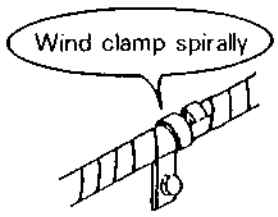
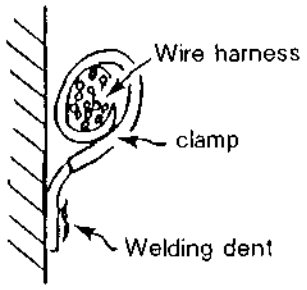
- Securely clamp, being careful not to damage wiring.

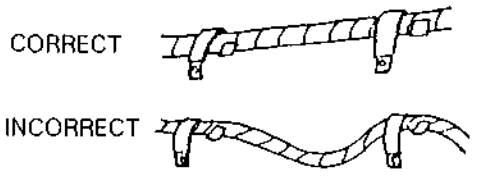


C079F007



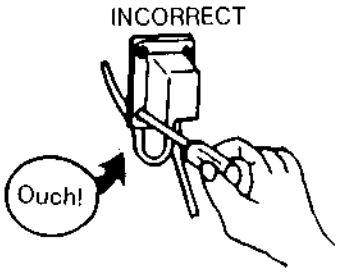
C079F008

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



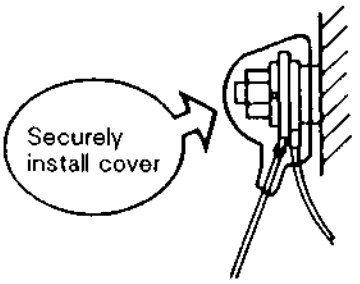
C079F009

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



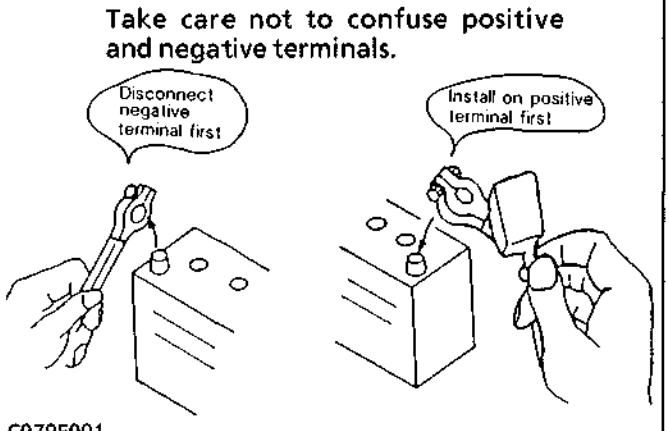
C079F010

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

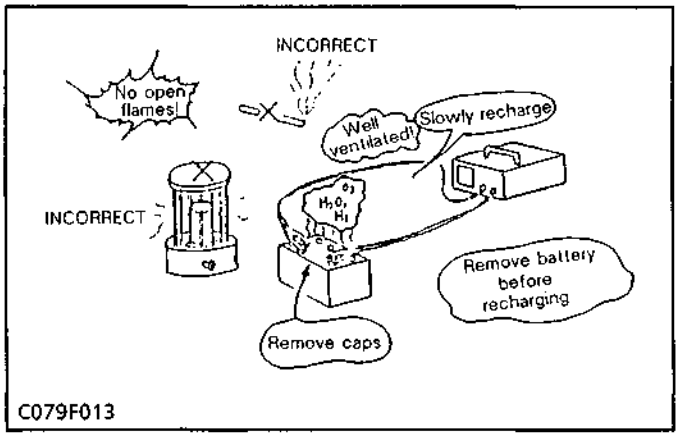


C079F011

■ Battery



C079F001



C079F013

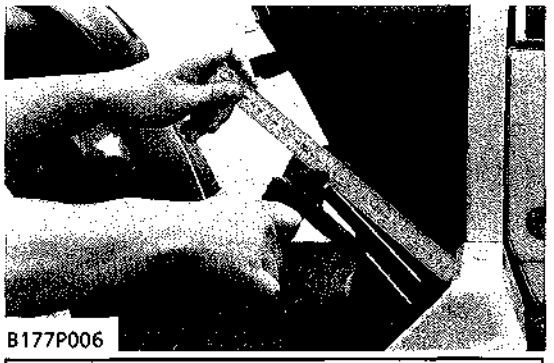
- When removing battery cord, disconnect negative wire first. When installing battery cord, check for polarity and connect positive wire first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting cord to battery terminals, apply grease to them and securely install terminal covers on them.
- Do not allow dirt and dust to collect on battery.

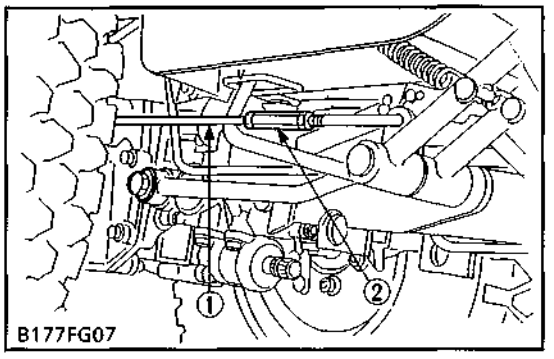
⚠ CAUTION

- **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.**

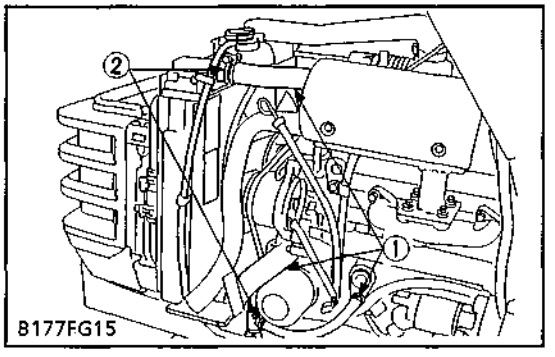

B177P006



B177FG07

(1) Brake Rod (2) Turn Buckle

(5) Check Point of Every 200 Hours



B177FG15

(1) Radiator Hose (2) Clamp Band

Checking Brake Pedal Free Travel

⚠ CAUTION

To avoid personal injury :
- **Stop the engine and chock the wheels before checking brake pedal.**

1. Release the parking brake.
2. Slightly depress the brake pedals and measure free travel at top of pedal stroke.
3. If the measurement is not within the factory specifications, loosen the lock nut and turn the turn buckle to adjust the brake rod length.
4. Retighten the lock nut securely.
   Keep the free travel in the right and left brake pedals equal.

Brake pedal free travel	Factory spec.	20 to 30 mm 0.8 to 1.2 in.

Replacing Engine Oil Filter Cartridge

See page G-12.

