



WORKSHOP MANUAL
TRACTOR

L2350

L2650(GST) L2950(GST)

L3450(GST) L3650(GST)

Kubota

TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of KUBOTA Tractors L2350, L2650, L2950, L3450 and L3650. It is divided into two parts, "Mechanism" and "Servicing".

■ Mechanism

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

■ Servicing

Under the heading "General" comes general precautions, check and maintenance and special tools. For each 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.

May '91

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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**

: Immediate hazards which **WILL** result in severe personal injury or death.



WARNING : Hazards or unsafe practices which **COULD** result in severe personal injury or death.



CAUTION : Hazards or unsafe practices which **COULD** result in minor personal injury.

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

■ **NOTE** : Gives helpful information.

SAFETY SERVICING AND REPAIRING

- (1) Before working on the machine :
 - Park the machine on a firm and level ground, and set the parking brake.
 - Lower the implement or mower to the ground.
 - **Stop the engine, and remove the key.**
 - Disconnect the battery's ground cable.
 - Clean the work area and machine.
- (2) Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- (3) Do not wear a necktie, scarf, necklace, loose or bulky clothing when you work near machine tools or moving parts.
- (4) Use tools appropriate to the work. Makeshift tools, parts, and procedures will not make good repairs.
- (5) When servicing is performed together by two or more persons, take care to perform all work safely.
- (6) Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.

- (7) If the engine must be running to do same work, make sure the area is well ventilated. Never run the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.
- (8) Do not touch the rotating or hot parts and high tension cords while the engine is running.
- (9) Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
- (10) To avoid sparks from an accidental short circuit, always disconnect the battery's ground cable first and connect it last.
- (11) 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.
- (12) Battery gas can explode. Keep sparks and open flame away from the top of battery, especially when charging the battery.
- (13) Never remove the radiator cap while the engine is running, or immediately after stopping. Otherwise, hot water will spout out from radiator. Wait for more than ten minutes to cool the radiator, before removing the cap.
- (14) 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.
- (15) Do not start the engine by shorting across starter terminals.
- (16) Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.
- (17) Do not alter or remove any part of machine safety system.
- (18) Keep a first aid kit and fire extinguisher handy at all times.

SAFETY DECALS

- The following safety decals are installed on the machine.

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

① Part No. 35260-3491-3

⚠ 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. 35260-2979-1

⚠ WARNING

TO AVOID PERSONAL INJURY:

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

④ Part No. 35820-9863-3

⚠ WARNING

TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY:

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

③ Part No. 35260-2978-2

⚠ WARNING

TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:

1. Kubota recommends the use of a Roll-Over Protective Structures (ROPS) and seat belt in almost all applications.
2. Remove the ROPS only when it substantially interferes with operation or itself presents a safety risk. (Examples include work in orchards and vineyards.) ALWAYS REINSTALL IT BEFORE USING THE TRACTOR IN OTHER APPLICATIONS.
3. Never use just the seat belt, or just the ROPS. They must be used together. For further details, consult your Operator's Manual or your local dealer.

⑤ Part No. 35200-2534-1

⚠ WARNING

TO AVOID PERSONAL INJURY:

1. Keep PTO shield in place at all times.
2. Do not operate the PTO at speeds faster than the speed recommended by the implement manufacturer.

- ⑥ [With Glide Shift Transmission]
Part No. 35370-3136-2

⚠ WARNING

BEFORE DISMOUNTING TRACTOR:

1. ALWAYS SET PARKING BRAKE
Leaving transmission in gear with the engine stopped will not prevent tractor with shuttle transmission from rolling.
2. LOCK SHUTTLE SHIFT LEVER IN NEUTRAL POSITION
This prevents movement of shuttle shift lever out of neutral position.
3. STOP THE ENGINE

- ⑧ [With mid-PTO]
Part No. 35070-6575-1

⚠ WARNING

TO AVOID PERSONAL INJURY:

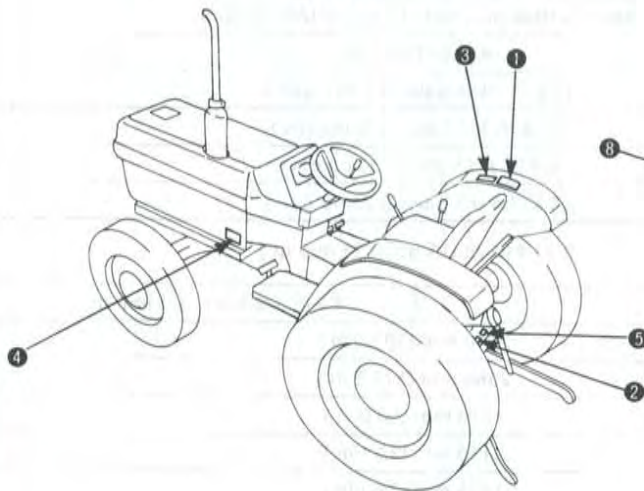
1. Before operation, be sure to read PTO revolution label to select the correct PTO lever (mid/rear) and PTO revolution speed.
2. Do not operate rear-PTO driven implements and mid-PTO driven implements at the same time.

- ⑦ Part No. 35080-6528-2

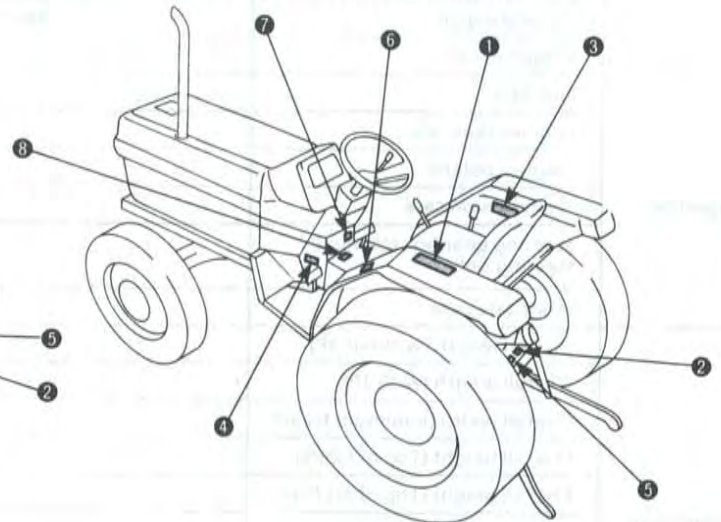
⚠ CAUTION

Pull the engine stop knob back and hold it until the engine stops in case of emergency.

[L2350]



[L2650, L2950, L3450, L3650]



B122F072

SPECIFICATIONS

Model		L2350 (2WD)	L2350 (4WD)
Maximum PTO power		15.3 kW (20.5 HP)	
Engine NET power		16.6 kW (22.2 HP)	
Engine	Model	D1102-AE	D1102-AE-2
	Type	Vertical, Water-Cooled, 4-cycle diesel	
	Number of cylinders	3	
	Bore and stroke	76 x 82 mm (3.0 x 3.2 in.)	
	Total displacement	1115 cm ³ (68.0 cu.in.)	
	Rated revolution	46.7 r/s (2800 rpm)	
	Maximum torque	77.5 N·m (7.9 kgf·m, 57.5 ft-lbs.)/1600 rpm	
	Combustion chamber	Indirect Injection (Spherical combustion chamber)	
	Fuel injection pump	Bosh K type mini pump	
	Governor	Centrifugal ball mechanical governor	
	Injection nozzle	Throttle type	
	Injection timing	Before T.D.C. 0.40 rad (23°)	
	Injection order	1-2-3	
	Injection pressure	14.22 MPa (145 kgf/cm ² , 2062 psi)	
	Compression ratio	21	
	Lubricating system	Forced lubrication by pump	
	Cooling system	Pressurized radiator, Forced circulation with water pump	
	Starting system	Electric starting with cell starter (12 V, 1.0 kW)	
	Alternator	12 V, 300 W	
	Battery	490- Cold cranking Amps at -18°C (-0.4°F)	
	Fuel	Diesel fuel No. 2-D [No. 1 diesel fuel if temperature is below -10°C (14°F)]	
	Lubricating oil	MIL-L-2104B or 2104C, CC or CD (API grade)	
	Weight (Dry)	149 kg (328.5 lbs)	
Capacities	Fuel tank	29 ℓ (7.7 U.S.gals., 6.4 Imp.gals.)	
	Engine crankcase	6.3 ℓ (6.7 U.S.qts., 5.5 Imp.qts.)	
	Engine coolant	6 ℓ (6.3 U.S.qts., 5.3 Imp.qts.)	
	Transmission case	28 ℓ (7.4 U.S.gals., 6.2 Imp.gals.)	
	Steering gear box (Manual steering only)	0.21 ℓ (0.22 U.S.qt., 0.18 Imp.qt.)	
	Front axle case	—	6 ℓ (6.3 U.S.qts., 5.3 Imp.qts.)
Dimensions	Overall length (without 3P)	2640 mm (103.9 in.)	
	Overall length (with 3P)	2960 mm (116.5 in.)	
	Overall width (minimum tread)	1270 mm (50.0 in.)	
	Overall height (Top of ROPS)	2110 mm (83.1 in.)	
	Overall height (Top of muffler)	1935 mm (76.2 in.)	
	Overall height (Top of steering wheel)	1380 mm (54.3 in.)	
	Wheel base	1555 mm (61.2 in.)	1565 mm (61.6 in.)
	Min.ground clearance	345 mm (13.6 in.)	311 mm (12.2 in.)
	Tread (Std tires)	Front	1010 mm (39.8 in.)
		Rear	1030 mm (40.6 in.)

Model			L2350 (2WD)	L2350 (4WD)
Traveling system	Tire size (Std. tires)	Front tires	4.00 – 15	6 – 14
		Rear tire	9.5 – 24	
	Clutch		Dry type single stage with single plate	
	Steering		Recirculating ball type manual steering	Recirculating ball type manual steering or integral type power steering (if equipped)
	Transmission		Gear shift, 8 forward and 2 reverse speeds	
	Brake	Traveling	Wet disk type	
		Parking	Connected with the traveling brake	
	Differential		Bevel gear	
Hydraulic system	Hydraulic control system		Position and draft control (if equipped)	
	Pump capacity (at 2800 engine)		17.3 ℓ /min. (4.6 GPM)	27.2 ℓ /min. (7.2 GPM)
	Three point hitch		Category 1	
	Maximum lifting force (24 in. behind lower linkend)		650 kg (1435 lbs.)	
Rear PTO	PTO shaft		SAE 1–3/8 6-splines	
	Revolution		1 speed 9 r/s (540 rpm) / engine 40.5 r/s (2430 rpm)	
Min. turning radius (with brake)			2.4 m (7.9 ft)	2.5 m (8.2 ft)
Traction system			Fixed drawbar or swing drawbar (if equipped)	
Weight (with ROPS)			890 kg (1962 lbs.)	1000 kg (2205 lbs.)
Traveling speed	Forward	1st	1.3 km/h (0.8 mph)	1.3 km/h (0.8 mph)
		2nd	1.6 km/h (1.0 mph)	1.7 km/h (1.0 mph)
		3rd	2.4 km/h (1.5 mph)	2.4 km/h (1.5 mph)
		4th	4.1 km/h (2.5 mph)	4.2 km/h (2.6 mph)
		5th	5.4 km/h (3.4 mph)	5.3 km/h (3.3 mph)
		6th	7.0 km/h (4.4 mph)	6.8 km/h (4.2 mph)
		7th	10.1 km/h (6.3 mph)	9.8 km/h (6.1 mph)
		8th	17.4 km/h (10.8 mph)	17.0 km/h (10.6 mph)
	Reverse	1st	2.1 km/h (1.3 mph)	2.2 km/h (1.4 mph)
		2nd	9.2 km/h (5.7 mph)	8.9 km/h (5.6 mph)

SPECIFICATIONS (Continued)

Model		L2650		L2950	
		2WD	4WD	2WD	4WD
Maximum PTO power		17.5 kW (23.5 HP)		19.4 kW (26.0 HP)	
Engine NET power		19.5 kW (26.1 HP)		21.3 kW (28.6 HP)	
Engine	Model	D1402-DI-AE		D1462-DI-AE	
	Type	Direct Injection, Vertical, Water-Cooled, 4-cycle diesel			
	Number of cylinders	3			
	Bore and stroke	85 x 82 mm (3.3 x 3.2 in.)		87 x 82 mm (3.4 x 3.2 in.)	
	Total displacement	1395 cm ³ (85.1 cu. in.)		1462 cm ³ (89.2 cu. in.)	
	Rated revolution	43.3 r/s (2600 rpm)			
	Maximum torque	89.2 N·m (9.1 kgf·m, 65.8 ft-lbs.) /1600 rpm		95.1 N·m (9.7 kgf·m, 70.2 ft-lbs.) /1600 rpm	
	Combustion chamber	Direct Injection			
	Fuel injection pump	Bosh K type mini pump			
	Governor	Centrifugal ball mechanical governor			
	Injection nozzle	4 hole type (stanadyne pencil nozzle)			
	Injection timing	Before T.D.C. 0.31 rad (18°)			
	Injection order	1-2-3			
	Injection pressure	22.75 MPa (232 kgf/cm ² , 3300 psi)			
	Compression ratio	19			
	Lubricating system	Forced lubrication by pump			
	Cooling system	Pressurized radiator, Forced circulation with water pump			
	Starting system	Electric starting with cell starter (12 V, 1.2 kW)			
	Alternator	12 V, 480 W			
	Battery	490- Cold cranking Amps at -18°C (- 0.4°F)			
	Fuel	Diesel fuel No. 2-D [No. 1 diesel fuel if temperature is below - 10°C(14°F)]			
	Lubricating oil	MIL-L-2104B or 2104C, CC or CD (API grade)			
	Weight (Dry)	177 kg (390.2 lbs)			
Capacities	Fuel tank	29 ℓ (7.7 U.S.gals., 6.4 Imp. gals.)			
	Engine crankcase	5.7 ℓ (6.0 U.S.qts., 5.0 Imp. qts.)			
	Engine coolant	4.6 ℓ (4.9 U.S.qts., 4.0 Imp. qts.)			
	Transmission case	28.5 ℓ (7.7 U.S.gals., 6.3 Imp. gals.)			
	Steering gear case	0.1 ℓ (0.11 U.S.qt., 0.09 Imp.qt.)	—	0.1 ℓ (0.11 U.S.qt., 0.09 Imp.qt.)	—
	Steering gear box (Manual steering only)	0.2 ℓ (0.21 U.S.qt., 0.18 Imp.qt.)	—	0.2 ℓ (0.21 U.S.qt., 0.18 Imp.qt.)	—
	Front axle case (4WD only)	—	6.5 ℓ (6.9 U.S.qts., 5.7 Imp.qts.)	—	6.5 ℓ (6.9 U.S.qts., 5.7 Imp.qts.)
Dimensions	Overall length (without 3P)	2770 mm (109.1 in.)		2795 mm (110.0 in.)	
	Overall length (with 3P)	2990 mm (117.7 in.)			
	Overall width (minimum tread)	1305 mm (51.4 in.)		1340 mm (52.7 in.)	
	Overall height (Top of ROPS)	2110 mm (83.1 in.)		2125 mm (83.7 in.)	
	Overall height (Top of muffler)	2030 mm (79.9 in.)			
	Overall height (Top of steering wheel)	1475 mm (58.1 in.)			
	Wheel base	1640 mm (64.6 in.)			

L3450		L3650	
2WD	4WD	2WD	4WD
22.4 kW (30.0 HP)		24.6 kW (33.0 HP)	
24.6 kW (33.0 HP)		27.2 kW (36.5 HP)	
V1902-DI-AE		V1902-DI X-AE	
Direct Injection, Vertical, Water-Cooled, 4-cycle diesel			
4			
85 x 82 mm (3.3 x 3.2 in.)			
1861 cm ³ (113.6 cu.in.)			
41.7 r/s (2500 rpm)		43.3 r/s (2600 rpm)	
115.7 N·m (11.8 kgf·m, 85.4 ft-lbs.)/1600 rpm		124.5 N·m (12.7 kgf·m, 91.9 ft-lbs.)/1600 rpm	
Direct Injection			
Bosh K type mini pump			
Centrifugal ball mechanical governor			
4 hole type (Stanadyne pencil nozzle)			
Before T.D.C. 0.31 rad (18°)			
1-3-4-2			
22.75 MPa (232 kgf/cm ² , 3300 psi)			
19			
Forced lubrication by pump			
Pressurized radiator, Forced circulation with water pump			
Electric starting with cell starter (12 V, 1.4 kW)			
12 V, 480 W			
447-Cold cranking Amps at - 18°C (- 0.4°F)			
Diesel fuel No. 2-D [No. 1 diesel fuel if temperature is below - 10°C(14°F)]			
MIL-L-2104B or 2104C, CC or CD (API grade)			
207 kg (456.4 lbs)			
29 ℓ (7.7 U.S.gals., 6.4 Imp. gals.)			
8.5 ℓ (8.9 U.S.qts., 7.5 Imp. qts.)			
5.6 ℓ (5.9 U.S.qts., 4.9 Imp. qts.)			
28.5 ℓ (7.7 U.S.gals., 6.3 Imp. gals.)			
0.1 ℓ (0.11 U.S. qt. 0.09 Imp. qt.)	—	0.1 ℓ (0.11 U.S. qt. 0.09 Imp. qt.)	—
—			
—	6.5 ℓ (6.9 U.S. qts. 5.7 Imp. qts.)	—	6.5 ℓ (6.9 U.S. qts. 5.7 Imp. qts.)
2900 mm (114.2 in.)		2950 mm (116.1 in.)	
3105 mm (122.2 in.)		3125 mm (123.0 in.)	
1370 mm (53.9 in.)		1480 mm (58.3 in.)	
2105 mm (82.9 in.)		2155 mm (84.8 in.)	
2030 mm (79.9 in.)		2050 mm (80.7 in.)	
1470 mm (57.9 in.)		1510 mm (59.4 in.)	
1735 mm (68.3 in.)			

Model			L2650		L2950	
			2WD	4WD	2WD	4WD
Dimensions	Min. ground clearance		345 mm (13.6 in.)			
	Tread (Std. tires)	Front	960 mm (37.8 in.) 1060 mm (41.7 in.) 1160 mm (45.7 in.) 1260 mm (49.6 in.)	1120 mm (44.1 in.)	960 mm (37.8 in.) 1060 mm (41.7 in.) 1160 mm (45.7 in.) 1260 mm (49.6 in.)	1120 mm (44.1 in.)
		Rear	1030 mm (40.6 in.), 1125 mm (44.3 in.), 1220 mm (48.0 in.), 1305 mm (51.4 in.), 1400 mm (55.1 in.)			
Traveling system	Tire size (Std. tires)	Front	4.00 – 15	7 – 16	5.00 – 15	7 – 16
		Rear	11.2 – 24		12.4 – 24	
	Clutch		Dry type dual stage (Live PTO)			
	Steering		Recirculating ball type manual steering or integral type power steering (if equipped)	Full hydrostatic power steering	Recirculating ball type manual steering or integral type power steering (if equipped)	Full hydrostatic power steering
	Transmission		Mechanical shuttle, 8 forward and 8 reverse speeds			
	Brake	Traveling	Wet disc type			
		Parking	Connected with the traveling brake			
	Differential		Bevel gear			
Hydraulic system	Hydraulic control system		Position and draft control (if equipped)			
	Pump capacity (at rated revolution engine)		Main pump 25.4 ℓ/min (6.7 GPM) Power steering pump 10.5 ℓ/min (2.8 GPM)	Main pump 25.4 ℓ/min (6.7 GPM) Power steering pum 17.1 ℓ/min (4.5 GPM)	Main pump 25.4 ℓ/min (6.7 GPM) Power steering pump 10.5 ℓ/min (2.8 GPM)	Main pump 25.4 ℓ/min (6.7 GPM) Power steering pump 17.1 ℓ/min (4.5 GPM)
	Three point hitch		Category 1			
	Max. lifting force (24 in. behind lower linkend)		900 kg (1985 lbs)			
Rear PTO	PTO shaft		SAE 1-3/8 6-splines			
	Revolution		2 speeds 9 r/s (540 rpm) / engine 38.3 r/s (2298 rpm) 16.7 r/s (1000 rpm) / engine 40.6 r/s (2438 rpm)			
Mid PTO	PTO shaft		USA No.5 (KUBOTA 10 tooth) Involute spline			
	Revolution		2 speeds 18 r/s (1080 rpm) / engine 38.3 r/s (2298 rpm) 33.3 r/s (2000 rpm) / engine 40.6 r/s (2438 rpm)			
Min. turning radius (with brake)			2.3 m (7.5 ft.)			
Traction system			Fixed drawbar or Swing drawbar (if equipped)			
Weight (with ROPS)			1080 kg (2380 lbs.)	1180 kg (2600 lbs.)	1110 kg (2445 lbs.)	1210 kg (2670 lbs.)
Traveling speed	Forward	1st	1.4 km/h (0.9 mph)		1.5 km/h (0.9 mph)	
		2nd	2.0 km/h (1.2 mph)		2.1 km/h (1.3 mph)	
		3rd	3.1 km/h (1.9 mph)		3.2 km/h (2.0 mph)	
		4th	4.4 km/h (2.7 mph)		4.6 km/h (2.9 mph)	
		5th	6.9 km/h (4.3 mph)		7.2 km/h (4.5 mph)	
		6th	9.6 km/h (6.0 mph)		10.0 km/h (6.2 mph)	
		7th	15.2 km/h (9.4 mph)		15.7 km/h (9.8 mph)	
		8th	21.4 km/h (13.3 mph)		22.3 km/h (13.8 mph)	
	Reverse	1st	1.3 km/h (0.8 mph)		1.3 km/h (0.8 mph)	
		2nd	1.8 km/h (1.1 mph)		1.9 km/h (1.2 mph)	
		3rd	2.8 km/h (1.8 mph)		2.9 km/h (1.8 mph)	
		4th	4.0 km/h (2.5 mph)		4.1 km/h (2.6 mph)	
		5th	6.2 km/h (3.9 mph)		6.5 km/h (4.0 mph)	
		6th	8.7 km/h (5.4 mph)		9.0 km/h (5.6 mph)	
		7th	13.7 km/h (8.5 mph)		14.2 km/h (8.8 mph)	
		8th	19.3 km/h (12.0 mph)		20.1 km/h (12.5 mph)	

L3450		L3650	
2WD	4WD	2WD	4WD
345 mm (13.6 in.)		365 mm (14.4 in.)	360 mm (14.2 in.)
1150 mm (45.3 in.) 1250 mm (49.2 in.) 1350 mm (53.1 in.) 1450 mm (57.1 in.)	1120 mm (44.1 in.)	1150 mm (45.3 in.) 1250 mm (49.2 in.) 1350 mm (53.1 in.) 1450 mm (57.1 in.)	1170 mm (46.1 in.)
1050 mm (41.3 in.), 1150 mm (45.3 in.), 1240 mm (48.8 in.) 1335 mm (52.6 in.), 1420 mm (55.9 in.), 1515 mm (59.6 in.)		1155 mm (45.5 in.), 1225 mm (48.2 in.), 1325 mm (52.2 in.) 1350 mm (53.1 in.), 1450 mm (57.1 in.)	
5.00 - 15	7 - 16	6.00 - 16	8-16
12.4 - 24		13.6 - 26	
Dry type dual stage (Live PTO)			
Integral type power steering	Full hydrostatic power steering	Integral type power steering	Full hydrostatic power steering
Mechanical shuttle, 8 forward and 8 reverse speeds			
Wet disc type			
Connected with the traveling brake			
Bevel gear			
Position and draft control (if equipped)			
Main pump 28.4 ℓ/min (7.5 GPM) Power steering pump 11.7 ℓ/min (3.1 GPM)	Main pump 28.4 ℓ/min (7.5 GPM) Power steering pump 14.7 ℓ/min (3.9 GPM)	Main pump 29.5 ℓ/min (7.8 GPM) Power steering pump 12.1 ℓ/min (3.2 GPM)	Main pump 29.5 ℓ/min (7.8 GPM) Power steering pump 15.3 ℓ/min (4.0 GPM)
Category 1			
930 kg (2050 lbs)			
SAE 1-3/8, 6-splines			
2 speeds 9 r/s (540 rpm) / engine 38.3 r/s (2298 rpm) 16.7 r/s (1000 rpm)/engine 40.6 r/s (2438 rpm)		1 speed 9 r/s (540 rpm) / engine 38.3 r/s (2298 rpm)	
USA No.5 (KUBOTA 10 tooth) Involute spline		—	
2 speeds 18 r/s (1080 rpm) / engine 38.3 r/s (2298 rpm) 33.3 r/s (2000 rpm)/engine 40.6 r/s (2438 rpm)		—	
2.4 m (7.9 ft)			
Fixed drawbar or swing drawbar (if equipped)			
1185 kg (2610 lbs)	1290 kg (2845 lbs)	1225 kg (2700 lbs)	1320 kg (2910 lbs)
1.3 km/h (0.8 mph)		1.4 km/h (0.9 mph)	
1.7 km/h (1.1 mph)		2.0 km/h (1.2 mph)	
2.8 km/h (1.7 mph)		3.1 km/h (1.9 mph)	
4.1 km/h (2.5 mph)		4.6 km/h (2.9 mph)	
6.1 km/h (3.8 mph)		6.9 km/h (4.3 mph)	
8.5 km/h (5.3 mph)		9.6 km/h (6.0 mph)	
13.3 km/h (8.3 mph)		15.1 km/h (9.4 mph)	
19.7 km/h (12.2 mph)		22.3 km/h (13.9 mph)	
1.1 km/h (0.7 mph)		1.3 km/h (0.8 mph)	
1.6 km/h (1.0 mph)		1.8 km/h (1.1 mph)	
2.5 km/h (1.5 mph)		2.8 km/h (1.7 mph)	
3.7 km/h (2.3 mph)		4.2 km/h (2.6 mph)	
5.5 km/h (3.4 mph)		6.2 km/h (3.9 mph)	
7.6 km/h (4.7 mph)		8.7 km/h (5.4 mph)	
12.0 km/h (7.5 mph)		13.6 km/h (8.5 mph)	
17.7 km/h (11.0 mph)		20.1 km/h (12.5 mph)	

SPECIFICATIONS (Continued)

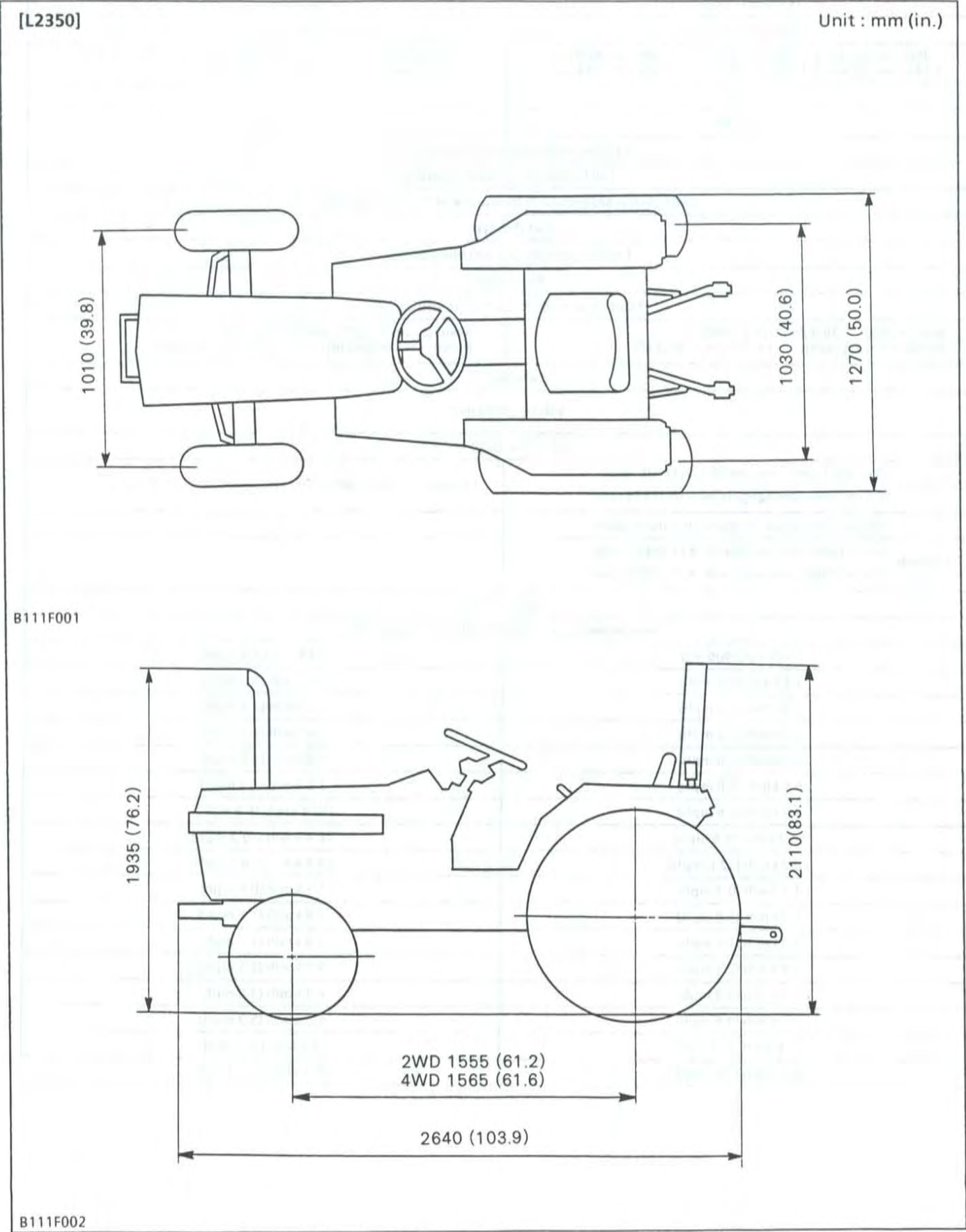
Model		L2650GST	L2950GST
Maximum PTO power		17.5 kW (23.5 HP)	19.4 kW (26.0 HP)
Engine NET power		19.5 kW (26.1 HP)	21.3 kW (28.6 HP)
Engine	Model	D1402-DI-AE	D1462-DI-AE
	Type	Direct injection, Vertical, Water-Cooled, 4-cycle diesel	
	Number of cylinders	3	
	Bore and stroke	85 x 82 mm (3.3 x 3.2 in.)	87 x 82 mm (3.4 x 3.2 in.)
	Total displacement	1395 cm ³ (85.1 cu. in.)	1462 cm ³ (89.2 cu. in.)
	Rated revolution	43.3 r/s (2600 rpm)	
	Maximum torque	89.2 N m (9.1 kgf m, 65.8 ft-lbs) / 1600 rpm	95.1 N m (9.7 kgf m, 70.2 ft-lbs) / 1600 rpm
	Combustion chamber	Direct Injection	
	Fuel injection pump	Bosh K type mini pump	
	Governor	Centrifugal ball mechanical governor	
	Injection nozzle	4 hole type (Stanadyne pencil nozzle)	
	Injection timing	Before T.D.C. 0.31 rad (18°)	
	Injection order	1-2-3	
	Injection pressure	22.75 MPa (232 kgf/cm ² , 3300 psi)	
	Compression ratio	19	
	Lubricating system	Forced lubrication by pump	
	Cooling system	Pressurized radiator, Forced circulation with water pump	
	Starting system	Electric starting with cell starter (12 V, 1.2 kW)	
	Alternator	12 V, 480 W	
	Battery	490- Cold cranking Amps at -18°C (-0.4°F)	
	Fuel	Diesel fuel No. 2-D [No. 1 diesel fuel if temperature is below -10°C (14°F)]	
	Lubricating oil	MIL-L-2104B or 2104C, CC or CD (API grade)	
	Weight (Dry)	177 kg (390.2 lbs)	
Capacities	Fuel tank	29 ℓ (7.7 U.S.gals., 6.4 Imp. gals.)	
	Engine crankcase	5.7 ℓ (6.0 U.S.qts., 5.0 Imp. qts.)	
	Engine coolant	4.6 ℓ (4.9 U.S.qts., 4.0 Imp. qts.)	
	Transmission case	27 ℓ (7.1 U.S.gals., 5.9 Imp. gals.)	
	Front axle case	6.5 ℓ (6.9 U.S.qts., 5.7 Imp. qts.)	
Dimensions	Overall length (without 3P)	2770 mm (109.1 in.)	2795 mm (110.0 in.)
	Overall length (with 3P)	2990 mm (117.7 in.)	
	Overall width (minimum tread)	1305 mm (51.4 in.)	1340 mm (52.7 in.)
	Overall height (Top of ROPS)	2110 mm (83.1 in.)	2125 mm (83.7 in.)
	Overall height (Top of muffler)	2030 mm (79.9 in.)	
	Overall height (Top of steering wheel)	1475 mm (58.1 in.)	
	Wheel base	1640 mm (64.6 in.)	

L3450 GST	L3650 GST
22.4 kW (30.0 HP)	24.6 kW (33.0 HP)
24.6 kW (33.0 HP)	27.2 kW (36.5 HP)
V1902-DI-AE	V1902-DI-X-AE
Direct Injection, Vertical, Water-Cooled, 4-cycle diesel	
4	
85 x 82 mm (3.3 x 3.2 in.)	
1861 cm ³ (113.6 cu.in.)	
41.7 r/s (2500 rpm)	43.3 r/s (2600 rpm)
115.7 N·m (11.8 kgf·m, 85.4 ft-lbs.)/1600 rpm	124.5 N·m (12.7 kgf·m, 91.9 ft-lbs.)/1600 rpm
Direct Injection	
Bosh K type mini pump	
Centrifugal ball mechanical governor	
4 hole type (Stanadyne pencil nozzle)	
Before T.D.C. 0.31 rad (18°)	
1-3-4-2	
22.75 MPa (232 kgf/cm ² , 3300 psi)	
19	
Forced lubrication by pump	
Pressurized radiator, Forced circulation with water pump	
Electric starting with cell starter (12 V, 1.4 kW)	
12 V, 480 W	
447 - Cold cranking Amps at -18°C (-0.4°F)	
Diesel fuel No. 2-D [No. 1 diesel fuel if temperature is below -10°C (14°F)]	
MIL-L-2104B or 2104C, CC or CD (API grade)	
207 kg (456.4 lbs)	
29 ℓ (7.7 U.S.gals., 6.4 Imp. gals.)	
8.5 ℓ (8.9 U.S.qts., 7.5 Imp. qts.)	
5.6 ℓ (5.9 U.S.qts., 4.9 Imp. qts.)	
27 ℓ (7.1 U.S.gals., 5.9 Imp. gals.)	
6.5 ℓ (6.9 U.S.qts., 5.7 Imp. qts.)	
2900 mm (114.2 in.)	2950 mm (116.1 in.)
3105 mm (122.2 in.)	3125 mm (123.0 in.)
1370 mm (53.9 in.)	1480 mm (58.3 in.)
2105 mm (82.9 in.)	2155 mm (84.8 in.)
2030 mm (79.9 in.)	2050 mm (80.7 in.)
1470 mm (57.9 in.)	1510 mm (59.4 in.)
1735 mm (68.3 in.)	

Model			L2650 GST		L2950 GST	
Dimensions	Min. ground clearance		345 mm (13.6 in.)			
	Tread (Std.tires)	Front	1120 mm (44.1 in.)			
		Rear	1030 mm (40.6 in.), 1125 mm (44.3 in.), 1220 mm (48.0 in.), 1305 mm (51.4 in.), 1400 mm (55.1 in.)			
Traveling system	Tire size (Std. tires)	Front	7 – 16			
		Rear	11.2 – 24		12.4 – 24	
	Clutch		Dry type single stage With single plate			
	Steering		Full hydrostatic power steering			
	Transmission		Glide shift transmission, 8 forward and 8 reverse speeds			
	Brake	Traveling	Wet disc type			
		Parking	Connected with the traveling brake			
	Differential		Bevel gear			
Hydraulic system	Hydraulic control system		Position and draft control (if equipped)			
	Pump capacity (at rated revolution engine)		Main pump 25.4 ℓ/min (6.7 GPM) Power steering pump 17.1 ℓ/min (4.5 GPM)			
	Three point hitch		Category 1			
	Max. lifting force (24 in. behind lower link end)		900 kg (1985 lbs)			
Rear PTO	PTO shaft		SAE 1-3/8 6-splines			
	Revolution		2 speeds 9 r/s (540 rpm) / engine 40.5 r/s (2430 rpm) 16.7 r/s (1000 rpm) / engine 40.6 r/s (2438 rpm)			
Mid PTO	PTO shaft		USA No.5 (KUBOTA 10 tooth) Involute spline			
	Revolution		2 speeds 18 r/s (1080 rpm) / engine 40.5 r/s (2430 rpm) 33.3 r/s (2000 rpm) / engine 40.6 r/s (2438 rpm)			
Min. turning radius (with brake)			2.3 m (7.5 ft.)			
Traction system			Fixed drawbar or swing drawbar (if equipped)			
Weight (with ROPS)			1205 kg (2655 lbs.)		1235 kg (2720 lbs.)	
Traveling speed	Forward	1st	1.6 km/h (1.0 mph)		1.6 km/h (1.0 mph)	
		2nd	2.2 km/h (1.4 mph)		2.2 km/h (1.4 mph)	
		3rd	3.4 km/h (2.1 mph)		3.5 km/h (2.2 mph)	
		4th	4.9 km/h (3.0 mph)		5.0 km/h (3.1 mph)	
		5th	6.9 km/h (4.3 mph)		7.7 km/h (4.8 mph)	
		6th	9.6 km/h (6.0 mph)		10.7 km/h (6.6 mph)	
		7th	15.0 km/h (9.3 mph)		16.7 km/h (10.4 mph)	
		8th	21.4 km/h (13.3 mph)		23.8 km/h (14.8 mph)	
	Reverse	1st	1.4 km/h (0.9 mph)		1.3 km/h (0.8 mph)	
		2nd	2.0 km/h (1.2 mph)		1.8 km/h (1.1 mph)	
		3rd	3.1 km/h (1.9 mph)		2.9 km/h (1.8 mph)	
		4th	4.4 km/h (2.7 mph)		4.1 km/h (2.5 mph)	
		5th	6.2 km/h (3.9 mph)		6.3 km/h (3.9 mph)	
		6th	8.6 km/h (5.3 mph)		8.7 km/h (5.4 mph)	
		7th	13.4 km/h (8.3 mph)		13.7 km/h (8.5 mph)	
		8th	19.1 km/h (11.9 mph)		19.5 km/h (12.1 mph)	

L3450GST	L3650GST
345 mm (13.6 in.)	360 mm (14.2 in.)
1120 mm (44.1 in.)	1170 mm (46.1 in.)
1050 mm (41.3 in.), 1150 mm (45.3 in.), 1240 mm (48.8 in.) 1335 mm (52.6 in.), 1420 mm (55.9 in.), 1515 mm (59.6 in.)	1155 mm (45.5 in.), 1225 mm (48.2 in.), 1325 mm (52.2 in.) 1350 mm (53.1 in.), 1450 mm (57.1 in.)
7 - 16	8-16
12.4 - 24	13.6 - 26
Dry type single stage with single plate	
Full hydrostatic power steering	
Glide shift transmission, 8 forward and 8 reverse speeds	
Wet disc type	
Connected with the traveling brake	
Bevel gear	
Position and draft control (if equipped)	
Main pump 28.4 ℓ/min (7.5 GPM) Power steering pump 14.7 ℓ/min (3.9 GPM)	Main pump 29.5 ℓ/min (7.8 GPM) Power steering pump 15.3 ℓ/min (4.0 GPM)
Category 1	
930 kg (2050 lbs)	
SAE 1-3/8, 6-splines	
2 speeds 9 r/s (540 rpm) / engine 40.5 r/s (2430 rpm) 16.7 r/s (1000 rpm)/engine 40.6 r/s (2438 rpm)	1 speed 9 r/s (540 rpm) / engine 40.5 r/s (2430 rpm)
USA No.5 (KUBOTA 10 tooth) Involute spline	—
2 speeds 18 r/s (1080 rpm) / engine 40.5 r/s (2430 rpm) 33.3 r/s (2000 rpm)/engine 40.6 r/s (2438 rpm)	—
2.4 m (7.9 ft)	
Fixed drawbar or swing drawbar (if equipped)	
1315 kg (2900 lbs)	1345 kg (2965 lbs)
1.4 km/h (0.8 mph)	1.6 km/h (1.0 mph)
1.9 km/h (1.2 mph)	2.2 km/h (1.4 mph)
3.0 km/h (1.8 mph)	3.4 km/h (2.1 mph)
4.2 km/h (2.6 mph)	4.9 km/h (3.0 mph)
6.5 km/h (4.0 mph)	7.5 km/h (4.7 mph)
9.0 km/h (5.6 mph)	10.4 km/h (6.5 mph)
14.2 km/h (8.8 mph)	16.4 km/h (10.2 mph)
20.2 km/h (12.6 mph)	23.4 km/h (14.5 mph)
1.1 km/h (0.7 mph)	1.3 km/h (0.8 mph)
1.5 km/h (1.0 mph)	1.8 km/h (1.1 mph)
2.4 km/h (1.5 mph)	2.8 km/h (1.7 mph)
3.5 km/h (2.1 mph)	4.0 km/h (2.5 mph)
5.3 km/h (3.3 mph)	6.1 km/h (3.8 mph)
7.4 km/h (4.6 mph)	8.5 km/h (5.3 mph)
11.6 km/h (7.2 mph)	13.4 km/h (8.3 mph)
16.6 km/h (10.3 mph)	19.1 km/h (11.9 mph)

DIMENSIONS

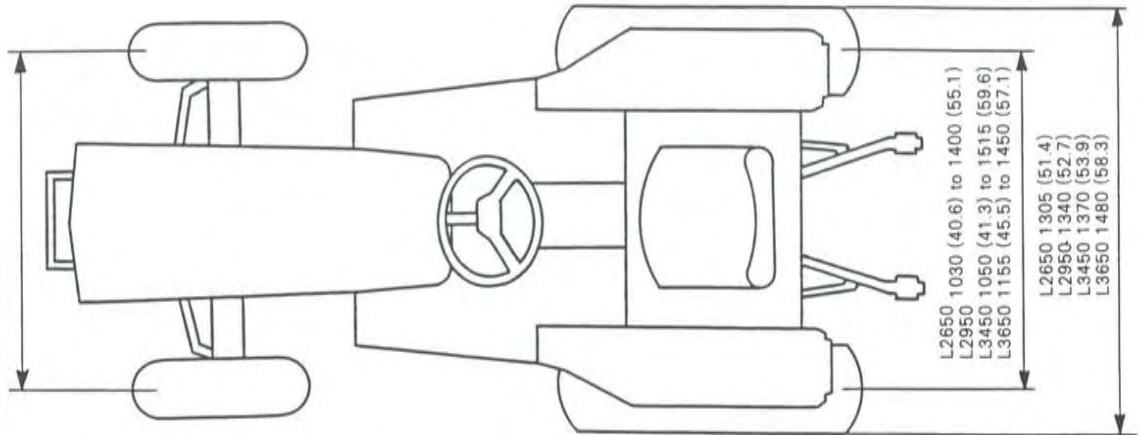


DIMENSIONS (Continued)

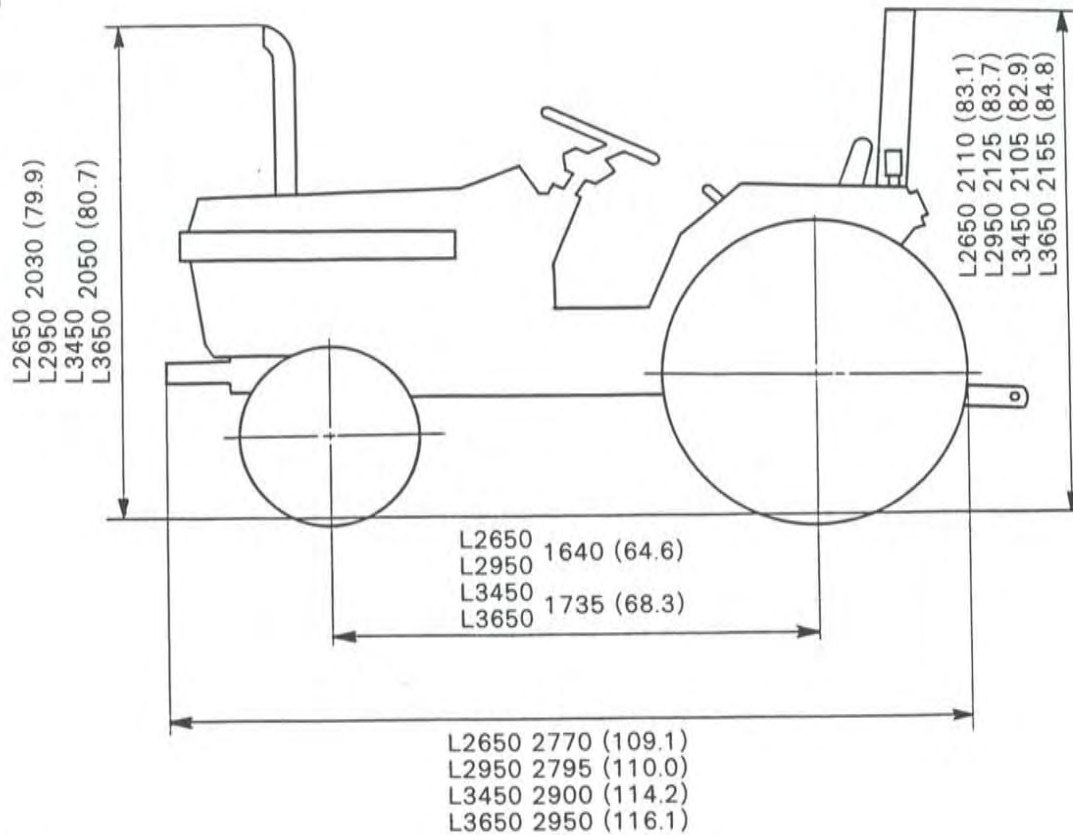
[L2650, L2950, L3450, L3650]

Unit : mm (in.)

L2650 2WD, L2950 2WD 960 (37.8) to 1260 (49.6)
 L2650 4WD, L2950 4WD 1120 (44.1)
 L3450 2WD, L3650 2WD 1150 (45.3) to 1450 (57.1)
 L3450 4WD 1120 (44.1)
 L3650 4WD 1170 (46.1)



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M MECHANISM

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1 ENGINE

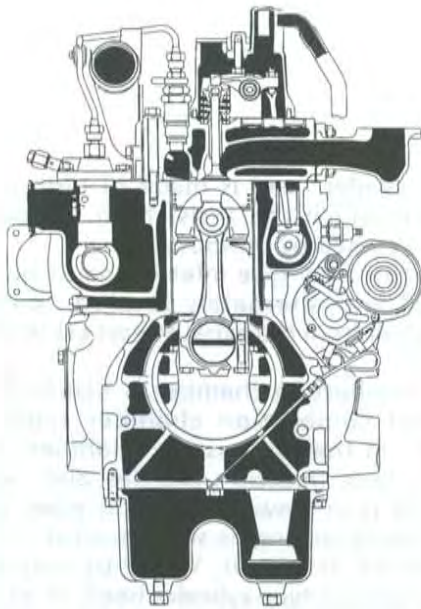
[1] FEATURES

The engines for KUBOTA "L series" tractors are water-cooled, 4-cycle diesel engines. They are designed and built by KUBOTA.

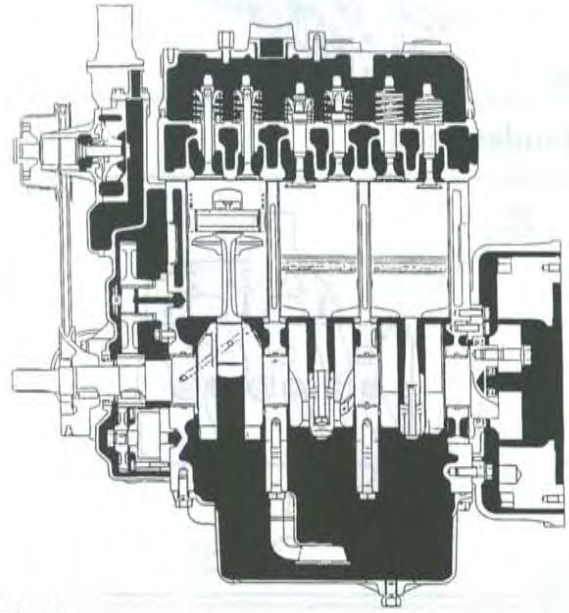
D1102 engine is a hemispherical combustion chamber KUBOTA designed, and the other models (D1402-DI, D1462-DI, V1902-DI) are direct injection types.

These engines are balance-matched to the "L series" tractors with greater power, low fuel consumption, reduced vibration and greater durability.

[D1102]

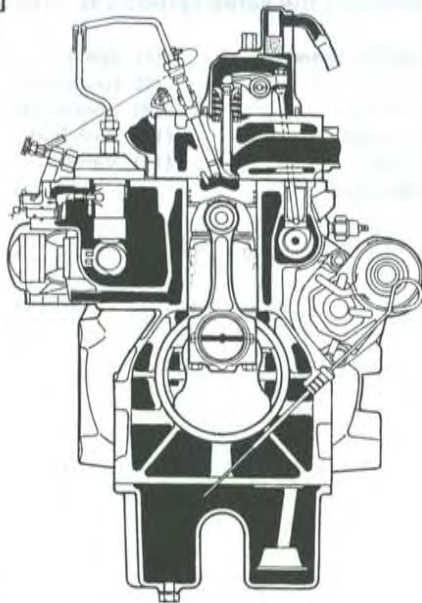


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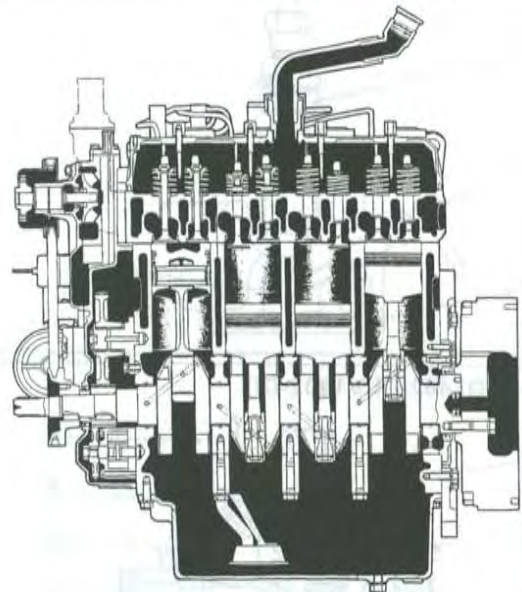


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[V1902-DI]

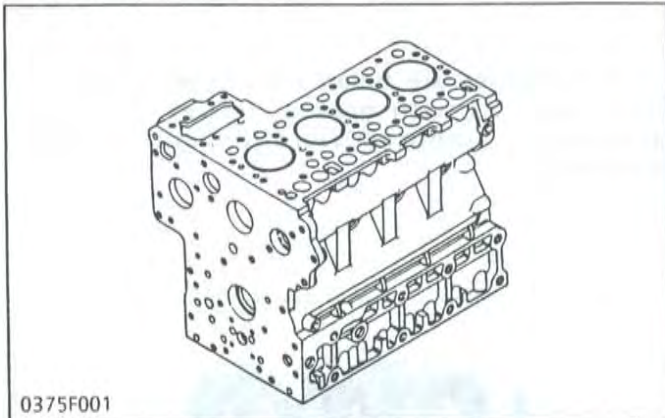


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[2] ENGINE BODY

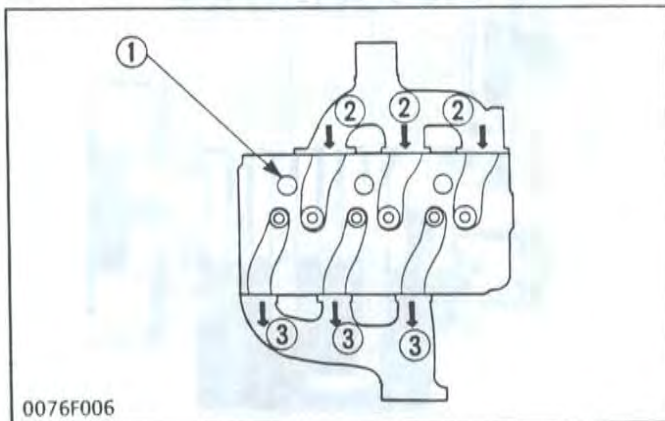
(1) Cylinder Block



The engine features a highly durable tunnel type cylinder block containing the main bearings.

Furthermore, cylinder liners allow effective cooling, less distortion, higher wear-resistance qualities, and each cylinder has its own chamber helps to minimize noise.

(2) Cylinder Head



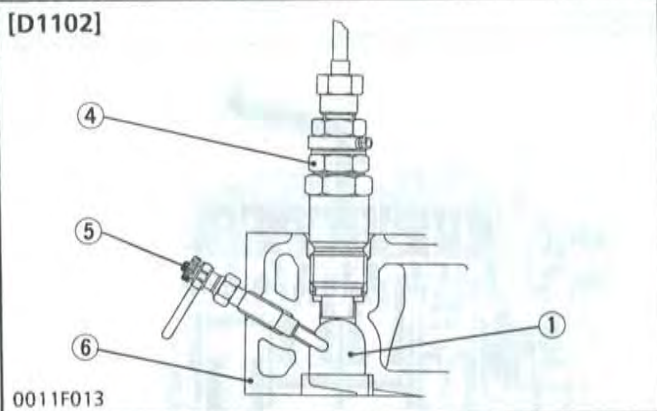
The cylinder head is made of high performance cast iron which can resist high temperature and pressure caused by combustion.

The cross-flow type inlet / exhaust port which are opposite and alternately located, lower the heat conduction from the exhaust port (3) to the inlet port (2).

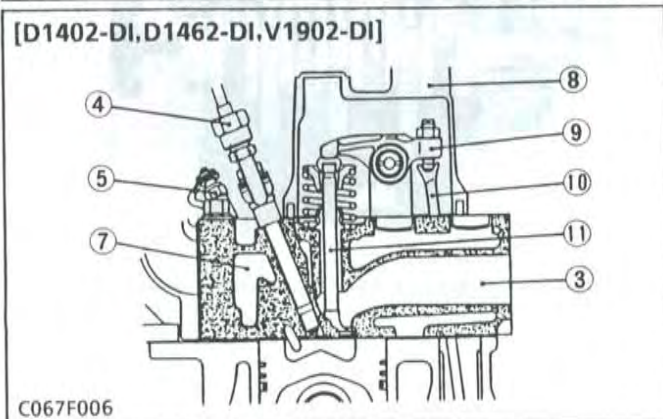
The combustion chamber is KUBOTA'S exclusive spherical combustion chamber type for D1102 engine. In the combustion chamber are installed throttle type injection nozzles and rapid heating sheathed type glow plugs. This glow plug assures easier than even engine starts even at -15°C (5°F).

D1402-DI, D1462-DI, V1902-DI engines installed direct injection type cylinder head, in which injection nozzles (4) and glow plugs (5) are installed, has the inlet ports, gas exhaust ports (3) and water jacket (7) surrounding the valve system (9), (10) and (11).

[D1102]

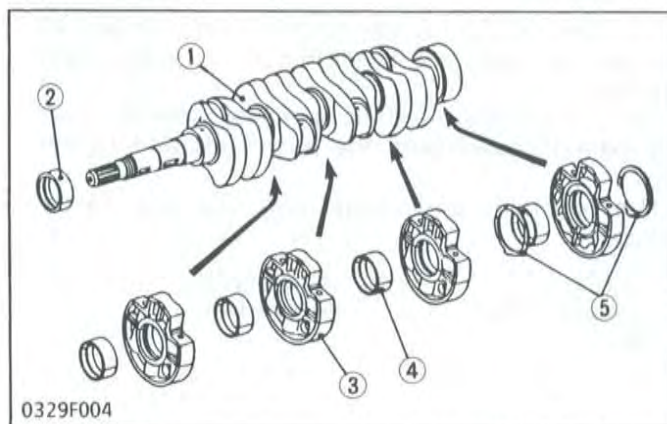


[D1402-DI, D1462-DI, V1902-DI]



- | | |
|------------------------|------------------|
| (1) Combustion Chamber | (7) Water Jacket |
| (2) Inlet Port | (8) Head Cover |
| (3) Exhaust Port | (9) Rocker Arm |
| (4) Injection Nozzle | (10) Push Rod |
| (5) Glow Plug | (11) Valve |
| (6) Cylinder Head | |

(3) Crankshaft

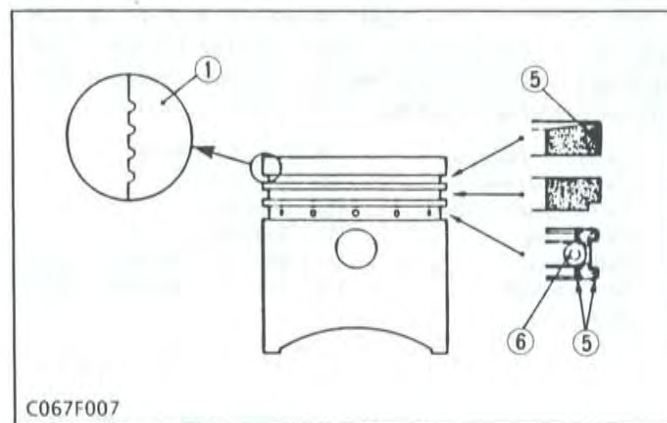


- | | |
|--------------------------|--------------------------|
| (1) Crankshaft | (4) Crankshaft Bearing 2 |
| (2) Crankshaft Bearing 1 | (5) Thrust Bearing |
| (3) Main Bearing Case | |

The crankshaft (1) is forged from chrome molybdenum steel, and the journal and pin are induction hardened to provide strength and improve wear resistance. The crankshaft is used to change the reciprocating motion of the piston into the rotational motion and also drives the oil pump, cam shaft, and fuel cam shaft. The counterweight balances the force to reduce vibrations and stress on the bearings.

The journal section of the crankshaft is supported on the sleeve bearing inserted inside the crank case and the four sets of main bearing cases (3) and the bearing metal (4). On both sides of the bearings on the flywheel side are inserted the side metals (5). Oil holes are provided on the crankshaft, bearing section and journal section to flow lubricating oil.

(4) Piston and Piston Rings



- | | |
|---------------------|------------------------|
| (1) Piston Top Land | (4) Oil Ring |
| (2) Top Ring | (5) Chrome Plating |
| (3) Second Ring | (6) Coil Expander Ring |

The piston is made of an aluminum alloy which is temperature and pressure resistant.

The head of the piston is flat for indirect injection type (D1102) and direct injection (D1402-DI, D1462-DI, V1902-DI) type has pistons with a cutout swirl cup cavity at their head. Furthermore, ribs (1) are provided between the piston head and top ring (2) to reduce distortion and to help heat radiation.

The piston has three piston rings. The top (2) and the second (3) rings are the compression rings, and the bottom ring (4) is the oil ring.

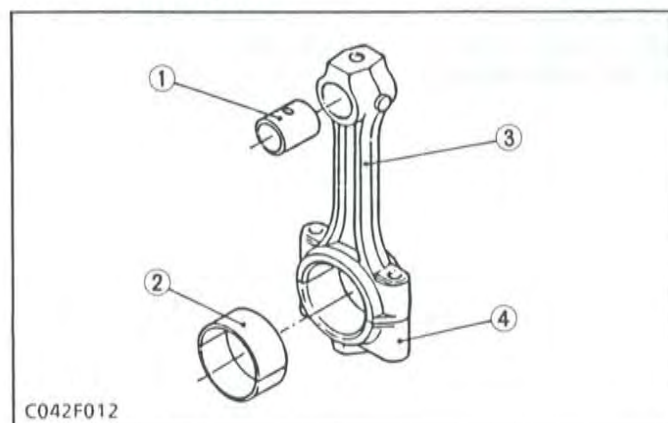
The top ring (2) is a keystone type, which can withstand heavy loads, and the barrel face on the ring fits well to the cylinder wall.

The second ring (3) is an undercut type, which prevents the oil from being carried up.

The oil ring (4) has chamfered contact faces and an expander ring (6), which increase the pressure of the oil ring against the cylinder wall to scrape the oil.

The top ring (2) and the oil ring (4) are plated with hard chrome to increase wear resistance.

(5) Connecting Rod

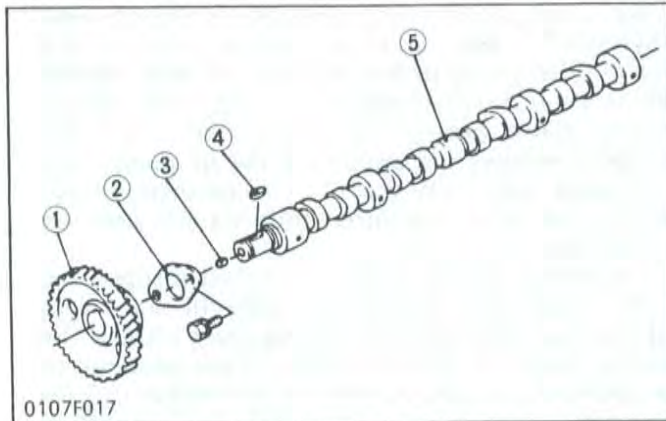


The connecting rod (3), which converts the reciprocating motion of the pistons caused by the fuel combustion into the rotating motion of the crankshaft, is made of hard forged steel.

The connecting rod has bearings at both ends. The small end has a solid type bearing - small end bushing (1), and the big end has a split type bearing - crankpin bearing (2).

- | | |
|-----------------------|------------------------|
| (1) Small End Bushing | (3) Connecting Rod |
| (2) Crankpin Bearing | (4) Connecting Rod Cap |

(6) Camshaft



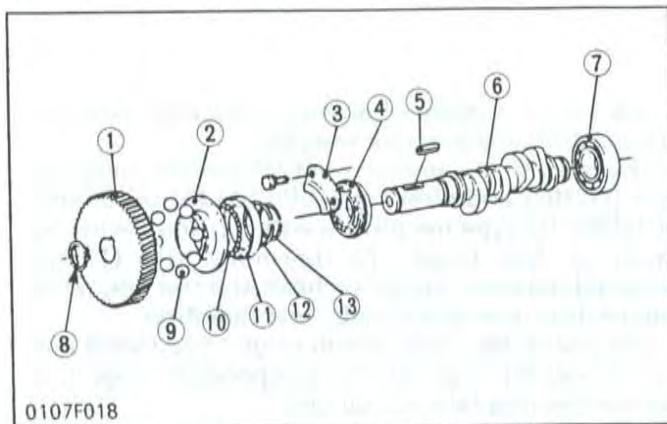
The camshaft (5) is made of special cast iron and its journal and cams are hardened to increase wear resistance.

The cams on the camshaft open and close the inlet and exhaust valves with the push rods and rocker arms.

The journals and their bearings are force-lubricated.

- | | |
|----------------------|-----------------|
| (1) Cam Gear | (4) Feather Key |
| (2) Camshaft Stopper | (5) Camshaft |
| (3) Plug | |

(7) Fuel Camshaft

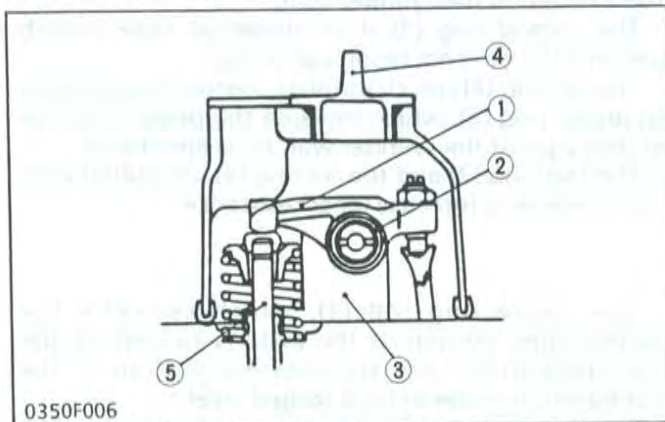


The fuel camshaft is made of carbon steel and its cams are hardened and tempered to increase wear resistance.

The cams on the fuel camshaft (6) drive the injection pump and the fuel transfer pump. The governor balls are installed on the fuel camshaft to control the engine speed.

- | | |
|---------------------------|--------------------------------|
| (1) Injection Pump Gear | (8) External Snap Ring |
| (2) Governor Sleeve | (9) Steel Ball |
| (3) Fuel Camshaft Stopper | (10) Steel Ball |
| (4) Ball Bearing | (11) Ball Case |
| (5) Feather Key | (12) Ball Case Snap Ring |
| (6) Fuel Camshaft | (13) Governor Sleeve Snap Ring |
| (7) Ball Bearing | |

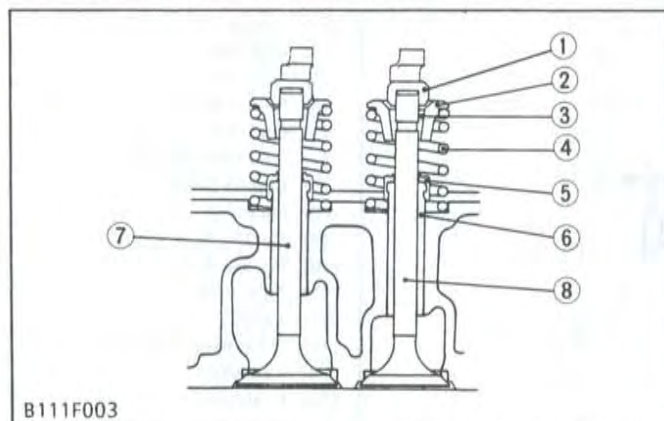
(8) Rocker Arm



The rocker arm assembly includes the rocker arms (1), rocker arm brackets (3) and rocker arm shaft (2) and converts the reciprocating motion of the push rods to an open / close movement of the inlet and exhaust valves. Valve control timing must be adjusted with screws on the rocker arms. Lubrication oil is pressure fed through the bracket to the rocker arm shaft so that the rocker arm bearings and the entire system are lubricated sufficiently.

- | | |
|------------------------|---------------------|
| (1) Rocker Arm | (4) Oil Filler Plug |
| (2) Rocker Arm Shaft | (5) Valve |
| (3) Rocker Arm Bracket | |

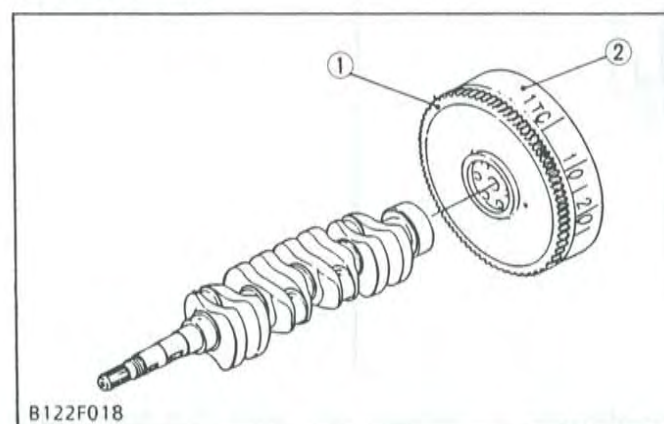
(9) Inlet and Exhaust Valves



The inlet 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 Collets | (7) Inlet Valve |
| (4) Valve Spring | (8) Exhaust Valve |

(10) Flywheel



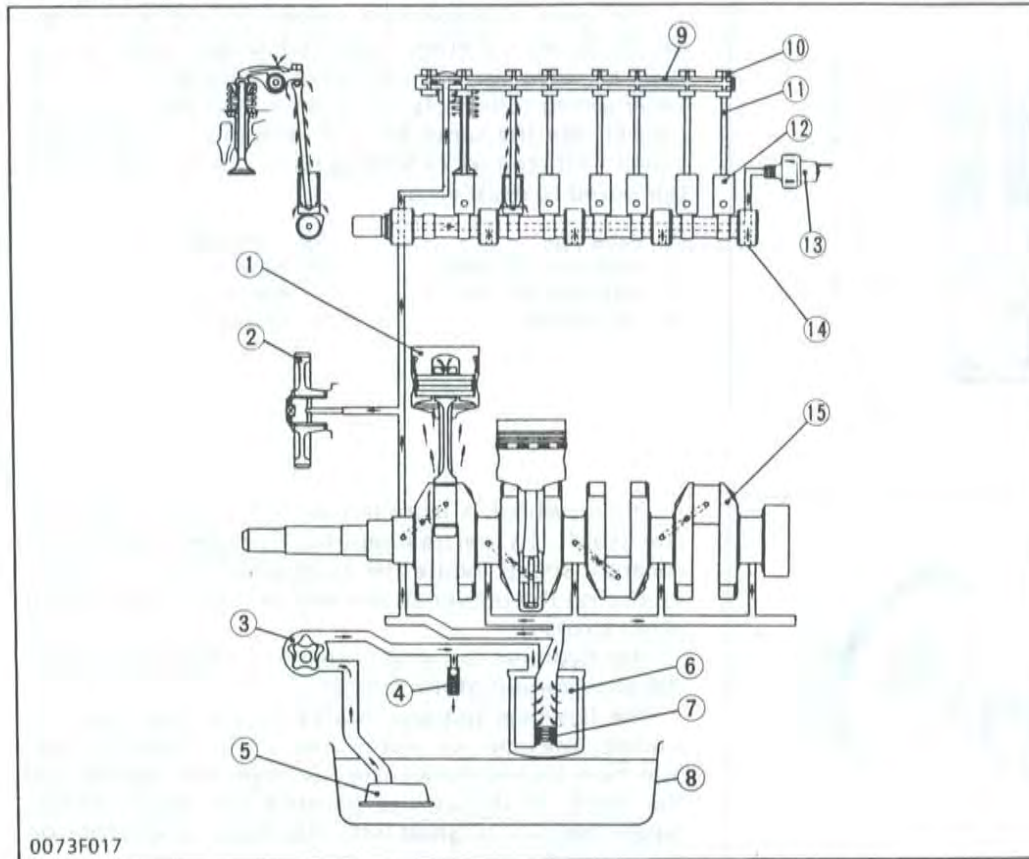
The flywheel is installed on the rear end of the crankshaft. Its inertia keeps the flywheel turning at a constant speed, while the crankshaft tends to speed up during the power stroke and to slow down during other strokes.

The flywheel has a ring gear (1), 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 mark of window on the clutch housing.

- | | |
|---------------|--------------|
| (1) Ring Gear | (2) Flywheel |
|---------------|--------------|

[3] LUBRICATING SYSTEM



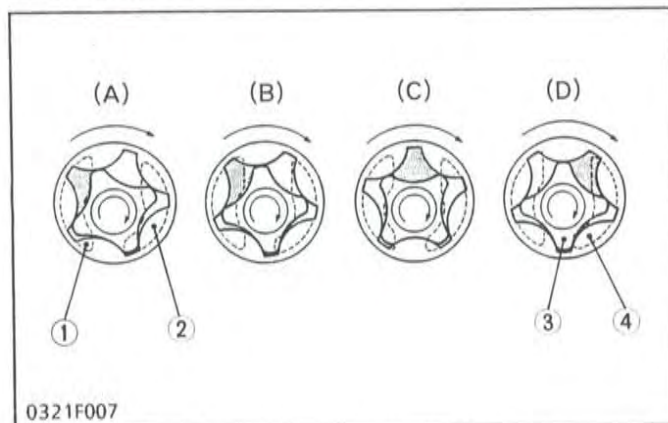
- (1) Piston
- (2) Idle Gear
- (3) Oil Pump
- (4) Relief Valve
- (5) Oil Filter
- (6) Oil Filter Element
- (7) Bypass Valve
- (8) Oil Pan
- (9) Rocker Arm Shaft
- (10) Rocker Arm
- (11) Push Rod
- (12) Tappet
- (13) Oil Pressure Switch
- (14) Camshaft
- (15) Crankshaft

0073F017

The lubricating oil is forced to each journal through the oil passages of the cylinder block, cylinder head and shafts. The oil, splashed by the

crankshaft or thrown off from the bearings, lubricates other engine parts such as the push rods (11), tappets (12), piston pins and timing gears.

(1) Oil Pump



0321F007

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

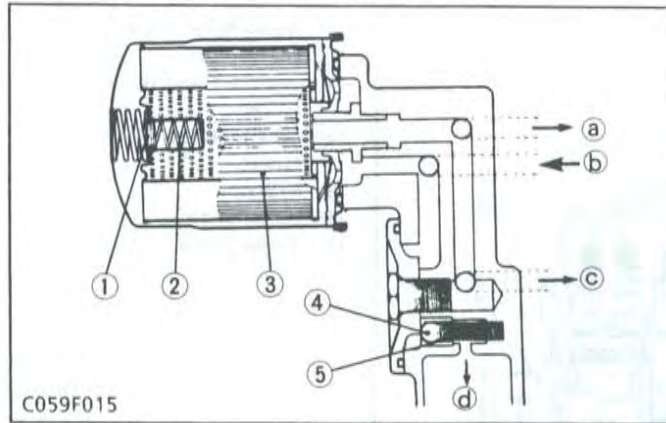
The oil pump is a gear pump, whose rotors have trochoid lobes. The inner rotor (3) has 4 lobes and the outer rotor (4) has 5 lobes, and they are eccentrically engaged with each other. The inner rotor, which is driven by the crankshaft through the gears, rotates the outer rotor in the same direction, varying the space between the lobes.

While the rotors rotate from (A) to (B), the space leading to the inlet port increases, which causes the oil to flow through the inlet port.

When the rotors rotate to (C), the port to which the space leads is changed from inlet to outlet.

At (D), the space decreases and sucked oil is discharged from the outlet port.

(2) Oil Filter and Relief Valve



C059F015

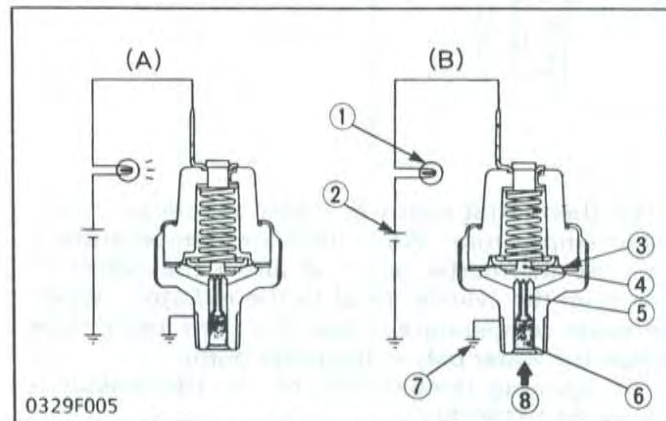
- | | |
|-----------------------------|-----------------------------|
| (1) Bypass Valve | (4) Relief Valve Ball |
| (2) Bypass Adjusting Spring | (5) Relief Adjusting Spring |
| (3) Filter Element | |

The lubricating oil force-fed by the pump is filtered by the filter cartridge, passing through the filter element from the outside to the inside. When the filter element accumulates dirt and the pressure difference between the inside and outside rises more than 98 kPa (1.0 kgf/cm², 14 psi), the bypass valve (1) opens to allow the oil to flow from the inlet line to outlet line, bypassing the filter element.

The relief valve (4) in the inlet line allows oil to prevent damage to the lubricating system, when the oil pressure rises more than 441 kPa (4.5 kgf/cm², 64 psi).

- | |
|---|
| (a) To Idle Gear, Camshaft and Rocker Arm |
| (b) From Oil Pump |
| (c) To Crankshaft Journal and Crankpin |
| (d) Drain of Relief Valve |

(3) Oil Pressure Switch



0329F005

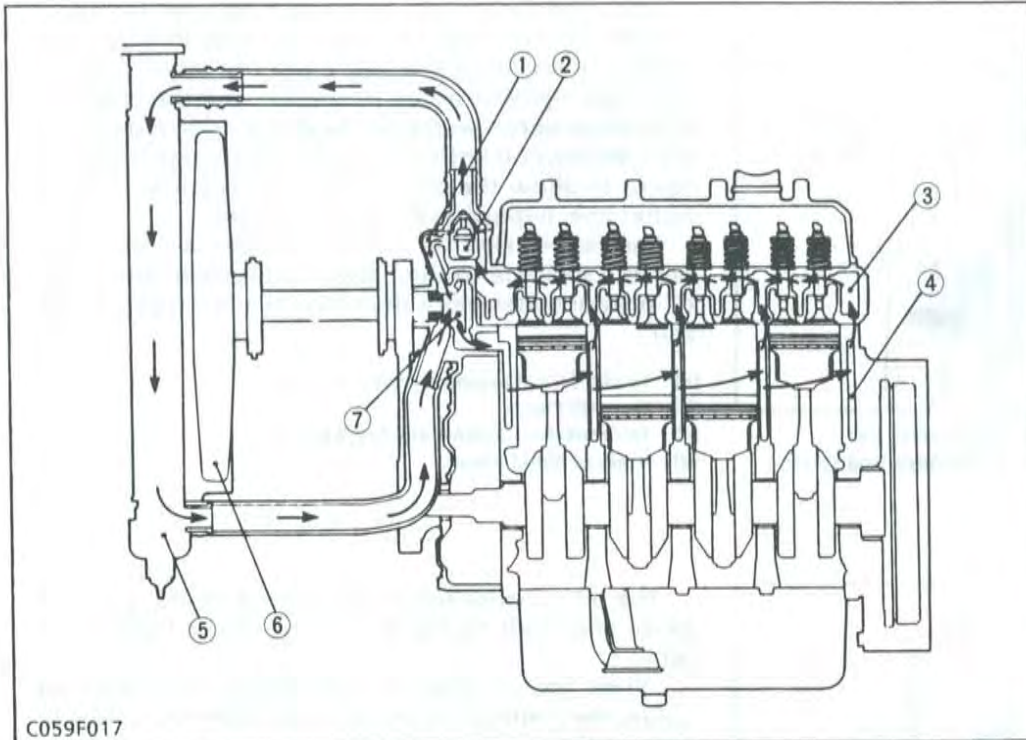
- | | |
|-------------------|--------------------|
| (1) Warning Lamp | (5) Contact |
| (2) Battery | (6) Oil Passage |
| (3) Rubber Gasket | (7) Cylinder Block |
| (4) Contact Rivet | (8) Oil |

The oil pressure switch is installed on the cylinder block and leads to the oil passage of the lubricating oil.

When the oil pressure falls below the specified value, the contacts of the oil pressure switch closes to turn on the warning lamp (1).

- | |
|---|
| (A) At Lower Oil Pressure |
| (49 kPa, 0.5 kgf/cm ² , 7 psi or less) |
| (B) At Proper Oil Pressure |

[4] COOLING SYSTEM



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

C059F017

The cooling system consists of a radiator (5), a centrifugal water pump (7), a fan (6) and a thermostat (2).

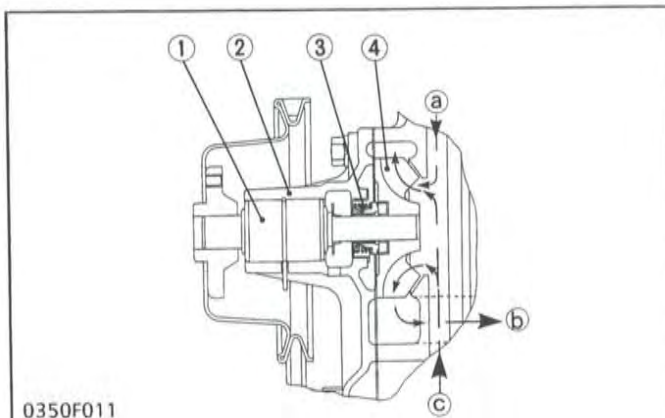
The water is cooled as it flows through the radiator core, and the cooling air through the radiator core by fan.

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 close to flow the water only to the water pump.

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

(1) Water Pump



0350F011

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.

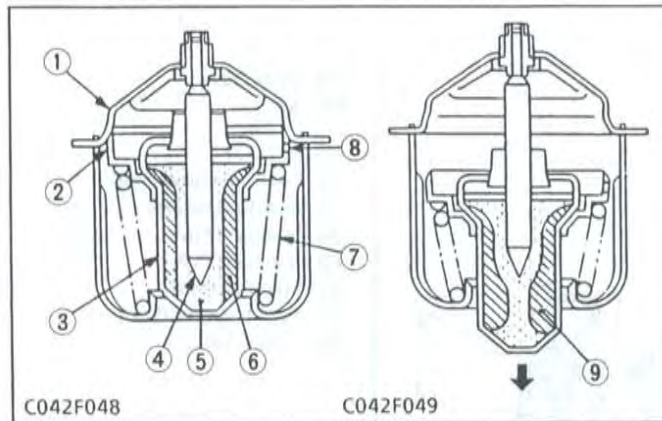
The mechanical seal (3) prevents the water from entering the bearing (1).

- (a) From Thermostat
- (b) To Cylinder Block
- (c) From Radiator

- (1) Bearing
- (2) Pump Body

- (3) Mechanical Seal
- (4) Pump Impeller

(2) Thermostat



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

The thermostat is wax pellet type, which controls the flow of the cooling water to the radiator to keep the proper temperature.

The case has a seat (1) and the pellet (3) has a valve (2). The spindle (4) attached to the case is inserted into the synthetic rubber (5) in the pellet. The pellet is charged with wax (6).

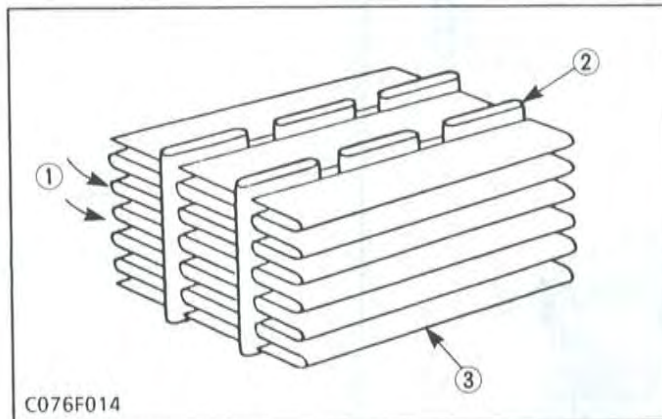
(A) At low temperature (lower than 82°C, 180°F)

The valve (2) is seated by the spring (7) and the cooling water circulates in the engine through the water return pipe but does not enter the radiator.

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

As the water temperature rises, the wax in the pellet (3) turns liquid and expands, repelling the spindle (4). The pellet lowers and the valve (2) opens to send the cooling water to the radiator.

(3) Radiator



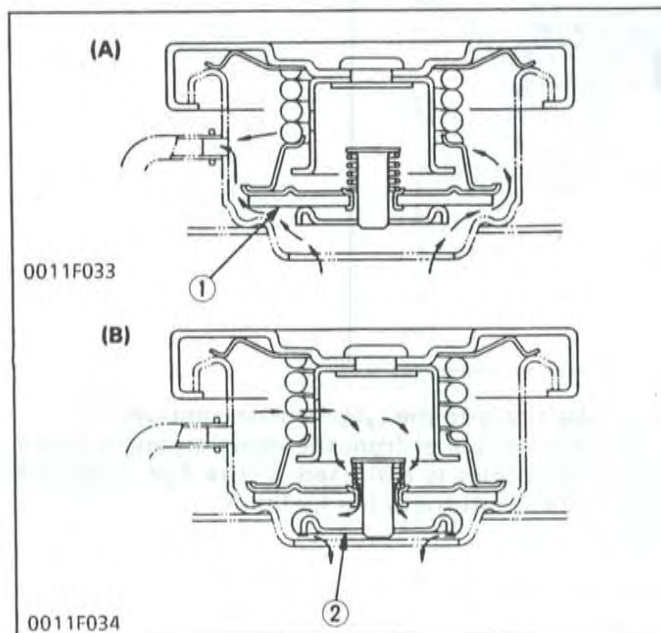
The radiator core consists of water carrying tubes (2) with fins (3) at a right angle to it.

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 | |

(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/cm², 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 low pressure

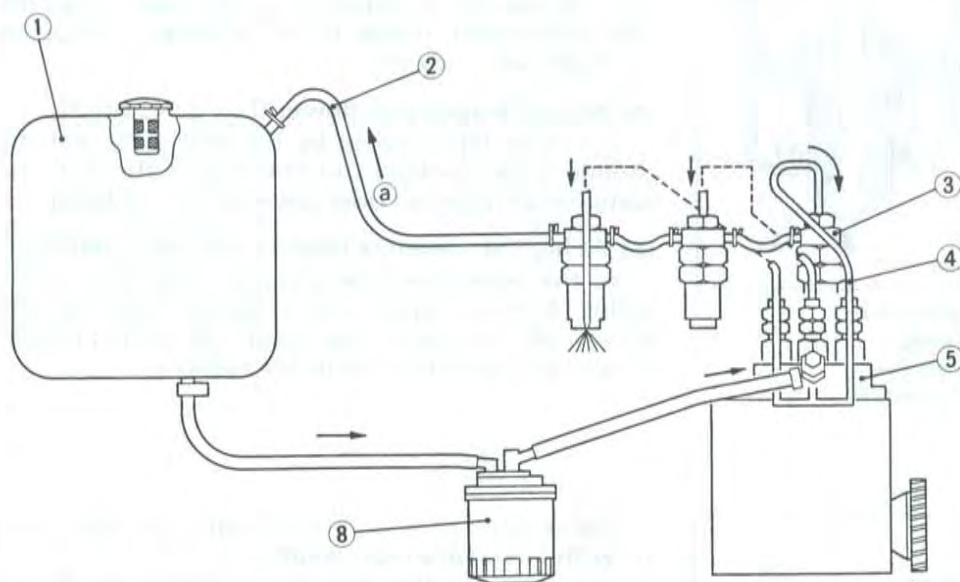
When the water temperature falls and a vacuum is formed in the radiator, the vacuum valve (2) opens to allow the air to enter the radiator.

- | |
|--------------------|
| (1) Pressure Valve |
| (2) Vacuum Valve |

[5] FUEL SYSTEM

(1) Fuel Lines

[D1102]



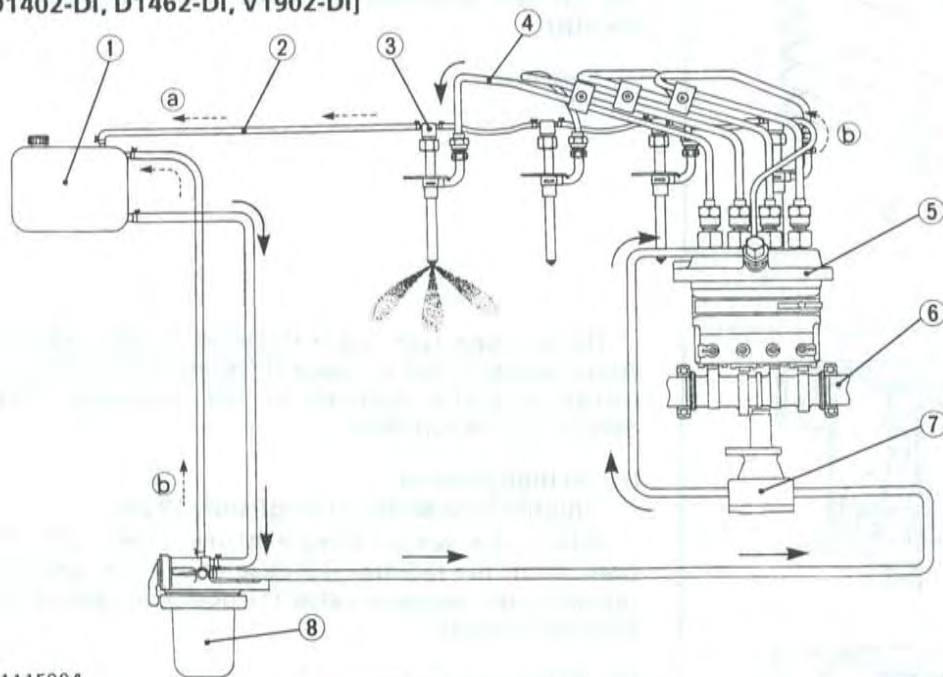
(a) Over Flow

(b) Air

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

0350F012

[D1402-DI, D1462-DI, V1902-DI]

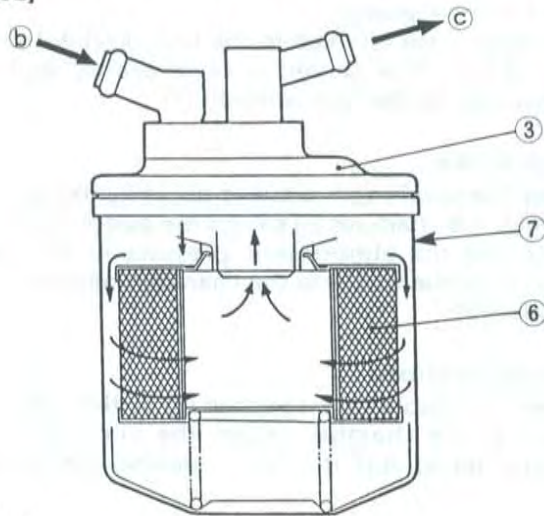


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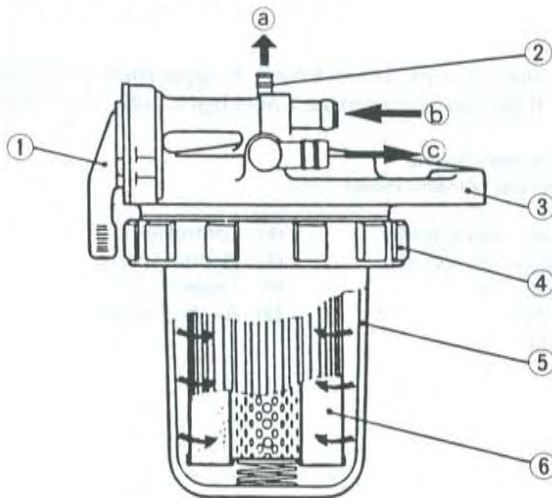
The fuel is fed from the tank (1) through the fuel filter (8) to the injection pump (5) by the fuel transfer pump (7) (except L2350). The injection pump force-feeds the fuel through the injection nozzles (3), which

inject the fuel into the cylinders for combustion.

The excessive fuel from the injection pump to the injection nozzles is collected in the fuel overflow pipes (2) and returns to the fuel tank.

(2) Fuel Filter**[D1102]**

0350F013

[D1402-DI, D1462-DI, V1902-DI]

C067F010

The fuel filter removes dirt and water with its fine filter paper, which collects particles of 15 microns (0.00059 in.) at 20 kPa (0.2 kgf/cm², 3 psi).

The fuel from the fuel tank is filtered by the filter element (6), while flowing through the filter element from its outside to inside.

The filter bracket (3) has an air vent (2) to take off air in the fuel line.

(a) To Fuel Tank

(b) From Fuel Tank

(c) To Fuel Injection Pump or Fuel Transfer Pump

(1) Cock

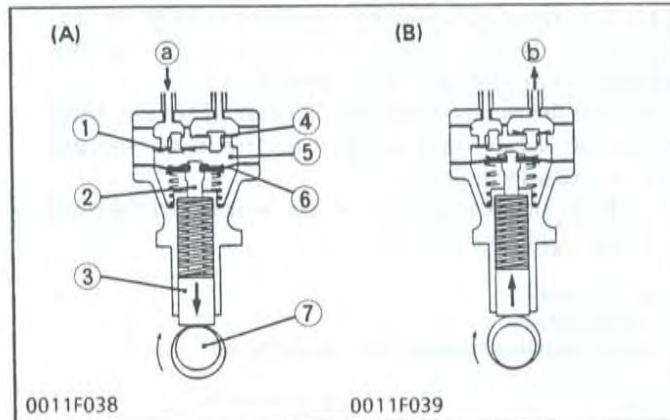
(2) Air Vent

(3) Filter Body

(4) Retainer Ring

(5) Pot

(6) Filter Element

(3) Fuel Transfer Pump (for D1402-DI, D1462-DI and V1902-DI)

- | | |
|------------------|-------------------|
| (1) Inlet Valve | (5) Chamber |
| (2) Push Rod | (6) Diaphragm |
| (3) Tappet | (7) Fuel Camshaft |
| (4) Outlet Valve | |

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

The diaphragm is linked to the tappet (3) with the push rod (2). The tappet is reciprocated by the eccentric cam on the fuel camshaft (7).

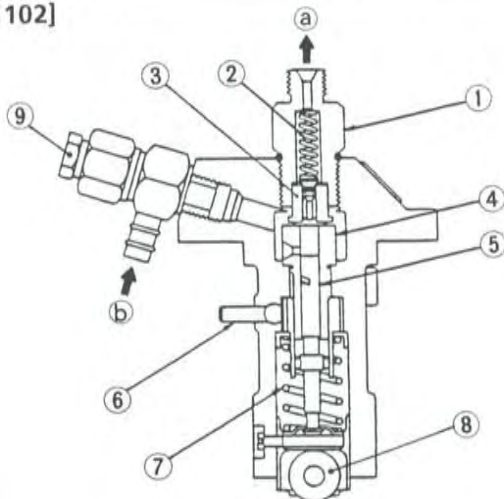
(A) Inlet Stroke

When the diaphragm is pulled down by the spring, vacuum in the chamber (5) causes the outlet valve (4) to close and the atmospheric pressure in the fuel tank to force the fuel into the chamber, opening the inlet valve (1).

(B) Discharge Stroke

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.

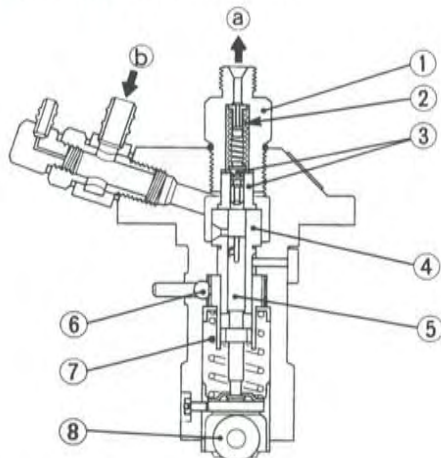
- (a) From Fuel Filter
(b) To Injection Pump

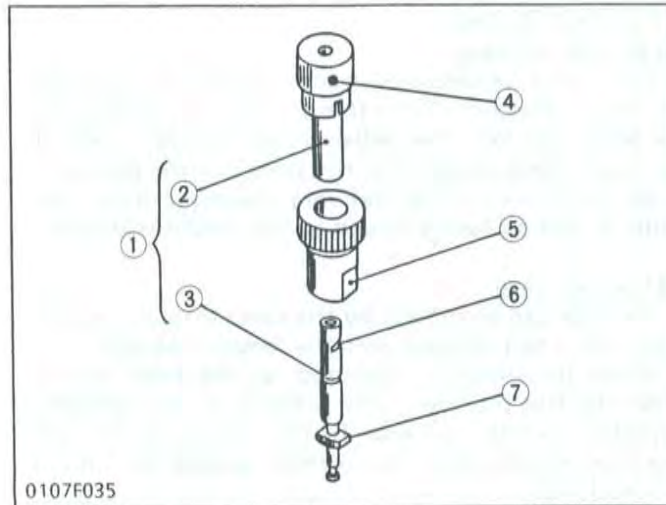
(4) Fuel Injection Pump**[D1102]**

The injection pump is Bosch K type mini injection pump. It features a compact and light weight design.

- (a) To Injection Nozzle
(b) From Fuel Transfer Pump

- | | |
|---------------------------|--------------------|
| (1) Delivery Valve Holder | (6) Control Rack |
| (2) Delivery Valve Spring | (7) Plunger Spring |
| (3) Delivery Valve | (8) Tappet |
| (4) Cylinder | (9) Air Vent Screw |
| (5) Plunger | |

[D1402-DI, D1462-DI, V1902-DI]

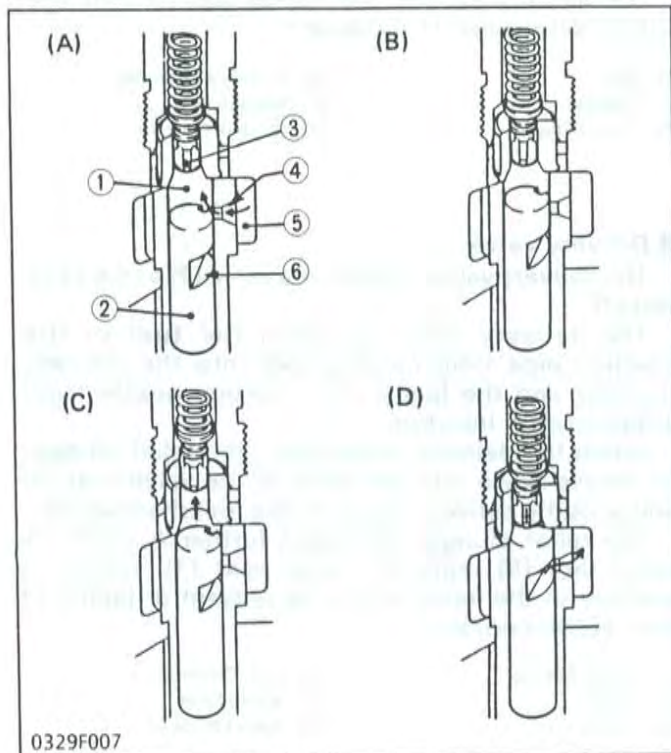


■ Pump Element

The pump element (1) consists of a plunger (3) and cylinder (2), their sliding surfaces are precision-machined to maintain fuel tightness.

The plunger (3) fits in the control sleeves (5) at the driving face (7). The sleeve is engaged with the control rack, which rotate the plunger in the cylinder to control the amount of fuel delivery.

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



■ Fuel Pressure-feed

(A) Before delivery

As the taper lowers, the plunger (2) lowers and fuel is drawn into the delivery chamber (1) through the feed hole (4) from the fuel chamber (5).

(B) Beginning of delivery

When the plunger is pushed up by the cam and the head of the plunger closes the feed hole, the pressure in the delivery chamber rises to push the delivery valve (3) open.

(C) Delivery

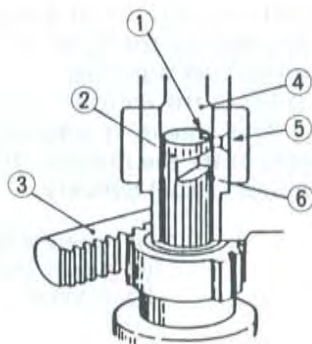
While the plunger is rising, delivery of fuel continues.

(D) End of delivery

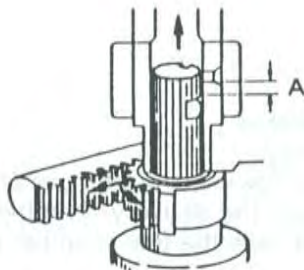
When the plunger rises further and the control groove (6) on its periphery meets the feed hole, the fuel returns to the fuel chamber from the delivery chamber through the control groove and the feed hole.

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

(A)



(B)



0329F008

■ Injection Control

(A) No fuel delivery

At the engine stop position of the control rack (3), the lengthwise slot (1) on the plunger (2) aligns with the feed hole (5). 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 is forced to the injection nozzle.

(B) Fuel delivery

The plunger is rotated by the control rack and the feed hole is not aligned with the lengthwise slot.

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

The amount of the fuel to be forced into the nozzle corresponds to distance A.

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

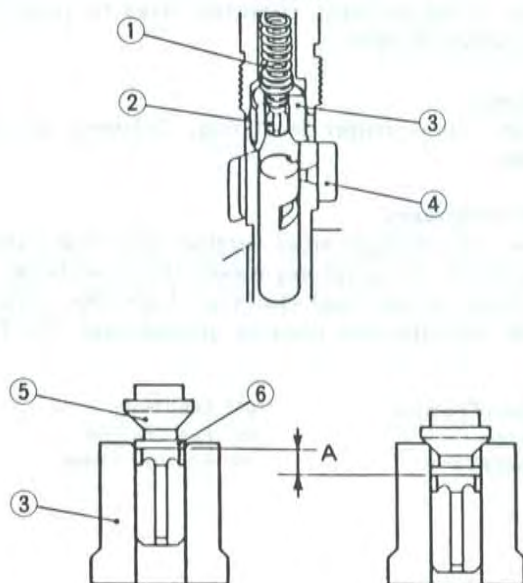
■ Delivery Valve

The delivery valve consists of a valve (2) and a valve seat (3).

The delivery valve prevents the fuel in the injection pipe from flowing back into the delivery chamber and the fuel in the injection nozzle from dribbling after injection.

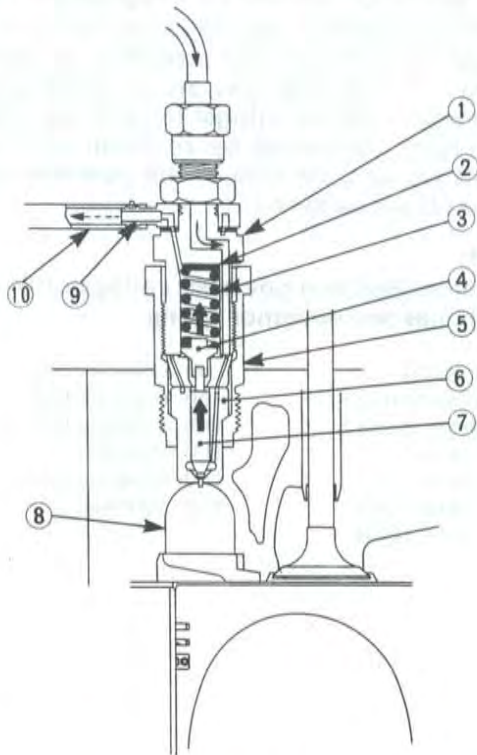
When the delivery stroke ends, the relief plunger (6) moves down into the bore of the valve seat (3) and seals the delivery line from the fuel chamber (4).

The relief plunger (6) lowers further A until the valve face (5) seats the valve seat (3), reducing pressure in the injection line to prevent dribbling at the injection nozzle.



- | | |
|------------------|--------------------|
| (1) Valve Spring | (4) Fuel Chamber |
| (2) Valve | (5) Valve Face |
| (3) Valve Seat | (6) Relief Plunger |

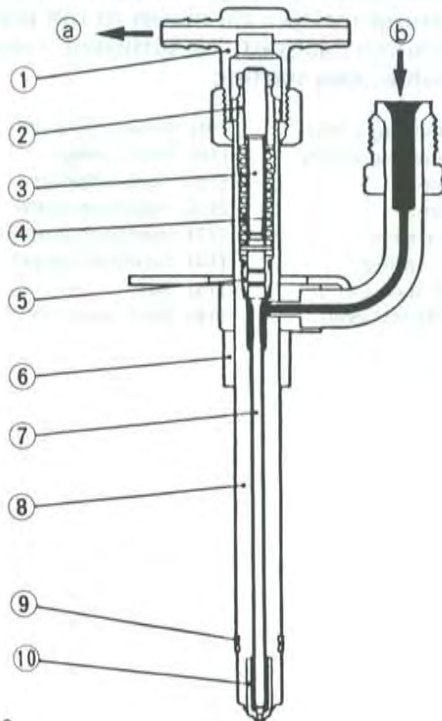
0329F009

(5) Fuel Injection Nozzle**[D1102]**

0011F046

This nozzle is throttle-type. Fuel fed from the pump is pressurized to push the needle valve (7) up and the fuel is then injected. The needle valve is pressed by the nozzle spring (3) through the push rod (4). Fuel overflow is passed from nozzle holder center through the fuel overflow nipple (9) and the fuel overflow pipe (10) to the fuel tank. The injection pressure is provided 13.7 to 14.7 MPa (140 to 150 kgf/cm², 1991 to 2133 psi). Injection pressure can be controlled by inserting shims between nozzle holder body (1) and adjusting washers (2). The pressure increases approx. 981 kPa (10 kgf/cm², 142 psi) when inserted a 0.1 mm (0.0039 in.) shim. Injection nozzle is also precision finished as is the injection pump, treat it carefully and protect from water and dust.

- (1) Nozzle Holder Body
- (2) Adjusting Washer
- (3) Nozzle Spring
- (4) Push Rod
- (5) Retaining Nut
- (6) Nozzle Body
- (7) Needle Valve
- (8) Combustion Chamber
- (9) Fuel Overflow Nipple
- (10) Fuel Overflow Pipe

[D1402-DI, D1462-DI, V1902-DI]

C059F030

The nozzle is a pencil type, which is suitable for the direct injection system.

When the fuel is not delivered from the injection pump, the valve (7) is tightly closed against the nozzle tip (10) by the pressure spring (4).

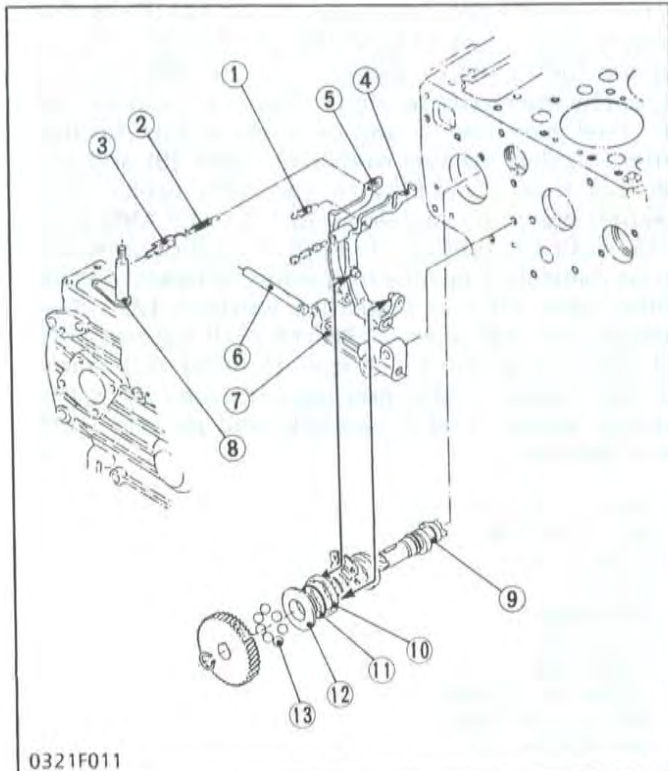
As the injection pump force feeds the fuel to the injection nozzle through the delivery pipe, the fuel pressure in the closed chamber is increases. When the fuel pressure raises and overcomes the tension of the pressure spring (4), the valve is pushed up and the fuel is sprayed through four 0.25 mm (0.00984 in.) diameter holes into the cylinder, where the fuel is ignited by the high-temperature and high-pressure air.

The excessive fuel from the injection pump flows through the space between the valve (7) and the valve guide (5) to the leak-off cap (1), cooling and lubricating the nozzle.

- (a) To Tank
- (b) From Injection Pump

- (1) Leak-off Cap
- (2) Pressure Adjusting Screw
- (3) Lift Adjusting Screw
- (4) Spring
- (5) Valve Guide
- (6) Compression Seal
- (7) Valve
- (8) Valve Body
- (9) Carbon Dam Seal
- (10) Nozzle Tip

(6) Governor

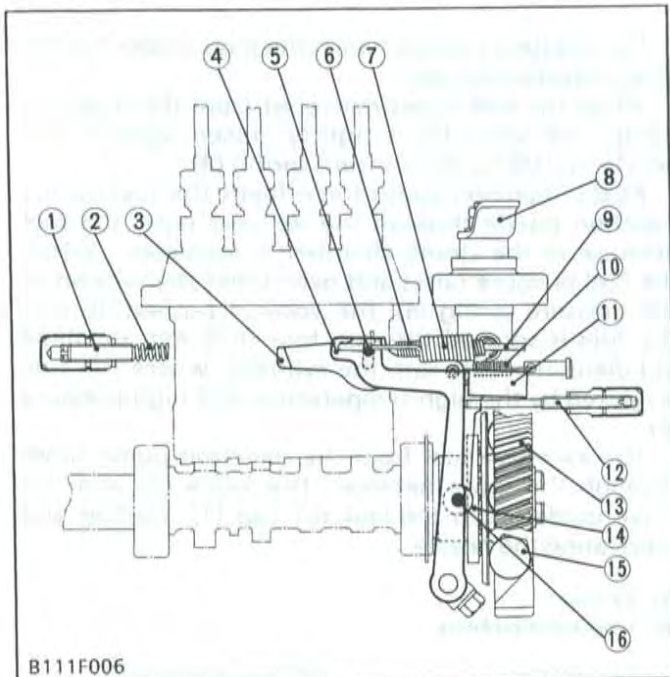


The governor serves to keep engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load. This engine uses an all-speed governor which controls the centrifugal force of the steel balls (12) weight, produced by rotation of the fuel camshaft (9), and the load of the governor spring 1 (2) and 2 (3) are balanced.

■ NOTE

- It is described two governor springs of DI engine. D1102 has one governor spring.

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

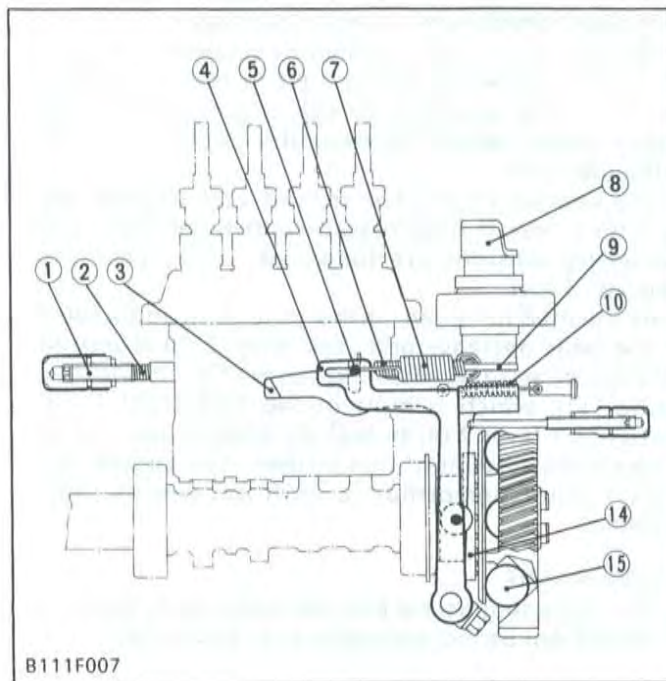


■ At Start

The steel ball (15) has no centrifugal force.

As the fork lever 1 (3) is pulled by the start spring (10), the control rack pin (5) moves to the maximum injection position. At start, the sufficient injection of the fuel enables easy starting.

- | | |
|-----------------------------|--------------------------|
| (1) Idling Adjusting Screw | (9) Governor Lever |
| (2) Idling Adjusting Spring | (10) Start Spring |
| (3) Fork Lever 1 | (11) Torque Spring |
| (4) Fork Lever 2 | (12) Adjusting Screw |
| (5) Control rack Pin | (13) Injection Pump Gear |
| (6) Governor Spring 1 | (14) Governor Sleeve |
| (7) Governor Spring 2 | (15) Ball |
| (8) Speed Control Lever | (16) Fork Lever Pin |



■ At Idling

At the idling position of the speed control lever (8), the governor spring 2 (7) is free and the governor spring 1 (6) pulls the fork lever 2 (4). Fork lever 1 (3) is pulled by the fork lever 2 (4) and the start spring (10).

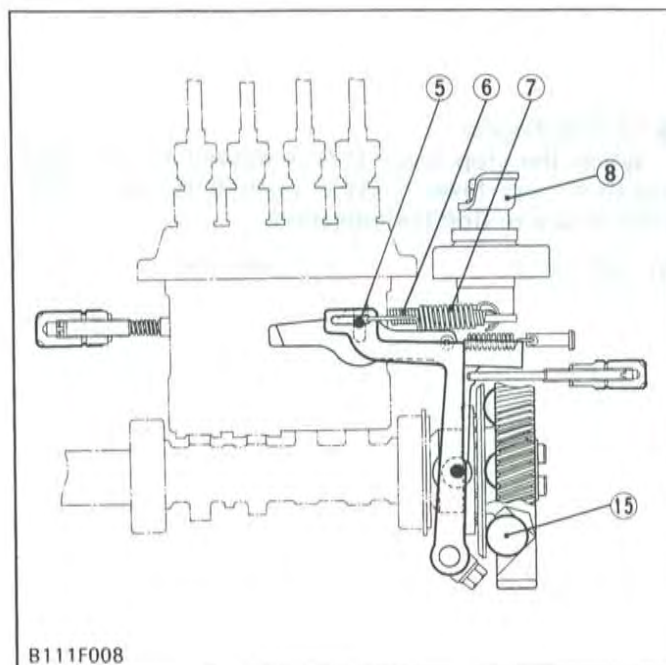
As the camshaft rotates, the balls (15) increase their centrifugal force to push the governor sleeve (14), which in turn pushes the fork lever 1 (3).

The control rack, which is pushed by the idle adjusting spring and the fork lever 1 (3), is kept at a position where these forces are balanced, providing stable idling.

■ IMPORTANT

- The idling speed has been factory-set. The idling adjusting screw (1) and spring (2) should not be disassembled and readjusted.

- | | |
|-----------------------------|-------------------------|
| (1) Idling Adjusting Screw | (7) Governor Spring 2 |
| (2) Idling Adjusting Spring | (8) Speed Control Lever |
| (3) Fork Lever 1 | (9) Governor Lever |
| (4) Fork Lever 2 | (10) Start Spring |
| (5) Control rack Pin | (14) Governor Sleeve |
| (6) Governor Spring 1 | (15) Ball |

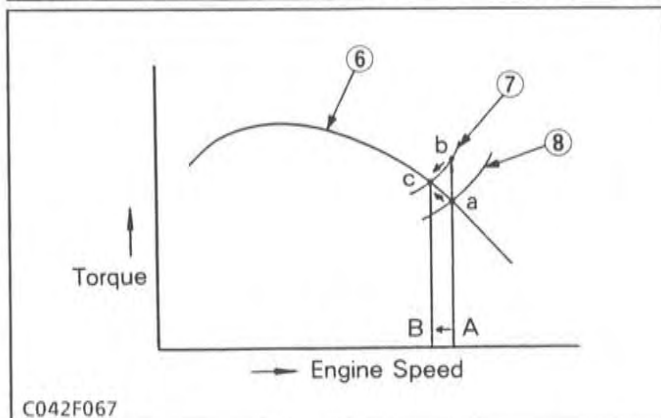


■ At Medium or High Speed Running

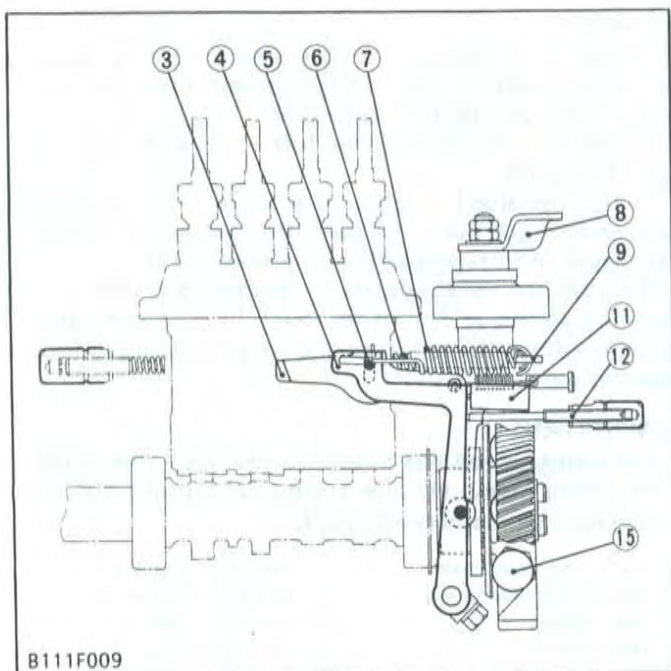
The engine speed is controlled when the tension of governor springs 1 (6) and 2 (7), which are pulled by the speed control lever (8), and the centrifugal force of steel balls (15) are balanced.

When the engine speed is dropped (A→B) with load increased (a→b), the centrifugal force of steel balls becomes smaller than the tension of governor springs 1 and 2. As a result, the control rack pin (5) is moved to the right and amount of fuel injected is increased to produce an engine torque required for the load.

- | | |
|-----------------------|-------------------------|
| (5) Control Rack Pin | (8) Speed Control Lever |
| (6) Governor Spring 1 | (15) Steel Ball |
| (7) Governor Spring 2 | |



- | | |
|-----------------------------|-----------------------------|
| (6) Engine Torque Curve | (8) Small Load Torque Curve |
| (7) Large Load Torque Curve | |



■ At High Speed Running with Overload

The fork lever 2 (4) is pulled by governor spring 1 (6) and the governor spring 2 (7) at their maximum tension. The overload to the engine lowers the engine speed, which decreases the centrifugal force of the balls (15).

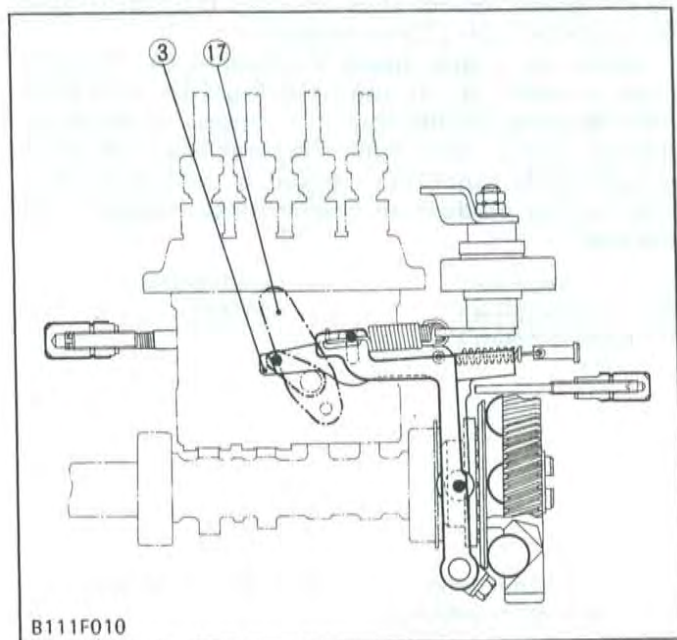
The control rack (5) is moved and held at the position where the decreased centrifugal force and the spring tensions are balanced, to increase the amount of fuel.

As the load increases further, the centrifugal force of the balls decrease and fork lever 2 (4) is moved until it contacts the adjusting screw (12). The torque spring (11), which is built in the fork lever 1 (3), pushes fork lever 2 (4) to pull the control rack and to increase the amount of fuel further. This enables the high torque performance at high speeds with overload.

■ IMPORTANT

- The Adjusting Screw (12) has been factory-set. It should not be disassembled and readjusted.

- | | |
|-----------------------|-------------------------|
| (3) Fork Lever 1 | (8) Speed Control Lever |
| (4) Fork Lever 2 | (9) Governor Lever |
| (5) Control Rack Pin | (11) Torque Spring |
| (6) Governor Spring 1 | (12) Adjusting Screw |
| (7) Governor Spring 2 | (15) Ball |



■ To Stop Engine

When the stop lever (17) is moved to the stop position, fork lever 1 (3) is pushed to move the control rack to stop fuel injection.

- | | |
|------------------|-----------------|
| (3) Fork Lever 1 | (17) Stop Lever |
|------------------|-----------------|

2 CLUTCH

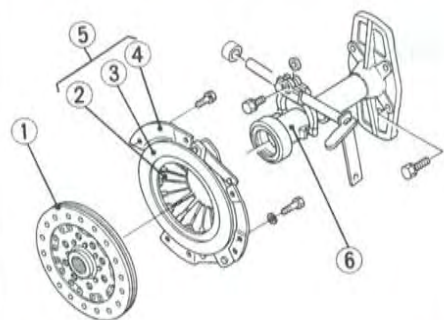
The clutch is located between the engine and transmission and is operated by stepping on the clutch pedal.

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.

There are two types of clutches. One is dry single plate type and the other is dual stage type clutch.

Tractors equipped with dual stage type clutch have a live PTO function which enables stoppage of the power transmission to the traveling system while the PTO is in rotation.

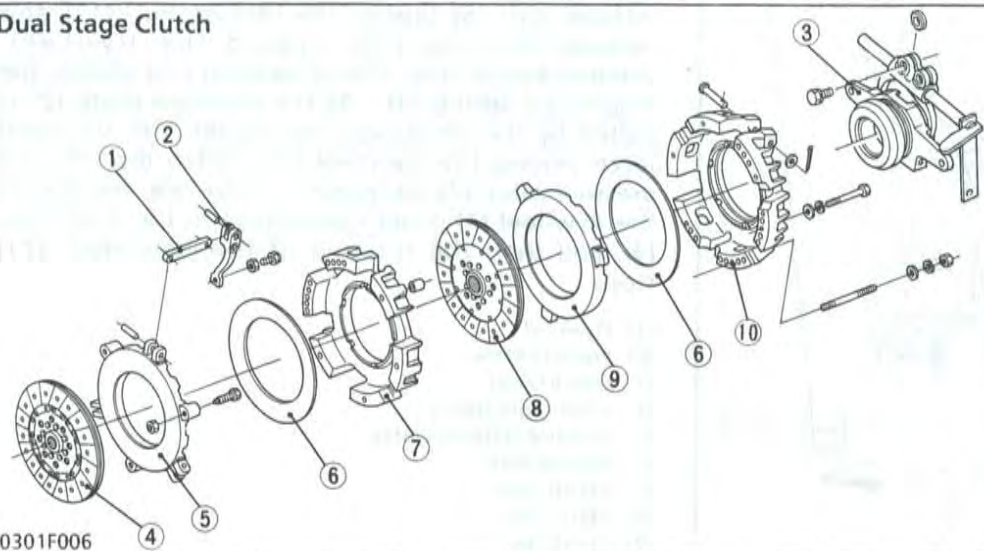
Single Plate Clutch



0301F005

- (1) Clutch Disc
- (2) Diaphragm Spring
- (3) Pressure Plate
- (4) Clutch Cover
- (5) Pressure Plate Assembly
- (6) Release Hub

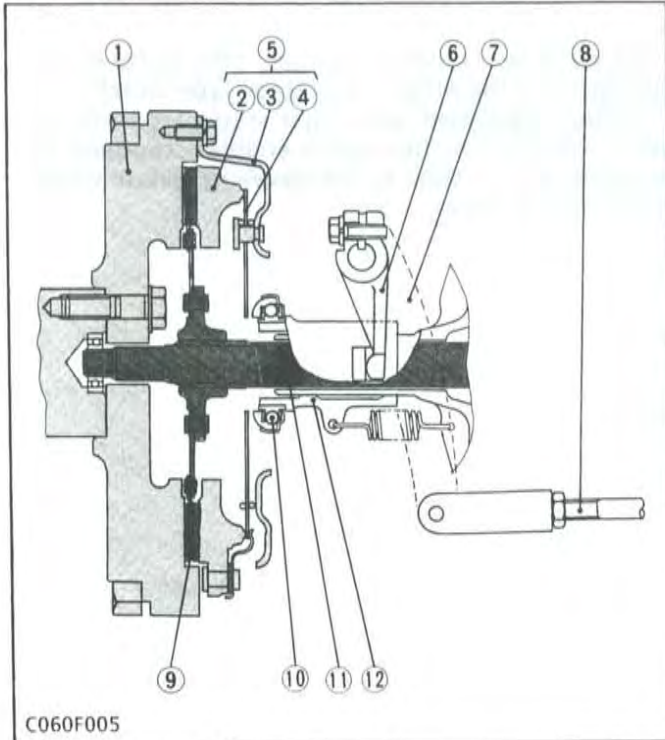
Dual Stage Clutch



0301F006

- (1) Release Rod
- (2) Release Lever
- (3) Release Hub
- (4) Clutch Disc 1 (Traveling)
- (5) Pressure Plate 1
- (6) Belleville Spring
- (7) Clutch Cover 1
- (8) Clutch Disc 2 (PTO)
- (9) Pressure Plate 2
- (10) Clutch Cover 2

[1] DRY TYPE, SINGLE STAGE CLUTCH

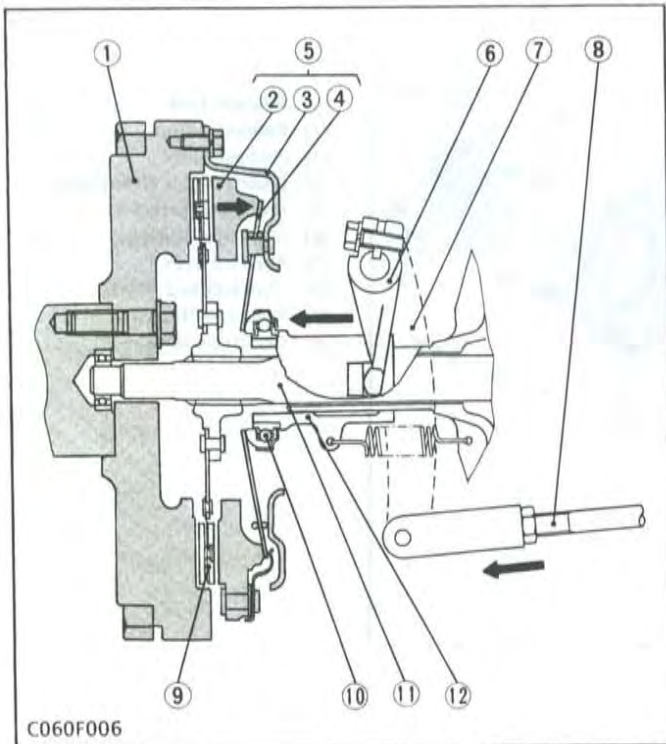


■ Clutch "Engaged"

When the clutch pedal is not depressed, the clutch release bearing (10) and the fingers of diaphragm spring (4) are not connected 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 main shaft (11) due to the frictional force among the flywheel (1), clutch disc (9) and pressure plate (2).

