# M MECHANISM

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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.

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# 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 cm³ (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/cm², 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.) | |

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# 1 ENGINE

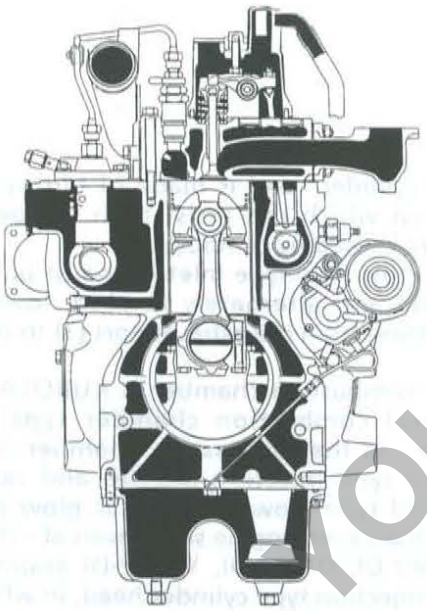
## [1] FEATURES

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

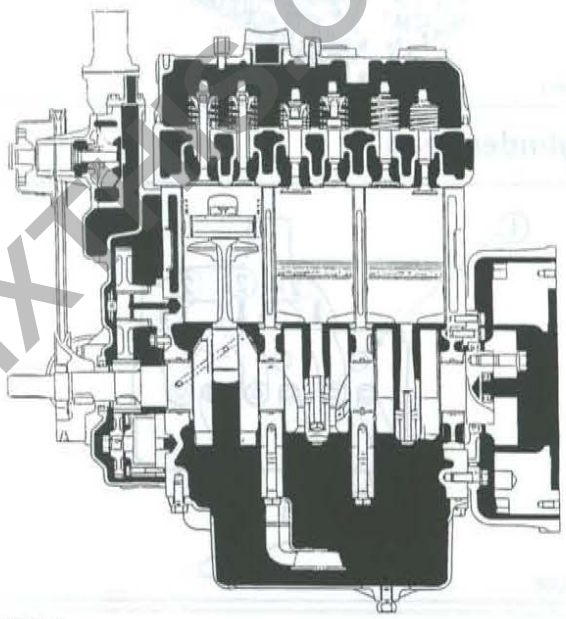
D1102 engine is a hemispherical combustion chamber KUBOTA designed, and the other models (D1402-DI, D1462-DI, V1902-DI) are direct injection types.

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

[D1102]

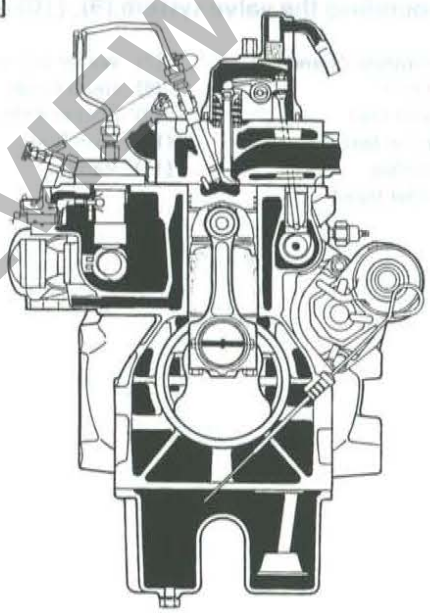


0350F002

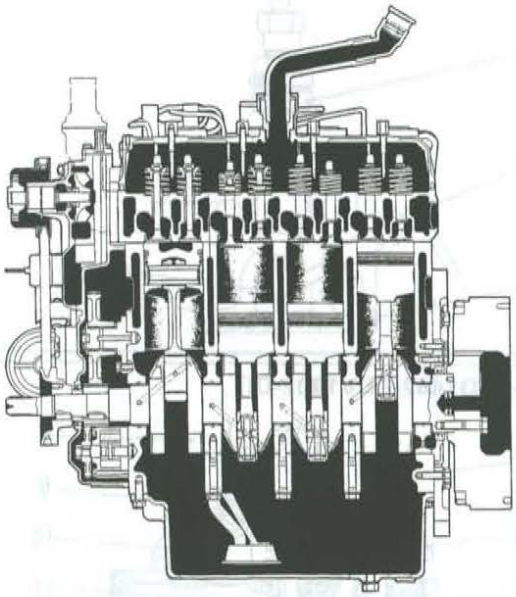


0350F003

[V1902-DI]



C067F001



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# 10 ELECTRICAL SYSTEM

## [1] WIRING DIAGRAM

- Key Switch

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

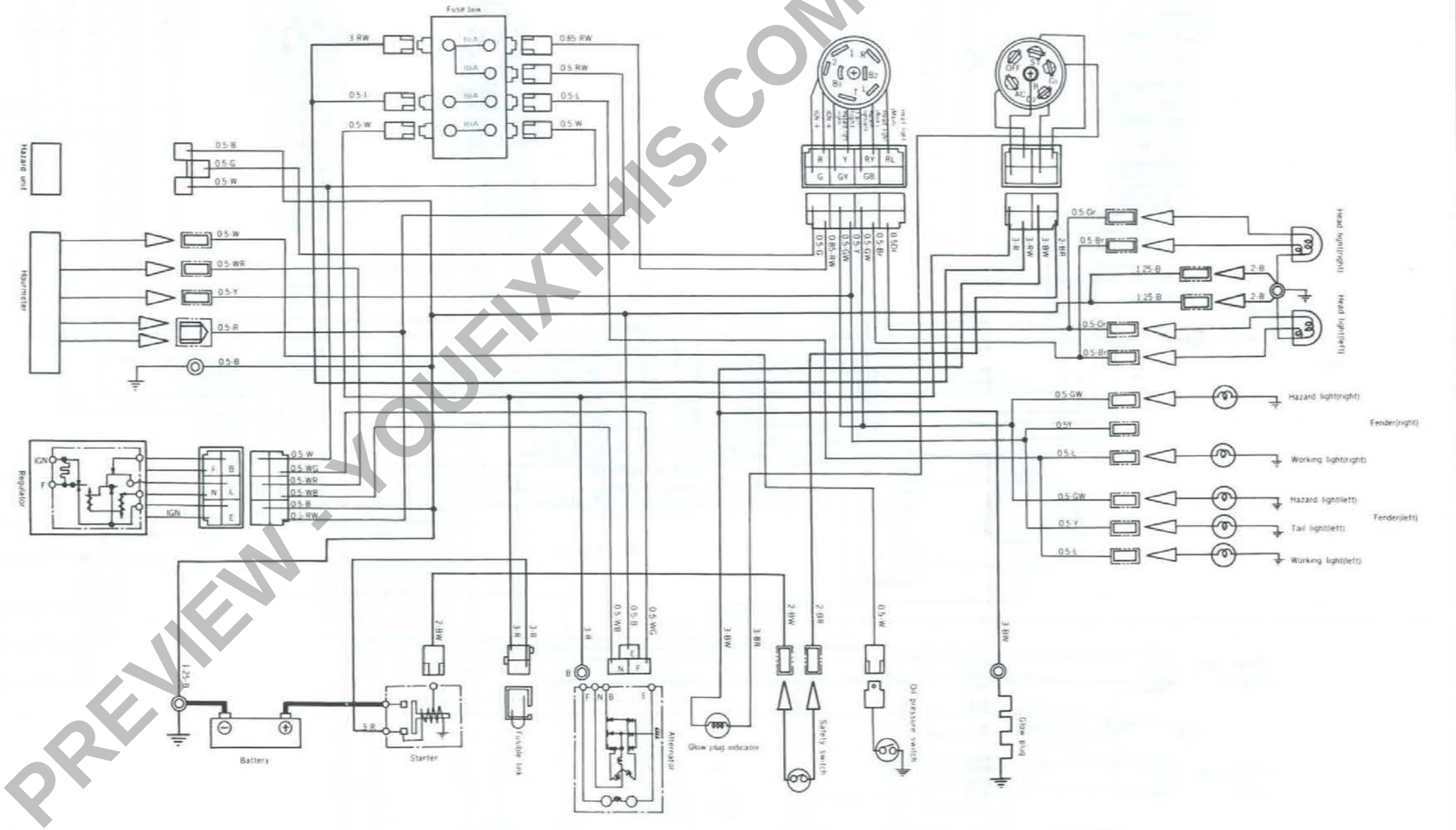
- Combination Switch

| 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]



