
2. Remove the rectifier (1).

(1) Rectifier

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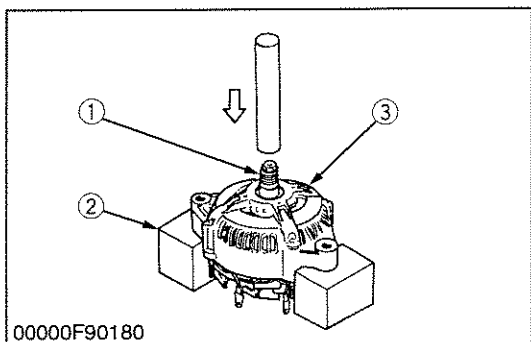
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**Rear End Frame**

1. Unscrew the two nuts and two screws holding the drive end frame and the rear end frame.
2. Remove the rear end frame (1).

(1) Rear End Frame

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**Rotor**

1. Press out the rotor (1) from drive end frame (3).

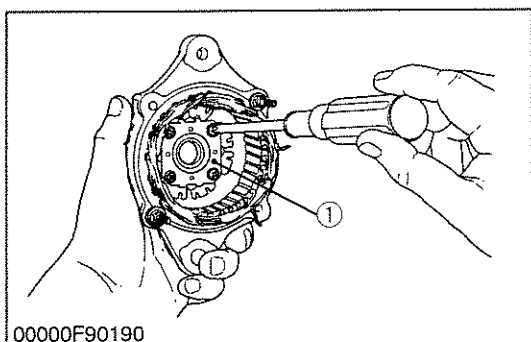
**■ IMPORTANT**

- Take special care not to drop the rotor and damage the slip ring or fan, etc.

(1) Rotor  
(2) Block

(3) Drive End Frame

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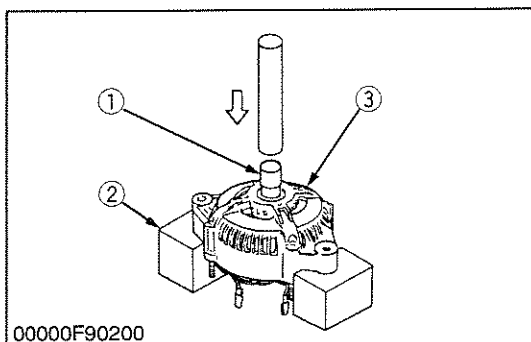
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**Retainer Plate**

1. Unscrew the four screws holding the retainer plate, and remove the retainer plate (1).

(1) Retainer Plate

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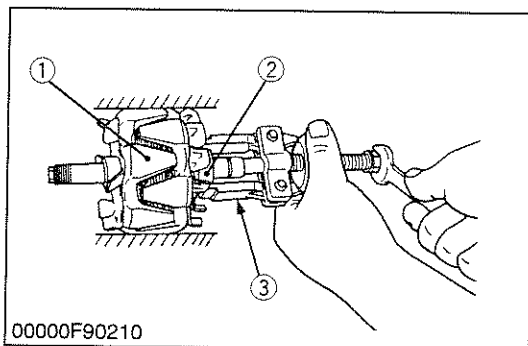
**Bearing on Drive End Side**

1. Press out the bearing from drive end frame (3) with a press and jig (1).

(1) Jig  
(2) Block

(3) Drive End Frame

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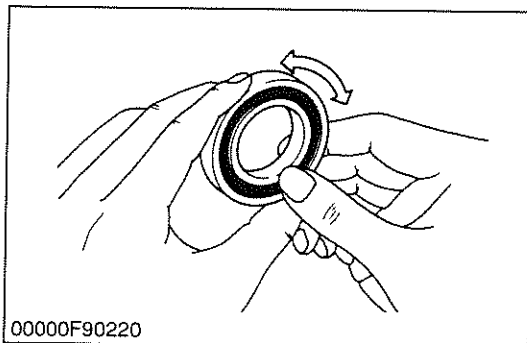
### Bearing at Slip Ring Side

1. Lightly secure the rotor (1) with a vise to prevent damage, and remove the bearing (2) with a puller (3).

(1) Rotor (3) Puller  
(2) Bearing

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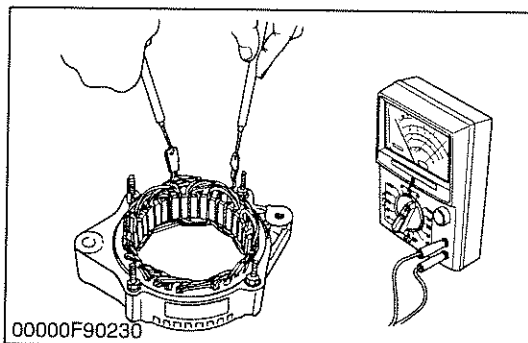
## SERVICING



### Bearing

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

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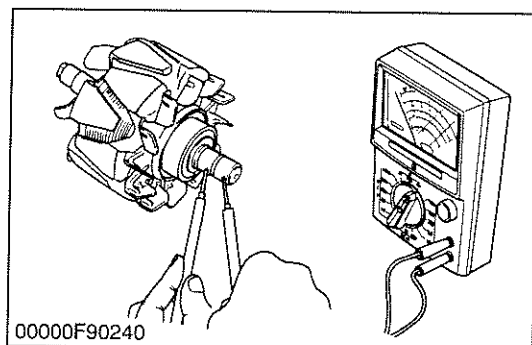


### Stator

1. Measure the resistance across each lead of the stator coil with an ohmmeter.
2. If the measurement is not within factory specification, replace it.
3. Check the continuity across each stator coil lead and core with an ohmmeter.
4. If infinity is not indicated, replace it.

Resistance	Factory spec.	Less than 1.0 ohms
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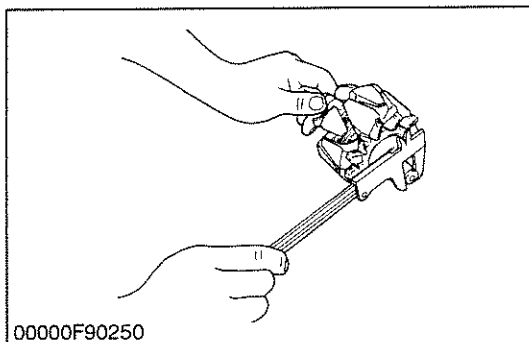


### Rotor

1. Measure the resistance across the slip rings with an ohmmeter.
2. If the resistance is not the factory specification, replace it.
3. Check the continuity across the slip ring and core with an ohmmeter.
4. If infinity is not indicated, replace it.

Resistance	Factory spec.	2.9 ohms
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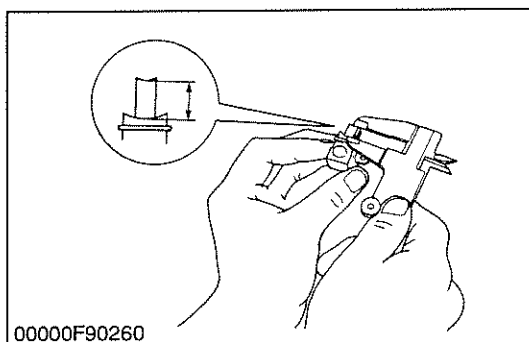


### Slip Ring

1. Check the slip ring for score.
2. If scored, correct with an emery paper or on a lathe.
3. Measure the O.D. of slip ring with vernier calipers.
4. If the measurement is less than the allowable limit, replace it.

Slip ring O.D.	Factory spec.	14.4 mm 0.567 in.
	Allowable limit	12.8 mm 0.504 in.

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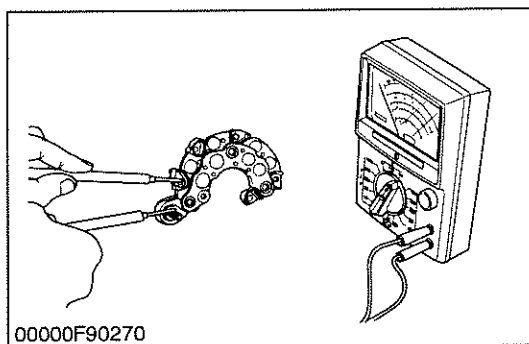


### Brush Wear

1. Measure the brush length with vernier calipers.
2. If the measurement is less than allowable limit, replace it.
3. Make sure that the brush moves smoothly.
4. If the brush is defective, replace it.

Brush length	Factory spec.	10.5 mm 0.413 in.
	Allowable limit	8.4 mm 0.331 in.

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### Rectifier

1. Check the continuity across each diode of rectifier with an analog ohmmeter. Conduct the test in the (R × 1) setting.
2. The rectifier is normal if the diode in the rectifier conducts in one direction and does not conduct in the reverse direction.

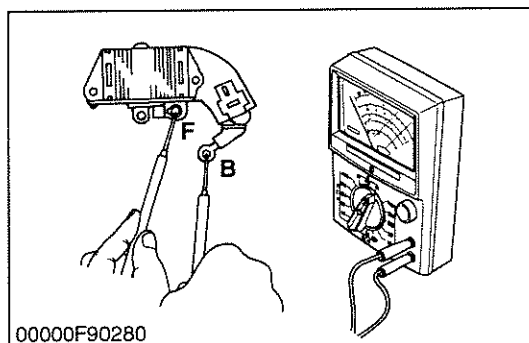
#### ■ IMPORTANT

- Do not use a 500 V megger for measuring because it will destroy the rectifier.

#### ■ NOTE

- Do not use an auto digital multimeter. Because it's very hard to check the continuity of rectifier by using it.

00000S90230



### IC Regulator

1. Check the continuity across the B terminal and the F terminal of IC regulator with an analog ohmmeter. Conduct the test in the (R × 1) setting.
2. The IC regulator is normal if the IC regulator conducts in one direction and does not conduct in the reverse direction.

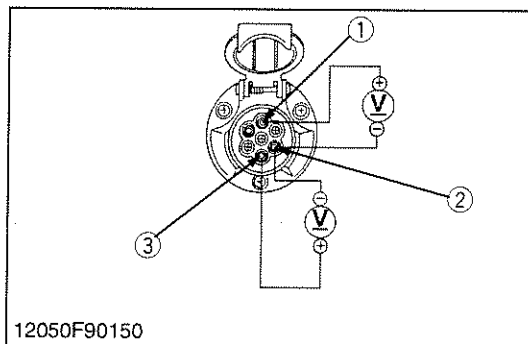
#### ■ IMPORTANT

- Do not use a 500 V megger for measuring because it will destroy the IC regulator.

#### ■ NOTE

- Do not use an auto digital multimeter. Because it's very hard to check the continuity of IC regulator by using it.

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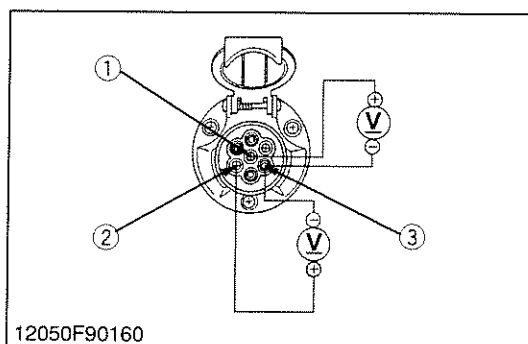
- (1) Green / White Lead      (3) Red / White Lead  
(2) Black Lead

### Turning Signal Terminals

1. Turn the main switch **ON**, and measure the voltage with voltmeter across the terminal (1) and terminal (2), and across the terminal (3) and terminal (2).
2. If the voltage differ from the battery voltage, the wiring harness or switches for turning signal are faulty.

Voltage Turning signal switch at LH or hazard switch at <b>ON</b>	Terminal (Green / White) – Terminal (Black)	Approx. battery voltage (Intermittently)
Voltage Turning signal switch at RH or hazard switch at <b>ON</b>	Terminal (Red / White) – Terminal (Black)	Approx. battery voltage (Intermittently)

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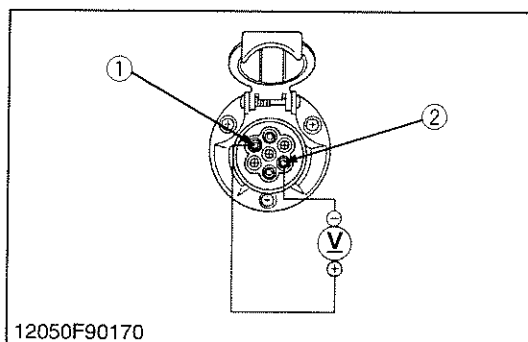
- (1) Yellow / White Lead      (3) Black Lead  
(2) Yellow / Red Lead

### Tail Terminals

1. Turn the main switch **ON**, and measure the voltage with voltmeter across the terminal (1) and terminal (2), and across the terminal (2) and terminal (3).
2. If the voltage differs from battery voltage, the wiring harness or switches for tail lights are faulty.

Voltage Light switch at <b>ON</b> , or position switch at <b>ON</b>	Terminal (Yellow / White) – Terminal (Black)	Approx. battery voltage
Voltage Light switch at <b>ON</b> , or position switch at <b>ON</b>	Terminal (Yellow / Red) – Terminal (Black)	Approx. battery voltage

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- (1) Yellow Lead      (2) Black Lead

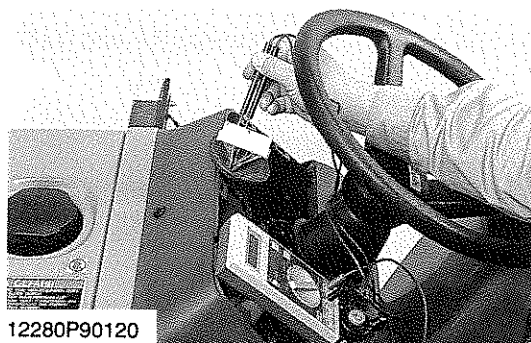
### Brake Light Terminal

1. Turn the main switch **ON**, and measure the voltage with voltmeter across the terminal (1) and terminal (2).
2. If the voltage differs from battery voltage, the wiring harness or switch for brake lights are faulty.