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



■ Clutch "Disengaged"

When the clutch pedal is depressed, the clutch rod (8) is pushed to move the clutch lever (7). Then, the release fork (6) pushes the release hub (12) and release bearing (10) toward the flywheel. Simultaneously, the release bearing (10) 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 main shaft (11) stops.

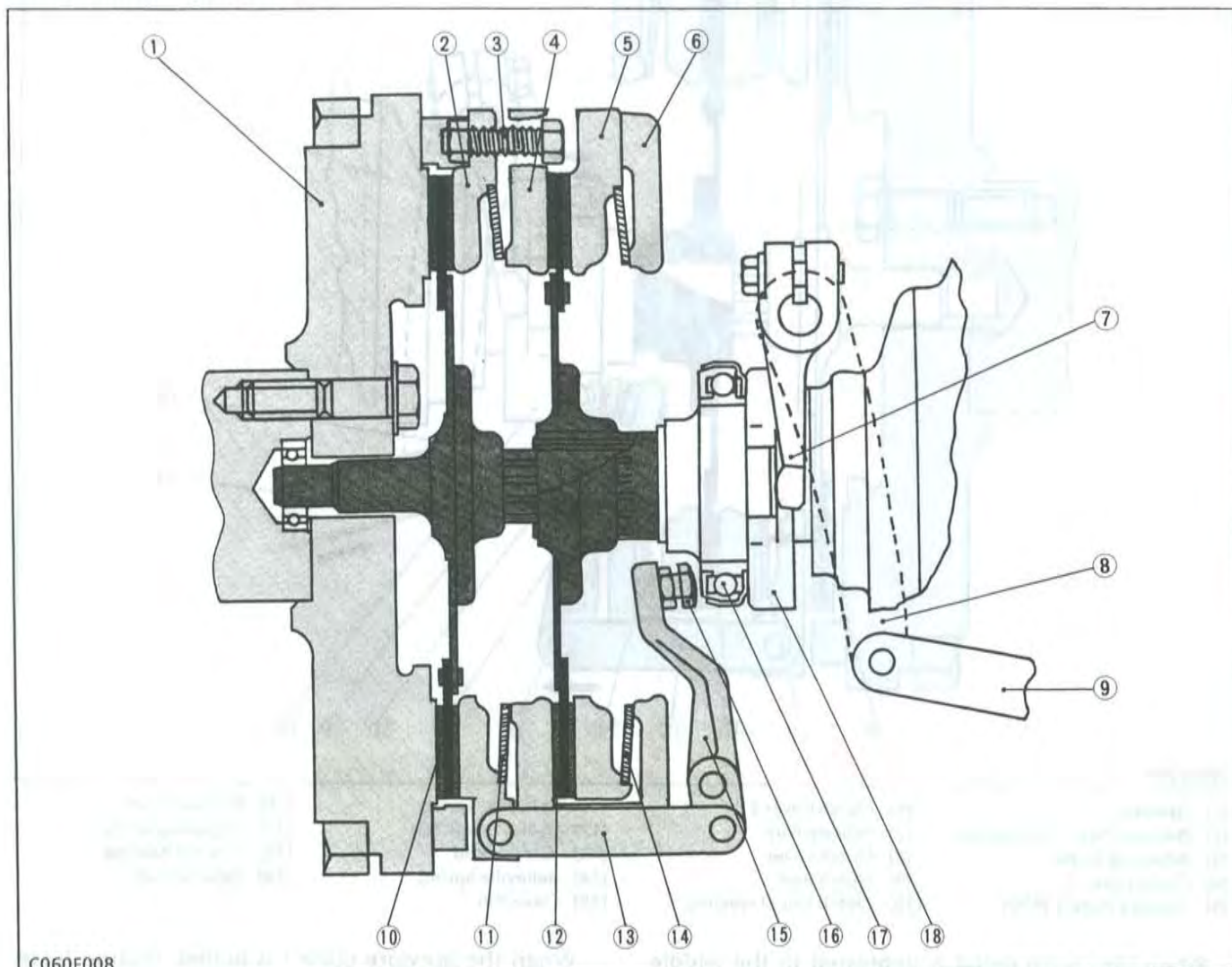
- (1) Flywheel
- (2) Pressure Plate
- (3) Clutch Cover
- (4) Diaphragm Spring
- (5) Pressure Plate Assembly
- (6) Release Fork
- (7) Clutch Lever
- (8) Clutch Rod
- (9) Clutch Disc
- (10) Release Bearing
- (11) Main Shaft
- (12) Release Hub

[2] DRY TYPE, DUAL STAGE CLUTCH

A dual stage clutch is a combination of two single plate clutches. One clutch controls power transmitted to the traveling, and the other to the PTO.

■ Traveling Clutch "Engaged"

■ PTO Clutch "Engaged"



C060F008

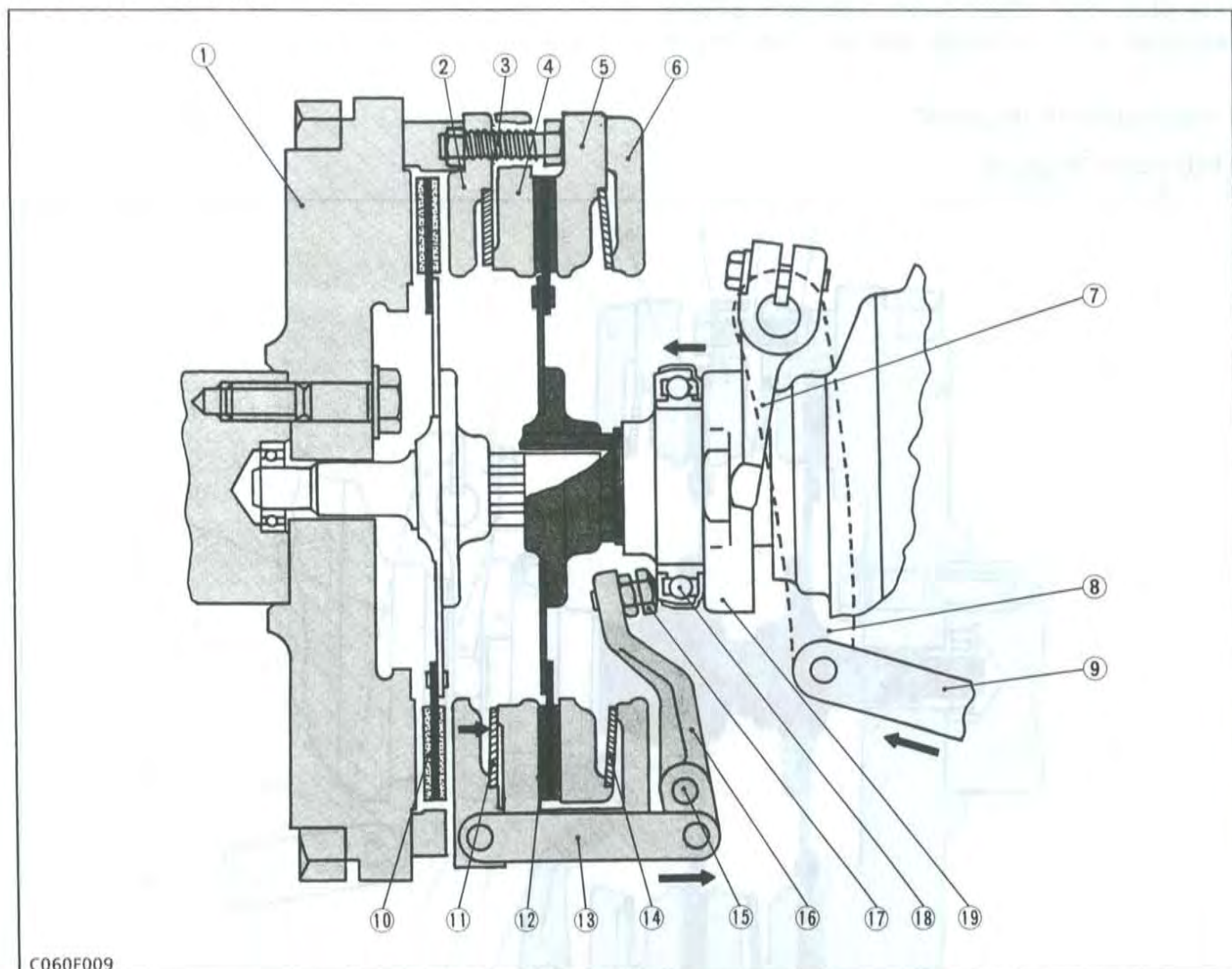
- | | | | |
|----------------------------------|------------------------------|------------------------|----------------------|
| (1) Flywheel | (6) Clutch Cover 2 | (11) Belleville Spring | (16) Adjusting Screw |
| (2) Pressure Plate 1 (Traveling) | (7) Release Fork | (12) Clutch Disc (PTO) | (17) Release Bearing |
| (3) Adjusting Screw | (8) Clutch Lever | (13) Release Rod | (18) Release Hub |
| (4) Clutch Cover 1 | (9) Clutch Rod | (14) Belleville Spring | |
| (5) Pressure Plate 2 (PTO) | (10) Clutch Disc (Traveling) | (15) Release Lever | |

When the clutch pedal is not depressed, there is a certain amount of clearance between the release bearing (17) and the adjusting screw (16) mounted on the release lever (15). Under the conditions above:

- The traveling clutch disc (10) is pressed between the flywheel (1) and the pressure plate 1 (2) by the force of the belleville spring (11).
- The PTO clutch disc (12) is pressed between the clutch cover 1 (4) and the pressure plate 2 (5) by the force of the belleville spring (14). Thus, the rotation of flywheel is transmitted to both the traveling and PTO systems.

■ Traveling Clutch "Disengaged"

■ PTO Clutch "Engaged"



C060F009

- | | | | |
|----------------------------------|------------------------------|------------------------|----------------------|
| (1) Flywheel | (6) Clutch Cover 2 | (11) Belleville Spring | (16) Release Lever |
| (2) Pressure Plate 1 (Traveling) | (7) Release Fork | (12) Clutch Disc (PTO) | (17) Adjusting Screw |
| (3) Adjusting Screw | (8) Clutch Lever | (13) Release Rod | (18) Release Bearing |
| (4) Clutch Cover 1 | (9) Clutch Rod | (14) Belleville Spring | (19) Release Hub |
| (5) Pressure Plate 2 (PTO) | (10) Clutch Disc (Traveling) | (15) Clevis Pin | |

When the clutch pedal is depressed to the middle of the stroke, the clutch rod (9) is pushed to move the clutch lever (8). Then, the release fork (7) pushes the release hub (19) and release bearing (18) toward the flywheel. Simultaneously, the release bearing (18) pushes the adjusting screw (17) attached to the release lever (16).

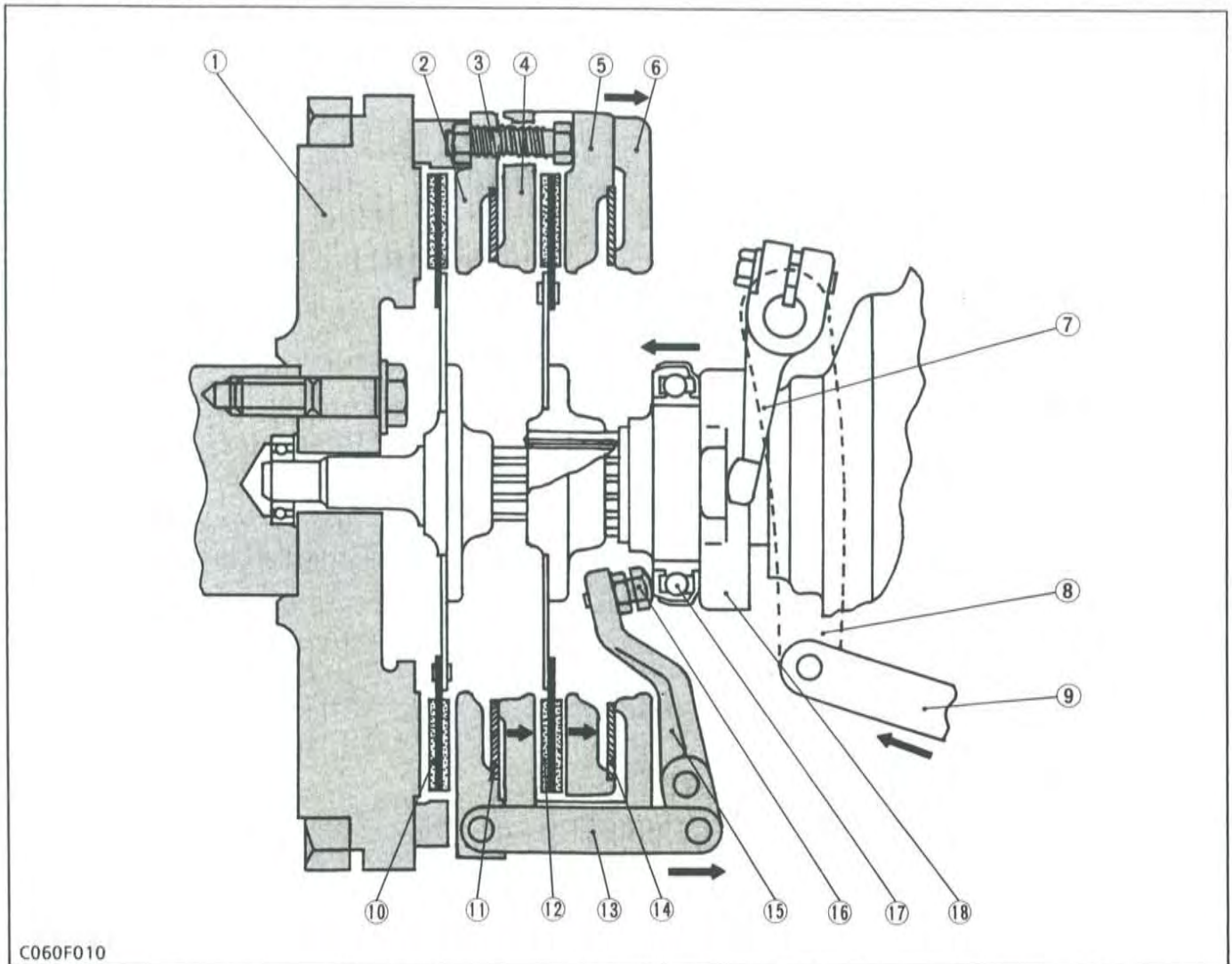
The release lever pulls the pressure plate 1 (2) by means of the release rod (13) as the lever turns at the clevis pin (15) as a fulcrum.

When the pressure plate 1 is pulled, friction force among the clutch cover 1 (4), clutch disc (10) and the pressure plate 1 (2) is lost. The rotation of flywheel is not transmitted to traveling system.

At this time, the pressure plate 2 (5) is in contact with the head of the adjusting screw (3) which serves as a stopper.

■ Traveling Clutch "Disengaged"

■ PTO Clutch "Disengaged"



C060F010

- | | | | |
|----------------------------------|------------------------------|------------------------|----------------------|
| (1) Flywheel | (6) Clutch Cover 2 | (11) Belleville Spring | (16) Adjusting Screw |
| (2) Pressure Plate 1 (Traveling) | (7) Release Fork | (12) Clutch Disc (PTO) | (17) Release Bearing |
| (3) Adjusting Screw | (8) Clutch Lever | (13) Release Rod | (18) Release Hub |
| (4) Clutch Cover 1 | (9) Clutch Rod | (14) Belleville Spring | |
| (5) Pressure Plate 2 (PTO) | (10) Clutch Disc (Traveling) | (15) Release Lever | |

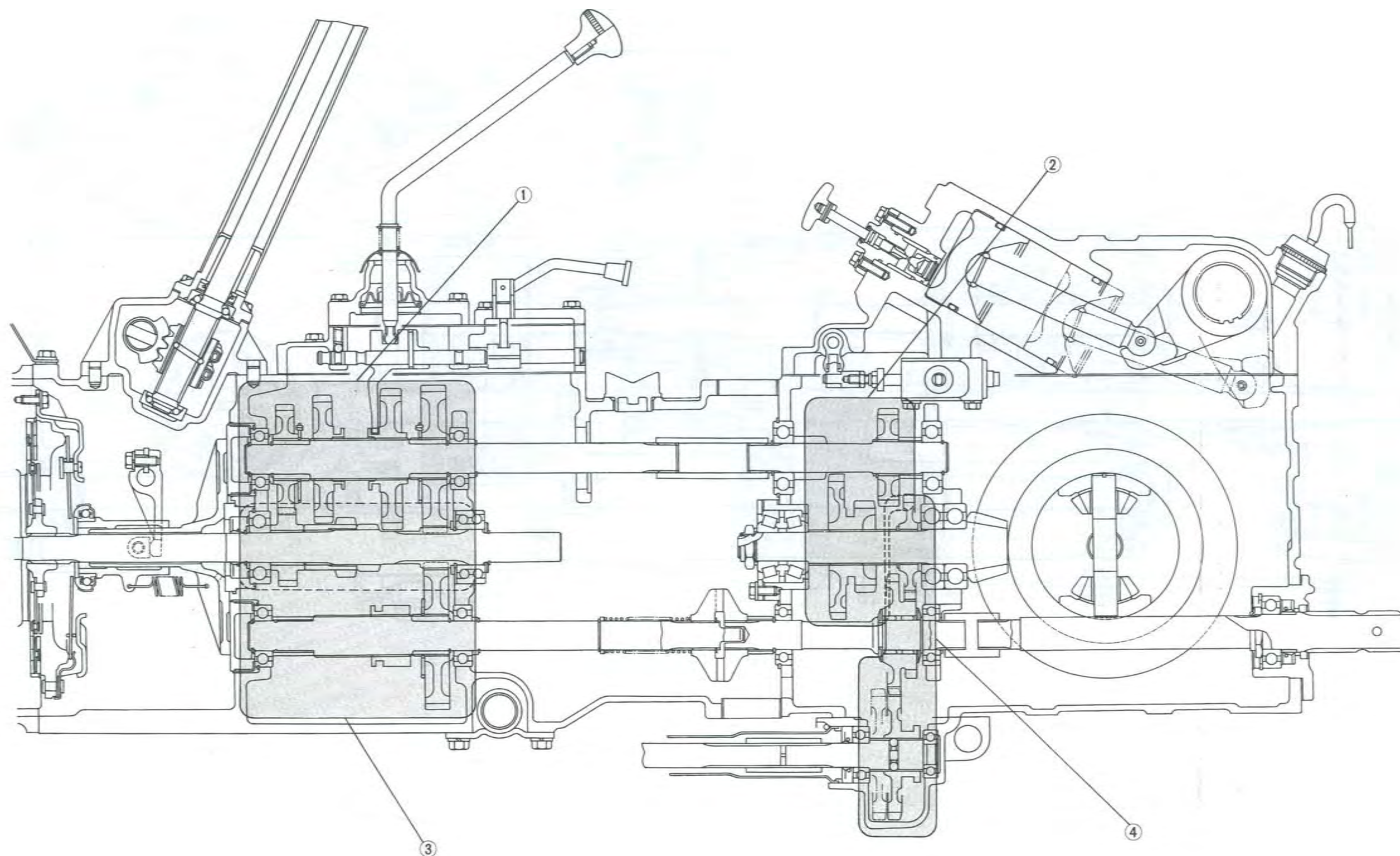
When the clutch pedal is depressed, to the full stroke, the pressure plate 2 (5) is pushed to the right by the adjusting screw (3).

This results in no friction among the flywheel (1), clutch disc (12) and pressure plate 2 (5).

The rotation of flywheel is not transmitted to PTO system and traveling system.

3 TRANSMISSION

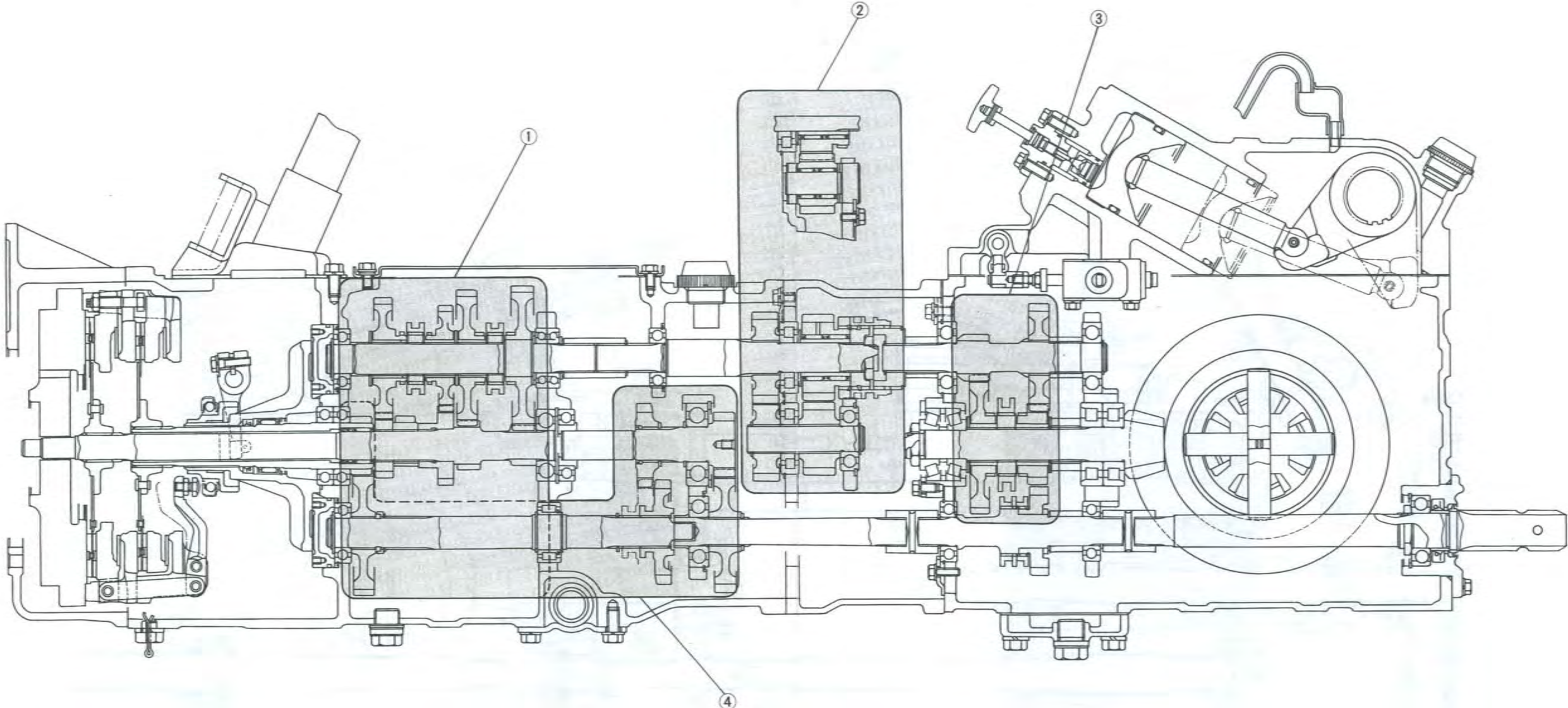
[L2350] (4WD, SINGLE STAGE CLUTCH, PARTIAL CONSTANT-MESH TYPE)



B122F021

- | | |
|-------------------------------|-------------------------------|
| (1) Main Gear Shift Section | (3) PTO Gear Shift Section |
| (2) Hi-Lo Range Shift Section | (4) Front Wheel Drive Section |

[L2950] (2WD, DUAL STAGE CLUTCH, CONSTANT-MESH TYPE)

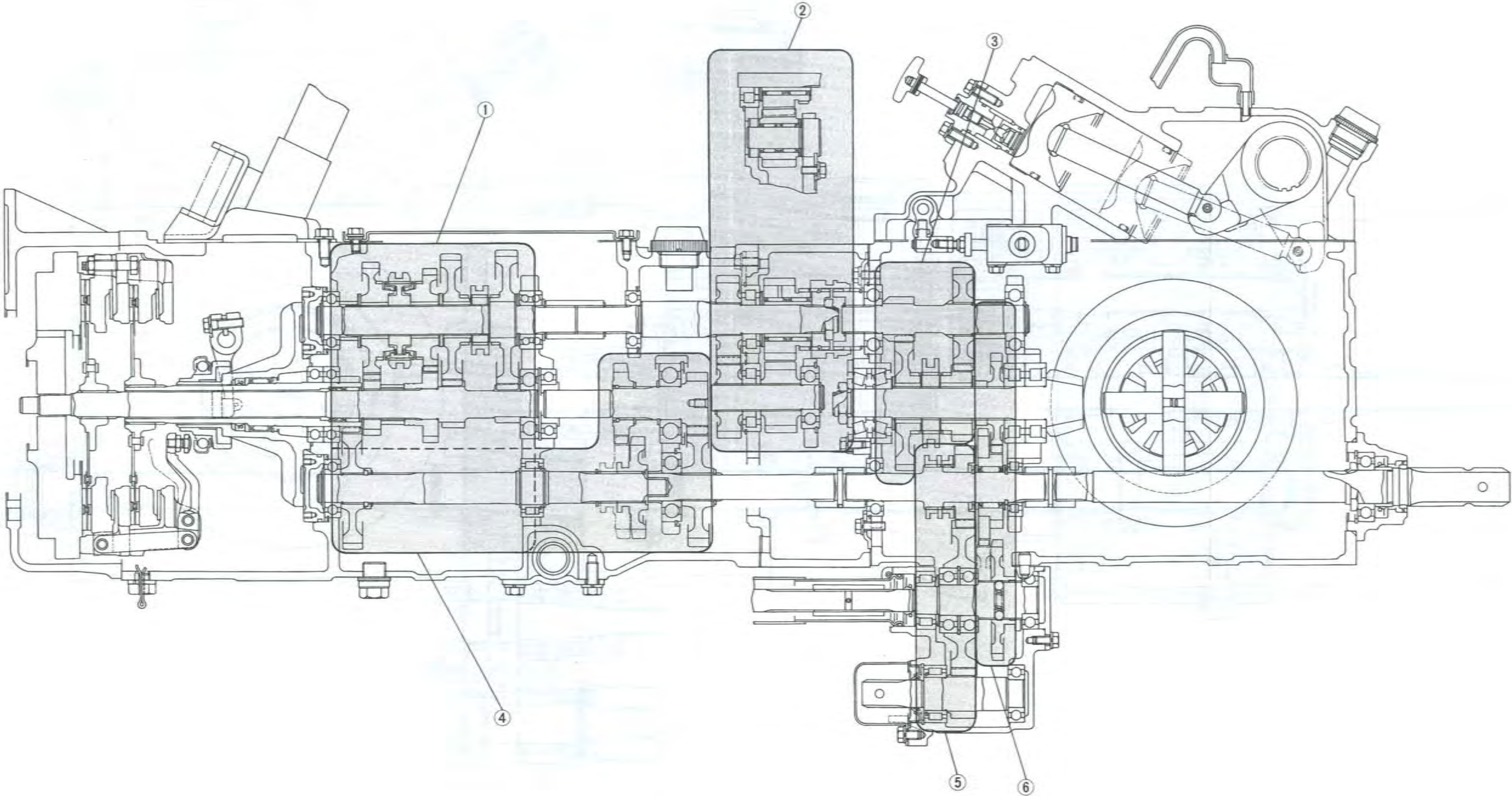


B122F001

- (1) Main Gear Shift Section
- (2) Shuttle Shift Section
- (3) Hi-Lo Range Shift Section
- (4) PTO Gear Shift Section

[L3450]

(4WD, DUAL STAGE CLUTCH, PARTIAL SYNCHROMESH, MID PTO TYPE)

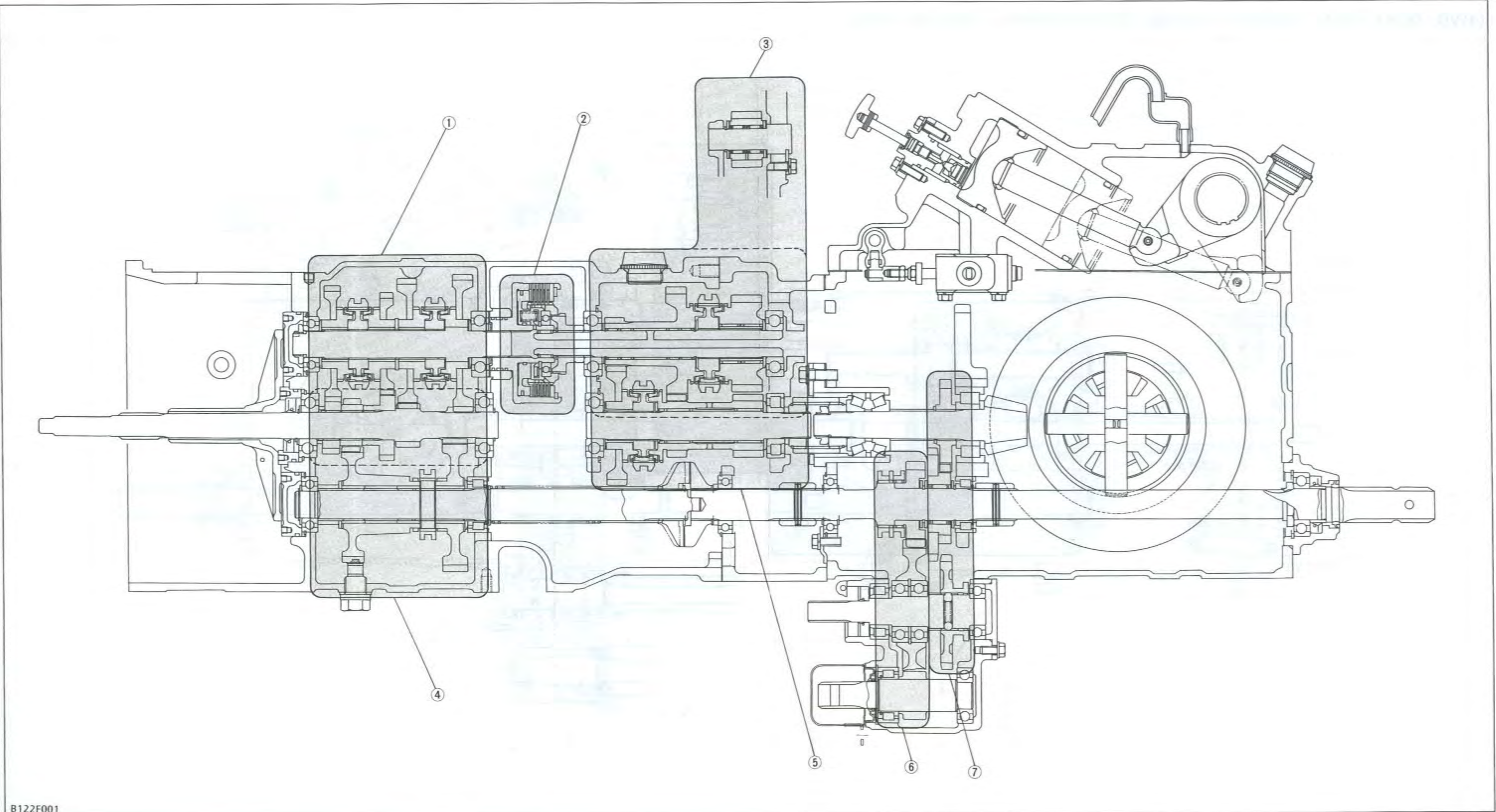


B122F002

- (1) Main Gear Shift Section
- (2) Shuttle Shift Section
- (3) Hi-Lo Range Shift Section

- (4) PTO Gear Shift Section
- (5) Mid PTO Section
- (6) Front Wheel Drive Section [4WD Type]

[L3450GST]



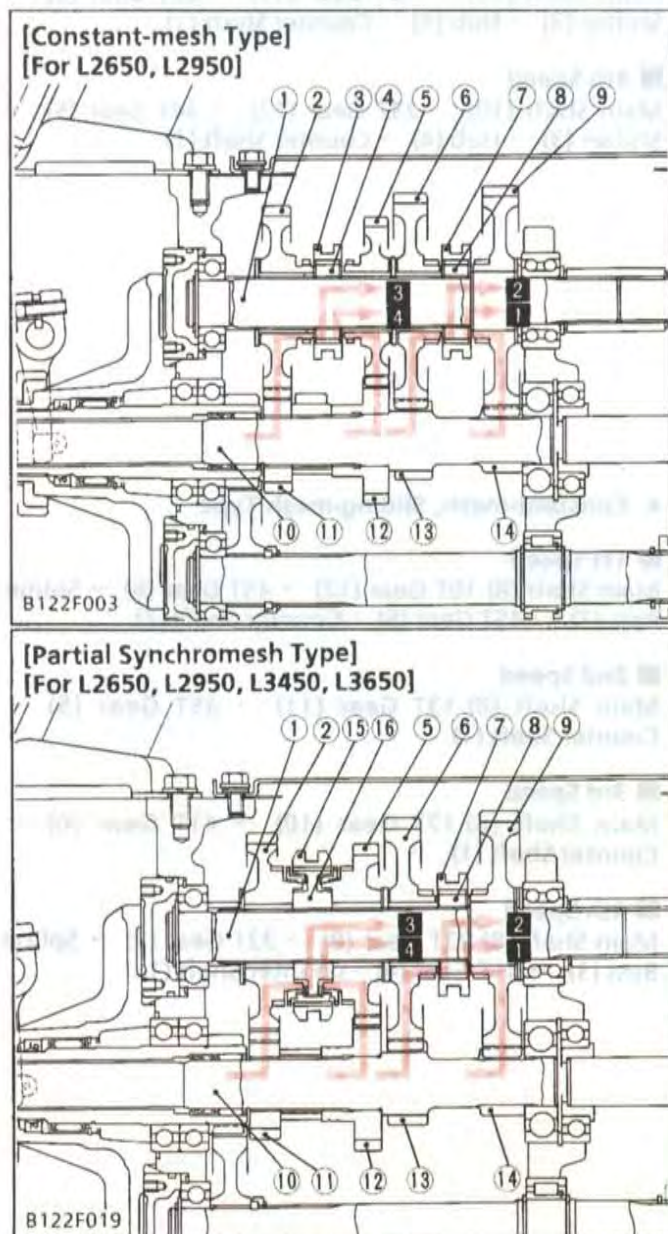
B122F001

- | | |
|-----------------------------|-------------------------------|
| (1) Main Gear Shift Section | (5) Hi-Lo Range Shift Section |
| (2) Clutch Pack | (6) Mid PTO Shift Section |
| (3) Shuttle Shift Section | (7) Front Wheel Drive Section |
| (4) PTO Gear Shift Section | |

[1] POWER TRAIN

The transmission consists of a series of gears and shafts shown previously. It offers the most suitable speed for traveling and operation by combination of these gears. It transmits power to the front axle [4WD Type], rear axle and PTO shaft.

(1) Main Gear Shift Section



- | | |
|-------------------|------------------------------|
| (1) Counter Shaft | (10) Main Shaft |
| (2) 37T Gear | (11) 18T Gear |
| (3) Shifter | (12) 22T Gear [L2650, L2950] |
| (4) Spline Boss | 23T Gear [L3450, L3650] |
| (5) 32T Gear | (13) 13T Gear |
| (6) 42T Gear | (14) 10T Gear |
| (7) Shifter | (15) Shifter |
| (8) Spline Boss | (16) Hub |
| (9) 45T Gear | |

L2350 has 8 forward and 2 reverse speeds. L2650, L2950, L3450 and L3650 have 8 forward and 8 reverse speeds. The traveling system consists of main gear shift section, shuttle shift section, Hi-Lo range shift section.

The PTO system offers 540 rpm or 540 rpm and 1000 rpm PTO speeds by the PTO gear shift lever.

The main shift section is used sliding-mesh type or constant-mesh type or synchromesh type shift systems. They are used depend upon the models and the specifications.

Rotary power which is transmitted from the engine to the main shaft via the clutch is changed in four ways by operating the main gear shift lever to shift the shifters, and transmits to the counter shaft.

Constant-mesh Type and Partial Synchromesh Type

• Constant-mesh Type and Partial Synchromesh Type

■ 1st Speed

Main Shaft (10) · 10T Gear (14) · 45T Gear (9) → Shifter (7) → Spline Boss (8) → Counter Shaft (1).

■ 2nd Speed

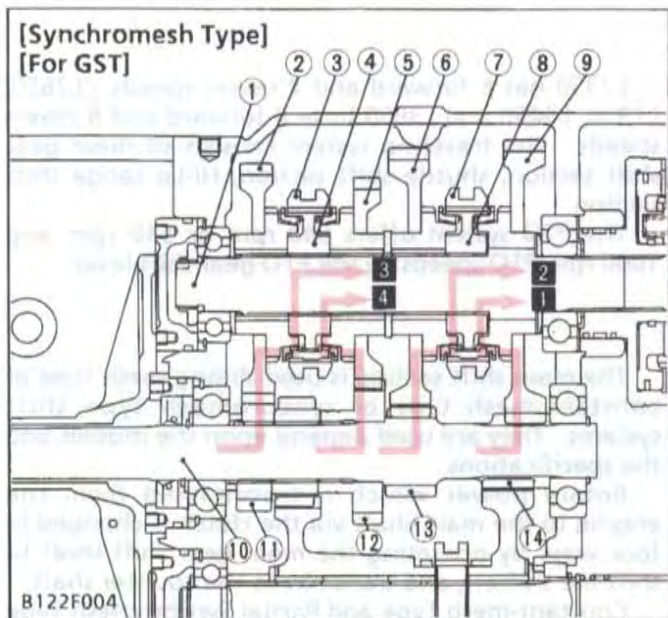
Main Shaft (10) · 13T Gear (13) → 42T Gear (6) → Shifter (7) → Spline Boss (8) → Counter Shaft (1).

■ 3rd Speed

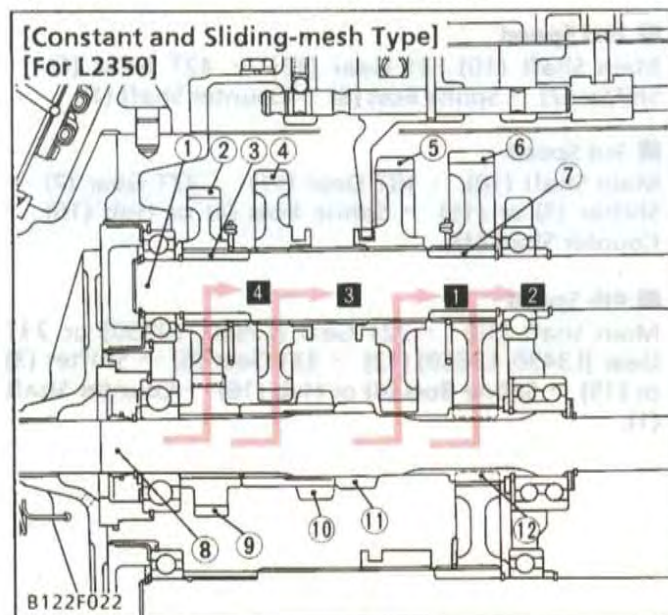
Main Shaft (10) · 18T Gear (11) · 37T Gear (2) → Shifter (3) or (15) · Spline Boss (4) or Hub (16) → Counter Shaft (1).

■ 4th Speed

Main Shaft (10) · 22T Gear [L2650, L2950] or 23T Gear [L3450, L3650] (12) → 32T Gear (5) → Shifter (3) or (15) → Spline Boss (4) or Hub (16) → Counter Shaft (1).



- | | |
|-------------------|-----------------|
| (1) Counter Shaft | (8) Hub |
| (2) 38T Gear | (9) 46T Gear |
| (3) Shifter | (10) Main Shaft |
| (4) Hub | (11) 18T Gear |
| (5) 34T Gear | (12) 23T Gear |
| (6) 43T Gear | (13) 13T Gear |
| (7) Shifter | (14) 10T Gear |



- | | |
|-------------------|-----------------|
| (1) Counter Shaft | (7) Spline Boss |
| (2) 32T Gear | (8) Main Shaft |
| (3) Spline Boss | (9) 23T Gear |
| (4) 41T Gear | (10) 17T Gear |
| (5) 45T Gear | (11) 13T Gear |
| (6) 45T Gear | (12) 10T Gear |

• Synchronmesh Type

■ 1st Speed

Main Shaft (10) → 10T Gear (14) → 46T Gear (9) → Shifter (7) → Hub (8) → Counter Shaft (1).

■ 2nd Speed

Main Shaft (10) → 13T Gear (13) → 43T Gear (6) → Shifter (7) → Hub (8) → Counter Shaft (1).

■ 3rd Speed

Main Shaft (10) → 18T Gear (11) → 38T Gear (2) → Shifter (3) → Hub (4) → Counter Shaft (1).

■ 4th Speed

Main Shaft (10) → 23T Gear (12) → 34T Gear (5) → Shifter (3) → Hub (4) → Counter Shaft (1).

• Constant-mesh, Sliding-mesh Type

■ 1st Speed

Main Shaft (8) → 10T Gear (12) → 45T Gear (6) → Spline Boss (7) → 45T Gear (5) → Counter Shaft (1).

■ 2nd Speed

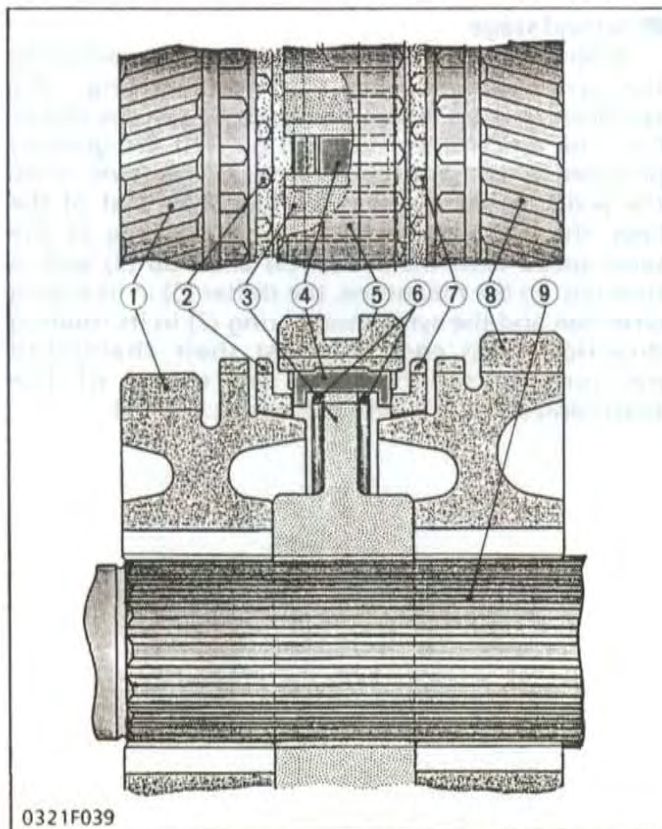
Main Shaft (8) → 13T Gear (11) → 45T Gear (5) → Counter Shaft (1).

■ 3rd Speed

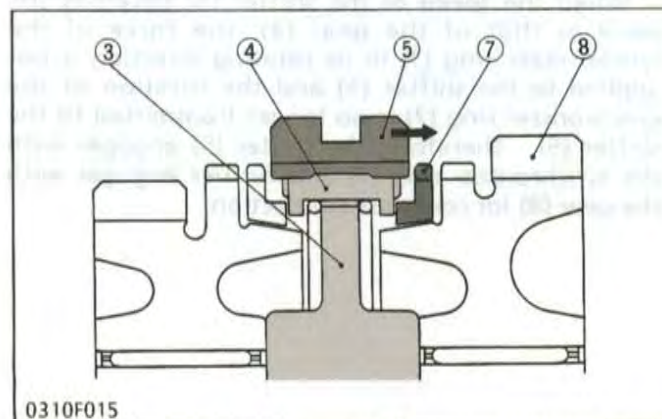
Main Shaft (8) → 17T Gear (10) → 41T Gear (4) → Counter Shaft (1).

■ 4th Speed

Main Shaft (8) → 23T Gear (9) → 32T Gear (2) → Spline Boss (3) → 41T Gear (4) → Counter Shaft (1).



- | | |
|-----------------------|-------------------------|
| (1) Gear | (6) Synchronizer Spring |
| (2) Synchronizer Ring | (7) Synchronizer Ring |
| (3) Hub | (8) Gear |
| (4) Synchronizer Key | (9) Counter Shaft |
| (5) Shifter | |



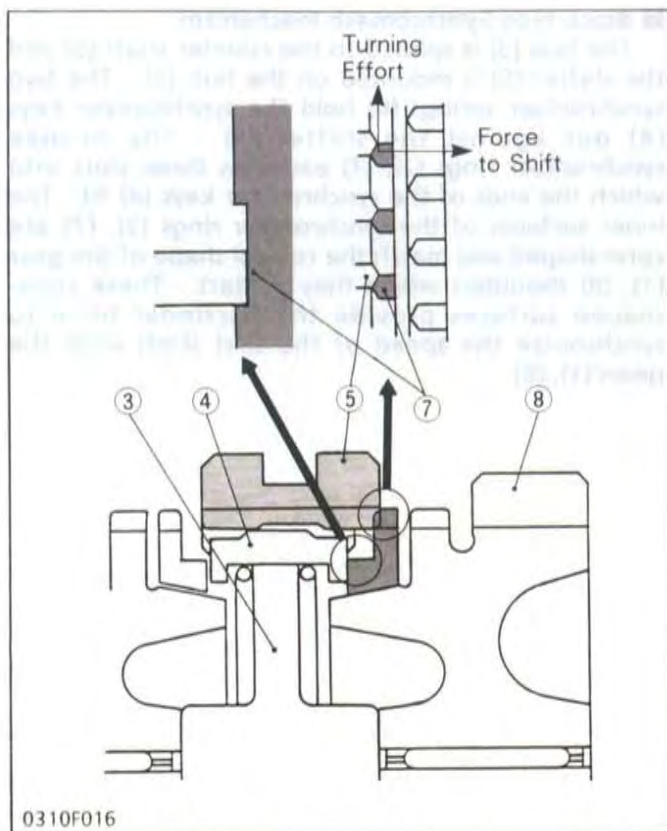
- | | |
|----------------------|-----------------------|
| (3) Hub | (7) Synchronizer Ring |
| (4) Synchronizer Key | (8) Gear |
| (5) Shifter | |

■ Block-type Synchronismesh Mechanism

The hub (3) is splined to the counter shaft (9) and the shifter (5) is mounted on the hub (3). The two synchronizer springs (6) hold the synchronizer keys (4) out against the shifter (5). The bronze synchronizer rings (2), (7) each has three slots into which the ends of the synchronizer keys (4) fit. The inner surfaces of the synchronizer rings (2), (7) are cone-shaped and match the conical shape of the gear (1), (8) shoulders which they contact. These cone-shaped surfaces provide the frictional force to synchronize the speed of the first shaft with the gears (1), (8).

■ First stage

An effort to place the main gear shift lever to the 3rd or 4th speed causes the shifter (5) and synchronizer keys (4) to move slightly. Then, the end surface of the synchronizer key (4) presses the synchronizer ring (7) against the cone-shaped portion of the gear (8). The frictional force generated at the cone-shaped portion rotates the synchronizer ring (7), synchronizer keys (4) and hub (3) which is splined to the counter shaft.



0310F016

(3) Hub
(4) Synchronizer Key
(5) Shifter

(7) Synchronizer Ring
(8) Gear

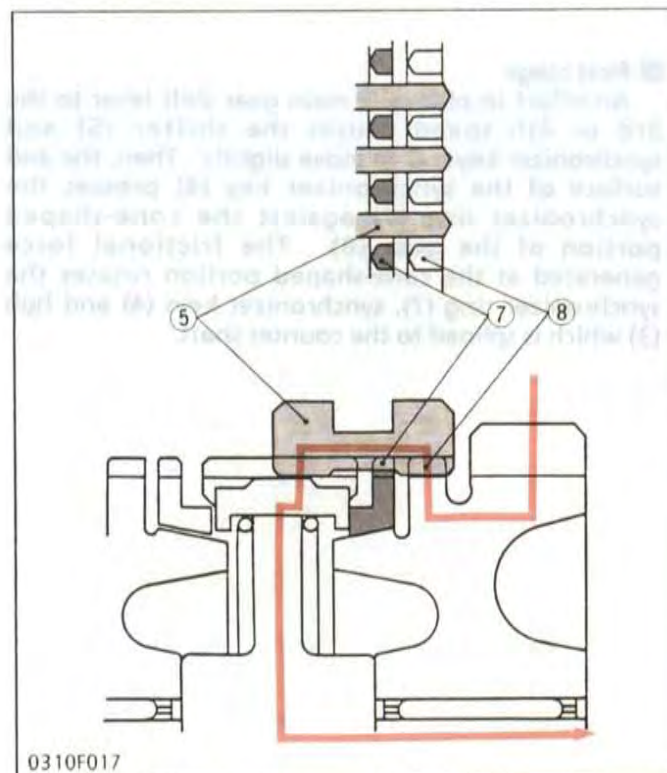
■ Second stage

When the synchronizer keys (4) are prevented by the synchronizer ring (7) from sliding, the synchronizer keys (4) are disengaged from the shifter (5). The synchronizer keys (4) go into the grooves provided in the synchronizer ring (7). However, since the width of the grooves is wider than that of the keys, the synchronizer keys begin rotating at the same speed with the shifter (5) and hub (3) with a time lag. In the meantime, the shifter (5) in its sliding direction and the synchronizer ring (7) in its rotating direction press each other at their chamfered portions to synchronize the speed of the synchronizer ring (7) with that of the gear (8).



■ Final stage

When the speed of the shifter (5) becomes the same as that of the gear (8), the force of the synchronizer ring (7) in its rotating direction is not applied to the shifter (5) and the rotation of the synchronizer ring (7) is no longer transmitted to the shifter (5). Therefore, the shifter (5) engages with the synchronizer ring (7) and further engages with the gear (8) for complete connection.



0310F017

(5) Shifter
(7) Synchronizer Ring

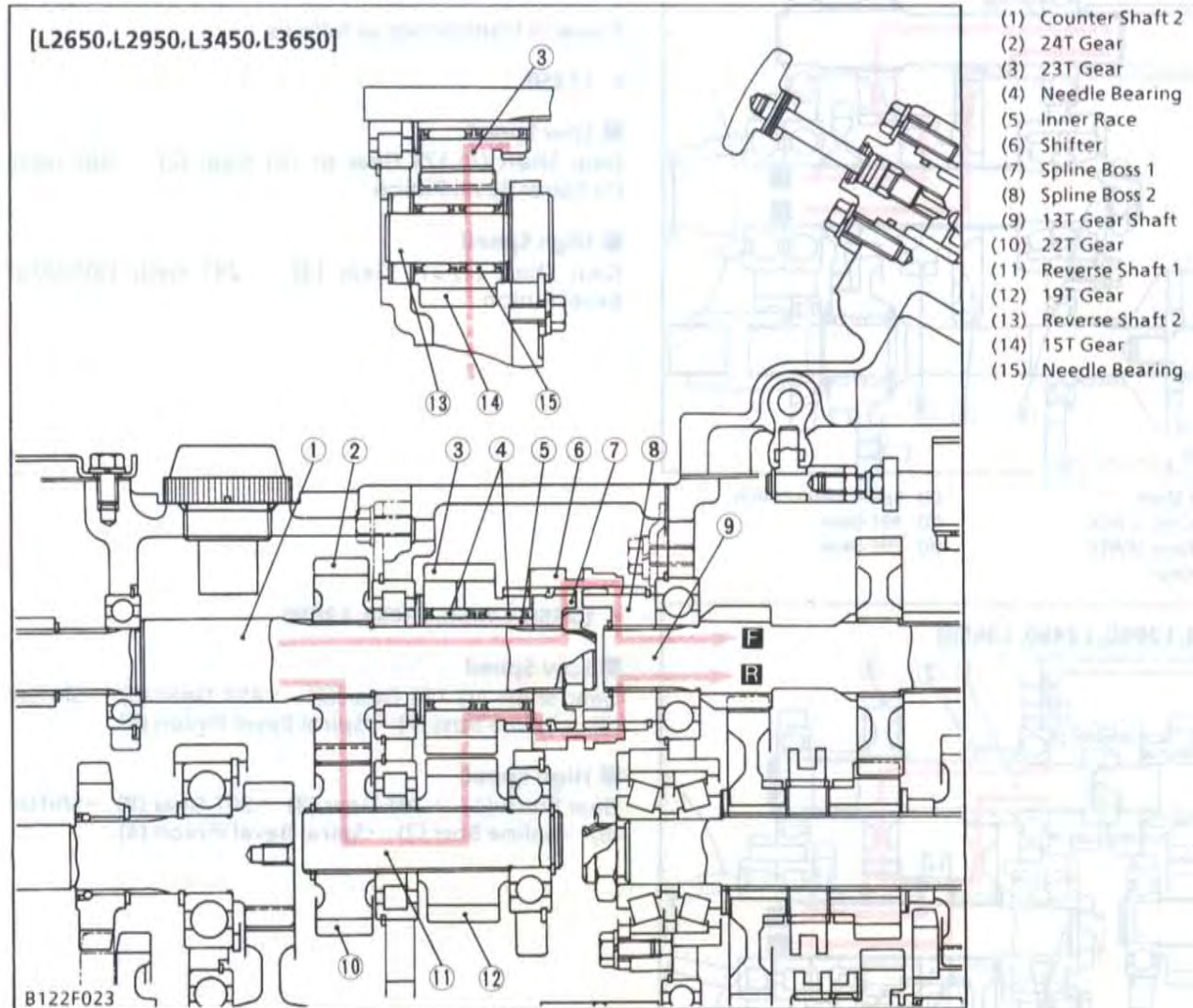
(8) Gear

(2) Shuttle Shift Section

For L2650, L2950, L3450 and L3650

The shuttle shift section allows the operator to change forward and reverse for each speed from the first to eighth with a single shift lever.

It also operates as a reduction unit when shifting from forward to reverse.



The 24T gear (2) and spline boss 1 (7) are splined to the counter shaft 2 (1). The 22T gear (10) and 19T gear (12) are splined to the reverse shaft 1 (11). The 24T gear (2) and 22T gear (10), the 19T gear (12) and 15T gear (14), the 15T gear and 23T gear (3) are constantly meshed with each other. Therefore, the 24T gear (2) and 23T gear (3) rotate in the opposite direction whenever the traveling clutch is engaged.

When the shuttle lever is moved to the forward or reverse position, the shifter (6) is slid to the rear or front by the mechanical linkage to be engaged with the spline boss 1 (7) or spline boss of 23T gear (3). Then, the power is transmitted to the 13T gear shaft (9).

Power is transmitted as follows.

■ Forward

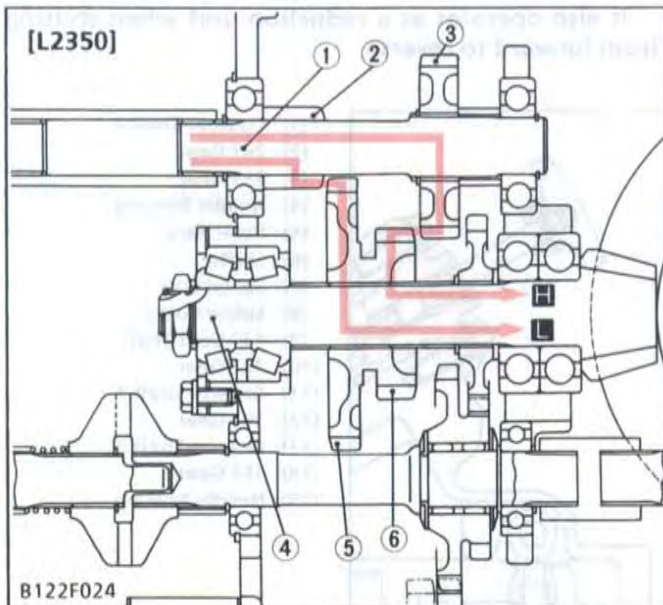
Counter Shaft 2 (1) → Spline Boss 1 (7) → Shifter (6) → Spline Boss 2 (8) → 13T Gear Shaft (9).

■ Reverse

Counter Shaft 2 (1) → 24T Gear (2) → 22T Gear (10) → Reverse Shaft 1 (11) → 19T Gear (12) → 15T Gear (14) → 23T Gear (3) → Shifter (6) → Spline Boss 2 (8) → 13T Gear Shaft (9).

■ IMPORTANT

- Do not shift the shuttle lever when the tractor is moving.

(3) Hi-Lo Range Shift Section**For L2350, L2650, L2950, L3450 and L3650**

- | | |
|--------------------------------------|-------------------------|
| (1) Gear Shaft | (4) Spiral Bevel Pinion |
| (2) 12T Gear (2WD)
10T Gear (4WD) | (5) 48T Gear |
| (3) 31T Gear | (6) 29T Gear |

Besides neutral, two ways of power flow from the gear shaft (1) to the spiral bevel pinion (4) are available by operating the auxiliary gear shift lever.

Power is transmitted as follows.

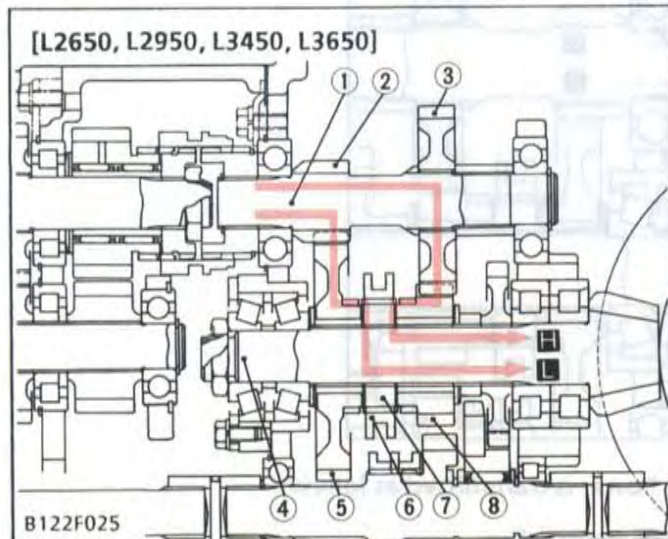
- **L2350**

- **Low Speed**

Gear Shaft (1)-12T Gear or 10T Gear (2) → 48T Gear (5)-Spiral Bevel Pinion.

- **High Speed**

Gear Shaft (1)-31T Gear (3) → 29T Gear (6)-Spiral Bevel Pinion.



- | | |
|-------------------------|-----------------|
| (1) Gear Shaft | (5) 45T Gear |
| (2) 13T Gear | (6) Shifter |
| (3) 28T Gear | (7) Spline Boss |
| (4) Spiral Bevel Pinion | (8) 20T Gear |

- **L2650, L2950, L3450, L3650**

- **Low Speed**

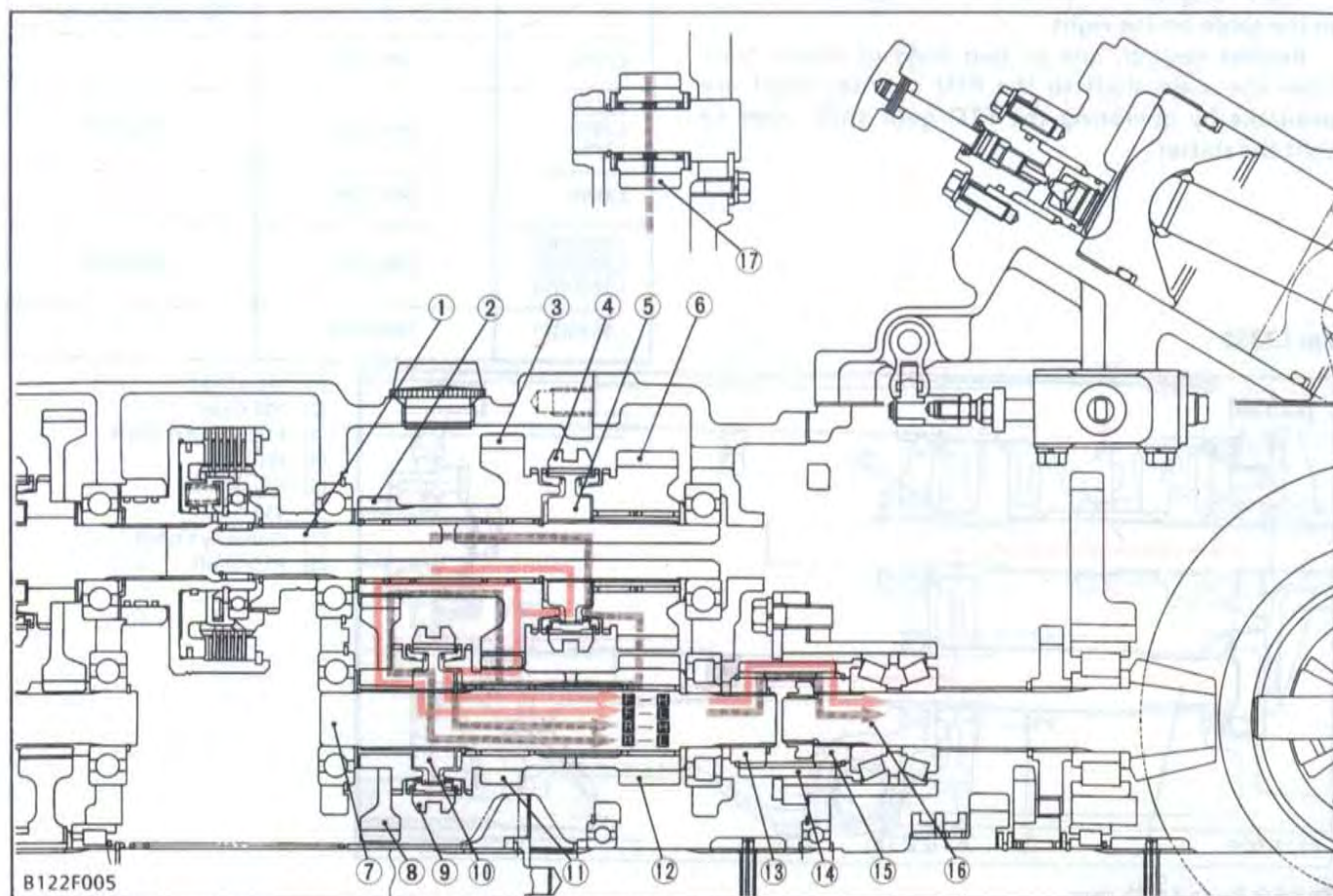
Gear Shaft (1)-13T Gear (2) → 45T Gear (5) → Shifter (6) → Spline Boss (7) → Spiral Bevel Pinion (4).

- **High Speed**

Gear Shaft (1) → 28T Gear (3) → 20T Gear (8) → Shifter (6) → Spline Boss (7) → Spiral Bevel Pinion (4).

(4) Shuttle Shift and Hi-Lo Range Shift Section

For GST



- | | | | |
|------------------------------|-----------------|-------------------------------|--------------------------|
| (1) Shuttle Shaft | (5) Hub | (10) Hub | (14) Coupling |
| (2) 17T Gear | (6) 27T Gear | (11) 17T Gear | (15) Spline Boss 2 |
| (3) 32T Gear (Only L2650GST) | (7) Hi-Lo Shaft | (12) 19T Gear (Only L2650GST) | (16) Spiral Bevel Pinion |
| 33T Gear (other models) | (8) 42T Gear | 18T Gear (Other models) | (17) 23T Gear |
| (4) Shifter | (9) Shifter | (13) Spline Boss 1 | |

They are used the synchromesh gears for the Hi-Lo shift and the shuttle shift gears.

Power is transmitted as follows.

■ Low Speed (Forward)

Shuttle Shaft (1) → Hub (5) → Shifter (4) → 32T Gear or 33T Gear (3) · 17T Gear (2) → 42T Gear (8) → Shifter (9) → Hub (10) → Hi-Lo Shaft (7) → Spline Boss 1 (13) → Coupling (14) → Spline Boss 2 (15) → Spiral Bevel Pinion (16).

■ High Speed (Forward)

Shuttle Shaft (1) → Hub (5) → Shifter (4) → 32T Gear or 33T Gear (3) · 17T Gear (11) → Shifter (9) → Hub (10) → Hi-Lo Shaft (7) → Spline Boss 1 (13) → Coupling (14) → Spline Boss 2 (15) → Spiral Bevel Pinion (16).

■ Low Speed (Reverse)

Shuttle Shaft (1) → Hub (5) → Shifter (4) → 27T Gear (6) → 23T Gear (17) → 19T Gear or 18T Gear (12) · 17T Gear (11) → 32T Gear or 33T Gear (3) · 17T Gear (2) → 42T Gear (8) → Shifter (9) → Hub (10) → Hi-Lo Shaft (7) → Spline Boss 1 (13) → Coupling (14) → Spline Boss 2 (15) → Spiral Bevel Pinion (16).

■ Higher Speed (Reverse)

Shuttle Shaft (1) → Hub (5) → Shifter (4) → 27T Gear (6) → 23T Gear (17) → 19T Gear or 18T Gear (12) · 17T Gear (11) → Shifter (9) → Hub (10) → Hi-Lo Shaft (7) → Spline Boss 1 (13) → Coupling (14) → Spline Boss 2 (15) → Spiral Bevel Pinion (16).

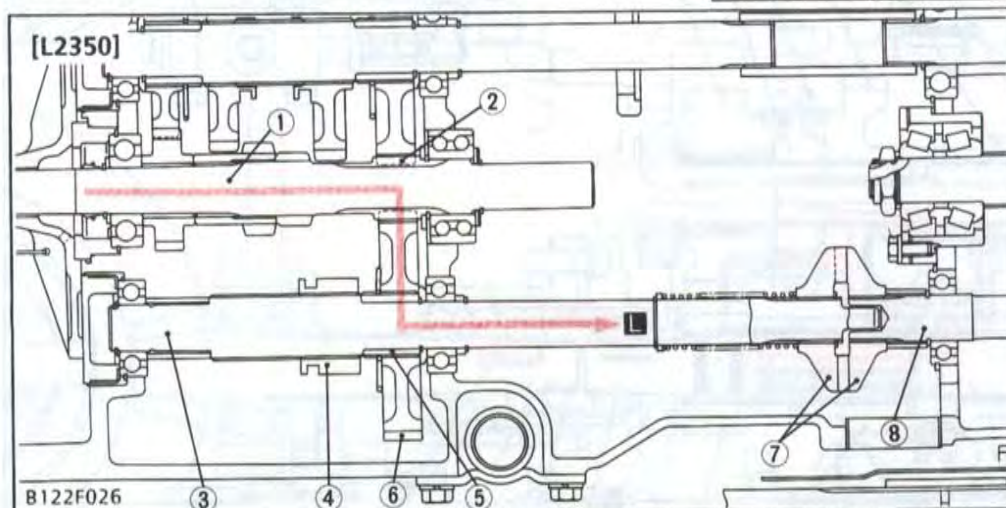
(5) Rear PTO Shift Section

The PTO system offers one or two speeds as shown in the table on the right.

Besides neutral, one or two ways of power train from the main shaft to the PTO counter shaft are available by operating the PTO gear shift lever to shift the shifter.

	Lower Speed PTO rpm/Engine rpm	Higher Speed PTO rpm/Engine rpm
L2350	540/2430	—
L2650 L2950 L3450	540/2298	1000/2438
L3650	540/2298	—
L2650GST L2950GST L3450GST	540/2430	1000/2438
L3650GST	540/2430	—

For L2350

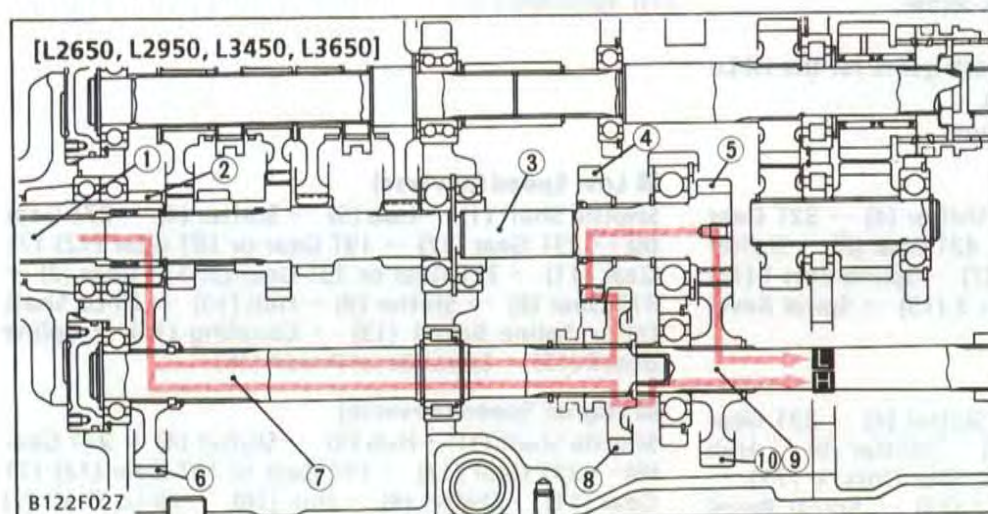


- (1) Main Shaft
- (2) 10T Gear
- (3) PTO Counter Shaft
- (4) Shifter
- (5) Spline Boss
- (6) 45T Gear
- (7) One-way Clutch
- (8) PTO Shaft

■ PTO Speed 540 rpm

Main Shaft (1) → 10T Gear (2) → 45T Gear (6) → Spline Boss (5) → Shifter (4) → PTO Counter Shaft (3) → One-way Clutch (7) → PTO Shaft (8).

For L2650, L2950, L3450 and L3650



- (1) Main Shaft
- (2) 16T Gear (L2650-L2950)
17T Gear (L3450-L3650)
- (3) PTO Gear Shaft
- (4) 18T Gear
- (5) 13T Gear (L2650-L2950)
12T Gear (L3450-L3650)
- (6) 39T Gear (L2650-L2950)
37T Gear (L3450-L3650)
- (7) PTO Counter Shaft 1
- (8) 23T Gear
- (9) PTO Counter Shaft 2
- (10) 29T Gear (L2650-L2950)
30T Gear (L3450-L3650)

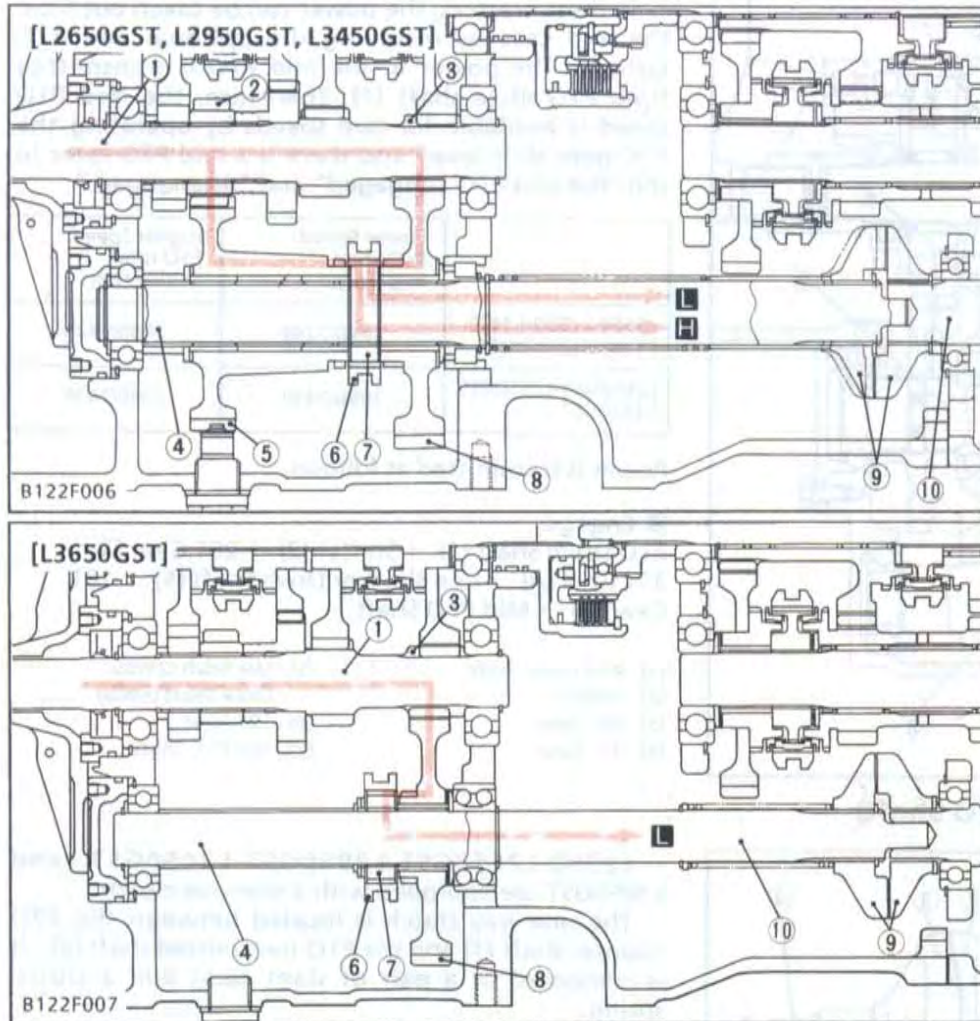
■ PTO Speed 540 rpm

16T Gear or 17T Gear (2) → 39T Gear or 37T Gear (6) → PTO Counter Shaft 1 (7) → 23T Gear (8) → 18T Gear (4) → PTO Gear Shaft (3) → 13T Gear or 12T Gear (5) → 29T Gear or 30T Gear (10) → PTO Counter Shaft 2 (9) → PTO Shaft.

■ PTO Speed 1000 rpm

16T Gear or 17T Gear (2) → 39T Gear or 37T Gear (6) → PTO Counter Shaft 1 (7) → 23T Gear (8) → PTO Counter Shaft 2 (9) → PTO Shaft.

For L2650GST, L2950GST, L3450GST and L3650GST



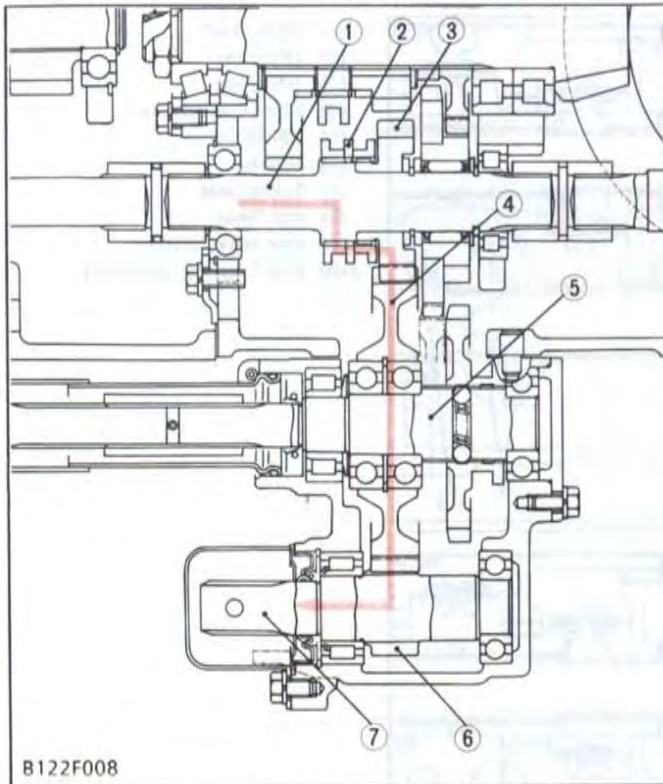
- (1) Main Shaft
- (2) 16T Gear
- (3) 10T Gear
- (4) PTO Counter Shaft
- (5) 39T Gear
- (6) Shifter
- (7) Spline Boss
- (8) 45T Gear
- (9) One-way Clutch
- (10) PTO Transmitted Shaft

■ PTO Speed 540 rpm

Main Shaft (1)-10T Gear (3) → 45T Gear (8) → Shifter (6) → Spline Boss (7) → PTO Counter Shaft (4) → One-way Clutch (9) → PTO Transmitted Shaft (10) → PTO Drive Shaft → PTO Shaft.

■ PTO Speed 1000 rpm

Main Shaft (1)-16T Gear (2) → 39T Gear (5) → Shifter (6) → Spline Boss (7) → PTO Counter Shaft (4) → One-way Clutch (9) → PTO Transmitted Shaft (10) → PTO Drive Shaft → PTO Shaft.

(6) Mid PTO Section (Option For L2650, L2950, L3450)

In these tractors, the power can be taken out from the mid case by installing the optional mid PTO system. The power to the mid PTO is transmitted from PTO drive shaft (1); therefore, the mid PTO speed is available for two speeds by operating the PTO gear shift lever, and there is a mid PTO lever to shift the mid PTO "engaged" and "disengaged."

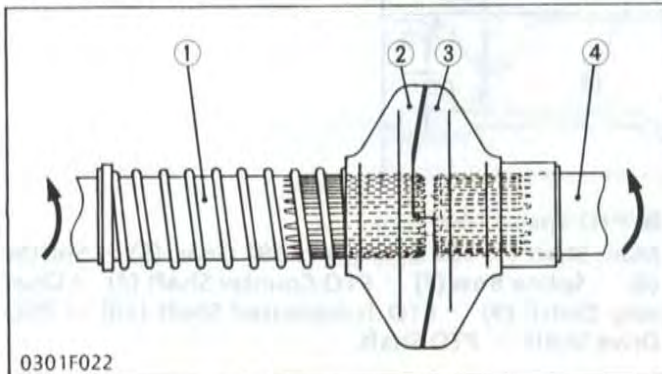
	Lower Speed PTO rpm/ Engine rpm	Higher Speed PTO rpm/ Engine rpm
L2650 L2950-L3450 (dual stage clutch)	1080/2298	2000/2438
L2650GST L2950GST L3450GST	1080/2430	2000/2438

Power is transmitted as follows.

■ Engage

PTO Drive Shaft (1) → Shifter (2) → 20T Gear (3) → 37T Gear (4) → Idle Shaft or Drive Shaft (5) → 10T Gear (6) → Mid PTO Shaft.

- | | |
|---------------------|---|
| (1) PTO Drive Shaft | (5) Idle Shaft (2WD)
Drive Shaft (4WD) |
| (2) Shifter | |
| (3) 20T Gear | (6) 10T Gear |
| (4) 37T Gear | (7) Mid PTO Shaft |

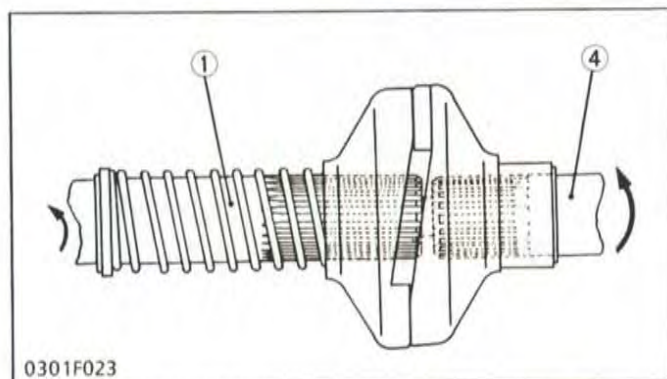
(7) One-way Clutch (For PTO Shaft)

L2350-L2650GST-L2950GST-L3450GST and L3650GST are equipped with a one-way clutch.

The one-way clutch is located between the PTO counter shaft (1) and the PTO transmitted shaft (4). It is composed of a pair of slant cams and a clutch spring.

One of the slant cams is splined to the PTO counter shaft (1), and the other is splined to the PTO transmitted shaft (4).

These two slant cams are engaged with each other by the force of the clutch spring. While the PTO counter shaft is driving the PTO transmitted shaft, these two slant cams will remain engaged.

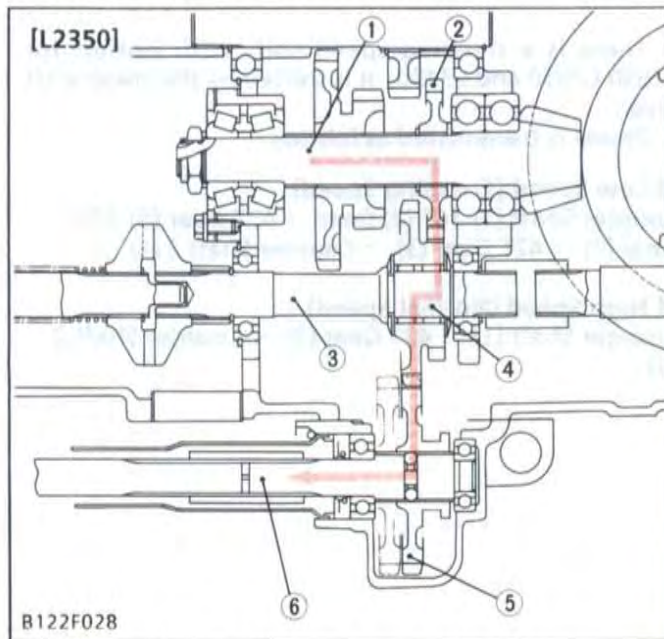


However, when the PTO shaft drives a rotary mower, for example, and if the engine speed is lowered, the slant cam on the PTO transmitted shaft will overrun.

This overrunning is caused by the inertia of the mower's blades. Then, engagement will not take place until the PTO counter shaft is running faster than the PTO transmitted shaft.

In this way, the one-way clutch protects the transmission and engine against damage, by allowing the PTO shaft, PTO drive shaft and PTO transmitted shaft to overrun if PTO shaft overspeeds.

- | | |
|-----------------------|---------------------------|
| (1) PTO Counter Shaft | (3) Slant Cam |
| (2) Slant Cam | (4) PTO Transmitted Shaft |

(8) Front Wheel Drive Section

- | | |
|-------------------------|----------------------------|
| (1) Spiral Bevel Pinion | (4) 18-34T Gears |
| (2) 24T Gear | (5) 33T Shift Gear |
| (3) PTO Drive Shaft | (6) Front Axle Drive Shaft |

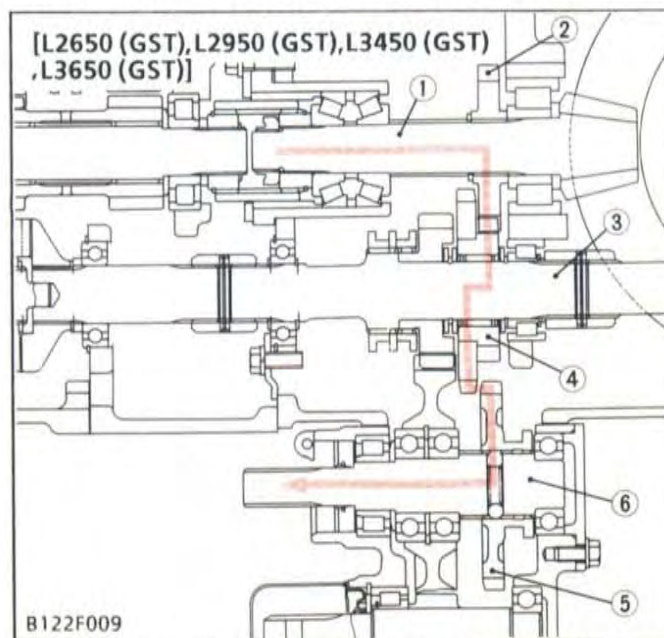
2-wheel drive or 4-wheel drive is selected by operating the front wheel drive lever to shift the 33T or 35T shift gear (5).

When the front wheel drive lever is set to Disengage, 33T shift gear or 35T shift gear (5) is in neutral and power is not transmitted to the front axle drive shaft (6).

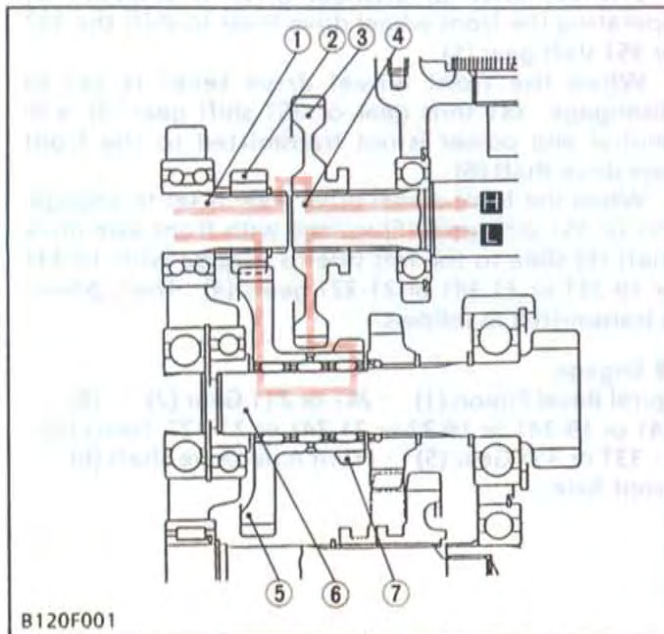
When the front wheel drive lever is set to Engage, 33T or 35T shift gear (5) splined with front axle drive shaft (6) slide to the left side to engage with 19-34T or 19-32T or 21-34T or 21-32T gears (4). Then, power is transmitted as follows.

■ Engage

Spiral Bevel Pinion (1) → 24T or 21T Gear (2) → 18-34T or 19-34T or 19-32 or 21-34T or 21-32T Gears (4) → 33T or 35T Gear (5) → Front Axle Drive Shaft (6) → Front Axle.



- | |
|--|
| (1) Spiral Bevel Pinion |
| (2) 24T Gear (L2650 L2950 L3450 L3650) |
| 21T Gear (L2650GST L2950GST L3450GST L3650GST) |
| (3) PTO Drive Shaft |
| (4) 19-34T Gears (L2650 L2950) |
| 19-32T Gears (L3450 L3650) |
| 21-34T Gears (L2650GST L2950GST) |
| 21-32T Gears (L3450GST L3650GST) |
| (5) 33T Gear (L2650 L2950 L2650GST L2950GST) |
| 35T Gear (L3450 L3650 L3450GST L3650GST) |
| (6) Front Axle Drive Shaft |

(9) Creeping Speed Shift Section (Option)

- | | |
|---------------------|--------------------|
| (1) Counter Shaft | (5) 45T Gear |
| (2) 14T Gear | (6) PTO Gear Shaft |
| (3) 42T Gear | (7) 17T Gear |
| (4) Counter Shaft 2 | |

There is a creeping speed shift with option for L2650-L2950 and L3450. It is shifted by the creep shift lever.

Power is transmitted as follows.

■ **Low Speed (Creeping Speed)**

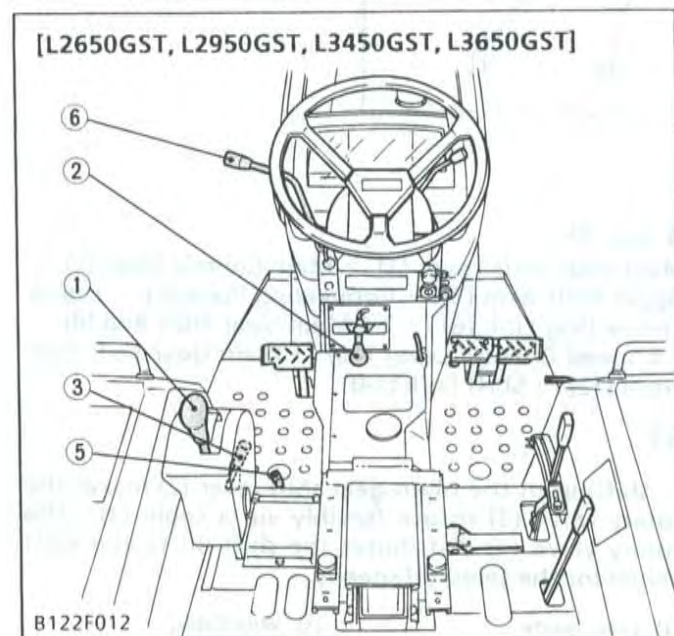
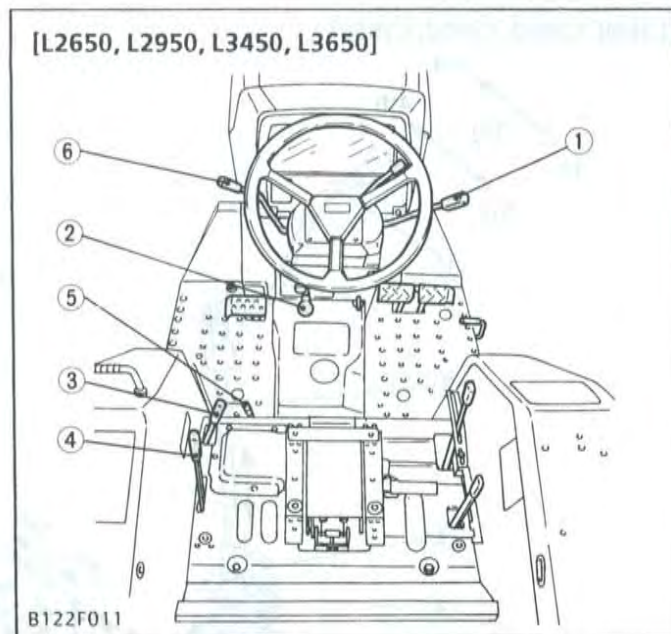
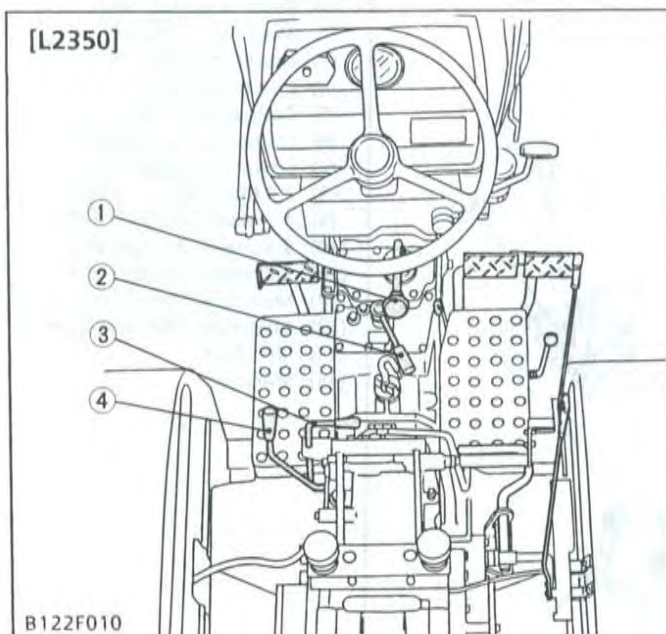
Counter Shaft (1) → 14T (2) Gear → 45T Gear (5) → 17T Gear (7) → 42T Gear (3) → Counter Shaft 2 (4).

■ **High Speed (Normal Speed)**

Counter Shaft (1) → 42T Gear (3) → Counter Shaft 2 (4).

[2] SHIFT LINKAGE MECHANISM

(1) Shift Levers



- | | |
|-----------------------------|----------------------------|
| (1) Main Gear Shift Lever | (4) Hi-Lo Gear Shift Lever |
| (2) PTO Gear Shift Lever | (5) Mid PTO Lever |
| (3) Front Wheel Drive Lever | (6) Shuttle Shift Lever |

■ L2350

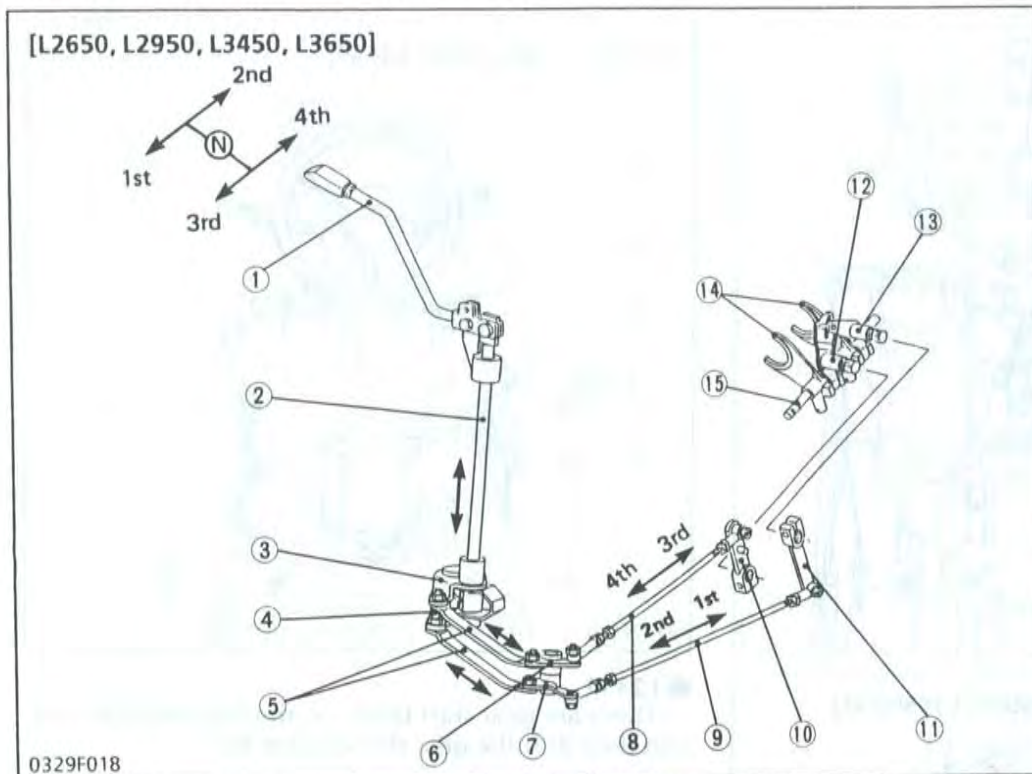
There are gear shift levers on the transmission case and they shift the gear shifters directly.

■ L2650·L2950·L3450·L3650

In these tractors, main gear shift lever and shuttle shift lever are arranged at the steering post. They allow for easy operating like the column shift of an

■ L2650GST·L2950GST·L3450GST·L3650GST

The shuttle lever is located at the steering post. The main shift lever is located left side of the seat and it shifts 1st to 8th gears. It is shifted by the rotary valve which is connected with the main shift lever by the shift wire cable.

(2) Main Gear Shift Lever**For L2650, L2950, L3450 and L3650**

- (1) Main Gear Shift Lever
- (2) Main Control Shaft
- (3) Upper Shift Arm
- (4) Lower Shift Arm
- (5) Connecting Plate
- (6) Upper Connecting Link
- (7) Lower Connecting Link
- (8) 3-4 Main Gear Shift Rod
- (9) 1-2 Main Gear Shift Rod
- (10) 3-4 Speed Change Lever
- (11) 1-2 Speed Change Lever
- (12) Main Gear Shift Arm Front
- (13) Main Gear Shift Arm Rear
- (14) Shift Fork
- (15) Shift Rod

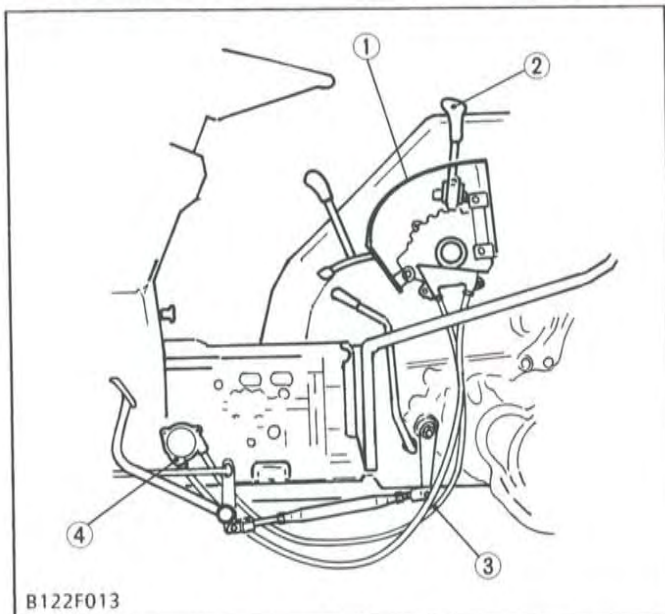
The motion of main gear shift lever linkage as follows.

■ 1st, 2nd

Main Gear Shift Lever (1) → Main Control Shaft (2) → Lower Shift Arm (4) → Connecting Plate (5) → Lower Connecting Link (7) → 1-2 Main Gear Shift Rod (9) → 1-2 Speed Change Lever (11) → Main Gear Shift Arm Rear (13) → Shift Fork (14).

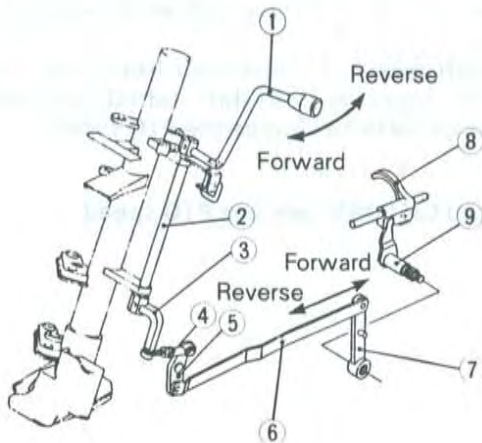
■ 3rd, 4th

Main Gear Shift Lever (1) → Main Control Shaft (2) → Upper Shift Arm (3) → Connecting Plate (5) → Upper Connecting Link (6) → 3-4 Main Gear Shift Rod (8) → 3-4 Speed Change Lever (10) → Main Gear Shift Arm Front (12) → Shift Fork (14).

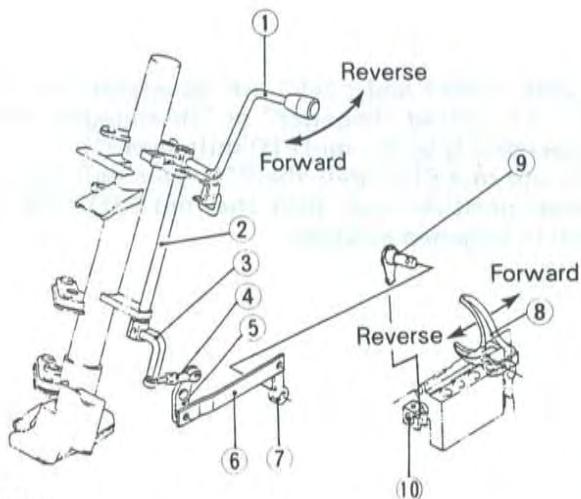
For L2650GST, L2950GST, L3450GST and L3650GST

Shifting of the main gear shift lever (2) makes the rotary valve (4) rotate forcibly via a cable (3). The rotary valve (4) distributes the shift oil to the shift valves for the selected speeds.

- (1) Lever Guide
- (2) Main Shift Lever
- (3) Wire Cable
- (4) Rotary Valve

(3) Shuttle Shift**[L2650, L2950, L3450, L3650]**

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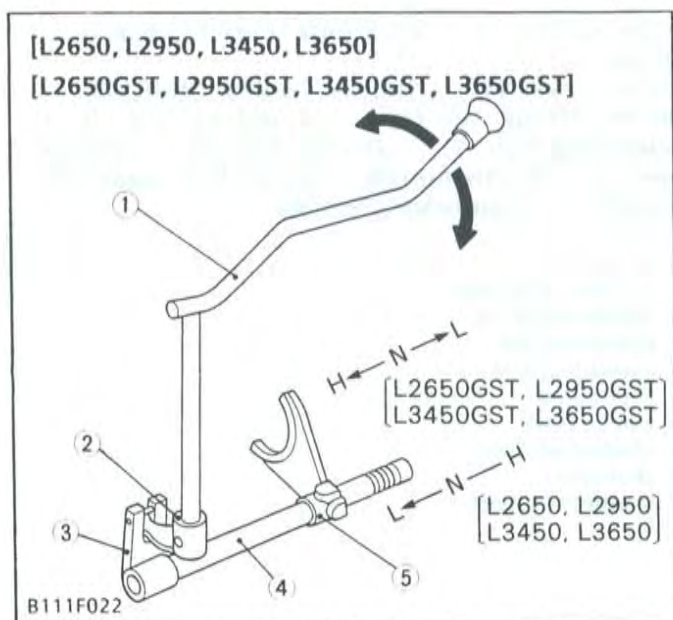
[L2650GST, L2950GST, L3450GST, L3650GST]

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The motion of shuttle shift lever linkage is as follows.

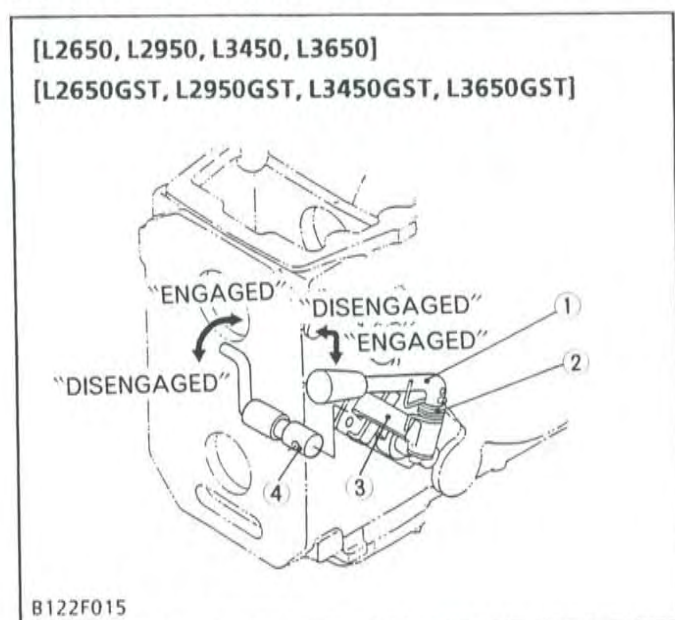
Shuttle Lever (1) → Shuttle Control Shaft (2) → Shuttle Change Arm (3) → Connecting Rod (4) → Connecting Arm (5) → Shuttle Rod (6) → Shuttle Lever (7) → Shuttle Arm (9) → Shuttle Shift Spool (10) (Only GST) → Shuttle Shift Fork (8).

- (1) Shuttle Lever
- (2) Shuttle Control Shaft
- (3) Shuttle Change Arm
- (4) Connecting Rod
- (5) Connecting Arm
- (6) Shuttle Rod
- (7) Shuttle Lever
- (8) Shuttle Shift Fork
- (9) Shuttle Arm
- (10) Shuttle Shift Spool

(4) PTO Shift

- (1) Shift Lever
(2) Shift Arm
(3) Shifter

- (4) Shift Rod
(5) Shift Fork

(5) Mid PTO Shift (Option)

- (1) Mid PTO Lever 1
(2) Spring

- (3) Mid PTO Lever 2
(4) Shift Lever

The PTO shift offers one or two PTO speeds by the PTO shift lever.

Shift lever (1) has shift arm (2) bolted to it. Shift rod (4) has shift fork (5) and shifter (3) individually bolted to it.

When shift lever (1) is operated from side to side, shift fork (5), together with shift rod (4), accordingly moves back or forth to change the PTO speed.

■ NOTE

- L3650 and L3650GST are one PTO speed.

L2650, L2950 and L3450 are equipped the mid-PTO. It is shifted "Engaged" or "Disengaged" semi-independently by the mid PTO shift lever (1).

To use mid PTO, shift the PTO gear shift lever to desired position and, shift the mid PTO lever (1) down to engaged position.

[3] GLIDE SHIFT TRANSMISSION

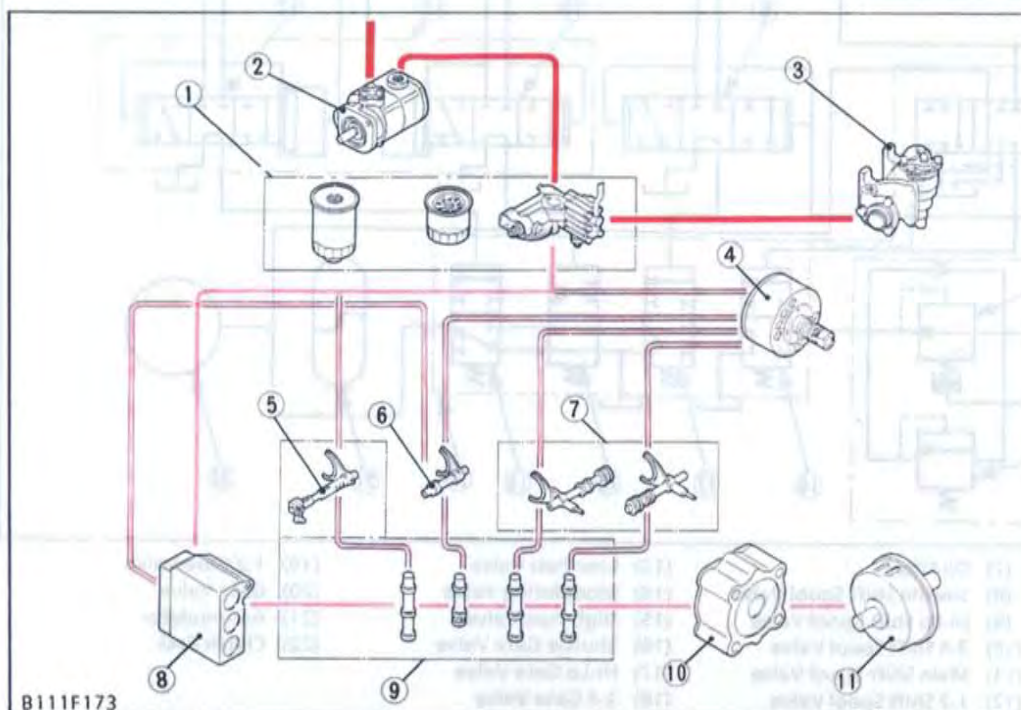
(1) Shift Mechanism

KUBOTA GST eliminates the need to operate a clutch. Axial efficiency and transmission of power to the PTO remain virtually unchanged with the gear shift transmission.

It is consisted with the full-synchromesh gears, one hydraulic clutch and the shift spool valves.

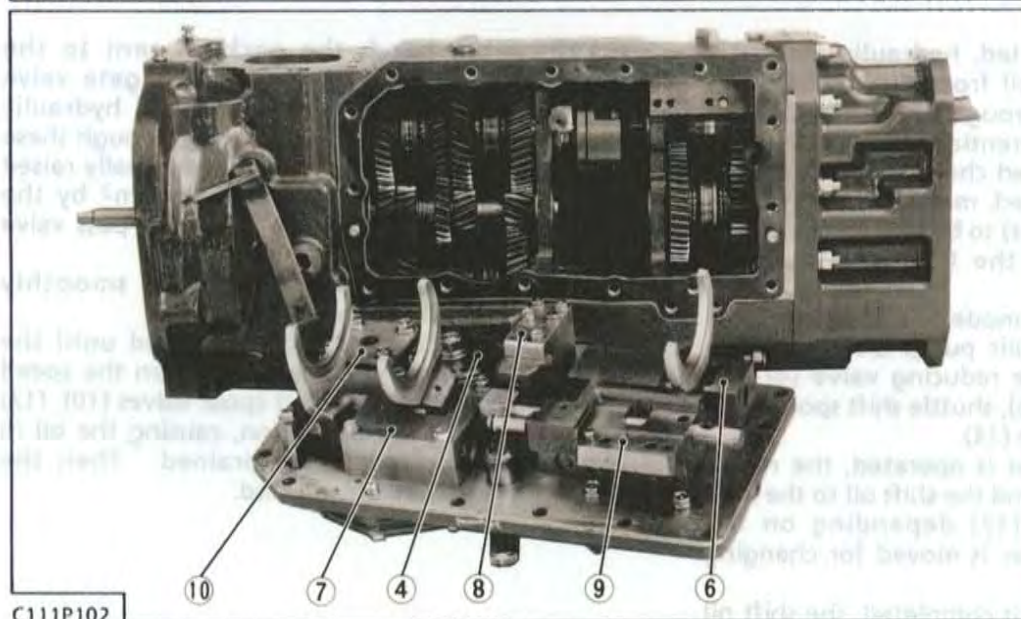
The GST replaces clutch operation with hydraulic pressure. When the operator moves the Speed Change Lever, the GST instantly and automatically performs the correct series of movements.

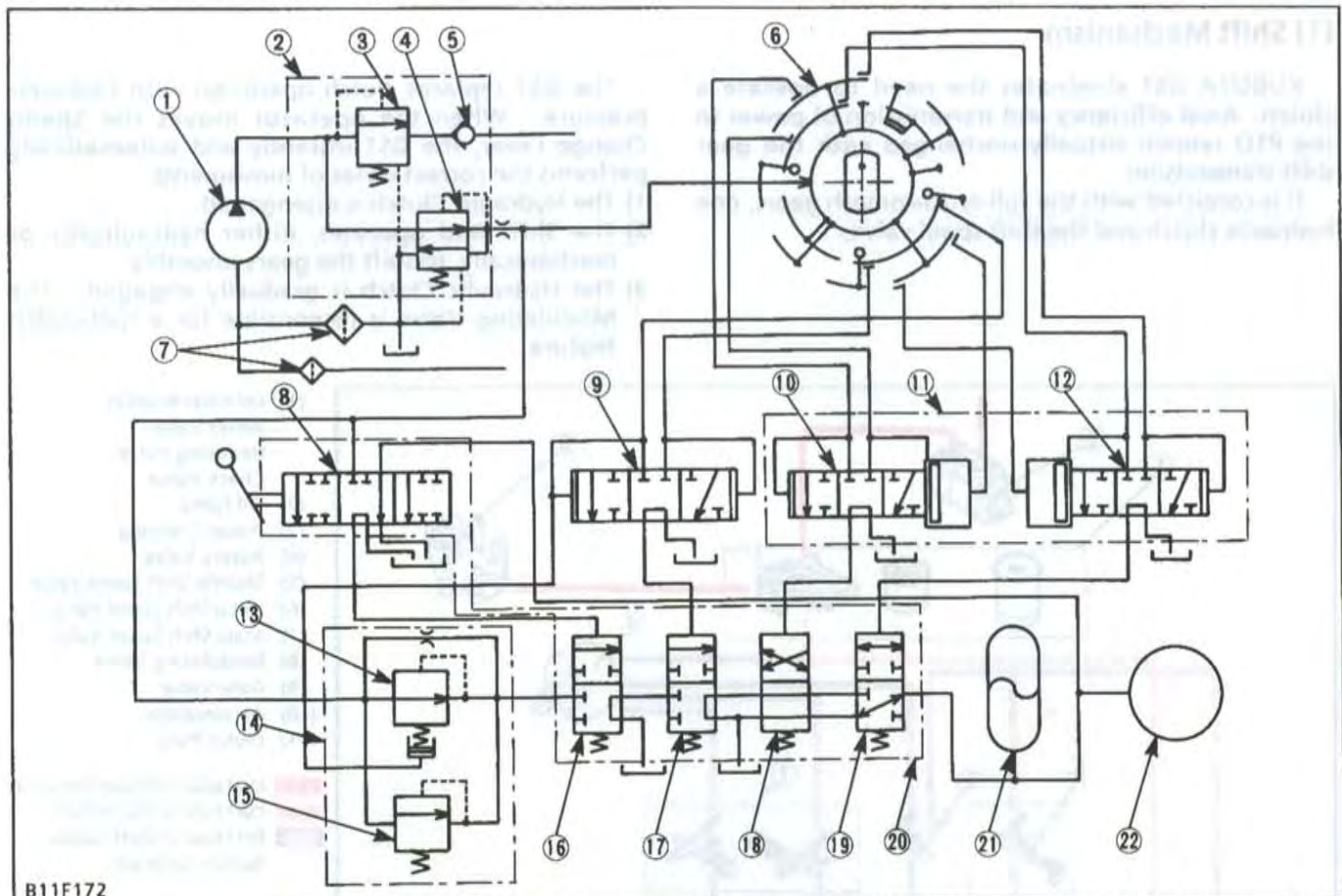
- 1) The Hydraulic Clutch is disengaged.
- 2) The Shift Rod operates, either hydraulically or mechanically, to shift the gears smoothly.
- 3) The Hydraulic Clutch is gradually engaged. The Modulating Valve is responsible for a half-clutch feature.



- (1) Oil Filter Bracket
Relief Valve
Reducing Valve
Check Valve
- (2) Oil Pump
- (3) Power Steering
- (4) Rotary Valve
- (5) Shuttle Shift Spool Valve
- (6) Hi-Lo Shift Spool Valve
- (7) Main Shift Spool Valve
- (8) Modulating Valve
- (9) Gate Valve
- (10) Accumulator
- (11) Clutch Pack

Red line Oil Flow to Power Steering
Pink line Oil Flow to Clutch Pack
Light pink line Oil Flow to Shift Valves Suction or Drain



(2) Hydraulic Circuit Diagram

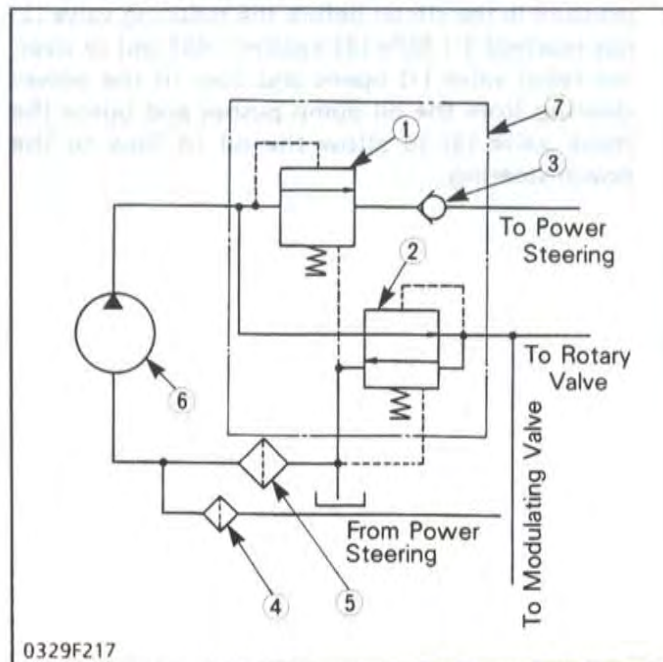
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- | | | | |
|--------------------|-------------------------------|-------------------------|---------------------|
| (1) Hydraulic Pump | (7) Oil Filter | (13) Low-Pass Valve | (19) 1-2 Gate Valve |
| (2) Filter Bracket | (8) Shuttle Shift Spool Valve | (14) Modulating Valve | (20) Gate Valve |
| (3) Relief Valve | (9) Hi-Lo Shift Spool Valve | (15) High-Pass Valve | (21) Accumulator |
| (4) Reducing Valve | (10) 3-4 Shift Spool Valve | (16) Shuttle Gate Valve | (22) Clutch Pack |
| (5) Check Valve | (11) Main Shift Spool Valve | (17) Hi-Lo Gate Valve | |
| (6) Rotary Valve | (12) 1-2 Shift Spool Valve | (18) 3-4 Gate Valve | |

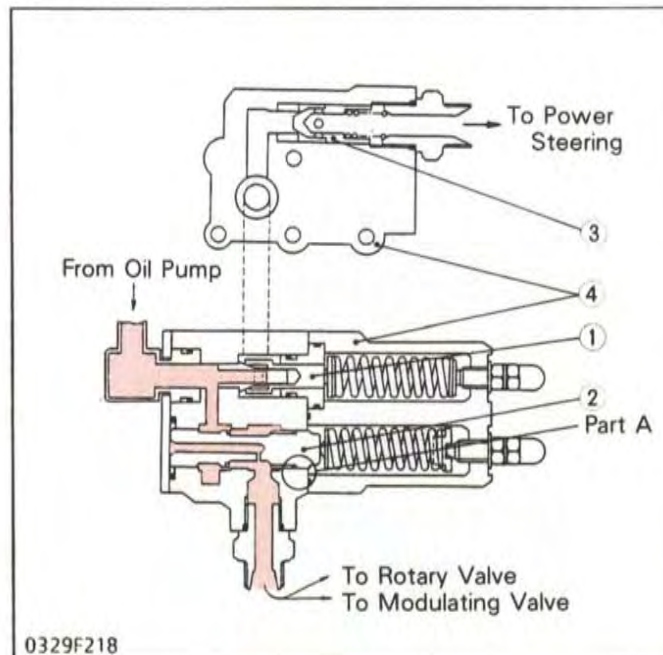
- When the engine is started, hydraulic pump (1) starts and sucks in the oil from the transmission case. The oil is filtered through the oil filter (7).
- The filtered oil is preferentially sent to the GST speed change mode. Except during changing the speed, most of the oil passes through the relief valve (3) to be sent to the power steering circuit, while the GST side is simply pressurized.
- In the GST speed change mode, the pressure of the oil sent from the hydraulic pump is regulated to about 24 kgf/cm² by the reducing valve (4) and sent to the rotary valve (6), shuttle shift spool valve (8), and modulating valve (14).
- When the GST shift lever is operated, the rotary valve (6) is actuated to send the shift oil to the shift spool valves (9), (10), (12) depending on the operation, and the shifter is moved for changing speeds.
- When the speed change is completed, the shift oil is sent to the gate valve (20), depending on the operation and the gate valves (16), (17), (18), (19), are opened.
- On the other hand, the pack oil sent to the modulating valve flows through the gate valve and sent to the accumulator (21) and hydraulic clutch (22). While the oil is flowing through these components, the pressure of oil is gradually raised to the set pressure of about 24 kgf/cm² by the action of the low-pass valve (13), high-pass valve (15) and accumulator.
- Therefore, the hydraulic clutch is smoothly connected with less shock.
- The hydraulic clutch is kept connected until the next speed changing is started. When the speed changing is started, the shift spool valves (10), (12) are set to the neutral position, causing the oil in the hydraulic clutch to be drained. Then the hydraulic clutch is disconnected.

(3) Oil Flow

(3)-1 Oil Filter Bracket



- | | |
|---|---------------------------------|
| (1) Relief Valve, 3.1 to 3.2 MPa
(32.0 to 33.0 kgf/cm ² , 455 to 469 psi) | (4) Paper Filter Cartridge |
| (2) Reducing Valve, 2.4 to 2.5 MPa
(24.0 to 25.0 kgf/cm ² , 341 to 356 psi) | (6) Oil Pump |
| (3) Check Valve | (7) Oil Filter Bracket Assembly |



- | | |
|---|-------------------------|
| (1) Relief Valve, 3.1 to 3.2 MPa
(32.0 to 33.0 kgf/cm ² , 455 to 469 psi) | (3) Check Valve |
| (2) Reducing Valve, 2.4 to 2.5 MPa
(24.0 to 25.0 kgf/cm ² , 341 to 356 psi) | (4) Reducing Valve Body |

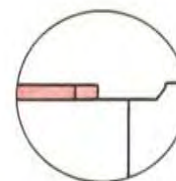
Function

1. The oil filter bracket assembly (7) is directly mounted on the oil pump and comprises the relief valve (1), reducing valve (2), and check valve (3).
2. Oil flow from the oil pump (6) is only distributed to GST system circuit for a moment when changing the speed of the tractor. Normally, the oil flows to the power steering.
3. Part of the power steering oil is used as the GST system oil. A relief valve (1) is installed in the power steering circuit to set the oil pressure at approximately 3.1 MPa (32 kgf/cm², 455 psi) so that the GST system pressure is maintained at approximately 2.4 MPa (24 kgf/cm², 341 psi) by the reducing valve (2).
4. Check valve (3) prevents to drop the power steering oil pressure in the circuit in a moment while shifting.

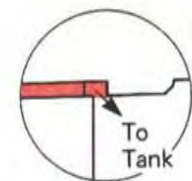
■ GST System Pressure from 0 to 2.4 MPa (0 to 24 kgf/cm², 0 to 341 psi)

1. The flow of the power steering oil pump passes through the reducing valve (2) into the GST system circuit until reaches 2.4 MPa (24 kgf/cm², 341 psi).
2. When oil pressure reaches to 2.4 MPa (24 kgf/cm², 341 psi). The reducing valve (2) moves to right side and it closes the way of oil flow to GST system circuit.
3. When the GST system circuit pressure rises excessively, the safety circuit of the reducing valve (2) actuates to protect the GST system circuit.

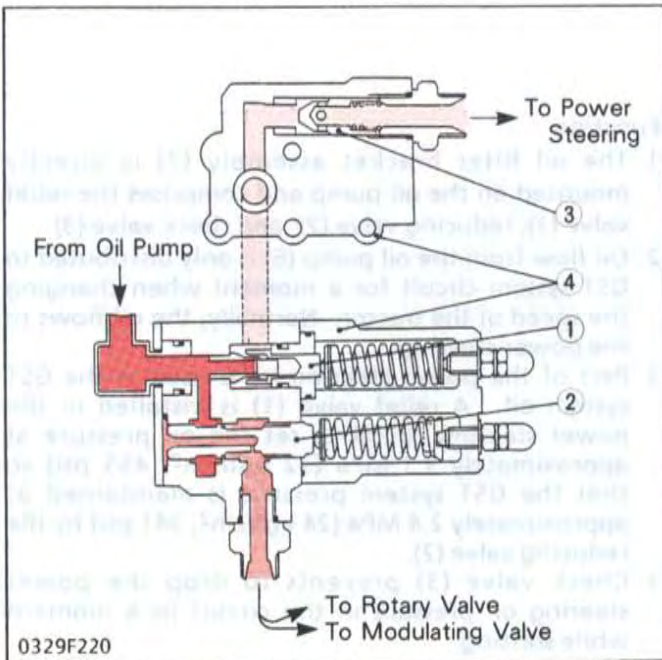
Part A
(Under normal pressure)



Part A
(Under excessive pressure)



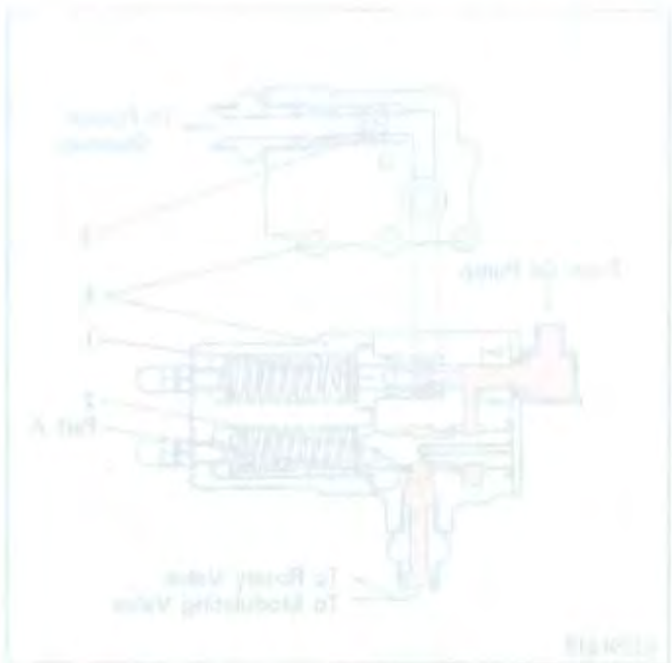
0329F221



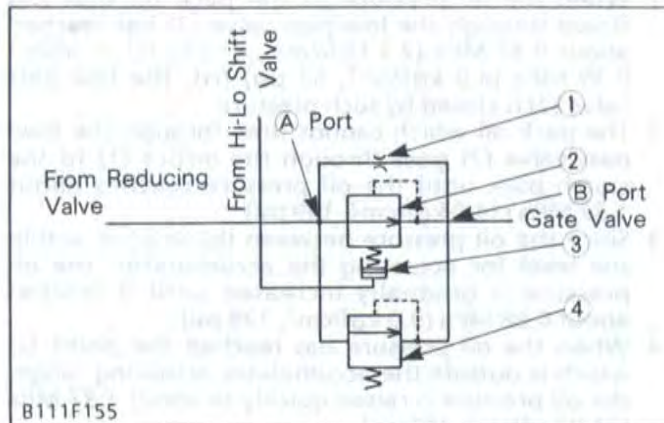
- (1) Relief Valve, 3.1 to 3.2 MPa (32.0 to 33.0 kgf/cm², 455 to 469 psi)
 (2) Reducing Valve, 2.4 to 2.5 MPa (24.0 to 25.0 kgf/cm², 341 to 356 psi)
 (3) Check Valve
 (4) Reducing Valve Body

■ When the Speed is not being changed (during Normal Operation)

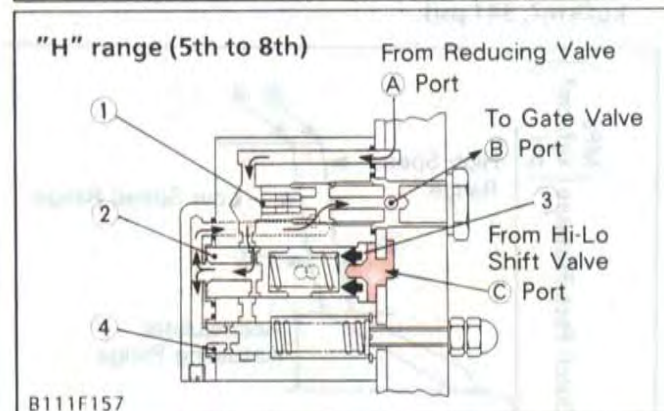
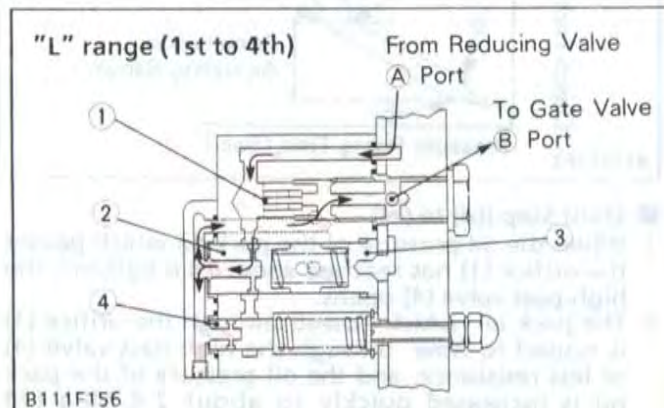
1. When the reducing valve (2) is closed and the pressure in the circuit before the reducing valve (2) has reached 3.1 MPa (32 kgf/cm², 455 psi) or over, the relief valve (1) opens and flow of the power steering from the oil pump pushes and opens the check valve (3) to allow the oil to flow to the power steering.



