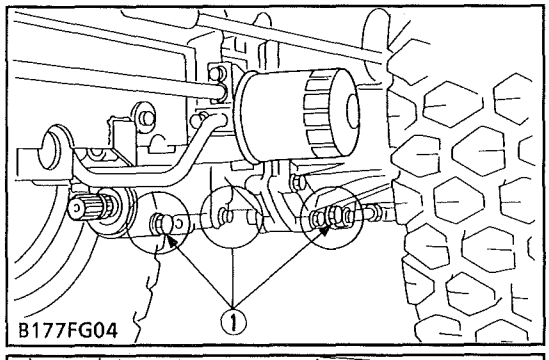
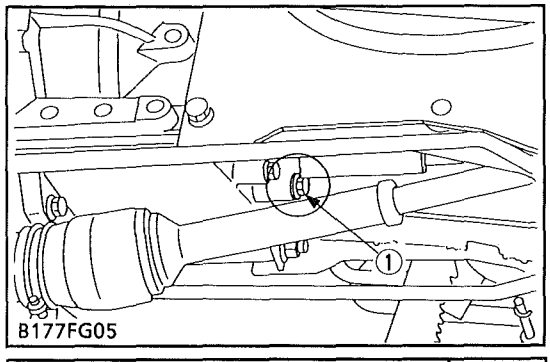
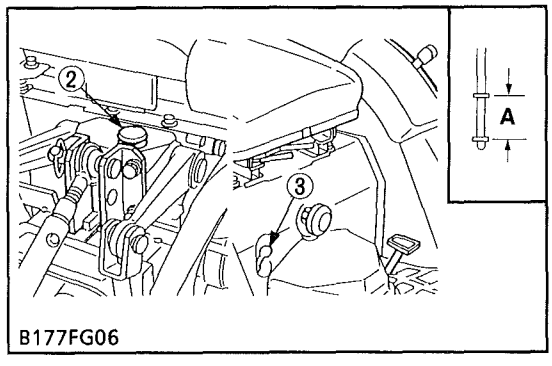
# [2] BRAKE ASSEMBLY

## DISASSEMBLING AND ASSEMBLING

### (1) Separating Rear Axle Case with Brake Assembly




**Drain the Transmission Fluid**

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1).
3. Drain the transmission oil.
4. Reinstall the four drain plugs (1).

**(When refilling)**

- Fill up from filling port after removing plug (2) until reaching the gauge (3).
- After running the engine for few minutes, stop it and check the oil level again. Add the oil to prescribed level if it is not correct level.

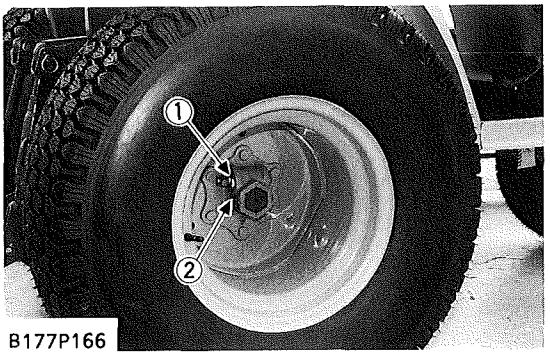
| | | |
|---|---|---|
| Transmission oil capacity | HST type | 12 ℓ<br>3.17 U.S.gals<br>2.6 Imp.gals |
| | Manual transmission type | 11 ℓ<br>2.9 U.S.gals<br>2.4 Imp.gals |

**■ IMPORTANT**

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

**(A) Oil level acceptable within this range.**

(1) Drain Plug
(2) Filling Plug
(3) Gauge




B177P166

(1) Cotter (2) Wheel Hub Pin

## Rear Wheel

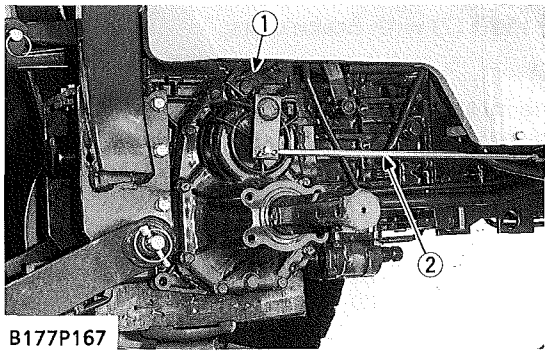
1. Place a jack under the transmission case.
2. Loosen the rear wheel cotter (1) setting bolt and nut.
3. Take out the wheel hub pin (2).
4. Take out the rear wheel.

**■ IMPORTANT**

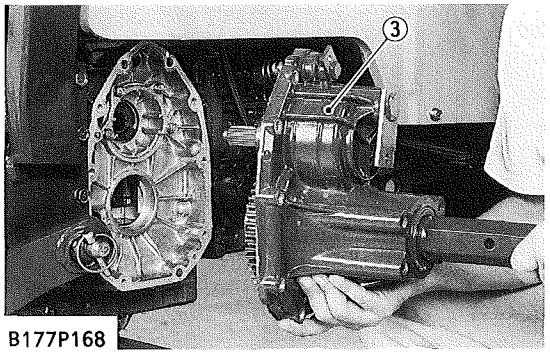
- **When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service.**

**(When reassembling)**

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




B177P167




B177P168

(1) Differential Lock Rod (2) Brake Rod (3) Rear Axle Case

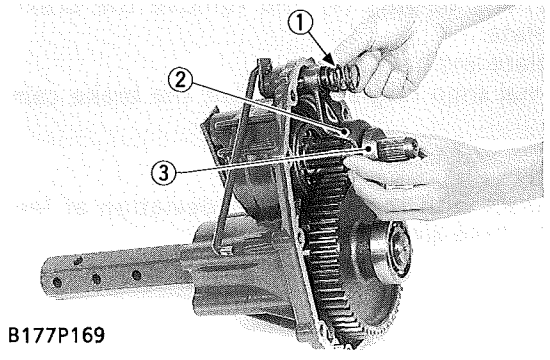
## Rear Axle Case with Brake Assembly

1. Disconnect the differential lock rod (1).
2. Disconnect the brake rod (2).
3. Remove the rear axle case mounting screw.
4. Separate the rear axle case (3) from differential gear case.

**(When reassembling)**

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

| | | |
|---|---|---|
| Tightening torque | Rear axle case mounting screws | 39 to 44 N·m<br>4.0 to 4.5 kgf·m<br>29 to 33 ft-lbs |

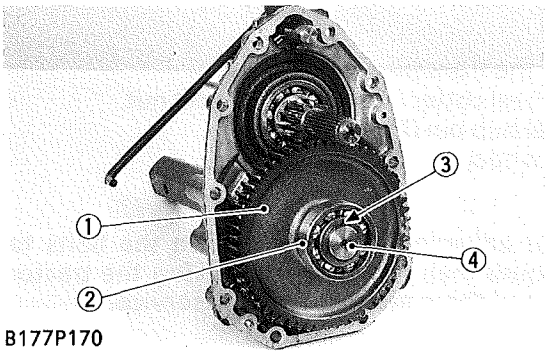



B177P169

## Differential Lock Shift Fork and Differential Lock Clutch

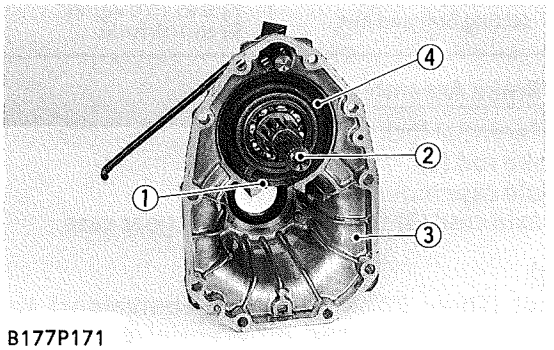
1. Remove the spring (1).
2. Draw out the differential lock shift fork (2) and differential lock clutch (3).

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

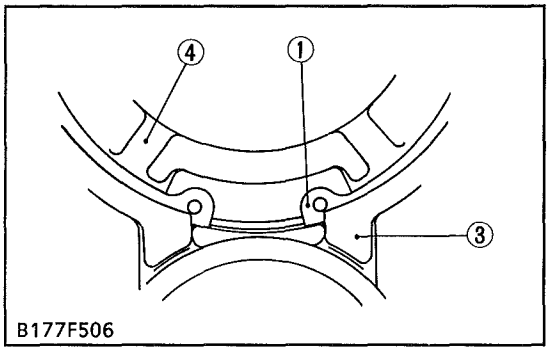


B177P170

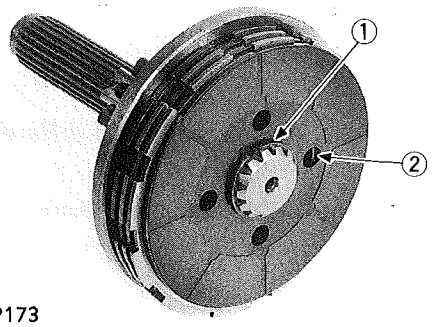
## (2) Disassembling Brake Assembly



B177P171



B177F506



B177P173

(1) External Snap Ring (2) Hole

### 57T Gear

1. Remove the external snap ring (3) and remove the bearing (2).
2. Draw out the 57T gear (1) from the rear axle (4).

(1) Gear
(2) Bearing
(3) External Snap Ring
(4) Rear Axle

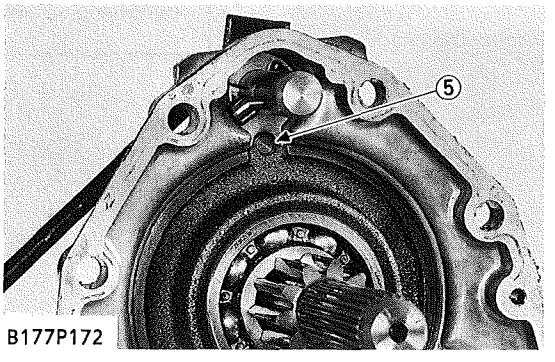
### Brake Assembly

1. Remove the internal snap ring (1).
2. Remove the brake shaft (2) with brake discs.

**(When reassembling)**

- When installing the internal snap ring (1) to rear axle case (3) as shown in the figure left.
- When installing the bearing holder (4) to the rear axle case (3), do not forget to install the straight pin (5). (Refer to the photo. below.)

(1) Internal Snap Ring
(2) Brake Shaft
(3) Rear Axle Case
(4) Bearing Holder
(5) Straight Pin



B177P172

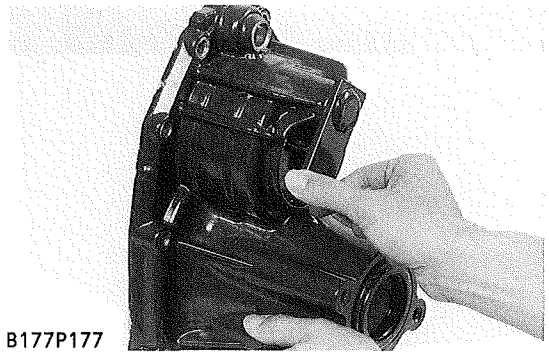
### Brake Discs and Friction Plate

1. Remove the external snap ring (1) and remove the brake discs and friction plate.
2. Remove the cam plate and balls.
3. Remove the external snap ring and pull out the brake cam lever.

**(When reassembling)**

- Install the brake discs with their holes (2) deviation at less than 1/3 of the total hole area.

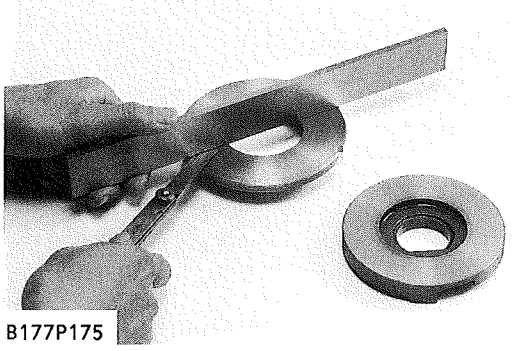
# SERVICING



B177P177

### Brake Cam Lever Movement

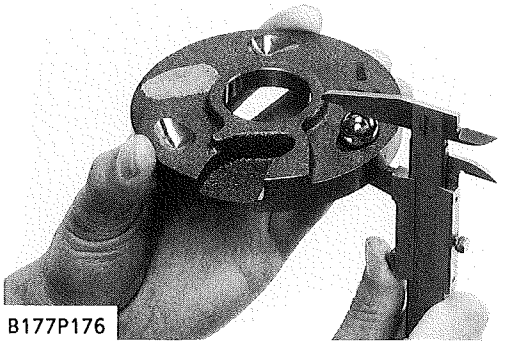
1. Move the brake cam lever by hand to check the movement.
2. If the movement is heavy, refine the brake cam with sandpaper.



B177P175

### Cam Plate Flatness and Bearing Holder Wear

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

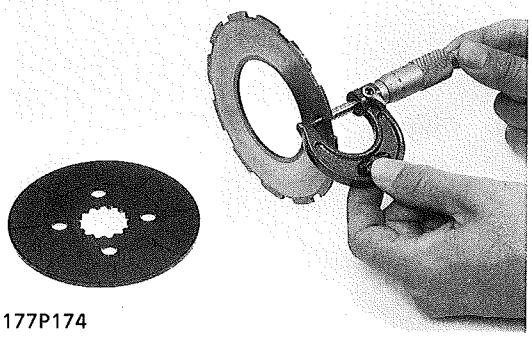


B177P176

### Height of Cam Plate and Ball

1. Measure the dimensions of the cam plate with the ball installed.
2. If the measurement is less than the allowable limit, replace the cam plate and balls.
3. Inspect the ball holes of cam plate for uneven wear. If the uneven wear is found, replace it.

| | | |
|---|---|---|
| Height of cam plate and ball | Factory spec. | 22.89 to 22.99 mm<br>0.9012 to 0.9051 in. |
| | Allowable limit | 22.40 mm<br>0.8819 in. |



B177P174

### Brake Disc and Friction Plate Wear

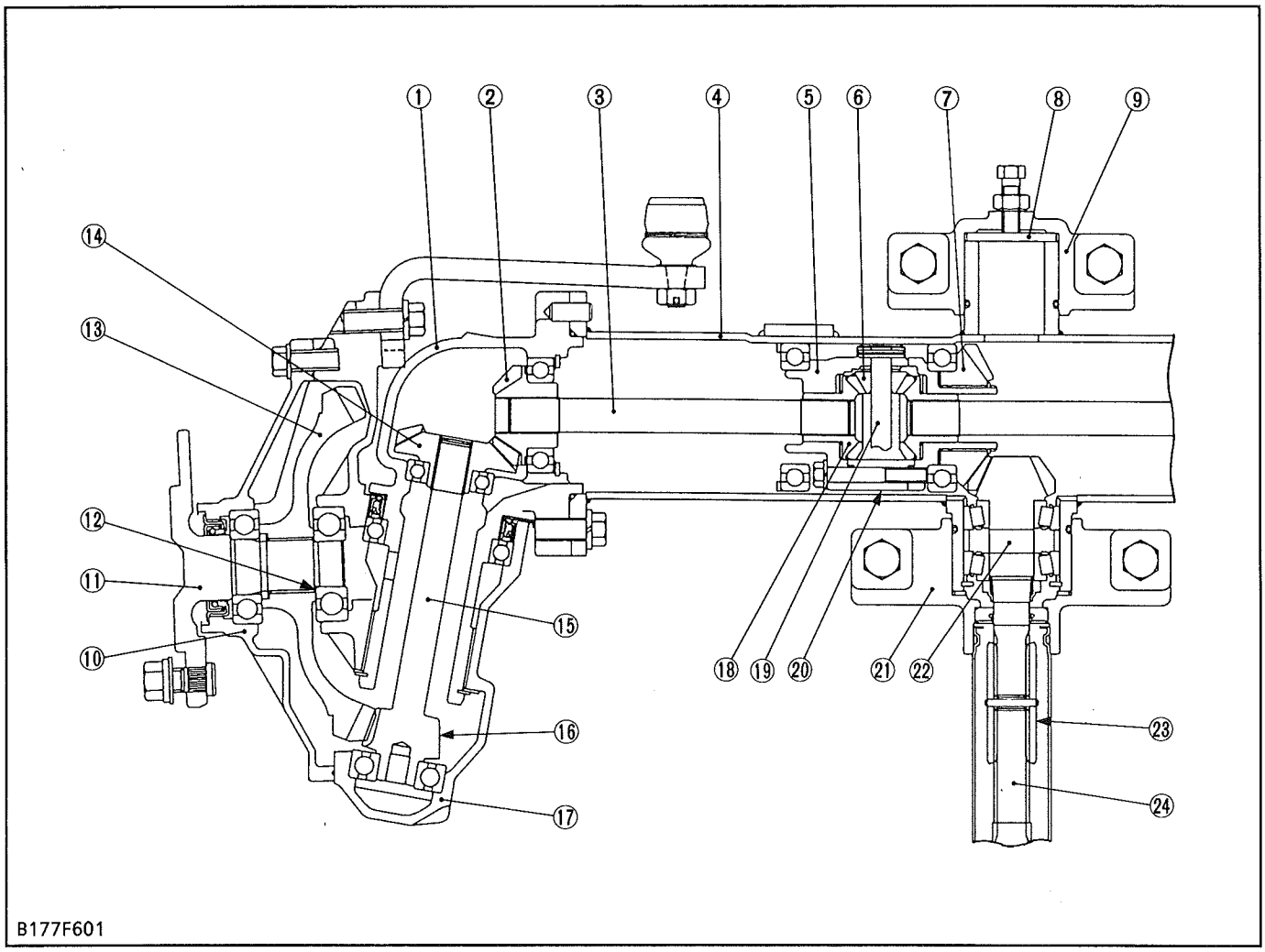
1. Measure the brake disc thickness and the friction plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Brake disc thickness | Factory spec. | 3.3 to 3.5 mm<br>0.130 to 0.138 in. |
| | Allowable limit | 3.0 mm<br>0.118 in. |
| Plate thickness | Factory spec. | 1.92 to 2.08 mm<br>0.0756 to 0.0819 in. |
| | Allowable limit | 1.52 mm<br>0.0598 in. |

# MECHANISM

## CONTENTS

# [1] STRUCTURE




B177F601

(1) Bevel Gear Case
(2) Bevel Gear
(3) Differential Yoke Shaft
(4) Front Axle Case
(5) Differential Case
(6) Differential Pinion
(7) Spiral Bevel Gear
(8) Collar
(9) Front Axle Bracket, Front
(10) Axle Flange
(11) Axle
(12) Collar
(13) Bevel Gear
(14) Bevel Gear
(15) Bevel Gear Shaft
(16) Bevel Gear
(17) Front Gear Case
(18) Differential Side Gear
(19) Pinion Shaft
(20) Differential Assembly
(21) Front Axle Bracket, Rear
(22) Spiral Bevel Pinion Shaft
(23) Coupling
(24) Propeller Shaft

The front axle of the 4WD is constructed as shown above. Power is transmitted from the transmission through the propeller shaft (24) to the spiral bevel pinion shaft (22), then to the spiral bevel gear (7) and to the differential gear (18).

The power through the differential side gear is transmitted to the differential yoke shaft (3), and to the bevel gear shaft (15) through the bevel gears (2), (4) in the bevel gear case (1).

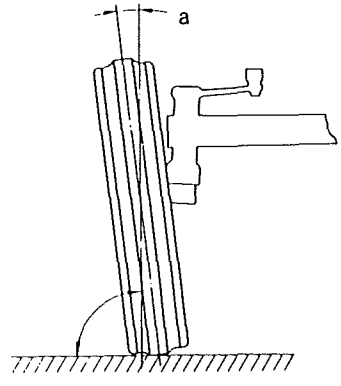
The revolution is greatly reduced by the bevel gears (16), (13), then the power is transmitted to the axle (11).

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]**



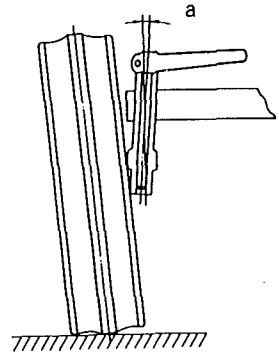

C045F051

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 | 0.035 rad.<br>2° |

**[Kingpin Angle]**




C045F053

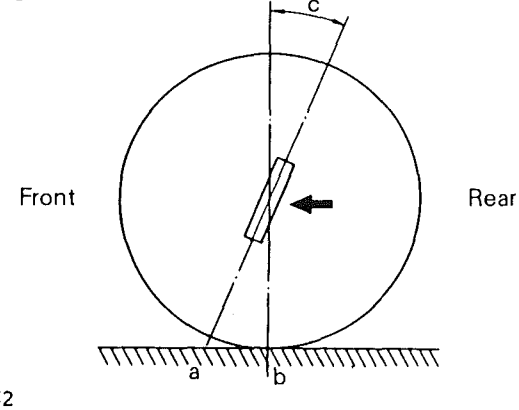
The kingpin is tilted from the vertical as viewed from the front.

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.

| | |
|---|---|
| Kingpin inclination | 0.209 rad.<br>12° |

**[Caster]**




C045F052

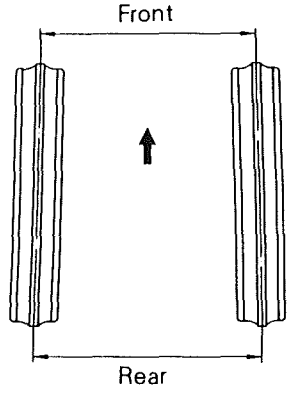
The kingpin is tilted forward as viewed from the side. The point (b) of the wheel center line is behind the point (a) of the kingpin shaft center line.

This inclination is called caster (c). Caster helps provide steering stability.

As with the kingpin inclination, caster reduces steering effort.

| | |
|---|---|
| Caster | 0 rad.<br>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 | 1 to 10 mm<br>0.04 to 0.39 in. |

# SERVICING

## CONTENTS

# TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Front Wheels Wander to Right or Left** | • Tire pressure uneven | Adjust | G-35 |
| | • Improper toe-in adjustment (improper alignment) | Adjust | 6-S3 |
| | • Clearance between front axle case boss and front axle bracket (front, rear) excessive | Replace | 6-S11 |
| | • Front axle rocking force too small | Adjust | 6-S4 |
| | • Front wheel sway excessive | Replace | 6-S4 |
| | • Tie-rod end loose | Tighten | 6-S6 |
| | • Air sucked in power steering circuit | Bleed | 7-S10 |
| **Front Wheels Can Not Be Driven** | • Front wheel driving gears in front axle gear case broken | Replace | 6-S7 |
| | • Universal joint broken | Replace | 6-S5 |
| | • Front wheel drive gears in transmission broken | Replace | – |
| | • Front differential gear broken | Replace | 6-S9 |
| | • Shift fork broken | Replace | – |
| | • Coupling displaced | Reassemble | 6-S5 |
| **Noise** | • Gear backlash excessive | Adjust or replace | 6-S10 to S12 |
| | • Oil insufficient | Replenish | G-18 |
| | • Bearings damaged or broken | Replace | – |
| | • Gears damaged or broken | Replace | – |
| | • Spiral bevel pinion shaft turning force improper | Adjust | 6-S11 |

# SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Front Wheel Alignment | Toe-in | 1 to 10 mm<br>0.04 to 0.39 in. | – |
| Front Wheel | Axial Sway | Less than 5 mm<br>0.20 in. | – |
| Front Axle | Rocking Force | 49.0 to 117.7 N<br>5.0 to 12.0 kgf<br>11.0 to 26.5 lbs | – |
| Differential Case, Differential Case Cover to differential Side Gear | Clearance | 0.040 to 0.082 mm<br>0.00157 to 0.00323 in. | 0.17 mm<br>0.0067 in. |
| Differential Case | I.D. | 26.000 to 26.021 mm<br>1.02362 to 1.02445 in. | – |
| Differential Case Cover | I.D. | 26.000 to 26.021 mm<br>1.02362 to 1.02445 in. | – |
| Differential Side Gear | O.D. | 25.939 to 25.960 mm<br>1.02122 to 1.02205 in. | – |
| Pinion Shaft to Differential Pinion | Clearance | 0.038 to 0.068 mm<br>0.00150 to 0.00268 in. | 0.17 mm<br>0.0067 in. |
| Pinion Shaft | O.D. | 9.972 to 9.987 mm<br>0.39260 to 0.39312 in. | – |
| Differential Pinion | I.D. | 10.025 to 10.040 mm<br>0.39469 to 0.39528 in. | – |
| Differential Pinion to Differential Side Gear | Backlash | 0.1 to 0.3 mm<br>0.004 to 0.012 in. | – |
| Shim | Thickness | 0.8 mm<br>0.031 in. | – |
| | | 1.0 mm<br>0.039 in. | – |
| | | 1.2 mm<br>0.047 in. | – |
| Spiral Bevel Pinion Shaft | Turning Force | 127.5 to 166.7 N<br>13.0 to 17.0 kgf<br>28.7 to 37.5 lbs | – |
| Spiral Bevel Pinion Shaft to Spiral Bevel Gear | Backlash | 0.1 to 0.3 mm<br>0.004 to 0.012 in. | – |
| 11T Bevel Gear to 16T Bevel Gear | Backlash | 0.10 to 0.30 mm<br>0.0039 to 0.0118 in. | – |
| Shim | Thickness | 0.8 mm<br>0.031 in. | – |
| | | 1.0 mm<br>0.039 in. | – |
| | | 1.2 mm<br>0.047 in. | – |
| | | 1.4 mm<br>0.055 in. | – |

**(Continued)**

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Front Axle Case Boss (Front) | O.D. | 49.920 to 49.945 mm<br>1.96535 to 1.96634 in. | – |
| Front Axle Bracket (Front) | I.D. | 50.150 to 50.200 mm<br>1.97441 to 1.97638 in. | – |
| Front Axle Case Boss (Rear) | O.D. | 64.910 to 64.940 mm<br>2.55551 to 2.55669 in. | – |
| Front Axle Bracket (Rear) | I.D. | 65.150 to 65.200 mm<br>2.56496 to 2.56693 in. | – |

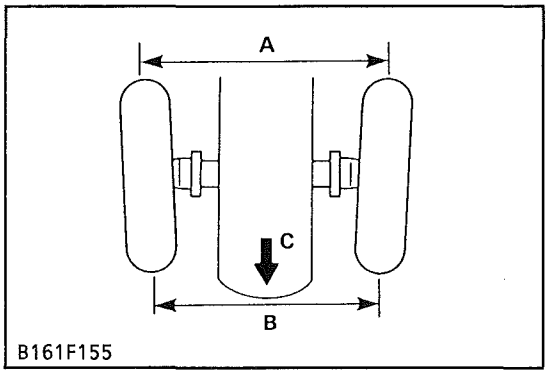
# TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts: See page G-9)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Lock nut of rocking force adjusting screw | 23.5 to 27.5 | 2.4 to 2.8 | 17.4 to 20.3 |
| Slotted nut of tie-rod end | 17.7to 34.3 | 1.8 to 3.5 | 13.0 to 25.3 |
| Slotted nut of drag link end | 17.7 to 34.3 | 1.8 to 3.5 | 13.0 to 25.3 |
| Lock nuts of tie-rod | 29.4 to 34.3 | 3.0 to 3.5 | 21.7 to 25.3 |
| Front axle shaft bracket mounting screw | 124 to 147 | 12.6 to 15.0 | 91.1 to 108.5 |
| Front wheel mounting nut | 77.5 to 90.2 | 7.9 to 9.2 | 57.1 to 66.5 |
| Bevel gear case mounting screw | 123.5 to 147.0 | 12.6 to 15.0 | 91.2 to 108.4 |
| Axle flange mounting screw | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Spiral bevel pinion shaft lock nut | 98.1 to 117.7 | 10.0 to 12.0 | 72.3 to 86.8 |
| Differential case cover mounting screw | 29.4 to 34.3 | 3.0 to 3.5 | 21.7 to 25.3 |

# CHECKING, DISASSEMBLING AND SERVICING

## CHECKING AND ADJUSTING



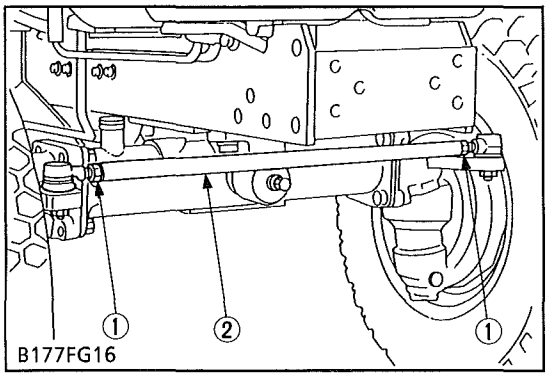
B161F155

### Toe-in

1. Inflate the tires to the specified pressure.
2. Turn the front wheels straight ahead.
3. Measure the toe-in (**A-B**).
4. If the measurement is not within the factory specifications, adjust the tie-rod length.

| | | |
|---|---|---|
| Toe-in (**A-B**) | Factory spec. | 1 to 10 mm<br>0.04 to 0.39 in. |

(A) Wheel to Wheel Distance at rear
(B) Wheel to Wheel Distance at front
(C) Front



B177FG16

### Toe-in Adjustment

1. Loosen the lock nuts (1).
2. Turn the tie-rod (2) until to be factory specification.
3. Tighten the lock nuts (1).

| | | |
|---|---|---|
| Tightening torque | Lock nuts | 29.4 to 34.3 N·m<br>3.0 to 3.5 kgf·m<br>21.7 to 25.3 ft-lbs |

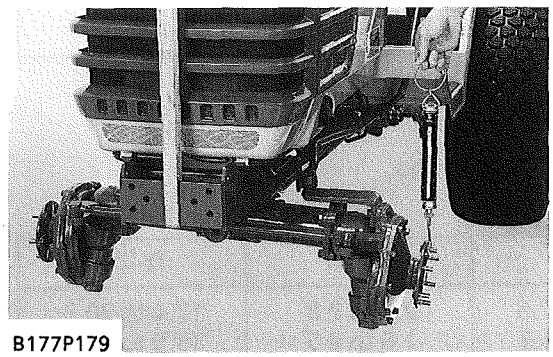
(1) Lock Nut (2) Tie-rod


B177P178

## Axial Sway of Front Wheel

1. Jack up the front side of tractor.
2. Set a dial gauge on the outside of rim.
3. Turn the front wheel slowly and read the runout of rim.
4. If the runout exceeds the factory specifications, check the bearing, rim, and front wheel hub.

| | | |
|---|---|---|
| Axial sway of front wheel | Factory spec. | Less than 5.0 mm<br>0.20 in. |

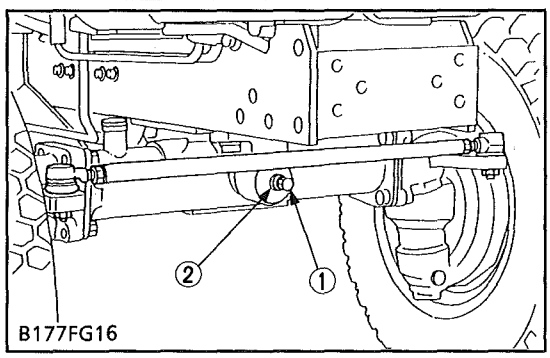

B177P179

## Front Axle Rocking Force

1. Jack up the front side of tractor.
2. Set a spring balance to the front axle flange.
3. Measure the front axle rocking force.
4. If the measurement is not within the factory specifications, adjust with the adjusting screw (1).
5. Tighten the lock nut (2) firmly.

| | | |
|---|---|---|
| Front axle rocking force | Factory spec. | 49.0 to 117.7 N<br>5.0 to 12.0 kgf<br>11.0 to 26.5 lbs |

| | | |
|---|---|---|
| Tightening torque | Lock nut | 23.5 to 27.5 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.3 ft-lbs |

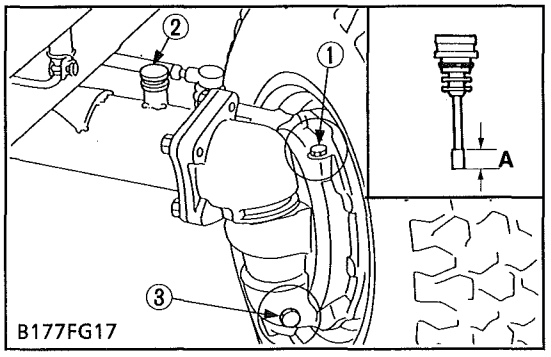


B177FG16

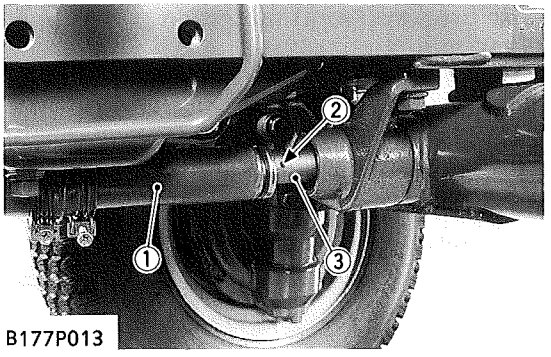
(1) Adjusting Screw (2) Lock Nut

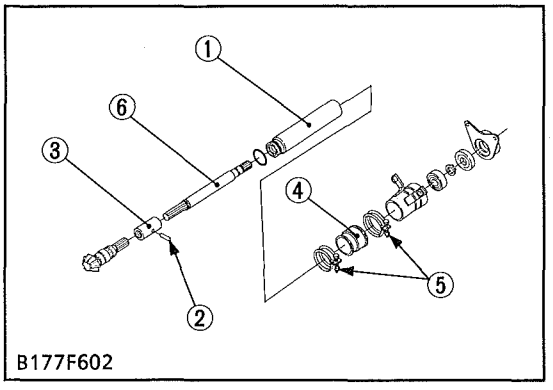
# DISASSEMBLING AND ASSEMBLING

## (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<br>3.9 U.S.qts.<br>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.)**

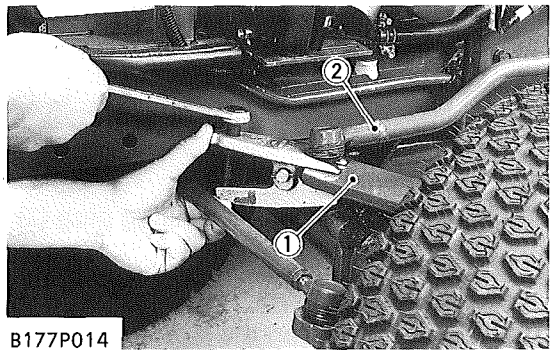
### Propeller Shaft

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.

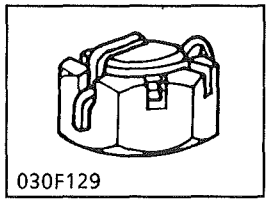
**(When reassembling)**

- 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



B177P014


030F129

### Drag Link

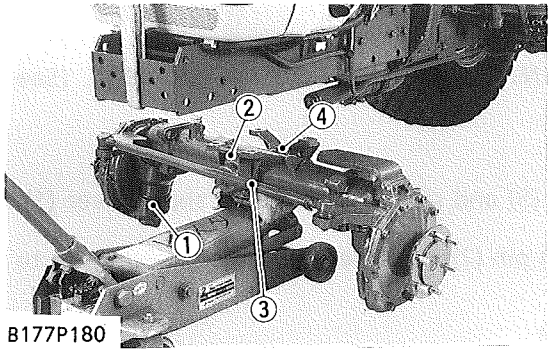
1. Steer the front wheels to the left.
2. Remove the slotted nut and disconnect the drag link (2) from the knuckle arm (1).

**■ IMPORTANT**

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

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

(1) Knuckle Arm (2) Drag Link



B177P180

(1) Front Gear Case
(2) Front Axle Bracket (Front)
(3) Tie-rod
(4) Front Axle Bracket (Rear)

### Front Axle

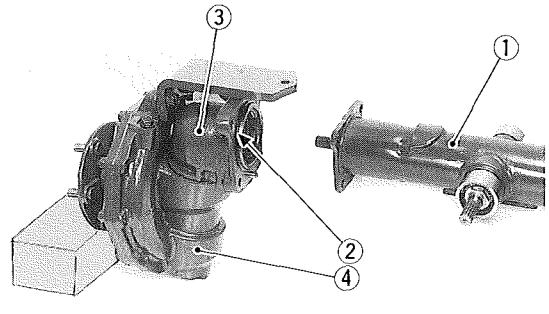
1. Place the jacks under the front axle, and hang up the front axle frame by the hoist to support it.
2. Remove the front wheels.
3. Remove the front axle bracket (Front) mounting screws and front axle bracket (Rear) mounting screws.
4. Separate the front axle from the front axle frame.
5. Remove the slotted nut and disconnect the tie-rod (3) from the front gear case (1).
6. Remove the front axle bracket (2), (4).

**(When reassembling)**

- Apply grease to the oil seal of front axle bracket (Rear) (4).

| | | |
|---|---|---|
| Tightening torque | Front axle bracket mounting screws | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.1 to 108.5 ft-lbs |
| | Front wheel 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 |
| | Slotted nut | 17.7 to 34.3 N·m<br>1.8 to 3.5 kgf·m<br>13.0 to 25.3 ft-lbs |

## (2) Disassembling Front Axle



B177P181

(1) Front Axle Case
(2) O-ring
(3) Bevel Gear Case
(4) Front Gear Case

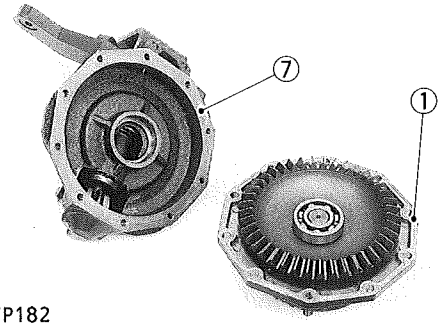
### Bevel Gear Case and Front Gear Case

1. Remove the bevel gear case mounting screws.
2. Remove the bevel gear case (3) and front gear case (4) as a unit from the front axle case (1).

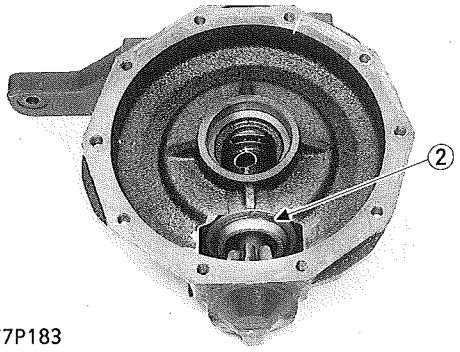
**(When reassembling)**

- Apply grease to the O-ring (2) and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies and right and left front gear case assemblies.

| | | |
|---|---|---|
| Tightening torque | Bevel gear case mounting screw | 123.5 to 147.0 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108.4 ft-lbs |




B177P182

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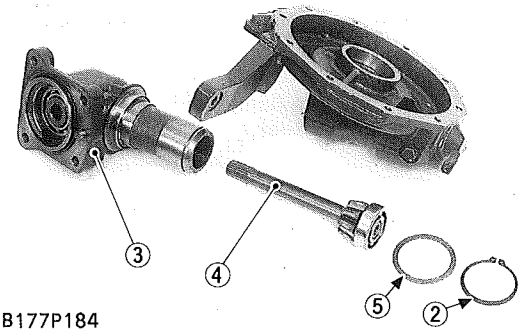
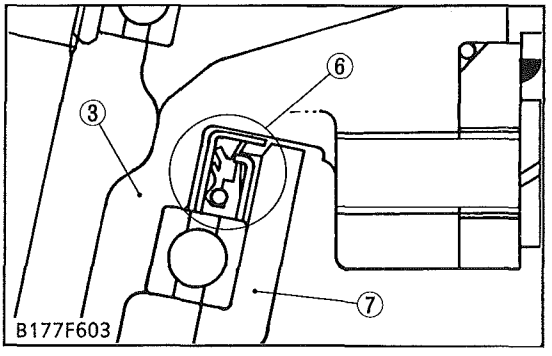



B177P184




B177F603

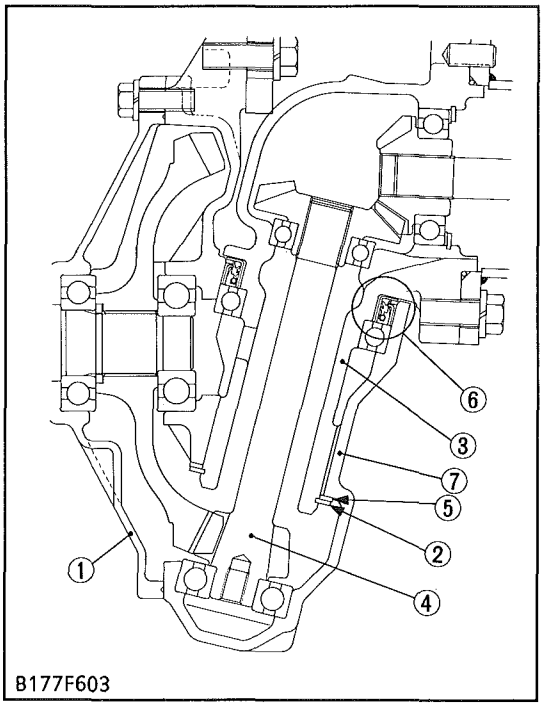
## Bevel Gear Case, Axle Flange and Front Gear Case

1. Remove the knuckle arm (Left side).
2. Remove the axle flange (1) mounting screws.
3. Remove the external snap ring (2).
4. Remove the bevel gear case (3) from front gear case (7).
5. Remove the bevel gear shaft (4) and ball bearing.

**(When reassembling)**

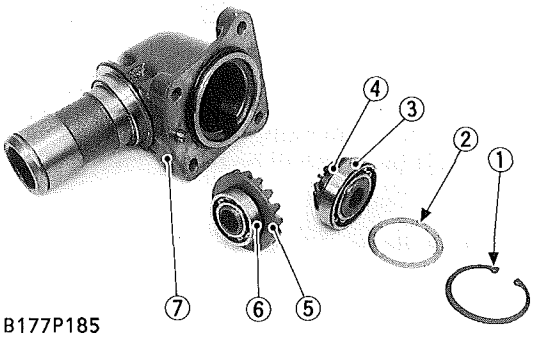
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the axle flange (1) and front gear case (7) after eliminate the water, oil and stuck liquid gasket.
- Tighten the axle flange mounting screws and nuts diagonally in several steps.
- Install the oil seal (6) of bevel gear case, noting its direction as shown in the figure below.

| | | |
|---|---|---|
| Tightening torque | Axle flange mounting screws | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |




B177F603

(1) Axle Flange
(2) External Snap Ring
(3) Bevel Gear Case
(4) Bevel Gear Shaft
(5) Thrust Collar
(6) Oil Seal
(7) Front Gear Case



B177P185

## Bevel Gear Case Gears

1. Remove the internal snap ring (1).
2. Take out the bevel gears (4), (5) with ball bearings (3), (6), and shims (2).

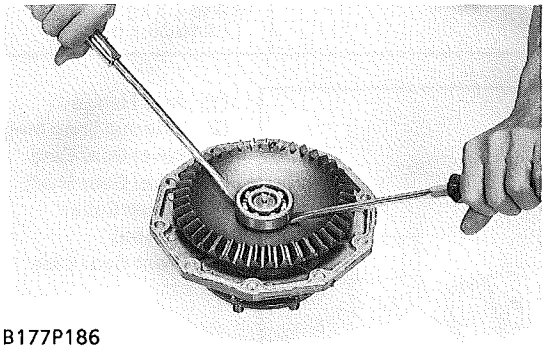
**(When reassembling)**

- Install the shims (2) to their original position.

**(Reference)**

- Thickness of adjusting shims :
  0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
  1.0 mm (0.039 in.)

(1) Internal Snap Ring
(2) Shim
(3) Ball Bearing
(4) Bevel Gear
(5) Bevel Gear
(6) Ball Bearing
(7) Bevel Gear Case


B177P186

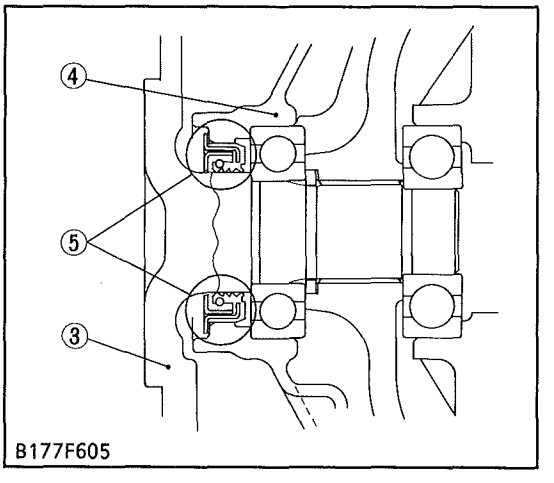
## Axle

1. Remove the bearing.
2. Take out the bevel gear (2).
3. Take out the collar (1).
4. Tap out the axle (3).

**(When reassembling)**

- Install the oil seal (5) of axle flange (4), noting its direction as shown in the figure below.

(1) Collar
(2) Bevel Gear
(3) Axle
(4) Axle Flange
(5) Oil Seal



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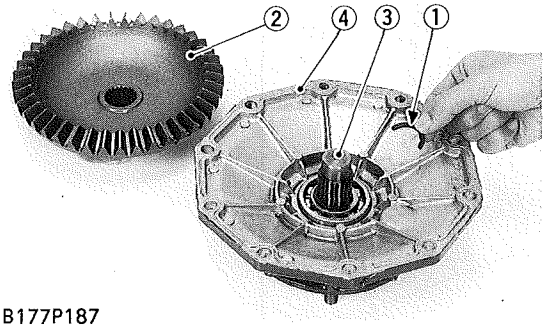

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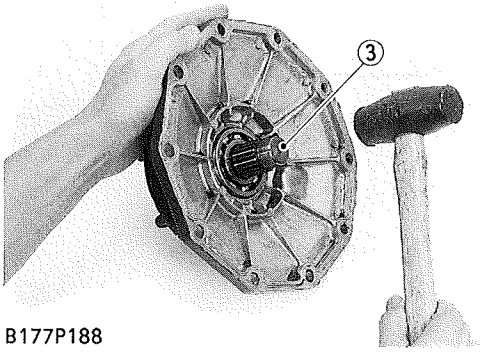

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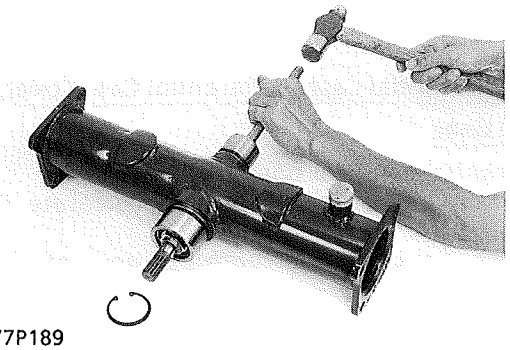
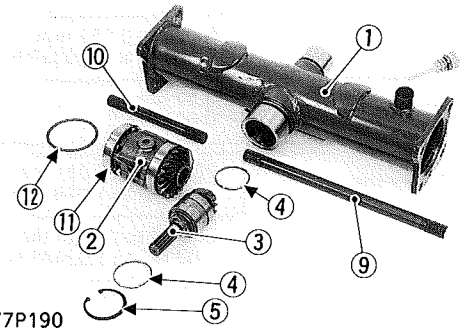
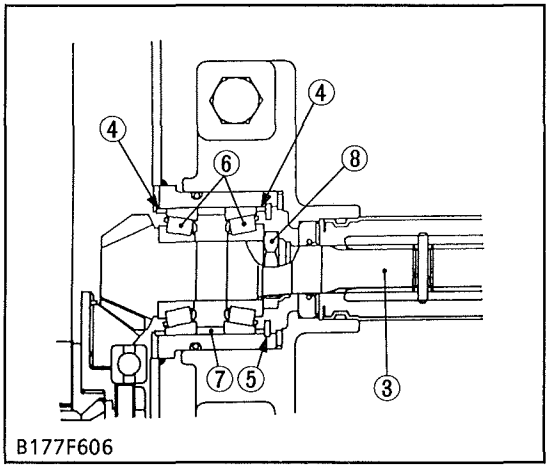


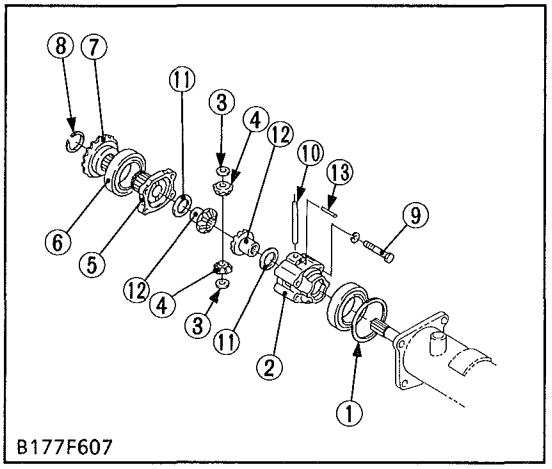
B177P189




B177P190




B177F606




B177F607

(1) Collar
(2) Differential Case
(3) Thrust Collar
(4) Differential Pinion
(5) Differential Case Cover
(6) Ball Bearing
(7) Spiral Bevel Gear
(8) External Snap Ring
(9) Screws
(10) Pinion Shaft
(11) Shim
(12) Differential Side Gear
(13) Straight Pin

## Spiral Bevel Pinion Shaft and Differential Gear Assembly

1. Take out the differential yoke shaft (9), (10).
2. Remove the internal snap ring (5).
3. Tap out the spiral bevel pinion shaft (3) by the brass rod and hammer.
4. Take out the differential gear assembly (2), ball bearing (11) and collar (12) from right side of front axle case (1).
5. Remove the stake of lock nut (8), and then remove the lock nut (8).
6. Remove the taper roller bearings (6).

**(When reassembling)**

- Replace the lock nut (8) with new ones.
- Apply grease to the O-ring of front axle case bosses.
- Install the shims and collars to their original position.
- Apply gear oil to the taper roller bearings (6) and install them correctly, noting their direction.
- Stake the lock nut (8) firmly.

(1) Front Axle Case
(2) Differential Gear Assembly
(3) Spiral Bevel Pinion Shaft
(4) Adjusting Collar
(5) Internal Snap Ring
(6) Taper Roller Bearings
(7) Collar
(8) Lock Nut
(9) Differential Yoke Shaft RH
(10) Differential Yoke Shaft LH
(11) Ball Bearing
(12) Collar

## Differential Gear

1. Remove the differential case cover mounting screws (9) and then take out the differential case cover (5), ball bearing (6) and spiral bevel gear (7) as a unit.
2. Remove the external snap ring (8), and then remove the ball bearing (6) and spiral bevel gear (7) as a unit with a puller.
3. Remove the straight pin (13).
4. Pull out the pinion shaft (10) and take out the differential pinions (4) and differential side gears (12).

**■ NOTE**

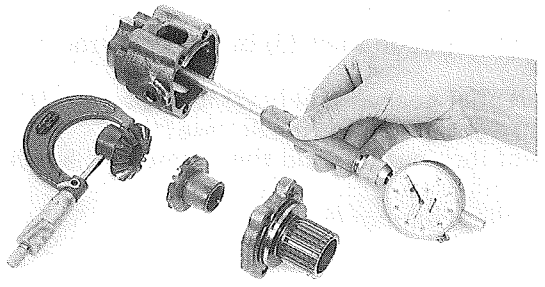
- **Arrange the parts to know their original position.**

**(When reassembling)**

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (12) and differential pinions (4).
- Install the pinion shaft (10) so that the hole on it may align with the hole on differential case (2), and install the straight pin (13).

| | | |
|---|---|---|
| Tightening torque | Differential case cover mounting screw | 29.4 to 34.3 N·m<br>3.0 to 3.5 kgf·m<br>21.7 to 25.3 ft-lbs |

# SERVICING

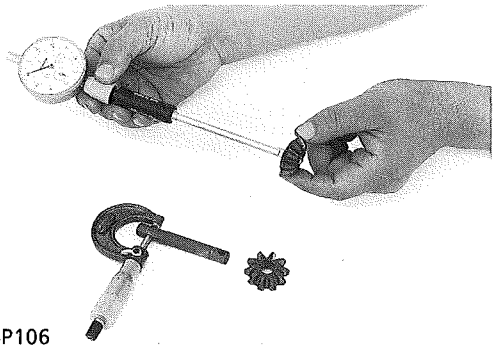


B177P192

## Clearance between Differential Case (Differential Case Cover) and Differential Side Gear

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

| | | |
|---|---|---|
| Clearance between differential case (Differential case cover) and differential side gear | Factory spec. | 0.040 to 0.082 mm<br>0.00157 to 0.00323 in. |
| | Allowable limit | 0.17 mm<br>0.0067 in. |
| Differential case bore I.D. | Factory spec. | 26.000 to 26.021 mm<br>1.02362 to 1.02445 in. |
| Differential case cover bore I.D. | Factory spec. | 26.000 to 26.021 mm<br>1.02362 to 1.02445 in. |
| Differential side gear O.D. | Factory spec. | 25.939 to 25.960 mm<br>1.02122 to 1.02205 in. |

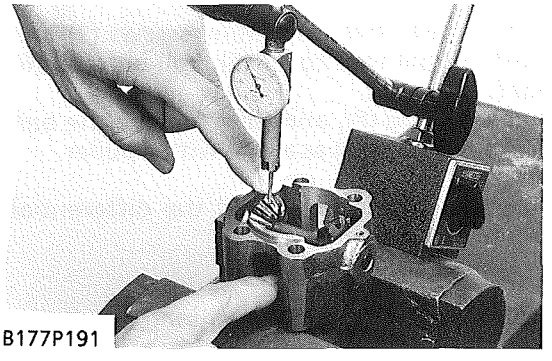


C094P106

## Clearance between Pinion Shaft and Differential Pinion

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

| | | |
|---|---|---|
| Clearance between pinion shaft and differential pinion | Factory spec. | 0.064 to 0.100 mm<br>0.00252 to 0.00394 in. |
| | Allowable limit | 0.25 mm<br>0.0096 in. |
| Pinion shaft O.D. | Factory spec. | 13.950 to 13.968 mm<br>0.54921 to 0.54992 in. |
| Differential pinion I.D. | Factory spec. | 14.032 to 14.050 mm<br>0.55244 to 0.55315 in. |



B177P191

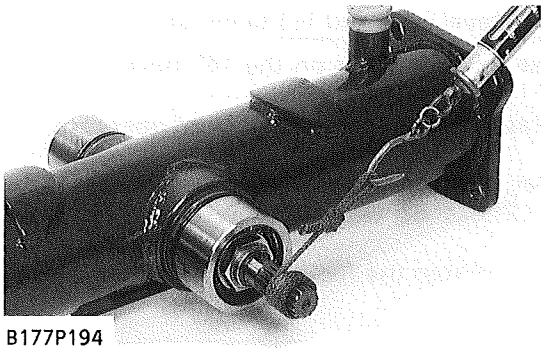
## Backlash between Differential Pinion and Differential Side Gear

1. Set a dial gauge (lever type) on a tooth of the differential pinion.
2. Fix the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement exceeds the factory specifications, adjust with the differential side gears shims.

| | | |
|---|---|---|
| Backlash between differential pinion and differential side gear | Factory spec. | 0.1 to 0.3 mm<br>0.004 to 0.012 in. |

**(Reference)**

- Thickness of adjusting shims :
  0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
  1.0 mm (0.039 in.)


B177P194

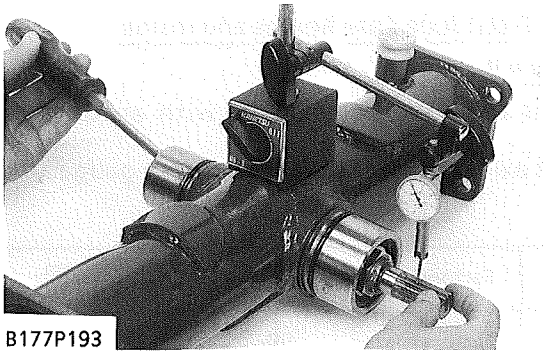
## Turning Force of Spiral Bevel Pinion Shaft

1. Install the spiral bevel pinion shaft assembly to the front axle case.
2. Wind a string around the spiral bevel pinion shaft and attach spring balance to the tip of the string.
3. Slowly pull the spring balance in a direction at right angle to the spiral bevel pinion shaft to measure the turning force.
4. If the turning force is not within the factory specifications, adjust with the lock nut.

| | | |
|---|---|---|
| Turning force | Factory spec. | 127.5 to 166.7 N<br>13 to 17 kgf<br>28.7 to 37.5 lbs |

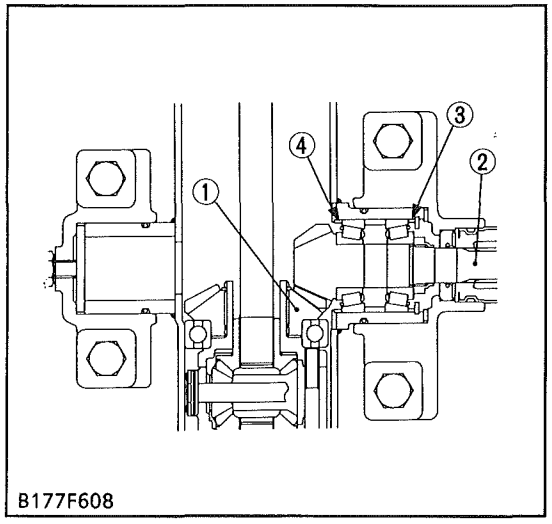
**■ NOTE**

- **The turning torque is figured by multiplying the radius (distance from the center of the spiral bevel pinion shaft to a point on the circumference from which the string is pulled) by the reading on the spring balance.**
- **After turning force adjustment, be sure to stake the lock nut.**


B177P193

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

1. Set a dial gauge (lever type) with its finger on the spline of spiral bevel pinion shaft.
2. Measure the backlash by moving the spiral bevel pinion shaft by hand lightly.
3. If the backlash is not within the factory specifications, change the adjusting collars (3), (4). For example change the adjusting collar (4) to 0.1 mm (0.004 in.) smaller size, and change the adjusting collar (3) to 0.1 mm (0.004 in.) larger size.
4. Adjust the backlash properly by repeating the above procedures.



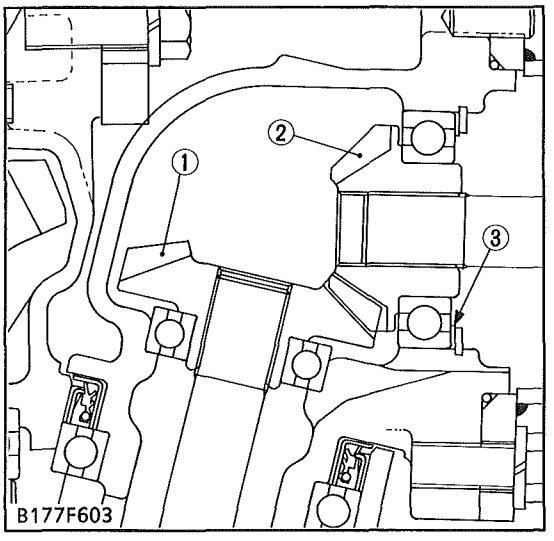
B177F608

| | | |
|---|---|---|
| Backlash between spiral bevel pinion shaft and spiral bevel gear | Factory spec. | 0.1 to 0.3 mm<br>0.004 to 0.012 in. |

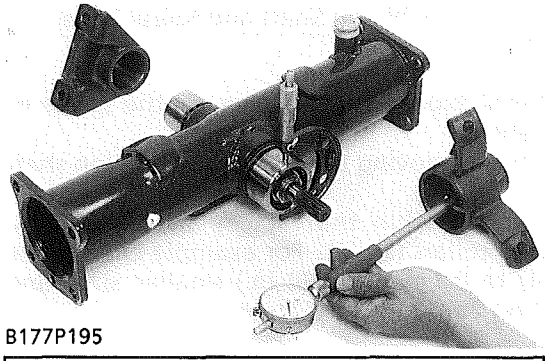
(1) Spiral Bevel Gear
(2) Spiral Bevel Pinion Shaft
(3) Adjusting Collar
(4) Adjusting Collar

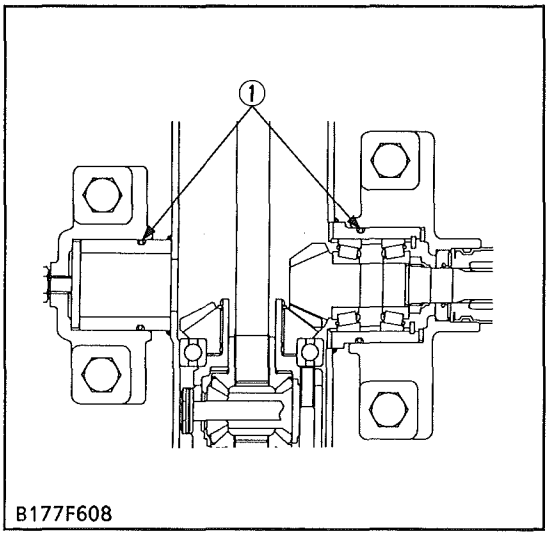
**(Reference)**

- Above factory specification should be measured on the tooth of spiral bevel pinion. When measuring the backlash on the spline of its shaft, factory specification will be 0.0571 to 0.1714 mm (0.00225 to 0.00675 in.).
- Thickness of adjusting collars (3), (4) :
  3.4 mm (0.134 in.) 4.1 mm (0.161 in.)
  3.6 mm (0.142 in.) 4.2 mm (0.165 in.)
  3.8 mm (0.150 in.) 4.4 mm (0.173 in.)
  4.0 mm (0.157 in.) 4.6 mm (0.181 in.)




(1) 16T Bevel Gear (3) Shim
(2) 11T Bevel Gear




## Backlash between 11T Bevel Gear and 16T Bevel Gear

1. Stick a strip of fuse to three spots on the 16T bevel gear (1) with grease.
2. Fix the front axle case, bevel gear case and front gear case.
3. Turn the axle.
4. Remove the bevel gear case from front axle case and measure the thickness of the fuses with an outside micrometer.
5. If the backlash is not within the factory specifications, adjust with shim (3).

| | | |
|---|---|---|
| Backlash between 11T bevel gear and 16T bevel gear | Factory spec. | 0.10 to 0.30 mm<br>0.0039 to 0.0118 in. |

**(Reference)**

- Thickness of adjusting shims (3) :
  0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
  1.0 mm (0.039 in.) 1.4 mm (0.055 in.)
- Tooth contact : More than 35 %

## Outside Diameter of Front Axle Case Bosses and Inside Diameter of Front Axle Bracket

1. Measure the front axle case bosses O.D. with an outside micrometer.
2. Measure the front axle bracket I.D. with a cylinder gauge.

**(Reference)**

| | | |
|---|---|---|
| Front axle case boss (front) O.D. | Factory spec. | 49.920 to 49.945 mm<br>1.96535 to 1.96634 in. |
| Front axle bracket (front) I.D. | Factory spec. | 50.150 to 50.200 mm<br>1.97441 to 1.97638 in. |
| Front axle case boss (rear) O.D. | Factory spec. | 64.910 to 64.940 mm<br>2.55551 to 2.55669 in. |
| Front axle bracket (rear) I.D. | Factory spec. | 65.150 to 65.200 mm<br>2.56496 to 2.56693 in. |

**(When reassembling)**

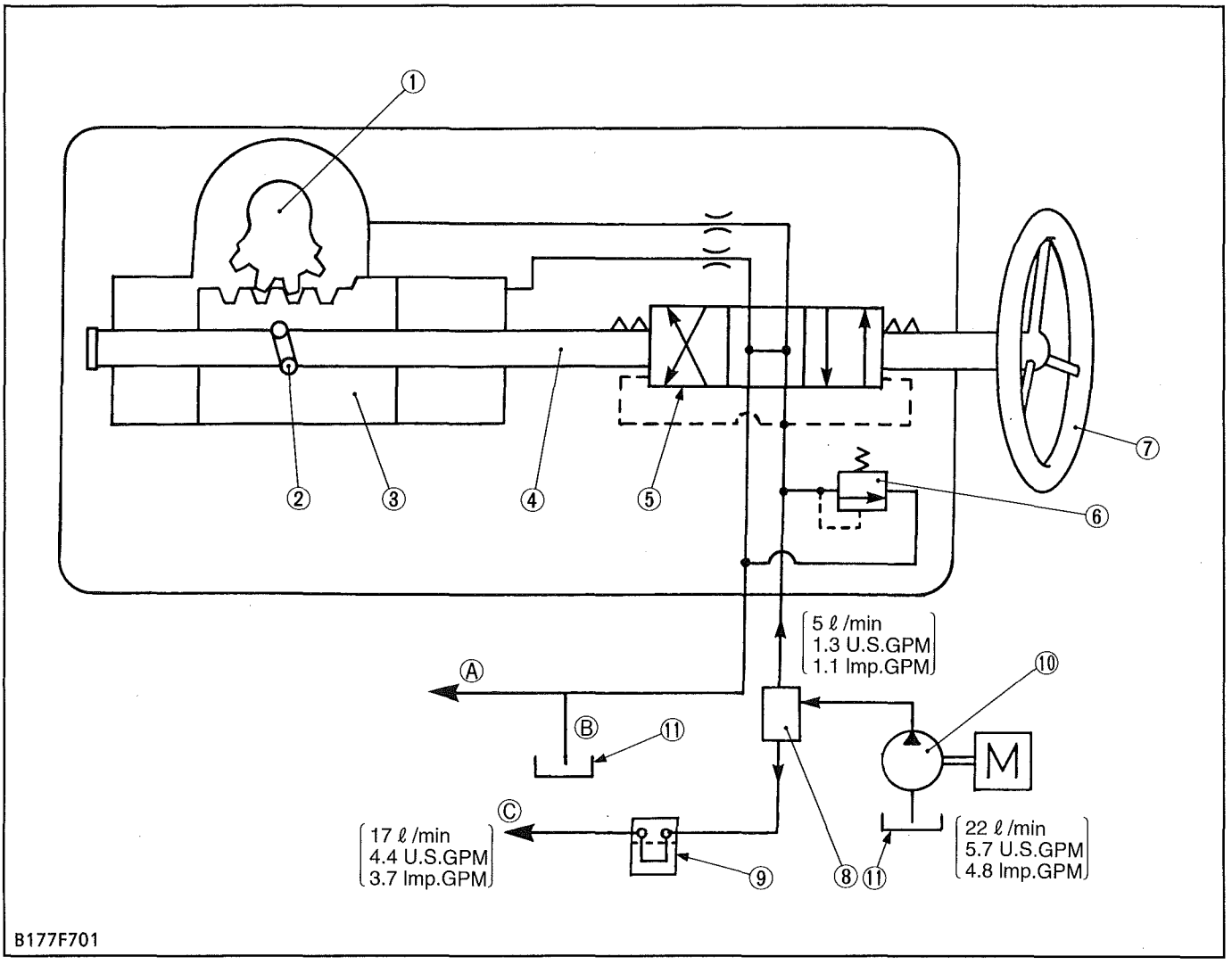
- Apply grease to the O-ring (1) and take care not to damage it.
- After mounting the front axle assy to the front axle frame, be sure to adjust the front axle rocking force (See page 6-S4).

(1) O-ring

# MECHANISM

## CONTENTS

# [1] HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM




(A) To Oil Cooler (HST Type Only) (B) To Transmission (Manual Transmission Type Only) (C) To Control Valve

(1) Sector Gear Shaft
(2) Balls
(3) Ball Nut
(4) Worm Shaft
(5) Sliding Valve
(6) Relief Valve
(7) Steering Wheel
(8) Flow Priority Valve
(9) Hydraulic Block Type Outlet
(10) Pump
(11) Transmission Case

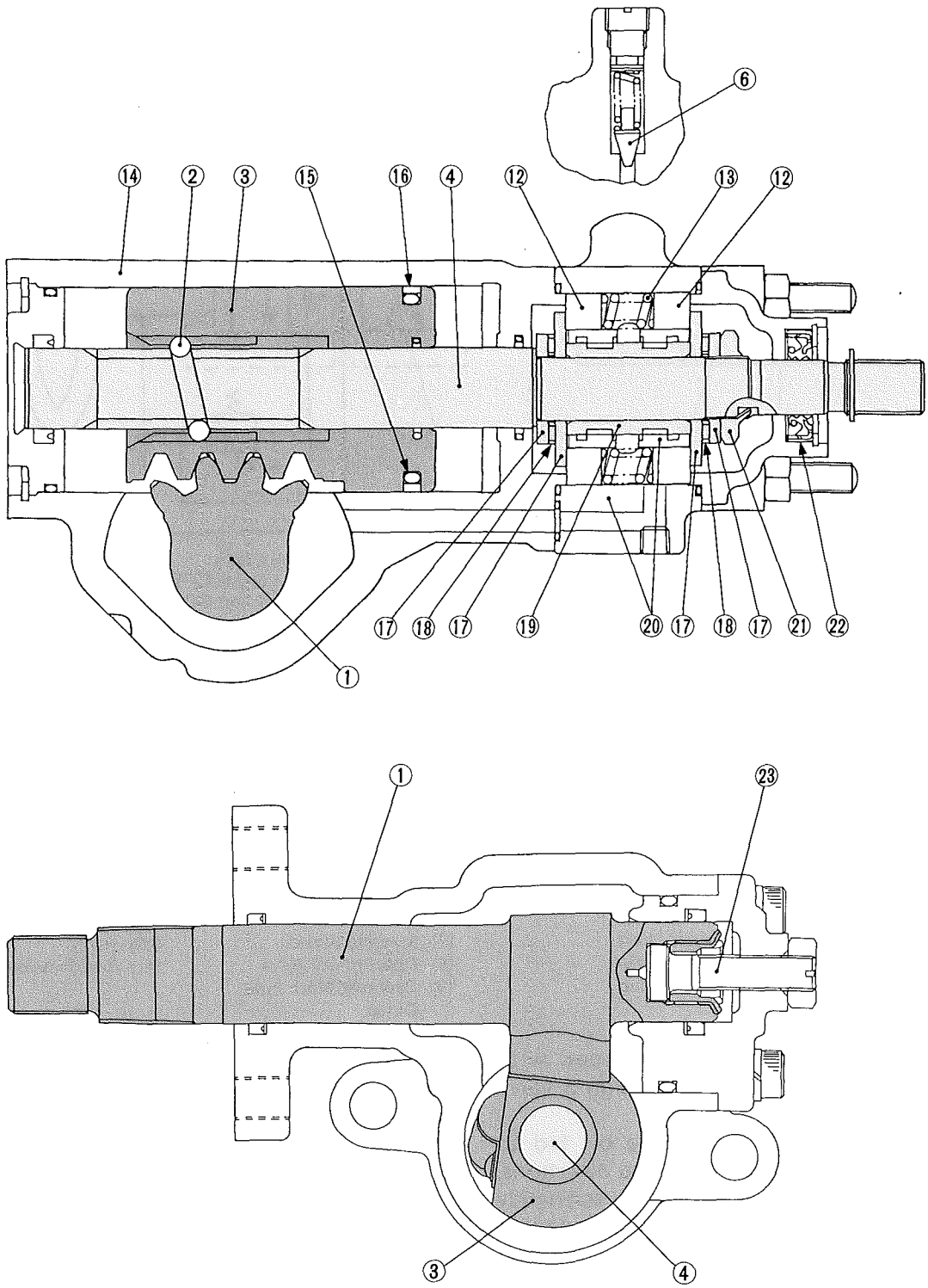
All models are available to be equipped with integral type power steering that of sliding valve with centering spring type.

Flow priority valve (8) divides the oil fed to hydraulic block type outlet (9) into two directions. One is the control flow to power steering ( constantly **5 ℓ/min., 1.3 U.S.GPM, 1.1 Imp.GPM** at any engine speed). And the other is excessive flow to control valve.

The mechanical gear section shown in the next page operates in the same way as ordinary manual steering systems. However, with power steering, the worm shaft (4) is supported only by the centering springs (13).

When the worm thrust force (turning force of the ball screw section) exceeds centering spring setting load, the worm shaft (4) axially shifts by a specified displacement (Stroke: about 0.4 mm (0.016 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 (4). The valve spool (19), fixed on the worm shaft (4) by the nut (21), changes the condition of the three-position, four-way open center (all ports open) valve (5) by sliding in the valve housing (20), to generate pressure as required.

## [2] POWER STEERING BODY

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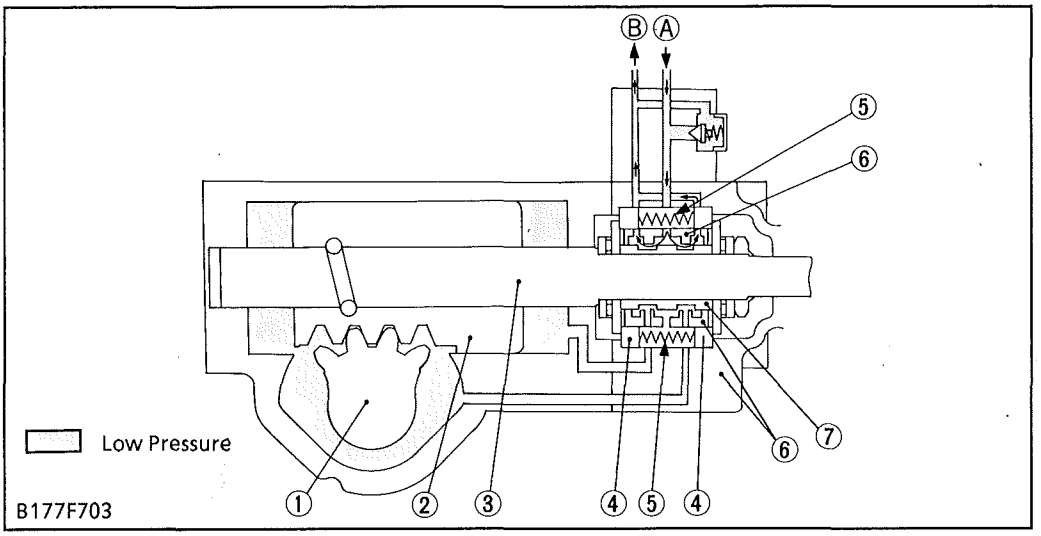
(1) Sector Gear Shaft
(2) Balls
(3) Ball Nut
(4) Worm Shaft
(6) Relief Valve
(12) Reaction Pistons
(13) Centering Springs
(14) Gear Case
(15) O-Ring
(16) Teflon Ring
(17) Thrust Races
(18) Thrust Needle Bearings
(19) Spool
(20) Valve Housing
(21) Nut
(22) Oil Seal
(23) Adjusting Screw for Play

# [3] OIL FLOW

## ■ Neutral Position



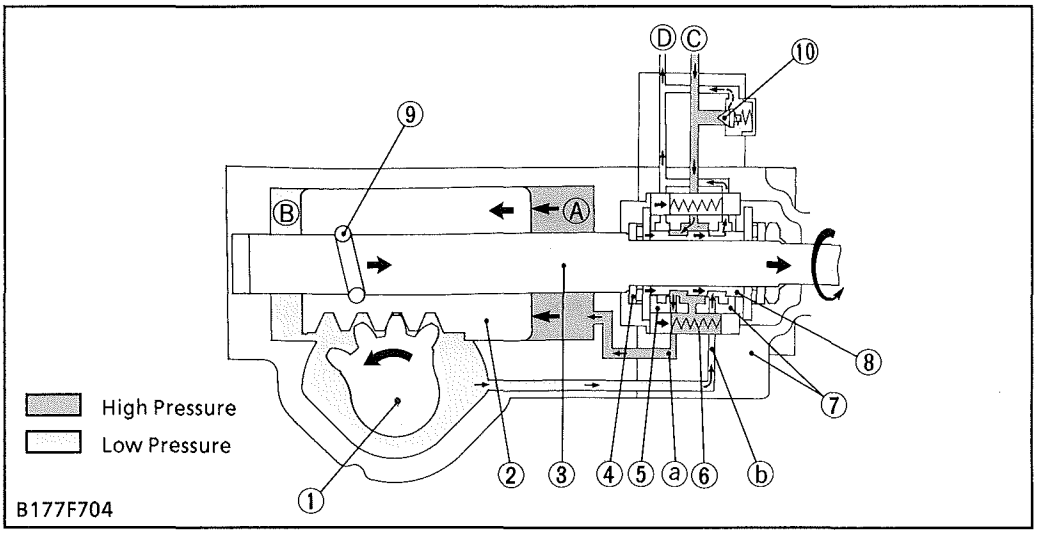

(A) From Pump (Through Flow Priority Valve)
(B) To HST Unit (HST Type) or Transmission Case (Manual Transmission Type)

(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).

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

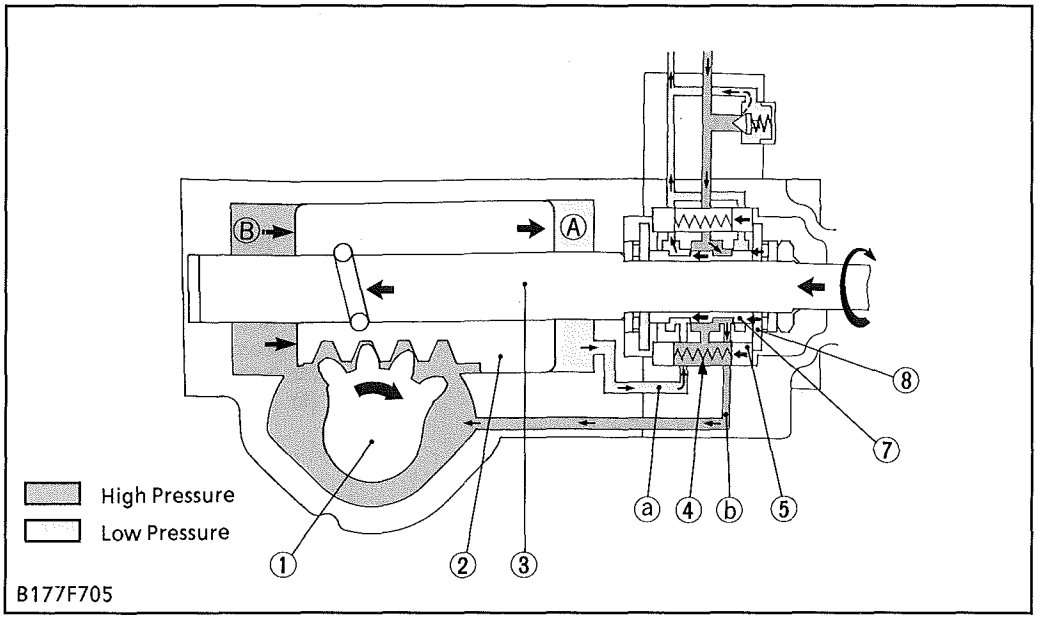



(1) Sector Gear Shaft
(2) Ball Nut
(3) Worm Shaft
(4) Thrust Race
(5) Reaction Piston
(6) Centering Spring
(7) Valve Housing
(8) Spool
(9) Ball
(10) Relief Valve

(A) Chamber "A"
(B) Chamber "B"
(C) From Pump
(D) To HST Unit or Transmission Case
(a) Port "a"
(b) Port "b"

1. When the steering wheel is turned counterclockwise, the worm shaft (3) 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" 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.