Voltage When stepping the brake pedal	Terminal (Yellow) – Terminal (Black)	Approx. battery voltage
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## [5] EASY CHECKER CHECKING



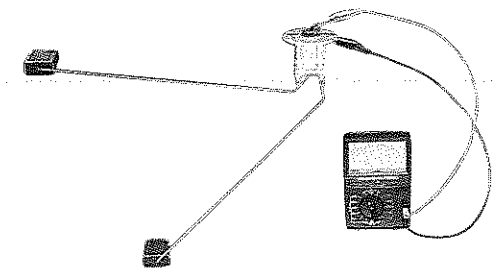
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### Easy Checker

1. Remove the panel board and disconnect the connector from it.
2. Turn the main switch on.
3. Measure the voltage with a voltmeter across the terminal (Red / Yellow) and the earth terminal (Black).
4. If the voltage differs from the battery voltage, the wiring harness, fuses and main switch should be checked.

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[6] GAUGE  
CHECKING



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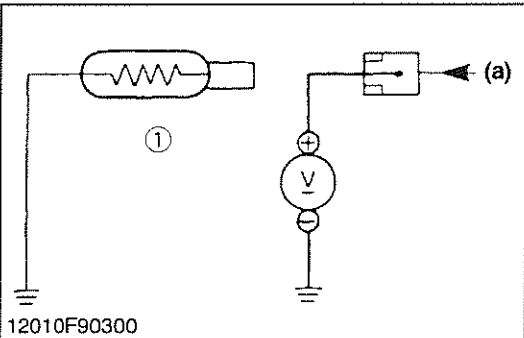
Fuel Level Sensor

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 values are not indicated, the sensor is faulty.

Resistance (Sensor terminal – its body)	Reference value	Float at upper-most position	1 to 5 ohms
		Float at lower- most position	103 to 107 ohms

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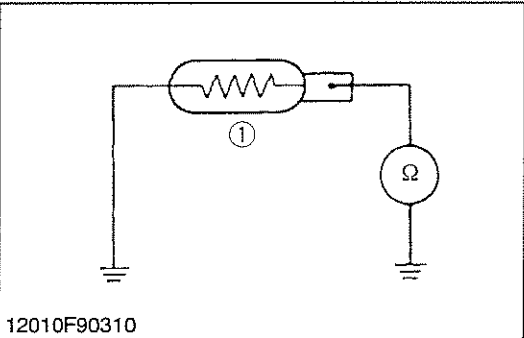
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Coolant Temperature Sensor

1) Lead Terminal Voltage

- 1. Disconnect the lead from the coolant temperature sensor after turning the main switch off.
- 2. Turn the main switch on and measure the voltage with a voltmeter across the lead terminal and the chassis.  
If the voltage differs from the battery voltage, the wiring harness, fuse or coolant temperature gauge is faulty.

Voltage	Lead terminal – Chassis	Approx. battery voltage
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2) Sensor Continuity

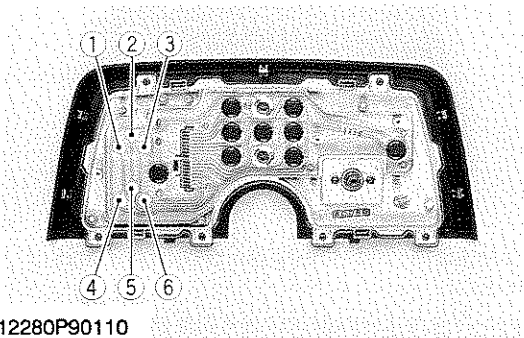
- 1. Measure the resistances with an ohmmeter across the sensor terminal and the chassis.
- 2. If the reference value is not indicated, the sensor is faulty.

Resistance (Sensor terminal – Chassis)	Reference value	Approx. 12.2 ohms	at 130 °C (266 °F)
		Approx. 23.6 ohms	at 105 °C (221 °F)
		Approx. 51.9 ohms	at 80 °C (176 °F)
		Approx. 153.9 ohms	at 50 °C (122 °F)

(1) Coolant Temperature Sensor

(a) From Temperature Gauge

12010S90350



12280P90110

Fuel Gauge and Coolant Temperature Gauge Continuity

- 1. Remove the panel board from the tractor.
- 2. Check the continuity with an ohmmeter across the **U** terminal (2) and **IGN** terminal (3) and across the **U** terminal (2) and **GND** terminal (1).
- 3. If infinity is indicated, the coolant temperature is faulty.
- 4. Check the continuity with an ohmmeter across the **U** terminal (5) and **IGN** terminal (6) and across the **U** terminal (5) and **GND** terminal (4).
- 5. If infinity is indicated, the fuel gauge is faulty.

- |                                       |                                |
|---------------------------------------|--------------------------------|
| (1) <b>GND</b> Terminal (Temperature) | (4) <b>GND</b> Terminal (Fuel) |
| (2) <b>U</b> Terminal (Temperature)   | (5) <b>U</b> Terminal (Fuel)   |
| (3) <b>IGN</b> Terminal (Temperature) | (6) <b>IGN</b> Terminal (Fuel) |

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## TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of KUBOTA rotary mower RCK48-16B. It is divided into two parts, "Mechanism" and "Servicing" for each section.

### ■ Mechanism

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

### ■ Servicing

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

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

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

March '99

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17040Z00010

## SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and decals on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.

It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.



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



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



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

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

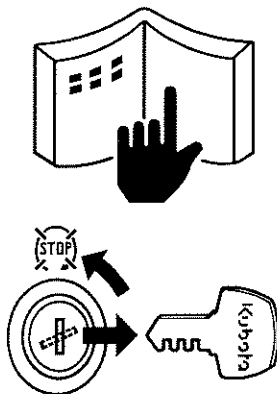
■ **NOTE** : Gives helpful information.

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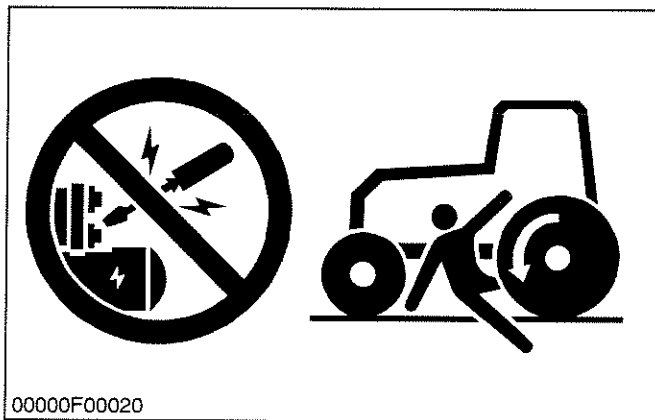
### BEFORE SERVICING AND REPAIRING

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

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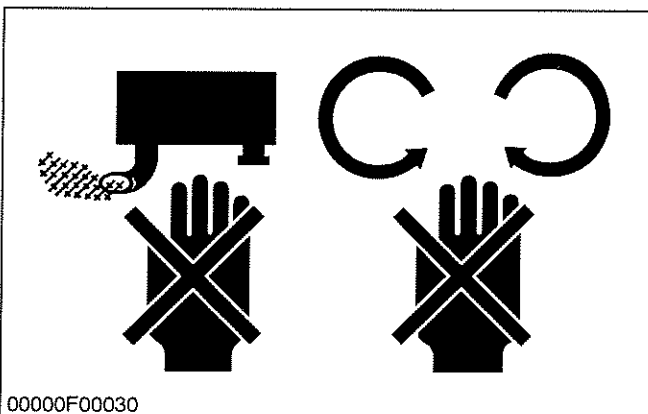
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## SAFETY STARTING

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

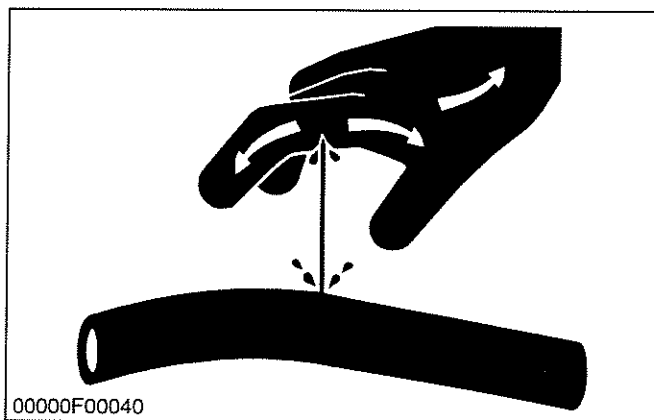
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## SAFETY WORKING

- (1) Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- (2) Wear close fitting clothing and safety equipment appropriate to the job.
- (3) Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
- (4) When servicing is performed together by two or more persons, take care to perform all work safely.
- (5) Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.
- (6) Do not touch the rotating or hot parts while the engine is running.
- (7) 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.
- (8) Escaping fluid (fuel or hydraulic oil) under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or fuel lines. Tighten all connections before applying pressure.

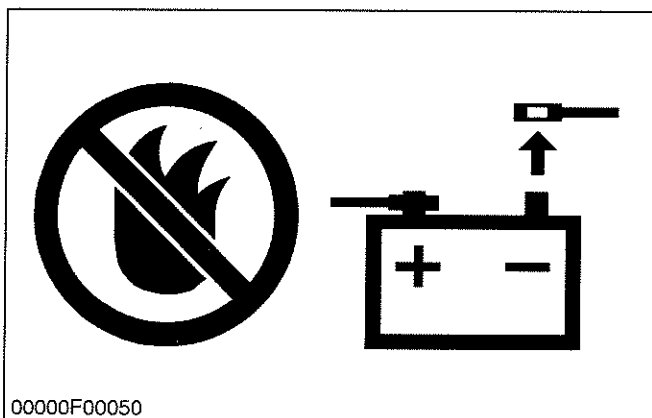
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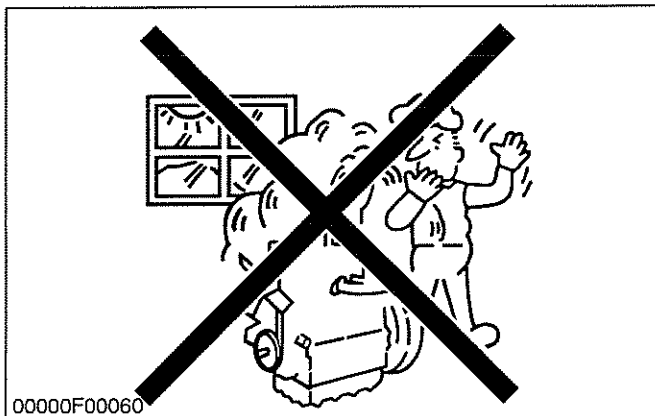


## AVOID FIRES

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

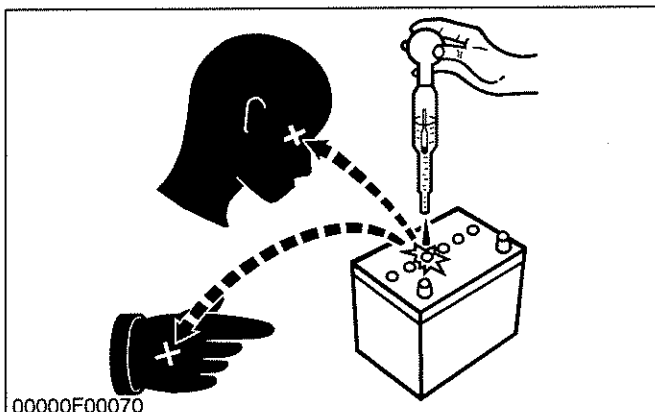
00000Z00050



**VENTILATE WORK AREA**

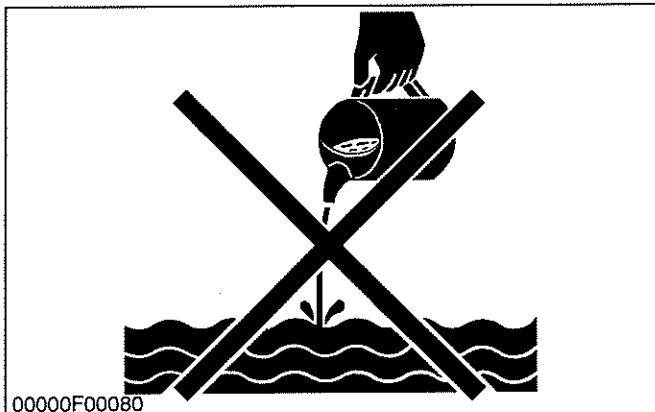
- (1) If the engine must be running to do some work, make sure the area is well ventilated. Never run the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.