(3)-2 Modulating Valve (Cut-Off Valve)



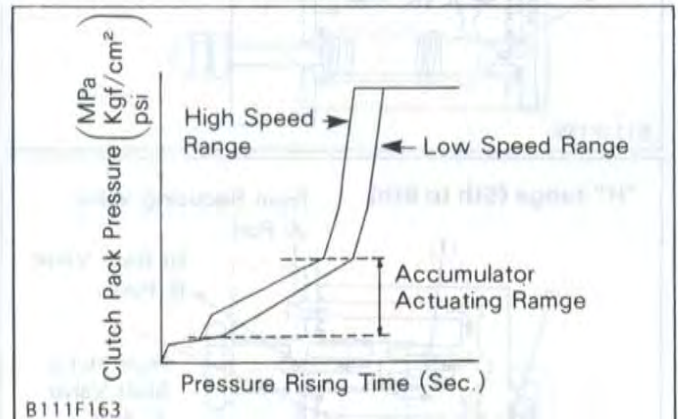
- (1) Orifice
(2) Low-Pass Valve
(3) Low-Pass Piston
(4) High-Pass Valve



- (1) Orifice
(2) Low-Pass Valve
(3) Low-Pass Piston
(4) High-Pass Valve

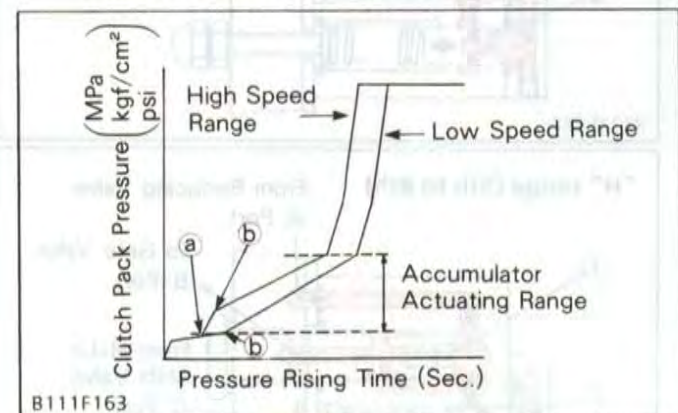
Function

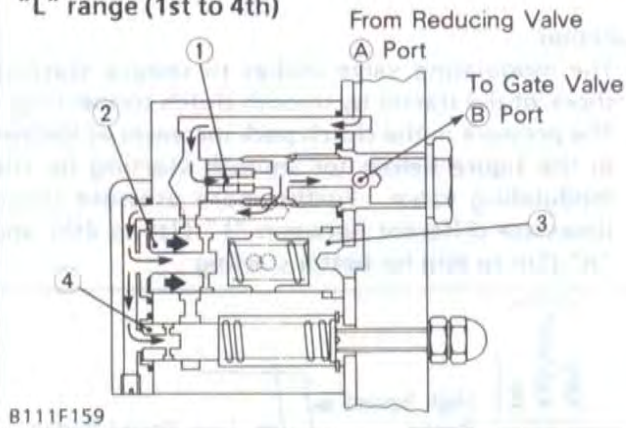
1. The modulating valve makes to reduce starting shock of the tractor by smooth clutch connecting.
2. The pressure in the clutch pack increases as follows in the figure below for smooth starting by the modulating valve. Furthermore pressure rising times are different between "L" (1st to 4th) and "H" (5th to 8th) for better starting.



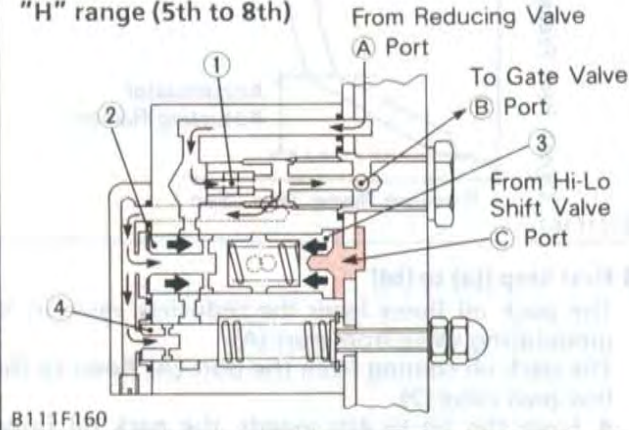
First Step [(a) to (b)]

1. The pack oil flows from the reducing valve in to modulating valve from port (A).
2. The pack oil coming from the port (A) flows to the low-pass valve (2).
 - From the 1st to 4th speeds, the pack oil flows through the low-pass valve (2) until the oil pressure reaches about 0.22 MPa (2.2 kgf/cm², 31 psi).
 - From 5th to 8th speeds, the low-pass piston (3) is pushed in by the shift oil (high speed range only) flowing from the port (C). The spring pushed in by the low-pass piston (3) pushes the low-pass valve (2) strongly, thus the pack oil flows through the low-pass valve (2) until the oil pressure reaches about 0.39 MPa (4.0 kgf/cm², 57 psi).

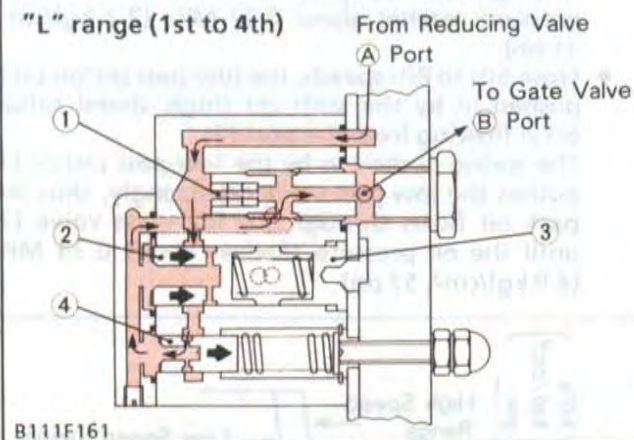


"L" range (1st to 4th)

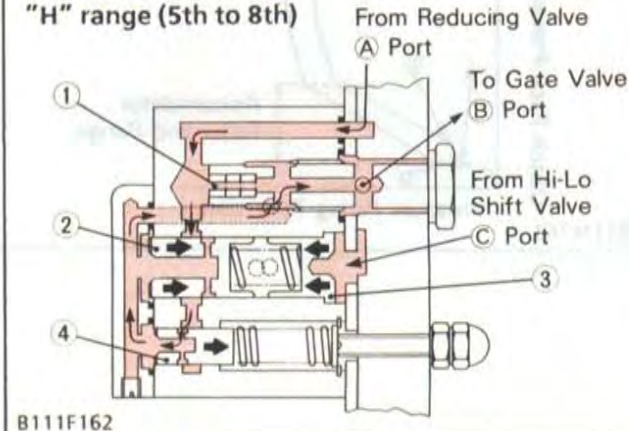
B111F159

"H" range (5th to 8th)

B111F160

"L" range (1st to 4th)

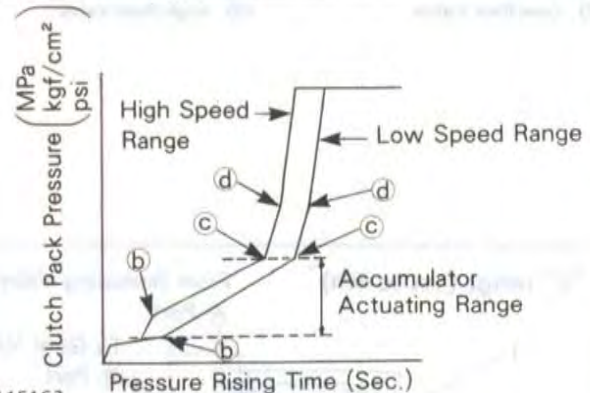
B111F161

"H" range (5th to 8th)

B111F162

■ Second Step [(b) to (d)]

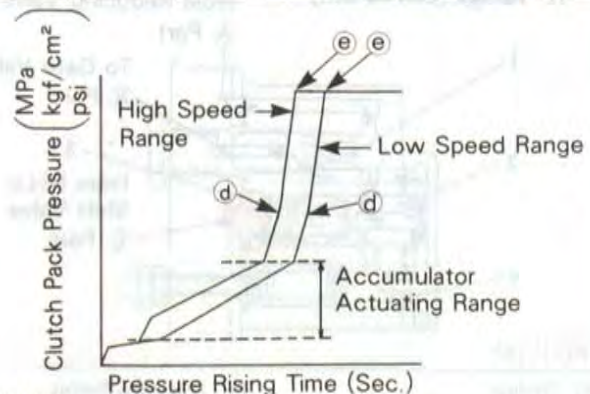
1. When the oil pressure of the pack oil that has flown through the low-pass valve (2) has reached about 0.22 MPa (2.2 kgf/cm², 31 psi) (L) or about 0.39 MPa (4.0 kgf/cm², 57 psi) (H), the low-pass valve (2) is closed by such pressure.
2. The pack oil which cannot flow through the low-pass valve (2) goes through the orifice (1) to the clutch pack until the oil pressure reaches about 1.37 MPa (14.0 kgf/cm², 199 psi).
3. Since the oil pressure between (b) to (c) is within the level for actuating the accumulator, the oil pressure is gradually increased until it reaches about 0.88 MPa (9.0 kgf/cm², 128 psi).
4. When the oil pressure has reached the point (c) which is outside the accumulator actuating range, the oil pressure is raised quickly to about 1.37 MPa (14.0 kgf/cm², 199 psi).



B111F163

■ Third Step [(d) to (e)]

1. When the oil pressure of the pack oil which passed the orifice (1) has reached about 14.0 kgf/cm², the high-pass valve (4) opens.
2. The pack oil which flowed through the orifice (1) is caused to flow through the high-pass valve (4) of less resistance, and the oil pressure of the pack oil is increased quickly to about 2.4 MPa (24 kgf/cm², 341 psi).

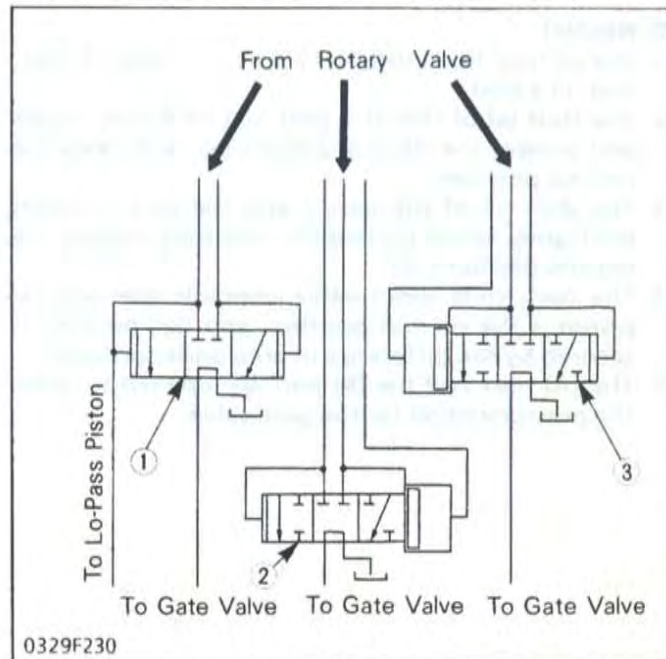


B111F163

- (1) Orifice
(2) Low-Pass Valve

- (3) Low-Pass Piston
(4) High-Pass Valve

(3)-3 Hi-Lo Shift Spool Valve and Main Shift Valve Assembly

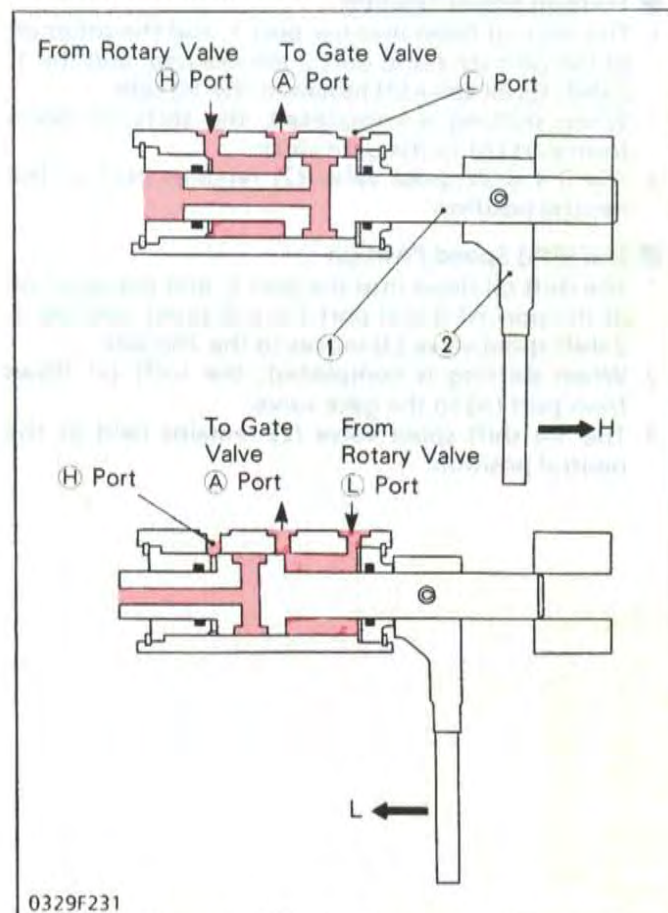


(1) Hi-Lo Shift Spool Valve (3) 1-2 Shift Spool Valve
(2) 3-4 Shift Spool Valve

Function

1. The shift oil distributed by the rotary valve assembly actuates the Hi-Lo shift spool valve (1), 3-4 shift spool valve (2), and 1-2 shift spool valve (3).
2. Each shift spool valve is equipped with a shift fork to move shifters for shifting speed.
3. When shifting is completed, the shift oil flows to the gate valves.

Hi-Lo Shift Spool Valve



(1) Hi-Lo Shift Spool Valve (2) Shift Fork

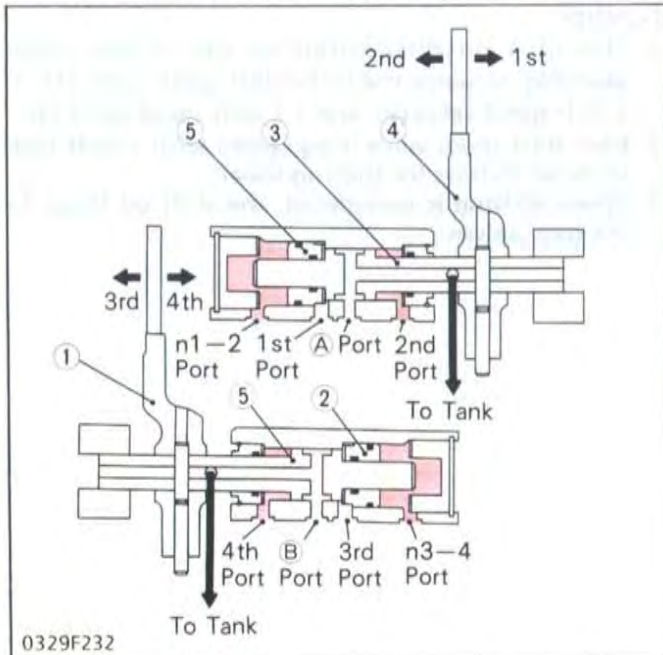
■ At Low Speed (1st, 2nd, 3rd and 4th shift)

1. The shift oil flows into port (L), and the Hi-Lo shift spool valve (1) shift to the Lo side.
2. When shifting is completed, the shift oil flows from port (A) to the gate valve.

■ At High Speed (5th, 6th, 7th and 8th shift)

1. The shift oil flows into port (H), and the Hi-Lo shift spool valve (1) shift to the Hi side.
2. When shifting is completed, the shift oil flows from port (A) to the gate valve.

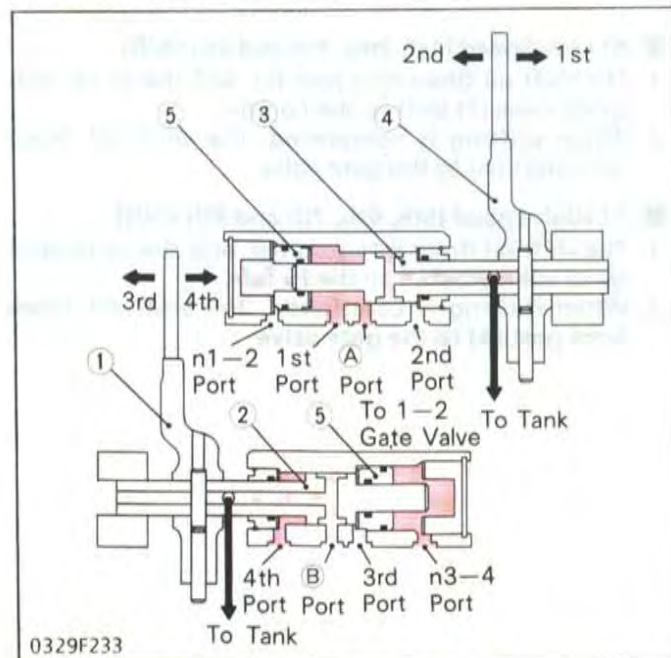
Main Shift Valve Assembly



- (1) 3-4 Shift Fork (4) 1-2 Shift Fork
 (2) 3-4 Shift Spool Valve (5) Neutral Piston
 (3) 1-2 Shift Spool Valve

■ Neutral

1. The shift oil flows into the 2 port, n1-2 port, 4 port, and n3-4 port.
2. The shift oil of the n1-2 port and n3-4 port moves and presses the neutral pistons (5), and keep the neutral position.
3. The shift oil of the port 2 and the port 4 moves shift spool valves (2) and (3) until they contact the neutral positions (5).
4. The each shift spool valve contacts the neutral piston is the neutral position, and this position is secured by the difference in area under pressure.
5. The (A) port and the (B) port are opened to drain the pressurized oil for the gate valve.



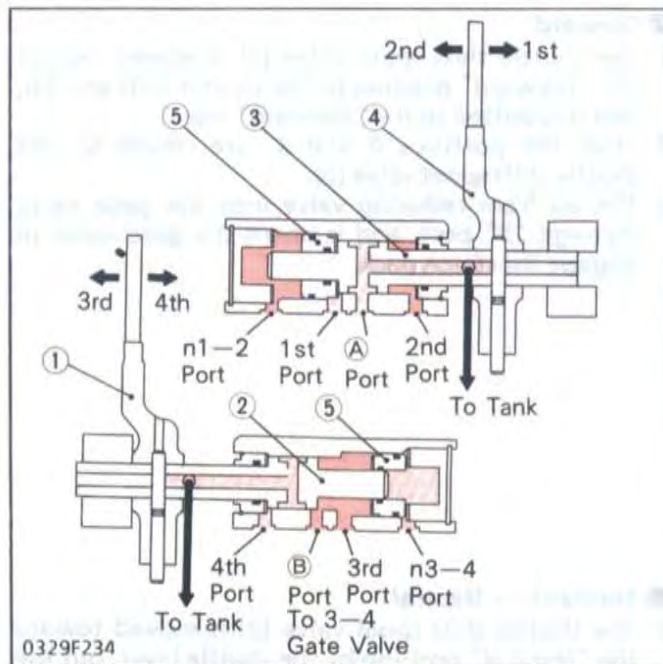
- (1) 3-4 Shift Fork (4) 1-2 Shift Fork
 (2) 3-4 Shift Spool Valve (5) Neutral Piston
 (3) 1-2 Shift Spool Valve

■ 1st (5th) Speed Position

1. The shift oil flows into the port 1, and the other oil of the port n1-2 and port 2 are drained, and the 1-2 shift spool valve (3) moves to the 1st side.
2. When shifting is completed, the shift oil flows from port (A) to the gate valve.
3. The 3-4 shift spool valve (2) remains held at the neutral position.

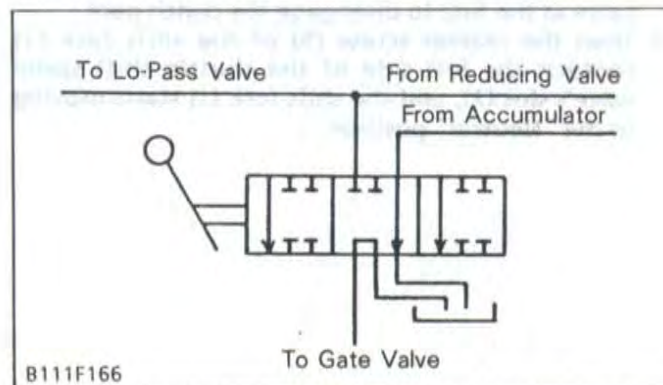
■ 2nd (6th) Speed Position

1. The shift oil flows into the port 2, and the other oil of the port n1-2 and port 1 are drained, and the 1-2 shift spool valve (3) moves to the 2nd side.
2. When shifting is completed, the shift oil flows from port (A) to the gate valve.
3. The 3-4 shift spool valve (2) remains held at the neutral position.

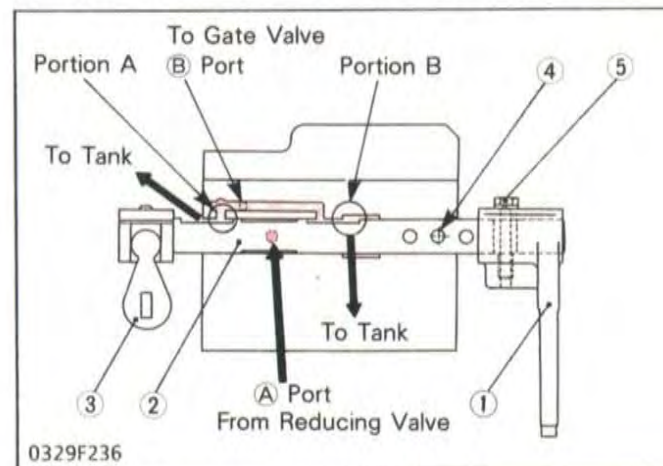


- (1) 3-4 Shift Fork (4) 1-2 Shift Fork
(2) 3-4 Shift Spool Valve (5) Neutral Piston
(3) 1-2 Shift Spool Valve

(3)-4 Shuttle Shift Spool Valve



- (1) Shuttle Lever (2) Shuttle Shift Spool Valve



- (1) Shift Fork (4) Detent
(2) Shuttle Shift Spool Valve (5) Reamer Bolt
(3) Shuttle Shift Arm

3rd (7th) Speed Position

1. The shift oil flows into the port 3, and the other oil of the port n3-4 and port 4 are drained, and the 3-4 shift spool valve (2) moves to the 3rd side.
2. When shifting is completed, the shift oil flows from port (B) to the gate valve.
3. The 1-2 shift spool valve (3) is moved to the neutral position by the shift oil flowing from port n1-2 and port 2, and held at that position.

4th (8th) Speed Position

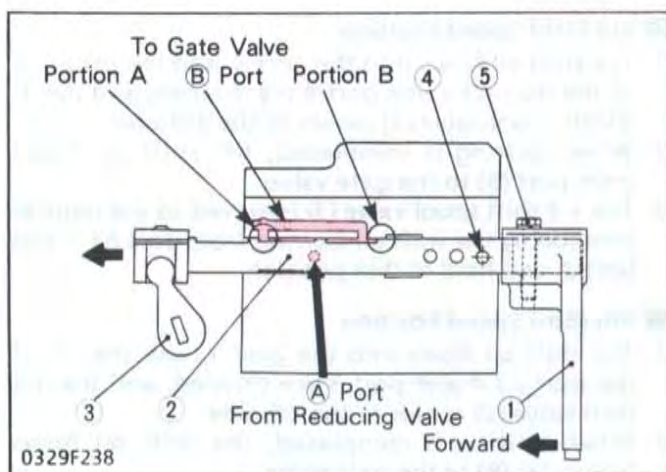
1. The shift oil flows into the port 4, and the oil of the port n3-4 and port 3 are drained, and the 3-4 shift valve (2) moves to the 4th side.
2. When shifting is completed, the shift oil flows from port (B) to the gate valve.
3. The 1-2 shift spool valve (3) remains held at the neutral position.

Function

1. The shuttle shift spool valve (2) is mechanically moved by the shuttle lever (1) with the link.
2. The shift fork is fitted to the shuttle shift spool valve (2) by the set pin, and moves the shifter for shifting.
3. When shifting is completed, the shift oil flows to the gate valve.

Neutral

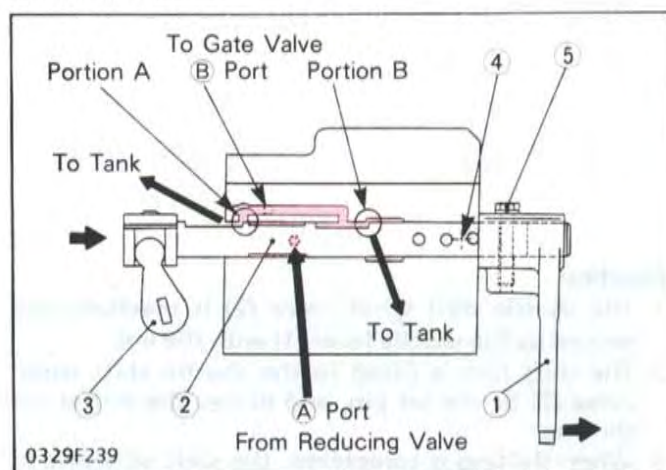
1. The shift oil flows into the port (A), but the shift oil is stopped by the shuttle shift spool valve (2), and the shift oil does not flow to the gate valve.



■ Forward

1. The shuttle shift spool valve (2) is moved toward the "Forward" position by the shuttle shift arm (3), and it is shifted to the "Forward" side.
2. Then the portions A and B are closed by the shuttle shift spool valve (2).
3. The oil from reducing valve into the gate valve through "B" port, and it opens the gate valve to engage the clutch pack.

- (1) Shift Fork (4) Detent
(2) Shuttle Shift Spool Valve (5) Reamer Screw
(3) Shuttle Shift Arm

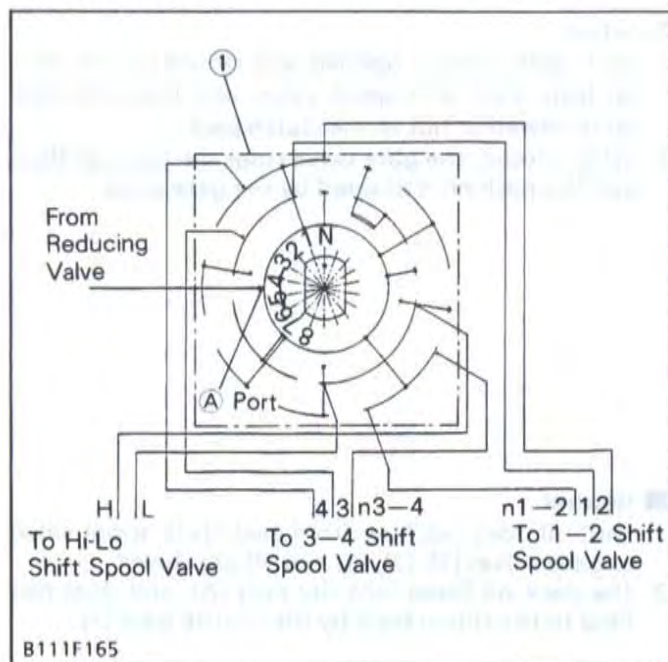


■ Forward → Neutral

1. The shuttle shift spool valve (2) is moved toward the "Neutral" position by the shuttle lever, but the shift fork does not move, because the reamer screw (5) does not contact the slot of shuttle shift spool valve (2).
2. The portions A and B are opened (Neutral position) to drain the pressurized oil for the gate valve at the first to disengage the clutch pack.
3. Then the reamer screw (5) of the shift fork (1) contacts the left side of the shuttle shift spool valve's slot (2), and the shift fork (1) starts moving to the "Neutral" position.

- (1) Shift Fork (4) Detent
(2) Shuttle Shift Spool Valve (5) Reamer Screw
(3) Shuttle Shift Arm

(3)-5 Rotary Valve



(1) Rotary Valve Assembly

Function

The rotary valve distributes the shift oil passing through the reducing valve to the shift valves for the selected speed.

The rotary valve is moved by the shift lever, therefore they are connected with the cables. The oil distribution of the rotary valve as follows in the table below.

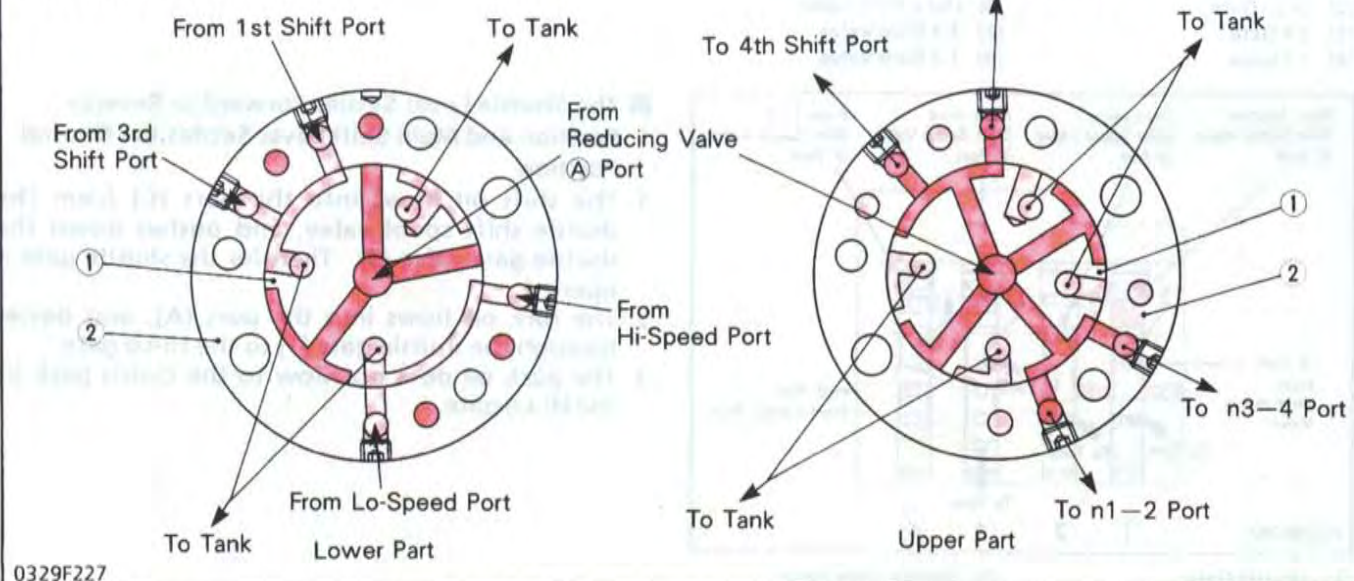
Pressurizing Port Table

Shift Range	Ports							
	Hi	Lo	4	3	n3-4	n1-2	1	2
N			o		o	o		o
1		o	o		o		o	
2		o	o		o			o
3		o		o		o		o
4		o	o			o		o
5	o		o		o		o	
6	o		o		o			o
7	o			o		o		o
8	o		o			o		o

* Items marked with "o" denote pressurizing ports and other items denote drain positions.

Neutral

[Neutral Position]

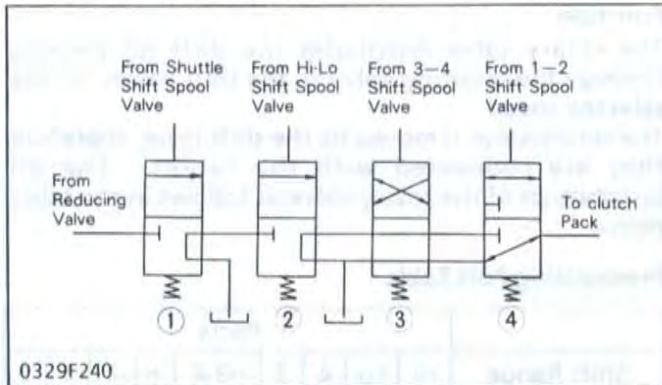


(1) Rotary Valve Body (Mobile) (2) Rotary Valve Case (Fixed)

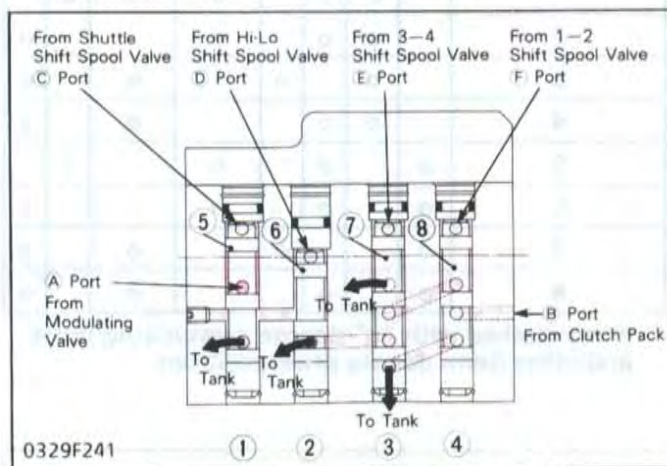
1. The rotary valve makes 9 positions from neutral to 8th by the movement of the rotary body (1) which is shifted by the shift lever.
2. The shift oil flows into the rotary valve body (1) from the reducing valve ("A" port) and it flows into the ports according to pressurizing port table.

3. The shift oil of the other ports (except pressurizing port) are drained by the rotary valve body (1).

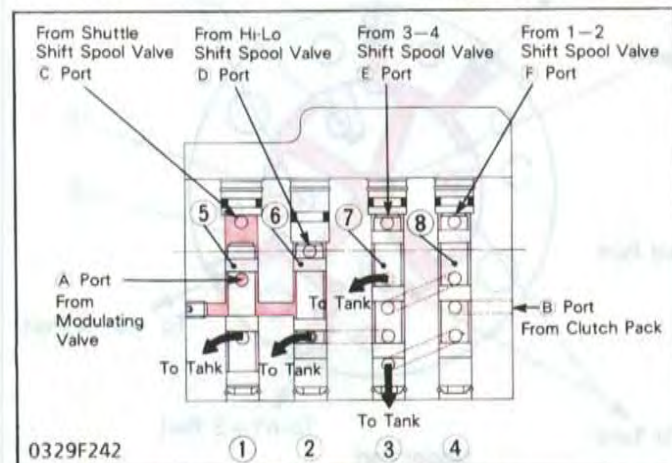
(3)-6 Gate Valve Assembly



- (1) Shuttle Gate
(2) Hi-Lo Gate
(3) 3-4 Gate
(4) 1-2 Gate



- (1) Shuttle Gate
(2) Hi-Lo Gate
(3) 3-4 Gate
(4) 1-2 Gate
(5) Shuttle Gate Valve
(6) Hi-Lo Gate Valve
(7) 3-4 Gate Valve
(8) 1-2 Gate Valve



- (1) Shuttle Gate
(2) Hi-Lo Gate
(3) 3-4 Gate
(4) 1-2 Gate
(5) Shuttle Gate Valve
(6) Hi-Lo Gate Valve
(7) 3-4 Gate Valve
(8) 1-2 Gate Valve

Function

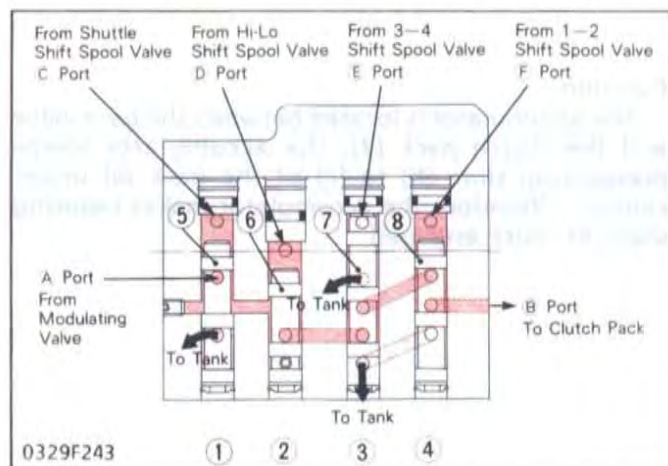
- Each gate valve is opened and closed by the shift oil from each shift spool valve, and thus the pack oil is flowed or not to the clutch pack.
- When closed, the gate valve stops the pack oil flow and the pack oil is drained by the gate valve.

■ Neutral

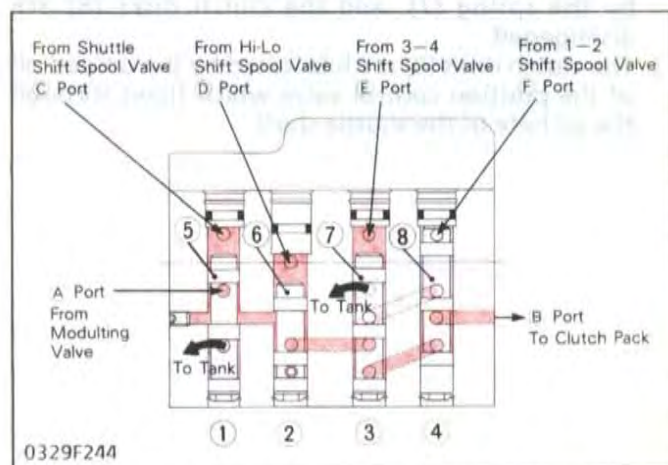
- Shift oil does not flow from each shift spool valve to gate valves (1), (2), (3) and (4) are closed.
- The pack oil flows into the port (A), and does not flow to the clutch pack by the shuttle gate (1).

■ The Shuttle Lever Settles Forward or Reverse Position and Main Shift Lever Settles the Neutral Position

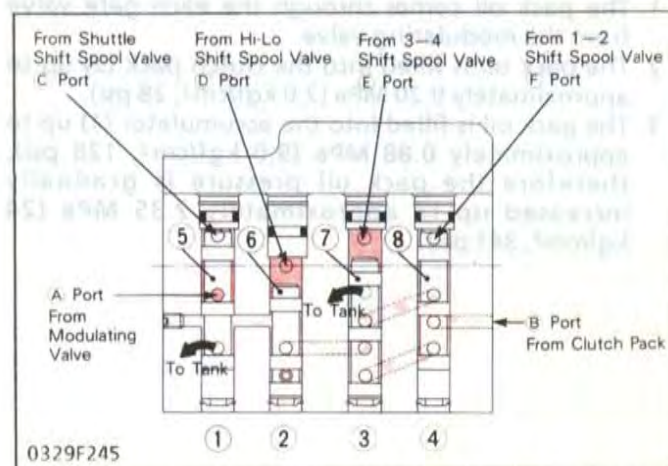
- The shift oil flows into the port (C) from the shuttle shift spool valve, and pushes down the shuttle gate valve (5). Therefore the shuttle gate is opened.
- The rack oil flows into the port (A), and passes through the shuttle gate (1) to the Hi-Lo gate.
- The pack oil does not flow to the clutch pack by the Hi-Lo gate.



- | | |
|------------------|------------------------|
| (1) Shuttle Gate | (5) Shuttle Gate Valve |
| (2) Hi-Lo Gate | (6) Hi-Lo Gate Valve |
| (3) 3-4 Gate | (7) 3-4 Gate Valve |
| (4) 1-2 Gate | (8) 1-2 Gate Valve |



- | | |
|------------------|------------------------|
| (1) Shuttle Gate | (5) Shuttle Gate Valve |
| (2) Hi-Lo Gate | (6) Hi-Lo Gate Valve |
| (3) 3-4 Gate | (7) 3-4 Gate Valve |
| (4) 1-2 Gate | (8) 1-2 Gate Valve |



- | | |
|------------------|------------------------|
| (1) Shuttle Gate | (5) Shuttle Gate Valve |
| (2) Hi-Lo Gate | (6) Hi-Lo Gate Valve |
| (3) 3-4 Gate | (7) 3-4 Gate Valve |
| (4) 1-2 Gate | (8) 1-2 Gate Valve |

■ The Shuttle Lever Settles Forward or Reverse and the Main Shift Lever Settles Position 1, 2, 5 or 6

1. The shift oil flows into the port (C), (D) and (F) from the shuttle, Hi-Lo and 1-2 shift spool valve, and pushes down the shuttle, Hi-Lo and 1-2 gate valve. Therefore each gate valve is opened.
2. The pack oil flows into port (A), and passes through the shuttle gate (1), Hi-Lo gate (2), 3-4 gate (3), and 1-2 gate (4) to the port (B), and flows to the clutch pack, and engages the clutch pack.

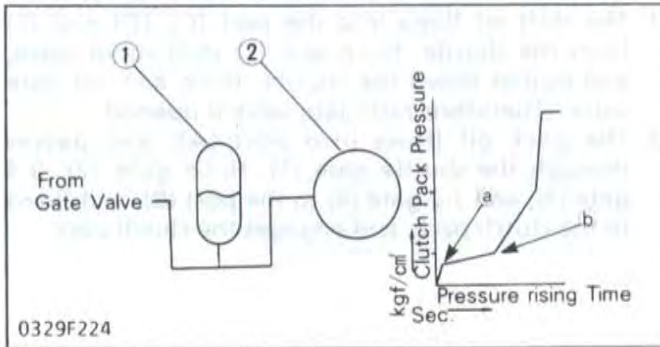
■ The Shuttle Lever Settles Forward or Reverse and the Main Shift Lever Settles Position 3, 4, 7 or 8

1. The shift oil flows into the port (C), (D) and (E) from the shuttle spool valve, Hi-Lo spool valve and 3-4 shift spool valve, and pushes down the shuttle gate valve, Hi-Lo gate valve and 3-4 gate valve. Therefore each gate valve is opened.
2. The pack oil flows into port (A), and passes through the shuttle gate (1), Hi-Lo gate (2), 3-4 gate (3), and 1-2 gate (4) to the port (B), and flows to the clutch pack, and engages the clutch pack.

■ The Shuttle Lever Settles the Neutral and the Main Shift Lever Settles the Neutral Position

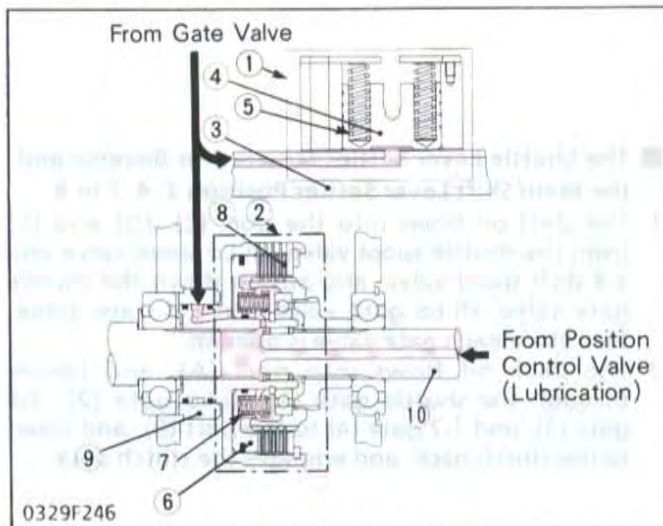
1. Shifting the shuttle lever back to the neutral position causes the shift oil to the port (C) to be drained on the shuttle spool valve side.
2. The shuttle gate valve (5) is returned to close position by the return spring.
3. The pack oil is stopped by the shuttle gate (1).
4. The rack oil on the clutch pack side is drained from the drain port of the shuttle spool valve and shuttle gate valve.

(3)-7 Accumulator and Clutch Pack



(1) Accumulator

(2) Clutch Pack



(1) Accumulator

(2) Clutch Pack

(3) Side Cover

(4) Piston

(5) Spring

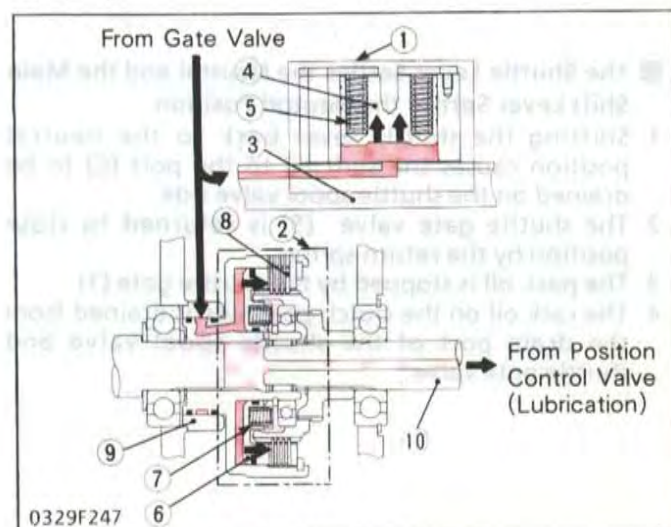
(6) Piston

(7) Spring

(8) Clutch Disk

(9) Support

(10) Shuttle Shaft



(1) Accumulator

(2) Clutch Pack

(3) Side Cover

(4) Piston

(5) Spring

(6) Piston

(7) Spring

(8) Clutch Disk

(9) Support

(10) Shuttle Shaft

Function

The accumulator is located between the gate valve and the clutch pack (2), the accumulator keeps pressurizing time (b) to (c) of the pack oil under control. Therefore the accumulator makes reducing shock of clutch engaged.

■ Neutral

1. The piston (4) of the accumulator is pushed back to the side cover side (3) by the spring (5).
2. Piston (6) of the clutch pack (2) is also pushed back by the spring (7), and the clutch disks (8) are disengaged.
3. The clutch disks (8) are lubricated by the unload oil of the position control valve which flows through the oil hole of the shuttle shaft.

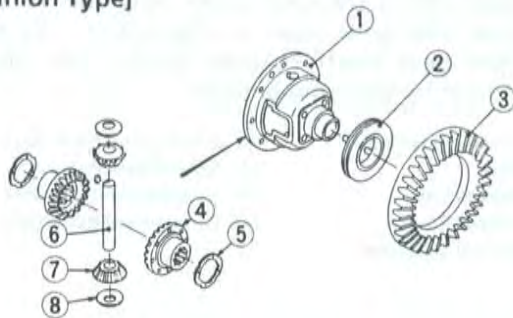
■ Shifting Position

1. The pack oil comes through the each gate valve from the modulating valve.
2. The pack oil is filled into the clutch pack (2) up to approximately 0.20 MPa (2.0 kgf/cm², 28 psi).
3. The pack oil is filled into the accumulator (1) up to approximately 0.88 MPa (9.0 kgf/cm², 128 psi), therefore the pack oil pressure is gradually increased up to approximately 2.35 MPa (24 kgf/cm², 341 psi).

4 DIFFERENTIAL GEAR

[1] STRUCTURE

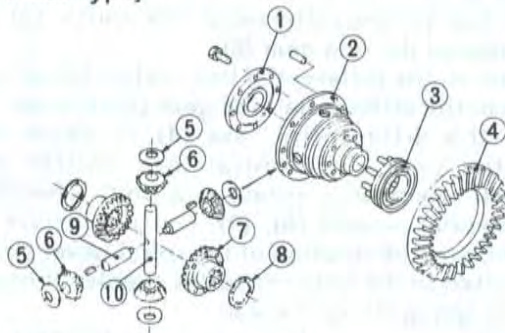
[2 Pinion Type]



C060F032

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

[4 Pinion Type]

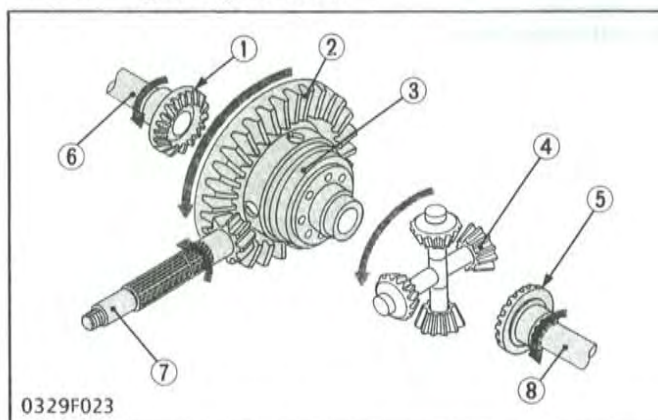


C060F033

- | | |
|--------------------------------|-----------------------------------|
| (1) Differential Case Cover | (7) Differential Side Gear |
| (2) Differential Case | (8) Differential Side Gear Washer |
| (3) Differential Lock Shifter | (9) Differential Pinion Shaft 2 |
| (4) Ring Gear | (10) Differential Pinion Shaft |
| (5) Differential Pinion Washer | |
| (6) Differential Pinion | |

[2] OPERATION

■ Traveling Straight Ahead



0329F023

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

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

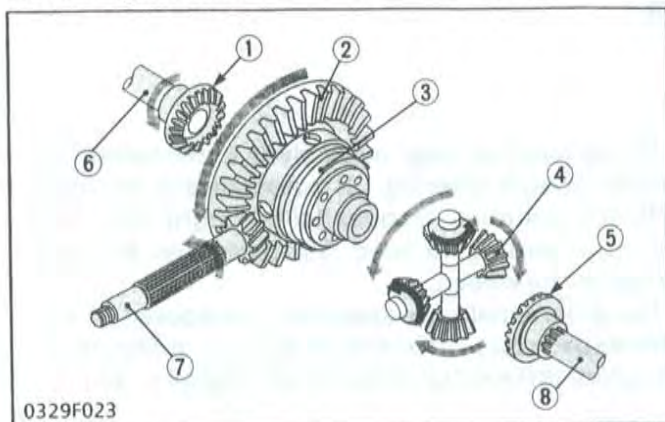
■ NOTE

- 2 Pinion Type : L2350 (2WD, 4WD)
L2650 (2WD) ; 19999 and below (4WD) ; 59999 and below
- 4 Pinion Type : L2650 (2WD) ; 20001 and above (4WD) ; 60001 and above
L2950 (2WD, 4WD, GST)
L3450 (2WD, 4WD, GST)
L3650 (2WD, 4WD, GST)

Rotation of the spiral bevel pinion (7) is transmitted to the ring gear (2) bolted to the differential case (3). When road resistance to the right and left wheels are equal, the differential pinions (4), and differential side gears (1), (5) are carried around by the ring gear (2), and differential case (3) rotate as a unit. Differential gear shafts (6), (8) receive the same rotation and both wheels travel at the same speed.

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

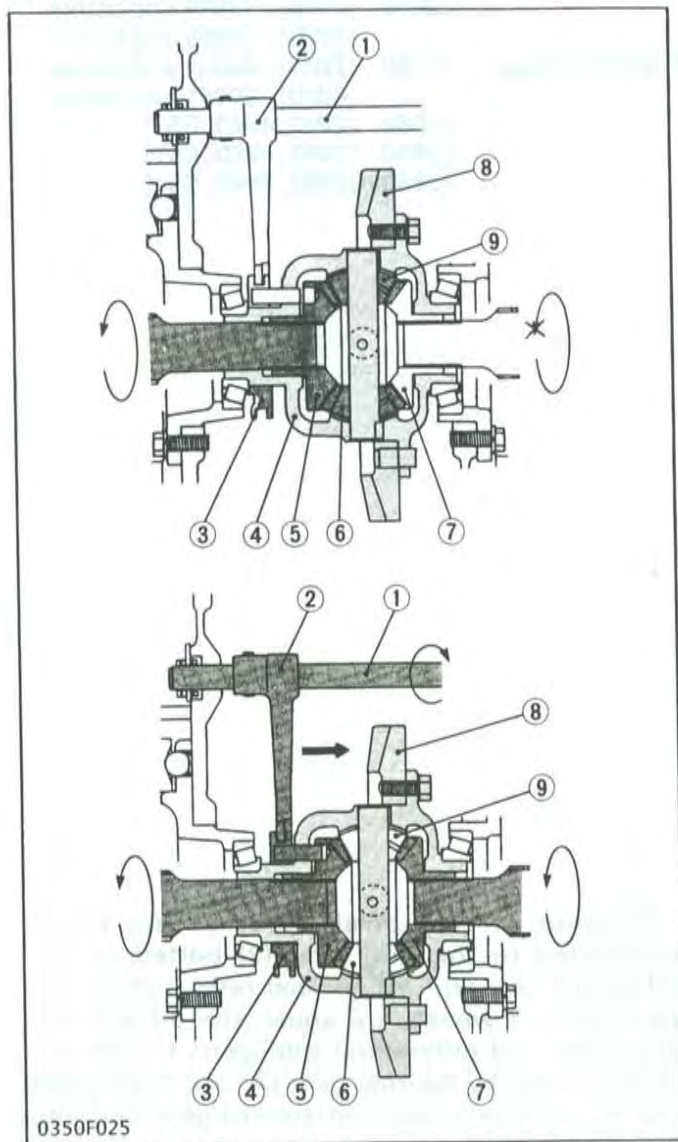
■ Turning a Corner



The power from the engine on spiral bevel pinion shaft (7) rotates ring gear (2). When turning a corner, the outer wheel must travel farther than the inner one. While differential pinions (4) rotate with the differential case (4), they spin on differential pinion shaft (9) to transmit more rotation to one differential side gear than to the other. As one differential gear shaft rotates faster, the other rotates slower by the same amount.

- | | |
|----------------------------|-------------------------------|
| (1) Differential Side Gear | (6) Differential Gear Shaft |
| (2) Ring Gear | (7) Spiral Bevel Pinion |
| (3) Differential Case | (8) Differential Gear Shaft |
| (4) Differential Pinion | (9) Differential Pinion Shaft |
| (5) Differential Side Gear | |

■ Differential Lock



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

When the differential lock pedal is stepped on, it causes the differential lock cam shaft (1), differential lock shift fork (2) and differential lock shifter (3) are moved forward the ring gear (8).

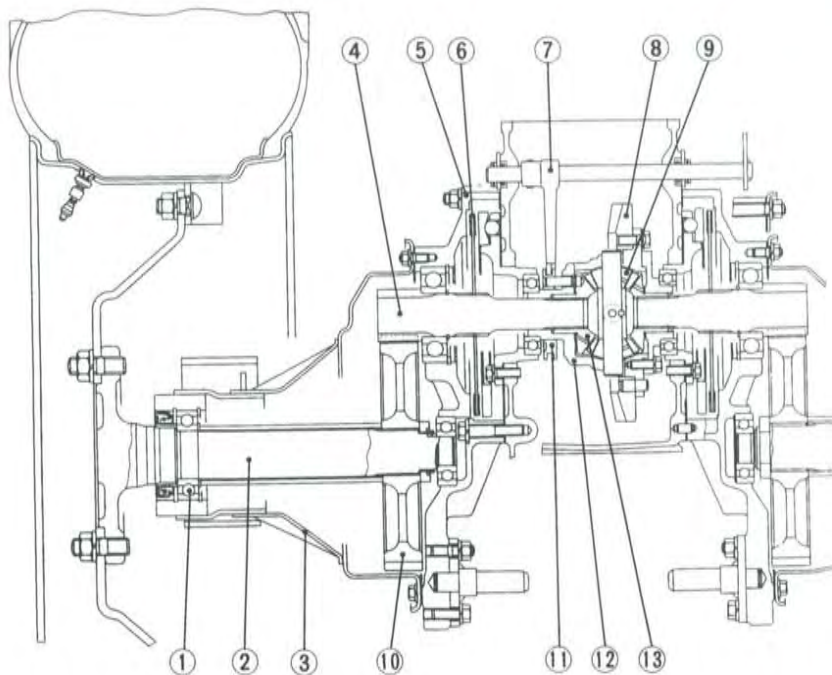
The pins on the differential lock shifter (3) go into the holes in the differential side gear (5) through the holes in the differential case (4) to cause the differential case, differential lock shifter and differential side gear to rotate as a unit. Therefore the differential pinions (6), (9), can not rotate on their axles, and the rotation of the spiral bevel pinion is transmitted to the both rear axles evenly. It means the tractor going straight ahead.

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

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

5 REAR AXLE

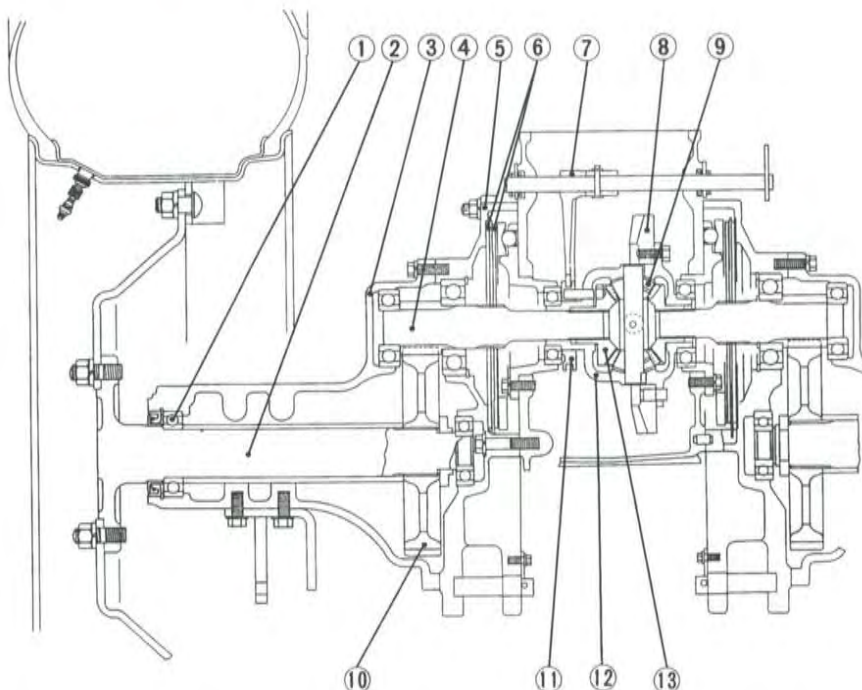
[L2350]



- (1) Ball Bearing
- (2) Rear Axle
- (3) Rear Axle Case
- (4) Differential Gear Shaft
- (5) Brake Case
- (6) Brake Discs
- (7) Differential Lock Shift Fork
- (8) Ring Gear
- (9) Differential Pinion
- (10) Final Gear
- (11) Differential Lock Shifter
- (12) Differential Case
- (13) Differential Side Gear

0350F024

[L2650, L2950, L3450, L3650]



B111F023

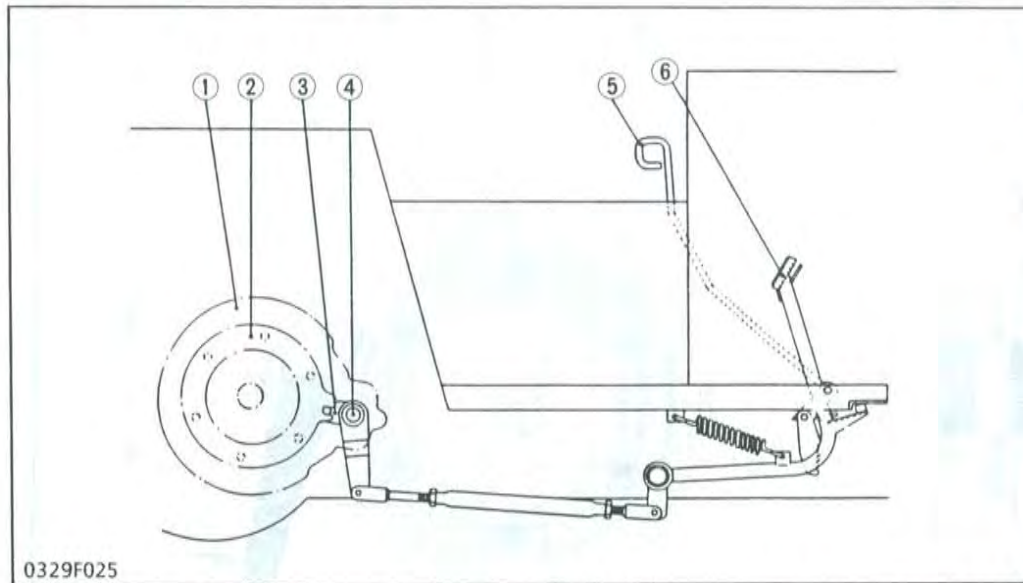
The final gears (10) are final reduction mechanism which further reduces the speed of rotation. The direction of power transmitted is changed by the differential gear.

The rear axles (2) are the final transmission mechanisms which transmit the power from the transmission to the rear wheels. The rotation speed

is reduced by the final gears (10).

The rear axles are the semi-floating type with the ball bearing (1) between the rear axle (2) and rear axle case (3), which support the rear wheel load besides transmitting power to the rear wheel. The rear axles also support the weight of the tractor.

6 BRAKES



- (1) Brake Case
- (2) Cam Plate
- (3) Brake Cam
- (4) Brake Cam Lever
- (5) Parking Brake Lever
- (6) Brake Pedal

Independent mechanical wet disc brakes are used for the right and left traveling brakes. They are operated by the brake pedals through the mechanical linkages.

■ Features of Wet Disc Brakes

1. Reduced disc wear

Although wet discs are worn by approx. several tens of microns depending on the accuracy of parts during the initial contact in initial period of 50 hours or so, almost no wear occurs afterwards. This means that very little brake adjustments are required.

2. Stable braking

Since the brake discs are immersed in transmission oil, **Fade*** is rarely caused even after repeated braking and a stable braking force is obtained.

3. Pedal stroke does not change under influence of heat.

Unlike internal expanding type brakes, the drum-to-shoe clearance of the wet disc brake does not increase due to thermal expansion and the increased pedal stroke does not result. Thus, the wet disc brake provides a constant pedal stroke.

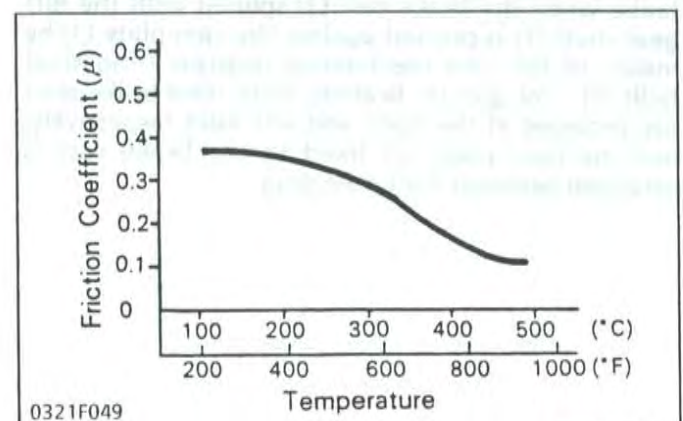
The parking brake is a mechanical type which is designed to actuate the traveling brakes through the linkage. Pulling the parking brake lever (6) results in the same state as that obtained when the brake pedals are pressed.

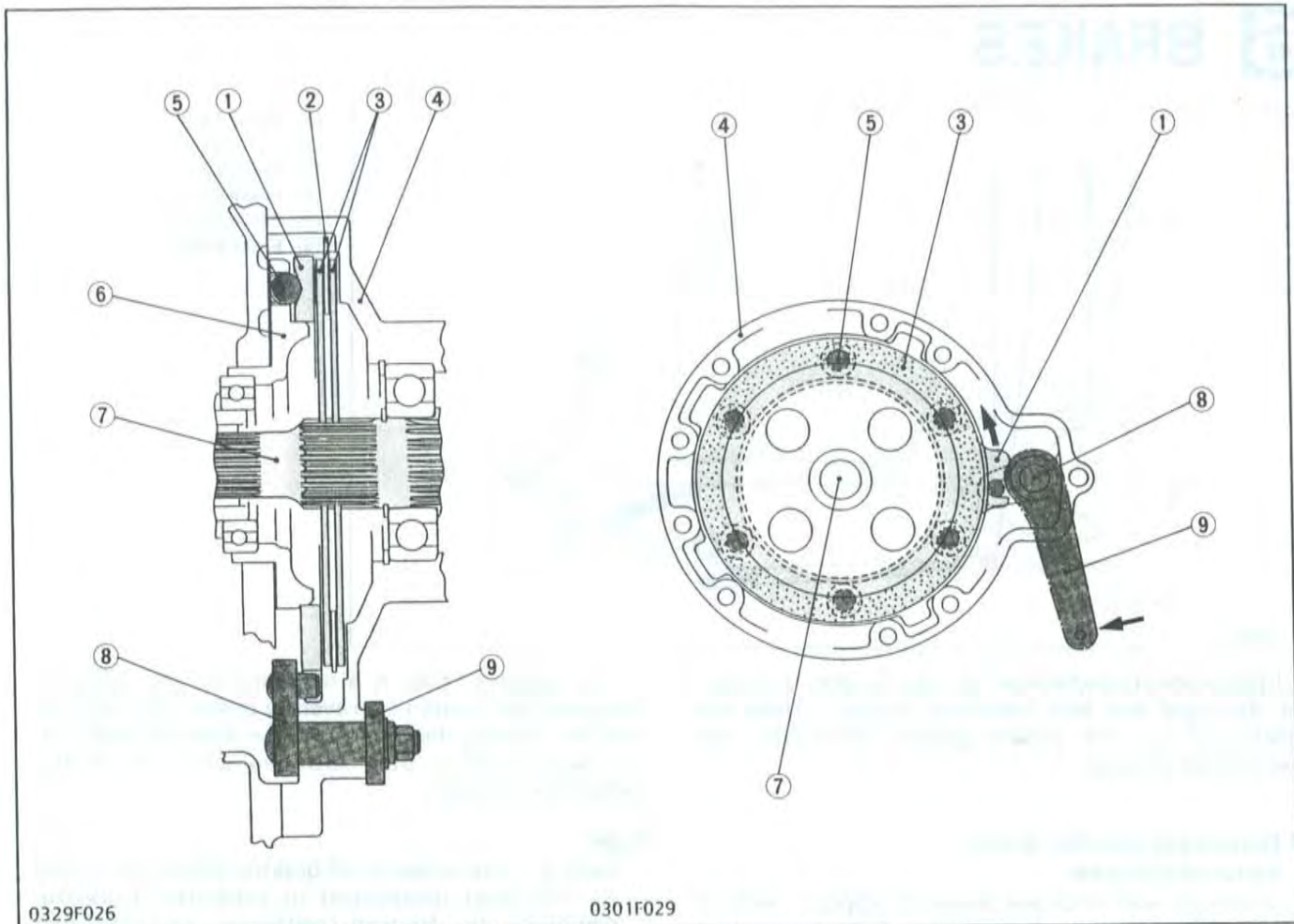
Fade*

Fade is a phenomenon of braking force loss caused by the heat generated in repeated braking. Generally, the friction coefficient of brake disc tends to lower and the braking force reduces with the rise of the temperature of the brake disc.

(Reference)

- Relationship between Temperature and Friction coefficient of brake disc.





0329F026

0301F029

- | | | | |
|----------------|----------------|---|---------------------|
| (1) Cam Plate | (4) Brake Case | (6) Differential Bearing Case | (8) Brake Cam |
| (2) Plate | (5) Steel Ball | (7) Brake Shaft (Differential Gear Shaft) | (9) Brake Cam Lever |
| (3) Brake Disc | | | |

The brake body is incorporated in the brake case (4) filled with transmission oil and is designed to brake when the brake disc (3) splined with the diff gear shaft (7) is pressed against the cam plate (1) by means of the cam mechanism incorporating steel balls (5). For greater braking force, two brake discs are provided at the right and left sides respectively, and the steel plate (2) fixed to the brake case is arranged between the brake discs.

■ During Braking

When the brake pedal is pressed, the linkage causes the brake cam lever (9) and brake cam (8) to turn into the direction of arrow shown in the above diagram. Therefore, the cam plate (1) also moves the direction of arrow. At this time, since the cam plate (1) rides on the steel balls (5) set in the grooves of the diff bearing case (6) to press the brake disc (3), the diff gear shaft (7) is braked by the frictional force generated by the cam plate (1) and brake disc (3).

■ NOTE

- L2350 2WD one brake disc for each side
- Others two brake discs for each side

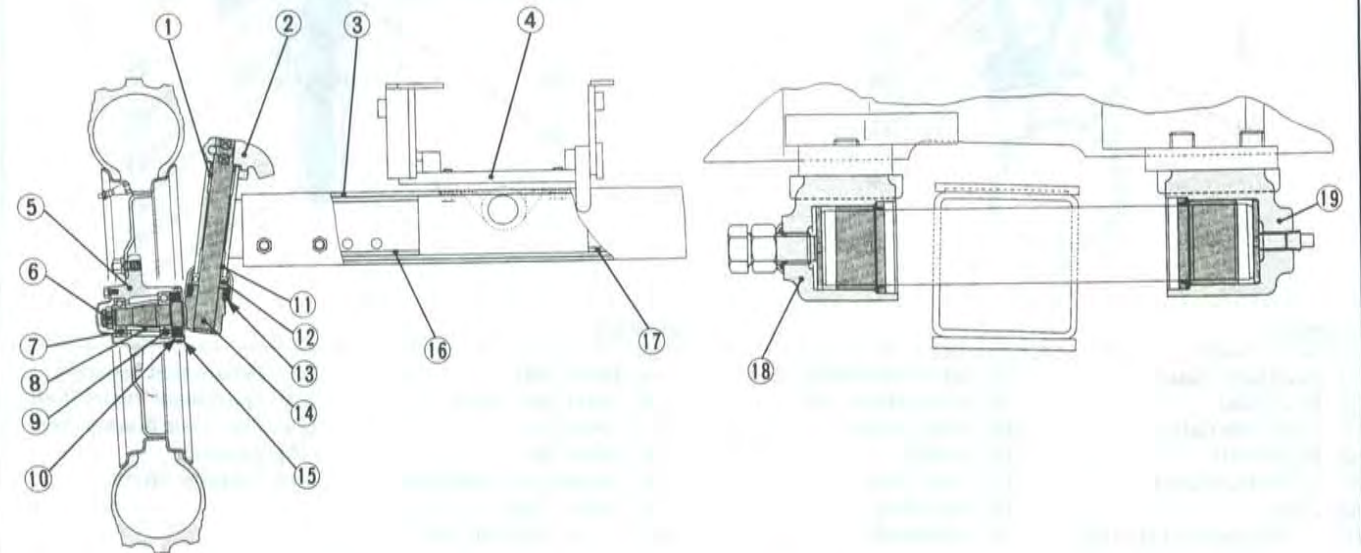
7 FRONT AXLE

The front axle supports the front of tractor and facilitates steering. There are two kinds of front axles. The two-wheel drive axle has free-running

front wheels and the four-wheel drive axle has powered front wheels.

[1] STRUCTURE

[TWO WHEEL DRIVE TYPE]



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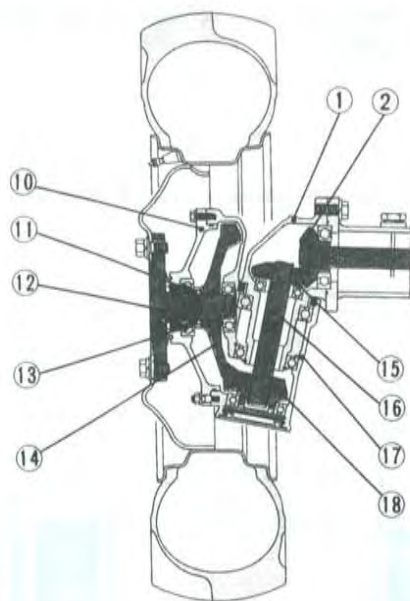
- | | | | |
|-----------------------|------------------|--------------------------|--------------------------------|
| (1) Bushing | (6) Slotted Nut | (11) Bushing | (16) Front Axle Right |
| (2) Knuckle Arm | (7) Ball Bearing | (12) Thrust Ball Bearing | (17) Front Axle Left |
| (3) Front Axle Middle | (8) Spacer | (13) Oil Seal | (18) Front Axle Bracket, Front |
| (4) Front Axle Frame | (9) Ball Bearing | (14) Knuckle Shaft | (19) Front Axle Bracket, Rear |
| (5) Front Wheel Hub | (10) Oil Seal | (15) Dust Cover | |

The front axle of the 2WD type is constructed as shown above. The shape of the front axle is relatively simple, and the front axle is supported at its center with the front axle brackets (18), (19) on the front axle frame (4), so that steering operation is stable even on uneven grounds in a farm field.

■ NOTE

- L2350 is not adjustable tread type.

[FOUR-WHEEL DRIVE TYPE]

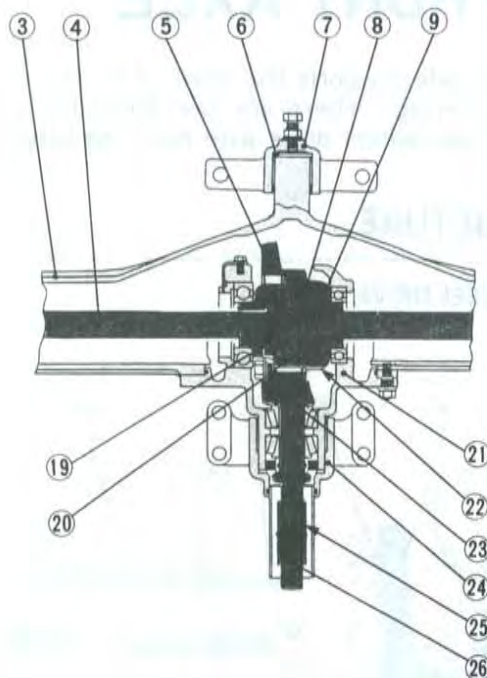


0329F027

- | | |
|-------------------------------|------------------------------|
| (1) Bevel Gear Case | (8) Differential Pinion Gear |
| (2) Bevel Gear | (9) Differential Case |
| (3) Front Axle Case | (10) Axle Flange |
| (4) Drive Shaft | (11) Collar |
| (5) Spiral Bevel Gear | (12) Front Axle |
| (6) Collar | (13) Snap Ring |
| (7) Front Axle Bracket, Front | (14) Bevel Gear |

The front axle of the 4WD is constructed as shown above. Power is transmitted from the transmission through the propeller shaft (26) and to the spiral bevel pinion shaft (23), then to the spiral bevel gear (5) after that to the differential gear.

The power through the differential is transmitted to the drive shaft (4), and to the bevel gear shaft (16) in the bevel gear case (1).



0329F028

- | | |
|-----------------------------|--------------------------------|
| (15) Bevel Gear | (22) Differential Assembly |
| (16) Bevel Gear Shaft | (23) Spiral Bevel Pinion Shaft |
| (17) Axle Case | (24) Front Axle Bracket, Rear |
| (18) Bevel Gear | (25) Coupling |
| (19) Differential Side Gear | (26) Propeller Shaft |
| (20) Pinion Shaft | |
| (21) Pinion Bearing Case | |

The revolution is greatly reduced by the bevel gears (18), (14), then the power is transmitted to the front axle (12).

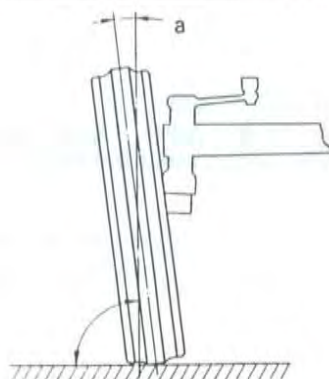
The differential system allows each wheel to rotate at a different speed to make turning easier.

[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

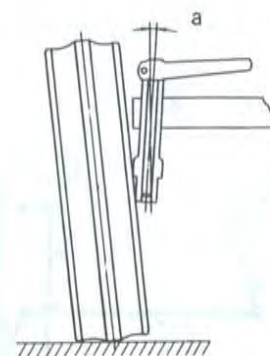


C045F051

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	0.026 to 0.044 rad. 1.5 to 2.5°
--------	------------------------------------

Kingpin Angle

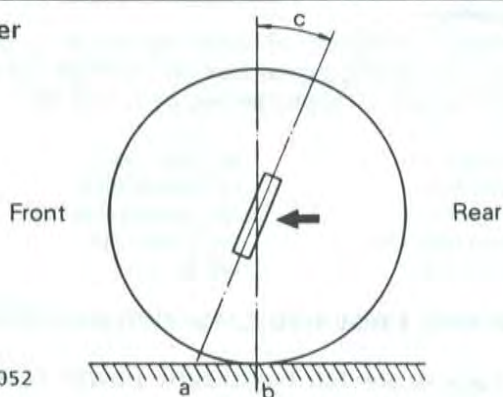


C045F053

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.

	2WD	4WD
Kingpin inclination	0.131 to 0.146 rad. 7.5 to 8.5°	0.166 to 0.183 rad. 9.5 to 10.5°

Caster

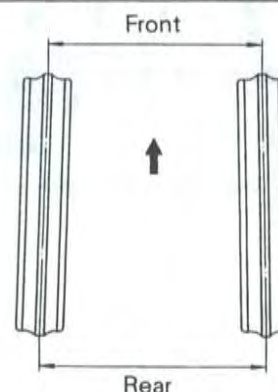


C045F052

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.

	2WD	4WD
Caster	0.026 to 0.044 rad. 1.5 to 2.5°	0.017 to 0.035 rad. 1.0 to 2.0°

Toe-in



C045F054

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.

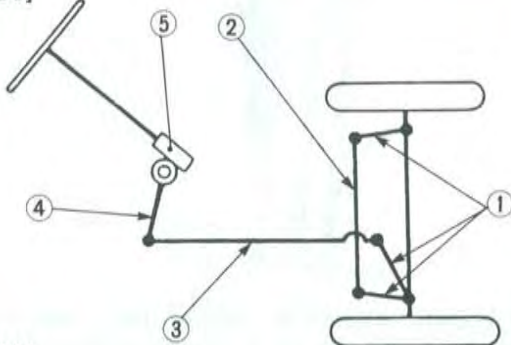
Toe-in	2 to 8 mm 0.08 to 0.32 in.
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8 STEERING

[1] STEERING LINKAGE

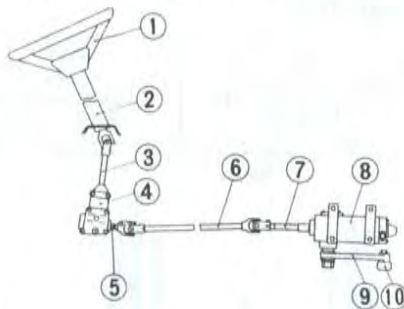
L series tractors have three kinds of steering systems.

[L2350]



B122F042

[L2650 2WD, L2950 2WD, L3450 2WD, L3650 2WD]



C060F038

■ L2350

This tractor is drag link type.

This type consists of five parts, a steering gear box (5), a pitman arm (4), a drag link (3), knuckle arms (1) and a tie rod (2).

- | | |
|------------------|-----------------------|
| (1) Knuckle Arms | (4) Pitman Arm |
| (2) Tie Rod | (5) Steering Gear Box |
| (3) Drag Link | |

■ L2650 2WD, L2950 2WD, L3450 2WD and L3650 2WD

The steering system includes the steering gear box (8) at the front of tractor, to which pitman arm (9) and tie rod are coupled directly. Accordingly, this steering system does not employ a drag link which ordinary tractors have, thus making it possible to increase front wheel steering angles and to reduce turning radius.

The steering power of steering wheel is transmitted to the steering gear box (8) through the joint shafts (3), (5), (6), (7) and steering gear case (4).

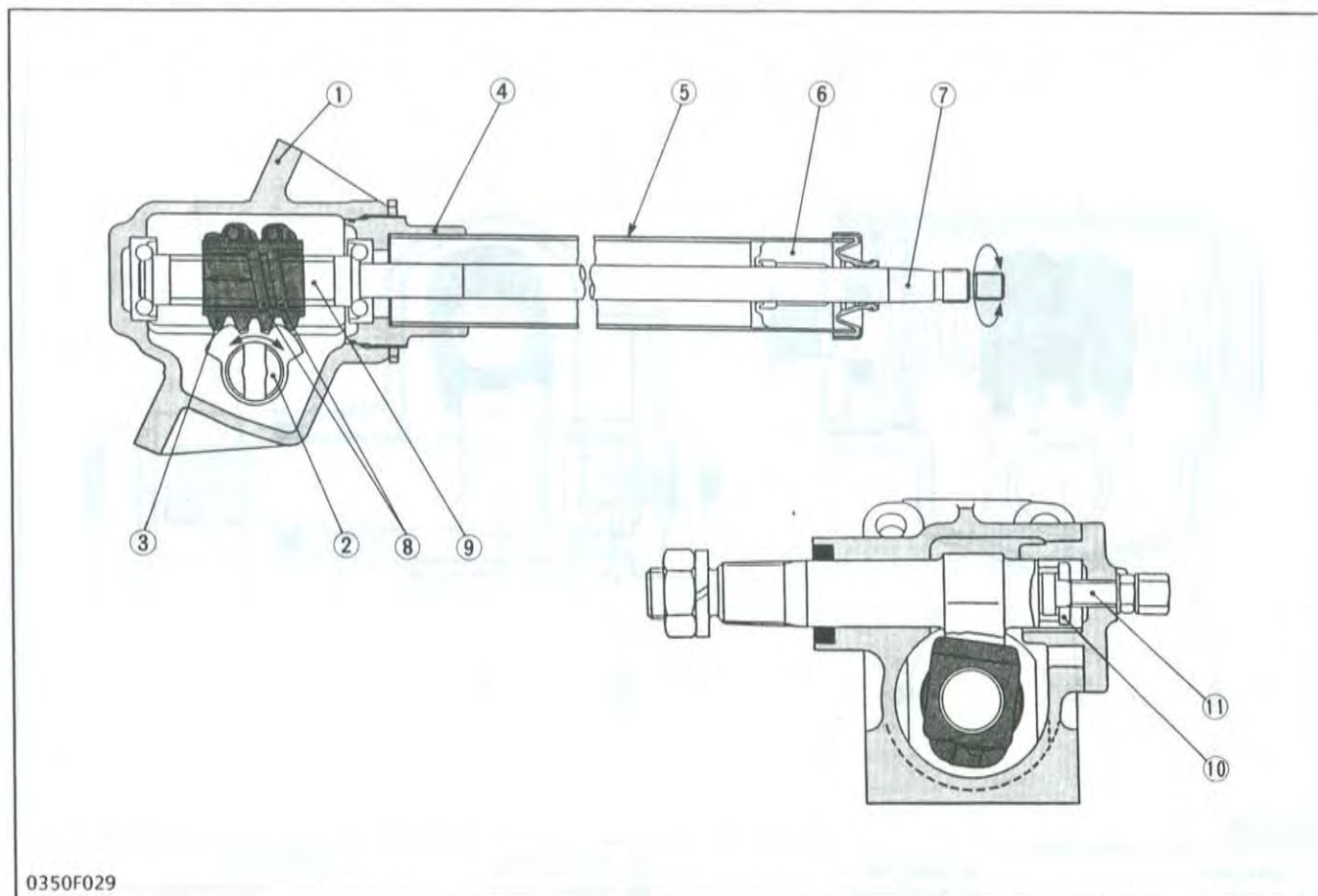
- | | |
|------------------------|-----------------------|
| (1) Steering Wheel | (6) Joint Shaft 3 |
| (2) Steering Post | (7) Joint Shaft 4 |
| (3) Joint Shaft 1 | (8) Steering Gear Box |
| (4) Steering Gear Case | (9) Pitman Arm |
| (5) Joint Shaft 2 | (10) Tie Rod |

■ L2650 4WD, L2950 4WD, L3450 4WD and L3650 4WD

These tractors are full hydrostatic power steering. Because this system is no linkage.

[2] MANUAL STEERING

(1) L2350



- | | | | |
|-----------------------|--------------------|--------------------|----------------------|
| (1) Gear Box | (4) Gear Box Cover | (7) Steering Shaft | (10) Shim |
| (2) Sector Gear Shaft | (5) Steering Post | (8) Ball | (11) Adjusting Screw |
| (3) Ball Nut | (6) Column Bushing | (9) Worm Shaft | |

The steering unit mainly consists of two parts, a ball nut (3) and a sector gear shaft (2). When the worm shaft (9) is rotated (by rotation of the steering wheel), the ball nut (3) is moved along the worm shaft, and this action causes the sector gear shaft (2) to rotate. The one end of the sector gear shaft carries the pitman arm. Rotation of the sector gear shaft causes the pitman arm to swing in one direction or the other.

The motion is then carried through the drag link to the knuckle arm at the wheel.

In this unit, friction is kept exceptionally low by interposing balls (8) between the worm teeth and grooves cut in the inner face of a ball nut (3).

As the worm shaft (9) rotates, the balls roll and cause the ball nut to move along the worm shaft.

This motion is carried to the sector gear by teeth on the side of the ball nut.

This forces the sector gear shaft (2) to rotate.

These balls are called "recirculating balls", because they continuously recirculate from one end

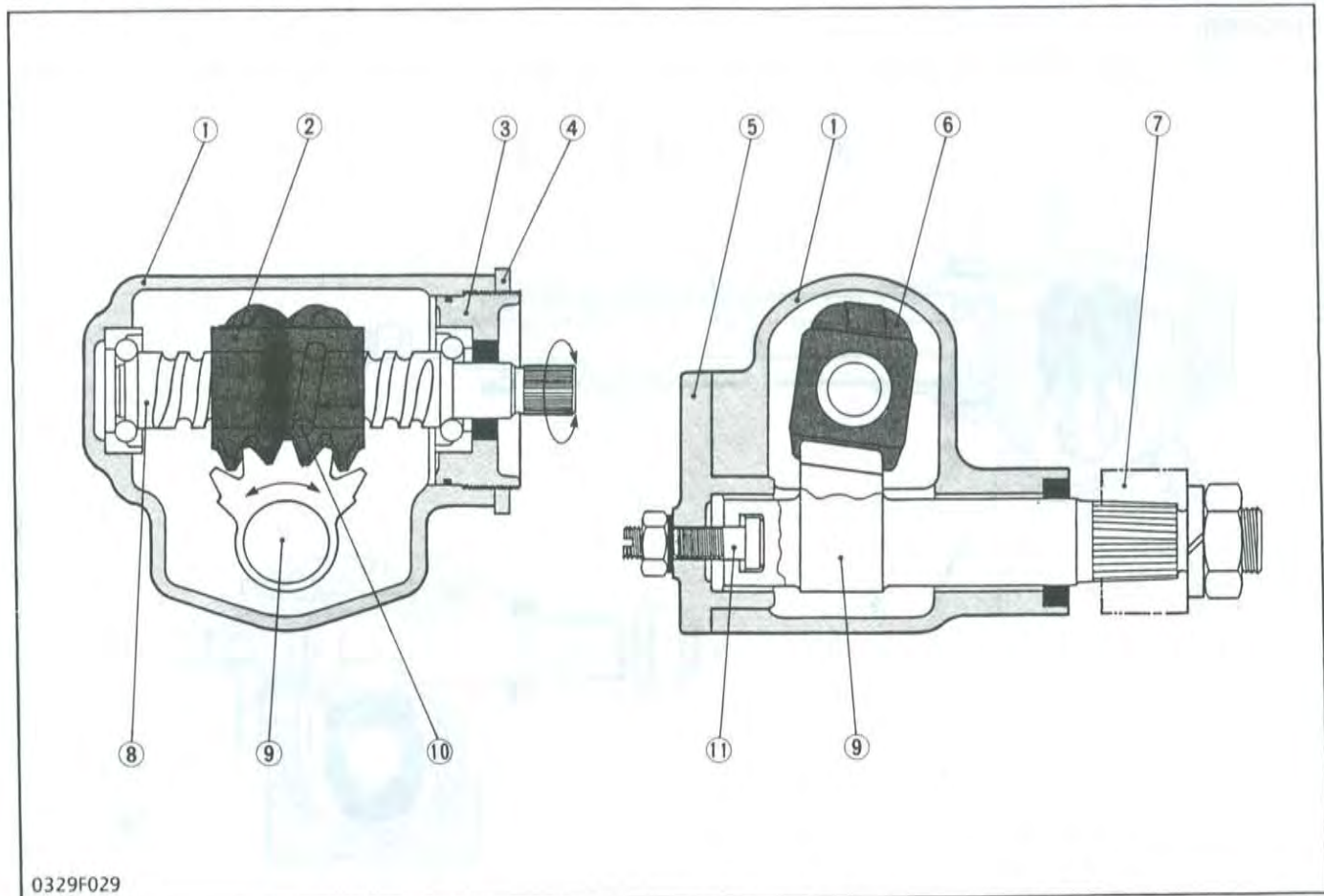
of the ball nut to the other through a pair of ball return guides.

For example, suppose that the operator makes a right turn. The worm gear is rotated in a clockwise direction (viewed from the operator's seat), and this causes the ball nut to move upward. The balls roll between the worm shaft and ball nut and as they reach the upper end of the ball nut, they enter the return guide and then roll back to a lower point, where they reenter the groove between the worm and ball nut.

Steering wheel play can be adjusted by turning an adjusting screw (11) at the end of the sector gear shaft, and with shims (10). As the sector gear shaft is shifted axially by the adjusting screw, the backlash between the sector gear and the ball nut teeth increases or decreases.

When the adjusting screw is turned clockwise, the steering wheel play reduces in proportion to the backlash. Counterclockwise increase the play.

(2) L2650 2WD, L2950 2WD



0329F029

- (1) Gear Box
- (2) Ball Nut
- (3) Rear Cover

- (4) Lock Nut
- (5) Side Cover
- (6) Ball Tube

- (7) Pitman Arm
- (8) Worm Shaft
- (9) Sector Gear Shaft

- (10) Ball
- (11) Adjusting Screw

The steering unit mainly consists of two parts, ball nut (2) and a sector gear shaft (9).

The steering gear box (1) converts the rotating motion of worm shaft (8) by the operator into the swinging motion, and at the same time, increases the torque transmitted to the pitman arm (7). Scores of balls are assembled into the screw groove of ball nut (2) so that the worm shaft (8) rotates lightly.

When the steering wheel is rotated, the worm shaft (8) rotates through the steering shaft, bevel gear, joint shafts. Thus the ball nut (2) is moved along the worm shaft (8). This motion is carried to the sector gear by teeth on the side of the ball nut (2). The end of the sector gear shaft (9) carries the pitman arm. Rotation of the sector gear shaft (9) causes the pitman arm to swing in one direction or the other. The motion is then carried to the knuckle arm at the wheel.

These balls are called "recirculating balls", because

they continuously recirculate from one end of ball nut to the other through a pair of ball return guides.

For example, suppose that the operator makes a right turn. The worm shaft is rotated in a counterclockwise direction (viewed from the operator's seat), and this causes the ball nut to move downward. The balls roll between the worm shaft and ball nut and as they reach the upper end of the ball nut, they enter the return guide and then roll back to a lower point, where they reenter the groove between the worm and ball nut.

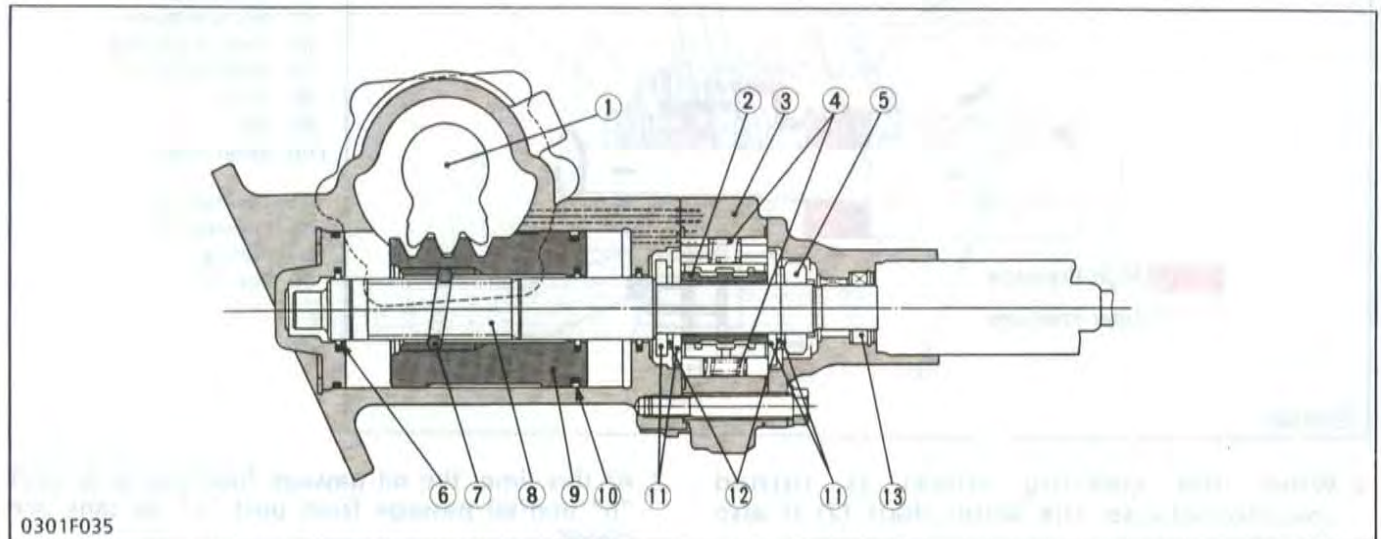
Steering wheel play can be adjusted by turning an adjusting screw (11) at the end of the sector gear shaft. As the sector gear shaft is shifted axially by the adjusting screw, the backlash between the sector gear and the ball nut teeth increases or decreases.

When the adjusting screw is turned clockwise, the steering wheel play reduces in proportion to the backlash. Counterclockwise increases the play.

[2] POWER STEERING (INTEGRAL TYPE)

(1) L2350 4WD

(1)-1 Structure



- (1) Sector Gear Shaft
- (2) Spool
- (3) Sleeve
- (4) Centering Spring

- (5) Lock Nut
- (6) Teflon Ring
- (7) Ball
- (8) Worm Shaft

- (9) Ball Nut
- (10) Teflon Ring
- (11) Thrust Race

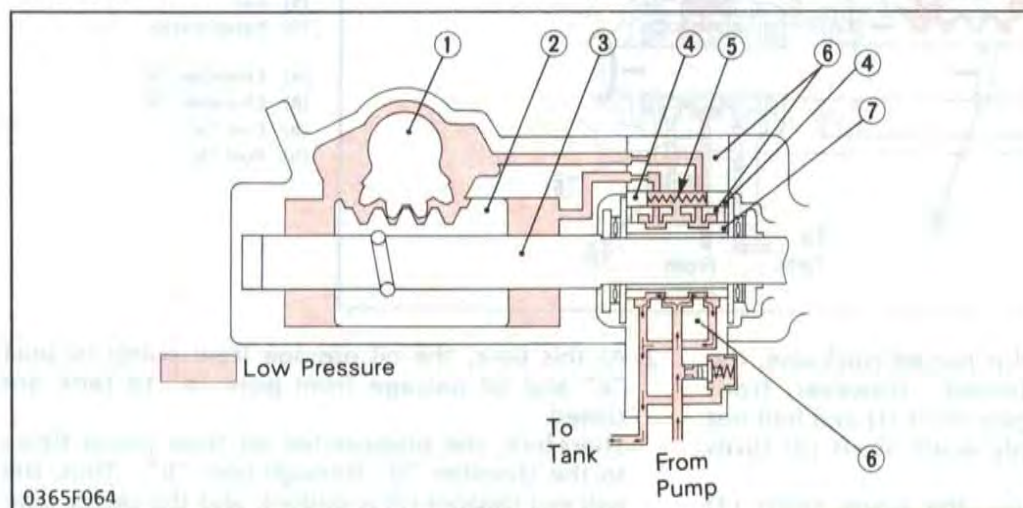
- (12) Needle Bearing
(Thrust Bearing)
- (13) Oil Seal

The mechanical gear section shown above operates in the same way as ordinary manual steering systems. However, with power steering, the worm shaft (8) is supported only by the centering spring (4). When the worm thrust force (turning force of the ball screw section) exceeds centering spring setting load, the worm shaft axially shifts by a specified displacement (stroke: about 1.5 mm 0.0591 in.). When a load is applied to tires and worm thrust

force required for operation is greater than the centering spring setting load, turning the steering wheel does not rotate the sector gear shaft (1), but rather axially moves the worm shaft. The valve spool (2), secured on the worm shaft by a lock nut (5), changes the condition of the three-position, four-way open center (all ports open) valve by sliding in the sleeve (3), to generate pressure as required.

(1)-2 Oil Flow

■ Neutral Position

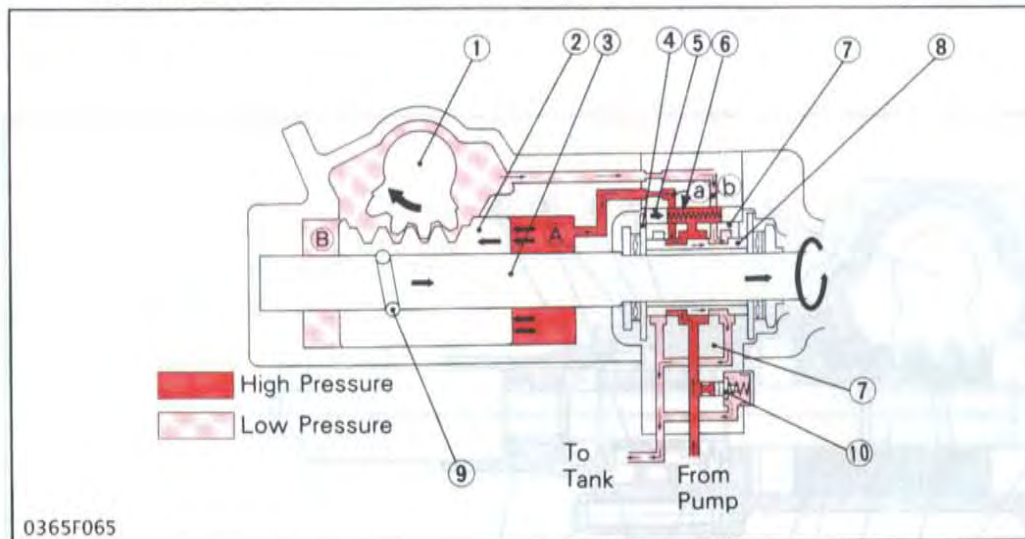


- (1) Sector Gear Shaft
- (2) Ball Nut
- (3) Worm Shaft
- (4) Reaction Pistons
- (5) Centering Spring
- (6) Valve Housing
- (7) Spool

When the steering wheel is not turned, the valve is placed in the neutral position by the centering springs (5) and pressurized reaction pistons (4), and the pressure-fed oil from pump through the flow priority valve flows to the tank.

Therefore, there is no difference between pressures on the right and left cylinder chambers. And the ball nut (2) and sector gear shaft (1) do not move. So, the front wheels keep the direction.

■ Left Turning



- (1) Sector Gear Shaft
- (2) Ball Nut
- (3) Worm Shaft
- (4) Thrust Race
- (5) Reaction Piston
- (6) Centering Spring
- (7) Valve Housing
- (8) Spool
- (9) Ball
- (10) Relief Valve
- (A) Chamber "A"
- (B) Chamber "B"
- (a) Port "a"
- (b) Port "b"

1. When the steering wheel is turned counterclockwise, the worm shaft (2) is also turned.

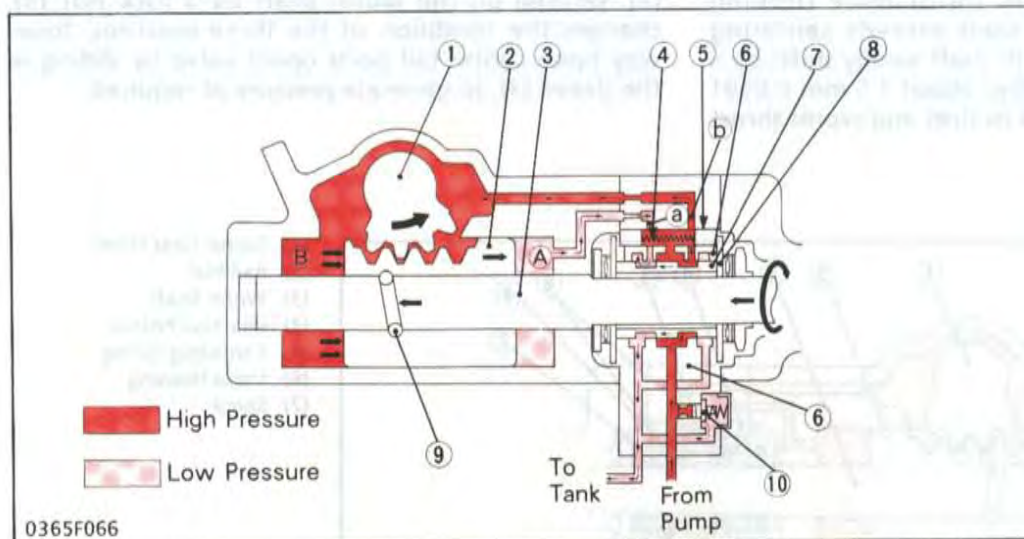
However, front wheel load stops sectors gear shaft (1) and ball nut (piston) (2) from moving, and only worm shaft (3) turns counterclockwise.

Then, due to the reaction, the worm shaft (3) moves upward a little. And the thrust race (4) pushes the spool (8), reaction piston (5) and centering springs (6).

2. At this time, the oil passage from pump to port "b" and oil passage from port "a" to tank are closed.

Therefore, the pressure-fed oil from pump flows to the chamber "A" through port "a". Thus, the ball nut (piston) (2) is pushed, and the sector gear shaft (5) is rotated in the direction of the arrow. Oil in chamber "B" flows to the tank through port "b".

■ Right Turning



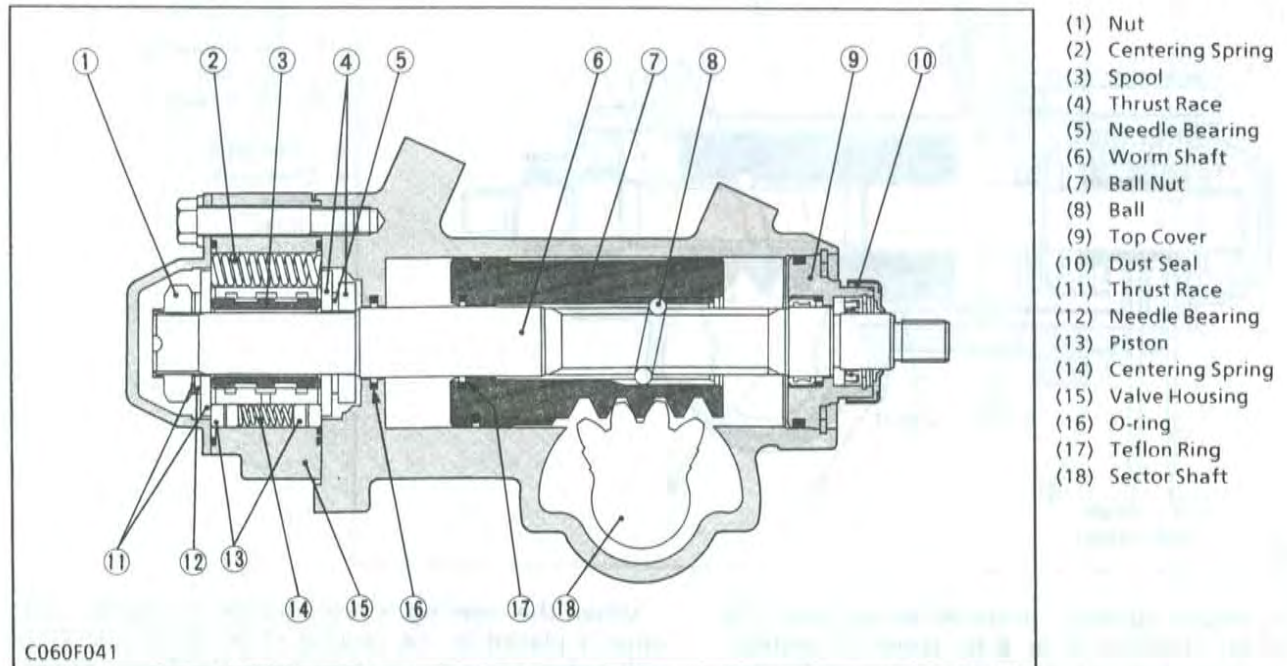
- (1) Sector Gear Shaft
- (2) Ball Nut
- (3) Worm Shaft
- (4) Centering Spring
- (5) Reaction Piston
- (6) Valve Housing
- (7) Spool
- (8) Thrust Race
- (9) Ball
- (10) Relief Valve
- (A) Chamber "A"
- (B) Chamber "B"
- (a) Port "a"
- (b) Port "b"

1. When the steering wheel is turned clockwise, the worm shaft (3) is also turned. However, front wheel load stops sector gear shaft (1) and ball nut (2) from moving, and only worm shaft (3) turns clockwise.

Then due to the reaction, the worm shaft (3) moves downward a little. And the thrust race (8) pushes the spool (7), reaction piston (5) and centering springs (4).

2. At this time, the oil passage from pump to port "a" and oil passage from port "b" to tank are closed.

Therefore, the pressure-fed oil from pump flows to the chamber "B" through port "b". Thus, the ball nut (piston) (2) is pushed, and the sector gear shaft (1) is rotated in the direction of the arrow. Oil in chamber "A" flows to the tank through the port "a".

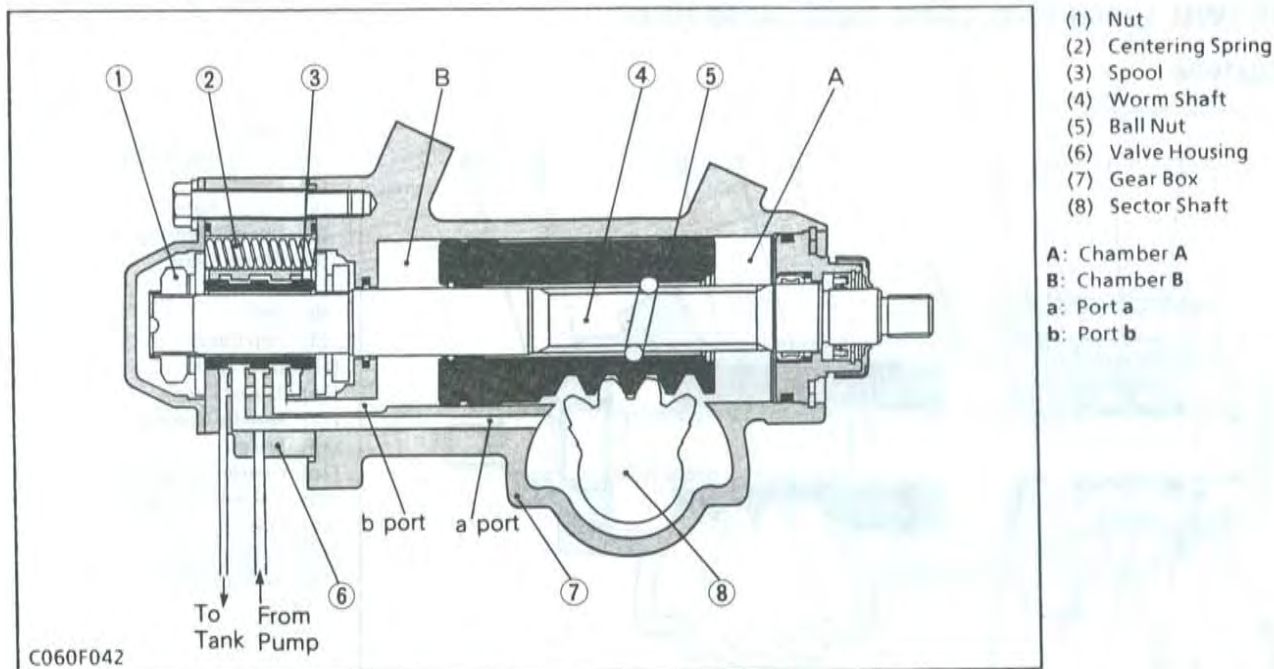
(2) L2650 2WD, L2950 2WD, L3450 2WD, L3650 2WD**(2)-1 Structure**

The power steering is an integral type and is divided into the two sections as shown above; the control valve section for controlling oil pressure and the hydraulic cylinder section for assisting the steering force.

The control valve section is a centering spring sliding valve type and is consisted of the spool (3),

valve housing (15), centering springs (2), (14) and other parts.

The hydraulic cylinder section is consisted of the gear box which constitutes the cylinder tube and the ball nut (7) and other parts which constitutes the piston.



During engine running, pressure-fed oil from the pump enters chamber A or B by spool (3) action, thereby moving ball nut (5) to the right or left. The spool is moved with a slight rotation of worm shaft (4), thus changing the oil path. Therefore, to move the spool (3) by the steering wheel, thus facilitating easy and smooth steering operation.

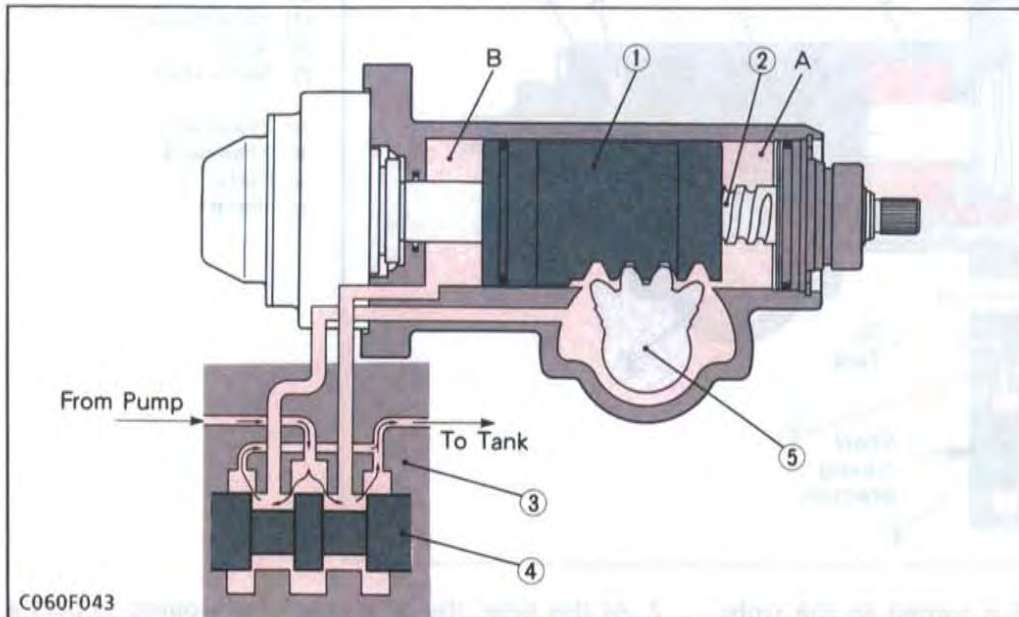
During engine stop or even when hydraulic circuit malfunctions, this system exhibits the same function as in manual steering.

Ports a and b are connected to the left and right cylinder chambers A and B respectively.

Oil fed from the pump pushes ball nut (5) (piston) in the cylinder chamber, thus rotating sector shaft (8). While the steering wheel is continuously rotated, the valve is always open therefore, the piston also follows it up.

When the steering wheel rotation is stopped, the valve is placed in the neutral state at the position well balanced with reaction from the front wheel, whereby the ball nut (5) (piston) stop, and the sector shaft also stops at that position. (Servo mechanism)

If the steering wheel is still rotated, when the front wheel reached the maximum steering angle, or resistance of moving wheel is too large, the relief valve is actuated, thus protecting the hydraulic circuit. Continuous the relief valve actuated causes oil temperature rise, which may perniciously affect each steering section.

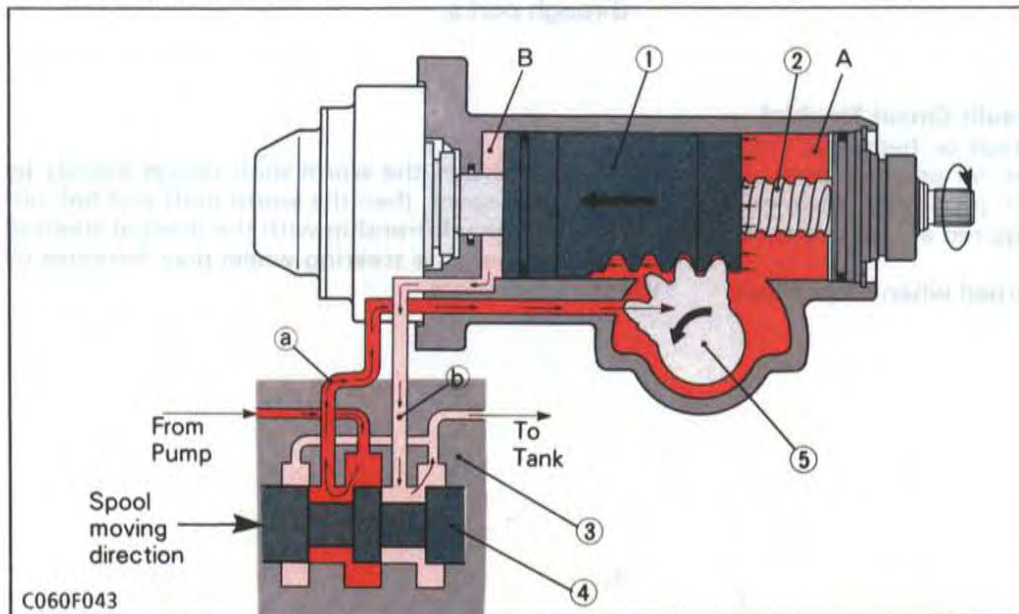
(2)-2 Oil Flow**■ Neutral Position**

- (1) Ball Nut
- (2) Worm Shaft
- (3) Valve Housing
- (4) Spool
- (5) Sector Shaft

When the steering wheel is not turned, the valve is placed in the neutral position by the centering spring, and the pressure-fed oil from pump returns to

the tank.

Therefore, there is no difference between pressures on the right and left cylinder chambers.

■ Left Turning

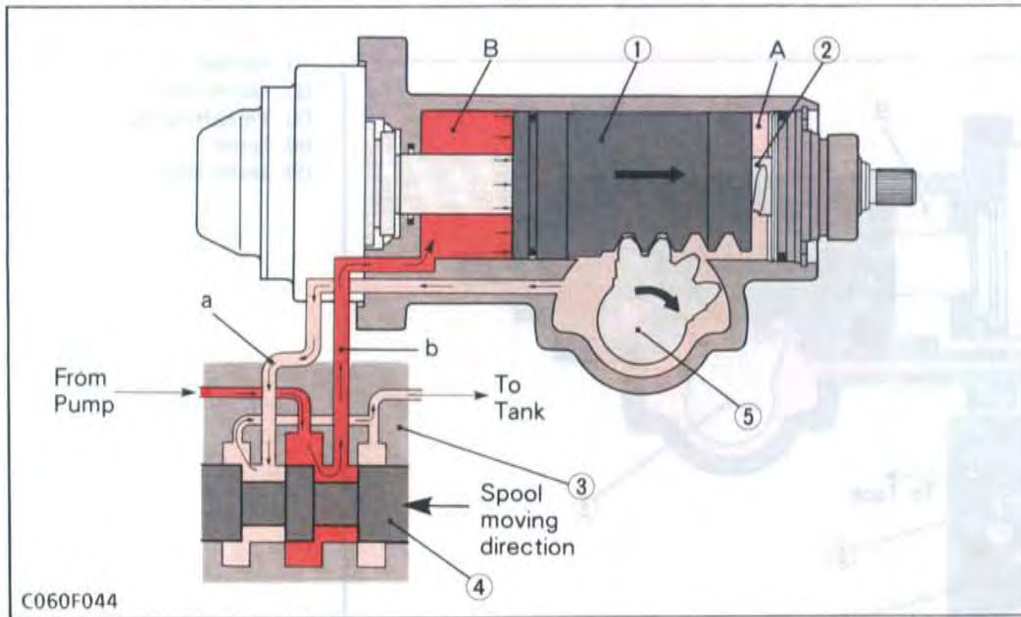
- (1) Ball Nut
- (2) Worm Shaft
- (3) Valve Housing
- (4) Spool
- (5) Sector Shaft

A: Chamber A
B: Chamber B
a: Port a
b: Port b

1. When the steering wheel is turned to the left, the worm shaft (2) attempts to turn to the right. However, front wheel load stops sector shaft (5) and ball nut (piston) (1) from moving, and only worm shaft (2) turns to the right. Therefore, the spool (4) is moved to the direction of the arrow, deflecting the centering spring.

2. At this time, the oil passage from pump to port b and oil passage from port a to oil tank are closed. Therefore, the pressure-fed oil from pump flows to the chamber A through port a. Thus, the ball nut (piston) (1) is pushed to the left, and the sector shaft (5) is rotated in the direction of the arrow. Oil in chamber B returns to the tank through port b.

■ Right Turning



1. When the steering wheel is turned to the right, the worm shaft (2) attempts to turn to the left. However, front wheel load stops sector shaft (5) and ball nut (1) from moving, and only worm shaft (2) turn to the left. Therefore, the spool (4) is moved to the direction of the arrow, deflecting the centering spring.

2. At this time, the oil passage from pump to port a and oil passage from port b to oil tank are closed. Therefore, the pressure-fed oil from pump flows to the chamber B through port b. Thus, the ball nut (piston) (1) is pushed to the right, and the sector shaft (5) is rotated in the direction of the arrow. Oil in chamber A returns to the tank through port a.

(3) Manual Operation

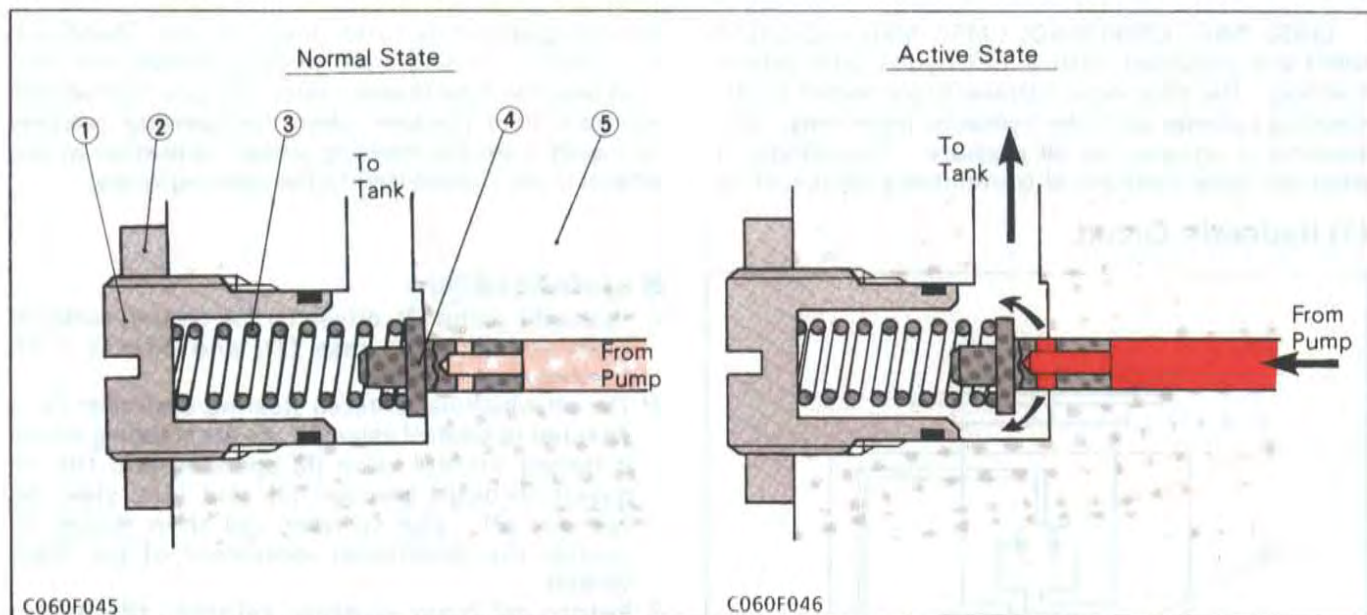
(When Engine Stops or Hydraulic Circuit Trouble)

Even when the engine stops or hydraulic circuit malfunctions thus leading to oil pressure operation stop, manual operation is possible. However, naturally, steering wheel required a larger operating power.

If the steering wheel is turned when oil pressure

ceases to operate, the worm shaft moves slightly by the stroke of spool, then the worm shaft and ball nut have the same relationship with the manual steering gear. However, the steering wheel play increases by the stroke of spool.

(4) Relief Valve



(1) Adjusting Screw
(2) Lock Nut

(3) Spring

(4) Poppet

(5) Valve Housing

This power steering is equipped with a direct-acting relief valve to restrict the maximum pressure in the hydraulic circuit and to prevent breakage of the hydraulic equipment.

When the pressure in the hydraulic circuit exceeds the relief valve setting pressure in such a case that the maximum steering angle of the front wheels is reached or road resistance to the front tires is too great, the spring (3) is compressed to generate a gap between the poppet (4) and the valve housing (5). The pressure-fed oil flows to tank port through the gap so that pressure rise is restricted.

The relief valve setting pressure can be adjusted by turning the adjusting screw (1).

(Reference)

- Relief valve setting pressure:

[L2350] 10.0 to 10.6 MPa
102 to 108 kgf/cm²
1451 to 1536 psi

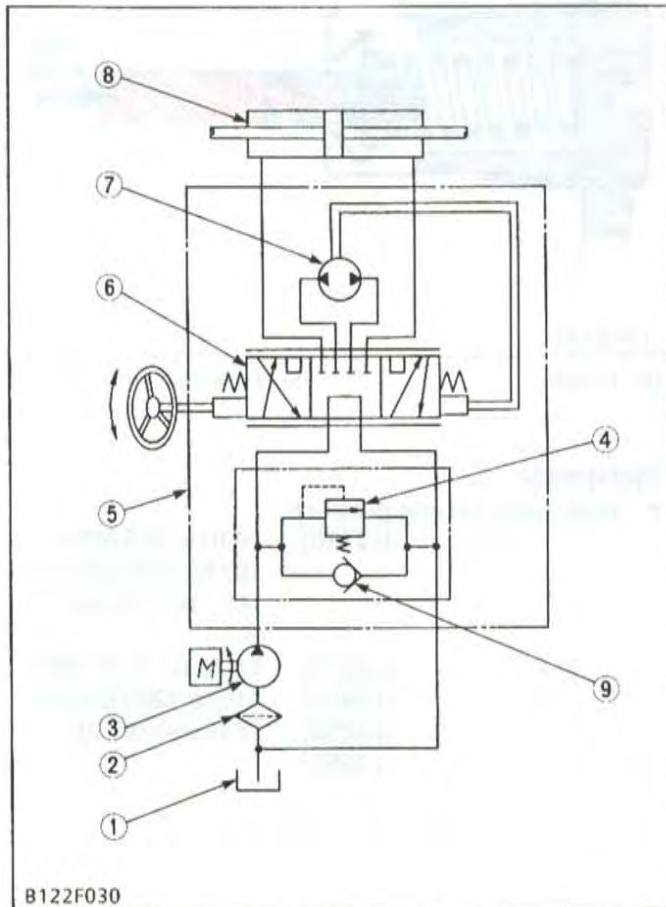
[L2650] 11.28 to 11.77 MPa
[L2950] 115 to 120 kgf/cm²
[L3450] 1636 to 1707 psi
[L3650]

[4] POWER STEERING (FULL HYDROSTATIC TYPE)

L2650 4WD, L2950 4WD, L3450 4WD and L3650 4WD are provided with a full hydrostatic power steering. The steering controller is connected to the steering cylinder with the hydraulic pipes only. This steering is actuated by oil pressure. Accordingly, it does not have mechanical transmitting parts such as

steering gear, pitman arm, drag link, etc. Therefore, it is simple in construction. In these models, the non-road reaction type is used. With this type, the wheels maintain their position when the operator releases his hands from the steering wheel. Vibration at the wheels is not transmitted to the steering wheel.