## ■ 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 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.

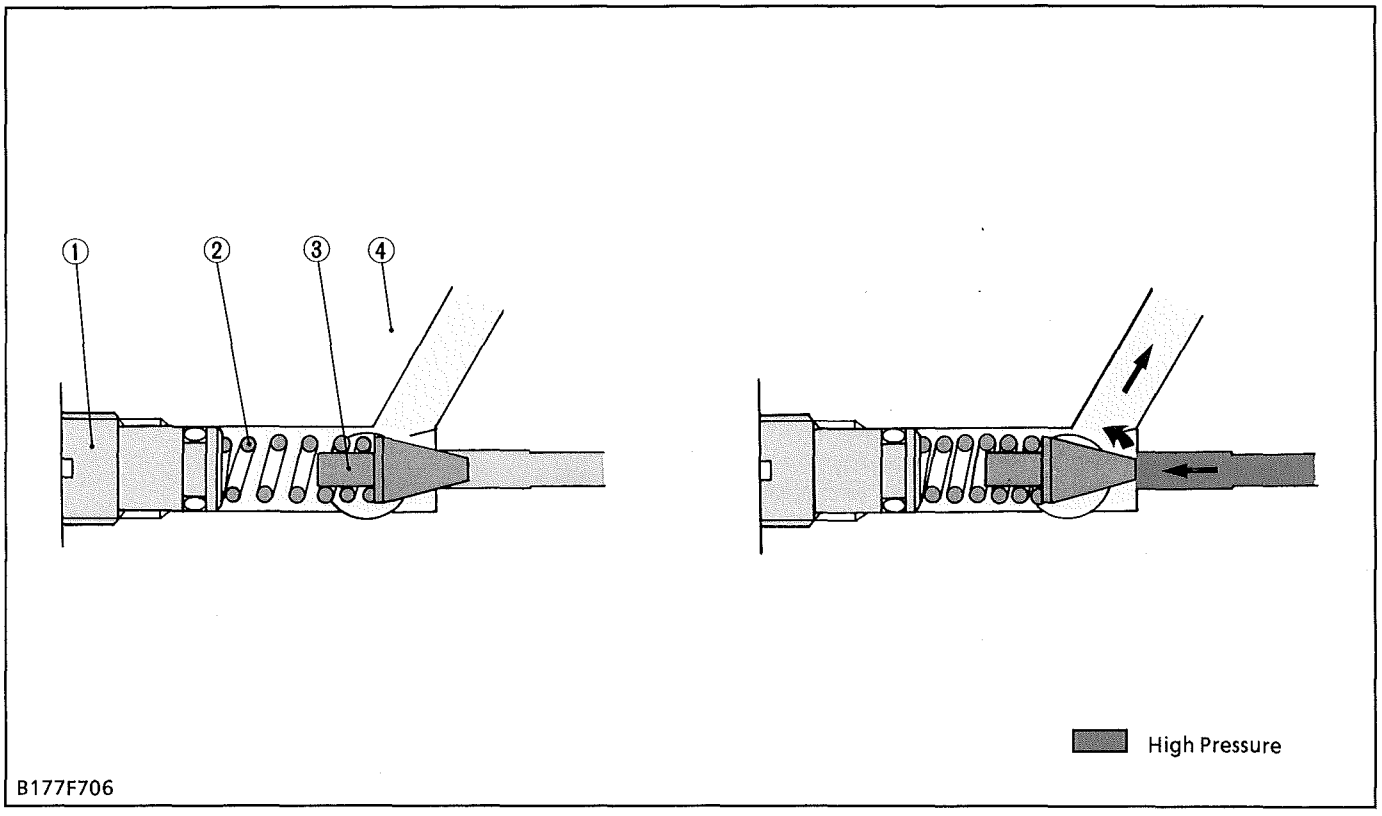
## ■ Manual Operation

**(When Engine Stops or Hydraulic Circuit Troubles)**

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

If the steering wheel is turned when hydraulic circuit ceases to operate, the worm shaft (3) moves slightly by the stroke of spool (7), then the worm shaft (3) and ball nut (2) have the same relationship with the manual steering gear. However, the steering wheel play increases by the stroke of spool (7).

## ■ Operation of Relief Valve




(1) Adjusting Screw (2) Spring (3) Poppet (4) 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 (2) is compressed to generate a gap between the poppet (3) and the valve housing (4). 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).

# SERVICING

## CONTENTS

# 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 | — |

# SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Steering Wheel | Play | 5.0 to 30.0 mm<br>0.2 to 1.2 in. | – |
| | Operation Force<br>Condition:<br>• Engine Speed<br>Approx. 2600 rpm | Less than 49 N<br>5.0 kgf.<br>11 lbs. | – |
| Relief Valve | Setting Pressure<br>Condition:<br>• Engine Speed:<br>Approx. 2600 rpm<br>• Oil Temperature:<br>45 to 55°C<br>113 to 131°F | 11.28 to 11.77 MPa<br>115 to 120 kgf/cm$^2$<br>1636 to 1707 psi | – |
| Steering Gear Box to Ball Nut | Clearance | 0.035 to 0.079 mm<br>0.00138 to 0.00311 in. | 0.15 mm<br>0.0059 in. |
| Gear Box Bore | I.D. | 56.005 to 56.030 mm<br>2.20492 too 2.20591 in. | – |
| Ball Nut | O.D. | 55.951 to 55.970 mm<br>2.20280 to 2.20354 in. | – |
| Bull Nut Assembly | Axial Play | 0 to 0.12 mm<br>0 to 0.0047 in. | 0.100 mm<br>0.00394 in. |
| Valve Housing to Spool | Clearance | 0.005 to 0.015 mm<br>0.00020 to 0.00059 in. | 0.025 mm<br>0.00098 in. |
| Spool | O.D. | 24.995 to 25.000 mm<br>0.98406 to 0.98425 in. | – |
| Valve housing | I.D. | 25.005 to 25.010 mm<br>0.98445 to 0.98465 in. | – |
| Valve housing to Piston | Clearance | 0.005 to 0.030 mm<br>0.00020 to 0.00118 in. | 0.06 mm<br>0.0024 in. |
| Piston | O.D. | 9.990 to 10.005 mm<br>0.39331 to 0.39390 in. | – |
| Valve housing | I.D. | 10.010 to 10.020 mm<br>0.39409 to 0.39449 in. | – |
| Sector Gear Shaft to Side Cover | Clearance | 0.005 to 0.034 mm<br>0.00020 to 0.00206 in. | 0.1 mm<br>0.0039 in. |
| Sector Gear Shaft | O.D. | 27.987 to 28.000 mm<br>1.10185 to 1.10236 in. | |
| Side Cover Side | I.D. | 28.005 to 28.021 mm<br>1.10256 to 1.10319 in. | |

**(Continued)**

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Sector Gear Shaft to Steering Gear Box | Clearance | 0.040 to 0.074 mm<br>0.00158 to 0.00291 in. | 0.20 mm<br>0.0078 in. |
| Sector Gear Shaft | O.D. | 27.987 to 28.000 mm<br>1.10185 to 1.10236 in. | – |
| Steering Gear Box | I.D. | 28.040 to 28.061 mm<br>1.10394 to 1.10476 in. | – |
| Sector Gear Shaft to Ball Nut | Backlash Deflection measured at piston arm end | Less than 0.30 mm<br>0.0118 in. | – |
| Worm Shaft | Turning Torque | Less than 0.78 N·m<br>0.08 kgf·m<br>0.58 ft-lbs. | – |

# TIGHTENING TORQUES

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

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Drag link end slotted nut | 17.7 to 34.3 | 1.8 to 3.5 | 13.0 to 25.3 |
| Tie rod lock nut | 29.4 to 34.3 | 3.0 to 3.5 | 21.7 to 25.3 |
| Pitman arm mounting nut | 147.1 to 176.5 | 15.0 to 18.0 | 108.5 to 130.2 |
| Power steering assembly mounting screw | 77.5 to 90.2 | 7.9 to 9.2 | 57.1 to 66.5 |
| Power steering delivery and return pipe end flare nut | 29.4 to 39.2 | 3.0 to 4.0 | 21.7 to 28.9 |
| Steering wheel mounting nut | 29.4 to 49.0 | 3.0 to 5.0 | 21.7 to 36.2 |
| Top cover mounting nut | 24.5 to 28.5 | 2.5 to 2.9 | 18.1 to 21.0 |
| Side cover mounting screw | 23.5 to 27.5 | 2.4 to 2.8 | 17.4 to 20.3 |

# CHECKING, DISASSEMBLING AND SERVICING

## CHECKING

**■ IMPORTANT**
- **Use only the transmission fluid (See page S.G-3), in no case use mixture of oils of different brands.**
- **Do not disassemble the hydraulic pump and power steering needlessly.**
- **After installing or reassembling the power steering hydraulic components, be sure to bleed air.**

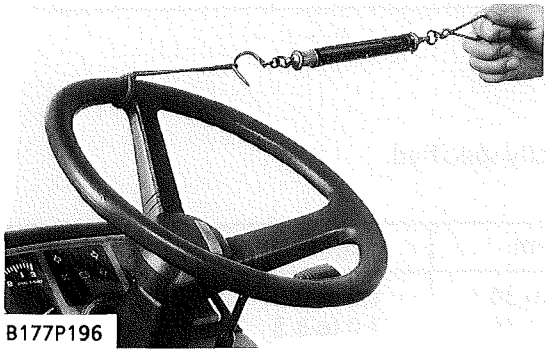
**(Bleeding)**
- Start the engine, then turn the steering wheel slowly in both directions all the way alternately several times, and stop the engine.

### Steering Wheel Play

1. Refer to the backlash between sector gear shaft and ball nut on page 7-S13.

| | | |
|---|---|---|
| Power steering wheel play | Reference value | 5.0 to 30.0 mm<br>0.2 to 1.2 in. |

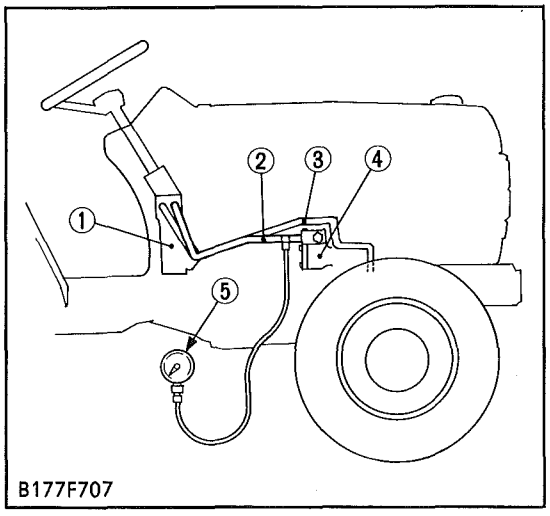
### Steering Wheel Operating Force


B177P196

**Condition**
- Engine speed ..... Approx. 2600 rpm
- Oil temperature.... 45 to 55 °C
  113 to 131 °F
- Tractor by itself
  (without any implement and weight)

1. Park the tractor on flat concrete place.
2. Start the engine. After warming up, set the engine speed at **approx. 2600 rpm.**
3. Set a spring balance to the steering wheel to measure the operating force.
4. If the measurement exceeds the factory specification, check the suction line, delivery line, and the performance of hydraulic pump.
   And then, check the power steering assembly.

| | | | |
|---|---|---|---|
| Steering wheel operating force | Factory spec. | Less than | 49 N<br>5.0 kgf<br>11 lbs |



B177F707

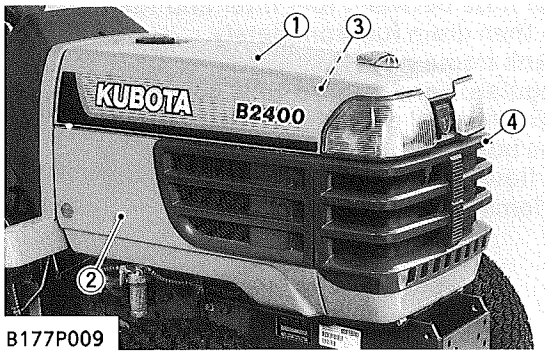
(1) Power Steering Valve
(2) Delivery Pipe
(3) Return Pipe
(4) Hydraulic Pump
(5) Pressure Gauge

### Relief Valve Setting Pressure

1. Remove the panel board, bonnet rear cover and right side cover to remove the power steering delivery pipe (2).
2. Remove the power steering delivery pipe (2).
3. Install the pressure gauge (5) to another power steering delivery pipe (2), and connect it to the original position.
4. Start the engine. After warming up, set the engine speed at approx. 2600 rpm.
5. Fully turn the steering wheel to the left or right end to read the relief pressure. After reading, stop the engine.
6. If the pressure is not factory specification, check the pump delivery line and adjust the relief valve setting pressure (Refer to 7-S8).

| | | |
|---|---|---|
| Power steering relief valve setting pressure | Factory spec. | 11.28 to 11.77 MPa<br>115 to 120 kgf/cm²<br>1636 to 1707 psi |

# [1] SEPARATING POWER STEERING BODY

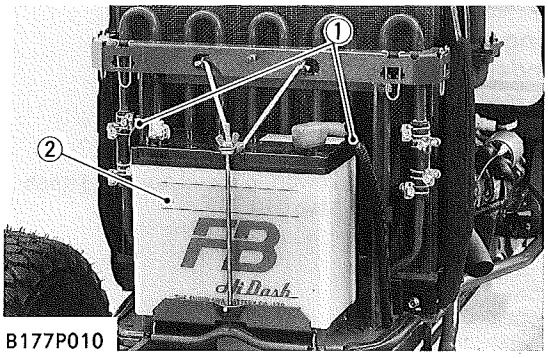


B177P009

## Hood and Side Cover

1. Open the hood (1) from the front and remove the spring lock pin and remove hood 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) Side Cover RH
(3) Side Cover LH
(4) Front Grille



B177P010

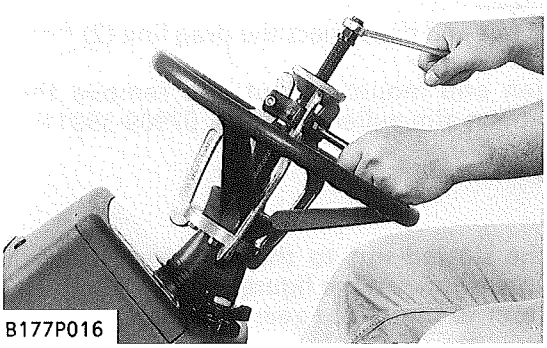
## Battery

1. Disconnect the battery cords (1) and dismount the battery (2).

**■ NOTE**

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

(1) Battery Cord
(2) Battery

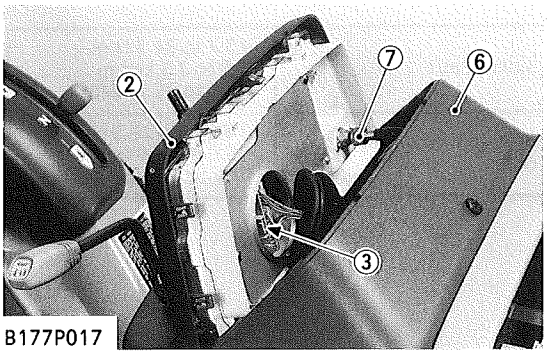

B177P016

## Steering Wheel

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

**(When reassembling)**

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

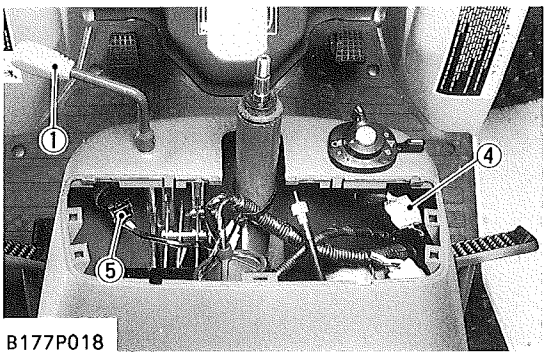


B177P017

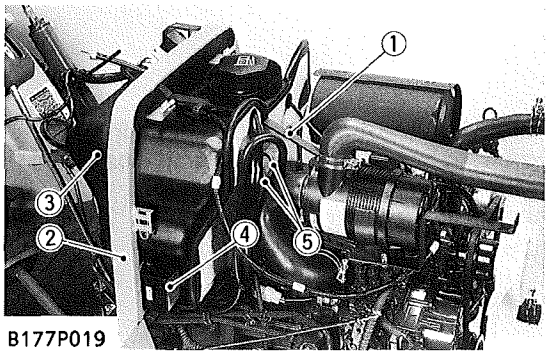
## Meter Panel and Panel Under Cover

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

(1) Hand Accelerator Lever
(2) Meter Panel
(3) Meter Panal Connector
(4) Combination Switch Connector
(5) Main Swithch Connector
(6) Panel Under Cover
(7) Hour-meter Cable



B177P018

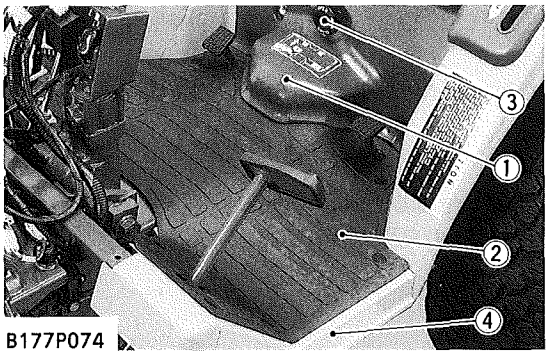


B177P019

## Fuel Tank

1. Disconnect the fuel hose between fuel filter and fuel tank at the fuel filter side, then drain fuel completely.
2. Remove the fuel tank frame stay (1).
3. Disconnect the regulator and hazard unit connectors, and remove the lead wire for fuel gauge.
4. Disconnect the fuse box (4).
5. Dismount the overflow hoses (5) of fuel line.
6. Remove the tank flame (2) with fuel tank (3).

(1) Fuel Tank Frame Stay
(2) Fuel Tank Frame
(3) Fuel Tank
(4) Fuse Box
(5) Overflow Hose

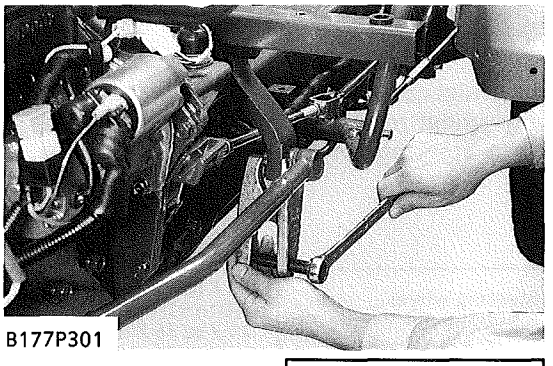


B177P074

## Step

1. Remove the lowering speed adjusting knob (3).
2. Remove the seat under cover (1).
3. Remove the rubber mat (2).
4. Remove the clutch spring and left hand step (4).

(1) Seat Under Cover
(2) Rubber Mat
(3) Lowering Speed Adjusting Knob
(4) Step (LH)


B177P301

## Drag Link and Pitman Arm

1. Remove the slotted nut and disconnect the drag link (2) from the pitman arm (1).
2. Remove the pitman arm mounting nut and remove the pitman arm with pitman arm puller (Code No. 07909-39011).

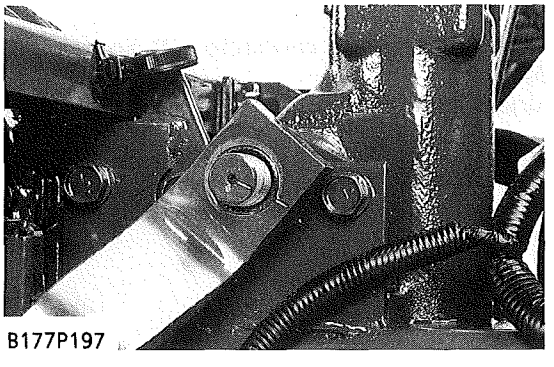
**(When reassembling)**

**■ IMPORTANT**

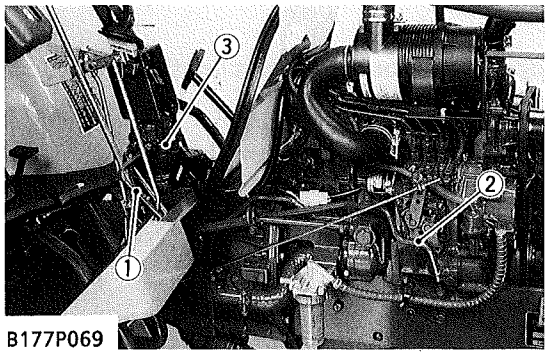
- **After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.**
- **Install the pitman arm to the sector gear shaft so that their marks align.**


030F129

| | | |
|---|---|---|
| Tightening torque | Slotted nut | 17.7 to 34.3 N·m<br>1.8 to 3.5 kgf·m<br>13.0 to 25.3 ft-lbs |
| | Pitman arm mounting nut | 147.1 to 176.5 N·m<br>15.0 to 18.0 kgf·m<br>108.5 to 130.2 ft-lbs |


B177P197

(1) Pitman Arm
(2) Drag Link




B177P069

(1) Power Steering Delivery Pipe
(2) Power Steering Return Pipe
(3) Power Steering Assembly

### Power Steering Assembly

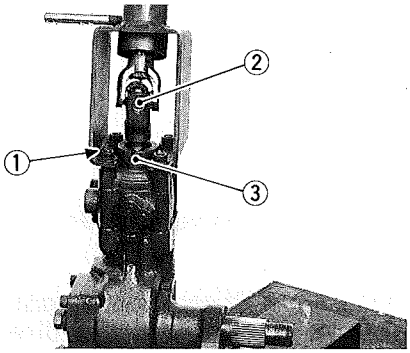
1. Remove the power steering delivery pipe (1) and return pipe (2).
2. Disconnect the speed set rod (HST type) and parking brake rod.
3. Remove the power steering assembly (3) from the center frame.

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Flare nut (PS delivery, return pipe) | 29.4 to 39.2 N·m<br>3.0 to 4.0 kgf·m<br>21.7 to 28.9 ft-lbs |
| | Power steering assembly mounting screw | 77.5 to 90.1 N·m<br>7.9 to 9.2 kgf·m<br>57.2 to 66.5 ft-lbs |

## [2] POWER STEERING BODY

## DISASSEMBLING AND ASSEMBLING

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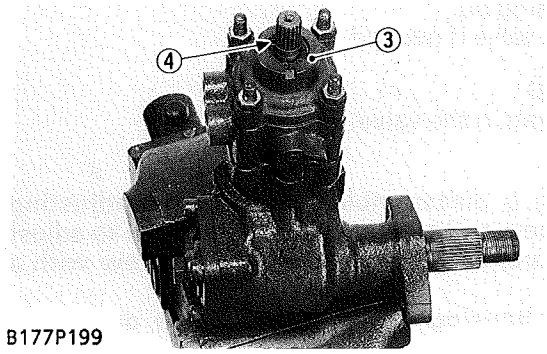



B177P199

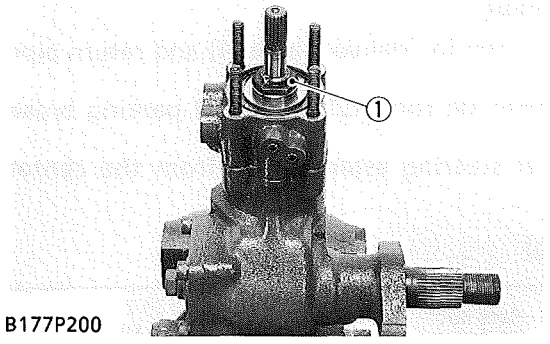
### Steering Column and Top Cover

1. Secure the steering assembly in a vise.
2. Turn the steering shaft several times to drain oil.
3. Loosen the steering column mounting nut (1), and remove the steering column with steering shaft and universal joint (2).
4. Remove the external snap ring (4) and nut which secure the top cover (3), and remove the top cover (3).

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Steering column mounting nut | 23.5 to 27.5 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.3 ft-lbs |
| | Top cover mounting nut | 23.5 to 27.5 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.3 ft-lbs |

(1) Steering Column Mounting Nut
(2) Universal Joint
(3) Top Cover
(4) External Snap Ring



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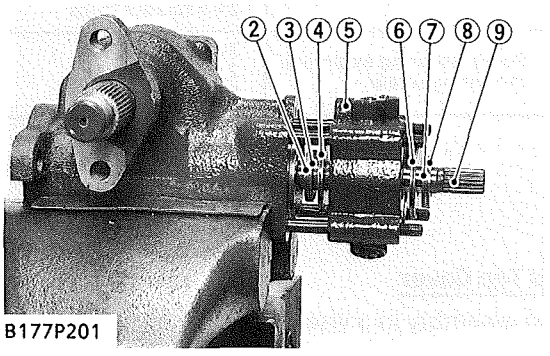


B177P201

## Valve Assembly

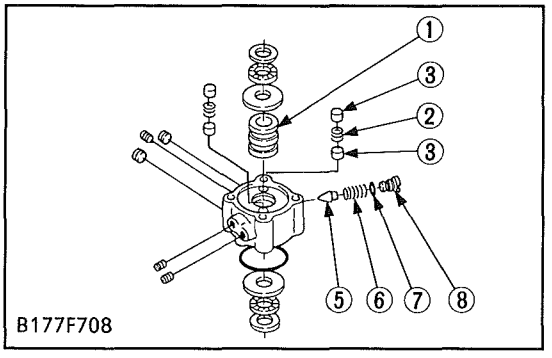
1. Install the four top cover mounting nuts to the stud bolt temporaly by hand.
2. Remove the stake of nut (1), then remove it.
3. Remove the valve assembly. Set the worm shaft horizontally to remove each part easily.

**(When reassembling)**

**■ IMPORTANT**

- **Lightly tighten the nut (1) by hand, and while holding the worm shaft (9), tighten with a wrench. After tightening, loosen the nut approx. 0.17 rad. (10°), and stake the nut (1) with a pin punch.**

(1) Nut
(2) Thrust Race
(3) Thrust Needle Bearing
(4) Thrust Race
(5) Valve Housing
(6) Thrust Race
(7) Thrust Needle Bearing
(8) Thrust Race
(9) Worm Shaft



B177F708

(1) Spool
(2) Centering Spring
(3) Reaction Pistons
(4) Valve Housing
(5) Relief Valve Poppet
(6) Relief Spring
(7) O-ring
(8) Adjusting Screw

## Disassembling Valve Housing

**■ IMPORTANT**

- **Do not disassemble the relief valve needlessly, since it has been factory-adjusted.**

1. Remove the centering springs (2) and reaction pistons (3).
2. Remove the spool (1) and remember the direction of it against valve housing (4).
3. Remove the relief valve if needed.

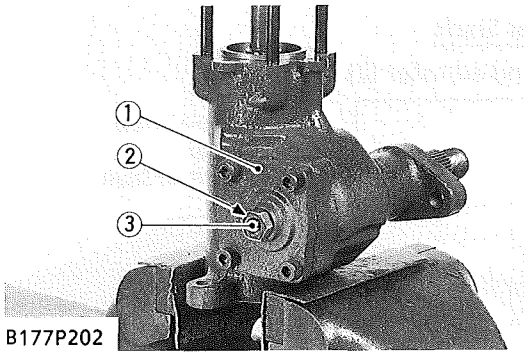
**(When reassembling)**

- Apply grease to seals in the valve.

**■ IMPORTANT**

- **If the relief valve is disassembled, replace the adjusting screw with new one, and after reassembly, be sure to adjust the setting pressure, then stake the adjusting screw with a punch.**
- **When the valve housing (4) or spool (1) are damaged, replace them as a unit.**

| | | |
|---|---|---|
| Power steering relief valve setting pressure | Factory spec. | 11.28 to 11.77 MPa<br>115 to 120 kgf/cm$^2$<br>1636 to 1707 psi |



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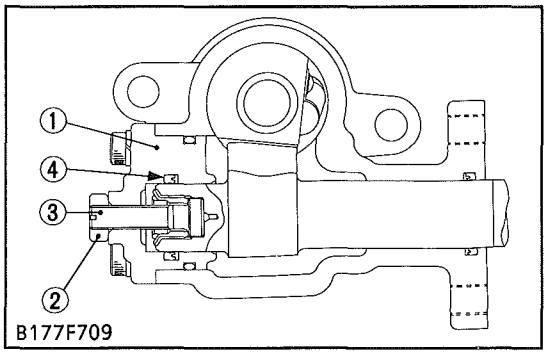

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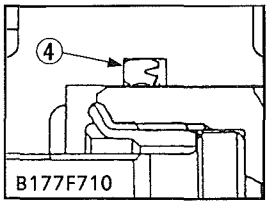


B177F710

(1) Side Cover
(2) Lock Nut
(3) Adjusting Screw
(4) U-Seal

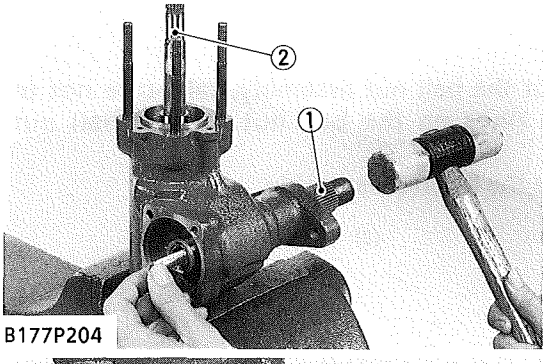
## Side Cover

1. Remove the lock nut (2) on the adjusting screw.
2. Remove the side cover mounting screws.
3. Turn the adjusting screw (3) clockwise to remove the side cover (1).

**(When reassembling)**

- Apply grease to the O-ring.
- Apply grease to the ring groove, before mounting the U-seal on it.
- Direct the lip of U-seal inward, as shown in the figure.
- Replace the lock nut with a new one, and after adjusting the backlash between sector gear and ball nut, be sure to stake the adjusting screw and lock nut with a punch.

| | | |
|---|---|---|
| Tightening torque | Lock nut | 48.1 to 55.9 N·m<br>4.9 to 5.7 kgf·m<br>35.4 to 41.2 ft-lbs |
| | Side cover mounting screw | 37.3 to 56.9 N·m<br>3.8 to 5.8 kgf·m<br>27.5 to 42.0 ft-lbs |



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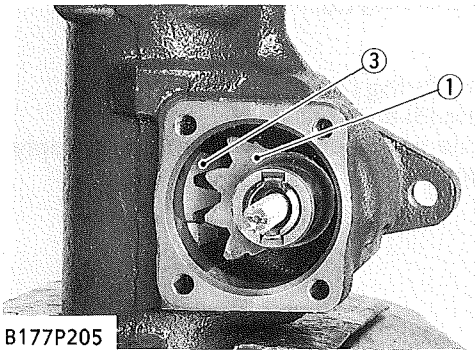


B177P205

## Sector Gear Shaft

1. Tap out the sector gear shaft (1) toward the side cover while holding another end to avoid dropping.

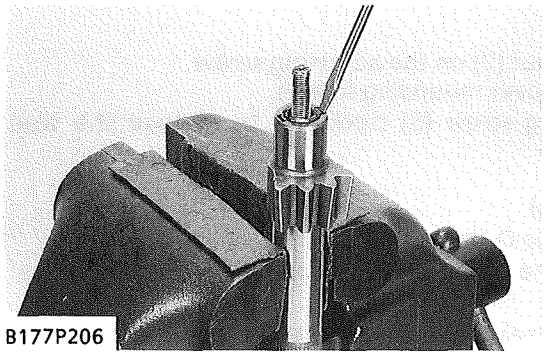
**(When reassembling)**

- Turn the worm shaft (2) so that the ball nut (3) is centered in its travel.
  Then, install the sector gear shaft (1) so that the center of its teeth engages the center of the teeth of the ball nut (3).

**■ NOTE**

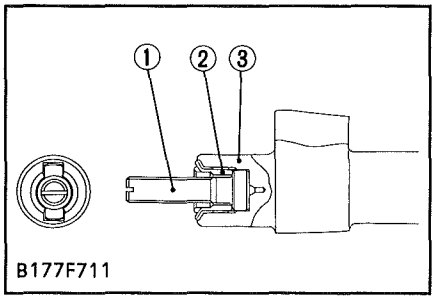
- **When setting the sector gear shaft (1), take care not to damage the oil seal and U-seal in the gear box.**

(1) Sector Gear Shaft
(2) Worm Shaft
(3) Ball Nut


B177P206

## Adjuster of Sector Gear Shaft

1. Remove the stake and adjuster (2).



B177F711

(1) Adjusting Screw
(2) Adjuster
(3) Sector Gear Shaft

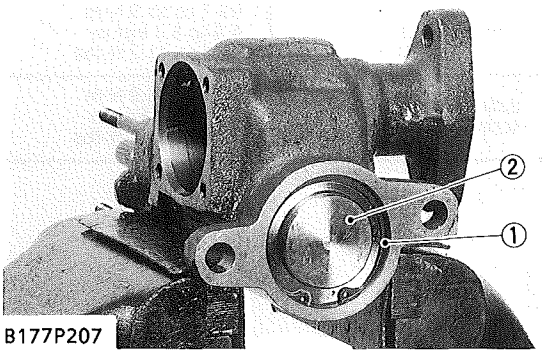
**(When reassembling)**
- Apply grease to the head of adjuster.

## Snap Ring

1. Remove the snap ring (1) which retains the end cover (2).

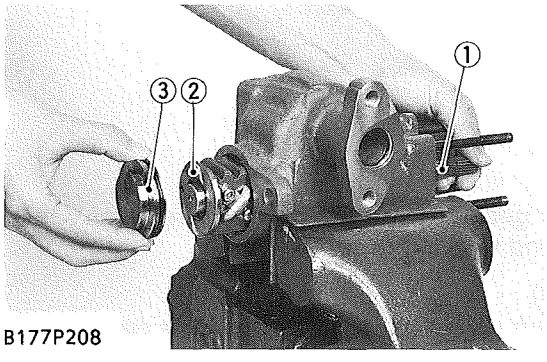
**(When reassembling)**

**■ NOTE**
- **Direct the blunt edge side of the snap ring (1) to the end cover (2).**



B177P207

(1) Snap Ring (2) End Cover



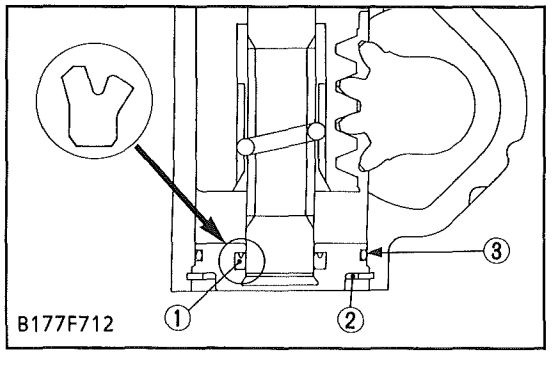
B177P208

## End Cover and Ball Nut Assembly

1. Tap out the worm shaft (1) toward the end cover (3) to remove it.
2. Remove the ball nut (2) and worm shaft (1) (ball nut assembly) as a unit.

**■ NOTE**
- **When drawing out the ball nut assembly, take care not to damage the seal rings on the ball nut (2) and ball nut surface.**
- **Never disassemble the ball nut assembly.**

(1) Worm Shaft (3) End Cover
(2) Ball Nut



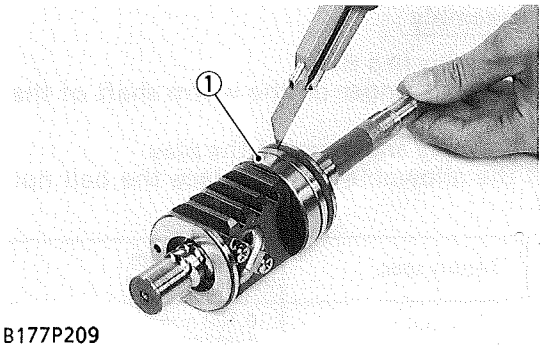
B177F712

## Seal Rings on End Cover

1. Remove the U-seal (1) and O-ring (3).

**(When reassembling)**
- Replace the U-seal (1) and O-ring (3) with new ones.
- Apply grease to the O-ring (3) and U-seal (1).
- Before setting them inside of the end cover and on it, apply grease to the ring grooves.

(1) U-seal (3) O-ring
(2) Snap Ring



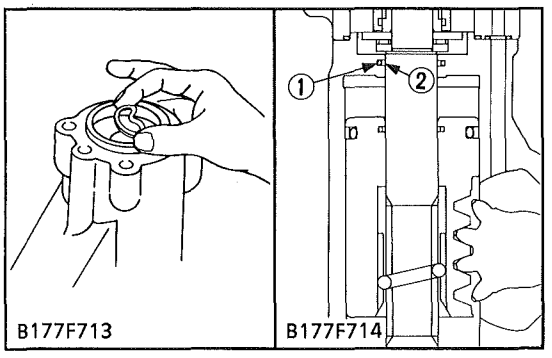
B177P209

### Seal Ring on Ball Nut

1. Cut the seal ring with a knife and remove it.
2. Remove the O-ring inside the teflon ring.

**(When reassembling)**
- Apply grease to the ring groove.
- Replace the seal rings with new ones.
- Stretch the teflon ring by hand, install it on the ball nut, and press it so that it is restored to its original form.

(1) Ball Nut



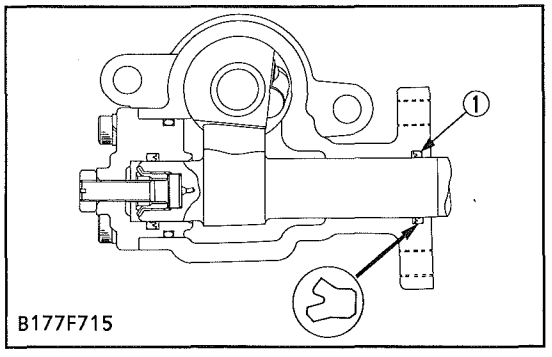
B177F713 B177F714

### Seal Rings on Gear Box

1. Remove the seal ring (1).
2. Remove the seal ring (2).

**(When reassembling)**
- Apply grease to the ring groove.
- Replace the seal rings (1) (2) with new ones.
- Change the shape of the seal ring (1) to the heart figure by fingers, install it on the gear box and press it so that it is restored to its original form.

(1) Seal Ring (2) Seal Ring



B177F715

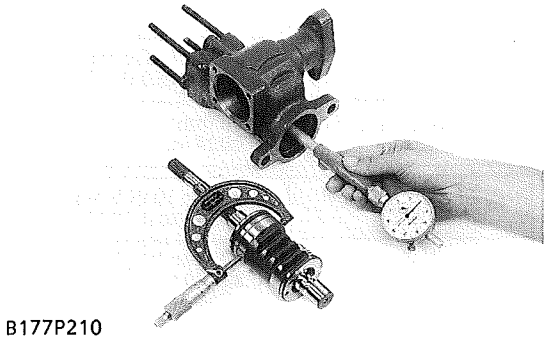
### U-Seal on Gear Box

1. Remove the U-seal (1) with a sharp tool.

**(When reassembling)**
- Replace the U-seal (1) with new ones.
- Direct the lip of the U-seal (1) inward.
- After applying grease to the ring groove and to seals, set them.

(1) U-Seal

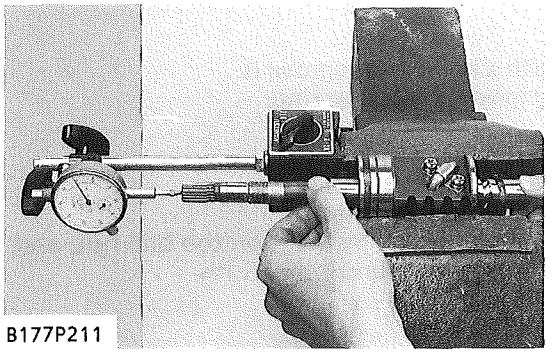
## SERVICING


B177P210

### Clearance between Steering Gear Box and Ball Nut

1. Measure the steering gear box cylinder I.D. with a cylinder gauge.
2. Measure the ball nut O.D. with an outside micrometer, and calculate this clearance.
3. If the clearance exceeds the allowable limit, replace the steering gear box or ball nut assembly.

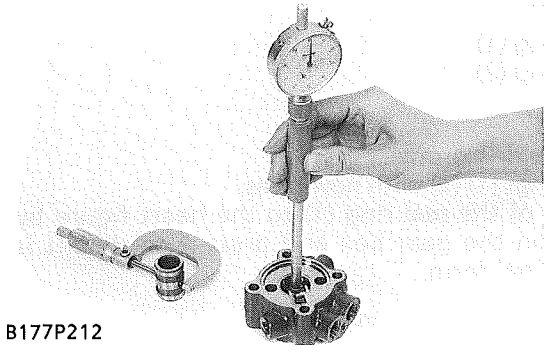
| | | |
|---|---|---|
| Clearance between steering gear box and ball nut | Factory spec. | 0.035 to 0.079 mm<br>0.001 to 0.00311 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |
| Gear box bore I.D. | Factory spec. | 56.005 to 56.030 mm<br>2.2049 to 2.20591 in. |
| Ball nut O.D. | Factory spec. | 55.951 to 55.970 mm<br>2.20280 to 2.20354 in. |


B177P211

## Axial Play of Ball Nut Assembly

1. Secure the ball nut assembly in a vise.
2. Set a dial indicator with its finger on the worm shaft of the ball nut assembly.
3. Move the worm shaft axially and measure the play.
4. If the play exceeds the allowable limit, replace the ball nut assembly.

| | | |
|---|---|---|
| Axial play of ball nut assembly | Factory spec. | 0 to 0.12 mm<br>0 to 0.0047 in. |
| | Allowable limit | 0.100 mm<br>0.00394 in. |


B177P212

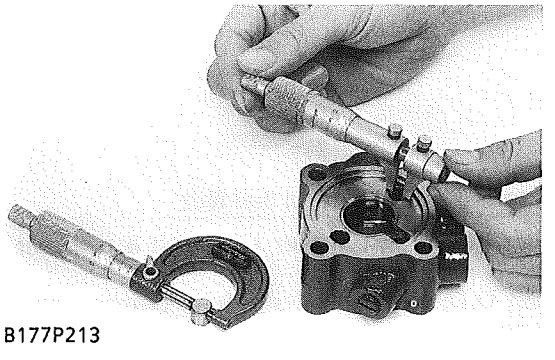
## Clearance between Valve Housing and Spool

1. Measure the valve housing I.D. with a cylinder gauge and the spool O.D. with an outside micrometer, and calculate this clearance.
2. If the clearance exceeds the allowable limit, replace the spool and valve housing as a unit.

**■ IMPORTANT**

- **Check to see if the spool slides smoothly in the valve housing.**

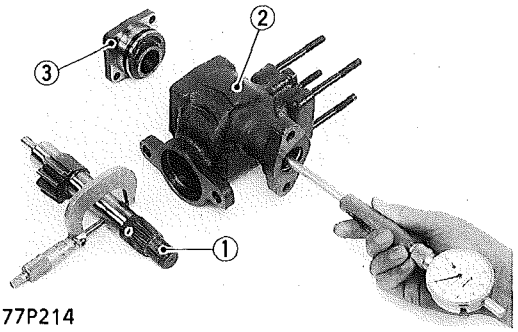
| | | |
|---|---|---|
| Clearance between valve housing and spool | Factory spec. | 0.005 to 0.015 mm<br>0.00020 to 0.00059 in. |
| | Allowable limit | 0.025 mm<br>0.00098 in. |
| Spool O.D. | Factory spec. | 24.995 to 25.000 mm<br>0.98406 to 0.98425 in. |
| Valve housing I.D. | Factory spec. | 25.005 to 25.010 mm<br>0.98445 to 0.98465 in. |


B177P213

## Clearance between Valve Housing and Piston

1. Measure the piston O.D. with an outside micrometer and valve housing I.D. with an inside micrometer, and calculate this clearance.
2. If the clearance exceeds the allowable limit, replace the defective parts.

| | | |
|---|---|---|
| Clearance between valve housing and piston | Factory spec. | 0.005 to 0.030 mm<br>0.00020 to 0.00118 in. |
| | Allowable limit | 0.06 mm<br>0.0024 in. |
| Piston O.D. | Factory spec. | 9.990 to 10.005 mm<br>0.39331 to 0.39390 in. |
| Valve housing I.D. | Factory spec. | 10.010 to 10.020 mm<br>0.39409 to 0.39449 in. |




B177P214

(1) Section Gear Shaft
(2) Steering Gear Box
(3) Side Cover

## Clearance between Sector Gear Shaft and Side Cover

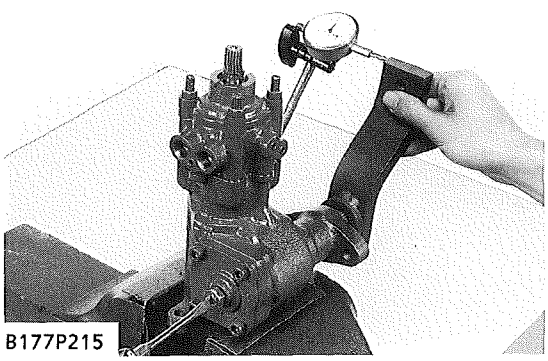
1. Measure the sector gear shaft O.D. with an outside micrometer and side cover I.D. with a cylinder gauge, and calculate the clearance.
2. If the clearance exceeds the allowable limit, replace the defective parts.

| | | |
|---|---|---|
| Clearance between side cover and sector gear shaft | Factory spec. | 0.005 to 0.034 mm<br>0.00020 to 0.00206 in. |
| | Allowable limit | 0.1 mm<br>0.0039 in. |
| Sector gear shaft O.D. | Factory spec. | 27.987 to 28.000 mm<br>1.10185 to 1.10236 in. |
| Side cover I.D. | Factory spec. | 28.005 to 28.021 mm<br>1.10256 to 1.10319 in. |

## Clearance between Sector Gear Shaft and Steering Gear Box

1. Measure the sector gear shaft O.D. with an outside micrometer and steering gear box I.D. with a cylinder gauge, and calculate the clearance.
2. If the clearance exceeds the allowable limit, replace the defective parts.

| | | |
|---|---|---|
| Clearance between sector gear shaft and steering gear box | Factory spec. | 0.040 to 0.074 mm<br>0.00158 to 0.00291 in. |
| | Allowable limit | 0.20 mm<br>0.0078 in. |
| Sector gear shaft O.D. | Factory spec. | 27.987 to 28.000 mm<br>1.10185 to 1.10236 in. |
| Steering gear box I.D. | Factory spec. | 28.040 to 28.061 mm<br>1.10394 to 1.10476 in. |

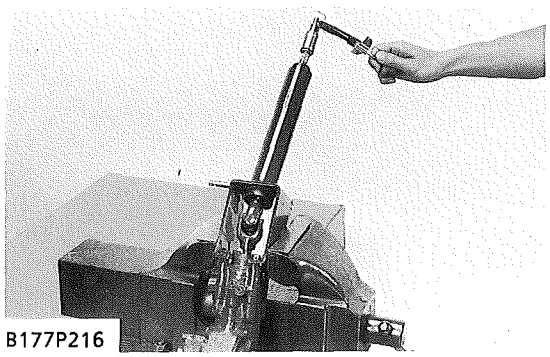


B177P215

## Backlash between Sector Gear Shaft and Ball Nut

1. Attach the pitman arm having no play.
2. Set a dial indicator with its finger on the pitman arm.
3. Move the pitman arm lightly, and measure the deflection.
4. If the measurement is not within the factory specification, adjust the backlash with the adjusting screw.

| | | |
|---|---|---|
| Backlash between sector gear shaft and ball nut | Factory spec. | Less than 0.30 mm<br>0.0118 in. |



B177P216

## Turning Torque of Worm Shaft

1. Set the torque wrench on the worm shaft and measure the torque required to initial turning.
2. If the measurement is not within the factory specification, disassemble the steering gear box.

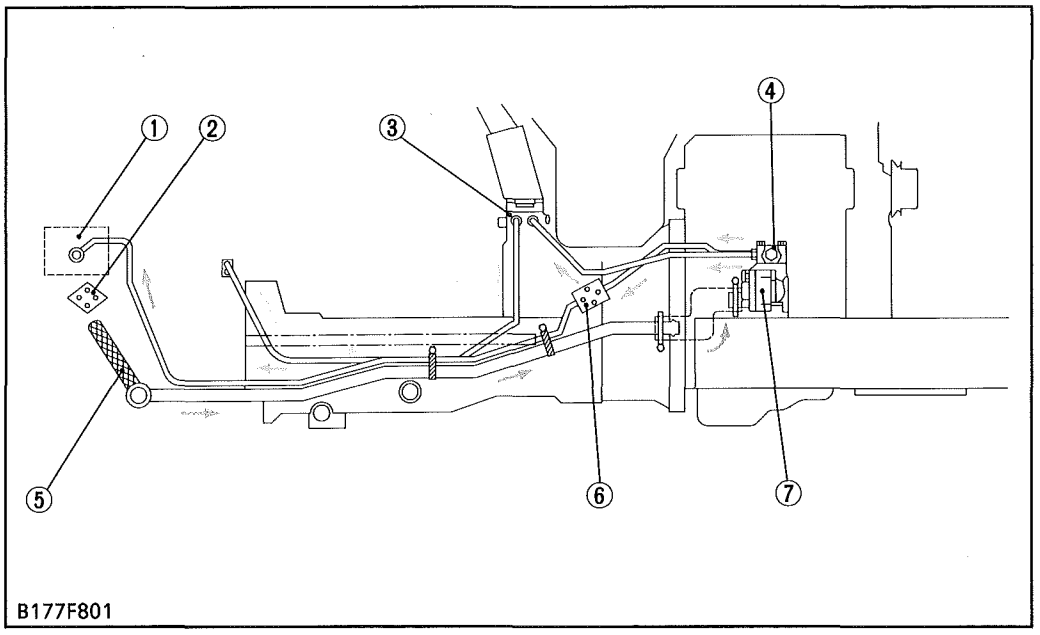
| | | |
|---|---|---|
| Turning torque of worm shaft | Factory spec. | Less than 0.78 N·m<br>0.08 kgf·m<br>0.58 ft-lbs |

# MECHANISM

## CONTENTS

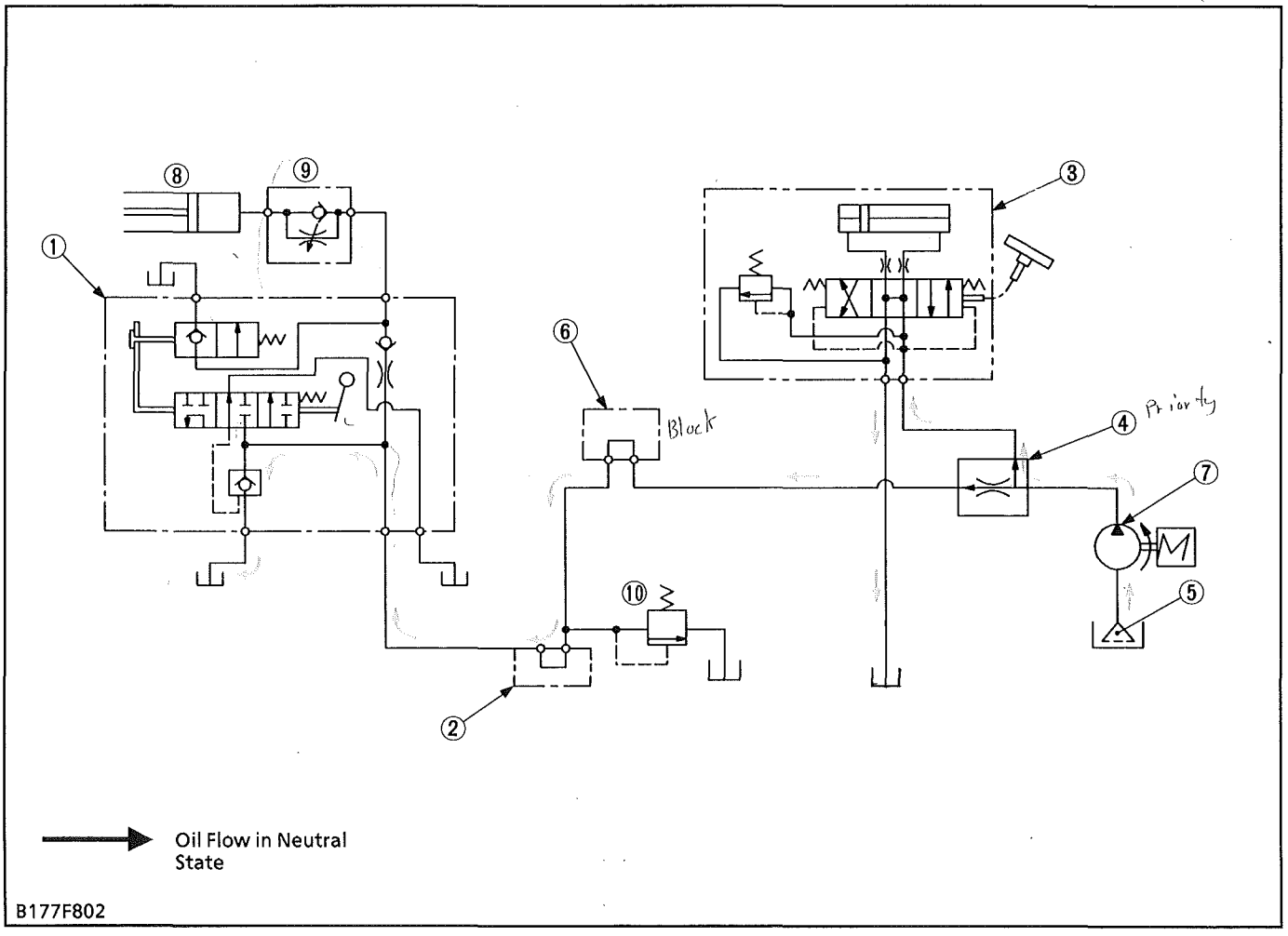
# [1] HYDRAULIC CIRCUIT

## ■ MANUAL TRANSMISSION



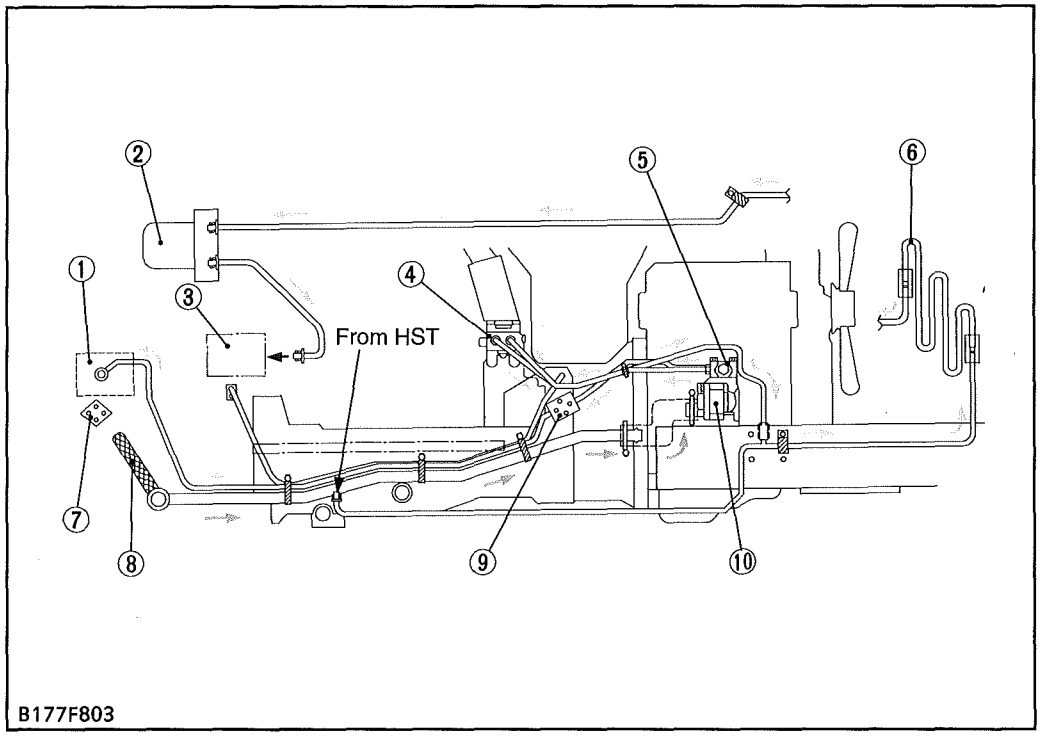

B177F801

(1) Position Control Valve
(2) Rear Hydraulic Outlet
(3) Power Steering
(4) Flow Priority Valve
(5) Oil Strainer
(6) Hydraulic Block Type Outlet
(7) Hydraulic Pump
(8) Hydraulic Cylinder
(9) Lowering Speed Adjusting Valve
(10) Relief Valve



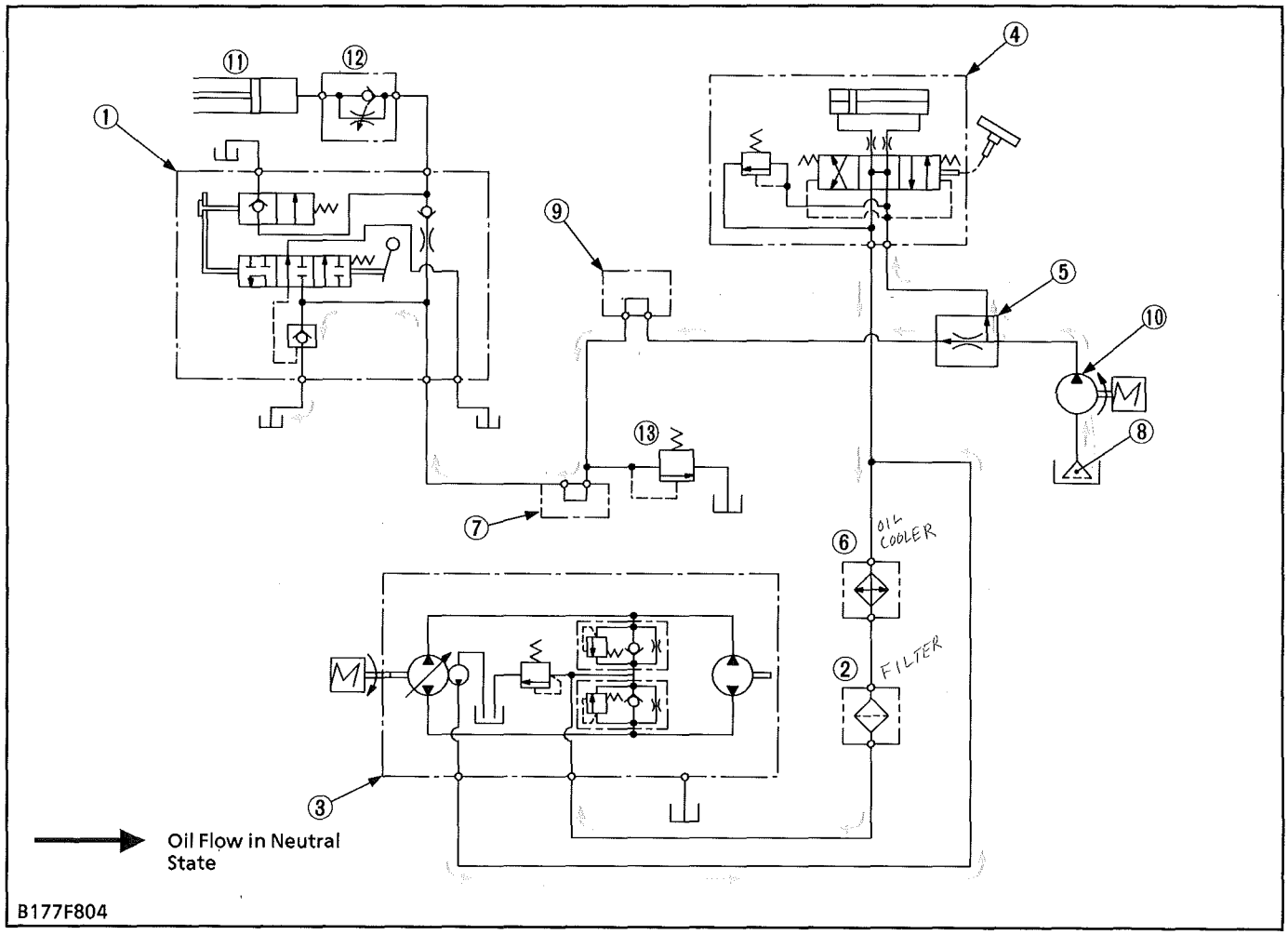

B177F802

## ■ HYDROSTATIC TRANSMISSION




B177F803

(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




B177F804

### ■ Hydraulic System

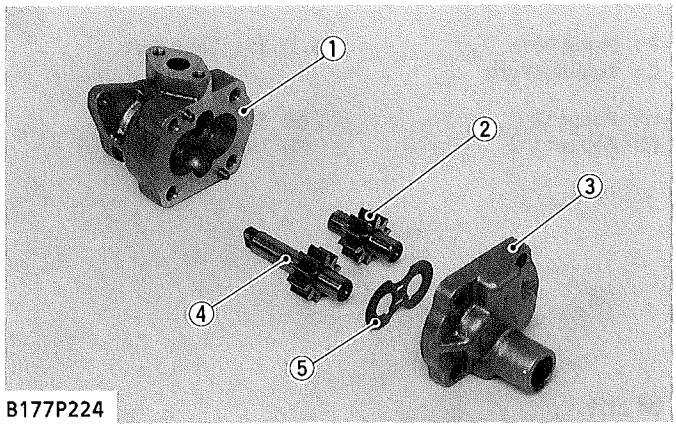
The hydraulic system of these tractors are composed of a hydraulic pump, hydraulic block type outlet, control valve, hydraulic cylinder, hydraulic oil filter and other components.

This system has the following functions.

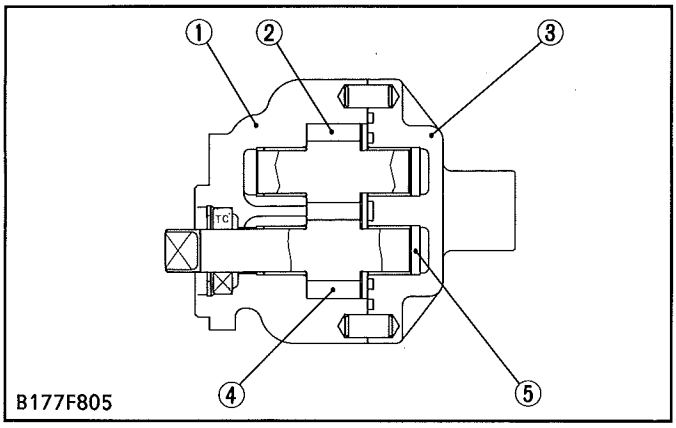
1. Position control of the rear implement connected to the 3-point hitch.
2. Hydraulic power take off from the hydraulic block type outlet to operate the implements such as a front loader, front blade and etc.

- Oil is supplied by a hydraulic pump connected to the engine. When an engine is started, a hydraulic pump starts running, sucks oil from a transmission case. The hydraulic pump forces out the oil to power steering, hydraulic block type outlet, control valve, hydraulic cylinder and hydrostatic transmission (only for HST).

## [2] HYDRAULIC PUMP



B177P224



B177F805

The hydraulic pump is composed of the casing (1), cover (3), side plate (5), and two spur gears (drive gear (4) and driven gear (2)) that are in mesh.

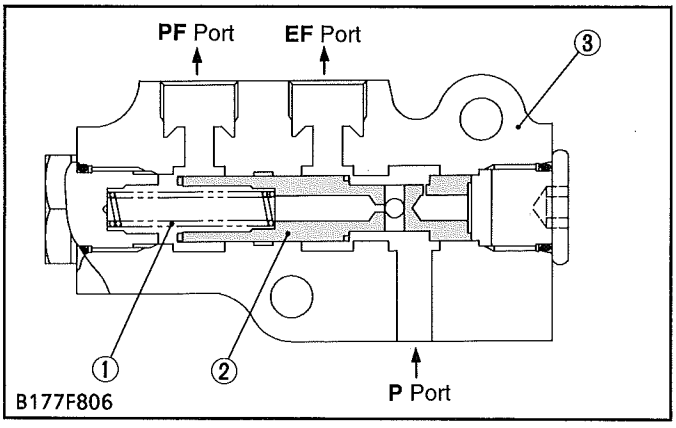
Hydraulic pump is driven by the fuel camshaft.

Maximum displacement is as follows.

| Displacement | Engine speed | Condition |
|---|---|---|
| 22.0 ℓ/min.<br>5.8 U.S. GPM<br>4.8 Imp. GPM | At 2600 rpm | 13.2 to 13.7 MPa<br>135 to 140 kg/cm²<br>1920 to 1991 psi |

(1) Casing
(2) Driven Gear
(3) Cover
(4) Drive Gear
(5) Side Plate

## [3] FLOW PRIORITY VALVE



B177F806

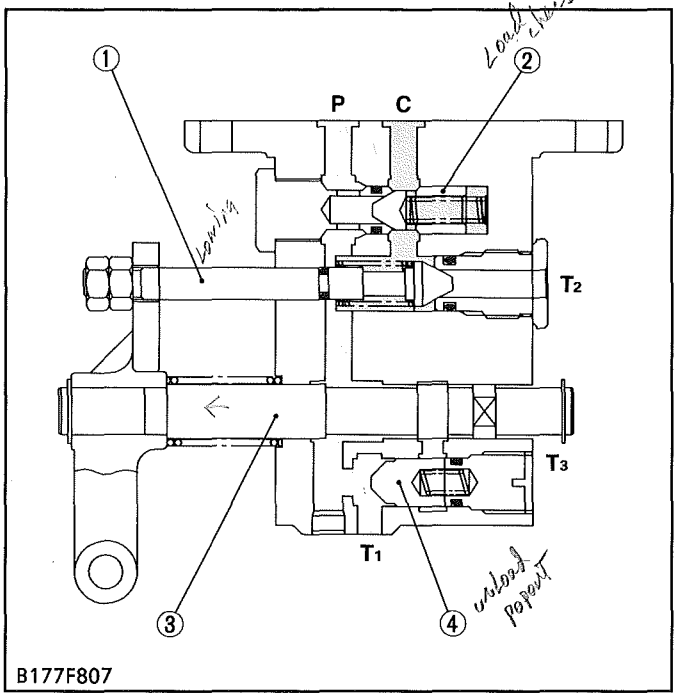
The flow priority valve is a flow devider that devides the flow from single hydraulic source (hydraulic pump) to actuates two circuits (position control circuit and power steering circuit) simultaneously.

This valve feeds fixedly controlled flow (5 ℓ/ min, 1.3 U.S. GPM, 1.1 Imp. GPM) to the **PF** port with priority and excessive flow to the **EF** port.

(1) Spring
(2) Spool
(3) Valve Body

# [4] POSITION CONTROL VALVE

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




B177F807

## ■ Neutral

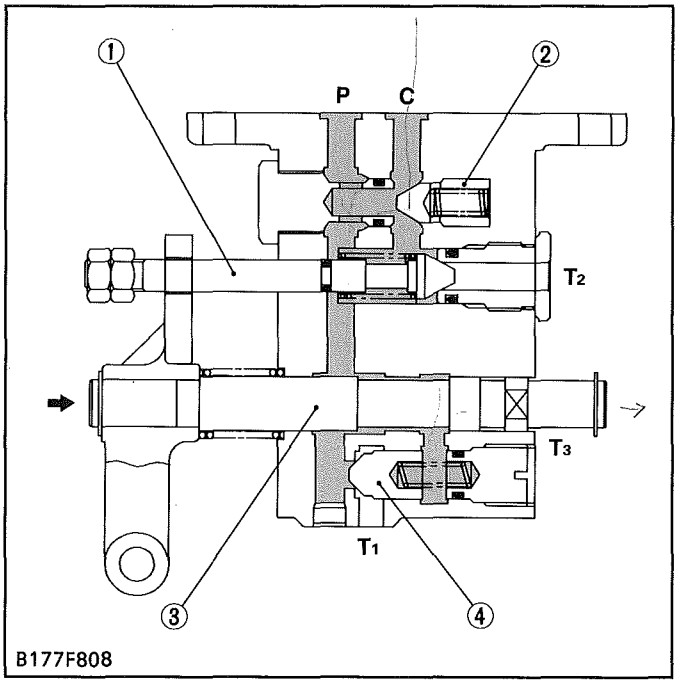
Oil forced into the control valve through the **P** port pushes open the unload poppet (4) and then returns to the transmission case through the **T1** port.

Oil behind the unload poppet (4) returns to the transmission case through the spool (3) and the **T3** port.

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

**P : Pump Port** **T1, T2, T3 : Tank Port**
**C : Cylinder Port**

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




B177F808

## ■ Lift

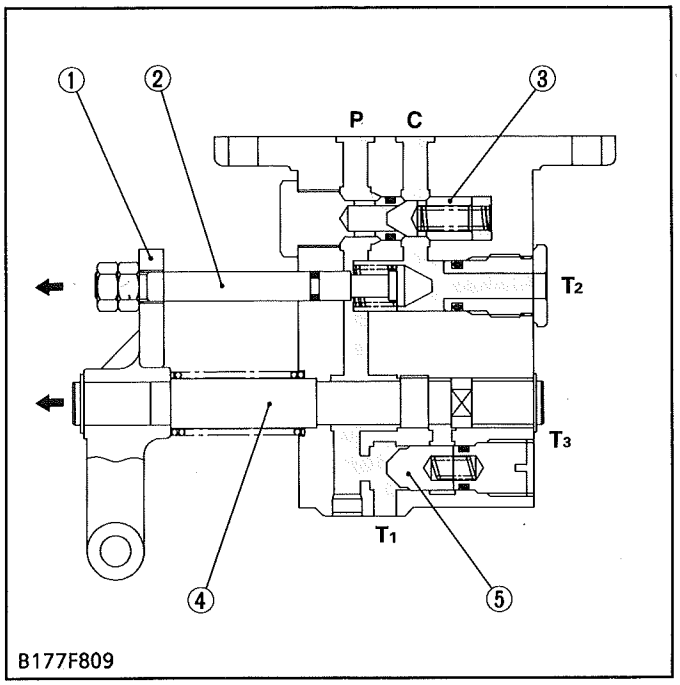
When the control lever is set to the **LIFT** position, the spool (3) is move to the right.

The oil forced into the control valve through the **P** port flows to the back of the unload poppet (4) to close it.

The oil pushes open the poppet 1 (2), and flows into the hydraulic cylinder through the **C** port to lift the implement.

**P : Pump Port** **T1, T2, T3 : Tank Port**
**C : Cylinder Port**

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



B177F809

■ **Down**

When the control lever is moved to **DOWN** position, the spool (4) is move to the left , and the poppet 2 (2) is also move to the left by the lever (1).

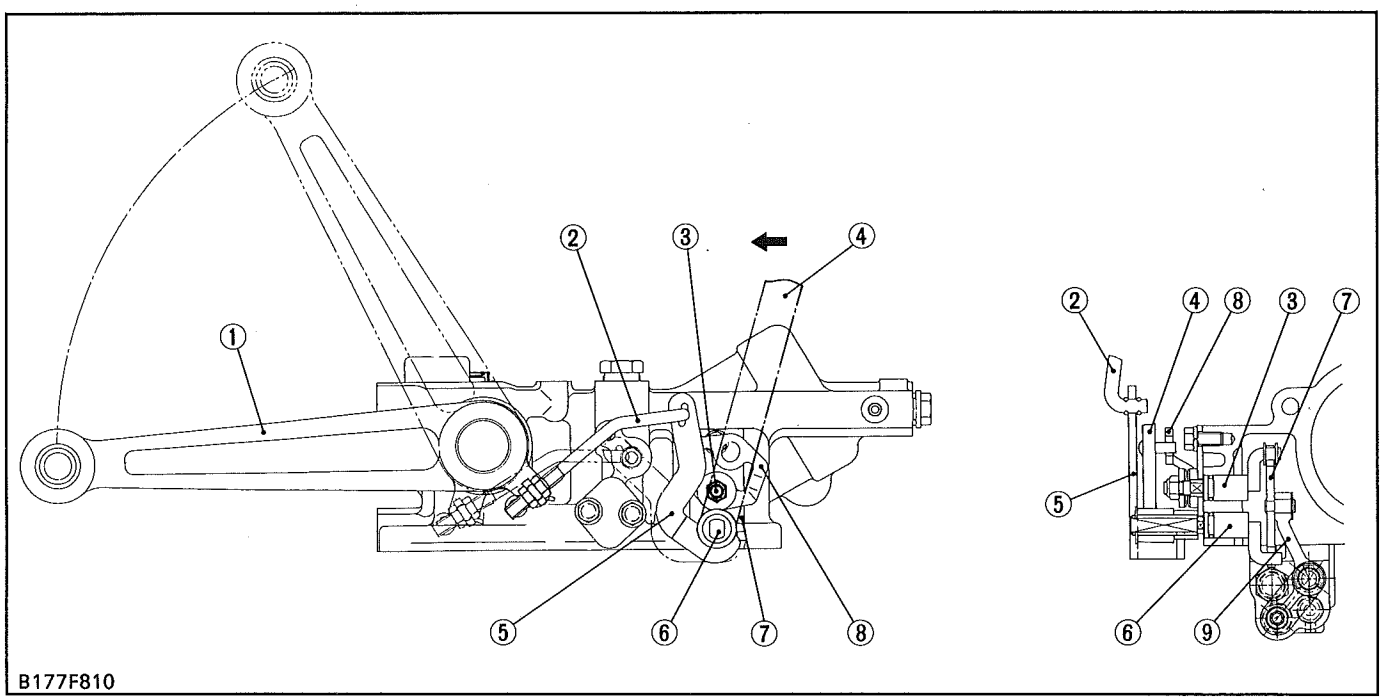
Oil in the hydraulic cylinder is forced out to the transmission case through the **T2** port by the weight of the implement, causing the implement to lower.

Oil forced into the control valve through the **P** port pushes open the unload poppet (5) and returns to the transmission case through the **T1** port.

**P : Pump Port**
**C : Cylinder Port**
**T1, T2, T3 : Tank Port**

(1) Lever
(2) Poppet 2
(3) Poppet 1
(4) Spool
(5) Unload Poppet

## [5] FEEDBACK LINKAGE FOR POSITION CONTROL



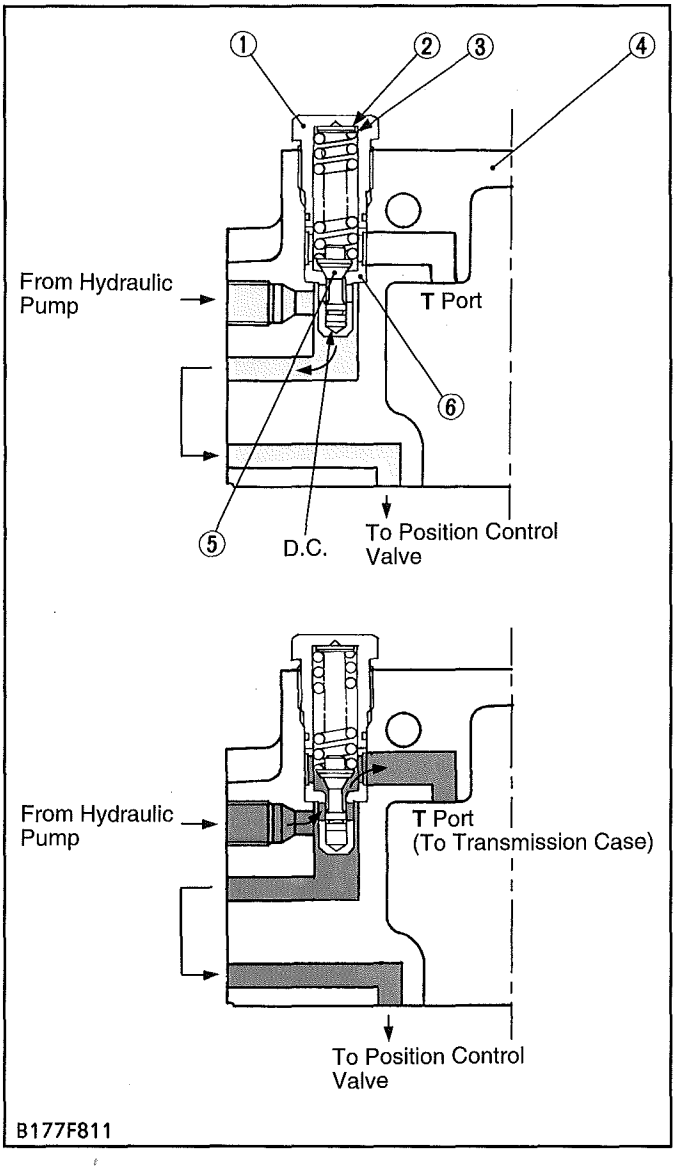
B177F810

(1) Lift Arm RH
(2) Feedback Rod
(3) Control Lever Shaft
(4) Position Control Lever
(5) Feedback Arm
(6) Feedback Arm Shaft
(7) Connecting Link
(8) Control Lever Arm
(9) Lever

When the position control lever (4) moved to rearward to lift the implement, the spool of the position control valve is pushed in to form a raising circuit by the motions of control lever arm (8), control lever shaft (3), connecting link (7) and the lever (9). And after the lift arm (1) moves upward, the spool is pulled out and return to form a neutral circuit by the motions of feedback rod (2), feedback arm (5), feedback arm shaft (6), connecting link (7) and the lever (9).

As a result,the implement height can be easily determined in proportion to the set position of the position control lever (4).

# [6] RELIEF VALVE




The Three point hydraulic system circuit has a relief valve to restrict the maximum pressure in the circuit. The relief valve is located top of the hydraulic cylinder body.

The relief valve is of the guide piston type with damping effect.

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

As shown in the figure, the guide is attached to the poppet (5) and a valve chamber **D.C.** (called the damping chamber) is formed at the bottom of the guide piston. The inlet of the valve leads to the chamber via a clearance between the sliding portion of the guide and the seat (6), minimizing valve vibration with the damping effect of the chamber.

When the oil pressure in the circuit is lower than the setting pressure of the relief valve, the relief valve is not operated and the oil fed to the relief valve from the hydraulic pump flows into the position control valve.

As the oil pressure in the circuit increases, so does the pressure in the damping chamber **D.C.** When the pressure rises above the valve setting and overcomes the spring force, the valve opens. Oil then flows out to the transmission case through **T** port, preventing any further rise in pressure. The valve closes again when enough oil is released to drop pressure below the valve setting.