Checking Radiator Hose and Hose Clamp

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

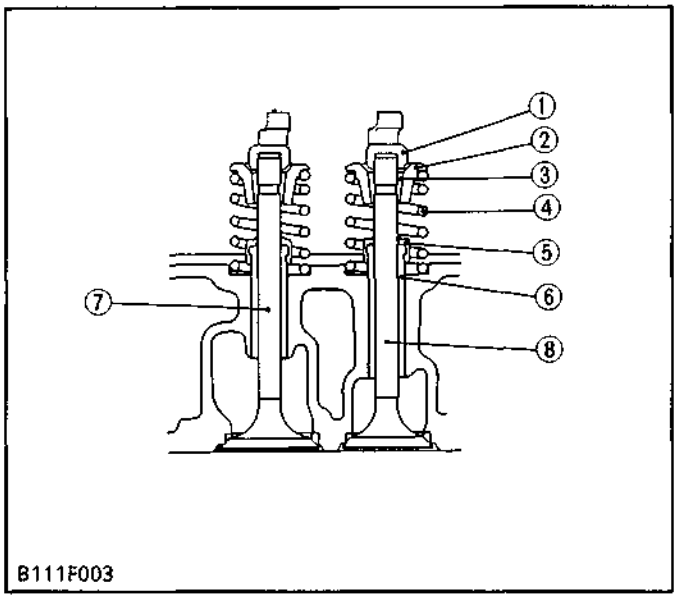
1. If hose clamps are loose or water leaks, tighten bands securely.
2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked.
   Replace hoses and hose clamps every 2 years or earlier if checked and found that hoses are swollen, hardened or cracked.

■ Precaution at Overheating

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

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

(8) Inlet and Exhaust Valves

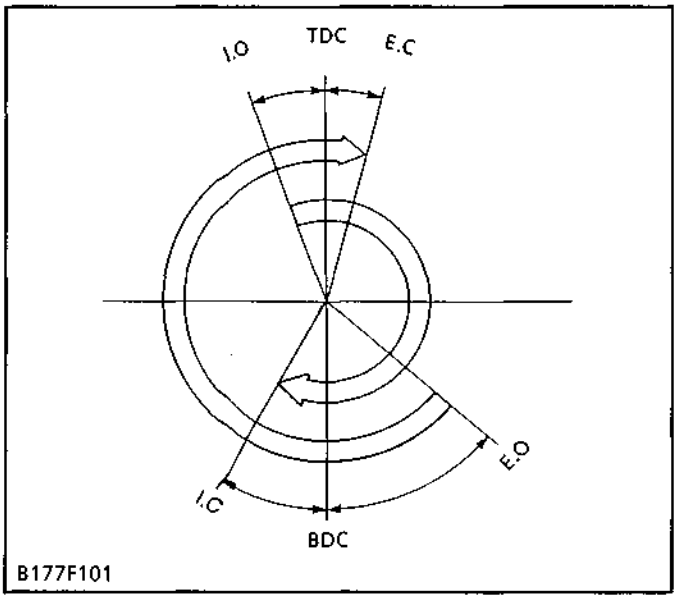


B111F003

The inlet and exhaust valves (7), (6) and their guides (6) are different from each other. Other parts, such as valve springs (4), valve spring retainers (3), valve spring collets (2), 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
(2) Valve Spring Retainer
(3) Valve Spring Collet
(4) Valve Spring
(5) Valve Stem Seal
(6) Valve Guide
(7) Inlet Valve
(8) Exhaust Valve

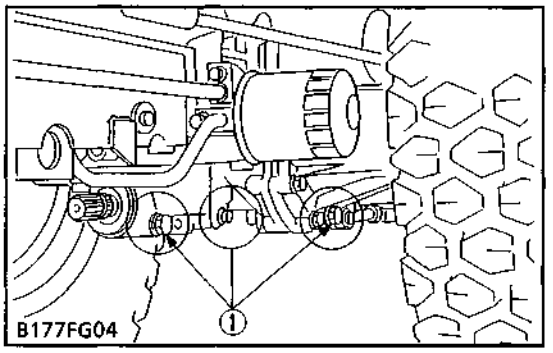
(9) Valve Timing

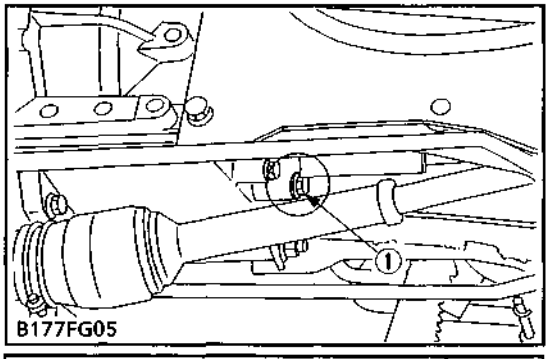


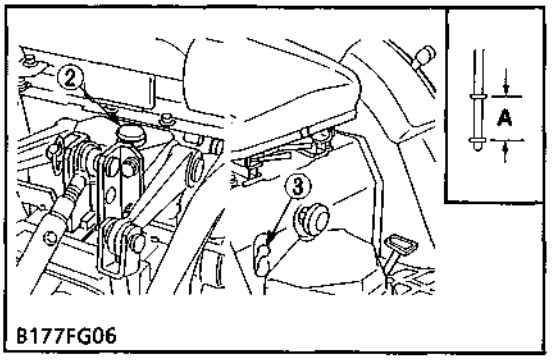
B177F101

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

Inlet valve open (I.O)	0.24 rad. (14°) before T.D.C
Inlet valve close (I.C)	0.52 rad. (30°) after B.D.C.
Exhaust valve open (E.O)	0.96 rad. (55°) before B.D.C.
Exhaust valve close (E.C)	0.24 rad. (14°) after T.D.C.







Drain the Transmission Oil

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1) at the bottom of the transmission case.
3. Drain the transmission oil.
4. After draining, screw in the four drain plugs (1).

(When refilling)

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

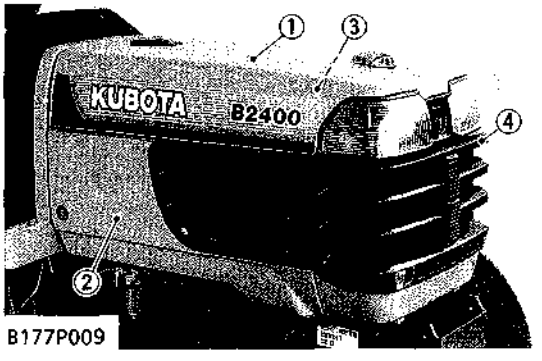
■ IMPORTANT

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

Transmission oil capacity	HST type	12.0 ℓ 3.17 U.S.gals. 2.4 Imp.gals
	Manual transmission type	11.0 ℓ 2.90 U.S.gals. 2.6 Imp.gals

[A] Oil level is acceptable within this range.

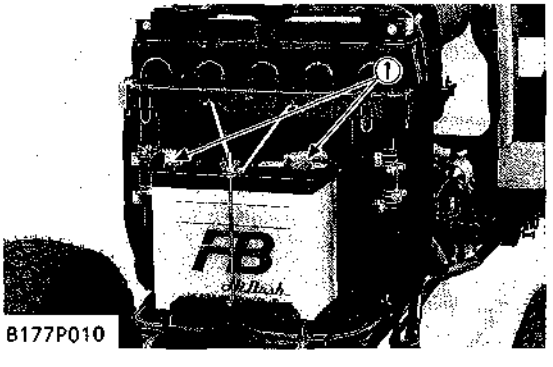
(1) Drain Plugs
(2) Filling Plug
(3) Dipstick



Hood and Side Cover

1. Open the hood from front and remove the spling lock pin and remove the food with hood rod for keeping it open.
2. Remove the front grille (4).
3. Remove the right and left side cover (2), (3).