(1) Hydraulic Circuit



■ Hydraulic Oil Flow

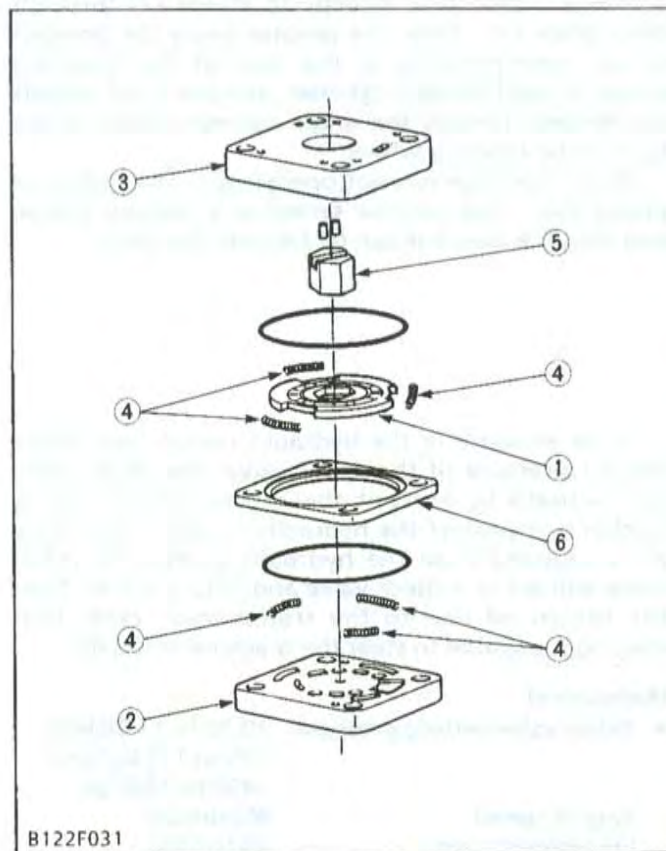
1. Hydraulic pump (3), driven by the engine, sucks oil from transmission case (1), and directs it to steering controller (5).
2. The oil which has entered steering controller (5) is directed to control valve (6). As the steering wheel is turned, control valve (6) operates, and the oil passes through gerotor (7) and into steering cylinder (8). The cylinder rod then moves to control the directional movement of the front wheels.
3. Return oil from steering cylinder (8) passes through control valve (6) and back into transmission case (1).
4. When the engine is not operating, and the steering wheel is turned, gerotor (7) rotates to supply oil in the pipe to steering cylinder (8). Thus the machine can be steered manually. Under this condition, check valve (9) opens, and oil returning from the steering cylinder, which would otherwise return to transmission case (1), flows to the pipe leading to the hydraulic pump.

- | | |
|-------------------------|-----------------------|
| (1) Transmission Case | (6) Control Valve |
| (2) Oil Filter | (7) Gerotor |
| (3) Hydraulic Pump | (8) Steering Cylinder |
| (4) Relief Valve | (9) Check Valve |
| (5) Steering Controller | |

(2) Steering Controller

The steering controller mainly consists of a control valve, a metering device and a relief valve with check valve. The metering device comprises a set of special gear called "Geroter".

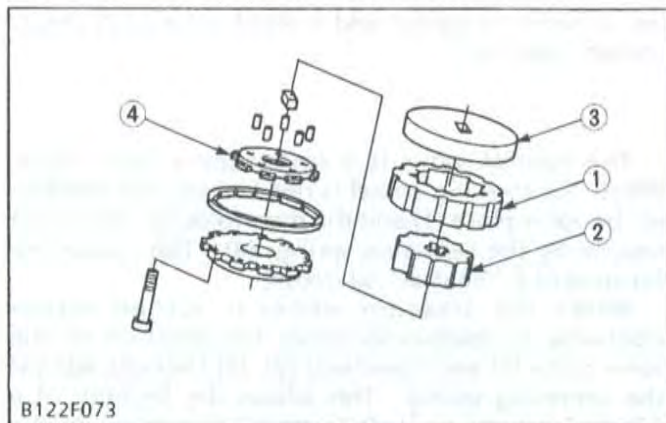
(2)-1 Control Valve



The control valve is a rotary plate type valve. When the steering wheel is not turned, the position of the valve plate (1) and the manifolds (2), (3) is kept neutral by the centering springs (4). This causes the forming of a "Neutral" oil circuit.

When the steering wheel is turned either clockwise or counterclockwise, the position of the valve plate (1) and manifolds (2), (3) changes against the centering spring. This allows the forming of a "Right Turning" or "Left Turning" oil circuit. At the same time, the geroter rotates with the valve plate and sends the oil to the cylinder corresponding to the rotation of the steering wheel.

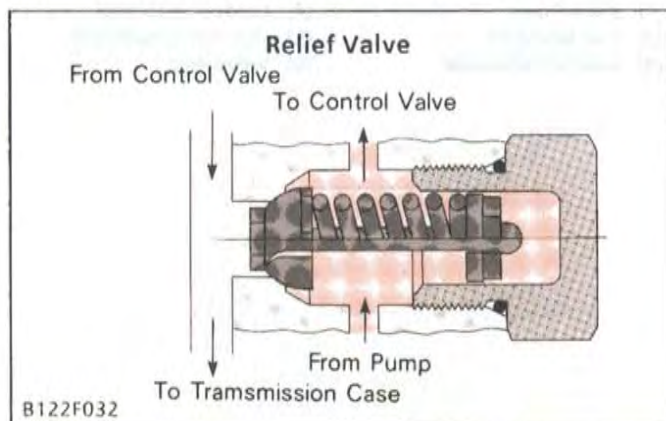
- | | |
|------------------------|------------------------|
| (1) Valve Plate | (4) Centering Springs |
| (2) Port Manifold | (5) Hex Drive Assembly |
| (3) Isolation Manifold | (6) Valve Ring |

(2)-2 Metering Device (Gerotor)

All oil directed from the hydraulic pump to the steering cylinder passes through the metering device (gerotor) on its way. This metering device is a trochoid pump. As the steering wheel is turned, the action is transmitted directly to stator (1) through drive plate (3). Thus, the gerotor sends the amount of oil corresponding to the turn of the steering wheel to the hydraulic cylinder, and the front wheels are moved through the angle corresponding to the turn of the steering wheel.

When the engine is not operating or the hydraulic pump fails. The gerotor serves as a manual pump, and thus the machine can be steered manually.

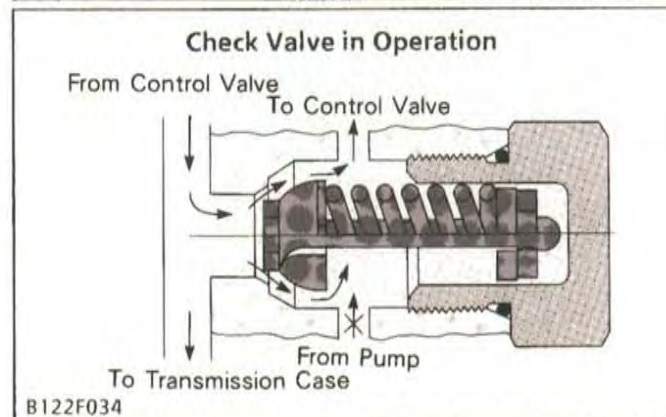
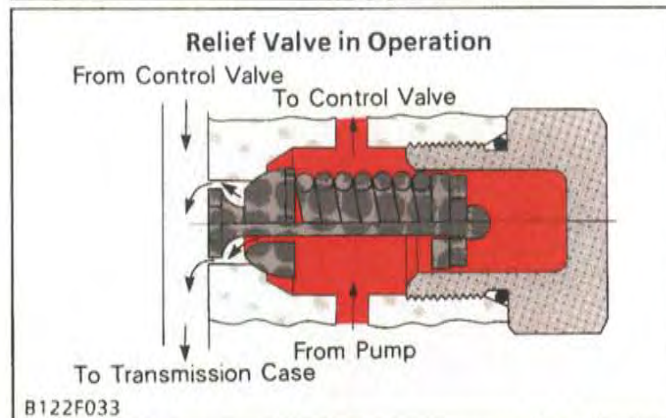
- (1) Stator (3) Drive Plate
(2) Rotor (4) Commutator

(2)-3 Relief Valve (with Check Valve)

If the pressure in the hydraulic circuit rises above the set pressure of the relief valve, the relief valve will actuate to prevent the pressure from rising further and protect the hydraulic system. Also, if no oil is supplied from the hydraulic pump, the relief valve will act as a check valve and help draw oil from the return oil line to the transmission case, thus making it possible to steer the machine manually.

(Reference)

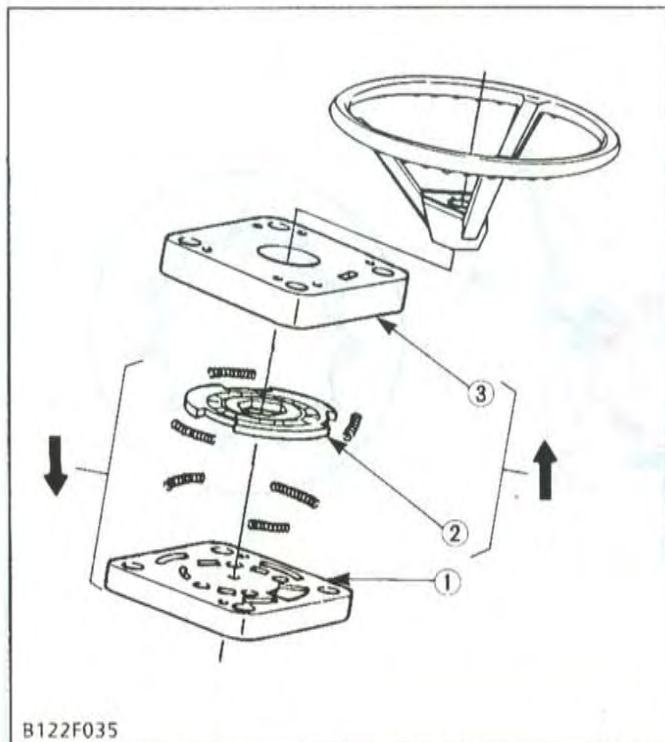
- Relief valve setting pressure: 10.30 to 11.28 MPa
105 to 115 kgf/cm²
1493 to 1636 psi
- Engine speed: Maximum
- Oil temperature: 45 to 55°C
(113 to 131°F)



(3) Oil Flow

The directions of oil flow shown in the views in the following explanation are those when viewed from the directions indicated just below.

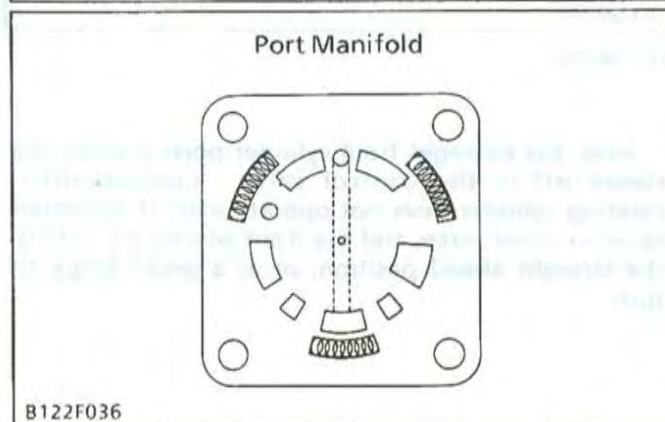
Views of the port manifold, the isolation manifold, and the valve plate are also given below.



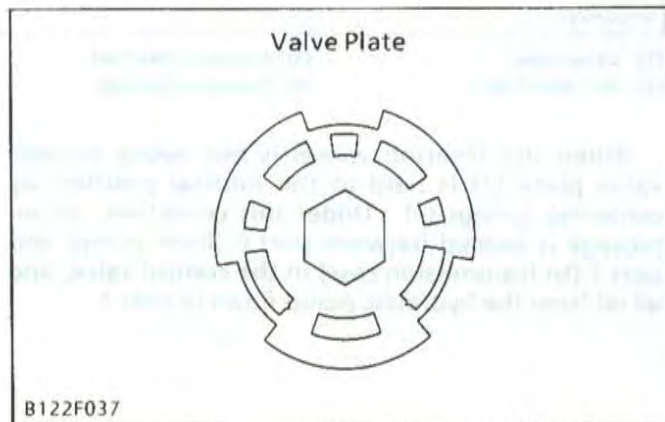
B122F035

(1) Port Manifold
(2) Valve Plate

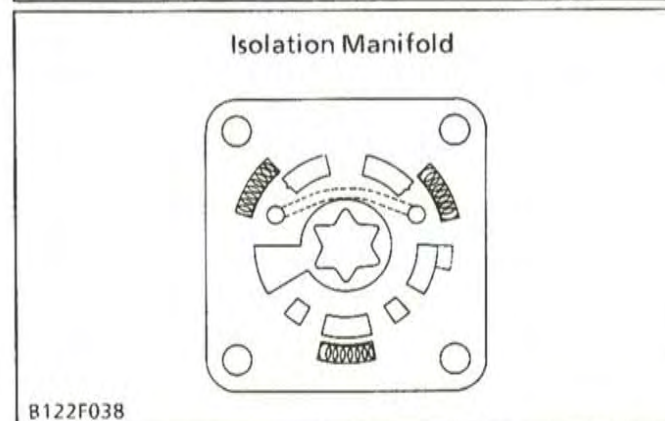
(3) Isolation Manifold



B122F036

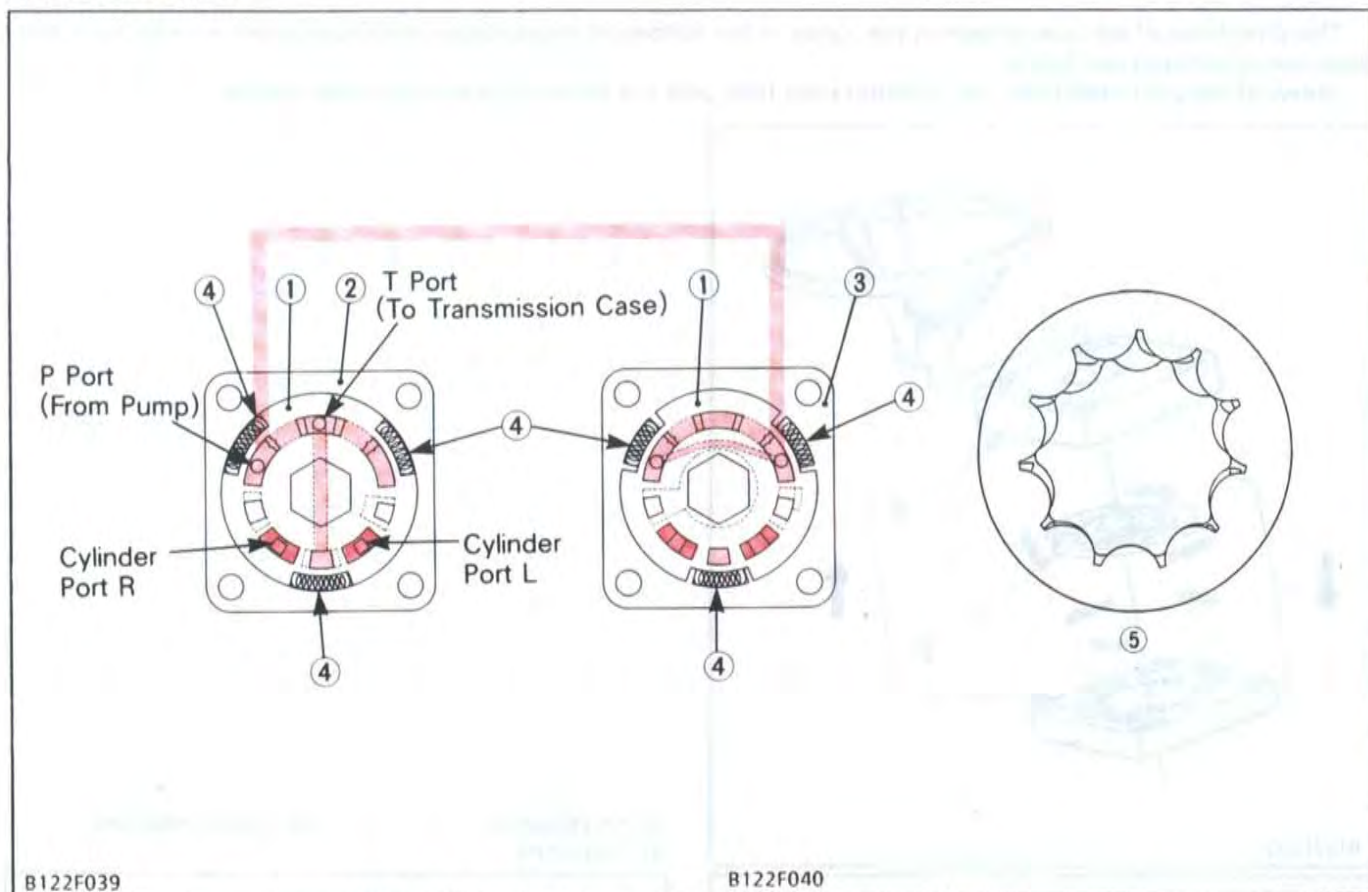


B122F037



B122F038

■ Neutral Position



B122F039

B122F040

(1) Valve Plate
(2) Port Manifold

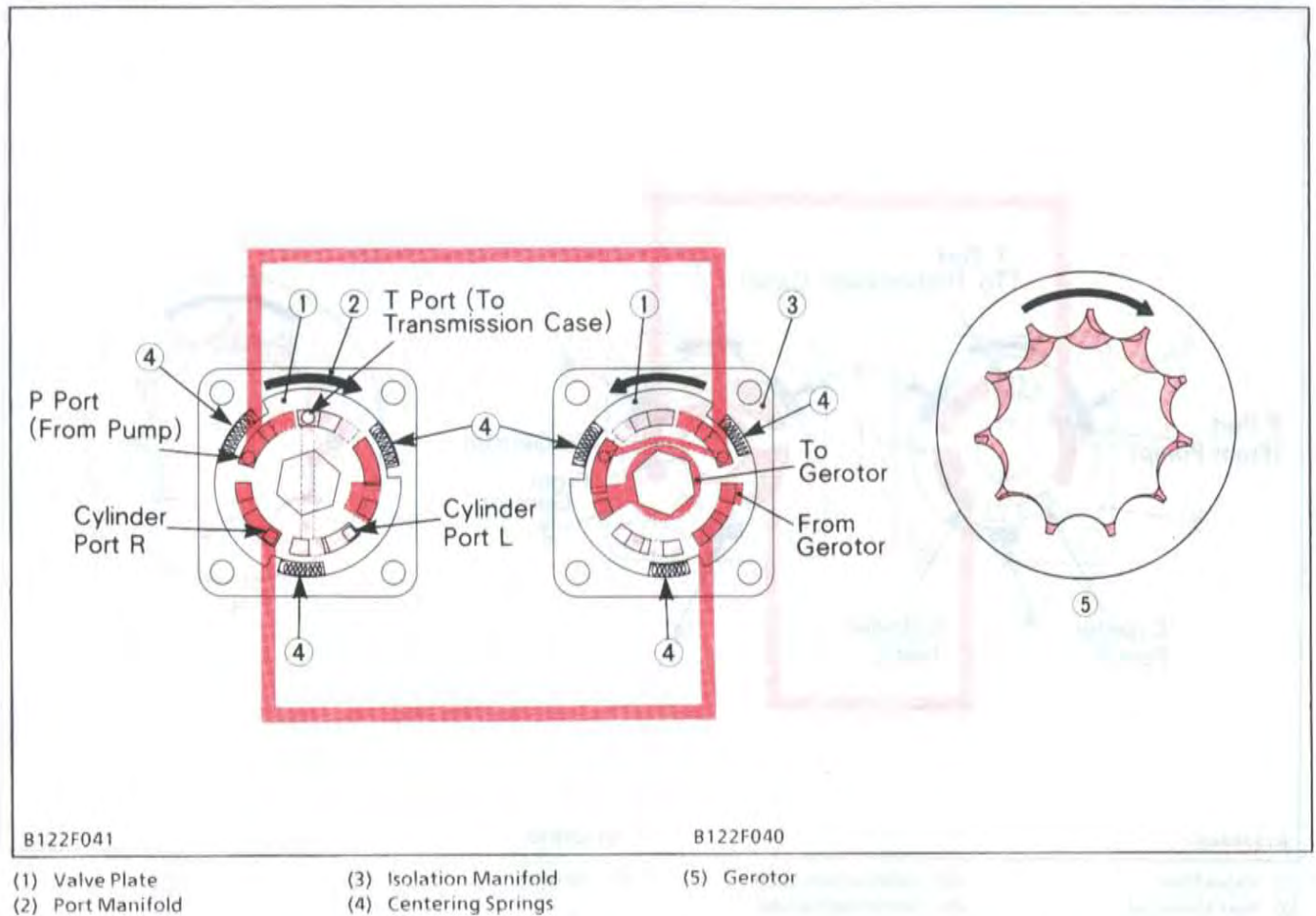
(3) Isolation Manifold
(4) Centering Springs

(5) Gerotor

When the steering wheel is not being turned, valve plate (1) is held in the neutral position by centering springs (4). Under this condition, an oil passage is formed between port P (from pump) and port T (to transmission case) in the control valve, and all oil from the hydraulic pump flows to port T.

Also, the passages from cylinder ports R and L are closed off in the control valve. Consequently, steering cylinder does not operate even if subjected to an external force, and the front wheels are held in the straight ahead position, or at a given angle of turn.

■ Right Turn



When the steering wheel is turned to the right, the action is transmitted through the drive plate, gerotor, and drive link to the control valve. Valve plate (1) then rotates to the right on manifolds (2) and (3), located on the opposite faces of the valve plate. Thus, the port P passage in the control valve is connected with gerotor (5).

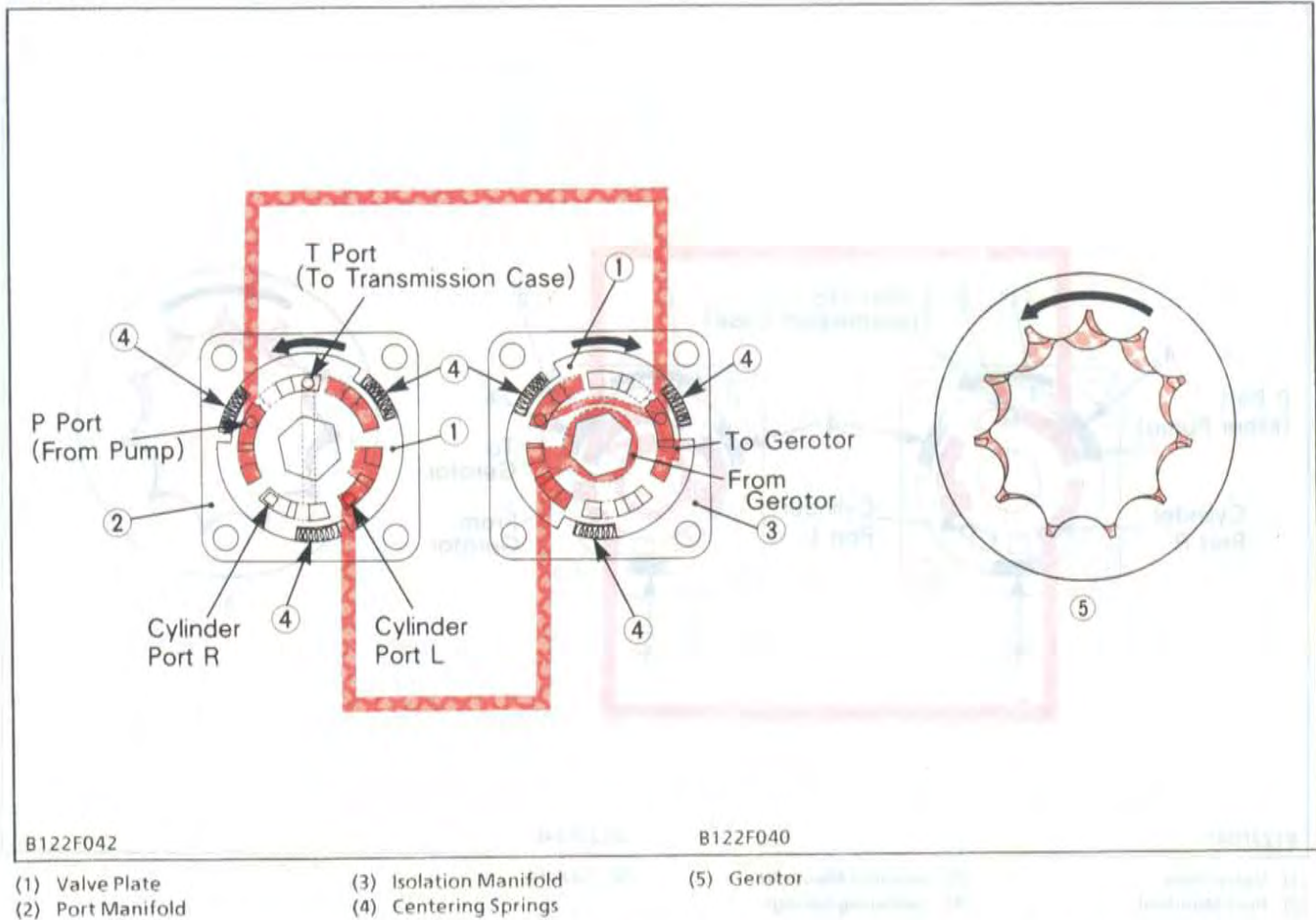
The stator of gerotor (5) turns by the amount corresponding to the turn of the steering wheel, and the gerotor performs the metering function and lets oil through it, the amount of which corresponds to

the turn of the steering wheel.

The oil which has passed through gerotor (5) flows back to the control valve, in which it is directed to cylinder port R to operate steering cylinder. Consequently, the front wheels are moved to the right through the angle corresponding to the amount of the oil.

When steering cylinder operates, oil returning to cylinder port L flows back to the transmission case through the passage connected to port T in the control valve.

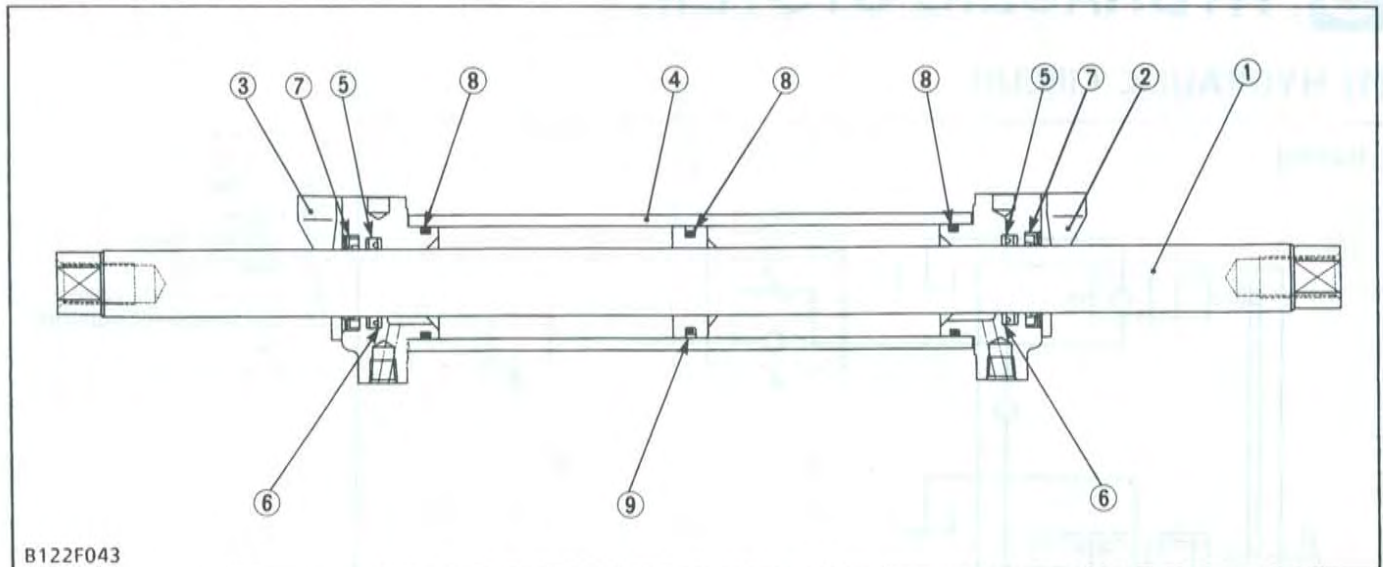
Left Turn



The steering system operates in the same way at a left-turn as well, except that oil flows into and out

of steering cylinder in the directions opposite to those at a right-turn.

(4) Steering Cylinder



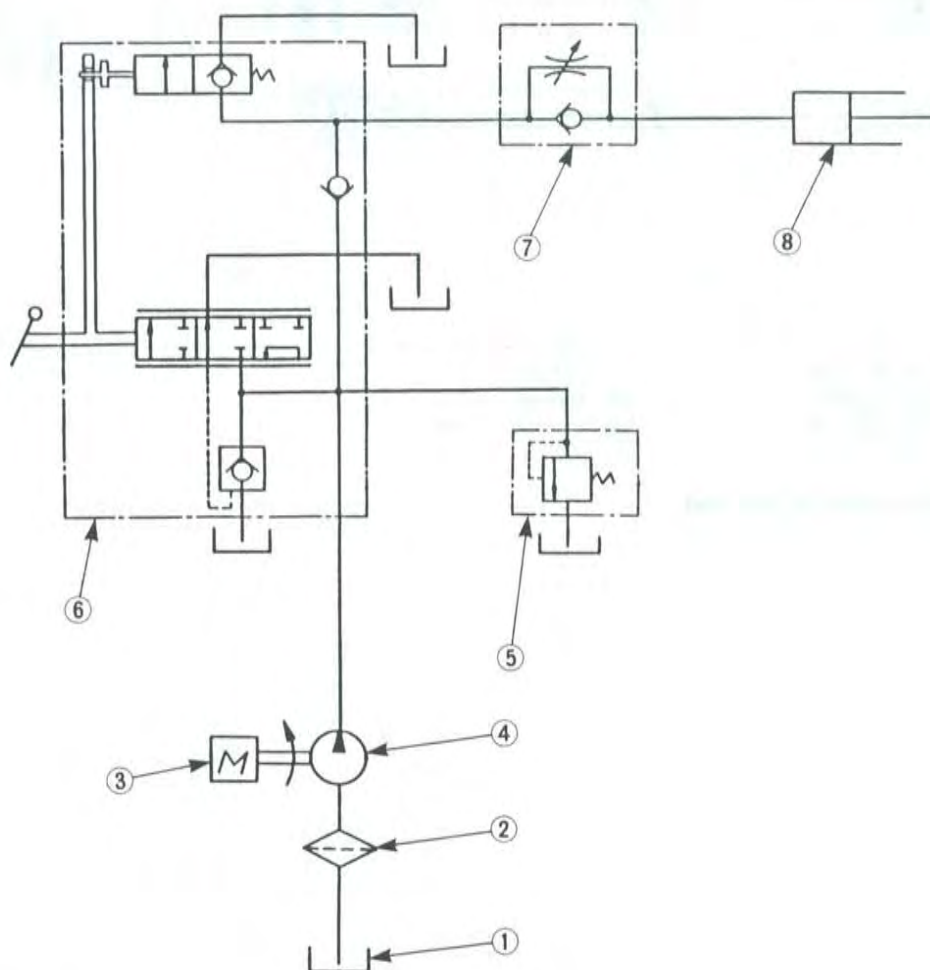
- | | | |
|-----------------|-----------------------|----------------------|
| (1) Rod | (4) Cylinder Tube | (7) Dust Seal |
| (2) Flange L.H. | (5) Packing (Rod) | (8) O-rings |
| (3) Flange R.H. | (6) Packing (Back Up) | (9) Packing (Piston) |

The steering cylinder adopted is of the double-rod, the double-acting type.

9 HYDRAULIC SYSTEM

[1] HYDRAULIC CIRCUIT

[L2350]



- (1) Oil Tank
(Transmission Case)
- (2) Oil Filter
- (3) Engine
- (4) Hydraulic Pump
- (5) Relief Valve
- (6) Position Control Valve
- (7) Lowering Speed Adjusting
Valve
- (8) Hydraulic Cylinder

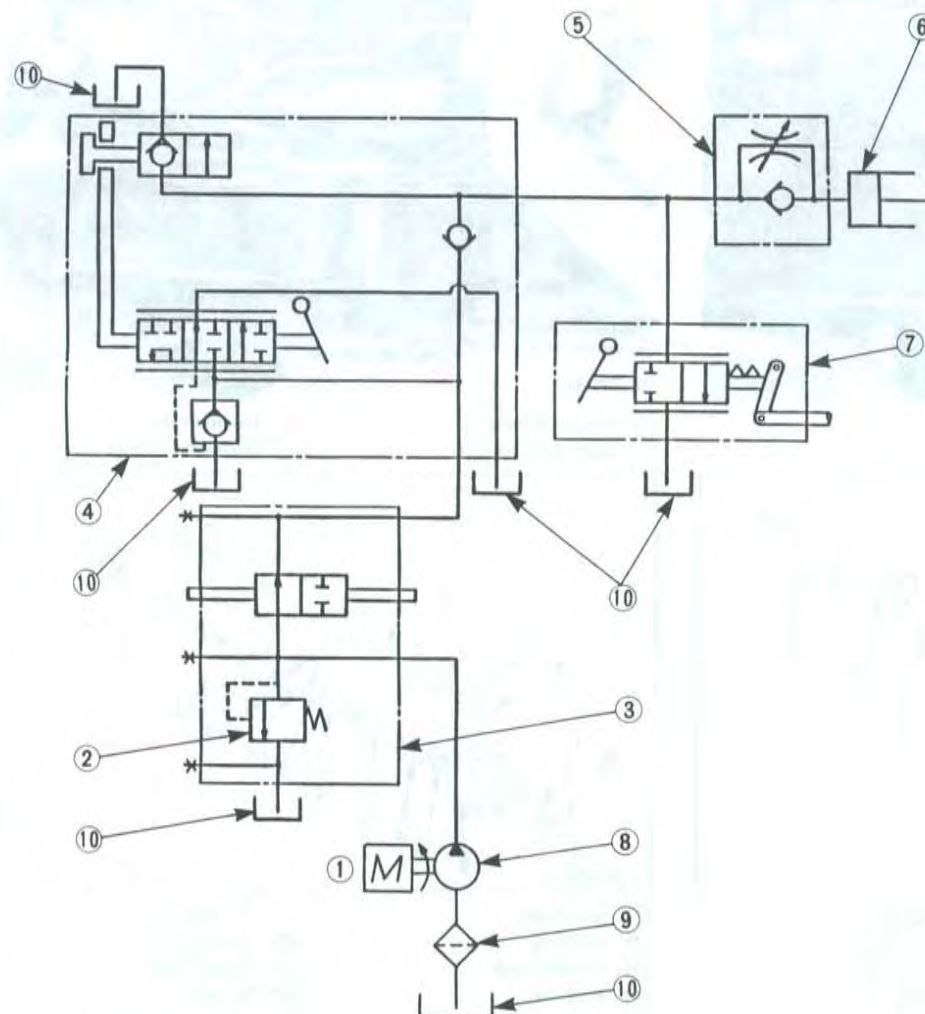
B122F044

■ Hydraulic Oil Flow

1. When the engine (3) is started, the hydraulic pump (4) is rotated to draw oil from the transmission case (1) through the suction pipe. Supplied oil is filtered by the oil filter (2).
2. Filtered oil is forced out by the hydraulic pump to the position control valve (6) through the delivery pipe.
3. The position control valve (6) switches the oil flow, and oil is channeled to the hydraulic cylinder (8) for the three-point hydraulic system or returned to the oil tank (transmission case).

- The hydraulic system has a relief valve (5) which restricts the maximum pressure in the circuit.

[L2650, L2950, L3450, L3650]



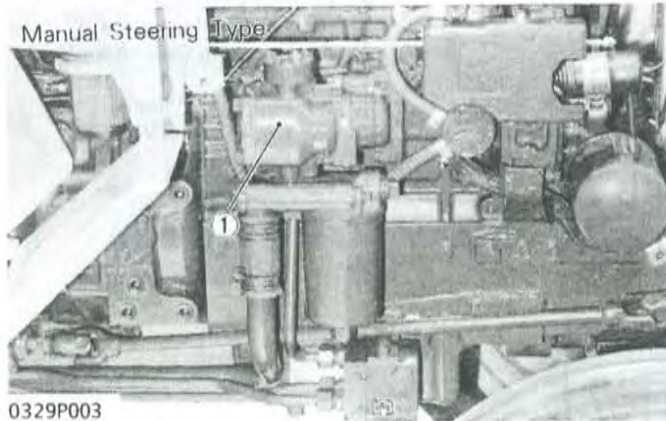
- (1) Engine
- (2) Relief Valve
- (3) Front Hydraulic Block
- (4) Position Control Valve
- (5) Lowering Speed Adjusting Valve
- (6) Hydraulic Cylinder
- (7) Draft Control Valve (Option)
- (8) Oil Pump
- (9) Oil Filter
- (10) Oil Tank (Transmission Case)

B122F045

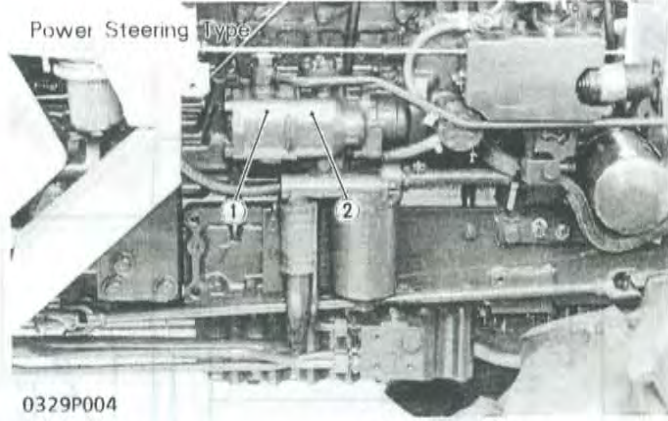
■ Hydraulic Oil Flow

1. When the engine (1) is started, the hydraulic pump (8) is rotated to draw oil from the transmission case (10) through the suction pipe. Supplied oil is filtered by the oil filter (9).
2. Filtered oil is forced out by the hydraulic pump to the front hydraulic block (3). When a front end loader is equipped with the tractor, oil pressure is taken from the front hydraulic block (3), and the return oil from the front end loader flows back to this front hydraulic block (3), to be returned into the oil hydraulic circuit.
3. After that oil into the position control valve (4) through the delivery pipe.
4. The position control valve (4) switches the oil flow, and oil is channeled to the hydraulic cylinder (6) for the three-point hydraulic system or returned to the oil tank (transmission case) (10).
5. The hydraulic system has a relief valve (2) which restricts the maximum pressure in the circuit.

[2] HYDRAULIC PUMP

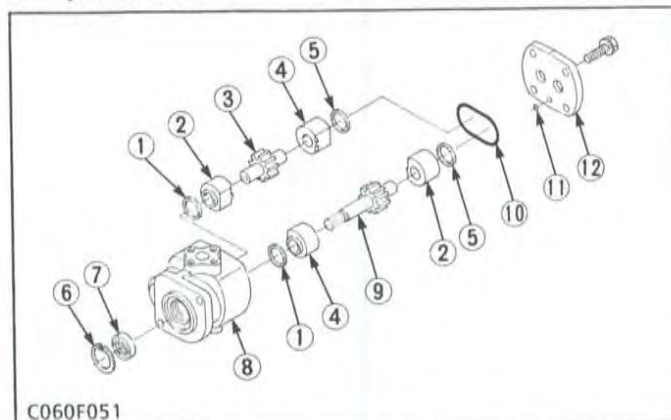


(1) Three Point Hydraulic Pump

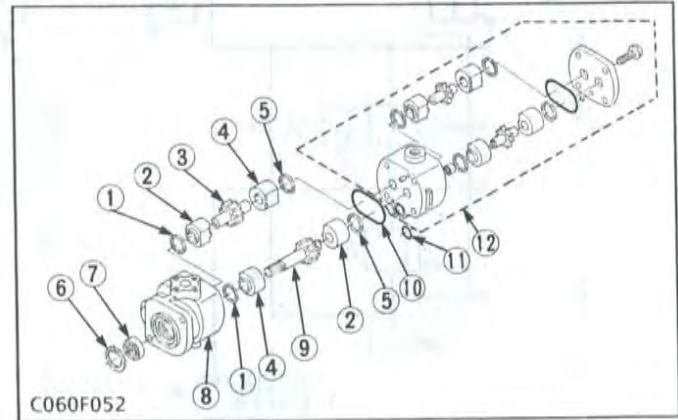


(1) Power Steering Hydraulic Pump

(2) Three Point Hydraulic Pump



- | | |
|------------------------|----------------|
| (1) Seal Ring | (7) Oil Seal |
| (2) Bushing | (8) Pump Body |
| (3) Driven Gear | (9) Drive Gear |
| (4) Bushing | (10) O-ring |
| (5) Seal Ring | (11) O-ring |
| (6) Internal Snap Ring | (12) Cover |



- | | |
|------------------------|------------------------------------|
| (1) Seal Ring | (7) Oil Seal |
| (2) Bushing | (8) Pump Body |
| (3) Driven Gear | (9) Drive Gear |
| (4) Bushing | (10) O-ring |
| (5) Seal Ring | (11) O-ring |
| (6) Internal Snap Ring | (12) Power Steering Hydraulic Pump |

The three point hydraulic system pump pressure-feeds the oil drawn from the transmission case through the oil filter to the control valve. The three point hydraulic system pump is driven by the engine fuel camshaft.

The power steering system pump is driven by the drive gear of three point hydraulic system pump. (See the figure above.) This pump pressure-feeds the oil drawn from the three point hydraulic system pump suction line to the power steering system.

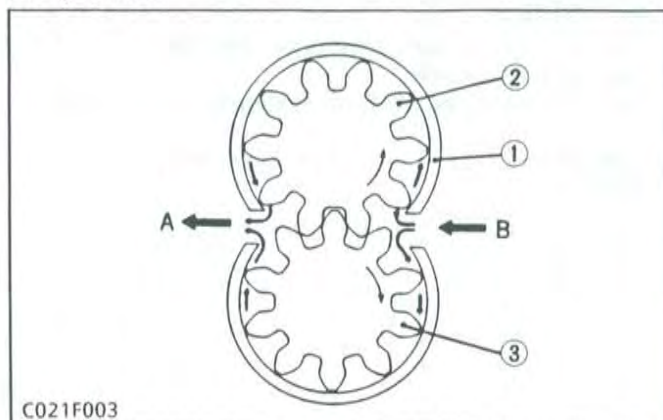
These hydraulic pumps are pressure loading type gear pumps with high volumetric efficiency.

(Reference)

- Pump discharge per revolution.

		Three point hydraulic system pump	Pump steering system pump
L2350	2WD	12.90 cc/rev. 0.787 cu.in./rev.	—
	4WD	9.027 cc/rev. 0.551 cu.in./rev.	—
L2650 L2950	Manual steering type		—
	Integral power steering type	9.027 cc/rev. 0.551 cu.in./rev.	3.703 cc/rev. 0.226 cu.in./rev.
	Full hydrostatic power steering type		6.068 cc/rev. 0.370 cu.in./rev.
L3450 L3650	Integral power steering type	11.72 cc/rev. 0.715 cu.in./rev.	4.778 cc/rev. 0.292 cu.in./rev.
	Full hydrostatic power steering type	11.69 cc/rev. 0.713 cu.in./rev.	6.068 cc/rev. 0.370 cu.in./rev.

■ Operation

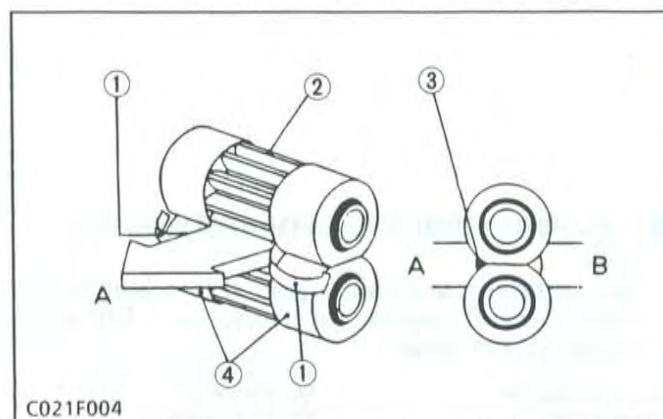


The hydraulic pump has two meshing gears (2), (3) whose teeth run close to the casing (1). One gear is a drive gear which drives the driven gear. When the drive gear is driven in the direction of the arrow by the fuel camshaft, the gear traps oil between the gear teeth and the casing. The higher the engine speed, the more the pump discharges.

A: Outlet
B: Inlet

(1) Casing
(2) Gear

(3) Gear



The pressure loading system automatically decreases the clearance between the gear and the bushings. A small amount of pressurized oil is fed behind the bushings, pressing them against the gears and forming a tighter seal against leakage. Therefore, leakage from the delivery side (high pressure) to the inlet side (low pressure) does not increase even if the pressure on the delivery side increases.

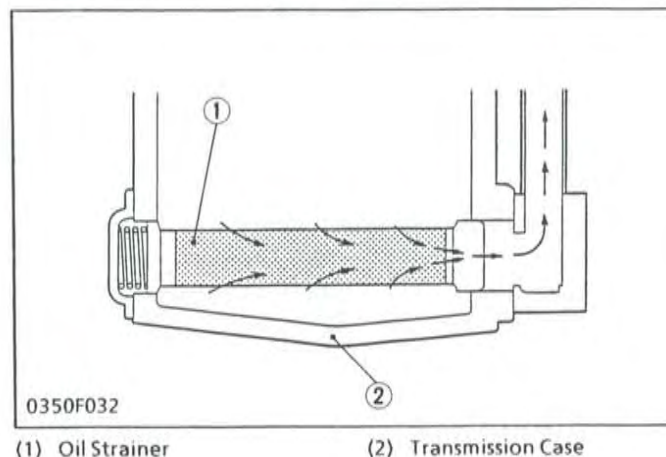
A: Outlet
B: Inlet

(1) Loading Pressure
(2) Gear

(3) Pressure Introducing Port
(4) Bushings

[3] OIL FILTER

The oil filter is located at the pump suction line.

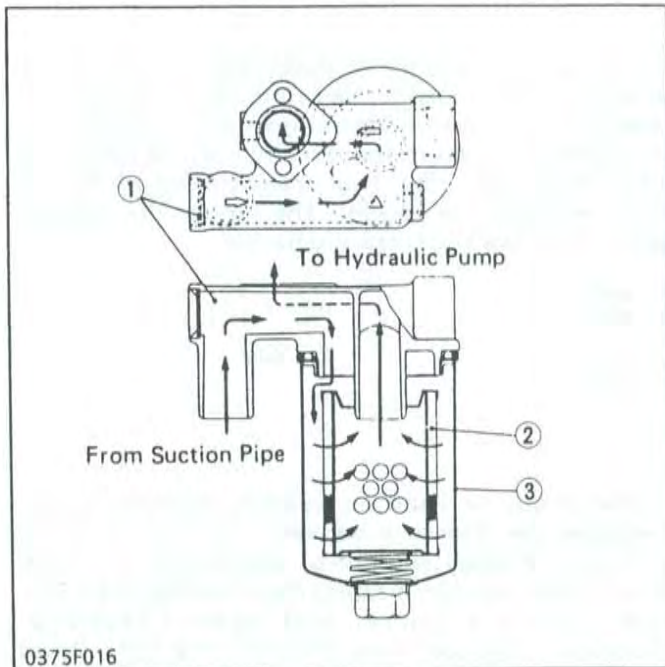


(1) Oil Strainer

(2) Transmission Case

■ L2350

This oil filter is located in the transmission case, and ensures a filtration degree of #38-65 mesh.

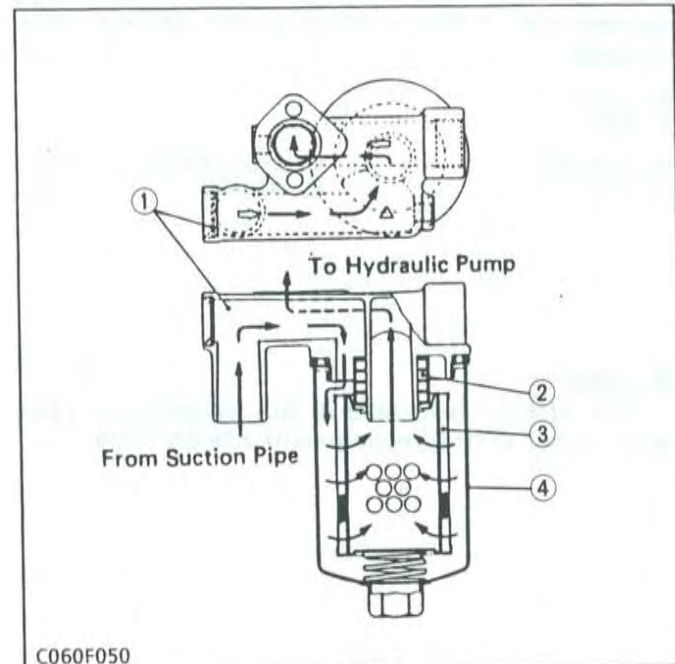


■ L2650 2WD, L2950 2WD, L3450 2WD, L3650 2WD and GST type

This oil filter is cartridge type, and located in the right side of engine.

This filter ensures a filtration degree of 150 mesh.

- | | |
|--------------------|-----------------|
| (1) Filter Bracket | (3) Filter Case |
| (2) Element | |



■ L2650 4WD, L2950 4WD, L3450 4WD and L3650 4WD

This oil filter is washable type. It is located in the right side of engine, and ensures a filtration degree of 140 mesh.

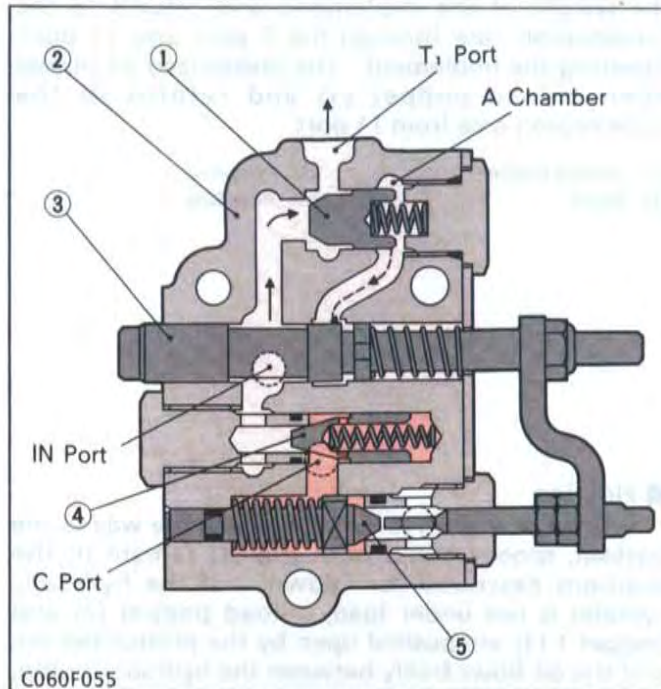
- | | |
|--------------------|-----------------|
| (1) Filter Bracket | (3) Element |
| (2) Magnet | (4) Filter Case |

[4] POSITION CONTROL VALVE

This position control valve is located under the hydraulic cylinder block.

(1) Oil Flow

[L2350]



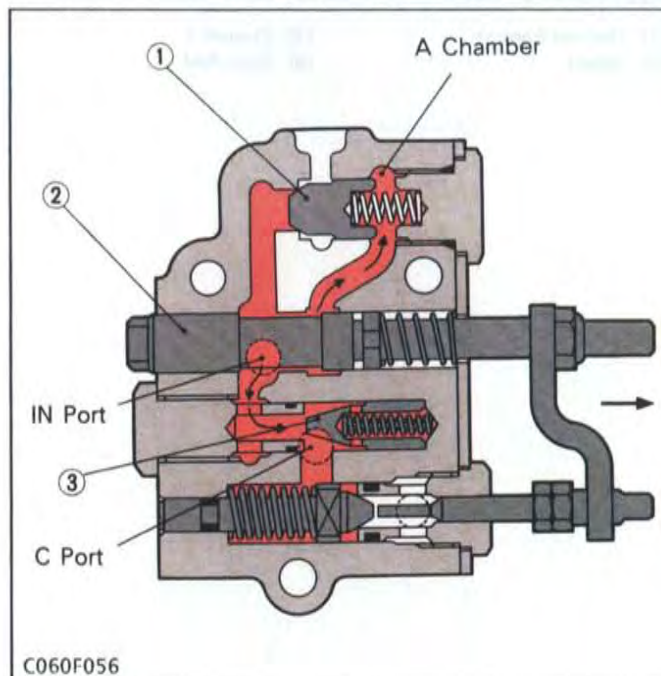
■ Neutral

Pressurized oil flows at the IN port, pushes open unload poppet (1) and returns to the transmission case from T1 port.

The oil in the A chamber behind the unload poppet returns to the transmission case through the clearance between spool (3) and control valve (2). The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 1 (4) and poppet 2 (5).

This allows the implement to be kept at a steady height.

- | | |
|-------------------|--------------|
| (1) Unload Poppet | (4) Poppet 1 |
| (2) Control Valve | (5) Poppet 2 |
| (3) Spool | |



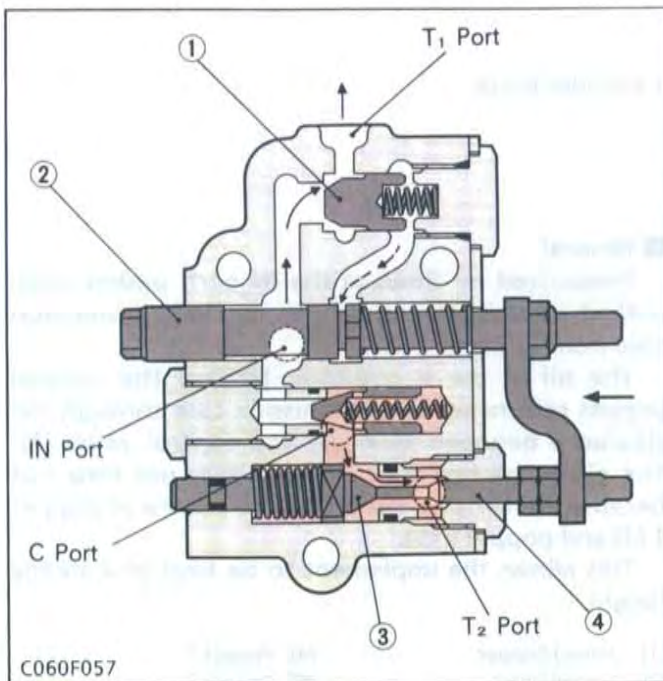
■ Lift

When the control lever is moved to UP, spool (2) is pulled by the spool operating lever, forming a circuit with the IN port and A chamber.

The pressurized oil thus flows into the A chamber and closes unload poppet (1).

The pressure in the circuit slowly rises, pushing open poppet 1 (3), and the hydraulic oil flows into the hydraulic cylinder from the C port, lifting the implement.

- | | |
|-------------------|--------------|
| (1) Unload Poppet | (3) Poppet 1 |
| (2) Spool | |



■ Down

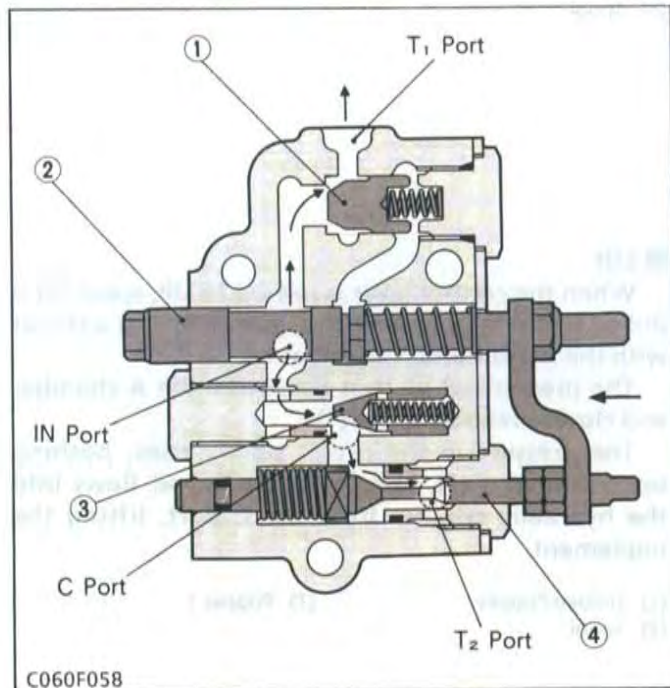
When the control lever is moved to **DOWN**, spool (2) and push rod (4) are pushed by the spool operating lever.

The push rod pushes open poppet 2 (3), forming a circuit with the C port and T2 port.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the transmission case through the C port and T1 port, lowering the implement. The pressurized oil pushes open unload poppet (1) and returns to the transmission case from T1 port.

- (1) Unload Poppet
- (2) Spool

- (3) Poppet 2
- (4) Push Rod



■ Floating

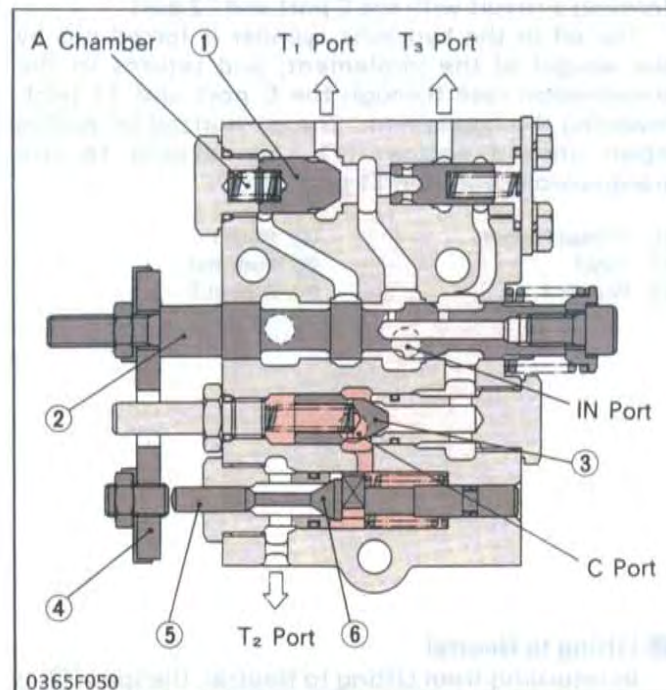
When the control lever is moved all the way to the bottom, spool (2) and push rod (4) remain in the positions described for "down". If the hydraulic cylinder is not under load, unload poppet (1) and poppet 1 (3) are pushed open by the pressurized oil, and the oil flows freely between the hydraulic pump, hydraulic cylinder and transmission case.

- (1) Unload Poppet
- (2) Spool

- (3) Poppet 1
- (4) Push Rod

[L2350 with Draft Control]

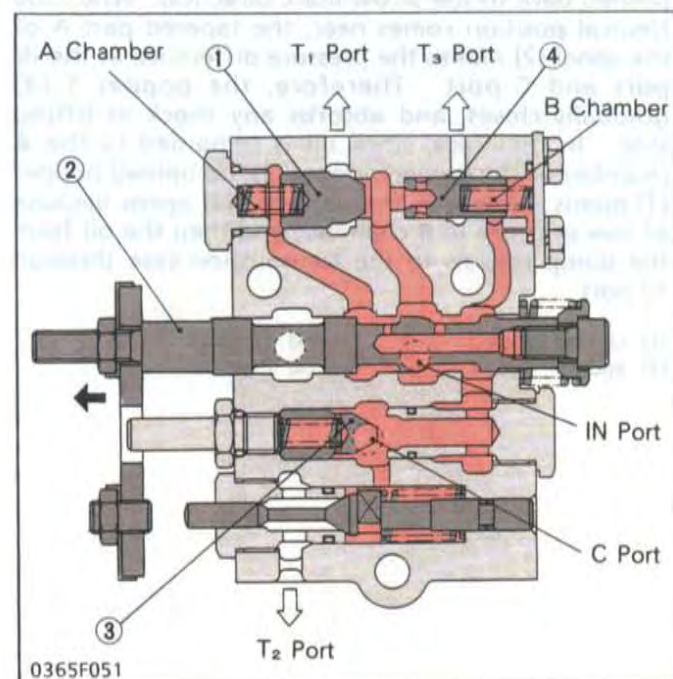
This valve is used for tractor equipped draft control. (optional)
It is functioning to absorb shocks when the implement goes up by draft control.

**■ Neutral**

Pressurized oil flows at the IN port, pushes open unload poppet (1) and returns to the transmission case from T1 port.

The oil in the A chamber behind the unload poppet returns to the transmission case through the clearance between spool (2) and control valve. The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 1 (3) and poppet 2 (6).

- | | |
|-------------------|--------------|
| (1) Unload Poppet | (4) Plate 1 |
| (2) Spool | (5) Push Rod |
| (3) Poppet 1 | (6) Poppet 2 |

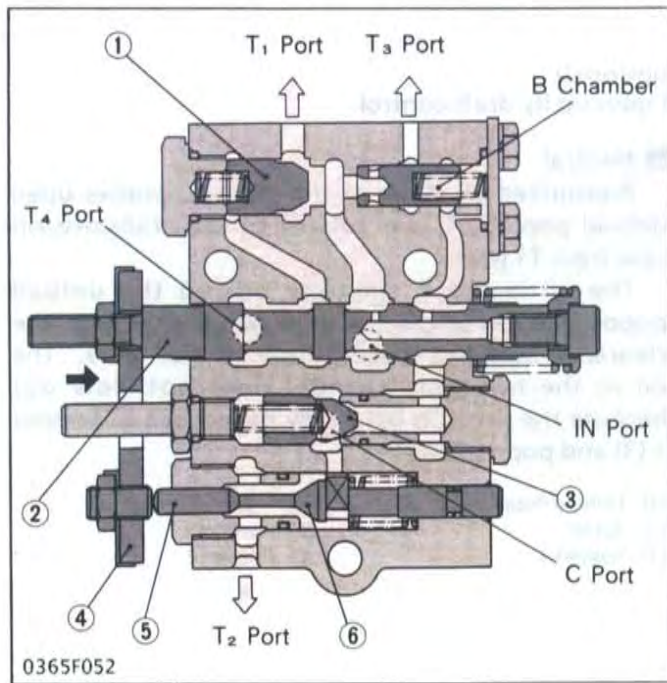
**■ Lift**

When the control lever is moved to UP, spool (2) moves to arrow-mark direction.

The oil entered IN port flows into the A chamber, B chamber and closes unload poppet (1), poppet 3 (4).

The pressure in the circuit slowly rises, pushing open poppet 1 (3), and the hydraulic oil flows into the hydraulic cylinder from the C port, lifting the implement.

- | | |
|-------------------|--------------|
| (1) Unload Poppet | (3) Poppet 1 |
| (2) Spool | (4) Poppet 3 |

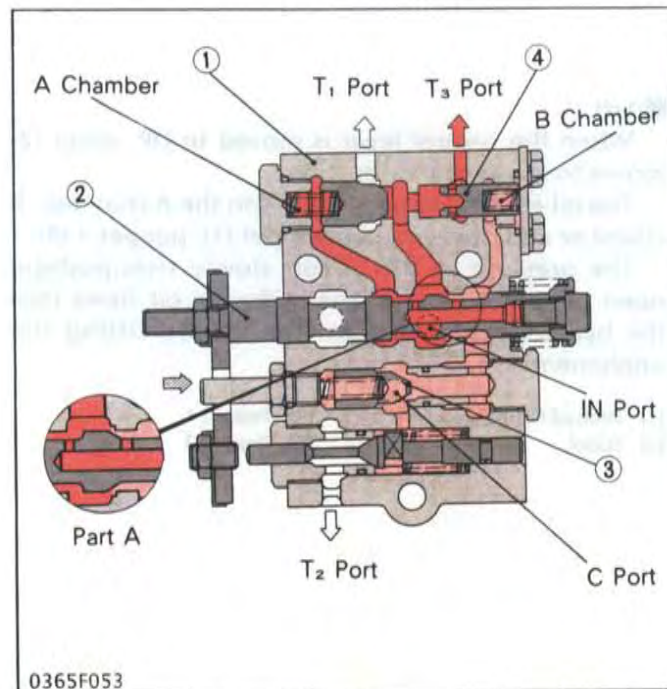


■ Down

When the control lever is moved to **DOWN**, spool (2) moves to arrow-mark direction, and pushes the push rod (5). The push rod pushes open poppet 2 (6), forming a circuit with the C port and T2 port.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the transmission case through the C port and T1 port, lowering the implement. The pressurized oil pushes open unload poppet (1) and returns to the transmission case from T1 port.

- | | |
|-------------------|--------------|
| (1) Unload Poppet | (4) Plate 1 |
| (2) Spool | (5) Push Rod |
| (3) Poppet 1 | (6) Poppet 2 |

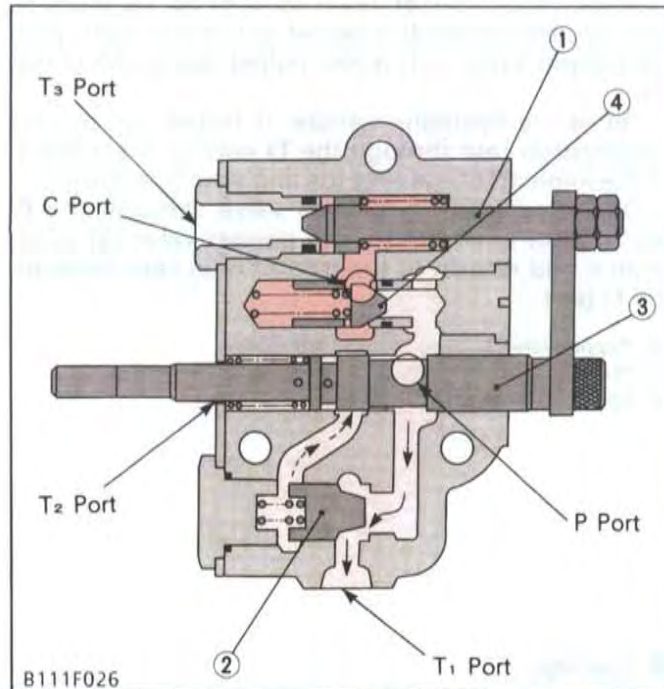


■ Lifting to Neutral

In returning from Lifting to Neutral, the spool (2) is pushed back to the arrow-mark direction. When the Neutral position comes near, the tapered part A of the spool (2) makes the pressure difference at the IN port and C port. Therefore, the poppet 1 (3) gradually closes, and absorbs any shock at lifting stop. In that case, since oil is remained in the A chamber of the unload poppet (1), no unload poppet (1) opens. However, the poppet 3 (4) opens because of low pressure in B chamber, and then the oil from the pump returns to the transmission case through T3 port.

- | | |
|-------------------|--------------|
| (1) Unload Poppet | (3) Poppet 1 |
| (2) Spool | (4) Poppet 3 |

[L2650, L2950, L3450, L3650]



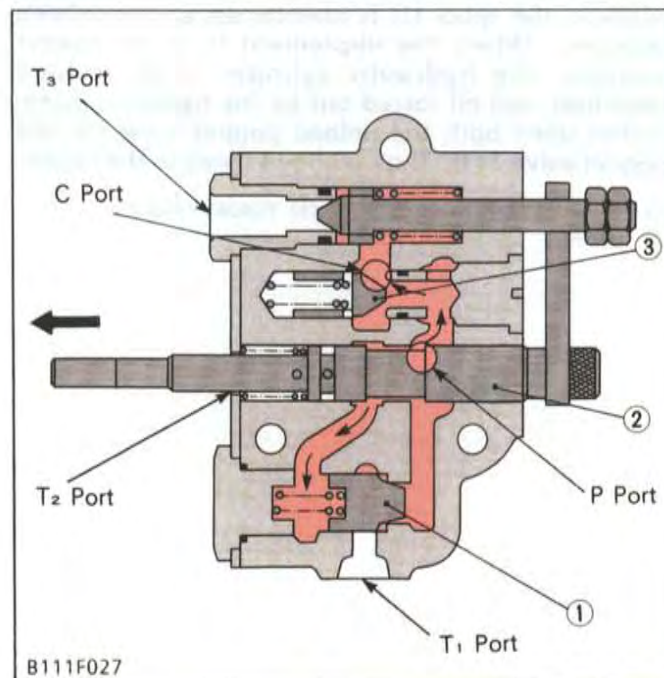
■ Neutral

Oil forced into the control valve through the **P** port pushes open the unload poppet valve (2) and then returns to the transmission case through the **T1** port.

Oil behind the unload poppet valve (2) returns to the transmission case through the spool (3) and the **T2** port.

Since the poppet valve 2 (4) and poppet valve 1 (1) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

- | | |
|-------------------------|--------------------|
| (1) Poppet Valve 1 | (3) Spool |
| (2) Unload Poppet Valve | (4) Poppet Valve 2 |



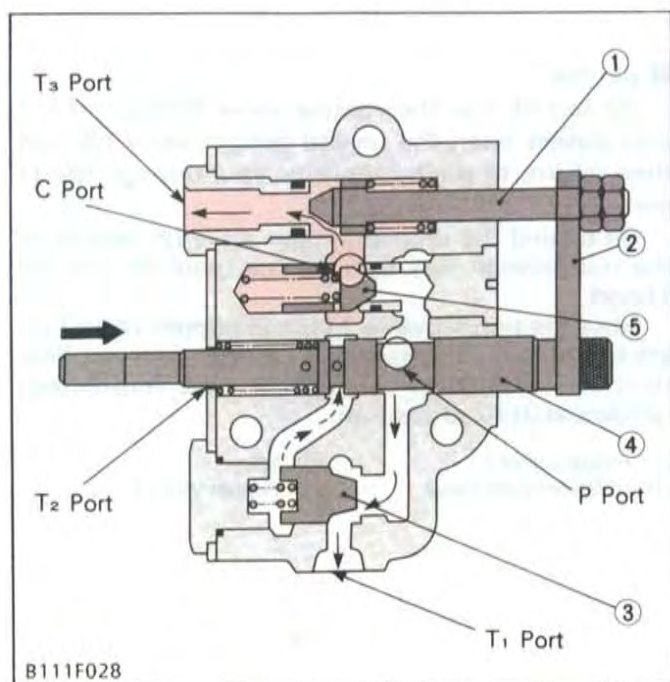
■ Lift

When the control lever is set to the **LIFT** position, the spool (2) is pushed to the left.

The oil forced into the control valve through the **P** port flows to the back of the unload poppet valve (1) to close it.

The oil pushes open the poppet valve 2 (3), and flows into the hydraulic cylinder through the **C** port to lift the implement.

- | | |
|-------------------------|--------------------|
| (1) Unload Poppet Valve | (3) Poppet Valve 2 |
| (2) Spool | |



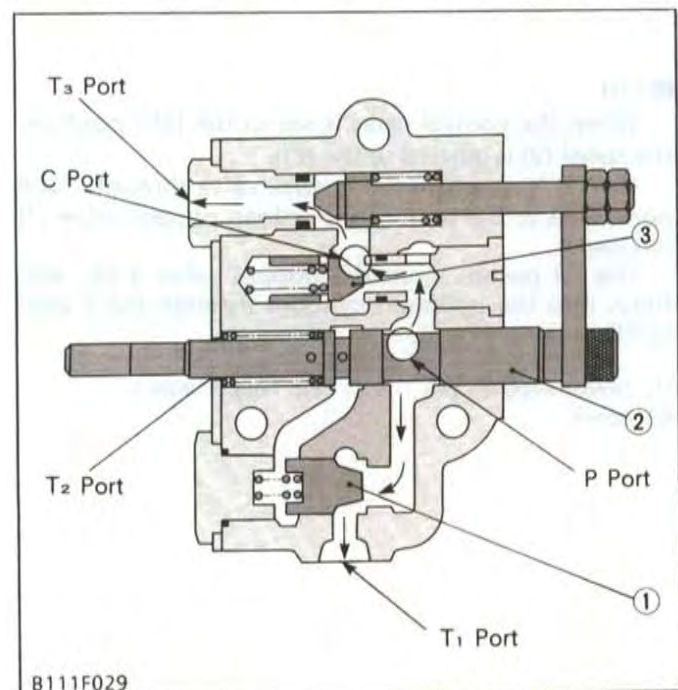
Down

When the control lever is moved to **DOWN** position, the spool (4) is pulled out to the right, and the poppet valve 1 (1) is also pulled out by the plate (2).

Oil in the hydraulic cylinder is forced out to the transmission case through the T3 port by the weight of the implement, causing the implement to lower.

Oil forced into the control valve through the P port pushes open the unload poppet valve (3) as in neutral and returns to the transmission case through the T1 port.

- | | |
|-------------------------|--------------------|
| (1) Poppet Valve 1 | (4) Spool |
| (2) Plate | (5) Poppet Valve 2 |
| (3) Unload Poppet Valve | |

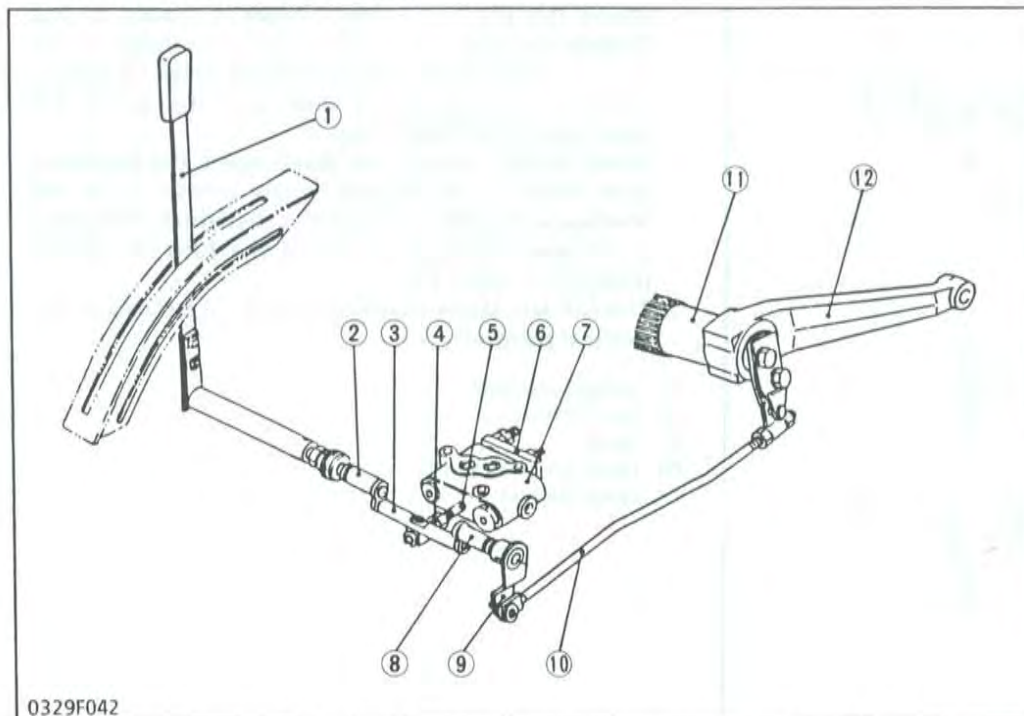


Floating

When the control lever is moved to its lowest position, the spool (2) is maintained at the **DOWN** position. When the implement is at its lowest position, the hydraulic cylinder is in no-load condition, and oil forced out by the hydraulic pump pushes open both the unload poppet valve (1) and poppet valve 2 (3). Thus, oil flows freely in the valves.

- | | |
|-------------------------|--------------------|
| (1) Unload Poppet Valve | (3) Poppet Valve 2 |
| (2) Spool | |

[5] POSITION CONTROL LINKAGE

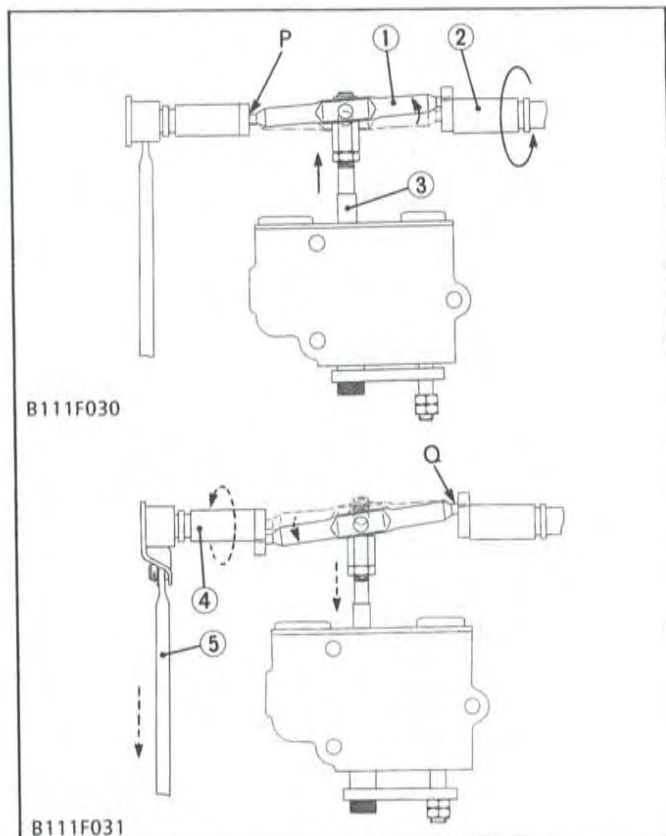


- (1) Position Control Lever
- (2) Control Arm
- (3) Spool Drive Lever
- (4) Spool Joint 1
- (5) Spool Head
- (6) Connecting Plate
- (7) Valve Body
- (8) Feedback Lever Shaft
- (9) Feedback Lever
- (10) Feedback Rod
- (11) Hydraulic Arm Shaft
- (12) Lift Arm

Position control is a mechanism to raise or lower the implement attached to the tractor in proportion to the movement of the control lever.

The implement can be positioned at any height by moving the position control lever. Fine position adjustment is also easy.

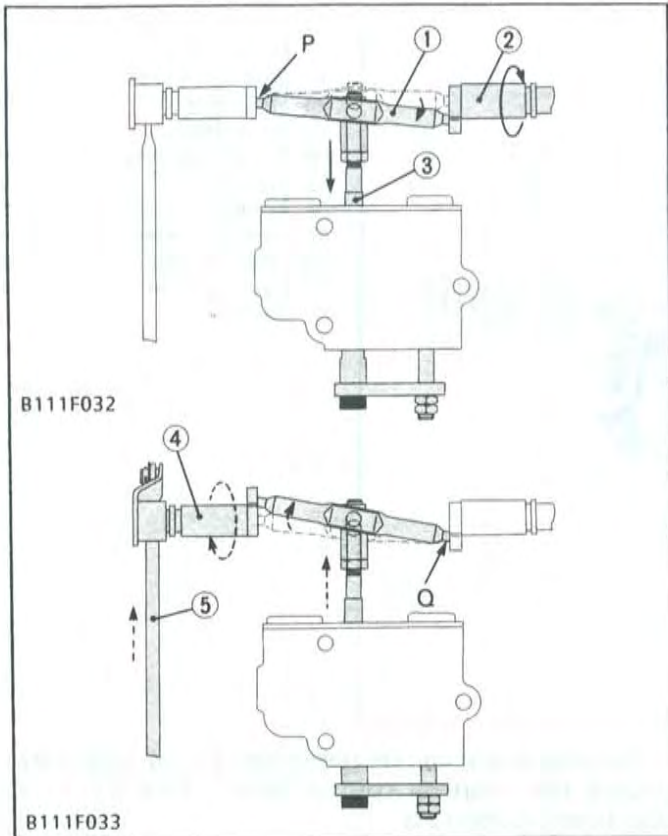
■ Lift



1. When the position control lever is moved to the **LIFT** position, the control arm (2) rotates to the arrow. Therefore, the spool drive lever (1) moves around the fulcrum P and pull the spool (3) opening the **LIFT** circuit.
2. When the lift arm moves upward, the feed back lever shaft (4) is rotated to the arrow, since the feed back rod (5) is actuated. Therefore, the spool drive lever (1) moves around the fulcrum Q and pushes the spool (3).
3. The lift arm stops when the spool returns to the neutral position.

- (1) Spool Drive Lever
- (2) Control Arm
- (3) Spool
- (4) Feedback Lever Shaft
- (5) Feedback Rod

■ Down



1. When the position control lever is moved to the **DOWN** position, the control arm (2) rotates to the arrow. Therefore, the spool drive lever (1) moves around the fulcrum P and pull the spool (3) opening the **DOWN** circuit.
2. When the lift arm moves downward, the feedback lever shaft (5) is rotated to the arrow, since the feedback rod (6) is actuated. Therefore, the spool drive lever (1) moves around the fulcrum Q and pushes the spool (3).
3. The lift arm stops when the spool (3) returns to the neutral position.

- (1) Spool Drive Lever
- (2) Control Arm
- (3) Spool
- (4) Feedback Lever Shaft
- (5) Feedback Rod

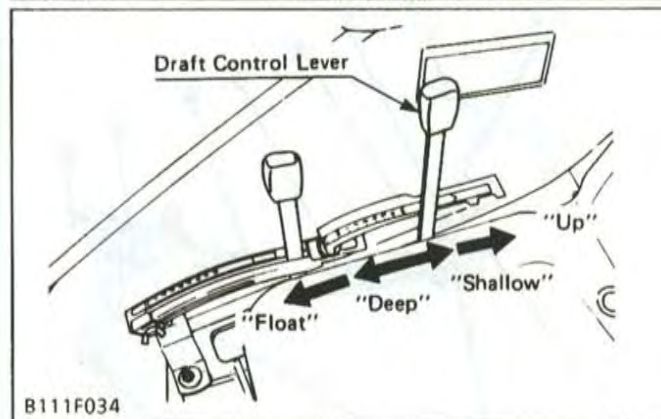
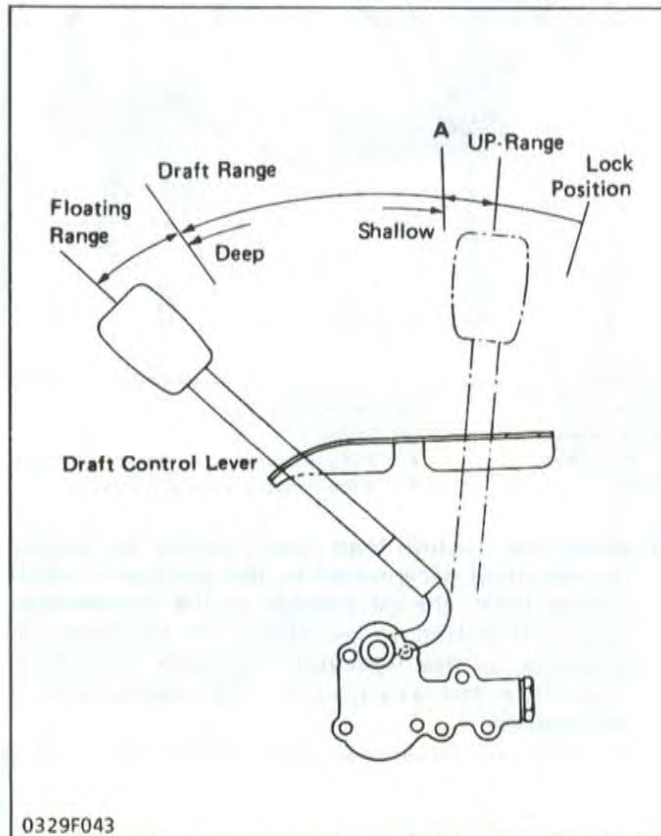
[6] DRAFT CONTROL (Option)

Draft control is a system which maintains a constant traction load, and is suited for the work which needs heavy traction load such as plowing.

The implement is automatically raised when its traction load is increased, and lowers when the traction load is decreased. By maintaining a constant load level, it prevents the slipping and being loaded

excessively on the tractor. The setting traction load can be adjusted by changing the position of the draft control lever.

The draft control system consists of a draft control valve and draft linkage mechanism. It functions when the traction load applied to the tractor from the mechanism is fed back to the draft control valve.



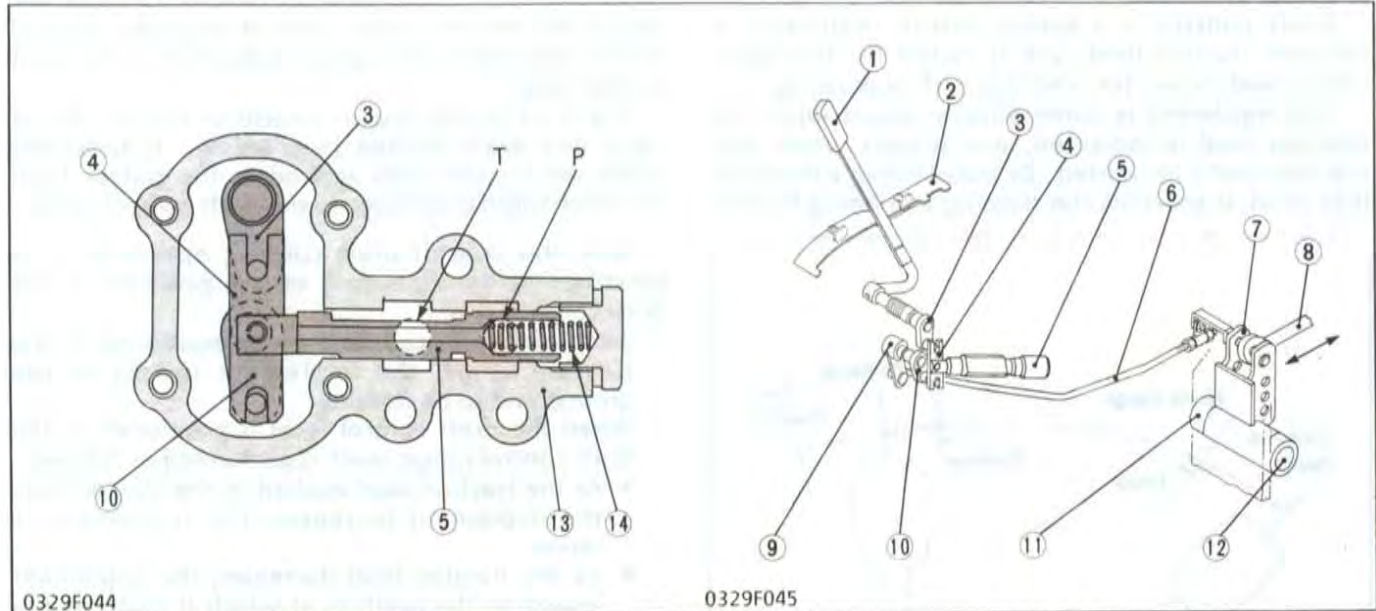
With this type of draft control, operation is as described below according to the position of the draft control lever.

1. When the draft control lever is positioned in the floating range, the implement lowers to the ground and to be floating.
2. When the draft control lever is positioned in the draft control range, work is performed as follows.
 - As the traction load applied to the tractor from the implement increases, the implement is raised.
 - As the traction load decreases, the implement lowers to the position at which it matches the setting traction load.
3. When the implement is raised as described in 2 above, the force to raise the implement is applied to the rear wheels so that the ground pressure of the wheels is momentarily increased to prevent slippage.
4. When the draft control lever is positioned at near A in the draft control range, the implement is raised or lowered according to a slight change in traction load.
5. When the draft control lever is positioned at UP range, the implement is raised at maximum lifting position.

(Reference)

- When the draft control is used, the position control lever must be set at the LIFT position to form the lift circuit in the position control valve. Therefore, in this type of draft control, the implement lowest position cannot be controlled by the position control lever.

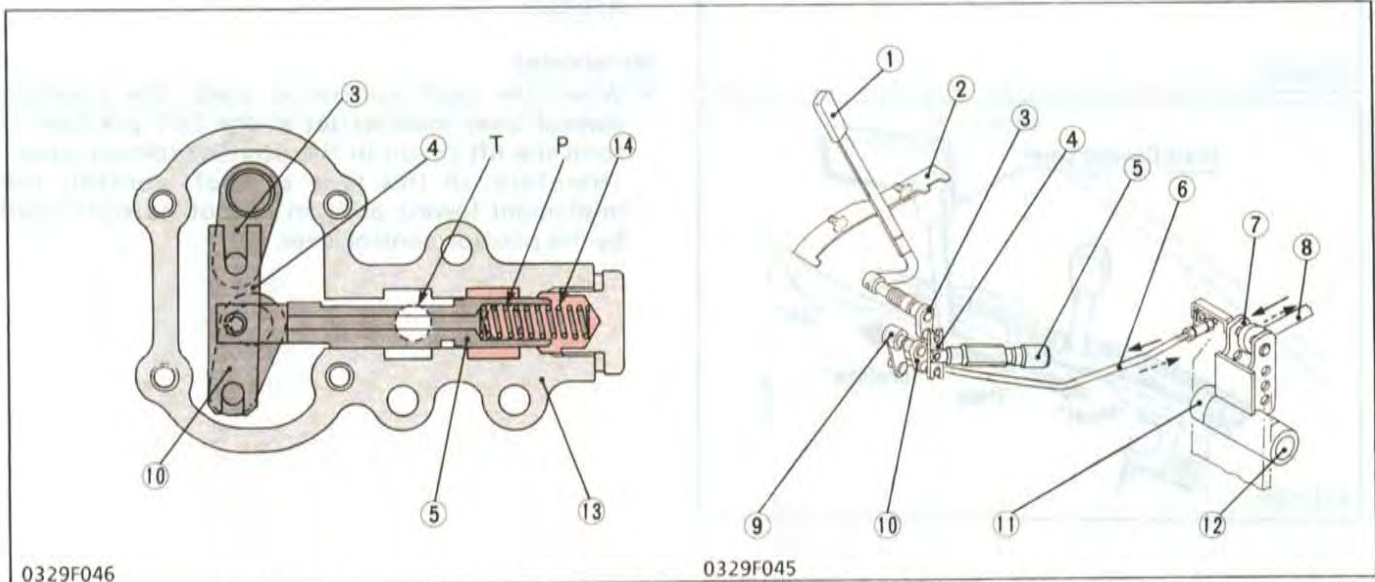
■ Operation



- | | | | |
|-------------------------|-----------------------|---------------------------|---|
| (1) Draft Control Lever | (5) Spool | (9) Feedback Lever | (13) Valve Body |
| (2) Lever Guide | (6) Draft Control Rod | (10) Feedback Lever Shaft | (14) Spring |
| (3) Control Lever Shaft | (7) Top Link Holder | (11) Top Link Bracket | P : P (Pump) Port (To Hydraulic Cylinder) |
| (4) Spool Drive Lever | (8) Top Link | (12) Torsion Bar | T : T Port (To Transmission Case) |

1. The traction load applied to the tractor from the implement acts as a torsional force to the torsion bar (12) via the top link (8) and the top link holder (7). When the torsion bar (12) is twisted, it is transmitted to the draft control valve via the draft control rod (6).

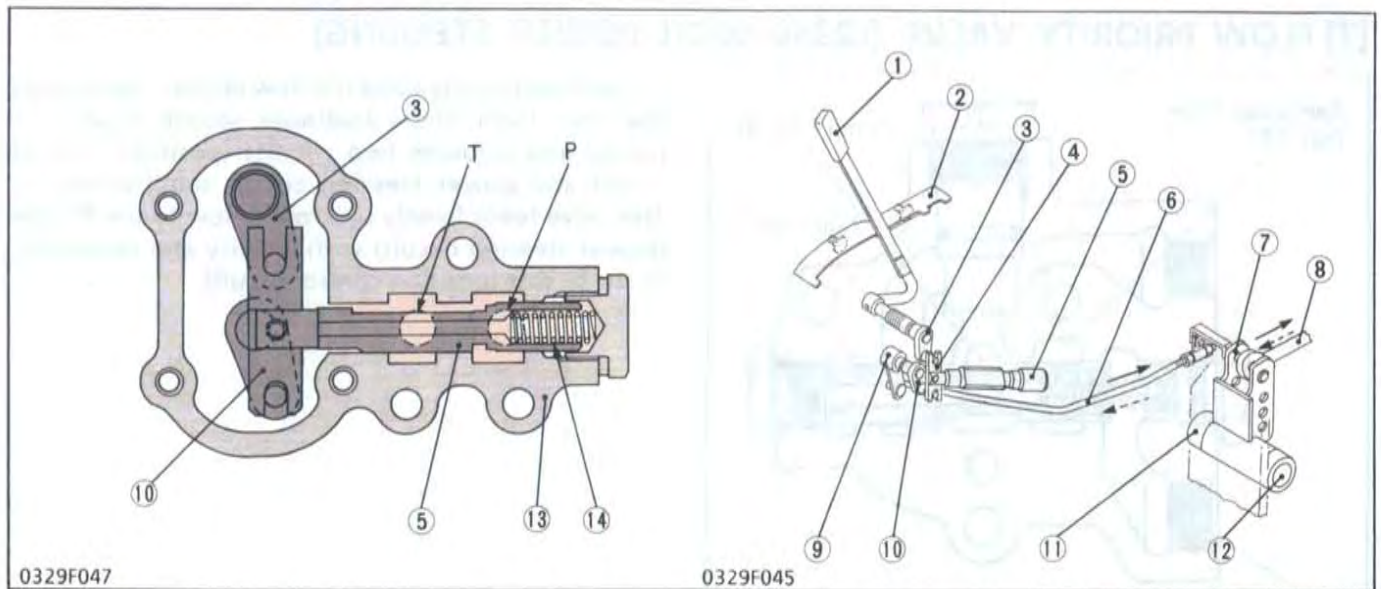
2. When the traction load nearly equals the setting traction load determined by the position of draft control lever, the oil passage to the transmission case is throttled to generate the constant oil pressure in the hydraulic cylinder. (neutral) Therefore the position of the implement is maintained.



3. When the traction load increases, the torsion bar (12) is twisted, and it is transmitted to the draft control valve via the draft control rod (6). As a result, the spool (5) in the draft control valve is pushed in, closing the oil passage to the

transmission case, so oil flows into the hydraulic cylinder to raise the implement.

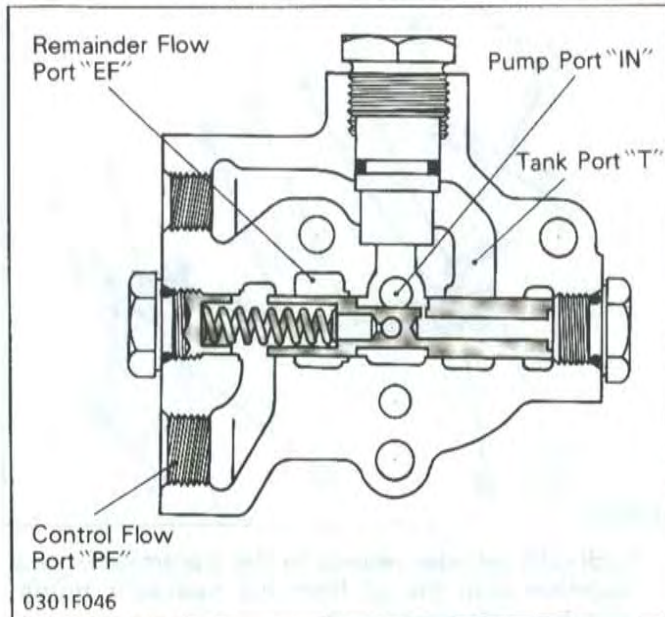
4. As the implement is raised and the traction load decrease, the torsion bar (12) is restored to form a neutral circuit in the draft control valve.



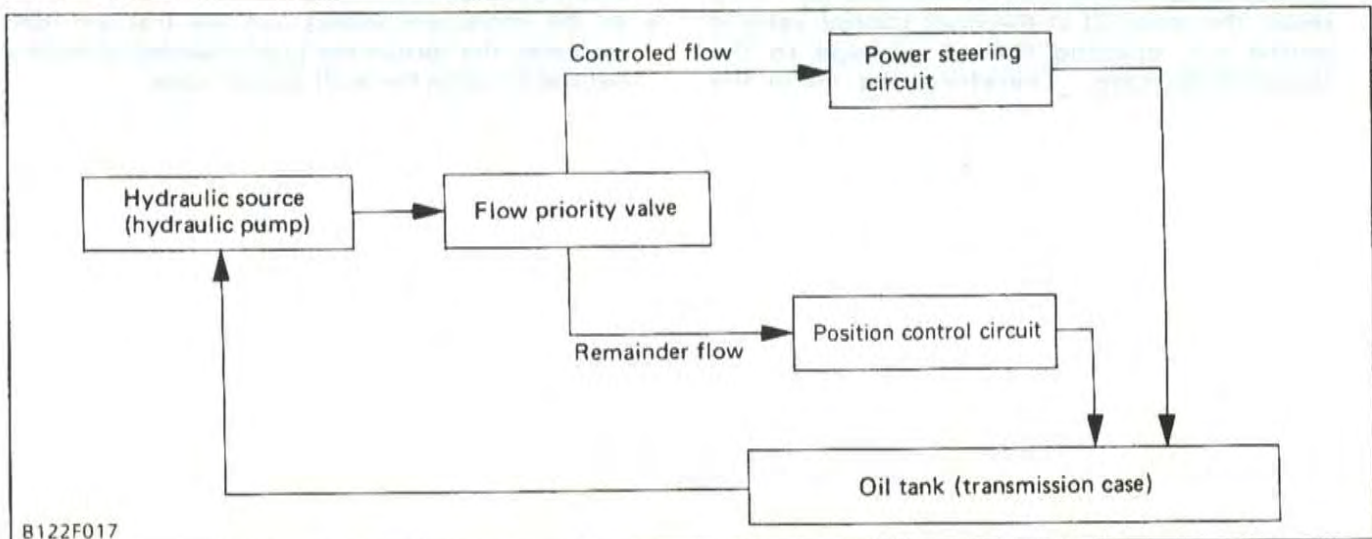
5. When the traction load decreases, the torsion bar (12) is restored and it is transmitted to the draft control valve via the draft control rod (6). As a result, the spool (5) in the draft control valve is pulled out, opening the oil passage to the transmission case. Therefore, the oil in the

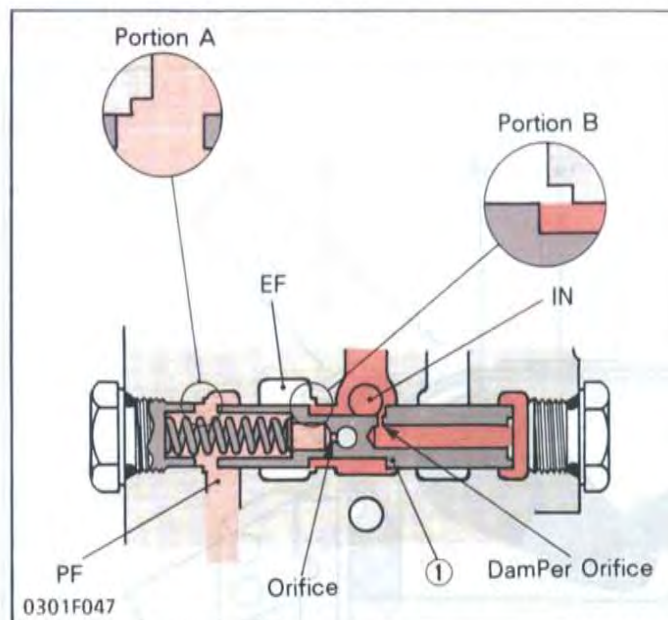
hydraulic cylinder returns to the transmission case together with the oil from the hydraulic pump, and the implement lowers.

6. As the implement lowers and the traction load increases, the torsion bar (12) is twisted to form a neutral circuit in the draft control valve.

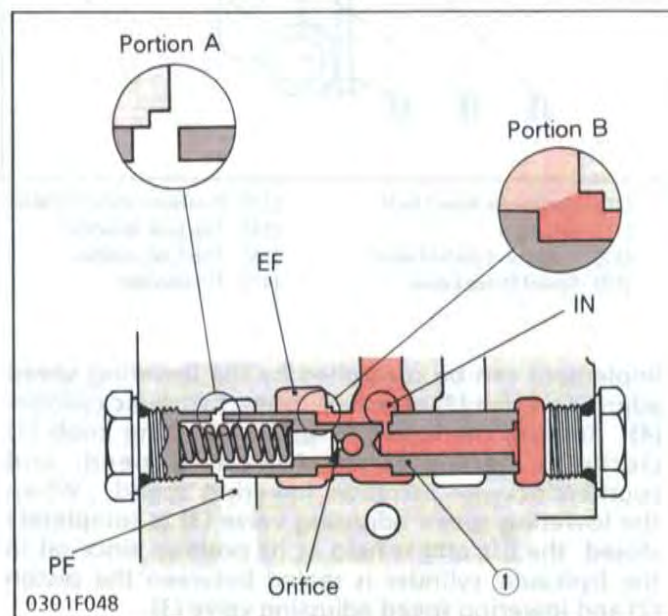
[7] FLOW PRIORITY VALVE (L2350 WITH POWER STEERING)

The flow priority valve is a flow divider that divides the flow from single hydraulic source (hydraulic pump) and actuates two circuits (position control circuit and power steering circuit simultaneously. This valve feeds fixedly controlled flow to the PF side (power steering circuit) with priority and remainder to the EF side (position control circuit).





(1) Plunger



(1) Plunger

1. When the engine starts, oil flows into the valve through **IN**-port.
2. A pressure difference is created between the ends of the orifice as the flow passes the orifice. This causes the plunger (1) to move to the left, deflecting the spring.
3. Then the oil passage is formed in portion **B** shown above, and the remainder flows to the **EF** side (position control circuit).
4. The plunger automatically balances itself to maintain the pressure difference between the ends of the orifice. Thus the fixedly controlled flow is fed to the **PF** side (power steering circuit) at all times even if the oil flow from the **IN** port is changes.

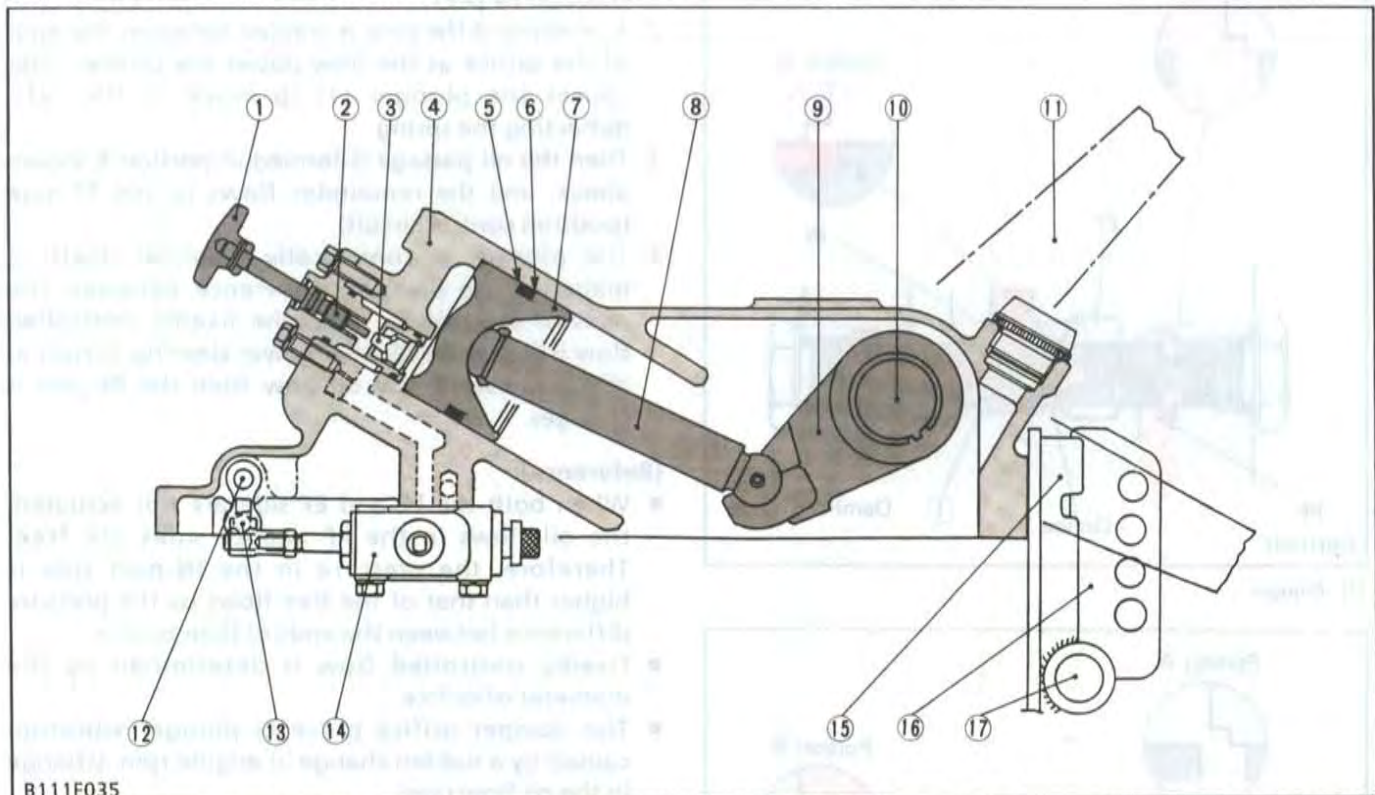
(Reference)

- When both the **PF** and **EF** side are not actuated, the oil flows in the **PF** and **EF** sides are free. Therefore, the pressure in the **IN**-port side is higher than that of the free flows by the pressure difference between the ends of then orifice.
 - Fixedly controlled flow is determined by the diameter of orifice.
 - The damper orifice prevents plunger vibration caused by a sudden change in engine rpm (change in the oil flow rate).
5. When the **PF** side circuit (power steering circuit) is actuated and the pressure rises, the plunger moves to the right, reducing the opening area of portion **B**, and widening the opening area of portion **A**. Therefore, there is no change in the controlled flow to the **PF** side. This is because the plunger moves in accordance with the balancing of the pressure difference between the ends of the orifice and the spring force, controlling the opening areas of the portions **A** and **B**.

(Reference)

- The pressure in the **IN**-port side is higher than the working pressure of the **PF** side by the pressure difference between the ends of the orifice. When the hydraulic raising/lowering circuit is not in operation, the oil of the **EF** side is a free flow.
6. When the **EF** side circuit (portion control circuit) is actuated and the **PF** side circuit (power steering circuit) is not, the pressure difference between the end of the orifice becomes larger, and causes the plunger to move to the left. Therefore, the opening area of portion **A** becomes larger to automatically prevent any excessive flow to the **PF** side.
 7. When the working pressures of the **PF** side and **EF** side circuits rise simultaneously, the opening areas of portions **A** and **B** are automatically controlled by balancing of the pressure difference between the ends of the orifice and the spring force to maintain the control flow at constant.

[8] HYDRAULIC CYLINDER



B111F035

- | | | | |
|------------------------------------|----------------------|---------------------------|-----------------------------|
| (1) Lowering Speed Adjusting Knob | (6) Back-up Ring | (10) Hydraulic Arm Shaft | (14) Position Control Valve |
| (2) Lowering Speed Adjusting Shaft | (7) Hydraulic Piston | (11) Lift Arm | (15) Top Link Bracket |
| (3) Lowering Speed Adjusting Valve | (8) Hydraulic Rod | (12) Position Control Arm | (16) Top Link Holder |
| (4) Hydraulic Cylinder | (9) Hydraulic Arm | (13) Spool Drive Lever | (17) Torsion Bar |
| (5) O-ring | | | |

The main components of the hydraulic cylinder are shown in the figure above.

While the lift arm (11) is rising, oil from the hydraulic pump flows into the hydraulic cylinder through the control valve. Then oil pushes out the piston (7).

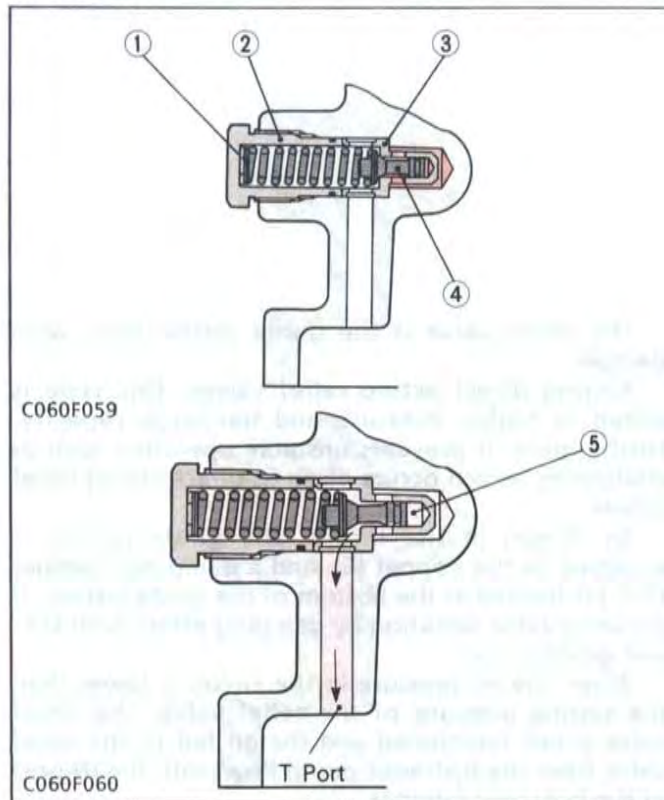
While the lift arm is lowering, oil in the hydraulic cylinder is discharged to the transmission case through the control valve (14) by the weight of the implement. At this time, the lowering speed of the

implement can be controlled by the lowering speed adjusting valve (3) attached to the hydraulic cylinder (4). Turning the lowering speed adjusting knob (1) clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve (3) is completely closed, the lift arm is held at its position since oil in the hydraulic cylinder is sealed between the piston (7) and lowering speed adjusting valve (3).

[9] RELIEF VALVE

The three point hydraulic system circuit has a relief valve to restrict the maximum pressure in the circuit.

[L2350]



- | | |
|----------|---------------------|
| (1) Shim | (4) Poppet |
| (2) Plug | (5) Damping Chamber |
| (3) Seat | |

This relief valve is located in the left side of hydraulic cylinder block.

This is a guide piston relief valve with damper, a direct acting relief valve suitable for relatively high pressure and capacity, and constructed so as to prevent chattering and other unstableness associated with direct acting relief valves. As shown in the diagram, poppet (4) has a guide, and there is a valve chamber called a damping chamber (5) in the base of this guide piston. The valve inlet is connected to this chamber through the clearance between the guide surface and the seat so that the chamber provides a damping effect, controlling valve vibration.

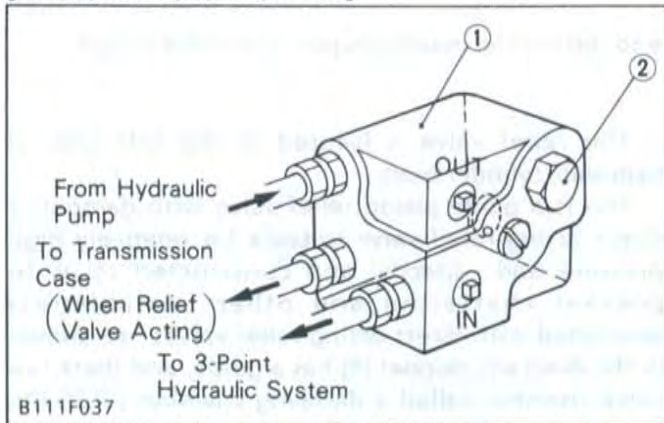
When the pressure in the circuit rises, the pressure in the damping chamber also rises, and when it exceeds the relief pressure setting (150 to 155 kgf/cm²) the spring is compressed, making a clearance between the poppet and the seat. The hydraulic oil can escape to the transmission case through this clearance, controlling the pressure rise.

(Reference)

- Relief valve setting pressure
14.70 to 15.19 MPa
150 to 155 kgf/cm²
2133 to 2204 psi

Engine speed: Maximum

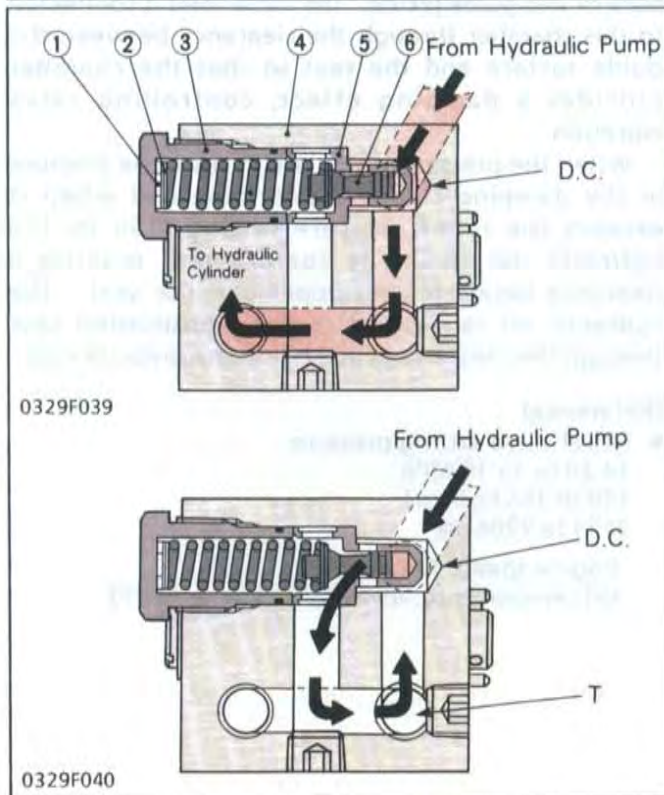
Oil temperature: 45 to 55°C (113 to 131°F)

[L2650, L2950, L3450, L3650]

The relief valve is incorporated in the front hydraulic block.

(1) Front Hydraulic Block

(2) Relief Valve Plug



- (1) Washer
- (2) Shim
- (3) Plug
- (4) Front Hydraulic Block
- (5) Seat
- (6) Poppet

D.C. : Damping Chamber
T : T Port
(To Transmission Case)

The relief valve is the guide piston type with damper.

Among direct acting relief valves, this type is suited to higher pressure and has large capacity. Furthermore, it prevents unstable operation such as chattering, which occurs often in direct acting relief valves.

As shown in the figure, the guide piston is attached to the poppet (6), and a damping chamber (D.C.) is formed at the bottom of the guide piston. It prevents valve vibration by damping effect with D.C. and guide piston.

When the oil pressure in the circuit is lower than the setting pressure of the relief valve, the relief valve is not functioned and the oil fed to the relief valve from the hydraulic pump flows into the IN-port of the hydraulic cylinder.

When the oil pressure in the circuit is increases more than valve setting. The valve opens and the oil flows to the transmission case through T port to prevent the pressure rising.

(Reference)

- Relief valve setting pressure
 - 16.7 to 17.2 MPa
 - 170 to 175 kgf/cm²
 - 2418 to 2489 psi

Engine speed: Maximum

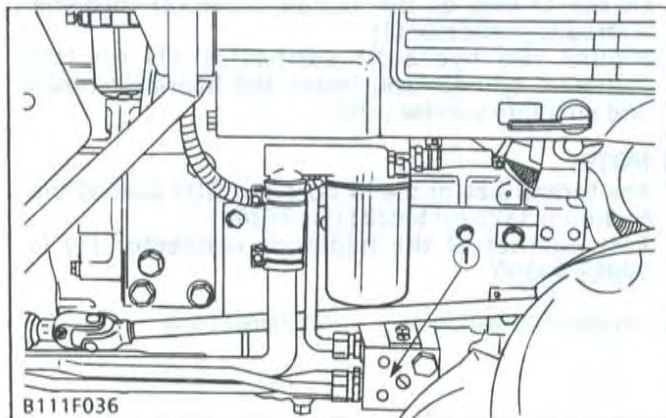
Oil temperature: 45 to 55°C (113 to 131°F)

[10] HYDRAULIC POWER TAKE OFF

Before taking out hydraulic power, check the following.

- Replenish transmission oil by the quantity equal to the flow rate required for the implement cylinder.
- Before attaching the implement, check the type and contamination of oil in the implement hydraulic circuit.

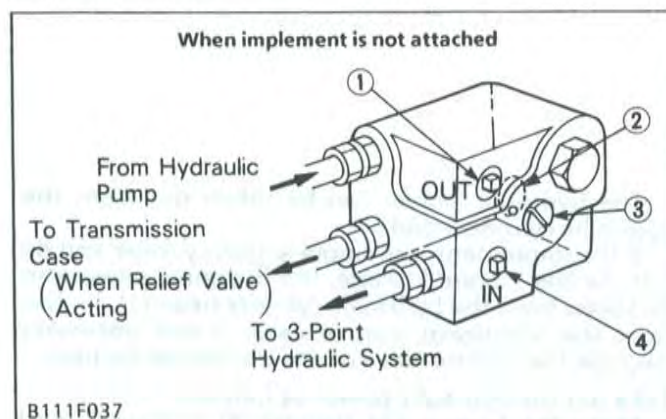
■ Front Hydraulic Block (L2650, L2950, L3450, L3650)



When an implement which requires hydraulic power is used, the hydraulic power can be taken out by the methods shown below.

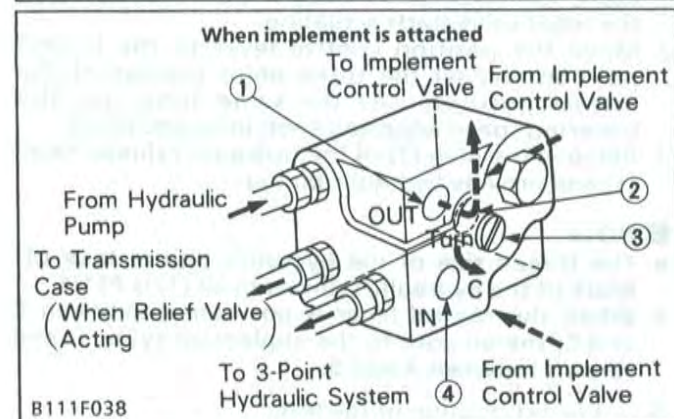
When a KUBOTA front loader is mounted on the tractor, take out necessary hydraulic power from this front hydraulic block. Even if the KUBOTA front loader is not mounted on the tractor and you want to take out hydraulic power to other implement, hydraulic power can also be taken from this front hydraulic block, provided that the control valve for the implements are required.

(1) Front Hydraulic Block



The following are the methods to take out hydraulic power.

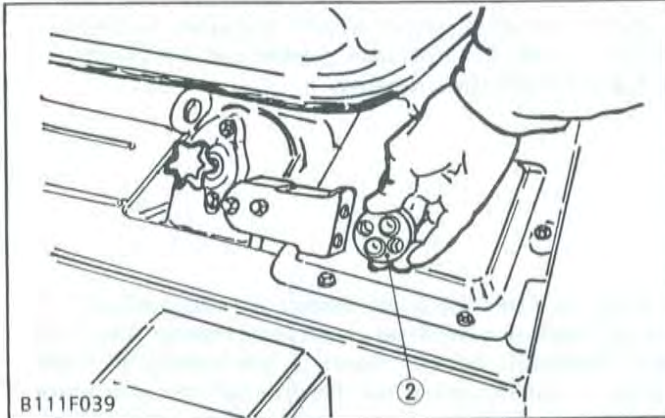
1. Remove the plugs from **OUT** port (1) and **IN** port (4) of the front hydraulic block.
2. Install the hydraulic take off adaptors (screw size PT3/8") to **OUT** port (1) and **IN** port (4).
3. Connect the hydraulic hose to the adaptor (**OUT** port side) and to the implement control valve **IN** port.
4. Connect the other hydraulic hose to the adaptor (**IN** port side) and to the implement control valve **TANK** (RETURN) port.
5. Turn the slit on the control spool (3) to the **C** mark side fully as shown in the figure.



- When implement is not attached, turn the slit on the control spool (3) to the **O** mark side fully.

- (1) **OUT** Port
- (2) **TANK** Port
- (3) Control Spool
- (4) **IN** Port

Hydraulic Connector



When the hydraulic power cannot be taken out from the front hydraulic block or when the hydraulic power is to be used for the implements at the rear of the tractor, mount the hydraulic connector (1) as shown in the left illustration. Necessary hydraulic power can be taken out, provided that the control valves for the implements are required.

Take out the hydraulic power as follows.

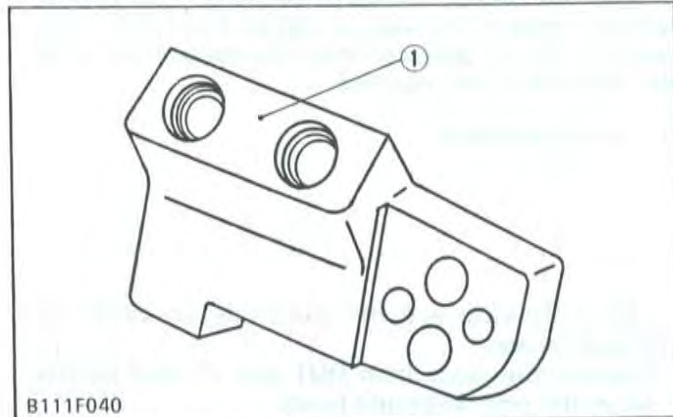
1. Remove the flange cover (2) from the hydraulic cylinder.
2. Fit the O-ring of the flange cover (2) into the hydraulic connector (1).
3. Mount the hydraulic connector (1) on the hydraulic cylinder and install the hydraulic hoses and auxiliary control valve.

NOTE

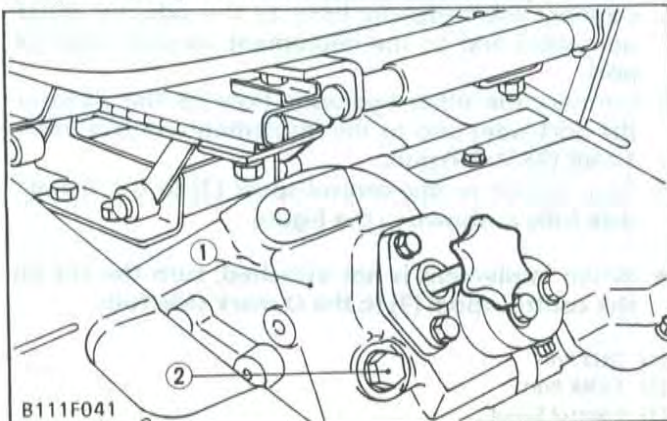
- The thread size of the IN port and OUT port of the hydraulic take off block (1) is PF3/8.
- Part number of the hydraulic connector (1) is 99063-93300.

(1) Hydraulic Connector

(2) Flange Cover



Hydraulic Cylinder Head



The hydraulic power can be taken out from the hydraulic cylinder head (1).

If the implements use single action cylinder and do not use the 3-point linkage, the hydraulic power can be taken from the hydraulic cylinder head (1). In this case, the additional control valve is not necessary because the control valve of the tractor can be used.

Take out the hydraulic power as follows.

1. Move the lever guide stopper (4) backward until the relief valve starts actuating.
2. Move the position control lever to the lowest position and set the three point linkage at the lowest position. At the same time, set the lowering speed adjusting knob in locked mode.
3. Remove the plug (2) of the hydraulic cylinder head (1) and provide hydraulic pipings.

NOTE

- The thread size of the hydraulic power take off block of the hydraulic cylinder head (1) is PT1/4.
- When the control lever is positioned between B and C, the oil goes to the implement cylinder and returns between A and B.

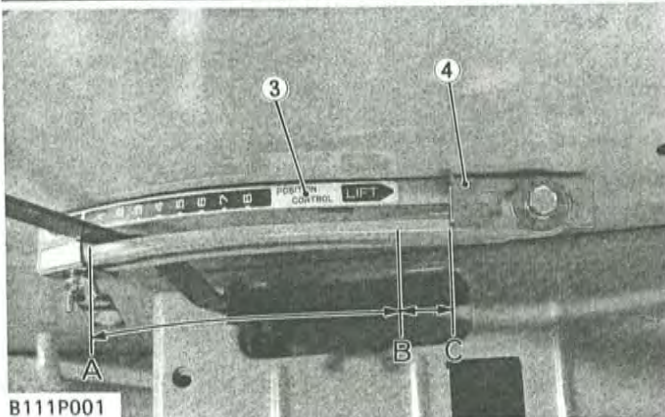
A — Lowest position of the lever

B — Position where the lever guide stopper was.

C — Position where the lever guide stopper is moved backward.

IMPORTANT

- If the control lever is always positioned between B and C, relief valve is actuated adversely affecting the hydraulic pump. When the hydraulic power is not used, the control lever must be between A and B.