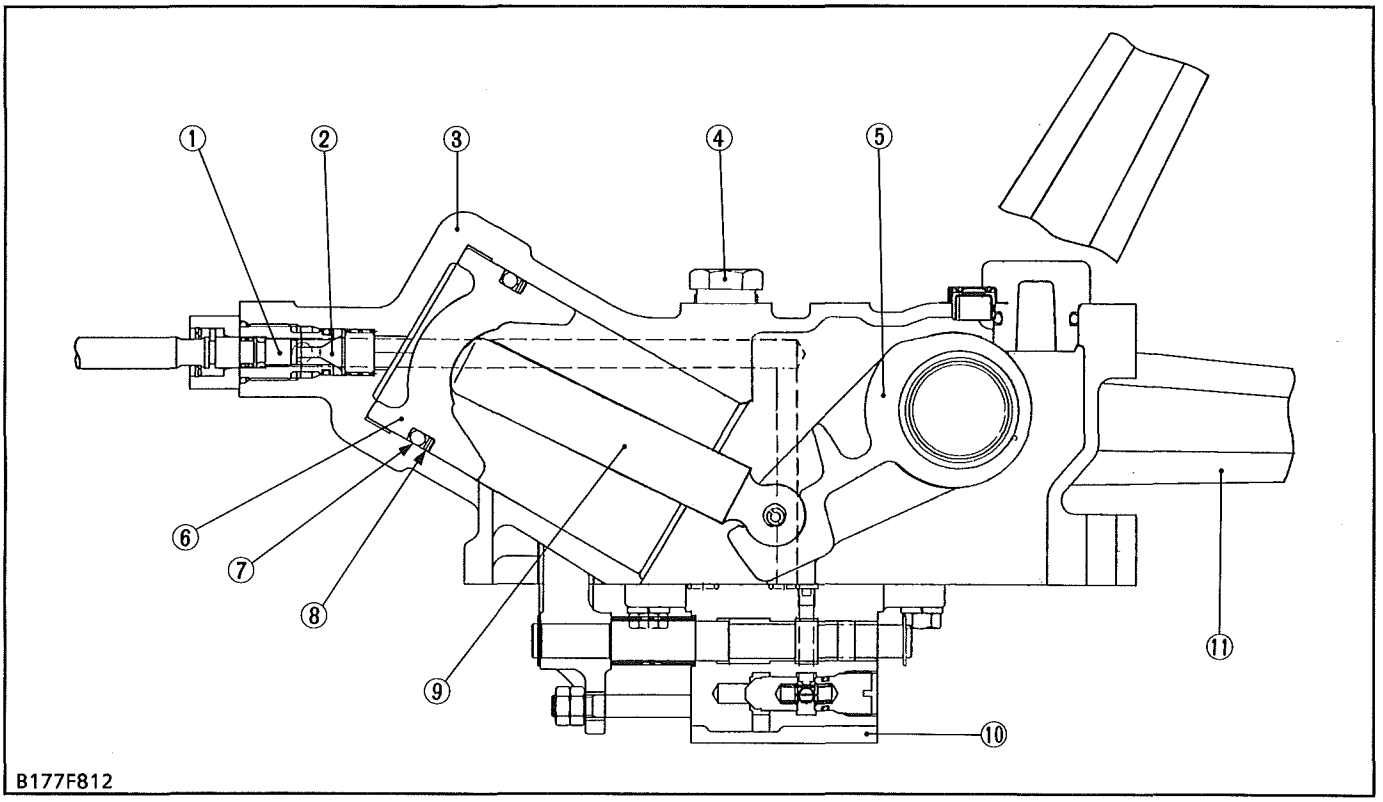
**(Reference)**

- Relief Valve setting pressure : 13.2 to 13.7 MPa
  135 to 140 kgf/cm²
  1920 to 1991 psi
  Engine speed : Maximum
  Oil temperature : 45 to 55 °C
  113 to 131 °F

**D.C. : Damping Chamber** **C : Cylinder Port**
**P : Pump Port** **T : Tank Port**

(1) Plug
(2) Washer
(3) Shim
(4) Hydraulic Cylinder Body
(5) Poppet
(6) Seat

# [7] HYDRAULIC CYLINDER




B177F812

(1) Lowering Speed Adjusting Shaft
(2) Lowering Speed Adjusting Valve
(3) Hydraulic Cylinder
(4) Relief Valve
(5) Hydraulic Arm
(6) Piston
(7) O-ring
(8) Back-up Ring
(9) Hydraulic Rod
(10) Position Control Valve
(11) Lift Arm

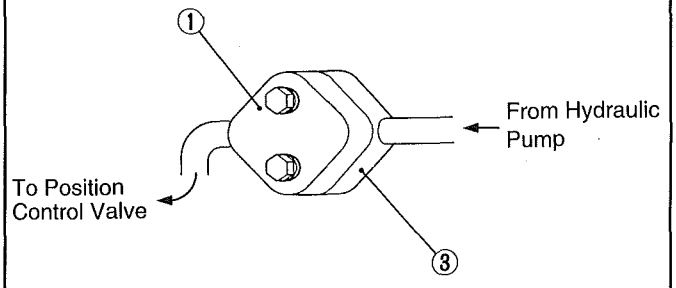
The main components of the hydraulic cylinder are shown in the figure above.

While the lift arm (11) is rising, oil from the hydraulic pump flows into the hydraulic cylinder through the position control valve (10). Then oil pushes out the piston (6).

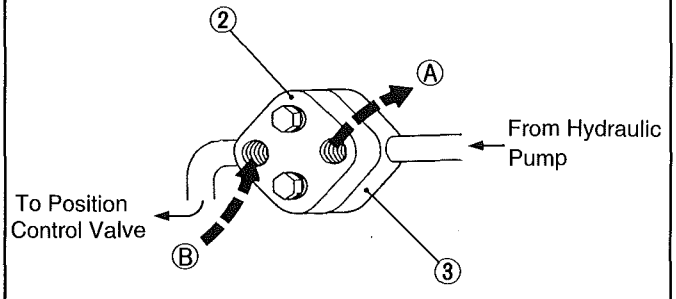
While the lift arm (11) is lowering, oil in the hydraulic cylinder is discharged to the transmission case through the position control valve (10) by the weight of the implement. At this time, the lowering speed of the implement can be controlled by the lowering speed adjusting valve (2) attached to the hydraulic cylinder (3). Turning the lowering speed adjusting knob (1) clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve (2) is completely closed, the lift arm (11) is held at its position since oil in the hydraulic cylinder is sealed between the piston (6) and lowering speed adjusting valve (2).

## [8] HYDRAULIC BLOCK TYPE OUTLET

**When implement is not attached**




**When implement is attached**




B177F813

The hydraulic block type outlet is located at the right hand side of the engine.

This hydraulic block type outlet is provided to take power out from the tractor to operate the hydraulic cylinders on the implement, such as front end loader, front blade and so on.

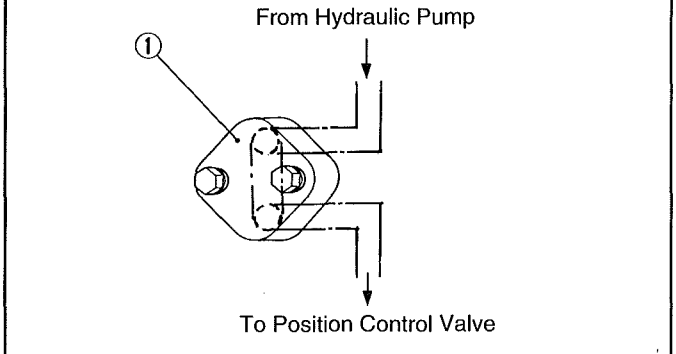
(1) Block Cover
(2) Block Outlet Cover (Option)
(3) Hydraulic Block

**(A) To Implement (Inlet) Max. flow 17 ℓ/min. (4.5 U.S. GPM, 3.7 Imp. GPM) No relief valve in the hydraulic block.**

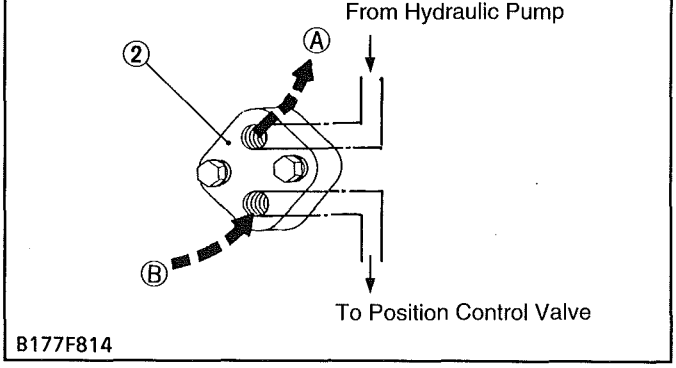
**(B) From Implement (Outlet)**

## [9] REAR HYDRAULIC OUTLET

**When implement is not attached**




**When implement is attached**




B177F814

The rear hydraulic outlet is located at the right hand side of the hydraulic cylinder body.

This rear hydraulic outlet is provided to take power out from the tractor to operate the hydraulic cylinders on the implement.

(1) Block Cover
(2) Block Outlet Cover (Option)

**(A) To Implement (Inlet) Max. flow 17 ℓ/min. (4.5 U.S. GPM, 3.7 Imp. GPM) Max. pressure 13.2 to 13.7 MPa (135 to 140 kgf/cm², 1920 to 1992 psi)**

**(B) From Implement (Outlet)**

# SERVICING

## CONTENTS

# TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Implement Does Not Rise (No Noise)** | ● Control valve broken | Replace | 8-S10 |
| | ● Control valve improperly adjusted | Adjust | 8-S11 |
| | ● Control valve improperly assembled | Assemble | 8-S11 |
| | ● Relief valve spring damaged | Replace | 8-S11 |
| | ● Spool sticks | Repair | 8-S11 |
| | ● Piston O-ring or cylinder damaged | Replace | 8-S10 |
| **(Noise)** | ● Oil strainer clogged | Clean or Replace | — |
| | ● Suction pipe loosen or broken | Repair or Replace | — |
| | ● Suction pipe connecting hose loosen or broken | Repair or Replace | — |
| | ● Suction pipe O-ring broken | Replace | — |
| | ● Insufficient transmission oil | Refill | G-8 |
| | ● Relief valve setting pressure too low | Adjust or Replace | 8-S8 |
| | ● Hydraulic pump broken | Replace | 8-S6 |
| **Implement Does Not Reach Maximum Height** | ● Feedback rod improperly adjusted | Adjust | 8-S8 |
| **Implement Does Not Lower** | ● Control valve malfunctioning | Repair or Replace | 8-S10 |
| **Implement Drops by Its Weight** | ● Hydraulic cylinder worn or damaged | Replace | 8-S10 |
| | ● Piston O-ring worn or damaged | Replace | 8-S10 |
| | ● Control valve malfunctioning | Replace | 8-S10 |
| **Implement Hunts** | ● Control valve improperly adjusted | Adjust | 8-S11 |

# SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| **[Hydraulic Pump]**<br>Pump Delivery at Engine 2600 rpm, Oil Temperature 50°C, 122°F | at no pressure | 22.0 ℓ / min.<br>5.8 U.S. GPM<br>4.8 Imp.GPM | — |
| | at 14.7 MPa<br>150 kgf / cm²<br>2133 psi | 18.0 ℓ / min.<br>4.8 U.S.GPM<br>4.0 Imp.GPM | 16.0 ℓ / min.<br>4.2 U.S. GPM<br>3.5 Imp.GPM |
| Gear Shaft to Bushing | Clearance | 0.020 to 0.091 mm<br>0.0008 to 0.0036 in. | 0.12 mm<br>0.0047 in. |
| Gear Shaft | O.D. | 14.970 to 14.980 mm<br>0.5894 to 0.5898 in. | — |
| Bushing | I.D. | 15.000 to 15.061 mm<br>0.5906 to 0.5930 in. | — |
| Side Plate | Thickness | 2.48 to 2.50 mm<br>0.0976 to 0.0984 in. | 2.40 mm<br>0.0945 in. |
| Gear to Casing | Clearance | — | 0.15 mm<br>0.0059 in. |
| Lift Arm | Free Play | 5 to 10 mm<br>0.20 to 0.40 in. | — |
| Relief Valve | Setting Pressure | 13.2 to 13.7 MPa<br>135 to 140 kgf/cm²<br>1920 to 1991 psi | — |
| Hydraulic Cylinder | I.D. | 70.05 to 70.10 mm<br>2.7579 to 2.7598 in. | 70.15 mm<br>2.7618 in. |
| Hydraulic arm shaft to Bushing | Clearance | 0.020 to 0.110 mm<br>0.0008 to 0.0043 in. | 0.30 mm<br>0.0118 in. |
| Hydraulic arm shaft Right | O.D. | 37.925 to 37.950 mm<br>1.4931 to 1.4941 in. | — |
| Hydraulic arm shaft, Left | O.D. | 33.925 to 33.950 mm<br>1.3356 to 1.3366 in. | — |
| Bushing, Right | I.D. | 37.970 to 38.035 mm<br>1.4949 to 1.4974 in. | — |
| Bushing, Left | I.D. | 33.970 to 34.035 mm<br>1.3374 to 1.3400 in. | — |

# TIGHTENING TORQUES

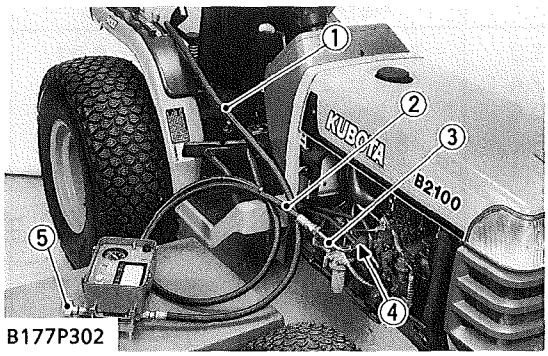
Tightening torques of screws and nuts on the table bellow is especially specified.
(For general use screws and nuts: See page G-8)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Fuel cut off solenoid mounting screws | 9.80 to 11.2 | 1.00 to 1.15 | 7.24 to 8.32 |
| Fuel filter bracket mounting screws | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Flow priority valve mounting screws | 17.7 to 20.6 | 1.8 to 2.1 | 13.0 to 15.2 |
| Delivery pipe flare nuts | 29.4 to 39.2 | 3.0 to 4.0 | 21.7 to 28.9 |
| Hydraulic pump mounting screw and nut | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Cover mounting screw | 34.3 to 39.2 | 3.5 to 4.0 | 25.3 to 28.9 |
| Hook and connecting plate mounting screws and nuts | 39.2 to 44.1 | 4.0 to 4.5 | 28.9 to 32.5 |
| Top link bracket mounting screws | 77.5 to 90.1 | 7.9 tp 9.2 | 57.2 to 66.5 |
| Hydraulic cylinder assembly mounting screws and nuts | 39.2 to 44.1 | 4.0 to 4.5 | 28.9 to 32.5 |
| Position control valve mounting screws | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Relief valve plug | 49.0 to 68.6 | 5.0 to 7.0 | 36.2 to 50.6 |
| Plug 3 | 39.2 to 58.8 | 4.0 to 6.0 | 28.9 to 43.4 |
| Plug 2 | 29.4 to 49.0 | 3.0 to 5.0 | 21.7 to 36.2 |
| Plug 1 | 29.4 to 49.0 | 3.0 to 5.0 | 21.7 to 36.2 |

# CHECKING, DISASSEMBLING AND SERVICING

## [1] HYDRAULIC PUMP

## CHECKING AND ADJUSTING



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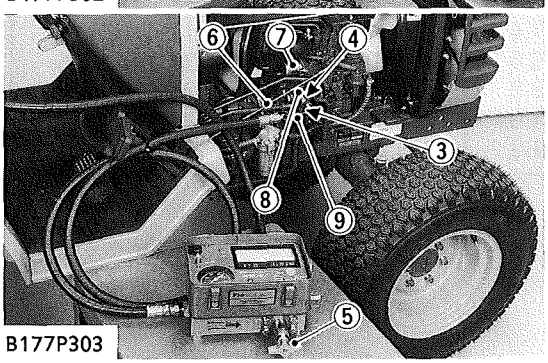
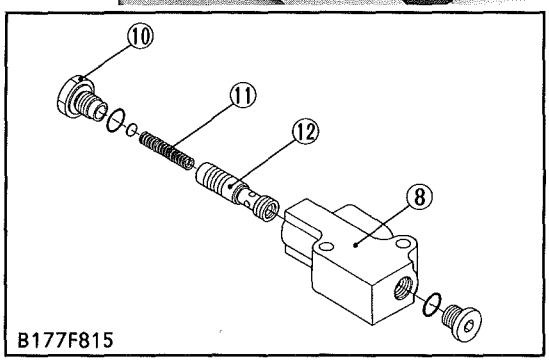

B177P303


B177F815

### Flowmeter Connecting and Test Preparation

■ **IMPORTANT**

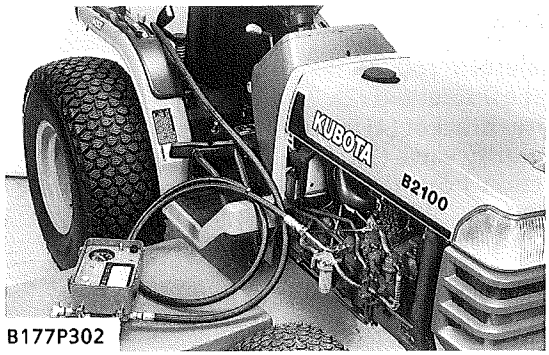
- **When using a flowmeter other than KUBOTA specified flowmeter (Code No.: 07916-52791), be sure to use the instructions with that flowmeter.**
- **In this hook-up, there is no relief valve. Therefore while testing, do not close the flowmeter loading valve completely.**

1. Disconnect the accelerator rod (6).
2. Remove the fuel cut off solenoid (7).
3. Remove the plug (10) and pull out the spool (12) and spring (11).
4. Disconnect the delivery pipes and remove the flow priority valve body (8).
5. Install the plugs to the flow priority valve body (8).
6. Install the flow priority valve body (8) to the hydraulic pump (9).
7. Install the fuel cut off solenoid (7).
8. Connect the accelerator rod (6).
9. Install the adaptor **69** (4) and adaptor **66** (3) to the flow priority valve body (8).
10. Connect the hydraulic test hose (2) **(Code No.: 07916-52651)** to the adaptor **66** and flowmeter **(Code No.: 07916 -52791)** inlet port.
11. Connect the another hydraulic test hose (1) to flowmeter outlet port and transmission oil filling port.
12. Open the flowmeter loading valve (5) completely. (Turn counterclockwise)
13. Start the engine and set the engine speed at **2600 rpm.**
14. Slowly close the loading valve to generate the pressure approx. **14.7 MPa ( 150 kgf/cm², 2133 psi ).** Hold in this condition until oil temperature reaches **approx. 50°C (122°F).**

**(Reference)**

- Adaptors **66** and **69** are included in the adaptor set **(Code No: 07916-54031).**

(1) Hydraulic Test Hose
(2) Hydraulic Test Hose
(3) Adaptor **66**
(4) Adaptor **69**
(5) Loading Valve
(6) Accelerator Rod
(7) Fuel Cut Off Solenoid
(8) Flow Priority Valve Body
(9) Hydraulic Pump
(10) Plug
(11) Spring
(12) Spool



B177P302

**Condition**

- Engine speed ..... approx. 2600 rpm
- Rated pressure ..... 14.7 MPa
  150 kgf/cm²
  2133 psi
- Oil temperature ..... 50 °C
  122 °F

## Pump Test

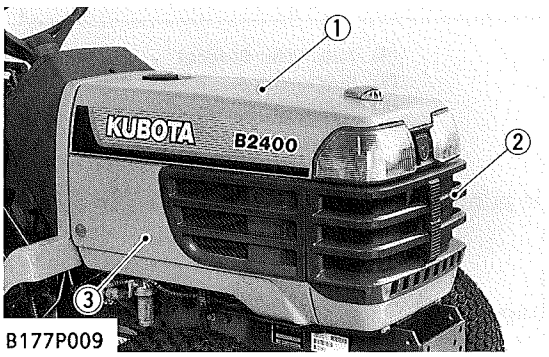
**■ NOTE**

- **Before pump testing, perform the Flowmeter Connecting and Test Preparation. (See page 8-S4).**

1. Open the loading valve completely.
2. Start the engine and set at **approx. 2600 rpm.**
3. Read and note the pump delivery at no pressure.
4. Slowly close the loading valve to increase pressure **approx. 14.7 MPa (150 kgf/cm², 2133 psi).**
5. Read and note the pump flow at rated pressure.
6. Open the loading valve and stop the engine.
7. If the pump delivery does not reach the allowable limit, check the pump suction line, oil filter or hydraulic pump.

| | | |
|---|---|---|
| Hydraulic pump delivery at no pressure | Factory spec. | Above 22 ℓ / min. 5.8 U.S. GPM 4.8 Imp. GPM |
| Hydraulic pump delivery at rated pressure | Factory spec. | Above 18 ℓ / min. 4.8 U.S.GPM 4.0 Imp. GPM |
| | Allowable limit | 16 ℓ / min. 4.2 U.S.GPM 3.5 Imp. GPM |

# DISASSEMBLING AND ASSEMBLING

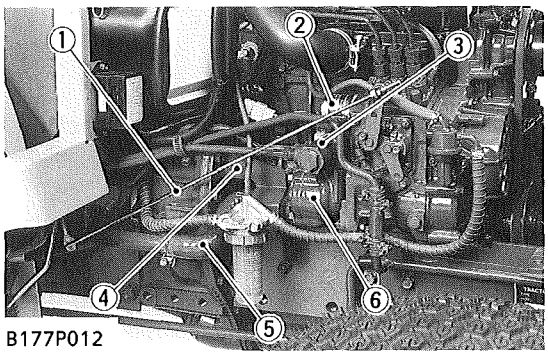


B177P009

## Hood, Front Grille and Side Cover

1. Open the hood (1).
2. Remove the front grille (2) and side cover RH (3).

(1) Hood
(2) Front Grille
(3) Side Cover RH



B177P012

## Removing Hydraulic Pump

1. Disconnect the accelerator rod (1).
2. Remove the fuel cut off solenoid (2).
3. Remove the fuel filter bracket (4) mounting screws.
4. Remove the flow priority valve (3).
5. Disconnect the suction hose (5) and remove the hydraulic pump (6).

**(When reassembling)**
- Apply grease to O-ring and take care not to damage it.
- Apply liquid gasket (Three Bond 1208D or equivalent) to the engine stop solenoid gasket.

| | | |
|---|---|---|
| Tightening torque | Fuel cut off solenoid mounting screws | 9.80 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.32 ft-lbs |
| | Fuel filter bracket mounting screws | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |
| | Flow priority valve mounting screws | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.0 to 15.2 ft-lbs |
| | Delivery pipe flare nuts | 29.4 to 39.2 N·m<br>3.0 to 4.0 kgf·m<br>21.7 to 28.9 ft-lbs |
| | Hydraulic pump mounting screw and nut | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |

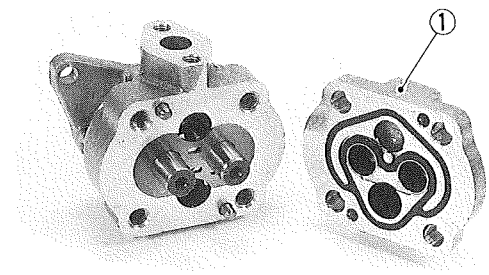
(1) Accelerator Rod
(2) Fuel Cut Off Solenoid
(3) Flow Priority Valve
(4) Fuel Fitter Bracket
(5) Suction Pipe
(6) Hydraulic Pump

## Cover

1. Secure the hydraulic pump with a vise, and remove the cover (1).

**(When reassembling)**
- Use care not to damage the O-ring.
- Align the holes of the cover and casing.

| | | |
|---|---|---|
| Tightening torque | Cover mounting screw | 34.3 to 39.2 N·m<br>3.5 to 4.0 kgf·m<br>25.3 to 28.9 ft-lbs |



B177P222

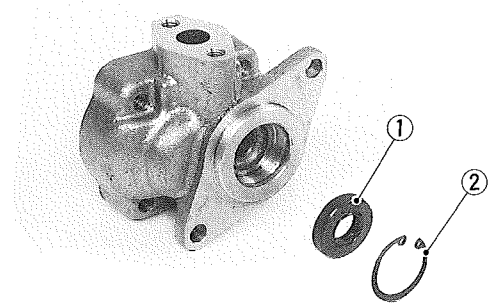
(1) Cover

## Oil Seal

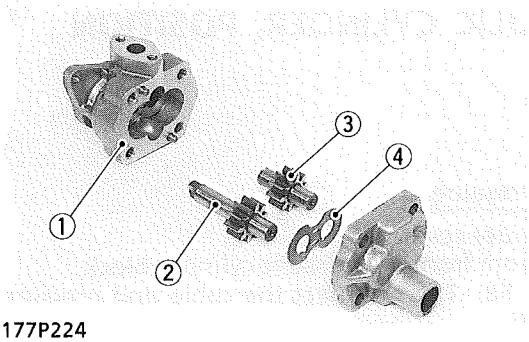
1. Remove the internal snap ring (2), and remove the oil seal (1).

**(When reassembling)**
- If the oil seal is defective, worn or scratched, replace it.

(1) Oil Seal
(2) Internal Snap Ring



B177P223




B177P224

### Side Plate and Gear

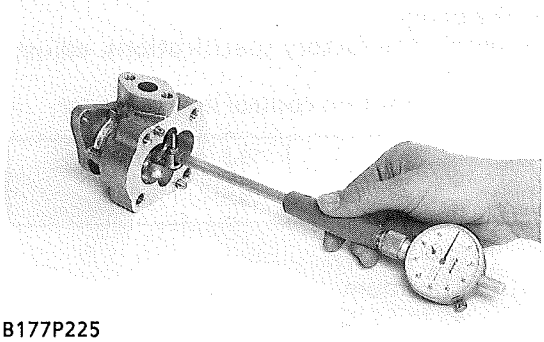
1. Remove the side plate (4).
2. Remove the drive gear (2) and driven gear (3) from the casing (1).

**(When reassembling)**

- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

(1) Casing
(2) Drive Gear
(3) Driven Gear
(4) Side Plate

## SERVICING

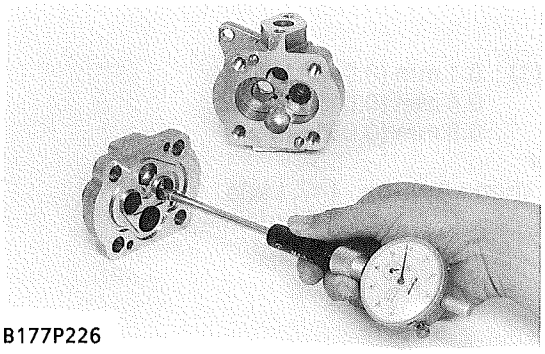


B177P225

### Clearance between Tip of Gear Tooth and Casing

1. Measure the gear O.D. with an outside micrometer.
2. Measure the casing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace the assembly.

| | | |
|---|---|---|
| Clearance between tip of gear tooth and casing | Allowable limit | 0.15 mm<br>0.0059 in. |

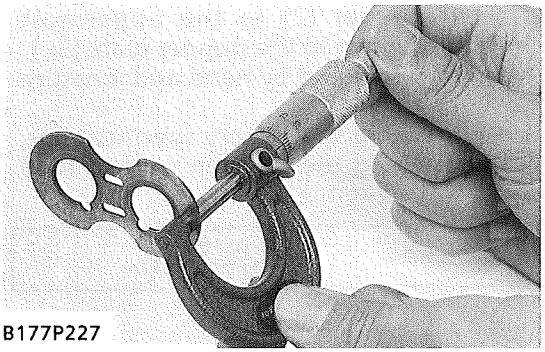


B177P226

### Clearance between Bushing and Shaft

1. Measure the shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace.

| | | |
|---|---|---|
| Clearance between bushing and shaft | Factory spec. | 0.020 to 0.091 mm<br>0.0008 to 0.0036 in. |
| | Allowable limit | 0.12 mm<br>0.0047 in. |
| Shaft O.D. | Factory spec. | 14.970 to 14.980 mm<br>0.5894 to 0.5898 in. |
| Bushing I.D. | Factory spec. | 15.000 to 15.061 mm<br>0.5906 to 0.5930 in. |



B177P227

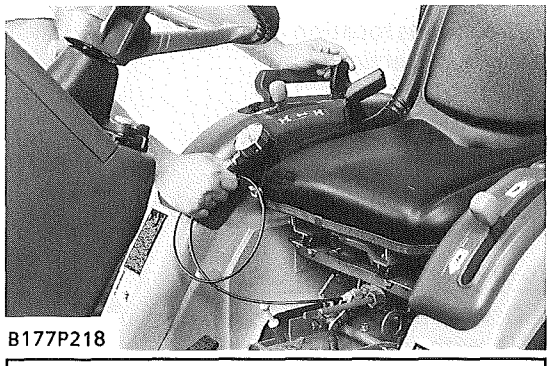
### Side Plate Thickness

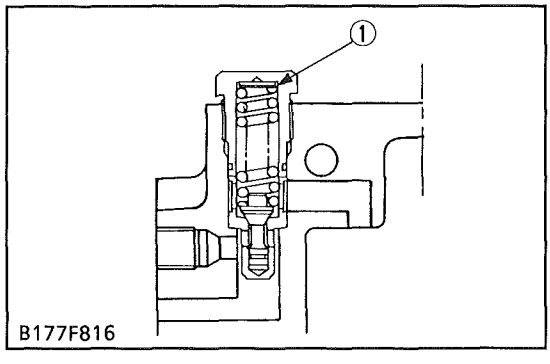
1. Measure the side plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Side plate thickness | Factory spec. | 2.48 to 2.50 mm<br>0.0976 to 0.0984 in. |
| | Allowable limit | 2.40 mm<br>0.0945 in. |

# [2] HYDRAULIC CYLINDER ASSEMBLY (HYDRAULIC CYLINDER, POSITION CONTROL VALVE, RELIEF VALVE AND ETC)

## CHECKING AND ADJUSTING


B177P218



B177F816

### Relief Valve Setting Pressure

1. Remove the seat under cover.
2. Remove the plug from front of hydraulic cylinder block.
3. Install the adaptor **58**. Then connect the cable and pressure gauge to adaptor **58**.
4. Remove the position control lever stopper.
5. Start the engine and set at maximum speed.
6. Move the position control lever all way up to operate the relief valve and read the gauge.
7. If the pressure is not within the factory specifications, adjust with the adjusting shims (1).
8. After checking, reinstall the position control lever stopper.

| | | |
|---|---|---|
| Relief valve setting pressure | Factory spec. | 13.2 to 13.7 MPa<br>135 to 140 kgf/cm$^2$<br>1920 to 1991 psi |

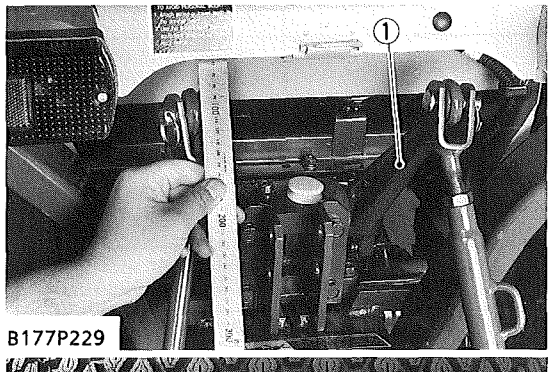
**Condition**

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

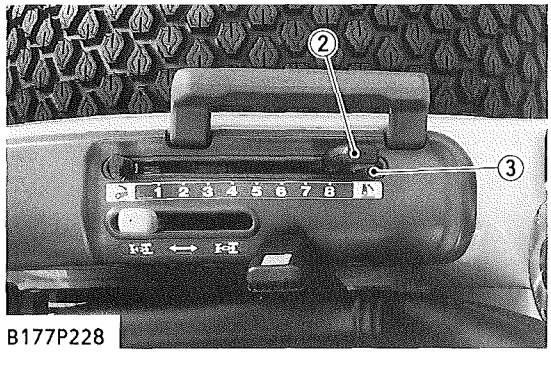
**(Reference)**

- Thickness of shims (1) : 0.1 mm (0.0039 in.)
  0.4 mm (0.0157 in.)
  0.8 mm (0.0315 in.)
- Pressure change per
  0.1 mm (0.0039 in.) shim : Approx. 147.1 kPa
  1.5 kgf/cm$^2$
  21.3 psi

(1) Shim



B177P229



B177P228

### Lift Arm Free Play

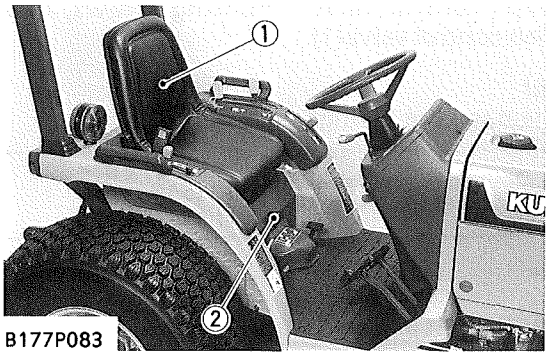
1. Set the position control lever (2) to the lowest position.
2. Start the engine, and set at the idling speed.
3. Move the position control lever (2) to the uppermost position. (Until the lever (2) contact to the stopper plate (3).)
4. Move the lift arm (1) to the upper end by hand and measure the free play.
5. If the measurement is not within the factory specifications, adjust the free play by changing the position control feed back rod setting length.

| | | |
|---|---|---|
| Lift arm free play | Factory spec. | 5 to 10 mm<br>0.20 to 0.40 in. |

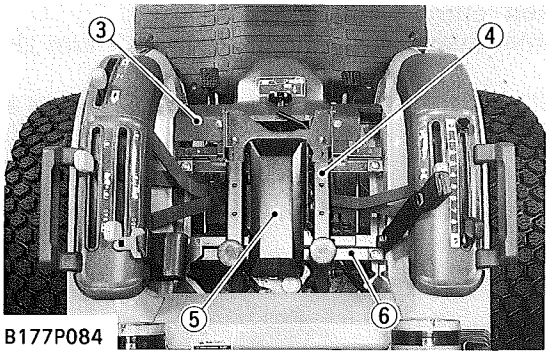
(1) Lift Arm
(2) Position Control Lever
(3) Stopper Plate

# DISASSEMBLING AND ASSEMBLING

## (1) Separating Hydraulic Cylinder Assembly



B177P083

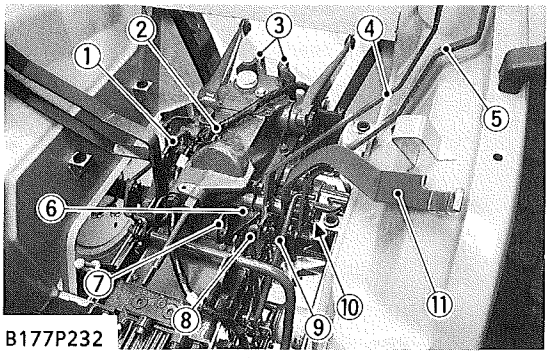


B177P084

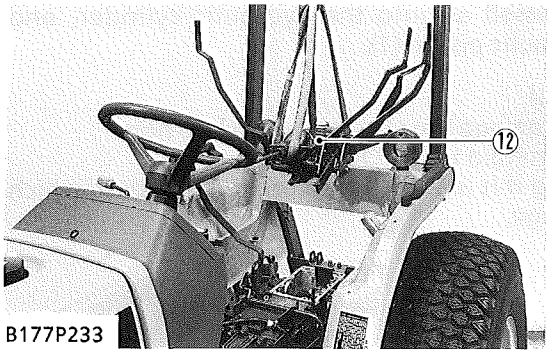
### Seat, Seat Rail, Seat Stay and Seat Under Cover

1. Remove the seat (1) and lowering speed adjusting knob (2).
2. Remove the tool box (5) and seat under cover (3).
3. Remove the seat stay (6) and seat rail (4) as a unit.

(1) Seat
(2) Lowering Speed Adjusting Knob
(3) Seat Under Cover
(4) Seat Rail
(5) Tool Box
(6) Seat Stay



B177P232



B177P233

### Hydraulic Cylinder Assembly

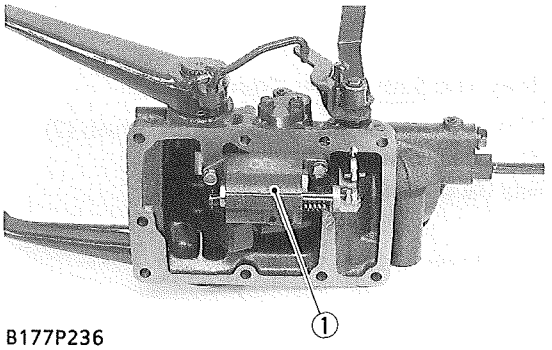
1. Remove the top link and disconnect the lift rods.
2. Disconnect the wiring harness (2) and delivery pipe (1).
3. Remove the external snap ring (10).
4. Move the levers (4), (5), (11) to outside and disconnect the rods (8), (9).
5. Remove the hook (7), connecting plate (6) and top link bracket (3).
6. Remove the hydraulic cylinder assembly mounting screws and nuts, and separate the hydraulic cylinder assembly (12).

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Hook and connecting plate mounting screws and nuts | 39.2 to 44.1 N·m<br>4.0 to 4.5 kgf·m<br>28.9 to 32.5 ft-lbs |
| | Top link bracket mounting screws | 77.5 to 90.1 N·m<br>7.9 to 9.2 kgf·m<br>57.2 to 66.5 ft-lbs |
| | Hydraulic cylinder assembly mounting screws and nuts | 39.2 to 44.1 N·m<br>4.0 to 4.5 kgf·m<br>28.9 to 32.5 ft-lbs |

(1) Delivery Pipe
(2) Wiring Harness
(3) Top Link Bracket
(4) Mid PTO Gear Shift Lever
(5) Rear PTO Gear Shift Lever
(6) Connecting Plate
(7) Hook
(8) Rod
(9) Rod
(10) External Snap Ring
(11) Hi-Lo Gear Shift Lever
(12) Hydraulic Cylinder Assembly

## (2) Disassembling Hydraulic Cylinder Assembly




B177P236

### Position Control Valve

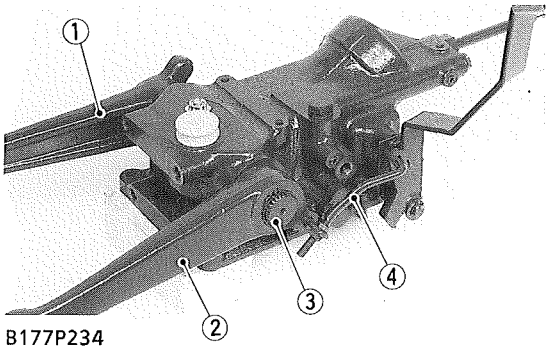
1. Remove the position control valve mounting screws, and remove the position control valve(1).

**(When reassembling)**

- Take care not to damage the O-rings.

| | | |
|---|---|---|
| Tightening torque | Position control valve mounting screws | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |

(1) Position Control Valve



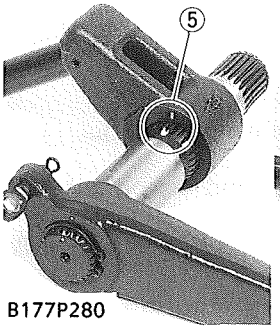

B177P234

### Lift Arm, Hydraulic Arm Shaft and Hydraulic Arm

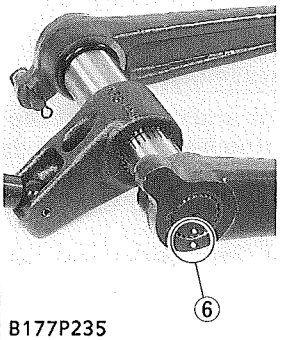
1. Remove the position control feedback rod (4).
2. Remove the external snap ring, and remove the lift arm LH (1).
3. Draw out the hydraulic arm shaft (3) and lift arm RH (2) as a unit.

**(When reassembling)**

- Align the alignment marks (5) of the hydraulic arm and hydraulic arm shaft.
- Align the alignment marks (6) of the lift arm LH and hydraulic arm shaft.
- Apply grease to the right and left bushings and O-rings.
- Take care not to damage the O-rings.

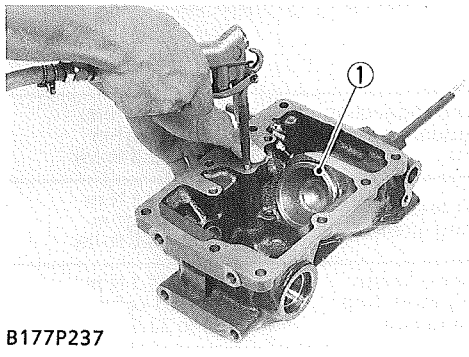



B177P280




B177P235

(1) Lift Arm LH
(2) Lift Arm RH
(3) Hydraulic Arm Shaft
(4) Feedback Rod
(5) Alignment Marks
(6) Alignment Marks



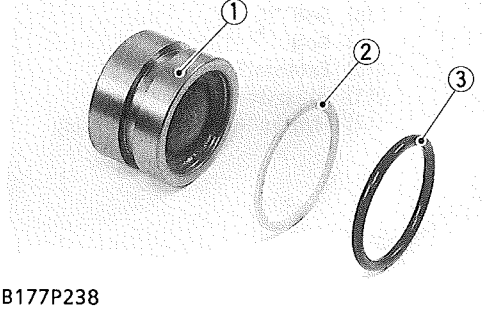

B177P237

### Hydraulic Piston

1. Inject the compressed air into the hydraulic cylinder, and take out the hydraulic piston (1).

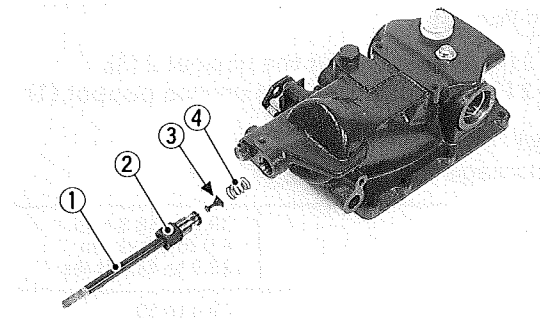
**(When reassembling)**

- Take care not to damage the O-ring and backup ring.
- Apply transmission fluid to the O-ring.
- Replace the O-ring if it is defective, worn or scratched, which may case oil leakage.




B177P238

(1) Hydraulic Piston
(2) Backup Ring
(3) O-ring



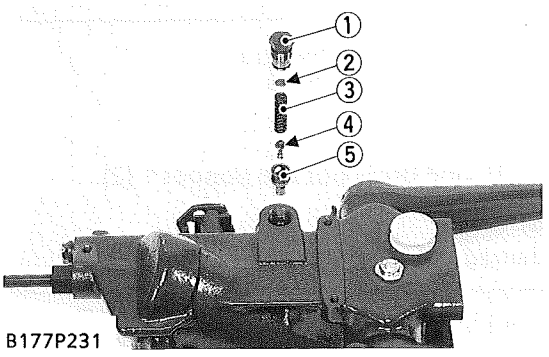
B177P242

### Lowering Speed Adjusting Valve

1. Remove the lowering speed adjusting valve body (2) with the lowering speed adjusting shaft (1).
2. Draw out the poppet (3) and spring (4).

**(When reassembling)**
- Take care not to damage the O-rings.

(1) Lowering Speed Adjusting Shaft
(2) Lowering Speed Adjusting Valve Body
(3) Poppet
(4) Spring



B177P231

### Relief Valve

1. Remove the plug (1), and draw out the shim (2), spring (3), poppet (4) and the valve seat (5).

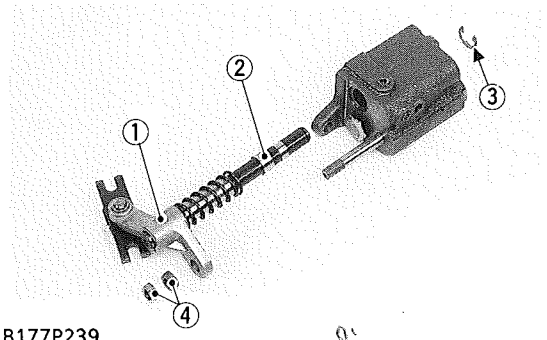
**(When reassembling)**
- Take care not to damage the O-ring.

| | | |
|---|---|---|
| Tightening torque | Relief valve plug | 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 disassembling and assembling the relief valve, be sure to adjust the relief valve setting pressure.**

(1) Plug
(2) Shim
(3) Spring
(4) Poppet
(5) Valve Seat

## (3) Disassembling Position Control Valve



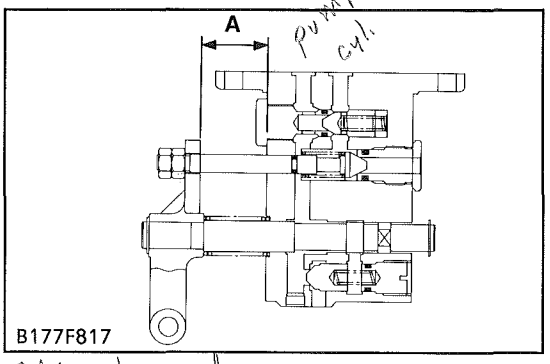
B177P239

### Spool

1. Remove the nuts (4) and snap ring (3).
2. Draw out the spool (2) with the lever (1).

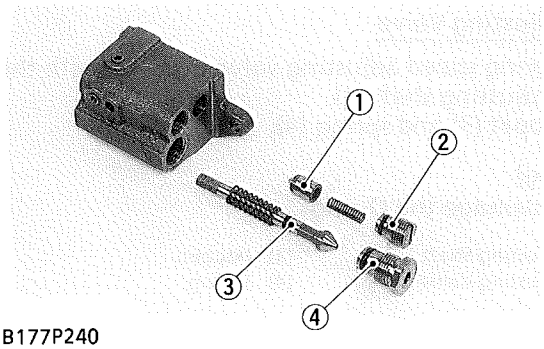
**■ IMPORTANT**
- **Measure the distance (A) between valve body and lever before disassembling.**

(1) Lever
(2) Spool
(3) Snap Ring
(4) Nuts



B177F817

Adjustment
Screw down on nuts until
Air shuts off then ½ turn more
And Lock




B177P240

## Poppet 2 and Unload Poppet

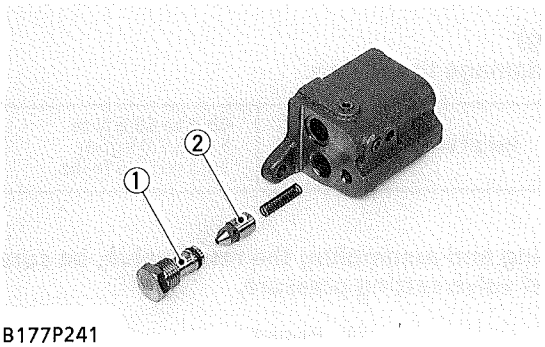
1. Remove the plug 3 (4), and draw out the poppet 2 (3).
2. Remove the plug 2 (2), and draw out the unload poppet (1).

**(When reassembling)**

- Take care not to damage the O-ring.

| | | |
|---|---|---|
| Tightening torque | Plug 3 | 39.2 to 58.8 N·m<br>4.0 to 6.0 kgf·m<br>28.9 to 43.4 ft-lbs |
| | Plug 2 | 29.4 to 49.0 N·m<br>3.0 to 5.0 kgf·m<br>21.7 to 36.2 ft-lbs |

(1) Unload Poppet
(2) Plug 2
(3) Poppet 2
(4) Plug 3




B177P241

## Poppet 1

1. Remove the plug 1 (1), and draw out the poppet 1 (2).

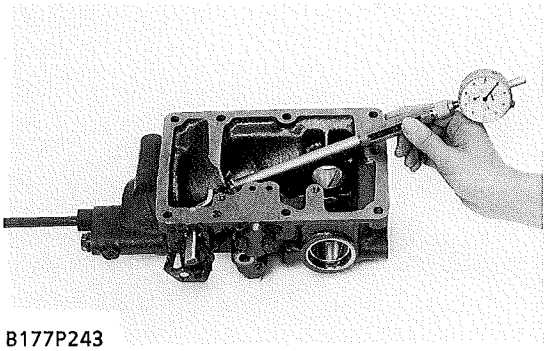
**(When reassembling)**

- Take care not to damage the O-ring.

| | | |
|---|---|---|
| Tightening torque | Plug 1 | 29.4 to 49.0 N·m<br>3.0 to 5.0 kgf·m<br>21.7 to 36.2 ft-lbs |

(1) Plug 1
(2) Poppet 1

# SERVICING



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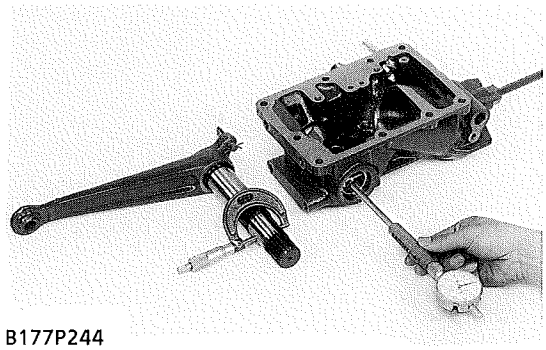


B177P244

## Hydraulic Cylinder Bore

1. Check the cylinder internal surface for scoring or damage.
2. Measure the cylinder I.D. with a cylinder gauge.
3. If the measurement exceeds the allowable limit, replace the hydraulic cylinder block.

| | | |
|---|---|---|
| Cylinder I.D. | Factory spec. | 70.05 to 70.10 mm<br>2.7579 to 2.7598 in. |
| | Allowable limit | 70.15 mm<br>2.7618 in. |

## Clearance between Hydraulic Arm Shaft and Bushing

1. Measure the hydraulic arm shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bushing.

| | | | |
|---|---|---|---|
| Clearance between hydraulic arm shaft and bushing | Right | Factory spec. | 0.020 to 0.110 mm<br>0.0008 to 0.0043 in. |
| | | Allowable limit | 0.30 mm<br>0.0118 in. |
| | Left | Factory spec. | 0.020 to 0.110 mm<br>0.0008 to 0.0043 in. |
| | | Allowable limit | 0.30 mm<br>0.0118 in. |
| Hydraulic arm shaft O.D. | Right | Factory spec. | 37.925 to 37.950 mm<br>1.4931 to 1.4941 in. |
| | Left | Factory spec. | 33.925 to 33.950 mm<br>1.3356 to 1.3366 in. |
| Bushing I.D. (after press fitted) | Right | Factory spec. | 37.970 to 38.035 mm<br>1.4949 to 1.4974 in. |
| | Left | Factory spec. | 33.970 to 34.035 mm<br>1.3374 to 1.3400 in. |

# MECHANISM

## CONTENTS

# [1] WIRING DIAGRAM AND ELECTRICAL CIRCUIT

## ■ With AC Dynamo

### • Main Switch

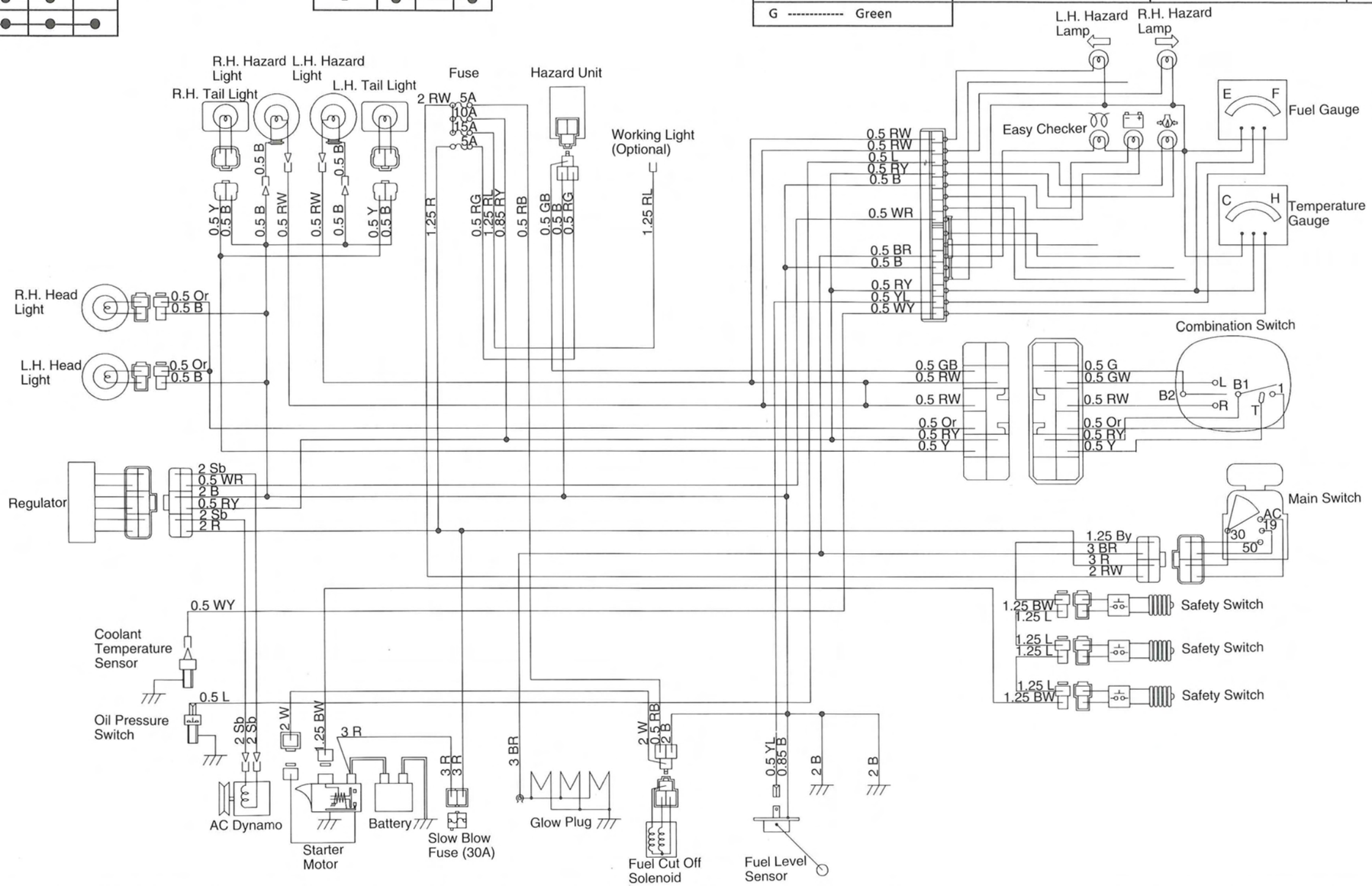
| Terminal / Key Position | 30 | AC | 19 | 50 |
|---|---|---|---|---|
| OFF | ● | | | |
| ON | ● | ● | | |
| PREHEAT | ● | ● | ● | |
| START | ● | ● | ● | ● |

### • Combination Switch

| Head Light Switch | | | | Hazard Light Switch | | | |
|---|---|---|---|---|---|---|---|
| | B1 | T | 1 | | B2 | R | L |
| OFF | ● | | | 1 | ● | ● | |
| ON | ● | ● | ● | OFF | ● | | |
| | | | | 2 | ● | | ● |

### • Color of Wiring

| | | | |
|---|---|---|---|
| W ---------- White | Or ---------- Orange | RL ---------- Red / Blue | BY ---------- Black / Yellow |
| R ---------- Red | WR ---------- White / Red | RG ---------- Red / Green | GW ---------- Green / White |
| L ---------- Blue | WY ---------- White / Yellow | RY ---------- Red / Yellow | GB ---------- Green / Black |
| Y ---------- Yellow | RB ---------- Red / Black | BW ---------- Black / White | Sb ---------- Sky Blue |
| B ---------- Black | RW ---------- Red / White | BR ---------- Black / Red | YL ---------- Yellow / Blue |
| G ---------- Green | | | |

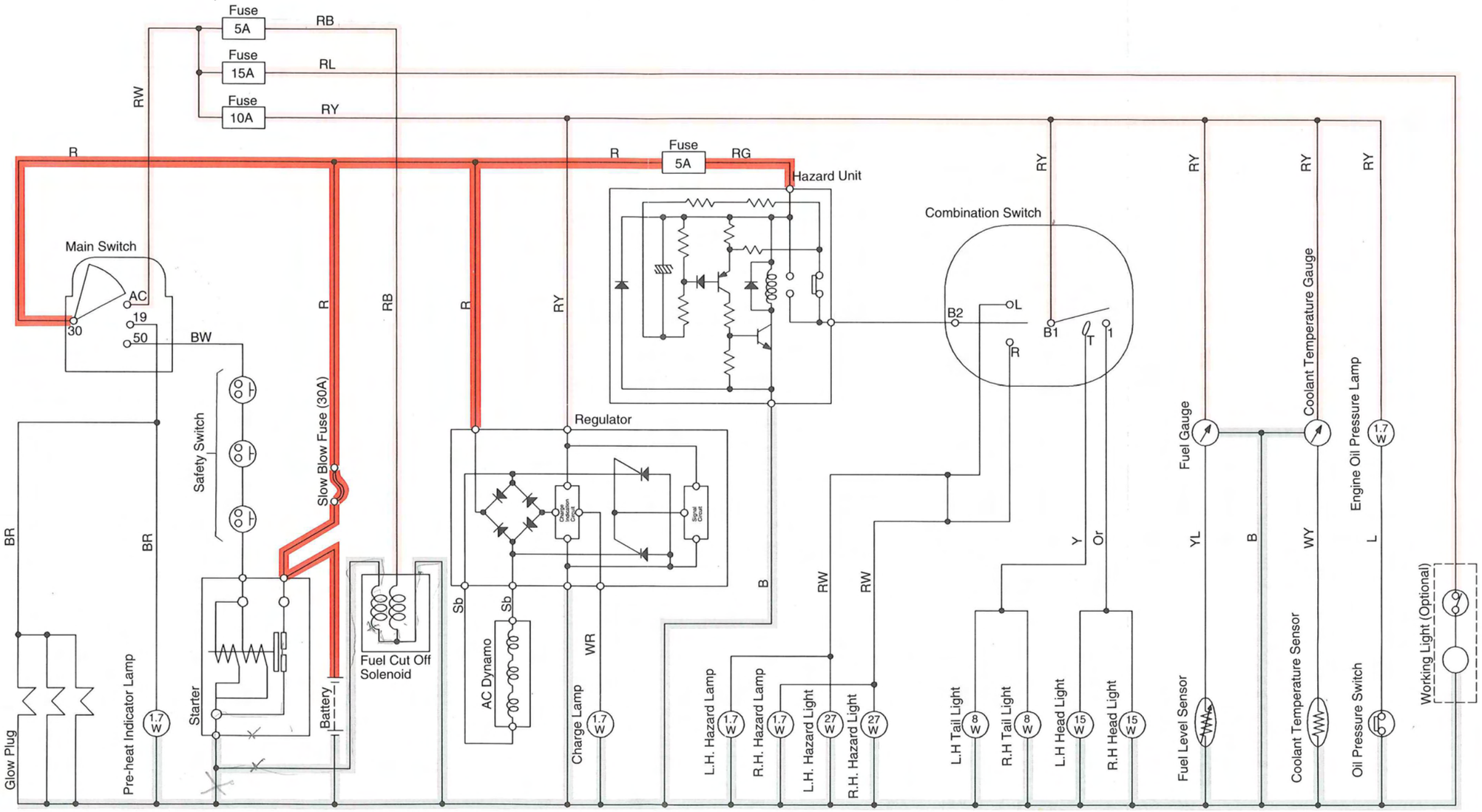



B177F901

## With AC Dynamo

### Color of Wiring

| | | | | | | |
|---|---|---|---|---|---|---|
| W ---------- White | Y ---------- Yellow | Or ---------- Orange | RB ---------- Red / Black | RG ---------- Red / Green | BR ---------- Black / Red | GB ---------- Green / Black |
| R ---------- Red | B ---------- Black | WR ---------- White / Red | RW ---------- Red / White | RY ---------- Red / Yellow | BY ---------- Black / Yellow | Sb ---------- Sky Blue |
| L ---------- Blue | G ---------- Green | WY ---------- White / Yellow | RL ---------- Red / Blue | BW ---------- Black / White | GW ---------- Green / White | YL ---------- Yellow / Blue |




Denotes battery voltage at any position of main switch.
Denotes battery voltage when turning on the main switch.
Denotes ground line.

B177F902

## With Alternator

### • Main Switch

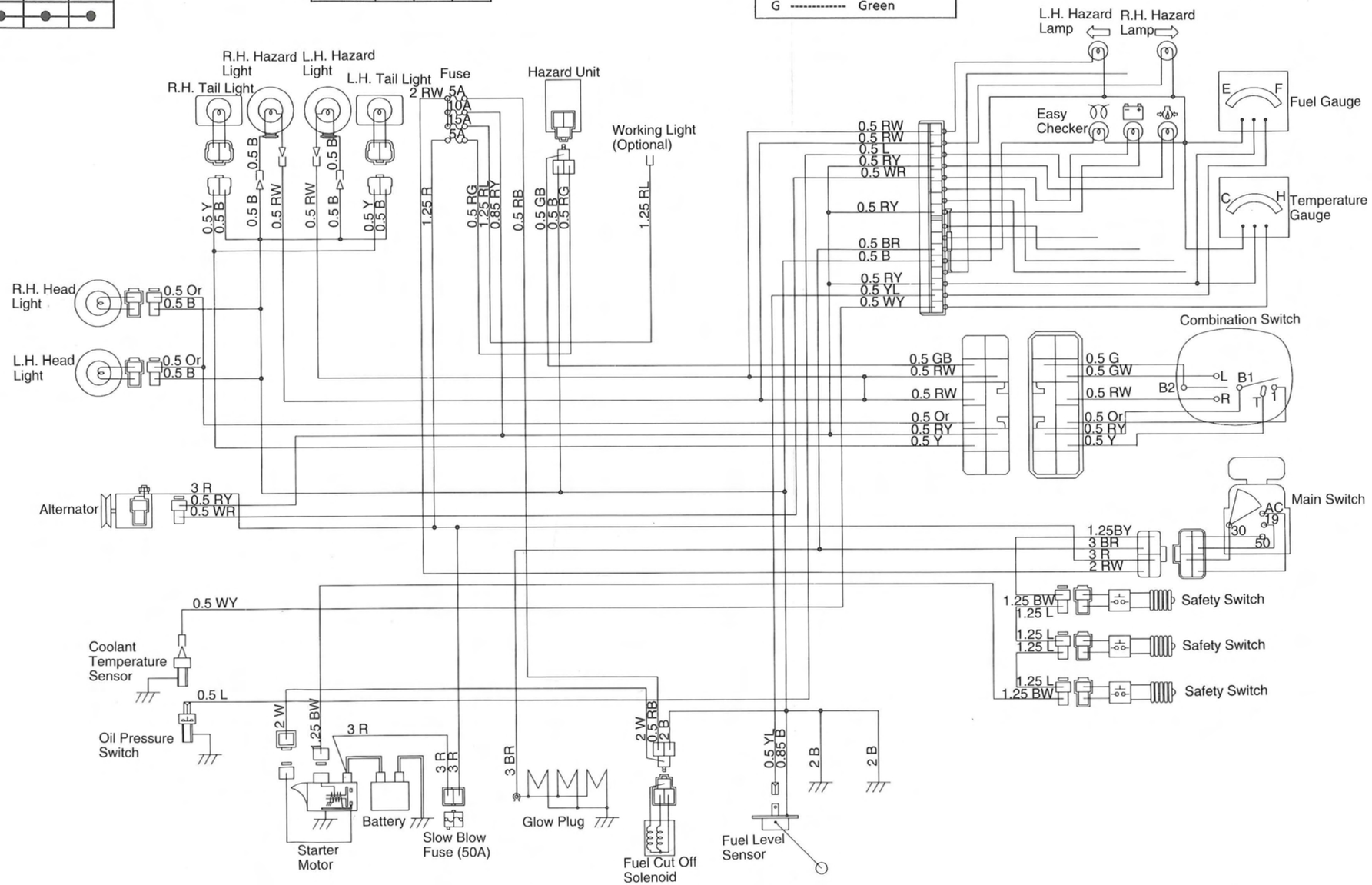
| Key Position \ Terminal | 30 | AC | 19 | 50 |
|---|---|---|---|---|
| OFF | ● | | | |
| ON | ● | ● | | |
| PREHEAT | ● | ● | ● | |
| START | ● | ● | ● | ● |

### • Combination Switch

| Head Light Switch | | | | Hazard Light Switch | | | |
|---|---|---|---|---|---|---|---|
| | B1 | T | 1 | | B2 | R | L |
| OFF | ● | | | 1 | ● | ● | |
| ON | ● | ● | ● | OFF | ● | | |
| | | | | 2 | ● | | ● |

### • Color of Wiring

| | | | |
|---|---|---|---|
| W ---------- White | Or ---------- Orange | RL ---------- Red / Blue | BY ---------- Black / Yellow |
| R ---------- Red | WR ---------- White / Red | RG ---------- Red / Green | GW ---------- Green / White |
| L ---------- Blue | WY ---------- White / Yellow | RY ---------- Red / Yellow | GB ---------- Green / Black |
| Y ---------- Yellow | RB ---------- Red / Black | BW ---------- Black / White | Sb ---------- Sky Blue |
| B ---------- Black | RW ---------- Red / White | BR ---------- Black / Red | YL ---------- Yellow / Blue |
| G ---------- Green | | | |

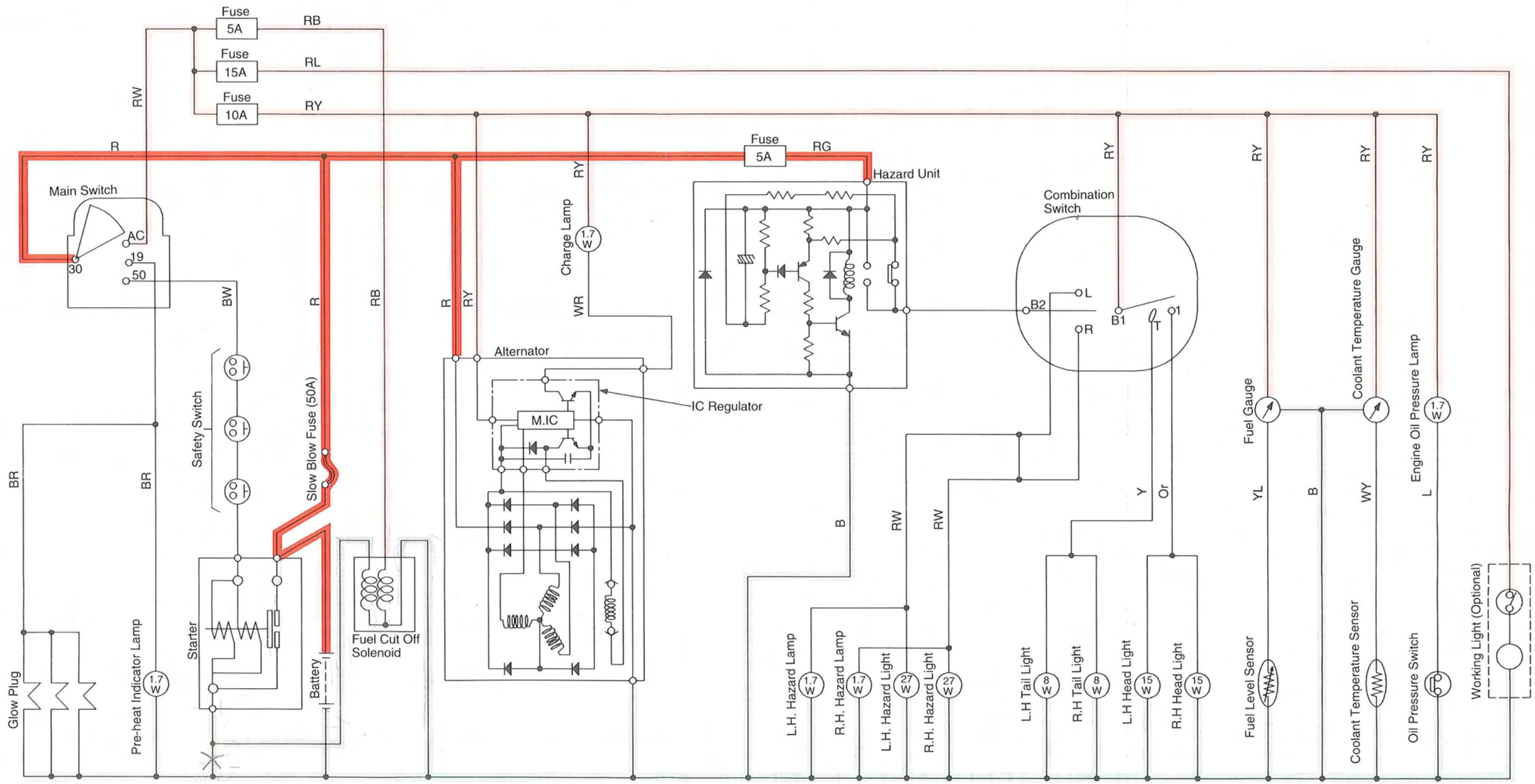



B177F903

## With Alternator

### Color of Wiring

| | | | | | | |
|---|---|---|---|---|---|---|
| W ---------- White | Y ---------- Yellow | Or ---------- Orange | RB ---------- Red / Black | RG ---------- Red / Green | BR ---------- Black / Red | GB ---------- Green / Black |
| R ---------- Red | B ---------- Black | WR ---------- White / Red | RW ---------- Red / White | RY ---------- Red / Yellow | BY ---------- Black / Yellow | Sb ---------- Sky Blue |
| L ---------- Blue | G ---------- Green | WY ---------- White / Yellow | RL ---------- Red / Blue | BW ---------- Black / White | GW ---------- Green / White | YL ---------- Yellow / Blue |



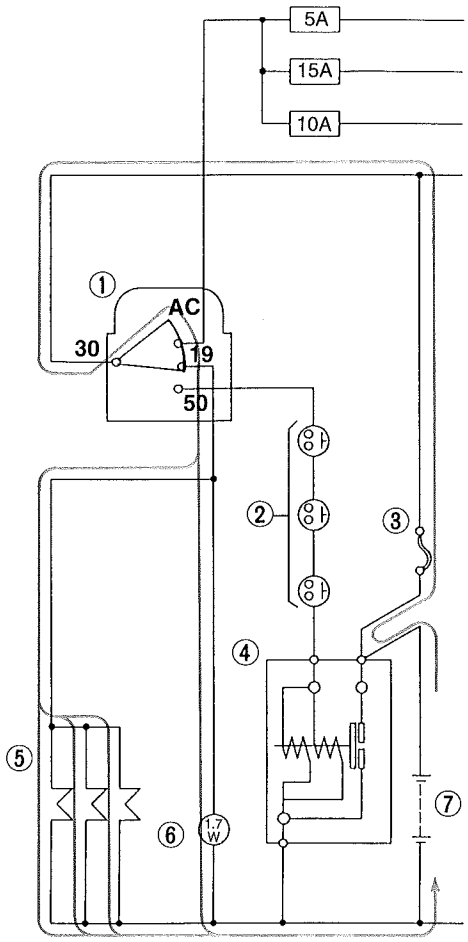

Denotes battery voltage at any position of main switch.
Denotes battery voltage when turning on the main switch.
Denotes ground line.

B177F904

# [2] STARTING SYSTEM

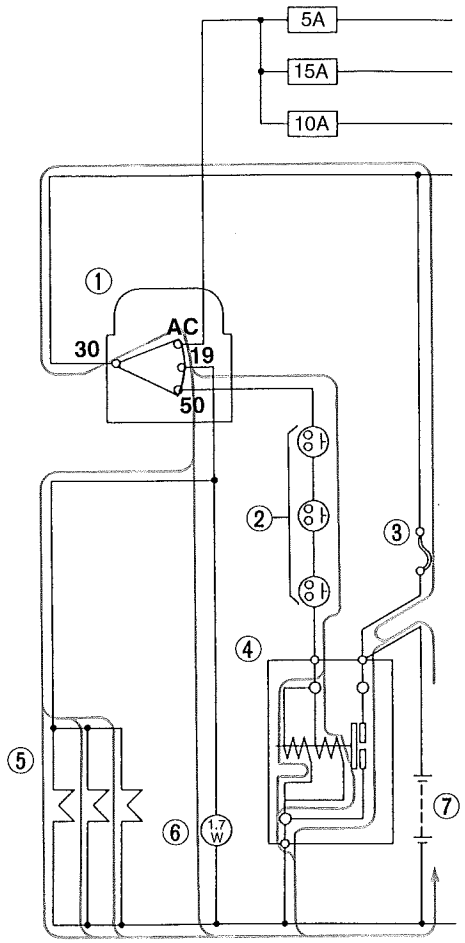
| Main Switch Table | | | | |
|---|---|---|---|---|
| Terminal / Key Position | 30 | AC | 19 | 50 |
| OFF | ● | | | |
| ON | ● | ● | | |
| PREHEAT | ● | ● | ● | |
| START | ● | ● | ● | ● |

**At the "PREHEAT" Position**




B177F905

**At the "START" Position**




B177F906

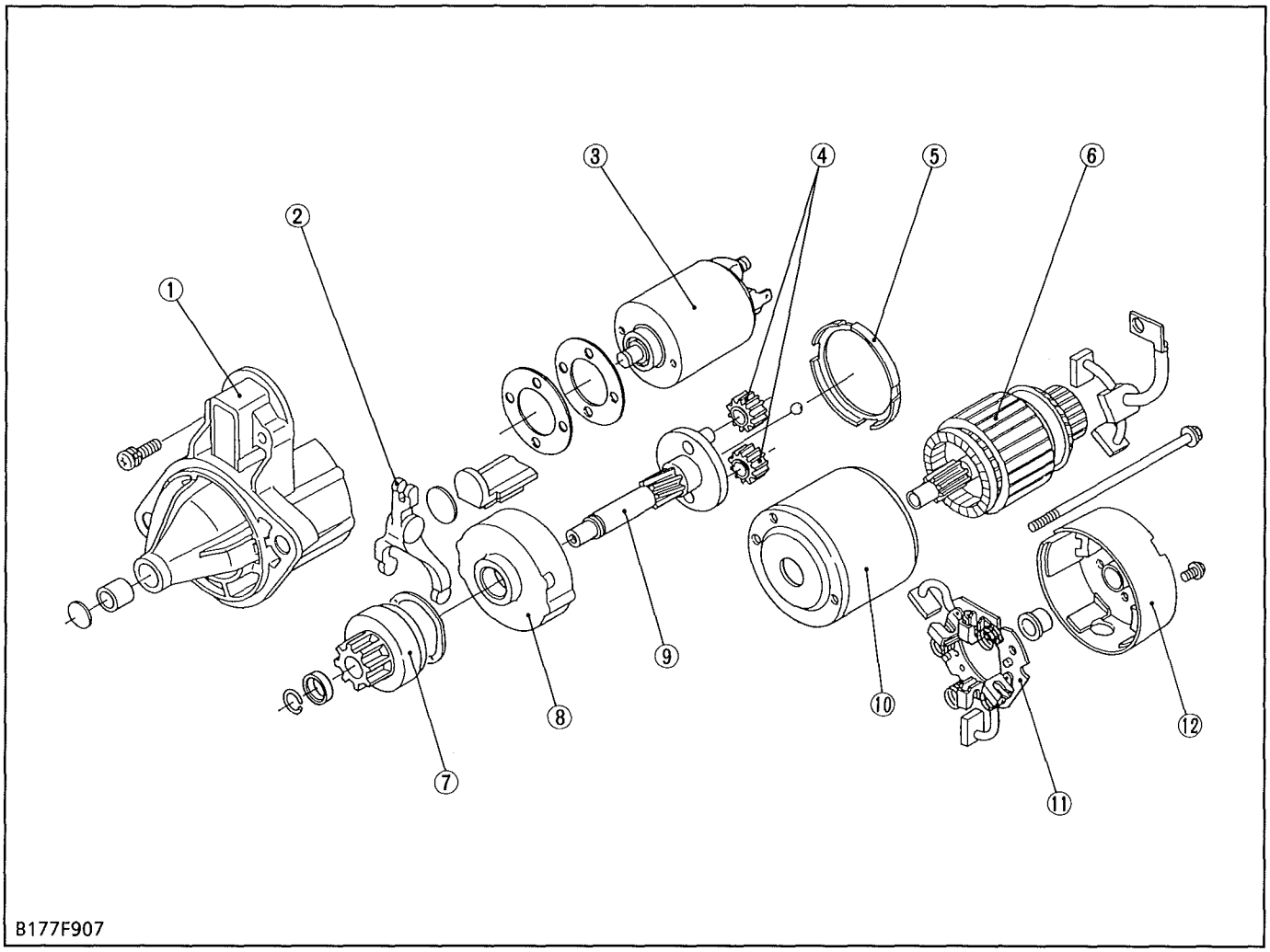
(1) Main Switch
(2) Safety Switches
(3) Slow Blow Fuse
(4) Starter Motor
(5) Glow Plugs
(6) Pre-heat Indicator Lamp
(7) Battery

When the main switch (1) is turned to the **PREHEAT** position, the terminal **30** is connected to the terminals **19** and **AC**. The glow plugs (5) become red-hot, and at the same time, the pre-heat indicator lamp (6) also lights on.

When the main switch is then turned to the **START** position with the safety switches (2) on, the terminal **30** is connected to the terminals **50** and **AC** so that the starter motor (4) begins running and the glow plugs are kept red-hot.

The main switch automatically returns to the **ON** position, the terminal **30** is connected only to the terminal **AC**, thereby causing the starting circuit to be opened, stopping the starter motor.

## (1) Starter

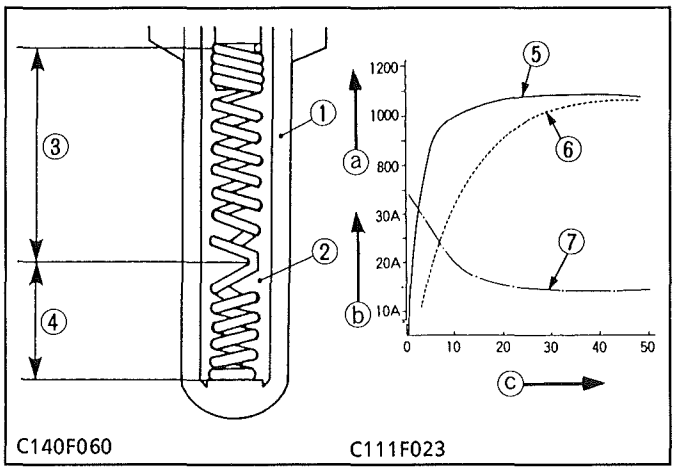



B177F907

(1) Front Bracket
(2) Lever
(3) Magnetic Switch
(4) Pinion Gear
(5) Gasket
(6) Armature Shaft
(7) Overrunning Clutch
(8) Internal Gear
(9) Gear Shaft
(10) Yoke
(11) Brush Holder
(12) Rear Bracket

The starter is a reduction type.
The reduction system is used planetary gears, and the speed of gear shaft (9) is reduced to approximately one fifth of the armature shaft (6).

## (2) Glow Plug




(a) Glow Plug Temperature (°C)
(b) Current (A)
(c) Time (Sec.)

(1) Sheath Tube
(2) Insulation Powder
(3) Heater also functioning as a Resistor
(4) Heater
(5) Super Glow Plug
(6) Conventional Quick-heating type Glow Plug
(7) Glow Plug Current

This plug is a two-material type QGS (Quick Glow System) for quick temperature rise, and has self-controlling function as well as excellent durability.

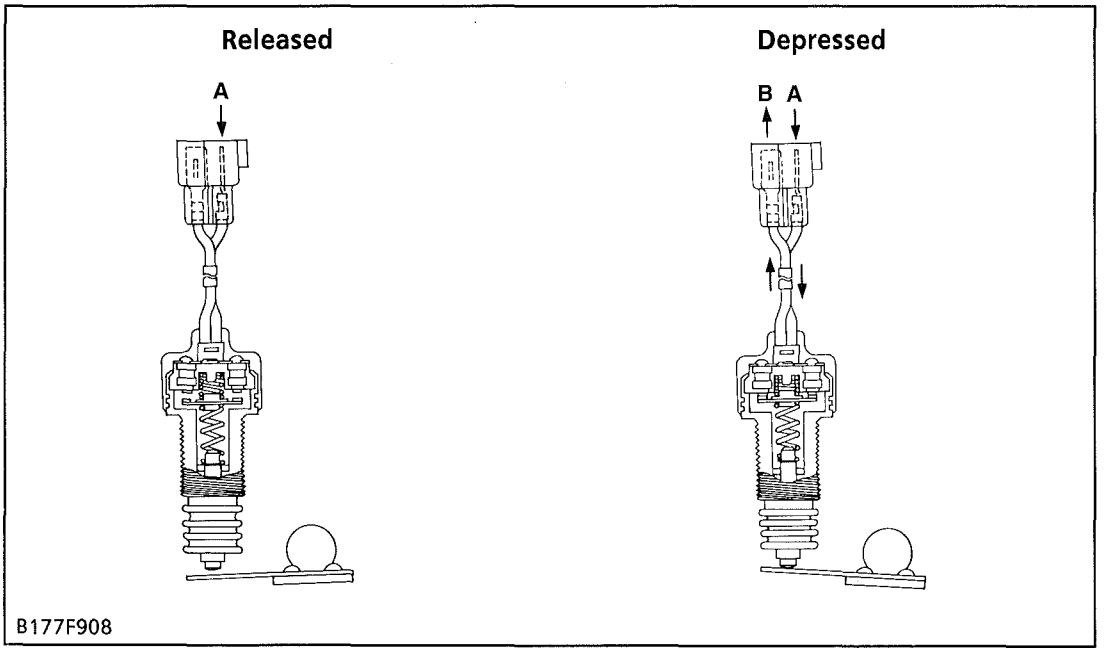
The heater (4) connected in series to the heater (3), which also functions as the resistor, is incorporated in the sheath tube (1) of the super glow plug.