(1) Hood
(2) Right Side Cover
(3) Left Side Cover
(4) Front Grille



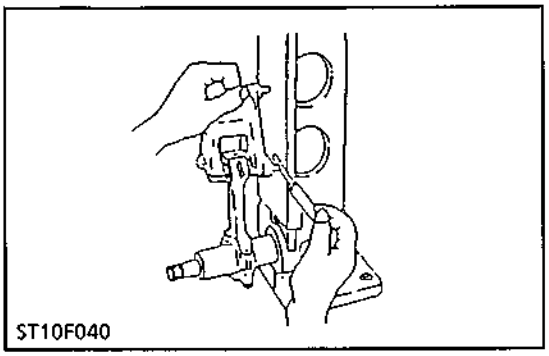
Battery

1. Disconnect the battery cords (1).

■ NOTE

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

(1) Battery Cord


ST10F040

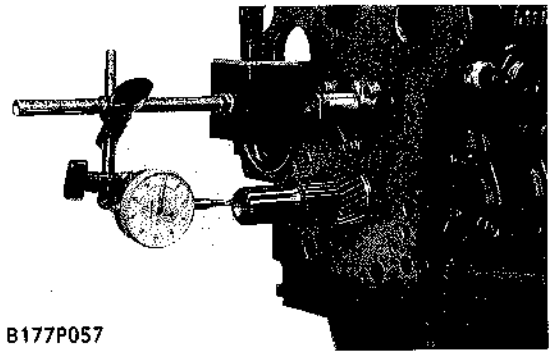
Connecting Rod Alignment

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

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

Connecting rod alignment	Allowable limit	0.05 mm 0.0020 in.

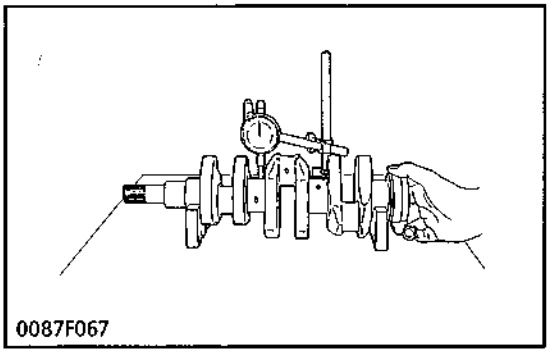
(4) Crankshaft


B177P057

End Play of Crankshaft

1. Move the crankshaft to the flywheel side.
2. Set a dial indicator to the crankshaft.
3. Measure the end play by pulling the crankshaft toward the crank gear.
4. If the measurement exceeds the allowable limit, replace the thrust bearing 1 and 2.

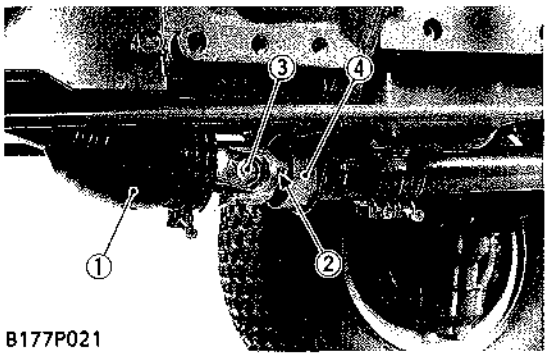
End play of crankshaft	Factory spec.	0.15 to 0.31 mm 0.0059 to 0.0122 in.
	Allowable limit	0.5 mm 0.0197 in.


0087F067

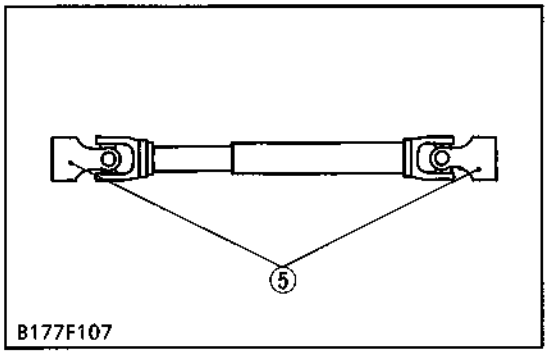
Crankshaft Alignment

1. Support the crankshaft with V-blocks on the surface plate and set a dial indicator with its tip on the intermediate journal at right angle.
2. Rotate the crankshaft on the V-blocks and get the misalignment (half of the measurement).
3. If the misalignment exceeds the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.0008 in.



B177P021



B177F107

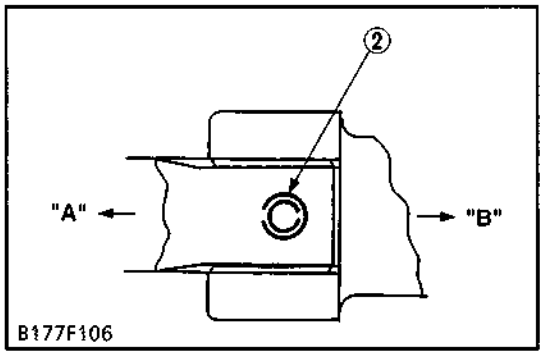
Universal Joint and Bearing Holder

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

(When reassembling)

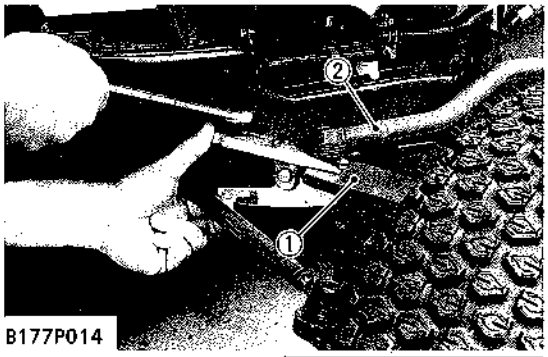
- Make sure the yokes (5) of universal joints must always be in the same plane as shown in the figure.
- Apply grease to the spline of the propeller shaft and universal joint.
- When inserting the spring pins (2), face their splits in the direction parallel to the universal joint as shown in the figure.

(1) Universal Joint Cover
(2) Spring Pins
(3) Universal Joint
(4) Bearing Holder
(5) Yoke

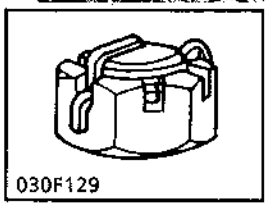


B177F106

[A] Front
[B] Rear



B177P014


030F129

Drag Link

1. Steer the front wheels to the left.
2. Remove the slotted nut and disconnect the drag link (2) from the knuckle arm (1).