00000Z00060

**PREVENT ACID BURNS**

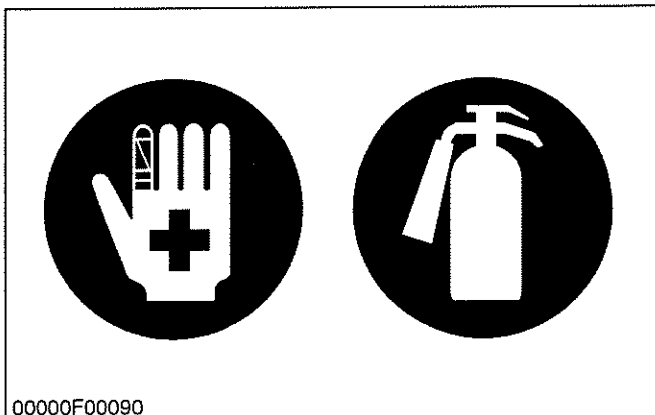
- (1) Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, clothing and cause blindness if splashed into eyes. Keep electrolyte away from eyes, hands and clothing. If you spill electrolyte on yourself, flush with water, and get medical attention immediately.

00000Z00070

**DISPOSE OF FLUIDS PROPERLY**

- (1) 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.

00000Z00080

**PREPARE FOR EMERGENCIES**

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

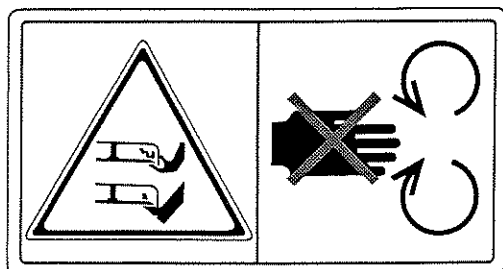
00000Z00090

## SAFETY DECALS

- The following safety decals are installed on the mower.  
If a decal becomes damaged, illegible or is not on the mower, replace it. The decal part number is listed in the parts list.

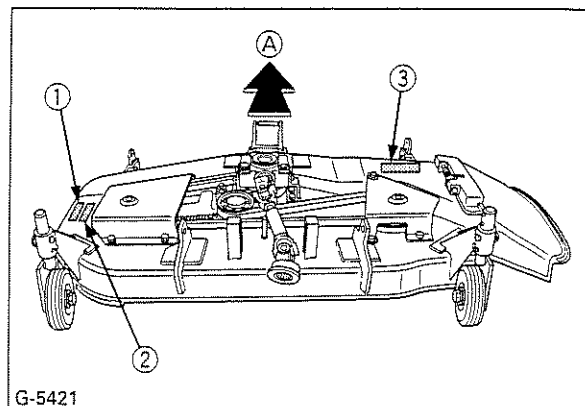
### [RCK48-16B]

#### SIGN① Part No.K5652-4179-2



#### ROTATING BLADES HAZARDOUS.

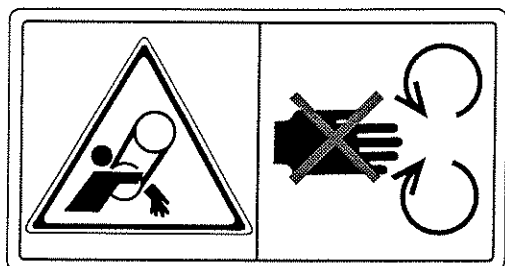
- DO NOT put hands or feet into mower when engine running.



G-5421

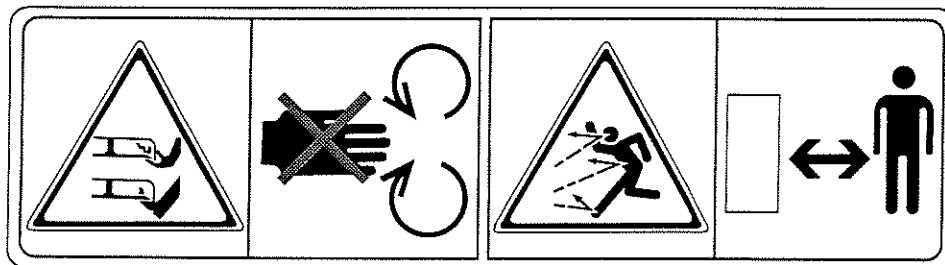
(A) Forward

#### SIGN② Part No.K5652-4180-2



- Keep all shields and guards in place.

#### SIGN③ Part No.K5652-4178-2



#### THROWN OBJECTS HAZARDOUS.

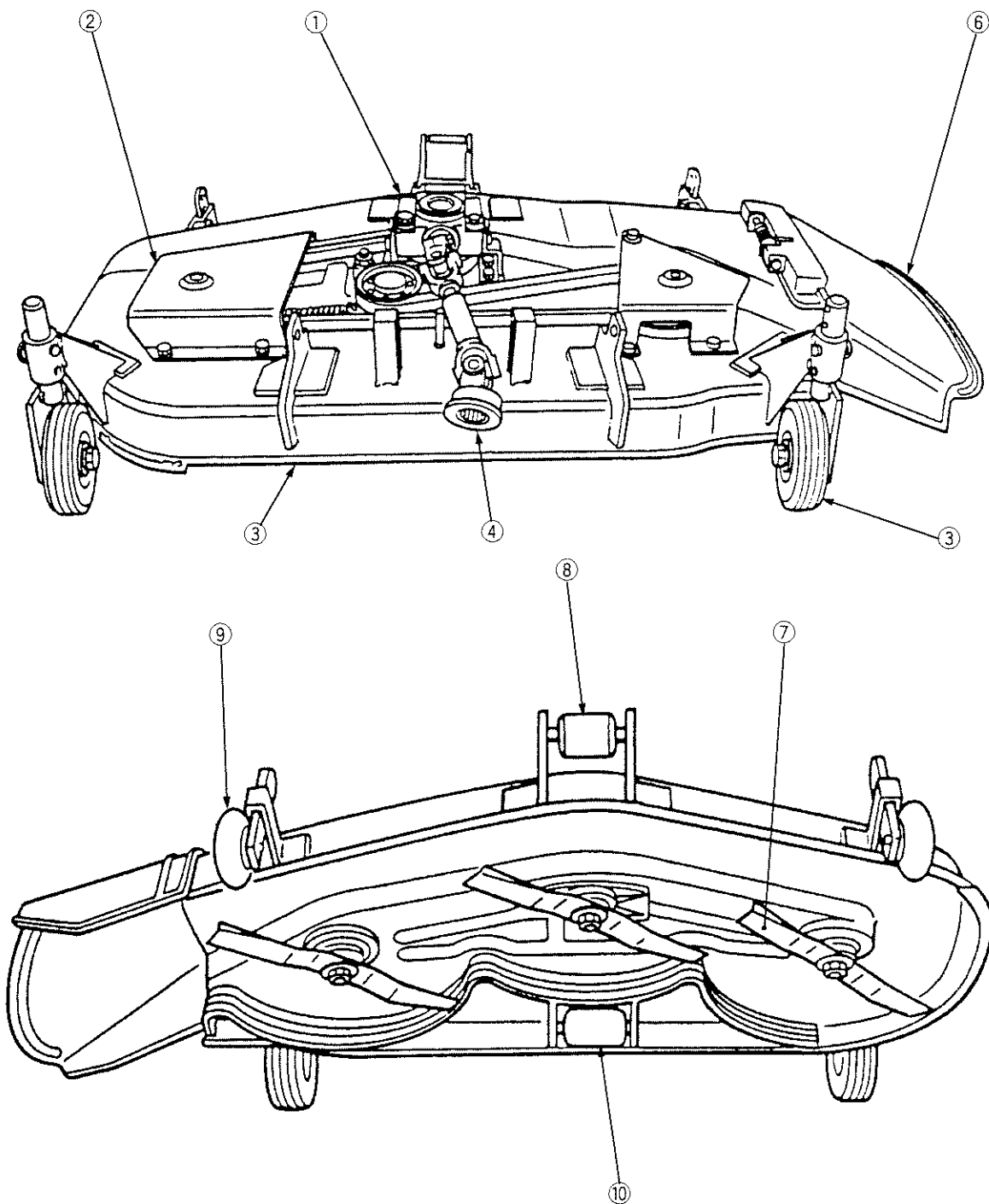
- Stay clear of discharge opening at all times.

### CARE OF DANGER, WARNING AND CAUTION LABELS

- Keep danger, warning and caution labels clean and free from obstructing material.
- Clean danger, warning and caution labels with soap and water, dry with a soft cloth.
- Replace damaged or missing danger, warning and caution labels with new labels from your local KUBOTA dealer.
- 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.
- Mount new danger, warning and caution labels by applying on a clean dry surface and pressing any bubbles to outside edge.

# TERMINOLOGY

[RCK48-16B]



17040F00020

(1) Gear Box  
(2) Belt Cover  
(3) Deck

(4) Universal Joint  
(5) Rear Gauge Wheel  
(6) Discharge Chute

(7) Blade  
(8) Front Anti-scalp Roller

(9) Anti-scalp Wheel  
(10) Rear Anti-scalp Roller

17040Z00030

# SPECIFICATIONS

Model		<b>RCK48-16B</b>
Suitable tractor		B1410, B1610
Mounting method		Parallel linkage
Adjustment of cutting height		Gauge wheel
Cutting width		1220 mm (48 in.)
Cutting height		25 to 102 mm (1.0 to 4.0 in.)
Weight (Approx.)		75 kg (165 lbs)
Blade spindle speed		55.7 S <sup>-1</sup> (3341 rpm)
Blade tip velocity		74.0 m/s
Blade length		424 mm (16.7 in.)
Number of blades		3
Dimensions	Total length	960 mm (37.8 in.)
	Total width	1544 mm (60.8 in.)
	Total height	295 mm (11.6 in.)

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# GENERAL

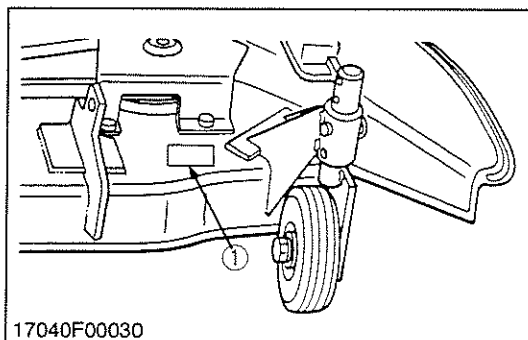
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# GENERAL

## [1] MOWER IDENTIFICATION

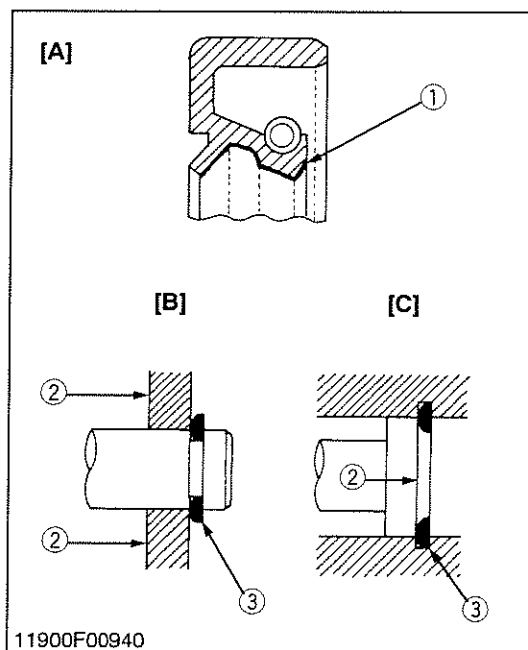


When contacting your local KUBOTA distributor, always specify mower serial number.

(1) Mower Serial Number

17040G00010

## [2] GENERAL PRECAUTION



- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Screws, bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently used should be made according to the drawings provided.
- Use KUBOTA genuine parts or KUBOTA-recommended parts and lubricants or their equivalents.
- Gaskets and o-rings must be replaced during reassembly.
- Apply grease to new o-rings or oil seals before assembling. See the figure.
- 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.
- Metric screws, bolts and nuts are not interchangeable with nonmetric fasteners.
- Remove oil and dirt from parts before measuring.

(1) Grease  
(2) Force  
(3) Sharp Edge

(A) Oil Seal  
(B) External Snap Ring  
(C) Internal Snap Ring

11900S00790




## [3] LUBRICANTS

No.	Place	Capacity	Lubricants
1	Gear box	0.36 L 0.38 U.S.qts. 0.32 Imp.qts	SAE 90 gear oil (API Service GL-5 gear oil)
<b>Greasing</b>			
2	Universal joint	Until grease overflows	SAE multi-purpose type grease
3	Spindle shafts		
4	Belt tension pulley		
5	Belt tension pivot		
6	Lift arms		
7	Rear gauge wheels		

17040G00020

## [4] TIGHTENING TORQUES (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	 <b>4</b> No-grade or 4T						 <b>7</b> 7T						 <b>9</b> 9T		
Material of bolt	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit Diameter	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M6 (6 mm, 0.24 in.)	7.85 to 9.31	0.80 to 0.95	5.79 to 6.87	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8 (8 mm, 0.31 in.)	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	16.7 to 19.6	1.7 to 2.0	12.3 to 14.4	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	29.5 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)	39.3 to 45.1	4.0 to 4.6	29.0 to 33.2	31.4 to 34.3	3.2 to 3.5	23.2 to 25.3	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5	60.9 to 70.6	6.2 to 7.2	44.9 to 52.0
M12 (12 mm, 0.47 in.)	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	/			77.5 to 90.2	7.9 to 9.2	57.2 to 66.5	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	103 to 117	10.5 to 12.0	76.0 to 86.7
M14 (14 mm, 0.55 in.)	108 to 125	11.0 to 12.8	79.6 to 92.5				124 to 147	12.6 to 15.0	91.2 to 108	/			167 to 196	17.0 to 20.0	123 to 144
M16 (16 mm, 0.63 in.)	167 to 191	17.0 to 19.5	123 to 141				197 to 225	20.0 to 23.0	145 to 166				260 to 304	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)	246 to 284	25.0 to 29.0	181 to 209				275 to 318	28.0 to 32.5	203 to 235				344 to 402	35.0 to 41.0	254 to 296
M20 (20 mm, 0.79 in.)	334 to 392	34.0 to 40.0	246 to 289				368 to 431	37.5 to 44.0	272 to 318				491 to 568	50.0 to 58.0	362 to 419

11790G00761

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)		
Unit Size	N·m	kgf·m	ft-lbs	Unit Size	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

17040G00030

## [5] MAINTENANCE CHECK LIST

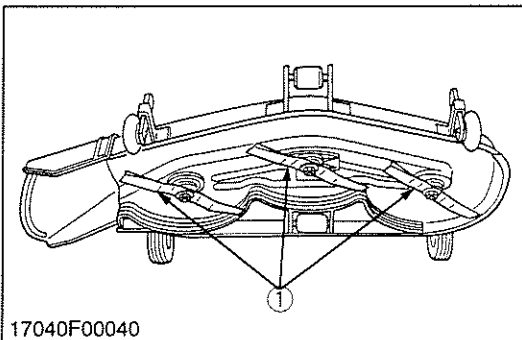
To keep the mower working in good condition as well as to avoid any accident and trouble, carry out periodic inspection and maintenance. Check the following points before use.