The resistance of this heater (3) cum resistor is small when the temperature is low, while the resistance becomes large when the temperature rises.

Therefore, because sufficient current is flown to the heater (4) during the initial period of energization, the temperature rises quickly and the resistance grows with the rise in the temperature of the resistor, the flowing current is reduced to prevent the heater (4) from being heated.

The ignition point is in the area of 2 to 3 mm (0.079 to 0.118 in.) from the tip of the plug in order to reduce its projection into the combustion chamber.

## (3) Safety Switch

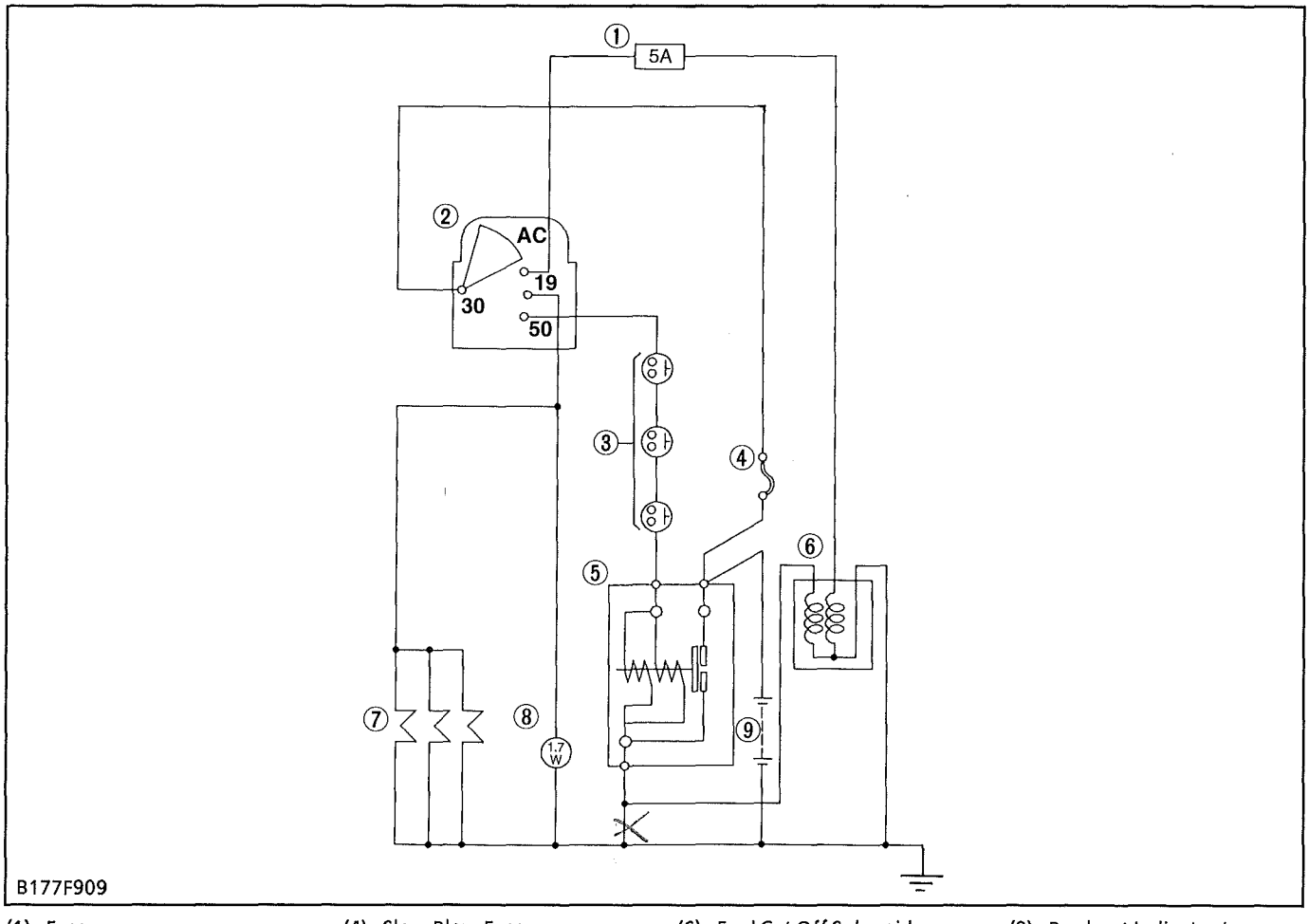



A: From Main Switch
B: To Starter

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

The safety switches are located three (Clutch pedal, PTO gear shift lever and main gear shift lever for manual transmission model or Hi-Lo gear shift lever for hydrostatic transmission model) different position.

# [3] ENGINE KEY SWITCH SHUT-OFF SYSTEM

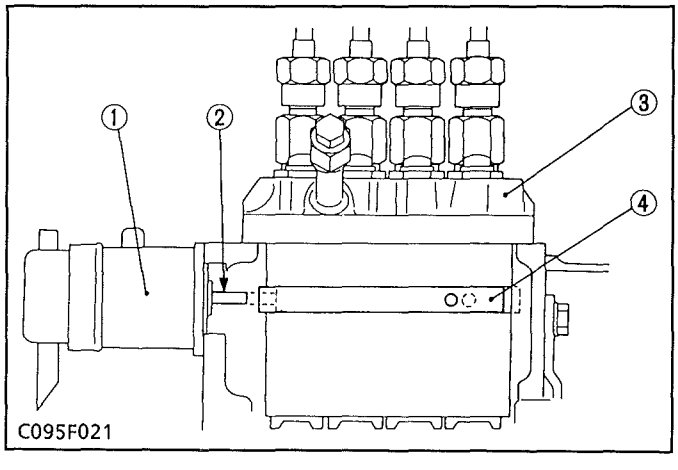



B177F909

(1) Fuse
(2) Main Switch
(3) Safety Switches
(4) Slow Blow Fuse
(5) Starter Motor
(6) Fuel Cut Off Solenoid
(7) Glow Plugs
(8) Pre-heat Indicator Lamp
(9) Battery

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.

## (1) Fuel Cut Off Solenoid



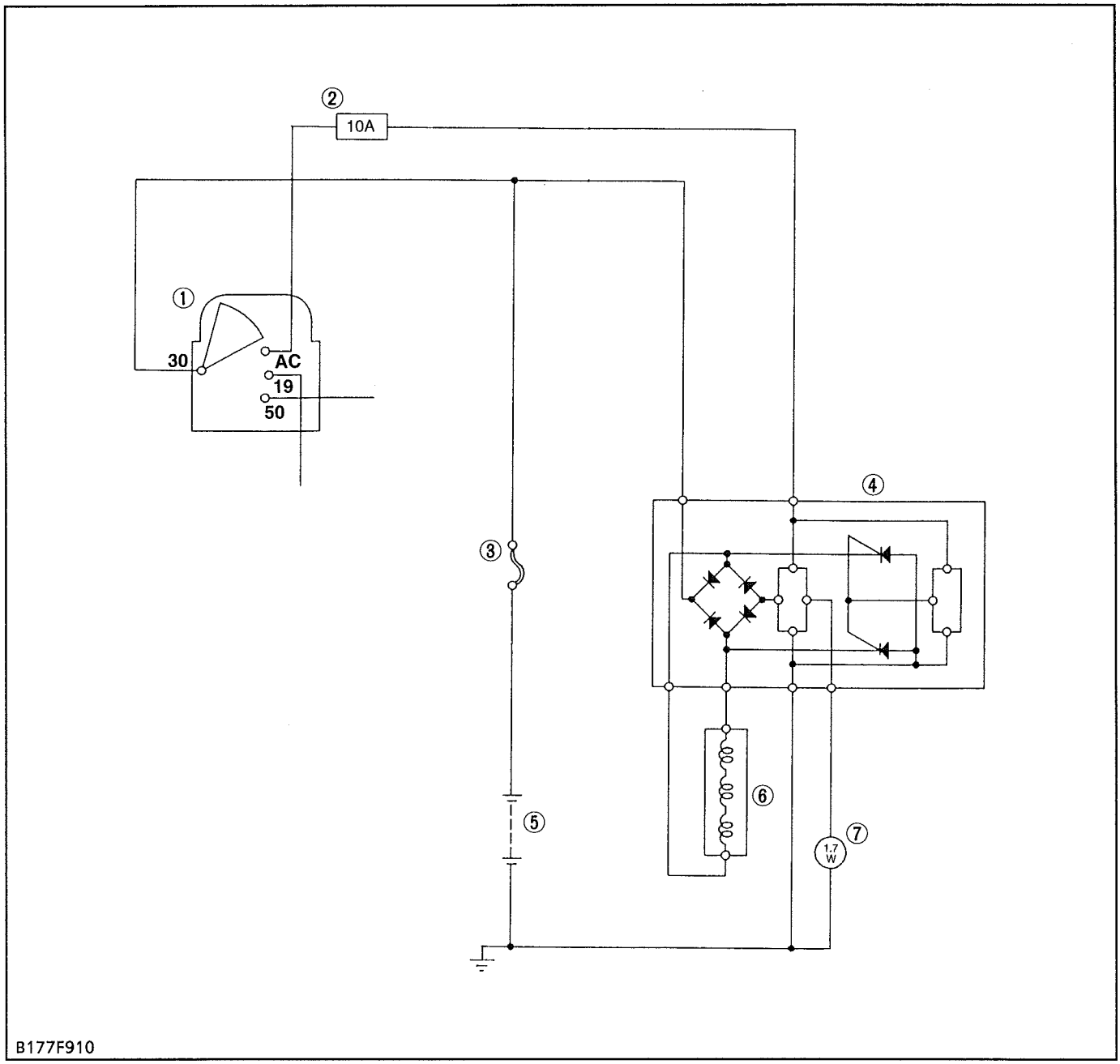

C095F021

Flowing of the battery current into the fuel cut off solenoid, the plunger (2) move to left side so that the movement of control rack (4) becomes free. When the battery current stops, the plunger (2) is returned to the original position by the spring to keep the control rack (4) in "No fuel injection" position.

(1) Fuel Cut Off Solenoid
(2) Plunger
(3) Injection Pump
(4) Control Rack

# [4] CHARGING SYSTEM

## ■ With AC Dynamo

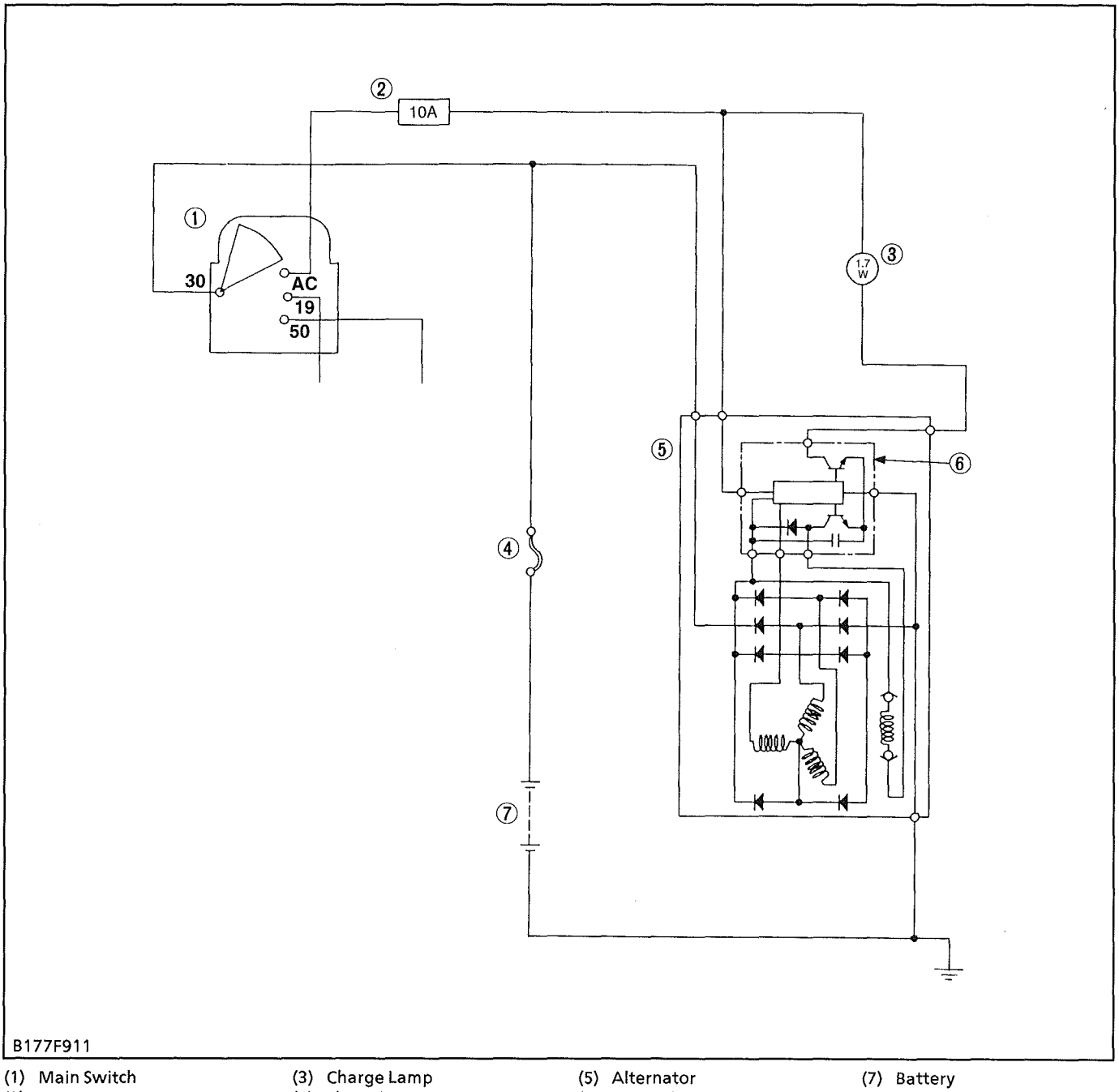



(1) Main switch
(2) Fuse
(3) Slow Blow Fuse
(4) Regulator
(5) Battery
(6) AC Dynamo
(7) Charge Lamp

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

It consists of a AC dynamo and a regulator.

## ■ With Alternator

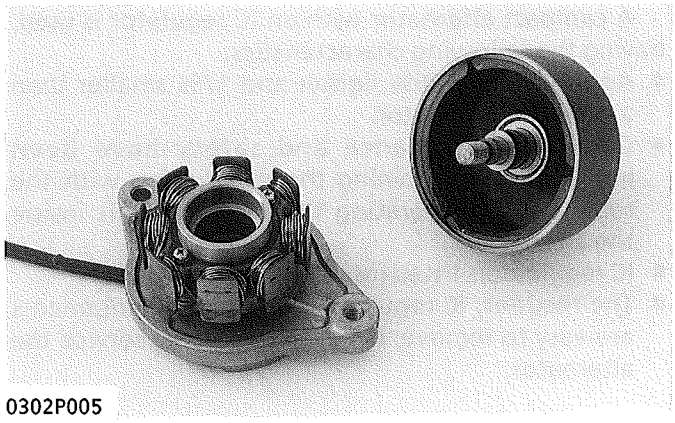



(1) Main Switch
(2) Fuse
(3) Charge Lamp
(4) Slow Blow Fuse
(5) Alternator
(6) IC Regulator
(7) Battery

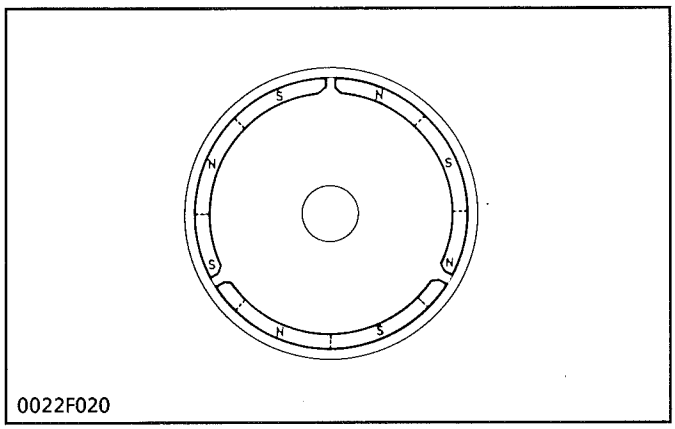
The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

This alternator has IC regulator.

## (1) AC Dynamo



0302P005

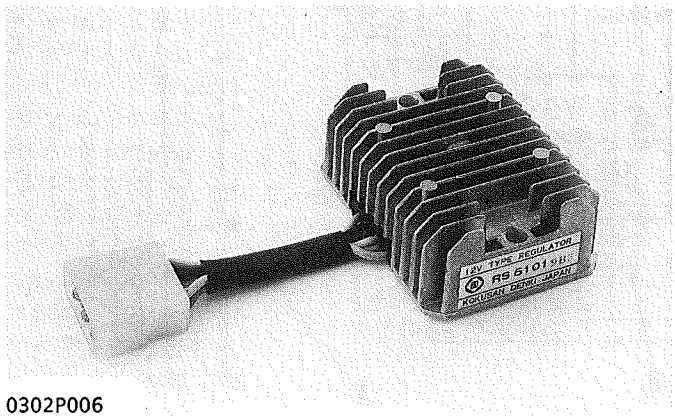



0022F020

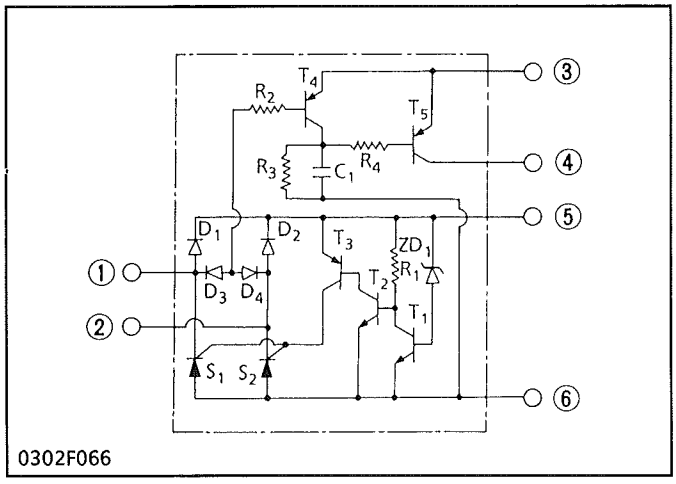
This dynamo is an 8-8 pole rotating magnet type generator. It is simple in construction, consisting of a stator and rotor. The rotor is made up of eight permanent magnet pole pieces assembled on a shaft and rotates on the center of the stator around which eight electromagnetic coils are provided for.

This dynamo produces higher voltage in slow speed rotation, and charges electric current to the battery during engine idling.

## (2) Regulator




0302P006



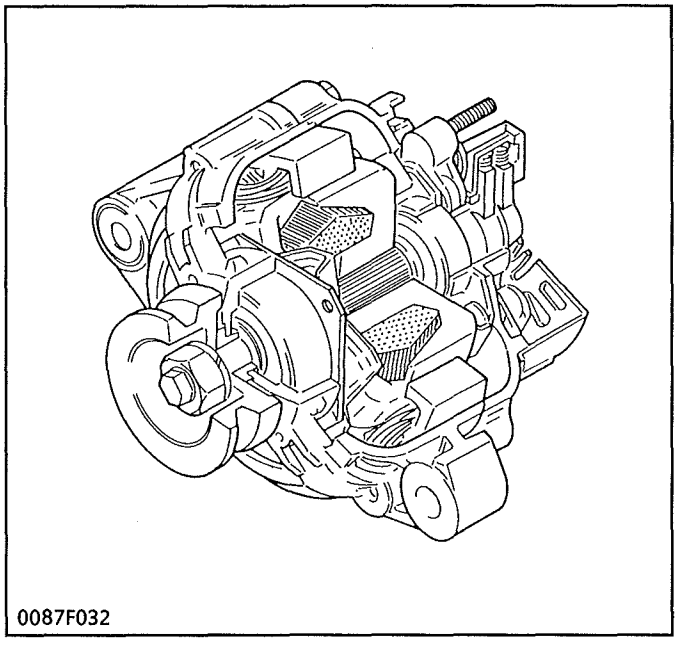

0302F066

A regulator has two functions:

1. When the battery voltage is low, it turns the SCR on to form a charging circuit to the battery.
2. During charging, it turns the charging lamp off.

(1) Light Blue (AC Dynamo)
(2) Light Blue (AC Dynamo)
(3) Yellow (Main Switch Terminal AC)
(4) Green (Charge Lamp)
(5) Red (Main Switch Terminal No.30)
(6) Black (Ground)
C1: Capacitor
D1: Diode
D2: Diode
D3: Diode
D4: Diode
R1: Resistor
R2: Resistor
R3: Resistor
R4: Resistor
S1: SCR (Silicon Controlled Rectifier)
S2: SCR (Silicon Controlled Rectifier)
T1: Transistor
T2: Transistor
T3: Transistor
T4: Transistor
T5: Transistor
ZD1: Zener Diode

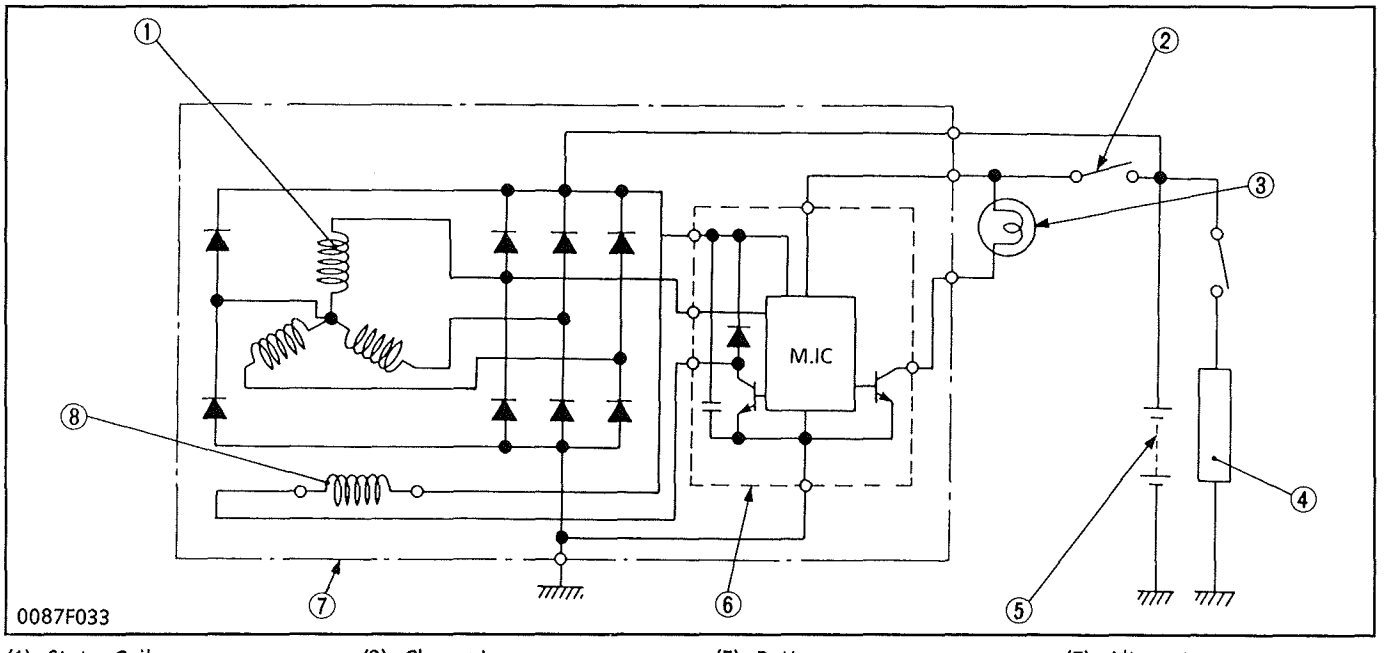
## (3) Alternator


0087F032

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.

## (4) 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:

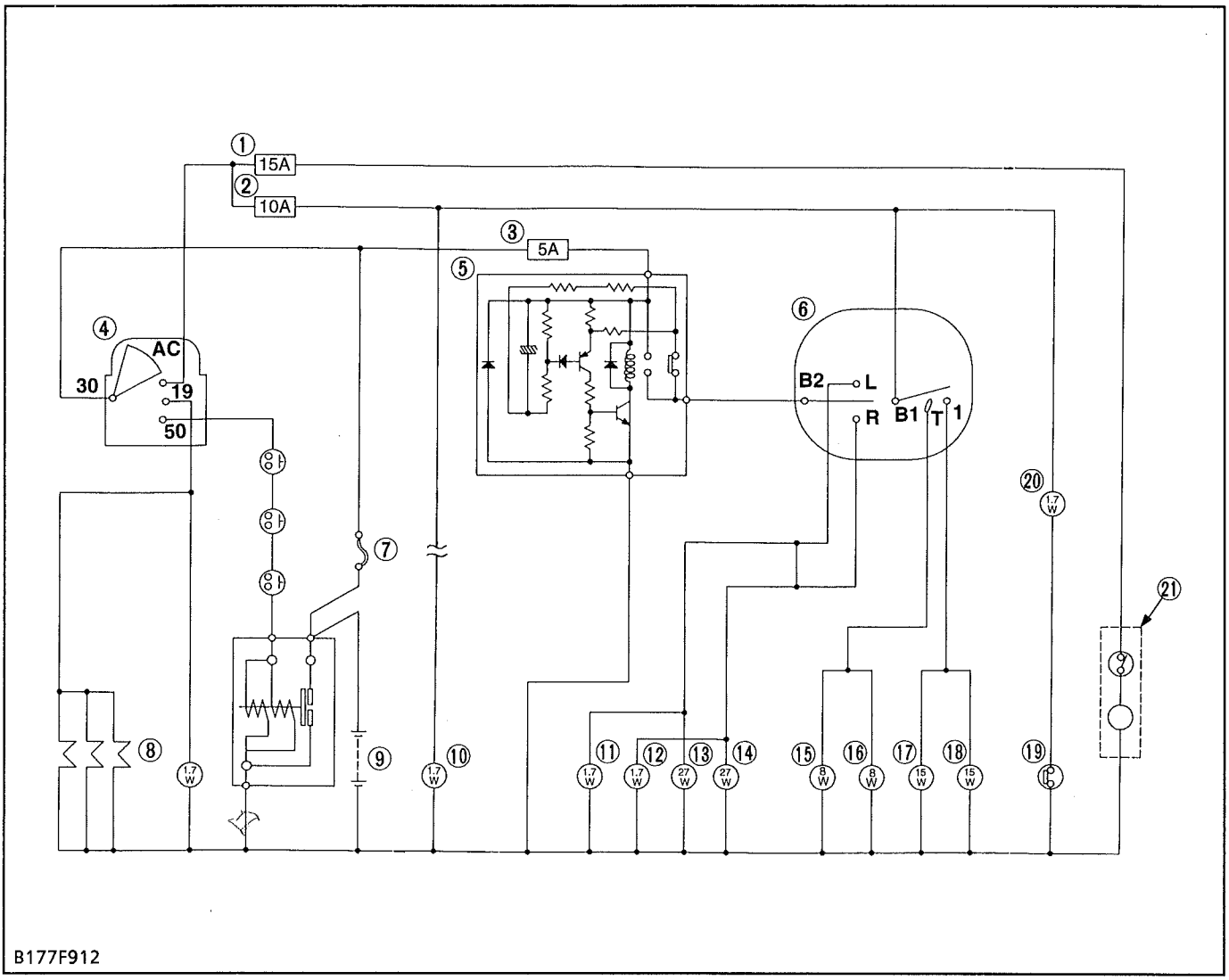
- The control voltage does not change over time, so the need for readjustment is eliminated. Since there are no moving parts, IC regulators are extremely durable and resistant to vibration.
- The overheat compensation characteristics ensure that the control voltage is reduced as the temperature rises, 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 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.

# [5] LIGHTING SYSTEM

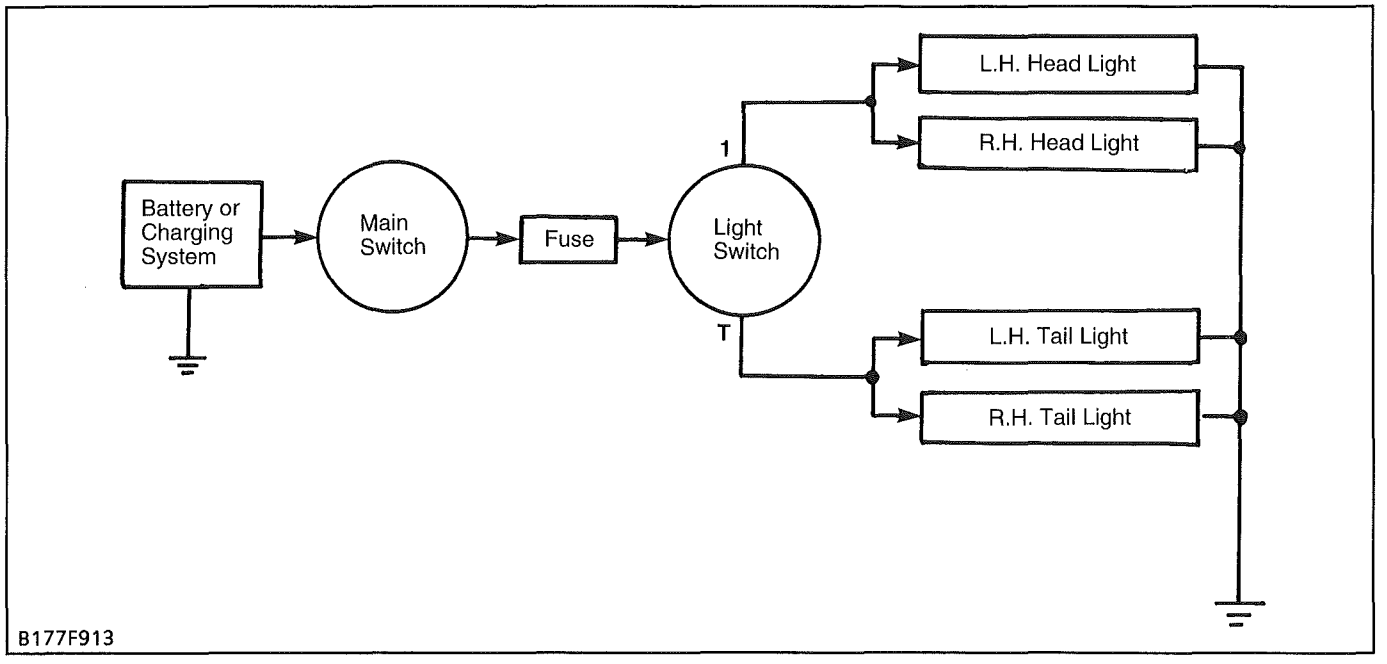



B177F912

(1) Fuse
(2) Fuse
(3) Fuse
(4) Main Switch
(5) Hazard Unit
(6) Combination Switch
(7) Slow Blow Fuse
(8) Pre-heat Indicator Lamp
(9) Battery
(10) Charge Lamp
(11) L.H. Hazard Lamp
(12) R.H. Hazard Lamp
(13) L.H. Hazard Light
(14) R.H. Hazard Light
(15) L.H. Tail Light
(16) R.H. Tail Light
(17) L.H. Head Light
(18) R.H. Head Light
(19) Oil Pressure Switch
(20) Engine Oil Pressure Lamp
(21) Working Light (Optional)

The lighting system consists of combination switch (light switch and hazard switch), head lights, tail lights, hazard unit, hazard lights, pilot lamps, etc.

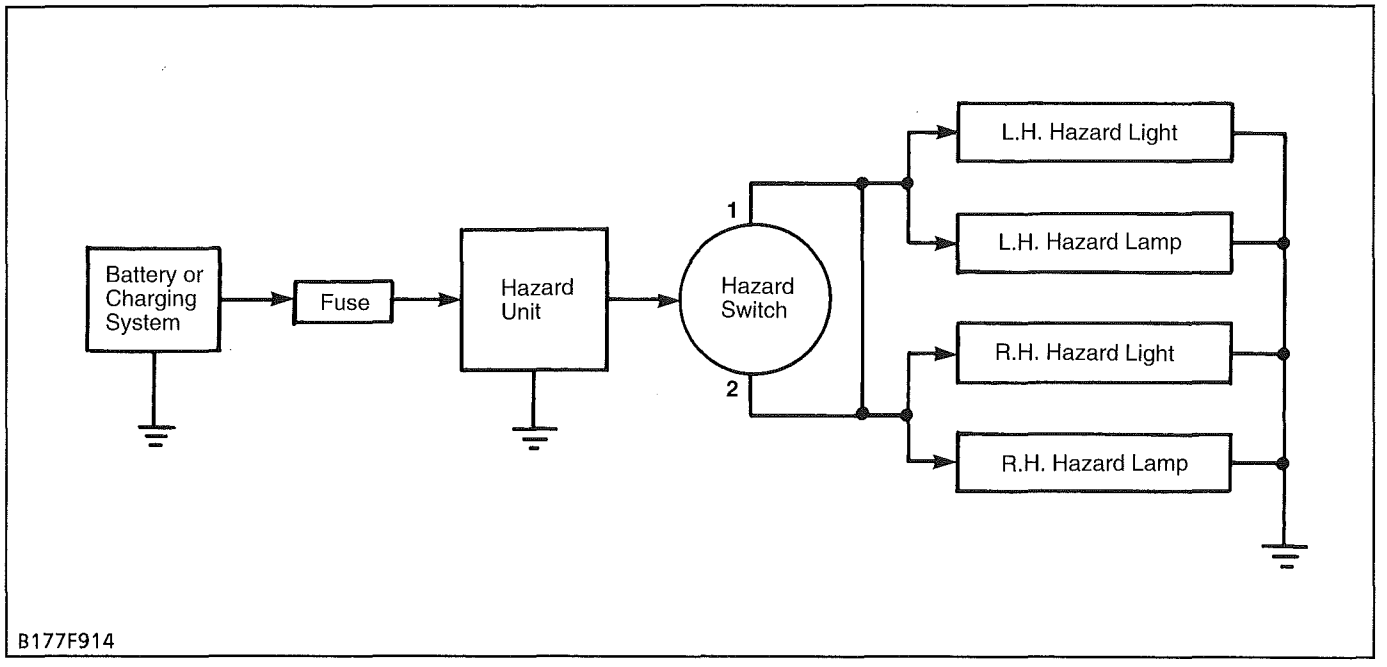
## (1) Head Light




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

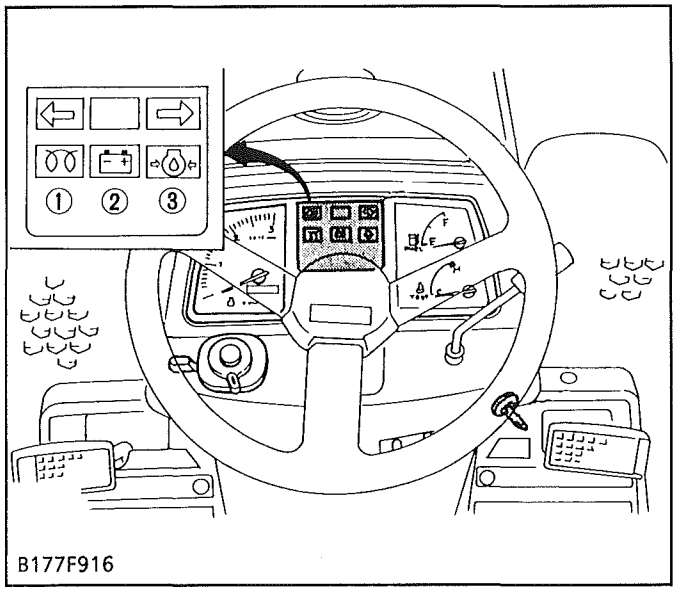



The hazard switch, which forms a combination switch with the light switch, has three positions; **OFF**, **1** and **2**. At either switch lever position of **1** or **2**, current flows to the same circuit, blinking the hazard lights and indicator lamps as shown in the figure above.

# [6] EASY CHECKER

To check the conditions of tractor easily before and during operation, easy checker combination of lamps on the easy checker board is provided.

## (1) Indication Items




B177F916

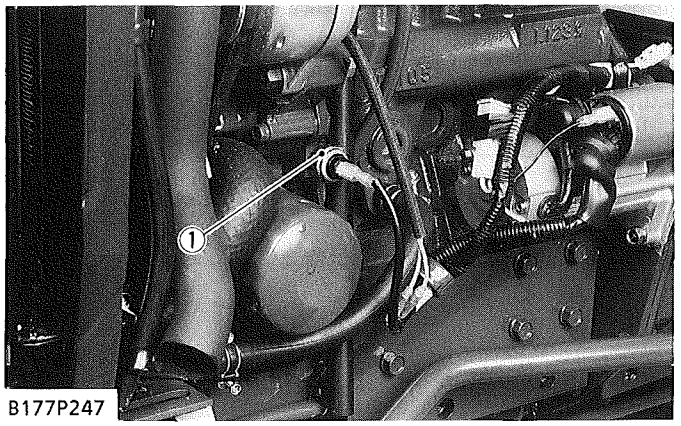
Pre-heat Indicator Lamp
When the key switch is in the "Preheat" position, the pre-heat indicator lamp illuminates.

Charge Lamp
When the charging system is not functioning properly, this lamp illuminates.

Oil Pressure Lamp
When the engine oil pressure is low, this lamp illuminates.

(1) Pre-heat Indicator Lamp
(2) Charge Lamp
(3) Oil Pressure Lamp

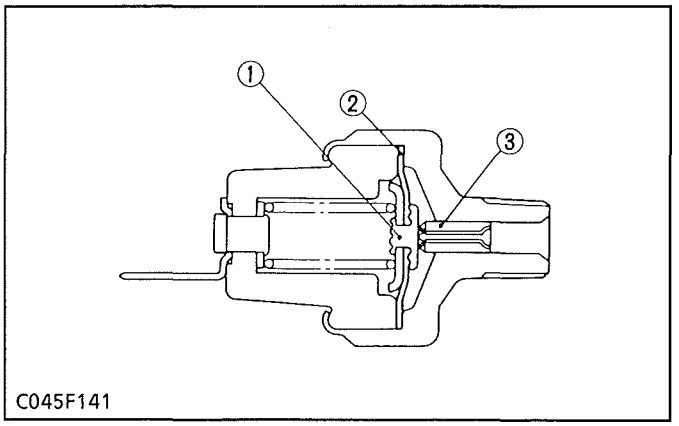
## (2) Low Engine Oil Pressure




B177P247

Low engine oil pressure is detected by the oil switch installed in the lubricating system of engine.

(1) Oil Pressure Switch



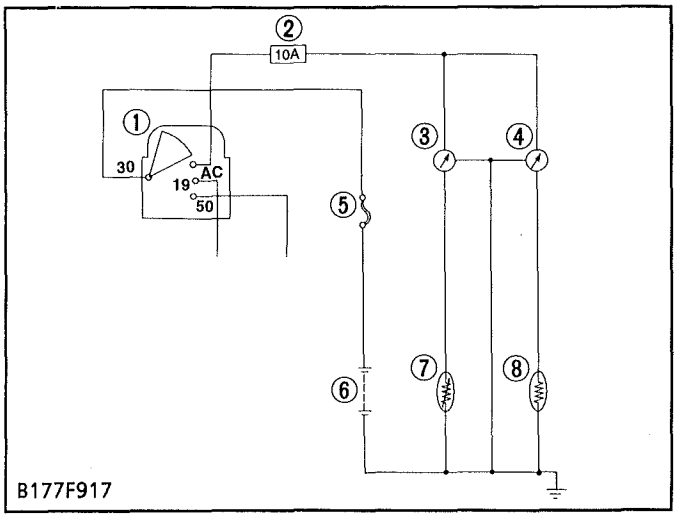

C045F141

### ■ Oil Pressure Switch

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

(1) Terminal Contact
(2) Diaphragm
(3) Body Contact

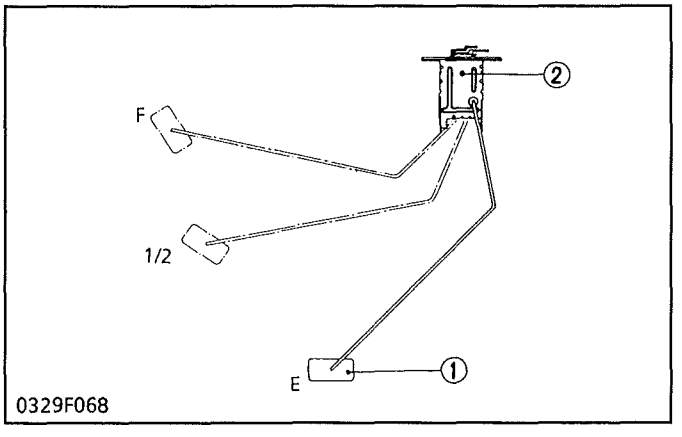
# [7] GAUGE




(1) Main Switch
(2) Fuse
(3) Fuel Gauge
(4) Water Temperature Gauge
(5) Slow Blow Fuse
(6) Battery
(7) Fuel Level Sensor
(8) Water Temperature Sensor

The fuel quantity and coolant temperature are indicated by the ammeters. The ammeters indicate each amperate flowing through the fuel level sensor (7) for the fuel quantity detection and through the coolant temperature sensor (8) for the coolant temperature detection.

## (1) Fuel Quantity




(1) Float
(2) Variable Resistor

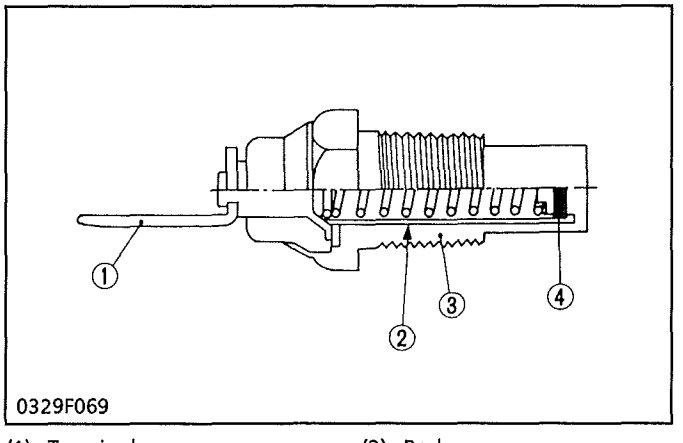
### ■ Fuel Level Sensor

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

As the float (1) lowers, the resistance of the variable resistor (2) varies. The relation between the amount of fuel and the resistance is as follows.

| F | 1/2 | E (Remaining fuel of approx. 3.0 ℓ, 0.79 U.S. gal, 0.66 Imp.gal) |
|---|---|---|
| 1 to 5 Ω | 28.5 to 36.5 Ω | 103 to 117 Ω |

## (2) Coolant Temperature




(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) | 153.9 Ω |
| 80°C (176°F) | 51.9 Ω |
| 105°C (221°F) | 23.6 Ω |
| 130°C (266°F) | 12.2 Ω |

# SERVICING

## CONTENTS

# TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **All Electrical Equipments Do Not Operate** | • Battery discharged or defective | Recharge or Replace | 9-S4 |
| | • Battery positive cable disconnected or improperly connected | Repair or Replace | 9-S4 |
| | • Battery negative cable disconnected or improperly connected | Repair or Replace | 9-S4 |
| | • Slow blow fuse blown | Replace | — |
| **Fuse Blown Frequently** | • Short-circuited | Repair or Replace | — |

## BATTERY

| | | | |
|---|---|---|---|
| **Battery Discharges Too Quickly** | • Battery defective | Recharge or Replace | 9-S4 |
| | • Dynamo defective | Repair or Replace | 9-S14 |
| | • Regulator defective | Replace | 9-S14 |
| | • Wiring harness disconnectd or improperly connected (between battery positive terminal and regulator **B** terminal, and between regulator and dynamo) | Repair or Replace | 9-S14 |
| | • Alternator defective | Repair or Replace | 9-S14 |
| | • IC Regulator defective | Replace | 9-S17 |
| | • Wiring harness disconnected or improperly connected (between battery positive terminal and alternator **B** terminal. | Repair or Replace | 9-S15 |
| | • Cooling fan belt slipping | Adjust tension | G-19 |

## STARTING SYSTEM

| | | | |
|---|---|---|---|
| **Starter Motor Does Not Operate** | • Battery discharged or defective | Recharge or Replace | 9-S4 |
| | • Slow blow fuse blown | Replace | — |
| | • Safety switch improperly adjusted or defective | Repair or Replace | G-14 |
| | • Wiring harness disconnected or improperly connected (between main switch **50** terminal and safety switches, between safety switches and starter motor, between battery positive terminal and starter motor) | Repair or Replace | 9-S7 |
| | • Starter motor defective | Repair or Replace | 9-S10 |
| | • Main switch defective | Replace | 9-S7 |
| **Pre-heat Indicator Lamp Does Not Light When Main Switch is in Pre-heat Position** | • Battery discharged or defective | Recharge or Replace | 9-S4 |
| | • Slow blow fuse blown | Replace | — |
| | • Wiring harness disconnected or improperly connected (between main switch **19** terminal and pre-heat indicator, between pre-heat indicator and glow plugs) | Repair or Replace | 9-S7 |
| | • Main switch defective | Replace | 9-S7 |
| | • Pre-heat indicator defective | Replace | 9-S9 |

## ENGINE KEY SWITCH SHUT-OFF SYSTEM

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Engine Does Not Stop When Main Switch is Turned Off** | • Fuse blown (5A)<br>• Wiring harness disconnected or improperly connected (between main switch **AC** terminal and fuel cut off solenoid)<br>• Fuel cut off solenoid defective | Replace<br>Repair or Replace<br>Replace | —<br>9-S13<br>— |
| **Engine Does Not Start** | • Fuel cut off solenoid defective | Replace | — |

## CHARGING SYSTEM

| | | | |
|---|---|---|---|
| **Charging Lamp Does Not Light When Main Switch is Turned ON** | • Fuse blown (10A)<br>• Wiring harness disconnected or improperly connected (between main switch **AC** terminal and panel board, between panel board and regulator, between dynamo and regulator)<br>• Regulator defective<br>• Dynamo defective<br>• Wiring harness disconnected or improperly connected (between main switch **AC** terminal and panel board, between panel board and alternator)<br>• Alternator defective | Replace<br>Repair or Replace<br>Replace<br>Repair or Replace<br>Repair or Replace<br>Repair or Replace | —<br>9-S14<br>—<br>9-S16<br>9-S15<br>9-S15 |
| **Charging Lamp Does Not Go Off When Engine is Running** | • Wiring harness disconnected or improperly connected (between dynamo and regulator, between main switch **30** terminal and regulator, between panel board and regulator)<br>• Dynamo defective<br>• Regulator defective<br>• Wiring harness disconnected or improperly connected (between main switch **30** terminal and alternator, between panel board and alternator)<br>• Alternator defective | Repair or Replace<br>Repair or Replace<br>Replace<br>Repair or Replace<br>Repair or Replace | 9-S14<br>9-S16<br>—<br>9-S15<br>9-S15 |

## LIGHTING SYSTEM

| | | | |
|---|---|---|---|
| **Head Light Does Not Light** | • Fuse blown (10A)<br>• Bulb blown<br>• Wiring harness disconnected or improperly connected (between main switch **AC** terminal and combination switch **B1** terminal, between combination switch **1** terminal and headlight) | Replace<br>Replace<br>Repair or Replace | —<br>—<br>9-S20 |
| **Tail Light Does Not Light** | • Fuse blown (10A)<br>• Bulb blown<br>• Wiring harness disconnected or improperly connected (between main switch **AC** terminal and combination switch **B1** terminal, between combination switch **T** terminal and tail light) | Replace<br>Replace<br>Repair or Replace | —<br>—<br>9-S21 |

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Hazard Light Does Not Light** | • Fuse blown (10A)<br>• Bulb blown<br>• Wiring harness disconnected or improperly connected (between main switch **AC** terminal and hazard unit,between hazard unit and combination switch **B2** terminal, between combination switch **R** or **L** terminal and hazard lights)<br>• Hazard unit defective<br>• Combination switch defective | Replace<br>Replace<br>Repair or Replace<br><br><br><br><br>Replace<br>Replace | —<br>—<br>9-S21<br><br><br><br><br>9-S22<br>9-S20 |
| **Hazard Indicator Lamp Does Not Light** | • Bulb blown<br>• Wiring harness disconnected or improperly connected (between combination switch **R** or **L** terminal and panel board) | Replace<br>Repair or Replace | —<br>9-S21 |
| **Hazard Light Does Not Flicker** | • Hazard unit defective | Replace | 9-S22 |

## EASY CHECKER

| | | | |
|---|---|---|---|
| **Oil Pressure Lamp Lights Up When Engine is Running** | • Engine oil pressure too low<br>• Engine oil insufficient<br>• Oil pressure switch defective<br>• Short circuit between oil pressure switch lead and chassis<br>• Circuit in panel board defective | Repair engine<br>Replenish<br>Replace<br>Repair<br><br>Replace | —<br>G-8<br>—<br>9-S24<br><br>9-S23 |
| **Oil Pressure Lamp Does Not Light When Main Switch is Turned ON and Engine is Not Running** | • Bulb blown<br>• Oil pressure switch defective<br>• Wiring harness disconnected or improperly connected (between panel board and oil pressure switch)<br>• Circuit in panel board defective | Replace<br>Replace<br>Repair or Replace<br><br>Replace | —<br>—<br>9-S24<br><br>9-S23 |

## GAUGES

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Fuel Gauge Does Not Function** | • Fuel gauge defective<br>• Fuel level sensor defective<br>• Wiring harness disconnected or improperly connected (between panel board and fuel level sensor)<br>• Circuit in panel board defective | Replace<br>Replace<br>Repair or Replace<br><br>Replace | 9-S26<br>9-S25<br>9-S25<br><br>— |
| **Coolant Temperature Gauge Does Not Function** | • Coolant temperature gauge defective<br>• Coolant temperature sensor defective<br>• Wiring harness disconnected or improperly connected (between panel board and coolant temperature sensor)<br>• Circuit in panel board defective | Replace<br>Replace<br>Repair or Replace<br><br>Replace | 9-S26<br>9-S26<br>9-S26<br><br>— |

# SERVICING SPECIFICATIONS

## STARTER MOTOR

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Mica | Undercut | 0.5 to 1.0 mm<br>0.020 to 0.039 in. | 0.2 mm<br>0.0079 in. |

## ALTERNATOR

| | | | |
|---|---|---|---|
| Slip Ring | O.D. | 14.4 mm<br>0.567 in. | 12.8 mm<br>0.504 in. |
| Brush | Length | 10.5 mm<br>0.413 in. | 8.4 mm<br>0.331 in. |

# CHECKING, DISASSEMBLING AND SERVICING

**⚠ CAUTION**

- **To avoid accidental short circuit, be sure to attach the positive cable to the positive terminal before the ground cable is attached to the negative terminal.**

**■ IMPORTANT**

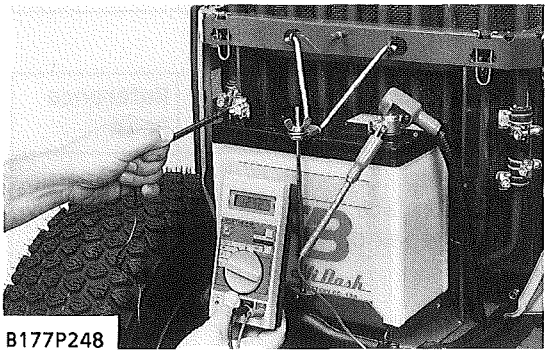
- **If the tractor is to be operated for a short time without battery (using a slave battery for starting), use additional current (lights) while engine is running and insulate terminal of battery. If this advice is disregarded, damage to alternator or dynamo and regulator may result.**

**■ NOTE**

- **In this section, when measuring resistance, voltage and amperage, leads of ohmmeter, voltmeter and ammeter are represented by —— marks in figure.**

## [1] BATTERY

## CHECKING



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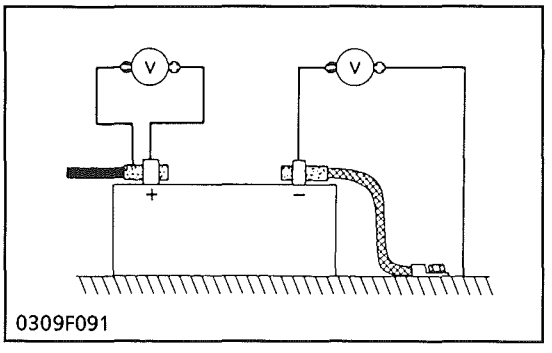


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### Battery Voltage

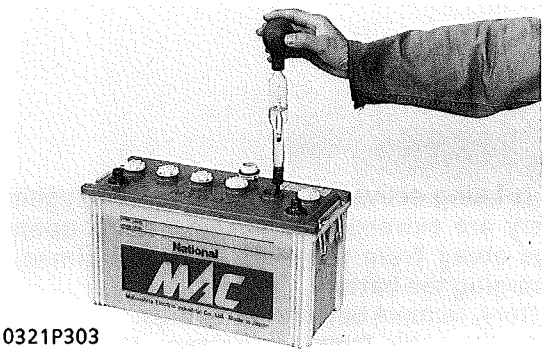
1. Stop the engine and turn the main switch off.
2. Connect the COM (−) lead of the voltmeter to the battery's negative terminal post and the (+) lead to the positive terminal post, and measure the battery voltage.
3. If the battery voltage is less than the factory specifications, check the battery condition. (See the next page.)

| | | |
|---|---|---|
| Battery voltage | Factory spec. | More than 12 V |

### Battery Terminal Connection

1. Turn the main switch on, and turn on the head light.
2. Measure the voltage with a voltmeter across the battery's positive terminal post and the cable terminal, and the voltage across the battery's negative terminal post and the chassis.
3. If the measurement exceeds the factory specifications, clean the battery terminal posts and cable clamps, and tighten them firmly.

| | |
|---|---|
| Factory spec. | Less than 0.1 V |

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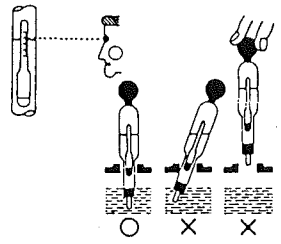

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| Specific Gravity | State of Charge |
|---|---|
| 1.260 Sp. Gr. | 100 % Charged |
| 1.230 Sp. Gr. | 75 % Charged |
| 1.200 Sp. Gr. | 50 % Charged |
| 1.170 Sp. Gr. | 25 % Charged |
| 1.140 Sp. Gr. | Very Little Useful Capacity |
| 1.110 Sp. Gr. | Discharged |

At an electrolyte temperature of 20 °C (68 °F)

## Battery Specific Gravity

**⚠ CAUTION**

- **Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water.**

1. Check the specific gravity of the electrolyte in each cell with a hydrometer.
2. When the electrolyte temperature differs from that at which the hydrometer was calibrated, correct the specific gravity reading following the formula mentioned in **(Reference)** below.
3. If the specific gravity is less than 1.215 (after it is corrected for temperature), charge or replace the battery.
4. If the specific gravity differs between any two cells by more than 0.05, replace the battery.

**■ NOTE**

- **Hold the hydrometer tube vertical without removing it from the electrolyte.**
- **Do not suck too much electrolyte into the tube.**
- **Allow the float to more freely and hold the hydrometer at eye level.**
- **The hydrometer reading must be taken at the highest electrolyte level.**

**(Reference)**

- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1 °C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with a decreases of 1 °C (0.0004 with a decrease of 1 °F).
  Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula :
  - Specific gravity at 20 °C = Measured value + 0.0007 × (electrolyte temperature – 20 °C)
  - Specific gravity at 68 °F = Measured value + 0.0004 × (electrolyte temperature – 68 °F)

# SERVICING

**Table 1 [with AC Dynamo]**

| Tractor Model | Battery Type | Volts (V) | Capacity at 5H.R (A.H) |
|---|---|---|---|
| B1700 B2100 B2400 | 50B24L(S)-MF | 12 | 36 |

| Tractor Model | Reserve Capacity (min) | Cold Cranking Amps | Normal Charging Rate (A) |
|---|---|---|---|
| B1700 B2100 B2400 | 71 | 390 | 4.5 |

**Table 2 [with Alternator]**

| Tractor Model | Battery Type | Volts (V) | Capacity at 5H.R (A.H) |
|---|---|---|---|
| B2100 B2400 | 55B24L(S)-MF | 12 | 36 |

| Tractor Model | Reserve Capacity (min) | Cold Cranking Amps | Normal Charging Rate (A) |
|---|---|---|---|
| B2100 B2400 | 79 | 433 | 4.5 |

**(Reference)**

Self-discharge Rate

| Temperature | Self-discharge rate |
|---|---|
| 30 °C (86 °F) | Approx. 1.0 % per day |
| 20 °C (68 °F) | Approx. 0.5 % per day |
| 10 °C (50 °F) | Approx. 0.25 % per day |

## Recharging

**⚠ CAUTION**

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

**1) Slow Charging**

1. Add distilled water if the electrolyte level is low. When charging, the amount of electrolyte should be slightly lower than the specified level to prevent overflow.
2. Connect the battery to the charging unit, following the manufacturer's instructions.
3. As the electrolyte generates gas while charging, remove all port caps.
4. The electrolyte temperature must not exceed 40 °C (105 °F) during charging.
   If it exceed 40 °C (105 °F), decrease the charging amperage or stop charging for a while.
5. When charging several batteries in series, charge at the rate of the smallest battery in the line.

**■ NOTE**

- **Slow charger operation differs with the type used. For details, refer to the manufacturer's instructions.**

**2) Quick Charging**

1. Determine the proper charging current and charging time with the tester attached to the quick charger.
2. Determine the proper charging current as 1/1 of the battery capacity. If the battery capacity exceeds 50 Ah, consider 50 A as the maximum.

**■ NOTE**

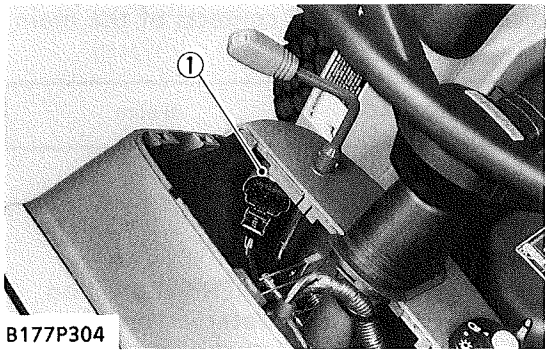
- **Quick charger operation differs with the type used. For details, refer to the manufacturer's instructions.**

## Directions for Storage

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

# [2] STARTING SYSTEM

## CHECKING



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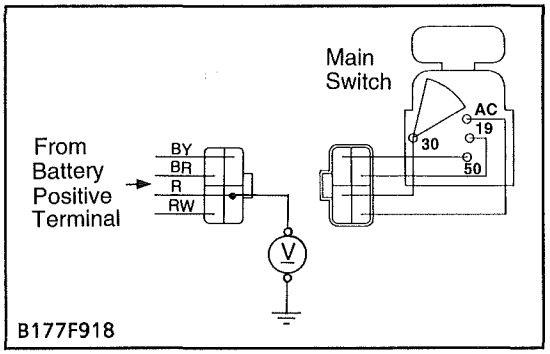
### Main Switch

1. Remove the panel board, and remove the main switch.
2. Perform the following checkings **1)** to **5)**.

(1) Main Switch

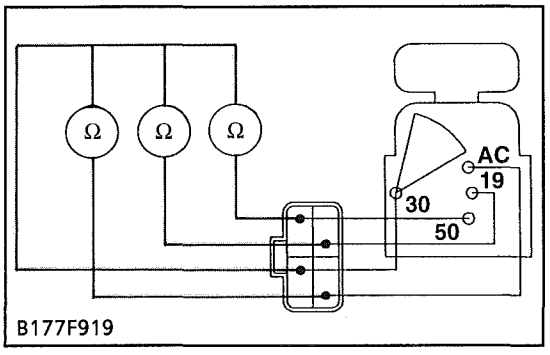


B177F918

**1) Connector Voltage**

1. Measure the voltage with a voltmeter across the connector **30** terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), the wiring harness is faulty.

| | | |
|---|---|---|
| Voltage | Connector **30** terminal – chassis | Approx. battery voltage |



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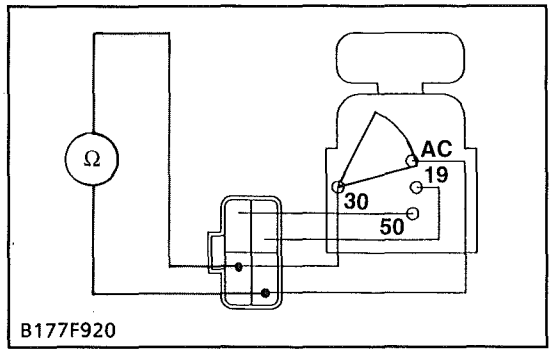
**2) Main Switch Key at Off Position**

1. Turn the main switch off.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **AC** terminal, **30** terminal and **50** terminal, **30** terminal and **19** terminal.
3. If infinity is not indicated, the contacts of the main switch are faulty.

| | | |
|---|---|---|
| Resistance | **30 – AC** | Infinity |
| | **30 – 50** | Infinity |
| | **30 – 19** | Infinity |



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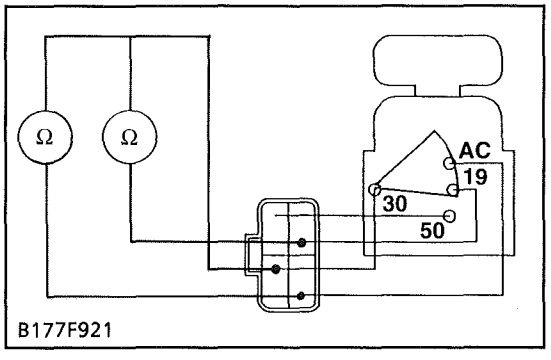
### 3) Main Switch Key at ON Position

1. Turn the main switch on.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, the **30 – AC** contacts of the main switch are faulty.

| | | |
|---|---|---|
| Resistance | **30 – AC** | 0 ohm |



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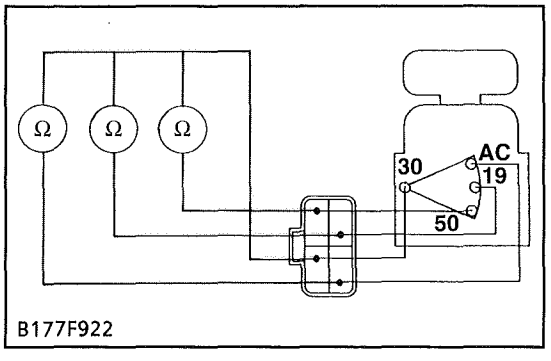
### 4) Main Switch Key at PREHEAT Position

1. Turn and hold the main switch key at the **PREHEAT** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, and measure the resistance across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

| | | |
|---|---|---|
| Resistance | **30 – 19** | 0 ohm |
| | **30 – AC** | |



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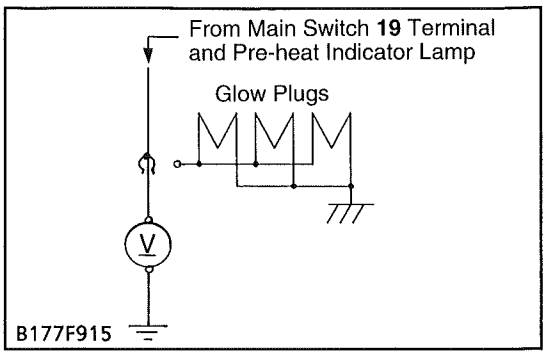
### 5) Main Switch Key at START Position

1. Turn and hold the main switch key at the **START** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, across the **30** terminal and the **50** terminal,and across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

| | | |
|---|---|---|
| Resistance | **30 – 19** | 0 ohm |
| | **30 – 50** | |
| | **30 – AC** | |

| Terminal / Key position | **30** | **AC** | **19** | **50** |
|---|---|---|---|---|
| OFF | ● | | | |
| ON | ● | ● | | |
| PREHEAT | ● | ● | ● | |
| START | ● | ● | ● | ● |

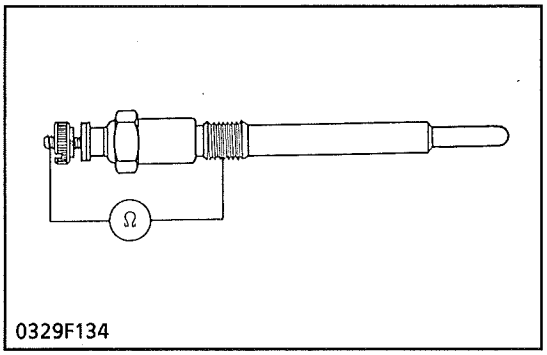



## Pre-heating

### 1) Lead Terminal Voltage

1. Disconnect the wiring lead from the glow plug terminal after turning the main switch off.
2. Turn the main switch key to the **PREHEAT** position, and measure the voltage across the lead terminal and the chassis.
3. Turn the main switch key to the **START** position, and measure the voltage with a voltmeter across the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

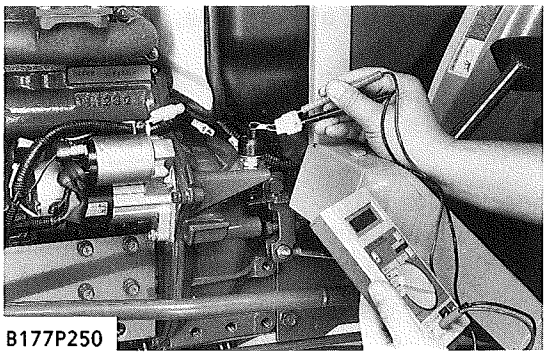
| | | |
|---|---|---|
| Voltage (Lead terminal chassis) | Main switch key at **PREHEAT** | Approx. battery voltage |
| | Main switch key at **START** | |




### 2) Glow Plug

1. Disconnect the leads from the glow plugs.
2. Measure the resistance with an ohmmeter across the glow plug terminal and the chassis.
3. If 0 ohm is indicated, the screw at the tip of the glow plug and the housing are short-circuited.
4. If the reference value is not indicated, the glow plug is faulty.

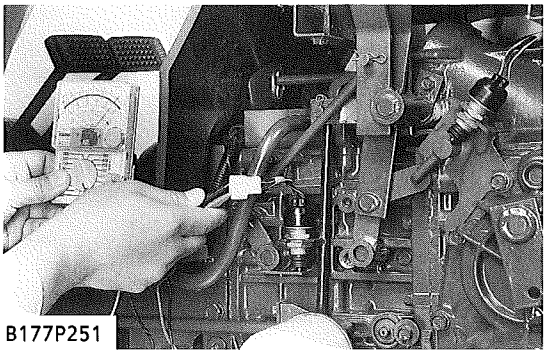
| | | |
|---|---|---|
| Glow plug resistance | Reference value | Approx. 0.9 ohms |

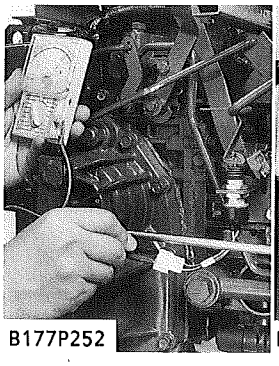


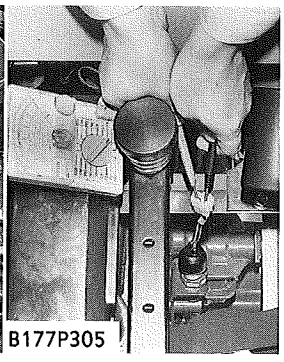

## Safety Switch

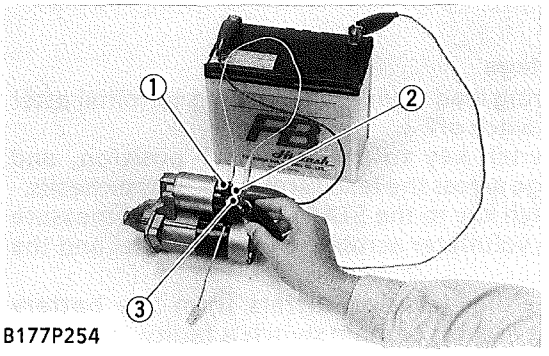
1. Remove the safety switch leads.
2. Connect the circuit tester to the safety switch leads.
3. Measure the resistance between leads.
4. If the safety switch is defective, replace it.

| | | |
|---|---|---|
| Resistance (Across switch terminal) | When switch push is pushed | 0 ohm |
| | When switch push is released | Infinity |





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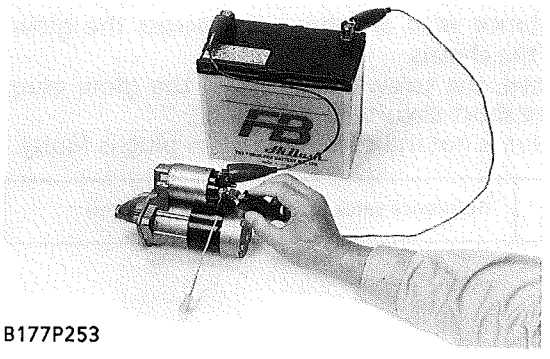
### Motor Test

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter.
3. Remove the starter from the engine.
4. Connect the jumper lead from the battery positive terminal post to the **B** terminal (2), and from the **B** terminal (2) to the **S** terminal (1).
5. Connect a jumper lead momentarily between the battery negative terminal post and the **M** terminal (3).
6. If the motor does not run, check the motor.

**⚠ CAUTION**

- **Secure the starter to prevent it from jumping up and down while testing the motor.**

(1) **S** Terminal
(2) **B** Terminal
(3) **M** Terminal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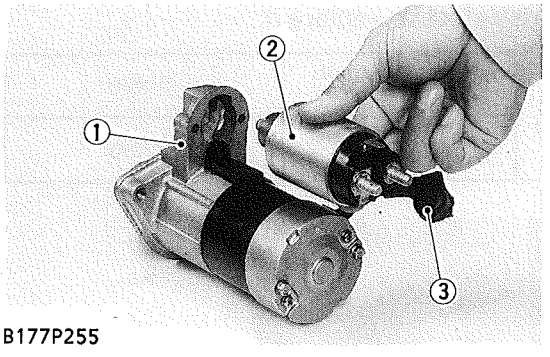
### Magnetic Switch Test

1. Connect the jumper lead from the battery positive terminal post to the **S** terminal.
2. The pinion gear should pop out, when a jumper lead is connected between the battery negative terminal post and the **M** terminal.
3. If the pinion gear does not pop out, check the magnetic switch.

**■ NOTE**

- **The test should be carried out for a short time, about 3 to 5 seconds.**

## DISASSEMBLING AND ASSEMBLING

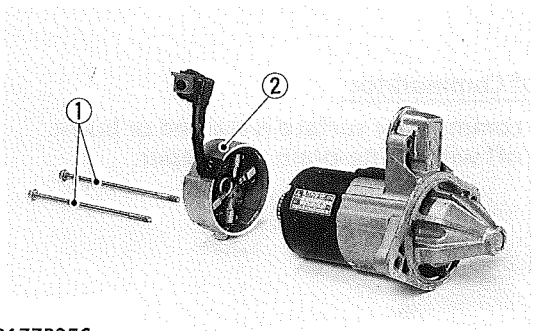


B177P255

### Magnetic Switch

1. Disconnect the connecting lead (3).
2. Remove the mounting screws, and separate the magnetic switch (2) from the front bracket (1).

(1) Front Bracket
(2) Magnetic Switch
(3) Connecting Lead

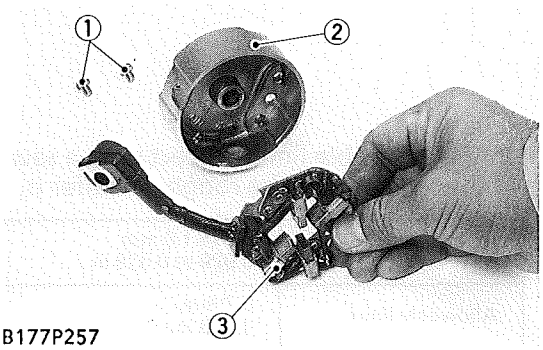



B177P256

## Rear Bracket

1. Remove the mounting screws (1).
2. Remove the rear bracket (2).

(1) Screw
(2) Rear Bracket

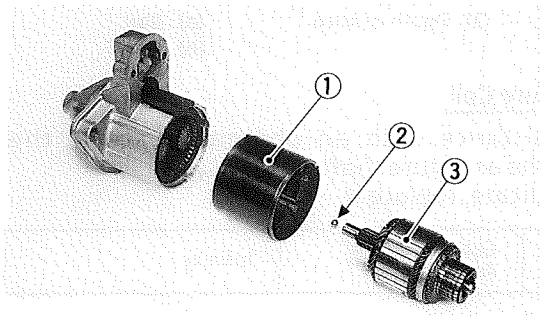



B177P257

## Brush Holder

1. Remove the mounting screws (1).
2. Remove the brush holder (3) from the rear bracket (2).

(1) Screw
(2) Rear Bracket
(3) Brush Holder




B177P258

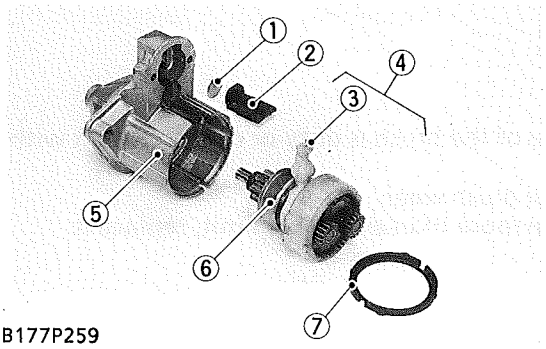
## Armature and Yoke

1. Draw out the armature (3), ball (2) and the yoke (1) from the front bracket.

**■ NOTE**

- **Before disassembling, put the parting marks on the yoke and front bracket.**

(1) Yoke
(2) Ball
(3) Armature




B177P259

## Shaft Assembly (with Overrunning Clutch)

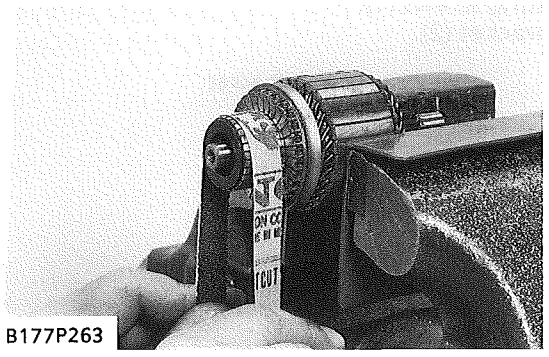
1. Remove the gasket **A** (7), gasket **B** (2) and the plate (1).
2. Draw out the shaft assembly (4) from the front bracket (5).

**(When reassembling)**

- Install the lever (3), noting its direction.

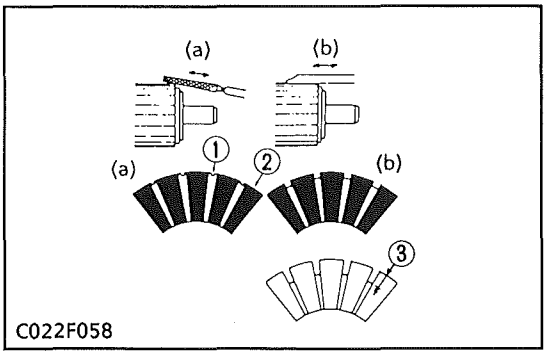
(1) Plate
(2) Gasket **B**
(3) Lever
(4) Shaft Assembly
(5) Front Bracket
(6) Overrunning Clutch
(7) Gasket **A**

# SERVICING


B177P263

### Staining or Burning of Commutator

1. Check to see if the commutator surface is stained or burnt.
2. If it is burnt, grind off with a fine-grain sandpaper.



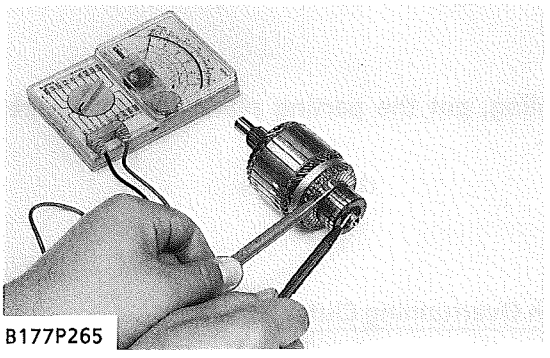
C022F058

### Mica Undercut

1. Check to see the mica undercut.
2. If the mica is less than the allowable limit, correct with a saw blade. As the edge of the segment will be rough, chamfer it.

| | | |
|---|---|---|
| Mica undercut | Factory spec. | 0.5 to 1.0 mm<br>0.020 to 0.039 in. |
| | Allowable limit | 0.2 mm<br>0.008 in. |

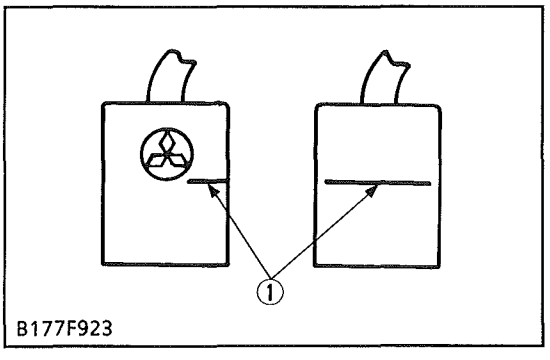
(1) Mica
(2) Segment
(3) Depth of Mica
(a) Bad
(b) Good


B177P265

### Grounding of Armature Coil

1. Measure the resistance with an ohmmeter across the commutator and the armature shaft.
2. If infinity is not indicate, replace it.

| | | |
|---|---|---|
| Resistance | Commutator – Armature | Infinity |

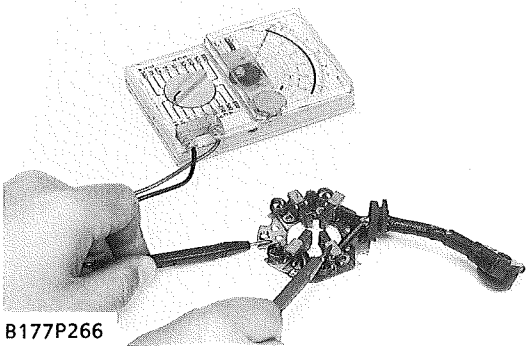


B177F923

### Brush Wear

1. If the conduct face of the brush is dirty or dusty, clean it with sandpaper.
2. Visually inspect the brush wear.
3. If the brush is worn more than allowable limit, replace it.