(When reassembling)

■ IMPORTANT

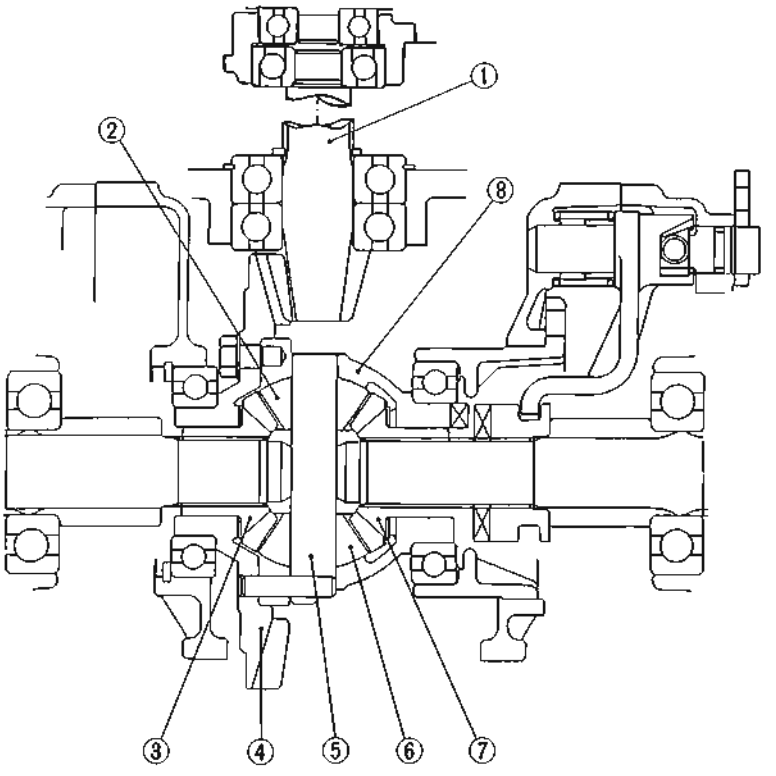
- **After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.**

Tightening torque	Slotted nut	17.7 to 34.3 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs

(1) Knuckle Arm
(2) Drag Link

[4] DIFFERENTIAL GEAR

(1) Differential Function



B177F321

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

1. During Straight Running

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

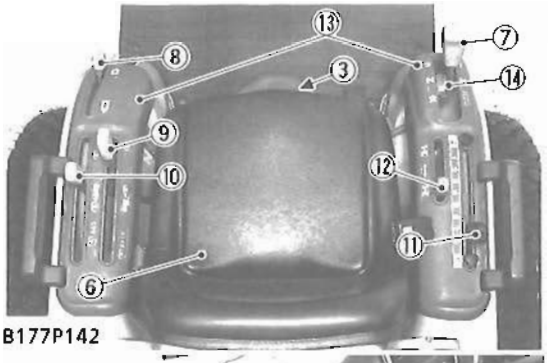
When road resistance to the right and left wheels are equàl, differential pinions (2), (6) and differential side gears (3), (7) are all rotate as a unit. Both rear axles received equal input, and both wheels turn at the same speed, allowing the tractor to go straight ahead.

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

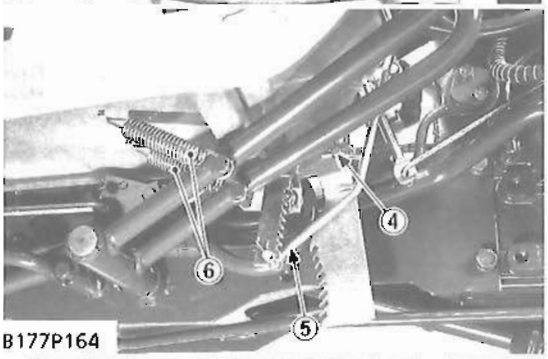
2. During Turning

When the tractor turns, the road resistance to the inside tire increases (as if braking is applied to that side only). In other words, if one of tires slows down, revolution difference is generated in the differential side gears (3), (7). When rotation of one differential side gear becomes lower than the other, differential pinions (2), (6) begin rotating around differential increased in speed by the speed increment of differential pinion rotating around differential pinion shaft. This means that rotation of one rear axle is slowed down and that of the other rear axle is increased. Thus, the tractor turn smoothly without power loss.

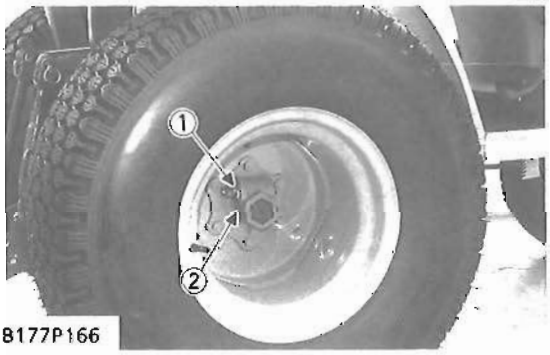
The combined number of revolutions of the right and left differential side gears is always twice that of the spiral bevel gear (4). When spiral bevel gear revolution is 100 rpm, and if one of the differential side gears stops moving, the revolution of the other differential side gear becomes 200 rpm and if one rotates at 50 rpm, the other rotates at 150 rpm.



B177P142



B177P164



B177P166

Step, Fender, Tire and Seat

1. Remove the lowering speed adjusting knob and seat under cover (3).
2. Remove the rubber mat.
3. Disconnect the speed set rod (4) (HST Type) and parking brake rod (5).
4. Remove the clutch and brake springs.
5. Remove the left and right hand side steps.
6. Remove the cotter (1) setting bolt and nut, then place the jack under the transmission case, and set the rigid rack under the rear axles.
7. Take out the wheel hub pin (2) and remove the rear wheels.
8. Remove the seat (6).
9. Remove the main gear shift lever grip (7) (Manual Transmission Type).
10. Remove the Hi-Lo gear shift lever grip (8), mid and rear-PTO gear shift lever grips (9), (10), position control lever grip (11) and front wheel drive lever grip (12).
11. Remove the left and right hand side lever guide (13).
12. Remove the main gear shift lever (14) (Manual Transmission Type).
13. Disconnect the wire harness and remove the fender stay, left and right hand side fenders.
14. Remove the tool box and seat stay with seat rail.