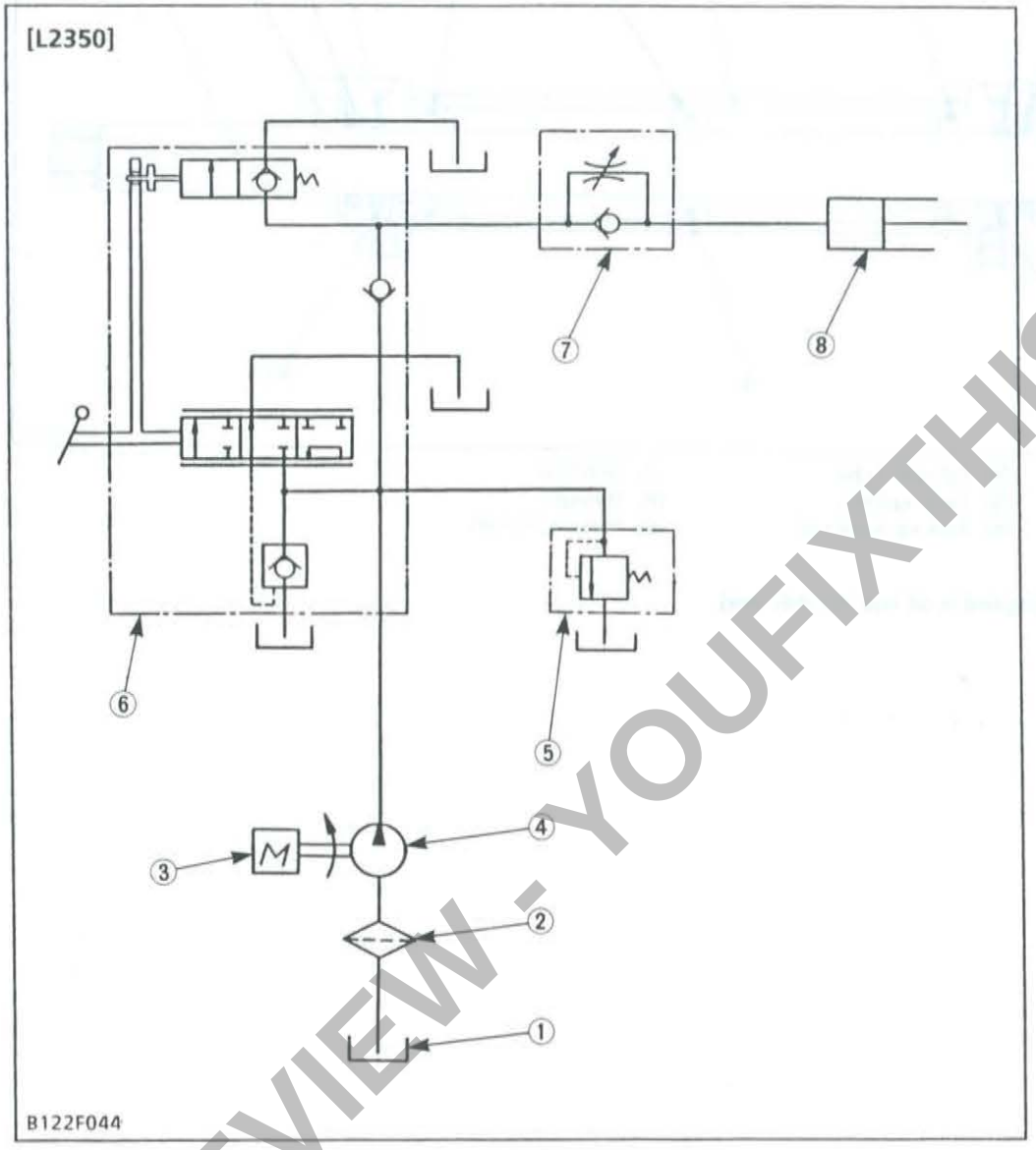

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# 9 HYDRAULIC SYSTEM

## [1] HYDRAULIC CIRCUIT




(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

### ■ 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.

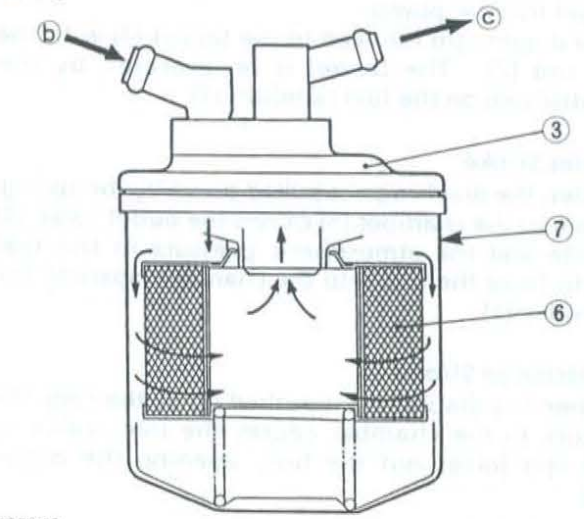
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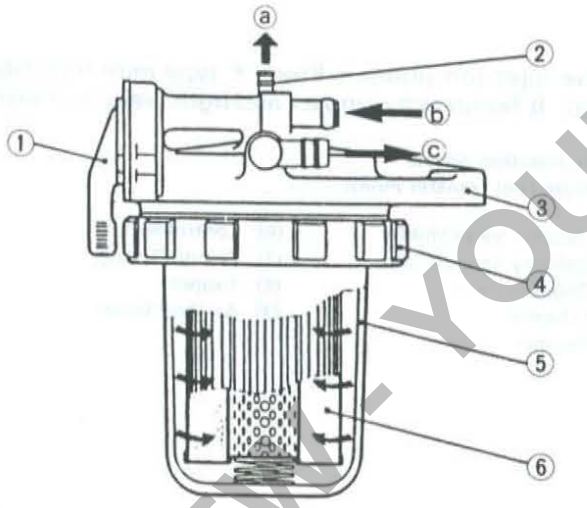
## (2) Fuel Filter

[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

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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 |
| 5 | Fuel | – |
| 6 | Fuel filter | S.G-19 |
| 7 | Fuel pipes | S.G-29 |
| 8 | Air bleed from fuel line | – |
| 9 | Battery and terminals | S.9-6 |
| 10 | Wiring connecters | M.10-1, 2, 3 |
| 11 | Idling speed | – |
| 12 | Maximum speed | – |
| 13 | Valve clearance | S.1-14 |