Service Interval	Check Points	Reference Page
Daily (Each use)	<ul style="list-style-type: none"> <li>• Anything unusual in previous day's operation</li> <li>• Make sure mower blade screws are tighten</li> <li>• Check mower blades for wear or damage</li> <li>• Check gear box oil level</li> <li>• Check oil leaks</li> <li>• Check all hardware</li> <li>• Make sure all pins are in place</li> <li>• Clean mower deck</li> <li>• Apply grease to universal joint</li> <li>• Apply grease to spindle shafts (Bevel gear shaft and blade shafts)</li> <li>• Apply grease to belt tension pulley</li> <li>• Apply grease to belt tension pivot</li> <li>• Apply grease to lift arms</li> </ul>	— G-3 S-2 G-5 — — — — G-4 G-4 G-5 G-5 G-5
Initial 50 hours	<ul style="list-style-type: none"> <li>• Change gear box oil</li> </ul>	G-5
Every 50 hours	<ul style="list-style-type: none"> <li>• Apply grease to rear gauge wheels</li> <li>• Check mower belt</li> </ul>	G-5 S-2
Every 150 hours	<ul style="list-style-type: none"> <li>• Change gear box oil</li> </ul>	G-5
Every 2 years (After purchase)	<ul style="list-style-type: none"> <li>• Replace gear box oil seal</li> </ul>	G-6

17040G00040

## [6] CHECK AND MAINTENANCE

### (1) Check Points of Daily or Each Use



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#### Retightening Mower Blade Screw

#### CAUTION

- To avoid injury, always handle the mower blade with care.
1. Dismount the mower and turn it over to expose the mower blades.
  2. Wedge a block of wood securely between the mower blade and mower deck.
  3. Retighten the mower blade screw to the specified torque.
  4. If the mower blade screw is worn or broken, replace it.

Tightening torque	Mower blade screw	98.1 to 117.7 N·m 10.0 to 12.0 kgf·m 72.3 to 86.8 ft·lbs
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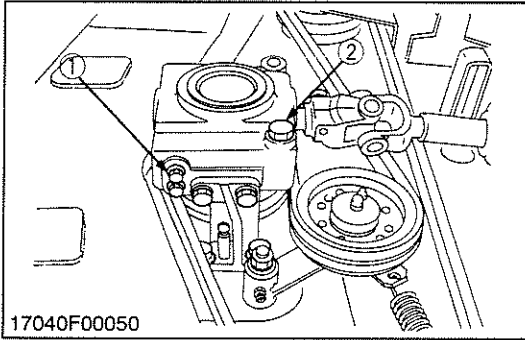
(1) Mower Blade Screw

17040G00050

#### Checking Mower Blade

1. See page S-2.

17030G00050



### Checking Gear Box Oil Level

1. Place the mower on level ground.
2. Loosen the check plug (1), and check to see if oil seep from the opening.
3. If the oil level is low, remove the oil filler plug (2) and add new gear oil.

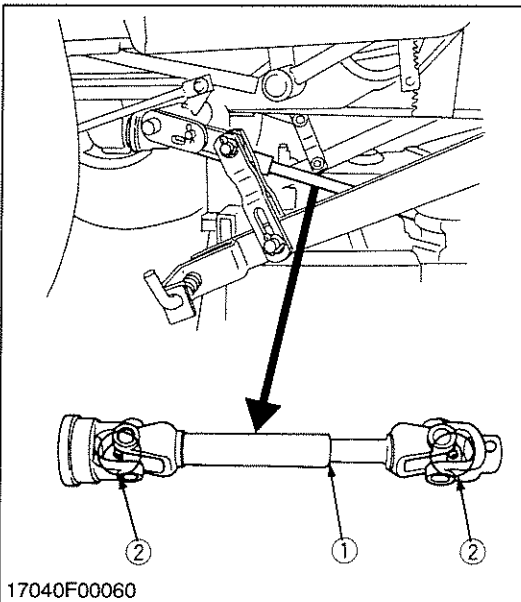
#### ■ IMPORTANT

- Use the specified gear oil.  
Refer to "LUBRICANTS". (See page G-1).

(1) Check Plug

(2) Oil Filler Plug

17040G00060



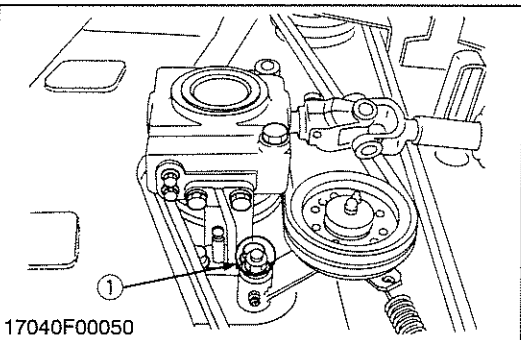
### Greasing Universal Joint

1. Grease the internal splines (1) and grease nipples (2) of the universal joint if the amount of grease is insufficient.

(1) Spline

(2) Grease Nipple

17040G00070

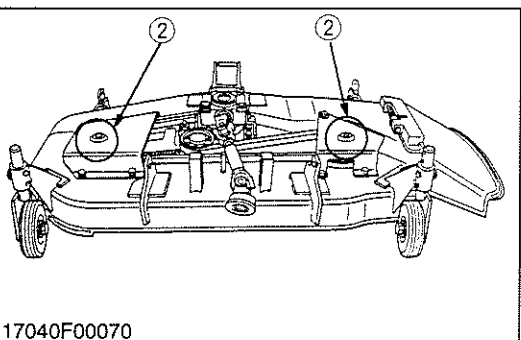


### Greasing Spindle Shafts

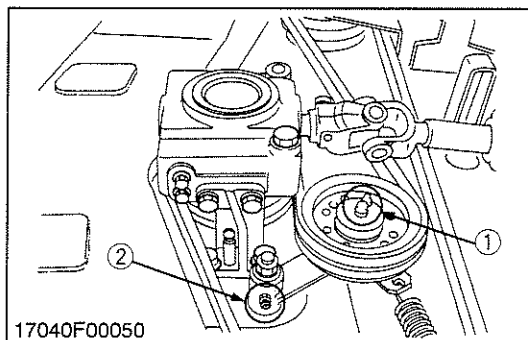
1. Grease the grease nipples (1), (2) of the spindle shafts if the amount of grease is insufficient.

(1) Grease Nipple (Bevel Gear Shaft)

(2) Grease Nipple (Blade Shaft)



17040G00080



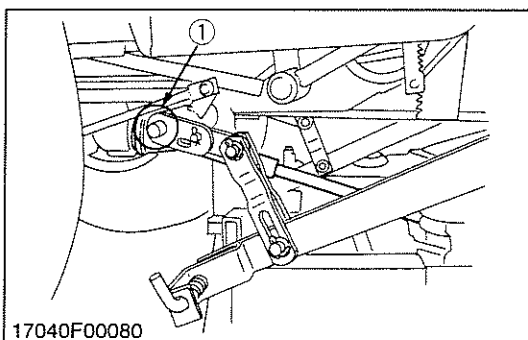
### **Greasing Belt Tension Pulley and Belt Tension Pivot**

1. Grease the grease nipple (1) of the belt tension pulley and belt tension pivot (2) if the amount of grease is insufficient.

(1) Grease Nipple

(2) Grease Nipple

17040G00090



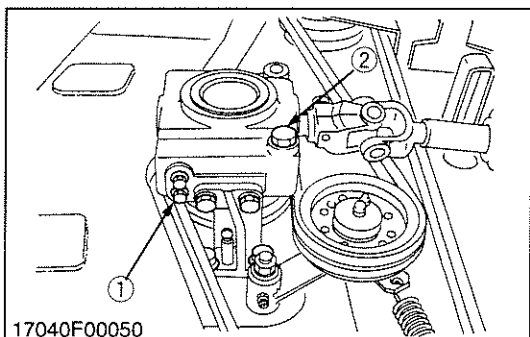
### **Greasing Lift Arms**

1. Grease the grease nipples (1) of the lift arms if the amount of grease is insufficient.

(1) Grease Nipple

17040G00100

## **(2) Check Point of Initial 50 Hours**



### **Changing Gear Box Oil**

1. Dismount the mower from the tractor, and place the mower on level ground.
2. Remove the oil filler plug (2).
3. Remove the drain plug (1), and drain the used oil completely.
4. After draining the used oil, reinstall the drain plug.
5. Fill with new oil up to the specified level.

#### **■ IMPORTANT**

- Use the specified gear oil.

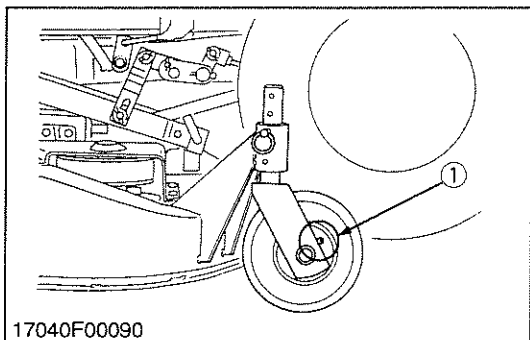
Refer to "LUBRICANTS". (See page G-1)

(1) Drain Plug

(2) Oil Filler Plug

17040G00110

## **(3) Check Points of Every 50 Hours**



### **Greasing Rear Gauge Wheels**

1. Grease the grease nipples (1) of the rear gauge wheels if the amount of grease is insufficient.

(1) Grease Nipple

17040G00120

### **Checking Mower Belt**

1. See page S-2.

17030G00140

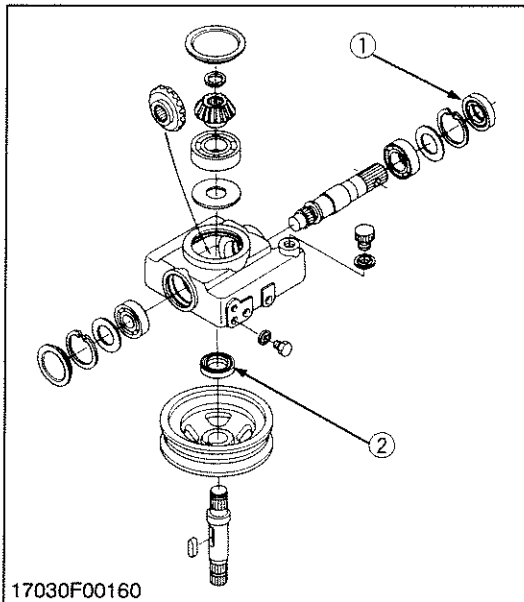
## (4) Check Point of Every 150 Hours

### Changing Gear Box Oil

1. See page G-5.

17040G00130

## (5) Check Point of Every 2 Years



17030F00160

### Replacing Gear Box Oil Seal

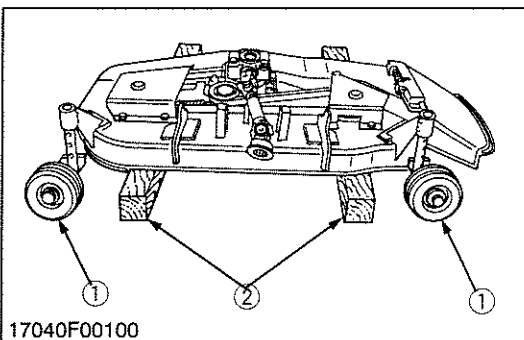
1. Replace the gear box oil seals (1), (2) with new ones. (See page S-6).

(1) Oil Seal

(2) Oil Seal

17030G00160

## [7] SETTING UP MOWER



17040F00100

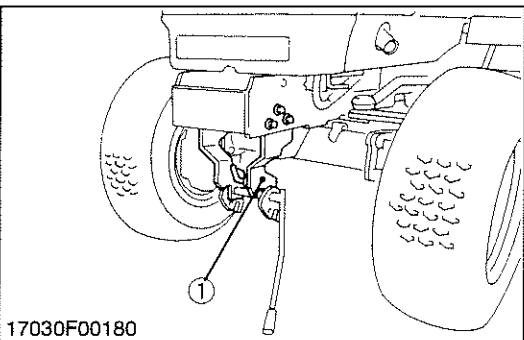
### Assembling Mower

1. Take out all mower components from the case, and assemble the mower.
2. Support the mower deck with a block (2) as shown in the figure.
3. Turn the rear gauge wheel (1) sideways position.
4. Remove the block.