(1) Hydraulic Cylinder Head

(3) Lever Guide

(2) Plug

(4) Lever Guide Stopper

10 ELECTRICAL SYSTEM

[1] WIRING DIAGRAM

- Key Switch

Terminal	B	AC	G1	G2	ST	OFF
HEAT	●	●	●			
OFF	●	●				
ON	●	●				
START	●	●	●	●	●	

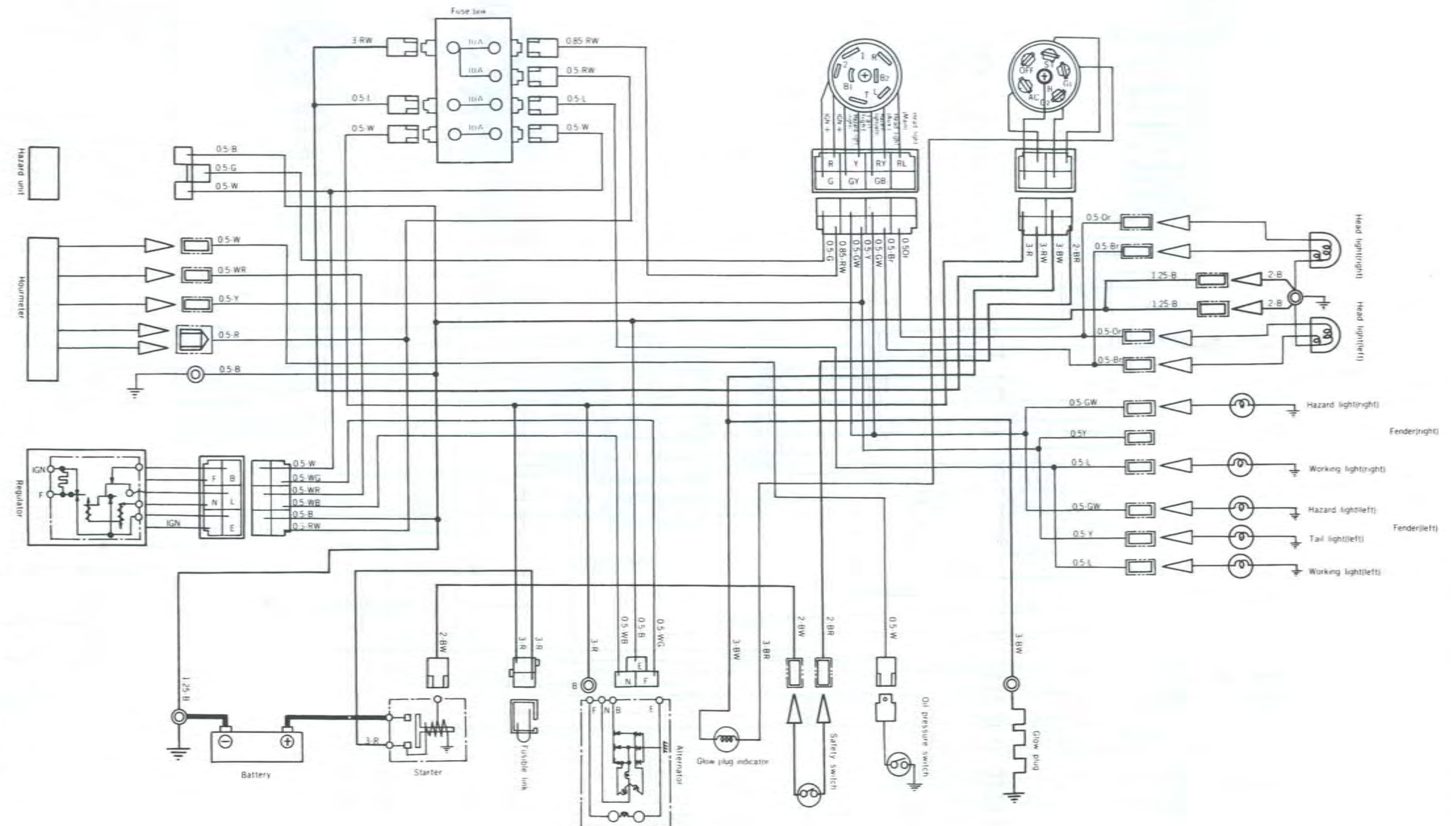
- **Combination Switch**

Head light switch					Hazard light switch			
Color	R	Y	RL	RY	Color	G	GY	GB
	B1	T	1	2		B2	R	L
OFF					1			
1					OFF			
2					2			

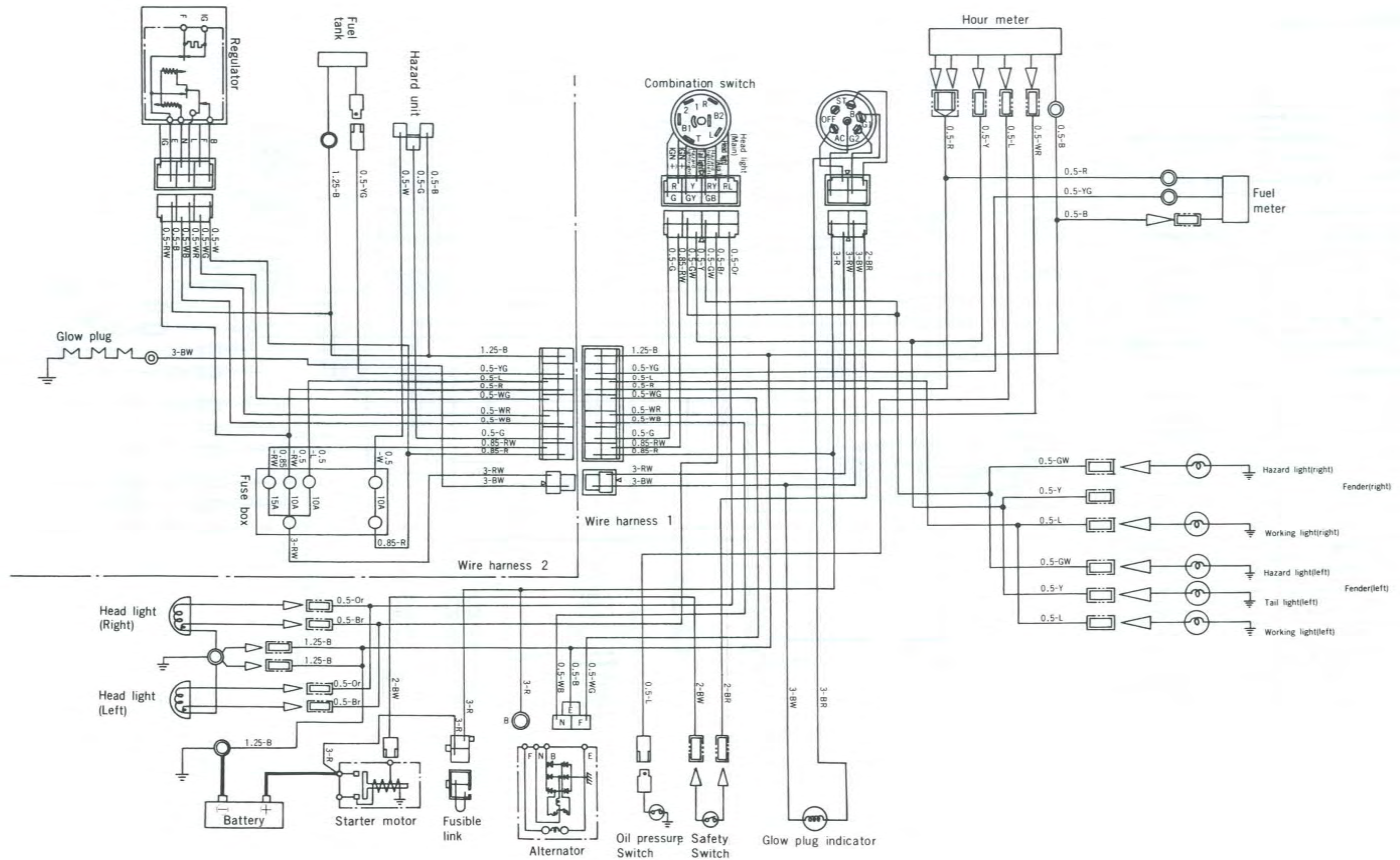
- Color of Wiring

W ----- White	RY ----- Red / Yellow
R ----- Red	BW ----- Black / White
L ----- Blue	BL ----- Black / Blue
Y ----- Yellow	BR ----- Black / Red
B ----- Black	BY ----- Black / Yellow
G ----- Green	GW ----- Green / White
Br ----- Brown	GY ----- Green / Yellow
Or ----- Orange	GB ----- Green / Black
Lg ----- Light green	GR ----- Green / Red
WG ----- White / Green	LW ----- Blue / White
WB ----- White / Black	LY ----- Blue / Yellow
WR ----- White / Red	YL ----- Yellow / Blue
WL ----- White / Blue	YB ----- Yellow / Black
RW ----- Red / White	BrW ----- Brown / White
RL ----- Red / Blue	BrR ----- Brown / Red

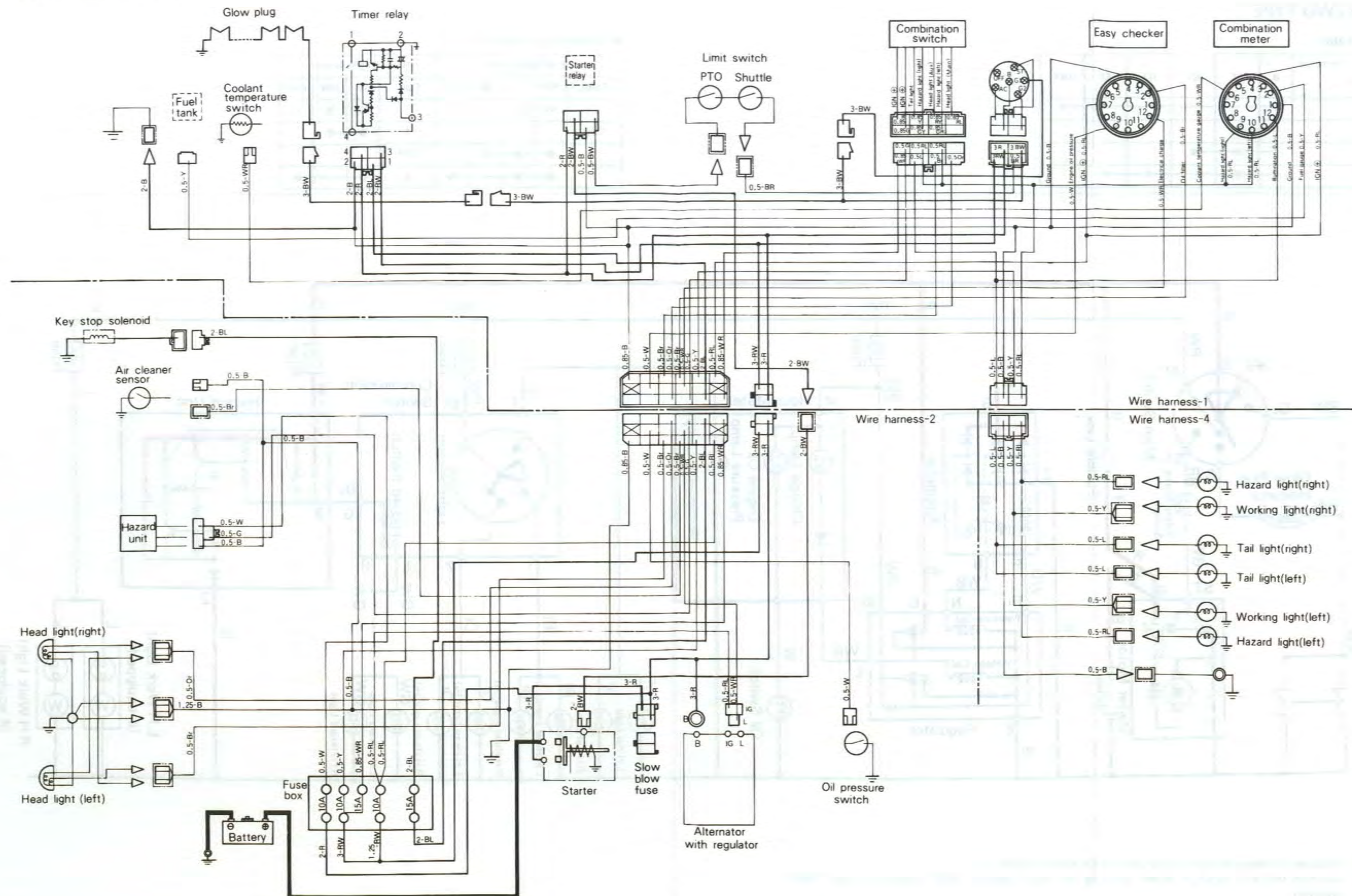
[L2350 2WD TYPE]



[L2350 4WD TYPE]



[L2650, L2950, L3450, L3650]



[2] ELECTRICAL CIRCUIT

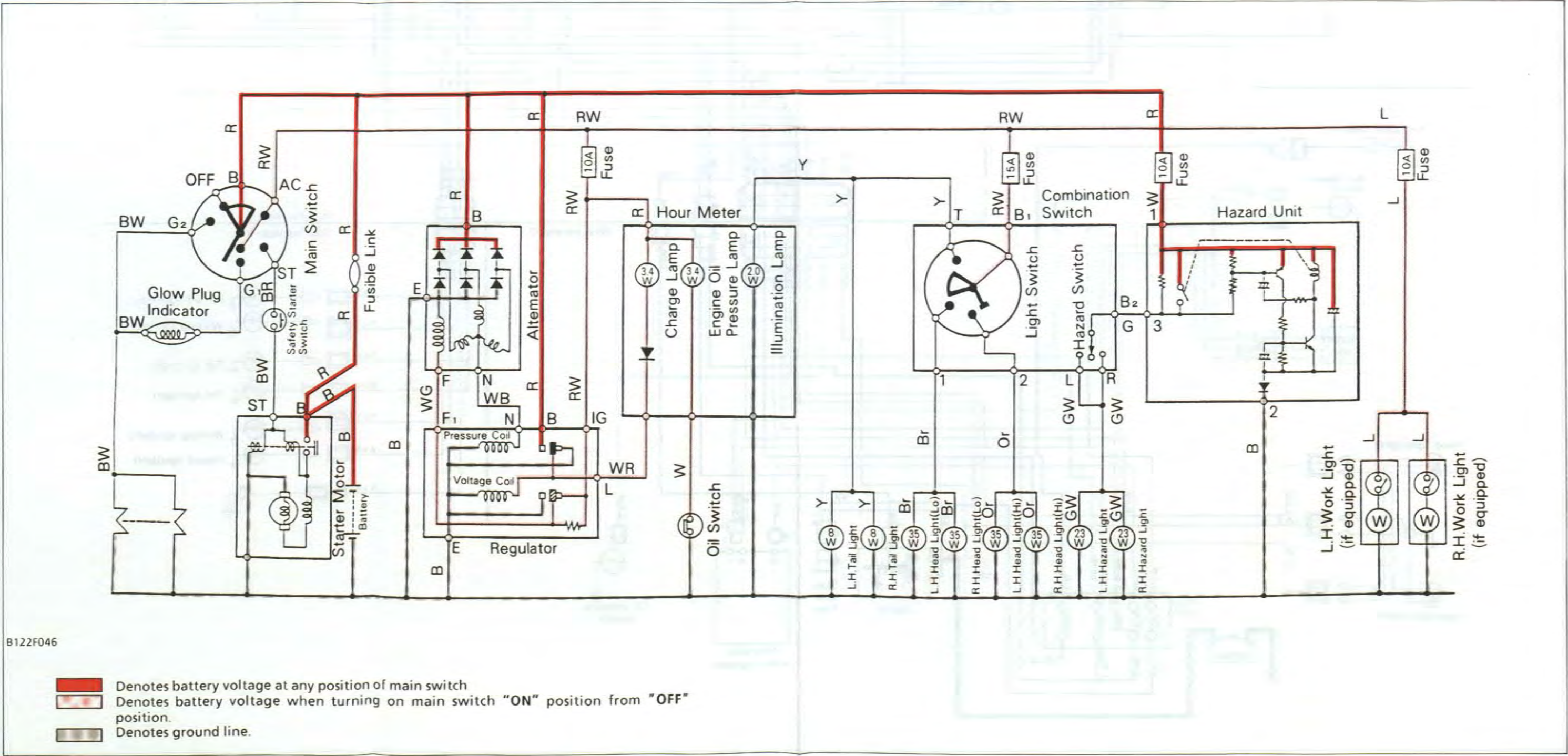
[2]-1 L2350 2WD TYPE

• Main Switch Table

Terminal	B	AC	G1	G2	ST	OFF
Key Position						
OFF	●					●
ON	●	●				
HEAT	●	●	●			
START	●	●		●	●	

• Combination Switch

Head light switch					Hazard light switch			
Color	RW	Y	Br	OR	Color	G	GW	GW
	B1	T	1	2		B2	R	L
OFF					1			
1					OFF			
2					2			



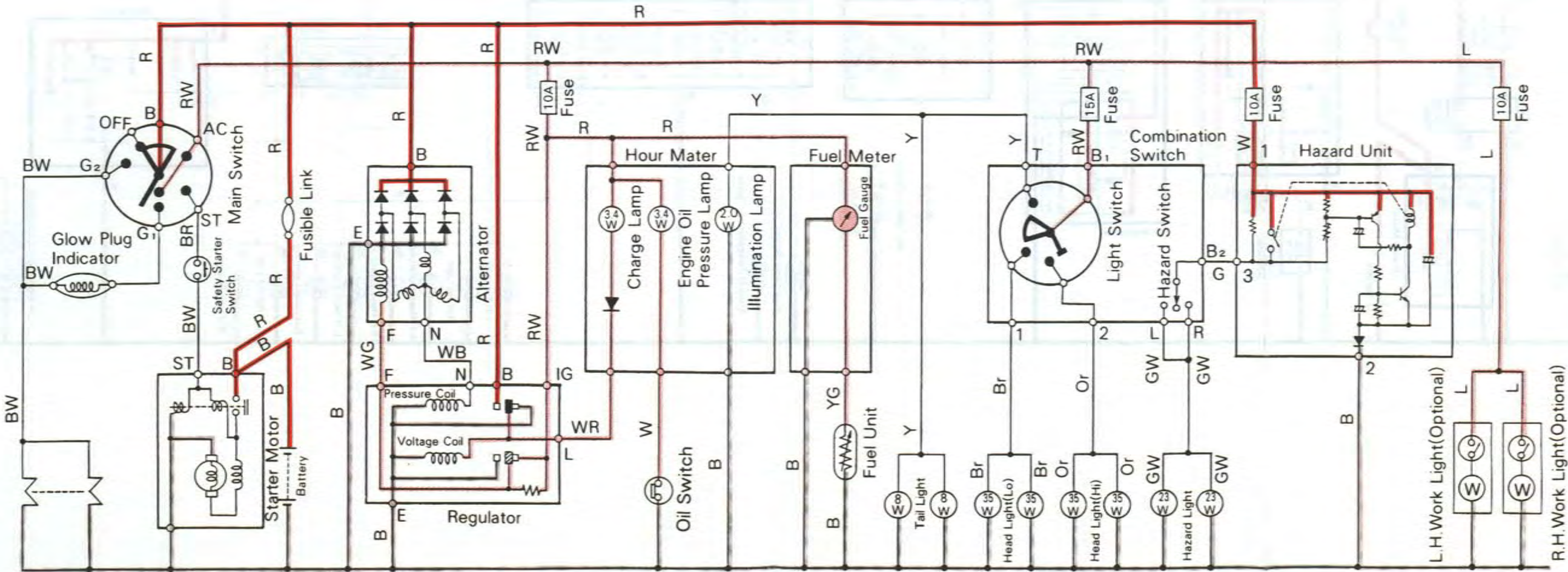
[2]-2 L2350 4WD TYPE

• Main Switch Table

Terminal	B	AC	G1	G2	ST	OFF
Key Position						
OFF	●					●
ON	●	●				
HEAT	●	●	●			
START	●	●		●	●	

• Combination Switch

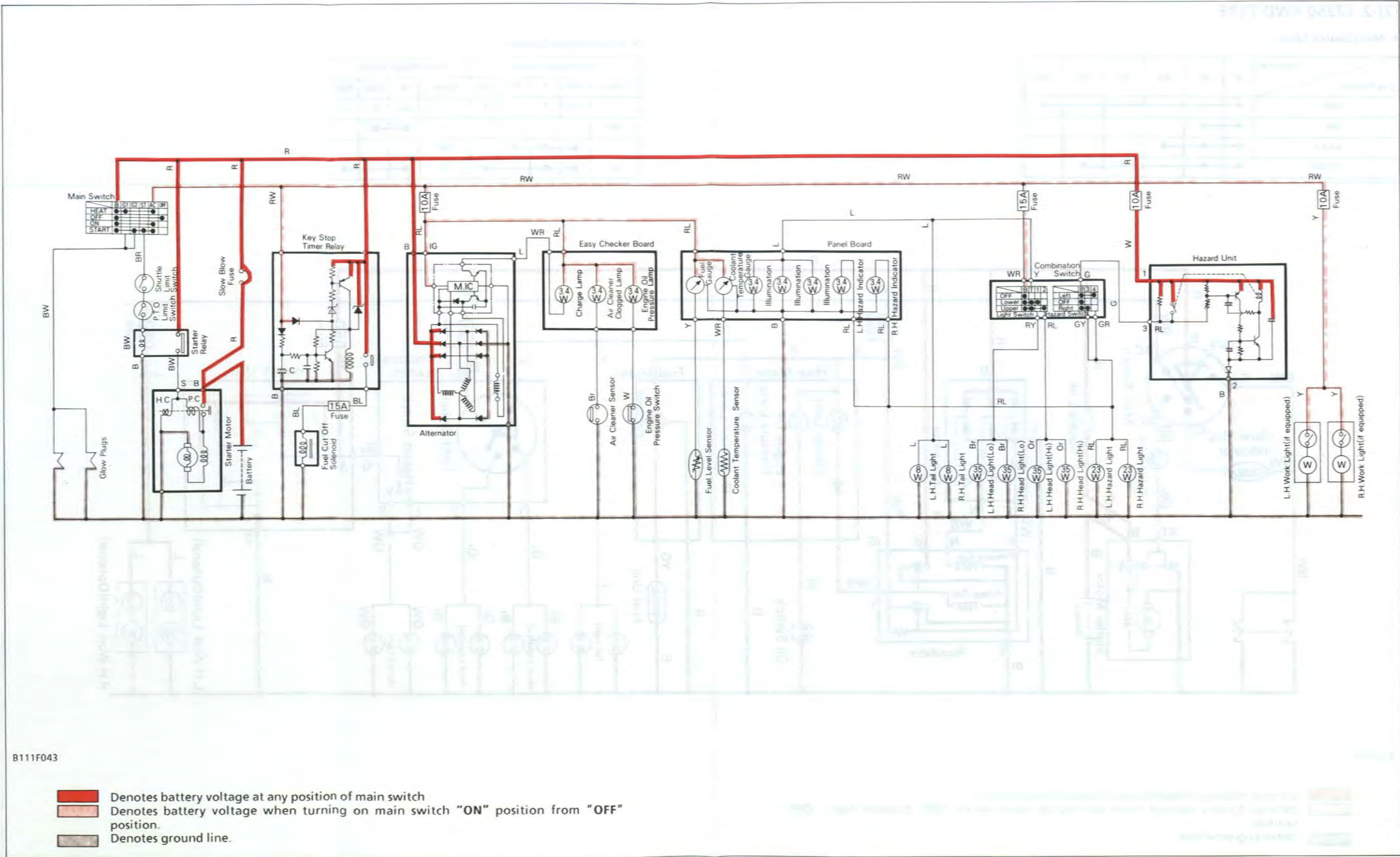
Head light switch					Hazard light switch		
Color	RW	Y	Br	OR	Color	G	GW
	B1	T	1	2		B2	R
OFF					1	●	●
1	●	●	●		OFF		
2	●	●		●	2	●	●



B122F047

- Denotes battery voltage at any position of main switch
- Denotes battery voltage when turning on main switch "ON" position from "OFF" position.
- Denotes ground line.

[2]-3 L2650, L2950, L3450, L3650



B111F043

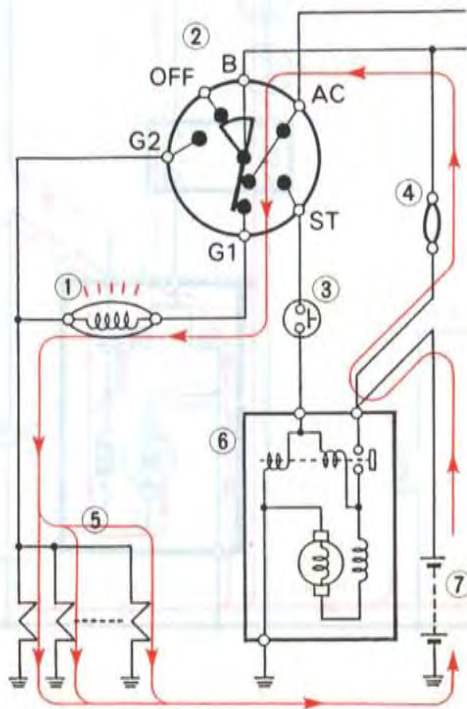
[3] STARTING SYSTEM

[3]-1 L2350

• Main Switch Table

Key Position \ Terminal	B	AC	G1	G2	ST	OFF
OFF	●					●
ON	●	●				
HEAT	●	●	●			
START	●	●		●	●	

At the **PREHEAT** Position

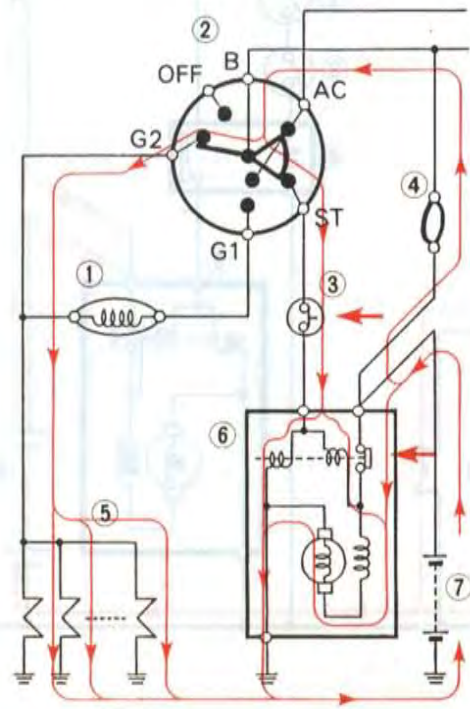


0329F058

(1) Glow Plug Indicator
(2) Main Switch

(3) Safety Starter Switch
(4) Fusible Link

At the **START** Position



0329F059

(5) Glow Plugs
(6) Starter Motor

(7) Battery

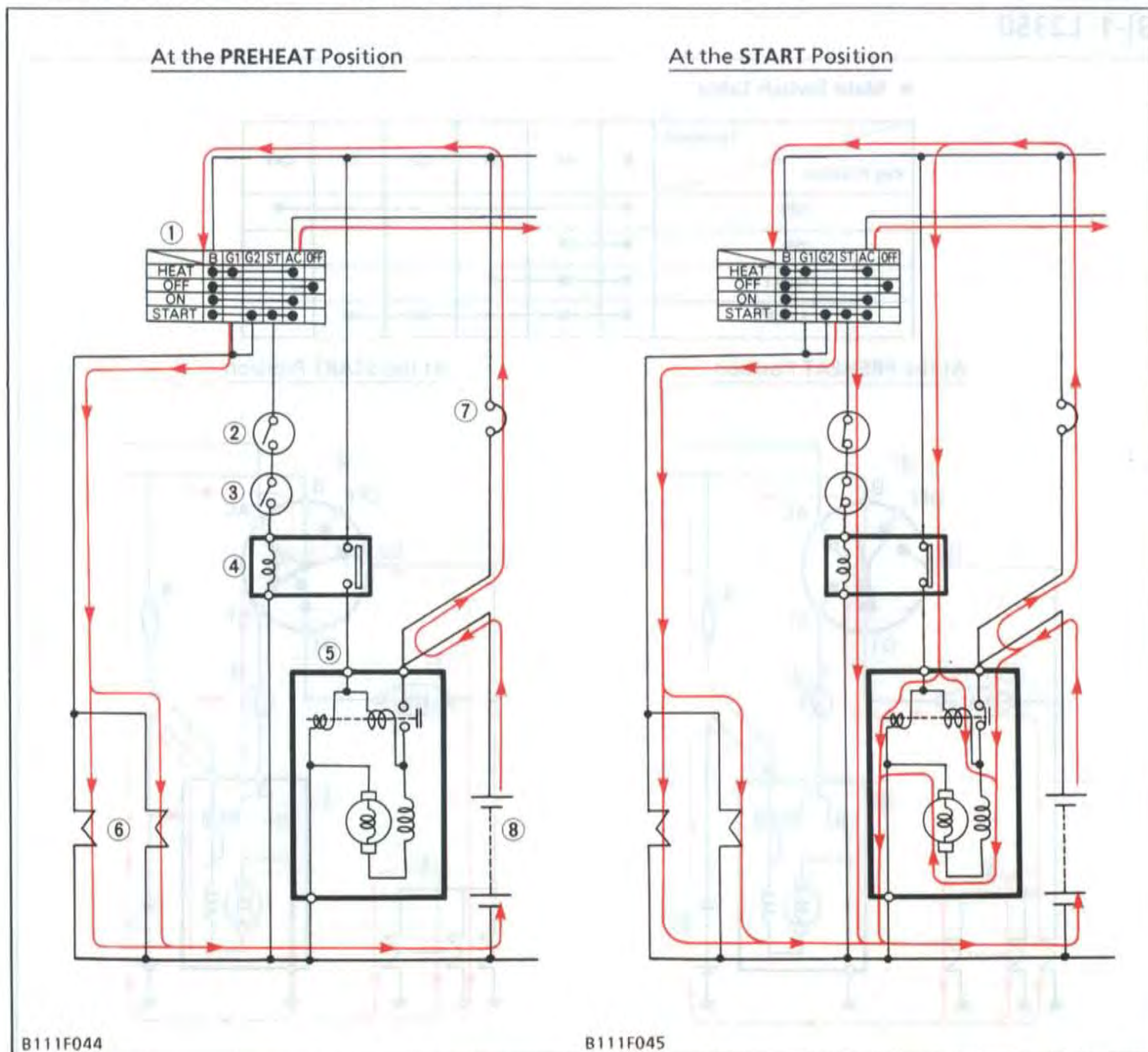
When the main Switch (2) is turned to the **PREHEAT** position, the terminal B is connected to the terminals G1 and AC. The glow plugs (5) become red-hot, and at the same time, the glow plug indicator (1) also becomes red-hot to indicate the red-hot condition of the glow plugs.

When the main switch is then turned to the **START** position with the safety starter switch (3) on, the

terminal B is connected to the terminals ST, G2 and AC so that the starter motor (6) begins running and the glow plugs are kept red-hot.

The main switch automatically returns to the **ON** position when it is released after the engine starts. At the **ON** position, the terminal B is connected only to the terminal AC, thereby causing the starting circuit to be opened, stopping the starter motor.

[3]-2 L2650, L2950, L3450, L3650



(1) Main Switch

(2) Shuttle Limit Switch

(3) PTO Limit Switch

(4) Starter Relay

(5) Starter Motor

(6) Glow Plugs

(7) Slow Blow Fuse

(8) Battery

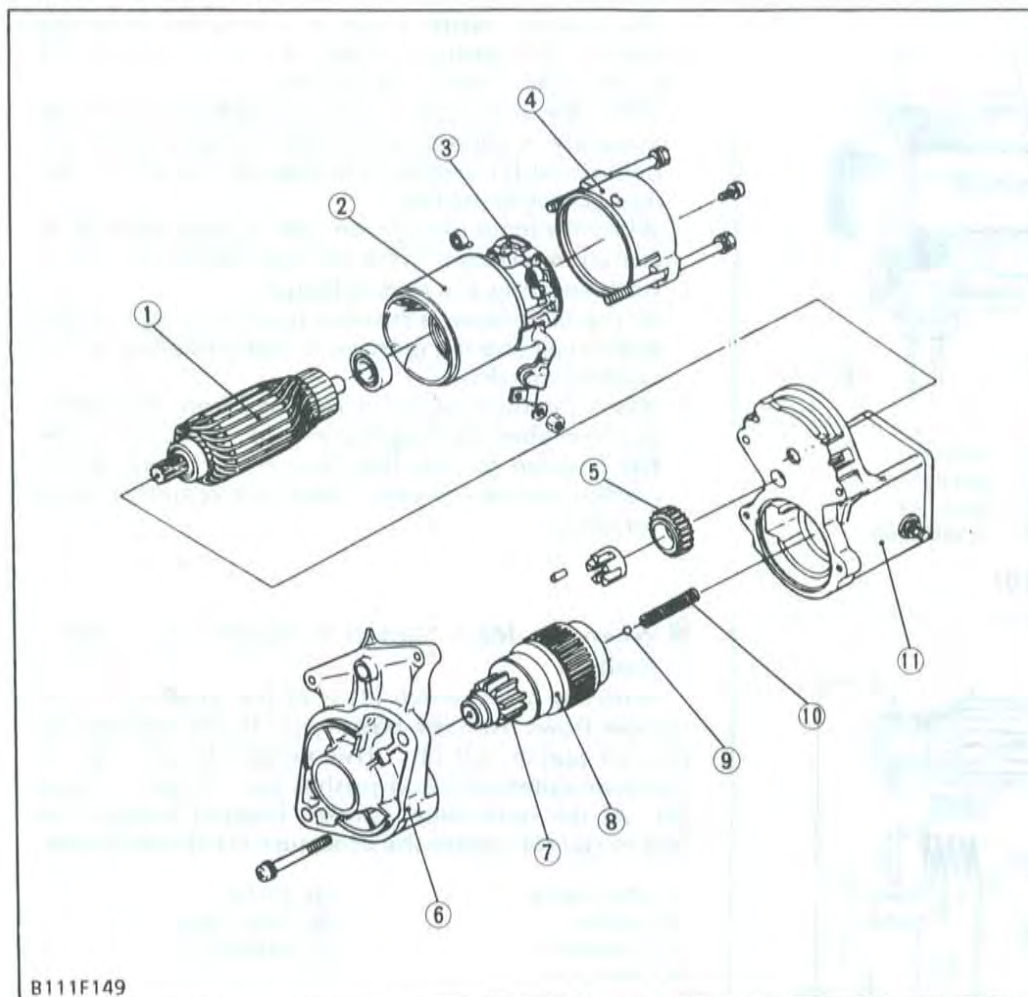
When the main Switch (1) is turned to the **PREHEAT** position, the terminal **B** is connected to the terminals **G1** and **AC**. The glow plugs (6) become red-hot.

When the main switch is turned to **START** position, the terminal **B** is connected to the terminals **ST**, **G2** and **AC**. The current from the terminal **ST** magnetizes and grounds the coil of the starter relay (4) after the shuttle limit switch (2) and the P.T.O.

limit switch (3) are turned on simultaneously. Therefore, the starter relay (4) is turned on and the starter motor starts. The current from **G2** flows to the glow plug (6).

The main switch (1) returns to **ON** position when it is released after the engine starts. At the **ON** position, the terminal **B** is connected only to the terminal **AC**, thereby causing the starting circuit to be opened, stopping the starter motor.

(1) Starter Motor



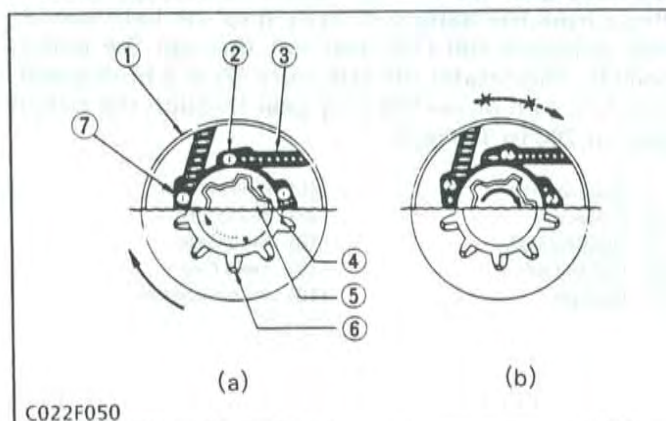
- (1) Armature
- (2) Yoke
- (3) Brush Holder
- (4) End Frame
- (5) Gear
- (6) Drive End Frame
- (7) Pinion
- (8) Roller Clutch
- (9) Ball
- (10) Spring
- (11) Magnet Switch

B111F149

The starter motor is a reduction type.
The speed of the pinion gear is reduced to approx.

one third of motor one.

Roller Clutch



C022F050

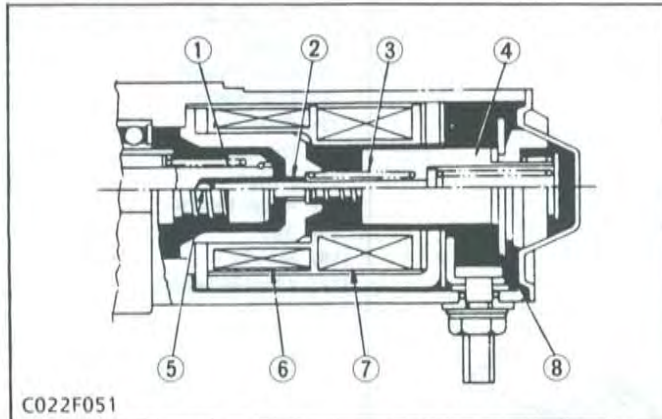
- (a) When power is transmitted
- (b) Idling rotation with pinion shaft speed exceeding that of outer clutch gear

The roller clutch prevents the armature from being driven by the rotational force of the engine when the pinion and the engine flywheel ring gear are in mesh.

- (a) When power is transmitted, the rotational force of the outer clutch gear (1) drives the pinion gear (6) through the roller (2).
- (b) Even when the pinion gear is driven by the engine flywheel ring gear and its speed exceeds that of the outer clutch gear, the rotation force of the ring gear is not transmitted to the outer clutch gear.

- (1) Outer Clutch Gear
- (2) Roller
- (3) Roller Spring
- (4) Inner Spline Tube
- (5) Pinion Shaft, Solid with Pinion Gear
- (6) Pinion Gear
- (7) Locked Position

Magnet Switch

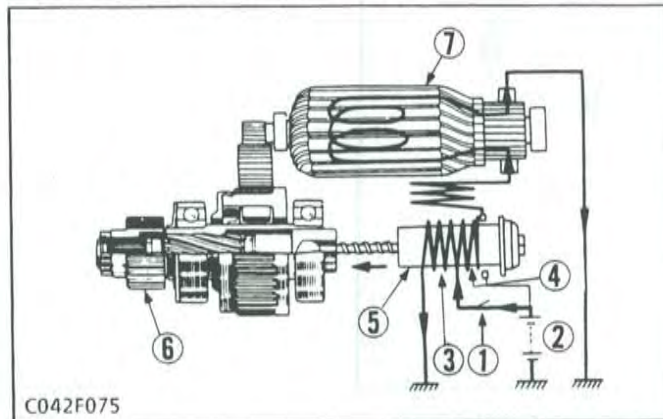


- | | |
|-------------------------|-------------------|
| (1) Clutch Pinion Shaft | (5) Steel Ball |
| (2) Plunger Shaft | (6) Holding Coil |
| (3) Return Spring | (7) Pull-in Coil |
| (4) Plunger | (8) Contact Plate |

The magnet switch series as a relay to drive the armature. It consists of a pull-in coil, a holding coil and a plunger. It works as follows.

1. When the main switch is at the **START** position, the armature is rotated at a small amperage as the pull-in coil (7) and the holding coil (6) attract the plunger (4) to the left.
2. When the main circuit from the contact plate (8) to armature is closed by the plunger (4), the armature starts rotating at a strong torque.
At the same time, a current stops flowing into the pull-in coil and the plunger is kept attracted by the holding coil alone.
3. When the main switch is released from the **START** position after starting the engine, it returns to the **ON** position so that the flow of a current to the holding coil also stops. Thus, the armature stops rotating.

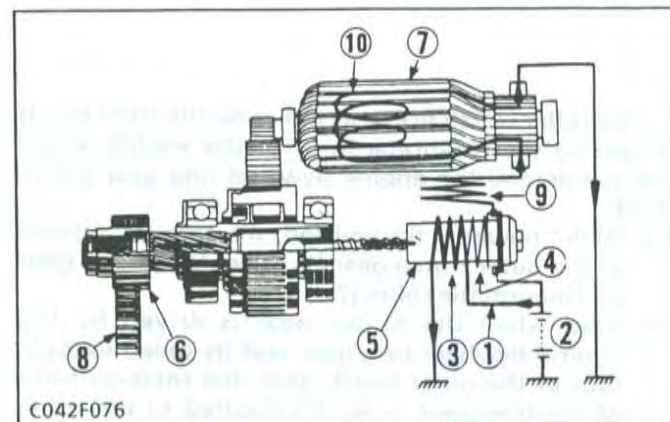
Operation of Starter Motor



■ When the Main Switch is Turned to "START" Position

With the main switch (1) is at the **START** position, current flows from the battery (2) to the holding coil (3) and pull-in coil (4). This moves the plunger (5) electromagnetically and pushes out the pinion gear (6). At the same time, current flowing through the pull-in coil (4) rotates the armature (7) at low speeds.

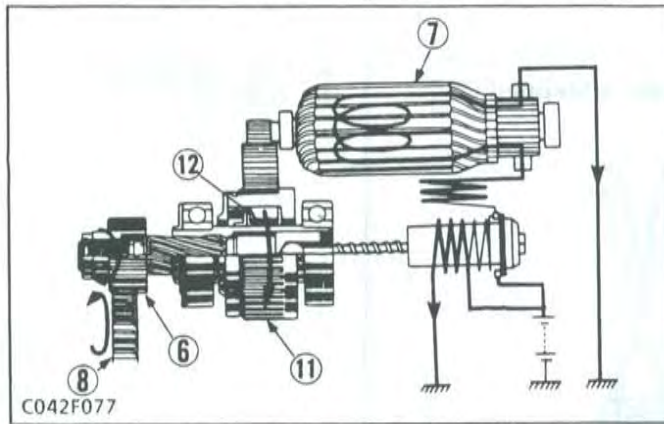
- | | |
|------------------|-----------------|
| (1) Main Switch | (5) Plunger |
| (2) Battery | (6) Pinion Gear |
| (3) Holding Coil | (7) Armature |
| (4) Pull-in Coil | |



■ When the Pinion Gear Meshes with the Ring Gear

When the pinion gear (6) comes into mesh with the ring gear (8) on the flywheel, a large current flows from the battery directly into the field coil (9) and armature coil (10), but not through the pull-in coil (4). This rotates the armature (7) at a high speed, which in turn drives the ring gear through the pinion gear at 200 to 300 rpm.

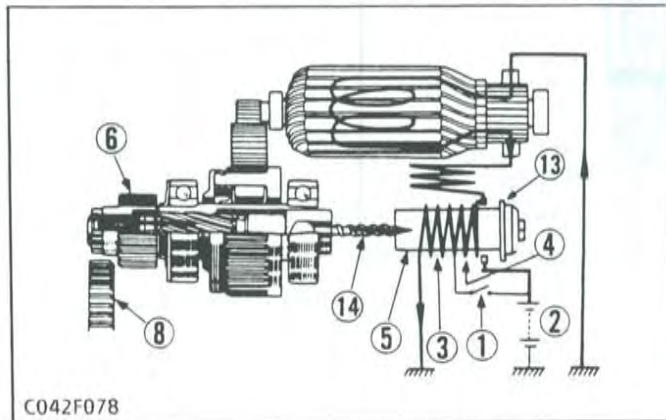
- | | |
|------------------|--------------------|
| (1) Main Switch | (6) Pinion Gear |
| (2) Battery | (7) Armature |
| (3) Holding Coil | (8) Ring Gear |
| (4) Pull-in Coil | (9) Field Coil |
| (5) Plunger | (10) Armature Coil |



■ When the Engine is Running

When the engine runs so fast that the ring gear (8) starts to turn the pinion gear (6), the roller clutch (11), (12) are actuated to prevent excessive high-speed revolutions of the armature (7).

- | | |
|-----------------|------------------|
| (6) Pinion Gear | (11) Clutch Gear |
| (7) Armature | (12) Roller |
| (8) Ring Gear | |



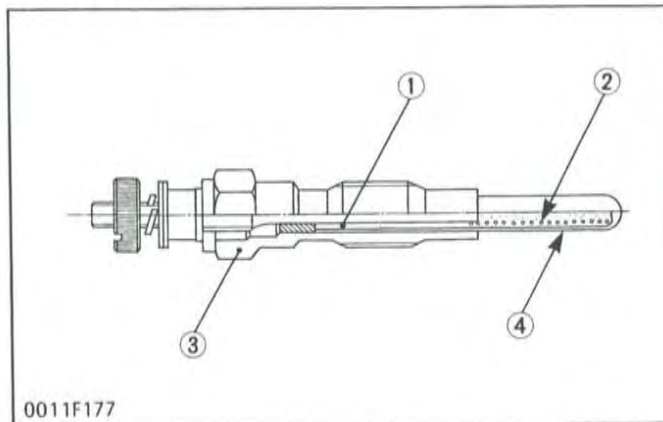
■ When the Main Switch is Released

When the main switch (1) released, the main switch returns from the **START** to the **ON** position and opens the starter circuit. Then, current flows from the battery (2) to the pull-in coil (4) and holding coil (3) through the contact plate (13). Since the magnetic forces of the pull-in coil and holding coil become partially opposed and cancel one another, the plunger (5) is restored by the tension of the return spring (14).

This opens the contacts on the contact plate and separates the pinion gear (6) from the ring gear (8), so that the pinion gear stops rotating.

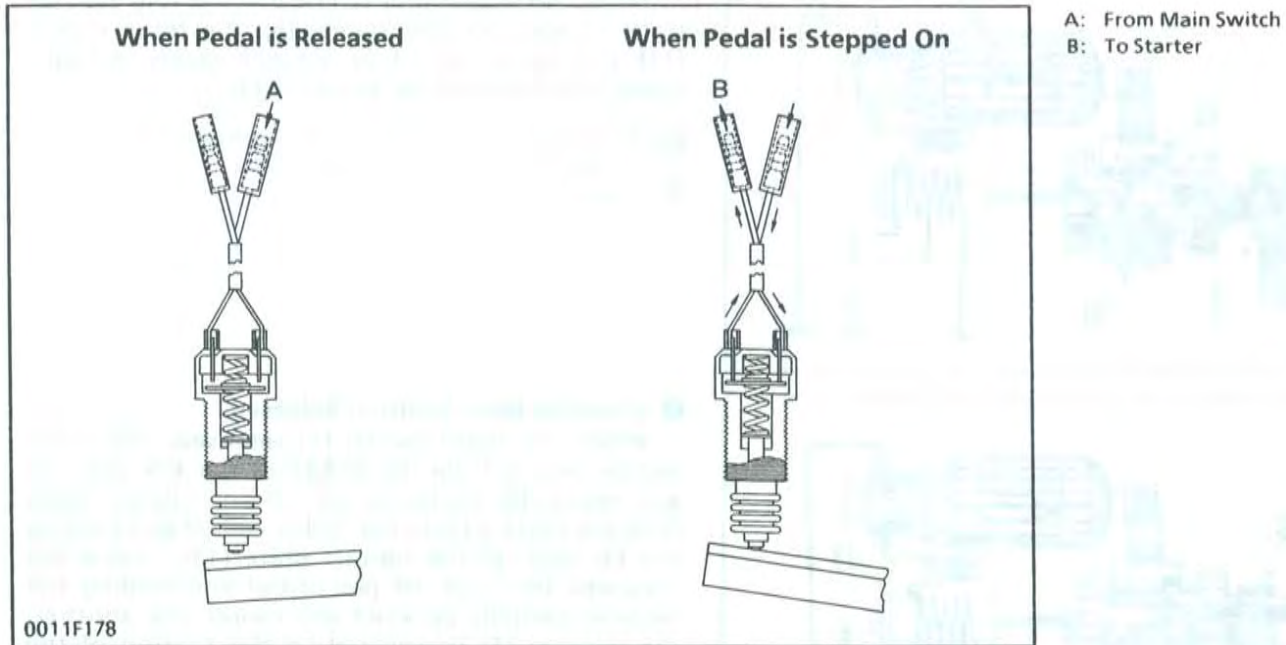
- | | |
|------------------|--------------------|
| (1) Main Switch | (6) Pinion Gear |
| (2) Battery | (8) Ring Gear |
| (3) Holding Coil | (13) Contact Plate |
| (4) Pull-in Coil | (14) Return Spring |
| (5) Plunger | |

(2) Glow Plug

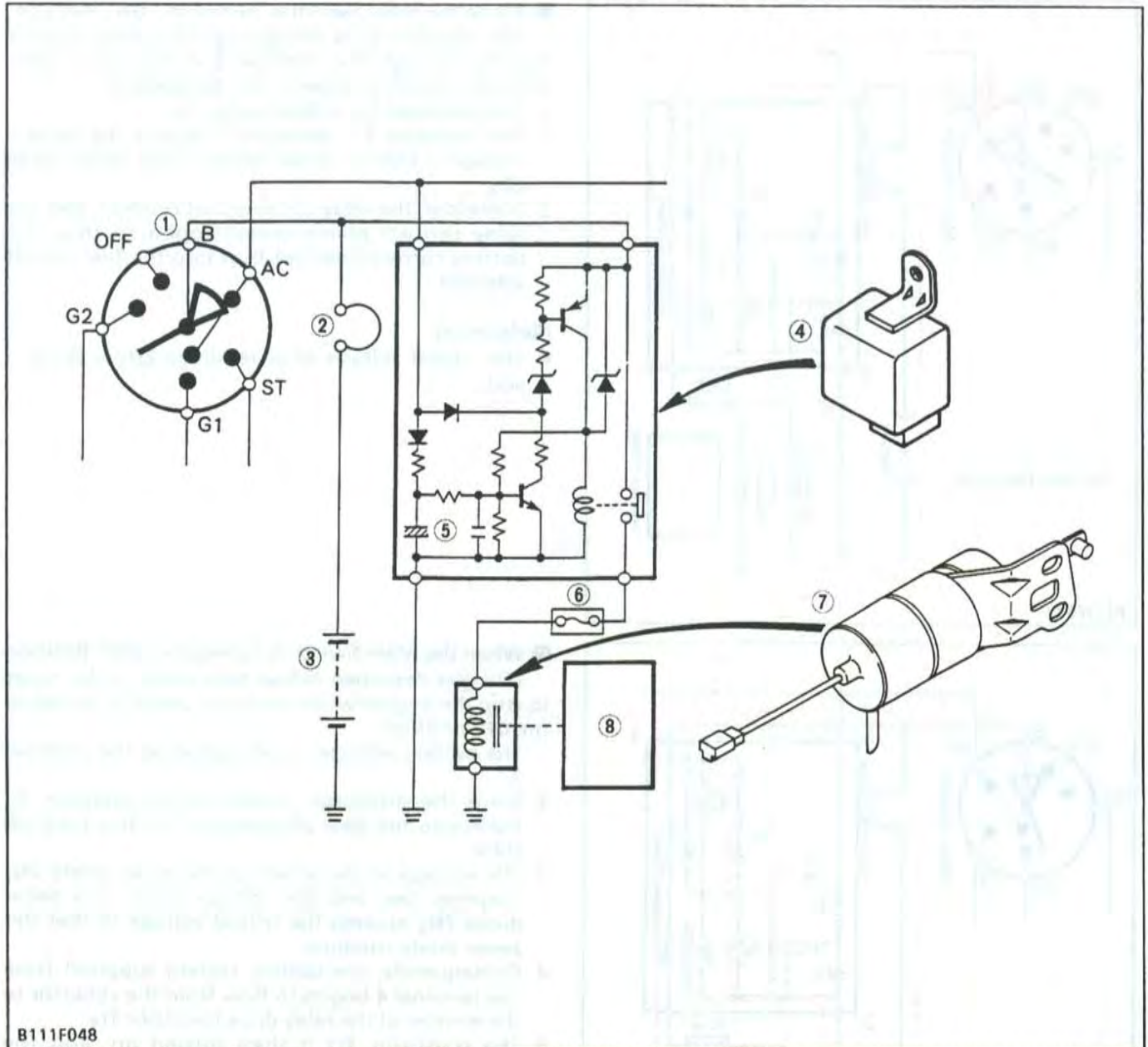


The glow plugs are located in each combustion chamber. They are heated up by the current of the battery to make starting easier.

- | | |
|-----------------------|----------------|
| (1) Insulating Powder | (3) Housing |
| (2) Heat Coil | (4) Metal Tube |

(3) Safety Switch (L2350 Only)

The safety switch prevents current from flowing to the starter when the clutch pedal is not depressed. This is to ensure safe starting.

[4] ENGINE KEY SWITCH SHUT-OFF SYSTEM (L2650, L2950, L3450, L3650)

(1) Main Switch
(2) Slow Blow Fuse

(3) Battery
(4) Timer Relay

(5) Capacitor
(6) Fuse

(7) Fuel Cut Off Solenoid
(8) Fuel Injection Pump

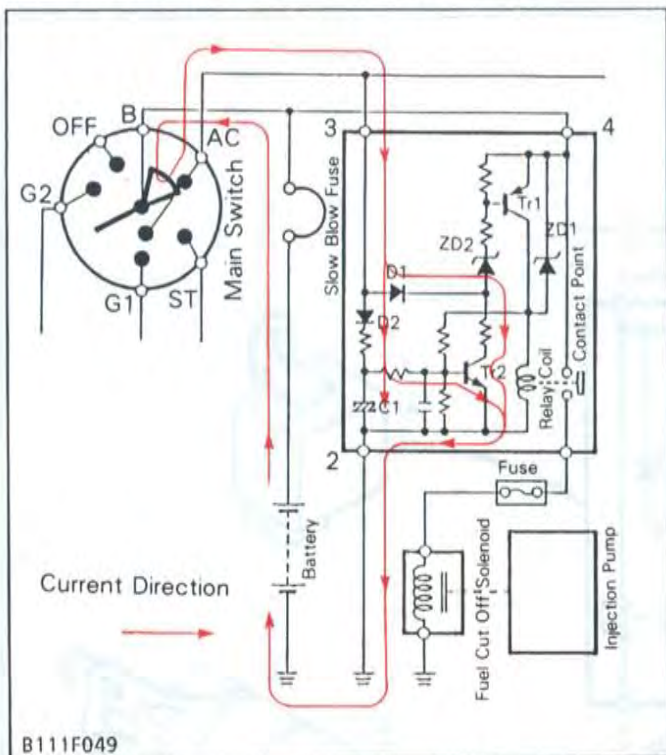
On the engine key switch shut-off system, turning the main switch from the ON position to the OFF position moves the fuel injection pump control rack to the "No Fuel Injection" position through the fuel cut off solenoid and the same linkage as when the stop lever is operated by manual operation.

As soon as the main switch (1) is turned from the ON position to the OFF position, the capacitor starts discharging and continues it for approx. 10 seconds.

During the discharging period, the current flows as follows:

Battery (3) → Main Switch (1) → Timer Relay (4) → Fuel Cut Off Solenoid (7) → Ground.
Then, the engine stops.

After 10 seconds, the relay contact point in the timer open to prevent the battery from overdischarging.

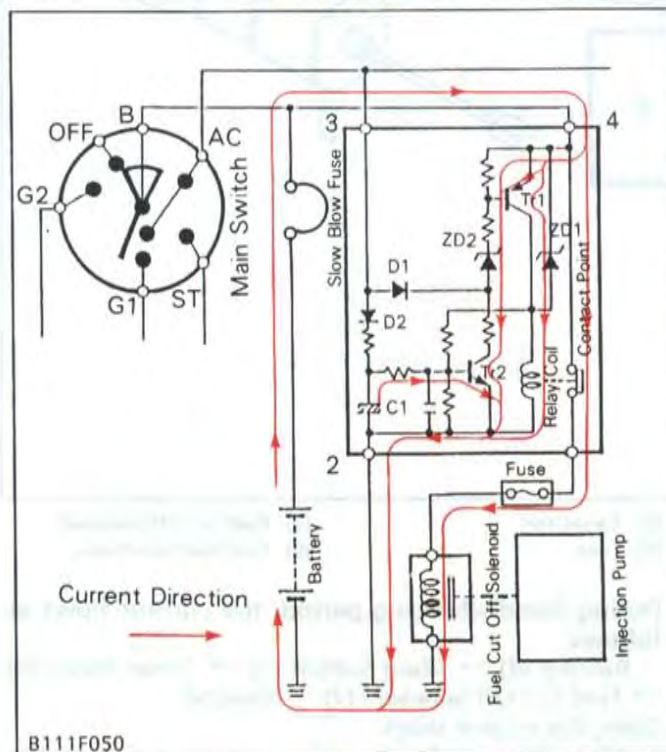
(1) Operation of Timer Relay**■ When the Main Switch is Turned to "ON" Position**

The capacitor C_1 is charged by the battery current flowing through the terminal 3 immediately after the main switch is turned to the ON position.

1. The transistor Tr_2 is then turned on.
2. The transistor Tr_1 remains off because the battery voltage is applied to the anode of the zener diode ZD_2 .
3. Therefore, the relay coil does not conduct, and the relay contact points remain open so that the battery current does not flow into the fuel cut off solenoid.

(Reference)

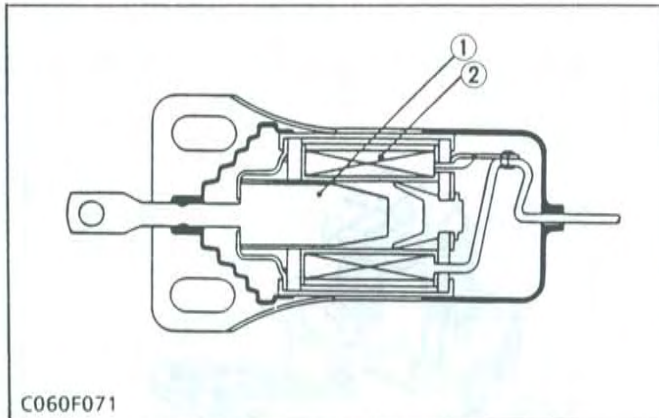
- The critical voltage of zener diode ZD_2 is about 5 volts.

**■ When the Main Switch is Turned to "OFF" Position**

Changes described below take place in the timer to stop the engine when the main switch is turned to the OFF position.

1. The battery voltage is not applied to the terminal 3.
2. Since the discharge current from capacitor C_1 flows into the base of transistor Tr_2 , it is held ON state.
3. The voltage at the anode of the zener diode ZD_2 becomes low, and the voltage across the zener diode ZD_2 exceeds the critical voltage so that this zener diode conducts.
4. Consequently, the battery current supplied from the terminal 4 begins to flow from the collector to the emitter of the relay drive transistor Tr_1 .
5. The transistor Tr_1 is then turned on, and the battery current flows into the relay coil to close relay contact point.
6. The battery current flows into the fuel cut off solenoid via the terminals 4 and 1.
7. As a result, the amount of the fuel injected from the injection pump becomes zero to stop the engine.
8. The transistor Tr_2 turns off after the discharging period approx. 10 seconds of the capacitor C_1 . No current flows through the circuit, and then the relay contact point opens so that the battery current does not flow into the fuel cut off solenoid.

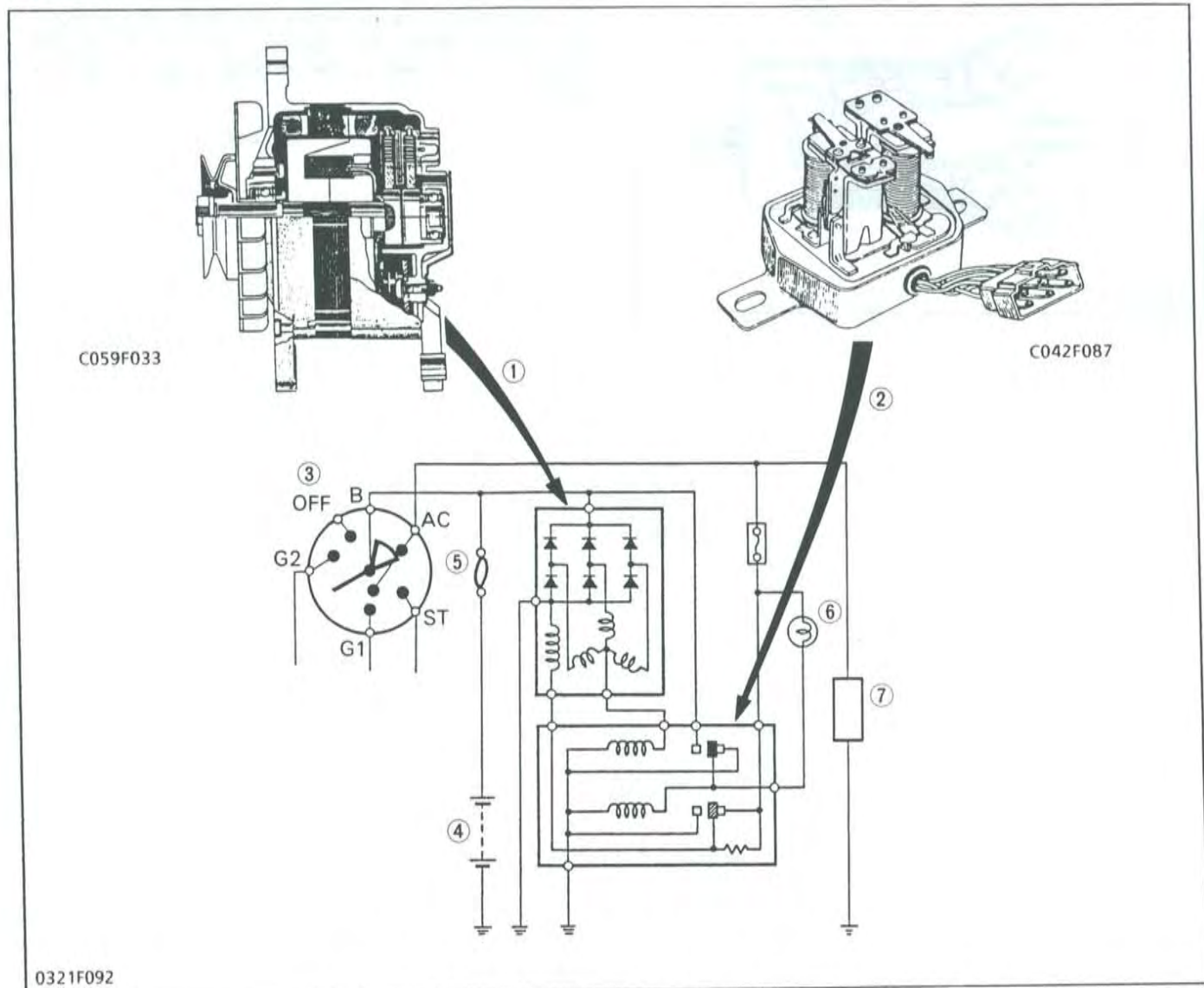
(2) Fuel Cut Off Solenoid



Flowing of the battery current into the coil (2) while the timer relay contact point is closed attracts the plunger (1) to actuate the stop lever of the injection pump. When the battery current stops, the plunger is returned to the original position by the spring.

(1) Plunger

(2) Coil

[5] CHARGING SYSTEM**(1) L2350**

(1) Alternator
(2) Regulator

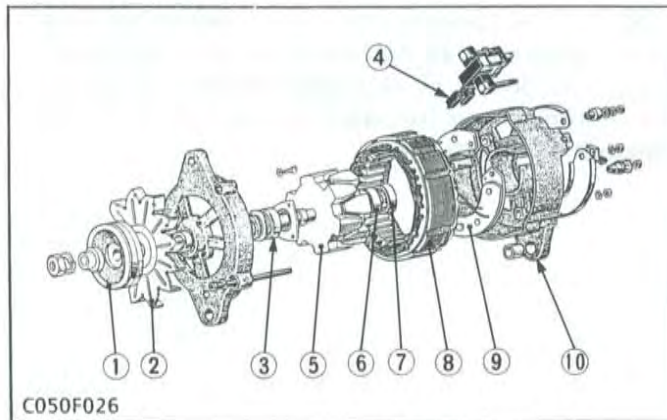
(3) Main Switch
(4) Battery

(5) Fusible Link
(6) Charge Lamp

(7) Loads

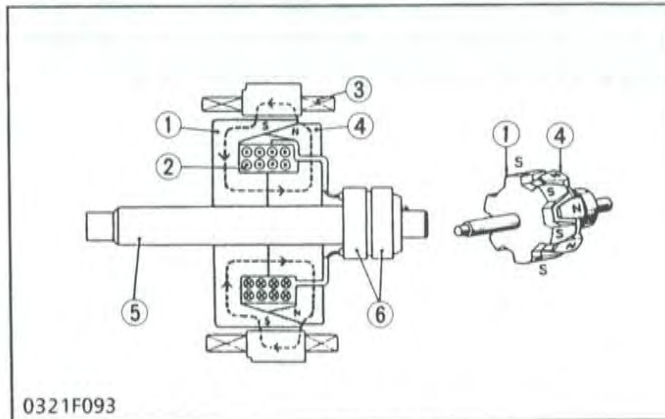
The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs. It consists of an alternator and regulator.

(1)-1 Alternator



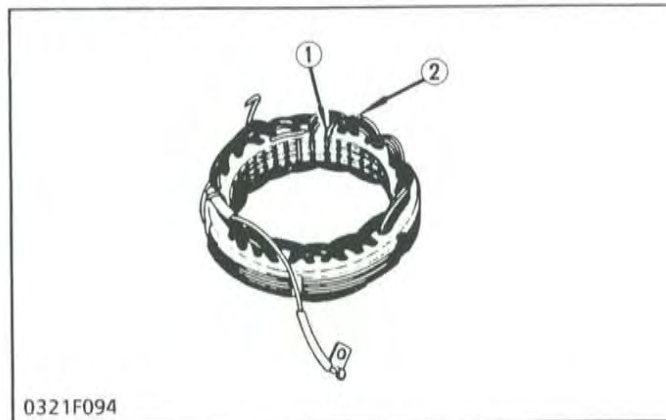
- | | |
|-------------|----------------|
| (1) Pulley | (6) Slip Ring |
| (2) Fan | (7) Bearing |
| (3) Bearing | (8) Stator |
| (4) Brush | (9) Rectifier |
| (5) Rotor | (10) End Plate |

1) Rotor



- | | |
|----------------|---------------|
| (1) Core | (4) Core |
| (2) Rotor Coil | (5) Shaft |
| (3) Stator | (6) Slip Ring |

2) Stator



- | | |
|----------|-----------------|
| (1) Slot | (2) Stator Coil |
|----------|-----------------|

The alternator is a unit that produces electric power to supply the current for each circuit and to charge the battery.

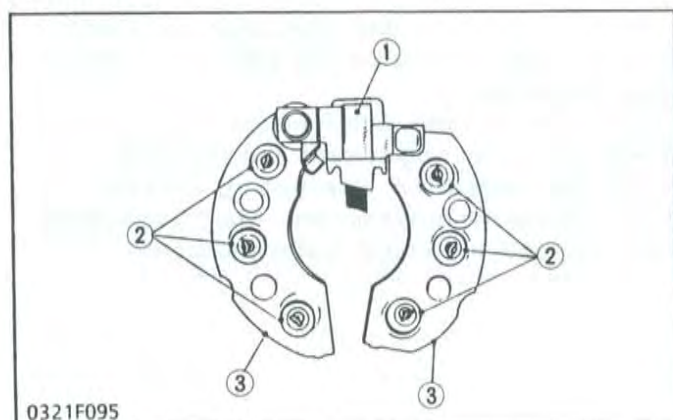
It has two functions, one function is to generate three-phase alternating current and the other is to rectify the generated alternating current for conversion into the direct current. Main components of the alternator are a rotor, stator and rectifier.

The rotor is an assembly of a rotor coil (2), core (1), (4) and shaft (5).

It rotates inside the stator (3) to generate three-phase current in the stator (3). The current flowing through the rotor's rotor coil (2) is regulated to change the magnetic force of the core (1), (4) so that the generated voltage of the stator (3) is controlled to a constant level.

The stator assembly is a laminated soft iron ring with Y-connected stator wiring in the slots (1). Inside the fixed stator, the magnetic rotor rotates to generate three-phase current. The magnitude of the generated voltage is dependent on the amperage that flows through the rotor's rotor coil.

3) Rectifier

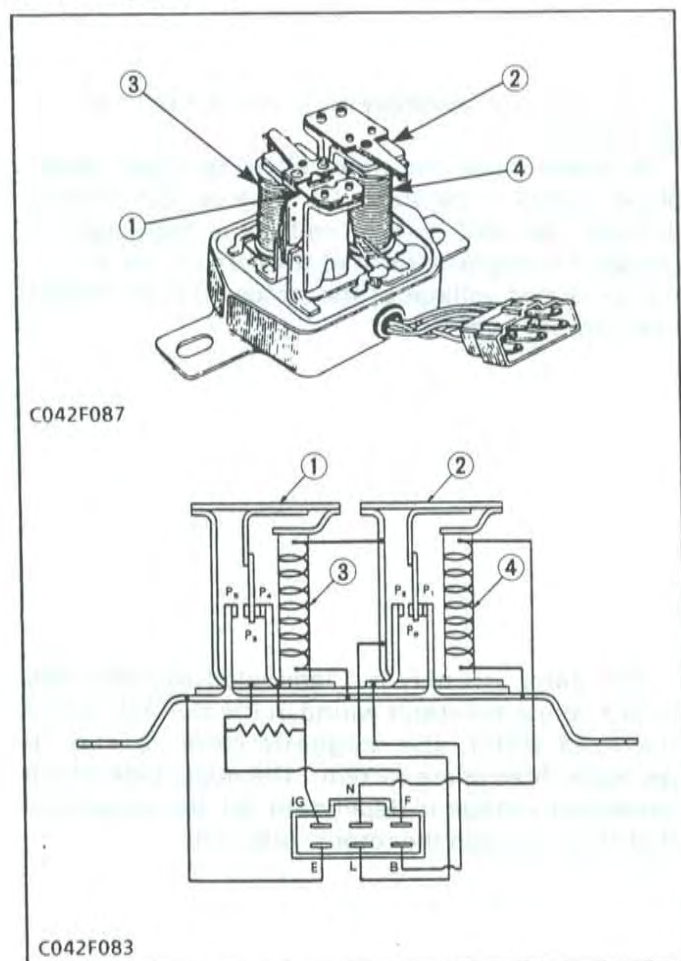


The rectifier converts the three-phase alternating current generated at the stator coil into the direct current. It consists of six diodes (2) which together form a three-phase full-wave bridge circuit and a holder (3) that holds them.

(1) Brush Holder
(2) Diode

(3) Holder

(1)-2 Regulator



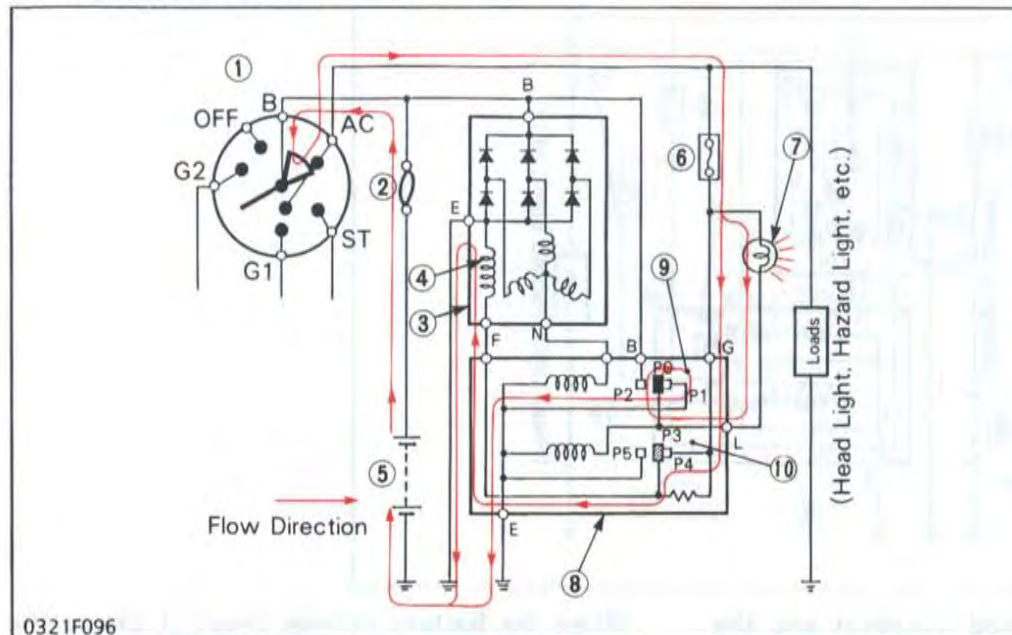
The regulator protects the electrical devices by regulating the voltages induced at the alternator. It consists of a voltage regulator which keeps the alternator-induced voltage constant, and a voltage relay which turns on and off the charge lamp.

(1) Voltage Regulator
(2) Voltage Relay

(3) Voltage Coil
(4) Pressure Coil

(1)-3 Operation of Charging System

■ When Main Switch is Turned to "ON" Position

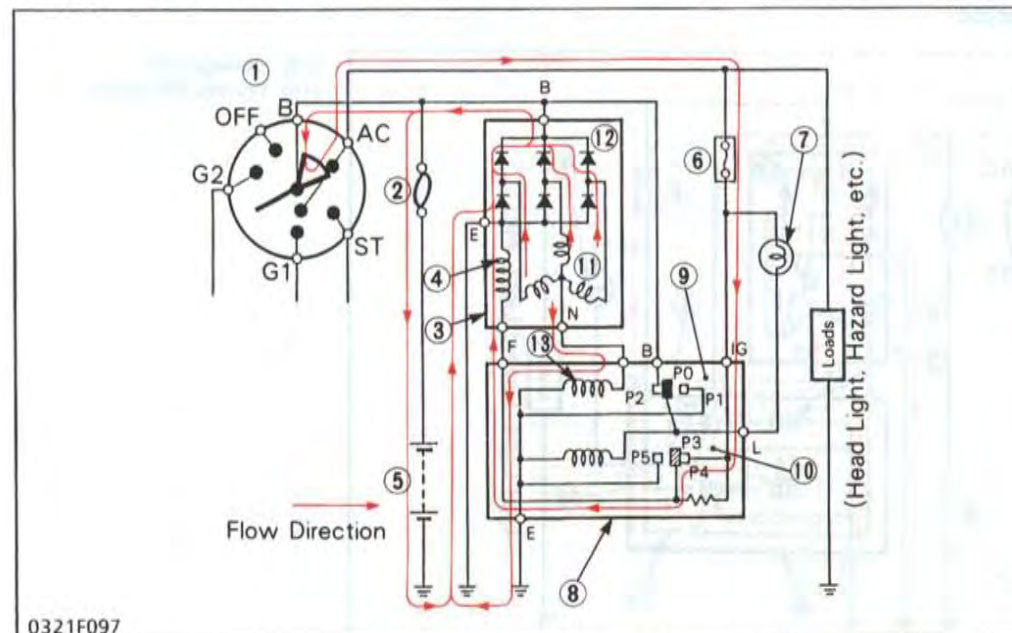


- (1) Main Switch
- (2) Fusible Link
- (3) Alternator
- (4) Rotor Coil
- (5) Battery
- (6) Fuse
- (7) Charge Lamp
- (8) Regulator
- (9) Voltage Relay
- (10) Voltage Regulator

When the main switch (1) is turned to the **ON** position, the battery voltage causes two flows of the current. As one of the flows, the current flows from the terminal IG of the regulator (8) to the contacts P3 and P4 and flows into the alternator's rotor coil (4)

from the terminal F thus magnetizing the rotor core. Then, it flows to the ground through the terminal E. The other flows from the charge lamp (7) of the easy checker to the ground through the contacts P0 and P1, and lights the charge lamp.

■ When Engine Starts

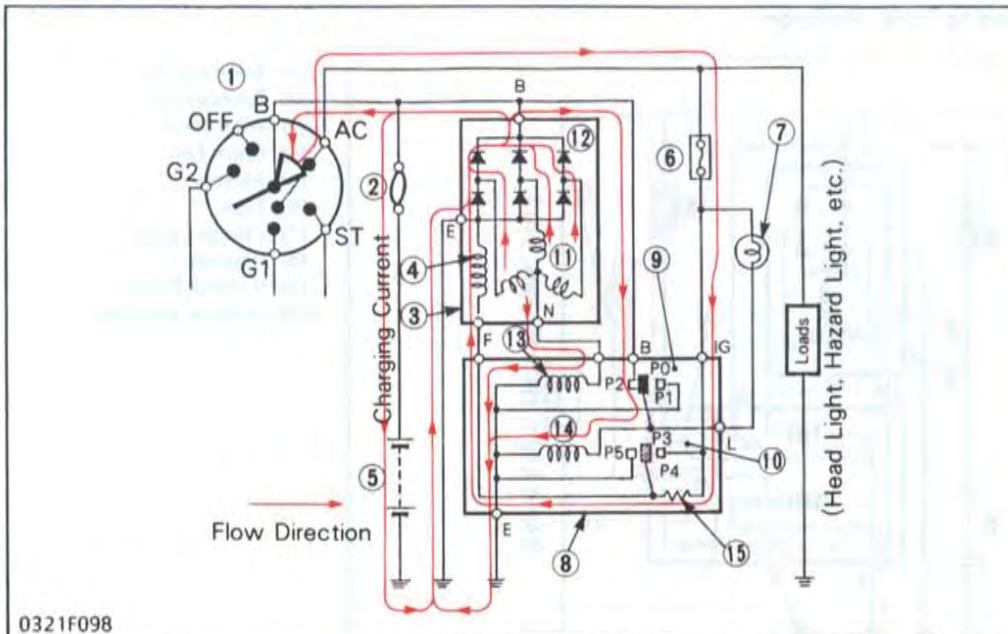


- (11) Stator Coil
- (12) Diodes (Rectifier)
- (13) Pressure Coil

When the engine starts, the three-phase alternating current is generated in the stator coil (11) and rectified by the rectifier (12). If the induced voltage is higher than the battery voltage, the battery is charged. And at the same time, the voltage at the

terminal N is applied to the pressure coil (13). When this voltage becomes higher than the threshold voltage of the voltage relay, contacts P0 and P2 close and turn off the charge lamp (7).

■ When Battery Voltage Rises



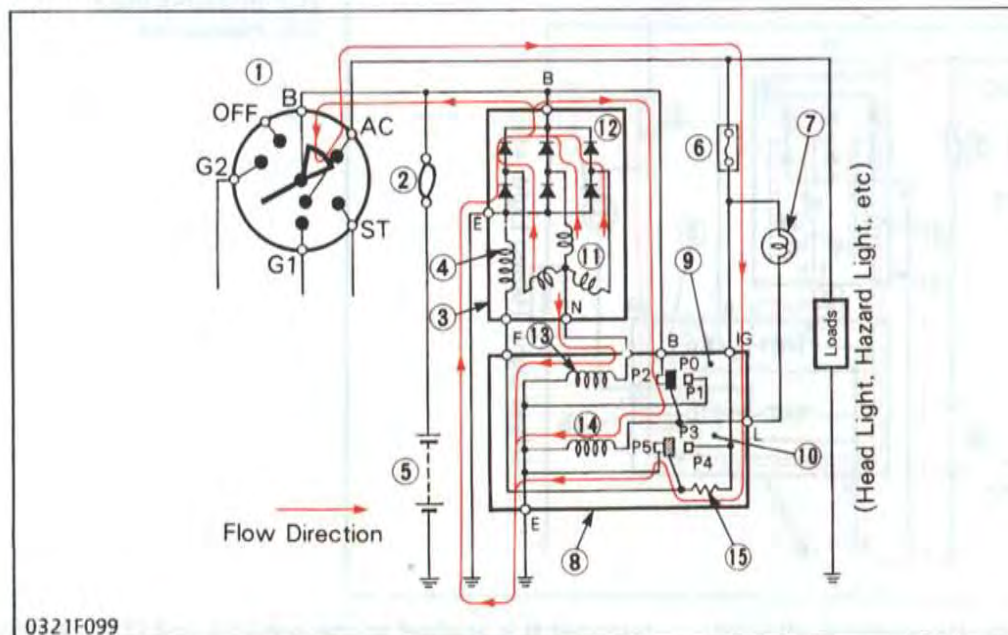
- (14) Voltage Coil
(15) Control Resistance

When the alternator speed increases and the voltage at the terminal B rises, the voltage coil (14) is excited, and contact P3 is attracted toward the P5 side and held midway between them. In this case, the rotor coil (14) and control resistance (15) are series-connected, so that the current flowing into the rotor coil is reduced. Thus, the rotor's magnetic force is reduced and the generated voltage drops.

When the battery voltage drops, it causes the voltage coil current to decrease and the magnetic force of the voltage coil becomes small, and closes contacts P3 and P4 again, thus increasing the magnetic force of the rotor coil to raise the generated voltage.

The operation above is repeated to maintain the generated voltage at a constant level.

■ When Over Charge Prevention



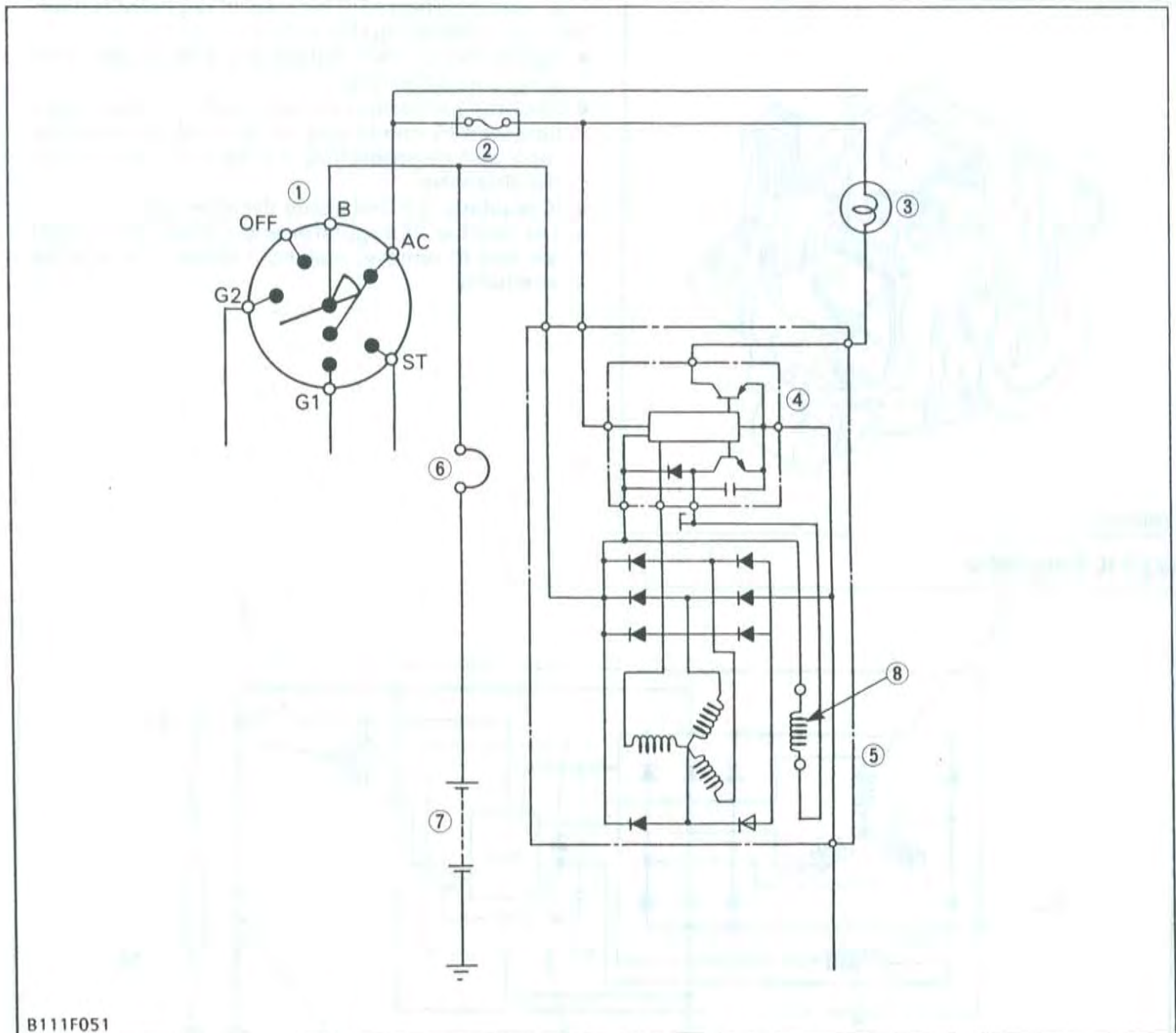
- (14) Voltage Coil
(15) Control Resistance

When the battery is charged nearly to capacity, the voltage coil (14) increases its attraction force and closes contacts P3 and P5. The current flowing through the control resistance (15) is directly

grounded.

Therefore, the current flowing into the rotor is further reduced, thus the generated voltage is maintained at a constant level.

(2) L2650, L2950, L3450, L3650



B111F051

(1) Main Switch
(2) Fuses

(3) Charge Lamp
(4) IC Regulator

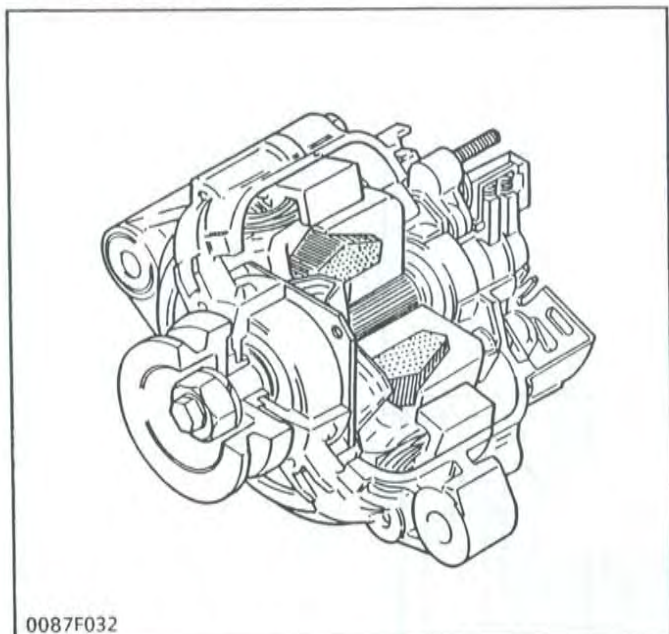
(5) Alternator
(6) Slow Blow Fuse

(7) Battery
(8) Rotor Coil

The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

This alternator has IC regulator.

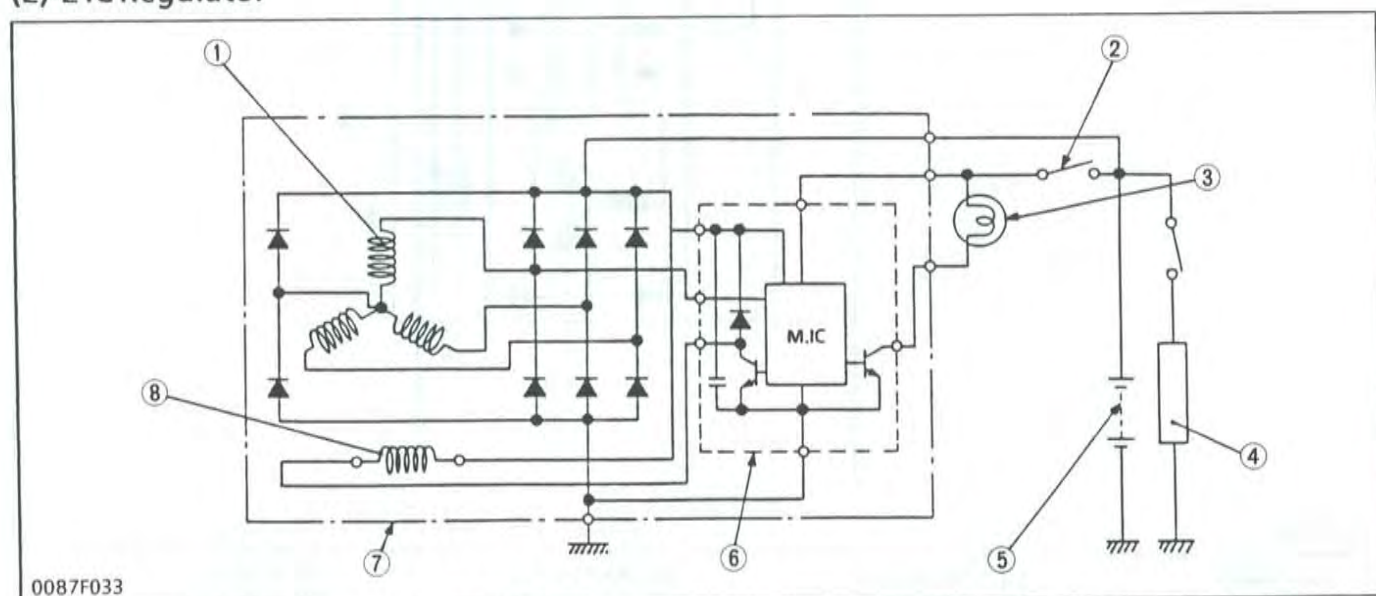
(2)-1 Alternator



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.

(2)-2 IC Regulator



(1) Stator Coil
(2) Main Switch

(3) Charge Lamp
(4) Load

(5) Battery
(6) IC Regulator

(7) Alternator
(8) Rotor Coil

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.

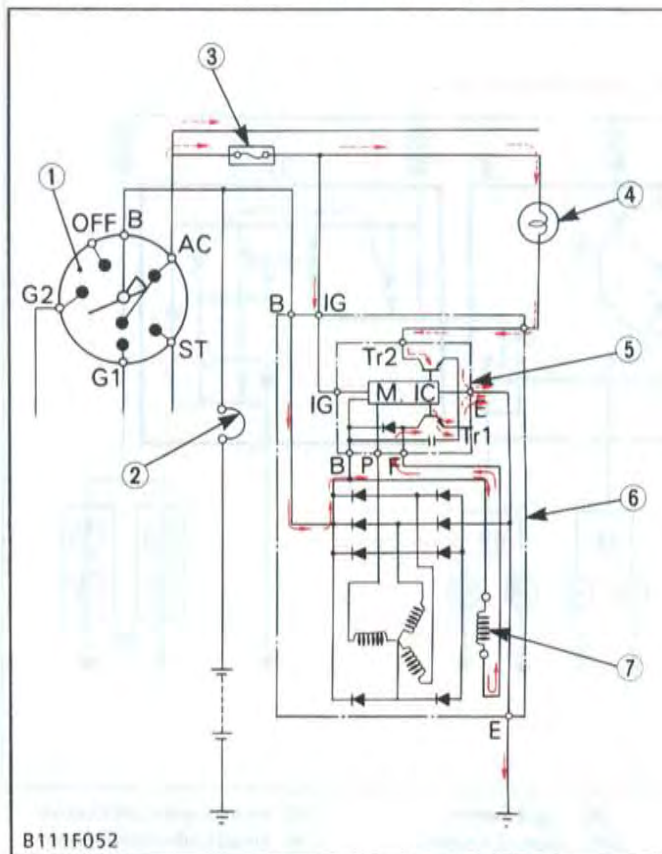
The internal circuitry of the IC regulator is shown in the diagram. It consists of a hybrid IC incorporating a monolithic IC. (The internal circuitry of the monolithic IC is extremely complex, so it is shown as simply "M.IC circuit").

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.

(2)-3 Operation of Charging System

■ When Main Switch is Turned To "ON" Position



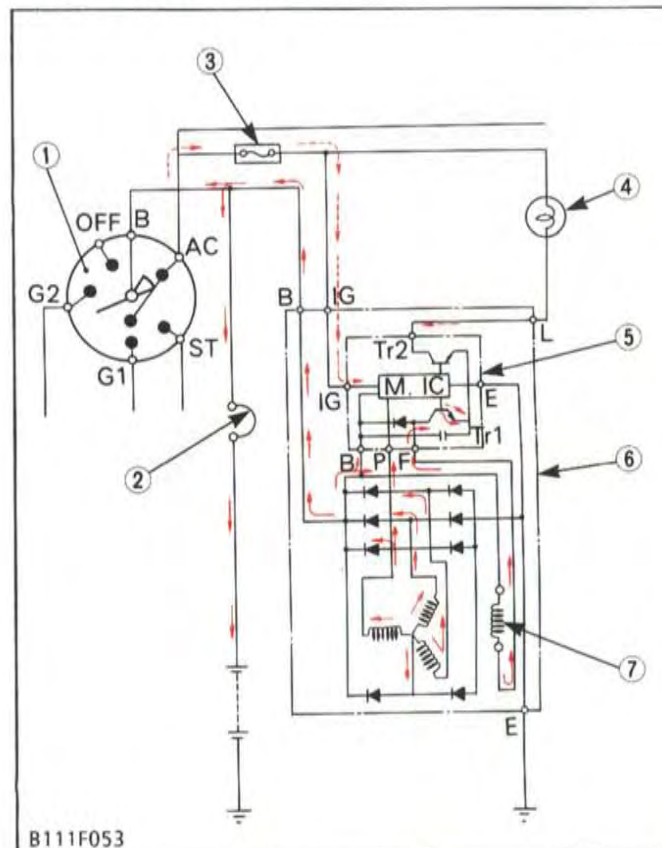
As the battery voltage is added to the terminal IG, M.IC circuit detect it and makes current pour to the Tr1. It results to pour the initial exciting current to the rotor coil. (In this case, M.IC circuit makes current pour on and off the Tr1 in pulse and limits the battery discharging current to small value (Approx. 0.17 A) when the main switch is turned on.)

As the alternator is not rotated, it doesn't generate. Therefore the voltage of terminal P is zero volt. M.IC circuit detects it and makes current pour to the Tr2. It results light on the charge lamp.

- (1) Main Switch
- (2) Slow Blow Fuse
- (3) Fuse
- (4) Charge Lamp
- (6) IC Regulator

- (6) Alternator
- (7) Rotor Coil
- M.IC : Monolithic IC
- Tr1 : Transistor
- Tr2 : Transistor

■ When Engine Starts

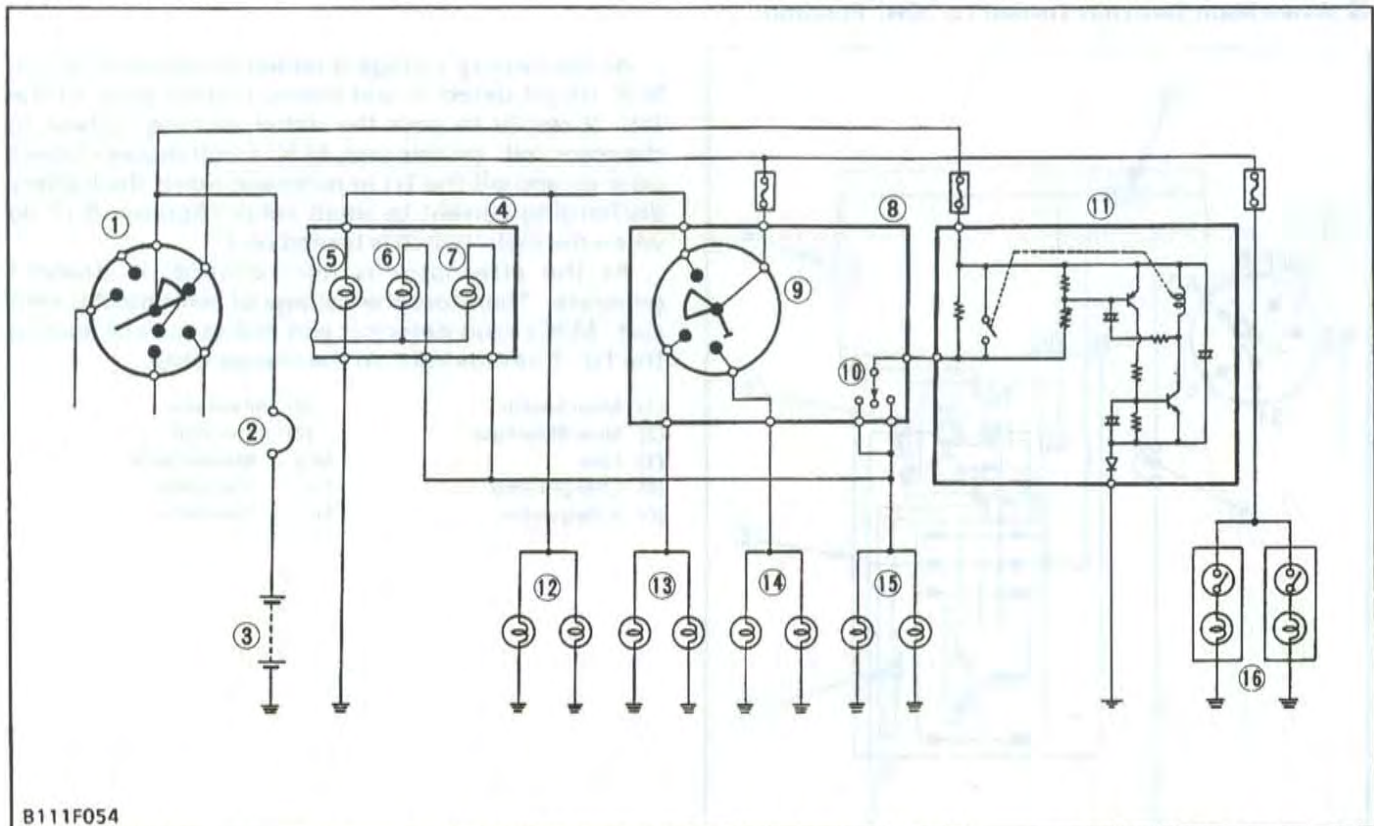


When the engine starts and the alternator rotates, M.IC circuit makes current pour continuously to the Tr1 instead of the uncontinuous (in pulse) current. Therefore a sufficient exciting current flows and a generated voltage rises rapidly. As a result, the current to the Tr2 is shut and lights off the charge lamp.

When terminal B voltage rises over the battery voltage, a charged current flows to the battery.

- (1) Main Switch
- (2) Slow Blow Fuse
- (3) Fuse
- (4) Charge Lamp
- (5) IC Regulator

- (6) Alternator
- (7) Rotor Coil
- M.IC : Monolithic IC
- Tr1 : Transistor
- Tr2 : Transistor

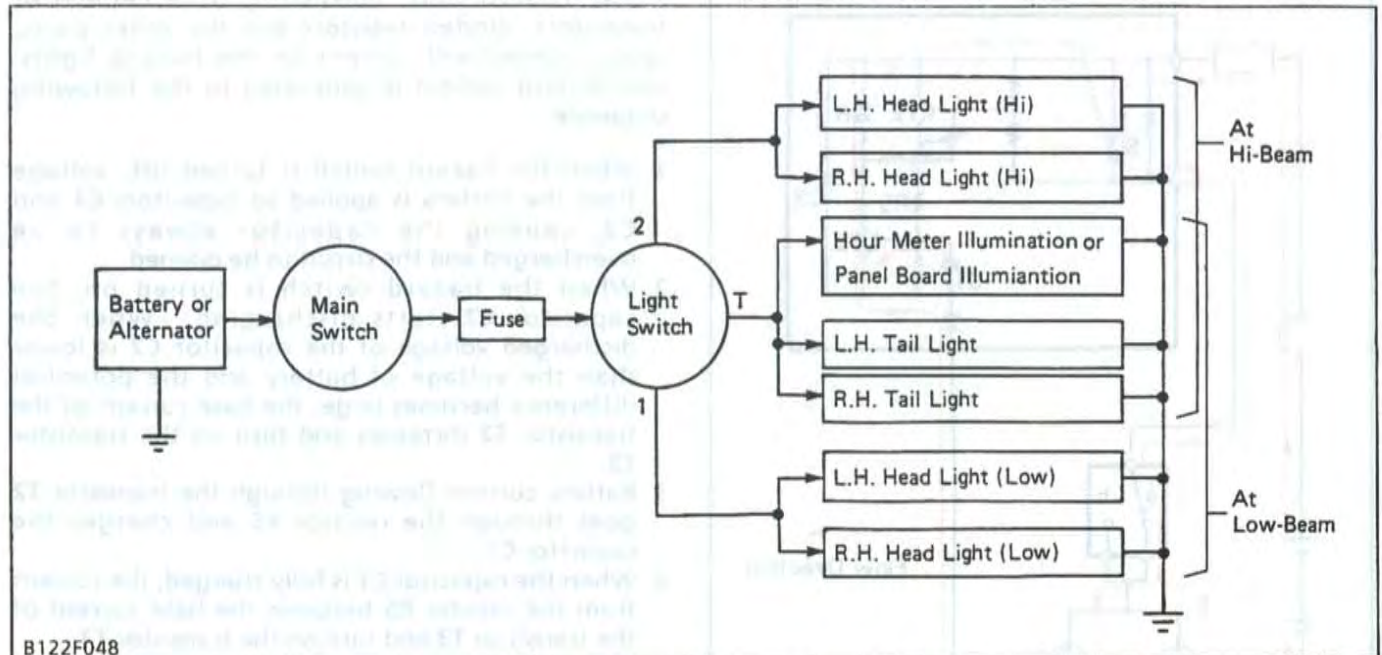
[6] LIGHTING SYSTEM

B111F054

- | | | | |
|---|------------------------------|--------------------|--------------------------------|
| (1) Main Switch | (5) Panel Board Illumination | (9) Light Switch | (13) Head Lights LOW-beam |
| (2) Slow Blow Fuse (except L2350)
Fusible Link (L2350) | (6) L.H. Indicator Lamp | (10) Hazard Switch | (14) Head Lights HIGH-beam |
| (3) Battery | (7) R.H. Indicator Lamp | (11) Hazard Unit | (15) Hazard Lights |
| (4) Panel Board | (8) Combination Switch | (12) Tail Lights | (16) Work Lights (if equipped) |

The lighting system consists of combination switch (light switch and hazard switch), head lights, tail lights, panel board illumination, hazard unit, hazard lights, hazard indicator lamps, work lights, etc.

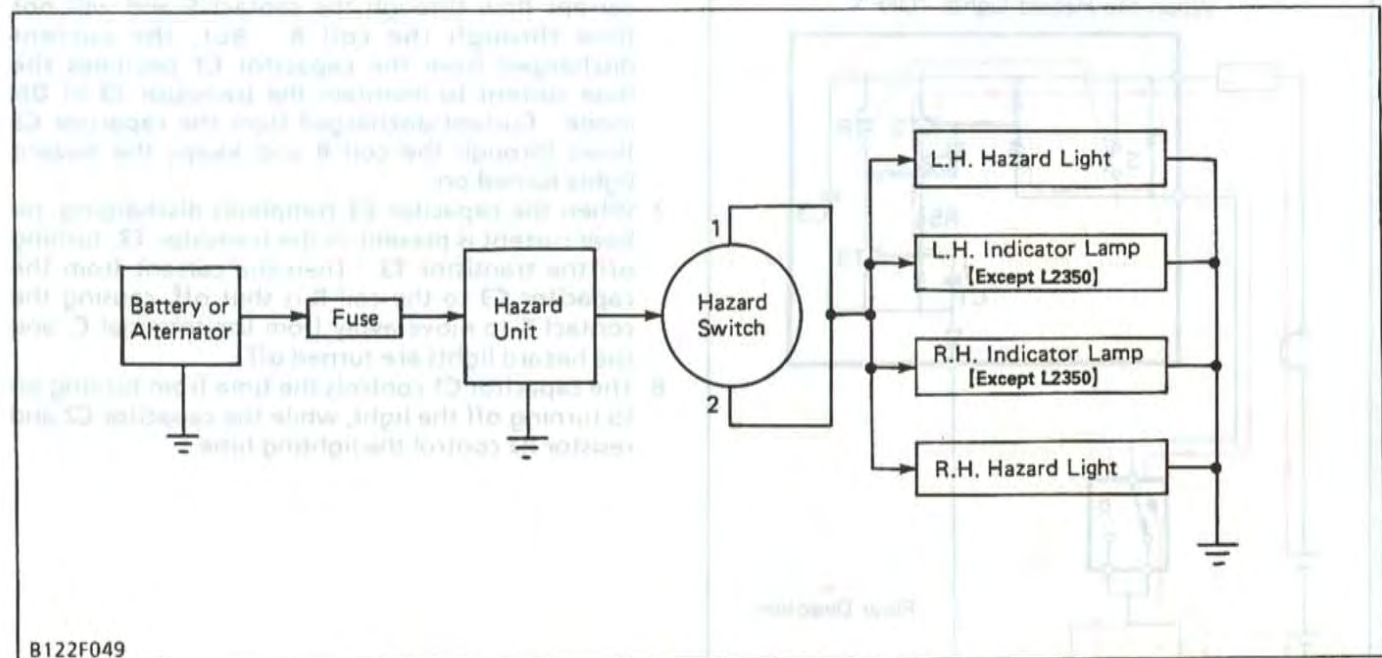
(1) Head Light



The light switch, which forms a combination switch with the hazard switch, has three position; **OFF, LOW-BEAM and HIGH-BEAM.**

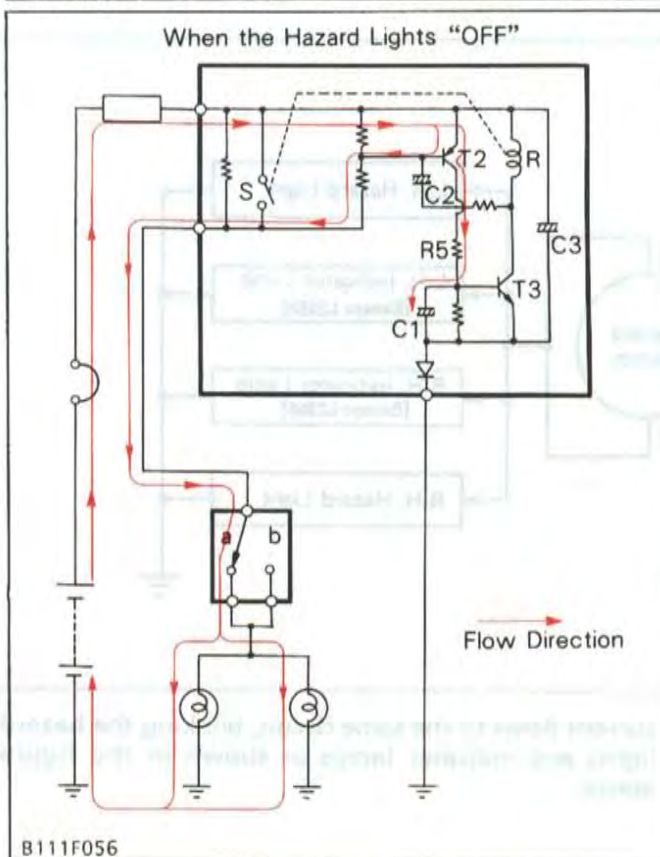
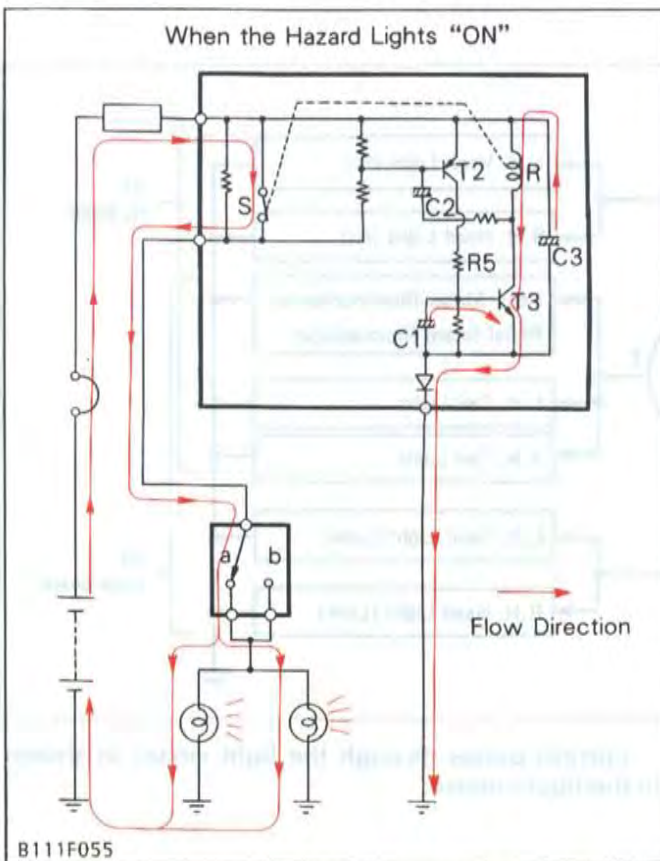
Current passes through the light circuit as shown in the figure above.

(2) Hazard Light



The hazard switch, which forms a combination switch with the light switch, has three positions; **OFF, 1 and 2.** At either switch lever position of 1 or 2,

current flows to the same circuit, blinking the hazard lights and indicator lamps as shown in the figure above.



■ Hazard Unit

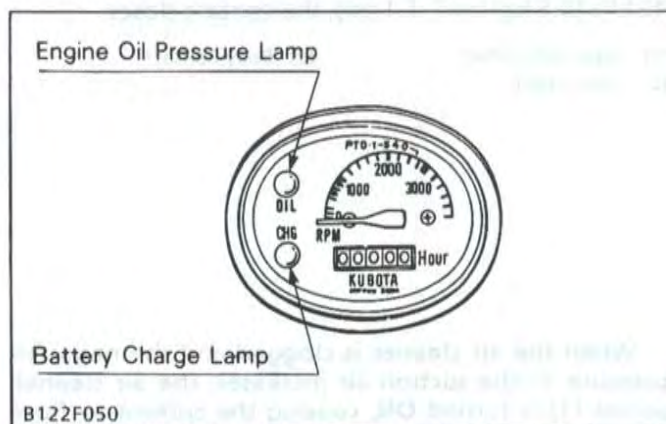
The hazard unit, consisting of a capacitor, transistors, diodes, resistors and the other parts, sends intermittent current to the hazard lights. Intermittent current is generated in the following sequence.

1. When the hazard switch is turned off, voltage from the battery is applied to capacitors **C2** and **C3**, causing the capacitor always to be overcharged and the circuit to be opened.
2. When the hazard switch is turned on, the capacitor **C2** starts discharging. When the discharged voltage of the capacitor **C2** is lower than the voltage of battery and the potential difference becomes large, the base current of the transistor **T2** increases and turn on the transistor **T2**.
3. Battery current flowing through the transistor **T2** goes through the resistor **R5** and charges the capacitor **C1**.
4. When the capacitor **C1** is fully charged, the current from the resistor **R5** becomes the base current of the transistor **T3** and turn on the transistor **T3**.
5. When the transistor **T3** is turned on, battery current magnetizes the coil **R**. As the contact **S** is drawn to be connected with the terminal **C**, the battery current flows through the hazard switch and turns on the hazard lights.
6. When the hazard light is lighted, all the battery current flow through the contact **S** and will not flow through the coil **R**. But, the current discharged from the capacitor **C1** becomes the base current to maintain the transistor **T3** in **ON** mode. Current discharged from the capacitor **C3** flows through the coil **R** and keeps the hazard lights turned on.
7. When the capacitor **C1** completes discharging, no base current is present in the transistor **T3**, turning off the transistor **T3**. Then the current from the capacitor **C3** to the coil **R** is shut off, causing the contact **S** to move away from the terminal **C**, and the hazard lights are turned off.
8. The capacitor **C1** controls the time from turning on to turning off the light, while the capacitor **C2** and resistor **R2** control the lighting time.

[7] WARNING LAMPS

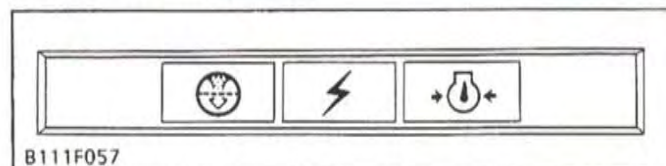
(1) Indication Items

L2350



- Engine oil pressure lamp
Light up when the engine oil pressure drops below approx. 49 kPa (0.5 kgf/cm², 7.1 psi)
- Battery charge lamp
Light up when battery charging is improper.

Except L2350

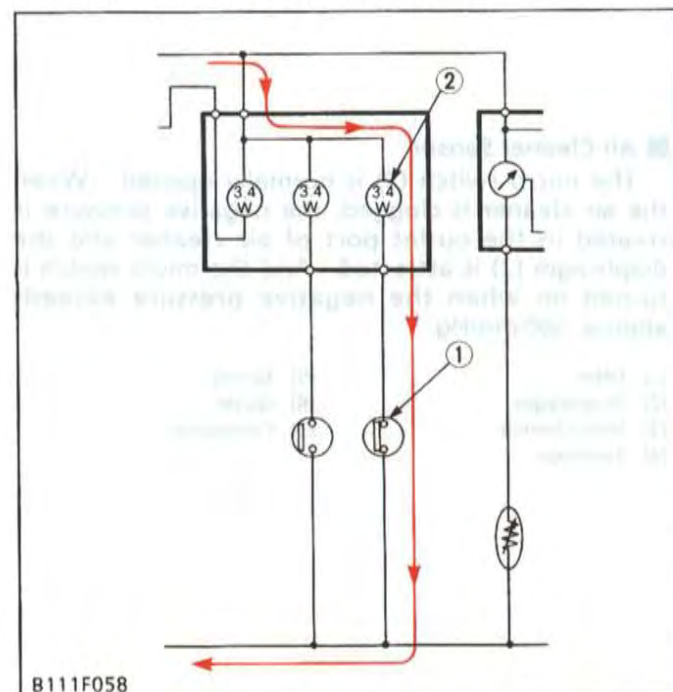


-  Air cleaner clogged lamp
Light up when the air cleaner is clogged.

-  Battery charge lamp
Light up when battery charging is improper.

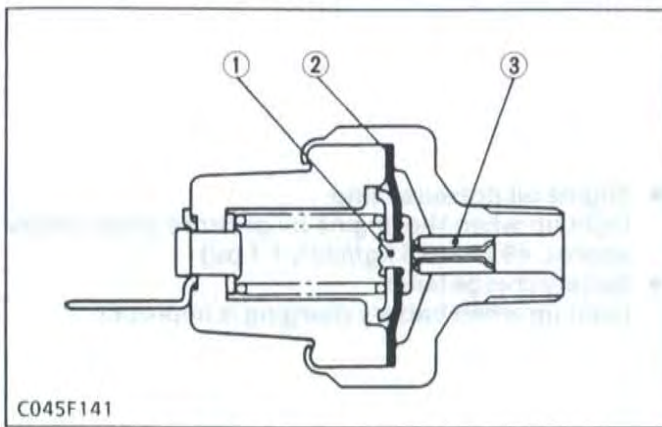
-  Engine oil pressure lamp
Light up when the engine oil pressure drops below approx. 49 kPa (0.5 kgf/cm², 7.1 psi)

(2) Engine Oil Pressure Alarm



When the engine oil pressure has dropped, the engine oil pressure switch (1) is activated to let the current flow from the main switch and to light up the lamp (2).

(1) Engine Oil Pressure Switch (2) Engine Oil Pressure Lamp



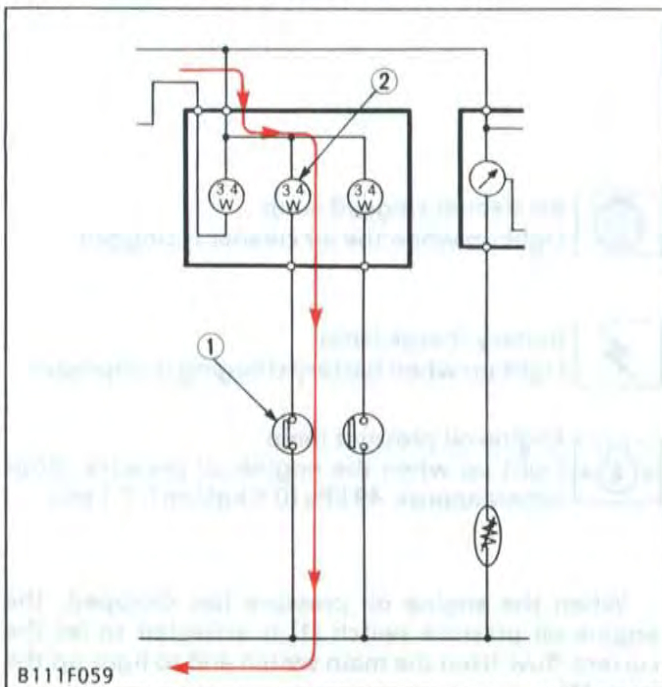
■ Oil Pressure Switch

While oil pressure is high and the force applied to the diaphragm (2) is larger than the spring tension, the terminal contact (1) is open separated from the body contact (3). If the pressure drops below approx. 49 kPa (0.5 kgf/cm², 7.1 psi), the contact closes.

- (1) Terminal contact
(2) Diaphragm

- (3) Body Contact

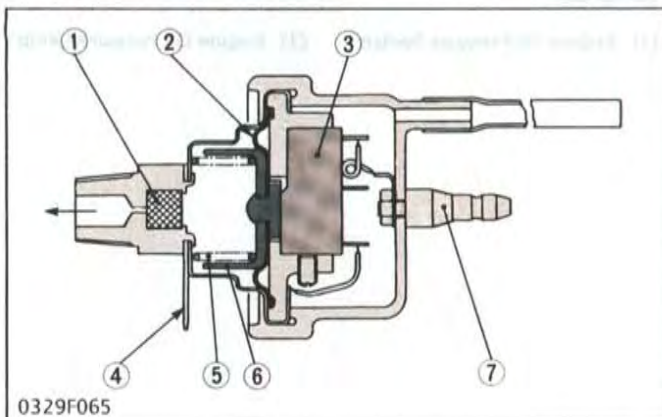
(3) Air Cleaner Clogged Lamp



When the air cleaner is clogged and the negative pressure of the suction air increases, the air cleaner sensor (1) is turned **ON**, causing the current to flow from the main switch and the lamp (2) is lighted.

- (1) Air Cleaner Sensor

- (2) Lamp



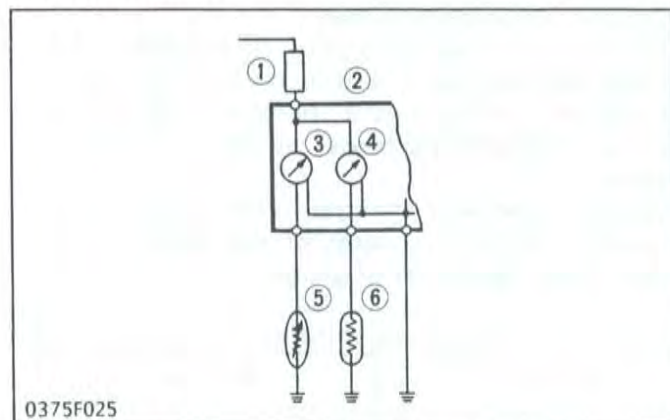
■ Air Cleaner Sensor

The micro switch (3) is normally opened. When the air cleaner is clogged, the negative pressure is created in the outlet port of air cleaner and the diaphragm (2) is attracted. And the micro switch is turned on when the negative pressure exceeds approx. 500 mmHg.

- (1) Filter
(2) Diaphragm
(3) Micro Switch
(4) Terminal

- (5) Spring
(6) Guide
(7) Connector

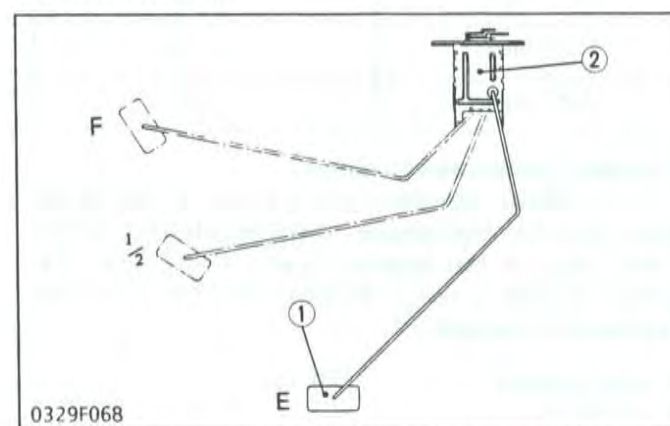
[8] GAUGES



The fuel quantity and coolant temperature are indicated by the ammeters. The ammeters indicate each amperate flowing through the fuel level sensor (5) for the fuel quantity detection and through the coolant temperature sensor (6) for the coolant temperature detection.

- (1) Fuse
- (2) Panel Board
- (3) Fuel Gauge
- (4) Water Temp. Gauge
- (5) Fuel Level Sensor
- (6) Coolant Temp. Sensor

(1) Fuel Gauge



■ Fuel Level Sensor

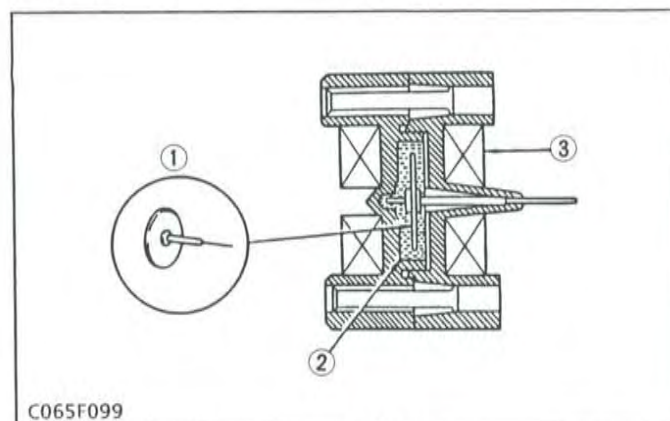
The remaining fuel quantity is detected by the fuel level sensor installed in the fuel tank and indicated on the fuel gauge. For detection, a float and a resistor are used.

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. 2.0ℓ, 0.53 U.S.gal, 0.44 Imp.gal)
1 to 5Ω	28.5 to 36.5Ω	103 to 117Ω

(1) Float

(2) Variable Resistor



(1) Rotor (Magnet)
(2) Silicone Oil

(3) Coil

■ Fuel Gauge

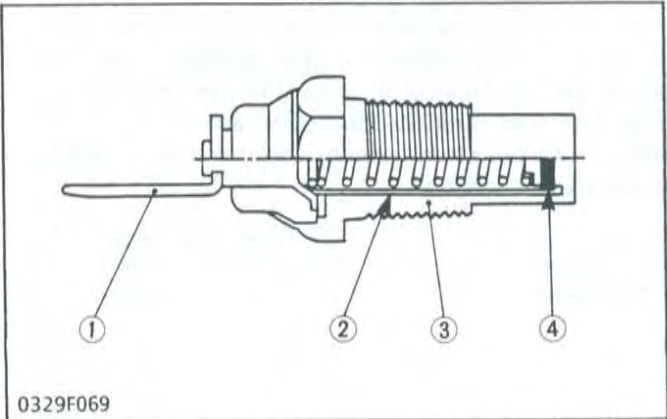
The gauge has a rotor (magnet) (1) and the shunt windings which cross the rotor with one another to generate magnetic field.

The magnetic field generated by the windings moves the rotor. The rotor is immersed in silicone oil (2) to regulate the rotation of the rotor.

As the rotor is disc type and symmetrical, the pointer stays where it was even when the main switch is turned off.

After filling up the tank and turning the main switch on, it will take about two minutes before the pointer comes to stop.

(2) Coolant Temperature Gauge



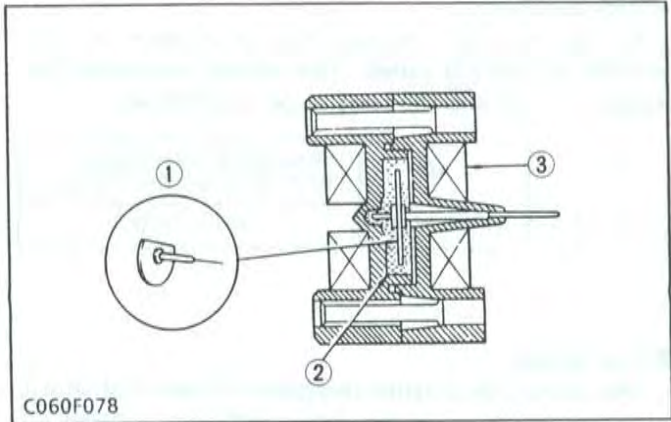
- (1) Terminal
- (2) Insulator
- (3) Body
- (4) Thermistor

■ 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)	148.8Ω
80°C(176°F)	50.3Ω
120°C(248°F)	16.0Ω
170°C(338°F)	5.6Ω



■ Coolant Temperature Gauge

The coolant temperature gauge is the same structure as the fuel gauge. But the rotor (1), which is disc type, is not symmetrical. Therefore, the pointer returns to the its original position when the main switch is turned off.