## (2) Troubleshooting

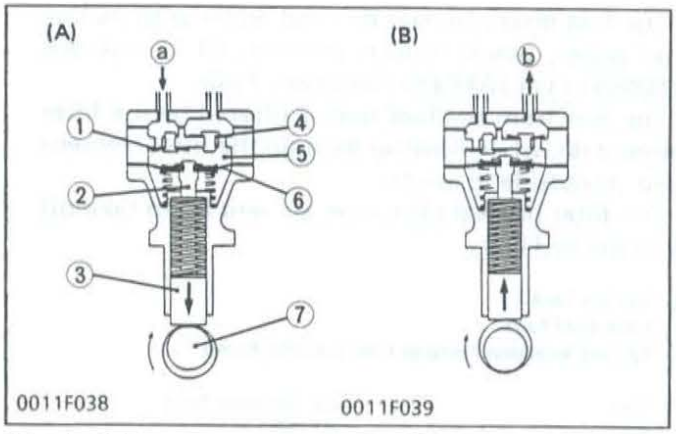
| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| Engine Does Not Start | • Incorrect injection timing | Adjust | S.1-47, 54 |
| | • Fuel camshaft worn | Replace | S.1-28 |
| | • Injection nozzle plugged | Clean | S.1-45. 51 |
| | • Fuel transfer pump malfunctioning | Repair or replace | S.1-28 |
| | • Seizure of crankshaft, camshaft, piston, cylinder liner or bearing | Repair or replace | – |
| | • Compression leak from cylinder | Check compression pressure | S.1-13 |
| | • Improper valve seat alignment, valve spring broken, valve seized | Repair or replace | S.1-21, 22, 23 |
| | • Improper valve timing | Correct or replace timing gear | S.1-27 |
| | • Piston ring and liner worn | Replace | S.1-33, 35, 43, 44 |
| | • Injection pump malfunctioning | Repair or replace | S.1-25,46, 47, 54, 55 |
| (Starter Does Not Run) | • Starter malfunctioning | Repair or replace | S.9-13 |
| | • Starter switch malfunctioning | Replace | S.9-10 |
| | • Safety switch malfunctioning [L2350] | Replace | S.9-11 |
| | • Shuttle limit switch, P.T.O. limit switch malfunctioning [Except L2350] | Replace | S.9-11 |
| | • Starter relay malfunctioning [Except L2350] | Replace | S.9-12 |

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




0011F038 0011F039

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

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).

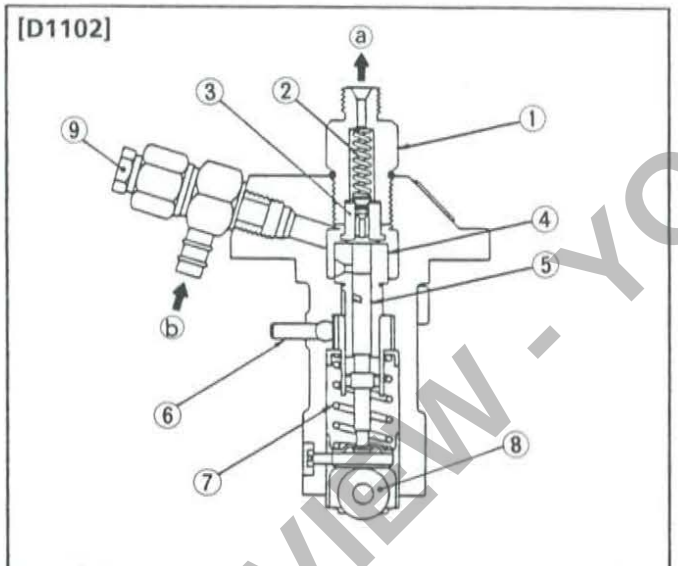
### (B) Discharge Stroke

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**

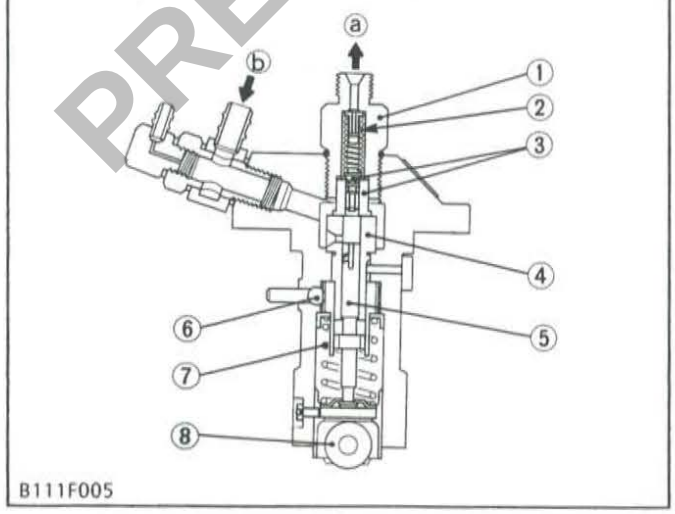
## (4) Fuel Injection Pump

[D1102]




0076F015

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




B111F005

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

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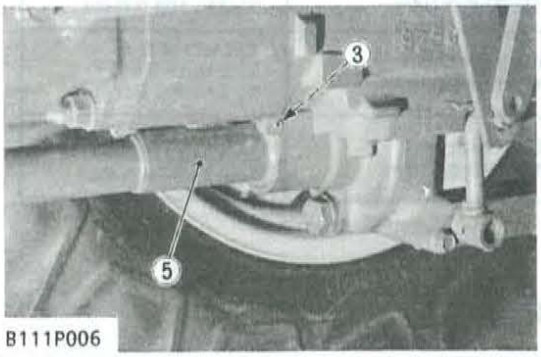


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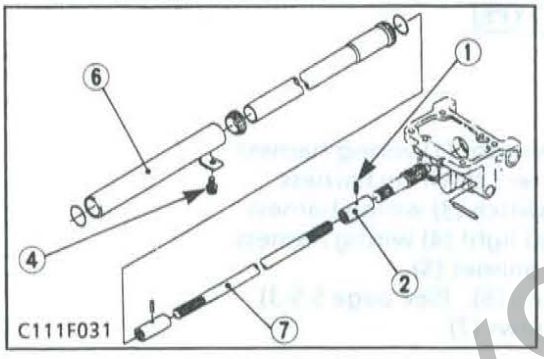
# DISASSEMBLING AND ASSEMBLING

## [1] L2350

### [1]-1 SEPARATING FRONT AXLE



B111P006



C111F031

**Front Axle Case Oil [4WD TYPE]**

1. Draining the front axle case oil. (See page S.G-17)

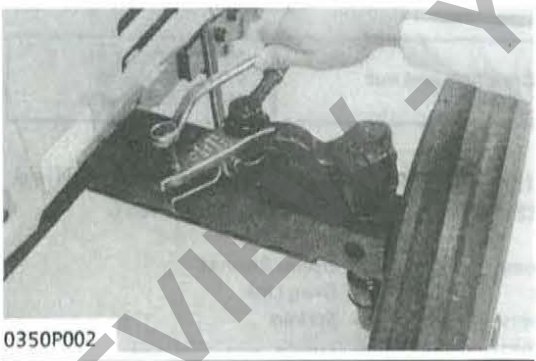
**Propeller Shaft [4WD TYPE]**

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
(2) Coupling
(3) Spring Pin
(4) Screw
(5) Propeller Shaft Cover 1
(6) Propeller Shaft Cover 2
(7) Propeller Shaft


0350P002

**Drag Link**

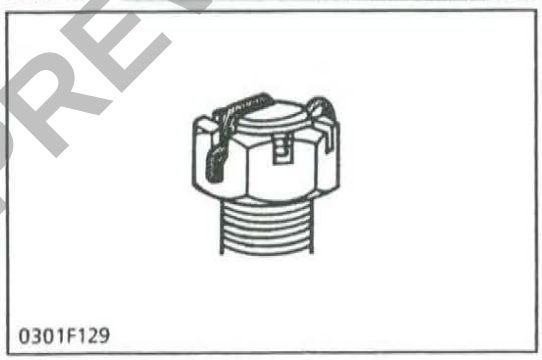
1. Remove the drag link end nut.
2. Remove the drag link end with the tie rod end lifter (Code No. 07909-39021).
3. Remove the drag link.