IMPORTANT

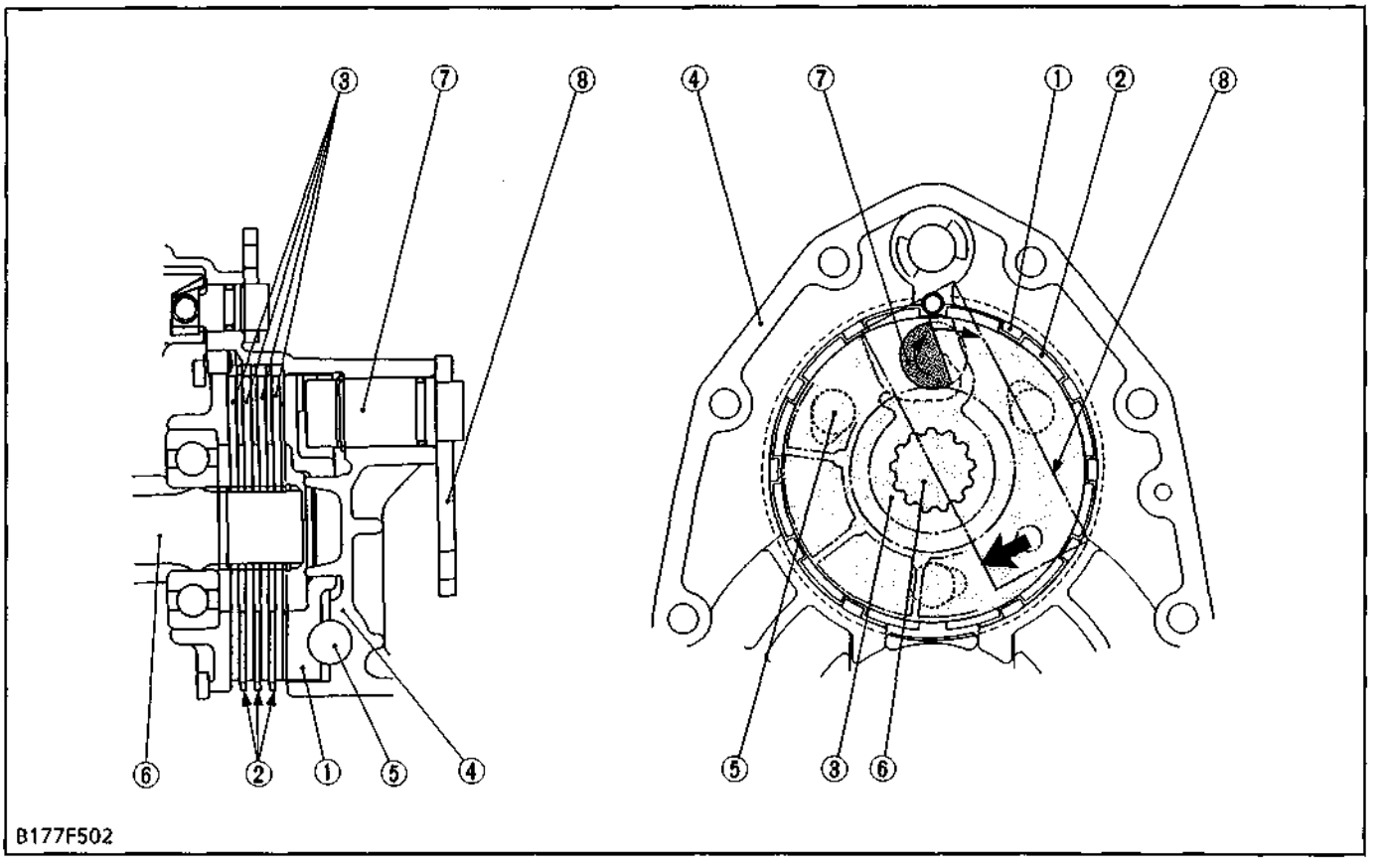
- **When refitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service.**

(When reassembling)

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

(1) Cotter
(2) Wheel Hub Pin
(3) Seat Under Cover
(4) Speed Set Rod
(5) Parking Brake Rod
(6) Seat
(7) Main Gear Shift Lever Grip
(8) Hi-Lo Gear Shift Lever Grip
(9) Mid-PTO Gear Shift Lever Grip
(10) Rear-PTO Gear Shift Lever Grip
(11) Position Control Lever Grip
(12) Front Wheel Drive Lever Grip
(13) Lever Guide
(14) Main Gear Shift Lever

[2] OPERATION



(1) Cam Plate
(2) Friction Plate
(3) Brake Disc
(4) Rear Axle Case
(5) Steel Ball
(6) Brake Shaft (Differential Gear Shaft)
(7) Brake Cam
(8) Brake Cam Lever

The brake body is incorporated in the rear axle case (4) filled with transmission oil and is designed to brake when the brake disc (3) splined with the differential gear shaft (6) is pressed against the cam plate (1) by means of the cam mechanism incorporating steel balls (5).

For greater braking force, four brake discs are provided at the right and left sides respectively, and the friction plate (2) fixed to the rear axle case is arranged between the brake discs.

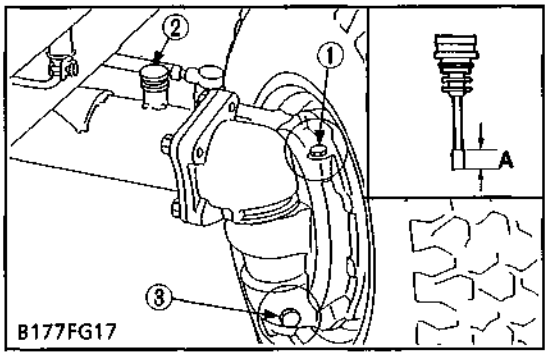
■ During Braking

When the brake pedal is pressed, the linkage causes the brake cam lever (8) and brake cam (7) to turn into the direction of arrow shown in the above figure.

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 rear axle case to press the brake disc (3), the differential gear shaft (6) is braked by the frictional force generated by the cam plate (1) and brake disc (3).

DISASSEMBLING AND ASSEMBLING

(1) Separating Front Axle



(1) Breather Plug
(2) Filling Plug with Dipstick
(3) Drain Plug
(A) **Oil level is acceptabel within this range.**

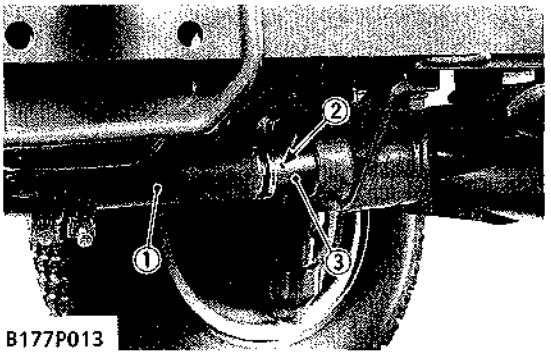
Draining Front Axle Case Oil

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

Front axle case oil capacity	3.7 ℓ 3.9 U.S.qts. 3.3 Imp.qts.

■ **IMPORTANT**

- **After ten minutes, check the oil level again, add oil to prescribed level.**
- **Use KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)**

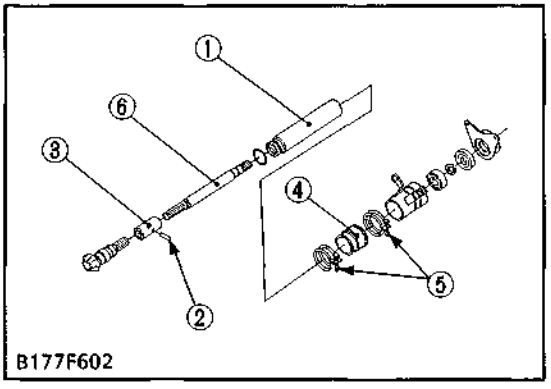


Propeller Shaft

1. Loosen the clamp (5) and slide the propeller shaft cover (1), (4) to the rear.
2. Tap out the spring pin (2), and then slide the coupling (3) to the rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft.