- (1) Rotor (Magnet)
- (2) Silicone Oil
- (3) Coil

11 OTHERS

[1] TIRES

(1) Types of Tire

The following tires can be mounted on models L2350, L2650, L2950, L3450 and L3650.

		
C045F069	C045F070	C045F074
Farm Tire (Front Tire of 2WD only)	FarmTire	Turf Tire

Model	Type of Tire	Front	Rear	Model	Type of Tire	Front	Rear
L2350 2WD	Farm Tire	4.00 - 15 Std.	9.5 - 24 Std.	L2950 2WD	Farm Tire	5.00 - 15 Std.	12.4 - 24 Std.
		4.00 - 15 Opt.	11.2 - 24 Opt.		Turf Tire	23 x 8.50 - 12 Std.	13.6 - 16 Std.
		5.00 - 15 Opt.	11.2 - 24 Opt.			25 x 8.50 - 14 Opt.	355/80-D20 Opt.
	Turf Tire	23 x 8.50 - 12 Std.	13.6 - 16 Std.	L2950 4WD	Farm Tire	7 - 16 Std.	12.4 - 24 Std.
		25 x 8.50 - 14 Opt.	355/80-D20 Opt.		Turf Tire	25 x 8.50 - 14 Std.	13.6 - 16 Std.
L2350 4WD	Farm Tire	6 - 14 Std.	9.5 - 24 Std.				212/80 -D15 Opt.
		7 - 16 Opt.	11.2 - 24 Opt.	L3450 2WD	Farm Tire	5.00 - 15 Std.	12.4 - 24 Std.
	Turf Tire	24 x 8.50 - 14 Std.	13.6 - 16 Std.				5.50 - 16 Opt.
L2650 2WD	Farm Tire	4.00 - 15 Std.	11.2 - 24 Opt.		Turf Tire	25 x 8.50 - 14 Std.	355/80-D20 Std.
		5.00 - 15 Opt.	11.2 - 24 Std.	L3450 4WD		Farm Tire	7 - 16 Std.
			12.4 - 24 Opt.				8 - 16 Opt.
	Turf Tire	23 x 8.50 - 12 Std.	13.6 - 16 Std.		Turf Tire	212/80 -D15 Std.	355/80-D20 Std.
		25 x 8.50 - 14 Opt.	355/80-D20 Opt.	L3650 2WD		Farm Tire	6.00 - 16 Std.
L2650 4WD	Farm Tire	7 - 16 Std.	11.2 - 24 Std.		Turf Tire	25 x 8.50 - 14 Std.	355/80-D20 Std.
		25 x 8.50 - 14 Std.	13.6 - 16 Std.			L3650 4WD	Farm Tire
		Turf Tire	212/80 - D15 Opt.	355/80-D20 Opt.			Turf Tire

(2) Tread Adjustment

(2)-1 Front Wheels

[2WD Type]

With 2WD models, the front tread can be adjusted in 4 steps.

⚠ CAUTION

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

[L2350]

Front axle is not adjustable.

To change the tread

- Lift the front of the tractor with a jack.
- Remove the front axle mounting screws and the tie rod mounting screws.
- Move the front axles (right and left) to the desired position, and tighten them with the screws.

■ IMPORTANT

- After tread adjustment, adjust toe-in.
Toe-in: All models 2 to 8 mm (0.08 to 0.31 in.)

4.00-15 Farm	5.00-15 Farm	23 x 8.50-12 Turf	25 x 8.50-14 Turf
 1010mm (39.8 in.) B122F051	 1025mm (40.4 in.) B122F051	 1110mm (43.7 in.) B122F052	 1210mm (47.6 in.) B122F052

[L2650, L2950, L3450, L3650]

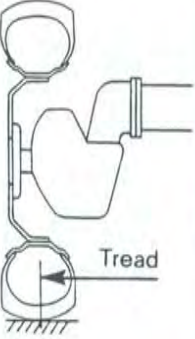
Models				
L2650 L2950 4.00-15 5.00-15 Farm Farm	960 mm (37.8 in.)	1060 mm (41.7 in.)	1160 mm (45.7 in.)	1260 mm (49.6 in.)
L2650 L2950 23 x 8.50 - 12 Turf	1080 mm (42.5 in.)	1180 mm (46.5 in.)	1280 mm (50.4 in.)	1380 mm (54.3 in.)
L2650 L2950 23 x 8.50 - 14 Turf	1325 mm (52.2 in.)	1425 mm (56.1 in.)	1525 mm (60.0 in.)	1625 mm (64.0 in.)
L3450 5.00 - 15 Farm	1150 mm (45.3 in.)	1250 mm (49.2 in.)	1350 mm (53.1 in.)	1450 mm (57.1 in.)
L3450 L3650 25 x 8.50 - 14 Turf	1325 mm (52.2 in.)	1425 mm (56.1 in.)	1525 mm (60.0 in.)	1625 mm (64.0 in.)
L3650 6.00 - 16 Farm	1150 mm (45.3 in.)	1250 mm (49.2 in.)	1350 mm (53.1 in.)	1450 mm (57.1 in.)

■ IMPORTANT

- The front tread width for the front loader application on 2WD models should not be greater than 1060 mm (41.7 in.) for L2650 and L2950, 1150 mm (45.3 in.) for L3450 and L3650.

[4WD Type]

Front axle is not adjustable

 0343F027	Models	L2350			L2650, L2950	
	Tires	6 – 14 Farm	7 – 16 Farm	24 × 8.50 – 14 Turf	7 – 16 Farm	25 × 8.50 – 14 Turf
	Tread	1010 mm (39.8 in.)	1010 mm (39.8 in.)	1115 mm (43.9 in.)	1120 mm (44.1 in.)	1185 mm (46.7 in.)
	Models	L3450			L3650	
	Tires	212/80 – D15 Turf	7 – 16 Farm	8 – 16 Farm	212/80 – D15 Turf	8 – 16 Farm
	Tread	1170 mm (46.1 in.)	1120 mm (44.1 in.)	1170 mm (46.1 in.)	1215 mm (47.8 in.)	1170 mm (46.1 in.)
	Models	L3650				
	Tires	212/80 – D15 Turf				
	Tread	1215 mm (47.8 in.)				

■ IMPORTANT

- Do not fill the front tires with liquid.

(2)-2 Rear Wheels

Rear tread can be adjusted in 6 steps depending on the model.

To change the tread

- Lift the rear tires off the ground.
- Follow the illustrations below to get the desired tread width.

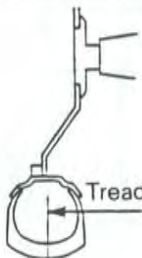
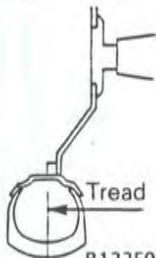
⚠ CAUTION

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

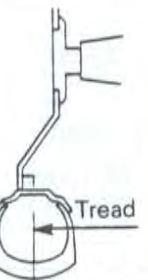
■ IMPORTANT

- 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.

[L2350]

9.5-24 Farm	13.6-16 Turf	355/80-D20 Turf	
 1030mm (40.6 in.) B122F057	 1150mm (45.3 in.) B122F058	 1150mm (45.3 in.) B122F058	
11.2-24 Farm			
 Tread 1025 mm (40.3 in.)	 Tread 1120 mm (44.0 in.)	 Tread 1200 mm (47.2 in.)	 Tread 1290 mm (50.8 in.) B122F059

[L2650, L2950, L3450, L3650]

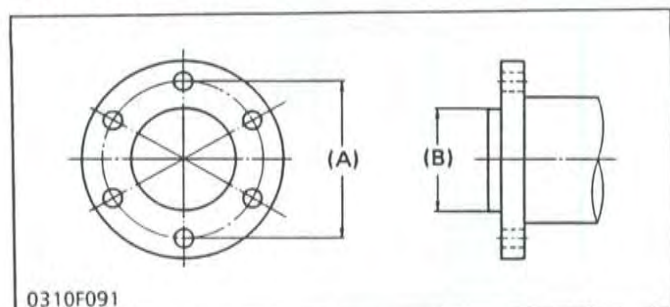
Models						
L2650 11.2 – 24 Farm		1030 mm (40.6 in.)	1125 mm (44.3 in.)	1220 mm (48.0 in.)	1305 mm (51.4 in.)	1400 mm (55.1 in.)
L2950 12.4 – 24 Farm		1030 mm (40.6 in.)	1125 mm (44.3 in.)	1220 mm (48.0 in.)	1305 mm (51.4 in.)	1400 mm (55.1 in.)
L3450 12.4 – 24 Farm	1050 mm (41.3 in.)	1150 mm (45.3 in.)	1240 mm (48.8 in.)	1335 mm (52.6 in.)	1420 mm (55.9 in.)	1515 mm (59.6 in.)
L3450 13.6 – 24 Farm		1155 mm (45.5 in.)	1225 mm (48.2 in.)	1325 mm (52.2 in.)	1350 mm (53.1 in.)	1450 mm (57.1 in.)
L3650 13.6 – 26 Farm		1155 mm (45.5 in.)	1225 mm (48.2 in.)	1325 mm (52.2 in.)	1350 mm (53.1 in.)	1450 mm (57.1 in.)

B122F060

Models		
L2650, L2950 13.6 – 16 Turf		1145 mm (45.1 in.)
L2650, L2950 355/80 – D20 Turf		1150 mm (45.3 in.)
L3450, L3650 355/80 – D20 Turf	1120 mm (44.1 in.)	1265 mm (49.8 in.)

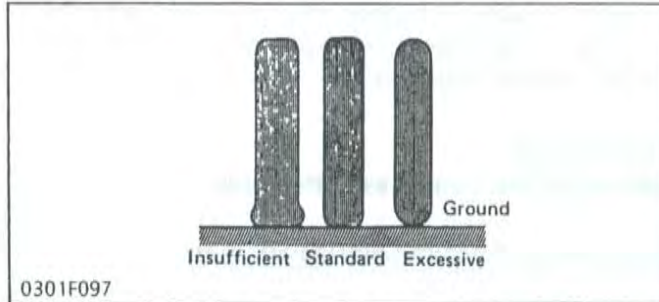
B122F061

(3) Wheel Hub



	Front wheel hub	Rear wheel hub
Screw circle diameter (A)	152.4 mm (6 in.)	170 mm (6.7 in.)
Number of screws	6	6
Screw sizes	M14 × 1.5	M16 × 1.5
Hub pilot diameter (B)	117.4 mm (4.625 in.)	135 mm (5.315 in.)

(4) Tire Pressure



CAUTION

- Do not attempt to mount a tire. This should be done by a qualified person with the proper equipment. Qualified persons with the proper tire mounting equipment should recognize the following warning.

WARNING

- Never exceed 241 kPa (2.5 kgf/cm², 35 psi) when attempting to seat a bead. If beads have not been seated by the time the pressure reaches 241 kPa (2.5 kgf/cm², 35 psi), deflate the assembly, reposition the tire on the rim, relubricate and reinflate. After seating the bead, adjust inflation pressure as recommended in the inflation pressure chart.

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. To inflate the wheel tires, use an air compressor or hand pump.

- Recommended inflation pressure**
Maintain the pressure shown below.

	Tire sizes	Inflation Pressure
Rear	9.5 – 24, 4PR	100 kPa (1.0 kgf/cm ² , 14 psi)
	11.2 – 24, 4PR	100 kPa (1.0 kgf/cm ² , 14 psi)
	12.4 – 24, 4PR	100 kPa (1.0 kgf/cm ² , 14 psi)
	13.6 – 24, 4PR	100 kPa (1.0 kgf/cm ² , 14 psi)
	13.6 – 26, 4PR	100 kPa (1.0 kgf/cm ² , 14 psi)
	13.6 – 16, 4PR	100 kPa (1.0 kgf/cm ² , 14 psi)
	355/80 – D20, 4PR	100 kPa (1.0 kgf/cm ² , 14 psi)
Front	4.00 – 15, 4PR	220 kPa (2.2 kgf/cm ² , 32 psi)
	5.00 – 15, 4PR	220 kPa (2.2 kgf/cm ² , 32 psi)
	5.50 – 16, 4PR	220 kPa (2.2 kgf/cm ² , 32 psi)
	6.00 – 16, 6PR	325 kPa (3.25 kgf/cm ² , 46 psi)
	6 – 14, 4PR	200 kPa (2.0 kgf/cm ² , 28 psi)
	7 – 16, 4PR	180 kPa (1.8 kgf/cm ² , 26 psi)
	8 – 16, 4PR	160 kPa (1.6 kgf/cm ² , 23 psi)
	23 × 8.50 – 12, 4PR	160 kPa (1.6 kgf/cm ² , 23 psi)
	24 × 8.50 – 14, 4PR	160 kPa (1.6 kgf/cm ² , 23 psi)
	25 × 8.50 – 14, 4PR	160 kPa (1.6 kgf/cm ² , 23 psi)
	27 × 8.50 – 15, 4PR	160 kPa (1.6 kgf/cm ² , 23 psi)
	212/80 – D15, 4PR	160 kPa (1.6 kgf/cm ² , 23 psi)

(5) Tire Liquid Injection

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

Another way is to inject water or another liquid, such as a calcium chloride solution in the tires. Water must not be used in winter since it freezes at 0°C (32°F). The calcium chloride solution will not freeze and moreover, affords higher effect than water since

its specific gravity is higher than that of water by about 20%. Below is an explanation of calcium chloride solution injection.

■ IMPORTANT

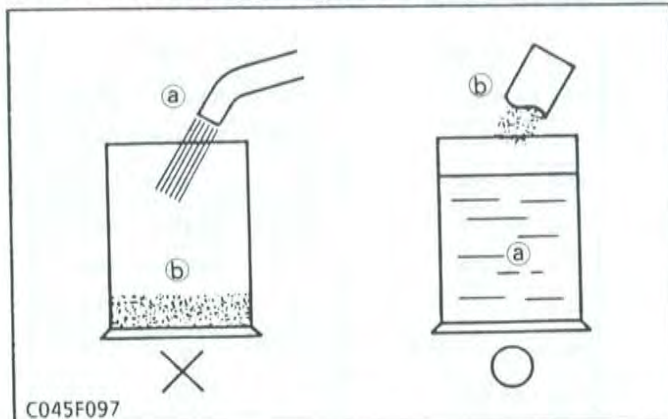
- Do not fill the front tires with liquid.

Preparation of Calcium Chloride Solution

⚠ CAUTION

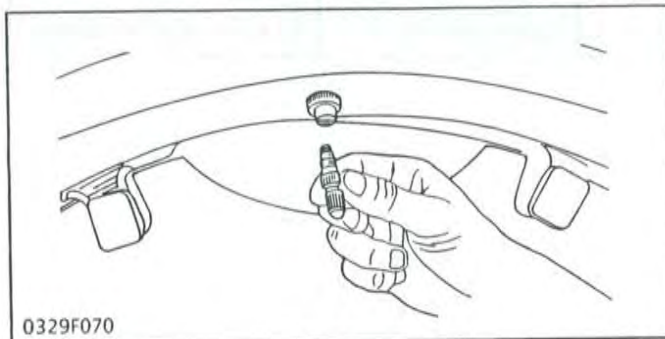
- When making a calcium chloride solution, do not pour water over calcium chloride since this results in chemical reaction which will cause high temperature. Instead add a small amount of calcium chloride to the water at a time until the desired solution is achieved.

Freezing temp	Weight of CaCl ₂ to be dissolved in 100ℓ (26.5 US gals. 22.0 Imp. gals.) of water
-5°C (23°F)	12 kg (26.4 lbs)
-10°C (14°F)	21 kg (46.3 lbs)
-15°C (5°F)	28 kg (61.7 lbs)
-20°C (- 4°F)	34 kg (75.0 lbs)
-25°C (-13°F)	40 kg (88.2 lbs)
-30°C (-22°F)	44 kg (97.0 lbs)
-35°C (-31°F)	49 kg (108.0 lbs)
-40°C (-40°F)	52 kg (114.6 lbs)
-45°C (-49°F)	56 kg (123.5 lbs)
-50°C (-58°F)	61 kg (134.5 lbs)

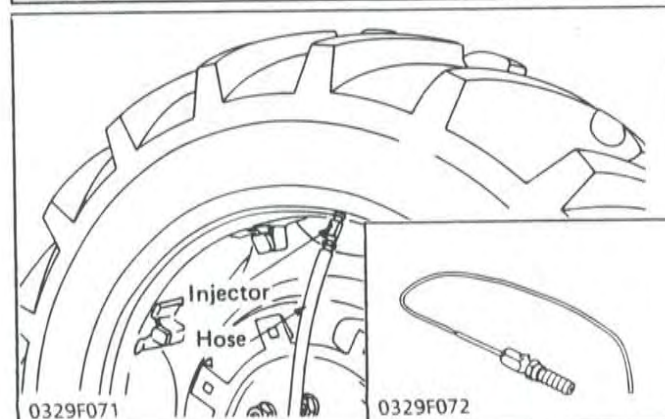


C045F097

(a) Water

(b) CaCl₂ (Calcium Chloride)

0329F070



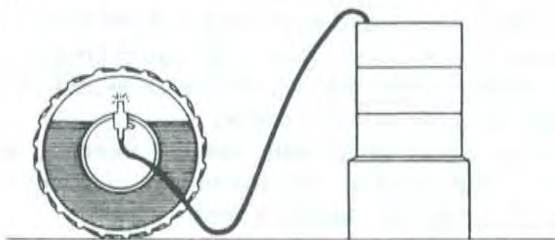
0329F071

0329F072

Attaching the Injector

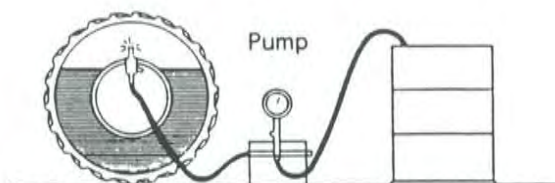
- Lift the rear tires off the ground.
- Turn the tire so that the air valve is at the top.
- Remove the air valve, and attach the injector.
(Code No: 07916-52281)

Fig. 1



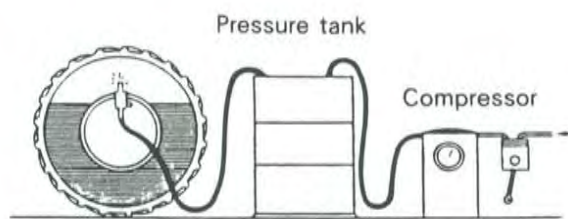
C045F098

Fig. 2



C045F099

Fig. 3



C045F100

Injection

⚠ CAUTION

- When a calcium chloride solution is used, cool it before pouring it into the tire.

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

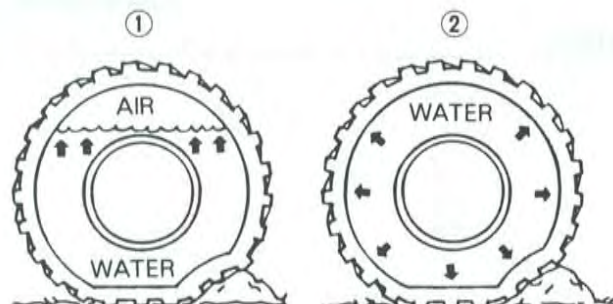
- Gravity injection (Fig. 1)
- Pump injection (Fig. 2)
- Pressure tank injection (Fig. 3)
- Injection directly from tap (only when water is being used).

■ NOTE

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

⚠ CAUTION

- Do not fill tires with water or solution more than 75% of full capacity (to the valve stem level)



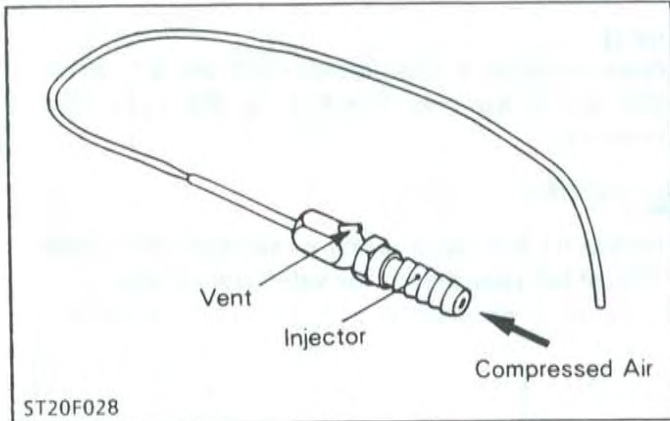
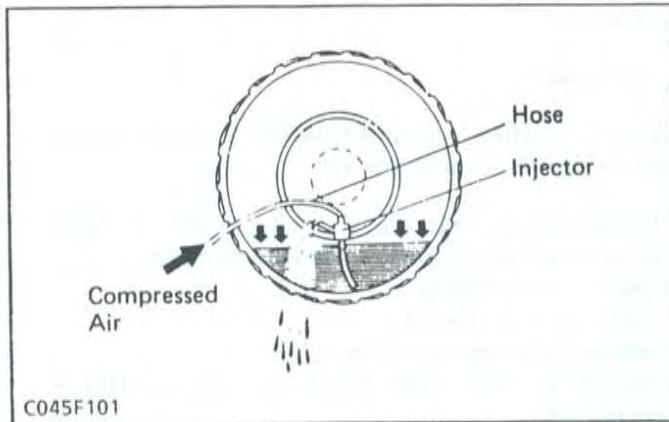
0309F058

(1) Correct - 75%
Air compresses
like a cushion

(2) Incorrect - 100% Full
Water can not be
compressed

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

Tire sizes	9.5-24	11.2-24	12.4-24	13.6-24	13.6-26
Slush free at -10°C (13°F) Solid at -30°C (-23°F) [Approx. 1 kg (2 lbs.) CaCl ₂ per 4 ℓ (1 gal) of water]	75 kg (165 lbs)	103 kg (227 lbs)	117 kg (258 lbs)	153 kg (337 lbs)	172 kg (379 lbs)
Slush free at -24°C (-12°F) Solid at -47°C (-52°F) [Approx. 1.5 kg (3.5 lbs.) CaCl ₂ per 4 ℓ (1 gal) of water]	81 kg (178 lbs)	108 kg (237 lbs)	125 kg (276 lbs)	160 kg (352 lbs)	181 kg (399 lbs)
Slush free at -47°C (-52°F) Solid at -52°C (-62°F) [Approx. 2.25 kg (5 lbs.) CaCl ₂ per 4 ℓ (1 gal) of water]	85 kg (187 lbs)	115 kg (253 lbs)	133 kg (293 lbs)	170 kg (375 lbs)	192 kg (423 lbs)



Draining water or solution

1. Lift the rear tires off the ground.
2. Turn the tire so that the air valve is at the bottom.
3. Remove the air valve, and drain liquid (liquid can only be drained to the level of the valve and liquid under that level remains inside).
4. To drain liquid completely, use the injector, and direct compressed air into the tire to force out the liquid through the injector's vent.

[2] SPECIFICATIONS OF IMPLEMENT LIMITATIONS

The KUBOTA Tractor has been through tested for proper performance with implements sold or approved by KUBOTA. Use with implements which exceed maximum specifications listed below, or otherwise unfit for use with the KUBOTA Tractor

may result in malfunctions or failures of the tractor, damage to other property and injury to the operator or others. (Any malfunctions or failures of the tractor resulting from use with improper implements are not covered by the warranty.)

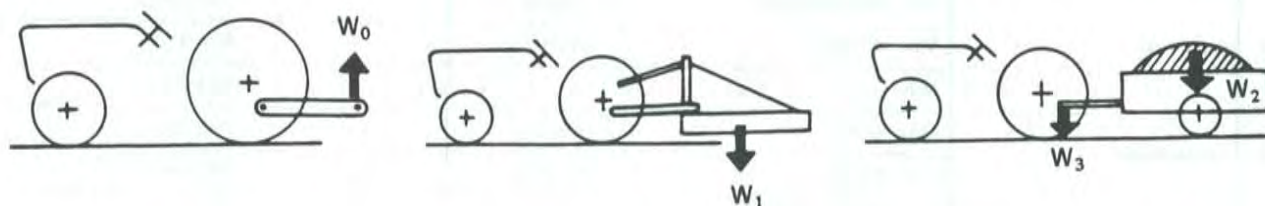
	Tread (max. width) with farm tires			Lift capacity lower link end W ₀
	Front		Rear	
	2WD	4WD		
L2350	1010 mm (40 in.)	1010 mm (40 in.)	1030 mm (41 in.)	850 kg (1875 lbs.)
L2650	1260 mm (50 in.)	1120 mm (44 in.)	1400 mm (55 in.)	1200 kg (2645 lbs.)
L2950	1260 mm (50 in.)	1120 mm (44 in.)	1400 mm (55 in.)	1200 kg (2645 lbs.)
L3450	1450 mm (57 in.)	1120 mm (44 in.)	1515 mm (60 in.)	1200 kg (2645 lbs.)
L3650	1450 mm (57 in.)	1170 mm (46 in.)	1450 mm (57 in.)	1200 kg (2645 lbs.)

	Actual figures			
	Trailer loading weight W ₂ Max. capacity		Max. Drawbar Load W ₃ 2WD, 4WD	Lift capacity 24 inch behind lower link end W ₁
	2WD	4WD		
L2350	1000 kg (2200 lbs.)	1000 kg (2200 lbs.)	330 kg (730 lbs.)	650 kg (1435 lbs.)
L2650	1500 kg (3300 lbs.)	1500 kg (3300 lbs.)	500 kg (1100 lbs.)	900 kg (1985 lbs.)
L2950	1500 kg (3300 lbs.)	1500 kg (3300 lbs.)	500 kg (1100 lbs.)	900 kg (1985 lbs.)
L3450	2000 kg (4400 lbs.)	2000 kg (4400 lbs.)	650 kg (1430 lbs.)	930 kg (2050 lbs.)
L3650	2500 kg (5500 lbs.)	2500 kg (5500 lbs.)	650 kg (1430 lbs.)	930 kg (2050 lbs.)

Lower link end Max.lift capacity W_0

Implement weight The implement's weight which can be put on the links: W_1

Trailer loading weight The max. loading weight for trailer (without trailer's weight): W_2



No.	Implement		Remarks		L2350
1	Trailer		Max. Load Capacity	kg (lbs.)	1000 (2200)
			Max. Drawbar Load	kg (lbs.)	330 (730)
2	Mower	Mid Mount	Max. Cutting Width	mm (in.)	1829 (72)
			Max. Weight	kg (lbs.)	200 (440)
		Rear Mount	Max. Cutting Width	mm (in.)	1829 (72)
			Max. Weight	kg (lbs.)	350 (770)
		Flail Mower	Max. Cutting Width	mm (in.)	1270 (50)
			Max. Weight	kg (lbs.)	350 (770)
		Sickle Bar	Max. Cutting Width	mm (in.)	1829 (72)
			Max. Weight	kg (lbs.)	400 (880)
3	Sprayer		Max. Tank capacity ℓ (gals.)	Rear mounted	300 (80)
				Pull type	800 (210)
4	Rotary Tiller		Max. Tilling Width	mm (in.)	1370 (54)
5	Bottom Plow		Max. Size		12 in. × 2, 16 in. × 1
6	Disc-harrow (Pull type)		Max. Harrowing Width	mm (in.)	1524 (60)
			Max. Weight	kg (lbs.)	300 (660)
7	Chisel Plow		Max. Cutting Width	mm (in.)	1829 (72)
			Max. Weight	kg (lbs.)	350 (770)
8	Broad Caster		Max. Tank Capacity	ℓ (gals.)	200 (53)
			Max. Weight	kg (lbs.)	100 (220)
9	Manure Spreader		Max. Capacity	kg (lbs.)	1000 (2200)
10	Cultivator		Max. Width	mm (in.)	1524 (60)
			Number of Rows		1
			Max. Weight	kg (lbs.)	250 (550)
11	Front Blade		Max. Cutting Width	mm (in.)	1829 (72)
			Max. Oil Pressure	kgf/cm² (psi.)	155 (2205)
			Sub Frame		Necessary
12	Rear Blade		Max. Cutting Width	mm (in.)	1829 (72)
			Max. Oil Pressure	kgf/cm² (psi.)	155 (2205)
13	Front-end Loader		Max. Lifting Capacity	kg (lbs.)	400 (880)
			Max. Oil Pressure (Extra Hydro Kit)	kgf/cm² (psi.)	155 (2205)
			Sub Frame		Necessary
14	Box Blade		Max. Cutting Width	mm (in.)	1321 (52)
			Max. Weight	kg (lbs.)	295 (650)
15	Back Hoe		Max. Digging Depth	mm (in.)	2288 (90)
			Max. Weight	kg (lbs.)	450 (990)
			Sub Frame		Necessary
16	Snow Blade		Max. Width	mm (in.)	1524 (60)
			Max. Weight	kg (lbs.)	300 (660)
17	Snow Blower		Max. Working Width	mm (in.)	1524 (60)
			Max. Weight	kg (lbs.)	250 (550)

No	Implement		Remarks		L2650	L2950	L3450	L3650
1	Trailer		Max. Load Capacity	kg (lbs.)	1500 (3300)		2000 (4400)	2500 (5500)
			Max. Drawbar Load	kg (lbs.)	500 (1100)		650 (1430)	
2	Mower	Mid Mount	Max. Cutting Width	mm (in.)	1829 (72)			—
			Max. Weight	kg (lbs.)	200 (440)			—
		Rear Mount	Max. Cutting Width	mm (in.)	1829 (72)			
			Max. Weight	kg (lbs.)	350 (770)			400 (880)
		Flail Mower	Max. Cutting Width	mm (in.)	1524 (60)			
			Max. Weight	kg (lbs.)	400 (880)			
		Sickle Bar	Max. Cutting Width	mm (in.)	2133 (84)			
			Max. Weight	kg (lbs.)	500 (1100)			
3	Sprayer		Max. Tank capacity ℓ (gals.)	Rear mounted	300 (80)		400 (106)	
				Pull type	800 (210)		1000 (264)	1200 (317)
4	Rotary Tiller		Max. Tilling Width	mm (in.)	1520 (60)			
5	Bottom Plow		Max. Size		12 in. × 2, 16 in. × 1		14 in. × 2	
6	Disc-harrow (Pull type)		Max. Harrowing Width	mm (in.)	1829 (72)			
			Max. Weight	kg (lbs.)	350 (770)			400 (880)
7	Chisel Plow		Max. Cutting Width	mm (in.)	1829 (72)			
			Max. Weight	kg (lbs.)	350 (770)			
8	Broad Caster		Max. Tank Capacity	ℓ (gals.)	200 (53)		250 (66)	300 (80)
			Max. Weight	kg (lbs.)	100 (220)			
9	Manure Spreader		Max. Capacity	kg (lbs.)	1500 (3300)		2000 (4400)	
10	Cultivator		Max. Width	mm (in.)	1829 (72)		2134 (84)	
			Number of Rows		1		2	
			Max. Weight	kg (lbs.)	300 (660)		350 (770)	400 (880)
11	Front Blade		Max. Cutting Width	mm (in.)	1829 (72)			
			Max. Oil Pressure	kgf/cm² (psi.)	175 (2490)			
			Sub Frame		Necessary			
12	Rear Blade		Max. Cutting Width	mm (in.)	1829 (72)			
			Max. Oil Pressure	kgf/cm² (psi.)	175 (2490)			
13	Front -end Loader		Max. Lifting Capacity	kg (lbs.)	450 (990)		650 (1430)	
			Max. Oil Pressure (Extra Hydro Kit)	kgf/cm² (psi.)	175 (2490)			
			Sub Frame		Necessary			
14	Box Blade		Max. Cutting Width	mm (in.)	1321 (52)		1651 (65)	1670 (66)
			Max. Weight	kg (lbs.)	295 (650)		330 (730)	350 (770)
15	Back Hoe		Max. Digging Depth	mm (in.)	2288 (90)			
			Max. Weight	kg (lbs.)	450 (990)			
			Sub Frame		Necessary			
16	Snow Blade		Max. Width	mm (in.)	1524 (60)			1830 (72)
			Max. Weight	kg (lbs.)	300 (660)			350 (770)
17	Snow Blower		Max. Working Width	mm (in.)	1524 (60)		1676 (66)	
			Max. Weight	kg (lbs.)	250 (550)		280 (620)	

S **SERVICING**

S.G **GENERAL**

S.S **SEPARATION**

S.1 **ENGINE**

S.2 **CLUTCH**

S.3 **TRANSMISSION**

S.4 **REAR AXLE**

S.5 **BRAKES**

S.6 **FRONT AXLE**

S.7 **STEERING**

S.8 **HYDRAULIC SYSTEM**

S.9 **ELECTRICAL SYSTEM**

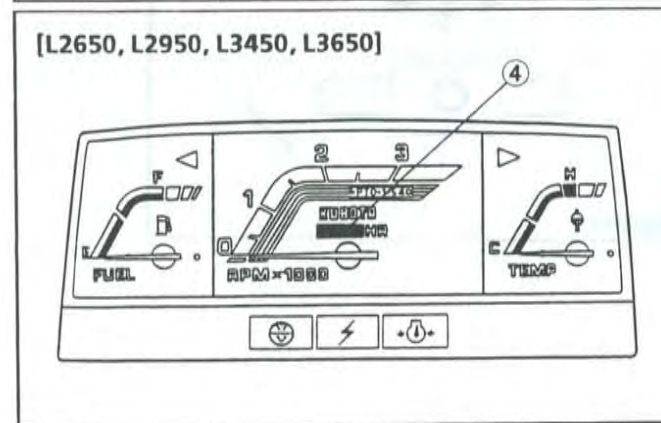
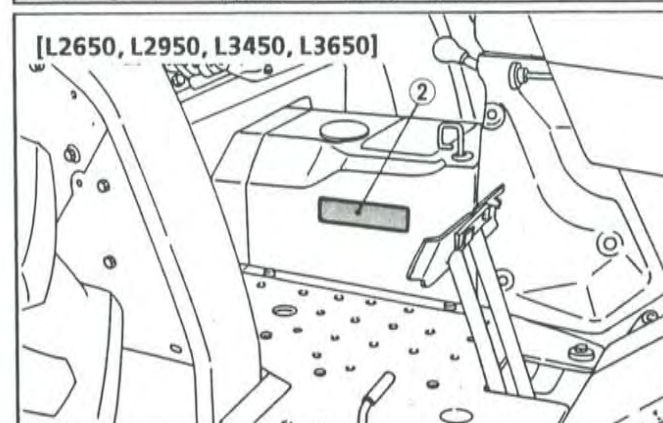
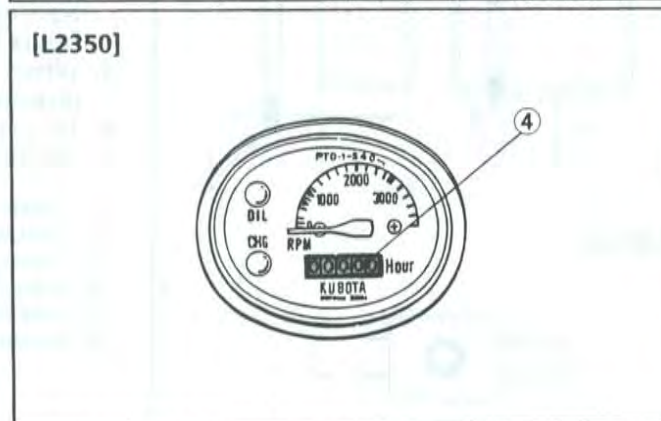
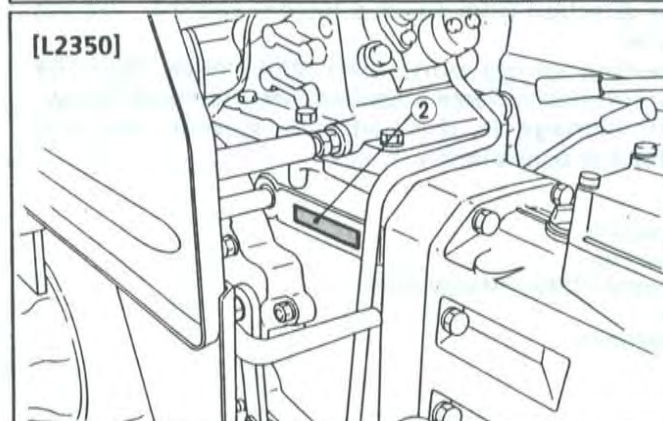
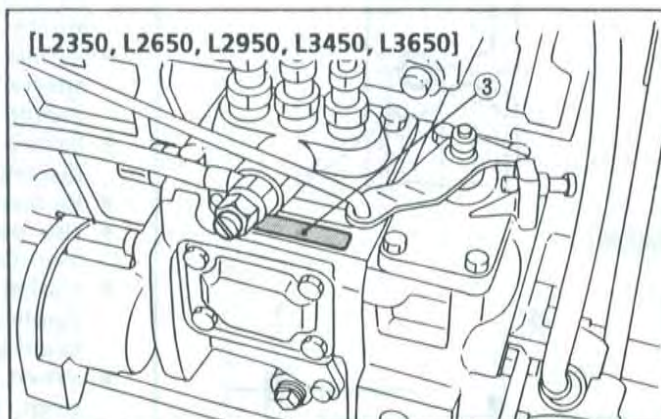
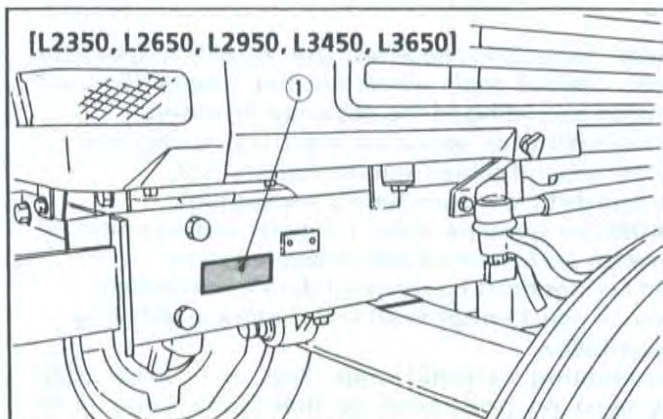
S.G GENERAL

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[1] TRACTOR IDENTIFICATION

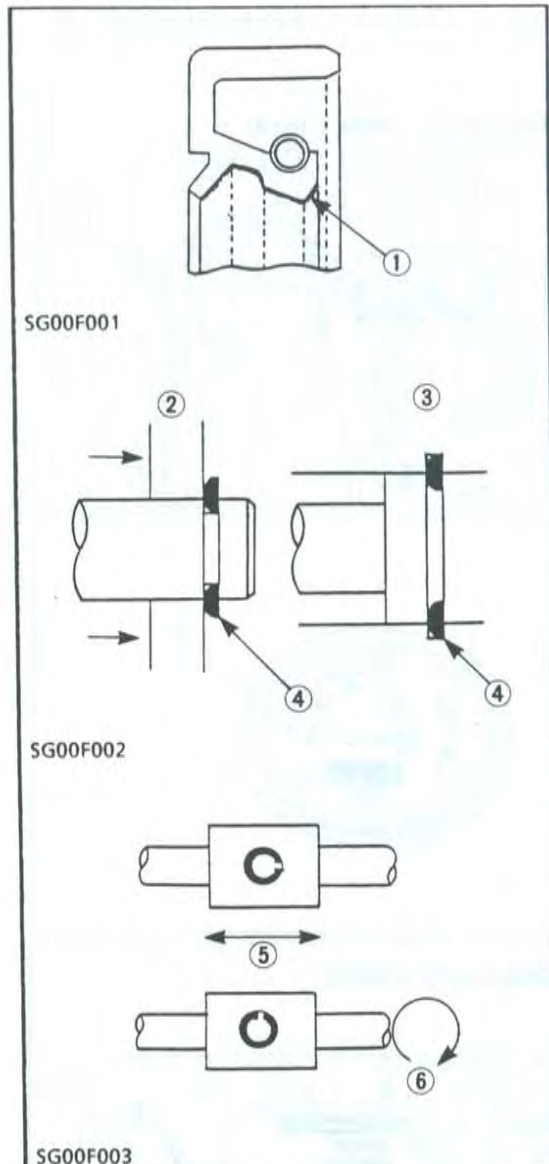
When contacting your local KUBOTA distributor, always specify engine serial number, tractor serial number and hourmeter reading.



(1) Identification plate
(2) Tractor serial number

(3) Engine serial number
(4) Hour meter

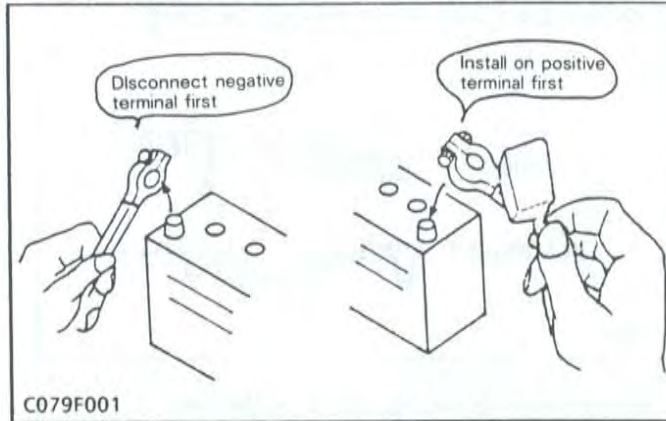
[2] GENERAL PRECAUTIONS



- 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 below.
- 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 below.
- When inserting spring pins, their splits must face the direction from which a force is applied. See the figure below.
- To prevent damage to the hydraulic system, use only specified fluid or equivalent.

- (1) Grease
- (2) External Snap Ring
- (3) Internal Snap Ring
- (4) Sharp Edge against the Direction of Force
- (5) Axial Force
- (6) Rotating Movement

[3] HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



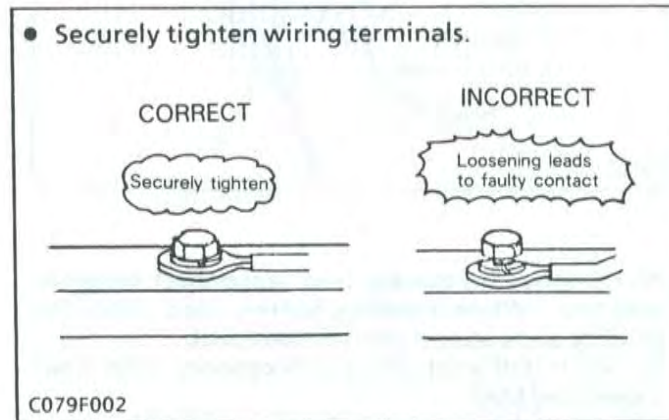
To ensure safety and prevent damage to the machine and surrounding equipment, heed the following precautions in handling electrical parts and wiring.

■ IMPORTANT

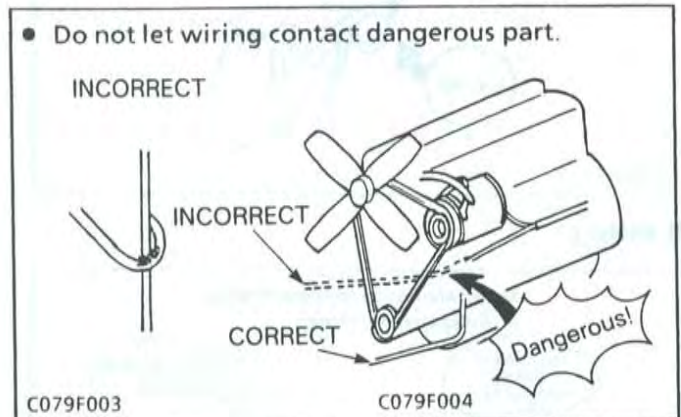
- Check electrical wiring for damage and loosened connection every year. To this end, educate the customer to do his or her own check and at the same time recommend the dealer to perform periodic check for a fee.
- Do not attempt to modify or remodel any electrical parts and wiring.
- When removing the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

■ Wiring

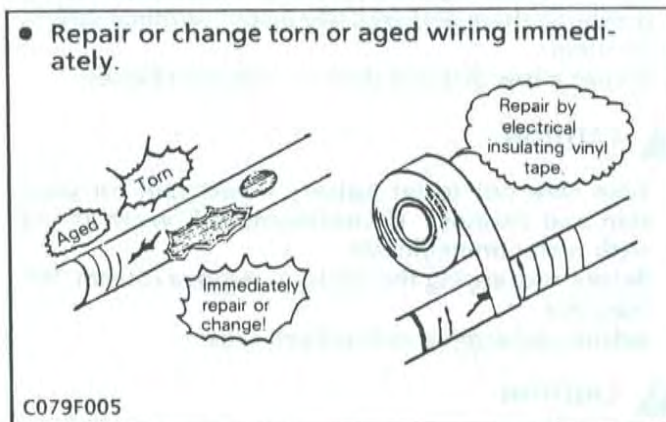
- Securely tighten wiring terminals.



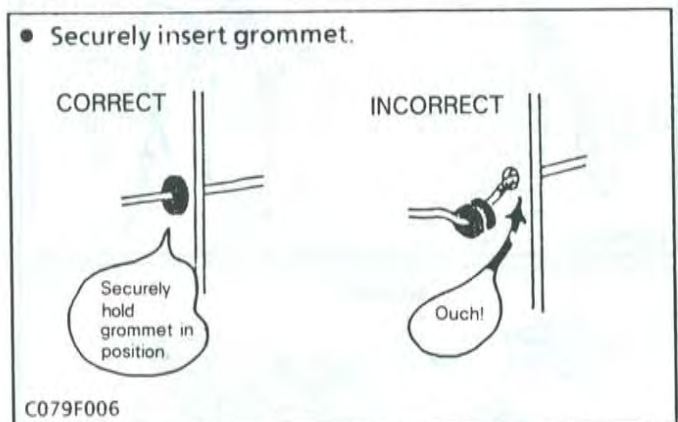
- Do not let wiring contact dangerous part.



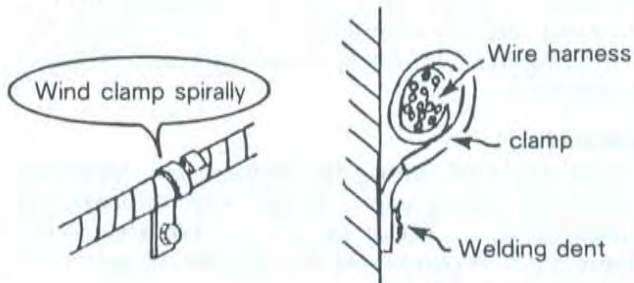
- Repair or change torn or aged wiring immediately.



- Securely insert grommet.



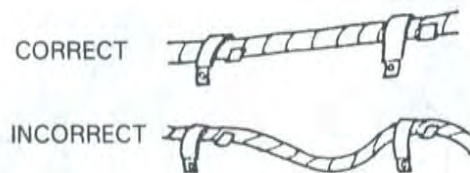
- Securely clamp, being careful not to damage wiring.



C079F007

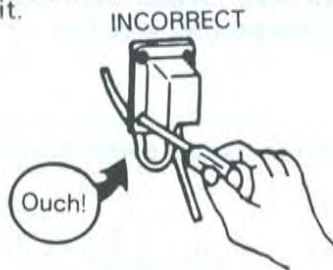
C079F008

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



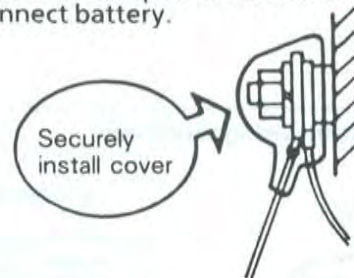
C079F009

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



C079F010

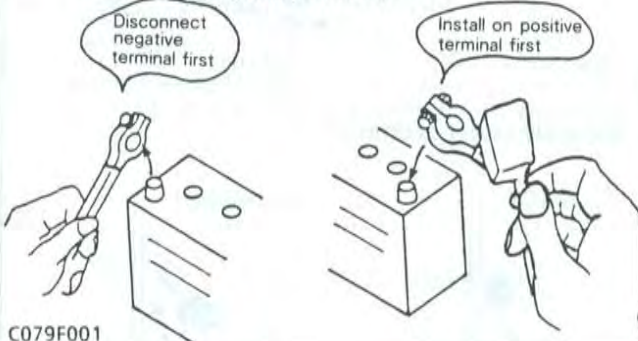
- After installing wiring, check protection of terminals and clamped condition of wiring, only then connect battery.



C079F011

Battery

Take care not to confuse positive and negative terminals



C079F001

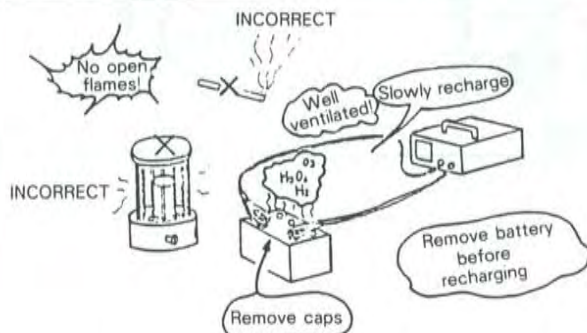
- When removing battery cord, disconnect negative wire first. When installing battery cord, check for polarity and connect positive wire first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting cord to battery terminals, apply grease to them and securely install 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.

CAUTION

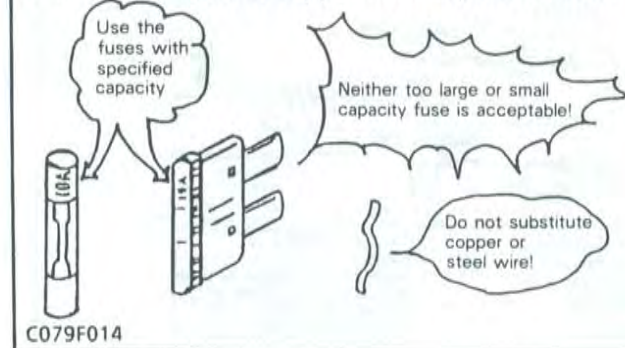
- Do recharging in a well-ventilated place where there is no open flame nearby, as hydrogen gas and oxygen are formed.



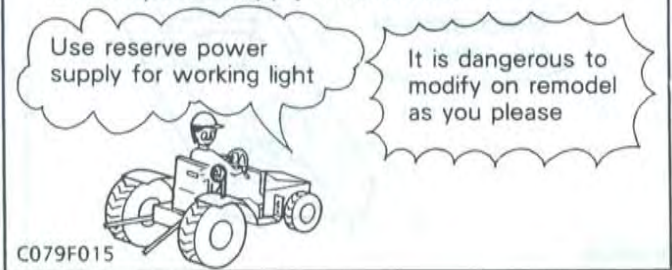
C079F013

Fuse

- Use fuses with specified capacity.
- Never use steel or copper wire in place of fuse.

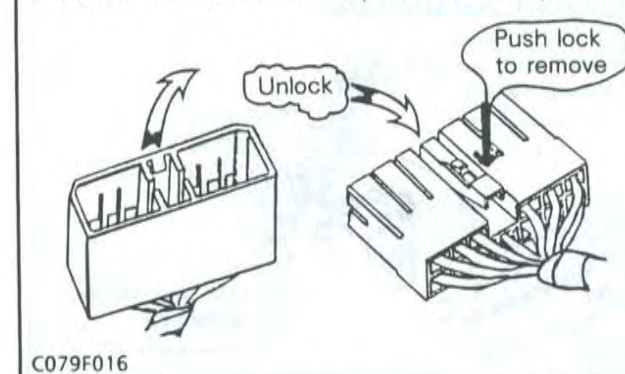


- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of reserve power supply is exceeded.

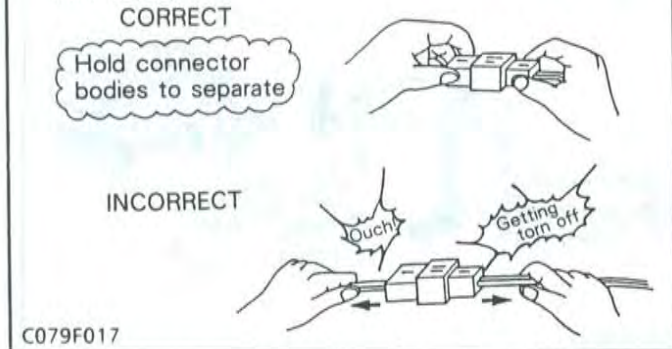


Connector

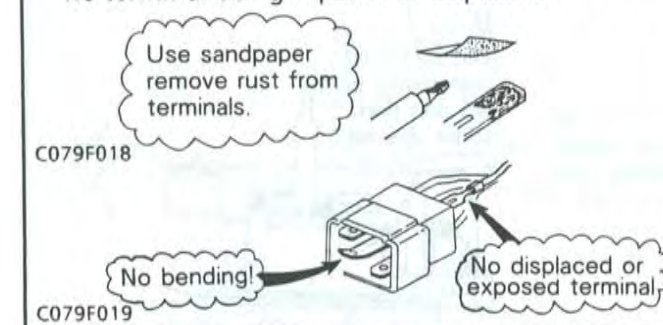
- For connector with lock, push lock to separate.



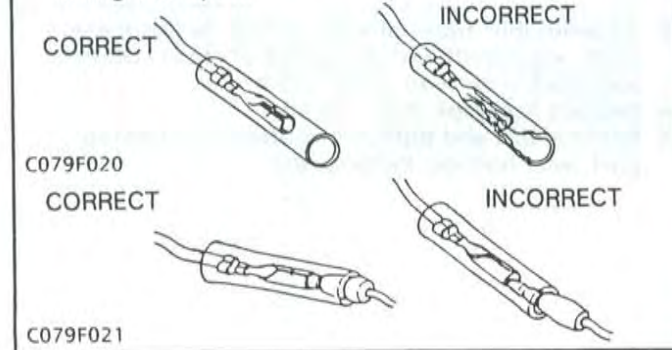
- In separating connectors, do not pull wire harnesses.



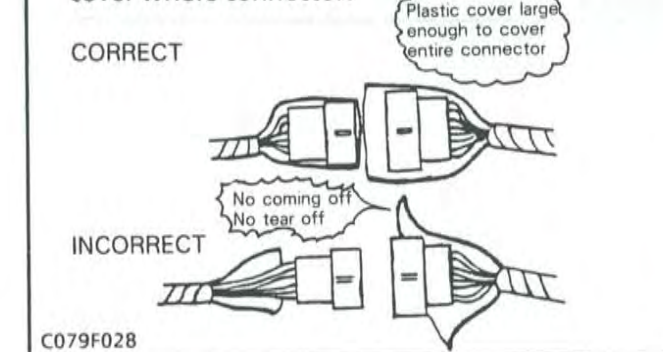
- Use sandpaper to remove rust from terminals.
- Repair deformed terminal. Make certain there is no terminal being exposed or displaced.



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

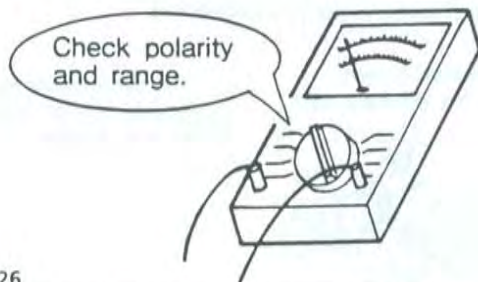


- Make certain plastic cover is large enough to cover whole connector.

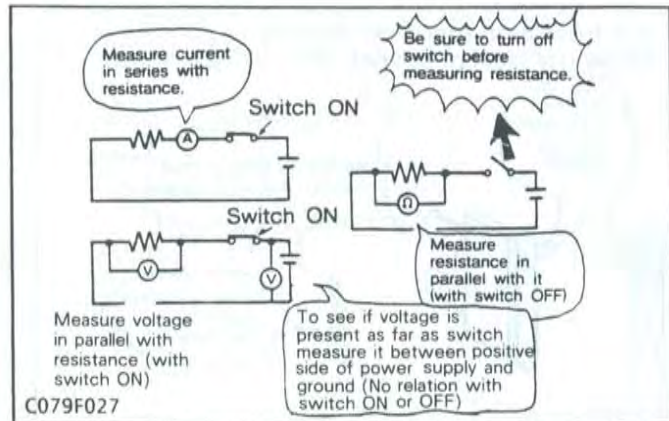


■ Handling of circuit testers

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



C079F026



C079F027

■ Handling of parts

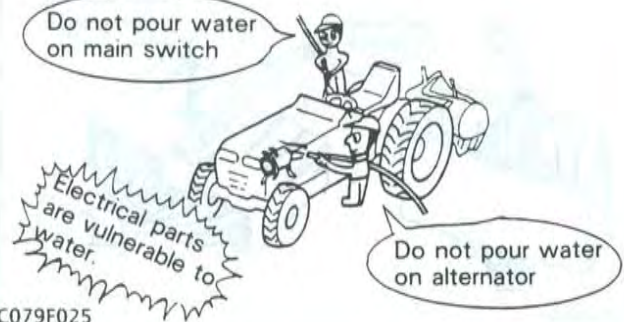
- Do not throw or drop electrical parts and wire harnesses.



C079F023

■ Turnbuckle

- Do not pour water on electrical parts such as main switch and alternator.



C079F025

■ Oil, dust and dirt

- If flammable material such as fuel, or lubricant spills, wipe it off with dry piece of cloth. Do not approach it with an open flame.
- Replace fuel pipe that is aged.
- Remove dirt and dust accumulated on heated part, wire harness, battery, etc.



C079F024

[4] LUBRICANTS

Location	Capacity					Lubricant
	L2350	L2650	L2950	L3450	L3650	
Fuel	29 ℓ 7.7 U.S.gals. 6.4 Imp. gals.					No.2-D diesel fuel No.1-D diesel fuel
Coolant	6.0 ℓ 6.3 U.S.qts. 5.3 Imp. qts.	4.6 ℓ 4.9 U.S.qts. 4.0 Imp. qts.	5.6 ℓ 5.9 U.S.qts. 4.9 Imp. qts.		Fresh clean water with anti-freeze	
Engine crankcase	6.3 ℓ 6.7 U.S.qts. 5.5 Imp. qts.	5.7 ℓ 6.0 U.S.qts. 5.0 Imp. qts.	8.5 ℓ 8.9 U.S.qts. 7.5 Imp. qts.		● Engine oil: API Service CC or CD Below 0°C (32°F) SAE 10W or 10W-30 0 to 25°C (32 to 77°F) SAE 20 or 10W-30 Above 25°C (77°F) SAE 30 or 10W-30	
Transmission case	28 ℓ 7.4 U.S.gals. 6.2 Imp.gals.	[Except GST] [GST]	28.5 ℓ 7.7 U.S.gals 6.3 Imp. gals 27 ℓ 7.1 U.S.gals 5.9 Imp. gals		● Multi-grade transmission fluid KUBOTA U D T Atlantic Richfield Arco Tractor Fluid Chevron Tractor Hydraulic Fluid Exxon Torque Fluid 56 Penzoil Hydra-Trans and Wet Br. Phillips H. T. Fluid Shell Donax TD.TT.TM Texaco T. D. H. Oil Union Hydraulic / Tractor Fluid Gulf Universal Fluid 425,350 Mobil Mobil Fluid 423,350	
Steering gear case	—	0.1 ℓ 0.11 U.S.qt. 0.09 Imp. qt.		Gear Oil SAE 80 or SAE 90		
Steering gear box [Manual Steering]	0.21 ℓ 0.22 U.S.qt. 0.18 Imp. qt.					
Front axle case [4WD]	6 ℓ 6.3 U.S.qts. 5.3 Imp. qts.	6.5 ℓ 6.9 U.S.qts. 5.7 Imp. qts.				
Greasing						
Clutch pedal	Until grease overflows				1 point	Multipurpose type grease
Brake pedal					1 point	
Pedal shaft support					1 point	
Lift rod (right)					1 point	
Top link					1 or 2 points	
Top link bracket (with draft control)					2 points	
Knuckle shaft [2WD]					2 points	
Battery terminal	A small amount				2 points	Bearing grease
Front wheel hub [2WD]					2 points	
Shift Guide [GST]					1 point	

[5] 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.

Grade	Nominal Diameter	Unit	*  No-grade or 4T SS41, S20C			*  7T S43C, S45C (Quenched and Tempered)			*  9T SCr435, SCM435 (Quenched and Tempered)		
			N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M 6 (6 mm, 0.24 in.)			7.84 to 9.31	0.80 to 0.95	5.79 to 6.87	9.80 to 11.2	1.00 to 1.15	7.24 to 8.32	12.3 to 14.2	1.25 to 1.45	9.05 to 10.5
M 8 (8 mm, 0.31 in.)			17.7 to 20.5	1.8 to 2.1	13.0 to 15.2	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)			39.2 to 45.0	4.0 to 4.6	29.0 to 33.2	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12 (12 mm, 0.47 in.)			62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5	103 to 117	10.5 to 12.0	76.0 to 86.8
M14 (14 mm, 0.55 in.)			108 to 125	11.0 to 12.8	79.6 to 92.5	124 to 147	12.6 to 15.0	91.2 to 108	167 to 196	17.0 to 20.0	123 to 144
M16 (16 mm, 0.63 in.)			167 to 191	17.0 to 19.5	123 to 141	196 to 225	20.0 to 23.0	145 to 166	260 to 303	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)			245 to 284	25.0 to 29.0	181 to 210	275 to 318	28.0 to 32.5	203 to 235	343 to 401	35.0 to 41.0	254 to 297
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	490 to 568	50.0 to 58.0	362 to 420

* The figures on the table above are indicated on the top of screw or bolt.

[6] MAINTENANCE CHECK LIST**L2350**

No.	Check point	Indication on hour meter (Change or check every interval shown below)																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	Greasing	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			S.G-17,18
2	Clutch pedal play check		○		○		○		○		○		○		○		○			S.G-20
3	Brake pedal play check		○		○		○		○		○		○		○		○			S.G-19
4	Air cleaner element cleaning		○		○		○		○		○		○		○		○			S.G-21
5	Engine oil change	○			○				○				○				○			S.G-13
6	Hydraulic oil filter cleaning	○			○				○				○				○			S.G-16
7	Battery electrolyte level check				○				○				○				○			S.G-21
8	Radiator hose check				○				○				○				○			S.G-22
9	Fan belt tension check				○				○				○				○			S.G-23
10	Toe-in check				○				○				○				○			S.G-22
11	Fuel line check				○				○				○				○			S.G-23
12	Front wheel hub bearing greasing [2WD only]						○						○							S.G-24
13	Engine oil filter cartridge replacement	○							○								○			S.G-14
14	Transmission fluid change	○							○								○			S.G-14
15	Front axle case oil change [4WD only]	○							○								○			S.G-17
16	Front axle back-and-forth play check								○								○			S.G-24
17	Fuel filter cartridge replacement								○								○			S.G-25
17	Steering gear box oil check [Manual steering only]								○								○			S.G-26
19	Radiator cleaning																○			S.G-26
20	Valve clearance check																○			S.G-27
21	Fuel injection nozzle injection pressure check																○			S.G-28
22	Air cleaner element replacement																	○ *		S.G-28
23	Fuel line replacement																		○ **	S.G-29
24	Radiator hose replacement																		○ **	S.G-30

Note: The jobs indicated by ○ must be done at 50 hours respectively.

* Every year or every 6 times of cleaning.

** Replace only if necessary.

L2650 (GST), L2950 (GST), L3450 (GST), L3650 (GST)

No.	Check point	Indication on hour meter (Change or check every interval shown below)																After purchase		Reference page
		25	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1 year	
1	Greasing		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o			S.G-18
2	Fuel filter element cleaning			o		o		o		o		o		o		o		o		S.G-19
3	Clutch pedal play check			o		o		o		o		o		o		o		o		S.G-20
4	Brake pedal play check			o		o		o		o		o		o		o		o		S.G-19
5	Air cleaner element cleaning			o		o		o		o		o		o		o		o		S.G-20
6	Hydraulic oil paper filter cartridge replacement [GST only]	o				o				o				o				o		S.G-12
7	Hydraulic oil filter cartridge replacement [GST only]		o			o				o				o				o		S.G-16
8	Hydraulic oil filter cleaning [Except GST]		o			o				o				o				o		S.G-16
9	Engine oil change		o			o				o				o				o		S.G-13
10	Toe-in check					o				o				o				o		S.G-22
11	Battery electrolyte level check					o				o				o				o		S.G-21
12	Radiator hose check					o				o				o				o		S.G-22
13	Fan belt tension check					o				o				o				o		S.G-23
14	Fuel line check					o				o				o				o		S.G-23
15	Power steering rubber hose check					o				o				o				o		S.G-23
16	Front wheel hub bearing greasing [2WD only]							o						o						S.G-24
17	Magnetic plug cleaning [GST only]		o							o								o		S.G-16
18	Transmission fluid change		o							o								o		S.G-14, 15
19	Front axle case oil change [4WD only]		o							o								o		S.G-17
20	Engine oil filter cartridge replacement		o							o								o		S.G-14
21	Front axle back-and-forth play check									o								o		S.G-24
22	Fuel filter element replacement									o								o		S.G-25

No.	Check point	Indication on hour meter (Change or check every interval shown below)																		After purchase		Reference page
		25	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1 year	2 years		
23	Steering gear case oil check									O								O			S.G-25	
24	Steering gear box oil check [Manual steering only]									O								O			S.G-26	
25	Radiator cleaning																	O			S.G-26,27	
26	Valve clearance check																	O			S.G-27	
27	Fuel injection nozzle injection pressure check																	O			S.G-28	
28	Air cleaner element replacement																	O *			S.G-28	
29	Power steering rubber hose replacement																		O **		S.G-29	
30	Fuel lines replacement																		O **		S.G-29	
31	Radiator hoses replacement																		O **		S.G-30	

Note: The jobs indicated by ○ must be done at initial 25 hours or initial 50 hours.

* Every year or every 6 times of cleaning.

** Replace only if necessary.

[7] CHECK AND MAINTENANCE

(1) Daily Check

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

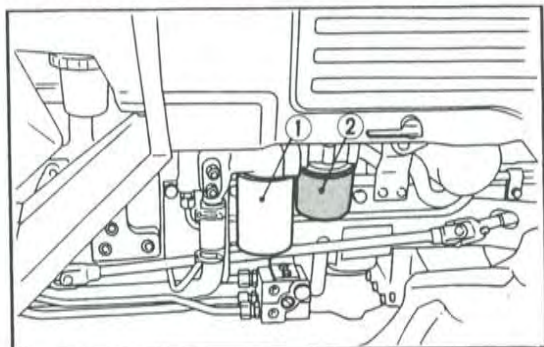
CAUTION

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

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 amount of transmission oil.
 - 5) Check the coolant level.
 - 6) Check for dust in the air cleaner dust cup.
 - 7) Check and clean the radiator screen.
 - 8) Check the bolts and nuts of the tires are tight.
 - 9) Check the SMV emblem for damage and cleaner replace as necessary if equipped.
 - 10) Check the amount of front axle case oil.
 - 11) Clean around the exhaust manifold and the muffler of the engine.
- While sitting in the operator's seat.
 - 1) Check the throttle pedal, brake pedals and clutch pedal.
 - 2) Check the parking brake.
 - 3) Check the steering wheel.
- Turning the key switch.
 - 1) Check the performance of the easy checker lights.
 - 2) Check headlights, tail lights and hazard lights. Clean if necessary.
 - 3) Check the performance of the meters and gauges.
 - 4) Check the horn if equipped.
- Starting the engine.
 - 1) Check to see that the lights on the Easy Checker go off.
 - 2) Check the color of the exhaust.
 - 3) Check the brakes for proper operation.

(2) Check Point of the Initial 25 Hours



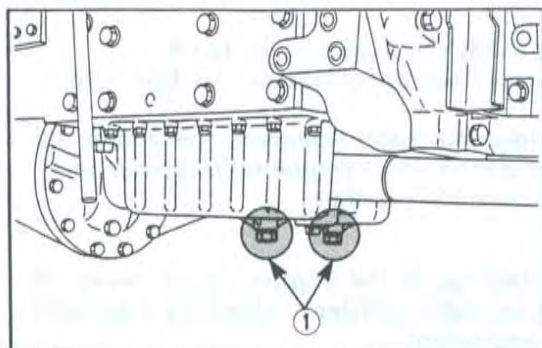
- (1) Hydraulic Oil Filter Cartridge
(2) Hydraulic Oil Paper Filter Cartridge

Hydraulic Oil Paper Filter Cartridge Replacement (GST only)

1. Detach the oil filter cartridges (2).
2. Apply a slight coat of oil onto the cartridge gasket.
3. Fill up hydraulic oil to the new filter cartridges (2) to install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.

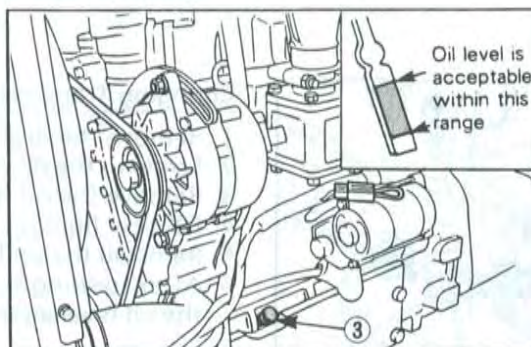
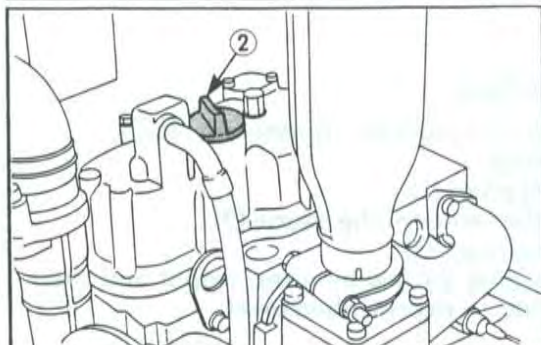
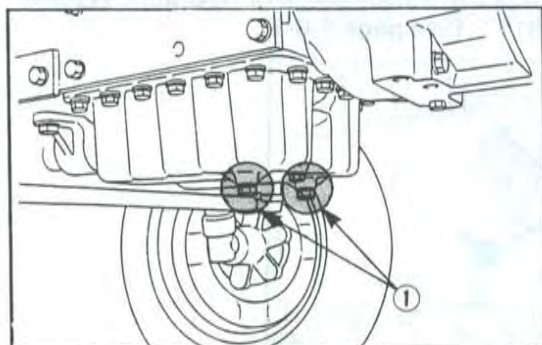
■ IMPORTANT

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

(3) Check Points of the Initial 50 Hours**[L2350]****Changing Engine Oil**

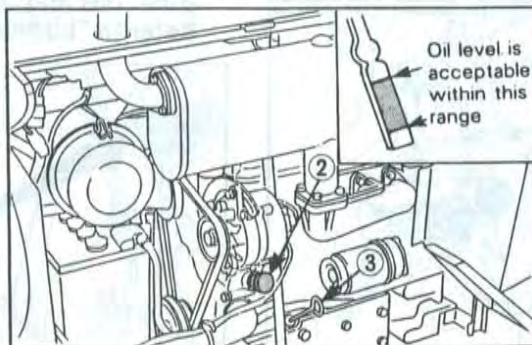
1. Start and warm up the engine for approx. 5 minutes.
2. Remove the drain plugs (1) to drain oil.
3. Screw in the drain plugs (1).
4. Fill new oil up to the upper line on the dipstick (3).
Refer to "LUBRICANTS". (See page S.G-7)

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

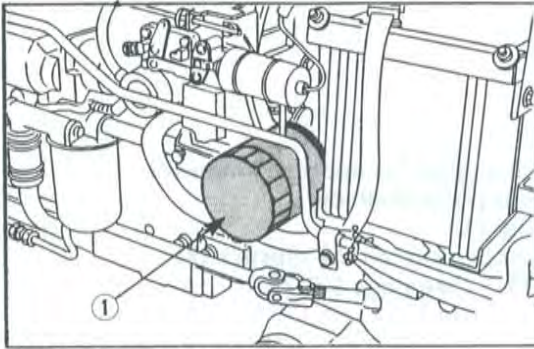
**[L2650(GST), L2950(GST), L3450(GST), L3650(GST)]**

(1) Drain Plugs

(2) Oil Inlet Plug



(3) Dipstick



(1) Oil Filter Cartridge

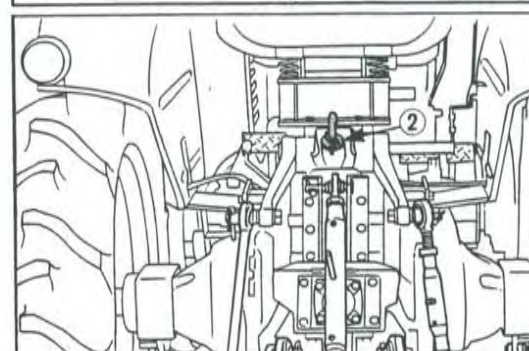
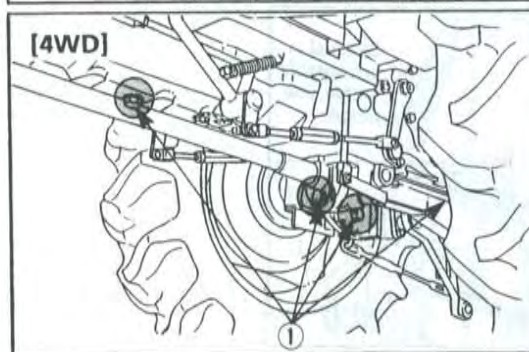
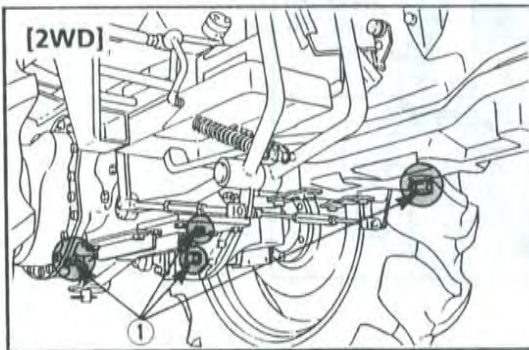
Engine Oil Filter Cartridge Replacement

1. Remove the engine oil filter cartridge (1).
2. When installing, apply the engine oil slightly to the rubber gasket.
3. To install the new cartridge (1), screw it in by hand. Overtightening may cause deformation of the rubber gasket.
4. After the new cartridge has been replaced, the engine oil level normally lowers a little. Add engine oil to proper level. Check for oil leaks around filter gasket.

■ IMPORTANT

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

[L2350]



(1) Drain Plugs
(2) Oil Filling Plug

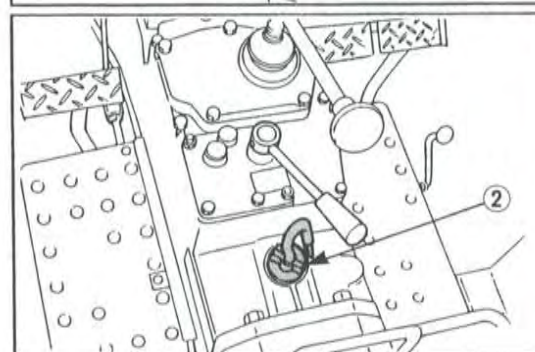
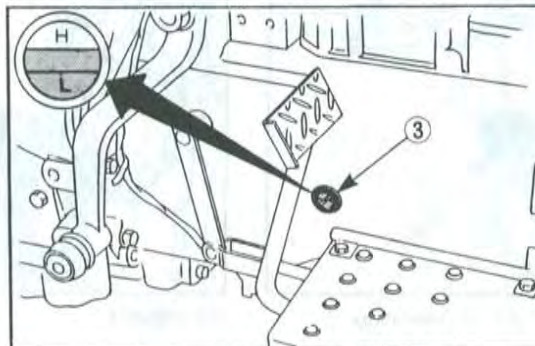
(3) Gauge

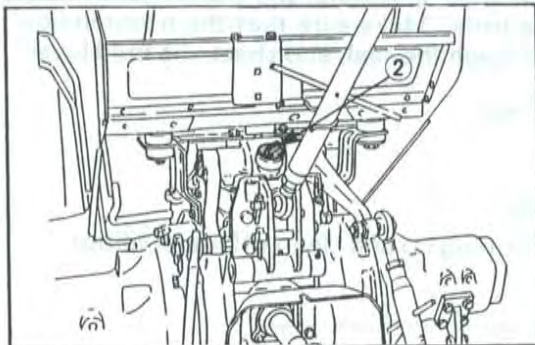
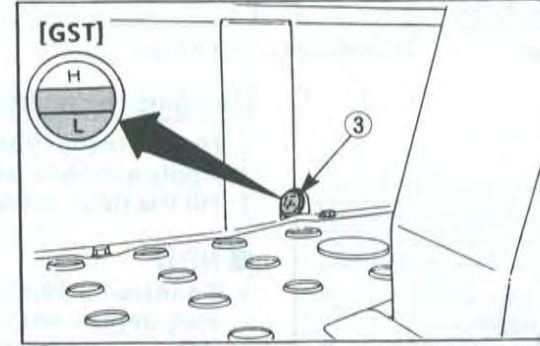
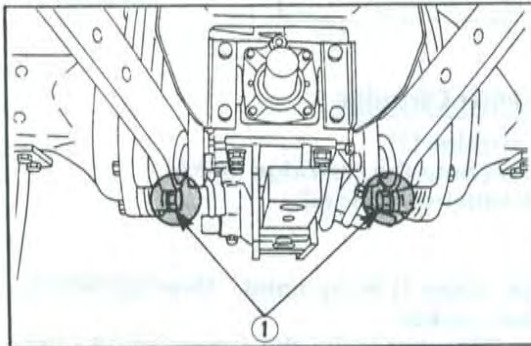
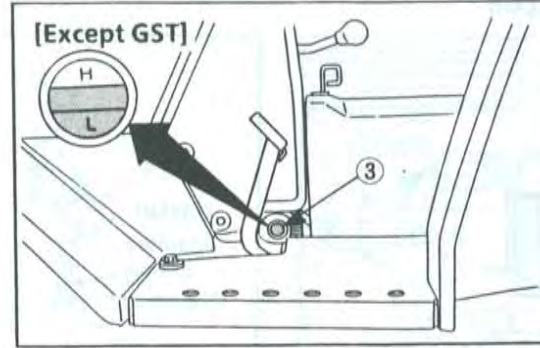
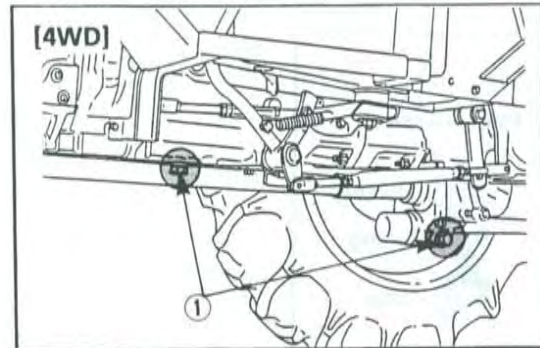
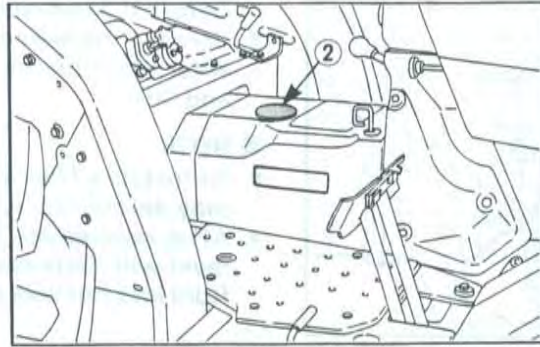
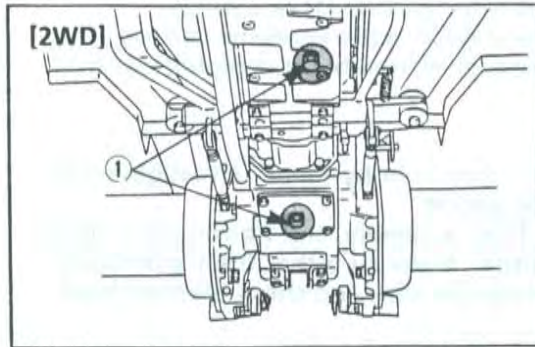
Changing Transmission Fluid

1. Remove the drain plugs (1) to drain transmission fluid.
2. Screw in the drain plugs.
3. Remove the oil filling plugs (2).
4. Fill new fluid up to the center of the gauge (3).
5. Reinstall the oil filling plugs (3).
6. After running the engine for few minutes, stop it and check the oil level again; add oil to prescribed level.

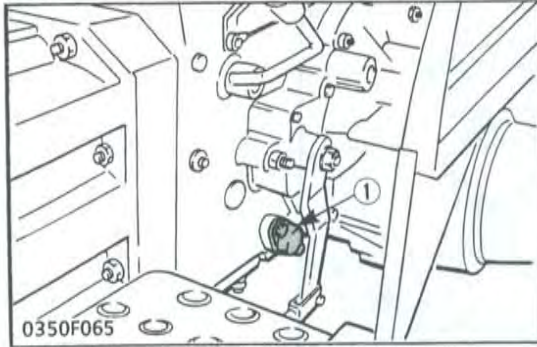
■ IMPORTANT

- Use only transmission fluid KUBOTA recommended. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS". (See page S.G-7)



[L2650(GST), L2950(GST), L3450(GST), L3650(GST)]

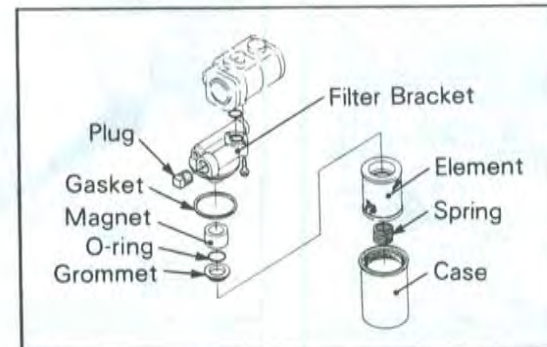
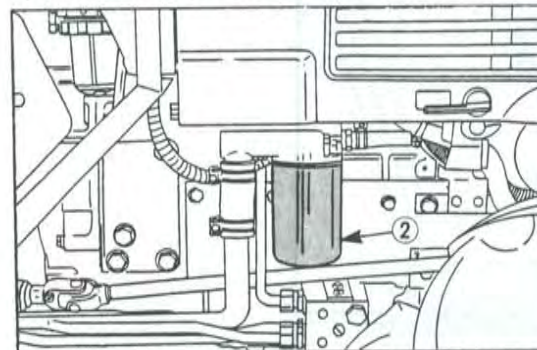
- (1) Drain Plugs
- (2) Oil Filling Plug
- (3) Gauge

[L2350]**Hydraulic Oil Filter Cleaning**

1. Detach the hydraulic oil filter retainer (1) or case (2).
2. Take out the element, and dip it in the kerosene to rinse.
3. After cleaning the element, reassemble it, keeping out dust and dirt.

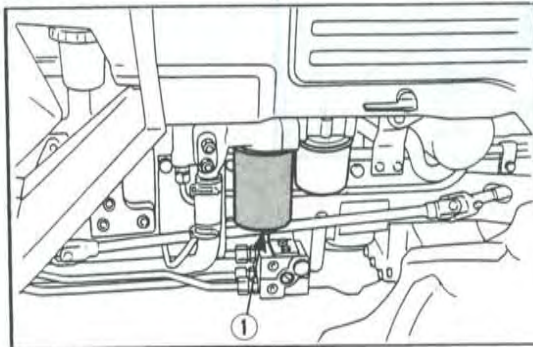
NOTE

- To install a filter case, screw it in by hand. Overtightening may deform the rubber gasket.
- After reassemble the filter assembly, the transmission fluid level will decrease a little. Make sure that the transmission fluid loss not leak through the seal, and check the fluid level.

[L2650, L2950, L3450, L3650]

(1) Hydraulic Oil Filter Retainer

(2) Hydraulic Oil Filter Case

[L2650GST, L2950GST, L3450GST, L3650GST]**Changing Hydraulic Oil Filter Cartridge**

1. Detach the oil filter cartridge (1).
2. Apply a slight coat of oil onto the cartridge gasket.
3. Fill the new cartridge with hydraulic oil.

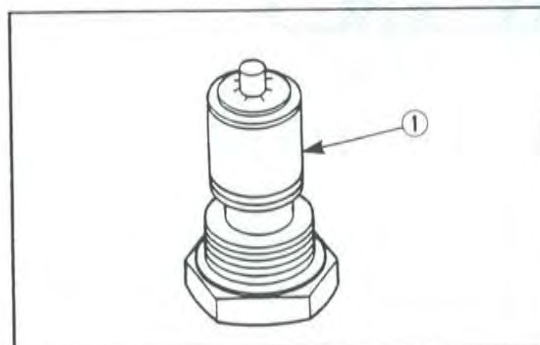
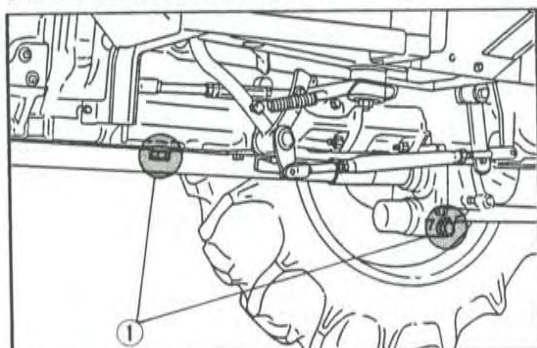
NOTE

- To install a filter case, screw it in by hand. Overtightening may deform the rubber gasket.
- After reassemble the filter assembly, the transmission fluid level will decrease a little. Make sure that the transmission fluid loss not leak through the seal, and check the fluid level.

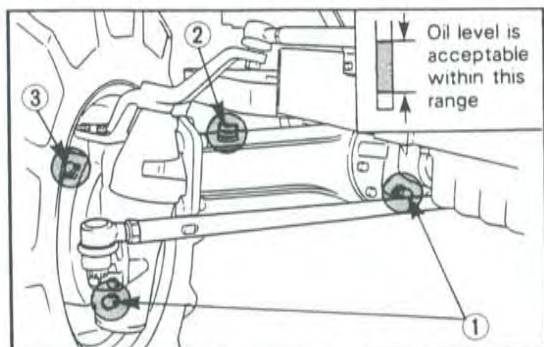
(1) Hydraulic Oil Filter Cartridge

Magnetic Plug Cleaning

1. Remove the magnetic plug (1) and clean off metal filings.

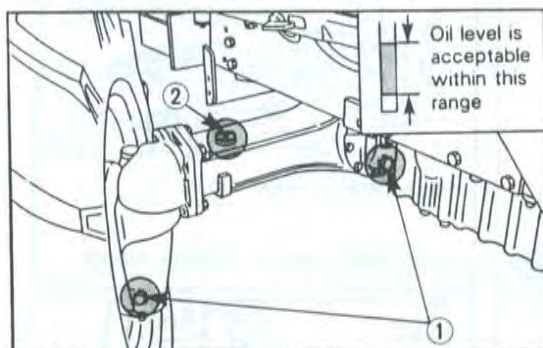
[L2650GST, L2950GST, L3450GST, L3650GST]

(1) Magnetic Plugs

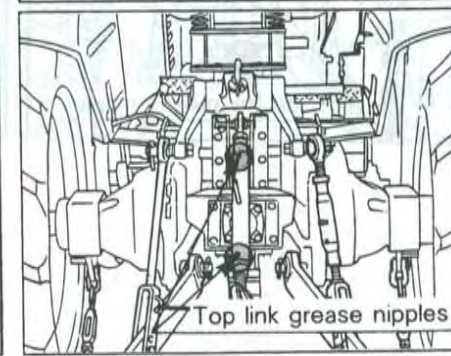
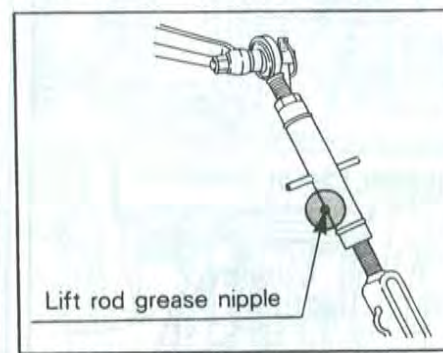
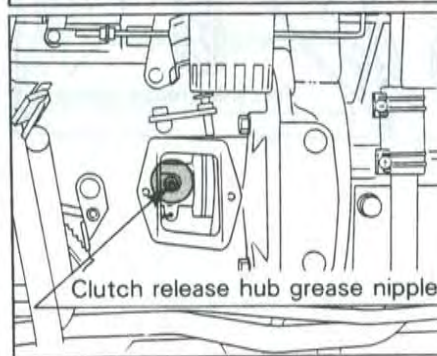
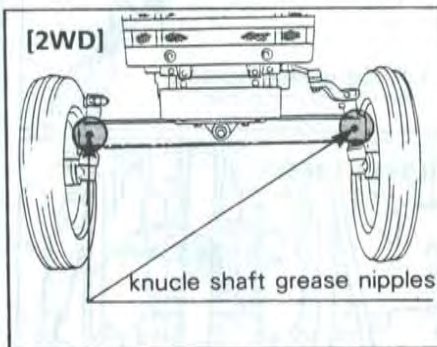
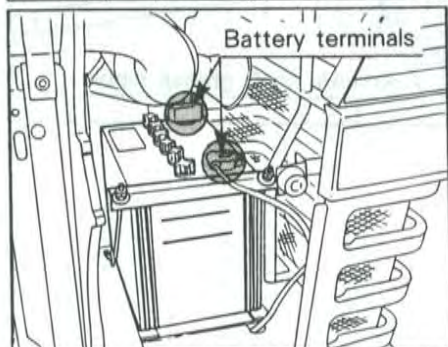
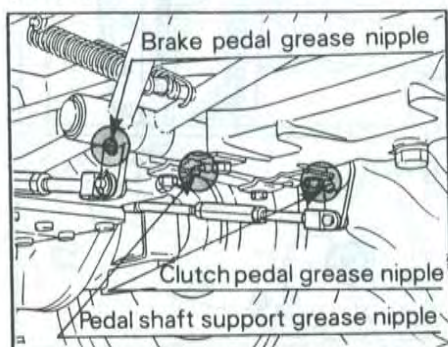
[L2350]**Changing Front Axle Case Oil [4WD TYPE]**

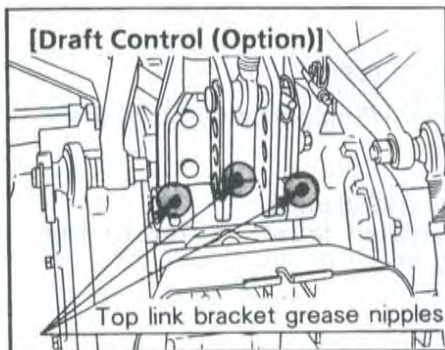
1. Remove the drain plugs (1) and filling port plug (2) to drain the oil.
2. Screw in the drain plugs (1).
3. Remove the air vent plugs (3). (L2350 only)
4. Fill new oil up to the specified level. Refer to the "LUBRICANTS" (See page S.G-7).

- (1) Drain Plugs
(2) Filling Port Plug
(3) Air Vent Plug

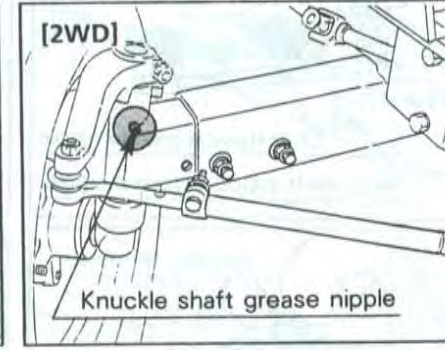
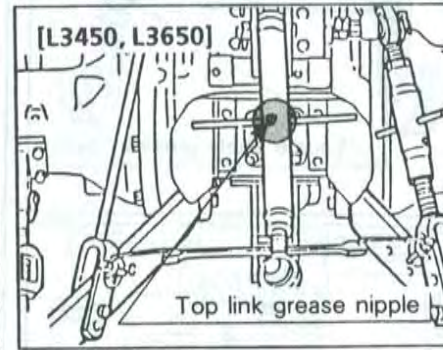
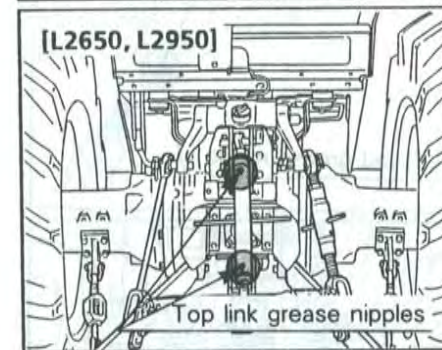
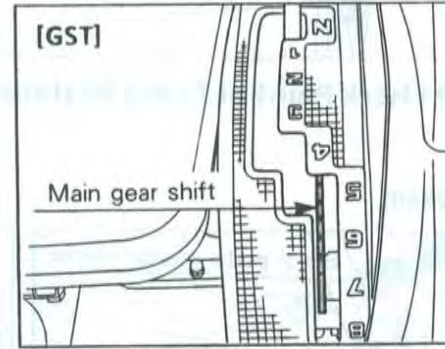
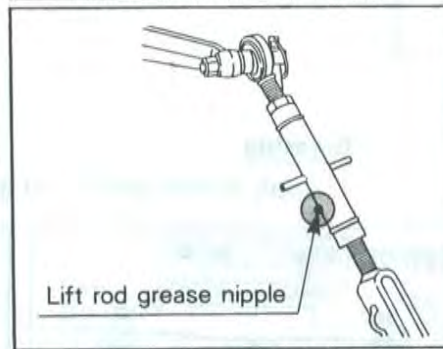
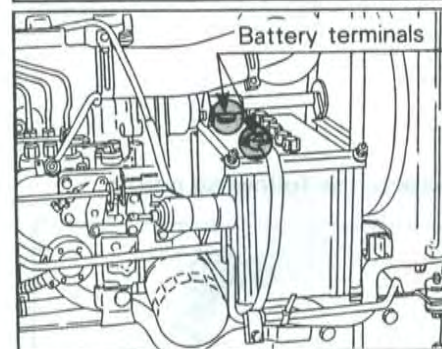
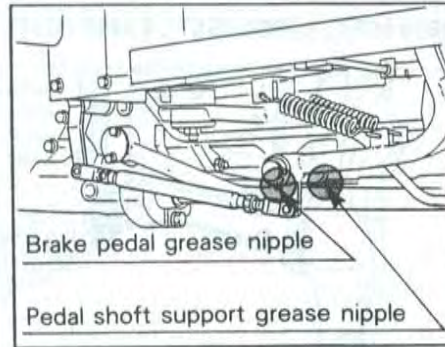
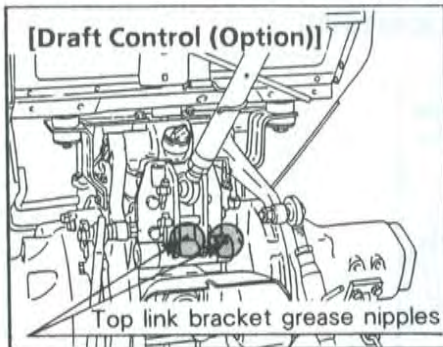
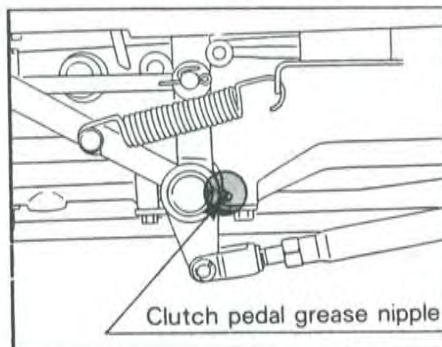
[L2650 (GST), L2950 (GST), L3450 (GST), L3650 (GST)]**(4) Check Point of Every 50 Hours****Greasing**

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

[L2350]

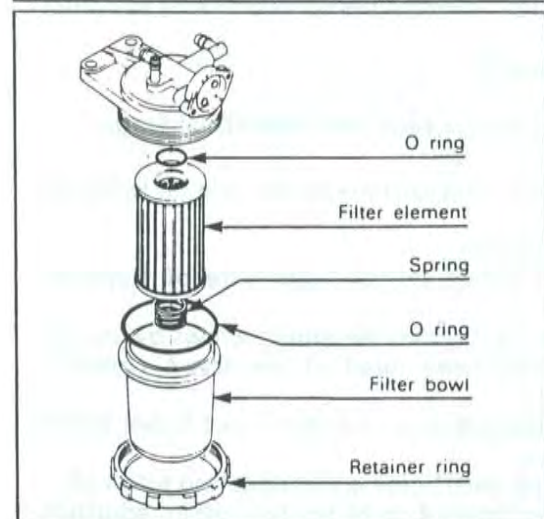
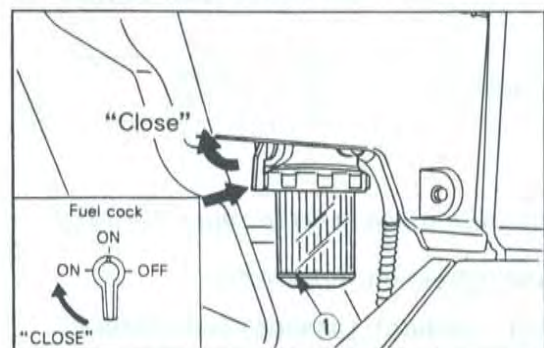


[L2650 (GST), L2950 (GST), L3450 (GST), L3650 (GST)]



(5) Check Points of Every 100 Hours

[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]



Fuel Filter Element and Fuel Filter Bowl Cleaning

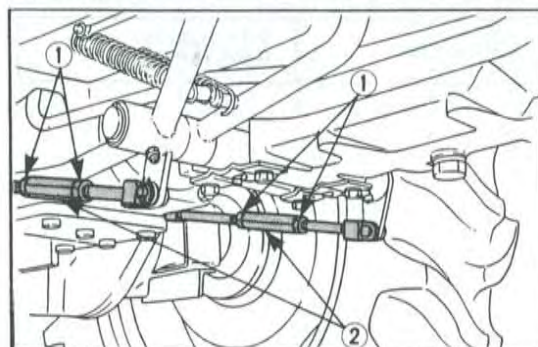
1. Close the fuel filter cock.
2. Unscrew the retainer ring and remove the filter bowl, and rinse the inside with kerosene.
3. Take out the element and dip it in the kerosene to rinse.
4. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
5. Bleed the fuel system. (See page S.G-31)

■ IMPORTANT

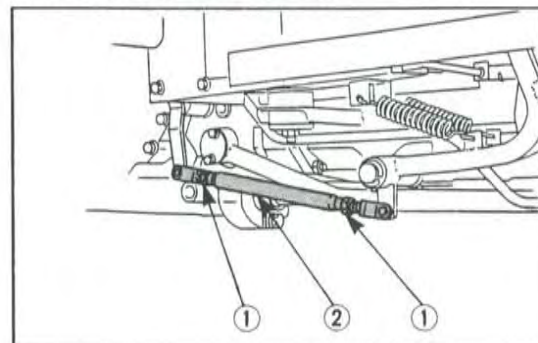
- This job should be not be done in the field, but in a clean place.
- If dust and dirt enter the fuel, the fuel pump and injection nozzles are subject to quick wear. To prevent this, be sure to clean the fuel filter bowl periodically.

(1) Fuel Filter

[L2350]



[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]



Checking Brake Pedal Play

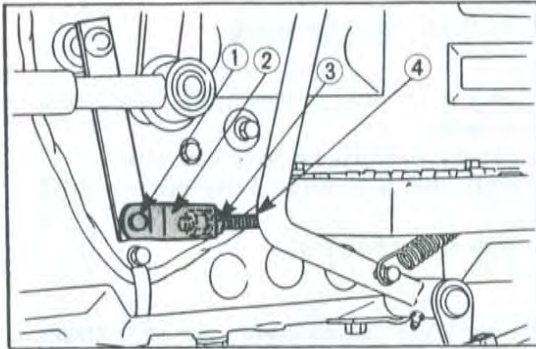
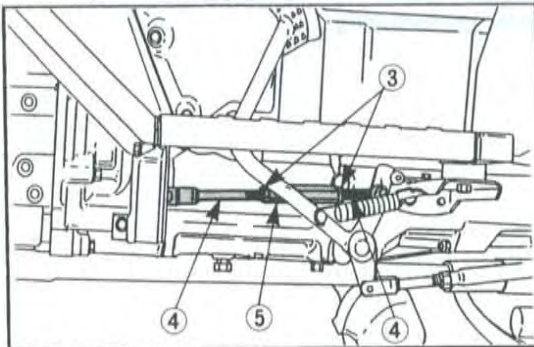
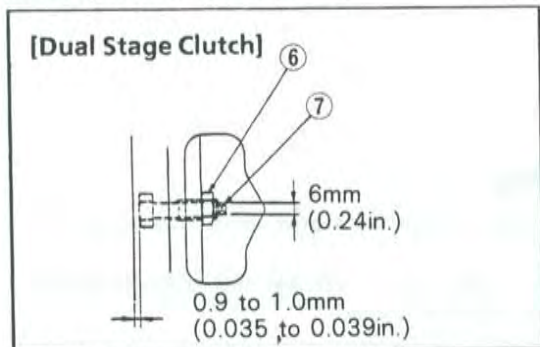
1. Depress the each brake pedal by hand, and measure the pedal play.
2. If the measurement is not within the factory specifications, adjust the play by turn buckle (2).

Brake pedal play	Factory spec.	20 to 30 mm 0.8 to 1.2 in.
------------------	---------------	-------------------------------

■ NOTE

- Keep the pedal play in the right and left brake pedals equal.
- After adjustment, secure the turn buckle (2) with the lock nuts (1).

(1) Lock Nuts
(2) Turnbuckle

[L2350]
**[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]**

[L2650, L2950, L3450, L3650]


- | | |
|----------------|---------------------|
| (1) Pin | (5) Turnbuckle |
| (2) Joint | (6) Lock Nut |
| (3) Lock Nuts | (7) Adjusting Screw |
| (4) Clutch Rod | |

Checking Clutch Pedal Play

1. Press the clutch pedal by hand, and measure the movement of the pedal edge.
2. If the measurement is not within the factory specifications, adjust it.

Clutch pedal play	Factory spec.	20 to 30 mm 0.8 to 1.2 in.
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Adjustment For L2350

1. Loosen the lock nut (3).
2. Remove the pin (1) and turn the joint (2) to adjust the clutch rod length.
3. Reinstall the pin (1) and tighten the lock nut (3).

Adjustment For L2650GST, L2950GST, L3450GST and L3650GST

1. Loosen the lock nuts (3), and turn the turnbuckle (5) to adjust the rod length.
2. Retighten the lock nuts (3).

Adjustment For L2650, L2950, L3450 and L3650 (Dual Stage Clutch)

1. Loosen the lock nuts (3), and turn the turnbuckle (5) to adjust the rod length.
2. Retighten the lock nuts (3).
3. Remove the cover located on the right side of flywheel housing case.
4. Loosen the lock nuts (6), tighten the adjust screws by using 6 mm (0.24 in.) spanner until head of the screw contacts pressure plate slightly.
5. Make 3/4 turn counterclockwise to give 0.9 to 1.0 mm (0.035 to 0.039 in.) clearance.
6. Tighten the lock nut (6) with holding the adjusting screw (7).
7. Repeat the sameway (from 4 to 6) for two other adjusting screws (7).
8. Reinstall the cover on the right side of flywheel housing case.

Clearance of the adjusting screw (7)	Factory spec.	0.9 to 1.0 mm 0.035 to 0.039 in.
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Compressed air cleaning method



C047F050

Liquid cleaning method



C047F051

Cleaning Air Cleaner Element

1. To clean the element, use clean dry compressed air on the inside of the element. Air pressure at the nozzle must not exceed 205 kPa (2.1 kgf/cm², 30 psi). Maintain reasonable distance between the nozzle and the element.
2. To wash the element, use KUBOTA Filter or Donaldson ND-1500 Filter Cleaner which is especially effective on oily and soot-laden filters.
3. Follow instructions that are supplied with the filter cleaner.

(6) Check Points of Every 200 Hours

Hydraulic Oil Paper Filter Cartridge Replacement [GST TYPE]

- See page S.G-12

Hydraulic Oil Filter Cartridge Replacement [GST TYPE]

- See page S.G-16

Hydraulic Oil Filter Cleaning [L2350, L2650, L2950, L3450, L3650]

- See page S.G-16

Hydraulic Oil Changing

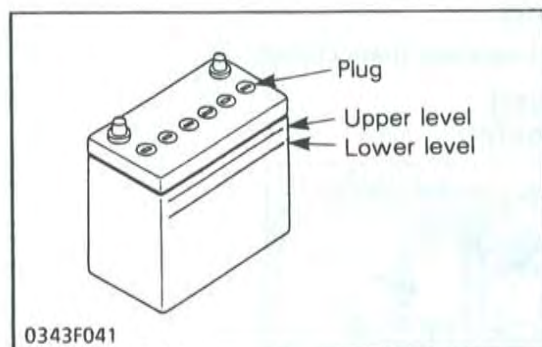
- See page S.G-13

Checking Battery Electrolyte Level

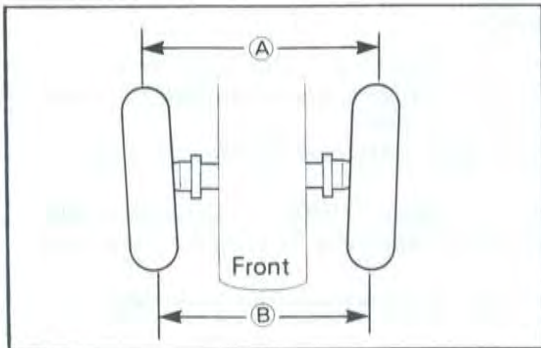
CAUTION

- Never remove the battery cap while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are splattered with it, wash it away completely with water.

1. Check that the battery electrolyte level is between the lower and upper levels.
2. If insufficient, add distilled water.



0343F041

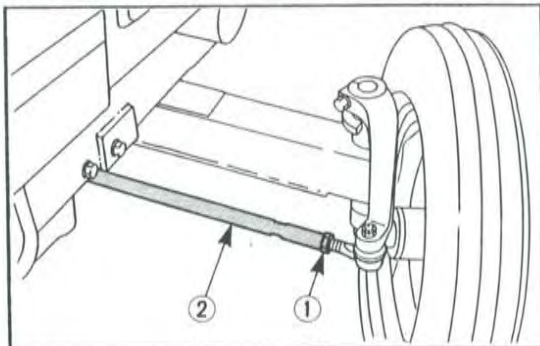


[L2350]

Checking Toe-in

1. Inflate the tires to the specified pressure.
2. Turn the front wheels straight ahead.
3. Measure the distance between the centers of front wheels at front and rear.
4. If the measurement exceeds the factory specification, adjust by changing the tie rod length.

Toe-in (A - B)	Factory spec.	2 to 8 mm 0.1 to 0.3 in.
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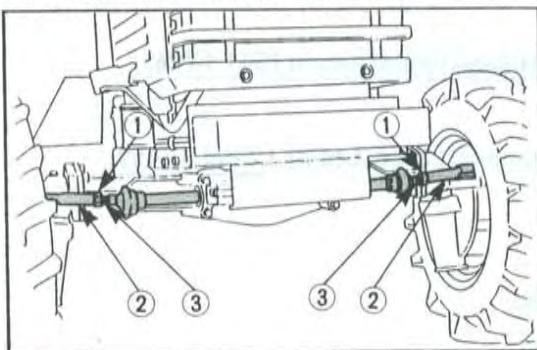
Adjustment

1. Loosen the lock nuts (1).
2. Turn the tie rod (2) or rods (3) to adjust the toe-in.
3. Tighten the lock nuts (1).

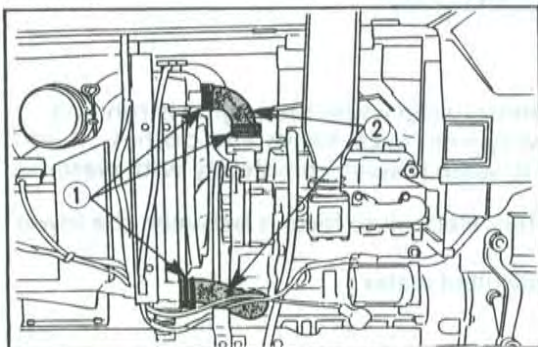
- (A) Heel
(B) Toe

- (1) Lock Nuts
(2) Tie Rod
(3) Rod

[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]



[L2350]



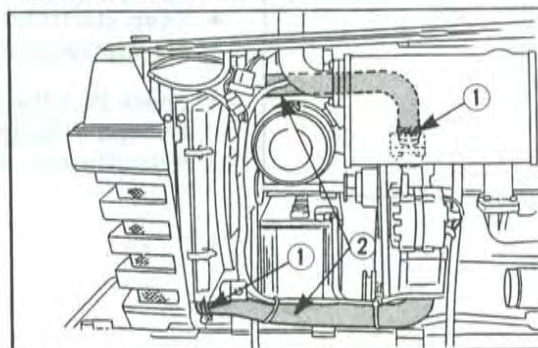
(1) Clamps

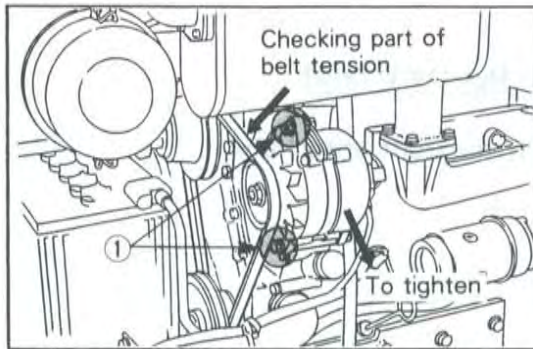
(2) Radiator Hoses

Checking Radiator Hoses

1. Check the radiator hoses and them clamps.

[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]





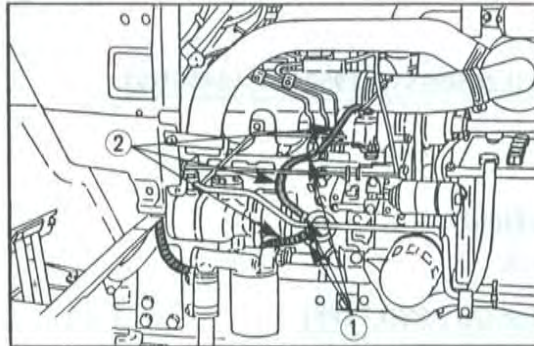
Checking Fan Belt Tension

1. Press the fan drive belt with a force of approx. 98N (10 kgf, 22 lbs.), and measure the deflection.
2. If the measurement is not the factory specification, adjust the fan drive belt tension.

Fan drive belt tension	Factory spec.	About 7 mm 0.3 in.
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(1) Nut

[L2350]



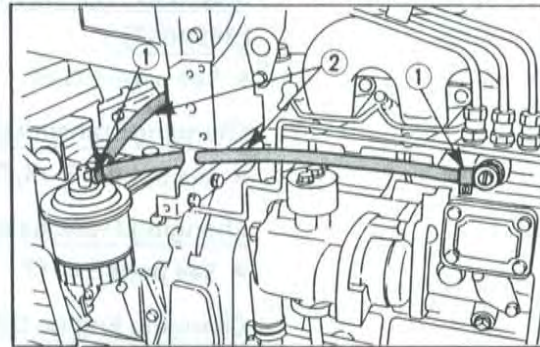
(1) Clamps

(2) Fuel Lines

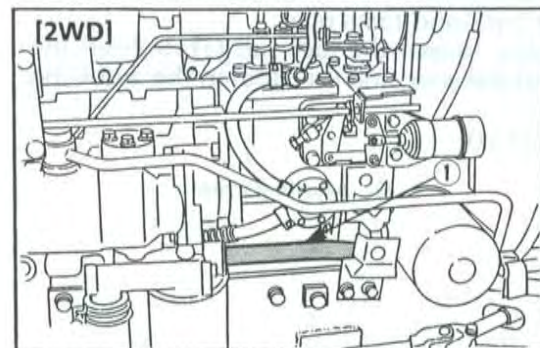
Fuel Lines Check

1. Check the fuel lines (2) and them clamps (1).

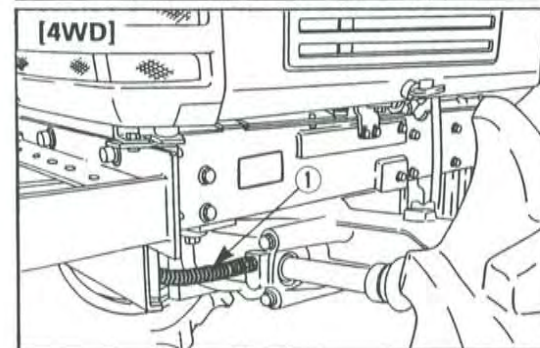
[L2650 (GST), L2950 (GST), L3450 (GST), L3650 (GST)]



[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]



[2WD]

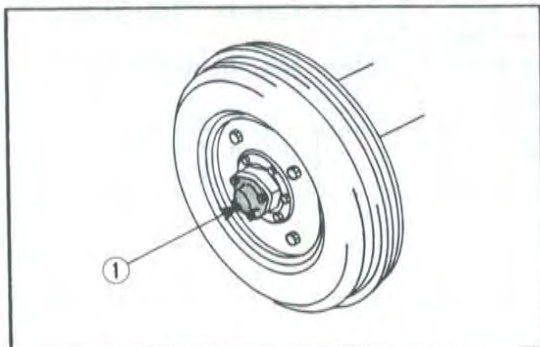


[4WD]

Power Steering Rubber Hose Check

1. Check the power steering rubber hose (1).

(1) Power Steering Rubber Hose

(7) Check Point of Every 300 Hours**Greasing for Front Wheel Hub [2WD TYPE]**

1. Detach the cover (1).
2. Apply bearing grease to the front wheel hubs.

(1) Front Wheel Hub Cover

(8) Check Points of Every 400 Hours**Magnetic Plug Cleaning [L2650GST, L2950GST, L3450GST, L3650GST]**

- See page S.G-16

Changing Transmission Fluid

- See page S.G-14, S.G-15

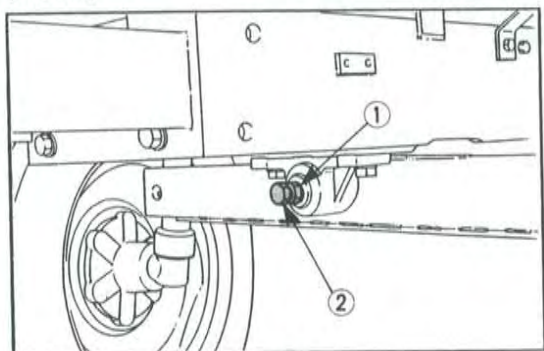
Changing Front Axle Case Oil [4WD TYPE]

- See page S.G-17

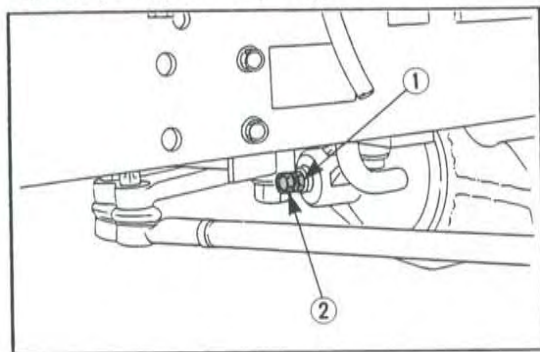
Changing Engine Oil Filter Cartridge

- See page S.G-14

[L2350]



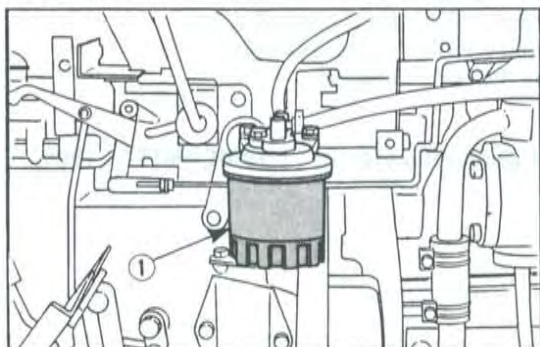
[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]

**Checking Front Axle Back-and-Forth Play**

1. Check the front axle back-and-forth play.
2. If it is not proper play, loosen the lock nut (1), tighten the adjusting screw (2) all the way, and then loosen the adjusting screw (2) by 1/6 turn.
3. Retighten the lock nut (1).

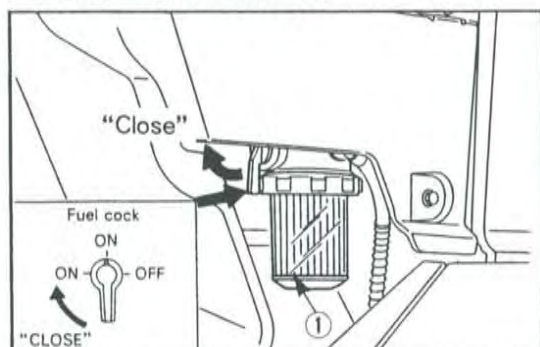
(1) Lock Nut

(2) Adjusting Screw

[L2350]**Fuel Filter Cartridge Replacement**

1. Empty the fuel out of a fuel tank.
2. Detach the filter (1) with the filter wrench.
3. Apply a slight coat of fuel to O-ring of the new filter (1).
4. Install it, and fully tighten it by hands.
5. Bleed the fuel system. (See page S.G-31)

(1) Fuel Filter

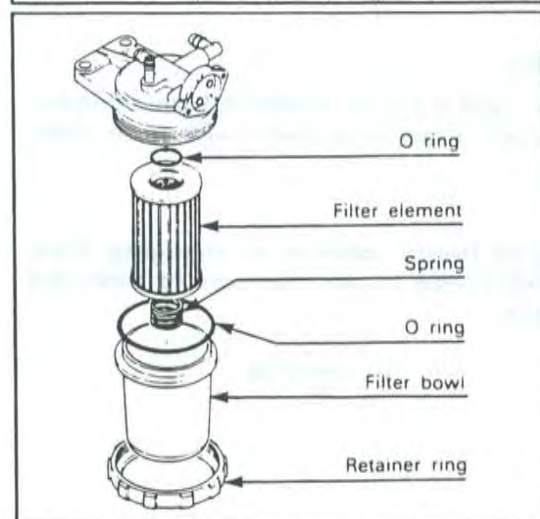
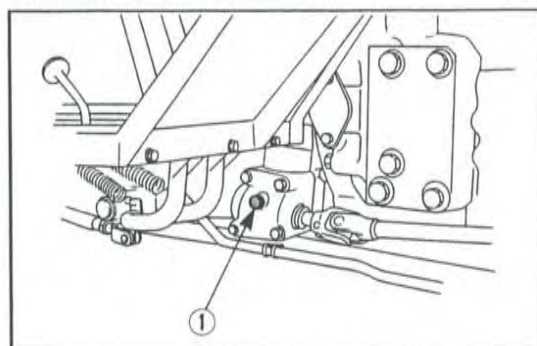
**[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]****Fuel Filter Element Replacement**

1. Close the fuel cock.
2. Unscrew the retainer ring and remove the filter bowl and clean the inside with clean fuel.
3. Take out the filter element and reinstall the new one. Reassemble the fuel filter (1).
4. Bleed the fuel line. (See page S.G-31)

■ IMPORTANT

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

(1) Fuel Filter

**[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]****Checking Steering Gear Case Oil**

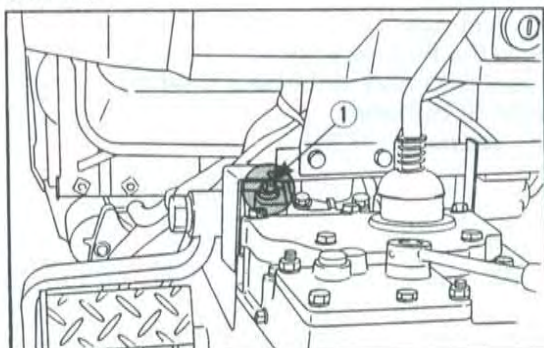
1. Remove the filling plug (1) to check the oil level. Check that the oil level reaches the rim of the filling port (1).
2. If the oil is insufficient, fill with new oil.

■ IMPORTANT

- Use only SAE weight gear oil, refer to "LUBRICANTS". (See page S.G-7)

(1) Filling Plug

[L2350]



Checking Steering Gear Box Oil

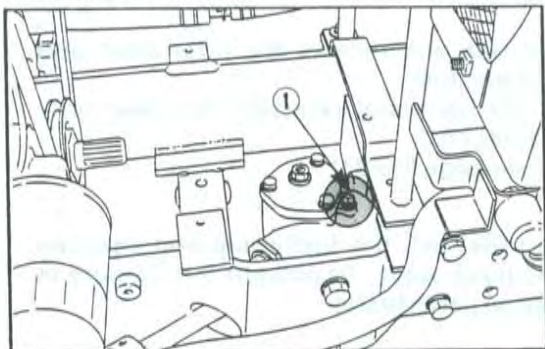
1. Remove the oil inlet plug (1) to check the oil level.
Check that the oil level reaches under inlet port.
2. If the oil is insufficient, fill with new oil.

■ IMPORTANT

- Use only SAE weight gear oil, refer to "LUBRICANTS". (See page S.G-7)

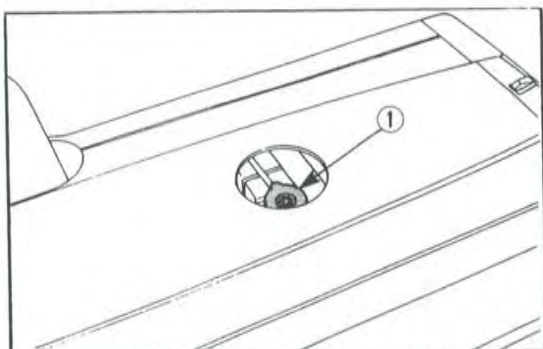
(1) Oil Inlet Plug

[L2650, L2950]



(9) Check Points of Every 800 Hours

[L2350]



Cleaning Cooling System

1. To clean the engine cooling system, KUBOTA Scale Inhibitor No. 20, or its equivalent, is recommended to effectively wash away scale build-up.

■ NOTE

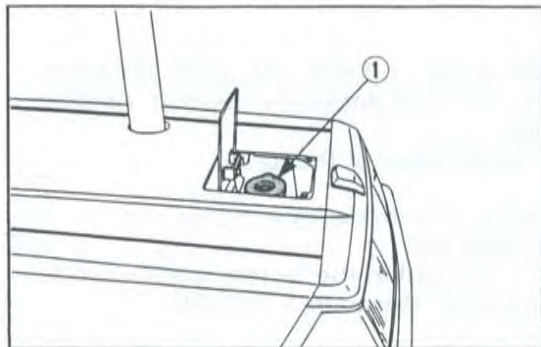
- When adding an anti-freeze solution or changing from water containing anti-freeze to pure, be sure to clean the engine cooling system.

(1) Radiator Cap

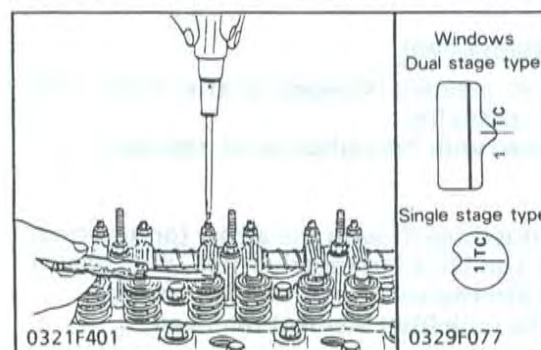
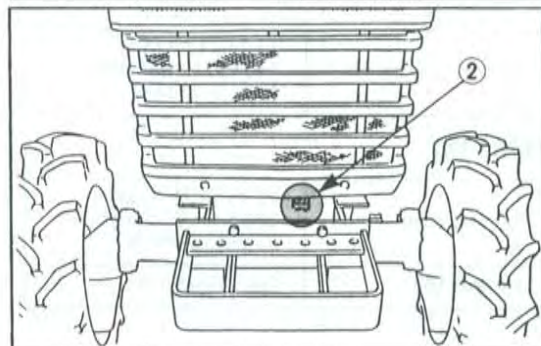
(2) Drain Plug



**[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]**



- (1) Radiator Cap
(2) Drain Plug



Checking Valve Clearance

1. Remove the cylinder head cover and the timing window cover on the flywheel housing and all glow plugs.
2. Turn the flywheel and align the 1 TC mark with the timing mark of window on the flywheel housing to position the 1st cylinder valves at the **top dead center during compression**.
3. Measure the clearance at the valves marked with O in the table below with a feeler gauge.
4. Turn the flywheel just one turn to position the 1st cylinder valves at the **top dead center during overlap**.
5. Measure the clearance at the valves marked with • in the table below with a feeler gauge.
6. If the clearance is not within the factory specifications, adjust.