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Drag link end nut | 49.0 to 68.6 N·m<br>5.0 to 7.0 kgf·m<br>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.**

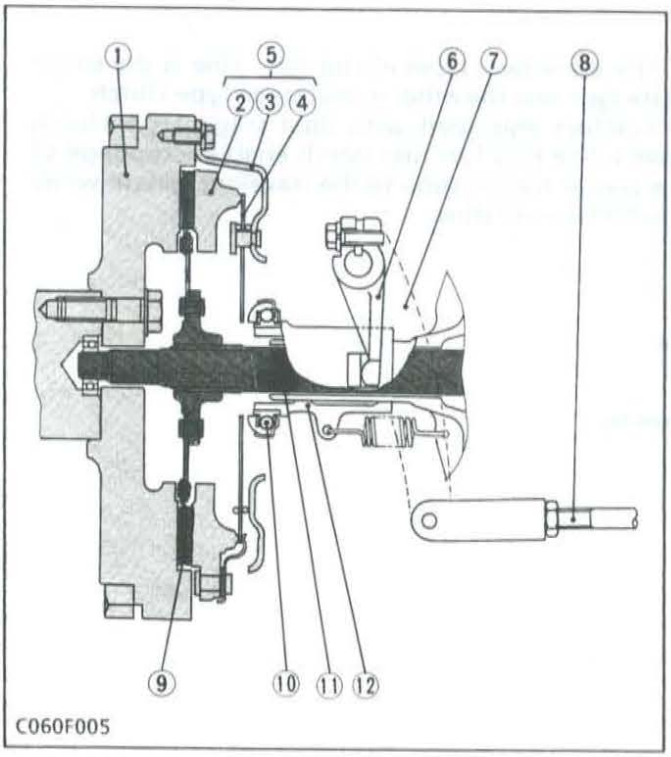

0301F129

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# [1] DRY TYPE, SINGLE STAGE CLUTCH



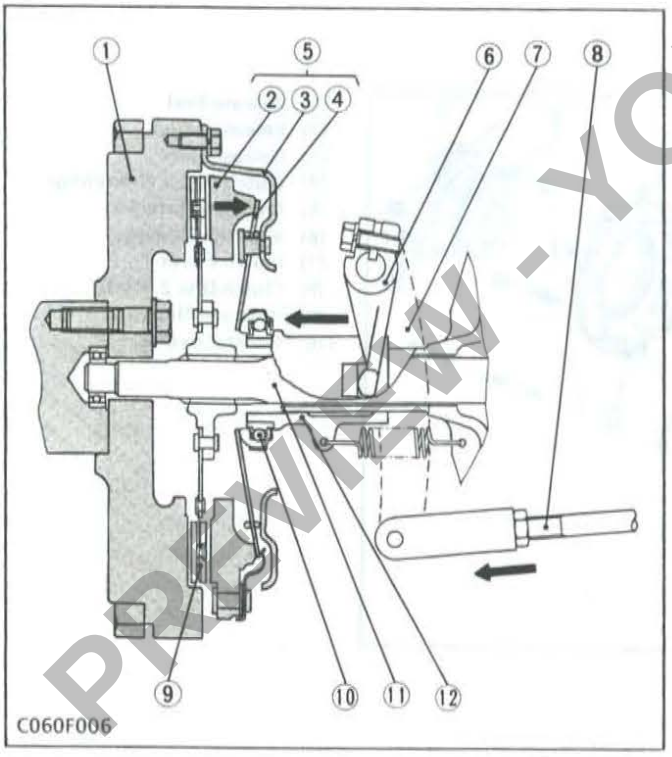
C060F005

## ■ 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



C060F006

## ■ Clutch "Disengaged"

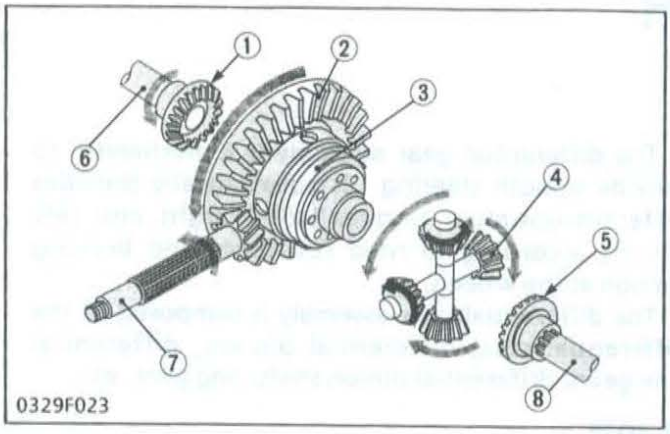
When the clutch pedal is depressed, the clutch rod (8) is pushed to move the clutch lever (7). Then, the release fork (6) pushes the release hub (12) and release bearing (10) toward the flywheel. Simultaneously, the release bearing (10) pushes the diaphragm spring (4). As the pressure plate (2) is pulled 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

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## ■ Turning a Corner

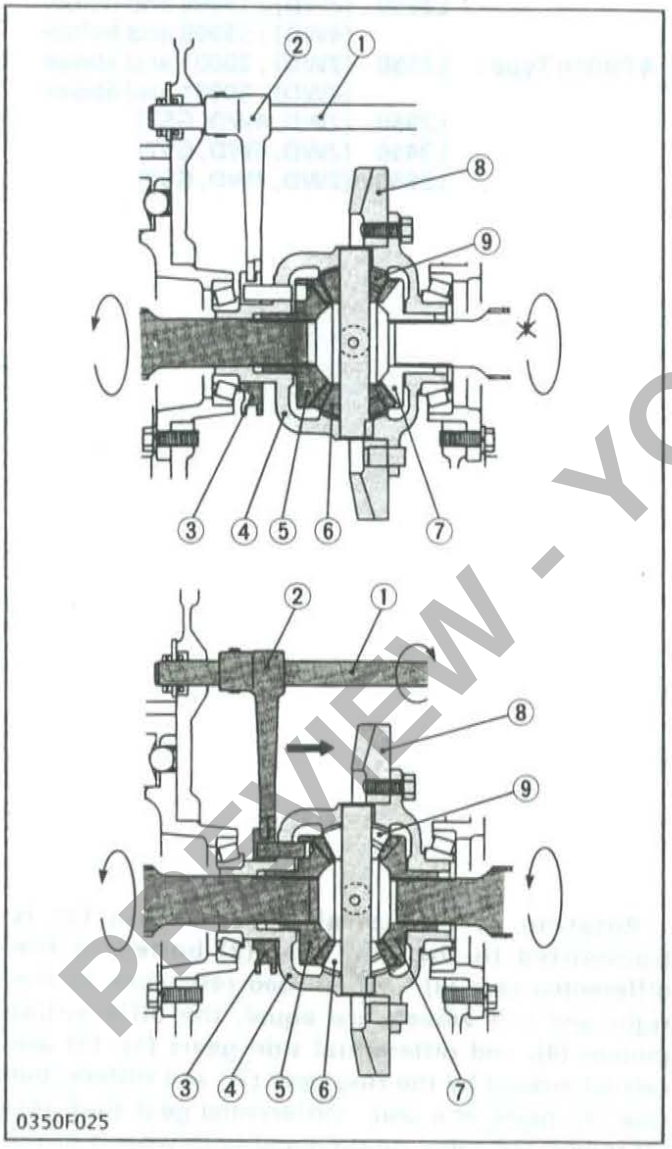


0329F023

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

## ■ Differential Lock



0350F025

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).