(1) Rear Gauge Wheel

(2) Block

17040G00140



17030F00180

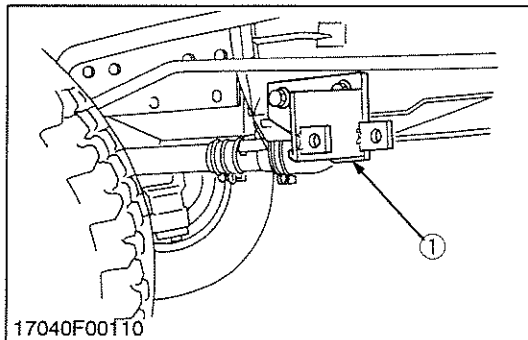
### Front Hanger Bracket

1. Attach the front hanger bracket (1) to the frame with M14 bolts.

(1) Front Hanger Bracket

17030G00180





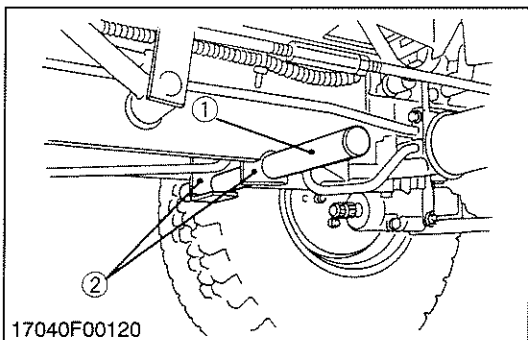
### Mid Hanger Bracket

1. Attach the mid hanger bracket (1) to the clutch housing with spring washers and nuts.

Tightening torque	Hanger bracket mounting screw	107.9 to 125.5 N·m 11.0 to 12.8 kgf·m 79.6 to 92.6 ft-lbs
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(1) Mid Hanger Bracket

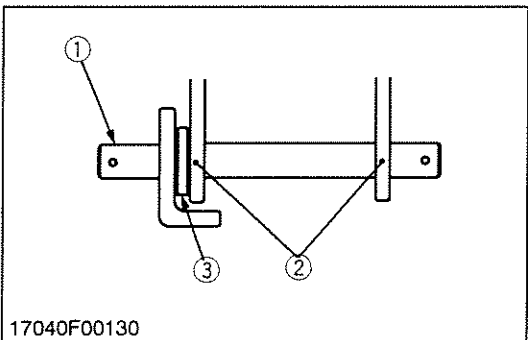
17040G00150



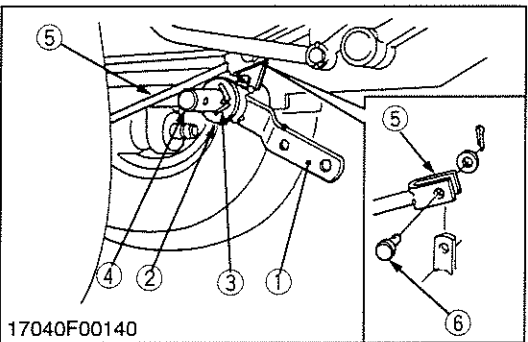
### Rear Hanger Bracket

1. Insert the rear hanger bracket (1) from left side of the frame holes, and set it with M8 bolt.

(1) Rear Hanger Bracket (3) Collar  
(2) Tractor Stay



17040G00160



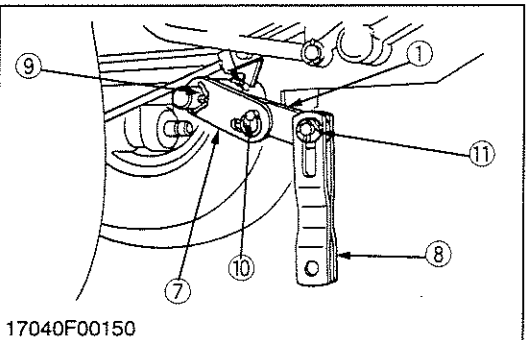
### Lift Arm, Lift Link and Connecting Rod

1. Install the lift arms (1), lift links (8) and connecting rods (5) to the rear hanger bracket with plain washers and cotter pins.

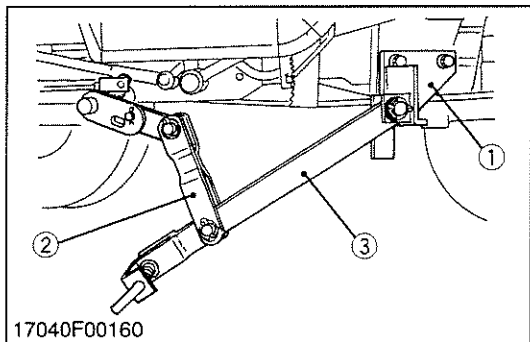
#### NOTE

- Completely bend the cotter pin (3), (9) to prevent contact with link stopper as shown in the figure.
- When assembling the connecting rod, insert the clevis pin from the outside as shown, and be sure to properly bend the cotter pin.

(1) Lift Arm (7) Link Stopper  
(2) Plain Washer (8) Lift Link  
(3) Cotter Pin (9) Cotter Pin  
(4) Rear Hanger Bracket (10) Clevis Pin  
(5) Connecting Rod (11) Clevis Pin  
(6) Clevis Pin



17040G00170



### Rear Link

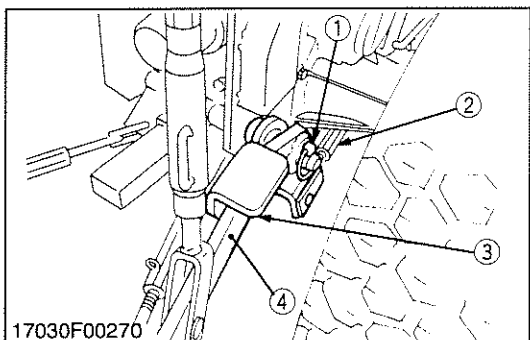
#### (When mounting the mower only)

1. Install the rear links (3) to the mid hanger brackets (1) with plain washers and cotter pins.
2. Attach the lift links (2) to the rear links (3) with clevis pins, plain washers and cotter pins.

(1) Mid Hanger Bracket  
(2) Lift Link

(3) Rear Link

17040G00180



### Lift Bracket

1. Remove the spacer and lower links from the shaft of lower link.
2. Attach both lift brackets (3) inside the lower links (4) with the lower link pins (1) as shown in the figure.
3. Connect the connecting rods (2) to the lift brackets (3) with clevis pins, plain washers and cotter pins.

#### ■ IMPORTANT

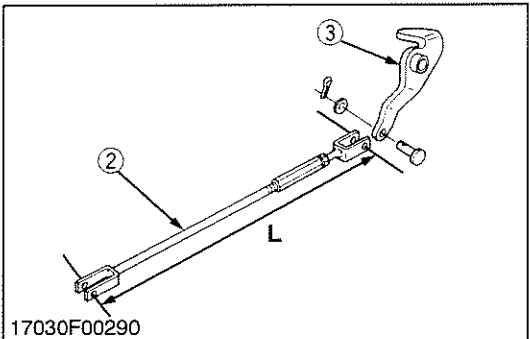
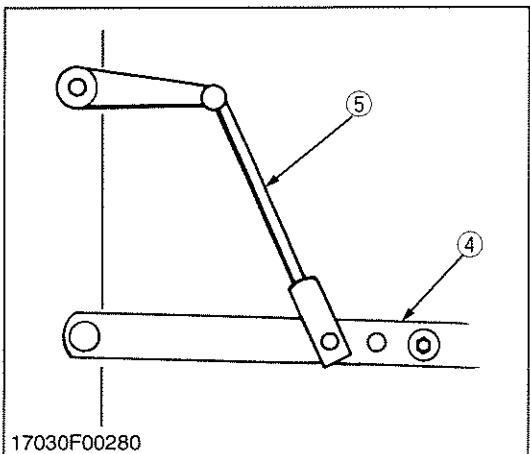
- Connect the lift rods (5) of the tractor as shown in the figure, and adjust the length of both lift rods equally with the turnbuckle of the right lift rod.

#### (Reference)

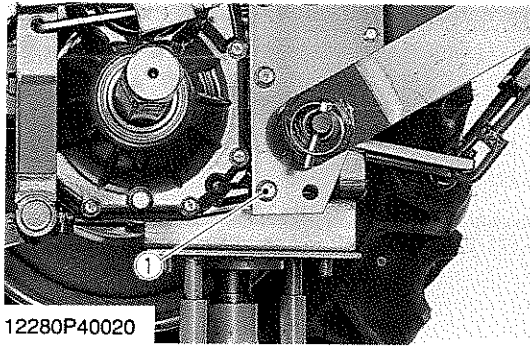
- Make sure the length (L) of the connecting rods (2) are as RCK48-16B : 570 mm (22.4 in.)

(1) Lower Link Pin  
(2) Connecting Rod  
(3) Lift Bracket

(4) Lower Link  
(5) Lift Rod



17040G00190



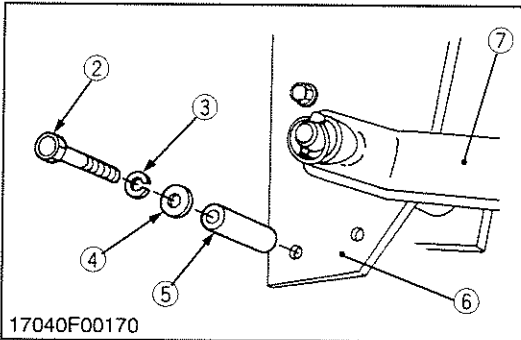
### Lift Bracket Stopper

1. Remove the lower link stay mounting screws (1).
2. Place the collar (5) in position and secure it using new screws with the plain washers and spring washers (right and left sides).

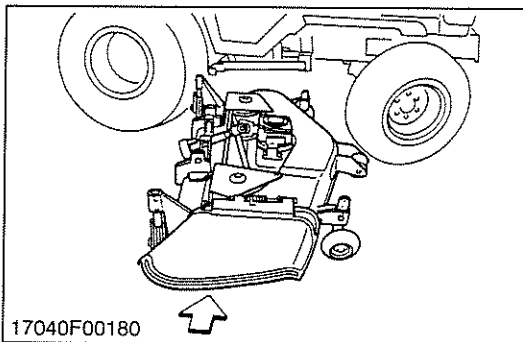
#### ■ IMPORTANT

- If you forget the assemble of the collar (5), otherwise both the tractor and the mower may get damage.

- |                   |                     |
|-------------------|---------------------|
| (1) Screw         | (5) Collar          |
| (2) Screw (New)   | (6) Lower Link Stay |
| (3) Spring Washer | (7) Lower Link      |
| (4) Plain Washer  |                     |



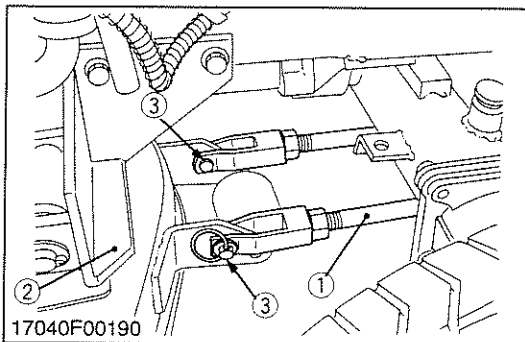
17040G00200



### Setting Mower

1. Turn the steering wheel fully left.
2. Install the mower from right side of the tractor.
3. Roll the mower under the tractor, and then return the steering wheel to center.

17040G00210



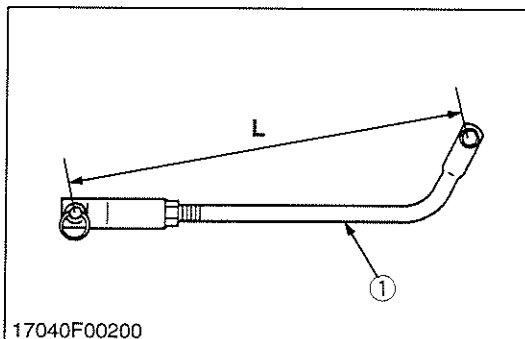
### Front Link

1. Attach both front links (1) to the mower deck with clevis pins, plain washers and snap rings as shown in the figure.

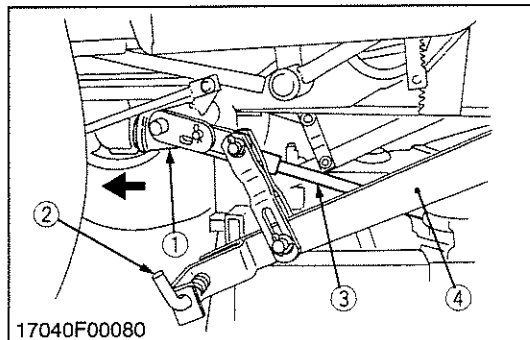
#### (Reference)

- Make sure the length (L) of the front link (1) is 485 mm (19.1 in.)