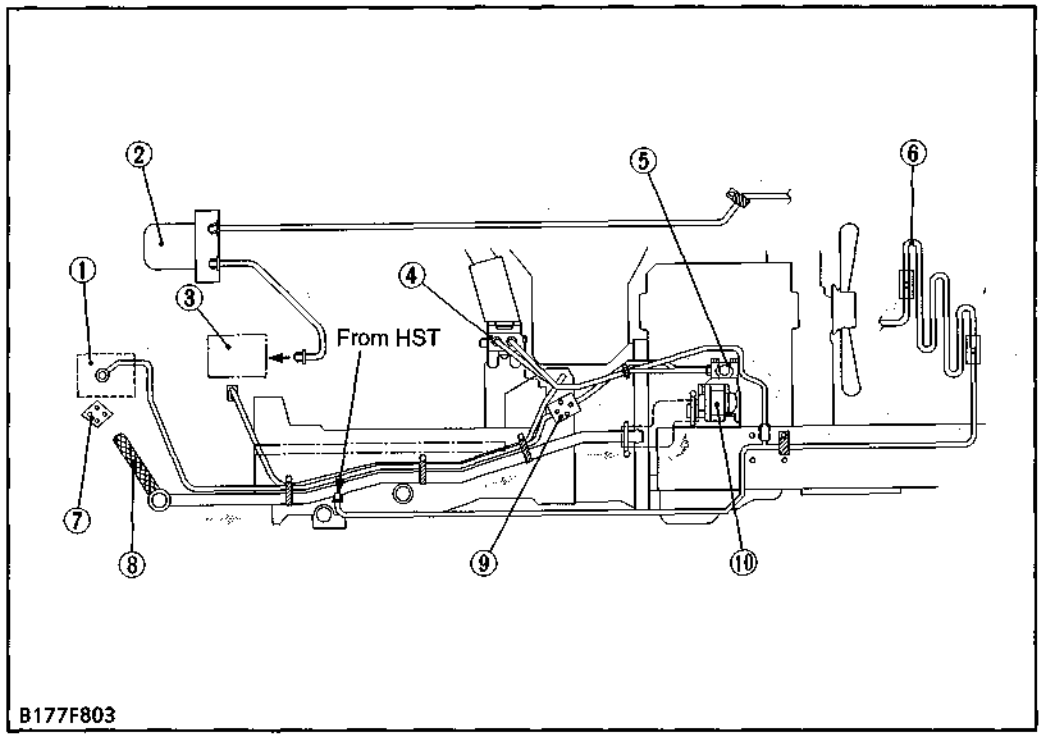


(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling
(4) Propeller Shaft Cover
(5) Clamp
(6) Propeller Shaft

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Excessive Steering Wheel Play	• Backlash between sector gear shaft and ball nut too large	Adjust	7-S13
	• Steering linkage worn	Replace	—
	• Sector gear shaft worn	Replace	7-S9
Tractor Pulls to Right or Left	• Tire pressure uneven	Adjust	G-36
	• Steering wheel play too small	Adjust	7-S13
	• Improper toe-in adjustment	Adjust	6-S3
Front Wheels Vibration	• Steering linkage worn	Replace	—
	• Improper toe-in adjustment	Adjust	6-S3
Hard Steering	• Transmission fluid improper or insufficient	Change	G-8
	• Oil leak from pipe joint	Retighten	—
	• Hydraulic pump malfunctioning	Replace	8-S6
	• Relief valve malfunctioning	Replace	7-S8
	• Seals in the steering gear box damaged	Replace	—
	• Backlash between sector gear shaft and ball nut too small	Adjust	7-S13
	• Air in the hydraulic pipes	Air vent	—
	• Low operating pressure	Refer to next item	—
Low Operating Pressure	• Hydraulic pump malfunctioning	Replace	8-S6
	• Improper relief valve adjustment	Adjust	7-S4, S8
	• Control valve malfunctioning	Replace	7-S8
	• Seals in the steering gear box damaged	Replace	—
	• Ball nut malfunctioning	Replace ball nut assembly	7-S11
	• Oil leak from pipe or pipe broken	Replace	—
Steering Wheel Does Not Return to Neutral Position	• Control valve malfunctioning	Replace	7-S8
	• Valve Spool and valve housing jammed	Repair or Replace	7-S8
	• Valve housing oil seal damaged	Replace	—
	• Centering spring weaken or broken	Replace	7-S8
Steering Force Fluctuates	• Insufficient oil	Replenish	G-8
	• Insufficient bleeding	Bleed	—
	• Control valve malfunctioning	Replace	7-S8
Noise	• Insufficient oil	Replenish	G-8
	• Air sucked in pump from suction circuit	Repair	—
	• Pipe deformed	Replace	—

■ HYDROSTATIC TRANSMISSION



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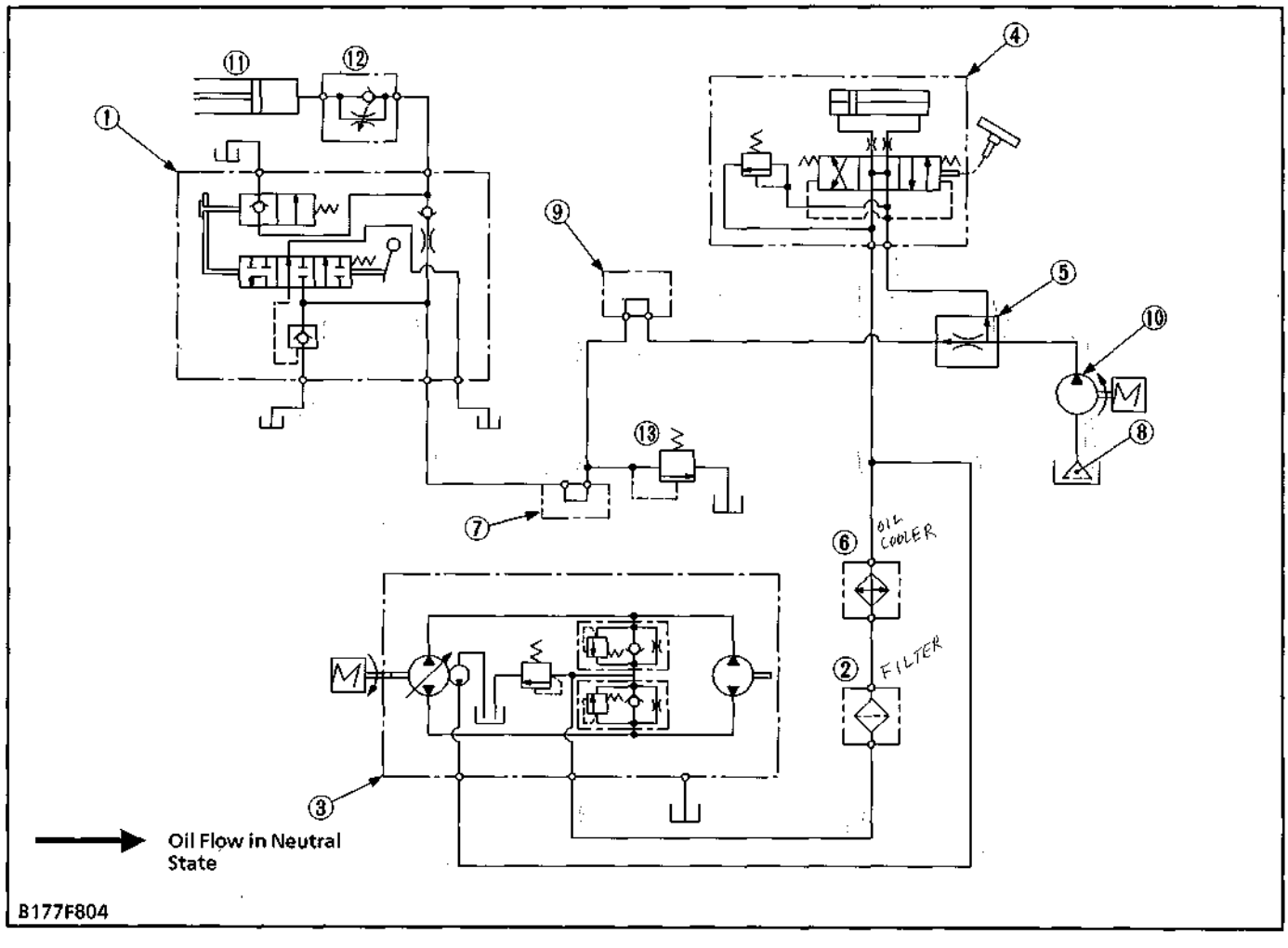
(1) Position Control valve
(2) Oil Filter
(3) Hydrostatic Transmission (HST)
(4) Power Steering
(5) Flow Priority Valve
(6) Oil Cooler
(7) Rear Hydraulic Outlet
(8) Oil Strainer
(9) Hydraulic Block Type Outlet
(10) Hydraulic Pump
(11) Hydraulic Cylinder
(12) Lowering Speed Adjusting Valve
(13) Relief Valve