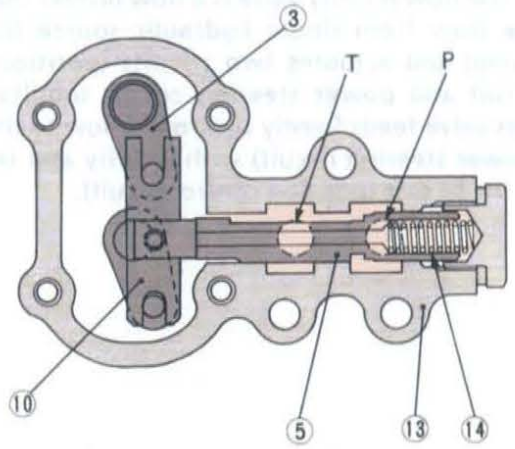
The pins on the differential lock shifter (3) go into the holes in the differential side gear (5) through the holes in the differential case (4) to cause the differential case, differential lock shifter and differential side gear to rotate as a unit. Therefore the differential pinions (6), (9), can not 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.

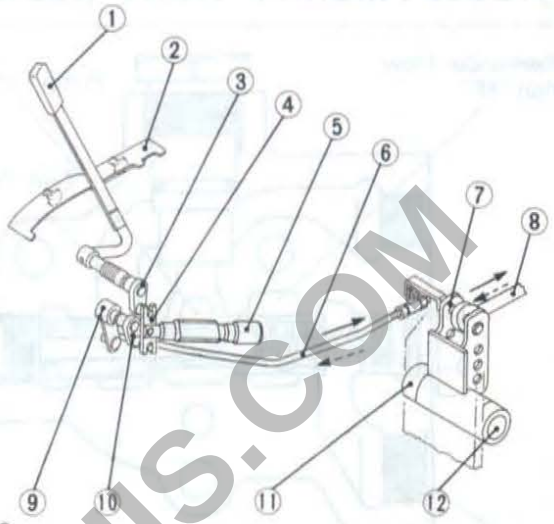
(1) Differential Lock Cam Shaft
(2) Differential Lock Shift Fork
(3) Differential Lock Shifter
(4) Differential Case
(5) Differential Side Gear
(6) Differential Pinion
(7) Differential Side Gear
(8) Ring Gear
(9) Differential Pinion

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0329F047



0329F045

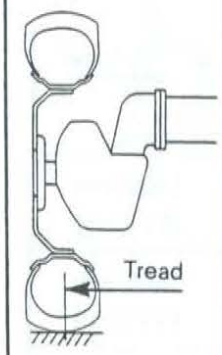
5. When the traction load decreases, the torsion bar (12) is restored and it is transmitted to the draft control valve via the draft control rod (6). As a result, the spool (5) in the draft control valve is pulled out, opening the oil passage to the transmission case. Therefore, the oil in the hydraulic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

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**[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** | **L2650, L2950** | **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**

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

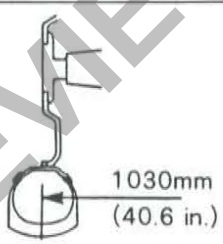
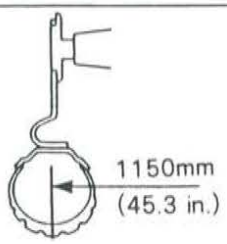
⚠ **CAUTION**

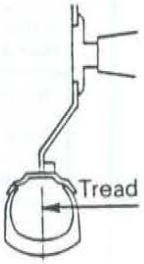
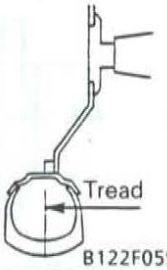
- **When working on slopes or working with trailer, set the wheel tread as wide as practical for the job for maximum stability.**

■ **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]**

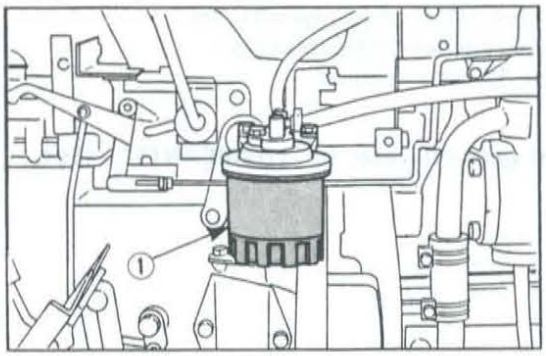
| 9.5–24 Farm | 13.6–16 Turf | 355/80–D20 Turf |
|---|---|---|
|   B122F057 |   B122F058 |   B122F058 |

| 11.2–24 Farm | | | |
|---|---|---|---|
|   |   |   |   B122F059 |
| 1025 mm (40.3 in.) | 1120 mm (44.0 in.) | 1200 mm (47.2 in.) | 1290 mm (50.8 in.) |

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**[L2350]**

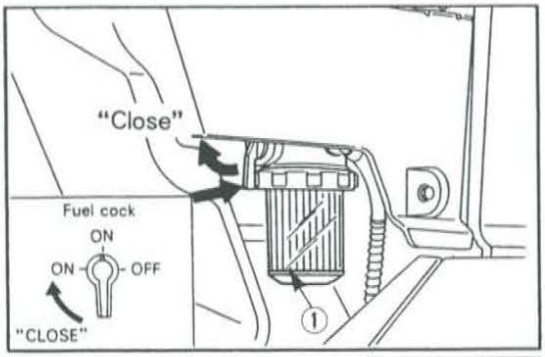



## Fuel Filter Cartridge Replacement

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)]**



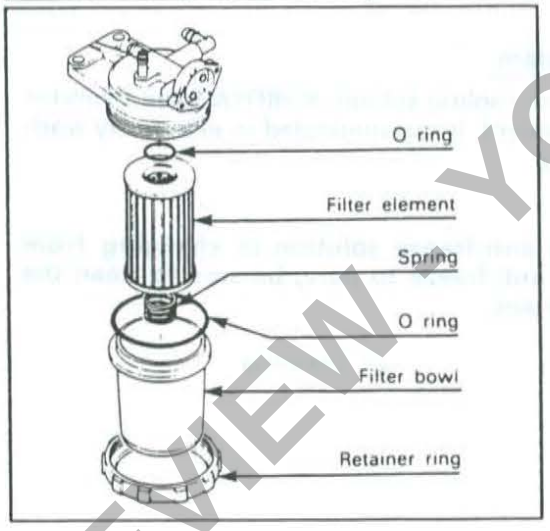

## Fuel Filter Element Replacement

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)

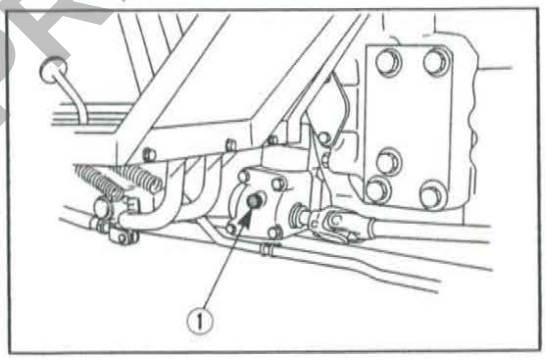
**■ IMPORTANT**

- **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**

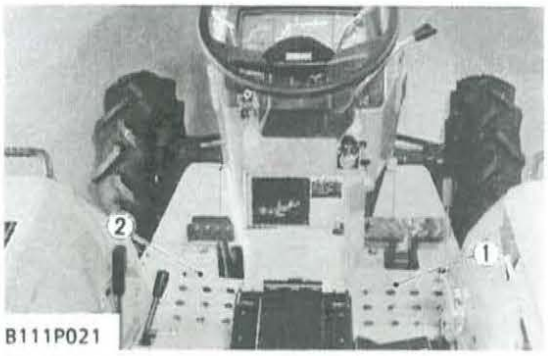
- **Use only SAE weight gear oil, refer to "LUBRICANTS". (See page S.G-7)**