- |                |                |
|----------------|----------------|
| (1) Front Link | (3) Clevis Pin |
| (2) Mower Deck | (4) Stopper    |



17040G00220



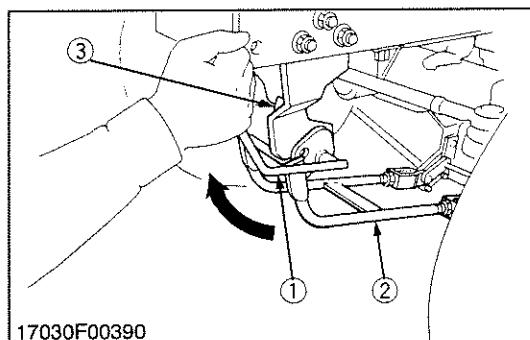
### Mounting Universal Joint and Rear Link

1. Pull back the coupler (1) of the universal joint.
2. Push the universal joint (3) onto the mid-PTO shaft, and release the coupler (1).
3. Slide the universal joint back and forward to make sure the universal joint is locked securely.
4. Lower the rear links.
5. Attach the rear links (4) to the mower deck, pulling the L-pins (2).

(1) Coupler  
(2) L-Pin

(3) Universal Joint  
(4) Rear Link

17040G00230



### Mounting Front Link

1. Push down the link fixing lever, pulling the L-pin.
2. Hook the front link (2) to the lever fulcrum, and turn the link fixing lever (1).
3. Return the L-pin (3).

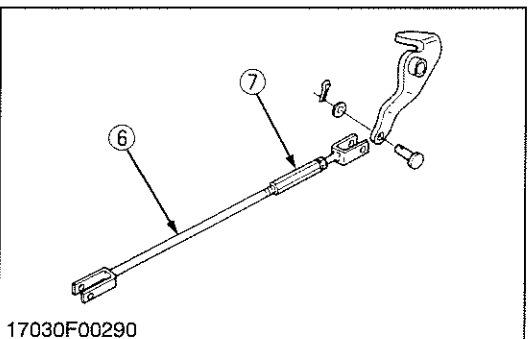
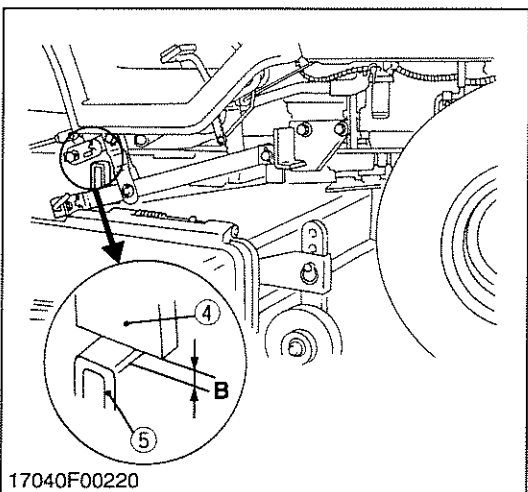
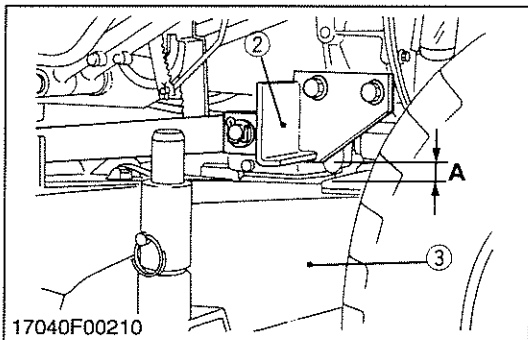
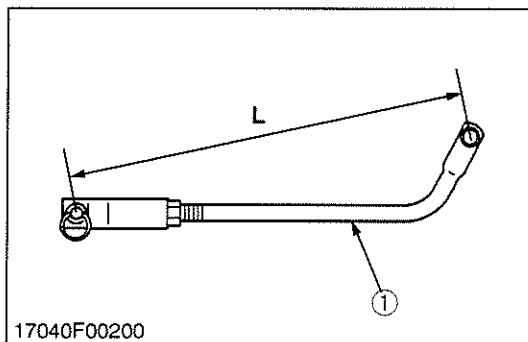
#### NOTE

- Make sure the link fixing lever (1) is fixed with L-pin (3) securely.

(1) Link Fixing Lever  
(2) Front Link

(3) L-pin

17030G00290



## Adjusting Front Link and Connecting Rod

### ⚠ CAUTION

- Before starting the engine, change the mid-PTO and gear shift lever into neutral.
  - Shut off the engine and allow the mower blades to stop before making adjustments.
1. Park the tractor on level ground with the mower touching the ground.
  2. Set the height of the four mower gauge wheels the same.
  3. If the front gauge wheels are not on the ground, remove the front link from the mower. And adjust the length (L) of the front link (1) until the front gauge wheels come into contact with the ground.
  4. Attach the front link to the mower.
  5. Start the engine.
  6. Lift the mower to the maximum lifting position and shut off the engine.
  7. Adjust the turnbuckles (7) of the left and right connecting rods (6) so that the clearances are within the factory specifications.

Clearance (A) between front stopper and mid hanger bracket	Factory spec.		2 to 4 mm 0.08 to 0.15 in.
Clearance (B) between rear stopper and tractor frame	Factory spec.	RH	5 to 8 mm 0.20 to 0.31 in.
		LH	3 to 5 mm 0.10 to 0.20 in.

### ■ IMPORTANT

- Proper adjustment for the connecting rod length is very important to avoid damage to the mower lifting system.

- |                        |                    |
|------------------------|--------------------|
| (1) Front Link         | (5) Rear Stopper   |
| (2) Mid Hanger Bracket | (6) Connecting Rod |
| (3) Deck               | (7) Turnbuckle     |
| (4) Tractor Frame      |                    |

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# MECHANISM

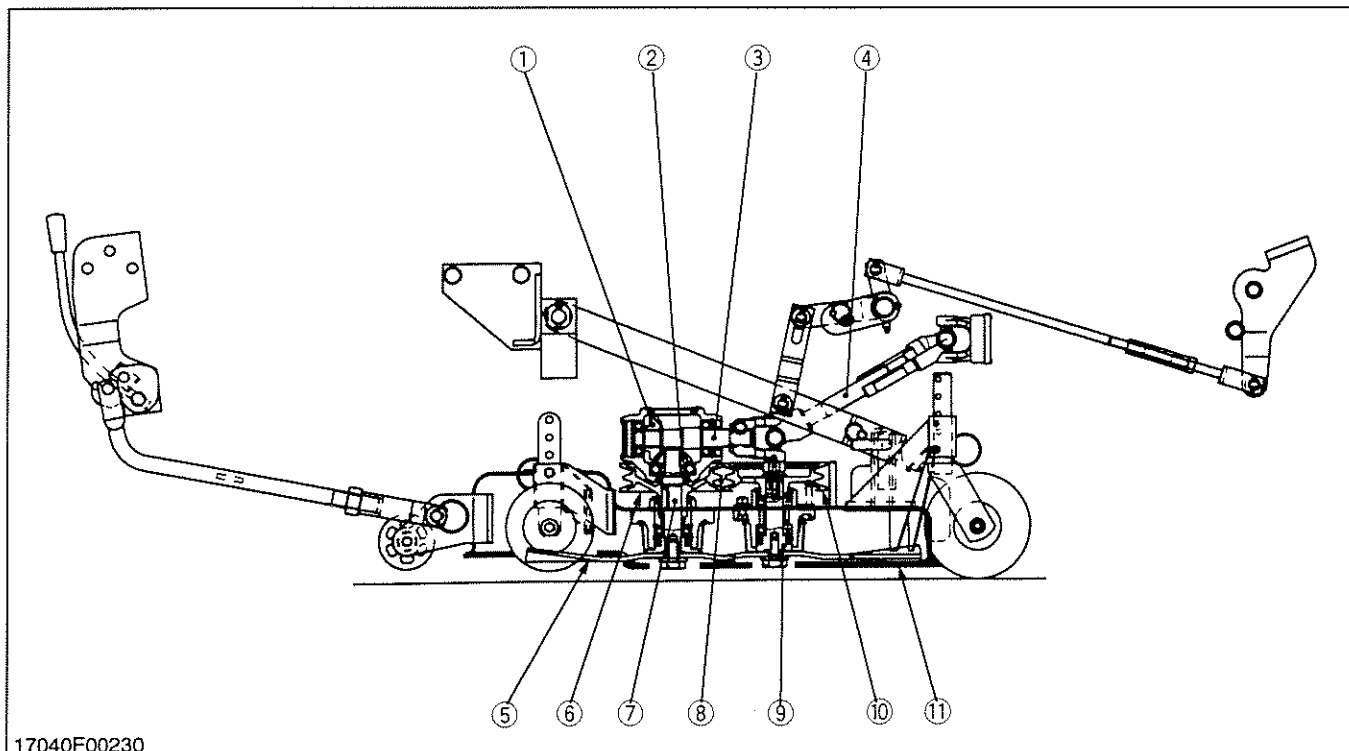
## CONTENTS

[1] POWER TRANSMISSION.....	M-1
[2] LIFTING MECHANISM.....	M-2





# [1] POWER TRANSMISSION



17040F00230

- (1) 21T Bevel Gear
- (2) 16T Bevel Gear
- (3) Pinion Shaft

- (4) Universal Joint
- (5) Center Blade
- (6) Center Pulley

- (7) Bevel Gear Shaft
- (8) Mower Belt
- (9) Blade Shaft

- (10) Outer Pulley
- (11) Outer Blade

The Power is transmitted from mid-PTO to blades as follows:

## ■ Center Blade

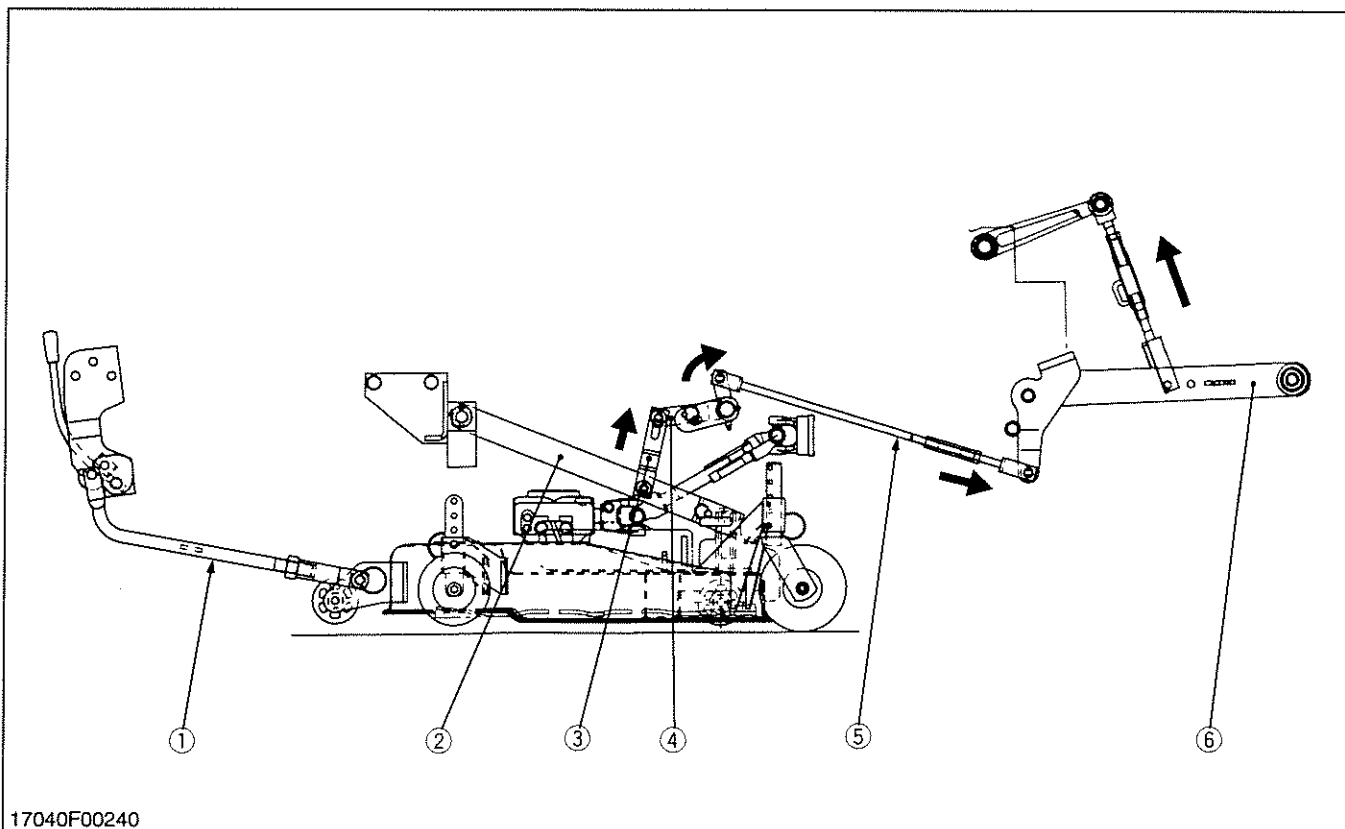
Mid-PTO Shaft → Universal Joint (4) → Pinion Shaft (3) → 21T Bevel Gear (1) → 16T Bevel Gear (2) → Bevel Gear Shaft (7) → Center Blade (5)

## ■ Outer Blade

Mid-PTO Shaft → Universal Joint (4) → Pinion Shaft (3) → 21T Bevel Gear (1) → 16T Bevel Gear (2) → Bevel Gear Shaft (7) → Center Pulley (6) → Mower Belt (8) → Outer Pulley (10) → Blade Shaft (9) → Outer Blade (11)

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## [2] LIFTING MECHANISM



(1) Front Link  
(2) Rear Link

(3) Lift Link  
(4) Lift Arm

(5) Connecting Rod

(6) Lower Link

The lifting of mower is performed by the hydraulic system installed on the tractor.