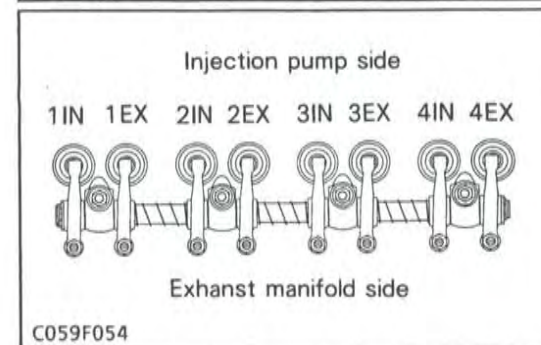
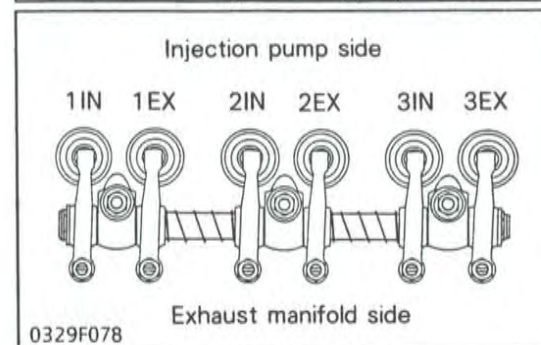
[D1102, D1402-DI, D1462-DI]

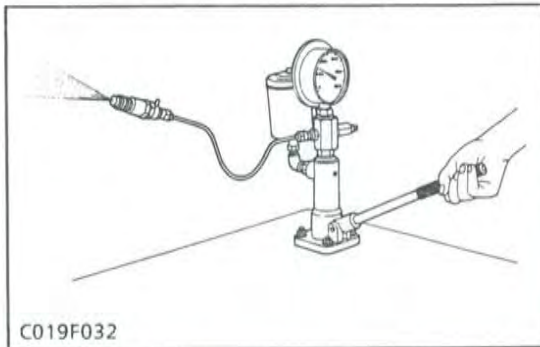
Cylinder No.	1		2		3	
Valve	IN.	EX.	IN.	EX.	IN.	EX.
Checking	O	O	•	O	O	•

[V1902-DI]

Cylinder No.	1		2		3		4	
Valve	IN.	EX.	IN.	EX.	IN.	EX.	IN.	EX.
Checking	O	O	O	•	•	O	•	•

Valve clearance IN and EX.	Factory spec	0.18 to 0.22 mm 0.0071 to 0.0087 in.
----------------------------	--------------	---





Checking Fuel Injection Nozzle Pressure

⚠ CAUTION

- Never to contact with spraying diesel fuel under pressure, which can have sufficient force penetrate the skin, causing serious personal injury.
- Be sure nobody is in the direction of the spray.

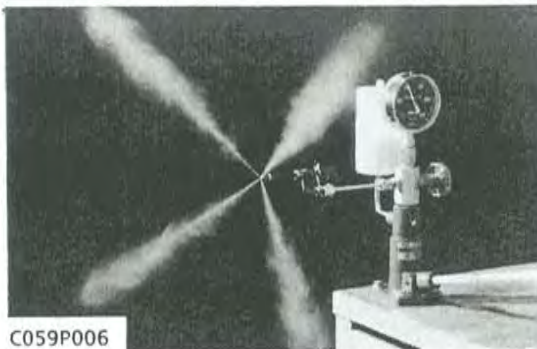
1. Set the injection nozzle to the nozzle tester firmly.
2. Measure the injection pressure.
3. If the measurement is not within the factory specifications, adjust the injection pressure. (See page S.1-45, 51)

[D1102]

Injection pressure	Factory spec.	13.7 to 14.7 MPa 140 to 150 kgf/cm ² 1990 to 2133 psi
--------------------	---------------	--

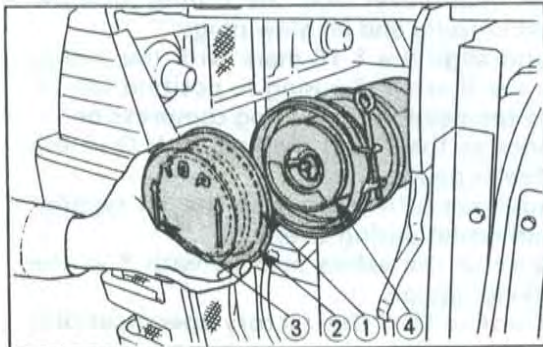
[D1402-DI, D1462-DI, V1902-DI]

Injection pressure	Factory spec.	22.41 to 23.44 MPa 228.5 to 239.0 kgf/cm ² 3250 to 3400 psi
Valve lift	Factory spec.	See page S.1-52

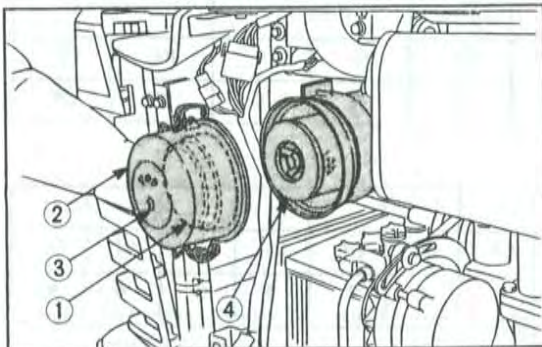


(10) Check Point of Every 1 Year

[L2350]



[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]



Air Cleaner Element Replacement

1. Replace the air cleaner element (4) yearly or after every sixth cleaning, whichever comes first.
2. If the element is stained with the carbon or oil, replace it.

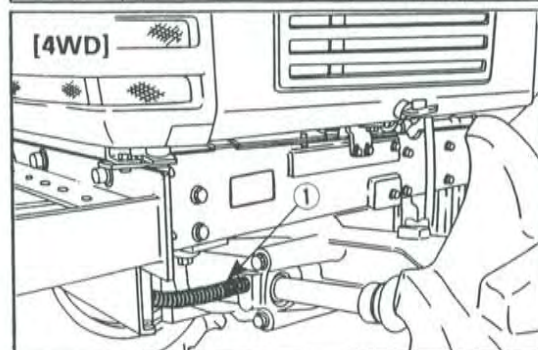
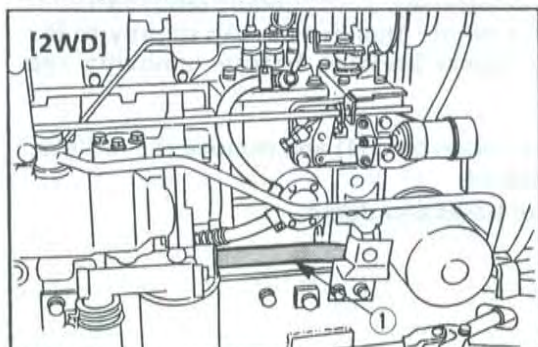
■ NOTE

- Be sure to refit the dust cup (2) with the arrow (on the rear) upright. If the dust cup (2) is improperly fitted, dust passes by the dust cup and directly adheres to the element (4).
- Do not run the engine with filter element removed.

- (1) Baffle
- (2) Dust Cup
- (3) Top Marks
- (4) Element

(11) Checking Points of Every 2 Years

[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]

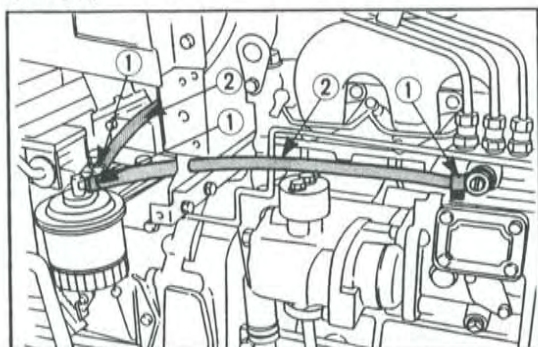


Power Steering Rubber Hose Replacement

1. Remove the power steering hose.
2. Replace the hose and clamps.
3. After replacing, bleed air of the power steering system.
(See page S.7-38)

(1) Power Steering Rubber Hose

[L2350]

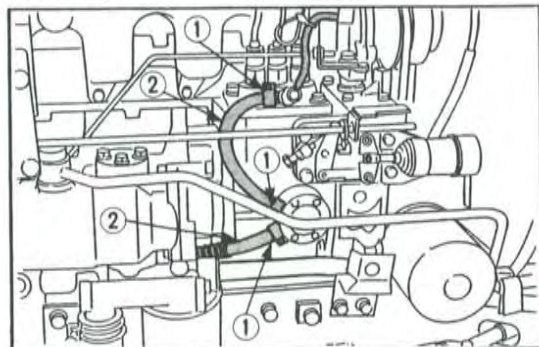


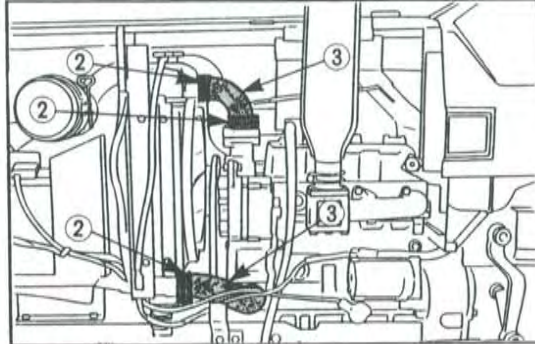
Fuel Lines Replacement

1. Empty the fuel out of a fuel tank. (L2350)
Close the fuel cock. (L2650, L2950, L3450, L3650)
2. Replace the fuel lines (1) and clamps (2).
3. Bleed the fuel lines. (See page S.G-31)

(1) Clamps
(2) Fuel Lines

[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]

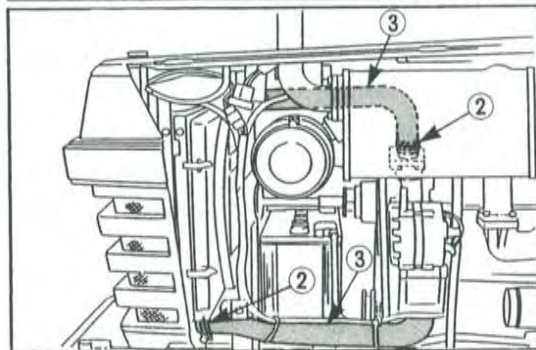
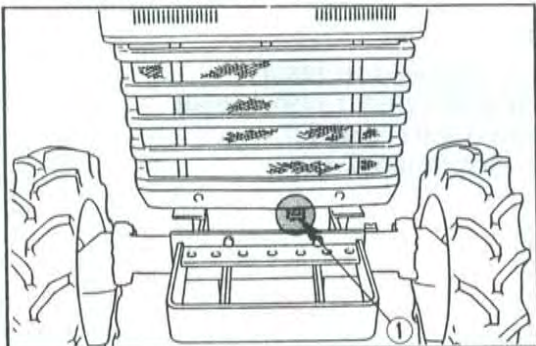


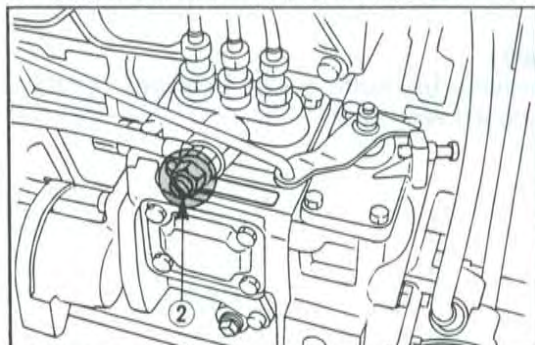
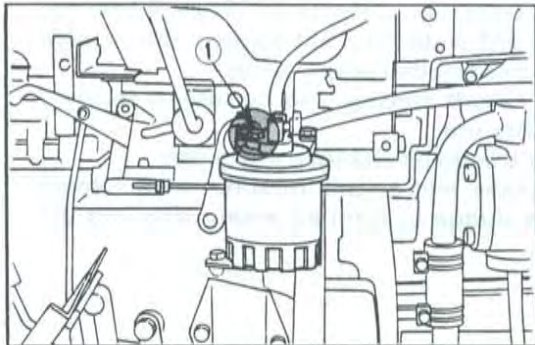
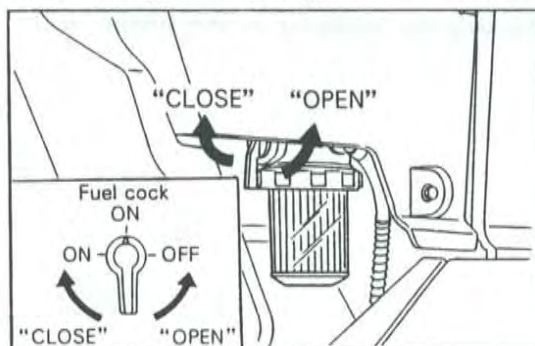
[L2350]**Radiator Hoses Replacement****⚠ CAUTION**

- Never remove the radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.

1. Remove the radiator drain plug (1) and remove the radiator cap to drain the coolant.
2. Replace the radiator hoses and clamps.

- (1) Drain Plug
(2) Clamps
(3) Radiator Hoses

**[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]**

(12) Others**[L2350]****[L2650 (GST), L2950 (GST)
L3450 (GST), L3650 (GST)]****Fuel Line Bleeding****L2350****⚠ CAUTION**

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

1. Fill the fuel to the tank.
2. Loosen the air vent plug (1) of the fuel filter two or three turns using a wrench.
3. When there are no more air bubbles in the fuel which flows out, tighten as before.
4. Loosen the air vent plug (2) of the injection pump and vent air in the same way.

■ IMPORTANT

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

(1) Air Vent Plug

(2) Air Vent Plug

L2650 (GST), L2950 (GST), L3450 (GST), L3650 (GST)

1. Fill the fuel to the tank.
2. Open the fuel cock (1).
3. Start the engine for about 1 minute, and then stop the engine.

(1) Fuel Cock

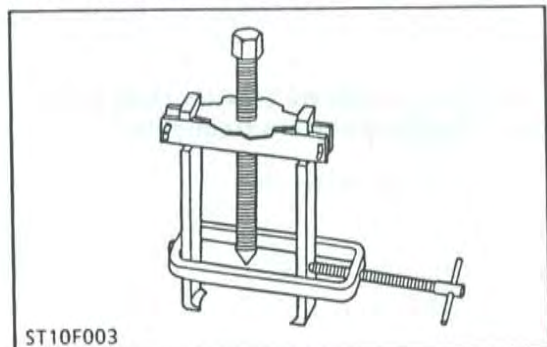
Antifreeze

If the cooling water freezes, the engine cylinder and radiator may crack. In cold weather before the temperature drops below 0°C (32°F), drain out the water or add a proper amount of antifreeze when the tractor is shut down.

- There are two types of antifreeze solutions, permanent type (PT) and semi-permanent type (SPT). For the Kubota Engine, be sure to use the permanent type.
- When antifreeze is used for the first time, fill and drain clean water two or three times so as to completely clean the inside of the radiator.

- Mix the antifreeze and the water, then pour the mixture into the radiator.
- When the cooling water mixed with antifreeze decreases due to evaporation, replenish with water only. If loss has been due to leaking, add water and antifreeze mixture with the same mix ratio as the original preparation.
- Antifreeze solutions absorb moisture, so be sure to securely close the container after use.
- Antifreeze and water should be changed every year.
- Do not use an antifreeze and a scale inhibitor at the same time. This may cause sludge to form adversely affecting the engine parts.

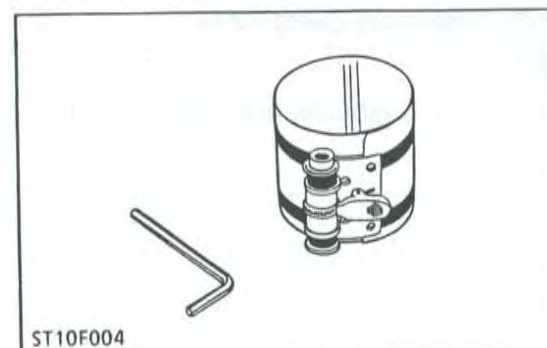
[8] SPECIAL TOOLS



Special Use Puller Set

Code No: 07916-09032

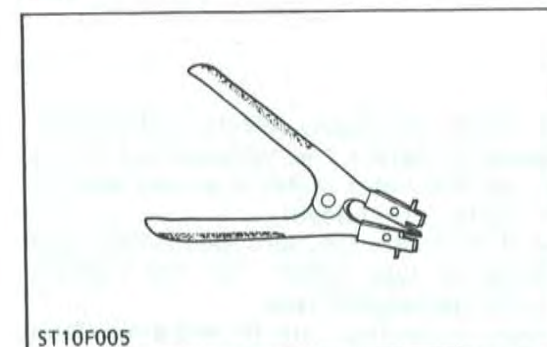
Application: Use exclusively for pulling out bearings, gears and other parts with ease.



Piston Ring Compressor

Code No: 07909-32111

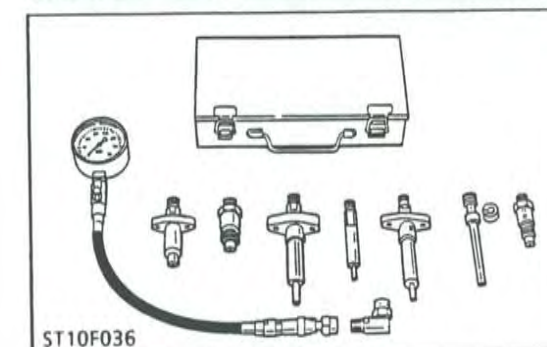
Application: Use exclusively for pushing in the piston with ease.



Piston Ring Tool

Code No: 07909-32121

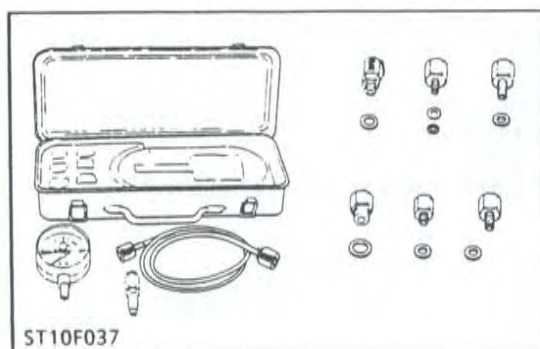
Application: Use exclusively for removing or installing the piston ring with ease.



Diesel Engine Compression Tester (Including Adaptor G)

Code No: 07909-30206 (Assembly)
 07909-30933 (A to F)
 07909-31211 (E and F)
 07909-31251 (G)
 07909-31231 (H)

Application: Use for measuring diesel engine compression pressure.



Diesel Engine Oil Pressure Tester

Code No: 07916-32032

Application: Use to measure lubricating, for all kinds of diesel engines.

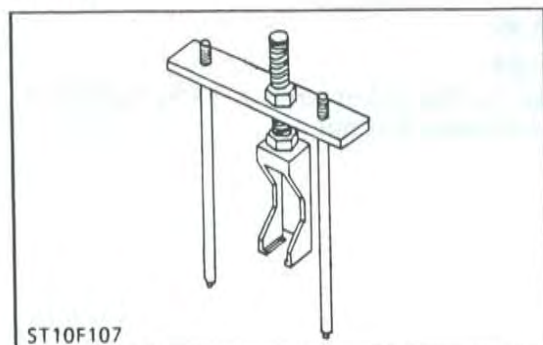


Nozzle Replacer

Code No: 07916-32721

Application: Use exclusively for pulling out pencil nozzle with ease and without damaging nozzle.

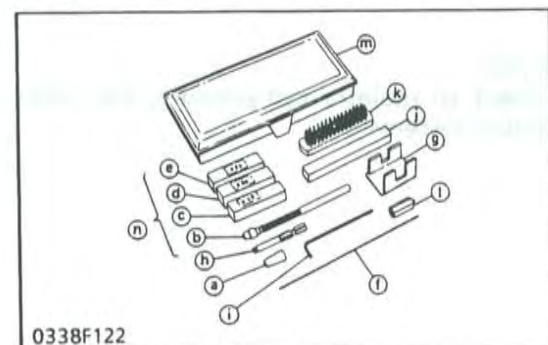
ST10P002



Nozzle Holder Puller

Code No: 07916-34061

Application: Use exclusively for pulling out pencil nozzle on condition of engine installed to tractor.



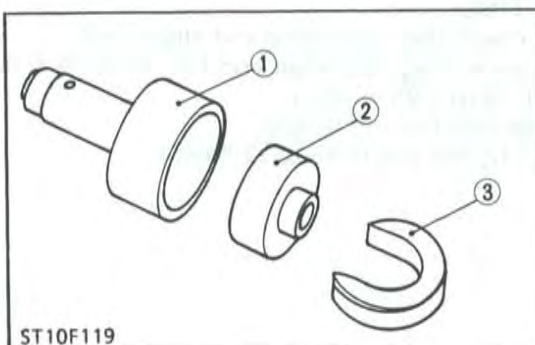
Nozzle Service Tool Kit

Code No: 07916-32881

Application: Use exclusively for overhauling a pencil nozzle of a diesel engine.

a. Carbon dam seal assembling tool (Part No. 07916-32741)
n. Cleaning wire and pin vice set (Part No. 07916-32731)

b. Pin vice	h. Needle valve retractor
c. Cleaning wire A ($\varnothing$ 0.15)	i. Hexagonal bar wrench
d. Cleaning wire B ($\varnothing$ 0.20)	j. Oil stone
e. Cleaning wire C ($\varnothing$ 0.23)	k. Nozzle cleaning brush
f. Tip scraper	l. Pressure adjusting wrench
g. Fixture	m. Housing (storage box)

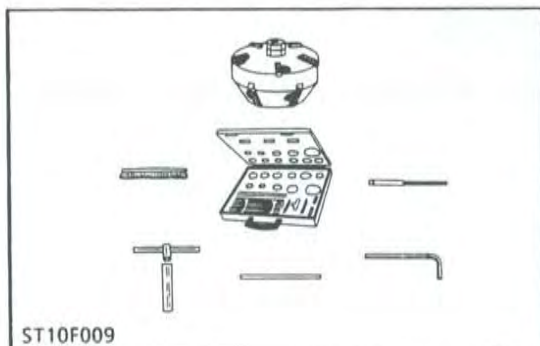


Auxiliary Socket For Fixing Crankshaft Sleeve

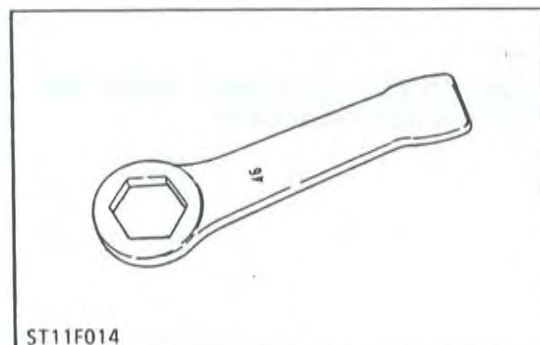
Code No: 07916-32091

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

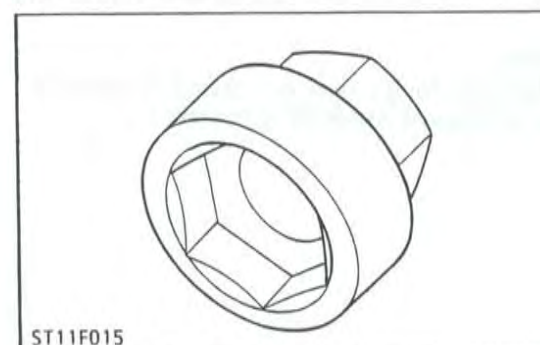
(1) Auxiliary Socket for Pushing
(2) Sleeve Guide
(3) Stopper

**Valve Seat Cutter**

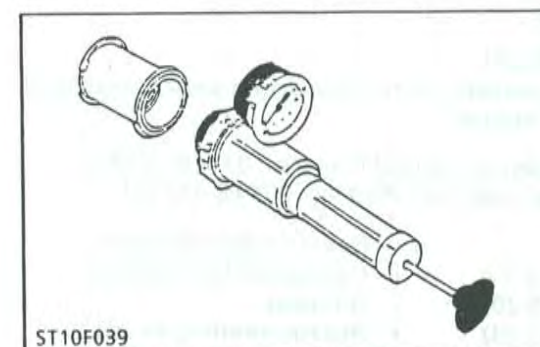
Code No: 07909-33102
 Application: Use to reseal valves.
 Angle: 0.785 rad. (45°)
 0.262 rad. (15°)
 0.523 rad. (30°) – Only 50.8 mm (2.000 in.)

**Socket Wrench 46**

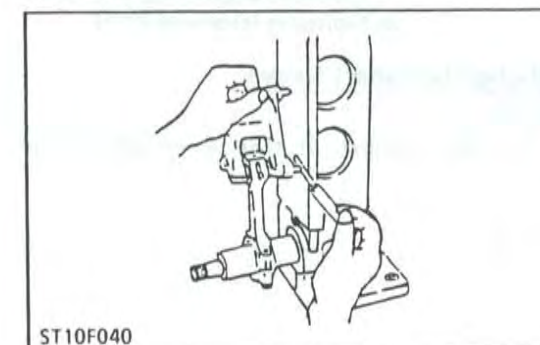
Code No: 07916-30901
 Application: Used also for the crankshaft-nut socket 46 to tighten or loosen the crankshaft nut.

**Crankshaft-Nut Socket 46**

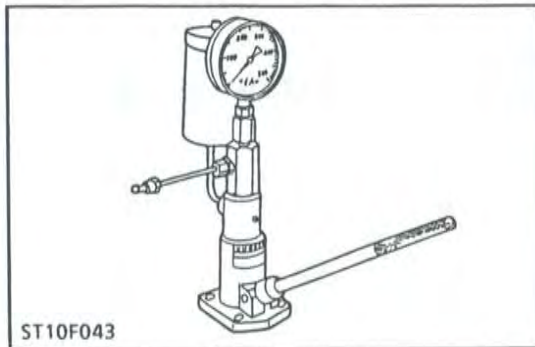
Code No: 07916-30821
 Application: Used also for the socket wrench 46 to tighten or loosen the crankshaft nut.

**Radiator Tester**

Code No: 07909-31551
 Application: Use to check of radiator cap pressure, and leaks from cooling systems.

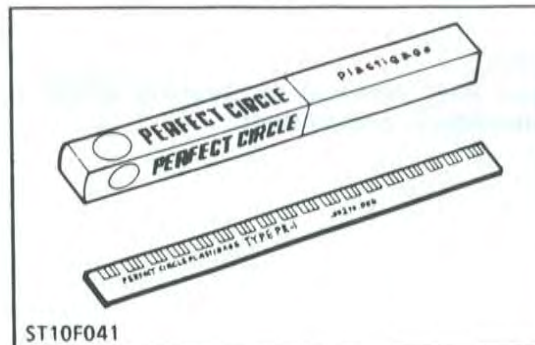
**Connecting Rod Alignment Tool**

Code No: 07909-31661
 Application: Use to check the connecting rod alignment.
 Applicable range: Connecting rod large end I.D. 30 to 75 mm
 (1.18 to 2.95 in. dia.)
 Connecting rod length
 65 to 330 mm (2.56 to 12.99 in.)

**Nozzle Tester**

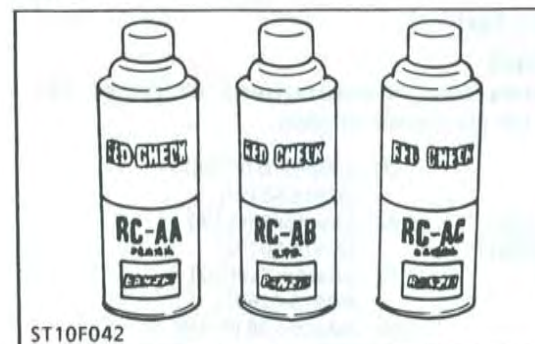
Code No: 07909-31361

Application: Use to check the fuel injection pressure and spraying condition of nozzle.

Measuring range: 0 to 49 MPa (0 to 500 kgf/cm², 0 to 7112 psi)**Press Gauge**

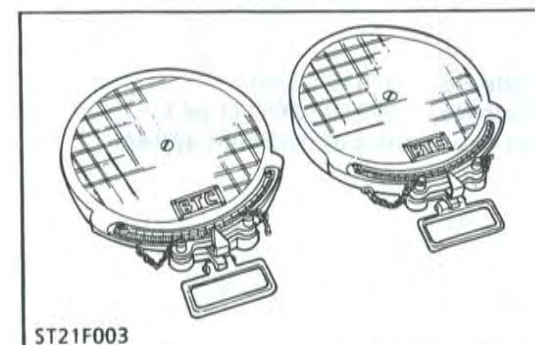
Code No: 07909-30241

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

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

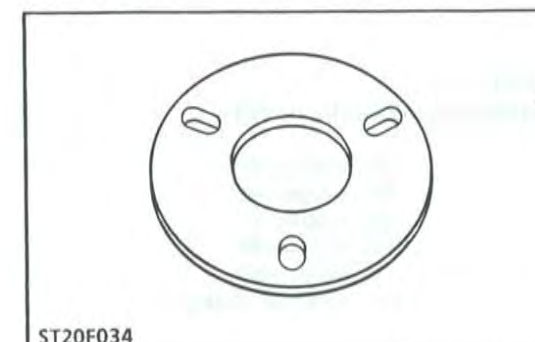
Code No: 07909-31371

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

**Turning Radius Gauge**

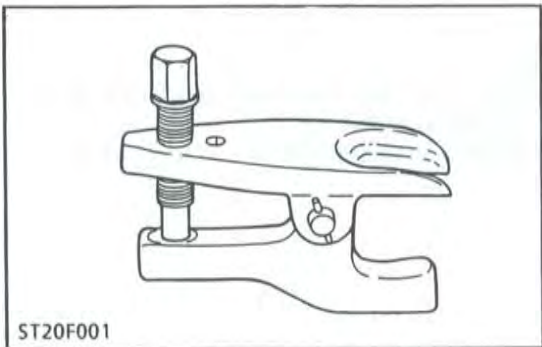
Code No: 07909-31701

Application: This allows easy measurement of steering angle for all tractor models.

**Power Steering Valve Holder**

Code No: 07916-52891

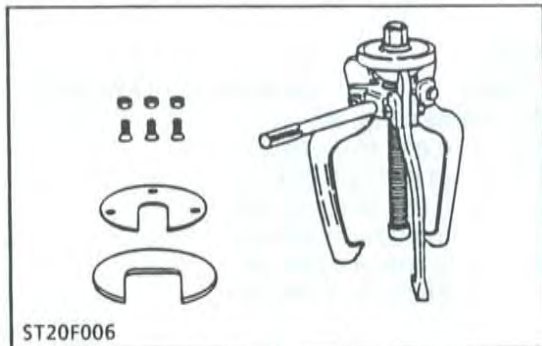
Application: Use for disassembling and assembling the power steering valve.



Tie Rod End Lifter

Code No: 07909-39021

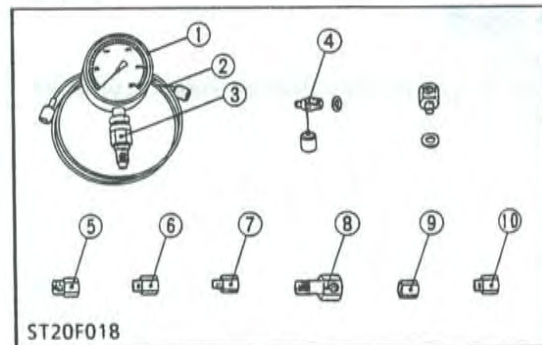
Application: This allows easy removal of tie rod end from tractor.



Steering Wheel Puller

Code No: 07916-51090

Application: This allows easy removal of steering wheel without damaging steering shaft.

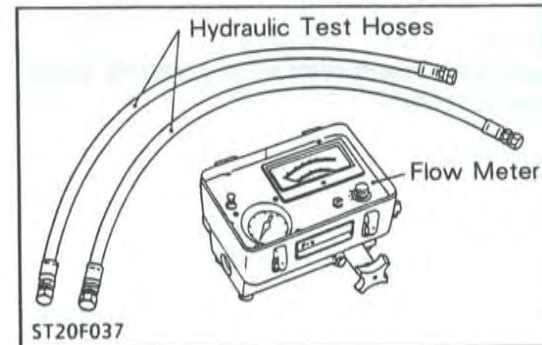


Relief Valve Set Pressure Test

Code No: 07916-50045

Application: This allows easy measurement of relief set pressure for all tractor models.

- | | |
|--|---------------------------------------|
| (1) Gauge (07916-50321) | (7) Adaptor D (PT1/8) (07916-50381) |
| (2) Cable (07916-50331) | (8) Adaptor E (PS3/8) (07916-50392) |
| (3) Threaded Joint (07916-50401) | (9) Adaptor F (PF1/2) (07916-62601) |
| (4) Threaded Joint (07916-50341) | (10) Adaptor 5B (PT1/4) (07916-52391) |
| (5) Adaptor B (M18 X P1.5) (07916-50361) | |
| (6) Adaptor C (PS3/8) (07916-50371) | |

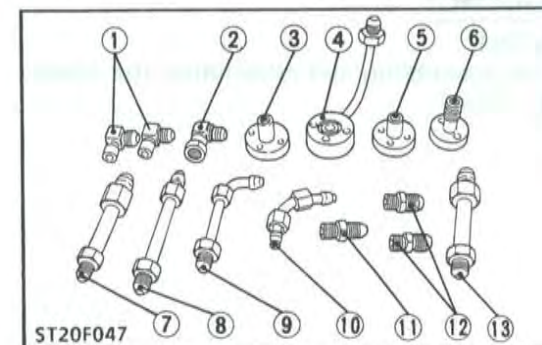


Flowmeter

Flowmeter Code No: 07916-52791

Hydraulic Test Hose Code No: 07916-52651 (1 pc.)

Application: This allows easy testing of hydraulic system.

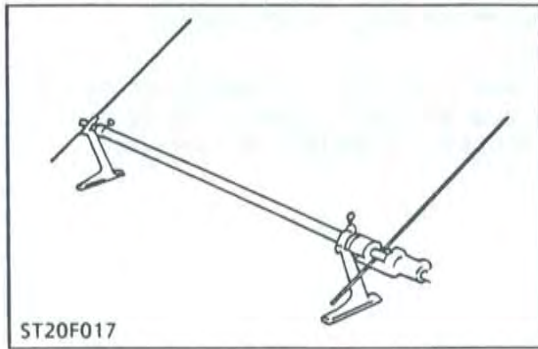


Adaptor Set

Code No: 07916-54031

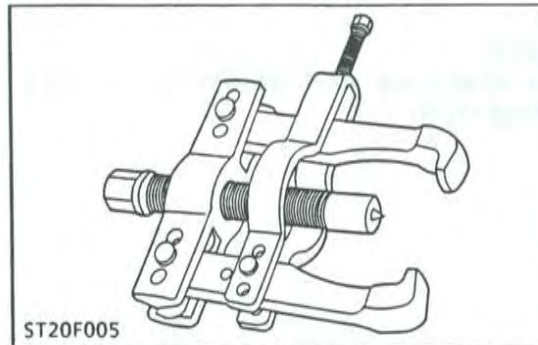
Application: Use for checking hydraulic pumps.

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

**Toe-in Gauge**

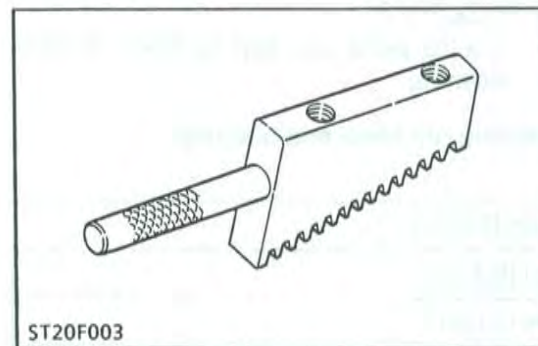
Code No: 07909-31681

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

**Pitman Arm Puller**

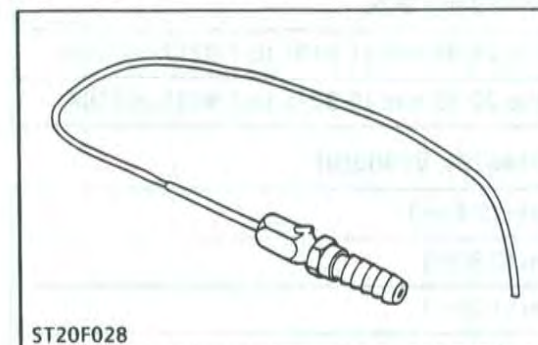
Code No: 07909-39011

Application: Use for pulling out pitman arm from steering.

**Pinion Locking Tool**

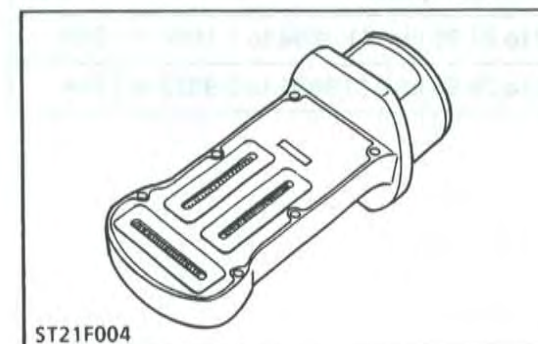
Code No: 07916-52311

Application: Use for preventing the shaft from turning when removing or tightening a spiral bevel pinion staking nut.

**Injector CH3**

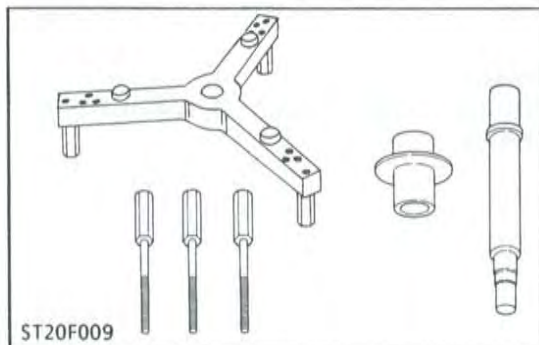
Code No: 07916-52501

Application: Use for injecting liquid (water or calcium chloride solution) into, and removing it from tires.

**Camber, Caster and King Pin Gauge**

Code No: 07909-31691

Application: This allows easy measurement of camber angle, caster angle and king pin inclination for all tractor models.

**Dual Stage Clutch Exclusive Tool (For L Series Tractor)**

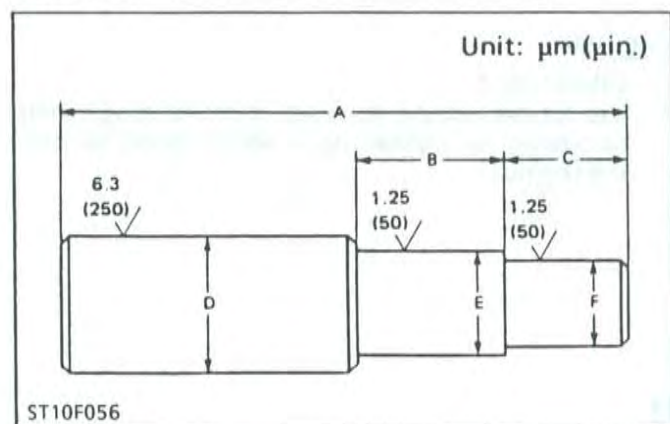
Code No: 07916-90052

Application: Use for mounting a dual stage clutch to the flywheel, and for checking and adjusting relative difference of the release lever or lever plate.

**Adaptor 72**

Code No: 07916-53791

Application: Use for checking and adjusting of GST modulating valve.

Unit: μm ($\mu\text{in.}$)**Bushing Replacing Tools**

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

(1) For connecting rod small end bushing
[D1102]

A	146 mm (5.8 in.)
B	20 mm (0.8 in.)
C	26 mm (1.0 in.)
D	30 mm (1.2 in.) DIA.
E	25.90 to 25.95 mm (1.0197 to 1.0217 in.) DIA.
F	22.90 to 22.95 mm (0.9016 to 0.9035 in.) DIA.

[D1402DI, D1462DI, V1902DI]

A	146 mm (5.8 in.)
B	20 mm (0.8 in.)
C	26 mm (1.0 in.)
D	30 mm (1.2 in.) DIA.
E	27.90 to 27.95 mm (1.0984 to 1.1004 in.) DIA.
F	24.90 to 24.95 mm (0.9803 to 0.9823 in.) DIA.

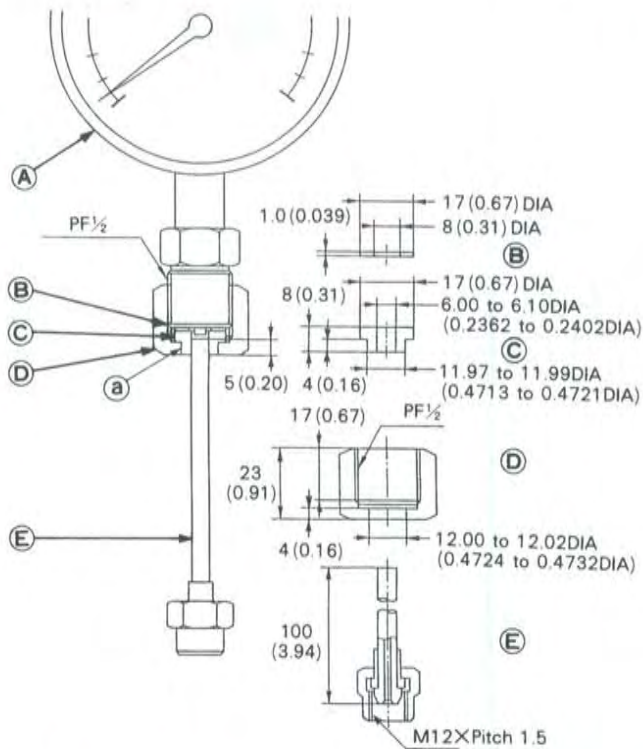
(2) For idle gear bushing
[D1102]

A	150 mm (5.9 in.)
B	30 mm (1.2 in.)
C	20 mm (0.8 in.)
D	25 mm (1.5 in.) DIA.
E	31.90 to 31.95 mm (1.256 to 1.258 in.) DIA.
F	27.80 to 27.95 mm (1.094 to 1.100 in.) DIA.

[D1402DI, D1462DI, V1902DI]

A	150 mm (5.9 in.)
B	30 mm (1.2 in.)
C	20 mm (0.8 in.)
D	38 mm (1.5 in.) DIA.
E	35.80 to 35.90 mm (1.409 to 1.413 in.) DIA.
F	31.80 to 31.90 mm (1.252 to 1.256 in.) DIA.

Unit: mm (in.)



ST10F046

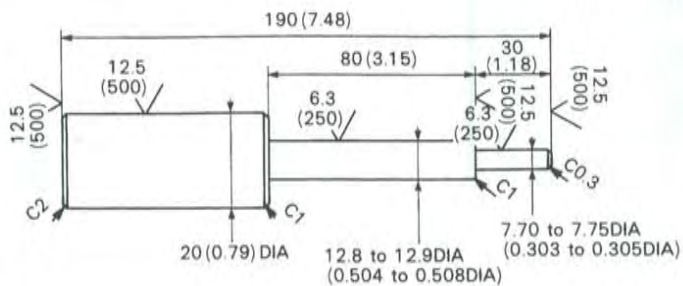
Injection Pump Pressure Tester

Application: Use to check fuel tightness of injection pumps.

(A)	Pressure gauge full scale more than 25 MPa (250 kgf/cm ² , 3500psi) and 50 MPa (500 kgf/cm ² , 7100 psi)
(B)	Gasket (copper)
(C)	Flange (steel)
(D)	Hex. nut with across the flat 25 mm (1.06 in.)
(E)	Injection pipe

(a) Apply adhesive

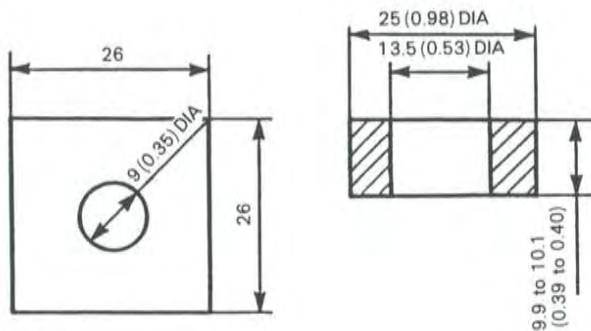
Unit : mm (in.)



ST11F301

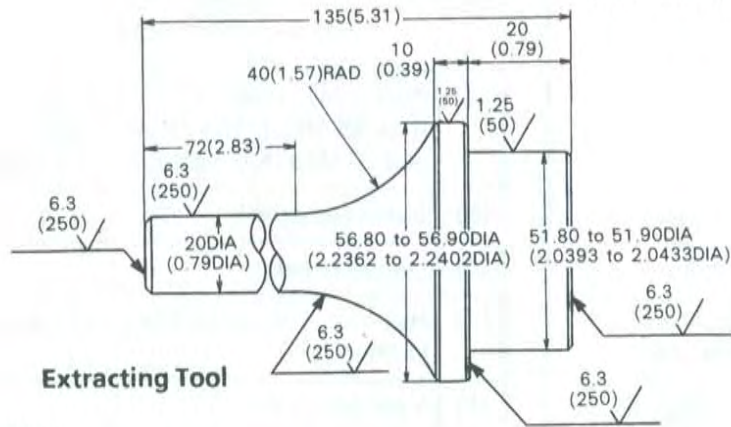
Valve Guide Replacing Tool

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

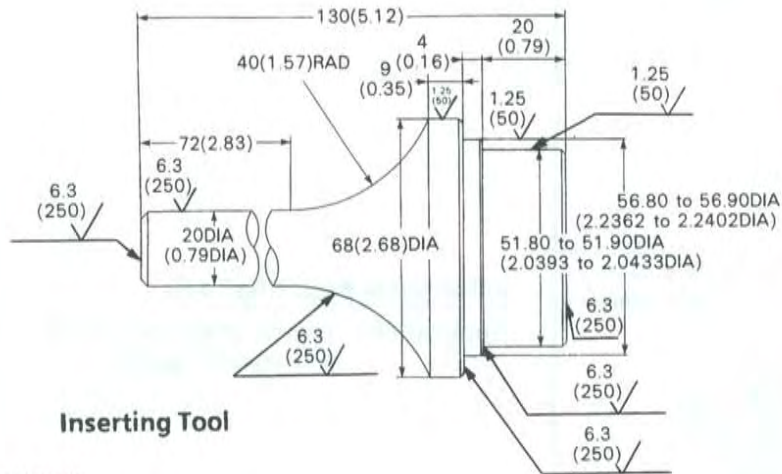


ST11F319

Unit: mm (in.)



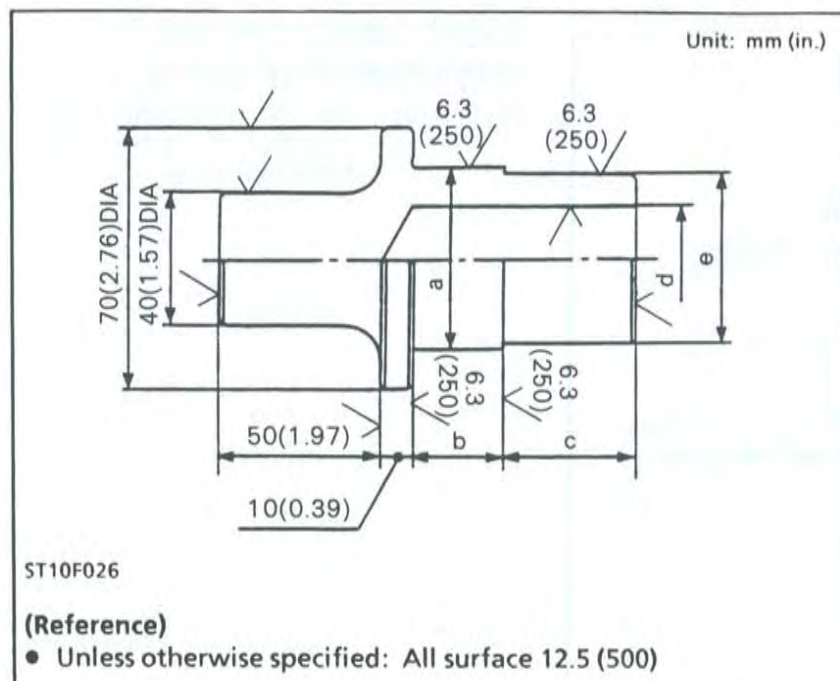
ST10F053



ST10F054

Crankshaft Bearing 1 Replacing Tool

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

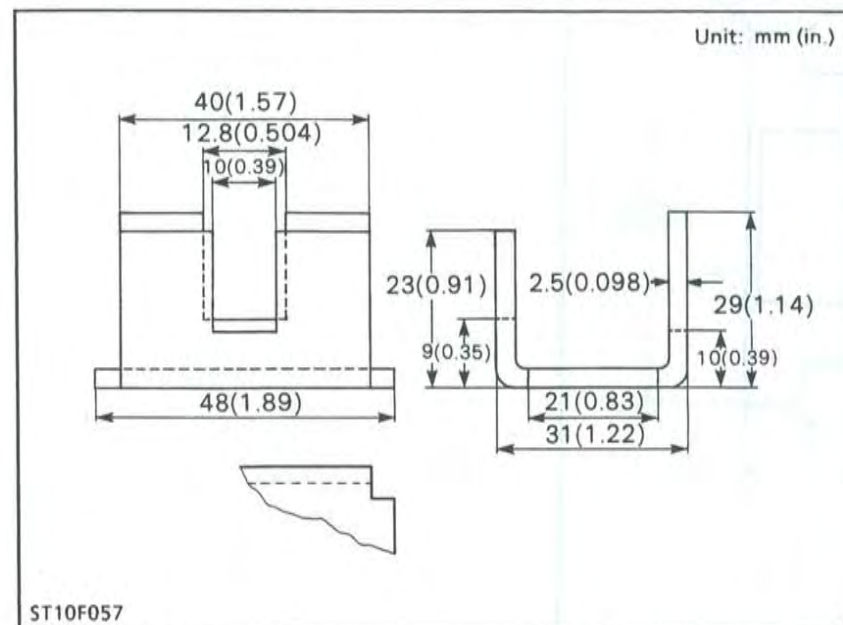


Hydraulic Arm Shaft Bushing Press-Fitting Tool

Application: Use for replacing the hydraulic arm shaft bushings in the hydraulic cylinder body.

Dimensions of hydraulic arm shaft bushing press-fitting tool.

	Right	Left
a	49.7 to 49.9 mm 1.9567 to 1.9646 in.	43.7 to 43.9 mm 1.7205 to 1.7283 in.
b	26.50 to 27.50 mm 1.0433 to 1.0827 in.	21.75 to 22.75 mm 0.8563 to 0.8957 in.
c	40 mm 1.57 in.	40 mm 1.57 in.
d	32 mm 1.26 in.	30 mm 1.18 in.
e	44.7 to 44.9 mm 1.7598 to 1.7677 in.	39.7 to 39.9 mm 1.5630 to 1.5709 in.

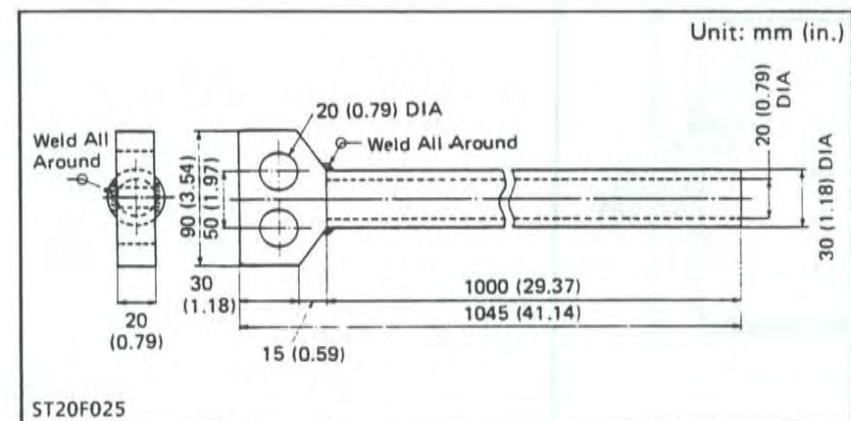


Nozzle Fixture

Application: Use to hold nozzle in it and to secure in the vise.

(Reference)

- Fixture is available from STANADYNE INC.

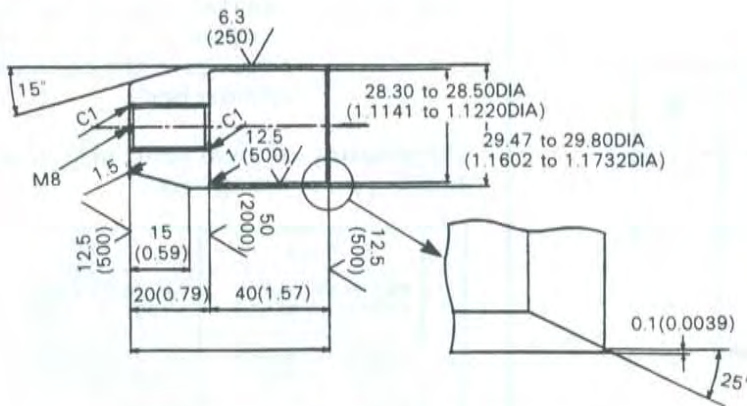


Test Bar

Application: Use for checking the lift range and floating range of hydraulic draft control.
(See page 5.8-16)

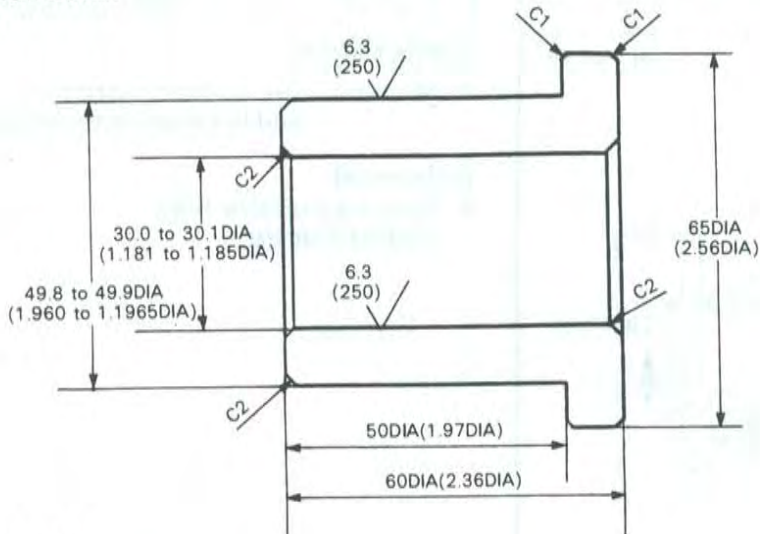
Oil Seal Guide

Unit: mm (in.)

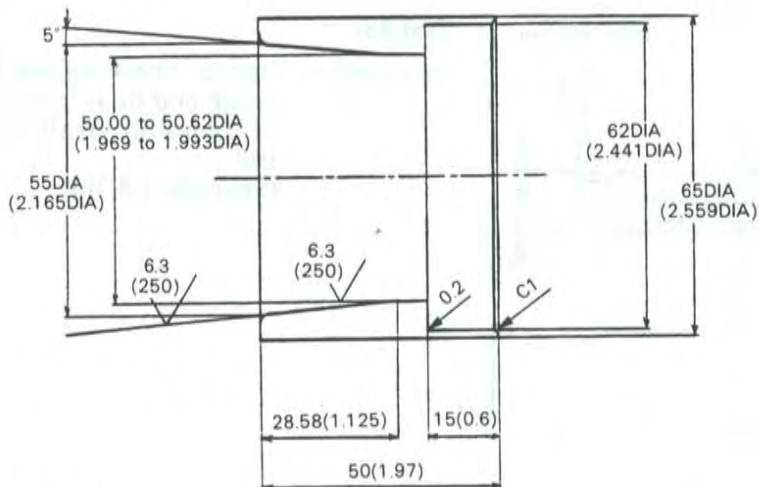
**Hydraulic Cylinder Assembling Tool****For Hydrostatic Power Steering**

Application: Use for assembling the cylinder of hydrostatic power steering.

B122F144

Rod Guide

B122F145

Cylinder Tube Guide

B122F146

S.S SEPARATION

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TIGHTENING TORQUES

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

[L2350]

Section	Item	N·m	kgf·m	ft-lbs
Front Axle	Front wheel mounting screw and nut	124 to 147	12.6 to 15.0	91.2 to 108.0
	Shaft bracket 1 (front) mounting screw	124 to 147	12.6 to 15.0	91.2 to 108.0
	Shaft bracket 2 (rear) mounting screw	103 to 117	10.5 to 12.0	76.0 to 86.8
	Front axle frame mounting screw to engine (Thread size: 10 mm, 0.39 in. DIA.)	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
	(Thread size: 12 mm, 0.47 in. DIA.)	103 to 117	10.5 to 12.0	76.0 to 86.8
Engine	Engine mounting screw and nut to clutch housing	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Clutch Housing	Clutch housing mounting nut to transmission case	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Rear Axle, Brake	Rear wheel mounting screw and nut	197 to 225	20 to 23	145 to 166
	Rear axle case mounting screw	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
	Brake case mounting screw and nut	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5
Steering	Steering wheel mounting nut	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
	Tie rod end nut	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6

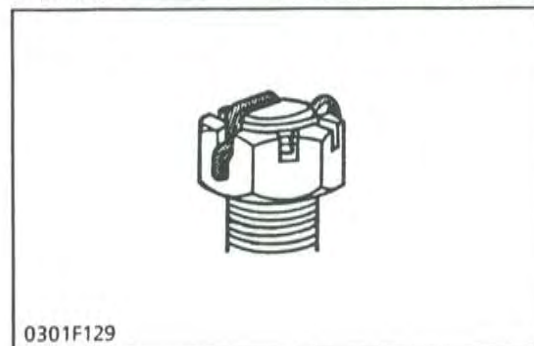
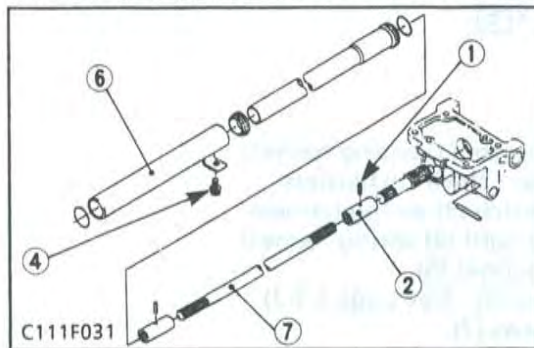
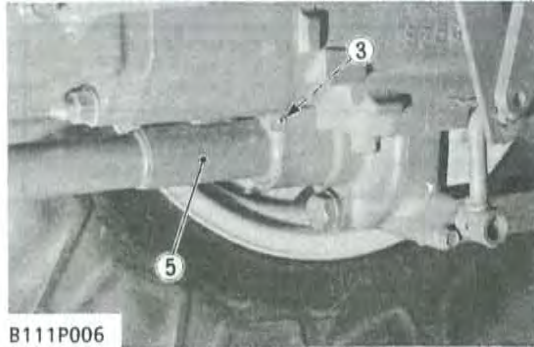
[L2650 (GST), L2950 (GST), L3450 (GST), L3650 (GST)]

Section	Item	N·m	kgf·m	ft·lbs
Front Axle	Front wheel mounting screw and nut	124 to 147	12.6 to 15.0	91.2 to 108.0
	Shaft bracket 1 (front) mounting screw	124 to 147	12.6 to 15.0	91.2 to 108.0
	Shaft bracket 2 (rear) mounting screw	103 to 117	10.5 to 12.0	76.0 to 86.8
	Front axle frame mounting screw to engine			
	(Thread size: 10 mm, 0.39 in. DIA.) (Thread size: 12 mm, 0.47 in. DIA.)	60.8 to 70.5 103 to 117	6.2 to 7.2 10.5 to 12.0	44.9 to 52.1 76.0 to 86.8
Engine	Engine mounting screw and nut to clutch housing	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Clutch Housing	Clutch housing mounting nut to mid case	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Mid Case	Mid case mounting nut to transmission case	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Rear Axle, Brake	Rear wheel mounting screw and nut	197 to 226	20 to 23	145 to 166
	Rear axle case mounting screw	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
	Rear axle case mounting nut	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
	Brake case mounting screw and nut			
	7T screw (Marked 7 on it's head) 9T screw (marked 9 on it's head) Nut	77.5 to 90.1 103 to 117 77.5 to 90.1	7.9 to 9.2 10.5 to 12.0 7.9 to 9.2	57.2 to 66.5 76.0 to 86.8 57.2 to 66.5
Rear Hitch	Drawbar frame mounting screw			
	(Thread size: 12 mm, 0.47 in. DIA.) (Thread size: 14 mm, 0.55 in. DIA.)	77.5 to 90.1 124 to 147	7.9 to 9.2 12.6 to 15.0	57.2 to 66.5 91.2 to 108.0
Steering	Steering wheel mounting nut	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
	Tie rod end nut [2WD TYPE]	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
	Steering joint shaft 3 lock screw	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
	Steering gear box mounting screw	124 to 147	12.6 to 15.0	91.2 to 108.0
	Power steering delivery pipe end eye joint screw (At steering gear box)	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
	Steering controller mounting nut	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
	Power steering hydraulic flared pipe	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
	Tie rod end nut [4WD TYPE]	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3
	Tie rod screw of cylinder rod side	98.1 to 117.7	10.0 to 12.0	72.3 to 86.8
	Steering cylinder mounting screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
	Power steering hydraulic hose	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Side Cover (GST TYPE)	Side cover mounting screw	42.2	4.3	31.1
	Hi-Lo shift spool valve mounting screw	17.7	1.8	13.0
	Gate valve mounting screw	17.7	1.8	13.0

DISASSEMBLING AND ASSEMBLING

[1] L2350

[1]-1 SEPARATING FRONT AXLE



Front Axle Case Oil [4WD TYPE]

1. Draining the front axle case oil. (See page S.G-17)

Propeller Shaft [4WD TYPE]

1. Remove the screw (4) then tap out the spring pin (3).
2. Slide the propeller shaft cover (5) to the front.
3. Tap out the spring pin (1) and slide the coupling (2) to the front.

(When reassembling)

- For assembling, slide the front coupling, too.

- | | |
|----------------|-----------------------------|
| (1) Spring Pin | (5) Propeller Shaft Cover 1 |
| (2) Coupling | (6) Propeller Shaft Cover 2 |
| (3) Spring Pin | (7) Propeller Shaft |
| (4) Screw | |

Drag Link

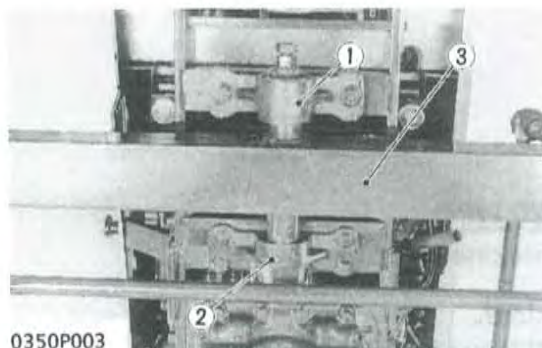
1. Remove the drag link end nut.
2. Remove the drag link end with the tie rod end lifter (Code No. 07909-39021).
3. Remove the drag link.

(When reassembling)

Tightening torque	Drag link end nut	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs
-------------------	-------------------	---

■ IMPORTANT

- After tightening the drag link end nut to the specified torque, install a cotter pin as shown in the figure left.



0350P003

Front Axle

1. Remove the front wheels.
2. Remove the shaft bracket 1 (1) mounting screws and shaft bracket 2 (2) mounting screws.
3. Take off the front axle assembly (3).

(When reassembling)

Tightening torque	Front wheel mounting screws and nuts	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108.0 ft-lbs
	Shaft bracket 1 mounting screws	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108.0 ft-lbs
	Shaft bracket 2 mounting screws	103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs

- (1) Shaft Bracket 1
(2) Shaft Bracket 2

(3) Front Axle

[1]-2 SEPARATING ENGINE FROM CLUTCH HOUSING**Propeller Shaft [4WD TYPE]**

(See page S.5-3)

Preparation 1

1. Disconnect the alternator (1) wiring harness.
2. Disconnect the starter (2) wiring harness.
3. Disconnect the oil switch (3) wiring harness.
4. Disconnect the head light (4) wiring harness.
5. Remove the upper bonnet (5).
6. Remove the drag link (6). (See page S.5-3)
7. Remove the two screws (7).

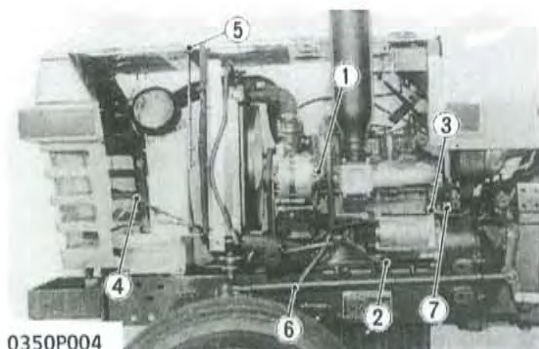
(When reassembling)

Tightening torque	Drag link end nut	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs
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■ IMPORTANT

- After tightening the drag link end nut to the specified torque, install a cotter pin as shown in the figure left.

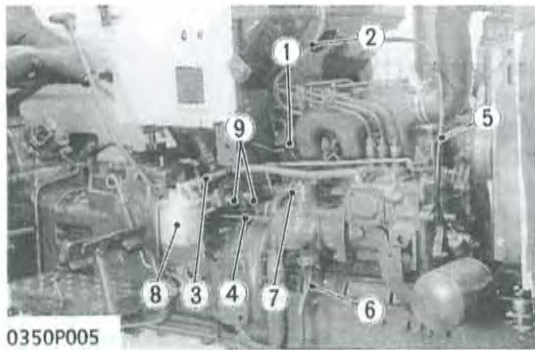
- (1) Alternator Wiring Harness (5) Upper Bonnet
(2) Starter Wiring Harness (6) Drag Link
(3) Oil Switch Wiring Harness (7) Screws
(4) Head Light Wiring Harness



0350P004



0301F129



0350P005

Preparation 2

1. Disconnect the glow plug (1) wiring harness.
2. Disconnect the return fuel pipe (2).
3. Disconnect the fuel pipe (3).
4. Remove the fuel filter (8).
5. Remove the accelerator rod (4).
6. Disconnect the flexible cable (5).
7. Remove the delivery pipe (6).
8. Remove the inlet pipe (7).
9. Remove the two screws (9).

(When reassembling)

- Be sure to install delivery pipe (6), inlet pipe (7) and the O-rings.

- | | |
|------------------------------|-------------------|
| (1) Wiring Harness Glow Plug | (6) Delivery Pipe |
| (2) Return Fuel Pipe | (7) Inlet Pipe |
| (3) Fuel Pipe | (8) Fuel Filter |
| (4) Accelerator Rod | (9) Screws |
| (5) Flexible Cable | |



0350P006

Separating Engine from Clutch Housing

1. Remove the engine mounting screws to clutch housing.
2. Separate the engine from clutch housing.

Tightening torque	Engine mounting screws and nuts to clutch housing	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
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[1]-3 SEPARATING ENGINE**Coolant**

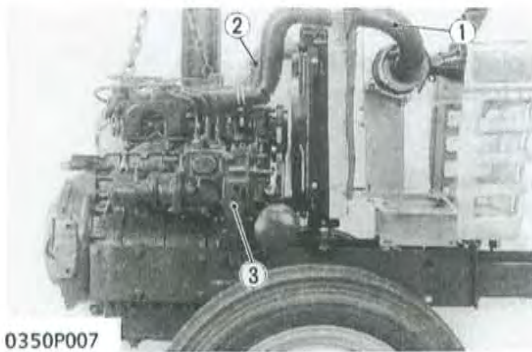
1. Draining the coolant. (See page S.G-26)

Propeller Shaft [4WD TYPE]

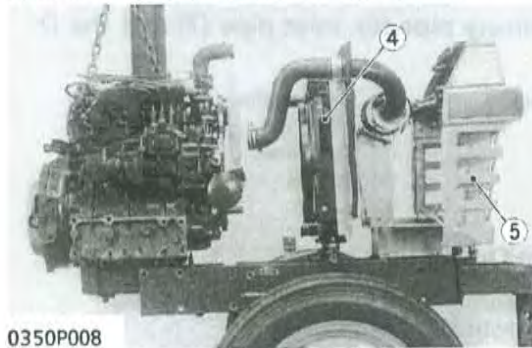
(See page S.5-3)

Separating Engine from Clutch Housing

Refer to [1]-2 SEPARATING ENGINE FROM CLUTCH HOUSING.
(See page S.5-4)



0350P007



0350P008

Front Axle Frame

1. Disconnect the air cleaner pipe (1).
2. Disconnect the radiator pipe upper (2).
3. Remove the support (3).
4. Disconnect the lower radiator pipe.
5. Remove the dipstick.
6. Remove the front axle frame mounting screws.
7. Separate the front axle frame with radiator (4) and front grille (5).

Tightening torques	Front axle frame mounting screws to engine	(Thread size: 10 mm, 0.39 in.DIA) 60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lb
		(Thread size: 10 mm, 0.39 in.DIA) 60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lb

- | | |
|-------------------------|------------------|
| (1) Air Cleaner Pipe | (4) Radiator |
| (2) Upper Radiator Pipe | (5) Front Grille |
| (3) Support | |

[1]-4 SEPARATING CLUTCH HOUSING

Transmission Fluid

1. Draining the transmission fluid. (See page S.G-14)

Propeller Shaft [4WD TYPE]

(See page S.5-3)

Preparation 1

1. Remove the panel (2) mounting screws.
2. Remove the switch board (3) mounting screws.
3. Disconnect the wiring harness for the hazard lights.
4. Remove the wiring harness retainer on the left step.
5. Remove the panel (2) and switch board (3) together.
6. Remove the steering wheel (1).

(When reassembling)

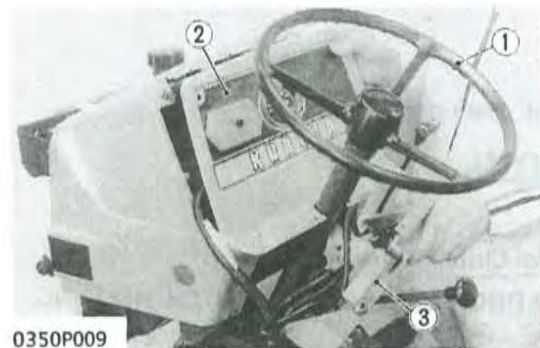
Tightening torque	Steering wheel mounting nut	29.9 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs
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- | | |
|--------------------|------------------|
| (1) Steering Wheel | (3) Switch Board |
| (2) Panel | |

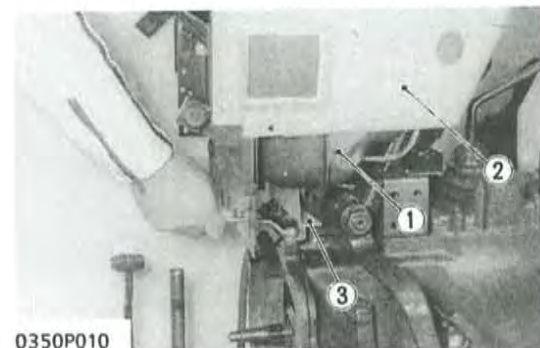
Preparation 2

1. Remove the fuel tank support (3) mounting screws.
2. Remove the fuel tank (1) with panel cover (2).

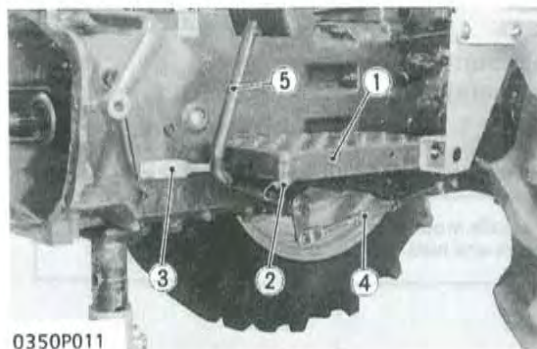
- | | |
|-----------------|------------------|
| (1) Fuel Tank | (3) Tank Support |
| (2) Panel Cover | |



0350P009



0350P010



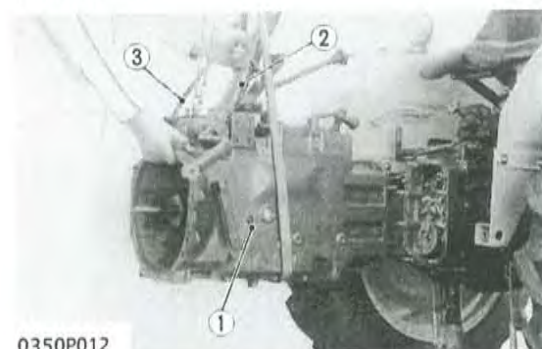
0350P011

Preparation 3:

1. Disconnect the brake rods (4) (right and left).
2. Disconnect the clutch rod (3).
3. Remove the springs (2) (right and left).
4. Remove the pedal assembly.
5. Remove the steps (1) (right and left).

- (1) Step
(2) Spring
(3) Clutch Rod

- (4) Brake Rod
(5) Clutch Pedal



0350P012

Dismounting Clutch Housing

1. Remove the hand accelerator lever assembly (3).
2. Remove the steering assembly (2).
3. Remove the power steering hydraulic pipes. [POWER STEERING TYPE]
4. Remove the clutch housing mounting nuts from the transmission case.
5. Separate the clutch housing (1) from the transmission case.

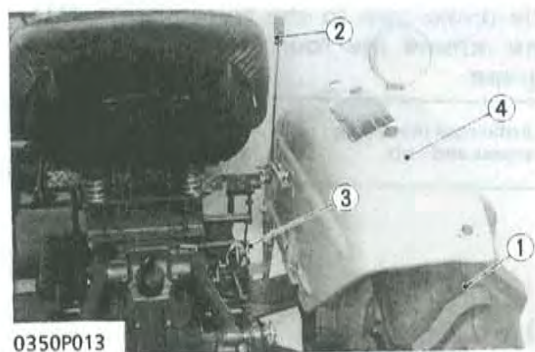
Tightening torques	Clutch housing mounting nut to transmission case	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
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- (1) Clutch Housing
(2) Steering Assembly

- (3) Hand Accelerator Lever Assembly

[1]-5 SEPARATING REAR AXLE CASE AND BRAKE CASE**Transmission Fluid**

1. Draining the transmission fluid. (See page S.G-14)



0350P013

Preparation

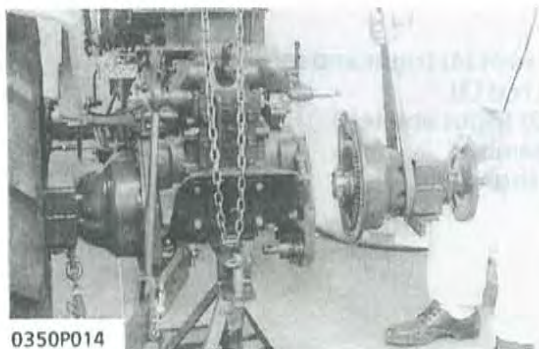
1. Remove the rear wheel (1).
2. Remove the position control lever (2).
3. Disconnect the wiring harness for the hazard lights.
4. Remove the rear fenders (4) (right and left).
5. Remove the differential lock pedal (3).
6. Remove the lower links.

(When reassembling)

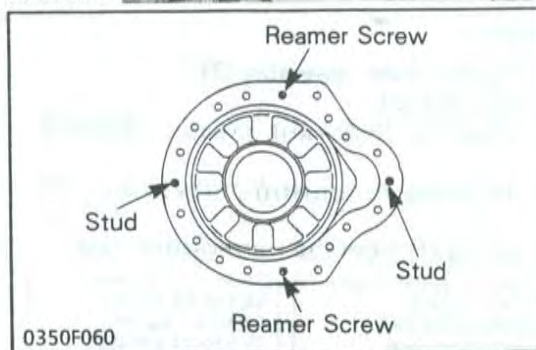
Tightening torque	Rear wheel mounting screws and nuts	197 to 225 N·m 20 to 23 kgf·m 145 to 166 ft-lbs
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- (1) Rear Wheel
(2) Position Control Lever

- (3) Differential Lock Pedal
(4) Rear Fender



0350P014



0350F060

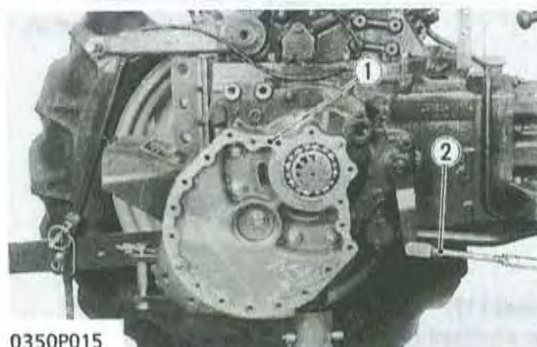
Rear Axle Case

1. Remove the rear axle mounting screws and nuts.
2. Remove the rear axle assembly.

(When reassembling)

- Tighten the reamer screws first.

Tightening torque	Rear axle mounting screws and nuts	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
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0350P015

(1) Brake Case

(2) Brake Rod

Brake Case

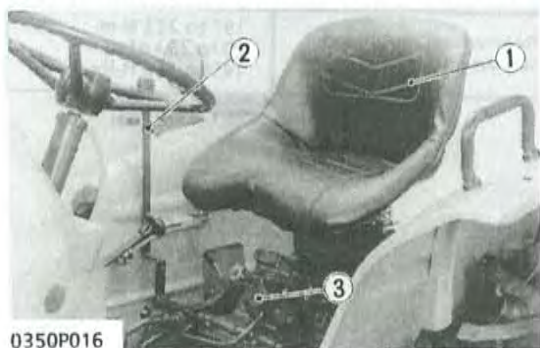
1. Disconnect the brake rod (2).
2. Remove the brake case mounting screws and nuts.
3. Remove the brake case (1).

(When reassembling)

- Apply grease to the brake ball seat. (Do not grease excessively)
- Before installing the brake case to the transmission case, install the camplate around the four protrusions on the differential bearing case.

Tightening torque	Brake case mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
-------------------	-------------------------------------	---

[1]-6 SEPARATING HYDRAULIC CYLINDER



0350P016

(1) Seat

(2) Position Control Lever

(3) Delivery Pipe

Preparation

1. Remove the seat (1) as a single unit.
2. Remove the position control lever (2).
3. Disconnect the delivery pipe (3).
4. Remove the lower link.
5. Disconnect the wiring harness on the hydraulic cylinder.
6. Remove the power steering hydraulic pipes. [POWER STEERING TYPE]



0350P017

Hydraulic Cylinder

1. Remove the hydraulic cylinder mounting screws and nuts.
2. Separate the hydraulic cylinder.

(When reassembling)

Tightening torque	Hydraulic cylinder mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
-------------------	---	---

[1]-7 SEPARATING TRANSMISSION CASE

Transmission Fluid

1. Draining the transmission fluid. (See page S.G-14)

Separating Clutch Housing

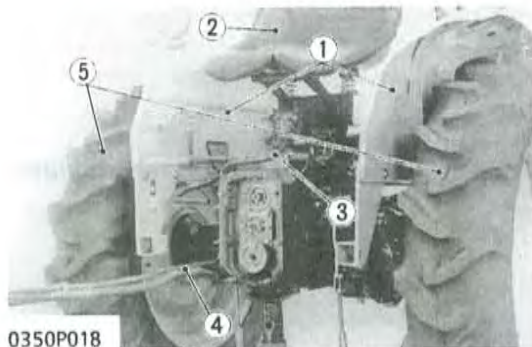
Refer to [1]-4 SEPARATING CLUTCH HOUSING (See page S.S-6)

Preparation

1. Remove the rear fenders (1).
2. Remove the seat (2).
3. Remove the delivery pipe (3).
4. Remove the inlet pipe (4).
5. Remove the rear wheels (5).

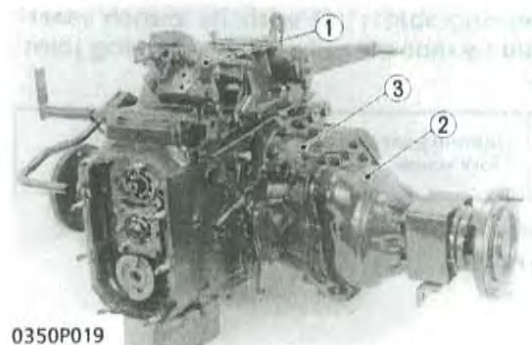
(When reassembling)

Tightening torque	Rear wheel mounting screws and nuts	197 to 225 N·m 20 to 23 kgf·m 145 to 166 ft-lbs
-------------------	-------------------------------------	---



0350P018

- | | |
|-------------------|-----------------|
| (1) Rear Fenders | (4) Inlet Pipe |
| (2) Seat | (5) Rear Wheels |
| (3) Delivery Pipe | |



0350P019

- | | |
|------------------------|----------------|
| (1) Hydraulic Cylinder | (3) Brake Case |
| (2) Rear Axle | |

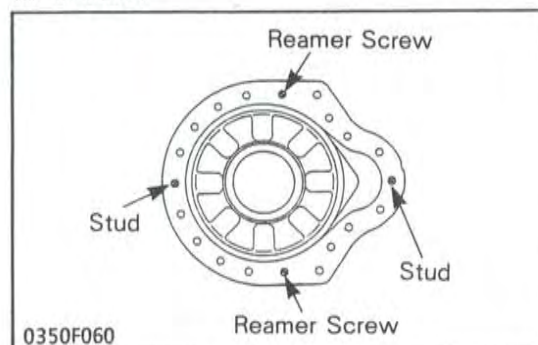
Dismounting Transmission Case

1. Remove the hydraulic cylinder (1).
2. Remove the rear axles (2).
3. Remove the brake cases (3).

(When reassembling)

- Apply grease to the brake ball seat. (Do not over grease)
- Before installing the brake case to the transmission case, install the camplate around the four protrusions on the differential bearing case.
- Tighten the reamer screws first to install the rear axles.

Tightening torques	Hydraulic cylinder mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Rear axle mounting screws and nuts	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
	Brake case mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs



0350F060

[2] L2650, L2950, L3450, L3650**[2]-1 REMOVING STEERING GEAR BOX [2WD TYPE]****Bumper and Tie Rods**

1. Remove the bumper.
2. Remove the tie rods with the tie rod end lifter (Code No: 07909-39021).

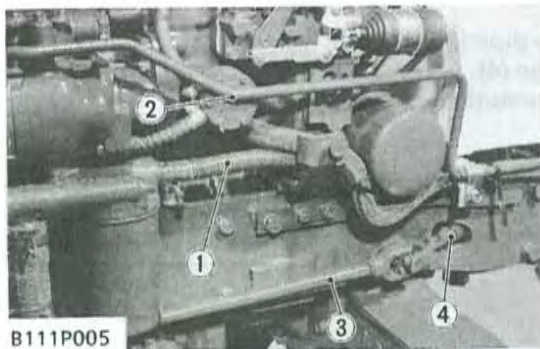
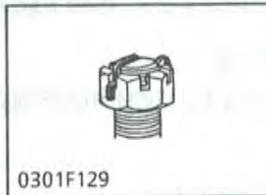
In this case, take special care not to damage the tie rod end nut (slotted nut). (It is preferable to replace it with an unrequired nut.)

(When reassembling)

Tightening torque	Tie rod end nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
-------------------	-----------------	---

■ IMPORTANT

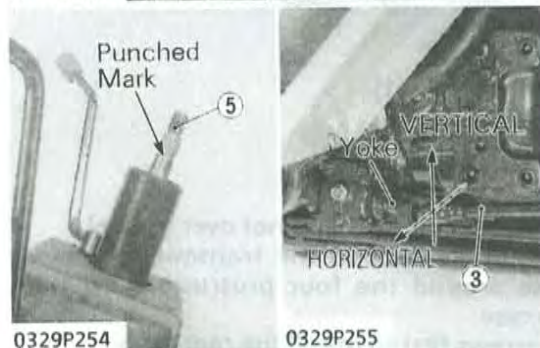
- After tightening the tie rod end nut to the specified torque, install a cotter pin as shown in the figure left.

**Preparation**

1. Remove the steering joint shaft 3 (3), 4 (4).
2. Remove the power steering delivery pipe (2) and return pipe (1).

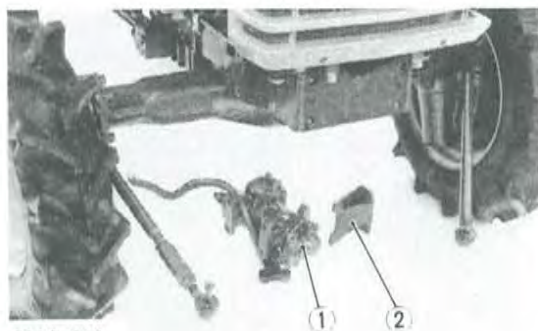
(When reassembling)

- Reassemble the steering shaft 1 (5) with its punch mark positioned on the side so that the yoke of the steering joint shaft 3 (3) is vertical.

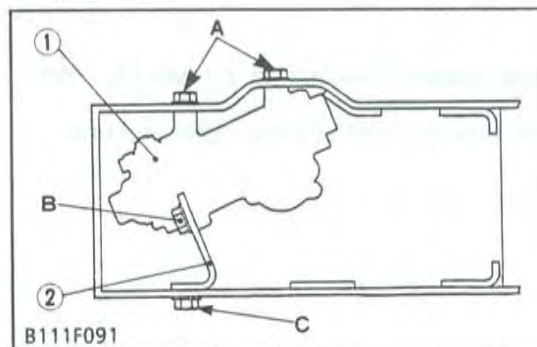


Tightening torque	Steering joint shaft 3 lock screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs
-------------------	-----------------------------------	---

- | | |
|----------------------------------|----------------------------|
| (1) Power Steering Return Pipe | (4) Steering Joint Shaft 4 |
| (2) Power Steering Delivery Pipe | (5) Steering Shaft 1 |
| (3) Steering Joint Shaft 3 | |



0329P019



B111F091

Steering Gear Box

1. Remove the steering support (2).
2. Remove the steering gear box (1).

(When reassembling)

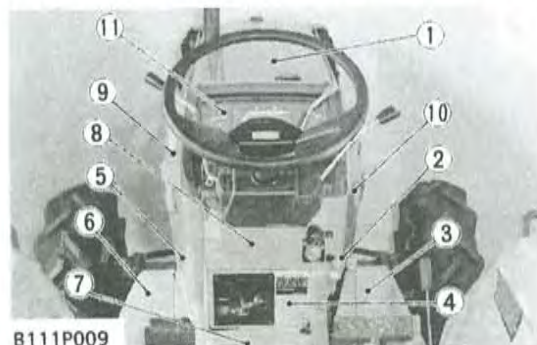
- After installing the steering gear box (1) and steering support (2) temporarily, tighten the steering gear box mounting screws to the specified torque in the order of A, C and B as illustrated on the left figure.

Tightening torque	Steering gear box mounting screws	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108.0 ft·lbs
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(1) Steering Gear Box

(2) Steering Support

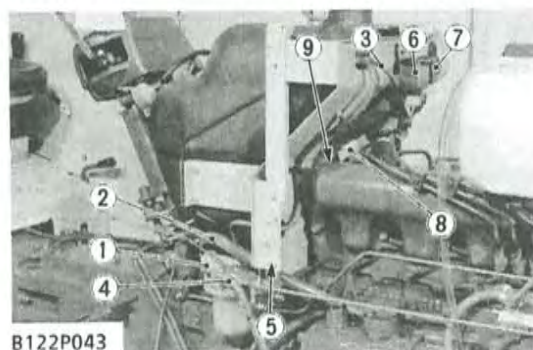
[2]-2 REMOVING STEERING CONTROLLER [4WD TYPE]



B111P009

Covers

1. Remove the side cover both side.
2. Remove the other covers (1), (2), (3), (4), (5), (6), (7), (8), (9), (10) and panel board (11).

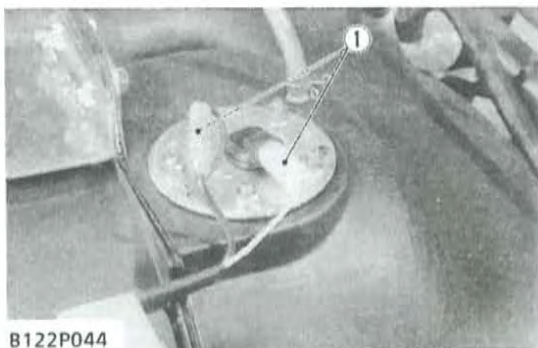


B122P043

Right Side

1. Close the fuel cock (1) on the fuel filter bracket.
2. Disconnect the fuel pipes (3), (4) from the fuel tank and the fuel filter bracket.
3. Disconnect the power steering hydraulic return hose (2) from the steering controller side.
4. Remove the engine stop rod guide mounting screw (5).
5. Disconnect the connectors from the engine key stop timer relay (6), starter relay (7), glow plug (8) and coolant temperature sensor (9).

- | | |
|--|---------------------------------|
| (1) Fuel Cock | (5) Screw |
| (2) Power Steering Hydraulic Return Hose | (6) Engine Key Stop Timer Relay |
| (3) Fuel Pipe | (7) Starter Relay |
| (4) Fuel Pipe | (8) Glow Plug |
| | (9) Coolant Temperature Sensor |

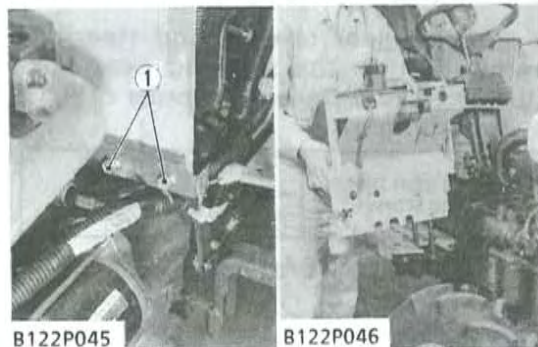


B122P044

Left Side

1. Disconnect the connectors (1) from fuel level sensor.

(1) Connectors



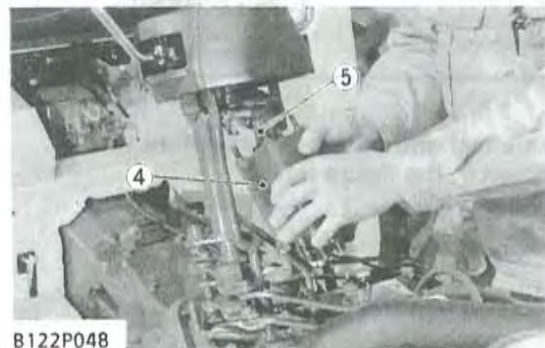
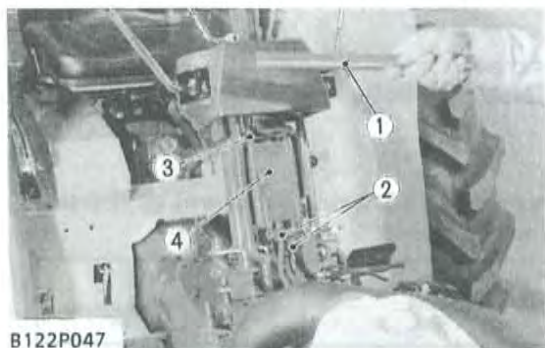
B122P045

B122P046

Fuel Tank

1. Remove the four tank support mounting screws (1) from both sides of tractor.
2. Remove the fuel tank, tank support and fuel filter as a unit.

(1) Screws



Steering Controller Assembly

1. Remove the bonnet support (1).
2. Disconnect the four power steering hydraulic flared pipes (2) from the steering controller assembly.
3. Remove the three steering controller mounting nuts (3), then remove the steering controller assembly (4) and joint shaft (5) as a unit.

(When reassembling)

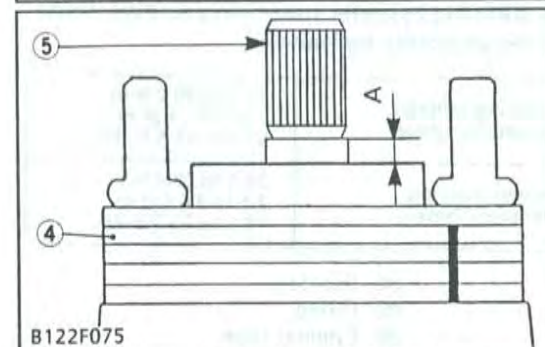
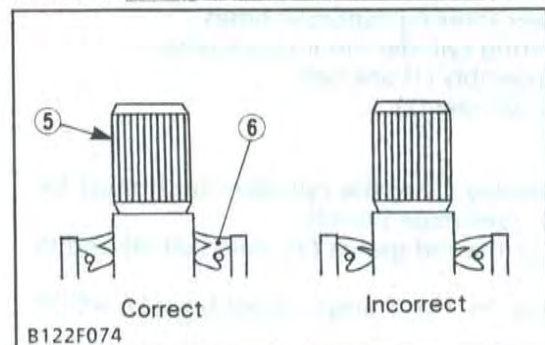
- Apply clean grease to the joint shaft (5).
- After install the joint shaft (5) to the steering controller (4), check the dust seal (6). (See figure)

■ IMPORTANT

- After install the joint shaft (5) to the steering controller (4), distance "A" is approx. 2 mm (0.08 in.). (See figure)

Tightening torques	Steering controller mounting nuts	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
	Power steering hydraulic flared pipes	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs

- | | |
|---|-------------------------|
| (1) Bonnet Support | (4) Steering Controller |
| (2) Power Steering Hydraulic Flared Pipes | (5) Joint Shaft |
| (3) Nuts | (6) Dust Seal |



[2]-3 REMOVING STEERING CYLINDER [4WD TYPE]



Front Wheels

1. Place the jack under the front bumper.
2. Remove the front wheels.

(When reassembling)

Tightening torque	Front wheel mounting screws and nuts	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108.0 ft-lbs
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Tie Rod

1. Remove the tie rod end both sides.
2. Remove the tie rod assembly both sides from the cylinder rod.

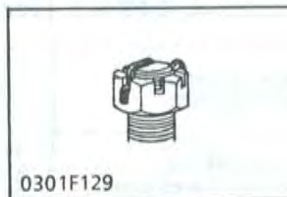
(When reassembling)

- Apply liquid lock (Three Bond 1372 or equivalent) to the tie rod screws of the cylinder rod side.

Tightening torques	Tie rod end nuts	39.2 to 45.1 N·m 4.0 to 4.6 kgf·m 28.9 to 33.3 ft-lbs
	Tie rod screws of the cylinder rod side	98.1 to 117.7 N·m 10.0 to 12.0 kgf·m 72.3 to 86.8 ft-lbs

■ IMPORTANT

- After tightening the tie rod end nut to the specified torque, install a cotter pin shown in the figure left.

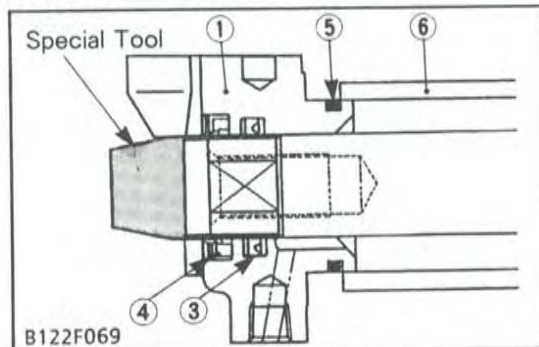


Steering Cylinder

1. Remove the two power steering hydraulic hoses.
2. Remove the four steering cylinder mounting screws.
3. Remove the flange assembly (1) one side.
4. Remove the steering cylinder (2).

(When reassembling)

- Insert the flange assembly (1) to the cylinder rod, it must be used the special tool. (See page S.G-42)
- Apply clean grease to the rod gasket (3), dust seal (4) and O ring (5).
- Do not spin or drive in the flange assembly (1) while installing.
- After tightening the steering cylinder mounting screws, must be check the rod moves smoothly by hand.

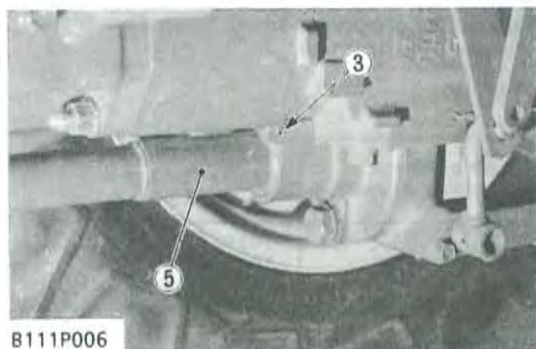


Tightening torques	Steering cylinder mounting screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Power steering hydraulic hoses	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs

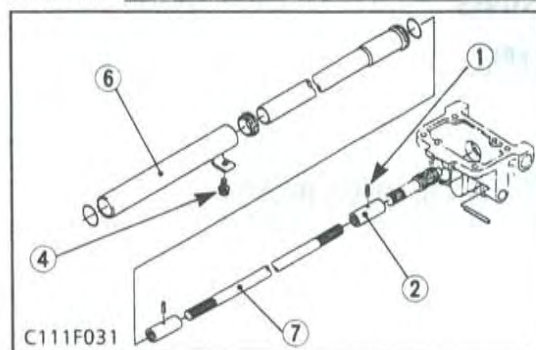
- (1) Flange Assembly
(2) Steering Cylinder
(3) Rod Gasket

- (4) Dust Seal
(5) O-ring
(6) Cylinder Tube

[2]-4 SEPARATING FRONT AXLE



B111P006



C111F031

Front Axle Case Oil

1. Draining the front axle case oil. (See page S.G-17)

Propeller Shaft [4WD type]

1. Remove the screws (4) then tap out the spring pin (3).
2. Slide the propeller shaft cover (5) to the front.
3. Tap out the spring pin (1) and slide the coupling (2) to the front.

(When reassembling)

- For assembling, slide the front coupling, too.

- | | |
|----------------|-----------------------------|
| (1) Spring Pin | (5) Propeller Shaft Cover 1 |
| (2) Coupling | (6) Propeller Shaft Cover 2 |
| (3) Spring Pin | (7) Propeller Shaft |
| (4) Screw | |

Bumper and Tie Rods [2WD TYPE]

1. Remove the bumper and tie rods. (See page S.S-10)

Bumper and Power Steering Hydraulic Hoses [4WD TYPE]

1. Remove the bumper and power steering hydraulic hoses. (See page S.S-14)



B111P007

Front Wheels

1. Place disassembly stand under the front axle, and support it with a jack.
2. Remove the front wheels.

(When reassembling)

Tightening torque	Front wheel mounting screws and nuts	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108.0 ft·lbs
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Front Axle

1. Place disassembly stand under the clutch housing, and support it with a jack.
2. Remove the shaft bracket 1 mounting screws and shaft bracket 2 mounting screws.
3. Separate the front axle with propeller shaft from the front axle frame.

(When reassembling)

Tightening torques	Shaft bracket 1 mounting screws	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108.0 ft-lbs
	Shaft bracket 2 mounting screws	103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs

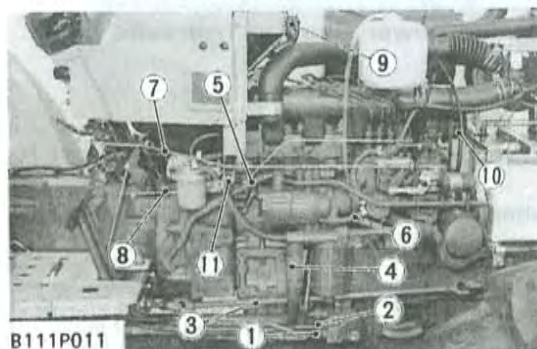
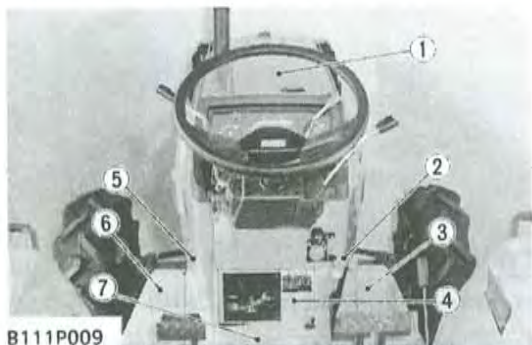
[2]-5 SEPARATING ENGINE FROM CLUTCH HOUSING

Propeller Shaft [4WD TYPE]

(See page S.5-15)

Covers

1. Remove the covers (1), (2), (3), (4), (5), (6), (7).



Right Side [2WD TYPE]

Remove the following parts.

- | | |
|-------------------|---------------------|
| (1) Delivery Pipe | (7) Stop Rod |
| (2) Return Pipe | (8) Accelerator Rod |
| (3) Joint Shaft | (9) Pipe |
| (4) Rubber Pipe | (10) Flexible Cable |
| (5) Pipe | (11) Screws |
| (6) Fuel Pipe | |

(When reassembling)

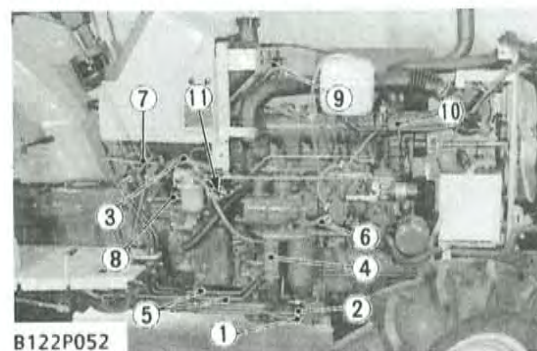
- Pay attention to steering joint arrangement. (See page S.5-10)

Tightening torque	Steering joint shaft 3 lock screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs
-------------------	--------------------------------------	---

Right Side [4WD TYPE]

Remove the following parts.

- | | |
|------------------------------------|---------------------|
| (1) Delivery Pipe | (7) Stop Rod |
| (2) Return Pipe | (8) Accelerator Rod |
| (3) Power Steering Return Hose | (9) Pipe |
| (4) Rubber Pipe | (10) Flexible Cable |
| (5) Power Steering Hydraulic Pipes | (11) Screws |
| (6) Fuel Pipe | |



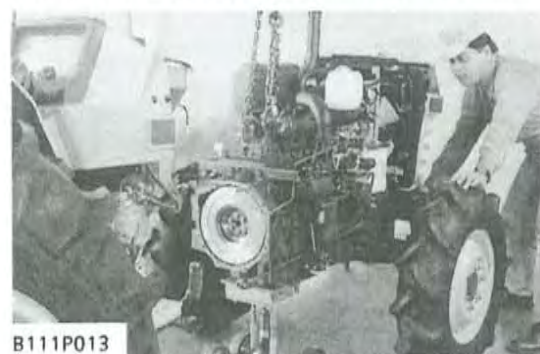


B111P012

Left Side

Remove the following parts.

- | | |
|------------------|-------------------|
| (1) 1P Connector | (3) 16P Connector |
| (2) 2P Connector | (4) Screws |



B111P013

Separating Engine

1. Place disassembly stand under the engine and clutch housing, and support them with jacks.
2. Remove the engine mounting screws and nuts.
3. Separate the engine from the clutch housing.

(When reassembling)

- Apply grease to splines.
- Apply liquid gasket (Three Bond 1104 or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine mounting screws and nuts to clutch housing	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs
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[2]-6 SEPARATING ENGINE**Coolant**

1. Draining the coolant. (See page S.G-27)

Propeller Shaft [4WD TYPE]

(See page S.S-15)

Covers

(See page S.S-16)

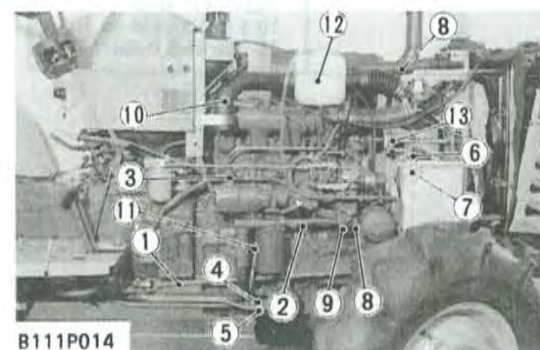
Right Side [2WD TYPE]

Remove the following parts.

- | | |
|------------------------|--------------------|
| (1) Joint Shaft | (8) Radiator Hoses |
| (2) P.S. Return Pipe | (9) Stay |
| (3) P.S. Delivery Pipe | (10) Pipe |
| (4) Return Pipe | (11) Pipe |
| (5) Delivery Pipe | (12) Reserve Tank |
| (6) Negative Terminal | (13) Fan Joint |
| (7) 1P Connector | |

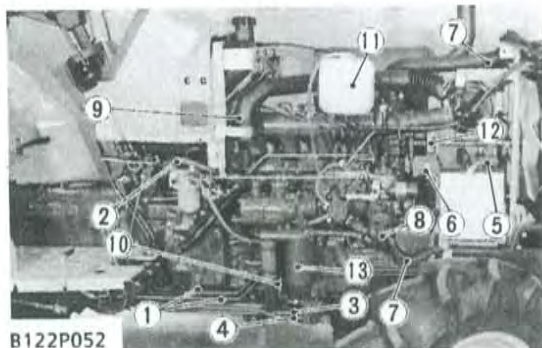
(When reassembling)

- Pay attention to steering joint arrangement. (See page S.S-10)



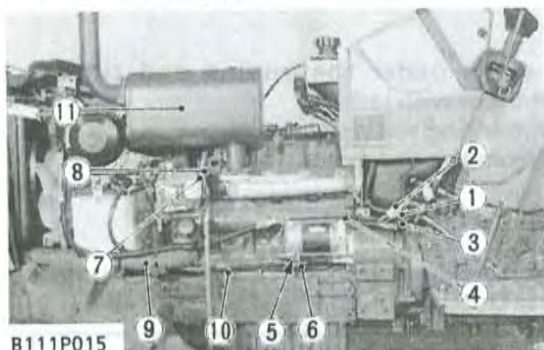
B111P014

Tightening torque	Steering joint shaft 3 lock screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft·lbs
-------------------	--------------------------------------	---

**Right Side [4WD TYPE]**

Remove the following parts.

- | | |
|------------------------------------|-----------------------|
| (1) Power Steering Hydraulic Pipes | (8) Stay |
| (2) Power Steering Return Hose | (9) Pipe |
| (3) Return Pipe | (10) Pipe |
| (4) Delivery Pipe | (11) Reserve Tank |
| (5) Negative Terminal | (12) Fan Joint |
| (6) 1P Connector | (13) Hydraulic Filter |
| (7) Radiator Hoses | |

**Left Side**

Remove the following parts.

- | | |
|-------------------|-------------------|
| (1) 1P Connector | (7) 2P Connector |
| (2) 2P Connector | (8) B Terminal |
| (3) 16P Connector | (9) Radiator Hose |
| (4) Jumper Lead | (10) Level Gauge |
| (5) S.Terminal | (11) Muffler |
| (6) B Terminal | |

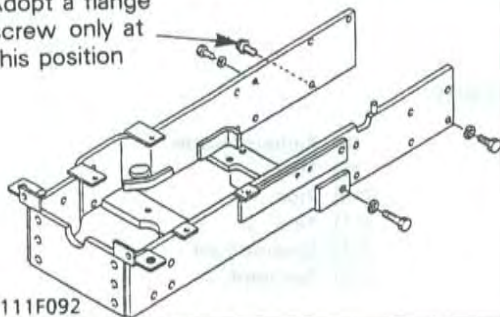
**Front Axle Flame**

1. Place disassembly stand under the clutch housing, and support it with jack.
2. Remove the front axle frame mounting screws.
3. Separate the front axle frame from engine.

(When reassembling)

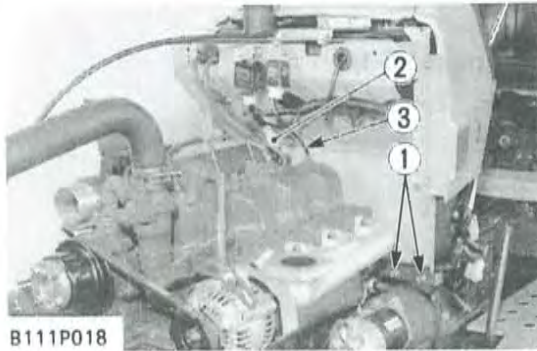
Tightening torques	Front axle frame mounting screws to engine	(Thread size: 10 mm, 0.39 in. DIA.) 60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
		(Thread size: 12 mm, 0.47 in. DIA.) 103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs

Adopt a flange screw only at this position

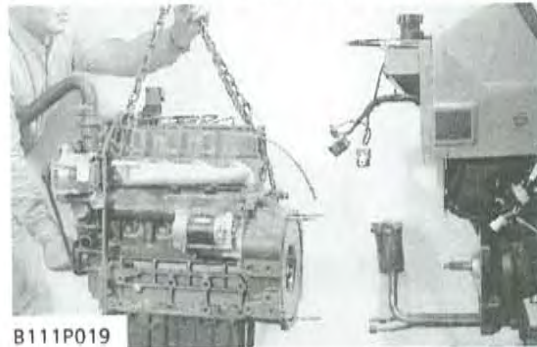
**Right Side**

Remove the following parts.

- | | |
|---------------------|--------------------|
| (1) Stop Rod | (5) Filter Bracket |
| (2) Accelerator Rod | (6) Pipe |
| (3) Flexible Cable | (7) Screws |
| (4) Fuel Pipe | |



B111P018



B111P019

Left Side

Remove the following parts.

- (1) Screws
- (2) 1P Connector
- (3) Jumper Lead

Engine

1. Connect the lift chain to the engine hooks, and hoist the engine.
2. Remove the engine mounting screws and nuts.
3. Separate the engine from the clutch housing.

(When reassembling)

- Apply grease to splines.
- Apply liquid gasket (Three bond 1104 or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine mounting screws and nuts	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
-------------------	---------------------------------	---

[2]-7 SEPARATING CLUTCH HOUSING AND MID CASE

Transmission Fluid

1. Draining the transmission fluid. (See page S.G-15)

Propeller Shaft [4WD TYPE]

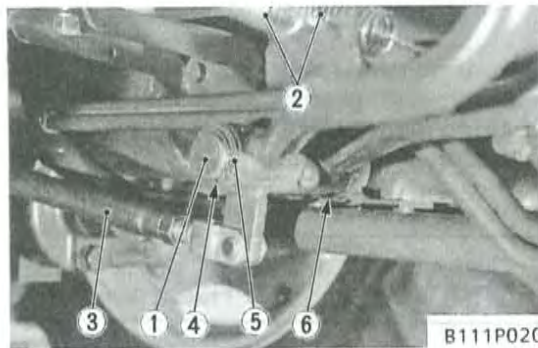
(See page S.S-15)

Brake Pedals and Clutch Pedal

1. Remove the clevis pins at the end of brake rods (3) and the clevis pin at the end of clutch rod.
2. Remove the brake pedal return springs (2) and clutch pedal return spring.
3. Tap out the spring pin (6) in the brake pedal LH.
4. Remove the external snap ring (4) and collar (5).
5. Draw out the brake pedal shaft (1) to the left side of tractor to remove the brake pedals and clutch pedal.

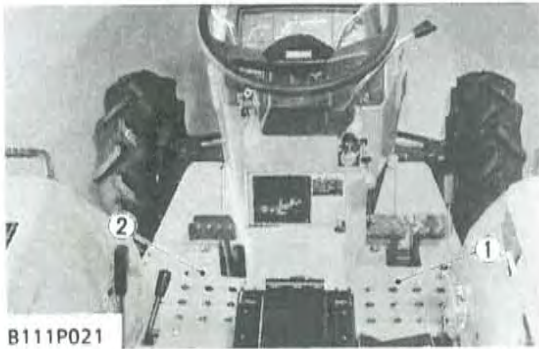
(When reassembling)

- After reassembling the pedals, inject grease and adjust the brake pedal play and clutch pedal play. (See page S.G-19. 20).



B111P020

- (1) Brake Pedal Shaft
- (2) Return Spring
- (3) Brake Rod
- (4) External Snap Ring
- (5) Collar
- (6) Spring Pin
- (7) Clevis Pin



B111P021

(1) Step RH

(2) Step LH

Covers and Steps

1. Remove the covers. (See page S.S-16)
2. Remove the steps.

Right Side

(See page S.S-16)

Left Side

(See page S.S-17)

Separating Engine

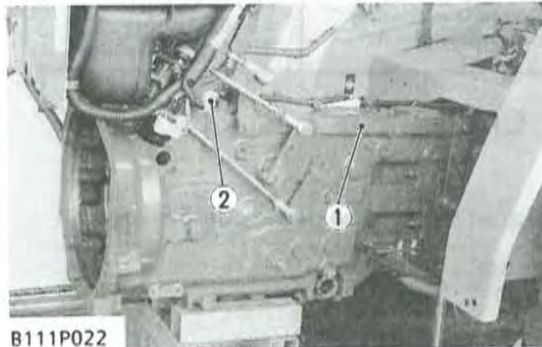
(See page S.S-17)

Shuttle Rod and Wire Harness

1. Remove the shuttle rod.
2. Remove the 4P connector.

(1) Shuttle Rod

(2) 4P Connector



B111P022

Clutch Housing

1. Place a jack under the transmission case.
2. Support the clutch housing with nylon lift straps and hoist.
3. Remove the clutch housing mounting nuts.
4. Separate the clutch housing from mid case.

(When reassembling)

Tightening torque	Clutch housing mounting nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
-------------------	------------------------------	---



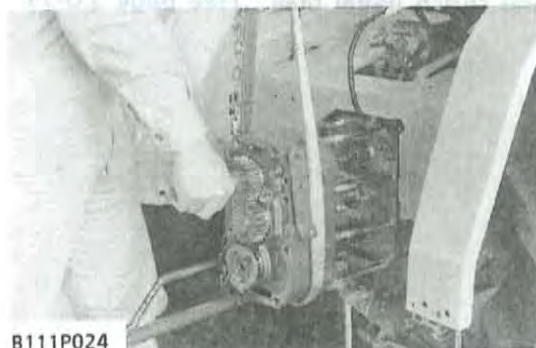
B111P023

Mid Case

1. Support the mid case with nylon lift strap and hoist.
2. Remove the mid case mounting nuts. (L2650, L2950)
3. Separate the mid case from transmission case.

(When reassembling)

Tightening torque	Mid case mounting nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
-------------------	------------------------	---



B111P024

[2]-8 SEPARATING REAR AXLE CASE AND BRAKE CASE



B111P025

(1) Rear Wheel (2) ROPS



B111P026



B111P027

(1) Brake Cam Lever (2) Clevis Pin (3) Fender Support

Transmission Fluid

1. Draining the transmission fluid. (See page S.G-15)

Rear Wheel and ROPS

1. Place the jack under the transmission case.
2. Remove the rear wheel (1) mounting screws and nuts.
3. Remove the rear wheel.
4. Remove the ROPS (2) mounting bolts and nuts.
5. Remove the ROPS.

(When reassembling)

Tightening torque	Rear wheel mounting screws and nuts	197 to 225 N·m 20 to 23 kgf·m 145 to 166 ft-lbs
-------------------	-------------------------------------	---

Rear Axle Case

1. Support the rear axle case with nylon lift strap and hoist.
2. Remove the rear axle case mounting screws and nut.
3. Separate the rear axle case.

(When reassembling)

- Apply liquid gasket (Three bond 1104 or equivalent) to the rear axle case gasket.

Tightening torques	Rear axle case mounting screws	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
	Rear axle case mounting nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

Brake Case

1. Remove the fender support (3).
2. Remove the clevis pin (2) at the end of brake rod.
3. Remove the brake case mounting screws and nuts.
4. Remove the brake case, tapping the brake cam lever (1) lightly.

(When reassembling)

- Apply grease to the brake ball seats. (Do not grease excessively.)
- Apply liquid gasket (Three bond 1104 or equivalent) to the brake case gasket.
- Before installing the brake case to the transmission case, install the cam plate around the four protrusions of the differential bearing case.
- Adopt a 9T screw (marked 9 on it's head) only at A position in the photograph.

Tightening torques	Brake case mounting 7T screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Brake case mounting 9T screw (At A position)	103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs

[2]-9 SEPARATING HYDRAULIC CYLINDER



B111P028

(1) Seat

(2) Floor Cover

Seat and Floor Cover

1. Remove the seat.
2. Remove the floor cover.



B111P030

Fender

1. Remove the fender mounting screws.
2. Support the fender with nylon lift strap and hoist.
3. Remove the fender.



B111P031

Hydraulic Cylinder

1. Remove the two screws to disconnect the delivery pipe from hydraulic cylinder, and loosen the delivery pipe nut at the front end of pipe.
2. Disconnect the draft control rod. (If equipped)
3. Remove the fender support both sides.
4. Remove the hydraulic cylinder mounting screws and nuts.
5. Separate the hydraulic cylinder.

(When reassembling)

Tightening torque	Hydraulic cylinder mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
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[2]-10 SEPARATING TRANSMISSION CASE

Transmission Fluid

1. Draining the transmission fluid. (See page S.G-15)

Propeller Shaft [4WD TYPE]

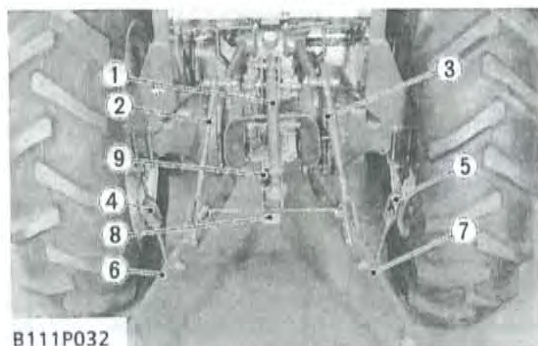
(See page S.S-15)

Set and Floor Cover

(See page S.S-22)

Fender

(See page S.S-22)



Three Point Hitch and Drawbar

Remove the following parts.

- | | |
|--------------------|-------------------|
| (1) Top Link | (6) Lower Link LH |
| (2) Lift Rod LH | (7) Lower Link RH |
| (3) Lift Rod RH | (8) Drawbar |
| (4) Check Chain LH | (9) Drawbar Frame |
| (5) Check Chain RH | |

(When reassembling)

Tightening torques	Drawbar frame mounting screws	(Thread size: 12 mm, 0.47 in. DIA.) 77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
		(Thread size: 14 mm, 0.55 in. DIA.) 124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs



Preparation

Remove the following parts.

- | | |
|-------------------|-----------------|
| (1) Delivery Pipe | (2) Return Pipe |
|-------------------|-----------------|



Rear Wheels and ROPS

1. Place a jack under the transmission case.
2. Support the clutch housing with nylon lift strap and hoist.
3. Remove the rear wheel mounting screws and nuts.
4. Remove the rear wheels.
5. Remove the ROPS.

Tightening torque	Rear wheel mounting screws and nuts	197 to 225 N·m 20 to 23 kgf·m 145 to 166 ft-lbs
-------------------	-------------------------------------	---



Clutch Housing and Mid Case

1. Place disassembly stand under the clutch housing and support the transmission case with nylon lift straps and hoist.
2. Remove the clutch housing mounting nuts. (L3450, L3650)
3. Remove the mid case mounting nuts. (L2650, L2950)
4. Separate the clutch housing and mid case.

(When reassembling)

Tightening torque	Clutch housing mounting nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
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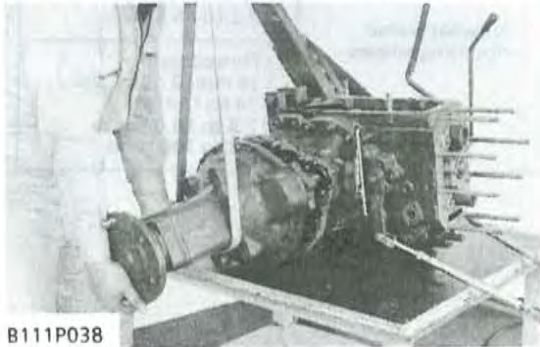
B111P037

Hydraulic Cylinder

1. Disconnect the draft control rod from draft control valve. (If equipped).
2. Remove the fender support both sides.
3. Remove the hydraulic cylinder mounting screws and nuts.
4. Separate the hydraulic cylinder.

(When reassembling)

Tightening torque	Hydraulic cylinder mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
-------------------	---	---



B111P038

Rear Axle Case and Brake Case

1. Support the rear axle case with nylon lift strap and hoist.
2. Remove the rear axle case mounting screws and nuts, and separate the rear axle case.
3. Remove the brake case mounting screws and nuts, and remove the brake case, tapping the brake cam lever lightly.

(When reassembling)

- Apply grease to the brake ball seats. (Do not grease excessively.)
- Apply liquid gasket (Three bond 1104 or equivalent) to the brake case gasket and rear axle case gasket.
- Before installing the brake case to the transmission case, install the cam plate around the four protrusions of the differential bearing case.
- When reassembling the brake case, tighten the 9T screw (marked 9 on it's head), noting it's position. (See page S.S-21)

Tightening torques	Rear wheel mounting screws and nuts	197 to 225 N·m 20 to 23 kgf·m 145 to 166 ft-lbs
	Rear axle case mounting screws	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
	Rear axle case mounting nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Brake case mounting 7T screws and nuts	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Brake case mounting 9T screw	103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs

[3] L2650GST, L2950GST, L3450GST, L3650GST

[3]-1 REMOVING STEERING CONTROLLER

Refer to [2]-2 REMOVING STEERING CONTROLLER (See page S.S-11).

[3]-2 REMOVING STEERING CYLINDER

Refer to [2]-3 REMOVING STEERING CYLINDER (See page S.S-13).

[3]-3 SEPARATING FRONT AXLE

Refer to [2]-4 SEPARATING FRONT AXLE (See page S.S-15).

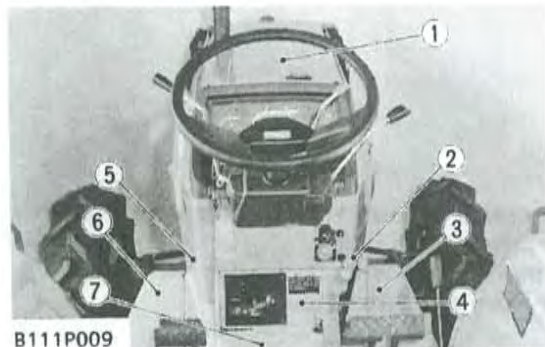
[3]-4 SEPARATING ENGINE FROM CLUTCH HOUSING

Propeller Shaft

(See page S.S-15)

Covers

1. Remove the covers (1), (2), (3), (4), (5), (6), (7).

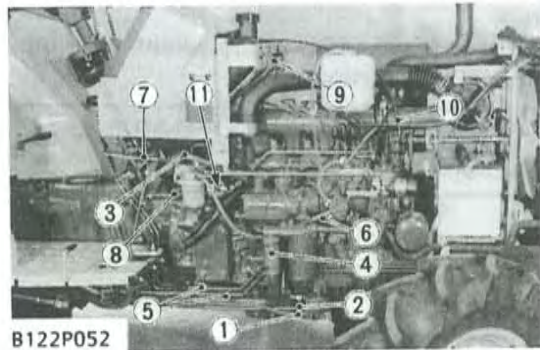


B111P009

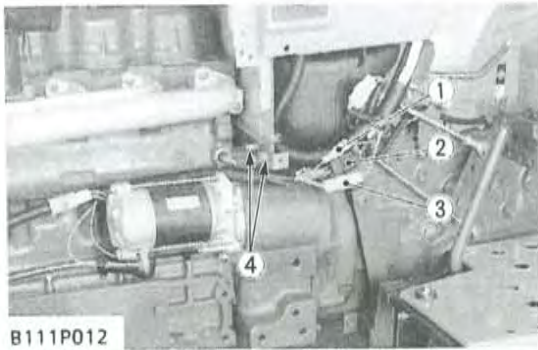
Right Side

Remove the following parts.

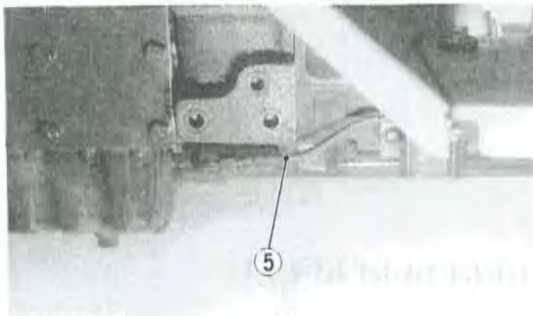
- | | |
|------------------------------------|---------------------|
| (1) Delivery Pipe | (7) Stop Rod |
| (2) Return Pipe | (8) Accelerator Rod |
| (3) Power Steering Return Hose | (9) Pipe |
| (4) Rubber Pipe | (10) Flexible Cable |
| (5) Power Steering Hydraulic Pipes | (11) Screws |
| (6) Fuel Pipe | |



B122P052



B111P012



0329P253



B111P013

Left Side

1. Disconnect the connectors (1), (2) and (3).
2. Disconnect the GST system hydraulic pipe (5).
3. Remove the screws (4).

- (1) 1P Connector
(2) 2P Connector
(3) 16P Connector

- (4) Screws
(5) GST System Hydraulic Pipe

Separating Engine

1. Place disassembly stand under the engine and clutch housing, and support them with jacks.
2. Remove the engine mounting screws and nuts.
3. Separate the engine from the clutch housing.