(1) Filling Plug

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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

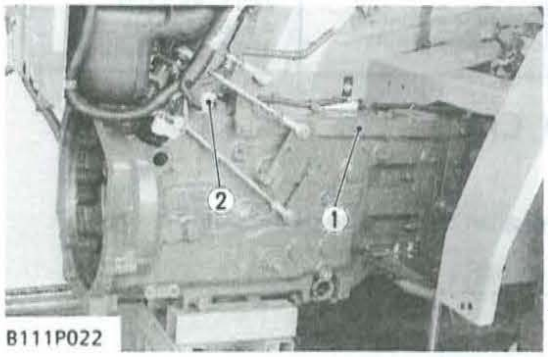
(See page S.S-16)

### Left Side

(See page S.S-17)

### Separating Engine

(See page S.S-17)

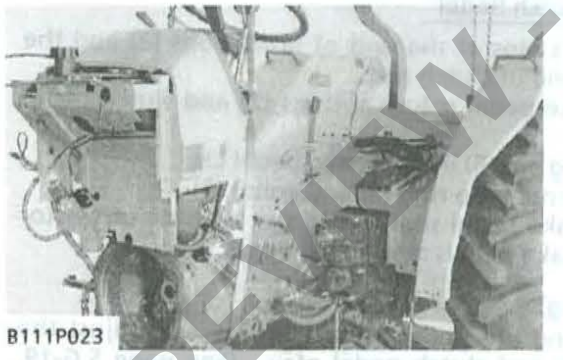


B111P022

### Shuttle Rod and Wire Harness

1. Remove the shuttle rod.
2. Remove the 4P connector.

(1) Shuttle Rod (2) 4P Connector


B111P023

### 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<br>7.9 to 9.2 kgf·m<br>57.1 to 66.5 ft-lbs |


B111P024

### 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.

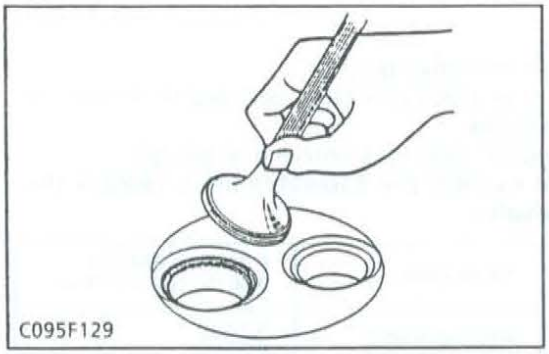
**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Mid case mounting nuts | 77.5 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.1 to 66.5 ft-lbs |

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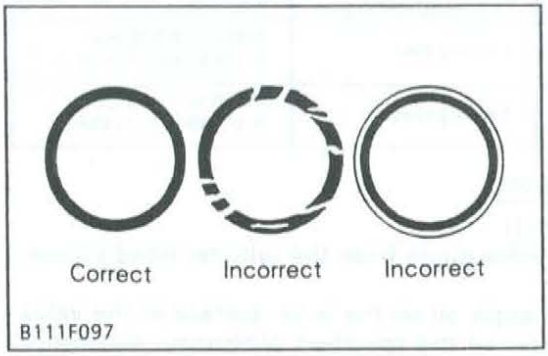


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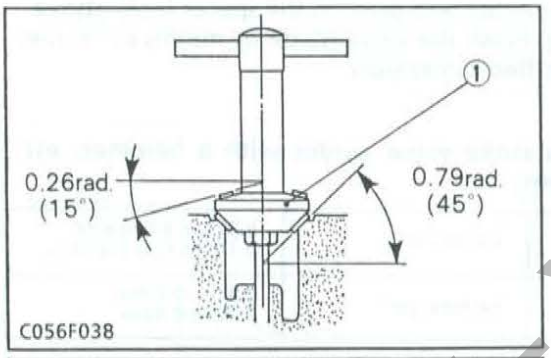

C095F129

## 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.



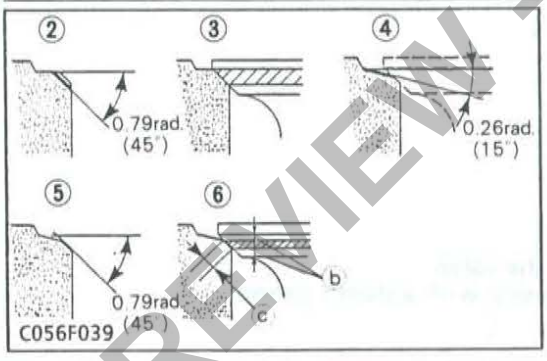
B111F097



C056F038

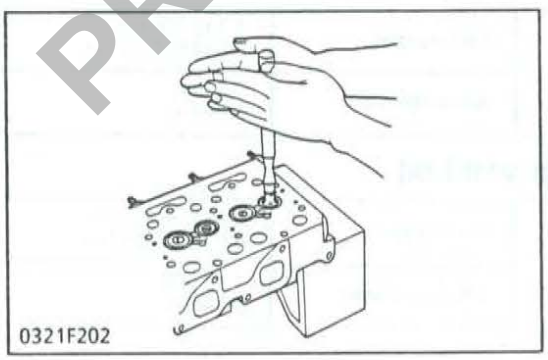
## Correcting Procedure for Valve Seat

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.



C056F039

(1) Valve Seat Cutter
(2) 0.79 rad. (45°) Cutter
(3) Contact Check
(4) 0.26 rad. (15°) Cutter
(5) 0.79 rad. (45°) Cutter
(6) Contact Check
(b) Identical Dimensions
(c) Seat Surface Width


0321F202

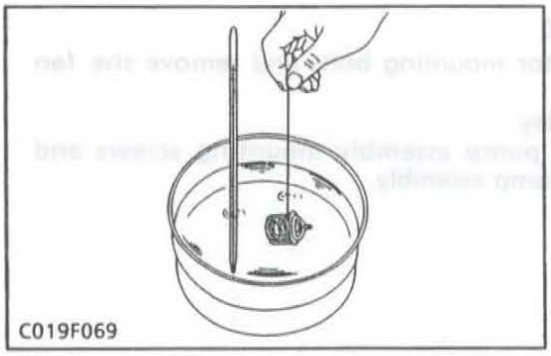
## Valve Lapping

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.