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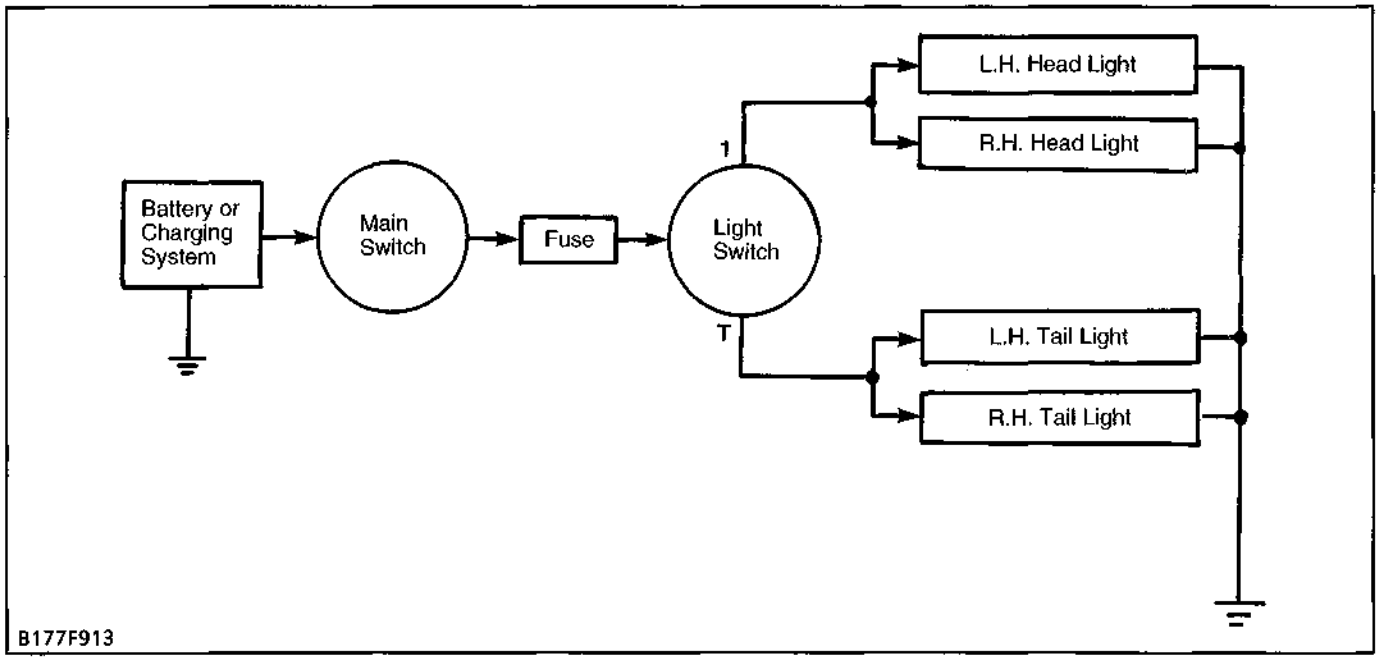
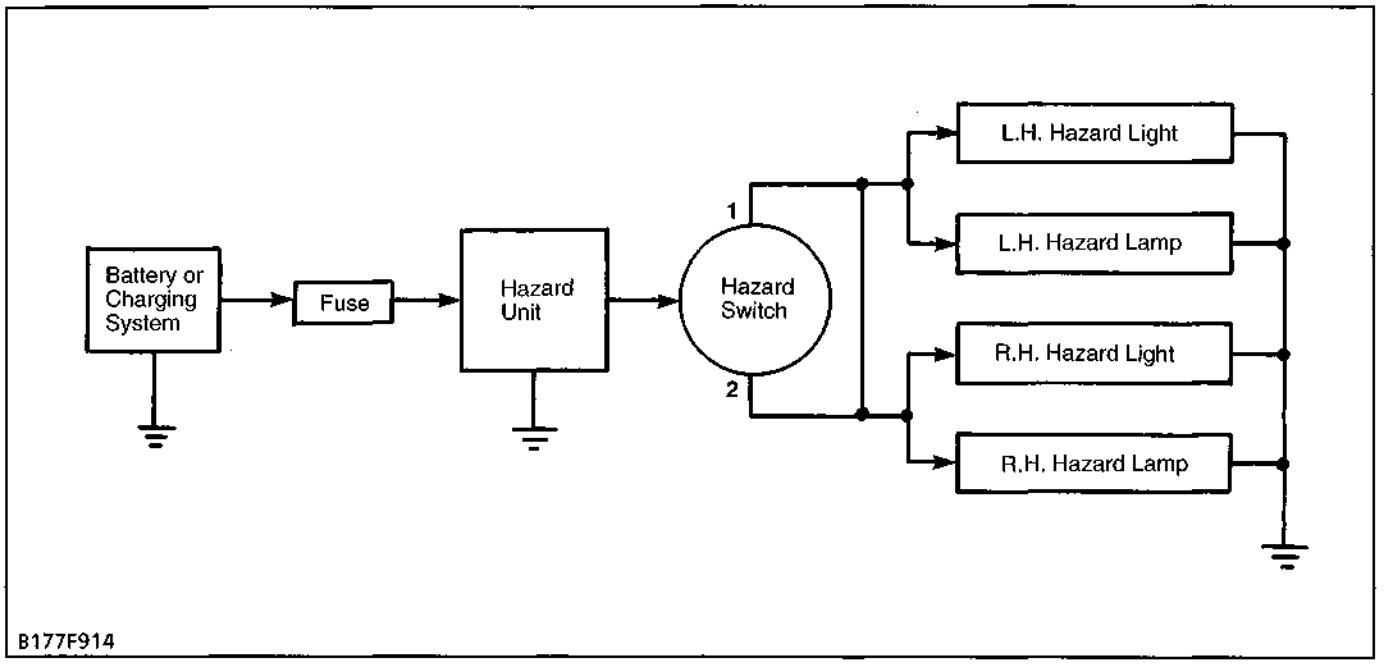
(1) Head Light



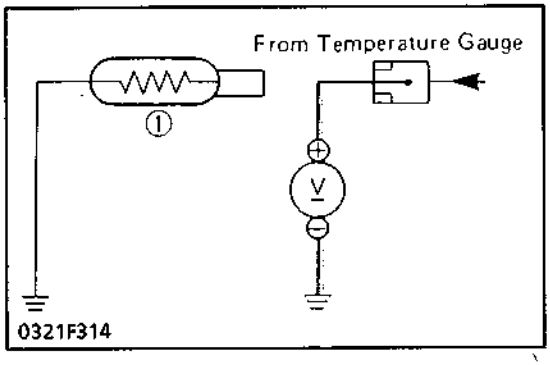
The light switch, which forms a combination switch with the hazard switch, has two position; **OFF** and **ON**.