(1) Allowable Limit Line


B177P266

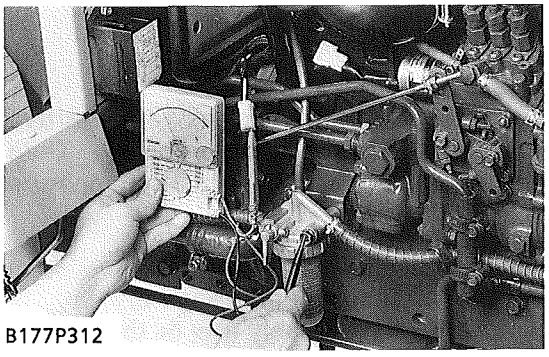
### Grounding of Brush Holder

1. Measure the resistance with an ohmmeter across the brush holder and the holder support.
2. If infinity is not indicated, replace it.

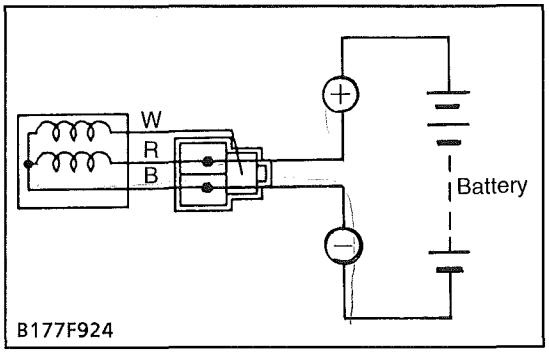
| | | |
|---|---|---|
| Resistance | Brush holder – Holder support | Infinity |

# [3] ENGINE KEY SWITCH SHUT-OFF SYSTEM

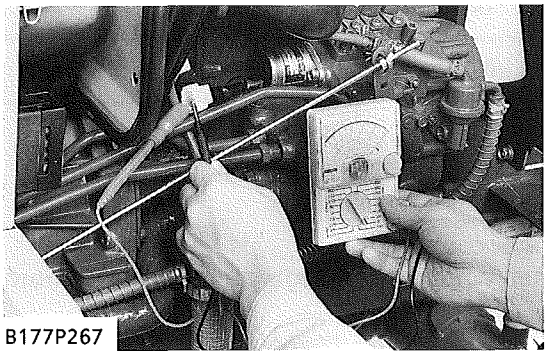
## CHECKING



B177P312




B177F924



B177P267

### Fuel Cut Off Solenoid

**1) Lead Terminal Voltage**

1. Disconnect the connector of fuel cut-off solenoid.
2. Turn the main switch **"ON"**.
3. Measure the voltage with voltmeter across the terminal 3 (red, black) of the wiring harness side and the chassis.
4. If the battery voltage (11 to 14 V) is not indicated, the fuse, the main switch or wiring harness are faulty.

| | | |
|---|---|---|
| Voltage | Terminal **3** (red, black) – chassis | Approx. battery voltage |

**2) Fuel Cut Off Solenoid Test**

1. Disconnect the lead from the fuel cut off solenoid after turning the main switch off.
2. Connect jumper leads from the battery positive terminal to the fuel cut off solenoid terminal **1** (red), and from the battery negative terminal to the fuel cut off solenoid terminal **2** (black).
3. If the solenoid plunger is not attracted, the fuel cut off solenoid is faulty.

**3) Fuel Cut Off Solenoid Resistance**

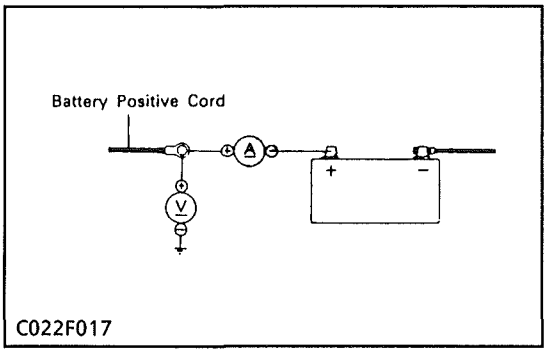
1. Disconnect the connector of fuel cut-off solenoid.
2. Measure the resistances with an ohmmeter across the terminal **3** (white) and terminal **2** (black), across the terminal **1** (red) and terminal **2** (black).
3. If the resistances are 0 ohm or infinity, fuel cut-off solenoid is faulty.

| | | |
|---|---|---|
| Resistance | Terminal **3** (white) – Terminal **2** (black) | Approx. 0.4 ohms |
| | Terminal **1** (red) – Terminal **2** (black) | Approx. 1.5 ohms |

# [4] CHARGING SYSTEM

## CHECKING

### ■ AC Dynamo



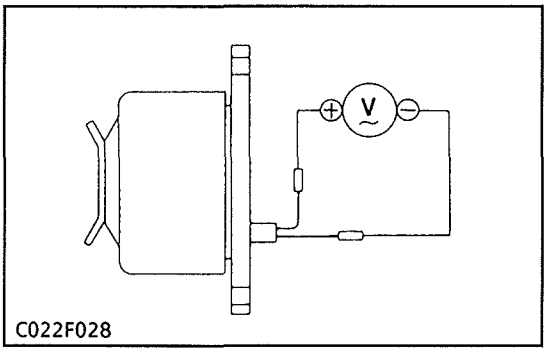
C022F017

#### Battery Charging Current

1. After starting the engine, disconnect the battery positive cord (+), and connect an ammeter and voltmeter. Then switch on all electrical loads (such as headlights) and measure the charging current.

**■ NOTE**
- **Connect an ammeter only after starting the engine.**
- **When the electrical loads is considerably low or the battery is fully charged, the specified reading may not be obtained.**

| | | |
|---|---|---|
| Factory spec. | Current | 14 to 15 A |
| | Dynamo speed | 5200 r.p.m |

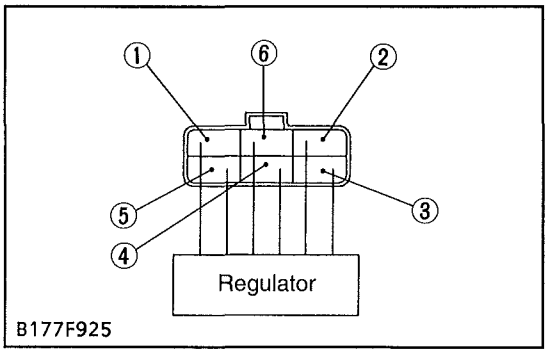


C022F028

#### Dynamo No-load Voltage

1. Disconnect the lead wires from the dynamo.
2. Start the engine, and check the generating voltage of the dynamo.

| | | |
|---|---|---|
| Factory spec. | Voltage | 14 to 15 V |
| | Dynamo speed | 5200 r.p.m |



B177F925

(1) Sky Blue
(2) Sky Blue
(3) Red
(4) Yellow
(5) Green
(6) Black

#### Continuity across Regulator's Terminals

1. Remove the regulator coupler.
2. Check with a tester whether the regulator is in optimum condition or not.

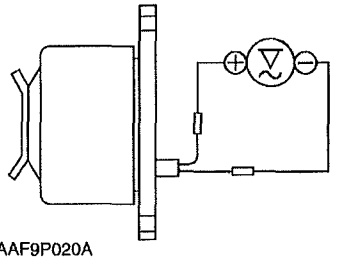
**■ Check Table**

**■ NOTE**
- **Type to use a high-resistance tester as far as possible.**
- **The judgement should be as below table. "ON" if the indicator moves, otherwise "OFF"**

| Tester - terminal \ Tester + terminal | | Cord colours | | | | | |
|---|---|---|---|---|---|---|---|
| | | Sky Blue | Sky Blue | Red | Yellow | Green | Black |
| Cord colours | Sky Blue | | OFF | ON | OFF | OFF | OFF |
| | Sky Blue | OFF | | ON | OFF | OFF | OFF |
| | Red | OFF | OFF | | OFF | OFF | OFF |
| | Yellow | ON | ON | ON | | OFF | ON |
| | Green | OFF | OFF | OFF | OFF | | OFF |
| | Black | OFF | OFF | OFF | OFF | OFF | |

The Correct Voltage Output

**[INCORRECT]**



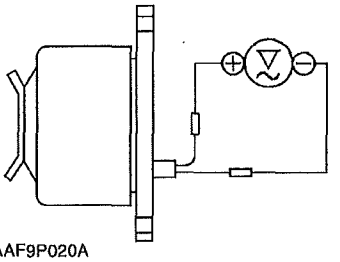
3TBAAAF9P020A

Dynamo No-load Voltage

1. Disconnect the lead wires from the dynamo.
2. Start the engine, and check the generating voltage of the dynamo.

| | | |
|---|---|---|
| Factory spec. | Voltage | 14 to 15 V |
| | Dynamo speed | 5200 $min^{-1}$ (rpm) |

**[CORRECT]**



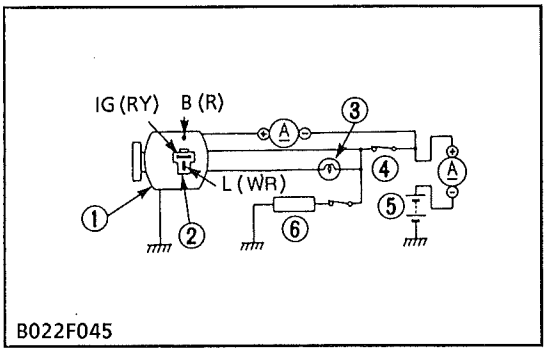
3TBAAAF9P020A

Dynamo No-load Voltage

3. Disconnect the lead wires from the dynamo.
4. Start the engine, and check the generating voltage of the dynamo.

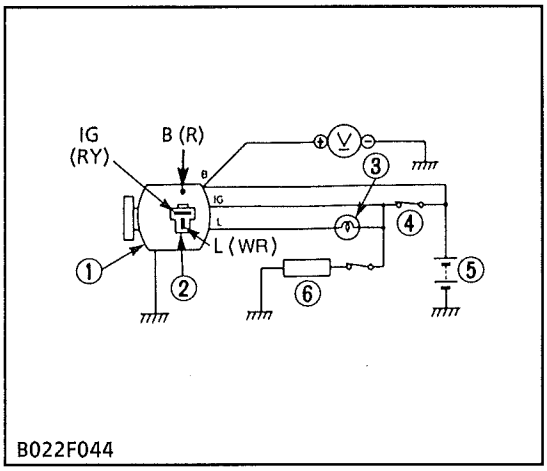
| | | |
|---|---|---|
| Factory spec. | Voltage | 14 to 15 V (at engine low idling speed) |
| | | 36 to 39 V (at engine high idling speed) |

## ■ Alternator




B022F045

(1) Alternator
(2) Alternator **2P** Connector
(3) Bulb
(4) Main Switch
(5) Battery
(6) Load




B022F044

(1) Alternator
(2) Alternator **2P** Connector
(3) Bulb
(4) Main Switch
(5) Battery
(6) Load

### Output Current

1. Disconnect the connector (2) from the alternator.
2. Connect the leads with the terminals as shown in the figures.
3. Start the engine and switch on all electrical loads (such as head lights).
4. Set the engine speed at approx. 2250 rpm, and measure the output current.
5. If the measurement is less than the factory specification, the alternator is defective.

| | | |
|---|---|---|
| Output current | Factory spec. | More than 40 A |

6. Run the engine at idling speed (low rpm) to see if the ammeter reads a negative (−) value (discharge). Then increase the engine rpm to make sure the ammeter reads a positive (+) value (charge).

### Alternator No-load Voltage

1. Disconnect the connector (2) from the alternator.
2. Connect the leads with the terminals as shown in the figures.
3. Start the engine and set its speed approx. 2250 rpm.
4. Disconnect the battery negative cord from the battery (5).
5. Measure the voltage across the alternator B terminal and the chassis.
6. If the measurement is less than the factory specification, disassemble the alternator and check the IC regulator.

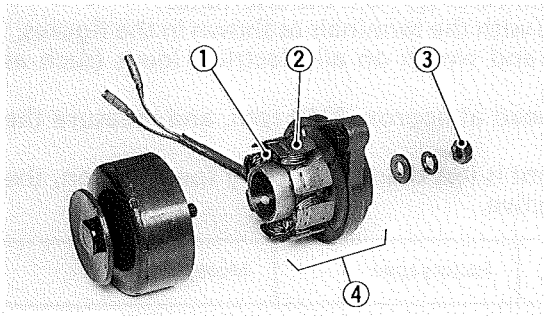
| | | |
|---|---|---|
| Voltage | Factory spec. | 14.2 to 14.8 V (at 25°C, 77°F) |

**(Reference)**

- Once the engine has started, the alternator temperature rises quickly up to an ambient temperature of 70 to 90°C (158 to 194 °F). As the temperature goes higher than 50°C (122°F), the alternator voltage slowly drops; at higher than 100°C (212°F), it drops by about 1 V.

# DIASSEMBLING AND ASSEMBLING

## ■ AC Dynamo

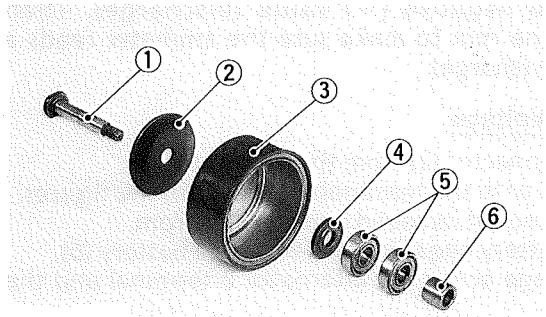



B177P306

### Stator

1. Remove the nut (3) and separate the stator comp. (4).
2. Unscrew the screws (1) and remove the stator (2).

(1) Screw
(2) Stator
(3) Nut
(4) Stator Comp.




B177P307

### Rotor

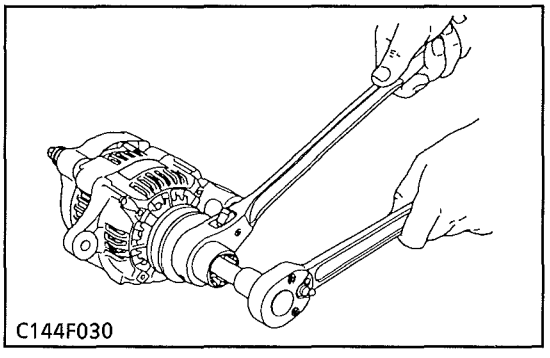
1. Tap out the shaft (1) from the rotor (3).

**(When reassembling)**

- Take care the direction of the collar (4), the flat side should face to the pulley (2) side.

(1) Shaft
(2) Pulley
(3) Rotor
(4) Collar
(5) Bearings
(6) Collar

## ■ Alternator

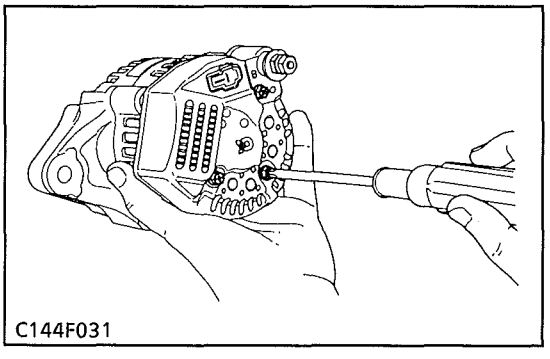


C144F030

### Pulley

1. Secure the hexagonal end of the pulley shaft with a double-ended ratchet wrench as shown in the figure, loosen the nut with a socket wrench and remove it.

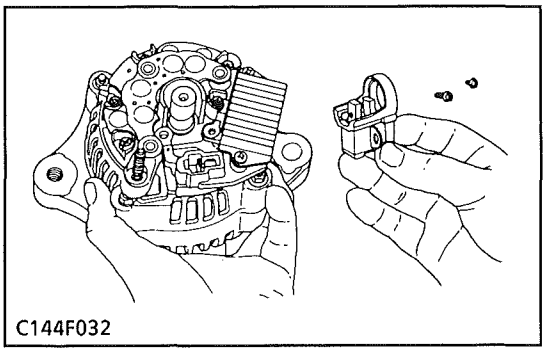
| | | |
|---|---|---|
| Tightening torque | Pulley lock nut | 58.3 to 78.9 N·m<br>5.95 to 8.05 kgf·m<br>43.0 to 58.2 ft-lbs |



C144F031

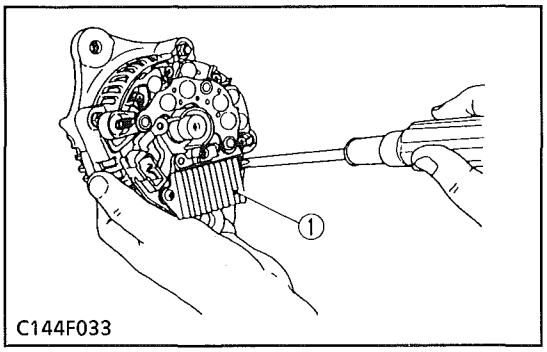
### Rear End Cover

1. Unscrew the three rear end cover screws and the terminal **B** nut and remove the rear end cover.


C144F032

## Brush Holder

1. Unscrew the two screws holding the brush holder and remove the brush holder.

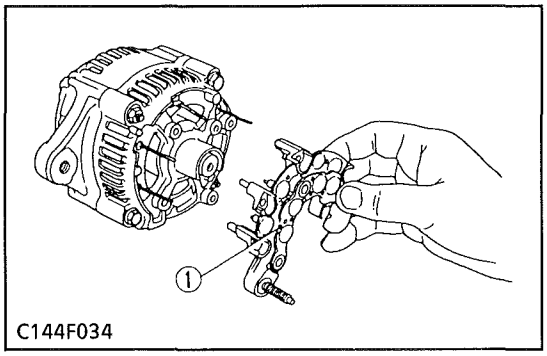


C144F033

## IC Regulator

1. Unscrew the three screws holding the IC regulator (1) and remove it.

(1) IC Regulator

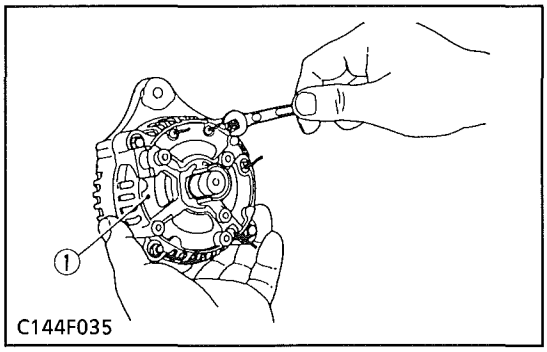


C144F034

## Rectifier

1. Remove the four screws holding the rectifier (1) and the stator lead wires.

(1) Rectifier

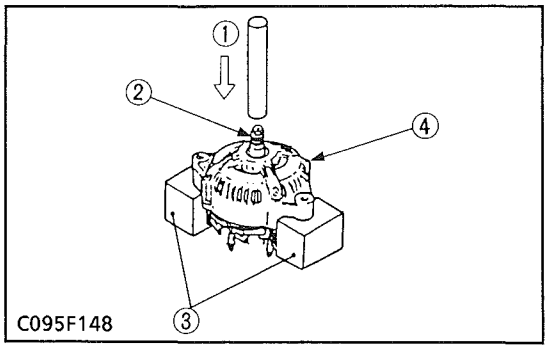


C144F035

## Rear End Frame

1. Remove the two nuts and two screws holding the drive end frame and the rear end frame.
2. Remove the rear end frame (1).

(1) Rear End Frame



C095F148

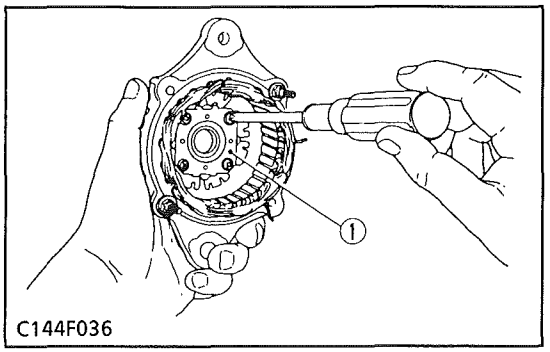
## Rotor

1. Press out the rotor (2) from drive end frame (4).

**■ IMPORTANT**

- **Take special care not to drop the rotor and damage the slip ring or fan, etc.**

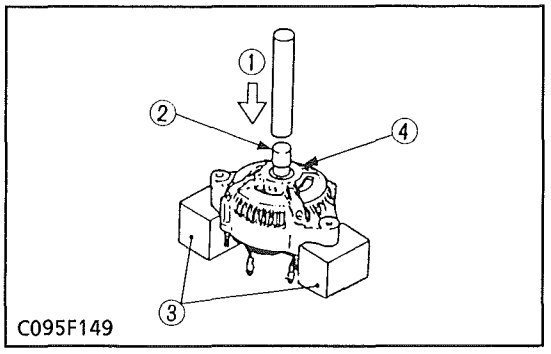
(1) Press
(2) Rotor
(3) Block
(4) Drive End Frame




### Retainer Plate

1. Remove the screws holding the retainer plate and remove the retainer plate (1).

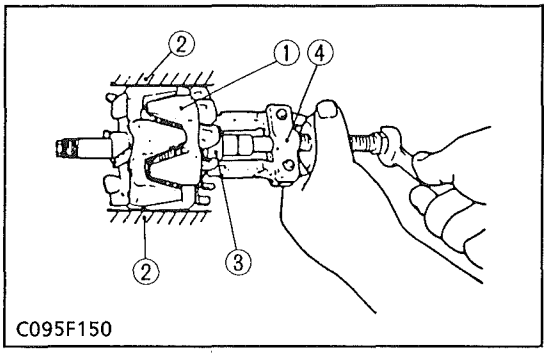
(1) Retainer Plate




### Bearing on the Drive End Side

1. Press out the bearing from drive end frame (4) using with press (1) and jig (2).

(1) Press
(2) Jig
(3) Block
(4) Drive End Frame

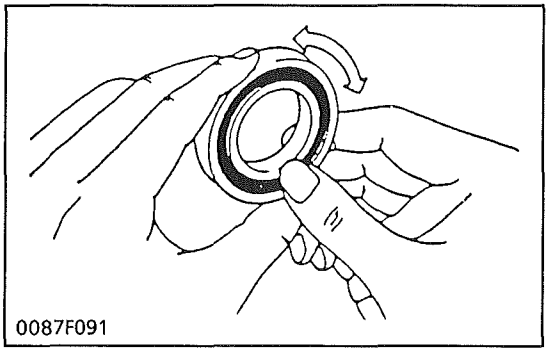



### Bearing at the Slip Ring Side

1. Lightly secure the rotor (1) with a vise (2) to prevent damage and remove the bearing using with puller (4).

(1) Rotor
(2) Vise
(3) Bearing
(4) Puller

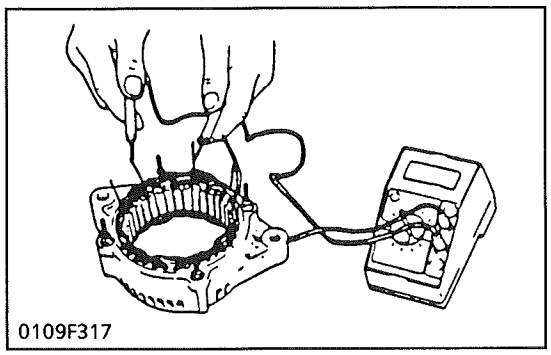
## SERVICING




### Bearing

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

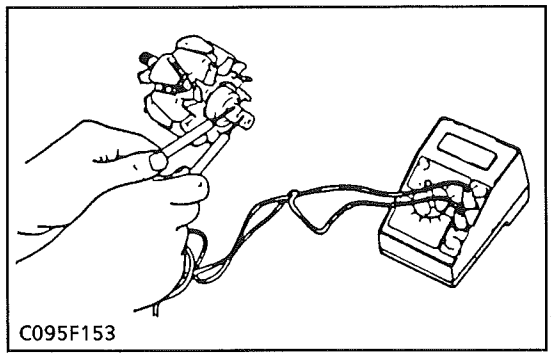
## ■ Alternator


0109F317

### Stator

1. Measure the resistance with an ohmmeter across each lead of the stator coil.
2. If the measurement is not within factory specification, replace it.
3. Check the continuity across each stator coil lead and core with an ohmmeter.
4. If infinity is not indicated, replace it.

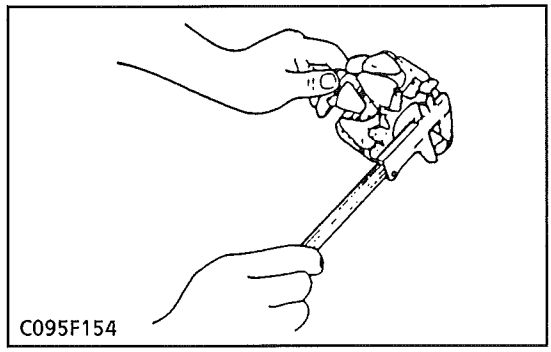
| | | |
|---|---|---|
| Resistance | Factory spec. | Less than 1.0 ohms |


C095F153

### Rotor

1. Measure the resistance across the slip rings.
2. If the resistance is not the factory specification, replace it.
3. Check the continuity across the slip ring and core with a an ohmmeter.
4. If infinity is not indicated, replace it.

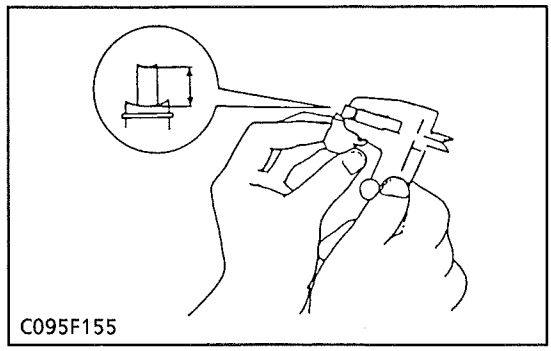
| | | |
|---|---|---|
| Resistance | Factory spec. | 2.9 ohms |


C095F154

### Slip Ring

1. Check the slip ring for score.
2. If scored, correct with an sand paper or on a lathe.
3. Measure the outside diameter of slip ring with a vernier caliper.
4. If the measurement exceeds the allowable limit, replace it.

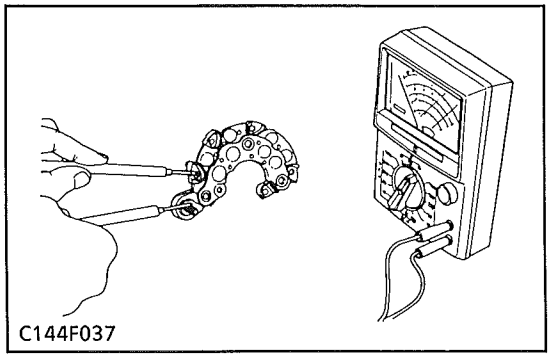
| | | |
|---|---|---|
| Slip ring O.D. | Factory spec. | 14.4 mm<br>0.567 in. |
| | Allowable limit | 12.8 mm<br>0.504 in. |


C095F155

### Brush Wear

1. Measure the length of brush with a vernier caliper.
2. If the measurement is less than allowable limit, replace it.
3. Make sure that the brush moves smoothly.
4. If the brush is defective, replace it.

| | | |
|---|---|---|
| Brush length | Factory spec. | 10.5 mm<br>0.413 in. |
| | Allowable limit | 8.4 mm<br>0.331 in. |

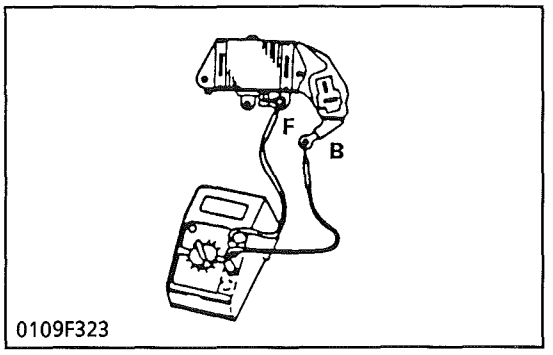

C144F037

### Rectifier

1. Check the continuity across each diode of rectifier with an ohmmeter.
2. The rectifier is normal if the diode in the rectifier conducts in one direction and does not conduct in the reverse direction.

**■ IMPORTANT**

- **Do not use a 500 V megger for measuring because it will destroy the rectifier.**



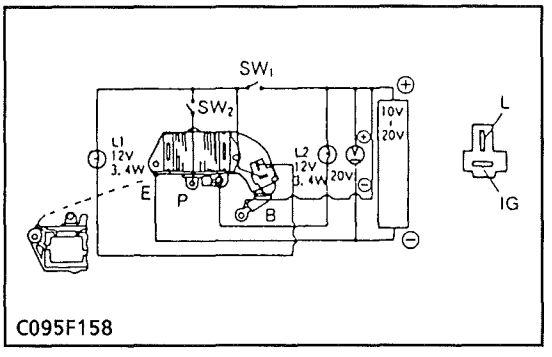
0109F323

### IC Regulator

1. Check the continuity across the **B** terminal and the **F** terminal of IC regulator with an ohmmeter.
2. The IC regulator is normal if the conducts in one direction and does not conduct in the reverse direction.

**■ IMPORTANT**

- **Do not use a 500 V megger for measuring because it will destroy the rectifier.**



C095F158

### IC Regulator Test

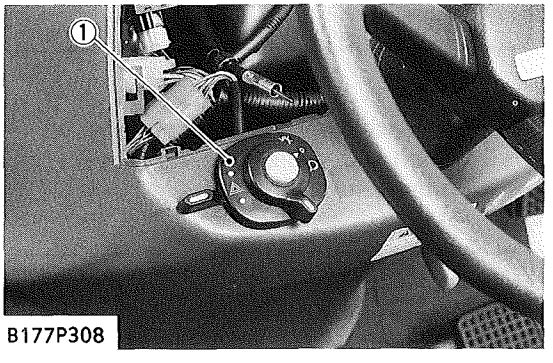
1. Connect the IC regulator unit, variable DC source, voltmeter, lamps and etc. so that they form a circuit as shown in the figure. (**SW1** and **SW2** shall be kept in the "**OFF**" position.)
2. Adjust the source voltage to 12 V.
3. Turn **SW1** "**ON**" check if **L1** (charge lamp substitution) is lit brilliantly and **L2** (rotor coil substitution) is dimly.
4. Then, turn **SW2** "**ON**" while **SW1** is still turned "**ON**". Check if **L1** is turns "**OFF**" and **L2** is lit brilliantly.
5. While keeping **SW1** and **SW2** in the "**ON**" position, raise the variable **DC** source voltage gradually from 12 V and check if the **L2** lamp is turned "**OFF**" at a voltage of 13.9 to 15.1 V at 25 °C (45 °F).

**■ IMPORTANT**

- **A wrong connection in the IC regulator may destroy the regulator in a short time, therefore, inspection of the IC regulator is to be done only after the wiring diagram in the maintenance standard has been thoroughly studied.**

## [5] LIGHTING SYSTEM

## CHECKING

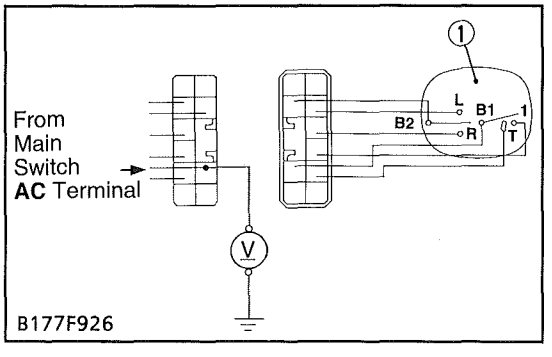


B177P308

### Combination Switch

1. Remove the panel board, and disconnect the combination switch connector.
2. Remove the combination switch (1) and perform the following checkings **1)** to **6)**.

(1) Combination Switch



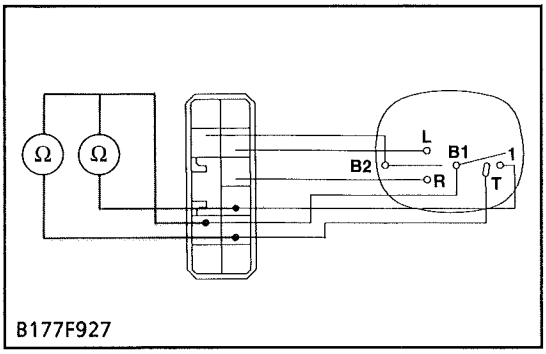
B177F926

### 1) Connector Voltage

1. Turn the main switch on, and measure the voltage with a voltmeter across the connector **B1** terminal and the chassis.
2. If the voltage differs from the battery voltage, the wiring harness or main switch is faulty.

| Voltage | B1 – Chassis | Approx. battery voltage |
|---|---|---|

(1) Combination Switch

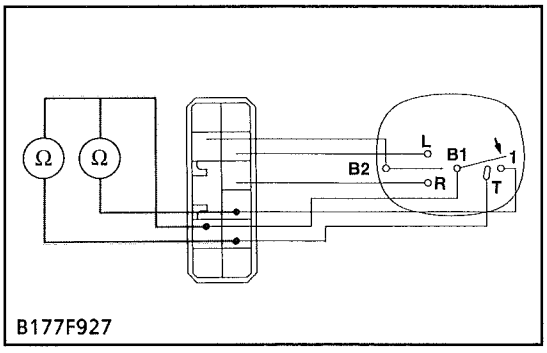


B177F927

**2) Headlight Switch Continuity When Setting Switch Knob at OFF Position**

1. Set the light switch knob to the **OFF** position.
2. Measure the resistances with an ohmmeter across the **B1** terminal and **1** terminal, and across the **B1** terminal and the **T** terminal.
3. If infinity is not indicated, the combination switch is faulty.

| | | |
|---|---|---|
| Resistance (Switch knob at **OFF** position) | **B1 – 1** | Infinity |
| | **B1 – T** | |

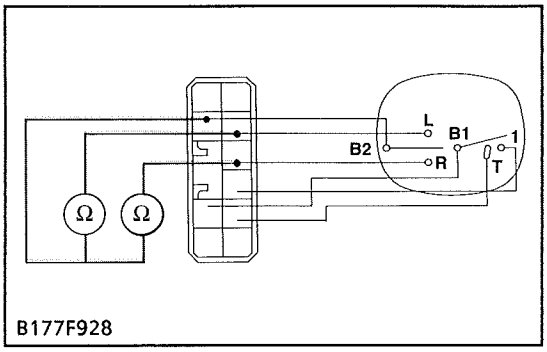


B177F927

**3) Headlight Switch Continuity When Setting Switch Knob at ON Position**

1. Measure the resistance with an ohmmeter across the **B1** terminal and **1** terminal, and across the **B1** terminal and **T** terminal.
2. If 0 ohm is not indicated, the combination switch is faulty.

| | | |
|---|---|---|
| Resistance (Switch knob at **ON** position) | **B1 – 1** | 0 ohm |
| | **B1 – T** | |

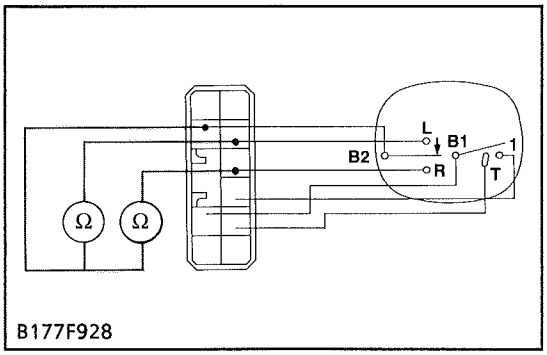


B177F928

**4) Hazard Switch Continuity When Setting Switch Knob at OFF Position**

1. Set the hazard switch knob to the **OFF** position.
2. Measure the resistances with an ohmmeter across the **B2** terminal and **L** terminal, and across **B2** terminal and **R** terminal.
3. If infinity is not indicated, the combination switch is faulty.

| | | |
|---|---|---|
| Resistance (Switch knob at **OFF** position) | **B2 – L** | Infinity |
| | **B2 – R** | |

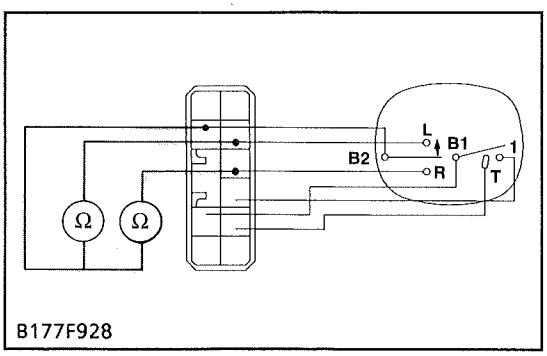


B177F928

**5) Hazard Switch Continuity When Setting Switch Knob at 1 Position**

1. Set the hazard switch knob to the **1** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal and **R** terminal.
3. If 0 ohm is not indicated, the combination switch is faulty.

| | | |
|---|---|---|
| Resistance (Switch knob at **1** position) | **B2 – R** | 0 ohm |
| | **B2 – L** | Infinity |

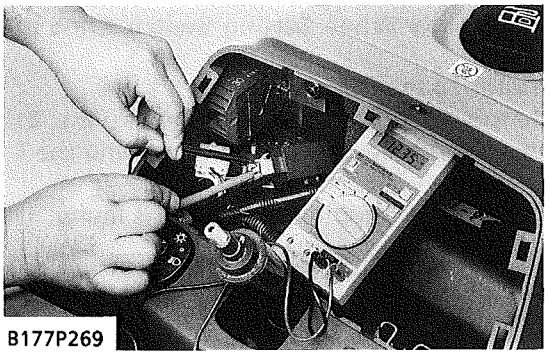


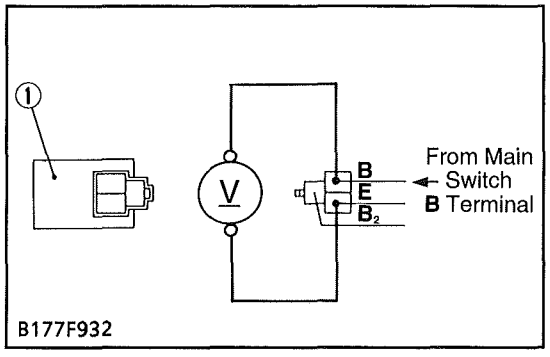
B177F928

**6) Hazard Switch Continuity When Setting Switch Knob at 2 Position**

1. Set the hazard switch knob to the **2** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal and **L** terminal.
3. If 0 ohm is not indicated, the combination switch is faulty.

| | | |
|---|---|---|
| Resistance (Switch knob at **2** position) | **B2 – L** | 0 ohm |
| | **B2 – R** | Infinity |


B177P269



B177F932

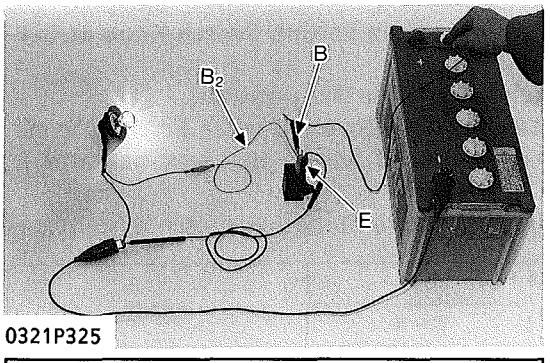
## Hazard Unit

### 1) Connector Voltage

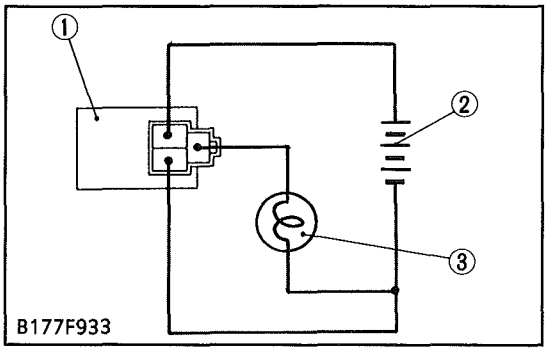
1. Disconnect the connector from the hazard unit after turning the main switch off.
2. Measure the voltage with a voltmeter across the connector **B** terminal and **E** terminal.
3. If the voltage differs from the battery voltage, the main switch, fuse or wiring harness is faulty.

| Voltage | B – E | Approx. battery voltage |
|---|---|---|

(1) Hazard Unit



0321P325



B177F933

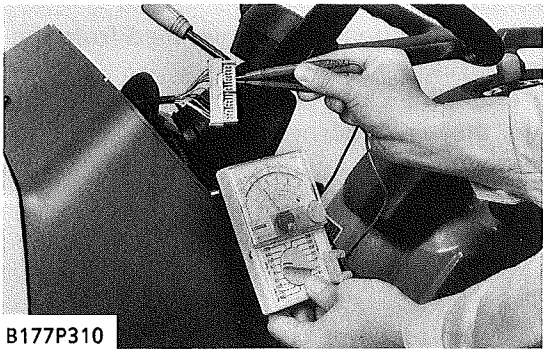
### 2) Hazard Unit Test

1. Remove the panel board.
2. Dosconnect the connector and remove the hazard unit.
3. Connect jumper leads from the **B2** terminal to the bulb, and from the bulb to the battery negative terminal.
4. Connect jumper lead from the **B** terminal to the battery positive terminal.
5. Connect jumper lead from the **E** terminal to the battery negative terminal.
6. If the bulb does not flicker, the hazard unit is faulty.

(1) Hazard Unit
(2) Battery (12V)
(3) Bulb

# [6] EASY CHECKER

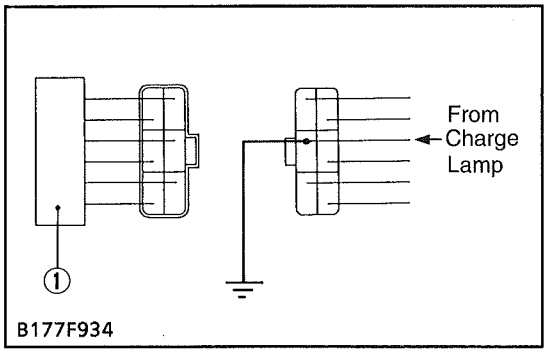
## CHECKING



B177P310

### Easy Checker

1. Remove the panel board and disconnect the connector from it.
2. Turn the main switch on.
3. Measure the voltage with a voltmeter across the terminal (Red-Yellow) and the earth terminal (Black).
4. If the voltage differs from the battery voltage, the wiring harness, fuses and main switch should be checked.



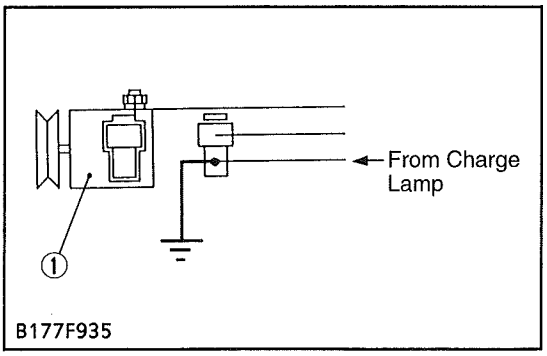

B177F934

### Charging Circuit (Panel Board and Wiring Harness)

#### ■ AC Dynamo

1. Remove the panel board from tractor.
2. Disconnect the 6-P connector from the regulator after turning the main switch off.
3. Turn the main switch on and connect a jumper lead from the wiring harness connector terminal (Black) to the chassis.
4. If the charge lamp does not light, the panel board circuit, regulator, wiring harness, or fuse is fault.

(1) Regulator

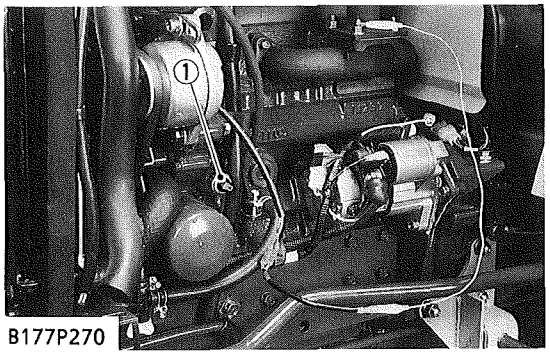



B177F935

#### ■ Alternator

1. Disconnect the 2-P connector from the alternator after turning the main switch off.
2. Turn the main switch on and connect a jumper lead from the wiring harness connector terminal (white, red) to the chassis.
3. If the charge lamp does not light, the panel board circuit, alternator, wiring harness or fuse is fault.

(1) Alternator



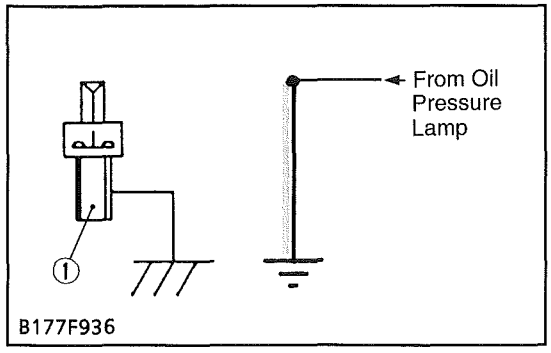
B177P270

## Engine Oil Pressure Switch

### 1) Panel Board and Wiring Harness

1. Disconnect the lead from the engine oil pressure switch after turning the main switch off.
2. Turn the main switch on and connect a jumper lead from the lead terminal to the chassis.
3. If the engine oil pressure indicator lamp does not light, the panel board circuit or the wiring harness is faulty.

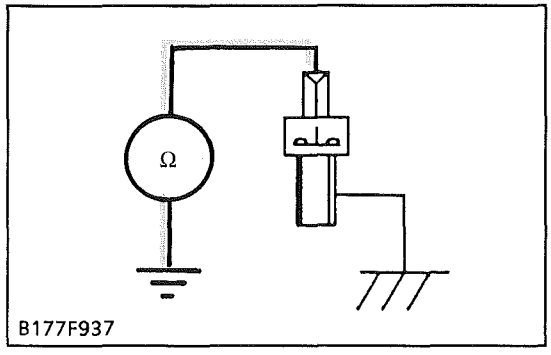
(1) Engine Oil Pressure Switch



B177F936

### 2) Switch Continuity

1. Measure the resistance with an ohmmeter across the switch terminal and the chassis.
2. If 0 ohm is not indicated in the normal state, the switch is faulty.
3. If infinity is not indicated at pressure over 4.9 kPa (0.5 kg/cm$^2$, 7 psi), the switch is faulty.

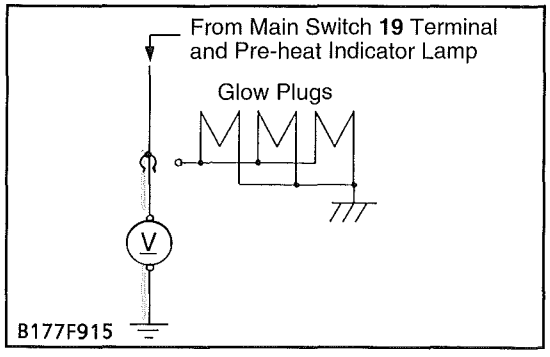


B177F937

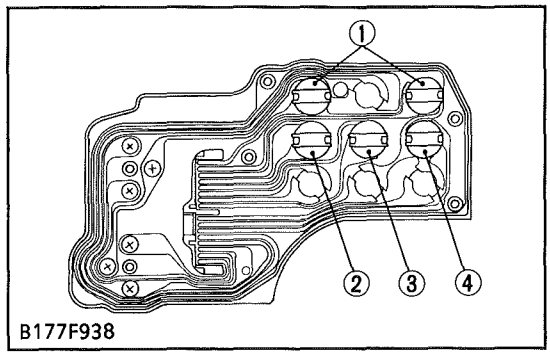
| | | |
|---|---|---|
| Resistance (Switch terminal - Chassis) | In normal state | 0 ohm |
| | At pressure over approx. 4.9 kPa (0.5 kgf/cm$^2$, 7 psi) | Infinity |

## Glow Plug

1. Disconnect the lead from the glow plug.
2. Connect the tester positive cable to the glow plug lead and negative one to the chassis.
3. Measure its voltage with a voltmeter, after turning the main switch to the preheating or starting position.
4. If its voltage is not approximately the battery one, check the main switch or wiring harness.



B177F915



B177F938

(1) Hazard
(2) Engine Oil Pressure
(3) Charge
(4) Pre-heat

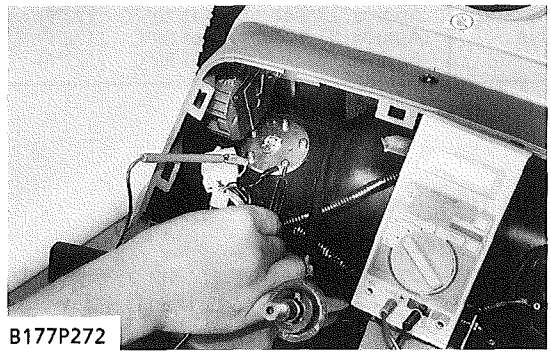
**Monitor Lamp (for Charge, Engine Oil Pressure, Pre-heat and Hazard)**

1. After removing the panel board from tractor, remove the plate behind the panel.
2. Remove the each lamp.
3. Measure the lamp resistance.
4. If it is infinity, replace the lamp with new.

| | |
|---|---|
| Lamp spec. | 12 V, 1.7 W |

# [7] GAUGE

## CHECKING


B177P272

**Fuel Level Sensor**

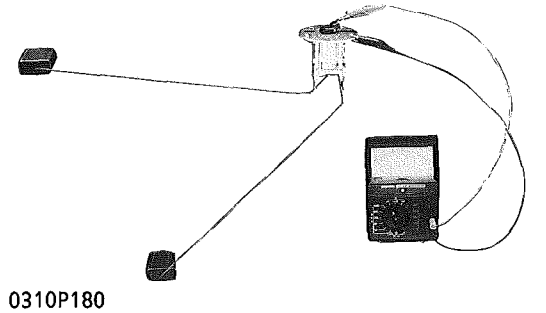
**1) Lead Terminal Voltage**

1. Remove the panel board and disconnect the connector from the fuel gauge unit after turning the main switch off.
2. Turn the main switch on and measure the voltage with a voltmeter across the connector terminal and the chassis.
3. If the voltage differs from the battery voltage, the wiring harness is faulty.

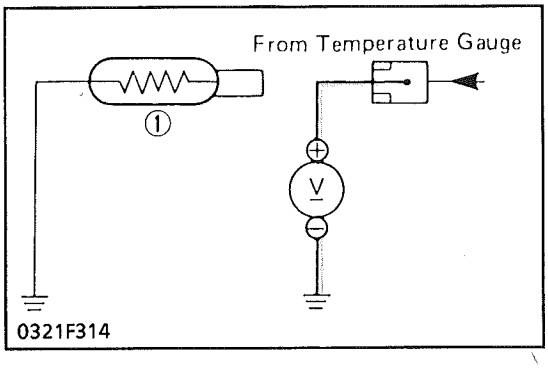
| | | |
|---|---|---|
| Voltage | Lead terminal - Chassis | Approx. battery voltage |

**2) Sensor Continuity**

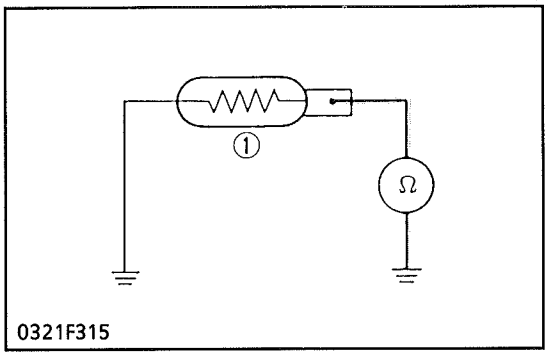
1. Remove the fuel level sensor from the fuel tank.
2. Measure the resistance with an ohmmeter across the sensor terminal and its body.
3. If the reference values are not indicated, the sensor is faulty.


0310P180

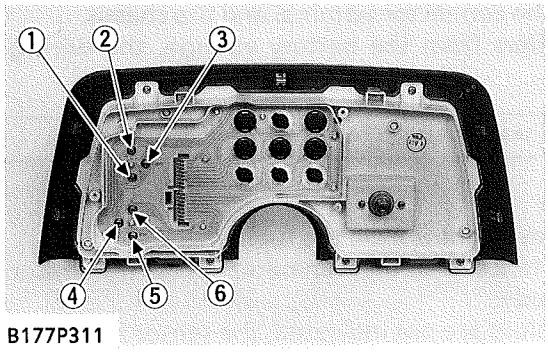
| | | | |
|---|---|---|---|
| Resistance (Sensor terminal - its body) | Reference value | Float at upper-most position | 1 to 5 ohms |
| | | Float at lower-most position | 103 to 107 ohms |



0321F314



0321F315



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<br>Approx. 23.6 ohms<br>Approx. 51.9 ohms<br>Approx. 153.9 ohms | at 130°C (266°F)<br>at 105°C (221°F)<br>at 80°C (176°F)<br>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)

# ⚠ SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and decals on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.
It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.

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

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

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

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

■ **NOTE** : Gives helpful information.

## 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 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.
(19) Be sure to chock the wheels to prevent accident during servicing the machine.

# SAFETY OPERATION

## [BEFORE OPERATION]

(1) Read the "OPERATOR'S MANUAL" carefully. Be thoroughly familiar with the controls and the proper use of the equipment.
(2) Do not wear loose, bulky clothing when operating the machine. Do wear safety shoes and eye protection.
(3) Do not operate the machine while under the influence of alcohol, medication, or other substances or while fatigued.
(4) Never allow children or inadequately trained persons to operate the machine. Keep everyone, especially children and pets, away from the area of operation.
(5) Thoroughly inspect the area where the machine is to be used. Remove all sticks, stones, bottles, cans, wires, etc.
(6) Remove all debris (string, wire or cords) which might wrap around blade shafts.
(7) Keep all shields and safety devices in place. If a shield, safety device or decal is missing, defective or damaged, repair or replace it before operating.
(8) Use only implements, attachments and accessories approved by KUBOTA.
(9) Fuel is very flammable. Handle fuel carefully.
- Use a properly and approved safety container.
- Refuel the machine outdoors.
- Shut off engine and allow it to cool before refueling.
- Do not refuel the machine while smoking or when near open flame or sparks.
- Do not overflow fuel while filling fuel tank.
- Install the fuel tank cap securely, and clean up any spilled fuel before starting the engine.

## [OPERATION]

(1) Operate the machine only in daylight or in good artificial light.
(2) Do not run the engine in a closed area without adequate ventilation.
(3) Before starting the engine, make sure that all shift levers are in neutral positions or in disengaged positions.
(4) Never start the engine while standing on ground. Start the engine only from operator's seat.
(5) Be alert when operating. To prevent loss of control :
- Watch for holes in the terrain or other hidden hazards.
- Do not drive close to ditches, creeks, or other hazardous areas.
- Reduce speed when making sharp turns.
- Avoid sudden stops and starts.
- Before backing up, look to the rear to make sure no people or obstacles are behind you or the machine.

(6) Keep side discharge chute, mulching plate or grass catcher (option) in place.
(7) Do not discharge clippings toward people or objects.
(8) Do not put hands or feet near or under mower deck.
(9) Shut the engine off and wait for all movement to stop before removing grass catcher or unclogging discharge chute.
(10) Adjust cutting height only when engine is stopped and mower blades have stopped turning.
(11) Mow across the face of slopes — never up and down. Exercise extreme caution when changing direction on slopes. Do not mow excessively steep slopes.
(12) To reduce fire hazards, keep the engine exhaust area free of grass or leaves.
(13) Disengage power to the mower blades before crossing gravel drives, walks, or roads.
(14) If the machine should start to vibrate abnormally, stop the engine and check immediately for the cause. Vibration is generally a warning of trouble.
(15) After striking a foreign object, stop the engine immediately and thoroughly inspect the machine for any damage. Repair damage before restarting and operating the machine.
(16) Before leaving the operator's position :
- All shift levers are in neutral positions or in disengaged positions.
- Shut off engine, and remove the key.

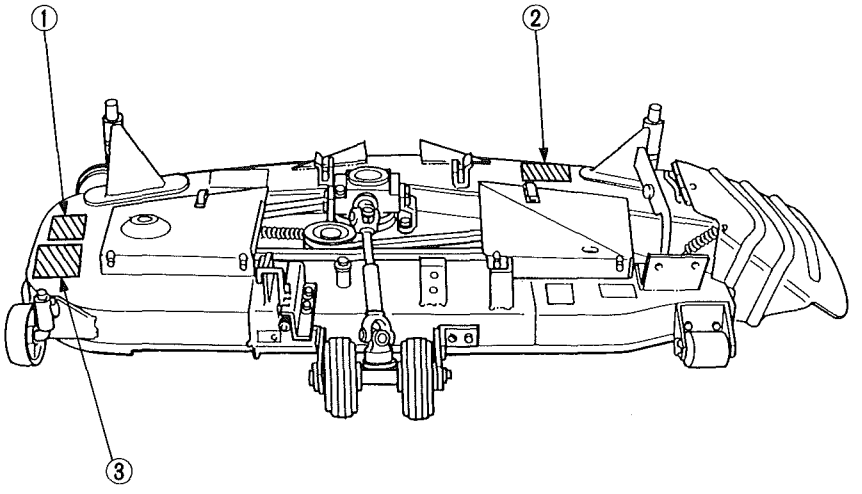
(17) Do not operate the rear gauge wheel adjusting lever without support by block.

## [TRANSPORTING]

(1) Disengage power to the mower blades, implements and attachments before transporting the machine.
(2) Do not tow this machine.
(3) Do not use this machine on public roads. If you must transport it, use a pick-up truck, trailer, or other suitable machine and ramp.
(4) Tie the machine down securely before transporting on public roads.

# SAFETY DECALS

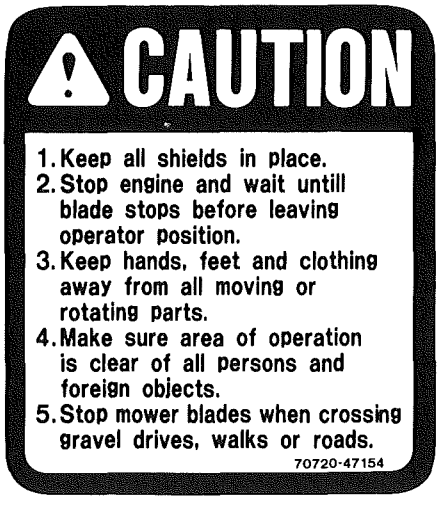
- **The following safety decals are installed on the mower.**
  **If a decal becomes damaged, illegible or is not on the mower, replace it. The decal part number is listed in the parts list.**




① Part No. 66071-61791


② Part No. 66071-61781


③ Part No. 70720-47154

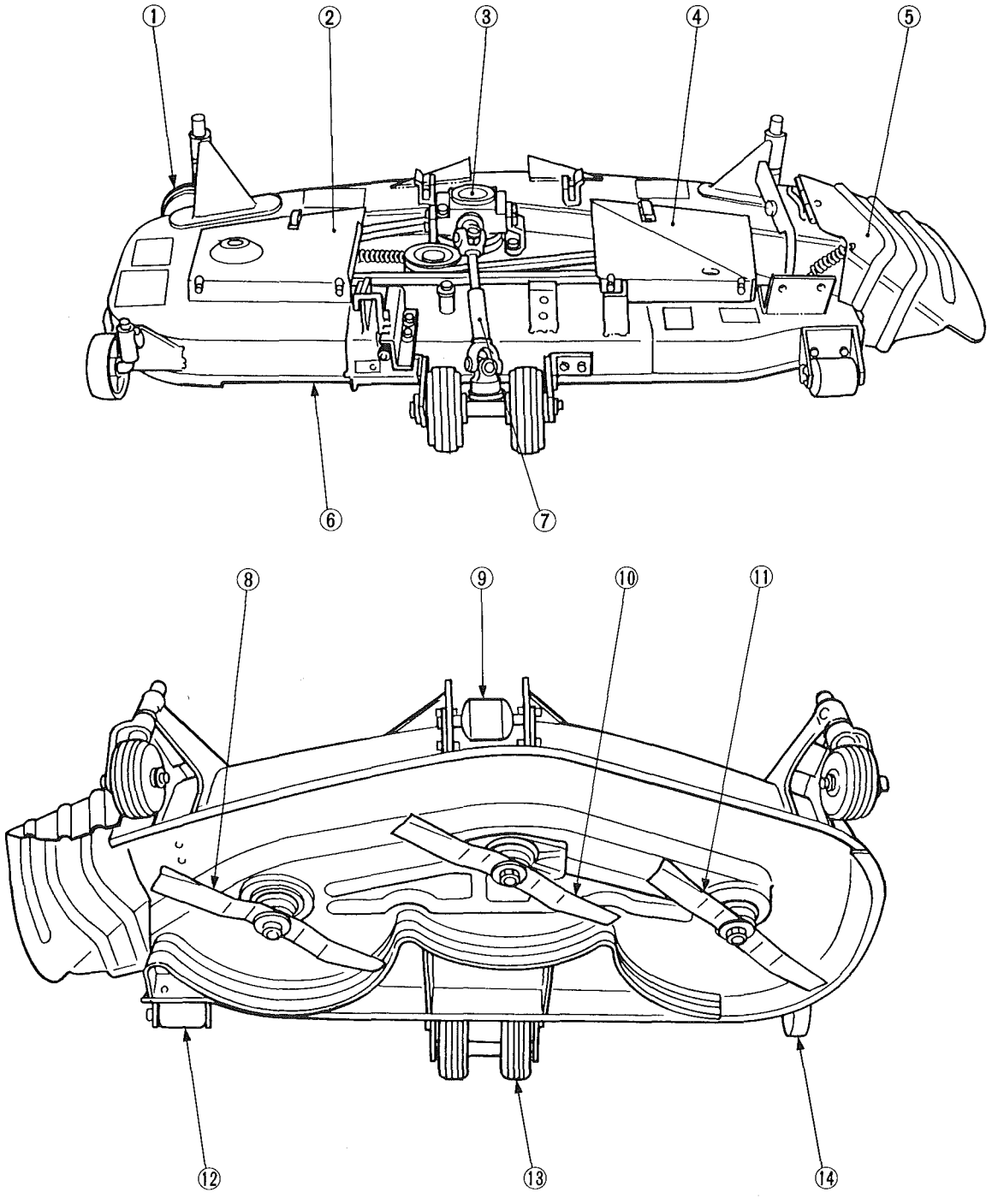



B177FM01

# SPECIFICATIONS

| Model | | RC54-24B | RC60-24B |
|---|---|---|---|
| Suitable tractor | | B1700, B2100, B2400 | |
| Mounting method | | Parallel linkage | |
| Adjustment of cutting height | | Gauge wheel | |
| Cutting width | | 1372 mm (54 in.) | 1524 mm (60 in.) |
| Cutting height | | 38 to 102 mm (1.5 to 4.0 in.) | |
| Weight (Approx.) | | 142 kg (314 lbs) | 152 kg (335 lbs) |
| Blade spindle speed | | 54.7 $S^{-1}$ (3280 rpm) | 49.5 $S^{-1}$ (2970 rpm) |
| Blade tip velocity | | 81.5 m/s (16050 fpm) | 81.3 m/s (15995 fpm) |
| Blade length | | 475 mm (18.7 in.) | 523 mm (20.6 in.) |
| Number of blades | | 3 | |
| Dimensions | Total length | 1008 mm (39.7 in.) | 1060 mm (41.7 in.) |
| | Total width | 1758 mm (69.2 in.) | 1881 mm (74.1 in.) |
| | Total height | 345 mm (13.6 in.) | 345 mm (13.6 in.) |

# EXTERIOR VIEW AND APPELLATION



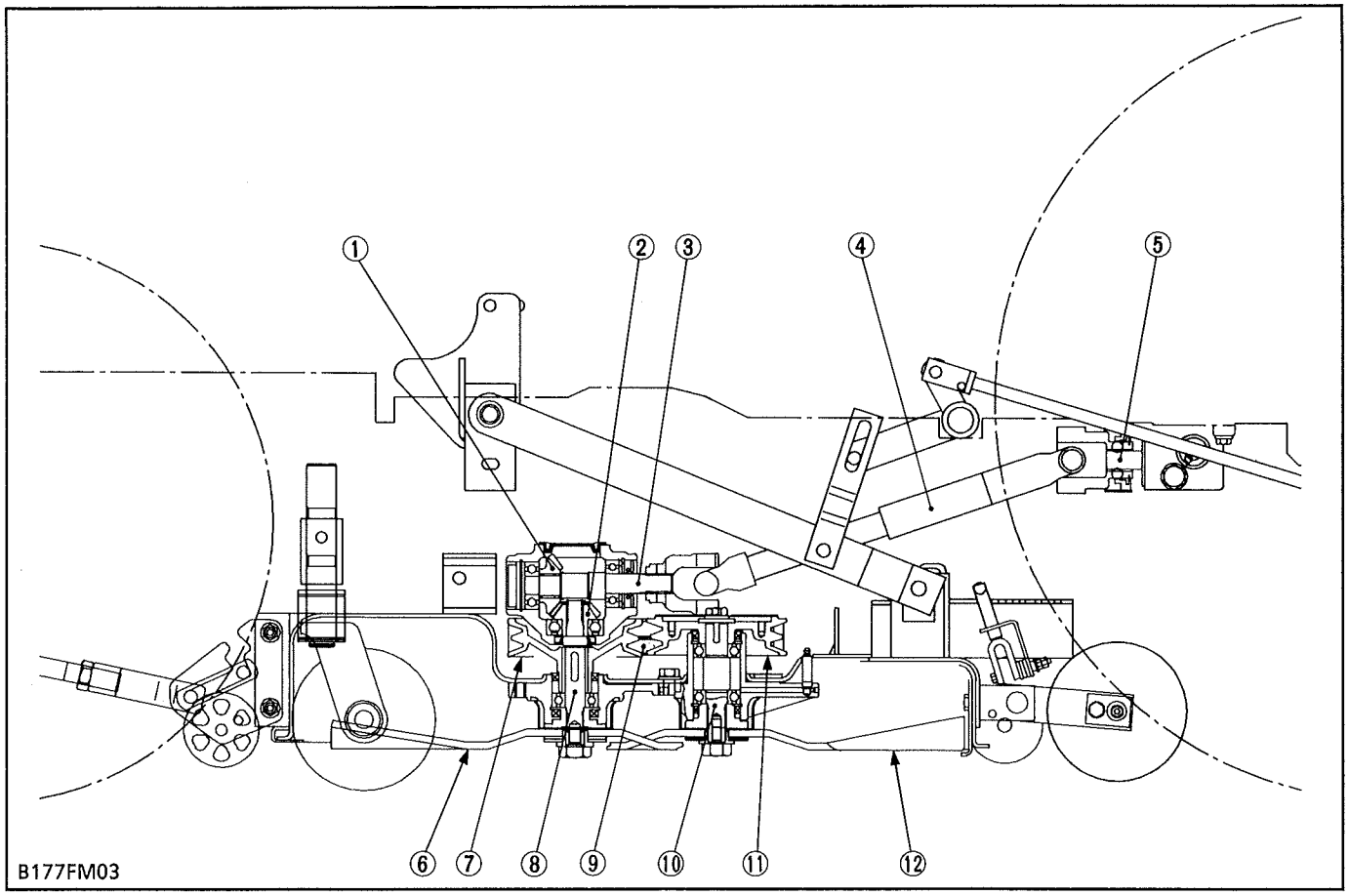

B177FM02

(1) Front Gauge Wheel
(2) Belt Cover (Left)
(3) Gear Box
(4) Belt Cover (Right)
(5) Discharge Deflector
(6) Deck
(7) Universal Joint
(8) Outer Blade
(9) Front Anti-scalp Roller
(10) Center Blade
(11) Outer Blade
(12) Rear Anti-scalp Roller
(13) Rear Gauge Wheel
(14) Anti-scalp Wheel

# MECHANISM

## CONTENTS

# [1] POWER TRANSMISSION




(1) 21T Bevel Gear (RC54-24B)
19T Bevel Gear (RC60-24B)
(2) 16T Bevel Gear
(RC54-24B·RC60-24B)
(3) Pinion Shaft
(4) Universal Joint
(5) Mid PTO Shaft
(6) Center Blade
(7) Center Pulley
(8) Bevel Gear Shaft
(9) Mower Belt
(10) Blade Shaft
(11) Outer Pulley
(12) Outer Blade

The power is transmitted from mid PTO to blades as follows:

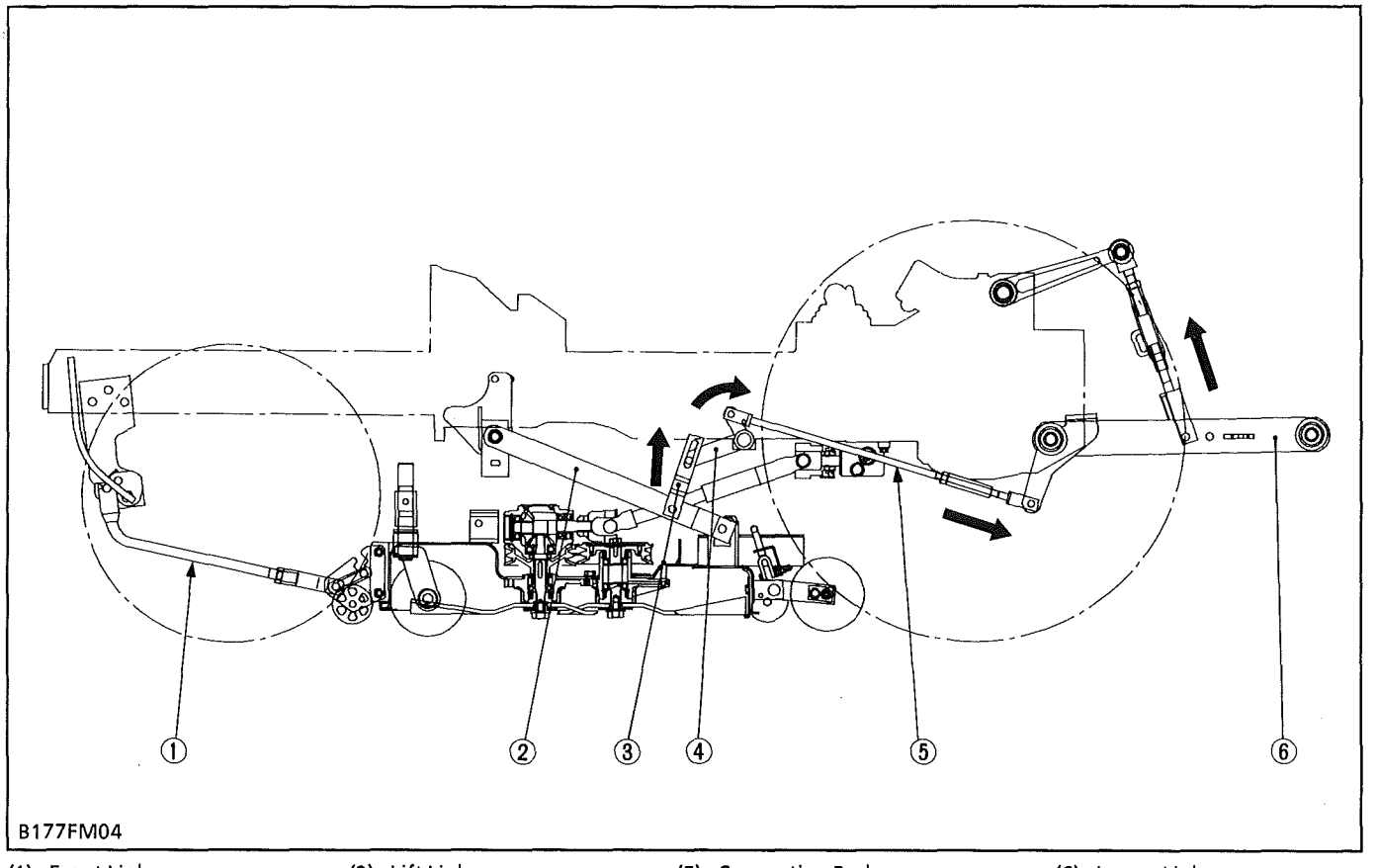
**■ Center Blade**

Mid PTO Shaft (5) → Universal Joint (4) → Pinion Shaft (3) → 21T Bevel Gear (or 19T Bevel Gear) (1) → 16T Bevel Gear (2) → Bevel Gear Shaft (8) → Center Blade (6)

**■ Outer Blade**

Mid PTO Shaft (5) → Universal Joint (4) → Pinion Shaft (3) → 21T Bevel Gear (or 19T Bevel Gear) (1) → 16T Bevel Gear (2) → Bevel Gear Shaft (8) → Center Pulley (7) → Mower Belt (9) → Outer Pulley (11) → Blade Shaft (10) → Outer Blade (12)

## [2] LIFTING MECHANISM




B177FM04

(1) Front Link
(2) Rear Link
(3) Lift Link
(4) Lift Arm
(5) Connecting Rod
(6) Lower Link

The lifting of mower is performed by the hydraulic system installed on the tractor.

For avoiding danger, the mower should be kept lifting when traveling. When the position control lever is moved to "**LIFT**" position, the lower links (6) are risen by the oil pressure of hydraulic system, and the connecting rods (5) are pulled rearward.

Therefore, lift arms (4) round and the mower is lifted by the lift links (3) and rear links.

As this link system is a pantographic linkage, the mower can be kept parallel at every position.

**⚠ CAUTION**

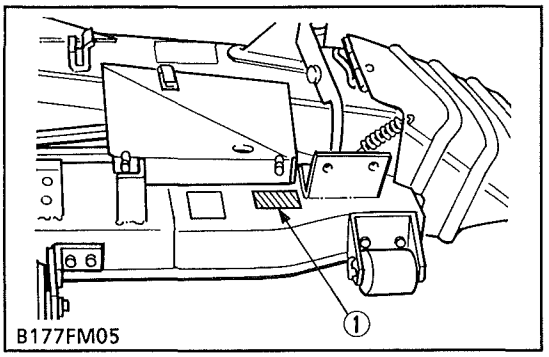
- **Never operate mower in transport position.**

# SERVICING

## CONTENTS

# GENERAL

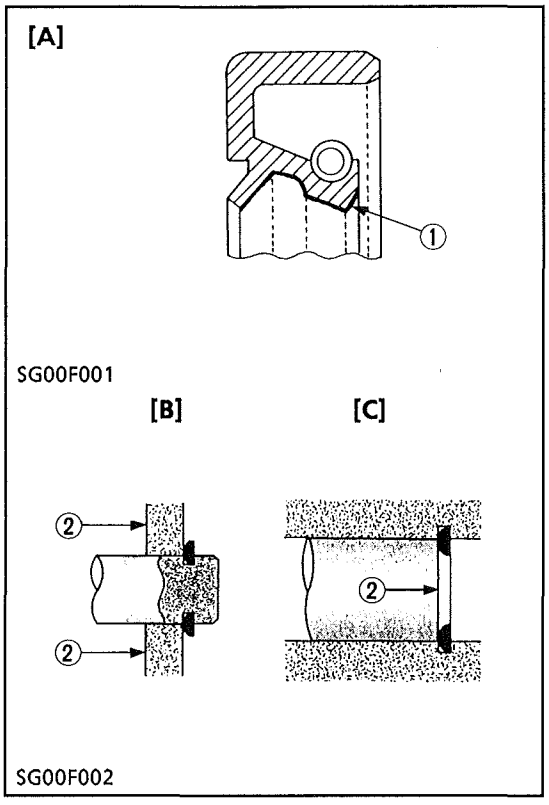
## [1] MOWER IDENTIFICATION




When contacting your local KUBOTA distributor, always specify mower serial number.

(1) Mower Serial Number

## [2] GENERAL PRECAUTION




- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Screws, bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently used should be made according to the drawings provided.
- Use KUBOTA genuine parts or KUBOTA - recommended parts and lubricants or their equivalents.
- Gaskets and O-rings must be replaced during reassembly.
- Apply grease to new O-rings or oil seals before assembling. See the figure.
- When reassembling external snap rings or internal snap rings, they must be positioned so that sharp edge faces against the direction from which a force is applied. See the figure.
- Use only metric tools when servicing this mower. Metric screws, bolts and nuts are not interchangeable with nonmetric fasteners.
- Remove oil and dirt from parts before measuring.

(1) Grease
(2) Force
(3) Sharp Edge

**[A] Oil Seal**
**[B] External Snap Ring**
**[C] Internal Snap Ring**

## [3] LUBRICANTS

| Place | Capacity | Lubricants |
|---|---|---|
| Gear box | 0.36 ℓ<br>0.38 U.S.qts.<br>0.32 Imp.qts. | SAE 90 gear oil<br>(API Service GL-5 gear oil) |
| **Greasing** | | |
| Universal joint | Until grease overflows | SAE multi-purpose type grease |
| Spindle shafts<br>(Bevel gear shaft and blade shafts) | Until grease overflows | |
| Belt tension pulley | Until grease overflows | |
| Belt tension pivot | Until grease overflows | |
| Lift arms | Until grease overflows | |
| Front gauge wheels | Until grease overflows | |
| Rear gauge wheels | Until grease overflows | |

## [4] TIGHTENING TORQUES (GENERAL USE SCREWS, BOLTS AND NUTS)

Screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual should be tightened according to the table below.

| Grade / Unit / Nominal Diameter | No-grade or 4T * ( ⬡ or ④ ) | | | 7T * ( ⑦ ) | | |
|---|---|---|---|---|---|---|
| | N·m | kgf·m | ft-lbs | N·m | kgf·m | ft-lbs |
| M 6 | 7.85 to 9.32 | 0.80 to 0.95 | 5.79 to 6.87 | 9.81 to 11.28 | 1.00 to 1.15 | 7.24 to 8.32 |
| M 8 | 17.65 to 20.59 | 1.80 to 2.10 | 13.0 to 15.2 | 23.54 to 27.46 | 2.40 to 2.80 | 17.4 to 20.2 |
| M10 | 39.23 to 45.11 | 4.00 to 4.60 | 29.0 to 33.2 | 48.05 to 55.90 | 4.90 to 5.70 | 35.5 to 41.2 |
| M12 | 62.76 to 72.57 | 6.40 to 7.40 | 46.3 to 53.5 | 77.47 to 90.22 | 7.90 to 9.20 | 57.2 to 66.5 |
| M14 | 107.9 to 125.5 | 11.0 to 12.8 | 79.6 to 92.5 | 123.6 to 147.1 | 12.6 to 15.0 | 91.2 to 108 |
| M16 | 166.7 to 191.2 | 17.0 to 19.5 | 123 to 141 | 196.1 to 225.6 | 20.0 to 23.0 | 145 to 166 |
| M18 | 245.2 to 284.4 | 25.0 to 29.0 | 181 to 210 | 274.6 to 318.7 | 28.0 to 32.5 | 203 to 235 |
| M20 | 333.4 to 392.3 | 34.0 to 40.0 | 246 to 289 | 367.7 to 431.5 | 37.5 to 44.0 | 272 to 318 |

* The figures on the table above are indicated the top of screw or bolt.