For avoiding danger, the mower should be kept lifting when traveling. When the position control lever is moved to "**LIFT**" position, the lower links (6) are risen by the oil pressure of hydraulic system, and the connecting rods (5) are pulled rearward.

Therefore, lift arms (4) round and the mower is lifted by the lift links (3) and rear links.

As this link system is a pantographic linkage, the mower can be kept parallel at every position.



### CAUTION

- **Never operate mower in transport position.**

17040M00020

# SERVICING

## CONTENTS

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SERVICING SPECIFICATIONS.....	S-1
TIGHTENING TORQUES.....	S-1
CHECKING, DISASSEMBLING AND SERVICING.....	S-2
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(1) Disassembling Mower.....	S-3
SERVICING .....	S-6



## TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
<b>Blade Does Not Turn</b>	<ul style="list-style-type: none"> <li>• Mid-PTO system malfunctioning</li> <li>• Broken mower belt</li> </ul>	Check transmission Replace mower belt	— S-2
<b>Blade Speed Is Slow</b>	<ul style="list-style-type: none"> <li>• Loosen mower belt</li> <li>• Clogged grass</li> <li>• Flattened out or worn cup washer</li> </ul>	Replace mower belt or tension spring Remove grass Replace cup washer	S-2 — S-4
<b>Cutting Is Poor</b>	<ul style="list-style-type: none"> <li>• Worn or broken mower blade</li> <li>• Loosen mower blade screw</li> <li>• Cutting height improper</li> </ul>	Sharpen or replace mower blade Retighten mower blade screw Adjust cutting height	S-2 S-4 S-3
<b>Mower Is Not Lifted</b>	<ul style="list-style-type: none"> <li>• Broken linkage system</li> <li>• Trouble of hydraulic system</li> </ul>	Replace linkage system Check hydraulic system	— —

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## SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Pinion Shaft	Turning Force	Less than 117.7 N 12.0 kgf 26.5 lbs	—
	Turning Torque	Less than 0.7 N·m 0.07 kgf·m 0.5 ft-lbs	—
Bevel Gears in Gear Box	Backlash	0.13 to 0.25 mm 0.0051 to 0.0098 in.	0.4 mm 0.0157 in.

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## TIGHTENING TORQUES

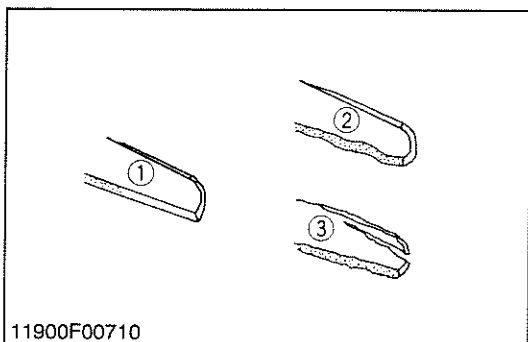
Tightening torques of screws, bolts and nuts on the table below are especially specified.  
 (For general use screws, bolts and nuts : See page G-2.)

Item	N·m	kgf·m	ft-lbs
Gear box bracket mounting screw	78.5 to 88.2	8.0 to 9.0	57.9 to 65.1
Mower blade screw	98.1 to 117.7	10.0 to 12.0	72.3 to 86.8
Gear box mounting screw	78.5 to 88.2	8.0 to 9.0	57.9 to 65.1
Pulley mounting nut	166.7 to 186.3	17.0 to 19.0	123.0 to 137.4
Pulley holder mounting screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5

17040S00010

# CHECKING, DISASSEMBLING AND SERVICING

## CHECKING AND ADJUSTING



### Checking Mower Blade

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

#### ■ IMPORTANT

- Never forget to set the two cup washers between mower blade and spline boss, when reassembling the mower blades.

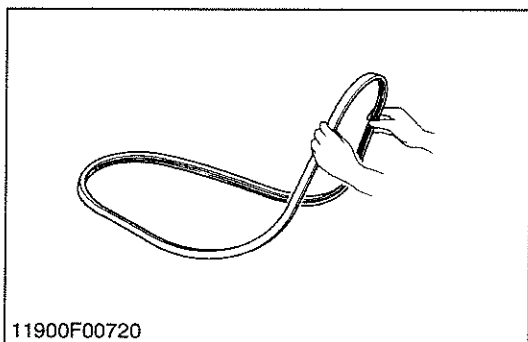
#### ■ NOTE

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

- (1) New Blade  
(2) Worn Blade

- (3) Cracked Blade

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### Checking Mower Belt

1. Check to see the mower belt.
2. Replace the mower belt with a new one, if there is found surface split at mower than 3 positions.

#### (When replacing mower belt)

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

Tightening torque	Gear box bracket mounting screw	78.5 to 88.2 N·m 8.0 to 9.0 kgf·m 57.9 to 65.1 ft·lbs
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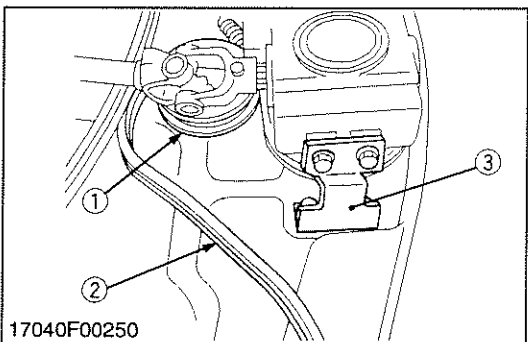
#### ■ IMPORTANT

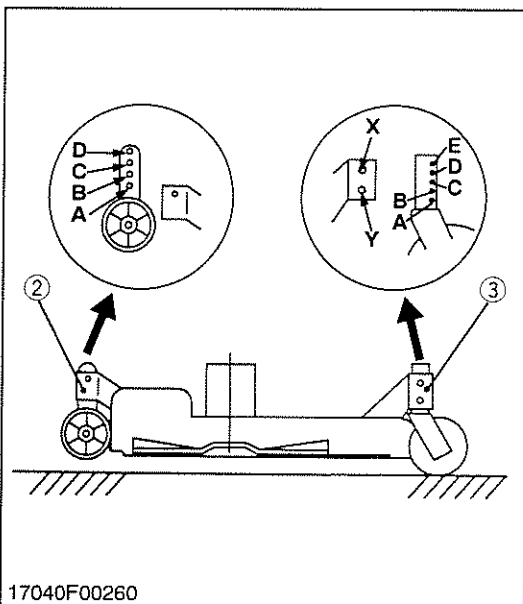
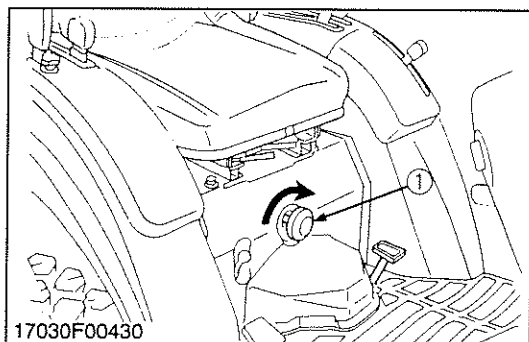
- After setting the gear box bracket mounting screws on the deck without tightening, then mount the other screws on the gear box. And finally tighten them.

- (1) Tension Pulley  
(2) Mower Belt

- (3) Gear Box Bracket (Right)

17040S00020





### Adjusting Cutting Height

1. The cutting height can be adjusted from 25 mm to 102 mm (from 1.0 in. to 4.0 in.).
2. To adjust the cutting height, lift the mower slightly and close the 3-point lowering speed knob (1).
3. Adjust the cutting height with the rear gauge wheel as shown in the table below.

The recommended cutting height is approx. 50 mm (2.0 in.).

Cutting height	Anti -scalp wheel	Rear gauge wheel
25 mm (1.0 in.)	A	X – A
38 mm (1.5 in.)	A	Y – C
51 mm (2.0 in.)	B	X – B
64 mm (2.5 in.)	B	X – D
76 mm (3.0 in.)	C	X – C
89 mm (3.5 in.)	C	Y – E
102 mm (4.0 in.)	D	X – D

### ■ IMPORTANT

- After adjusting the cutting height, open the 3-point lowering speed knob (1) and adjust the lowering speed of the mower.

(1) 3-Point Lowering Speed Knob  
(2) Anti-scalp Wheel

(3) Rear Gauge Wheel

17040S00030

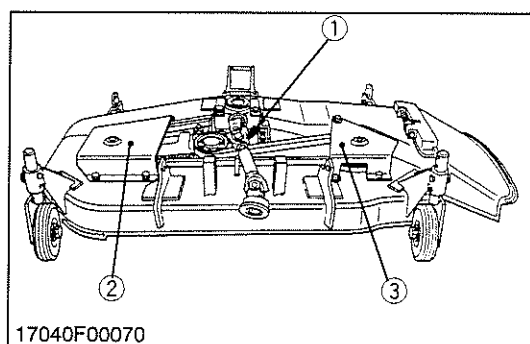
### Adjusting Front Link and Connecting Rod

1. See page G-9, G-11.

17040S00040

## DISASSEMBLING AND ASSEMBLING

### (1) Disassembling Mower



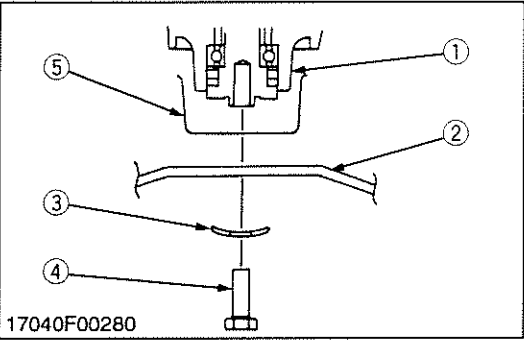
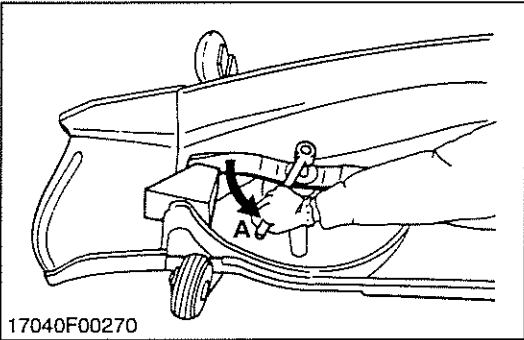
### Universal Joint and Belt Cover

1. Remove the universal joint (1).
2. Remove the left and right belt covers (2), (3).

(1) Universal Joint  
(2) Belt Cover (Left)

(3) Belt Cover (Right)

17040S00050



**Mower Blades (Center Blade and Outer Blades)**

- 1. Turn over the mower.
- 2. Unscrew the mower blade screw (4), and remove the cup washer (3), mower blade (2) and dust cover (5).

**NOTE**

- To remove the blade securely, wedge a block of wood between one blade and the mower deck in such position that it will hold the blade safely while loosening or tightening the blade screw.

**(When reassembling)**

- Be sure to assemble the two cup washers between the mower blade and spline boss.

**IMPORTANT**

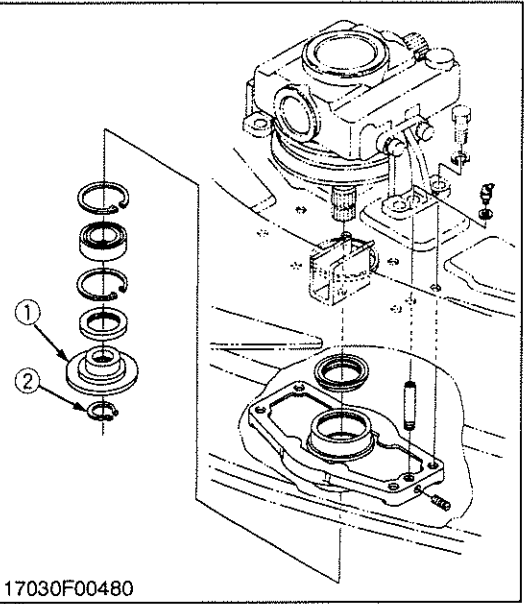
- Make sure the cup washer is not flattened out or worn, causing blade to slip easily.  
Replace two cup washers if either is damaged.