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## SERVICING


C019F069

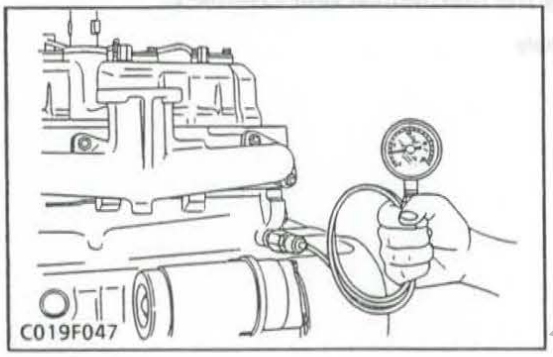
### Operating Temperature of Thermostat

1. Place a thermostat and a thermometer in water and heat the water.
2. Check to see if the thermostat begins to open at 80.5 to 83.5°C (176.9 to 182.3°F).
3. Check to see if the thermostat opens fully around 95°C (203°F).
4. If the measurement is defective, replace the thermostat.

| Reference value | | |
|---|---|---|
| Temperature at which thermostat should start to open | Temperature at which thermostat completely opens | Distance of lift |
| 80.5 to 83.5°C<br>176.9 to 182.3°F | 95°C<br>203°F | 8 mm<br>0.3150 in. |

## [7] LUBRICATING SYSTEM

## CHECKING AND ADJUSTING


C019F047

### Oil Pressure

1. Remove the oil switch and set a pressure gauge. (See page S.G-33)
2. Start the engine. Measure the oil pressure both at idling and at the rated speed.
3. If the measurement is not within the factory specification, check the oil pump, oil-ways, oil clearances and pressure regulating valve.

**(When reassembling)**

- Supply the specified amount of recommended oil.
- The oil filter must not be clogged or broken.

| | | | |
|---|---|---|---|
| Oil pressure | Factory spec. | At rated speed | 294 to 441 kPa<br>3.0 to 4.5 kgf/cm²<br>43 to 64 psi |
| | Allowable limit | At rated speed | 245 kPa<br>2.5 kgf/cm²<br>36 psi |
| | | At idle speed | 98 kPa<br>1.0 kgf/cm²<br>14 psi |

## DISASSEMBLING AND ASSEMBLING

### Oil Pump Assembly

1. Remove the oil pump assembly. (See page S.1-28)

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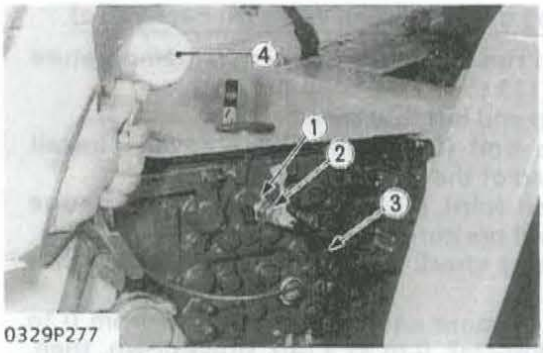
## [L2650GST, L2950GST, L3450GST, L3650GST]

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Engine mounting screw and nut to clutch housing | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |
| Main shaft case mounting screw | 23.5 to 27.5 | 2.4 to 2.8 | 17.4 to 20.3 |
| Clutch housing mounting nut to mid case | 77.5 to 90.2 | 7.9 to 9.2 | 57.1 to 66.5 |
| Mid case mounting nut to transmission case | 77.5 to 90.2 | 7.9 to 9.2 | 57.1 to 66.5 |
| Counter shaft 22 nut | 4.90 to 6.86 | 0.5 to 0.7 | 3.62 to 5.06 |
| Spiral bevel pinion lock nut | 147 to 196 | 15 to 20 | 108 to 145 |
| Pinion bearing case mounting screw | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |
| Differential bearing case mounting screw | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |
| PTO shaft lock nut | 147 to 196 | 15 to 20 | 108 to 145 |
| PTO shift fork setting screw | 9.81 to 11.28 | 1.0 to 1.15 | 7.23 to 8.32 |
| PTO shifter setting screw | 9.81 to 11.28 | 1.0 to 1.15 | 7.23 to 8.32 |
| 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 |
| Shuttle shift fork mounting screw (reamer screw) | 7.85 | 0.8 | 5.79 |
| Main shift valve mounting screw 6 mm | 7.85 | 0.8 | 5.79 |
| 8 mm | 17.7 | 1.8 | 13.6 |
| Accumulator mounting screw | 17.7 | 1.8 | 13.6 |
| Rotary valve mounting screw | 7.85 | 0.8 | 5.79 |
| Rotary valve detent plate mounting nut | 62.8 | 6.4 | 46.3 |
| Modulating valve mounting nut | 7.85 | 0.8 | 5.79 |
| Reducing valve case fixing screw | 7.85 | 0.8 | 5.79 |

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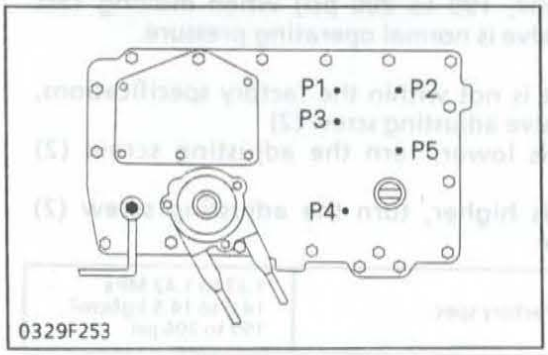


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0329P277

**Pressure discahrging port diagram**



0329F253

(1) Adaptor D
(2) Threaded Joint
(3) Cable
(4) Pressure Gauge

## Checking and Adjusting of GST System Pressure (P1 to P5)

1. Remove the left step and the left foot cover.
2. Remove the each plugs of P1 to P5 and set the adaptor D (1) (Code No: 07916-50381), threaded joint (2) (Code No: 07916-50392), cable (3) (Code No: 07916-50331), and pressure gauge (4) (Code No: 07916-52961).
3. Start the engine and measure the pressure of each port and each main shift lever position as the pressure table.

| | | |
|---|---|---|
| GST system pressure | Factory spec. | 2.35 to 2.45 MPa<br>24.0 to 25.0 kgf/cm²<br>341 to 356 psi |

**Condition**

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

**Pressure Table** o ···· Pressure is 24 kgf/cm² (341 psi)

| Shift Position | P1 | P2 | P3 | P4 | P5 |
|---|---|---|---|---|---|
| Neutral | | | o | | |
| 1st Shift | | o | o | o | o |
| 2nd Shift | | o | o | o | o |
| 3rd Shift | o | | o | o | o |
| 4th Shift | o | | o | o | o |
| 5th Shift | | o | o | o | o |
| 6th Shift | | o | o | o | o |
| 7th Shift | o | | o | o | o |
| 8th Shift | o | | o | o | o |

**■ NOTE**

- Shuttle shift lever must be at "Forward" or "Reverse" position when checking the pressure.
- Measure the pressure according to P1 to P5 and use the results of measurement to locate causes of trouble when performing trouble-shooting. (Refer to page S.3-3, 4, 5)
- This pressure adjustment can be made by the reducing valve adjustor but individual and separate pressure change is not possible.

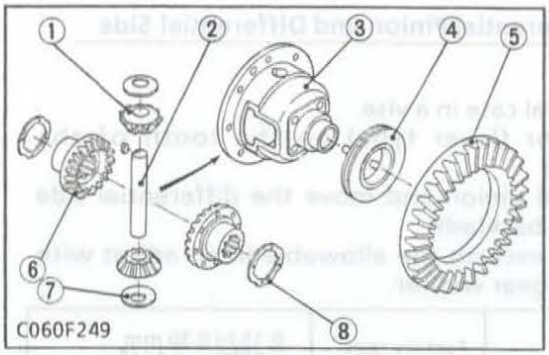
**⚠ CAUTION**

- Disengage the main clutch when checking the pressure.