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.



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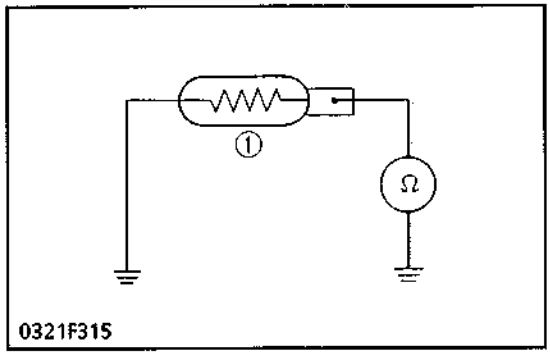

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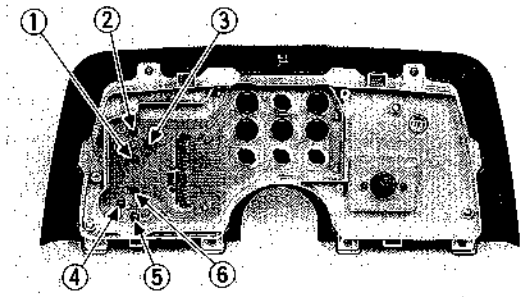


B177P311

Coolant Temperature Sensor

1) Lead Terminal Voltage

1. Disconnect the lead from the coolant temperature sensor after turning the main switch off.
2. Turn the main switch on and measure the voltage with a voltmeter across the lead terminal and the chassis.
3. If the voltage differs from the battery voltage, the wiring harness, fuse or coolant temperature gauge is faulty.

Voltage	Lead terminal – Chassis	Approx. battery voltage

2) Sensor Continuity

1. Measure the resistances with an ohmmeter across the sensor terminal and the chassis.
2. If the reference value is not indicated, the sensor is faulty.

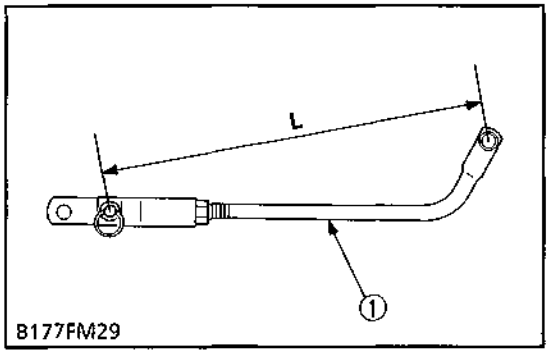
Resistance (Sensor terminal – Chassis	Reference value	Approx. 12.2 ohms Approx. 23.6 ohms Approx. 51.9 ohms Approx. 153.9 ohms	at 130°C (266°F) at 105°C (221°F) at 80°C (176°F) at 50°C (122°F)

(1) Coolant Temperature Sensor

Fuel Gauge and Coolant Temperature Gauge Continuity

1. Remove the panel board from the tractor.
2. Check the continuity with an ohmmeter across the **U** terminal (1) and **IGN** terminal (2) and across the **U** terminal (1) and **GND** terminal (3).
3. If infinity is indicated, the fuel gauge is faulty.
4. Check the continuity with an ohmmeter across the **U** terminal (6) and **IGN** terminal (5) and across the **U** terminal (6) and **GND** terminal (4).
5. If infinity is indicated, the coolant temperature gauge is faulty.

(1) **U** Terminal (Fuel)
(2) **IGN** Terminal (Fuel)
(3) **GND** Terminal (Fuel)
(4) **GND** Terminal (Temperature)
(5) **IGN** Terminal (Temperature)
(6) **U** Terminal (Temperature)



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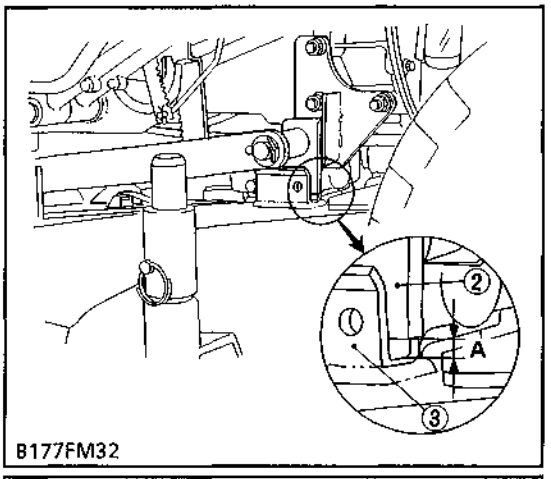

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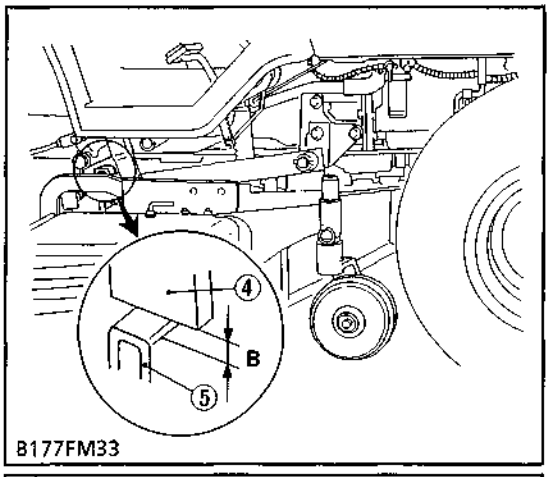

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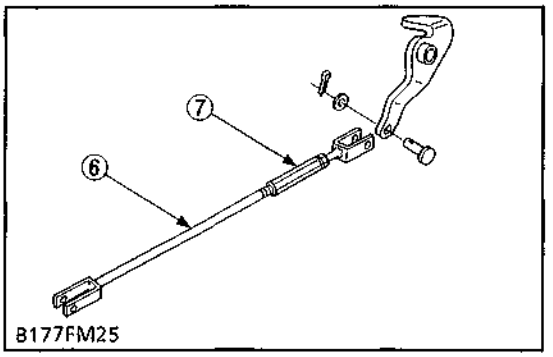

B177FM25

Adjusting Front Link and Connecting Rod

⚠ CAUTION

- **Before starting the engine, change the mid PTO and gear shift lever into neutral.**
- **Shut off the engine and allow the mower blades to stop before making adjustments.**

1. Park the tractor on level ground with the mower touching the ground.
2. Set the height of the four mower gauge wheels the same.
3. If the front gauge wheels are not on the ground, remove the front link from the mower. And adjust the length (L) of the front link (1) until the front gauge wheels come into contact with the ground.
4. Attach the front link to the mower.
5. Start the engine.
6. Lift the mower to the maximum lifting position and shut off the engine.
7. Adjust the turnbuckles (7) of the left and right connecting rods (6) so that the clearances are within the factory specifications.

Clearance (A) between front stopper and mid hanger bracket	Factory spec.	2 to 5 mm 0.08 to 0.20 in.
Clearance (B) between rear stopper and tractor frame	Factory spec.	5 to 10 mm 0.20 to 0.39 in.

■ IMPORTANT

- **Proper adjustment for the connecting rod length is very important to avoid damage to the mower lifting system.**

(1) Front Link
(2) Mid Hanger Bracket
(3) Front Stopper
(4) Tractor Frame
(5) Rear Stopper
(6) Connecting Rod
(7) Turnbuckle