(When reassembling)

- Apply grease to splines.
- Apply liquid gasket (Three Bond 1104 or equivalent) to joint face of the engine and clutch housing.

Tightening torque

Engine mounting
screws and nuts to
clutch housing48.1 to 55.8 N·m
4.9 to 5.7 kgf·m
35.5 to 41.2 ft-lbs

[3]-5 SEPARATING ENGINE

Coolant

1. Draining the coolant. (See page S.G-27)

Propeller Shaft

(See page S.S-15)

Covers

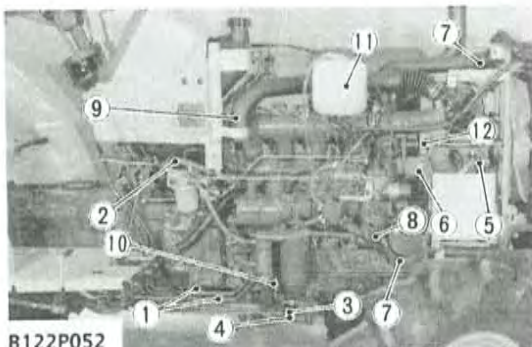
(See page S.S-25)

Right Side

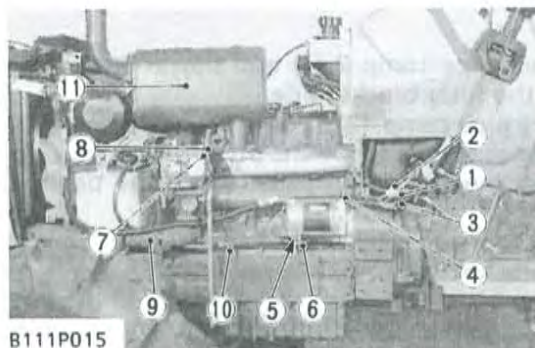
Remove the following parts.

- (1) Power Steering Hydraulic Pipes
(2) Power Steering Return Hose
(3) Return Pipe
(4) Delivery Pipe
(5) Negative Terminal
(6) 1P Connector

- (7) Radiator Hoses
(8) Stay
(9) Pipe
(10) Pipe
(11) Reserve Tank
(12) Fan Joint



B122P052



Left Side

Remove the following parts.

- | | |
|-------------------|-------------------|
| (1) 1P Connector | (7) 2P Connector |
| (2) 2P Connector | (8) B Terminal |
| (3) 16P Connector | (9) Radiator Hose |
| (4) Jumper Lead | (10) Level Gauge |
| (5) S.Terminal | (11) Muffler |
| (6) B Terminal | |

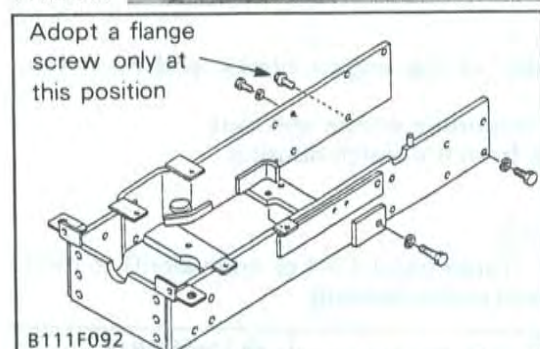


Front Axle Flame

1. Place disassembly stand under the clutch housing, and support it with jack.
2. Remove the front axle frame mounting screws.
3. Separate the front axle frame from engine.

(When reassembling)

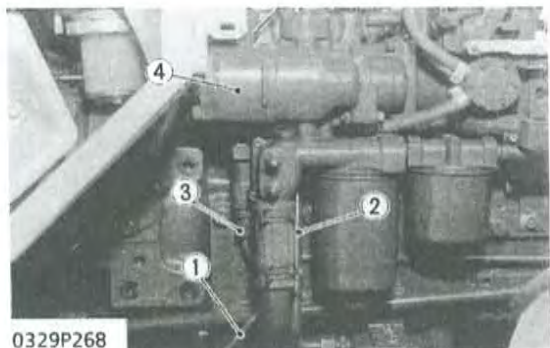
Tightening torques	Front axle frame mounting screws to engine	(Thread size: 10 mm, 0.39 in. DIA.) 60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
		(Thread size: 12 mm, 0.47 in. DIA.) 103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs



Right Side

Remove the following parts.

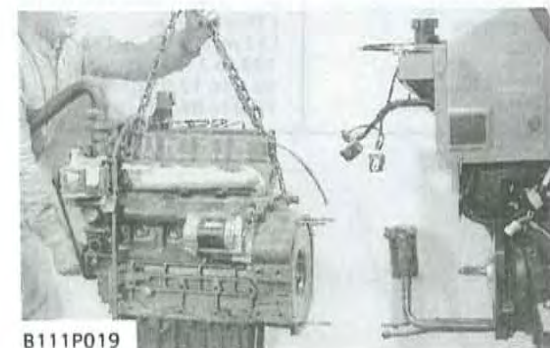
- | | |
|---------------------|---------------|
| (1) Stop Rod | (4) Fuel Pipe |
| (2) Accelerator Rod | (5) Pipe |
| (3) Flexible Cable | (6) Screws |



0329P268



0329P269



B111P019

Filter Bracket Assembly

1. Remove the delivery pipe comp 2 (1) and power steering pipe 1 comp (3) on the filter bracket side.
2. Remove the delivery pipe comp. (2).
3. Remove the delivery pipe P-RE (5) on the pump side.
4. Remove the power steering return pipe before the paper filter.
5. Remove the oil pressure pump (4) as a complete unit.
6. Remove the filter bracket as a complete unit.

- | | |
|---------------------------------|------------------------|
| (1) Delivery Pipe Comp 2 | (5) Delivery Pipe P-RE |
| (2) Delivery Pipe Comp | (6) Filter Cartridge |
| (3) Power Steering Pipe 1 Comp. | (7) Paper Filter |
| (4) Oil Pressure Pump | |

Engine

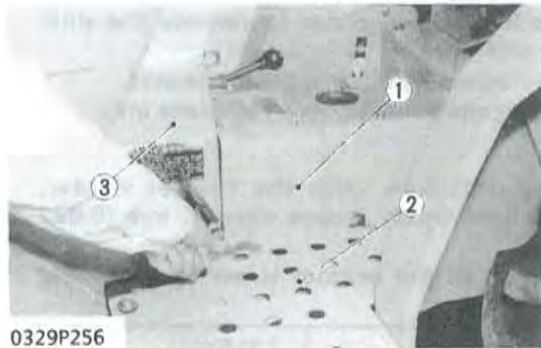
1. Connect the lift chain to the engine hooks, and hoist the engine.
2. Remove the engine mounting screws and nuts.
3. Separate the engine from the clutch housing.

(When reassembling)

- Apply grease to splines.
- Apply liquid gasket (Three bond 1104 or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine mounting screws and nuts	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
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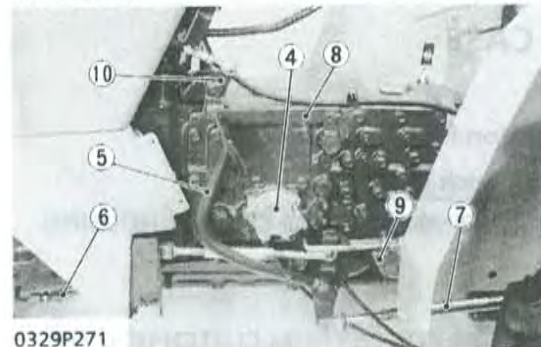
[3]-6 REMOVING SIDE COVER FROM CLUTCH HOUSING



0329P256

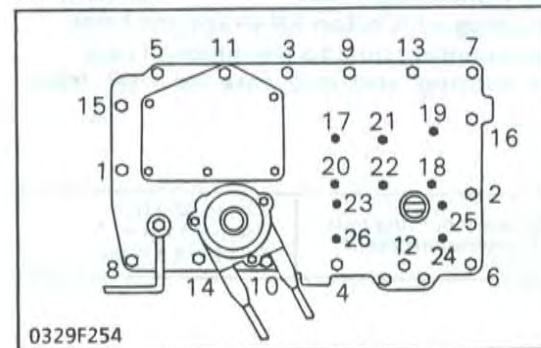
(1) Left Foot Cover
(2) Left Step

(3) Side Cover



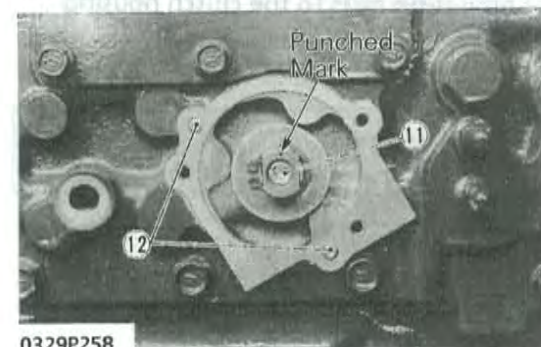
0329P271

(4) Shift Cable
(5) Clutch Pedal
(6) Delivery Pipe Comp. 1
(7) Brake Rod
(8) Shuttle Rod
(9) Left Rear Support
(10) Connecting Arm



0329F254

17 to 22 denote gate valve mounting screws
23 to 26 denote Hi-Lo spool valve mounting screws
1 to 16 denote side cover mounting screws



0329P258

Transmission Fluid

1. Draining the transmission fluid (See page S.G-15).

Side Cover Assembly

1. Start the engine, set all shift levers to neutral positions and stop the engine.
2. Remove the steps (right and left), foot covers (right and left), and side cover.
3. Remove the clutch rod and brake rod (7) and pull out the brake pedal shaft.
4. Remove the shift cable (4).
5. Remove the delivery pipe comp. 1 (6).
6. Remove the shuttle rod (8).
7. Remove the left step rear support (9).
8. Set the connecting arm (10) free.
9. Remove the Hi-Lo shift spool valve and the gate valve mounting screws.
10. Remove the side cover mounting screws and take off the side cover. (Leave the Hi-Lo shift spool valve and the gate valve.)

(When reassembling)

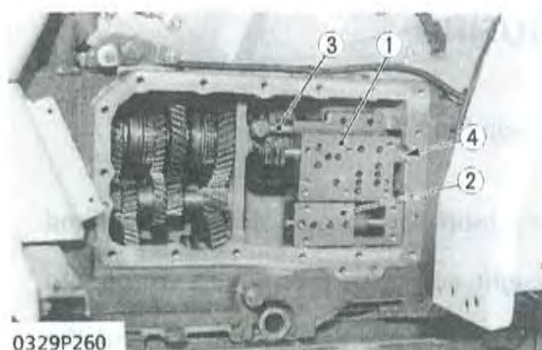
- To facilitate the side cover reassembly, install a stud or guide bar at the upper left (position 15) and upper right (position 7) of the housing case. The stud or guide bar is used as the guide.
- Set the shift lever to neutral position, point the punch mark of the rotary valve shaft (11) upwards, align the punch mark with the straight pin (12), and assemble.
- After assembly, adjust the shift cable. (For adjustment, refer to page S.3-54)
- Hand tighten the side cover mounting screws and tighten them regularly in order from screw 1 to screw 16.
- Before mounting the Hi-Lo shift spool valve and gate valve on the side cover, install an 8 mm stud or guide bar on the valve. This stud or guide bar is used as the guide to facilitate the assembly.
- Tighten mounting screws of the Hi-Lo shift spool valve and gate valve in the order 17 to 22 and 23 to 26.

NOTE

- Note the angle of the shuttle arm and securely fit it into the groove of the shift fitting.
- Hand tighten the Hi-Lo shift spool valve and the gate valve and securely tighten them with a wrench.
- If not tightened straight, the knock pin is scraped resulting in possible oil leakage. If excessively tightened, the valve will not operate properly.

Tightening torques	Side cover mounting screws	42.2 N·m 4.3 kgf·m 31.1 ft-lbs
	Mounting screws of Hi-Lo shift spool valve and gate valve	17.7 N·m 1.8 kgf·m 13.0 ft-lbs

(11) Rotary Valve Shaft
(12) Straight Pin



0329P260
 (1) Gate Valve (3) Pipe
 (2) Hi-Lo Shift Spool Valve (4) Reamer Screw

Gate Valve, Hi-Lo Shift Spool Valve

1. Move the snap ring of the pipe for gate valve assembly (1) and move the pipe (3) toward the gate valve assembly side.
2. Remove the reamer screw securing the shuttle shift spool and the shift fork after loosen the lock washer, and move the shuttle shift spool to left side in order to remove the shift fork from the shuttle shift spool.
3. Remove the gate valve assembly (1) as a complete unit.
4. Remove the Hi-Lo shift spool valve (2) as a complete unit.

(When reassembling)

- After tightening the shift fork with the reamer screw, confirm that the shift fork freely moves about 5 mm (0.021 in.).
- Confirm the lock washer of the reamer screw for replacing and lock up.

Tightening torque	Shuttle shift fork mounting reamer screw	7.85 N·m 0.8 kgf·m 5.79 ft-lbs
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[3]-7 SEPARATING CLUTCH HOUSING AND MID CASE

Transmission Fluid

1. Draining the Transmission fluid (See page S.G-15).

Separating Engine From Clutch Housing

Refer to [3]-4 SEPARATING ENGINE FROM CLUTCH HOUSING. (See page S.S-25)

Side Cover Assembly

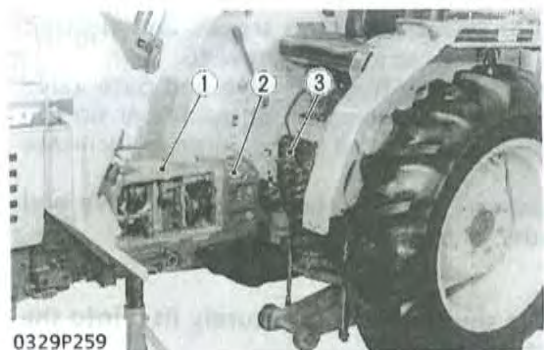
Refer to [3]-6 REMOVING SIDE COVER FROM CLUTCH HOUSING. (See page S.S-29)

Clutch Housing and Mid Case

1. Place a jack under the transmission case.
2. Support the clutch housing with nylon lift straps and hoist.
3. Remove the mid case mounting nuts to transmission case.
4. Separate the clutch housing and mid case as a set from transmission case.

(When reassembling)

Tightening torque	Mid case mounting nuts to transmission case	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
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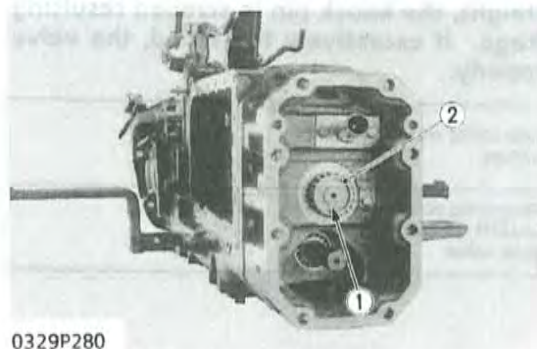
0329P259
 (1) Clutch Housing (3) Transmission Case
 (2) Mid Case

Mid Case

1. Remove the external snap ring (1) and the spline boss (2).
2. Remove the mid case mounting nuts to the clutch housing.
3. Divide the mid case.

(When reassembling)

Tightening torque	Mid case mounting nuts to clutch housing	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
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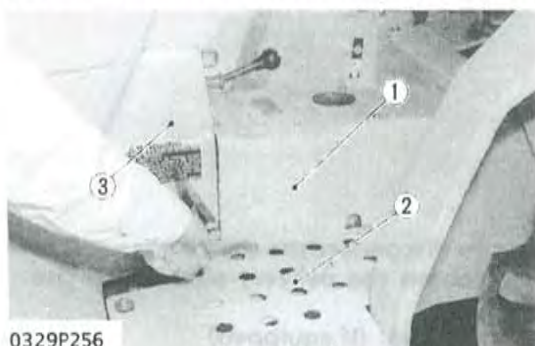


0329P280
 (1) Snap Ring (2) Spline Boss

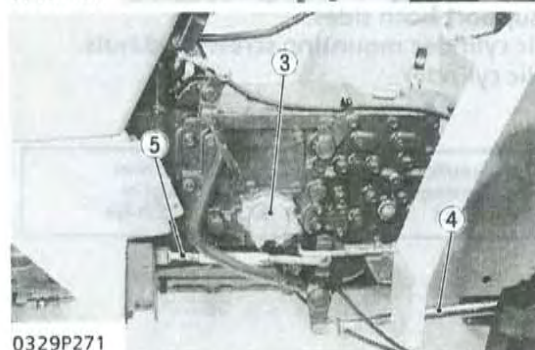
[3]-8 SEPARATING REAR AXLE CASE AND BRAKE CASE

Refer to [2]-8 SEPARATING REAR AXLE CASE AND BRAKE CASE. (See page S.S-21)

[3]-9 SEPARATING HYDRAULIC CYLINDER



0329P256



0329P271



0329P272



0329P273

Shift Cable

1. Remove the left foot cover (1) and the left step (2).
2. Remove the brake rod (4) and the clutch rod (5).
3. Remove the shift cable (3).
4. Remove the seat.
5. Remove the rear step (7).
6. Remove the shift guide fixing nut and the shift guide cover (6).
7. Remove the shift guide assembly (8) with the shift cable fitted.

- (1) Left Foot Cover
- (2) Left Step
- (3) Shift Cable
- (4) Brake Rod

- (5) Clutch Rod
- (6) Shift Guide Cover
- (7) Rear Step
- (8) Shift Guide Assembly



B111P030



B111P031

Fender

1. Remove the fender mounting screws.
2. Support the fender with nylon lift strap and hoist.
3. Remove the fender.

Hydraulic Cylinder

1. Remove the two screws to disconnect the delivery pipe from hydraulic cylinder, and loosen the delivery pipe nut at the front end of pipe.
2. Disconnect the draft control rod. (If equipped)
3. Remove the fender support both sides.
4. Remove the hydraulic cylinder mounting screws and nuts.
5. Separate the hydraulic cylinder.

(When reassembling)

Tightening torque	Hydraulic cylinder mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
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[3]-10 SEPARATING TRANSMISSION CASE**Transmission Fluid**

1. Draining the transmission fluid. (See page S.G-15)

Propeller Shaft [4WD TYPE]

(See page S.S-15)

Shift Cable

(See page S.S-31)

Fender

(See page S.S-32)

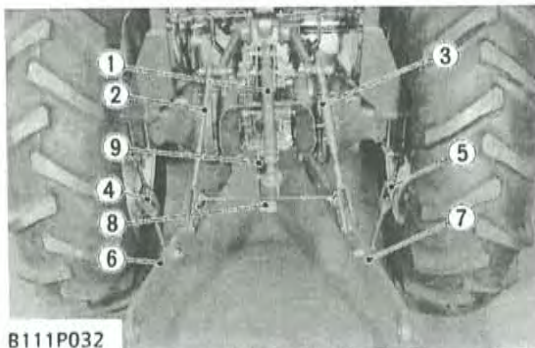
Three Point Hitch and Drawbar

Remove the following parts.

- | | |
|--------------------|-------------------|
| (1) Top Link | (6) Lower Link LH |
| (2) Lift Rod LH | (7) Lower Link RH |
| (3) Lift Rod RH | (8) Drawbar |
| (4) Check Chain LH | (9) Drawbar Frame |
| (5) Check Chain RH | |

(When reassembling)

Tightening torques	Drawbar frame mounting screws	(Thread size: 12 mm, 0.47 in. DIA.) 77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
		(Thread size: 14 mm, 0.55 in. DIA.) 124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs



B111P032



B111P033

Preparation

Remove the following parts.

(1) Delivery Pipe

(2) Return Pipe



B111P034

Rear Wheels and ROPS

1. Place a jack under the transmission case.
2. Support the clutch housing with nylon lift strap and hoist.
3. Remove the rear wheel mounting screws and nuts.
4. Remove the rear wheels.
5. Remove the ROPS.

Tightening torque	Rear wheel mounting screws and nuts	197 to 225 N·m 20 to 23 kgf·m 145 to 166 ft-lbs
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B111P035

Clutch Housing and Mid Case

1. Place disassembly stand under the clutch housing and support the transmission case with nylon lift straps and hoist.
2. Remove the mid case mounting nuts to the transmission case.
3. Separate the clutch housing and mid case.

(When reassembling)

Tightening torque	Mid case mounting nuts to transmission case	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
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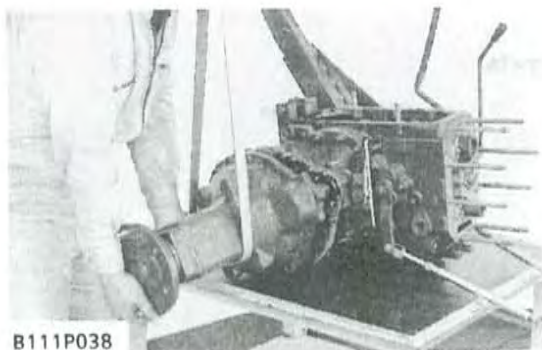
B111P037

Hydraulic Cylinder

1. Disconnect the draft control rod from draft control valve. (If equipped).
2. Remove the fender support both sides.
3. Remove the hydraulic cylinder mounting screws and nuts.
4. Separate the hydraulic cylinder.

(When reassembling)

Tightening torque	Hydraulic cylinder mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
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Rear Axle Case and Brake Case

1. Support the rear axle case with nylon lift strap and hoist.
2. Remove the rear axle case mounting screws and nuts, and separate the rear axle case.
3. Remove the brake case mounting screws and nuts, and remove the brake case, tapping the brake cam lever lightly.

(When reassembling)

- Apply grease to the brake ball seats. (Do not grease excessively.)
- Apply liquid gasket (Three bond 1104 or equivalent) to the brake case gasket and rear axle case gasket.
- Before installing the brake case to the transmission case, install the cam plate around the four protrusions of the differential bearing case.
- When reassembling the brake case, tighten the 9T screw (marked 9 on it's head), noting it's position. (See page S.S-22)

Tightening torques	Rear wheel mounting screws and nuts	197 to 225 N·m 20 to 23 kgf·m 145 to 166 ft-lbs
	Rear axle case mounting screws	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
	Rear axle case mounting nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Brake case mounting 7T screws and nuts	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Brake case mounting 9T screw	103 to 117 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs

S.1 ENGINE

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TROUBLESHOOTING

Before troubleshooting, confirm symptoms of trouble, and accomplish basic inspection.

(1) Basic Inspection

No.	Contents	Reference Page
1	Engine oil	S.G-13
2	Coolant	S.G-26, 27
3	Fan belt	S.G-23
4	Air cleaner	S.G-21, 28
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8	Air bleed from fuel line	–
9	Battery and terminals	S.9-6
10	Wiring connectors	M.10-1, 2, 3
11	Idling speed	–
12	Maximum speed	–
13	Valve clearance	S.1-14

(2) Troubleshooting

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	● Incorrect injection timing ● Fuel camshaft worn ● Injection nozzle plugged ● Fuel transfer pump malfunctioning ● Seizure of crankshaft, camshaft, piston, cylinder liner or bearing ● Compression leak from cylinder	Adjust Replace Clean Repair or replace Repair or replace	S.1-47, 54 S.1-28 S.1-45, 51 S.1-28 –
(Starter Does Not Run)	● Improper valve seat alignment, valve spring broken, valve seized ● Improper valve timing	Check compression pressure Repair or replace	S.1-13 S.1-21, 22, 23
	● Piston ring and liner worn	Correct or replace timing gear Replace	S.1-27 S.1-33, 35, 43, 44
	● Injection pump malfunctioning	Repair or replace	S.1-25, 46, 47, 54, 55
	● Starter malfunctioning ● Starter switch malfunctioning	Repair or replace Replace	S.9-13 S.9-10
	● Safety switch malfunctioning [L2350] ● Shuttle limit switch, P.T.O. limit switch malfunctioning [Except L2350] ● Starter relay malfunctioning [Except L2350]	Replace Replace Replace	S.9-11 S.9-11

Symptom	Probable Cause	Solution	Reference Page
Engine Revolution Is Not Smooth	● Injection pump malfunctioning ● Incorrect nozzle opening pressure ● Injection nozzle stuck or plugged ● Governor malfunctioning	Repair or replace Adjust Replace Repair	S.1-25,46, 47, 54, 55 S.1-45,48, 51, 52 S.1-45,48, 51, 58 S.1-26, 28
Either White or Blue Exhaust Gas Is Observed	● Piston ring and liner worn or stuck ● Incorrect injection timing ● Deficient compression	Repair or replace Adjust Check compression pressure	S.1-33,35, 43, 44 S.1-47,54 S.1-13
Either Black or Dark Gray Exhaust Gas Is Observed	● Overload	Lessen the load	—
Deficient Output	● Incorrect injection timing ● Engine's moving parts seem to be seizing ● Uneven fuel injection ● Deficient nozzle injection ● Compression leak	Adjust Repair or replace Repair or replace injection pump Repair or replace nozzle Check compression pressure	S.1-47,54 — S.1-25,46, 47, 54, 55 S.1-45,48, 51, 52 S.1-13
Excessive Lubricant Oil Consumption	● Piston ring's gap facing the same direction ● Oil ring worn or stuck ● Piston ring groove worn ● Valve stem and guide worn ● Crankshaft bearing, and crank pin bearing worn	Shift ring gap direction Replace Replace piston Replace Replace	S.1-33 S.1-37 S.1-37 S.1-21 S.1-39,40, 41, 42
Fuel Mixed into Lubricant Oil	● Injection pump's plunger worn ● Fuel transfer pump broken [Except L2350]	Replace pump element or pump Replace	S.1-25 S.1-28
Water Mixed into Lubricant Oil	● Head gasket defective ● Cylinder block or cylinder head flawed	Replace Replace or repair	S.1-19 S.1-20
Low Oil Pressure	● Oil strainer clogged ● Oil filter cartridge clogged ● Relief valve stuck with dirt ● Relief valve spring weaken or broken ● Excessive oil clearance of crankshaft bearing ● Excessive oil clearance of crank pin bearing ● Excessive oil clearance of rocker arm bush ● Oil passage clogged ● Oil pump defective	Clean Replace Clean Replace Replace Replace Replace Clean Repair or replace	S.1-32 S.G-14 — — S.1-39,40, 41 S.1-42 S.1-23 — S.1-28,63
High Oil Pressure	● Relief valve defective	Replace	—

Symptom	Probable Cause	Solution	Reference Page
Engine Overheated	- Radiator net and radiator fin clogged with dust - Inside of radiator corroded - Cooling water flow route corroded	Clean	–
		Clean or replace	S.G-26,27
		Clean or replace	S.G-26,27, 30
	- Radiator cap defective - Radiator hose damaged - Overload running	Replace	S.1-60
		Replace	S.G-30
		Loosen the load	–
	- Head gasket defective - Incorrect injection timing	Replace	S.1-19
		Adjust	S.1-47,54
	- Thermostat defective - Water pump defective - Mechanical seal defective	Replace	S.1-61,62
		Replace	S.1-61
		Replace	S.1-61

SERVICING SPECIFICATIONS

[1] ENGINE BODY

CYLINDER HEAD

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	–	0.05 mm 0.0020 in.
Top Clearance	[D1102]	0.7 to 0.9 mm 0.0276 to 0.0354 in.	–
	[D1402-DI] [D1462-DI] [V1902-DI]	0.6 to 0.7 mm 0.0236 to 0.0276 in.	–
Cylinder Head Gasket	Thickness [D1102]	Free 1.30 to 1.60 mm 0.0512 to 0.0630 in.	–
	[D1402-DI] [D1462-DI] [V1902-DI]	1.25 to 1.45 mm 0.0492 to 0.0571 in.	–
Compression Pressure	[D1102]	2.84 to 3.24 MPa 29 to 33 kgf/cm ² 412 to 469 psi	2.26 MPa 23 kgf/cm ² 320 psi
	[D1402-DI] [D1462-DI] [V1902-DI]	2.75 to 3.04 MPa 28 to 31 kgf/cm ² 398 to 441 psi	2.16 MPa 22 kgf/cm ² 313 psi

VALVES

Item		Factory Specification	Allowable Limit
Valve Clearance (Cold)		0.18 to 0.22 mm 0.0071 to 0.0087 in.	—
Valve Seat	Width	IN, EX. 2.1 mm IN, EX. 0.083 in.	—
	Angle	IN, EX. 0.783 to 0.787 rad. IN, EX. 44°55' to 45°05'	—
Valve Face	Angle	IN, EX. 0.792 to 0.796 rad. IN, EX. 45°23' to 45°37'	—
Valve Recessing	[D1102]	1.1 to 1.3 mm 0.043 to 0.051 in.	1.6 mm 0.063 in.
	[D1402-DI]	0.65 to 0.85 mm	1.15 mm
	[D1462-DI]	0.026 to 0.033 in.	0.045 in.
	[V1902-DI]		
Valve Stem to Valve Guide	Clearance	0.04 to 0.07 mm 0.0016 to 0.0028 in.	0.1 mm 0.0039 in.
Valve Stem	O.D.	7.960 to 7.975 mm	—
Valve Guide	I.D.	0.3134 to 0.3140 in. 8.015 to 8.030 mm 0.3156 to 0.3161 in.	—
Valve Guide	Protrusion	9.8 to 10.2 mm 0.39 to 0.40 in.	—

VALVE TIMING

Inlet Valve	Open	[D1102]	0.35 rad., 20° before T.D.C.	—
		[D1402-DI] [D1462-DI] [V1902-DI]	0.14 rad., 8° before T.D.C.	—
	Close	[D1102]	0.79 rad., 45° after B.D.C.	—
		[D1402-DI] [D1462-DI] [V1902-DI]	0.35 rad., 20° after B.D.C.	—
Exhaust Valve	Open	[D1102]	0.87 rad., 50° before B.D.C.	—
		[D1402-DI] [D1462-DI] [V1902-DI]	0.63 rad., 60° before B.D.C.	—
	Close	[D1102]	0.26 rad., 15° after T.D.C.	—
		[D1402-DI] [D1462-DI] [V1902-DI]	0.21 rad., 12° after T.D.C.	—

VALVE SPRING

Item	Factory Specification	Allowable Limit
Free Length	41.7 to 42.2 mm 1.6417 to 1.6614 in.	41.2 mm 1.6220 in.
Setting Load / Setting Length	117.7 N/35.15 mm 12 kgf/35.15 mm 26.5 lbs/1.38 in.	100.0 N/35.15 mm 10.2 kgf/35.15 mm 22.5 lbs/1.38 in.
Tilt	—	1.0 mm 0.039 in.

ROCKER ARM

Rocker Arm Shaft to Rocker Arm	Clearance	0.018 to 0.070 mm 0.0007 to 0.0028 in.	0.15 mm 0.0059 in.
Rocker Arm Shaft	O.D.	13.973 to 13.984 mm 0.5501 to 0.5506 in.	—
Rocker Arm Bore	I.D.	14.002 to 14.043 mm 0.5513 to 0.5529 in.	—

TIMING GEAR

Timing Gear	Backlash	0.04 to 0.11 mm 0.0016 to 0.0043 in.	0.15 mm 0.0059 in.
Idle Gear	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.0201 in.	0.90 mm 0.0354 in.
Idle Gear Shaft to Idle Gear Bushing	Clearance	0.020 to 0.054 mm 0.0008 to 0.0021 in.	0.10 mm 0.0039 in.
Idle Gear Shaft	O.D. [D1102]	27.967 to 27.980 mm 1.10106 to 1.10158 in.	—
	D1402-DI	31.959 to 31.975 mm	—
	D1462-DI	1.2582 to 1.2589 in.	—
	V1902-DI		
Idle Gear Bushing	I.D. [D1102]	28.000 to 28.021 mm 1.10236 to 1.10319 in.	—
	D1402-DI	32.000 to 32.025 mm	—
	D1462-DI	1.2598 to 1.2608 in.	—
	V1902-DI		
(Service Parts Dimension) Idle Gear Shaft to Idle Gear Bushing	Clearance	0.020 to 0.084 mm 0.0008 to 0.0033 in.	0.10 mm 0.0039 in.
Idle Gear Shaft	O.D. [D1102]	27.967 to 27.980 mm 1.10106 to 1.10158 in.	—
	D1402-DI	31.967 to 31.980 mm	—
	D1462-DI	1.25854 to 1.25906 in.	—
	V1902-DI		
Idle Gear Bushing	I.D. [D1102]	28.000 to 28.046 mm 1.10236 to 1.10417 in.	—
	D1402-DI	32.000 to 32.046 mm	—
	D1462-DI	1.25984 to 1.26165 in.	—
	V1902-DI		

TAPPET AND PUSH ROD

Item		Factory Specification	Allowable Limit
Tappet to Guide	Clearance	0.020 to 0.062 mm 0.0008 to 0.0024 in.	0.07 mm 0.0028 in.
	Tappet O.D.	23.959 to 23.980 mm 0.94327 to 0.94410 in.	—
	Tappet Guide I.D.	24.000 to 24.021 mm 0.94488 to 0.94571 in.	—
Push Rod		Alignment	— 0.25 mm 0.0098 in.

CAMSHAFT

Camshaft	Side Clearance	0.07 to 0.22 mm 0.0028 to 0.0087 in.	0.3 mm 0.0118 in.
Camshaft	Alignment	—	0.05 mm 0.020 in.
Cam	Height (IN., EX.) [D1102]	33.36 mm 1.3134 in.	33.31 mm 1.3114 in.
	[D1402-DI]	33.463 to 33.483 mm	33.42 mm
	[D1462-DI] [V1902-DI]	1.3174 to 1.3182 in.	1.3157 in.
Camshaft	Oil Clearance	0.050 to 0.091 mm 0.0020 to 0.0036 in.	0.15 mm 0.0059 in.
Camshaft Journal	O.D.	39.934 to 39.950 mm 1.5722 to 1.5728 in.	—
Camshaft Bearing	I.D.	40.000 to 40.025 mm 1.5748 to 1.5758 in.	—

PISTON AND PISTON RING

Piston Pin-bore	I.D. [D1102] [D1402-DI] [D1462-DI] [V1902-DI]	23.000 to 23.013 mm 0.9055 to 0.9060 in. 25.000 to 25.013 mm 0.9843 to 0.9848 in.	23.053 mm 0.9076 in. 25.05 mm 0.9862 in.
Compression Ring 2 to Ring Groove	Clearance	0.093 to 0.120 mm 0.0037 to 0.0047 in.	0.2 mm 0.008 in.
Piston Ring Groove	Width	2.055 to 2.070 mm 0.08091 to 0.08150 in.	—
Compression Ring 2	Width	1.950 to 1.962 mm 0.07677 to 0.07734 in.	—
Oil Ring to Ring Groove	Clearance	0.020 to 0.052 mm 0.00079 to 0.00205 in.	0.15 mm 0.0059 in.
Piston Ring Groove	Width	5.010 to 5.030 mm 0.19724 to 0.19803 in.	—
Oil Ring	Width	4.978 to 4.990 mm 0.19598 to 0.19646 in.	—

PISTON AND PISTON RING (Continued)

Item		Factory Specification	Allowable Limit
Compression Ring 1	Ring Gap	0.30 to 0.45 mm 0.0118 to 0.0177 in.	1.25 mm 0.0492 in.
Compression Ring 2	Ring Gap	0.30 to 0.45 mm 0.0118 to 0.0177 in.	1.25 mm 0.0492 in.
Oil Ring	Ring Gap	0.25 to 0.45 mm 0.0098 to 0.0177 in.	1.25 mm 0.0492 in.
Piston and Piston Ring	Oversize	+ 0.5 mm + 0.020 in.	—

CONNECTING ROD

Connecting Rod	Alignment	0.02 mm 0.0008 in.	0.05 mm 0.0020 in.
Piston Pin to Small End Bushing	Clearance	0.014 to 0.038 mm 0.0006 to 0.0015 in.	0.15 mm 0.0059 in.
Piston Pin	O.D.		
Small End Bushing	[D1102]	23.002 to 23.011 mm 0.9056 to 0.9059 in.	—
	[D1402-DI] [D1462-DI] [V1902-DI]	25.002 to 25.011 mm 0.9843 to 0.9847 in.	—
	I.D.		
	[D1102]	23.025 to 23.040 mm 0.9065 to 0.9071 in.	—
	[D1402-DI] [D1462-DI] [V1902-DI]	25.025 to 25.040 mm 0.9852 to 0.9858 in.	—
(Service Parts Dimension) Piston Pin to Small End Bushing	Clearance	0.015 to 0.067 mm 0.0006 to 0.0026 in.	0.15 mm 0.0059 in.
Piston Pin	O.D.		
	[D1102]	23.002 to 23.011 mm 0.9056 to 0.9059 in.	—
	[D1402-DI] [D1462-DI] [V1902-DI]	25.002 to 25.011 mm 0.9843 to 0.9847 in.	—
Small End Bushing	I.D.		
	[D1102]	23.026 to 23.069 mm 0.9065 to 0.9082 in.	—
	[D1402-DI] [D1462-DI] [V1902-DI]	25.026 to 25.069 mm 0.9853 to 0.9870 in.	—

CRANKSHAFT

Item		Factory Specification	Allowable Limit
Crankshaft	Alignment	0.02 mm 0.0008 in.	0.08 mm 0.0031 in.
Crankshaft to Crankshaft Bearing 1	Oil Clearance	0.040 to 0.118 mm 0.00157 to 0.00465 in.	0.20 mm 0.0079 in.
Crankshaft	O.D.	51.921 to 51.940 mm 2.04414 to 2.04489 in.	—
Crankshaft Bearing 1	I.D.	51.980 to 52.039 mm 2.04646 to 2.04878 in.	—
Crankshaft to Crankshaft Bearing 2	Oil Clearance	0.040 to 0.104 mm 0.00157 to 0.00409 in.	0.20 mm 0.0079 in.
Crankshaft	O.D.	51.921 to 51.940 mm 2.04414 to 2.04489 in.	—
Crankshaft Bearing 2	I.D.	51.980 to 52.025 mm 2.04646 to 2.04823 in.	—
Crank Pin to Crank Pin Bearing	Oil Clearance [D1102]	0.035 to 0.093 mm 0.0014 to 0.0037 in.	0.20 mm 0.0079 in.
	[D1402-DI] [D1462-DI] [V1902-DI]	0.025 to 0.087 mm 0.0010 to 0.0034 in.	0.20 mm 0.0079 in.
Crank Pin	O.D. [D1102]	43.959 to 43.975 mm 1.7307 to 1.7313 in.	—
	[D1402-DI] [D1462-DI] [V1902-DI]	46.959 to 46.975 mm 1.8488 to 1.8494 in.	—
Crank Pin Bearing	I.D. [D1102]	44.010 to 44.052 mm 1.7327 to 1.7343 in.	—
	[D1402-DI] [D1462-DI] [V1902-DI]	47.000 to 47.046 mm 1.8504 to 1.8522 in.	—
Crankshaft	Side Clearance	0.15 to 0.31 mm 0.0059 to 0.0122 in.	0.50 mm 0.0197 in.
Crankshaft Sleeve	Wear	—	0.10 mm 0.004 in.

FLYWHEEL

Flywheel	Flatness	—	1.00 mm 0.039 in.
	Sway	—	0.05 mm 0.0020 in.

CYLINDER

Item		Factory Specification	Allowable Limit
Cylinder	I.D. [D1102]	76.000 to 76.019 mm 2.9921 to 2.9929 in.	76.169 mm 2.9988 in.
	[D1402-DI,V1902-DI]	85.000 to 85.022 mm 3.3465 to 3.3473 in.	85.170 mm 3.3531 in.
	[D1462-DI]	87.000 to 87.022 mm 3.4252 to 3.4261 in.	87.170 mm 3.4319 in.
Oversized Cylinder	I.D. [D1102]	76.500 to 76.519 mm 3.0118 to 3.0126 in. in.	76.669 mm 3.0185 in.
	[D1402-DI,V1902-DI]	85.500 to 85.522 mm 3.3661 to 3.3670 in.	85.670 mm 3.3728 in.
	[D1462-DI]	87.500 to 87.522 mm 3.4449 to 3.4457 in.	87.670 mm 3.4516 in.

[2] LUBRICATING SYSTEM**OIL PUMP**

Engine Oil Pressure	At Idle Speed	98 kPa 1.0 kgf/cm ² 14 psi	—
	At Rated Speed	294 to 441 kPa 3.0 to 4.5 kgf/cm ² 43 to 64 psi	245 kPa 2.5 kgf/cm ² 36 psi
Inner Rotor to Outer Rotor	Clearance	0.10 to 0.16 mm 0.0039 to 0.0063 in.	0.20 mm 0.0079 in.
Outer Rotor to Pump Body	Clearance	0.11 to 0.19 mm 0.0043 to 0.0075 in.	0.25 mm 0.0098 in.
Inner Rotor to Cover	End Clearance	0.105 to 0.150 mm 0.0041 to 0.0059 in.	0.20 mm 0.0079 in.

[3] COOLING SYSTEM**RADIATOR**

Item		Factory Specification	Allowable Limit
Radiator	Water Tightness	Water tightness at specified pressure 137 kPa, 1.4 kgf/cm ² , 20 psi	—
Radiator Cap	Opening Pressure	10 seconds or more 88 → 59 kPa 0.9 → 0.6 kgf/cm ² , 13 → 9 psi	—
Fan Belt Tension	Deflection	7 mm/98N, 10 kgf 0.28 in./22 lbs.	—

THERMOSTAT

Valve Opening Temperature	At Beginning	80.5° to 83.5°C 176.9° to 182.3°F	—
	Opened Completely 8 mm, 0.315 in.	95°C 203°F	—

[4] FUEL SYSTEM**INJECTION PUMP**

Injection Order	[D1102 D1402-DI D1462-DI]	1-2-3	—
	[V1902-DI]	1-3-4-2	—
Injection Timing	[D1102]	0.401 to 0.436 rad. 23° to 25° before T.D.C.	—
	[D1402-DI D1462-DI V1902-DI]	0.298 to 0.3316 rad. 17° to 19° before T.D.C.	—
Pump Element Fuel Tightness	[D1102]	—	14.77 MPa 150 kgf/cm ² 2133 psi
	[D1402-DI D1462-DI V1902-DI]	60 seconds or more 39.23 MPa → 34.32 MPa 400 kgf/cm ² → 350 kgf/cm ² 5689 psi → 4978 psi	30 seconds 39.23 MPa → 34.32 MPa 400 kgf/cm ² → 350 kgf/cm ² 5689 psi → 4978 psi

INJECTION PUMP (Continued)

Item		Factory Specification	Allowable Limit
Delivery Valve Fuel Tightness	[D1102]	—	5 seconds 9.81 MPa → 9.32 MPa 100 kgf/cm ² → 95 kgf/cm ² 1422 psi → 1351 psi
	[D1402-DI] [D1462-DI] [V1902-DI]	10 seconds or more 18.63 MPa → 17.65 MPa 190 kgf/cm ² → 180 kgf/cm ² 2702 psi → 2560 psi	5 seconds 18.63 MPa → 17.65 MPa 190 kgf/cm ² → 180 kgf/cm ² 2702 psi → 2560 psi

INJECTION NOZZLE

Injection Nozzle Fuel Injection Pressure	[D1102]	13.73 to 14.71 MPa 140 to 150 kgf/cm ² 1991 to 2133 psi	—
	[D1402-DI] [D1462-DI] [V1902-DI]	22.41 to 23.44 MPa 228.5 to 239.0 kgf/cm ² 3250 to 3400 psi	—
Nozzle Valve Seat Fuel Tightness	[D1102]	When the pressure is 12.75 MPa (130 kgf/cm ² , 1849 psi) the valve seat must be fuel tightness	—
	[D1402-DI] [D1462-DI] [V1902-DI]	No fuel leak for 5 seconds at pressure 18.96 to 20.00 MPa 193.3 to 203.9 kgf/cm ² 2750 to 2900 psi	—

TIGHTENING TORQUES

Screws, bolts and nuts must be tightened to the specified torque using a torque wrench. Several screws, and nuts such as those used on the cylinder head must be tightened in proper sequence and at the proper torque.

(For general use screws and nuts: See page S.G-8)

Item	Size x Pitch	N·m	kgf·m	ft-lbs
* Cylinder head cover cap nuts	M8 x 1.25	6.9 to 8.8	0.7 to 0.9	5.1 to 6.5
* Cylinder head screws	M10 x 1.25	83.4 to 88.3	8.5 to 9.0	61.5 to 65.1
* Bearing case screws 1	M8 x 1.25	36.3 to 41.2	3.7 to 4.2	26.8 to 30.4
* Bearing case screws 2	M10 x 1.25	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
* Flywheel screws	M12 x 1.25	98.1 to 107.9	10.0 to 11.0	72.3 to 79.6
* Connecting rod screws	M8 x 1.0	44.1 to 49.0	4.5 to 5.0	32.5 to 36.2
* Rocker arm bracket nuts	M8 x 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
* Crankshaft nut	M30 x 1.5	137.3 to 156.9	14.0 to 16.0	101.3 to 115.7
Glow plugs	M10 x 1.25	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Drain plug	M12 x 1.25	32.4 to 37.3	3.3 to 3.8	23.9 to 27.5
Oil switch	PT1/8	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Nozzle holder assembly [D1102]		39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Nozzle holder body retaining nut [D1102]		58.8 to 78.4	6.0 to 8.0	43.4 to 57.9
Nozzle locating screws [Except D1102]	M8 x 1.25	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Injection pipe retaining nuts	M12 x 1.5	14.7 to 24.5	1.5 to 2.5	10.8 to 18.1
	M14 x 1.5	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7

■ NOTE

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

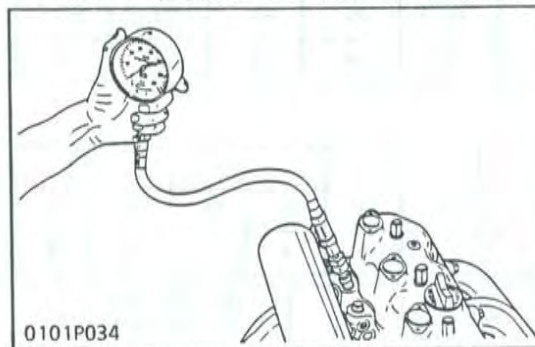
CHECKING, DISASSEMBLING AND SERVICING

[1] CYLINDER HEAD

CHECKING AND ADJUSTING



0101P034



0101P034

Compression Pressure

1. Warm up the engine.
2. Remove the air cleaner and the nozzle holders from all the cylinders.
3. Set a compression tester to the cylinder to be measured.
4. Run the engine with the starter at 200 to 300 rpm and read constant maximum on the tester. Execute the test at least twice. (Run the engine for 5 to 10 seconds for each test.)

NOTE

- For the test, use a fully charged battery and the specified valve clearance.
- If the compression pressure is below the given allowable limit, pour a small amount of oil through the nozzle holder hole and test again.
- If the pressure recovers to the standard level, inadequate pressure may be caused by wear or adhesion of the piston rings. Check the related points.
- If the pressure does not recover, cylinder head or valve problems may be the cause. Check the related points.
- If the compression differs more than 10% among the cylinders, trace the cause of pressure variation and take corrective measures.

TEST EQUIPMENT

Compression tester (Code No: 07909-30204)

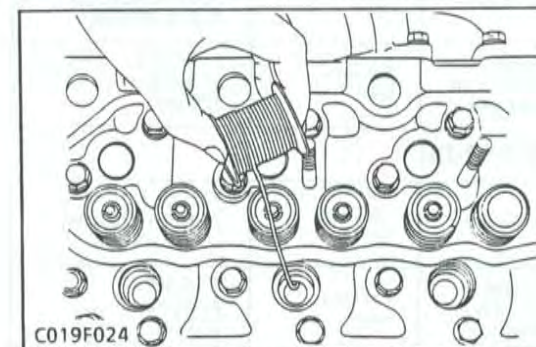
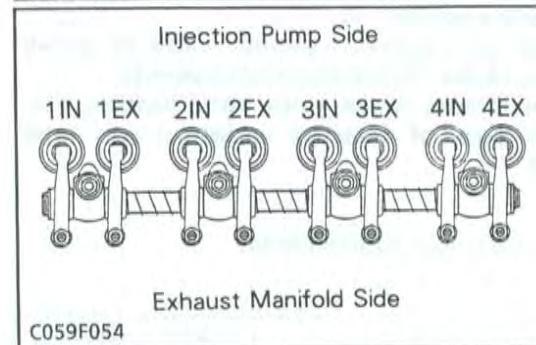
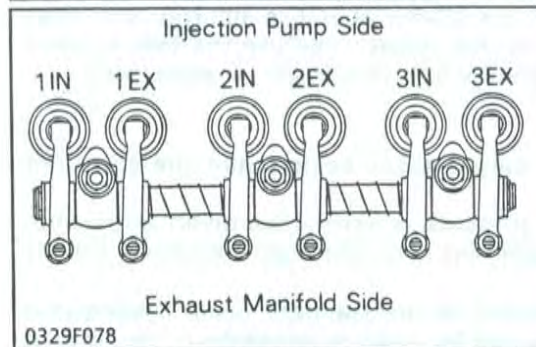
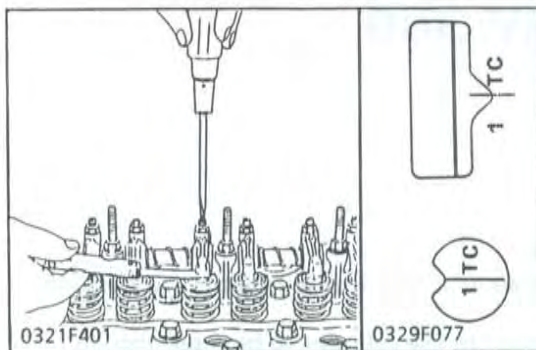
[D1102]

Reference compression pressure	Factory spec.	2.84 to 3.24 MPa 29 to 33 kgf/cm ² 412 to 469 psi
Compression pressure allowable limit should be more than 75% of reference compression pressure	Factory spec.	2.26 MPa 23 kgf/cm ² 320 psi

[D1402-DI, D1462-DI, V1902-DI]

Reference compression pressure	Factory spec.	2.75 to 3.04 MPa 28 to 31 kgf/cm ² 398 to 441 psi
Compression pressure allowable limit should be more than 75% of reference compression pressure	Factory spec.	2.16 MPa 22 kgf/cm ² 313 psi

- Difference in compression pressure among cylinders should be within 10%.



Valve Clearance

1. Remove the cylinder head cover and the timing window cover on the flywheel housing and all glow plugs.
2. Turn the flywheel and align the 1 TC mark with the timing mark of window on the flywheel housing to position the 1st cylinder valves at the top dead center during compression.
3. Measure the clearance at the valves marked with ○ in the table below with a feeler gauge.
4. Turn the flywheel just one turn to position the 1st cylinder valves at the top dead center during overlap.
5. Measure the clearance at the valves marked with ● in the table below with a feeler gauge.
6. If the clearance is not within the factory specifications adjust.

[D1102, D1402-DI, D1462-DI]

Cylinder No.	1		2		3	
Valve	IN.	EX.	IN.	EX.	IN.	EX.
Checking	○	○	●	○	○	●

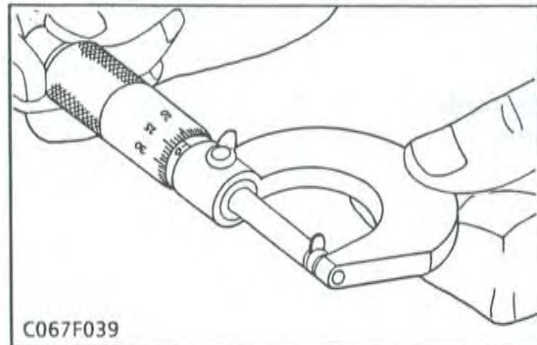
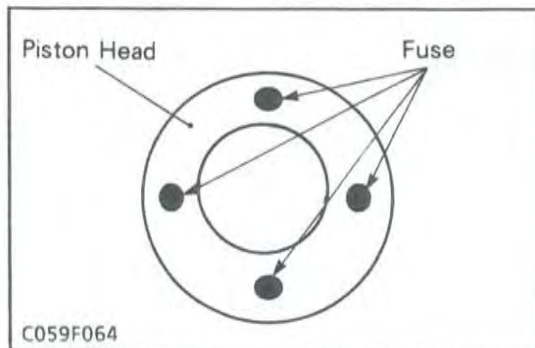
[V1902-DI]

Cylinder No.	1		2		3		4	
Valve	IN.	EX.	IN.	EX.	IN.	EX.	IN.	EX.
Checking	○	○	○	●	●	○	●	●
Valve clearance IN. and EX.		Factory spec.				0.18 to 0.22 mm 0.0071 to 0.0087 in.		

Top Clearance [D1102]

1. Remove the nozzle holder.
2. Lower the piston in the cylinder to be measured.
3. Insert a high-quality fuse from the nozzle holder hole. Be careful not to let the fuse touch the valve surface.
4. Rotate the engine with your hand.
5. Take the fuse out carefully.
6. Measure the place where the fuse was crushed with vernier calipers.
7. If the clearance is not within the factory specification, adjust by inserting a shim between the cylinder head and the gasket.

Top clearance	Factory spec.	0.7 to 0.9mm 0.0276 to 0.0354 in.
Thickness of gasket shim	Factory spec.	0.20 mm 0.0079 in.



Top Clearance [D1402-DI, D1462-DI, V1902-DI]

1. Remove the cylinder head.
2. Move the piston up and stick a strip of fuse on the piston head at four position with grease.
3. Lower the piston and install the cylinder head. (Use a new cylinder head gasket and tighten with a specified tightening torque.)
4. Turn the flywheel until the piston passes through the TDC.
5. Remove the cylinder head and measure the thickness of the fuses.
6. If the measurement is not within the factory specifications, insert or remove the gasket shim. If the measurement exceeds the factory specification on the engine without the shim, check the oil clearances between the crankpin and bearing and between the piston pin and bush.

Top clearance	Factory spec.	0.6 to 0.7 mm 0.024 to 0.035 in.
Thickness of gasket shim	Factory spec.	0.20 mm 0.0079 in.

DISASSEMBLING AND ASSEMBLING



(1) Cylinder Head Cover

Cylinder Head Cover

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

(When reassembling)

- Check to see if the head cover gasket is not defective.
- To prevent valve stem seizure, apply enough engine oil to the valve guide and valve stem.

Tightening torque	Cylinder head cover cap nuts	6.9 to 8.8 N·m 0.7 to 0.9 kgf·m 5.1 to 6.5 ft-lbs
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(1) Injection Pipes

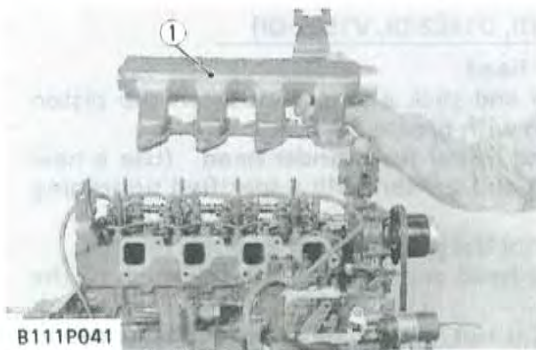
Injection Pipes

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

(When reassembling)

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

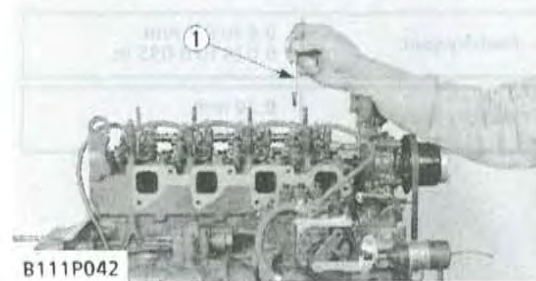
Tightening torque	Retaining nuts (M12 × 1.5)	15 to 25 N·m 1.5 to 2.5 kgf·m 11 to 18 ft-lbs
	Retaining nuts (M14 × 1.5)	25 to 29 N·m 2.5 to 3.0 kgf·m 18 to 22 ft-lbs



(1) Inlet Manifold

Inlet Manifold

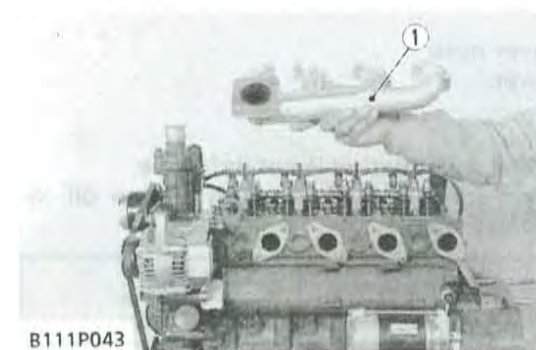
1. Remove the inlet manifold.



(1) Glow Plug

Glow Plugs

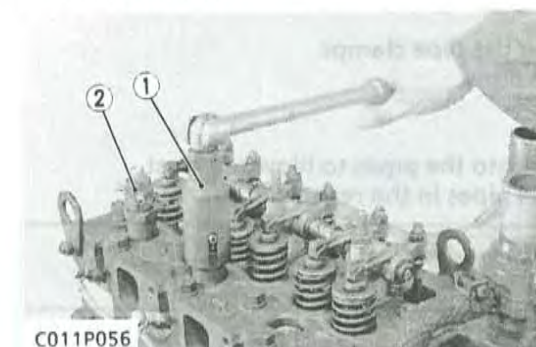
1. Remove the glow plug cords.
2. Remove the glow plugs.



(1) Exhaust Manifold

Exhaust Manifold

1. Remove the exhaust manifold.



(1) Nozzle Holder Socket Wrench

(2) Rock Nut

Nozzle Holder Assembly [D1102]

1. Remove the pipe clips holding the fuel overflow pipes, and detach the pipes.
2. Detach the nozzle holders using a 27 mm (1.0630 in.) nozzle holder socket wrench (1), after loosening the rock nuts (2).
3. Detach the copper gaskets on the seats on which the nozzles are to be installed.

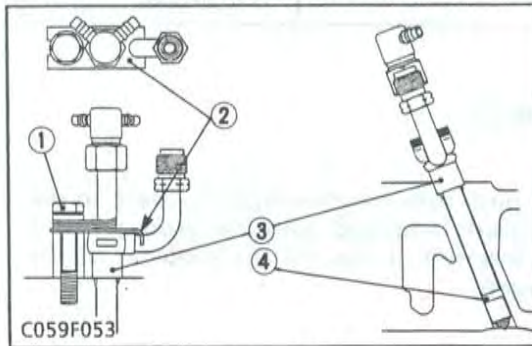
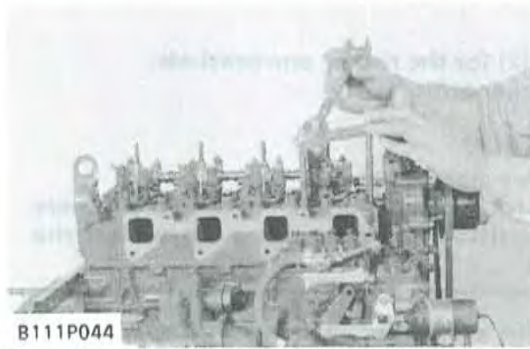
(When reassembling)

- Return the nozzle holders after confirming that there are no metallic particles or foreign matter on the surface on which the nozzles are to be installed.

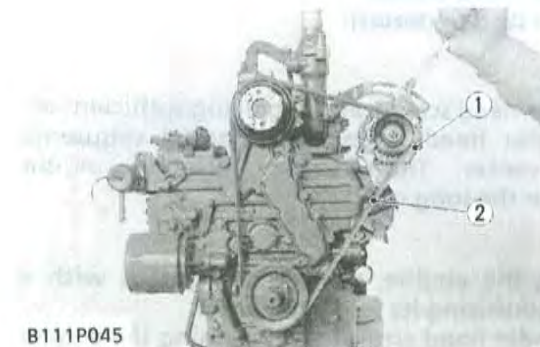
Tightening torque	Nozzles	39 to 49 N·m 4.0 to 5.0 kgf·m 29 to 36 ft·lbs
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SPECIAL TOOL:

Nozzle holder socket wrench (Code No: 07916-30841)



- (1) Locating Screw (3) Compression Seal
(2) Locating Plate (4) Carbon Dam Seal



- (1) Alternator (2) Fan Belt

Injection Nozzle Assembly [D1402-DI, D1462-DI, V1902-DI]

1. Remove the locating screws (1) and the locating plates (2).
2. Draw out the injection nozzles assembly using the nozzle replacer (Code No: 07916-32721, See page S.G-33).

■ IMPORTANT

- Never draw out the nozzle by prying with screw-drivers or other similar tools. This can deform the nozzle body.
- Do not interchange nozzles among cylinders. Mark the cylinder number on the nozzle to prevent interchanging.
- Cap the nozzle inlet and tip to prevent damage in handling.
- Cover the nozzle bores on cylinder head to prevent entrance of foreign materials.

(When reassembling)

- Replace the scored compression seal (3).
- Replace the carbon dam seal (4), whenever the nozzle is removed from the engine, using the replacing tool (Code No: 07916-32741).
- Wipe out oil on the nozzle body and use no lubricants on the nozzle body.
- Insert nozzle with a rocking and twisting motion to prevent damage to the carbon dam seal (4).
- Place the clamp spacer and the locating plate in their proper position and tighten the bolts, noting not to damage them. They control tip protrusion and direction.

Tightening torque	Locating screws	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs
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Alternator and Fan Belt

1. Loosen the nut and tension screw.
2. Detach the fan belt (2) and alternator (1).

(When reassembling)

- Check to see if the fan belt is placed in a correct position (where letters on the belt can be read from your side), and there is no oil or grease on the belt.
- Fan belt tension:
The belt should deflect approx. 7 mm (0.3 in.) when the center of the belt is depressed with a finger pressure of 98 N (10 kgf, 22 lbs.).



(1) Rocker Arms

(2) Set Nuts

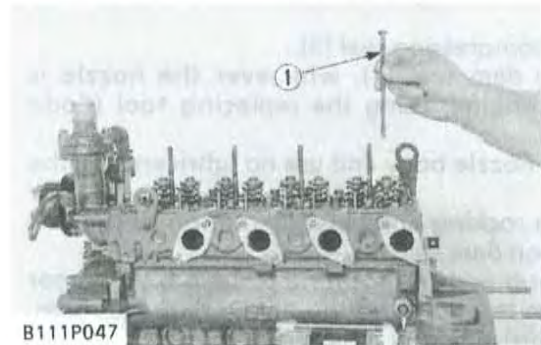
Rocker Arm

1. Remove the set nuts (2) for the rocker arm brackets.
2. Detach the whole rocker arms (1).

(When reassembling)

- Always adjust the valve clearance.
- Before installing the rocker arm bracket, check to see if there are any metallic particles on the surface on which the assembly is mounted.

Tightening torque	Rocker arm set nuts	24 to 28 N·m 2.4 to 2.8 kgf·m 17 to 20 ft-lbs
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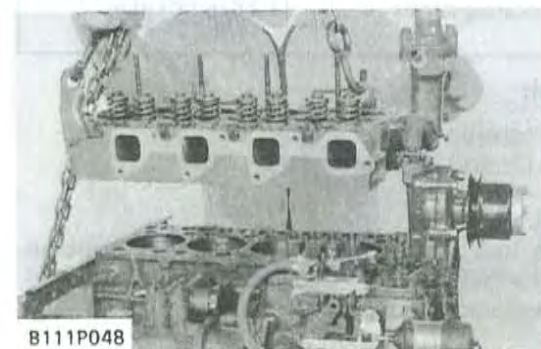
(1) Push-rods

Push-rods

1. Remove the push-rods (1).

(When reassembling)

- Before inserting the push rods into the tappets, check to see if their ends are properly engaged with the grooves. If a push rod is roughly inserted, it may hit the shoulder of the tappet and be damaged.



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Cylinder Head

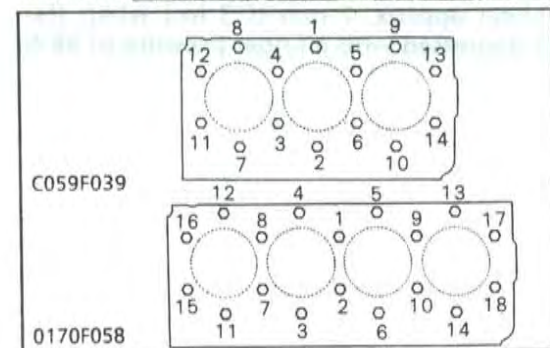
1. Remove the cylinder head screws.
2. Lift up the cylinder head to detach.

(When reassembling)

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

■ IMPORTANT

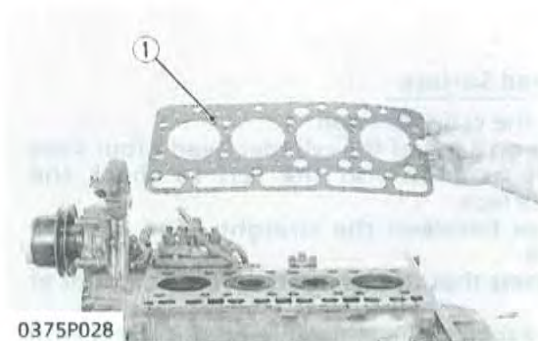
- When overhauling the engine, replace the gasket with a new one without confusing its front and back. Retighten the cylinder head screws after running the engine for 30 minutes.



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Tightening torque	Cylinder head screws	83.4 to 88.3 N·m 8.5 to 9.0 kgf·m 61.5 to 65.1 ft-lbs
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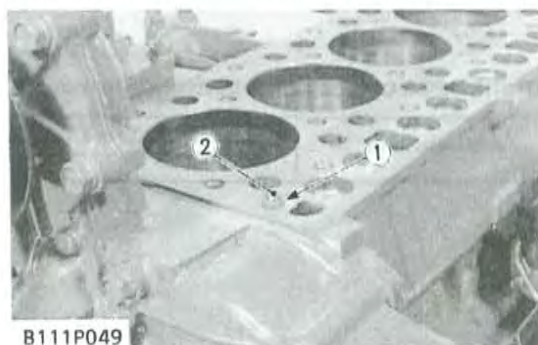
Cylinder Head Gasket

1. Detach the cylinder head gasket, being careful not to scratch it.

(When reassembling)

- Before installing the gasket, check to see there is no foreign matter on the cylinder head and the cylinder.

(1) Cylinder Head Gasket

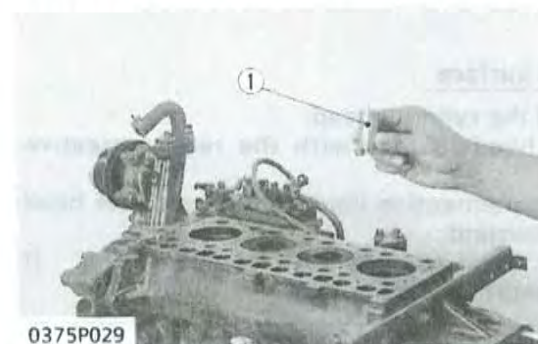


O-ring

1. Remove the O-ring from the periphery of the oil pipe on the crankcase.

(1) O-ring

(2) Pipe Pin



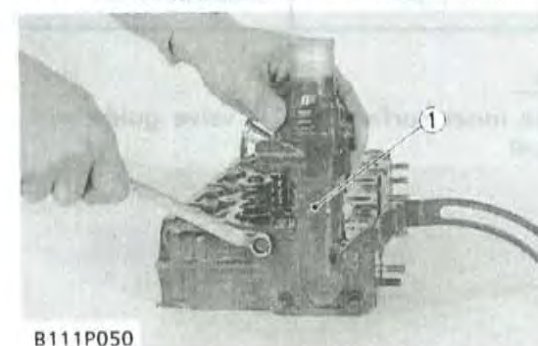
Tappets

1. Remove the tappets from the crankcase.

(When reassembling)

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

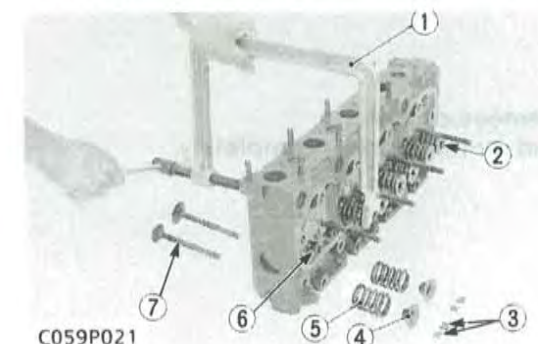
(1) Tappets



Water Flange

1. Remove the water flange from the cylinder head.

(1) Water Flange



Valves

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

■ IMPORTANT

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

(1) Valve Spring Replacer

(2) Valve Cap

(3) Valve Spring Collet

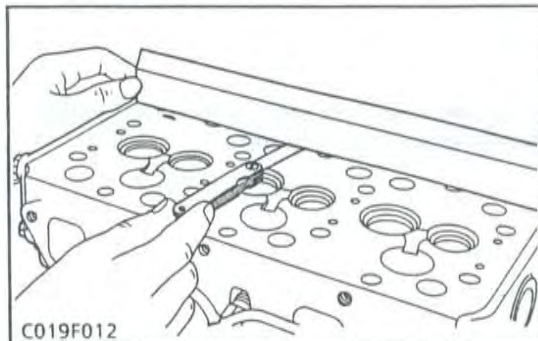
(4) Valve Spring Retainer

(5) Valve Spring

(6) Valve Stem Seal

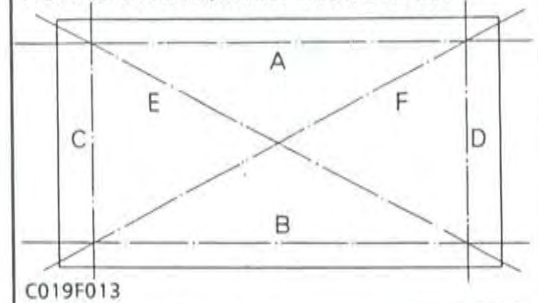
(7) Valve

SERVICING

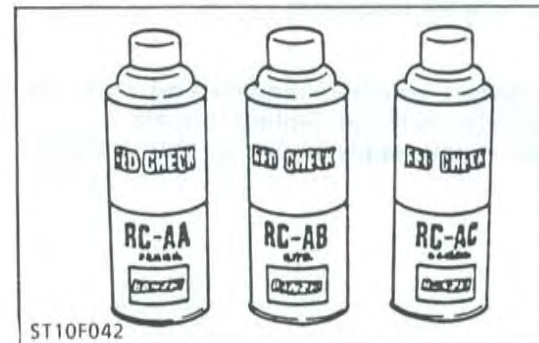


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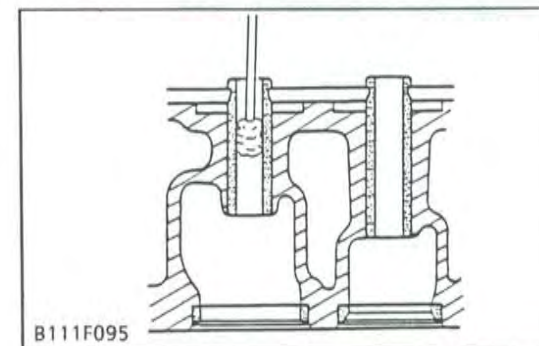
How to check cylinder head surface



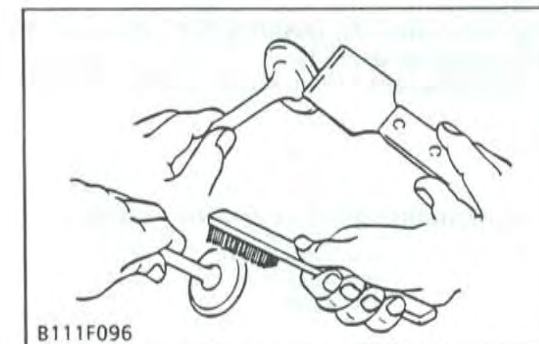
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B111F095



B111F096

Flatness of Cylinder Head Surface

1. Clean the surface of the cylinder head.
2. Place a straight edge on each of the cylinder head's four sides and two diagonally as shown at the left to check the straightness of the surface.
3. Insert a feeler gauge between the straight edge and the cylinder head surface.
4. The maximum thickness that can be inserted is the amount of flatness.
5. If the measurement exceeds the allowable limit, correct with a surface grinder.

NOTE

- Do not place the straight edge on the combustion chamber.

Cylinder head surface length	Allowable limit	0.05 mm (0.002 in.) per 100 mm (4 in.)
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Flaw of Cylinder Head Surface

1. Clean the surface of the cylinder head.
2. Spray the cylinder head surface with the red permeative liquid.
3. Wash away the red permeative liquid on the cylinder head surface with the detergent.
4. Spray the cylinder head surface with the developer. If flawed, it can be identified as red marks.

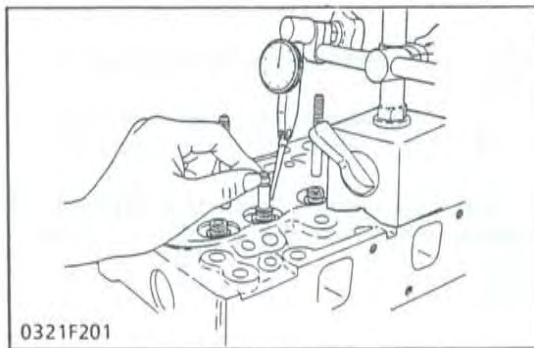
Flaw of cylinder head surface	Factory spec.	Should be no flaw
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Clean the Valve Guide

1. Wash and clean the inner surface of the valve guide with kerosine or diesel fuel.

Clean the Valve

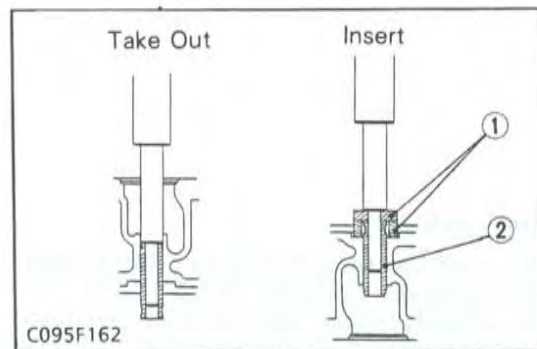
1. Use a scraper and remove carbon.
2. Use a wire brush and remove carbon completely.



Guide Clearance

1. Remove carbon from the valve guide.
2. After making sure that the valve stem is straight, insert the valve into the valve guide.
3. Measure the stem guide clearance with a dial gauge.
4. If the measurement exceeds the allowable limit, replace the stem guide and the valve.

Valve stem clearance	Factory spec.	0.040 to 0.070 mm 0.00157 to 0.00276 in.
	Allowable limit	0.1 mm 0.004 in.
Valve guide bore I.D.	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.
Valve stem O.D.	Factory spec.	7.960 to 7.975 mm 0.31339 to 0.31398 in.



(1) Spacer

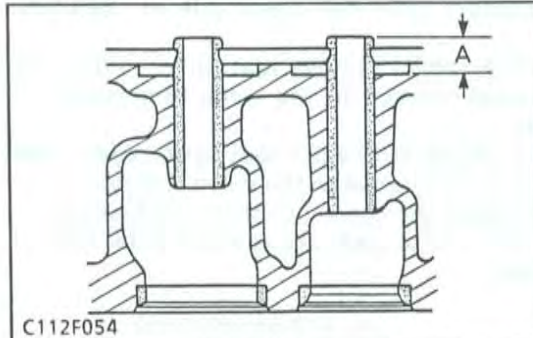
(2) Valve Guide

Replace the Valve Guide

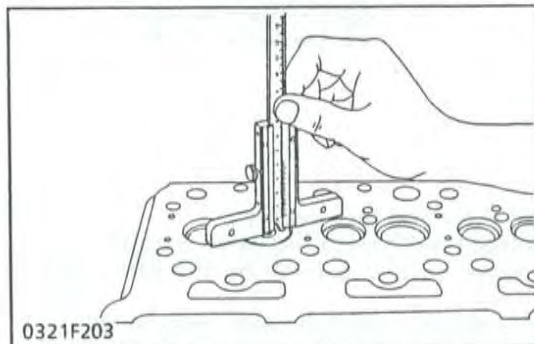
1. Remove the spacer (1).
2. Press out the used valve guide from the cylinder head's lower end.
3. Before pressing in, apply oil on the outer surface of the valve guide, place a spacer of the specified protrusion allowance (A) on the cylinder head, and press in the spacer from above.
4. After press-fitting, finish the valve guide by means of reamer machining to specified dimension.

NOTE

- Be careful not to strike valve guides with a hammer, etc. during replacement.



Valve guide bore I.D.	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.
Valve guide protrusion	Factory spec.	9.8 to 10.2 mm 0.39 to 0.40 in.



Valve Recessing

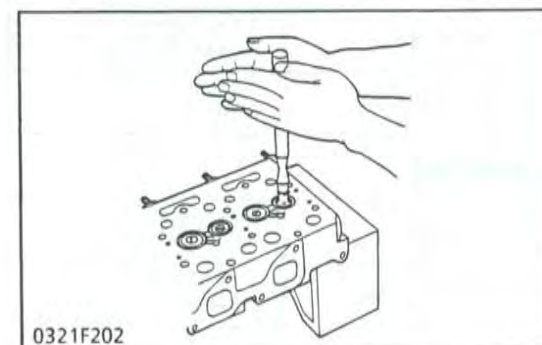
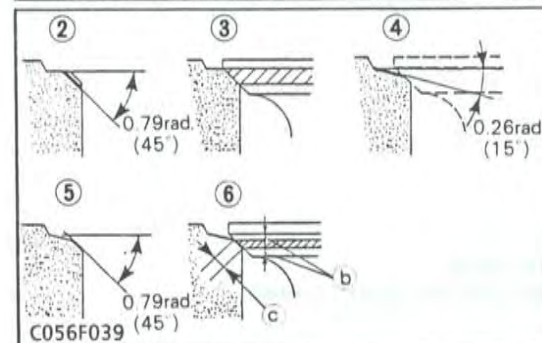
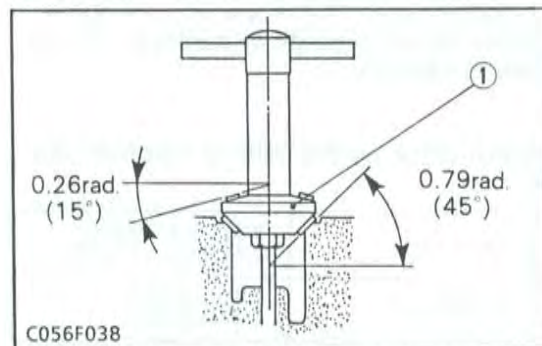
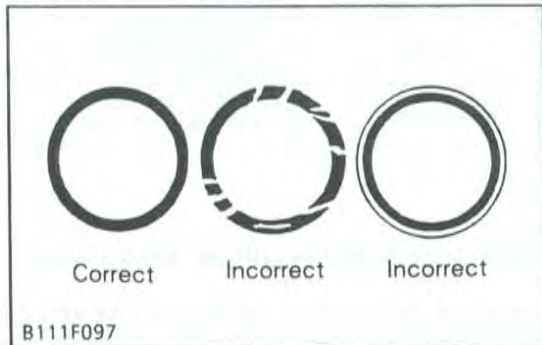
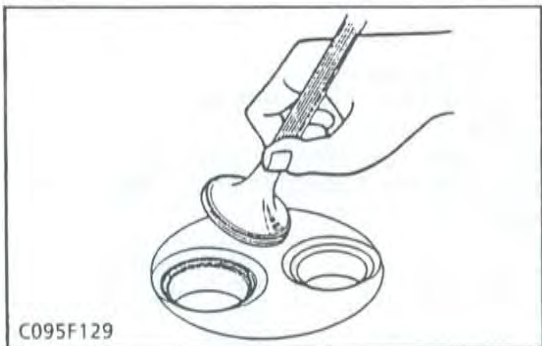
1. Clean the face of the valve.
2. Measure the recessing with a depth gauge.

[D1102]

Valve recessing	Factory spec.	1.1 to 1.3 mm 0.043 to 0.051 in.
	Allowable limit	1.6 mm 0.063 in.

[D1402-DI, D1462-DI, V1902-DI]

Valve recessing	Factory spec.	0.65 to 0.85 mm 0.026 to 0.033 in.
	Allowable limit	1.15 mm 0.045 in.



Valve Seating

1. Coat the valve face lightly with red lead 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.

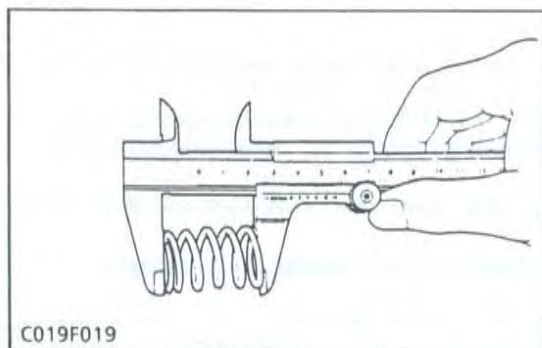
Correcting Procedure for Valve Seat

1. Correct the valve seat surface using a 0.79 rad. (45°) valve seat cutter (Valve seat cutter set: Code No. 07909-33102).
2. Place the valve and visually check the contact position between the valve face and valve seat with red lead.
(If the valve has been used for a long period of time, the seat tends to come in contact with the upper side of the valve face.)
3. Cut the seat with a 0.26 rad. (15°) valve seat cutter so that the valve seat width makes contact in the same dimensions to the valve face width.
4. Cut 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 is more than 70% of the total contact area.

- | | |
|----------------------------|----------------------------|
| (1) Valve Seat Cutter | (5) 0.79 rad. (45°) Cutter |
| (2) 0.79 rad. (45°) Cutter | (6) Contact Check |
| (3) Contact Check | (b) Identical Dimensions |
| (4) 0.26 rad. (15°) Cutter | (c) Seat Surface Width |

Valve Lapping

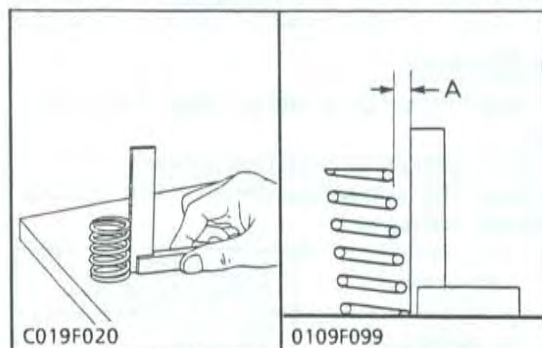
1. Apply compound on the valve face evenly.
2. Put the valve on its seat hold it with the valve flapper.
3. Turn and flap the valve back and forth on the valve seat to lap.
4. Remove the compound and clean the valve and the seat.
5. Apply oil on the valve face and finish to complete fitting.
6. Repeat lapping until the valve seats correctly, checking the seating.



Valve Spring Free Length

1. Measure the spring with a set of vernier calipers.
2. If the measurement exceeds the allowable limit, replace.

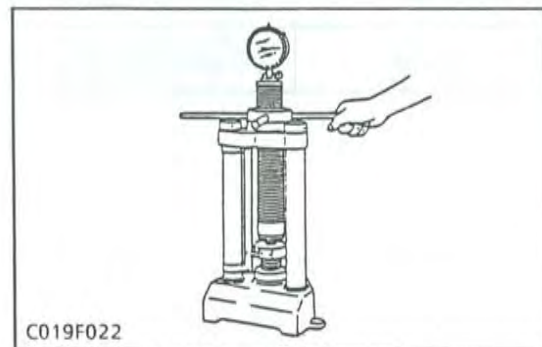
Valve spring free length	Factory spec.	41.7 to 42.2 mm 1.64 to 1.66 in.
	Allowable limit	41.2 mm 1.622 in.



Valve Spring Squareness

1. Put the spring on a surface plate, place a square on the side of the spring, and check to see if the entire side is in contact with the square.
2. Rotate the spring and measure the maximum B. (See the illustration at left.)
3. If the measurement exceeds the allowable limit, replace.
The flat surface at the end of the spring coil must exceed the full circumference by two-thirds.
Check the entire surface of the spring for scratches.

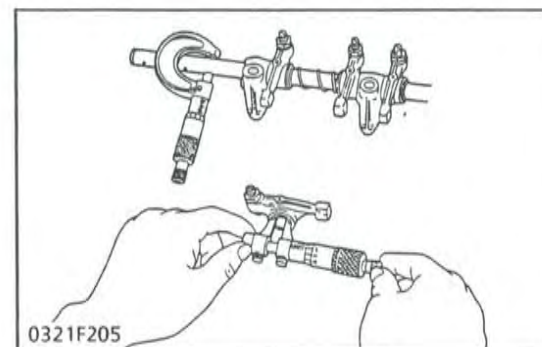
Valve spring squareness	Allowable limit	1.0 mm 0.039 in.
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Valve Spring Tension

1. Place the spring on a tester and compress it to the same degree that it is actually compressed in the engine. (31 mm, 1.2 in.)
2. Read the compression load on the gauge.
3. If the measurement exceeds the allowable limit, replace.

Valve spring tension	Factory spec.	117 N/35.15 mm 12.0 kgf/35.15 mm 26.5 lbs./1.38 in.
	Allowable limit	100 N/35.15 mm 10.2 kgf/35.15 mm 22.5 lbs./1.38 in.



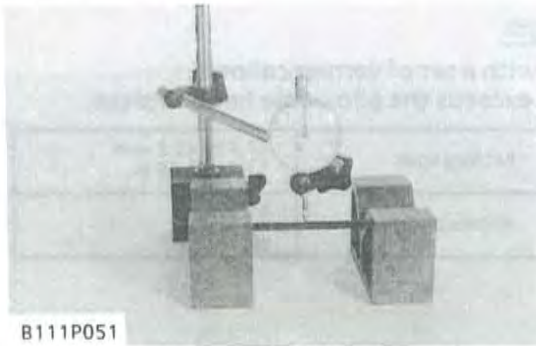
Oil Clearance between Rocker Arm Shaft and Rocker Arm

1. Measure the rocker arm bore I.D.
2. Measure the rocker arm shaft O.D.
3. If the clearance exceeds the allowable limit, replace.

Oil clearance between rocker arm shaft and rocker arm	Factory spec.	0.018 to 0.070 mm 0.00071 to 0.00276 in.
	Allowable limit	0.15 mm 0.0059 in.

Rocker arm shaft O.D.	Factory spec.	13.973 to 13.984 mm 0.55012 to 0.55055 in.
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Rocker arm bore I.D.	Factory spec.	14.002 to 14.043 mm 0.55126 to 0.55287 in.
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Bend of Push Rod

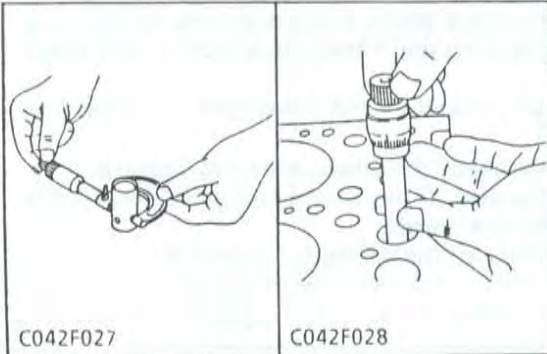
1. Place a V block on the surface plate and put the push rod on the V block.
2. Place the dial gauge at the center of the push rod, rotate the push rod, and set the dial gauge to "0" when the push rod is at its lowest position.
3. Rotate the push rod and read the maximum value on the dial gauge.
4. If the alignment exceeds the allowable limit, replace push rod.

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

1. Measure the tappet guide bore I.D. of the cylinder block with an inside micrometer.
2. Measure the tappet O.D. with an outside micrometer.
3. If the clearance exceeds the allowable limit or the sliding surface is scored, replace the tappet.

Clearance between tappet and guide bore	Factory spec.	0.020 to 0.062 mm 0.00079 to 0.00244 in.
	Allowable limit	0.07 mm 0.0028 in.
Tappet O.D.	Factory spec.	23.959 to 23.980 mm 0.94327 to 0.94410 in.
Guide bore I.D.	Factory spec.	24.000 to 24.021 mm 0.94488 to 0.94571 in.



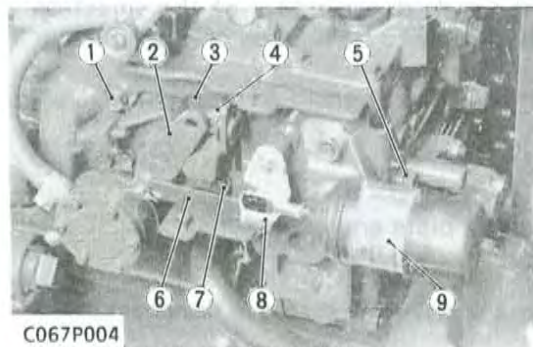
[2] TIMING GEARS

DISASSEMBLING AND ASSEMBLING



B111P052

(1) Hydraulic Pump



C067P004

- | | |
|-----------------------|------------------|
| (1) Screw | (6) Stop Lever 1 |
| (2) Engine Stop Lever | (7) Screw |
| (3) Leaf Spring | (8) Stop Lever 2 |
| (4) Stop Rod | (9) Solenoid |
| (5) Screw | |



B111P053

- | |
|--------------------------|
| (1) Fork Lever 1 |
| (2) Engine Stop Lever |
| (3) Injection Pump Cover |



B111P054

- | |
|----------------------|
| (4) Control Rack Pin |
| (5) Groove |
| (6) Shims |

Cylinder Head Assembly

1. Remove the cylinder head assembly. (See page S.1-15)

Hydraulic Pump

1. Remove the hydraulic pump mounting screws.
2. Detach the hydraulic pump (1).

Solenoid [D1402-DI, D1462-DI, V1902-DI]

1. Disconnect the stop lever 1 (6) from the engine stop lever (2).
2. Remove the screws (1), (5) and (7).
3. Remove the solenoid (9) with its support.

(When reassembling)

- Loosen the solenoid mounting screws.
- Install the support and complete the linkage between the solenoid and the engine stop lever.
- Pushing the solenoid plunger to the bottom, pull the stop lever 2 (8) with it until the engine stop lever (2) is turned to the end, then tighten the screws.

■ NOTE

- Be sure to install the leaf spring (3) in its position.

Injection Pump

1. Remove the injection pump cover (3) with the engine stop lever (2).
2. Remove the injection pump.

(When reassembling)

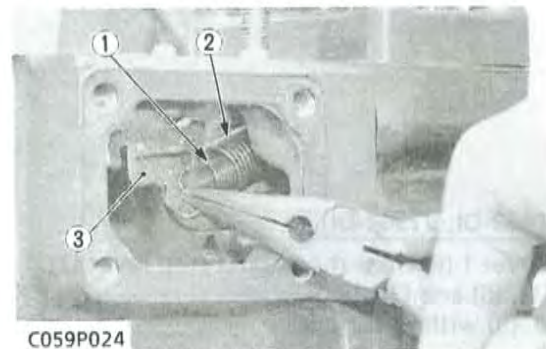
- Apply liquid gasket (Three Bond 1215, 1104 or equivalent) to the both sides of injection pump cover gasket and shim (6) and install them.
- Install the injection pump so that its control rack pin (4) engages with the groove (5) of fork lever 1.
- Install the injection pump cover with the arm of engine stop lever (2) at the right of the arm of fork lever 1 (1). [Except D1102]

[5] GEAR CASE, TIMING GEAR, CAMSHAFT, OIL PUMP**Governor Spring [D1102]**

1. Disconnect the governor spring from governor fork lever 2.

(When reassembling)

- Fix the governor spring to the speed control lever, and pull the spring or wire through the window of the injection pump, and spring will be able to be hooked on the governor fork with ease.
Bend the end of the governor spring to prevent it from falling off.

**Governor Spring [D1402-DI, D1462-DI, V1902-DI]**

1. Disconnect the governor spring 1 (1) and 2 (2) from the fork lever 2 (3).

(When reassembling)

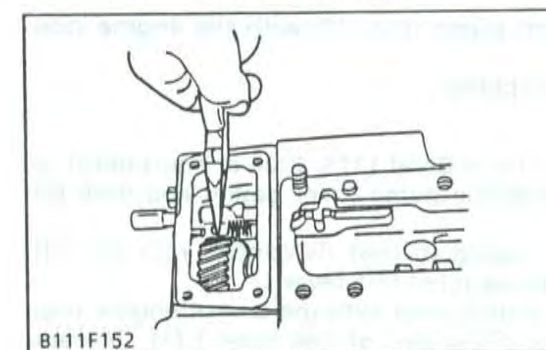
- Fix the governor spring to the speed control lever, and pull the spring or wire through the window of the injection pump, and spring will be able to be hooked on the governor fork with ease.
Bend the end of the governor spring to prevent it from falling off.

**Speed Control Plate**

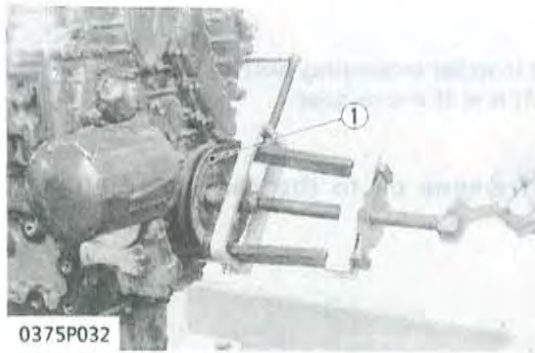
1. Remove the speed control plate and governor spring.

(When reassembling)

- Be careful not to drop the governor spring in the gear case.

**Start Spring**

1. Remove the start spring from the gear case.



0375P032

(1) Fan Drive Pulley

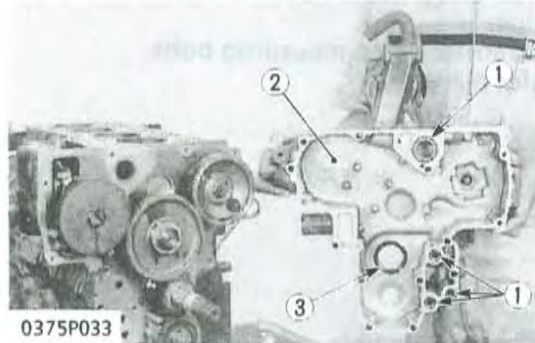
Fan Drive Pulley

1. Loosen and remove the crankshaft nut.
2. Draw out the pulley with a puller.

(When reassembling)

- Do not tighten the nut excessively, it may damage the oil slinger, causing oil leakage.

Tightening torque	Crankshaft nut	137.3 to 156.9 N·m 14.0 to 16.0 kgf·m 101.3 to 115.7 ft-lbs
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0375P033

(1) O-rings

(2) Gear Case

(3) Oil Seal

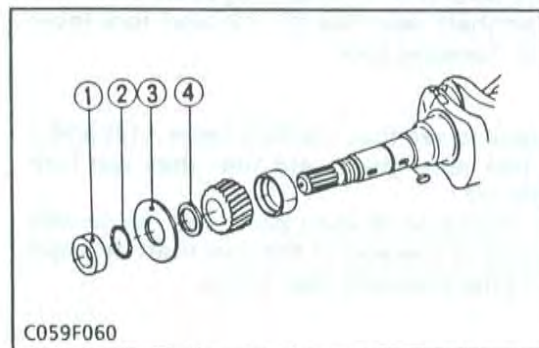
Gear Case

1. Remove the oil filter assembly.
2. Remove the gear case (2).
3. Remove the O-rings (1).

- Check to see if there are four O-rings (1) inside the gear case (2).

(When reassembling)

- Apply a thin film of engine oil to the oil seal (3), and install it, noting the lip come off.
- Before installing the gear case gasket, apply a non-drying adhesive.



C059F060

(1) Crankshaft Collar

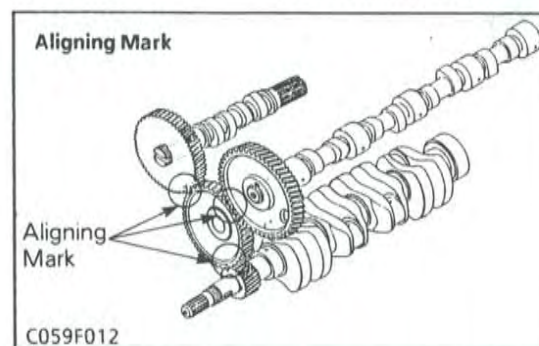
(2) O-ring

(3) Crankshaft Oil Slinger

(4) Crank Gear Collar

Crankshaft Oil Slinger

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



C059F012

Idle Gear

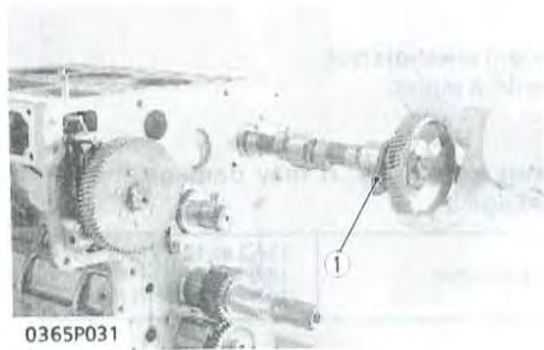
1. Remove the external snap ring.
2. Detach the idle gear collar 2.
3. Detach the idle gear.
4. Detach the idle gear collar 1.

(When reassembling)

- Check to see each gear is aligned with its aligning mark:
 - Idle gear and crank gear
 - Idle gear and camshaft gear
 - Idle gear and injection pump gear

Tappets

(See page S.1-19)



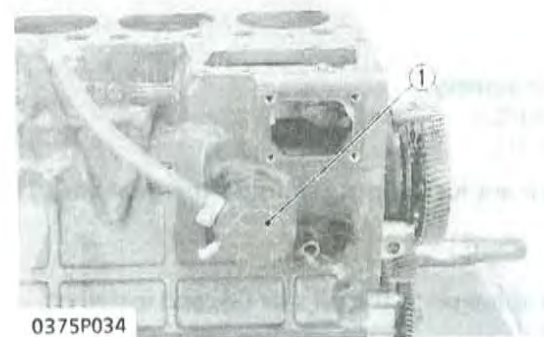
Gear and Camshaft

1. Remove the camshaft stopper mounting bolts.
2. Draw out the camshaft and the cam gear.

(When reassembling)

- Apply a thin film of engine oil to the camshaft before installation.

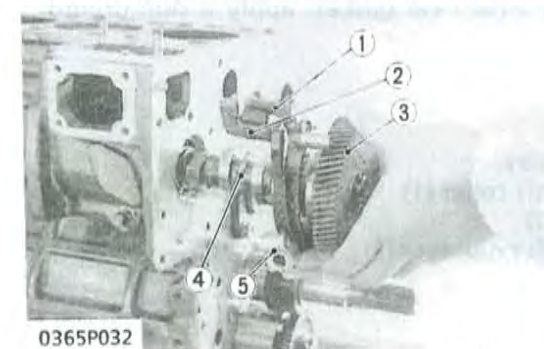
(1) Camshaft Stopper



Fuel Transfer Pump [D1402-DI, D1462-DI, V1902-DI]

1. Disconnect the fuel pipe.
2. Remove the two fuel transfer pump mounting bolts. Detach the fuel transfer pump.

(1) Fuel Transfer Pump



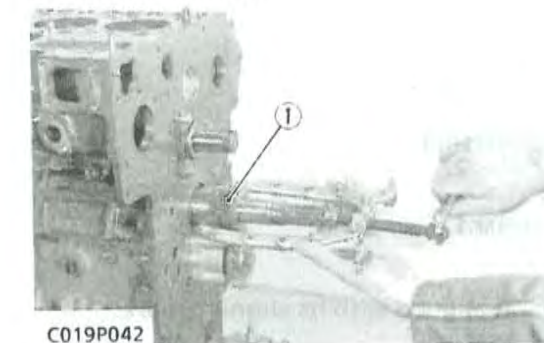
Fuel Camshaft and Fork Lever Assembly

1. Detach the fuel camshaft cover.
2. Remove the three fork lever holder mounting bolts.
3. Draw out the fuel camshaft assembly (3), (4) and fork lever assembly (1), (2), (5) at the same time.

(When reassembling)

- After installation, check to see that the fork lever 1 (2) and 2 (1) are fixed to the fork lever shaft, and that they can turn smoothly in the holder (5).
- Apply a thin film of engine oil to each part, and reassembly so that the drive groove at the end of the camshaft engages with the drive shaft of the hydraulic gear pump.

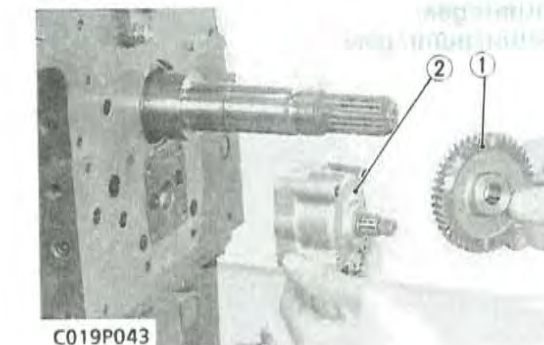
- (1) Fork Lever 2 (4) Fuel Camshaft
(2) Fork Lever 1 (5) Fork Lever Holder
(3) Fuel Camshaft Gear



Crank Gear

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

(1) Crank Gear



Oil Pump

1. Straighten the claw of the claw washer of the oil pump, and remove the nut.
2. Draw out the oil pump drive gear (1) with gear puller.
3. Remove the four oil pump mounting bolts. Detach the oil pump (2).

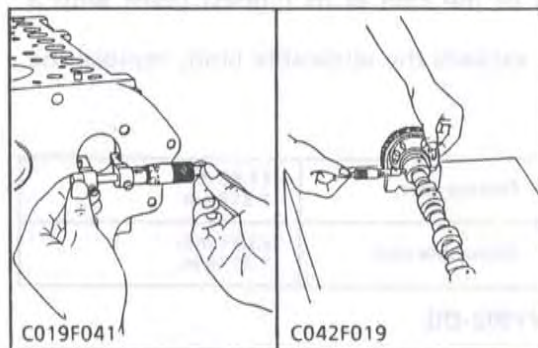
(When reassembling)

- Be sure to bend the claw of claw washer.

(1) Pump Drive Gear

(2) Oil Pump

SERVICING

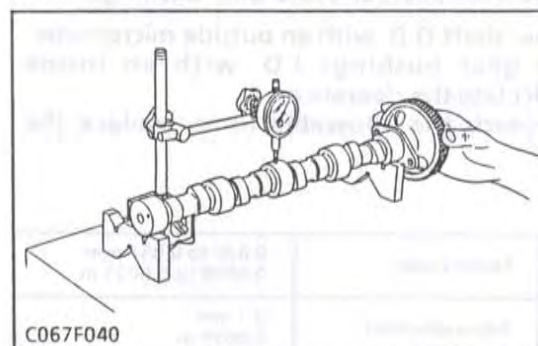


Oil Clearance of Camshaft

1. Measure the camshaft bearing in the crankcase with an inside micrometer.
2. Measure the camshaft journal with an outside micrometer. Calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the camshaft.

Oil clearance of camshaft	Factory spec.	0.050 to 0.091 mm 0.0020 to 0.0036 in.
	Allowable limit	0.15 mm 0.0059 in.

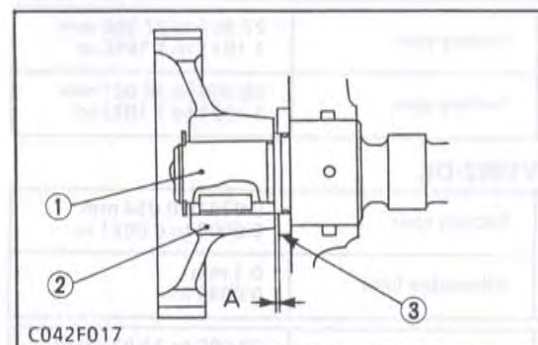
Camshaft bearing journal O.D.	Factory spec.	39.934 to 39.950 mm 1.57221 to 1.57284 in.
Camshaft bearing I.D.	Factory spec.	40.000 to 40.025 mm 1.57480 to 1.57579 in.



Camshaft Alignment

1. Gently put the camshaft on V blocks.
2. Set a dial gauge to the journal.
3. While slowly rotating the camshaft, read the dial gauge. The camshaft flexure is half of the reading.
4. If the measurement exceeds the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.05 mm 0.0020 in.
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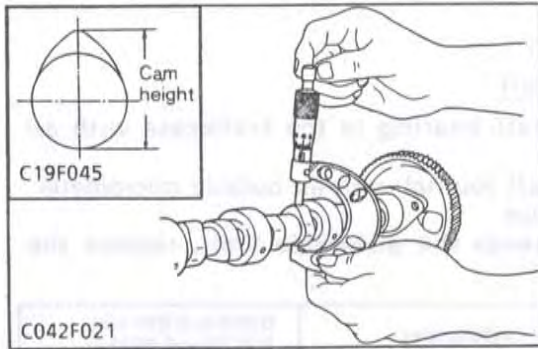
- (1) Camshaft
(2) Cam Gear

- (3) Stopper

Cam Gear Side Clearance

1. Pull the cam gear (2) with the camshaft (1) to its end.
2. Measure the clearance A between the cam gear (2) and the camshaft stopper (3).
3. If the clearance exceeds the allowable limit, replace the camshaft stopper (3).

Side clearance	Factory spec.	0.07 to 0.22 mm 0.028 to 0.087 in.
	Allowable limit	0.3 mm 0.0118 in.



Cam Heights of Intake and Exhaust

1. Measure the height of the cam at its highest point with a micrometer.
2. If the measurement exceeds the allowable limit, replace the camshaft.

[D1102]

Cam heights of intake and exhaust	Factory spec.	33.36 mm 1.3134 in.
	Allowable limit	33.31 mm 1.3114 in.

[D1402-DI, D1462-DI, V1902-DI]

Cam heights of intake and exhaust	Factory spec.	33.463 to 33.483 mm 1.3174 to 1.3182 in.
	Allowable limit	33.42 mm 1.3157 in.

Clearance between Idle Gear Shaft and Idle Gear Bushings

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

[D1102]

Clearance between idle gear shaft and idle gear bushings	Factory spec.	0.020 to 0.054 mm 0.0008 to 0.0021 in.
	Allowable limit	0.1 mm 0.0039 in.

Idle gear shaft O.D.	Factory spec.	27.967 to 27.980 mm 1.1011 to 1.1056 in.
Idle gear bushing I.D.	Factory spec.	28.000 to 28.021 mm 1.1024 to 1.1032 in.

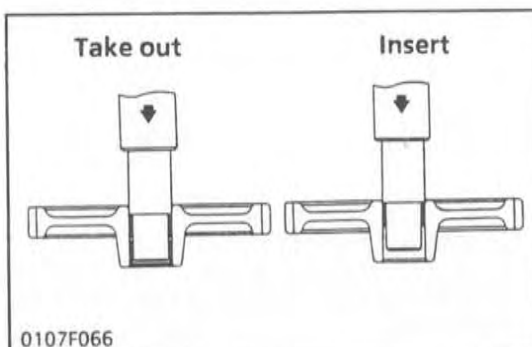
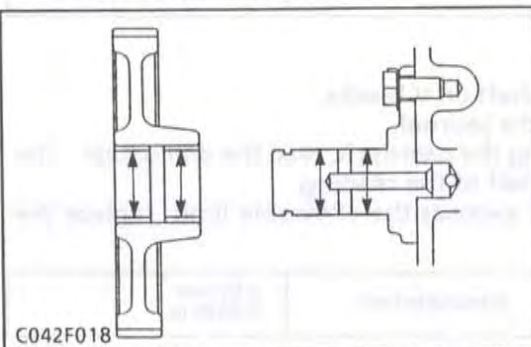
[D1402-DI, D1462-DI, V1902-DI]

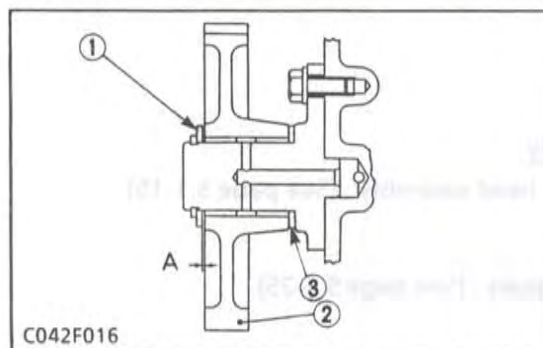
Clearance between idle gear shaft and idle gear bushings	Factory spec.	0.020 to 0.054 mm 0.0008 to 0.0021 in.
	Allowable limit	0.1 mm 0.0039 in.

Idle gear shaft O.D.	Factory spec.	32.000 to 32.025 mm 1.2598 to 1.2608 in.
Idle gear bushing I.D.	Factory spec.	31.959 to 31.975 mm 1.2582 to 1.2589 in.

Replace the Idle Gear Bushings

1. Prepare the necessary tool. (See page S.G-38)
2. Press out the used bushes and press a new part in, using this tool.
3. After pressing in the bushing, finish with a reamer to the specified factory specification.



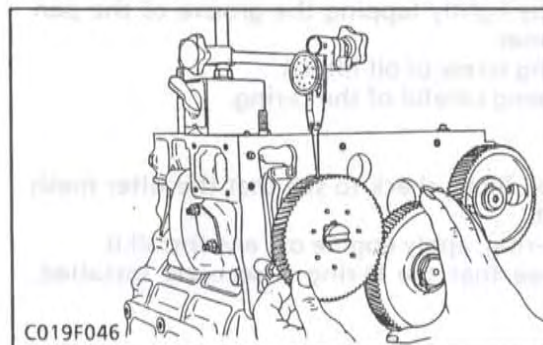


- (1) Idle Gear Collar 2 (3) Idle Gear Collar 1
(2) Idle Gear

Idle Gear Side Clearance

1. Pull the idle gear collar 2 (1) and push the idle gear (2) to each end.
2. Measure the clearance A between the idle gear and the idle gear collar 2 with a feeler gauge.
3. If the clearance exceeds the allowable limit, replace the idle gear collar 1 (3)

Side clearance	Factory spec.	0.20 to 0.51 mm 0.0079 to 0.0201 in.
	Allowable limit	0.9 mm 0.035 in.



Gear Backlash

1. Install a lever-type indicator between the gear teeth.
2. Clamp one gear, rotate the other and measure the backlash.
3. If the backlash exceeds the allowable limit, replace the gear.

Gear backlash	Factory spec.	0.04 to 0.11 mm 0.0016 to 0.0043 in.
	Allowable limit	0.15 mm 0.0059 in.

[3] CRANKCASE

DISASSEMBLING AND ASSEMBLING

Cylinder Head Assembly

1. Remove the cylinder head assembly. (See page S.1-15)

Timing Gears

1. Remove the timing gears. (See page S.1-25)

Oil Pan and Oil Filter 1

1. Lay the engine on the engine cradle on its side.
2. Remove the oil pan mounting screws.
3. Detach the oil pan by lightly tapping the groove of the pan with a wooden hammer.
4. Remove the mounting screw of oil filter 1.
5. Detach oil filter 1, being careful of the O-ring.

(When reassembling)

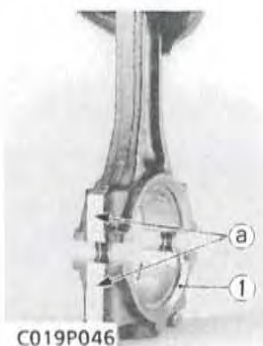
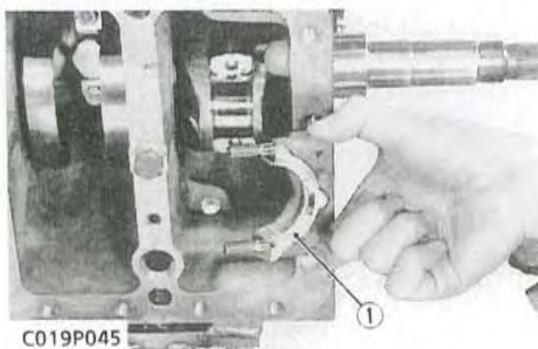
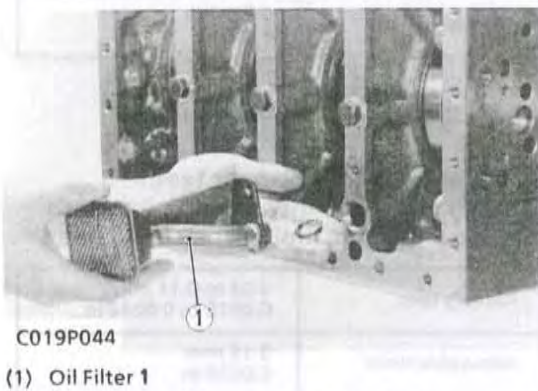
- After cleaning the oil filter, check to see that the filter mesh is clean, and install it.
- Visually check the O-ring, apply engine oil, and install it.
- After checking to see that the O-ring is securely installed, attach the oil filter.

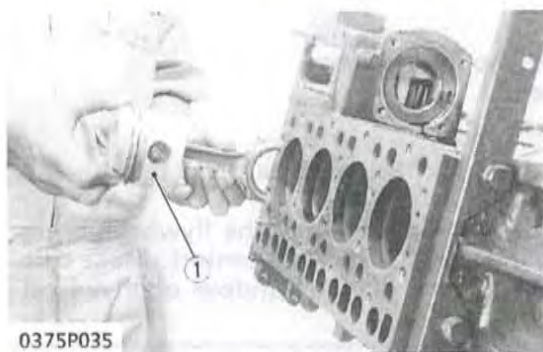
Connecting Rod Cap

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

■ IMPORTANT

- Apply engine oil to the connecting rod screws and tighten them to 44.1 to 49.0 N·m (4.5 to 5.0 kgf·m, 32.5 to 36.2 ft·lbs).





Pistons

1. Turn the crankshaft by 3.14 rad (180°) and bring the piston to top dead center.
2. Draw out the piston upward by lightly tapping it from the bottom of the crankcase with the grip of a hammer.
3. Draw out the other piston in the same method as above.

(When reassembling)

- Before inserting the pistons into the cylinders, apply enough engine oil to the pistons.

■ IMPORTANT

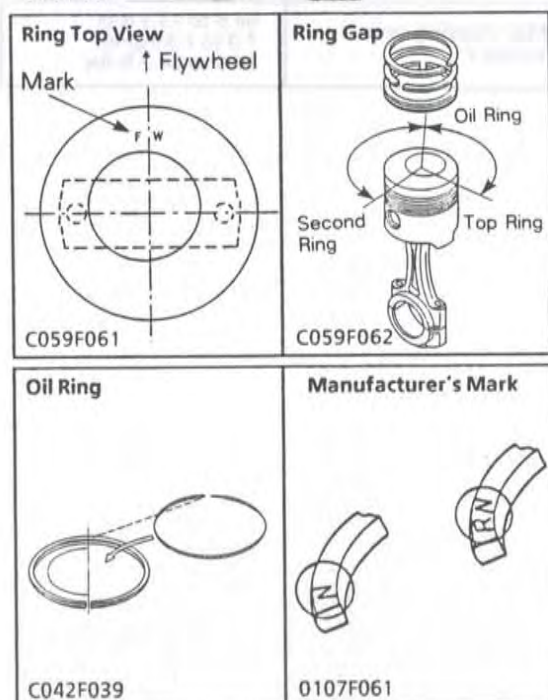
- Install the piston rings with their gaps making an angle of 2.09 rad (120°) or 3.14 rad (180°) to each other. (Place the top ring with their gaps on the opposite side of the combustion chamber.)
- Attach a ring to the pistons securely with a piston ring compressor, and set them to the cylinder, being careful about the cylinder number and the position of the connecting rod (Connecting rods must be installed with their ends bearing the number toward the fuel injection pump).
- Carefully insert the pistons. Otherwise, their chrome-plated section may be scratched, causing trouble inside the liner.

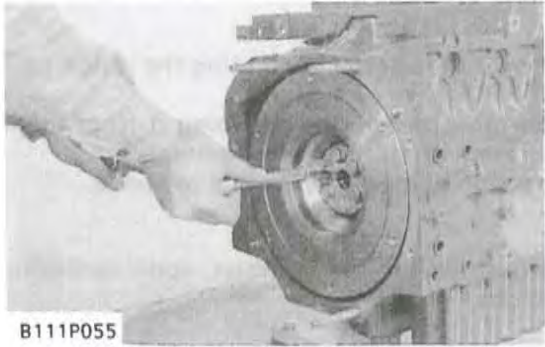
Piston Ring and Piston Pin

1. Remove the piston rings with a piston ring replacing tool (Code No : 07909-32121).
2. Remove the piston pin.

(When reassembling)

- Clean all the parts before assembling.
- Heat the piston in approx. 80°C (176°F) of oil for 10 to 15 minutes, when inserting the piston pin into the piston.
- Install the piston and connecting rod with the mark **FW** on the piston to the flywheel and the mark on the connecting rod to the injection pump. [Except D1102]
- Install the piston rings with their manufacturer's mark to the top of piston.
- Install the expander in the oil ring with its gap opposite to the gap of oil ring.
- Install the top ring with its gap at 1.57 rad (90°) from piston pin to the exhaust port.
- Install the second ring and oil ring with their gap at every 2.09 rad (120°).





B111P055

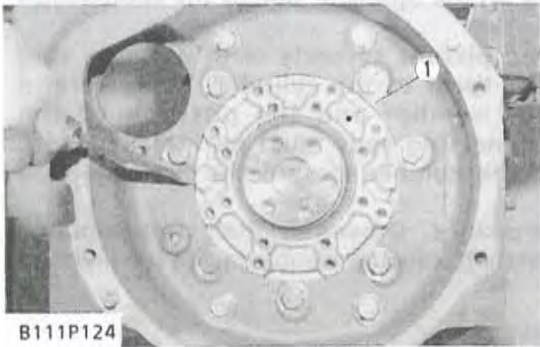
Flywheel

1. Remove the flywheel mounting screws.
2. Remove the flywheel.

(When reassembling)

- Check to see that there are no metal particles left on the flywheel mounting surface.
- To ease alignment of the crankshaft and the flywheel, bring the crank of No.1 cylinder to TC (top dead center). Make sure of the flywheel 1 TC, align it in the window on flywheel housing.

Tightening torque	Flywheel mounting screws	98 to 108 N·m 10 to 11 kgf·m 72 to 80 ft-lbs
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B111P124

Bearing Case Cover

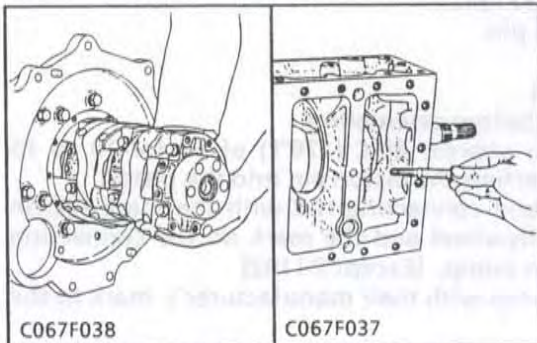
1. Loosen the screws first inside and next outside, and lift the cover (1).

(When reassembling)

- Apply grease to the oil seal lip and take care that it is not rolled when installing.

Tightening torque	Bearing case cover screws	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
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(1) Bearing Case Cover



C067F038

C067F037

Crankshaft

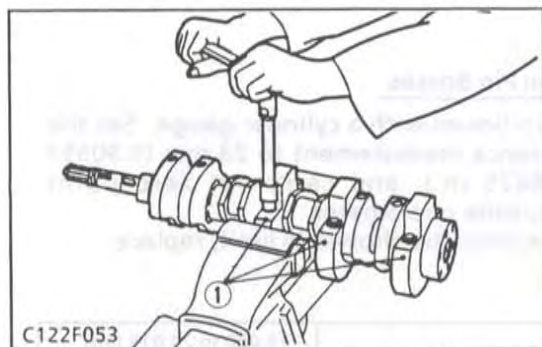
1. Remove the main bearing case screws 2.
2. Pull out the crankshaft, taking care not to damage the crankshaft bearing 1.

(When reassembling)

- Apply oil to the main bearing case screws 2.
- Clean the oil passage of the crankshaft with compressed air.

Tightening torque	Main bearing case screws 2	68.6 to 73.5 N·m 7.0 to 7.5 kgf·m 50.6 to 54.2 ft-lbs
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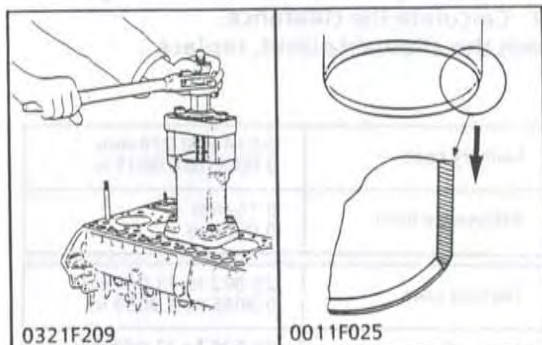




(1) Main Bearing Case



C019P055



0321F209

0011F025

Main Bearing Case

1. Remove the main bearing case screws 1 and remove the main bearing cases (1).
2. Remove the thrust bearing from the flywheel end bearing case.
3. Detach the other bearing case in the same method. Be careful not to mix them up.

■ IMPORTANT

- Mark the location number to the bearing case, to prevent interchanging.

(When reassembling)

- Clean the oil holes in the main bearing cases.
- Install the main bearing cases with their side marks toward the gear case.
- Place the thrust bearings on the bearing case with their oil grooves outside.
- Apply engine oil to the main bearing case mounting screws.

Tightening torque	Main bearing case screws 1	36.3 to 41.2 N·m 3.7 to 4.2 kgf·m 26.8 to 30.4 ft-lbs
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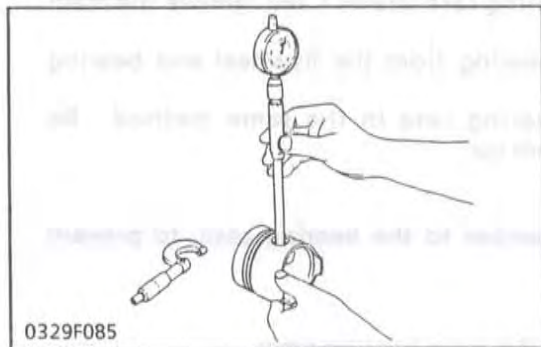
Cylinder Liner [D1102]

1. Install the dry liner changer (Code No: 07916-30043) on the cylinder block and replace the cylinder liner with new one.
2. Bore and hone to the specified dimension (See the table in Cylinder Liner)

■ IMPORTANT

- Clean the cylinder liner and the bore, and apply oil to them.
- Insert the liner with its chamfered end downward (See figure).

SERVICING

**Inside Diameter of Piston Pin Bosses**

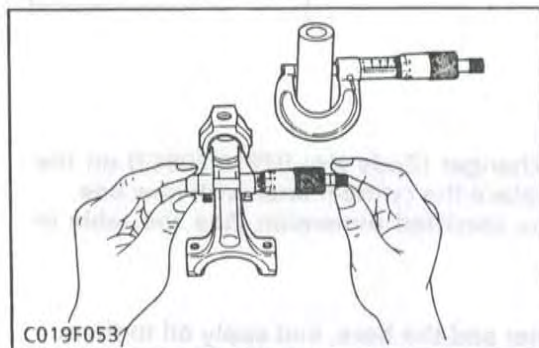
1. Measure the piston pin bosses with a cylinder gauge. Set the cylinder gauge's reference measurement to 23 mm (0.90551 in.) or 25 mm (0.98425 in.), and carry out zero point adjustment with an outside micrometer.
2. If the measurement exceeds the allowable limit, replace.

[D1102]

Inside diameter of piston pin bosses	Factory spec.	23.000 to 23.013 mm 0.90551 to 0.78898 in.
	Allowable limit	25.053 mm 0.90759 in.

[D1402-DI, D1462-DI, V1902-DI]

Inside diameter of piston pin bosses	Factory spec.	25.000 to 25.013 mm 0.98425 to 0.98477 in.
	Allowable limit	25.053 mm 0.98634 in.

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

1. Measure the piston pin with an outside micrometer.
2. Measure the I.D. of connecting rod small end bushing with an inside micrometer. Calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

[D1102]

Clearance between piston pin and small end bushing	Factory spec.	0.014 to 0.038 mm 0.0006 to 0.0015 in.
	Allowable limit	0.15 mm 0.0059 in.

Piston pin O.D.	Factory spec.	23.002 to 23.011 mm 0.9056 to 0.9059 in.
Small end bushing I.D.	Factory spec.	23.025 to 23.040 mm 0.9065 to 0.9071 in.

[D1402-DI, D1462-DI, V1902-DI]

Clearance between piston pin and small end bushing	Factory spec.	0.014 to 0.038 mm 0.0006 to 0.0015 in.
	Allowable limit	0.15 mm 0.0059 in.

Piston pin O.D.	Factory spec.	25.002 to 25.011 mm 0.9843 to 0.9847 in.
Small end bushing I.D.	Factory spec.	25.025 to 25.040 mm 0.9852 to 0.9858 in.