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(1) Differential Pinion
(2) Differential Pinion Shaft
(3) Differential Case
(4) Differential Lock Shifter
(5) Spiral Bevel Gear
(6) Differential Side Gear
(7) Differential Pinion Washer
(8) Differential Side Gear Washer

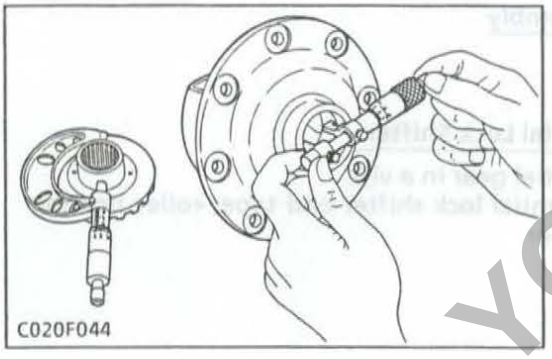
### Differential Pinion and Differential Side Gear

1. Draw out the differential pinion shaft (2).
2. Take out the differential pinions (1) and the differential side gears (6).

■ **NOTE**
- **Arrange the parts to know their original position.**

(When reassembling)
- Examine the thrust and bearing surface of both differential side gears (6). If they are worn or damaged, bores in the differential case may also be damaged.
- Check the differential pinions (1) and pinion shaft (2) for excessive wear. If these parts are damaged or excessively worn, also replace parts they are in mesh with, or they are sliding on.
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential pinions.
- Install the parts to their original position.

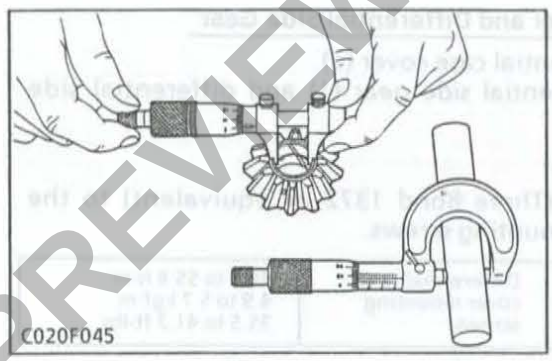
## SERVICING




### Clearance between Differential Case Bore and Differential Side Gear Boss

1. Measure the bore I.D. of the differential case.
2. Measure the boss O.D. of the differential side gear and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

| | | |
|---|---|---|
| Clearance between differential case bore and differential side gear boss | Factory spec. | 0.050 to 0.151 mm<br>0.00197 to 0.00594 in. |
| | Allowable limit | 0.35 mm<br>0.0138 in. |
| Differential case bore I.D. | Factory spec. | 38.000 to 38.062 mm<br>1.49606 to 1.49850 in. |
| Differential side gear boss O.D. | Factory spec. | 37.911 to 37.950 mm<br>1.49256 to 1.49410 in. |




### Clearance between Differential Pinion Shaft and Differential Pinion

1. Measure the differential pinion shaft O.D.
2. Measure the differential pinion I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace.

| | | |
|---|---|---|
| Clearance between differential pinion shahft and pinion | Factory spec. | 0.100 to 0.142 mm<br>0.00394 to 0.00559 in. |
| | Allowable limit | 0.30 mm<br>0.0118 in. |
| Differential pinion shaft O.D. | Factory spec. | 19.939 to 19.960 mm<br>0.78500 to 0.78583 in. |
| Differential pinion boss I.D. | Factory spec. | 20.060 to 20.081 mm<br>0.78976 to 0.79059 in. |

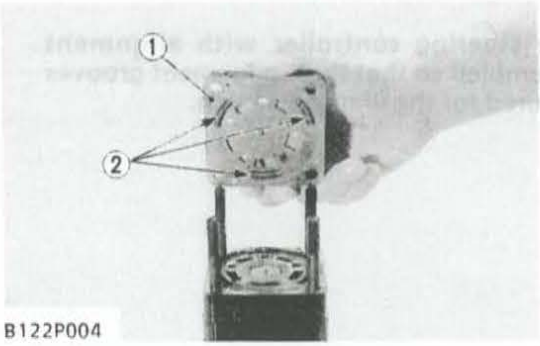
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B122P004

(1) Port Manifold (2) Springs

### Port Manifold and Springs

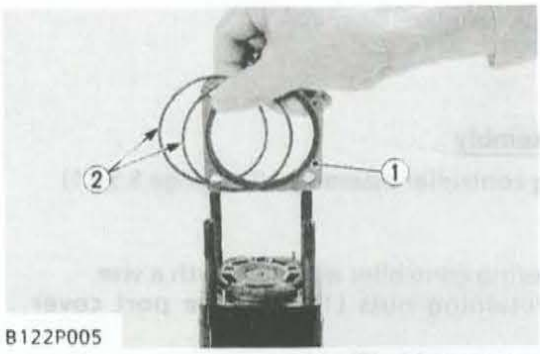
1. Carefully lift the port manifold (1) from the unit.
2. Remove the three springs (2) from the port manifold pockets.

■ **NOTE**

- **Be prepared to catch three springs (2) which may become disengaged when removing the port manifold (1).**

**(When reassembling)**

- Apply a few drops of oil to the valve plate.
- Install three 3/4 inch (19 mm) springs (2) into the spring pockets.
- Assemble the port manifold with the springs toward the valve plate.
- Be careful not to pinch a sprig during installation.
- The two alignment pins, in the valve plate, will engage the holes in the port manifold.
- The pin on the hex. drive assembly must engage the center hole in the port manifold (1).




B122P005

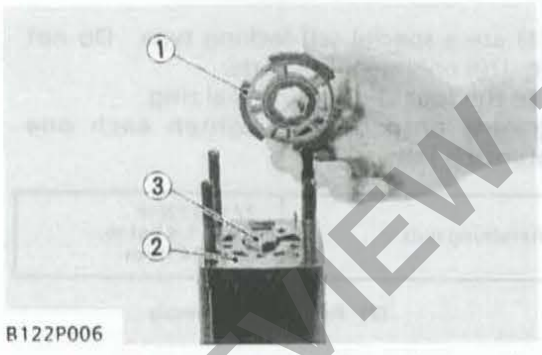
(1) Valve Ring (2) Seal Rings

### Valve Ring

1. Remove the valve ring (1) with the two seal rings (2).

**(When reassembling)**

- Apply clean grease to the seal rings (2).
- Install the valve ring (1) over the bolts and alignment pins with seal ring facing the isolation manifold.




B122P006

(1) Valve Plate (3) Hex. Drive Assembly
(2) Isolation Manifold

### Valve Plate and Hex. Drive Assembly

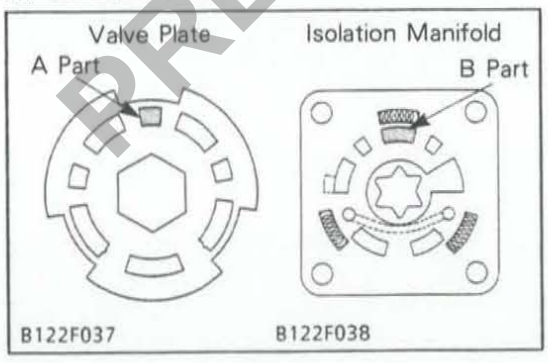
1. Remove the valve plate (1) by lifting it from the isolation manifold (2).
2. Pull out the hex. drive assembly (3) from the drive link.

**(When reassembling)**

- Aligning the three springs slots of the valve plate (1) centrally over the three springs placed in the isolation manifold (2).
- Place hex. drive assembly (3), pin side up, through the hole in the isolation manifold (2).

■ **IMPORTANT**

- **Place the valve plate (1) with the surface that reads "shaft side" down over the hex. drive assembly (3).**
- **Aligning the A part of the valve plate (1) and the B part of the isolation manifold (2).**




B122F037 B122F038



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