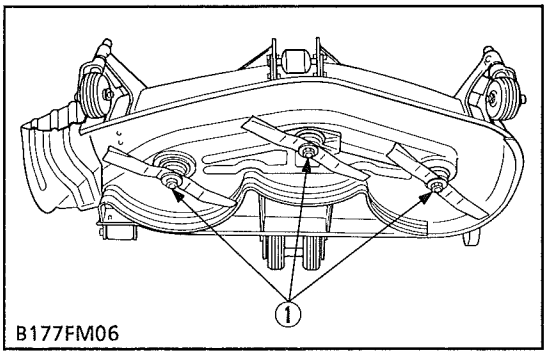
# [5] MAINTENANCE CHECK LIST

To keep the mower working in good condition as well as to avoid any accident and trouble, carry out periodic inspection and maintenance. Check the following points before use.

| Service Interval | Check Points | Reference Page |
|---|---|---|
| Daily (Each use) | • Anything unusual in previous day's operation | – |
| | • Make sure mower blade screws are tighten | M-S3 |
| | • Check mower blades for wear or damage | M-S14 |
| | • Check gear box oil level | M-S4 |
| | • Check oil leaks | – |
| | • Check all hardware | – |
| | • Make sure all pins are in place | – |
| | • Clean mower deck | – |
| | • Apply grease to universal joint | M-S4 |
| | • Apply grease to spindle shafts (Bevel gear shaft and blade shafts) | M-S4 |
| | • Apply grease to belt tension pulley | M-S5 |
| | • Apply grease to belt tension pivot | M-S5 |
| | • Apply grease to lift arms | M-S5 |
| Initial 50 hours | • Change gear box oil | M-S5 |
| Every 50 hours | • Apply grease to front gauge wheels | M-S6 |
| | • Apply grease to rear gauge wheels | M-S6 |
| | • Check mower belt | M-S14 |
| Every 150 hours | • Change gear box oil | M-S5 |
| Every 2 years (After purchase) | • Replace gear box oil seal | M-S6 |

# [6] CHECK AND MAINTENANCE

## (1) Check Points of Daily or Each Use




(1) Mower Blade Screw

### Retightening Mower Blade Screw

**⚠ CAUTION**

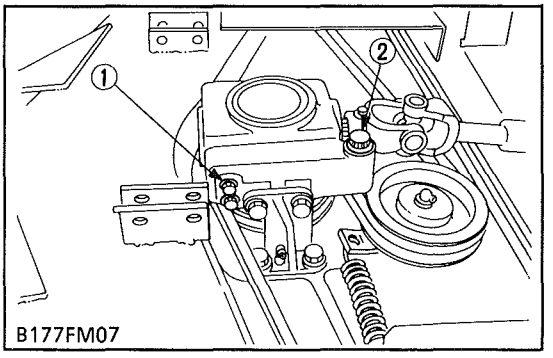
- **To avoid injury, always handle the mower blade with care.**

1. Dismount the mower and turn it over to expose the mower blades.
2. Wedge a block of wood securely between the mower blade and mower deck.
3. Retighten the mower blade screw to the specified torque.
4. If the mower blade screw is worn or broken, replace it.

| | | |
|---|---|---|
| Tightening torque | Mower blade screw | 98.1 to 117.7 N·m<br>10.0 to 12.0 kgf·m<br>72.3 to 86.8 ft-lbs |

### Checking Mower Blade

1. See page M-S14.



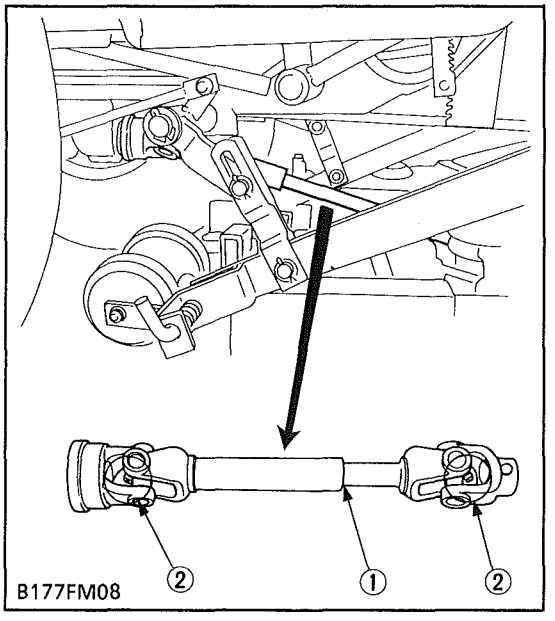

## Checking Gear Box Oil Level

1. Place the mower on level ground.
2. Loosen the check plug (1), and check to see if oil seep from the opening.
3. If the oil level is low, remove the oil filler plug (2) and add new gear oil.

**■ IMPORTANT**

- **Use the specified gear oil. Refer to "LUBRICANTS". (See page M-S2.)**

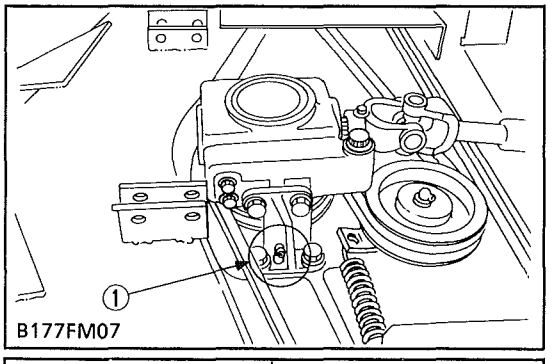
(1) Check Plug (2) Oil Filler Plug




## Greasing Universal Joint

1. Grease the internal splines (1) and grease nipples (2) of the universal joint if the amount of grease is insufficient.

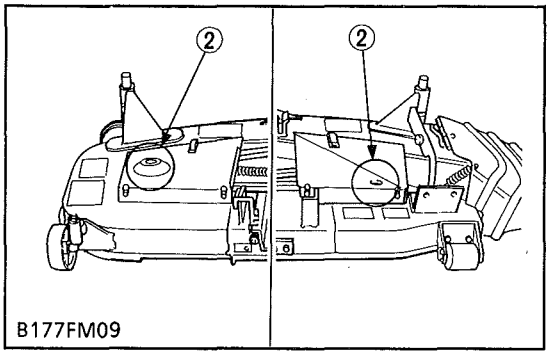
(1) Spline (2) Grease Nipple

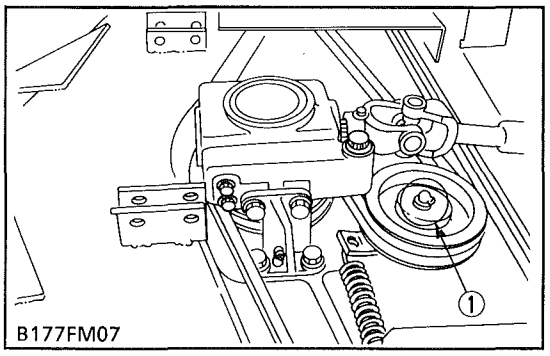



## Greasing Spindle Shafts

1. Grease the grease nipples (1), (2) of the spindle shafts if the amount of grease is insufficient.

(1) Grease Nipple (Bevel Gear Shaft) (2) Grease Nipple (Blade Shaft)

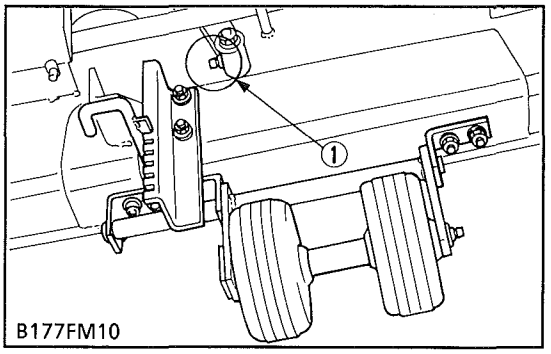





### Greasing Belt Tension Pulley

1. Grease the grease nipple (1) of the belt tension pulley if the amount of grease is insufficient.

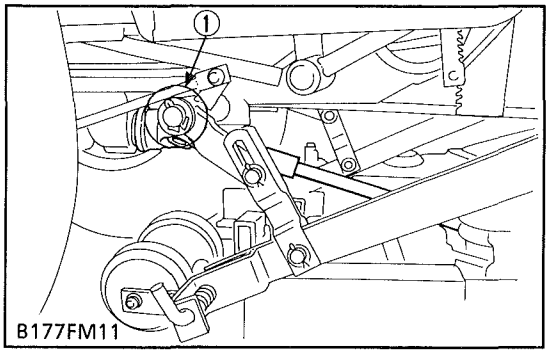
(1) Grease Nipple




### Greasing Belt Tension Pivot

1. Grease the grease nipple (1) of the belt tension pivot if the amount of grease is insufficient.

(1) Grease Nipple

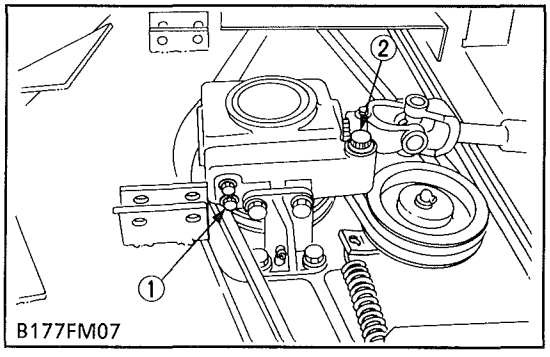



### Greasing Lift Arms

1. Grease the grease nipples (1) of the lift arms if the amount of grease is insufficient.

(1) Grease Nipple

## (2) Check Point of Initial 50 Hours




### Changing Gear Box Oil

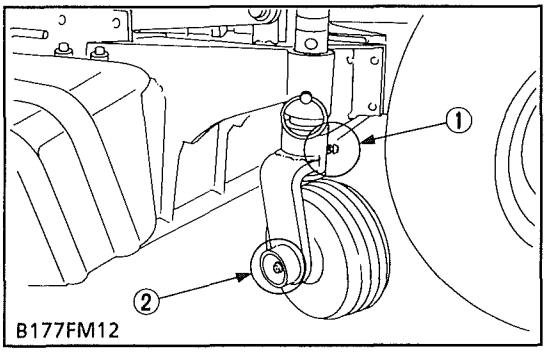
1. Dismount the mower from the tractor, and place the mower on level ground.
2. Remove the oil filler plug (2).
3. Remove the drain plug (1), and drain the used oil completely.
4. After draining the used oil, reinstall the drain plug.
5. Fill with new oil up to the specified level.

**■ IMPORTANT**

- **Use the specified gear oil. Refer to "LUBRICANTS". (See page M-S2.)**

(1) Drain Plug (2) Oil Filler Plug

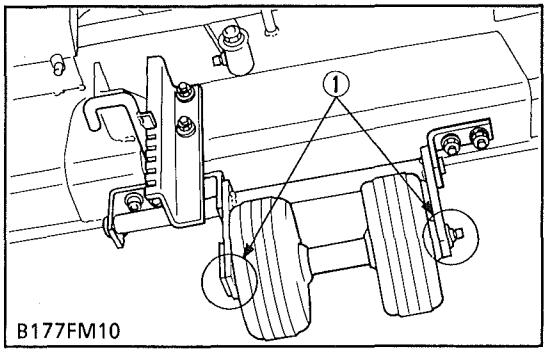
## (3) Check Points of Every 50 Hours




### Greasing Front Gauge Wheels

1. Grease the grease nipples (1), (2) of the front gauge wheels if the amount of grease is insufficient.

(1) Grease Nipple (Front Gauge Wheel Bracket)
(2) Grease Nipple (Front Gauge Wheel)




### Greasing Rear Gauge Wheels

1. Grease the grease nipples (1) of the rear gauge wheels if the amount of grease is insufficient.

(1) Grease Nipple

### Checking Mower Belt

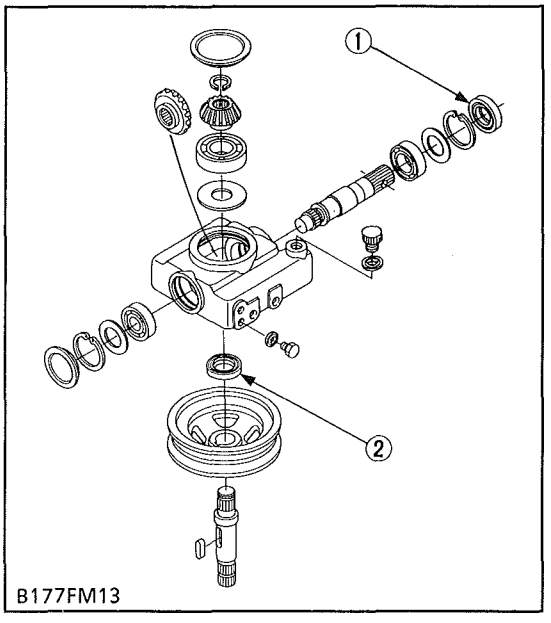
1. See page M-S14.

## (4) Check Point of Every 150 Hours

### Changing Gear Box Oil

1. See page M-S5.

## (5) Check Point of Every 2 Years




### Replacing Gear Box Oil Seal

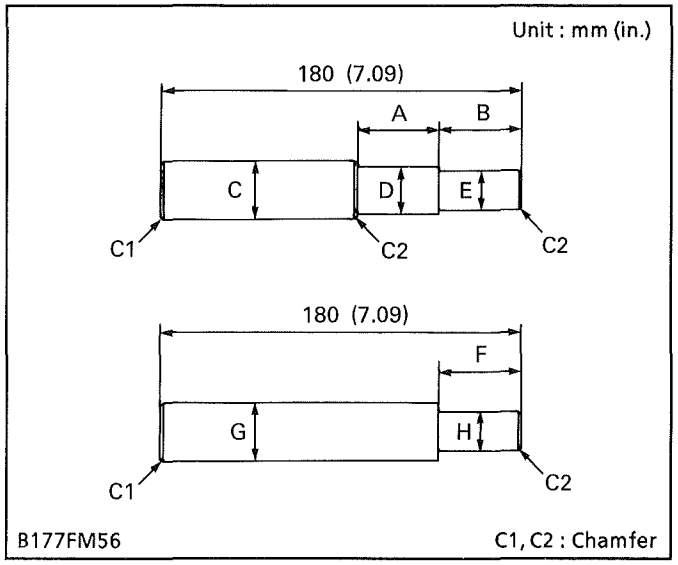
1. Replace the gear box oil seals (1), (2) with new ones. (See page M-S19.)

(1) Oil Seal
(2) Oil Seal

# [7] SPECIAL TOOLS

**NOTE**

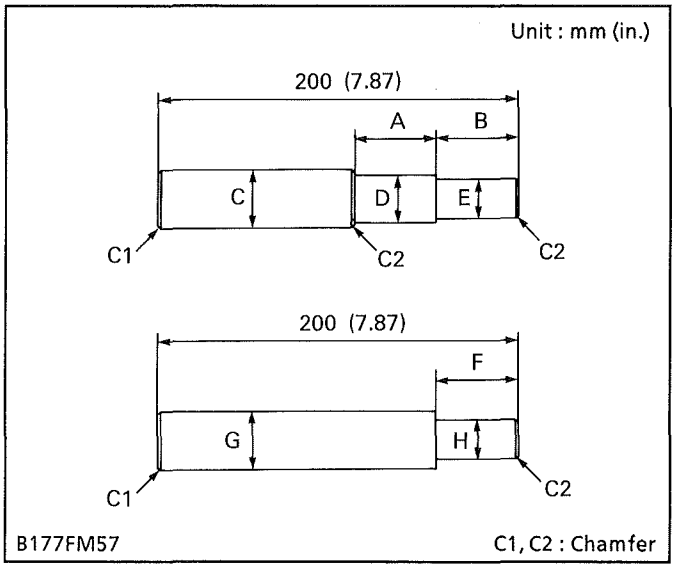
- **The following special tools are not provided, so make them referring to the figures.**




### Tension Arm Bushing Replacing Tool

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

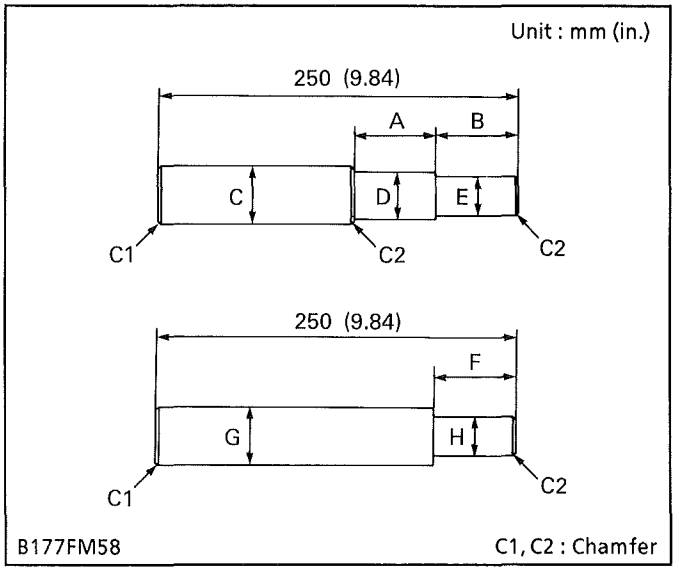
| | | |
|---|---|---|
| A | 43 mm | 1.69 in. |
| B | 42 mm | 1.65 in. |
| C | 28 mm Dia. | 1.10 in. Dia. |
| D | 22.90 to 22.95 mm Dia. | 0.9016 to 0.9035 in. Dia. |
| E | 19.90 to 19.95 mm Dia. | 0.7835 to 0.7854 in. Dia. |
| F | 42 mm | 1.65 in. |
| G | 28 mm Dia. | 1.10 in. Dia. |
| H | 19.90 to 19.95 mm Dia. | 0.7835 to 0.7854 in. Dia. |
| C1 | 2.0 mm | 0.079 in. |
| C2 | 1.0 mm | 0.039 in. |




### Front Gauge Wheel Bushing Replacing Tool

Application : Use to press out and to press fit the front gauge wheel bushing.

| | | |
|---|---|---|
| A | 46 mm | 1.81 in. |
| B | 45 mm | 1.77 in. |
| C | 40 mm Dia. | 1.57 in. Dia. |
| D | 33.90 to 33.95 mm Dia. | 1.3346 to 1.3366 in. Dia. |
| E | 29.90 to 29.95 mm Dia. | 1.1772 to 1.1791 in. Dia. |
| F | 45 mm | 1.77 in. |
| G | 40 mm Dia. | 1.57 in. Dia. |
| H | 29.90 to 29.95 mm Dia. | 1.1772 to 1.1791 in. Dia. |
| C1 | 2.0 mm | 0.079 in. |
| C2 | 1.0 mm | 0.039 in. |

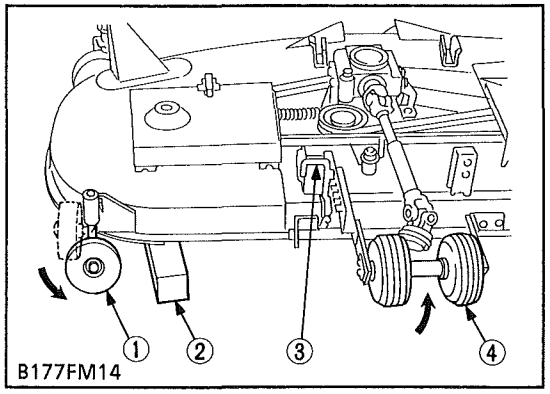



### Rear Link Bushing Replacing Tool

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

| | | |
|---|---|---|
| A | 92 mm | 3.62 in. |
| B | 90 mm | 3.54 in. |
| C | 28 mm Dia. | 1.10 in. Dia. |
| D | 22.90 to 22.95 mm Dia. | 0.9016 to 0.9035 in. Dia. |
| E | 19.90 to 19.95 mm Dia. | 0.7835 to 0.7854 in. Dia. |
| F | 90 mm | 3.54 in. |
| G | 28 mm Dia. | 1.10 in. Dia. |
| H | 19.90 to 19.95 mm Dia. | 0.7835 to 0.7854 in. Dia. |
| C1 | 2.0 mm | 0.079 in. |
| C2 | 1.0 mm | 0.039 in. |

# [8] SETTING UP MOWER



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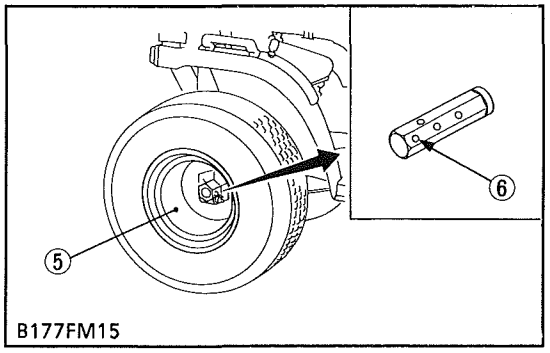


B177FM15

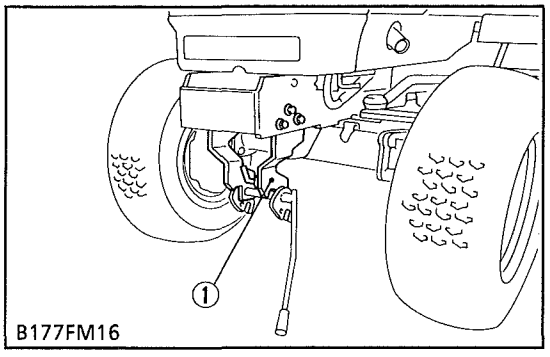
## Assembling Mower

**⚠ CAUTION**

- **Do not operate the rear gauge wheel adjusting lever (3) without support by block (2).**

1. Take out all mower components from the case, and assemble the mower.
2. Support the mower deck with a block (2) as shown in the figure.
3. Turn the anti-scalp wheel (1) sideway position, and set the rear gauge wheel (4) on the lowest cutting height.
4. Remove the a block.
5. Park the tractor on level ground, and set the rear wheels (5) of the tractor at the outer position (6) as shown in the figure.

(1) Anti-scalp Wheel
(2) Block
(3) Rear Gauge Wheel Adjusting Lever
(4) Rear Gauge Wheel
(5) Rear Wheel
(6) Outer Position

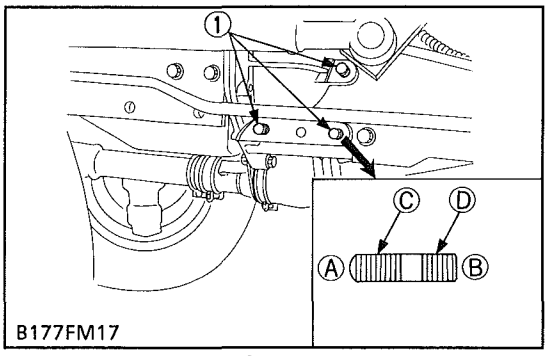


B177FM16

## Front Hanger Bracket

1. Attach the front hanger bracket (1) to the frame with M14 bolts.

(1) Front Hanger Bracket



B177FM17

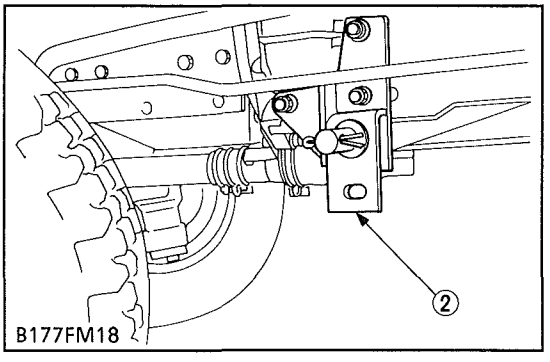
## Mid Hanger Bracket

1. Screw M12 stud bolts (1) in the clutch housing.
2. Attach the mid hanger bracket (2) to the clutch housing with spring washers and nuts.

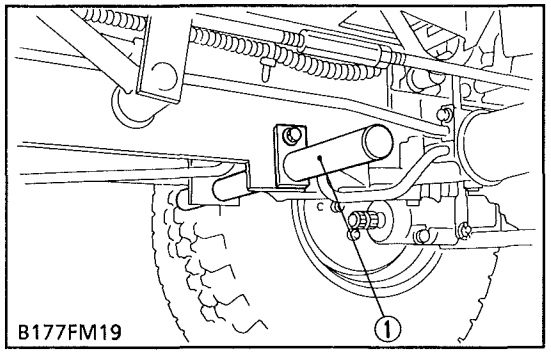
| | | |
|---|---|---|
| Tightening torque | Stud bolt | 31.4 N·m<br>3.2 kgf·m<br>23.1 ft-lbs |
| | Nut | 68.6 N·m<br>7.0 kgf·m<br>50.6 ft-lbs |

(1) Stud Bolt
(2) Mid Hanger Bracket

**(A) Outside**
**(B) Inside**
**(C) Thread Size : M12 x Pitch 1.25**
**(D) Thread Size : M12 x Pitch 1.75**



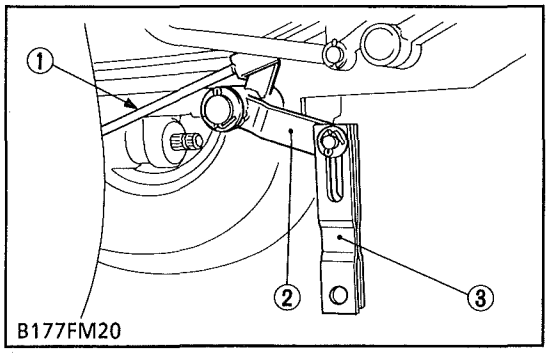
B177FM18




## Rear Hanger Bracket

1. Insert the rear hanger bracket (1) from left side of the frame holes, and set it with M8 bolt.

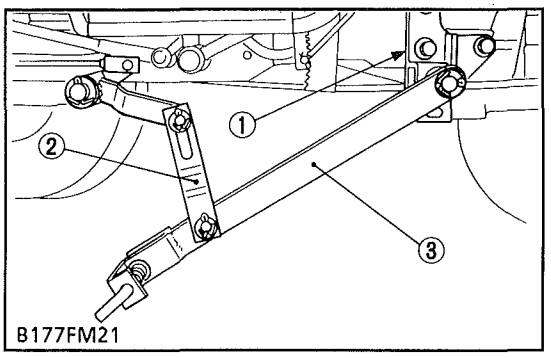
(1) Rear Hanger Bracket




## Lift Arm, Lift Link and Connecting Rod

1. Install the lift arms (2), lift links (3) and connecting rods (1) to the rear hanger bracket with plain washers and cotter pins.

(1) Connecting Rod
(2) Lift Arm
(3) Lift Link



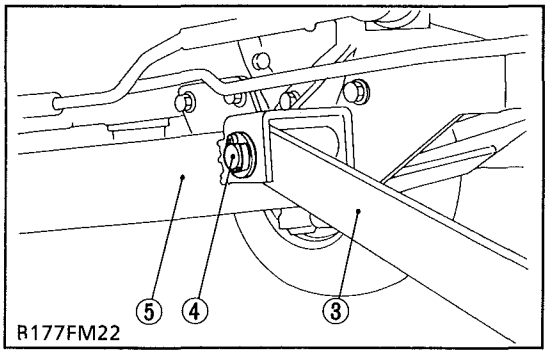

## Rear Link

**(When mounting the mower only)**

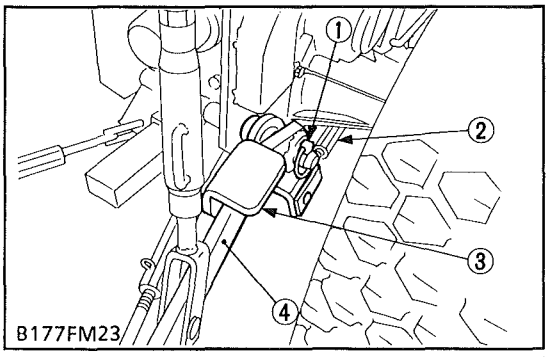
1. Install the rear links (3) to the mid hanger brackets (1) with plain washers and cotter pins.
2. Attach the lift links (2) to the rear links (3) with clevis pins, plain washers and cotter pins.

**(When mounting the mower with front loader)**

1. Install the rear links (3) to the front loader frame (5) with pins (4), plain washers and cotter pins.
2. Attach the lift links (2) to the rear links (3) with clevis pins, plain washers and cotter pins.




(1) Mid Hanger Bracket
(2) Lift Link
(3) Rear Link
(4) Pin (20 mm dia. x 135 mm length, 0.79 in. dia. x 5.31 in. length)
(5) Front Loader Frame



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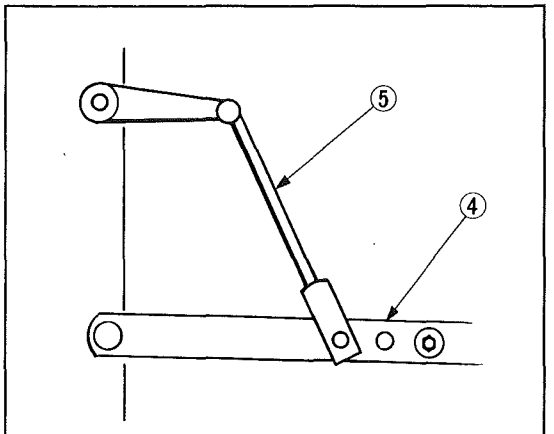

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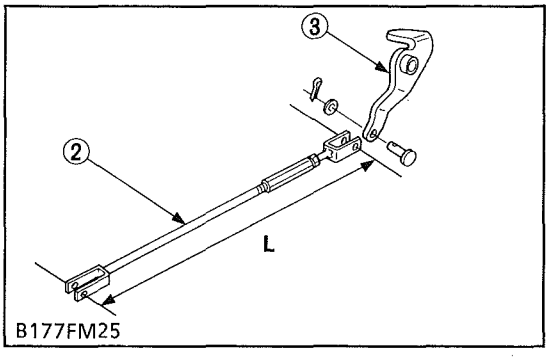
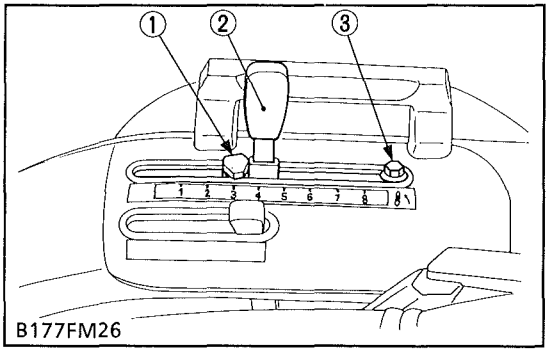


B177FM25



B177FM26

## Lift Bracket

1. Remove the spacer and lower links from the shaft of lower link.
2. Attach both lift brackets (3) inside the lower links (4) with the lower link pins (1) as shown in the figure.
3. Connect the connecting rods (2) to the lift brackets (3) with clevis pins, plain washers and cotter pins.

**■ IMPORTANT**

- **Connect the lift rods (5) of the tractor as shown in the figure, and adjust the length of both lift rods equally with the turnbuckle of the right lift rod.**

**(Reference)**

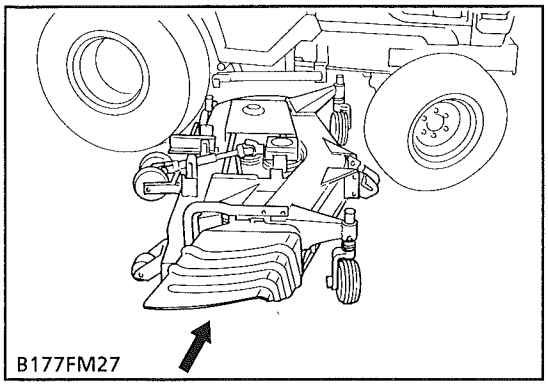
- Make sure the length (L) of the connecting rod (2) is 625 mm (24.6 in.).

(1) Lower Link Pin
(2) Connecting Rod
(3) Lift Bracket
(4) Lower Link
(5) Lift Rod

## Setting Position Control Lever

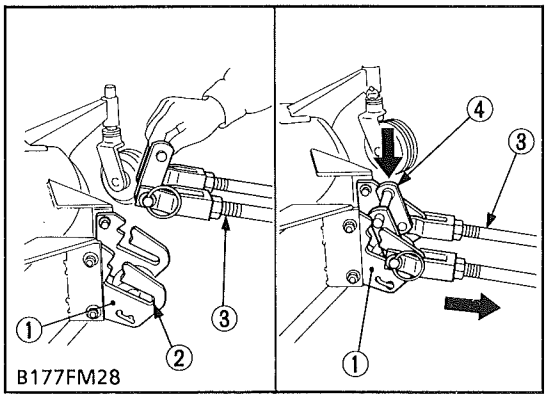
1. Set the stop screw (3) at the top of the range to pull the position control lever (2) back fully.
2. Set the stop knob screw (1) at the **"3"** range as shown in the figure.

(1) Stop Knob Screw
(2) Position Control Lever
(3) Stop Screw


B177FM27

## Setting Mower

1. Turn the steering wheel fully left.
2. Install the mower from right side of the tractor.
3. Roll the mower under the tractor, and then return the steering wheel.



B177FM28

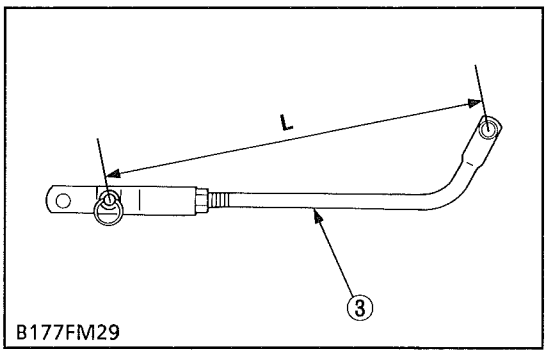
## Front Link

1. Hook the front link (3) with the clevis pin section to front end of the groove (2), and then turn the stopper (4) as shown in the figure.

**(Reference)**

- Make sure the length (L) of the front link (3) is as follows.
  RC54-24B : 505 mm (19.9 in.)
  RC60-24B : 500 mm (19.7 in.)

(1) Stay
(2) Groove
(3) Front Link
(4) Stopper



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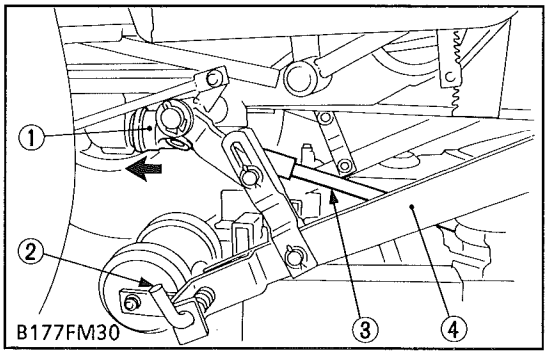
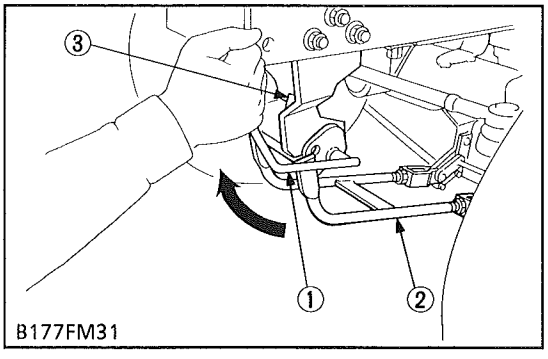


B177FM30

## Mounting Universal Joint and Rear Link

1. Pull back the coupler (1) of the universal joint.
2. Push the universal joint (3) onto the mid PTO shaft, and release the coupler (1).
3. Slide the universal joint back and forward to make sure the universal joint is locked securely.
4. Lower the rear links.
5. Attach the rear links (4) to the mower deck, pulling the L-pins (2).

(1) Coupler
(2) L-pin
(3) Universal Joint
(4) Rear Link



B177FM31

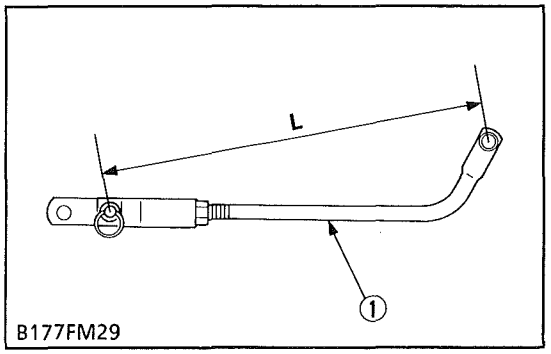
## Mounting Front Link

1. Push down the link fixing lever, pulling the L-pin.
2. Hook the front link (2) to the lever fulcrum, and turn the link fixing lever (1).
3. Return the L-pin (3).

**■ NOTE**

- **Make sure the link fixing lever (1) is fixed with L-pin (3) securely.**

(1) Link Fixing Lever
(2) Front Link
(3) L-pin



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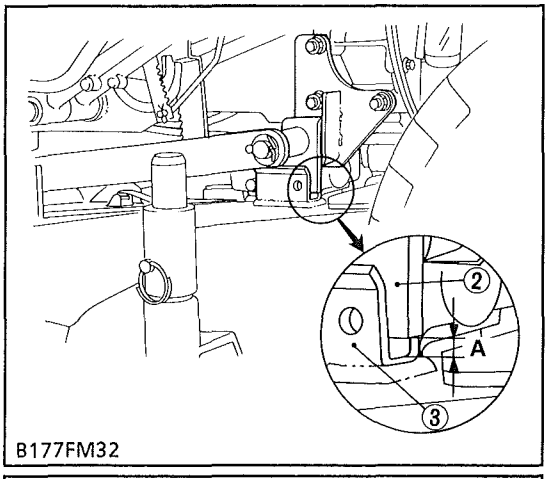

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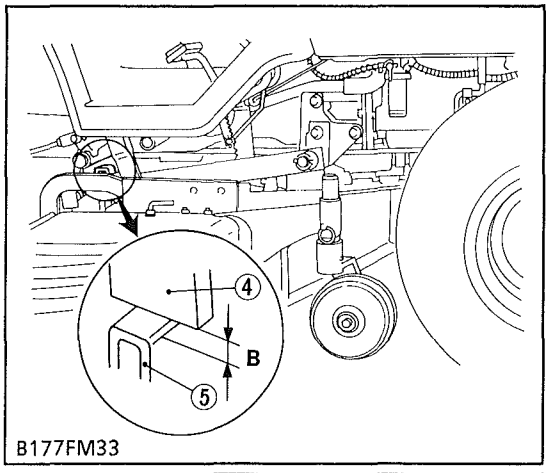

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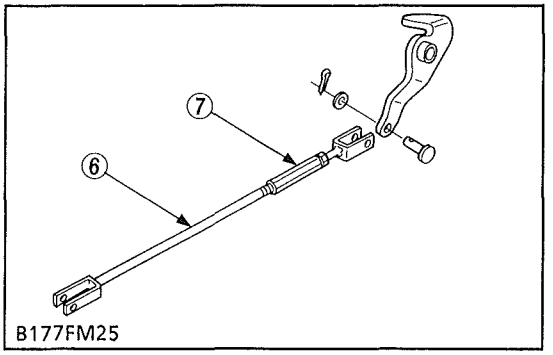


B177FM25

## 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<br>0.08 to 0.20 in. |
| Clearance (B) between rear stopper and tractor frame | Factory spec. | 5 to 10 mm<br>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

# TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Blade Does Not Turn** | • Mid PTO system malfunctioning<br>• Broken mower belt | Check transmission<br>Replace mower belt | –<br>M-S14 |
| **Blade Speed Is Slow** | • Loosen mower belt<br>• Clogged grass<br>• Flattened out or worn cup washer | Replace mower belt or tension spring<br>Remove grass<br>Replace cup washer | M-S14<br>S18<br>–<br>M-S17 |
| **Cutting Is Poor** | • Worn or broken mower blade<br>• Loosen mower blade screw<br>• Cutting height improper | Sharpen or replace mower blade<br>Retighten mower blade screw<br>Adjust cutting height | M-S14<br>M-S3<br>M-S15 |
| **Mower Is Not Lifted** | • Broken linkage system<br>• Trouble of hydraulic system | Replace linkage system<br>Check hydraulic system | –<br>– |

# SERVICING SPECIFICATIONS

| Item | | Factory Specification | Limite de service |
|---|---|---|---|
| Pinion Shaft | Turning Force | Less than 117.7 N<br>12.0 kgf<br>26.5 lbs | – |
| | Turning Torque | Less than 1.47 N·m<br>0.15 kgf·m<br>1.08 ft-lbs | – |
| Bevel Gears in Gear Box | Backlash | 0.10 to 0.20 mm<br>0.0039 to 0.0079 in. | 0.4 mm<br>0.0157 in. |
| Tension collar to Tension Arm Bushing | Clearance | 0.025 to 0.127 mm<br>0.00098 to 0.00500 in. | 0.30 mm<br>0.0118 in. |
| Tension Coller | O.D. | 19.954 to 19.975 mm<br>0.78559 to 0.78642 in. | – |
| Tension Arm Bushing | I.D. | 20.000 to 20.081 mm<br>0.78740 to 0.79059 in. | – |
| Front Gauge Wheel Bushing | I.D. | 30.000 to 30.085 mm<br>1.18110 to 1.18445 in. | 31.000 mm<br>1.22047 in. |
| Rear Link Bushing | I.D. | 20.000 to 20.081 mm<br>0.78740 to 0.79059 in. | 21.000 mm<br>0.82677 in. |

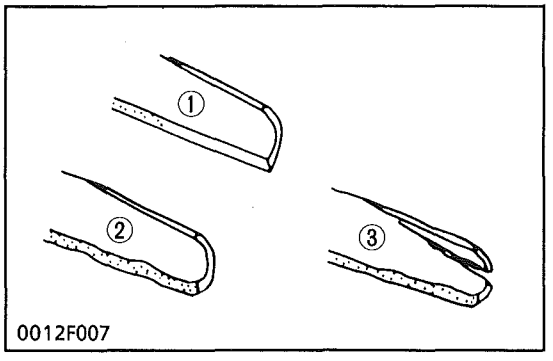
# TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts : See page M-S2)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Gear box bracket mounting screw | 78.5 to 88.2 | 8.0 to 9.0 | 57.9 to 65.1 |
| Mower blade screw | 98.1 to 117.7 | 10.0 to 12.0 | 72.3 to 86.8 |
| Gear box mounting screw | 78.5 to 88.2 | 8.0 to 9.0 | 57.9 to 65.1 |
| Outer pulley mounting nut | 166.7 to 186.3 | 17.0 to 19.0 | 123.0 to 137.4 |
| Pulley holder mounting screw | 77.5 to 90.2 | 7.9 to 9.2 | 57.1 to 66.5 |

# CHECKING, DISASSEMBLING AND SERVICING

## CHECKING AND ADJUSTING



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(1) New Blade
(2) Worn Blade
(3) Cracked Blade

### Checking Mower Blade

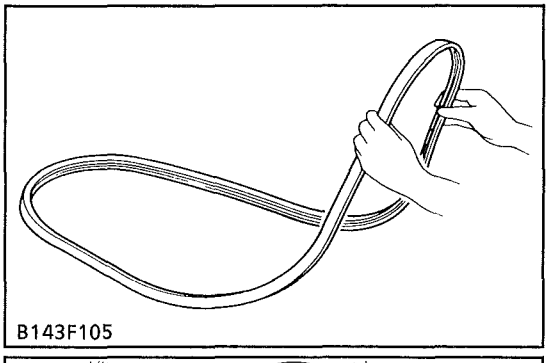
1. Check the cutting edge of mower blade.
2. Sharpen the cutting edges, if the mower blades are as shown in figure ②.
3. Replace the mower blades, if they are as shown in figure ③.

**■ IMPORTANT**

- **Never forget to set the two cup washers between mower blade and spline boss, when reassembling the mower blades.**

**■ NOTE**

- **To sharpen the mower blades by yourself, clamp the mower blade securely in a vise and use a large mill file along the original bevel.**
- **To balance the mower blade, place a small rod through the center hole and check to see if the blade balances evenly. File heavy side of the blade until it balances out even.**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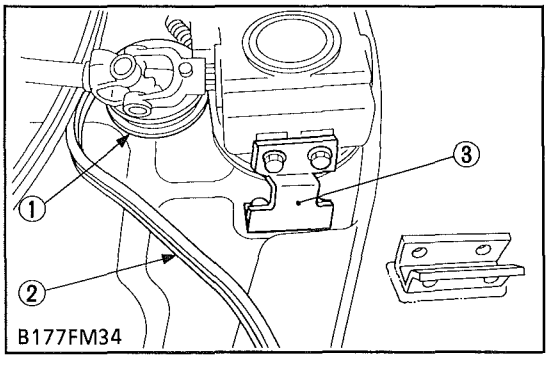
### Checking Mower Belt

1. Check to see the mower belt.
2. Replace the mower belt with a new one, if there is found surface split at more than 3 positions.

**(When replacing mower belt)**

1. Dismount the mower from the tractor.
2. Remove the left and right hand belt cover from the mower deck.
3. Clean around the gear box.
4. Remove the right hand bracket (3) which mounts the gear box to the mower deck.
5. Remove the mower belt (2) from the tension pulley (1). Slip the mower belt over the top of the gear box.
6. To install a new belt, reverse the above procedure.



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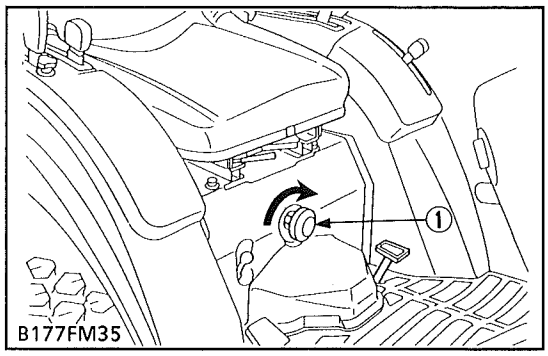
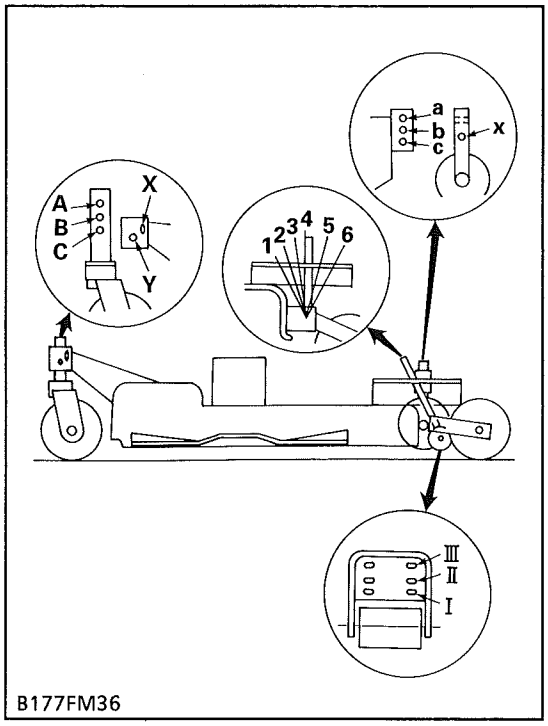
| | | |
|---|---|---|
| Tightening torque | Gear box bracket mounting screw | 78.5 to 88.2 N·m<br>8.0 to 9.0 kgf·m<br>57.9 to 65.1 ft-lbs |

**■ IMPORTANT**

- **After setting the gear box bracket mounting screws on the deck without tightening, then mount the other screws on the gear box. And finally tighten them.**

(1) Tension Pulley
(2) Mower Belt
(3) Gear Box Bracket (Right)




## Adjusting Cutting Height

1. The cutting height can be adjusted from 38 mm to 102 mm (from 1.5 in. to 4.0 in.).
2. To adjust the cutting height, lift the mower slightly and close the 3-point lowering speed knob (1).
3. Adjust the cutting height with the front gauge wheels, rear gauge wheel, anti-scalp wheel and anti-scalp rollers as shown in the table below.
   The recommended cutting height is approx. 50 mm (2.0 in.).

| Cutting height | Front gauge wheel | Rear gauge wheel | Anti-scalp wheel | Anti-scalp roller |
|---|---|---|---|---|
| 38 mm (1.5 in.) | C – X | 1 | a – x | I |
| 51 mm (2.0 in.) | C – Y | 2 | | |
| 64 mm (2.5 in.) | B – X | 3 | b – x | II |
| 76 mm (3.0 in.) | B – Y | 4 | | |
| 89 mm (3.5 in.) | A – X | 5 | c – x | III |
| 102 mm (4.0 in.) | A – Y | 6 | | |

**■ IMPORTANT**

- **After adjusting the cutting height, open the 3-point lowering speed knob (1) and adjust the lowering speed of the mower.**

(1) 3-point Lowering Speed Knob

## Adjusting Front Link and Connecting Rod

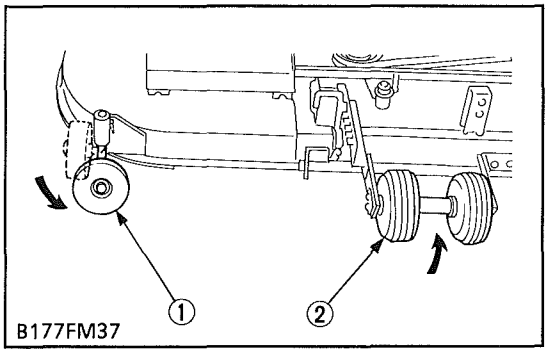
1. See page M-S12.

# DISASSEMBLING AND ASSEMBLING

## (1) Dismounting Mower

**⚠ CAUTION**

- **When dismounting or mounting the mower, park the tractor on flat ground, apply the parking brake, and stop the engine.**



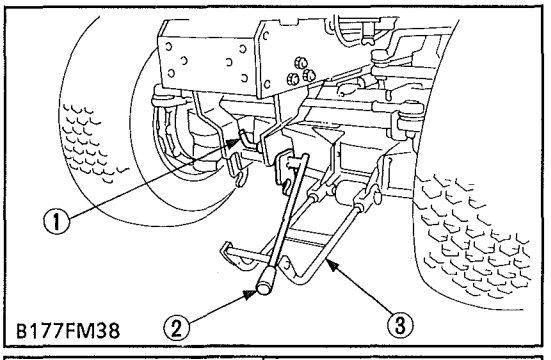

### Anti-scalp Wheel

1. Start the engine, and lift the mower.
2. Turn the anti-scalp wheel (1) sideway position and set the rear gauge wheel (2) on the lowest cutting height.
3. Lower the mower, and stop the engine.

**(When reassembling)**

- After mounting the mower, turn the anti-scalp wheel straight position.

(1) Anti-scalp Wheel (2) Rear Gauge Wheel



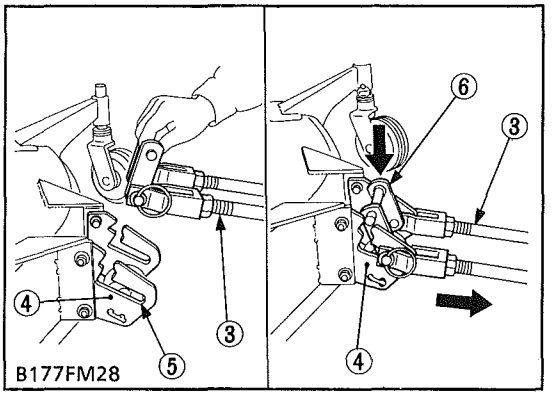

### Front Link

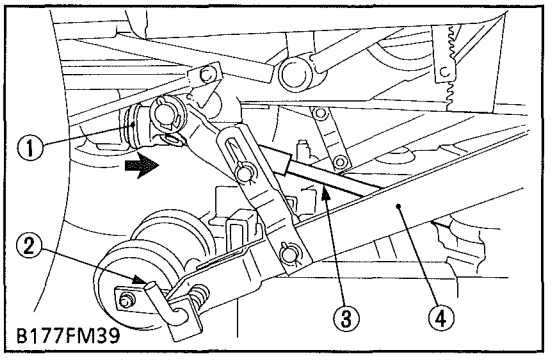
1. Push down the link fixing lever (2) to disconnect the front link (3), pulling the L-pin (1).
2. Remove the front link (3) from the stay (4).

**(When reassembling)**

- Hook the front link (3) with the clevis pin section to front end of the groove (5), and then turn the stopper (6) as shown in the figure.
- Make sure the link fixing lever (2) is fixed with L-pin (1) securely.

(1) L-pin
(2) Link Fixing Lever
(3) Front Link
(4) Stay
(5) Groove
(6) Stopper



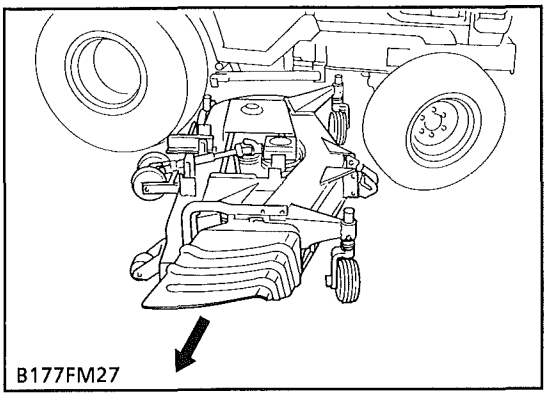

### Rear Link and Universal Joint

1. Disconnect the rear links (4), pulling the L-pin (2).
2. Pull back the coupler (1) to unlock, and remove the universal joint (3) from the mid PTO shaft.
3. Start the engine, and shift the position control lever to **"LIFT"** position.

**(When reassembling)**

- Apply grease to the splines and grease nipples of the universal joint.
- Slide the universal joint back and forward to make sure the universal joint is locked securely.

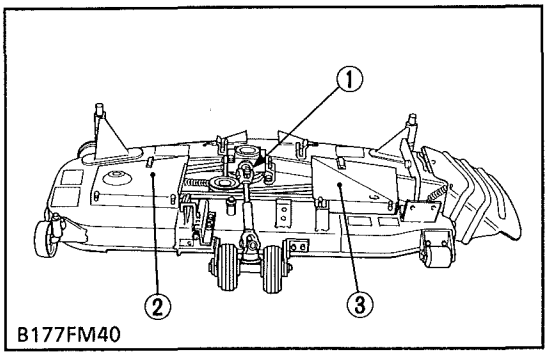
(1) Coupler
(2) L-pin
(3) Universal Joint
(4) Rear Link


B177FM27

### Taking Out Mower

1. Turn the steering wheel fully left.
2. Take out the mower to the right side of the tractor.

## (2) Disassembling Mower

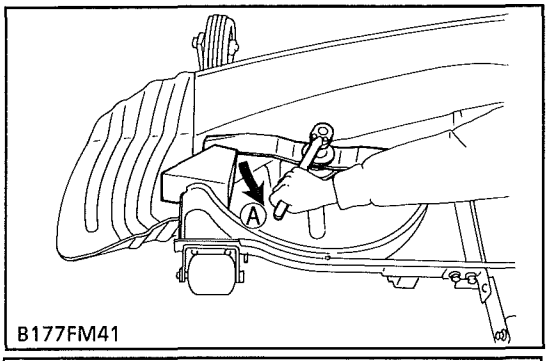


B177FM40

### Universal Joint and Belt Cover

1. Remove the universal joint (1).
2. Remove the left and right belt covers (2), (3).

(1) Universal Joint
(2) Belt Cover (Left)
(3) Belt Cover (Right)



B177FM41

### Mower Blades (Center Blade and Outer Blades)

1. Turn over the mower.
2. Unscrew the mower blade screw (5), and remove the spline boss (4), two cup washers (3), mower blade (2) and dust cover (1).

**■ NOTE**

- **To remove the blade securely, wedge a block of wood between one blade and the mower deck in such position that it will hold the blade safely while loosing or tightening the blade screw.**

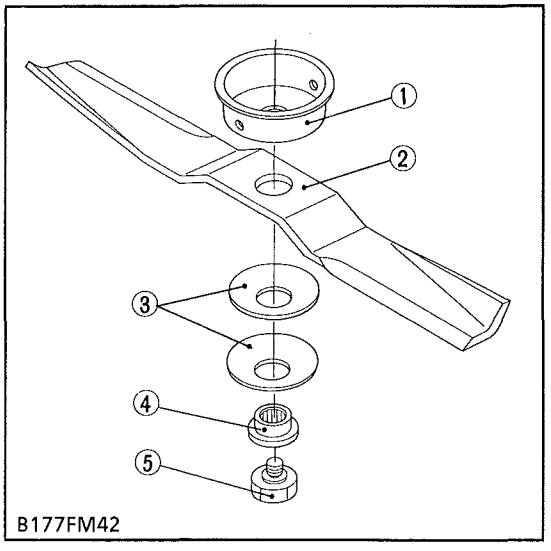
**(When reassembling)**

- Be sure to assemble the two cup washers between the mower blade and spline boss.

**■ IMPORTANT**

- **Make sure the cup washer is not flattened out or worn, causing blade to slip easily.**
  **Replace two cup washers if either is damaged.**

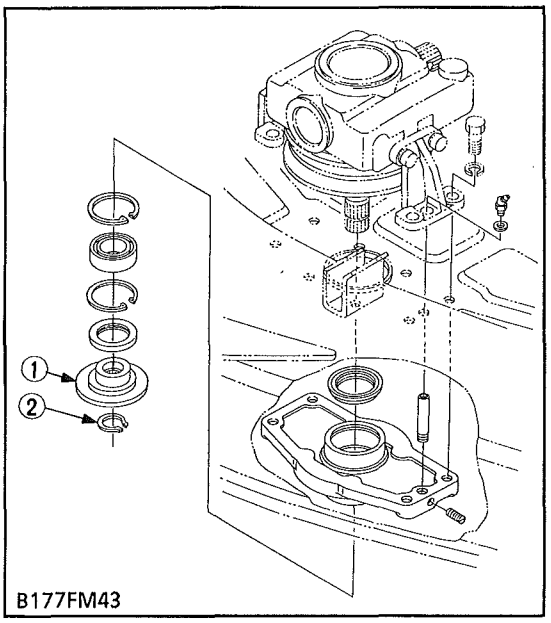
| | | |
|---|---|---|
| Tightening torque | Mower blade screw | 98.1 to 117.7 N·m<br>10.0 to 12.0 kgf·m<br>72.3 to 86.8 ft-lbs |



B177FM42

(1) Dust Cover
(2) Mower Blade
(3) Cup Washer
(4) Spline Boss
(5) Mower Blade Screw

**(A) Loosen**

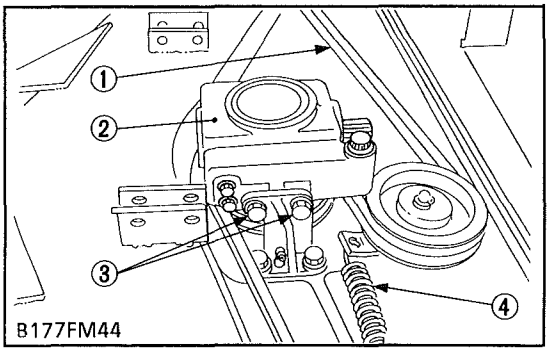


B177FM43

## Blade Boss

1. Remove the external snap ring (2).
2. Remove the blade boss (1).

(1) Blade Boss
(2) External Snap Ring



B177FM44

## Gear Box and Mower Belt

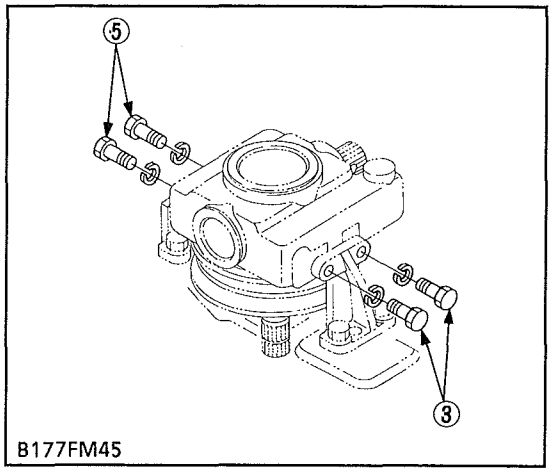
1. Turn over the mower.
2. Remove the tension spring (4).
3. Unscrew the left and right gear box mounting screws (3), (5) and remove the gear box (2) from the mower deck.
4. Remove the mower belt (1).

**(When reassembling)**

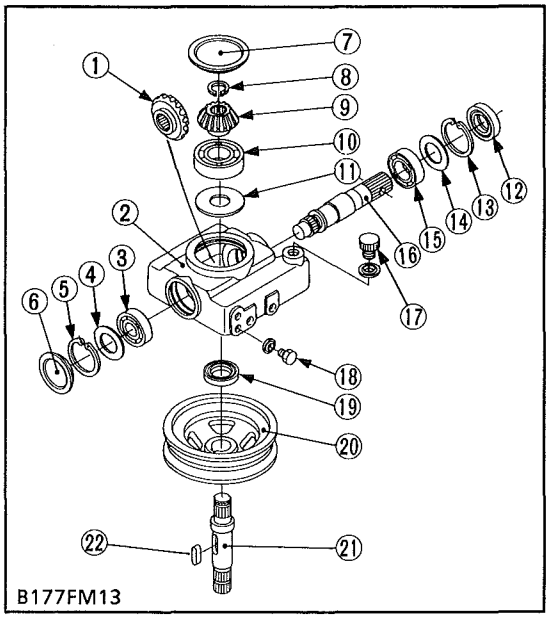
- Install the reamer screws (3) at their original positions as shown in the figure.

| | | |
|---|---|---|
| Tightening torque | Gear box mounting screw | 78.5 to 88.2 N·m<br>8.0 to 9.0 kgf·m<br>57.9 to 65.1 ft-lbs |

(1) Mower Belt
(2) Gear Box
(3) Gear Box Mounting Screw (Reamer Screw)
(4) Tension Spring
(5) Gear Box Mounting Screw



B177FM45



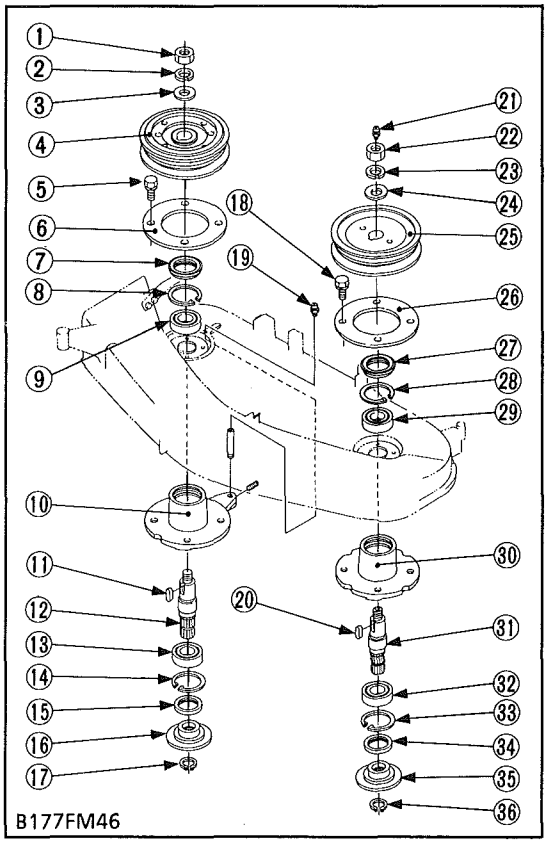

## Disassembling Gear Box

1. Unscrew the drain plug (18), and drain gear box oil.
2. Remove the center pulley (20) with a puller, and remove the feather key (22) on the bevel gear shaft.
3. Remove the gear box caps (6), (7).
4. Remove the oil seal (12), internal snap ring (13) and shim (14).
5. Tap out the pinion shaft (16) with the ball bearing (15), and remove the 21T bevel gear (or 19T bevel gear) (1).
6. Remove the internal snap ring (5), shim (4) and ball bearing (3).
7. Remove the external snap ring (8), and draw out the bevel gear shaft (21).
8. Remove the 16T bevel gear (9), ball bearing (10), shim (11) and oil seal (19).

**(When reassembling)**

- Replace the oil seals (12), (19) and gear box caps (6), (7) with new ones.
- Check the backlash and turning torque.
  If not proper, adjust with the shims (4), (11), (14).
  (See page M-S21, 22.)

(1) 21T Bevel Gear (RC54-24B)
19T Bevel Gear (RC60-24B)
(2) Gear Box
(3) Ball Bearing
(4) Shim
(5) Internal Snap Ring
(6) Gear Box Cap
(7) Gear Box Cap
(8) External Snap Ring
(9) 16T Bevel Gear
(RC54-24B·RC60-24B)
(10) Ball Bearing
(11) Shim
(12) Oil Seal
(13) Internal Snap Ring
(14) Shim
(15) Ball Bearing
(16) Pinion Shaft
(17) Oil Filler Plug
(18) Drain Plug
(19) Oil Seal
(20) Center Pulley
(21) Bevel Gear Shaft
(22) Feather Key




## Outer Pulley and Blade Shaft

1. Unscrew the outer pulley mounting nut (22), and remove the outer pulley (25) and feather key (20).

**■ NOTE**

- **The outer pulley mounting nut has left-hand threads. Turn it clockwise to loosen.**

2. Unscrew the pulley holder mounting screws (18), and separate the left pulley holder (30) and plate (26) from the mower deck.
3. Remove the external snap ring (36) on the left blade shaft (31).
4. Remove the spline boss (35) and oil seal (34).
5. Remove the internal snap ring (33) and tap out the left blade shaft (31) with the ball bearings (29), (32), taking care not to damage the grease nipple (21).
6. Remove the oil seal (27) and internal snap ring (28).
7. Remove the ball bearings (29), (32) from the blade shaft (31).
8. Remove the right pulley holder (10) and blade shaft (12) as above.

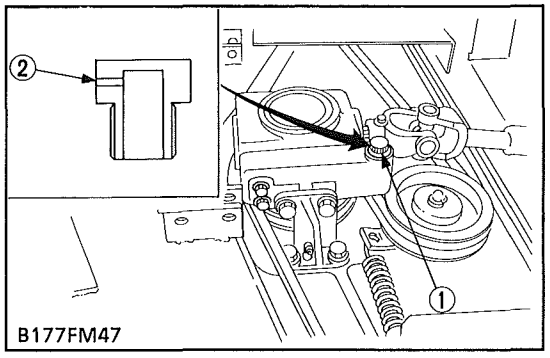
**(When reassembling)**

- Replace the oil seals (34), (27), (15) and (7) with new ones.

| | | |
|---|---|---|
| Tightening torque | Outer pulley mounting nut | 166.7 to 186.3 N·m<br>17.0 to 19.0 kgf·m<br>123.0 to 137.4 ft-lbs |
| | Pulley holder mounting screw | 77.5 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.1 to 66.5 ft-lbs |

(1) Outer Pulley Mounting Nut
(2) Spring Washer
(3) Plain Washer
(4) Outer Pulley (Right)
(5) Pulley Holder Mounting Screw
(6) Plate
(7) Oil Seal
(8) Internal Snap Ring
(9) Ball Bearing
(10) Pulley Holder (Right)
(11) Feather Key
(12) Blade Shaft (Right)
(13) Ball Bearing
(14) Internal Snap Ring
(15) Oil Seal
(16) Spline Boss
(17) External Snap Ring
(18) Pulley Holder Mounting Screw
(19) Grease Nipple
(20) Feather Key
(21) Grease Nipple
(22) Outer Pulley Mounting Nut
(23) Spring Washer
(24) Plain Washer
(25) Outer Pulley (Left)
(26) Plate
(27) Oil Seal
(28) Internal Snap Ring
(29) Ball Bearing
(30) Pulley Holder (Left)
(31) Blade Shaft (Left)
(32) Ball Bearing
(33) Internal Snap Ring
(34) Oil Seal
(35) Spline Boss
(36) External Snap Ring

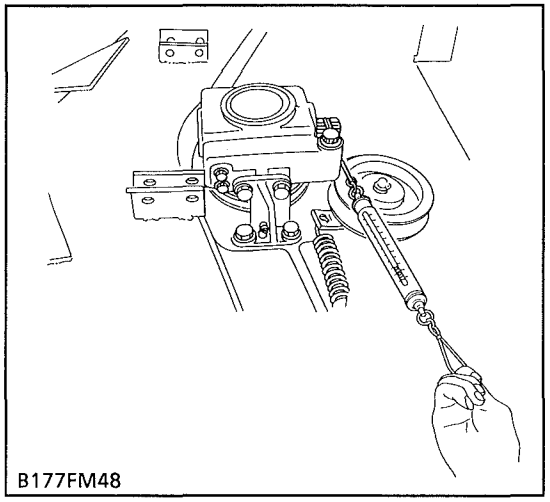
# SERVICING




## Oil Filler Plug

1. Remove the oil filler plug (1) from the gear box.
2. Check the hole of breather does not clogging.
3. If the breather hole (2) has clogged, clean it.

(1) Oil Filler Plug (2) Breather Hole



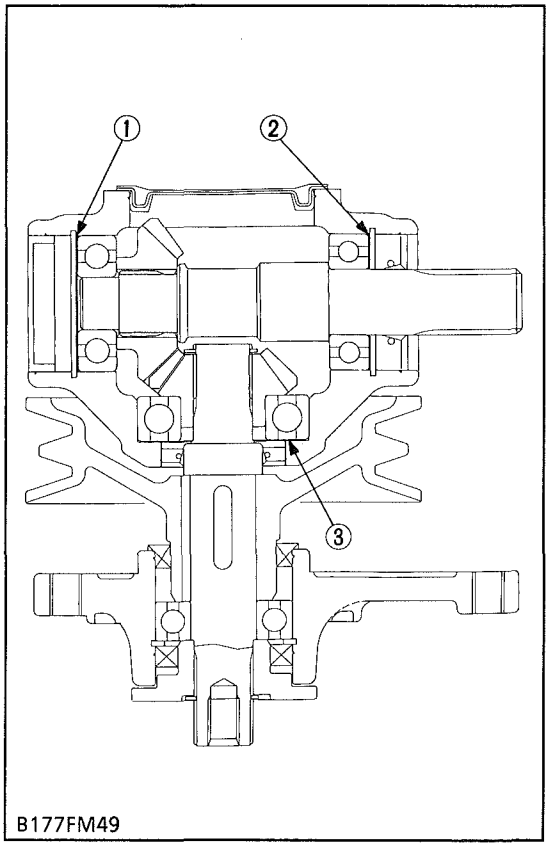

## Turning Torque of Pinion Shaft

1. Remove the mower belt, and reassemble the gear box to the mower deck.
2. Wind a string around the pinion shaft and set a spring balance (or push-pull gauge) to the tip of the string, and then slowly pull the spring balance horizontally to measure the turning force.
3. If the measurement exceeds the factory specification, check the bearing and gears and adjust the adjusting shims (1), (2), (3).

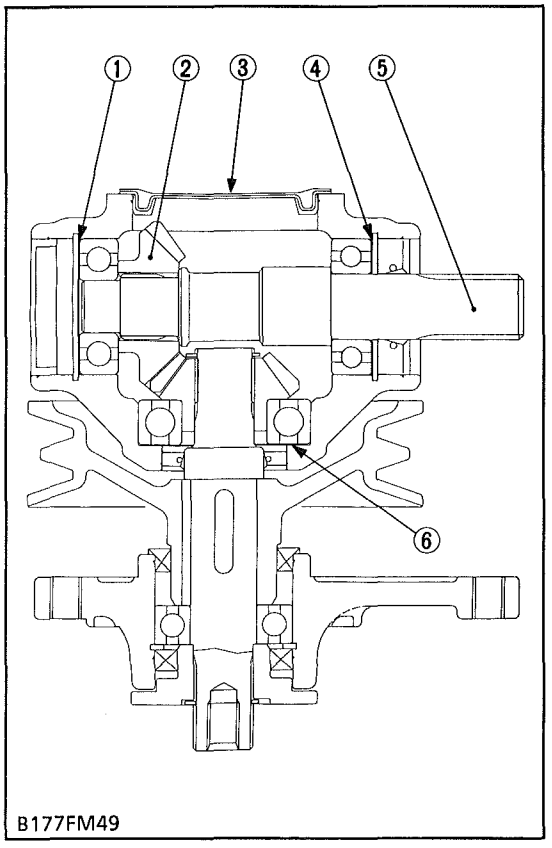
| | | |
|---|---|---|
| Turning force | Factory spec. | Less than 117.7 N<br>12.0 kgf<br>26.5 lbs |
| Turning torque | Factory spec. | Less than 1.47 N·m<br>0.15 kgf·m<br>1.08 ft-lbs |

**(Reference)**

- Thickness of adjusting shims (1), (2), (3) : 0.2 mm (0.0079 in.)
  0.3 mm (0.0118 in.)




(1) Adjusting Shim
(2) Adjusting Shim
(3) Adjusting Shim



B177FM49

## Backlash between Bevel Gears

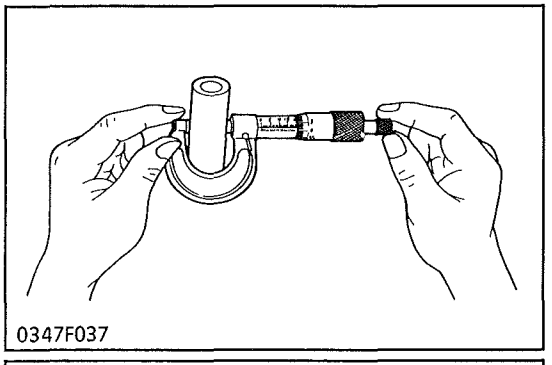
1. Remove the gear box cap (3).
2. Place fuses the 21T bevel gear (or 19T bevel gear) (2) on the pinion shaft (5).
3. Turn the pinion shaft.
4. Take out the fuses, and measure the thickness of fuses with an outside micrometer. (Backlash equal thickness of fuse)
5. If the backlash exceeds the allowable limit, adjust with shims (1), (4), (6).

| | | |
|---|---|---|
| Backlash between bevel gears | Factory spec. | 0.10 to 0.20 mm<br>0.0039 to 0.0079 in. |
| | Allowable limit | 0.4 mm<br>0.0157 in. |

**(Reference)**

- Thickness of adjusting shims (1), (4), (6) : 0.2 mm (0.0079 in.)
  0.3 mm (0.0118 in.)

(1) Shim
(2) 21T Bevel Gear (RC54-24B)
19T Bevel Gear (RC60-24B)
(3) Gear Box Cap
(4) Shim
(5) Pinion Shaft
(6) Shim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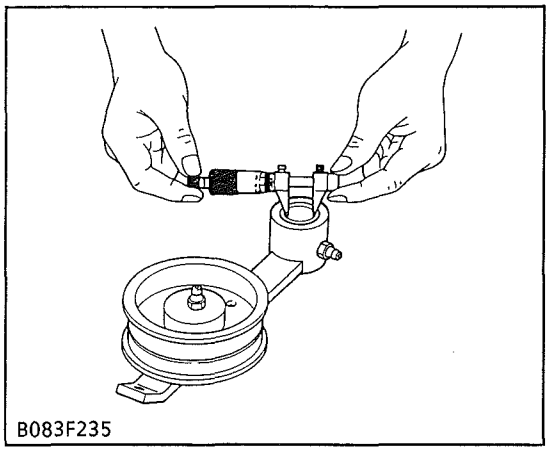
## Clearance between Tension Collar and Tension Arm Bushing

1. Measure the tension collar O.D. with an outside micrometer.
2. Measure the tension arm bushing I.D. with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

| | | |
|---|---|---|
| Clearance between tension collar and tension arm bushing | Factory spec. | 0.025 to 0.127 mm<br>0.00098 to 0.00500 in. |
| | Allowable limit | 0.30 mm<br>0.0118 in. |

| | | |
|---|---|---|
| Tension collar O.D. | Factory spec. | 19.954 to 19.975 mm<br>0.78559 to 0.78642 in. |
| Tension arm bushing I.D. | Factory spec. | 20.000 to 20.081 mm<br>0.78740 to 0.79059 in. |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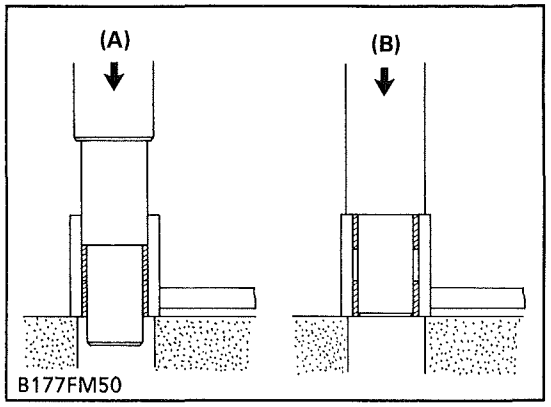

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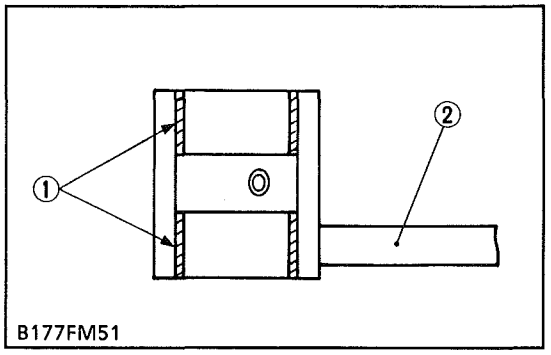


B177FM51

## Replacing Tension Arm Bushing

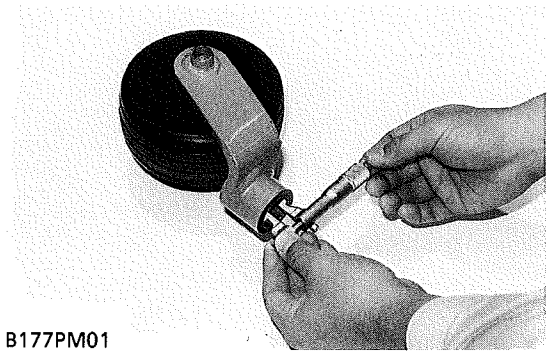
**(When removing)**

1. Remove the grease nipple from the tension arm.
2. Using a tension arm bushing replacing tool (see page M-S7), press out the used bushings.

**(When installing)**

1. Clean new bushings and apply gear oil to them.
2. Using a tension arm bushing replacing tool, press in new bushings (1) until they are flush with tension arm (2) as shown in the figure.

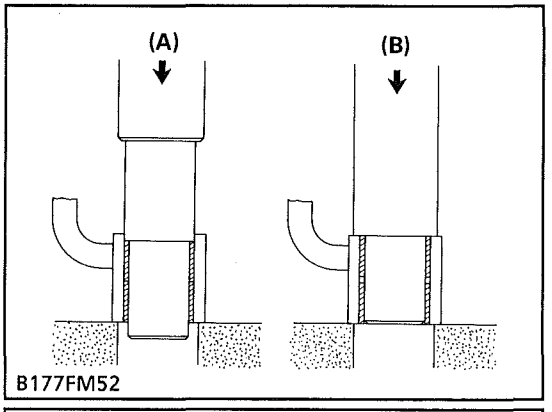
(1) Tension Arm Bushing
(2) Tension Arm
**(A) When Removing**
**(B) When Installing**


B177PM01

## Front Gauge Wheel Bushing Wear

1. Measure the front gauge wheel bushing I.D. with an inside micrometer.
2. If the measurement exceeds the allowable limit, replace the bushings.

| | | |
|---|---|---|
| Front gauge wheel bushing I.D. | Factory spec. | 30.000 to 30.085 mm<br>1.18110 to 1.18445 in. |
| | Allowable limit | 31.000 mm<br>1.22047 in. |



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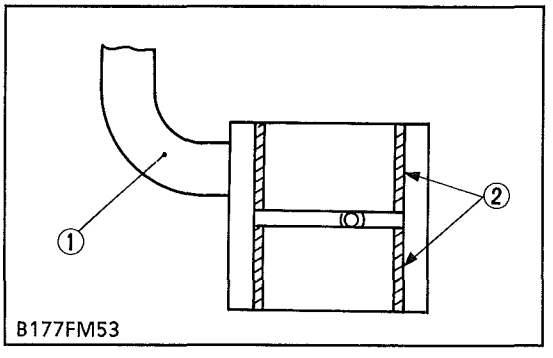


B177FM53

## Replacing Front Gauge Wheel Bushing

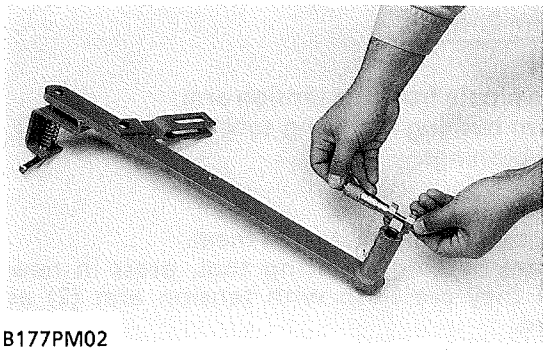
**(When removing)**

1. Using a front gauge wheel bushing replacing tool (see page M-S7), press out the used bushings.

**(When installing)**

1. Clean new bushing and apply gear oil to them.
2. Using a front gauge wheel bushing replacing tool, press in new bushings (2) until they are flush with front gauge wheel stay (1) as shown in the figure.