Tightening torque	Mower blade screw	98.1 to 117.7 N·m 10.0 to 12.0 kgf·m 72.3 to 86.8 ft-lbs
-------------------	-------------------	--

- (1) Spindle Holder
- (2) Mower Blade
- (3) Cup Washer
- (4) Mower Blade Screw
- (5) Dust Cover

(A) Loosen

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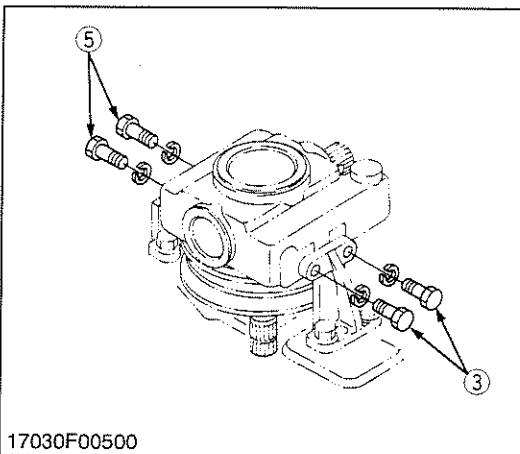
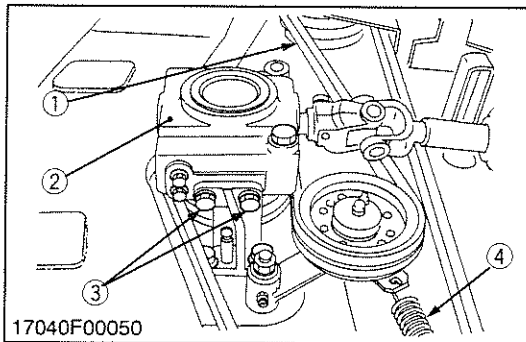
**Blade Boss**

- 1. Remove the external snap ring (2).
- 2. Remove the blade boss (1).

- (1) Blade Boss
- (2) External Snap Ring

17030S00090





### Gear Box and Mower Belt

1. Turn over the mower.
2. Remove the tension spring (4).
3. Unscrew the left and right gear box mounting screws (3), (5) and remove the gear box (2) from the mower deck.
4. Remove the mower belt (1).

#### (When reassembling)

- Install the reamer screws (3) at their original positions as shown in the figure.

Tightening torque	Gear box mounting screw	78.5 to 88.2 N·m 8.0 to 9.0 kgf·m 57.9 to 65.1 ft·lbs
-------------------	-------------------------	---

- |   |                             |
|---|-----------------------------|
| (1) Mower Belt                                | (4) Tension Spring          |
| (2) Gear Box                                  | (5) Gear Box Mounting Screw |
| (3) Gear Box Mounting Screw<br>(Reamer Screw) |                             |

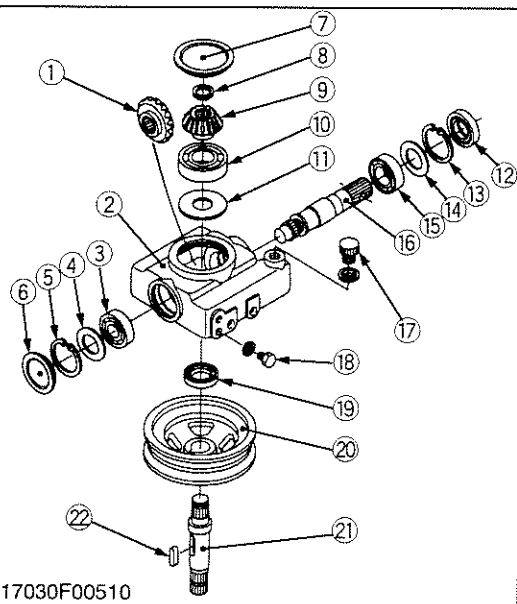
17040S00070

### Disassembling Gear Box

1. Unscrew the drain plug (18), and drain gear box oil.
2. Remove the center pulley (20) with a puller, and remove the feather key (22) on the bevel gear shaft.
3. Remove the gear box caps (6), (7).
4. Remove the oil seal (12), internal snap ring (13) and shim (14).
5. Tap out the pinion shaft (16) with the ball bearing (15), and remove the 21T bevel gear (1).
6. Remove the internal snap ring (5), shim (4) and ball bearing (3).
7. Remove the external snap ring (8), and draw out the bevel gear shaft (21).
8. Remove the 16T bevel gear (or 18T bevel gear) (9), ball bearing (10), shim (11) and oil seal (19).

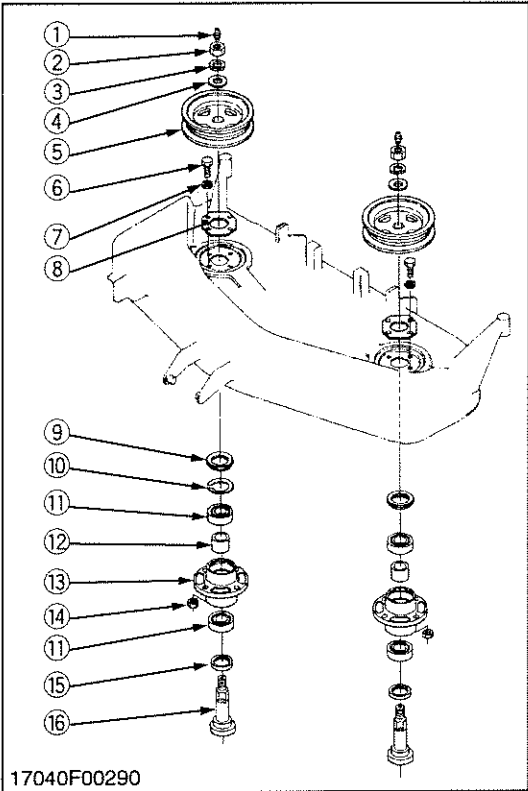
#### (When reassembling)

- Replace the oil seals (12), (19) and gear box caps (6), (7) with new ones.
- Check the backlash and turning torque.  
If not proper, adjust with the shims (4), (11), (14).  
(See page S-8, S-9).



- |                        |                         |
|------------------------|-------------------------|
| (1) 21T Bevel Gear     | (12) Oil Seal           |
| (2) Gear Box           | (13) Internal snap Ring |
| (3) Ball Bearing       | (14) Shim               |
| (4) Shim               | (15) Ball Bearing       |
| (5) Internal Snap Ring | (16) Pinion Shaft       |
| (6) Gear Box Cap       | (17) Oil Filler Plug    |
| (7) Gear Box Cap       | (18) Drain Plug         |
| (8) External Snap Ring | (19) Oil Seal           |
| (9) 16T Bevel Gear     | (20) Center Pulley      |
| (10) Ball Bearing      | (21) Bevel Gear Shaft   |
| (11) Shim              | (22) Feather Key        |

17040S00080



**Pulley and Blade Shaft**

- 1. Unscrew the pulley mounting nut (2), and remove the pulley (5).
- **NOTE**
- The pulley mounting nut has left-hand threads. Turn it clockwise to loosen.
- 2. Unscrew the pulley holder mounting screws (6), and separate the pulley holder (13) and plate (8) from the mower deck.
  - 3. Remove the oil seal (9).
  - 4. Remove the grease nipple (1) and tap out the left blade shaft (16).
  - 5. Remove the oil seals (9), (15) and internal snap rings (10).
  - 6. Remove the ball bearings (11) from the pulley holder (13).

**(When reassembling)**

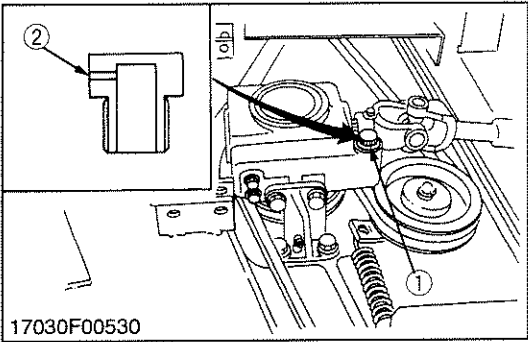
- Replace the oil seals (9) and (15) with new ones.

Tightening torque	Pulley mounting nut	166.7 to 186.3 N·m 17.0 to 19.0 kgf·m 123.0 to 137.4 ft·lbs
	Pulley holder mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs

- |                                  |                                 |
|----------------------------------|---------------------------------|
| (1) Grease Nipple                | (9) Oil Seal                    |
| (2) Pulley Mounting Nut          | (10) Internal Snap Ring         |
| (3) Spring Washer                | (11) Ball Bearing               |
| (4) Plain Washer                 | (12) Distance Piece             |
| (5) Pulley                       | (13) Pulley Holder              |
| (6) Pulley Holder Mounting Screw | (14) Pulley Holder Mounting Nut |
| (7) Spring Washer                | (15) Oil Seal                   |
| (8) Plate                        | (16) Blade Shaft                |

17040S00090

**SERVICING**

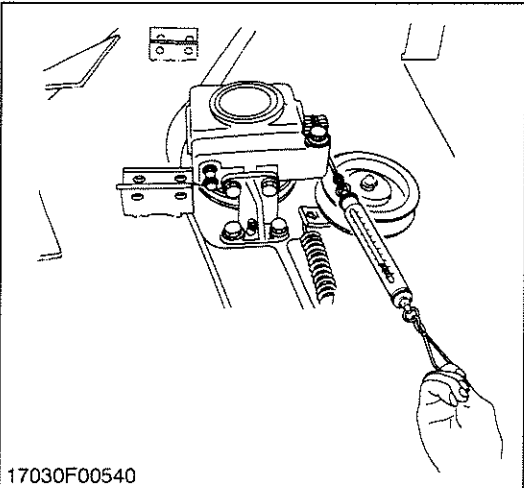


**Oil Filler Plug**

- 1. Remove the oil filler plug (1) from the gear box.
- 2. Check the hole of breather does not clogging.
- 3. If the breather hole (2) has clogged, clean it.

- |                     |                   |
|---------------------|-------------------|
| (1) Oil Filler Plug | (2) Breather Hole |
|---------------------|-------------------|

17030S00130



**Turning Torque of Pinion Shaft**

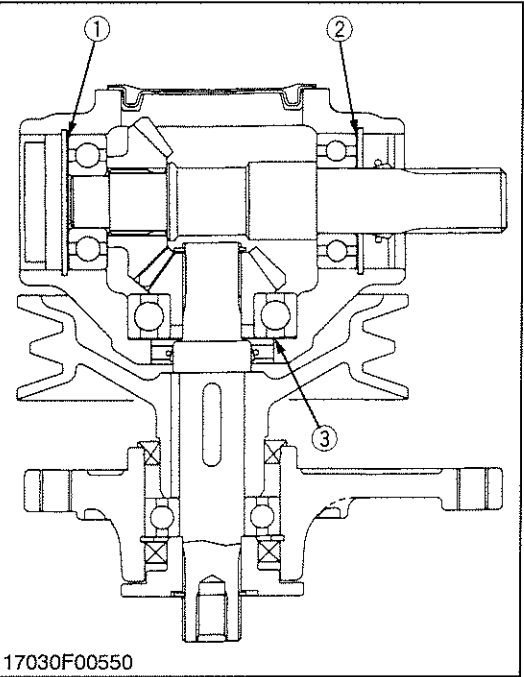
1. Remove the mower belt, and reassemble the gear box to the mower deck.
2. Wind a string around the pinion shaft and set a spring balance (or push-pull gauge) to the tip of the string, and then slowly pull the spring balance horizontally to measure the turning force.
3. If the measurement exceeds the factory specification, check the bearing and gears and adjust the adjusting shims (1), (2), (3).

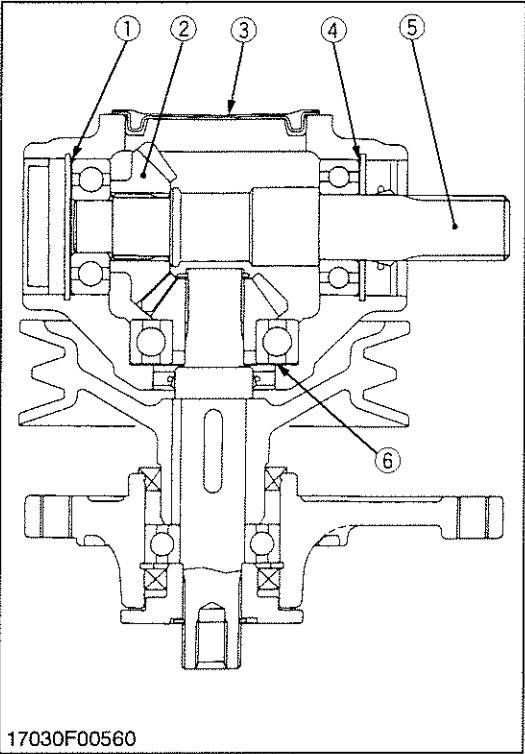
Turning force	Factory spec.	Less than 117.7 N 12.0 kgf 26.5 lbs
Turning torque	Factory spec.	Less than 1.47 N·m 0.15 kgf·m 1.08 ft-lbs

**(Reference)**

- Thickness of adjusting shims (1), (2), (3): 0.2 mm (0.0079 in.)  
0.3 mm (0.0118 in.)

- (1) Adjusting Shim (3) Adjusting Shim  
(2) Adjusting Shim





**Backlash between Bevel Gears**

- 1. Remove the gear box cap (3).
- 2. Place fuses the 19T bevel gear (or 17T bevel gear) (2) on the pinion shaft (5).
- 3. Turn the pinion shaft.
- 4. Take out the fuses, and measure the thickness of fuses with an outside micrometer. (Backlash equal thickness of fuse)
- 5. If the backlash exceeds the allowable limit, adjust with shims (1), (4), (6).

Backlash between bevel gears	Factory spec.	0.10 to 0.20 mm 0.0039 to 0.0079 in.
	Allowable limit	0.4 mm 0.0157 in.

**(Reference)**

- Thickness of adjusting shims (1), (4), (6): 0.2 mm (0.0079 in.)  
0.3 mm (0.0118 in.)
- (1) Shim

(2) 19T Bevel Gear (RCK60-27B)  
17T Bevel Gear (RC72-27B)

(3) Gear Box Cap

(4) Shim

(5) Pinion Shaft

(6) Shim

17030S00150