(1) Front Gauge Wheel Stay
(2) Front Gauge Wheel Bushing
**(A) When Removing**
**(B) When Installing**

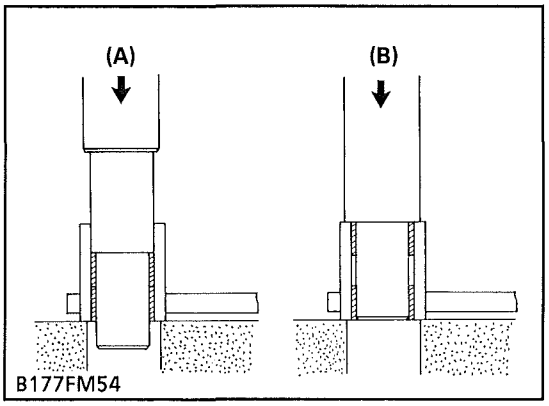


B177PM02

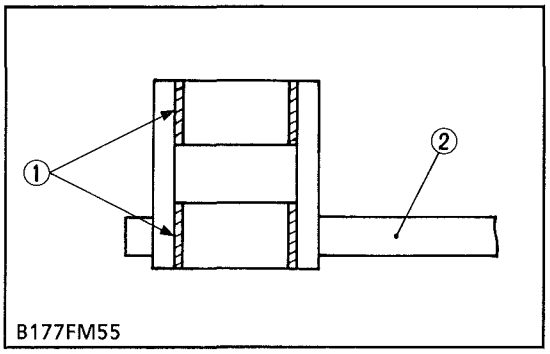
## Rear Link Bushing Wear

1. Measure the rear link bushing I.D. with an inside micrometer.
2. If the measurement exceeds the allowable limit, replace the bushings.

| | | |
|---|---|---|
| Rear link bushing I.D. | Factory spec. | 20.000 to 20.081 mm<br>0.78740 to 0.79059 in. |
| | Allowable limit | 21.000 mm<br>0.82677 in. |




B177FM54




B177FM55

## Replacing Rear Link Bushing

**(When removing)**

1. Using a rear link bushing replacing tool (see page M-S7), press out the used bushings.

**(When installing)**

1. Clean new bushings and apply gear oil to them.
2. Using a rear link bushing replacing tool, press in new bushings (1) until they are flush with rear link (2) as shown in the figure.

(1) Rear Link Bushing
(2) Rear Link
**(A) When Removing**
**(B) When Installing**

# TO THE READER

In this section, the main additional functions of BI-SPEED TURN for B1700HSDB, B2100HSDB and B2400HSDB tractor and 2 wheel drive for B1700E and B2400HSE are explained separately in two items, "Mechanism" and "Servicing".

As for the items which are not explained in this section, refer to Workshop Manual for B1700·B2100·B2400.

■ **Mechanism**

Information on the construction and function are included for B1700E·B2400HSE for 2WD tractor and B1700HSDB·B2100HSDB and B2400HSDB for Bi-SPEED TURN tractor. This part should be understood before proceeding with troubleshooting, disassembling and servicing.

■ **Servicing**

For B1700E·B2400HSE for 2WD tractor and B1700HSDB·B2100HSDB and B2400HSDB for Bi-SPEED TURN tractor, 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.

**August '95**

# SPECIFICATIONS [HST type, 4WD, Bi-speed Turn]

| Model | | | B1700 HSDB | B2100 HSDB | B2400 HSDB |
|---|---|---|---|---|---|
| PTO power | | | 9.7 kW (13.0 HP)* | 12.0 kW (16.0 HP)* | 13.4 kW (18.0 HP)* |
| Engine | Maker | | KUBOTA | | |
| | Model | | D905-D10 | D1005-D10 | D1105-D10 |
| | Type | | Indirect Injection. Vertical, water-cooled, 4-cycle diesel | | |
| | Number of cylinders | | 3 | | |
| | Bore and stroke | | 72 x 73.6 mm (2.83 x 2.90 in.) | 76 x 73.6 mm (2.99 x 2.90 in.) | 78 x 78.4 mm (3.07 x 3.09 in.) |
| | Total displacement | | 898 cm³ (54.8 cu.in.) | 1001 cm³ (61.1 cu.in.) | 1123 cm³ (68.5 cu.in.) |
| | Engine gross power | | 12.7 kW (17.0 HP) | 15.7 kW (21.0 HP) | 17.9 kW (24.0 HP) |
| | Rated revolution | | 43.3 r/s (2600 rpm) | | |
| | Maximum torque | | 51 N·m (38 ft-lbs) | 59 N·m (44 ft-lbs) | 67 N·m (50 ft-lbs) |
| | Battery | | 12V, RC : 71 min, CCA : 390 A (12V, RC : 79 min, CCA : 433A) | | |
| | Starting system | | Electric starting with cell starter 12V, 1.0 kW | | |
| | Lubricating system | | Forced lubrication by trochoidal pump | | |
| | Cooling system | | Pressurized radiator, forced circulation with water pump | | |
| | Fuel | | Diesel fuel No.2-D [above-10°C (14°F)], Diesel fuel No. 1 [below–10°C (14°F)] | | |
| Capacities | Fuel tank | | 24 ℓ (6.3 U.S.gals, 5.3 Imp.gal) | | |
| | Engine crankcase (with filter) | | 3.0 ℓ (3.2 U.S.qts, 2.6 Imp.qts) | | |
| | Engine coolant | | 3.4 ℓ (3.6 U.S.qts, 2.6 Imp.qts) | | |
| | Transmission case | | 12.0 ℓ (3.17 U.S.gals, 12.4 Imp.gals) | | |
| | Front axle case | | 4.5 ℓ (4.8 U.S.qts, 4.0 Imp.qts) | | |
| Dimensions | Overall length (without 3P) | | 2280 mm (89.8 in.) | 2300 mm (90.6 in.) | 2330 mm (91.7 in.) |
| | Overall width (min. tread) | | 989 mm (38.9 in.) | 1077 mm (42.4 in.) | 1175 mm (46.3 in.) |
| | Overall height (with ROPS) | | 1915 mm (75.4 in.) | 1940 mm (76.4 in.) | 1965 mm (77.4 in.) |
| | Overall height (top of seat) | | 1293 mm (50.9 in.) | 1318 mm (51.9 in.) | 1343 mm (52.9 in.) |
| | Wheelbase | | 1500 mm (59.0 in.) | | |
| | Min. ground clearance | | 270 mm (10.6 in.) | 270 mm (10.6 in.) | 285 mm (11.2 in.) |
| | Treads | Front | 855 mm (33.7 in.) | 855 mm (33.7 in.) | 855 mm (33.7 in.) |
| | | Rear | 778 to 948 mm (30.6 to 37.3 in.) | 836 to 1006 mm (32.9 to 39.6 in.) | 890 to 1064 mm (35.0 to 41.9 in.) |
| Weight (with ROPS) | | | 645 kg (1422 lbs) | 657 kg (1449 lbs) | 672 kg (1482 lbs) |
| Clutch | | | Dry single plate | | |
| Traveling system | Tires | Front | 6-12 | 6-12 | 7-12 |
| | | Rear | 8.3-16 | 9.5-16 | 11.2-16 |
| | Steering | | Integral type power steering | | |
| | Transmission | | Main-hydrostatic transmission, High-Low gear shift (2 forward, 2 reverse) | | |
| | Brake | | Wet disk type | | |
| | Min. turning radius (with brake) | | 2.1 m (6.9 feet) | | |
| Hydraulic system | Hydraulic control system | | Position Control | | |
| | Pump capacity | | 22 ℓ/min (5.8 gals/min) | | |
| | Three point hitch | | SAE Category I | | |
| | Max. lift force | At lift points | 580 kg (1280 lbs) | | |
| | | 24 in. behind lift points | 460 kg (1015 lbs) | | |
| PTO shaft | Rear-PTO | | SAE 1-3/8, 6 splines | | |
| | Revolution | | 540 rpm at 2600 engine rpm | | |
| | Mid-PTO | | USA No. 5 (KUBOTA 10-tooth) involute spline | | |
| | Revolution | | 2537 rpm at 2600 engine rpm | | |

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

# [2WD Type]

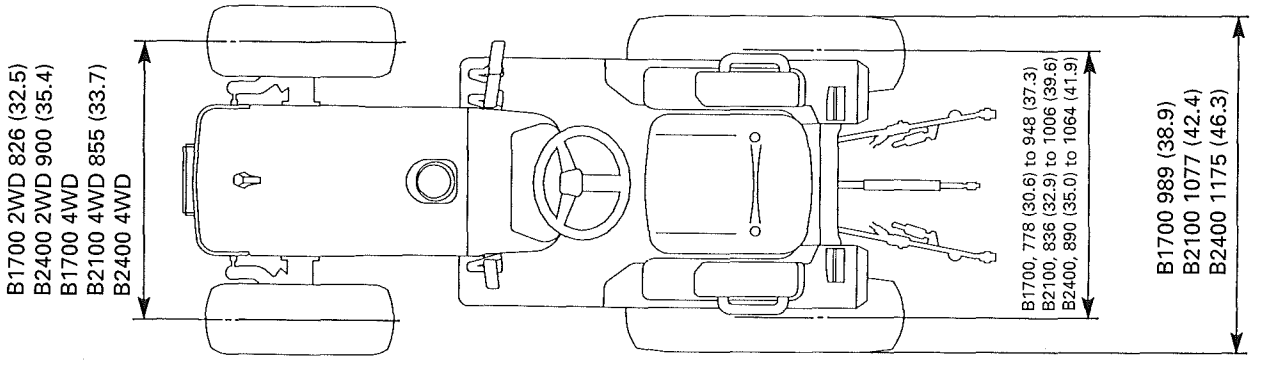
| Model | | | B1700 E (Manual Transmission Type) | B2400 HSE (HST Type) |
|---|---|---|---|---|
| PTO power | | | 10.5 kW (14.0 HP)* | 13.4 kW (18.0 HP)* |
| Engine | Maker | | KUBOTA | |
| | Model | | D905-D10 | D1105-D10 |
| | Type | | Indirect Injection. Vertical, water-cooled, 4-cycle diesel | |
| | Number of cylinders | | 3 | |
| | Bore and stroke | | 72 x 73.6 mm (2.83 x 2.90 in.) | 78 x 78.4 mm (3.07 x 3.09 in.) |
| | Total displacement | | 898 cm³ (54.8 cu.in.) | 1123 cm³ (68.5 cu.in.) |
| | Engine gross power | | 12.7 kW (17.0 HP) | 17.9 kW (24.0 HP) |
| | Rated revolution | | 43.3 r/s (2600 rpm) | |
| | Maximum torque | | 51 N·m (38 ft-lbs) | 67 N·m (50 ft-lbs) |
| | Battery | | 12V, RC : 71 min, CCA : 390 A (12V, RC : 79 min, CCA : 433A) | |
| | Starting system | | Electric starting with cell starter 12V, 1.0 kW | |
| | Lubricating system | | Forced lubrication by trochoidal pump | |
| | Cooling system | | Pressurized radiator, forced circulation with water pump | |
| | Fuel | | Diesel fuel No.2-D [above-10°C (14°F)], Diesel fuel No. 1 [below–10°C (14°F)] | |
| Capacities | Fuel tank | | 24 ℓ (6.3 U.S.gals, 5.3 Imp.gal) | |
| | Engine crankcase (with filter) | | 3.0 ℓ (3.2 U.S.qts, 2.6 Imp.qts) | |
| | Engine coolant | | 3.4 ℓ (3.6 U.S.qts, 2.6 Imp.qts) | |
| | Transmission case | | 11.0 ℓ (2.90 U.S.gals, 2.4 Imp.gals) | 12.0 ℓ (3.17 U.S.gals, 12.4 Imp.gals) |
| | Front axle case | | — | |
| Dimensions | Overall length (without 3P) | | 2280 mm (89.8 in.) | 2330 mm (91.7 in.) |
| | Overall width (min. tread) | | 989 mm (38.9 in.) | 1175 mm (46.3 in.) |
| | Overall height (with ROPS) | | 1915 mm (75.4 in.) | 1965 mm (77.4 in.) |
| | Overall height (top of seat) | | 1293 mm (50.9 in.) | 1343 mm (52.9 in.) |
| | Wheelbase | | 1500 mm (59.0 in.) | |
| | Min. ground clearance | | 295 mm (11.6 in.) | 305 mm (12.0 in.) |
| | Treads | Front | 826 mm (32.5 in.) | 900 mm (35.4 in.) |
| | | Rear | 778 to 948 mm (30.6 to 37.3 in.) | 890 to 1064 mm (35.0 to 41.9 in.) |
| Weight (with ROPS) | | | 575 kg (1268 lbs) | 612 kg (1346 lbs) |
| Clutch | | | Dry single plate | |
| Traveling system | Tires | Front | 5.00-10 | 6.50-10 |
| | | Rear | 8.3-16 | 11.2-16 |
| | Steering | | Integral type power steering | |
| | Transmission | | Gear shaft, 6 forward and 2 reverse | Main-hydrostatic transmission, High-Low gear shift (2 forward, 2 reverse) |
| | Brake | | Wet disk type | |
| | Min. turning radius (with brake) | | 2.0 m (6.6 feet) | |
| Hydraulic system | Hydraulic control system | | Position Control | |
| | Pump capacity | | 22 ℓ/min (5.8 gals/min) | |
| | Three point hitch | | SAE Category I | |
| | Max. lift force | At lift points | 580 kg (1280 lbs) | |
| | | 24 in, behind lift points | 460 kg (1015 lbs) | |
| PTO shaft | Rear-PTO | | SAE 1-3/8, 6 splines | |
| | Revolution | | 540 rpm at 2600 engine rpm | |
| | Mid-PTO | | USA No. 5 (KUBOTA 10-tooth) involute spline | |
| | Revolution | | 2531 rpm at 2600 engine rpm | 2537 rpm at 2600 engine rpm |

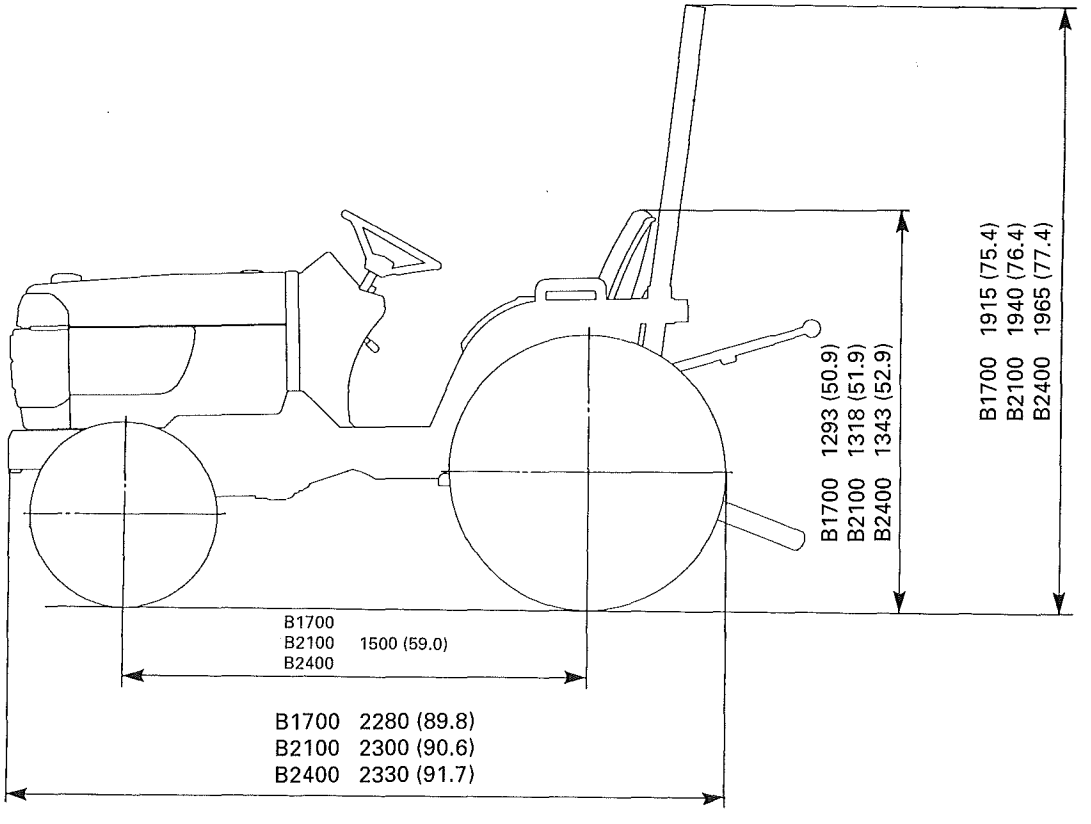
Note: * Manufacture's estimate the company reserves the right to change the specifications without notice.

# DIMENSION

Maximum dimension is shown against farm tire variation.

Unit: mm (in.)

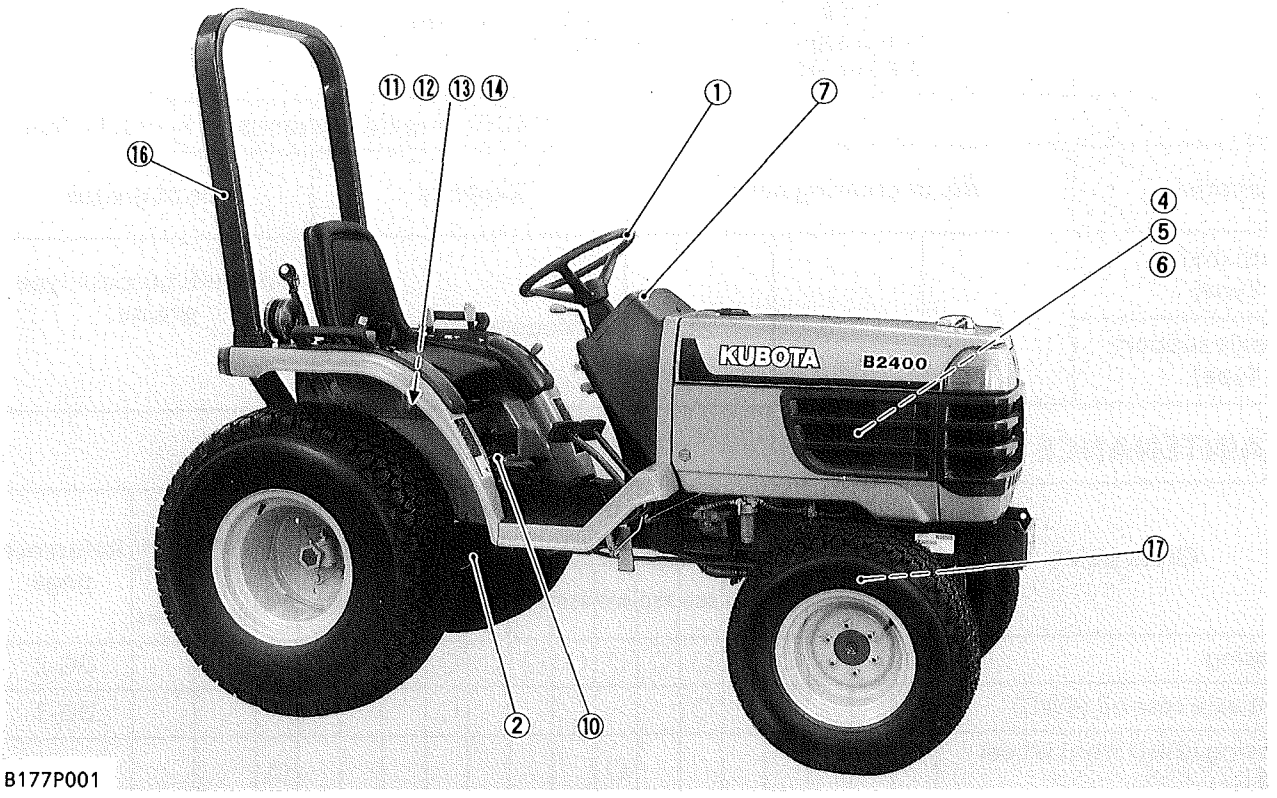



B177F003

# G GENERAL

## [1] FEATURES




B177P001

(1) Integral Power Steering

(2) Standard Mid PTO

(3) Simultaneous Mounting of Both the Mid Mount Mower and Front Loader

(4) E-TVCS Diesel Engine

(5) Engine Key Shut-Off System

(6) Large Hydraulic Pump

(7) Combination Panel of Easy Checker

(8) Main Shift Lever Located in the Right Side of Transmission

(9) New Design

(10) Variation of Transmission

(11) Wet Disc Brake

(12) Position Control Valve

(13) Hydraulic Block Type Outlet

(14) Rear Hydraulic Outlet

(15) Auxiliary Control Valve (Option)

(16) ROPS

**(17) Bi-speed Turn**

(Small turning radius)

## [2] LUBRICANTS, FUEL AND COOLING WATER

| Place | Capacity | | | Lubricants, fuel and cooling water |
|---|---|---|---|---|
| | B1700 | B2100 | B2400 | |
| Front axle case [4WD, Bi-speed] | 4.5 ℓ<br>4.8 U.S.qts.<br>4.0 Imp.qts. | | | KUBOTA SUPER UDT fluid * or<br>SAE 80, 90 gear oil |

* KUBOTA original transmission hydraulic fluid

| Greasing | No. of greasing point | | | Capacity | Type of grease |
|---|---|---|---|---|---|
| Knuckle shaft (2WD Type) | 2 | — | 2 | Moderate amount | SAE multi purpose type grease |
| Front axle support (2WD Type) | | | | | |

## [3] MAINTENANCE CHECK LIST

| 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 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | | DG-2 |
| 2 | Front axle case oil (4WD) | | | | | | ○ | | | | | | ○ | | | | | | | DG-3 |
| 3 | Greasing (2WD front wheel hub) | | | | | | | | ○ | | | | | | | | ○ | | | DG-3 |

## [4] CHECK AND MAINTENANCE

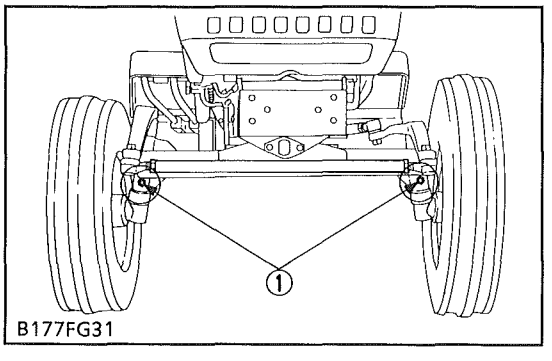
**⚠ CAUTION**

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

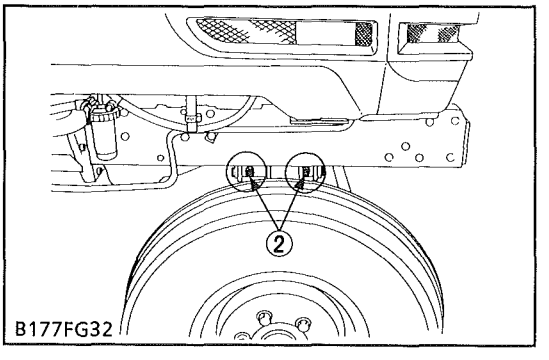
### (1) Check Points of Every 50 Hours

#### Greasing

1. Apply grease to the following points. (2WD Type)



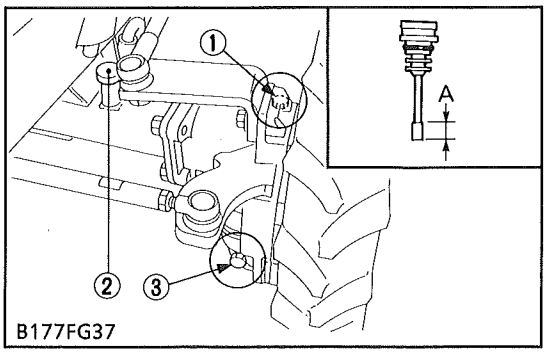
B177FG31



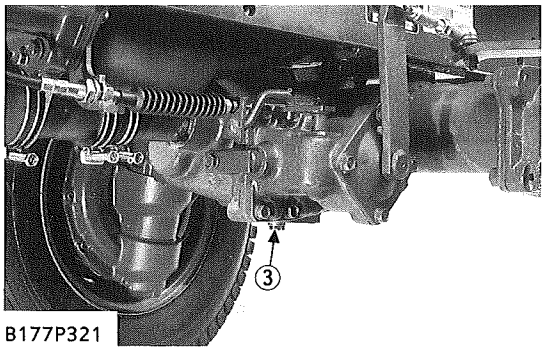
B177FG32

(1) Knuckle Shaft Grease Nipple
(2) Front Axle Support Grease Nipple

## (2) Check Point of Every 300 Hours



B177FG37



B177P321

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

### Changing Front Axle Case Oil

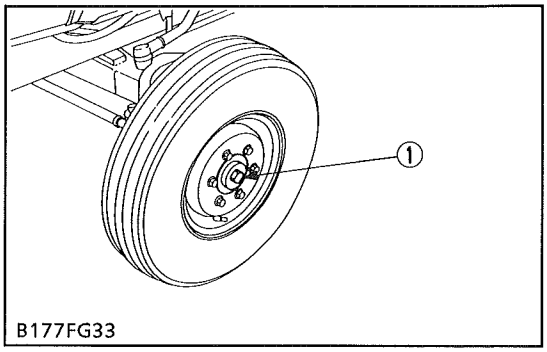
1. Place the oil pans underneath the front axle case.
2. Remove the both right and left hand side drain plugs (3) and filling plug (2) to drain the oil.
3. Remove the right and left breather plugs.
4. After draining, reinstall the drain plugs (3).
5. Fill with new oil up to the upper notch on the dipstick.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

**■ 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 DG-2.)**

| | |
|---|---|
| Front axle case oil capacity | 4.5 ℓ<br>4.8 U.S. qts<br>4.0 Imp. qts |

## (3) Check Point of Every 400 Hours



B177FG33

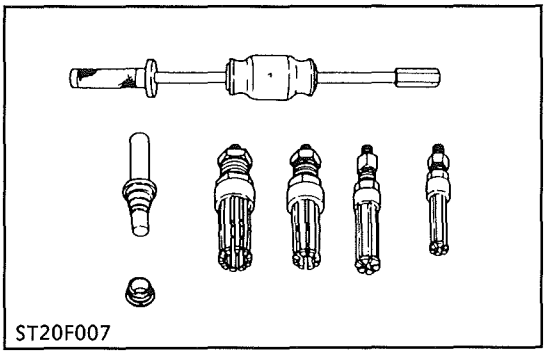
(1) Front Wheel Hub Cover

### Lubricate Grease Fitting

1. Detach the cover, and apply bearing grease.

# [5] SPECIAL TOOLS

## (1) Special Tools for Tractor


ST20F007

**Knuckle Spindle Bushing Replacement Tool**

Code No.: 07916-51030
Application: This allows easy press fitting and removal of knuckle spindle bushing for front axle without use of press.

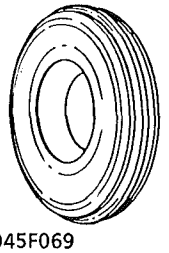
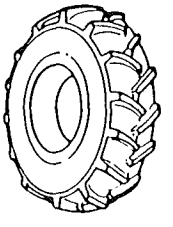
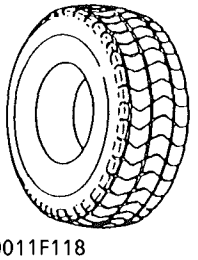
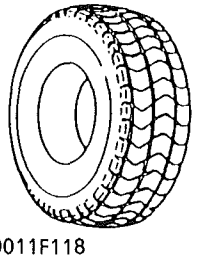
# [6] TIRES

## (1) Type of Tire

**■ IMPORTANT**

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

The following tires can be mounted on Models B1700, B2100 and B2400.

| Type of Tire | Type of tractor | Front Tire | | Rear Tire | |
|---|---|---|---|---|---|
| Farm Tire | 2 Wheel Drive |  C045F069 | [B1700] 5.00-10<br>[B2400] 6.50-10 |  C045F070 | [B1700] 8.3-16<br>[B2400] 11.2-16 |
| Turf Tire | 2 & 4 Wheel Drive |  0011F118 | [B1700, B2100, B2400] 23 x 8.50-12 |  0011F118 | [B1700, B2100, B2400] 33 x 12.5-15 |

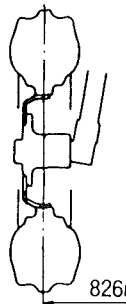
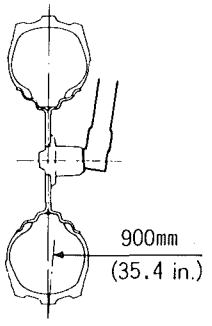
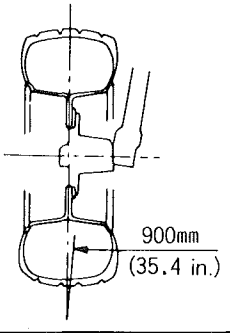
## (2) Tread Adjustment

### Front Wheel

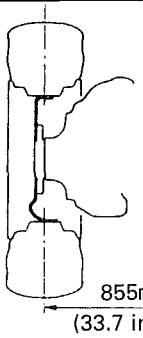
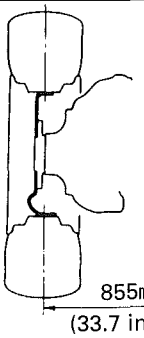
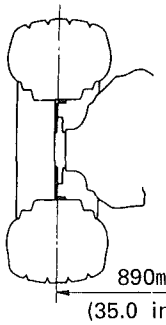
Front tread cannot be adjusted.

**■ IMPORTANT**
- **Do not turn front discs to obtain wider tread.**

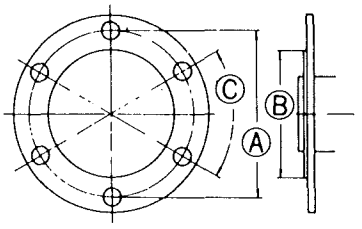
### [2WD Type]

| Models | B1700E | B2400HSE | B1700E<br>B2400HSE |
|---|---|---|---|
| Tires | 5.00-10 Farm | 6.50-10 Farm | 23 x 8.50-12 Turf |
| Tread | 826 mm<br>32.5 in. | 900 mm<br>35.4 in. | 900 mm<br>35.4 in. |
| |  B177FG34 |  B177FG35 |  B177FG36 |

### [Bi-speed Turn Type]

| Models | B1700HSDB<br>B2100HSDB | B2400HSDB | B1700HSDB<br>B2100HSDB<br>B2400HSDB |
|---|---|---|---|
| Tires | 6-12 Farm | 7-12 Farm | 23 x 8.5-12 Turf |
| Tread | 855 mm<br>33.7 in. | 855 mm<br>33.7 in. | 890 mm<br>35.0 in. |
| |  0354F096 |  0354F096 |  0354F097 |

## (3) Wheel Hub




0319F072

| | Front Wheel Hub |
|---|---|
| Type | 2WD |
| Screw circle diameter (A) | 120 mm<br>4.7 in. |
| Number of screws | 6 |
| Screw sizes | M12 x Pitch 1.25 |
| Pilot bore diameter (B) | 69.5 mm<br>2.74 in. |
| Hole spacing (C) | Equal 1.05 rad<br>(60 deg.) |

## (4) Tire Pressure

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

| | Tire sizes | Inflation Pressure |
|---|---|---|
| Front | 5.00 – 12, 4PR<br>6.50 – 12, 4PR | 270 kPa (2.8 kgf/cm$^2$, 40 psi)<br>200 kPa (2.0 kgf/cm$^2$, 28 psi) |

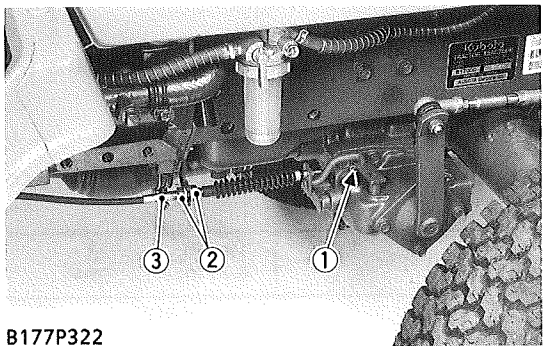
■ **NOTE**

- **Maintain the maximum pressure in front tires, if using a front loader or when equipped with lots of front weight.**

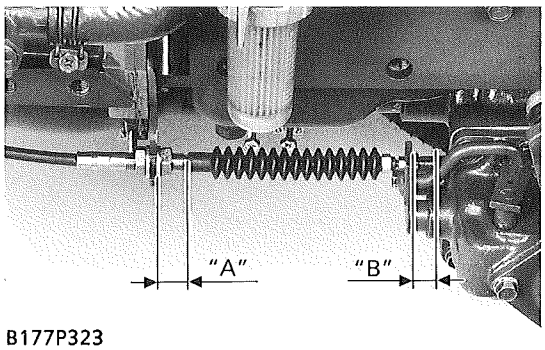
# 1 ENGINE

## SERVICING

Propeller Shaft Cover and Coupling and Drag Link on page 1-S13 are altered as explained below.




B177P322




B177P323

### Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

**(When reassembling)**

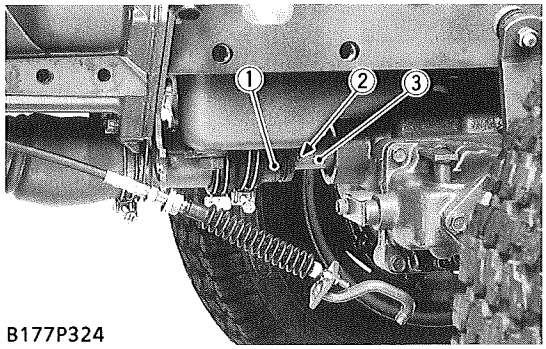
- When reassembling the bi-speed turn cable (3), make sure to set the distance "A".

| | | |
|---|---|---|
| Distance : "A" | Factory spec. | 18 mm<br>0.71 in. |

**(Reference)**

| | | |
|---|---|---|
| Distance : "B" | Factory spec. | 10 mm<br>0.39 in. |

(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable




B177P324

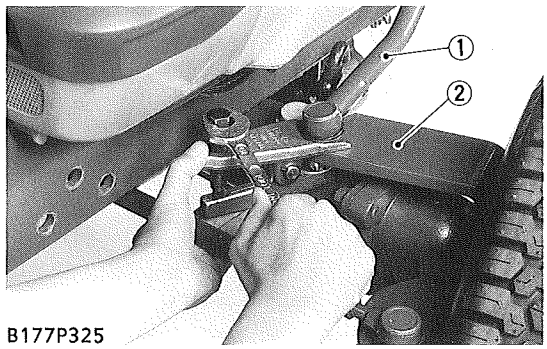
### Propeller Shaft Cover and Coupling

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

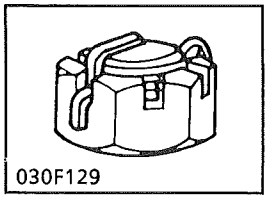
**(When reassembling)**

- Apply grease to the splines of the propeller shaft and coupling

(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling




B177P325



030F129

### Drag Link

1. Remove the cotter pin and loosen the slotted nut.
2. Disconnect the drag link (1) with a pitman arm puller from the knuckle arm (2).

**(When reassembling)**

**■ IMPORTANT**

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

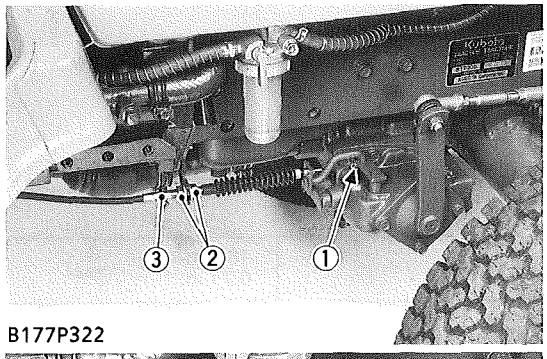
| | | |
|---|---|---|
| Tightening torque | Slotted nut | 17.7 to 34.5 N·m<br>1.8 to 3.5 kgf·m<br>13 to 25.3 ft-lbs |

(1) Drag Link
(2) Knuckle Arm

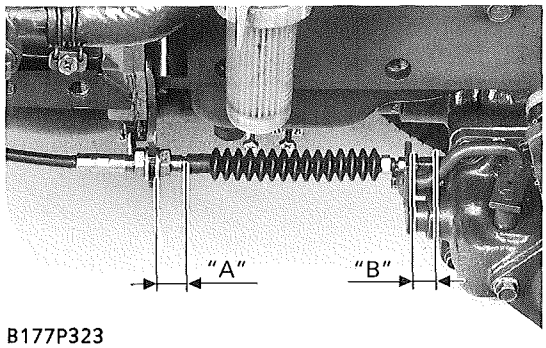
# 2 CLUTCH

## SERVICING

Propeller Shaft Cover and Coupling on 2-S6 are altered as explained below.




B177P322




B177P323

### Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

**(When reassembling)**

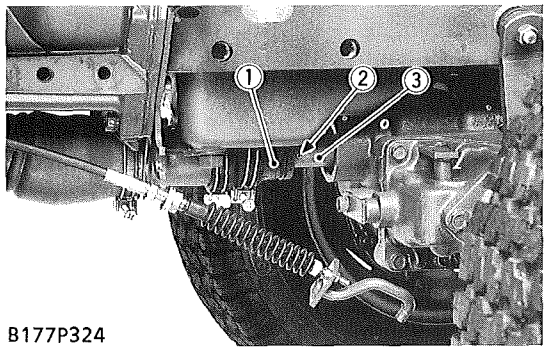
- When reassembling the bi-speed turn cable (3) make sure to set the distance "A".

| | | |
|---|---|---|
| Distance : "A" | Factory spec. | 18 mm<br>0.71 in. |

**(Reference)**

| | | |
|---|---|---|
| Distance : "B" | Factory spec. | 10 mm<br>0.39 in. |

(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable




B177P324

### Propeller Shaft Cover and Coupling

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

**(When reassembling)**

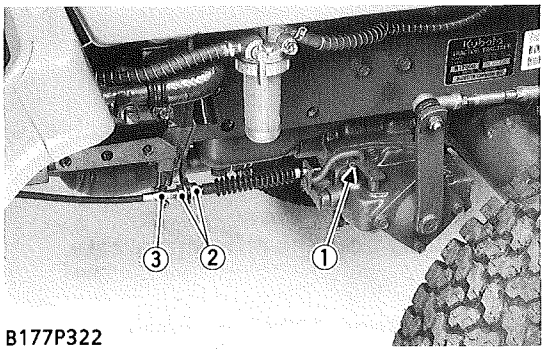
- Apply grease to the spline of the propeller shaft and coupling.

(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling

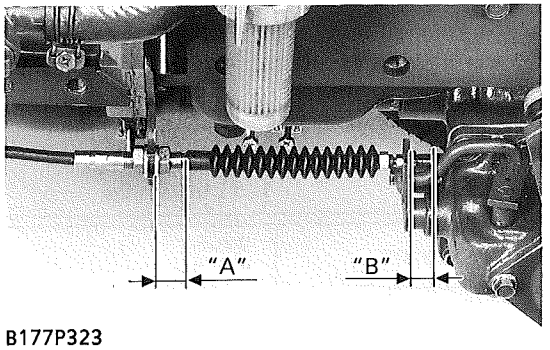
# 3 TRANSMISSION

## SERVICING

Propeller Shaft Cover and Coupling on page 3-S13 and 3-S20 are altered as explained below.




B177P322




B177P323

### Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

**(When reassembling)**

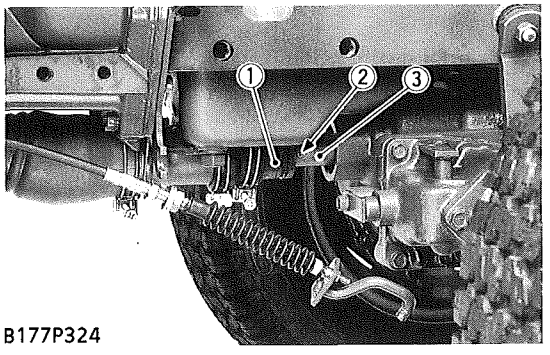
- When reassembling the bi-speed turn cable (3) make sure to set the distance "A".

| | | |
|---|---|---|
| Distance : "A" | Factory spec. | 18 mm<br>0.71 in. |

**(Reference)**

| | | |
|---|---|---|
| Distance : "B" | Factory spec. | 10 mm<br>0.39 in. |

(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable




B177P324

### Propeller Shaft Cover and Coupling

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

**(When reassembling)**

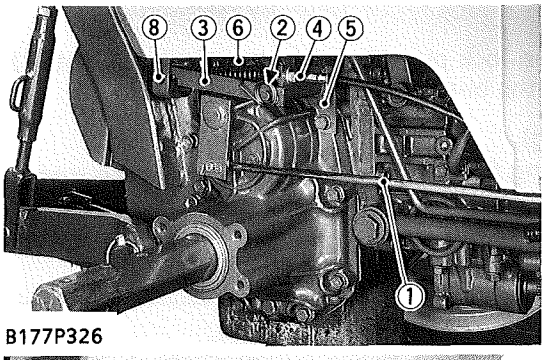
- Apply grease to the spline of the propeller shaft and coupling.

(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling

# 4 REAR AXLE

## SERVICING

Rear Axle Case on page 4-S2 is altered as explained below.



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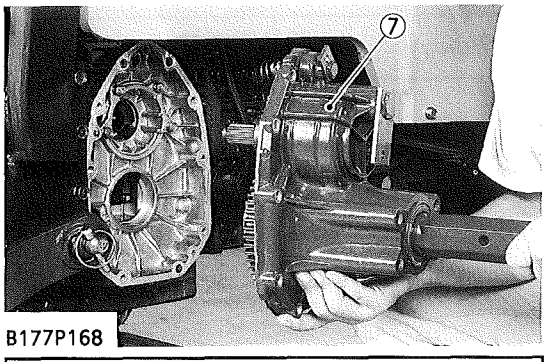
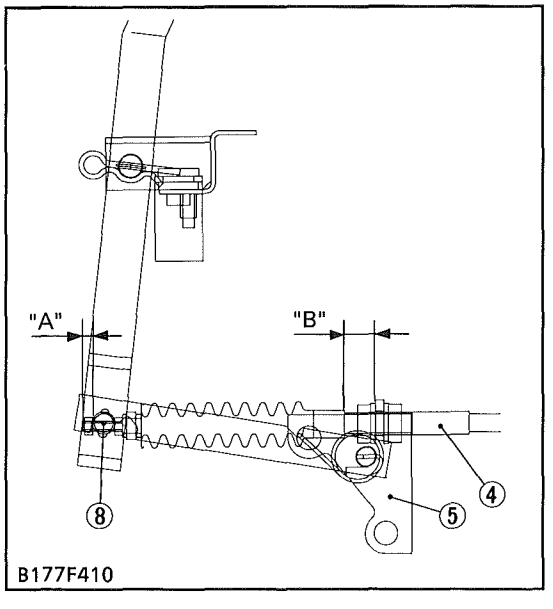


B177P168



B177F410

### Rear Axle Case

1. Disconnect the brake rod (1).
2. Remove the spring (2) and lever holding plate (3).
3. Loosen the lock nuts and remove the bi-speed turn cable (4) from cable support (5).
4. Disconnect the differential lock rod (6).
5. Remove the rear axle case mounting screw.
6. Separate the rear axle case (7) from the differential case.

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the rear axle case and differential gear ease after eliminating the water, oil and stuck liquid gasket.
- When reassembling the bi-speed turn cable (4), make sure to set the distance "A".

| | | |
|---|---|---|
| Tightening torque | Rear axle case mounting screws | 39 to 44 N·m<br>4.0 to 4.5 kgf·m<br>29 to 33 ft-lbs |

| | | |
|---|---|---|
| Distance : "A" | Factory spec. | 8 mm<br>0.31 in. |

**(Reference)**

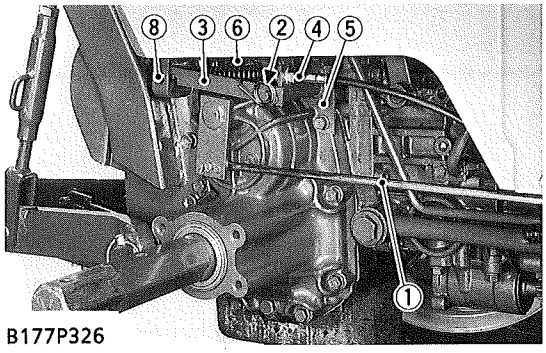
| | | |
|---|---|---|
| Distance : "B" | Factory spec. | 19 mm<br>0.75 in. |

(1) Brake Rod
(2) Spring
(3) Lever Holding Plate
(4) Bi-speed Turn Cable
(5) Cable Support
(6) Differential Lock Rod
(7) Rear Axle Case
(8) Bi-speed Turn Lever Rod

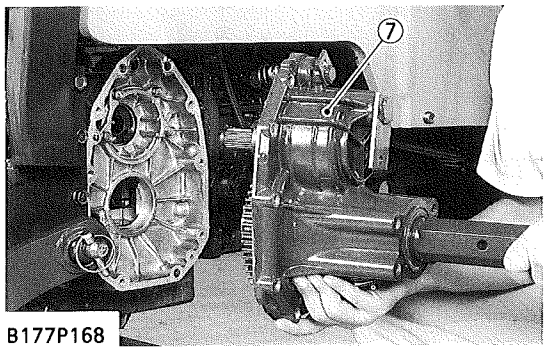
# 5 BRAKES

## SERVICING

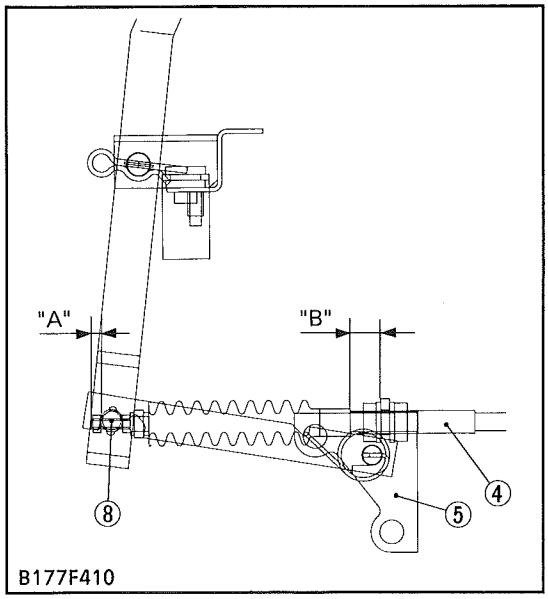
Rear Axle Case with Brake Assembly on page 5-S5 is altered as explained below.




B177P326




B177P168




B177F410

### Rear Axle Case

1. Disconnect the brake rod (1).
2. Remove the spring (2) and lever holding plate (3).
3. Loosen the lock nuts and remove the bi-speed turn cable (4) from cable support (5).
4. Disconnect the differential lock rod (6).
5. Remove the rear axle case mounting screw.
6. Separate the rear axle case (7) from the differential case.

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the rear axle case and differential gear ease after eliminating the water, oil and stuck liquid gasket.
- When reassembling the bi-speed turn cable (4), make sure to set the distance "A".

| | | |
|---|---|---|
| Tightening torque | Rear axle case mounting screws | 39 to 44 N·m<br>4.0 to 4.5 kgf·m<br>29 to 33 ft-lbs |

| | | |
|---|---|---|
| Distance : "A" | Factory spec. | 8 mm<br>0.31 in. |

**(Reference)**

| | | |
|---|---|---|
| Distance : "B" | Factory spec. | 19 mm<br>0.75 in. |

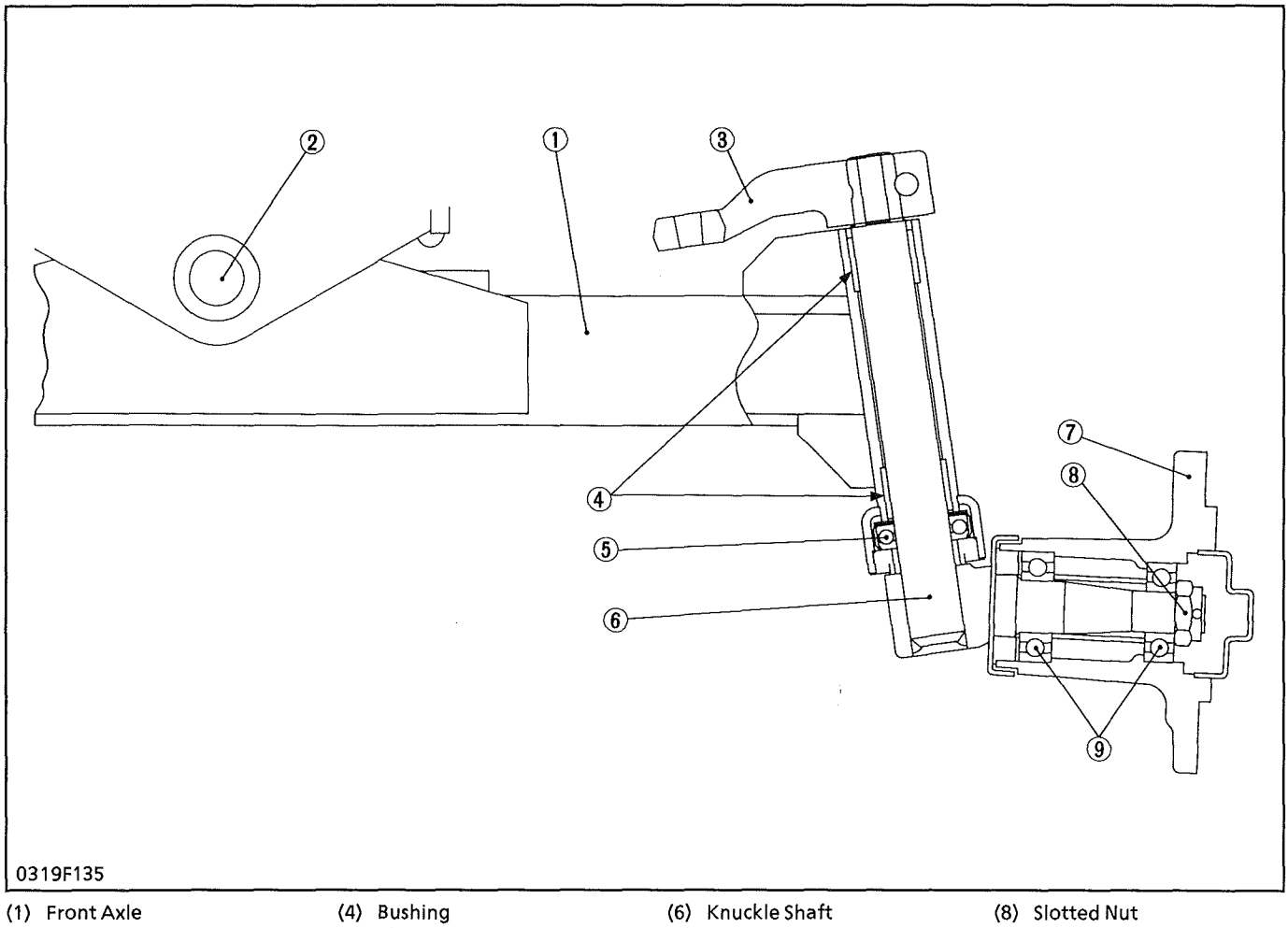
(1) Brake Rod
(2) Spring
(3) Lever Holding Plate
(4) Bi-speed Turn Cable
(5) Cable Support
(6) Differential Lock Rod
(7) Rear Axle Case
(8) Bi-speed Turn Lever Rod

# 6 FRONT AXLE

## MECHANISM

### [1] STRUCTURE

#### (1) Two Wheel Drive Type




0319F135

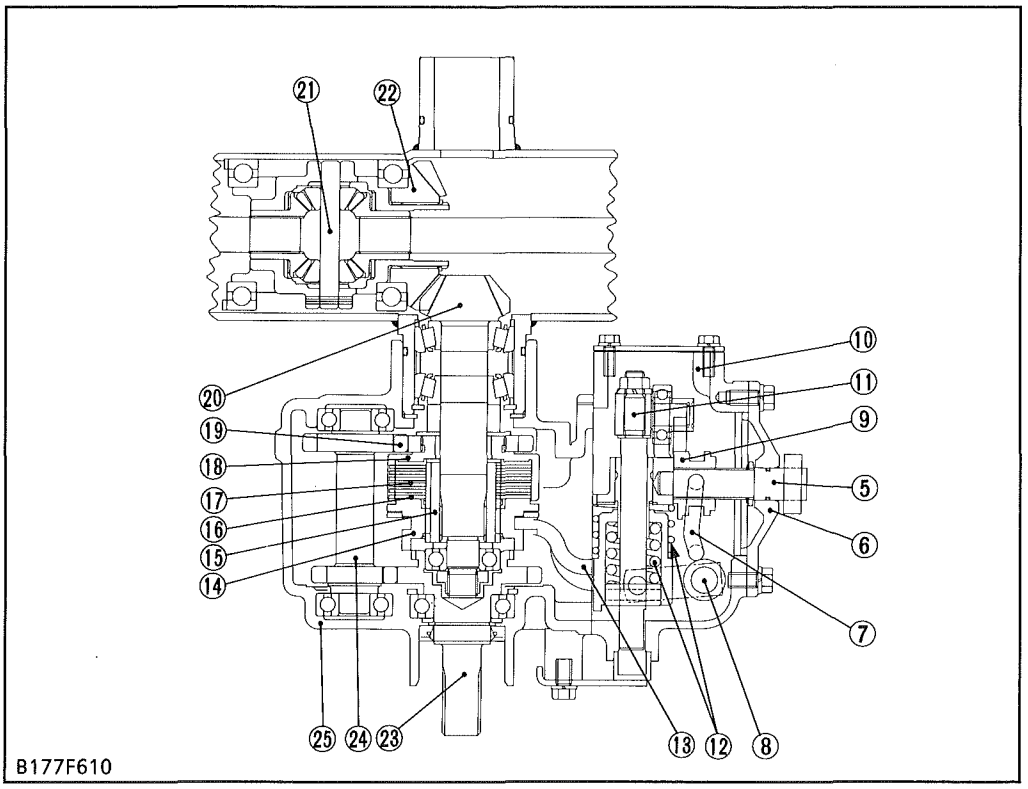
(1) Front Axle
(2) Center Pin
(3) Knuckle Arm
(4) Bushing
(5) Thrust Ball Bearing
(6) Knuckle Shaft
(7) Front Wheel Hub
(8) Slotted Nut
(9) Ball Bearing

The front axle of the 2WD type is constructed as shown above.

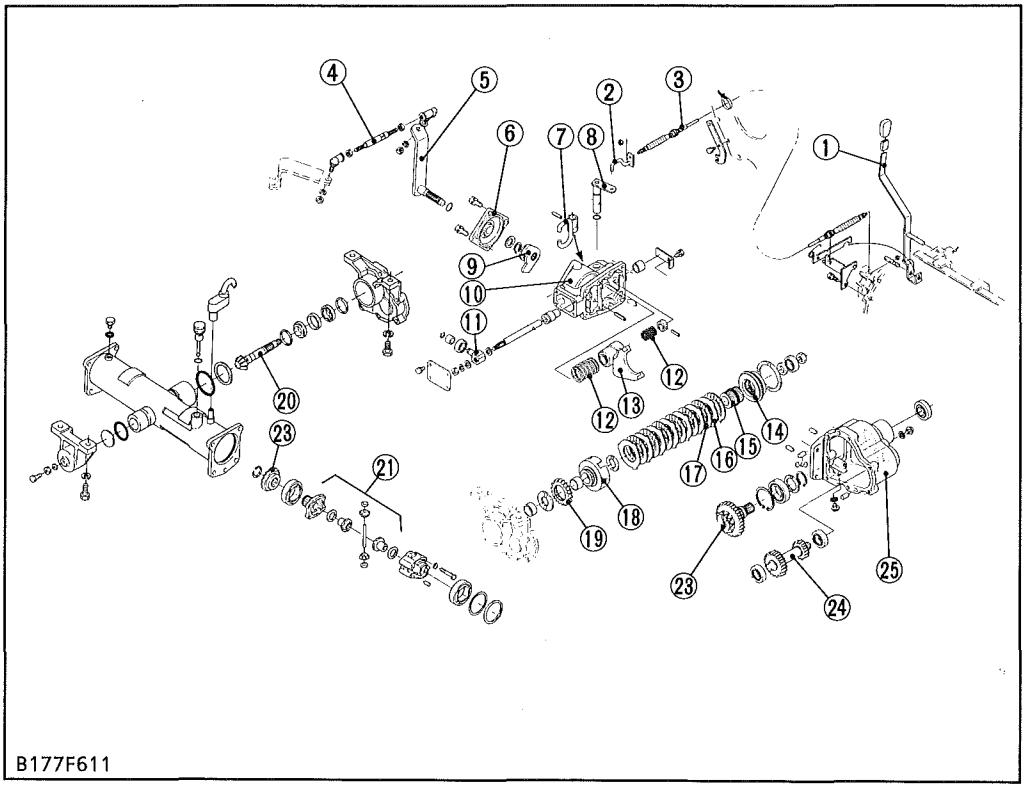
The knuckle shaft (6) is attached to the front axle (1) by the "RUMOAN" method.

With this method, the shape of the front axle is relatively simple, and the front axle is supported at its center with center pin (2), so that steering operation is stable even on an uneven ground encountered in a farm fields.

## (2) Bi-speed Turn Type




B177F610



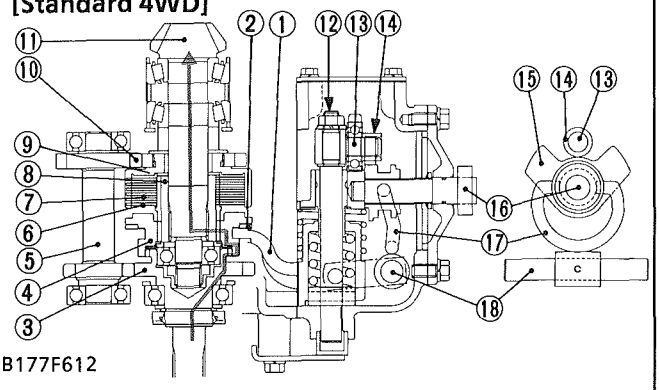

B177F611

(1) Bi-speed Turn Lever
(2) Bi-speed Turn Rod
(3) Bi-speed Turn Change Cable
(4) Shift Rod
(5) Shift Lever
(6) Shift Lever Fulcrum
(7) Change Fork
(8) Change Lever
(9) Shift Cam
(10) Bi-speed Turn Case
(11) Shift Roller Shaft
(12) Spring
(13) Bi-speed Turn Shift Fork
(14) Shifter
(15) Coupling
(16) Clutch Disc
(17) Friction Plate
(18) Clutch Drum
(19) 18T Gear
(20) Spiral Bevel Pinion Shaft
(21) Front Differential Assembly
(22) Bevel Gear
(23) Gear Shaft
(24) Gear Shaft
(25) Bi-speed Turn Gear Case

The front axle with bi-speed turn is constructed as shown above. Front wheel speed change mechanism, which is located in the bi-speed turn gear case (25) and bi-speed turn case (10), consists of the bi-speed turn lever (1), shift rod (4), shift cam (9), shift fork (13), bi-speed turn clutch assembly (14 to 18), gears (19) (23) (24) and so on.

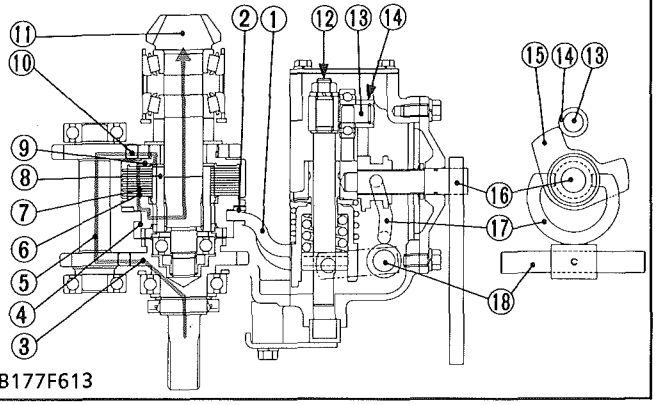
## ■ Bi-speed Turn Power Train

[Standard 4WD]




B177F612

[Bi-speed Turn 4WD]




B177F613

Bi-speed clutch is mechanically engaged when front wheel reaches approximately 0.42 rad. (24°) turning angle.

This bi-speed turn front wheel speed is 1.53 times higher than the standard front wheel speed.

### ■ Standard 4WD

21T Gear Shaft (3) → Shifter (4) → Bi-speed Turn Coupling (8) → Spiral Bevel Pinion Shaft (11) → Front Axle.

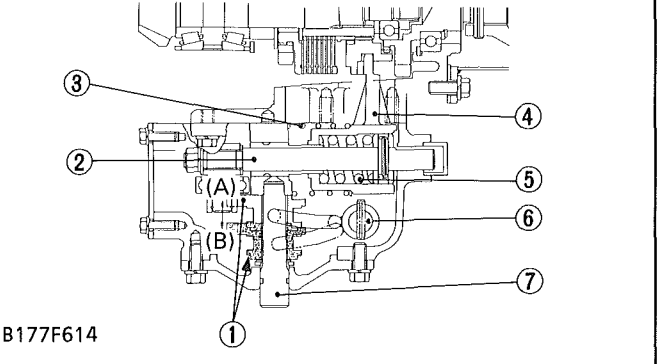
### ■ Bi-speed Turn 4WD

21T Gear Shaft (3) → 13T-10T Gear Shaft (5) → 18T Gear (10) → Bi-speed Turn Clutch Drum (9) → Friction Plate (7) → Clutch Disc (6) → Bi-speed Turn Coupling (8) → Spiral Bevel Pinion Shaft (11) → Front Axle.

(1) Shift Fork
(2) Shifter Collar
(3) 21T Gear Shaft
(4) Shifter
(5) 13T-10T Gear Shaft
(6) Clutch Disk
(7) Friction Plate
(8) Bi-speed Turn Coupling
(9) Bi-speed Turn Clutch Drum
(10) 18T Gear
(11) Spiral Bevel Pinion Shaft
(12) Shift Rod
(13) Shift Roller Shaft
(14) Shift Roller
(15) Shift Cam
(16) Shift Lever
(17) Change Fork
(18) Change Lever

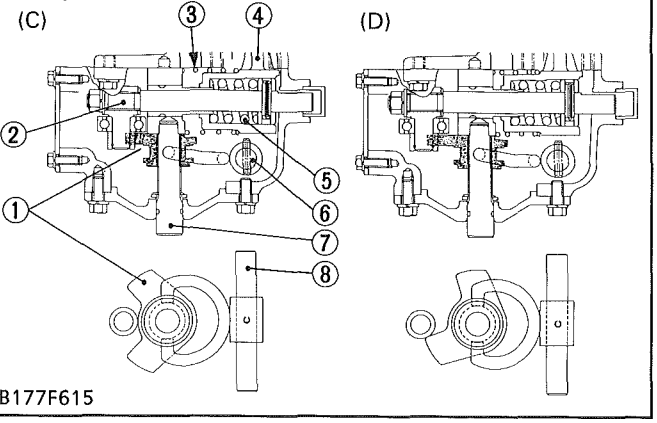
## ■ Bi-speed Cam

[Standard 4WD]




B177F614

[Bi-speed Turn 4WD]




B177F615

Bi-speed turn 4WD and standard 4WD positions are selected by change lever (6) to move the position of shift cam (1). This lever is operated by the bi-speed turn change lever located on the right side of the clutch housing.

### ■ Standard 4WD Position

The bi-speed turn change lever is shifted to the **"OFF"** position.

The shift cam (1) is free to turn, so that the shift rod (2) and shift fork (4) are remained in standard 4WD position by springs (3), (5).

### ■ Bi-speed Turn 4WD Position

The bi-speed turn change lever is shifted to the **"ON"** position.

When the steering wheel is turned more than approx. 0.44 rad. (25°) turning angle, the shift lever (7) and shift cam (1) are turned together. This cam make the shift rod (2) move the arrow direction so that the shifter is engaged with the bi-speed turn clutch.

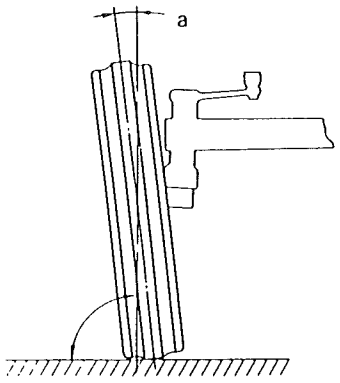
When the steering wheel is turned less than approx. 0.40 rad. (23°) turning angle, the shift rod doesn't move in spite of the cam rotation.

(1) Shift Cam
(2) Shift Rod
(3) Spring
(4) Shift Fork
(5) Spring
(6) Change Lever
(7) Shift Lever
(A) Bi-speed turn "ON"
(B) Bi-speed turn "OFF"
(C) Less than 0.40 rad. (23°) turning angle
(D) More than 0.44 rad. (25°)

## [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]



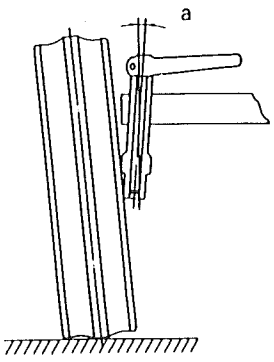

C045F051

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 | 2WD<br>4WD | 0.035 rad.<br>2° |

### [Kingpin Angle]




C045F053

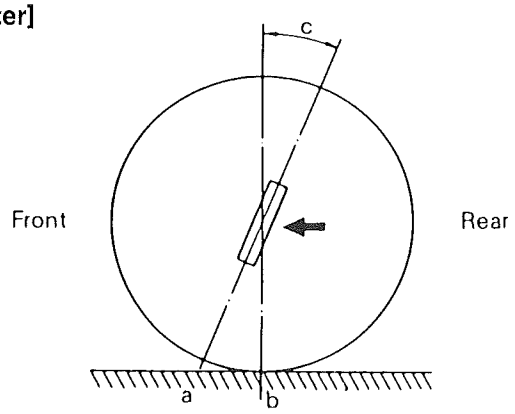
The kingpin is tilted from the vertical as viewed from the front.

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.

| | | |
|---|---|---|
| Kingpin inclination | 2WD | 0.140 rad. (8°) |
| | 4WD | 0.209 rad. (12°) |

### [Caster]




C045F052

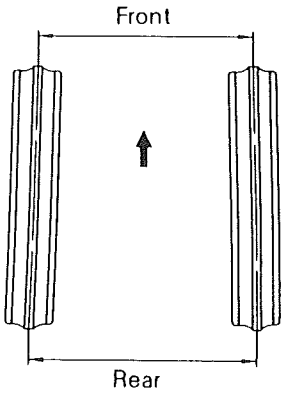
The kingpin is tilted forward as viewed from the side. The point (b) of the wheel center line is behind the point (a) of the kingpin shaft center line.

This inclination is called caster (c). Caster helps provide steering stability.

As with the kingpin inclination, caster reduces steering effort.

| | | |
|---|---|---|
| Caster | 2WD<br>4WD | 0 rad.<br>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 | 2WD<br>4WD | 1 to 10 mm<br>0.04 to 0.39 in. |

# SERVICING

# TROUBLESHOOTING

## [2WD TYPE]

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Front Wheels Wander to Right or Left** | • Clearance between center pin and pin support excessive (2WD) | Replace | D6-S6, S12 |
| | • Improper toe-in adjustment (improper alignment) | Adjust | — |
| | • Knuckle shaft bushing worn (2WD) | Replace | D6-S6, S12 |
| | • Tire pressure uneven | Inflate | DG-6 |

## [BI-SPEED TURN TYPE]

| | | | |
|---|---|---|---|
| **Bi-speed Turn System Does Not Operate or Slipping** | • Bi-speed turn clutch friction torque too low | Adjust | D6-S13 |
| | • Shift fork spring weaken or damaged | Replace | D6-S14 |
| | • Shift fork deformed, worn or broken | Replace | D6-S13 |
| | • Change fork deformed or broken | Replace | D6-S11 |
| | • Shift cam rusted | Repair or Replace | D6-S10 |
| | • Shift roller worn | Replace | D6-S10 |
| | • Clutch disc worn | Replace | D6-S12, S14 |
| | • Friction plate worn or deformed | Replace | D6-S12, S14 |
| | • Gear broken | Replace | D6-S11 |
| | • Shifter collar worn | Replace | D6-S12 |
| | • Wrong assembly of shift cam | Reinstall | D6-S10 |
| | • Wrong linkage adjustment | Readjust | D6-S7 |
| **Bi-speed Turn Does Not Return to Standard 4WD Position** | • Shift fork deformed | Replace | D6-S13 |
| | • Shift cam deformed | Replace | D6-S10 |
| | • Wrong linkage adjustment | Readjust | D6-S7 |
| **Different Bi-speed Turn Starting Angle Between Right and Left turning** | • Shift rod improperly adjusted | Adjust | D6-S4 |
| | • Shift lever and shift cam improperly assembled | Reassemble | D6-S10 |
| | • Shift cam worn | Replace | D6-S10 |

# SERVICING SPECIFICATIONS

## [2WD TYPE]

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Center Pin to Pin Support | Clearance | 0.05 to 0.25 mm<br>0.0020 to 0.0098 in. | 0.70 mm<br>0.0276 in. |
| Center Pin | O.D. | 24.90 to 25.00 mm<br>0.9803 to 0.9842 in. | — |
| Pin Support | I.D. | 25.05 to 25.15 mm<br>0.9862 to 0.9901 in. | — |

# SERVICING SPECIFICATIONS (Continued)

## [2WD TYPE]

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Knuckle Shaft to Bushing | Clearance | 0.040 to 0.105 mm<br>0.0016 to 0.0041 in. | 0.50 mm<br>0.0197 in. |
| Knuckle Shaft | O.D. | 24.948 to 24.980 mm<br>0.9822 to 0.9835 in. | — |
| Bushing | I.D. | 25.020 to 25.053 mm<br>0.9850 to 0.9863 in. | — |
| Front Wheel Alignment | Toe-in | 0 to 10 mm<br>0 to 0.39 in. | — |
| | Camber Angle | 0.035 rad.<br>2.0° | — |
| | Caster Angle | 0 rad.<br>0° | — |
| | King Pin Inclination | 0.209 rad.<br>12° | |
| Front Wheel | Steering Angle | 0.84 to 0.87 rad.<br>48° to 50° | — |
| | Axial Sway | 0 to 3 mm<br>0 to 0.118 in. | — |

## [BI-SPEED TURN TYPE]

| | | | |
|---|---|---|---|
| Bi-speed Turn Clutch | Dynamic Friction torque of bi-speed turn clutch on the front axle wheel hub | 441.3 to 490.4 N·m<br>45 to 50 kgf·m<br>325.5 to 361.7 ft-lbs | — |
| Shift Fork to Shifter Groove (with Shifter Collar) | Clearance | 0.1 to 0.7 mm<br>0.004 to 0.028 in. | 1.0 mm<br>0.04 in. |
| Bi-speed Turn Spring (short) | Free Length | 32.5 to 33.5 mm<br>1.280 to 1.319 in. | — |
| | Maximum Setting Length | 25.5 mm, 1.00 in.<br>(load 1613 N, 164.5 kgf·m, 362.7 lbs) | 25.5 mm, 1.00 in.<br>(load 1411 N, 143.9 kgf, 317.4 lbs) |
| Bi-speed Turn Spring (long) | Free Length | 52.0 mm, 2.047 in. | — |
| | Setting Length | 35.0 mm, 1.378 in.<br>(load 86.3 N, 8.8 kgf, 19.4 lbs) | 35.0 mm, 1.378 in.<br>(load 75.5 N, 7.7 kgf, 17.0 lbs) |
| Bi-speed Turn Clutch Disc | Thickness | 1.7 to 1.9 mm<br>0.067 to 0.075 in. | 1.4 mm<br>0.055 in. |
| Bi-speed Turn Friction Plate | Thickness | 0.95 to 1.05 mm<br>0.037 to 0.041 in. | 0.8 mm<br>0.0315 in. |

# TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.

### [2WD TYPE]

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Front wheel mounting screw | 77.4 to 90.2 | 7.9 to 9.2 | 57.2 to 66.5 |
| Front wheel hub slotted nut | 117.6 to 156.8 | 12 to 16 | 86.8 to 115.7 |
| Knuckle arm mounting bolts and nuts | 77.4 to 90.2 | 7.9 to 9.2 | 57.2 to 66.5 |
| Tie rod end slotted nut | 48.1 to 55.9 | 4.9 to 5.7 | 35.5 to 41.2 |
| Center pin slotted nut | Less than 9.8 | Less than 1.0 | Less than 7.2 |
| Lock plate mounting nut | 17.7 to 19.6 | 1.8 to 2.0 | 13.0 to 14.5 |

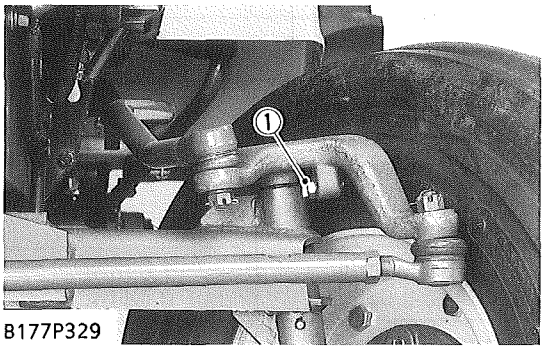
### [BI-SPEED TURN TYPE]

| | | | |
|---|---|---|---|
| Shift lever fulcrum mounting screws | 17.7 to 20.5 | 1.8 to 2.1 | 13.0 to 15.2 |
| Bi-speed turn case mounting screws | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Bi-speed turn gear case mounting screws | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Bearing holder mounting screws | 48.1 to 55.8 | 4.9 to 5.7 | 35.5 to 41.2 |
| Case cover mounting screw | 17.7 to 20.5 | 1.8 to 2.1 | 13.0 to 15.2 |
| Bi-speed turn gear case mounting screw | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Spiral bevel pinion shaft staking nut | 127 to 167 | 13 to 17 | 94.0 to 123.0 |

# CHECKING, DISASSEMBLING AND SERVICING

## CHECKING AND ADJUSTING

### (1) 2WD Type



B177P329

**Front Wheel Steering Angle**

1. Inflate the tires to the specified pressure.
2. Place the turning radius gauge under the front wheels.
3. Steer the wheels to the extreme right and left, and measure the steering angle.
4. If the angle is not within the factory specifications, adjust with the adjusting bolt (1).

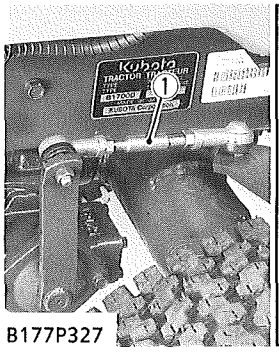
| | | | |
|---|---|---|---|
| Front wheel steering angle | Factory spec. | 2WD | 0.84 to 0.87 rad.<br>48° to 50° |

**■ NOTE**

- **Adjust the steering angle with the adjusting bolt at the right side when the steering wheel is turned counter clockwise, and adjust with the adjusting bolt at the left side when it is turned clockwise.**
- **After adjustment, secure the adjusting bolts with the lock nut.**

(1) Adjusting Bolt

## (2) Bi-speed Turn Type



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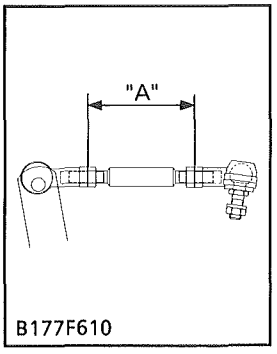

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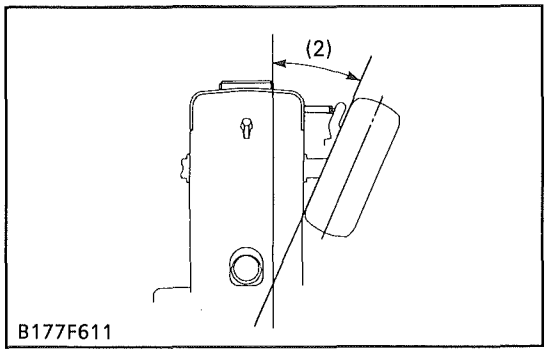

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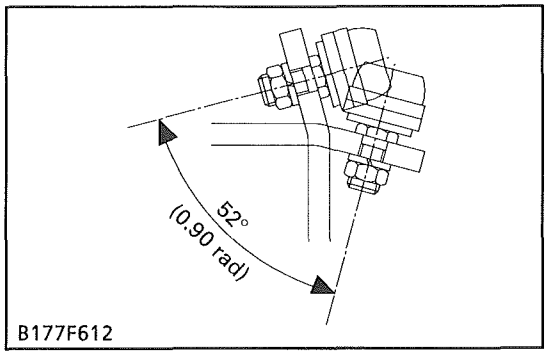


B177F612

### Bi-speed Turn Shift Rod

1. Set the front wheel drive lever to the 4WD position.
2. Hoist the front of the tractor to a position where you can turn the front wheels with your hands.
3. Turn the steering wheel and set the steering angle of the inside tire to 0.42 rad. (24°). At this time, make sure both the left and right tires turn simultaneously in the same direction.
4. If both tires do not turn in the same direction, adjust length "A" of the bi-speed turn shift rod while being careful not to change the steering angle.
   (Set the neutral position when 4WD and bi-speed changes at 0.42 rad. (24°).)

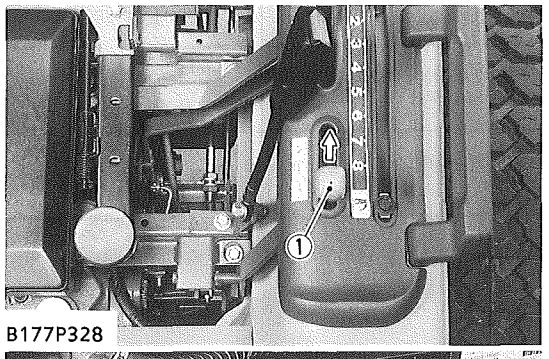
| | | |
|---|---|---|
| Distance "A" | Factory spec. | 84 mm<br>3.3 in. |
| Steering inner angle*<br>(When bi-speed turn neutral) | Factory spec. | 0.40 to 0.44 rad.<br>23° to 25° |

* When the wheels are steered to more than 0.44 rad. (25°), the bi-speed turn starts to work.

**■ NOTE**

5. When you adjust the bi-speed turn shift rod, be sure the angle of the shift rod end is the same as the angle in the figure left.

(1) Bi-speed Turn Shift Rod (2) Steering Inner Angle



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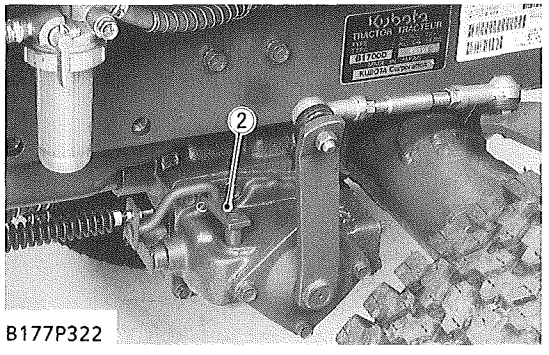


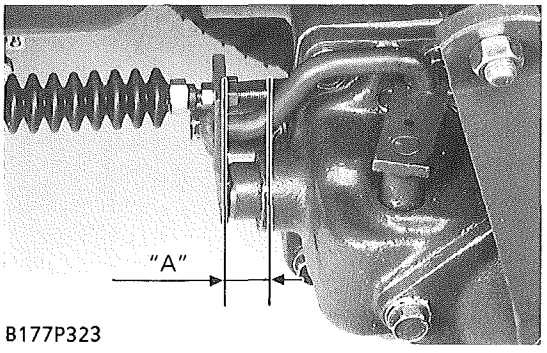
B177P322

### Bi-speed Turn Change Cable

1. Set the bi-speed turn lever (1) to the Bi-speed "ON" position.
2. Push the bi-speed case change lever (2) to the rear (Bi-speed "ON" direction), and make sure there is no play in the lever.
3. If there is play in the lever, adjust the bi-speed turn cable inner length "A".

**(Reference)**

| | | |
|---|---|---|
| Cable inner length "A" | Factory spec. | 10 mm<br>0.39 in. |



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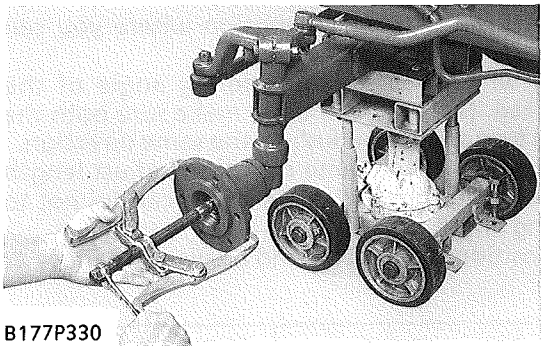
(1) Bi-speed Turn Lever (2) Bi-speed Case Change Lever

# DISASSEMBLING AND ASSEMBLING

## [1] 2WD TYPE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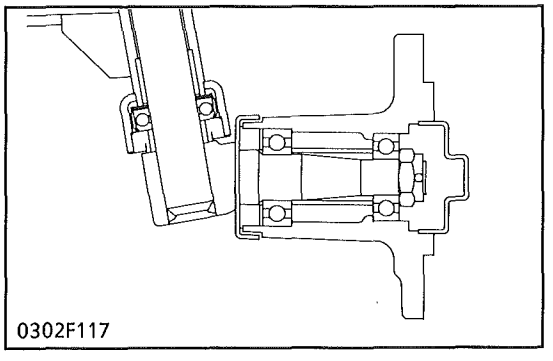

0302F117

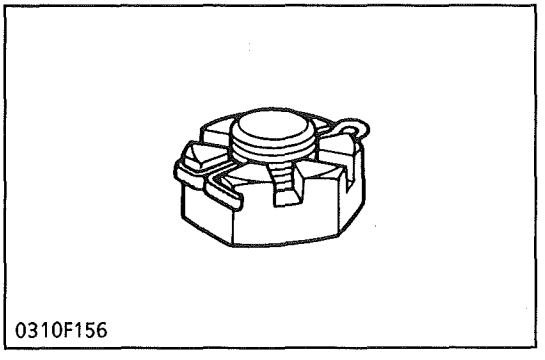
### Front Wheel Hub

1. Remove the front wheels.
2. Remove the front wheel caps.
3. Remove the cotter pin and slotted nuts.
4. Remove the front wheel hub with a puller.

**(When reassembling)**

- Bend the cotter pin as shown in the figure below.

| | | |
|---|---|---|
| Tightening torque | Front wheel mounting screw | 77.4 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.2 to 66.5 ft-lbs |
| | Slotted nut | 118 to 157 N·m<br>12 to 16 kgf·m<br>86.8 to 115.7 ft-lbs |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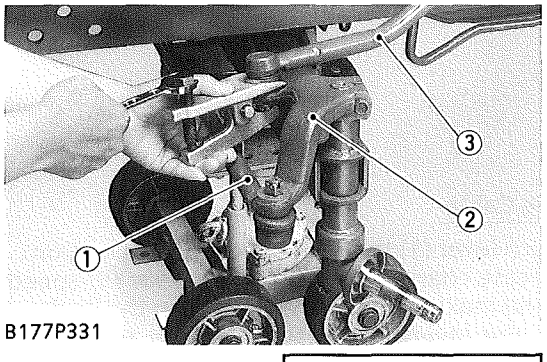

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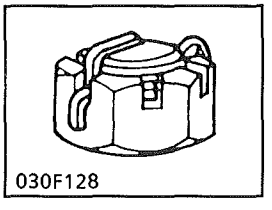

030F128

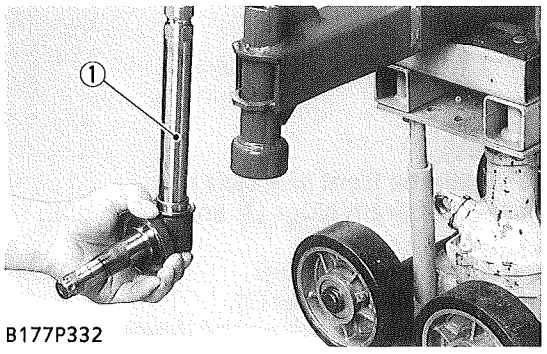
### Tie-rod and Knuckle Arm

1. Pull out the cotter pins, and loosen the slotted nuts.
2. Remove the tie-rod (1) and drag link (3) with the tie-rod end lifter. (Code No. 07909-39021)
3. Remove the knuckle arm (2).

**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Knuckle arm mounting bolt and nut | 77.4 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.2 to 66.5 ft-lbs |
| | Slotted nut for tie-rod end | 48.1 to 55.9 N·m<br>4.9 to 5.7 kgf·m<br>35.5 to 41.2 ft-lbs |

(1) Tie-rod
(2) Knuckle Arm
(3) Drag Link



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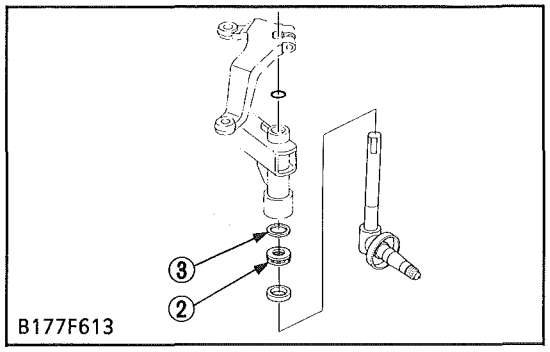


B177F613

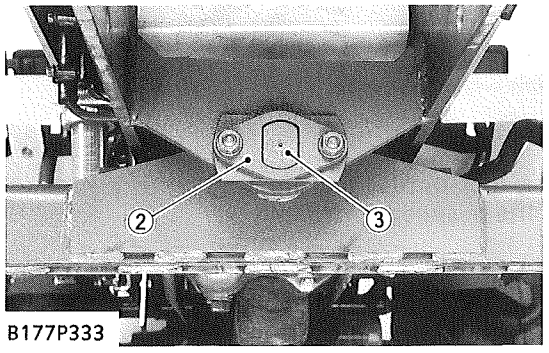
## Knuckle Shaft

1. Remove the knuckle shaft (1) from the front axle assembly.

**(When reassembling)**

- Install the thrust bearing (2) and collar (3) in its proper direction.

(1) Knuckle Shaft
(2) Thrust Bearing
(3) Collar



B177P333

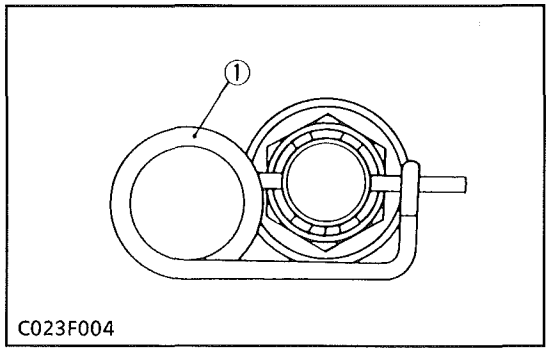
## Separation of Front Axle and Front Axle Frame

1. Remove the set spring (1).
2. Remove the slotted nut.
3. Remove the lock plate (2), and pull out the center pin (3) to forward.
4. Separate the front axle from the front axle frame.

**(When reassembling)**

- After reassembling the center pin, apply grease until it overflows from the end.

| | | |
|---|---|---|
| Tightening torque | Slotted nut | Less than 9.8 N·m<br>1.0 kgf·m<br>7.23 ft-lbs |
| | Lock plate mounting nut | 17 to 19.6 N·m<br>1.8 to 2.0 kgf·m<br>13.0 to 14.5 ft-lbs |



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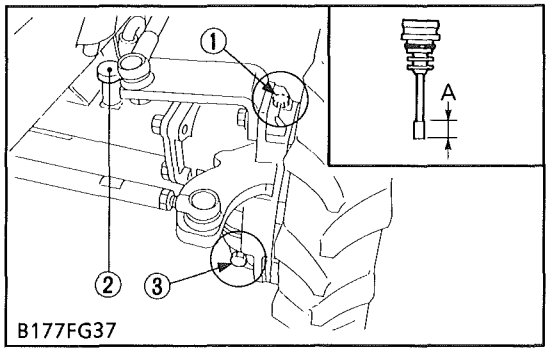
**■ NOTE**

- **Tighten the slotted nut to 9.8 N·m (1.0 kgf·m, 7.23 ft-lbs). If the slot and pin hole do not meet, loosen the nut until they do meet, and then install the set spring.**
- **When installing the set spring (1), insert it from the left side, as shown in figure.**

(1) Set Spring
(2) Lock Plate
(3) Center Pin

# [2] BI-SPEED TURN TYPE

## (1) Separating Front Axle



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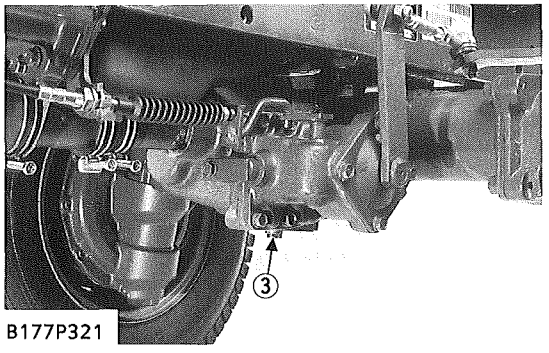

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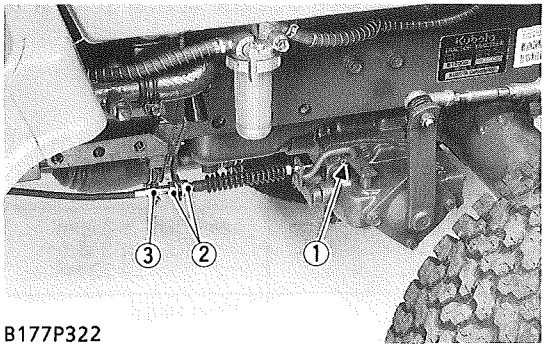

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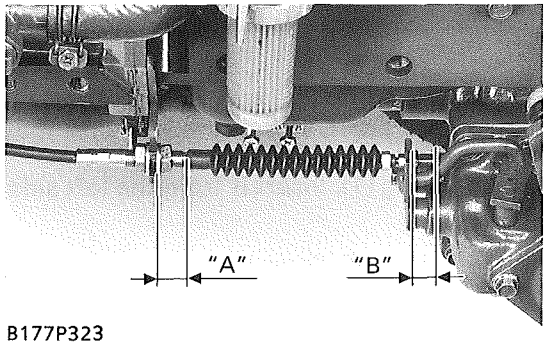


B177P323

### 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 | 4.5 ℓ<br>4.8 U.S.qts.<br>4.0 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 DG-2.)**

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

### Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

**(When reassembling)**

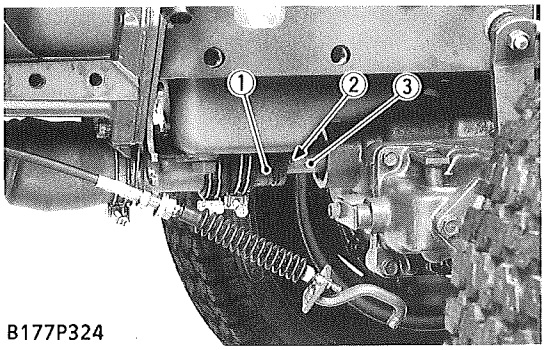
- When reassembling the bi-speed turn cable (3), make sure the distance "A".

| | | |
|---|---|---|
| Distance : "A" | Factory spec. | 18 mm<br>0.71 in. |

**(Reference)**

| | | |
|---|---|---|
| Distance : "B" | Factory spec. | 10 mm<br>0.39 in. |

(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable



B177P324

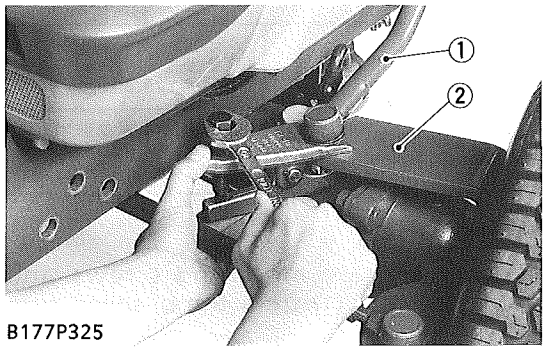
## Propeller Shaft

1. Loosen the clamp (4) and slide the propeller shaft cover (1) 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) Clamp



B177P325

## Drag Link

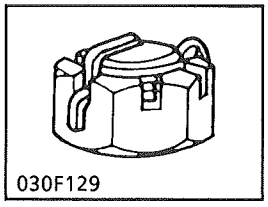
1. Steer the front wheels to the left.
2. Remove the slotted nut and disconnect the drag link (2) from the knuckle arm (1).

**■ IMPORTANT**

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

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

(1) Knuckle Arm
(2) Drag Link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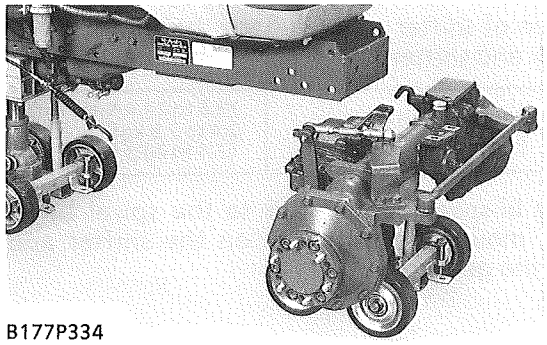
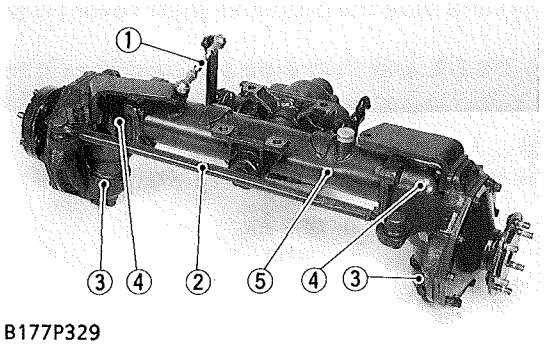

B177P334

## Front Axle

1. Place the jack under the clutch housing.
2. Place the jack under the front axle.
3. Remove the front wheels.
4. Remove the front axle brackets (Front and Rear) mounting screws.
5. Separate the front axle from the front axle frame.

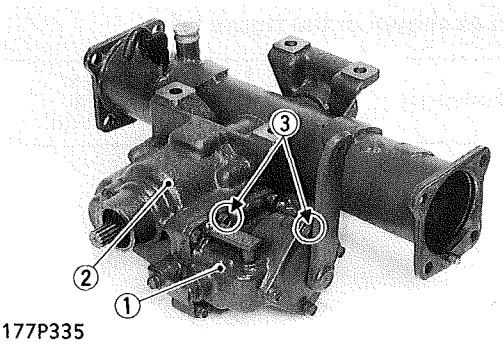
| | | |
|---|---|---|
| Tightening torque | Front axle bracket mounting screws | 124 to 147 N·m<br>12.6 to 15.0 kgf·m<br>91.1 to 108.5 ft-lbs |
| | Front wheel mounting screws | 77.5 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.1 to 66.5 ft-lbs |

## (2) Disassembling Front Axle




B177P329

(1) Bi-speed Turn Rod
(2) Tie-rod
(3) Front Gear Case
(4) Bevel Gear Case
(5) Front Axle Case




B177P335

(1) Bi-speed Turn Case
(2) Bi-speed turn Gear Case
(3) Screws with Adhesive

### Tie-rod and Bevel Gear Case Assembly

1. Remove the bi-speed turn rod (1).
2. Remove the slotted nut and disconnect the tie-rod (2) from the front gear case (3).
3. Remove the bevel gear case (4) and front gear case (3) as a unit from the front axle case (5).

**(When reassembling)**

- Apply grease to the O-ring and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies.

| | | |
|---|---|---|
| Tightening torque | Slotted nut | 17.7 to 34.3 N·m<br>1.8 to 3.5 kgf·m<br>13.0 to 25.3 ft-lbs |
| | Bevel gear case mounting screw | 123.5 to 147.0 N·m<br>12.6 to 15.0 kgf·m<br>91.2 to 108.4 ft-lbs |

### Separation of Bi-speed Turn Case

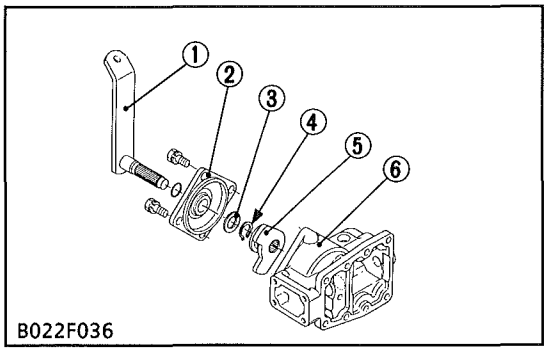
1. Remove the bi-speed turn case mounting screws and separate the bi-speed turn case (1) from the bi-speed turn gear case (2).

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the bi-speed turn case (1) and bi-speed turn gear case.
- Apply liquid gasket (Three Bond 1208D or equivalent) to threads of screws (3).
- Install the bi-speed turn case to the bi-speed turn gear case, noting the position of shifter collar. (Place the shifter collar between shift fork and shifter)

| | | |
|---|---|---|
| Tightening torque | Bi-speed turn case mounting screw | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |

- After shifting the bi-speed turn shifter to the spiral bevel pinion shaft side, mount the shift fork on the shifter and install the case to the gear case.



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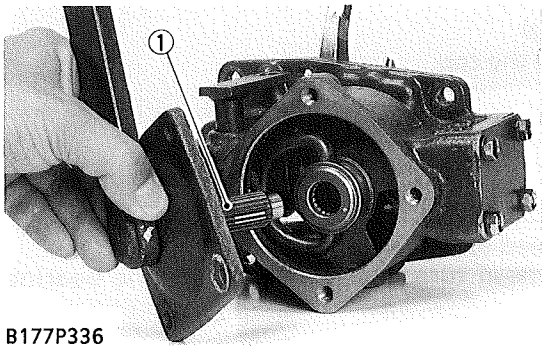

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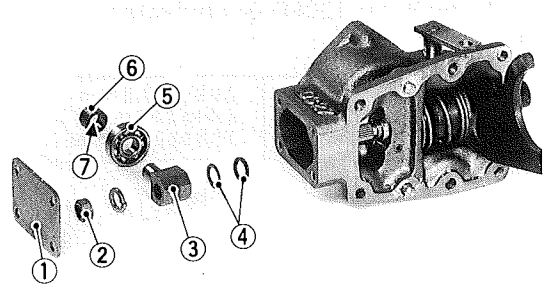


B022P005

## Shift Cam

1. Remove the case cover (2) with the shift lever and shift cam (5).
2. Remove the external snap ring (4) and collar (3).
3. Remove the shift lever (1).

**■ NOTE**

- **The white marks is painted on the shift lever (1) for aligning the shift cam.**

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the bi-speed turn case (6) and case cover (2).
- When installing the shift cam, be sure to align the marks on the shift cam and shift lever.

| | | |
|---|---|---|
| Tightening torque | Case cover mounting screw | 17.7 to 20.5 N·m<br>1.8 to 2.1 kgf·m<br>13.0 to 15.2 ft-lbs |

(1) Shift Lever
(2) Case Cover
(3) Collar
(4) External Snap Ring
(5) Shift Cam
(6) Bi-speed Turn Case

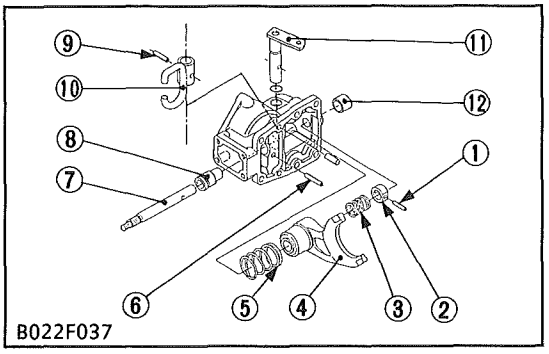
## Shift Roller Shaft

1. Remove the cover (1).
2. Remove the nut (2) and the shift roller shaft ass'y.
3. Tap out the shift roller shaft (3), while holding the bearing (5) to remove the shift roller (6). The retainer ring (7) is mounted inside of the roller.

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the cover (1) and bi-speed turn case.

(1) Cover
(2) Nut
(3) Shift Roller Shaft
(4) Adjusting Shim
(5) Ball Bearing
(6) Shift Roller
(7) Retainer Ring



B022F037

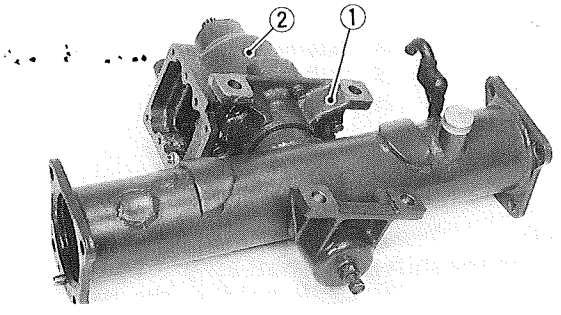
(1) Spring Pin
(2) Pressure Collar
(3) Spring
(4) Shift Fork
(5) Spring
(6) Spring Pin
(7) Shift Rod
(8) Shift Rod Collar
(9) Spring Pin
(10) Change Fork
(11) Change Lever
(12) Cap

## Shift Fork, Shift Rod and Change Lever

1. Push the shift fork to the front till the spring pin (1) can be seen and tap out the spring pin (1).
2. Remove the cap (12) and tap out the shift rod (7) to the front.
3. Tap out the spring pin (6).
4. Tap out the shift rod collar (8) by the rod to the front.
5. Take off the shift fork (4), springs (3) (5) and pressure collar (2) together.
6. Tap out the spring pin (9), using the screw hole for the fulcrum mounting screw on the case. Remove the change lever (11) and change fork (10).

**(When reassembling)**

- Apply adhesive to the cap.



B177P337

## Separation of Bi-speed Turn Gear Case

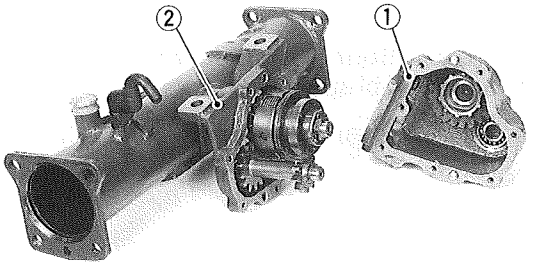
1. Remove the bi-speed turn gear case mounting screws (1).
2. Separate the bi-speed turn gear case (2) from the bearing holder (3).

**(When reassembling)**

- Apply liquid gasket (Three Bond 1208D or equivalent) to the bi-speed turn gear case.

| | | |
|---|---|---|
| Tightening torque | Bi-speed turn gear case mounting screw | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |

(1) Bi-speed Turn Gear Case
(2) Bearing Holder



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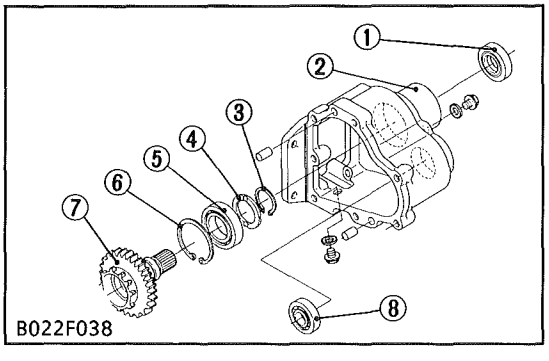


B022F038

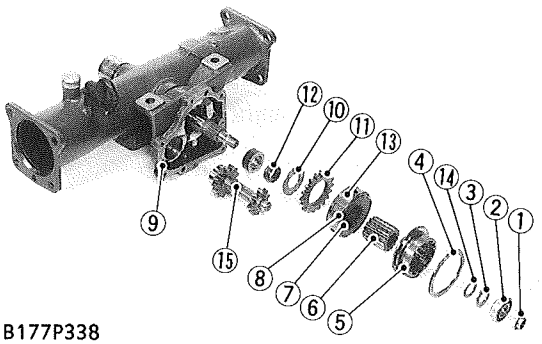
## Ball Bearing and Oil Seal

1. Remove the oil seal (1) and remove the external snap ring (3) and thrust collar (4).
2. Tap out the gear shaft (7).
3. Remove the internal snap ring (6) and remove the ball bearing (5) from the bi-speed turn gear case (2).
4. Remove the ball bearing (8) from the bi-speed turn gear case (2).

**(When reassembling)**

- Apply grease to the oil seal.

(1) Oil Seal
(2) Bi-speed Turn Gear Case
(3) External Snap Ring
(4) Thrust Collar
(5) Ball Bearing
(6) Internal Snap Ring
(7) Gear Shaft
(8) Ball Bearing



B177P338

(1) Nut
(2) Ball Bearing
(3) Plain Washer
(4) Shifter Collar
(5) Shifter
(6) Bi-speed turn Coupling
(7) Clutch Disc
(8) Friction Plate
(9) Bearing Holder
(10) Thrust Collar
(11) Bi-speed Turn Gear
(12) Inner Ring
(13) Bi-speed Turn Clutch Drum
(14) Collar
(15) Gear Shaft

### Bi-speed Turn Clutch Assembly

1. Put back the stakes of the nut (1) and remove it.
2. Pull out the ball bearing (2) with a puller and remove the plain washer (3) shifter collar (4) and shifter (5).
3. Remove the bi-speed turn coupling (6), clutch discs (7), friction plates (8), collar (14) and bi-speed turn clutch drum (13).
4. Remove the thrust collar (10), bi-speed turn gear (11) and inner ring (12) from the bi-speed turn clutch drum (13).
5. Remove the gear shaft (15).

**(When reassembling)**

- Apply molybdenum desulphid (Three Bond 1901 or equivalent) to the inner ring.
- Replace the staking nut with a new one and tighten the nut and be sure to stake it.

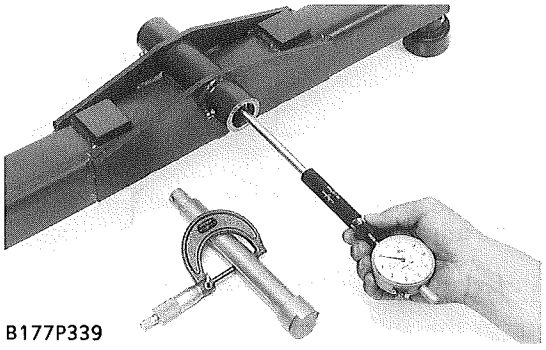
See D6-S15

| | | |
|---|---|---|
| Tightening torque | Staking nut | 127 to 167 N·m<br>13 to 17 kgf·m<br>~~94.0 to 123.0 ft-lbs~~<br>21.7 - 25.3 FT-LBS |

- After installing the gear shaft with the bearing, reinstall the bi-speed turn clutch ass'y.

## SERVICING

### [2WD TYPE]

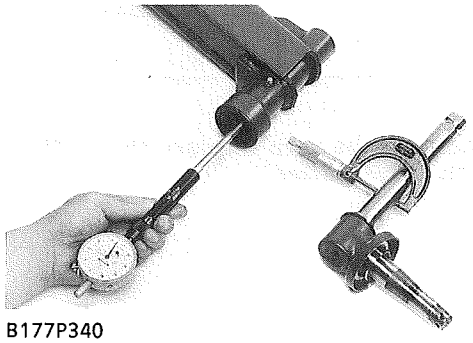


B177P339

### Clearance between Center Pin and Pin Support

1. Measure the center pin O.D. with an outside micrometer.
2. Measure the pin support I.D. of the front axle with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

| | | |
|---|---|---|
| Clearance between center pin and pin support | Factory spec. | 0.05 to 0.25 mm<br>0.0020 to 0.0098 in. |
| | Allowable limit | 0.70 mm<br>0.0276 in. |
| Center pin O.D. | Factory spec. | 24.90 to 25.00 mm<br>0.9803 to 0.9842 in. |
| Pin support I.D. | Factory spec. | 25.05 to 25.15 mm<br>0.9862 to 0.9901 in. |



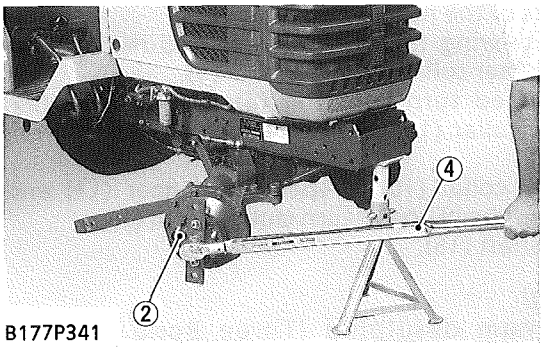
B177P340

### Clearance between Knuckle Shaft and Bushing

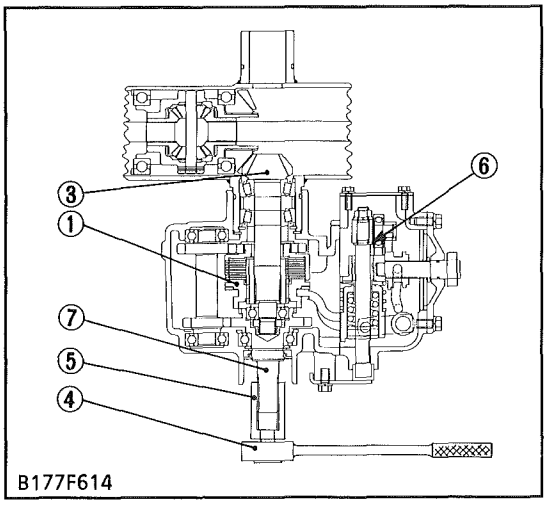
1. Measure the knuckle shaft O.D. at several points with an outside micrometer. (The knuckle shaft tends to show concentrated wear.)
2. Similarly, measure the knuckle shaft bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace.

| | | |
|---|---|---|
| Clearance between knuckle shaft and bushing | Factory spec. | 0.040 to 0.105 mm<br>0.0016 to 0.0041 in. |
| | Allowable limit | 0.50 mm<br>0.0197 in. |
| Knuckle shaft O.D. | Factory spec. | 24.948 to 24.980 mm<br>0.9822 to 0.9835 in. |
| Bushing I.D. | Factory spec. | 25.020 to 25.053 mm<br>0.9850 to 0.9863 in. |

## [BI-SPEED TURN TYPE]

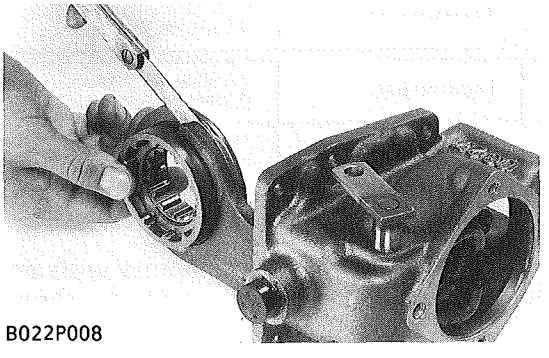


B177P341



B177F614

(1) Bi-speed Turn Clutch
(2) Front Wheel Hub
(3) Spiral Bevel Pinion Shaft
(4) Torque Wrench
(5) Jig
(6) Shim
(7) Gear Shaft


B022P008

### Bi-speed Turn Clutch Friction Torque

1. Lift up the front of tractor and set the stand.
2. Remove the front tires.
3. Shift the front wheel drive lever to "ON" position.
4. Shift the bi-speed turn lever to "ON" position.
5. Set the parking brake.
6. Fully turn the steering wheel to the left or right to set the bi-speed turn "ON" position.
7. Set the torque wrench (4) with the special jig on the front wheel hub (2) and set the special jig (locking bar) on the other side of front wheel hub.
8. Measure the torque, when the bi-speed turn clutch is slipped.
9. If the torque is not within the factory specifications, adjust it with the shims (6).

| | | |
|---|---|---|
| Dynamic friction torque of bi-speed turn clutch on the front wheel hub | Factory spec. | 441.3 to 490.4 N·m<br>45 to 50 kgf·m<br>325.5 to 361.7 ft-lbs |

**(Reference)**

- Thickness of shims :
  1.0 mm (0.039 in.), 1.5 mm (0.059 in.)
- When the dynamic friction torque of bi-speed turn clutch is measured on the gear shaft (7), its factory specifications as follows.

| | | |
|---|---|---|
| Dynamic friction torque of bi-speed turn clutch on the gear shaft | Reference value | 86.40 to 96.01 N·m<br>8.81 to 9.79 kgf·m<br>63.65 to 70.81 ft-lbs |

**■ NOTE**

- **Check the springs, clutch discs and friction plates if the correct torque can't be adjusted.**

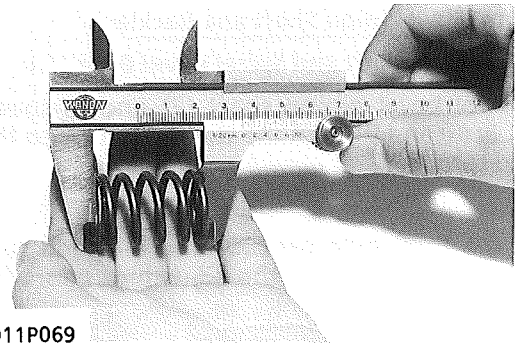
### Clearance between Shift Fork and Shifter Groove

1. Place the shift fork in the shifter groove and measure the clearance with a feeler gauge.
2. If the clearance exceeds the allowable limit, replace.

| | | |
|---|---|---|
| Clearance between shift fork and shifter groove | Factory spec. | 0.1 to 0.7 mm<br>0.004 to 0.028 in. |
| | Allowable limit | 1.0 mm<br>0.04 in. |

**■ NOTE**

- **When measuring the clearance, be sure to place the shifter collar between the shift fork and shifter.**

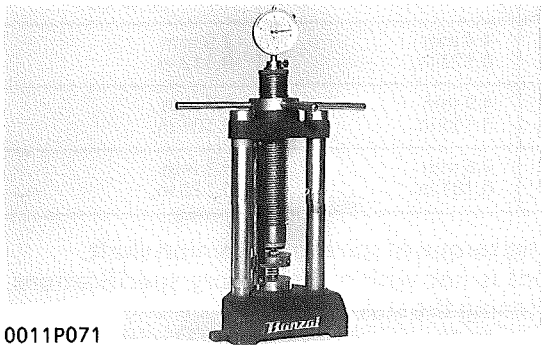


0011P069

## Free Length of Bi-speed Turn Spring

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

| | | |
|---|---|---|
| Free length of bi-speed turn spring (short) | Factory spec. | 32.5 to 32.6 mm<br>1.280 to 1.283 in. |
| | Allowable limit | 28.5 mm<br>1.22 in. |
| Free length of bi-speed turn spring (long) | Factory spec. | 52.0 mm<br>2.047 in. |
| | Allowable limit | 45.5 mm<br>1.791 in. |

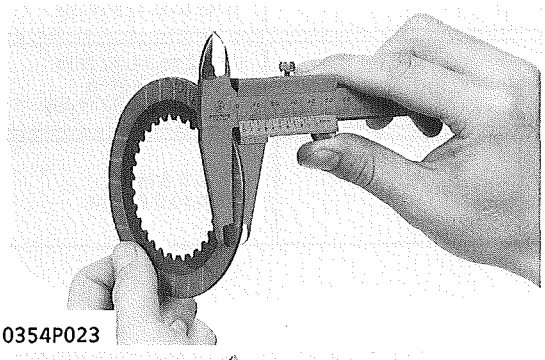


0011P071

## Working Load of Bi-speed Turn Spring

1. Put the spring on the spring tester and compress it to the specified length.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Working load of bi-speed turn spring (short) | Factory spec. | Load 1613 N/Setting length 25.5 mm<br>164.5 kgf/25.5 mm<br>362.7 lbs/1.00 in. |
| | Allowable limit | Load 1411 N/Setting length 25.5 mm<br>143.9 kgf/25.5 mm<br>317.4 lbs/1.00 in. |
| Working load of bi-speed turn spring (long) | Factory spec. | Load 86.3 N/Setting length 35.0 mm<br>8.8 kgf/35.0 mm<br>19.4 lbs/1.378 in. |
| | Allowable limit | Load 75.5 N/Setting length 35.0 mm<br>7.7 kgf/35.0 mm<br>17.0 lbs/1.378 in. |



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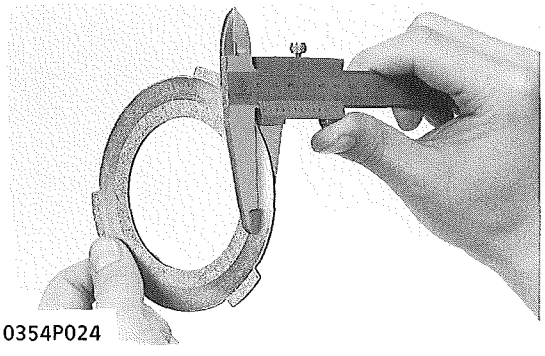


0354P024

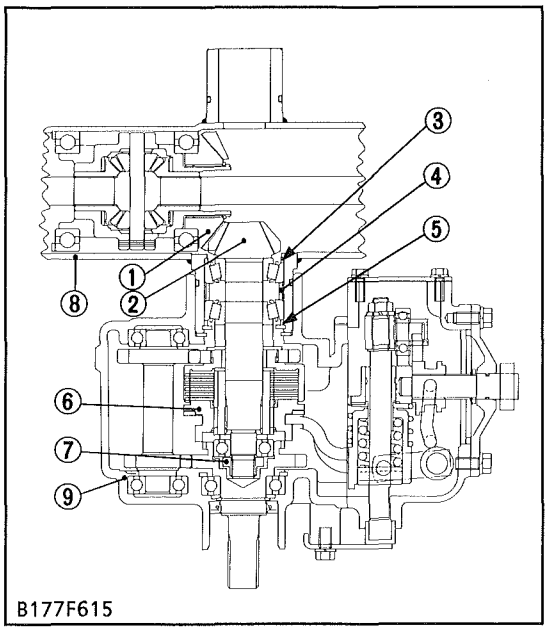
## Clutch Disc Wear and Friction Plate Wear

1. Measure the thickness of the clutch disc and friction plate (steel plate) with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

| | | |
|---|---|---|
| Thickness of clutch disc | Factory spec. | 1.7 to 1.9 mm<br>0.067 to 0.075 in. |
| | Allowable limit | 1.4 mm<br>0.055 in. |
| Thickness of friction plate | Factory spec. | 0.95 to 1.05 mm<br>0.037 to 0.075 in. |
| | Allowable limit | 0.8 mm<br>0.0315 in. |

**(When reassembling)**

- After keeping clutch discs in transmission oil for several seconds and apply transmission oil to friction plate, reassembling them in order.




(1) Spiral Bevel Gear
(2) Spiral Bevel Pinion Shaft
(3) Collar
(4) Collar
(5) Collar
(6) Bi-speed Turn Clutch Assembly
(7) Staking Nut
(8) Front Axle Case
(9) Bi-speed Turn Case

## Turning Force of Spiral Bevel Pinion Shaft and Backlash between Spiral Bevel Pinion Shaft and Spiral Bevel Gear

1. Reassemble the spiral bevel pinion shaft (2) and bi-speed turn clutch assembly (6) and tighten the staking nut (7) to the minimum specified torque.

**■ IMPORTANT**

- **Before assemble the front axle case (8) and bi-speed turn case (9), noting the combination of the adjusting collars (3), (5) as shown below.**

| | Thickness of collar | |
|---|---|---|
| | Collar (3) | Collar (5) |
| Combination 1 | 4.4 mm<br>0.173 in. | 2.9 mm<br>0.112 in. |
| Combination 2 | 4.2 mm<br>0.165 in. | 2.7 mm<br>0.106 in. |
| Combination 3 | 4.6 mm<br>0.181 in. | 3.1 mm<br>0.122 in. |

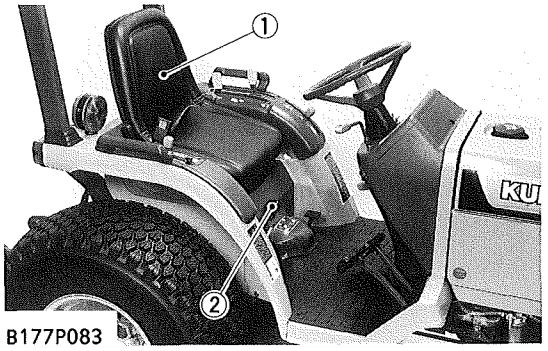
2. Measure the turning torque of spiral bevel pinion shaft.
3. If the measurement is not within the factory specifications, adjust with retightening the staking nut.
4. Stick the strip of fuse on the spiral bevel gear (1) with grease.
5. Carefully rotate the spiral bevel pinion shaft (2) one full turn.
6. Remove the fuse and measure the thickness of the fuse.
7. If the measurement is not within the factory specification, change the adjusting collar (3), (4) and (5).
8. Adjust the backlash properly by repeating the above procedures.
9. After adjusting the backlash, stake the staking nut (7).

| | | |
|---|---|---|
| Turning torque | Factory spec. | 0.78 to 0.98 N·m<br>0.08 to 0.10 kgf·m<br>0.58 to 0.723 ft-lbs |
| Tightening torque | Staking nut | 29.42 to 34.32 N·m<br>3.0 to 5.0 kgf·m<br>21.70 to 25.32 ft-lbs |
| Backlash between spiral bevel pinion shaft and spiral bevel gear | Factory spec. | 0.1 to 0.3 mm<br>0.004 to 0.012 in. |

# 8 HYDRAULIC SYSTEM

## SERVICING

Seat, Seat Rail, Seat Stay and Seat Under Cover on page 8-S9 is altered as explained below.



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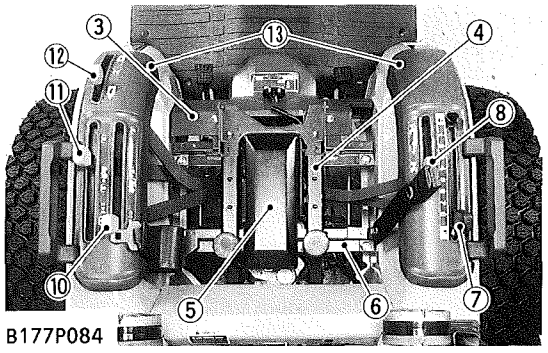

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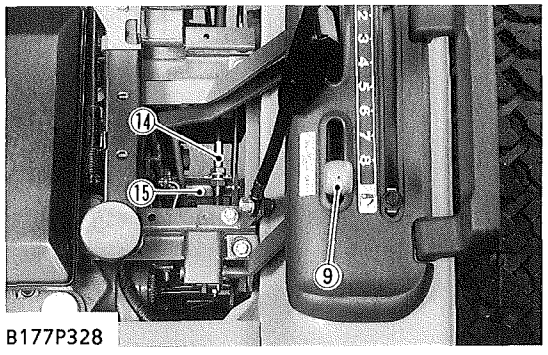

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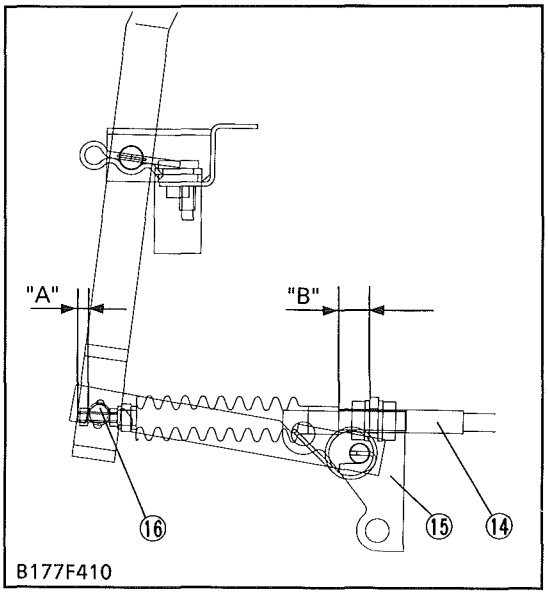


B177F410

**Seat, Seat Rail, Seat Stay, Seat Under Cover and Fender (RH)**

1. Remove the seat (1) and lowering speed adjusting knob (2).
2. Remove the tool box (5) and seat under cover (3).
3. Remove the position control lever grip (7), front wheel drive lever grip (8), bi-speed turn lever grip (9), mid and rear-PTO gear shift lever grips (10) (11) and Hi-Lo gear shift lever grip (12).
4. Remove the left and right hand side lever guide (13).
5. Remove the seat stay (6) and seat rail (4) as a unit.

**(When reassembling)**

- When connecting the bi-speed turn cable (14), make sure the distance "A".

| | | |
|---|---|---|
| Distance : "A" | Factory spec. | 8 mm<br>0.31 in. |

**(Reference)**

| | | |
|---|---|---|
| Distance : "B" | Factory spec. | 19 mm<br>0.75 in. |

(1) Seat
(2) Lowering Speed Adjusting Knob
(3) Seat Under Cover
(4) Seat Rail
(5) Tool Box
(6) Seat Stay
(7) Position Control Lever Grip
(8) Front Wheel Drive Lever Grip
(9) Bi-speed Turn Lever Grip
(10) Mid-PTO Gear Shift Lever Grip
(11) Rear-PTO Gear Shift Lever Grip
(12) Hi-Lo Gear Shift Lever Grip
(13) Lever Guide
(14) Bi-speed Turn Cable
(15) Cable Support
(16) Bi-speed Turn Lever Rod

# TO THE READER

In this section, the main additional functions and altered points of NEW B1700, B2100 and B2400 tractor from previous model are explained.

As for the items which are not explained in this section, refer to Workshop Manual for B1700, B2100 and B2400.

## ■ Mechanism

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

## ■ Servicing

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

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

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

**NOTE :** The same model names are used for the new and the previous tractor. Therefore, different serial numbers are used to distinguish between the new and the previous models.

* Serial number on the new B1700, B2100 and B2400 tractor

| MODEL | Serial number | MODEL | Serial number |
|---|---|---|---|
| B1700E | above 10141 | B2100HE | above 30001 |
| B1700D | above 50443 | B2100HD | above 72036 |
| B1700HE | above 30001 | B2400E | above 10001 |
| B1700HD | above 71831 | B2400D | above 50005 |
| B2100E | above 10001 | B2400HE | above 30155 |
| B2100D | above 50403 | B2400HD | above 72546 |

**June '96**

# G GENERAL

## [1] MAINTENANCE CHECK LIST

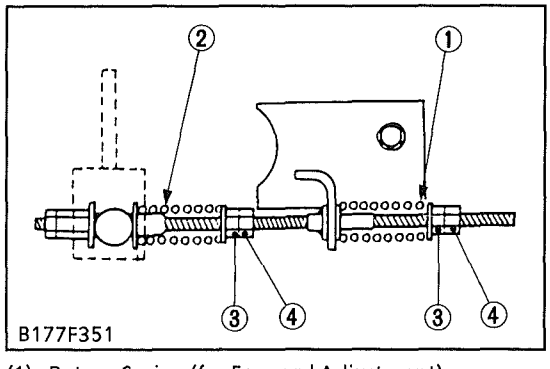
| No. | Check point | Indication on hour meter (Change or check every interval shown below) | | | | | | | | | | | | | | | After purchase | | Reference page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 | 700 | 750 | 800 | 1 year | 2 years | |
| 1 | HST pedal return spring | | ○ | | ○ | | ○ | | ○ | | ○ | | ○ | | ○ | | ○ | | | EG-1 |

## [2] CHECK AND MAINTENANCE

**⚠ CAUTION**

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

### (1) Check Points of Every 100 Hours




(1) Return Spring (for Forward Adjustment)
(2) Return Spring (for Reverse Adjustment)
(3) Adjustment Nut
(4) Lock Nut

**Checking HST Pedal Performance**

**⚠ WARNING**

**To avoid personal injury :**

- **Do not operate if tractor moves on level ground with foot off HST pedal.**

1. Set the engine speed to 1500 rpm.
2. Shift the range gear shift lever to the high position.
3. Move the HST pedal from the forward to the neutral position to make sure that the tractor comes to a complete stop, and check the same for the movement from the rearward to the neutral position.
4. If HST pedal is too slow in returning to neutral position, adjust the HST pedal spring compression.

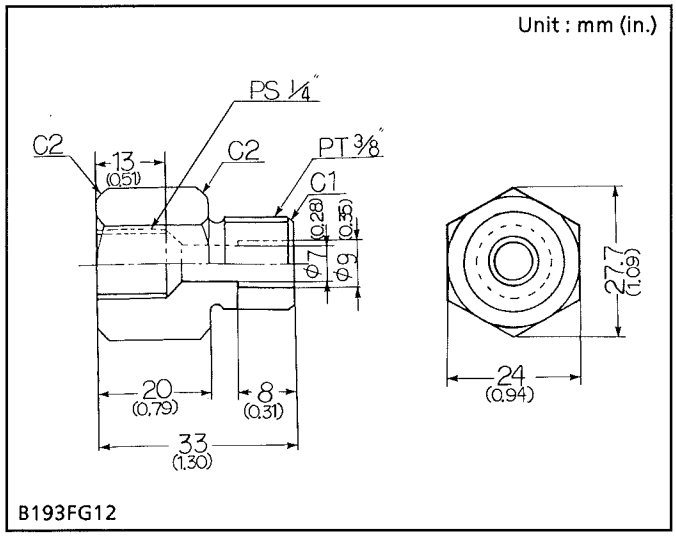
| | Length (A) | Length (B) |
|---|---|---|
| Normal compression | 50 mm (2.0 in.) | 50 mm (2.0 in.) |
| Max. compression | 42 mm (1.7 in.) | 42 mm (1.7 in.) |

**■ IMPORTANT**

- **Do not compress the return spring shorter than Max. compression length 42 mm (1.7 in.).**

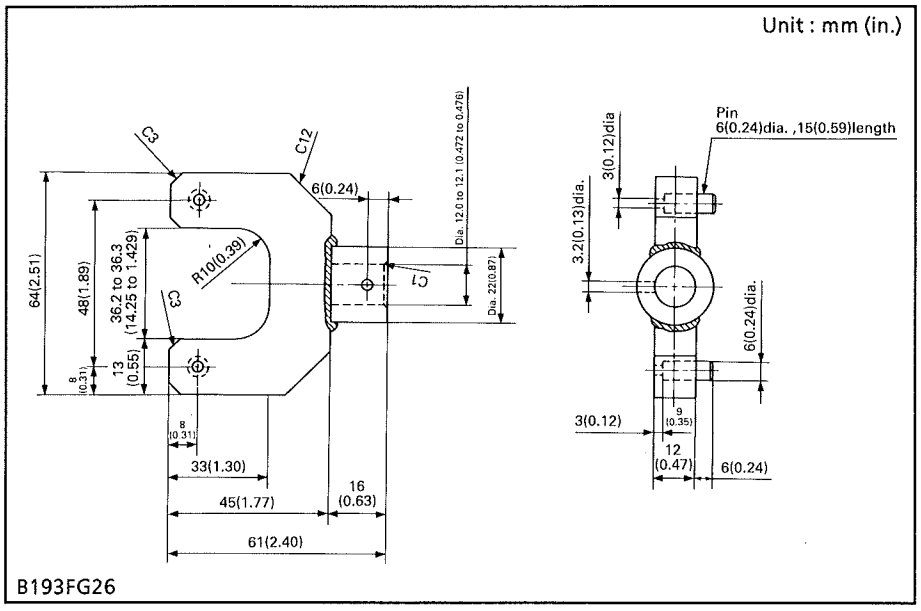
# [3] SPECIAL TOOLS

## (1) Special Tools for Tractor



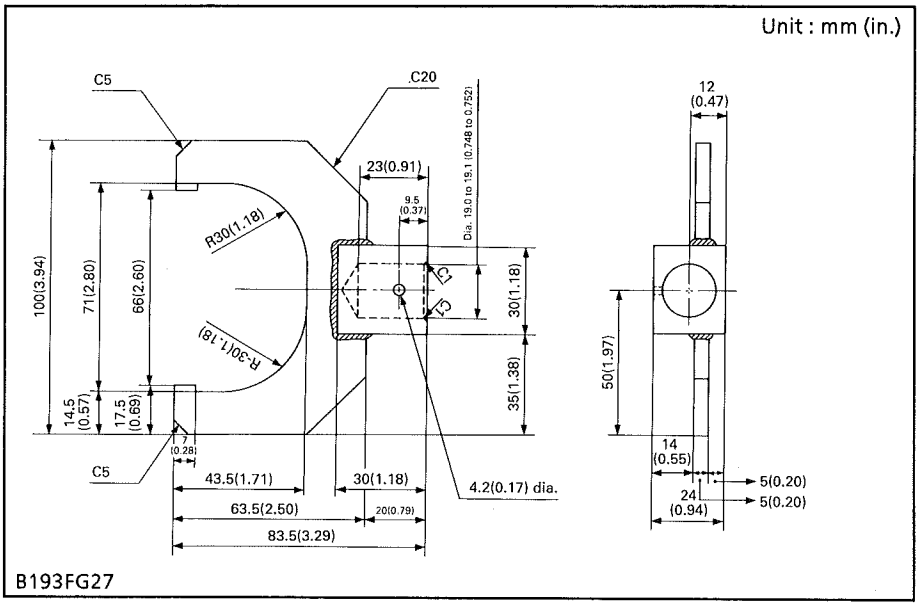

**PS Adaptor**

Application: Use for checking the power steering relief pressure.




**PS Lock Nut Wrench**

Application: Use for tighten the lock nut for plug.

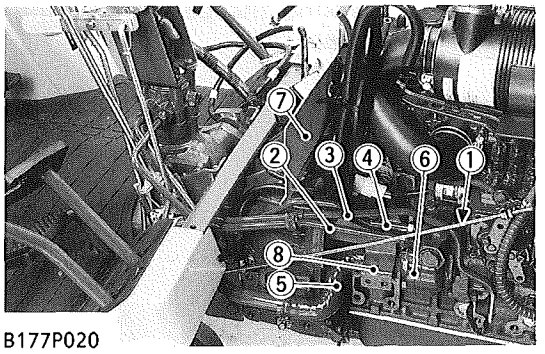



**PS Plug Wrench**

Application: Use for tighten the plug for ball nut assembling.

# 1 ENGINE

## SERVICING



B177P020

### Suction Pipe, Delivery Pipe and Power Steering Pipes and Others

1. Remove the foot accelerator rod (1).
2. Remove the power steering delivery pipe (2).
3. Remove the power steering return pipe (3). (HST Type)
4. Loosen the joint bolt of delivery pipe on the hydraulic cylinder and disconnect the flare nut of 3-point hitch delivery pipe (4).
5. Remove the fuel filter bracket (8).
6. Loosen the cramp of suction hose (5) and remove the suction hose from the hydraulic pump (6).
7. Remove the shutter plate (7).

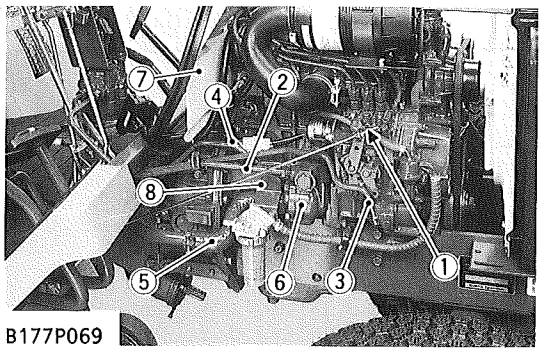
**(When reassembling)**

| | | |
|---|---|---|
| Tightening torque | Power steering delivery pipe | 34.0 to 39.0 N·m<br>3.5 to 4.0 kgf·m<br>25.0 to 28.8 ft-lbs |
| | Flare nut<br>(P.S. return pipe and 3-point hitch delivery pipe) | 29.4 to 39.2 N·m<br>3.0 to 4.0 kgf·m<br>21.7 to 28.9 ft-lbs |
| | Joint bolt | 34.3 to 44.1 N·m<br>3.5 to 4.5 kgf·m<br>25.3 to 32.5 ft-lbs |
| | Fuel filter bracket mounting screw | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.0 to 15.2 ft-lbs |

(1) Foot Accelerator Rod
(2) Power Streering Delivery Pipe
(3) Power Streering Return Pipe
(4) 3-Point Hitch Delivery Pipe
(5) Suction Hose
(6) Hydraulic Pump
(7) Shutter Plate
(8) Fuel Filter Bracket

# 2 CLUTCH

## SERVICING



B177P069

### Suction Pipe, Delivery Pipe and Power Steering Pipes and Others

1. Remove the foot accelerator rod (1).
2. Remove the power steering delivery pipe (2).
3. Remove the power steering return pipe (3). (HST type)
4. Disconnect the flare nut of 3-point hitch delivery pipe (4) from flow priority valve and loosen the joint bolt on the hydraulic cylinder.
5. Remove the fuel filter bracket (8) with fuel filter.
6. Loosen the clamps of suction hose (5) and remove the suction hose from the hydraulic pump (6).
7. Remove the shutter plate (7).

**(When reassembling)**

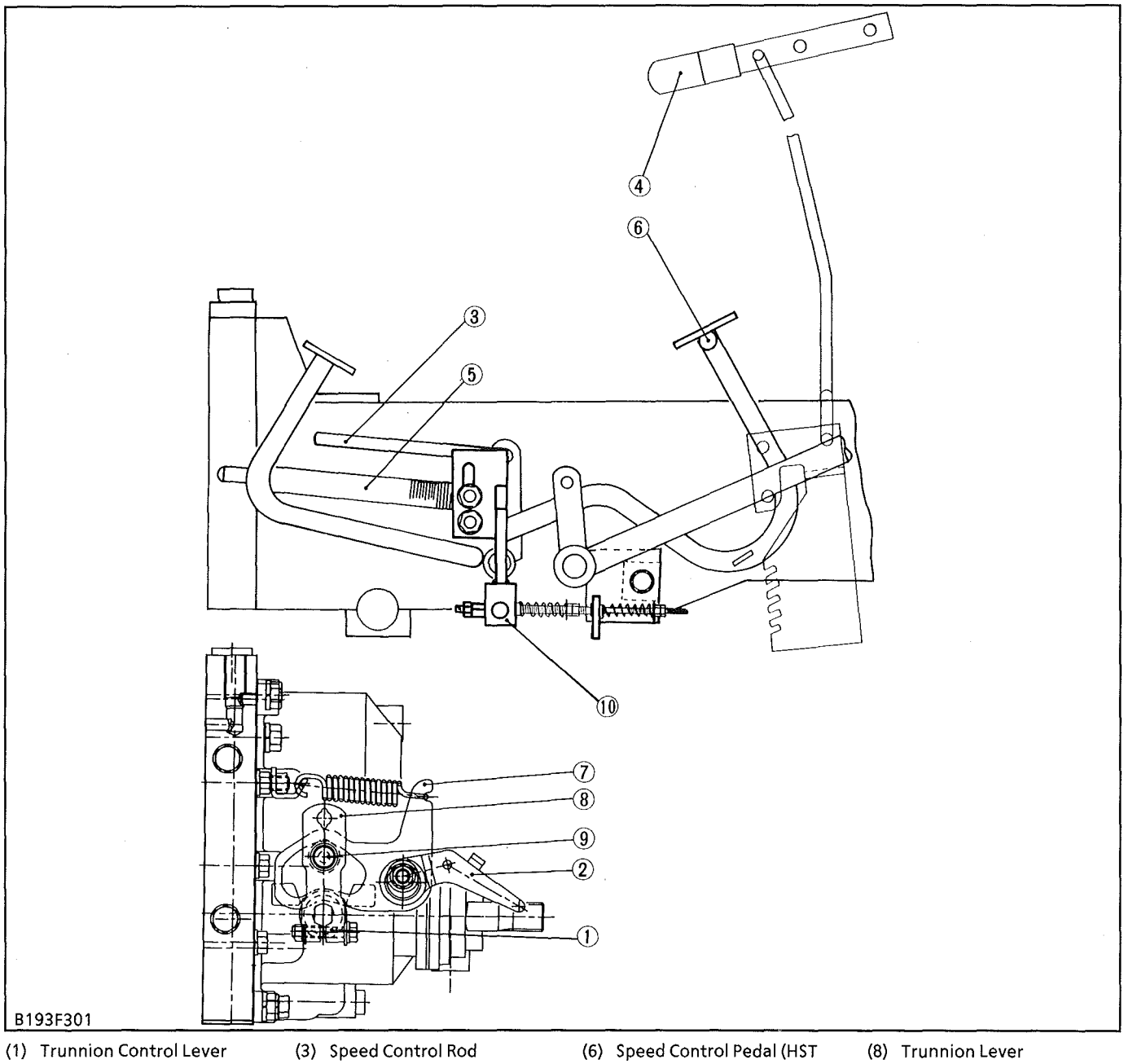
| | | |
|---|---|---|
| Tightening torque | Power steering delivery pipe | 34.0 to 39.0 N·m<br>3.5 to 4.0 kgf·m<br>25.0 to 28.8 ft-lbs |
| | Flare nut<br>(P.S. return pipe and 3-point hitch delivery pipe) | 29.4 to 39.2 N·m<br>3.0 to 4.0 kgf·m<br>21.7 to 28.9 ft-lbs |
| | Joint bolt | 58.8 to 78.5 N·m<br>6.0 to 8.0 kgf·m<br>43.4 to 57.9 ft-lbs |
| | Fuel filter bracket mounting screw | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.0 to 15.2 ft-lbs |

(1) Foot Accelerator Rod
(2) Power Steering Delivery Pipe
(3) Power Steering Return Pipe
(4) 3-Point Hitch Delivery Pipe
(5) Suction Hose
(6) Hydraulic Pump
(7) Shutter Plate
(8) Fuel Filter Bracket

# 3 TRANSMISSION

## MECHANISM

### (1) Control Linkage




(1) Trunnion Control Lever Assembly
(2) Neutral Adjuster
(3) Speed Control Rod
(4) Speed Set Lever
(5) Damper
(6) Speed Control Pedal (HST Pedal)
(7) Trunnion Arm
(8) Trunnion Lever
(9) Roller
(10) HST Pedal Spring Assembly

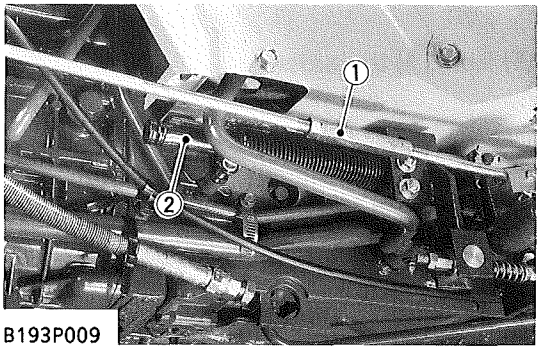
The speed control pedal (6) and the trunnion shaft of variable swashplate are linked with the speed control rod (3) and the trunnion control lever assembly (1). As the front footrest of the pedal is depressed, the swashplate rotates and forward travelling speed increases. Depressing the rear footrest increases reverse speed.

The roller (9) on the trunnion lever (8) holded with spring seats the detent of the trunnion arm (7) so that the trunnion lever returns to neutral. Then, the swashplate is returned to neutral with the trunnion control lever assembly, by means of HST pedal spring assembly (10), when the pedal is released. The damper (5) connected to the speed control pedal restricts the movement of the linkage to prevent abrupt operation or reversing.

The speed set lever (4) linked to the speed control pedal enables the linkage not to return to neutral and to keep a certain forward speed while the speed control pedal is released.

# SERVICING

## CHECKING AND ADJUSTING



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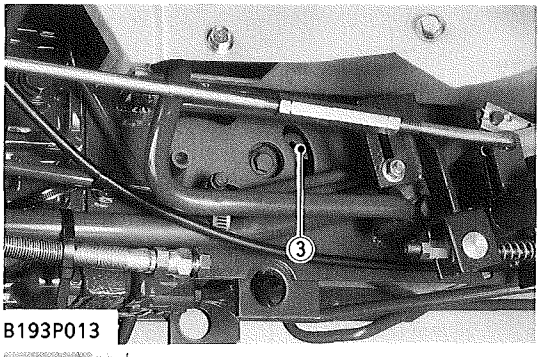
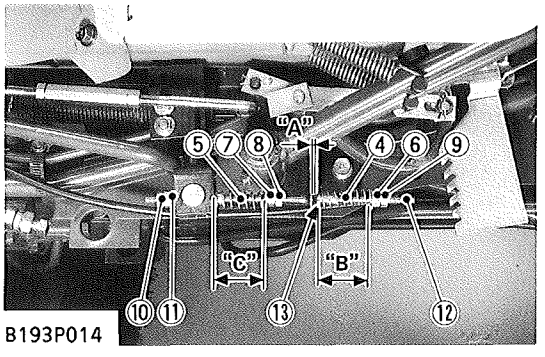


B193P013



B193P014

(1) Brake Rod (RH)
(2) HST Pedal Damper
(3) Neutral Adjuster
(4) Return Spring (for forward adjustment)
(5) Return Spring (for reverse adjustment)
(6) Adjusting Nut
(7) Adjusting Nut
(8) Lock Nut
(9) Lock Nut
(10) Lock Nut
(11) Neurtal Position Adjusting Nut
(12) Rod
(13) Stay

### Neutral

1. Disengage the front wheel drive lever. (Drive only rear wheels.)
2. Lift the rear of the tractor so that the rear wheels are off the ground and run the engine at low idling and drive only rear wheels.
3. Depress the one end of speed control pedal and release, and do the same at the other end.
4. If the rear wheels do not stop turning, adjust as following procedure.

### Adjusting Neutral

1. Disconnect the brake rod RH (1).
2. Loosen the lock nut (8) (9) and adjusting nut (6) (7) until springs (4) (5) are freely.
3. Loosen the lock nut (10) and neutral position adjusting nut (11) until washer welded on the rod (12) comes off from stay (13).
4. Remove the HST pedal damper (2).
5. Loosen the neutral adjuster (3) setting screw.

**(When rear wheels tend to turn forward)**

1. Rotate the neutral adjusting lever clockwise so that the rear wheels turn reverse.
2. Then rotate it counterclockwise until wheels stop completely.

**(When rear wheels tend to turn reverse)**

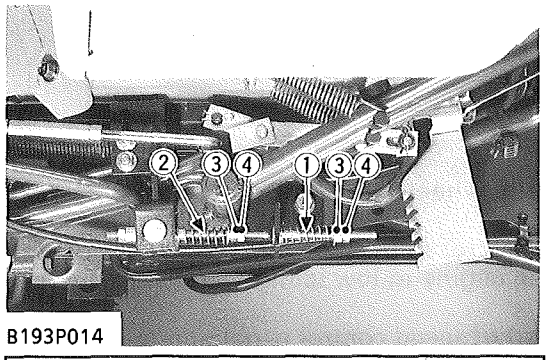
1. Rotate the neutral adjusting lever counterclockwise so that the rear wheels turn forward.
2. Then rotate it clockwise until wheels stop completely.

**(After adjusting neutral)**

1. Make sure the HST control pedal (d) is at the neutral position. (Let the pedal go from the forward to the neutral position, as well as from the rearward to the neutral position. Make sure the pedal returns to just the same neutral position.)
2. Turn the neutral position adjusting nut (11) to move the rod (12) until there is a clearance "A" 0 mm (0 in.) between the welded washer and the stay (13). (Set in position with a slight contact.) Now turn this nut counterclockwise by half a turn. Now lock the nut (10). (Be careful not overtighten the nut (11). Otherwise the HST pedal may get stuck.)
3. Finally lock the double nut (8), (9) so that the spring (4), (5), should be 49 to 51 mm (1.93 to 2.01 in.) forward and 49 to 51 mm (1.93 to 2.01 in.) rearward in length B and C.

| | Length (B) | Length (C) |
|---|---|---|
| Normal compression | 50 mm (2.0 in.) | 50 mm (2.0 in.) |
| Max. compression | 42 mm (1.7 in.) | 42 mm (1.7 in.) |

| | | |
|---|---|---|
| Tightening torque | Neutral adjuster setting screw | 39.2 to 44.1 N·m<br>4.0 to 4.5 kgf·m<br>28.9 to 32.5 ft-lbs |



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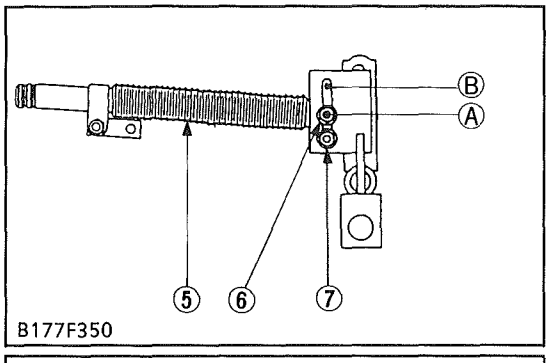

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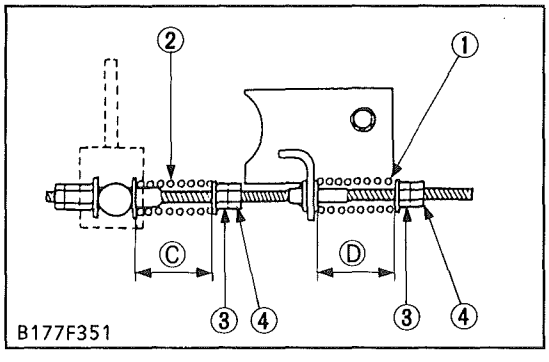


B177F351

(1) Return Spring (for forward adjustment)
(2) Return Spring (for reverse adjustment)
(3) Adjusting Nut
(4) Lock Nut
(5) Damper
(6) Nut for Fixing the damper
(7) Nut
(A) Normal Setting Position
(B) Slower Setting Position
(C) Spring Length
(D) Spring Length

## HST Pedal Performance

1. Set the engine speed to 1500 rpm.
2. Shift the range gear shift lever to **Hi** position.
3. Move the HST pedal from the forward to the neutral position to make sure that the tractor comes to a complete stop. Check the same for the movement from the rearward to the neutral position.
4. If the tractor fails to stop, take the following steps to readjust the HST pedal spring (1), (2).
   To make the HST pedal return back more slowly, readjust the damper in the procedure below.

**(When adjusting speed HST pedal damper)**

- The damper is controls HST pedal returning speed. Move the damper (5) from (A) towards (B) if slower stopping is needed.

1. Loosen the nut (6).
2. Move the damper (5) from (A) towards (B).
3. Tighten the nut (6).

**■ IMPORTANT**

- **Do not loosen the nut (7) when moving damper position.**
- **If the pedal returns to neutral too fast when the operator removes his foot, turf damage and / or premature tire wear may occur.**

**(When adjusting HST pedal returning spring)**

**⚠ WARNING**

**To avoid personal injury :**

- **Do not operate if tractor moves on level ground with foot off Speed Control Pedal.**
- **The return spring can adjust returning force of HST pedal.**

1. If HST pedal is too slow in returning to neutral position when removing the foot form HST pedal.

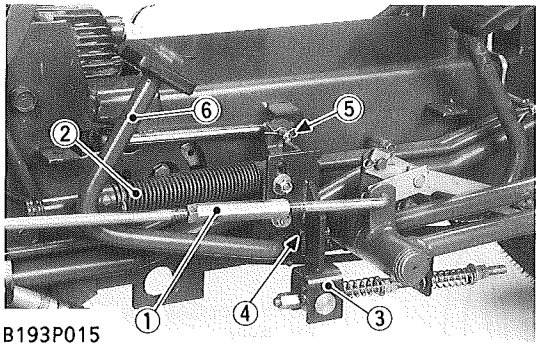
| | Length (C) | Length (D) |
|---|---|---|
| Normal compression | 50 mm (2.0 in.) | 50 mm (2.0 in.) |
| Max. compression | 42 mm (1.7 in.) | 42 mm (1.7 in.) |

**■ IMPORTANT**

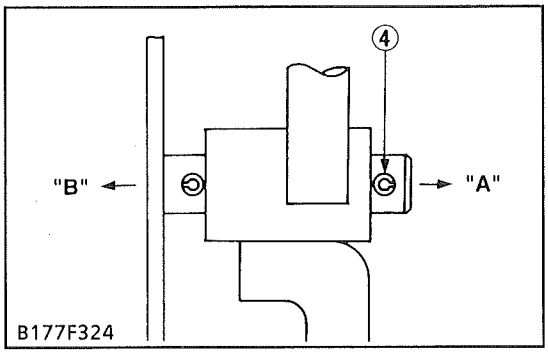
- **Do not compress the Return Spring shorter than Max. compression length.**

# DISASSEMBLING AND ASSEMBLING

## [1] SEPARATING CENTER FRAME AND TRANSMISSION ASSEMBLY



B193P015



B177F324

(1) Brake Rod
(2) Damper
(3) HST Pedal Spring assembly
(4) Spring Pin
(5) Spring Lock Pin
(6) HST Pedal

[A] Outside
[B] Inside

### HST Pedal (HST Type)

1. Disconnect the right hand side brake rod (1).
2. Remove the damper (2).
3. Remove the HST pedal spring assembly (3).
4. Tap out the spring pin (4) and remove the spring lock pin (5), then draw out the HST pedal (6).

**(When reassembling)**

- Tap in the spring pin (4) as shown in the figure.

**■ NOTE**

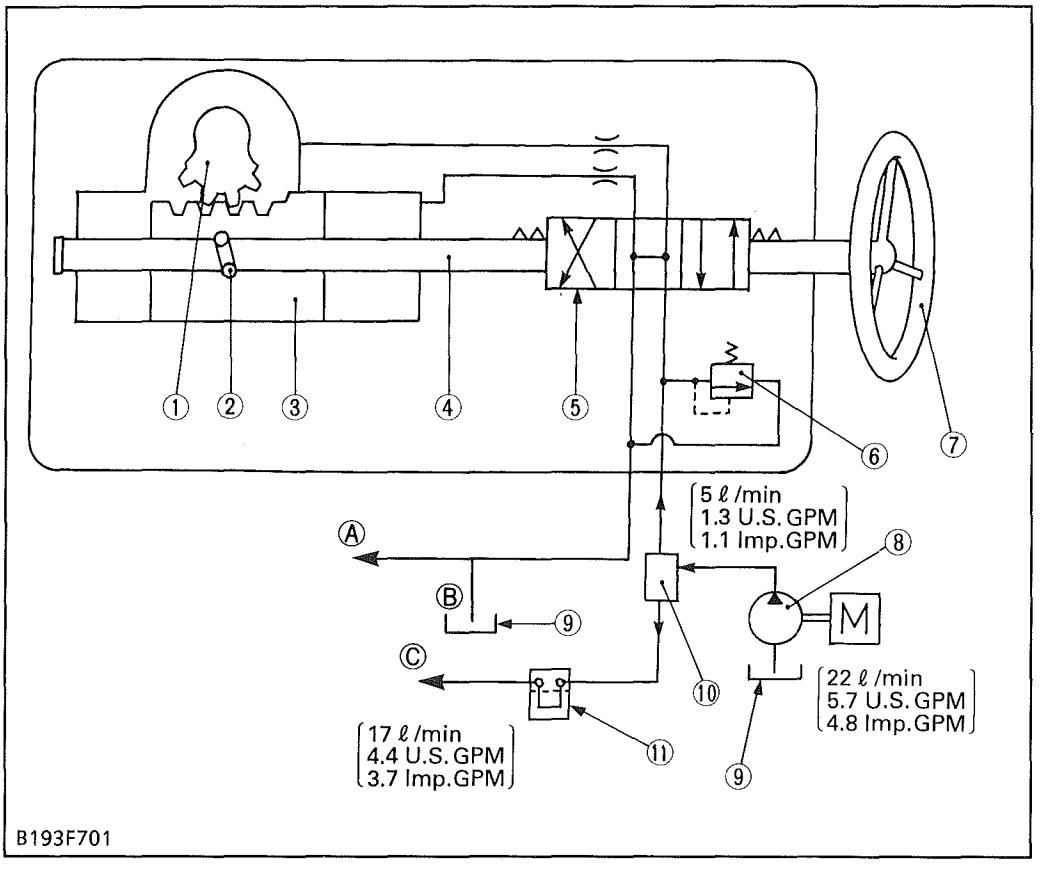
- **After reassembling the HST pedal spring assembly, must adjust the spring force and check the pedal performace (See page 3-S7, S8)**

| | | |
|---|---|---|
| Tightening torque | Stay mounting screw (M12) | 77.4 to 90.2 N·m<br>7.9 to 9.2 kgf·m<br>57.1 to 66.5 ft-lbs |
| | Arm mounting bolt and nut (M8) | 23.5 to 29.8 N·m<br>2.4 to 2.8 kgf·m<br>17.3 to 20.5 ft-lbs |
| | Damper adjusting nut | 23.5 to 29.8 N·m<br>2.4 to 2.8 kgf·m<br>17.3 to 20.5 ft-lbs |

# 7 STEERING

## MECHANISM

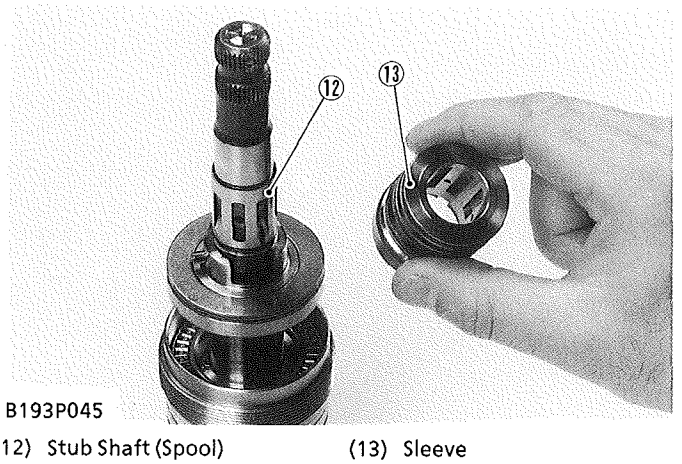
### [1] HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM




B193F701

(A) To Oil Cooler (HST Type Only)
(B) To Transmission Case (Manual Transmission Type Only)
(C) To Control Valve

(1) Sector Gear Shaft
(2) Balls
(3) Ball Nut
(4) Worm Shaft
(5) Control Valve
(6) Relief Valve
(7) Steering Wheel
(8) Pump
(9) Transmission Case
(10) Flow Priority Valve
(11) Hydraulic Block Type Outlet




B193P045

(12) Stub Shaft (Spool) (13) Sleeve

All models are available to be equipped with integral type power steering that of rotary type control valve with torsion bar. (Note that this torsion bar doubles as a centering spring)

Flow priority valve (10) divides the oil into two directions. One is the control flow to power steering (constantly 5 ℓ/min., 1.3 U.S.GPM, 1.1 Imp.GPM at any engine speed). And the other is excessive flow to control valve.

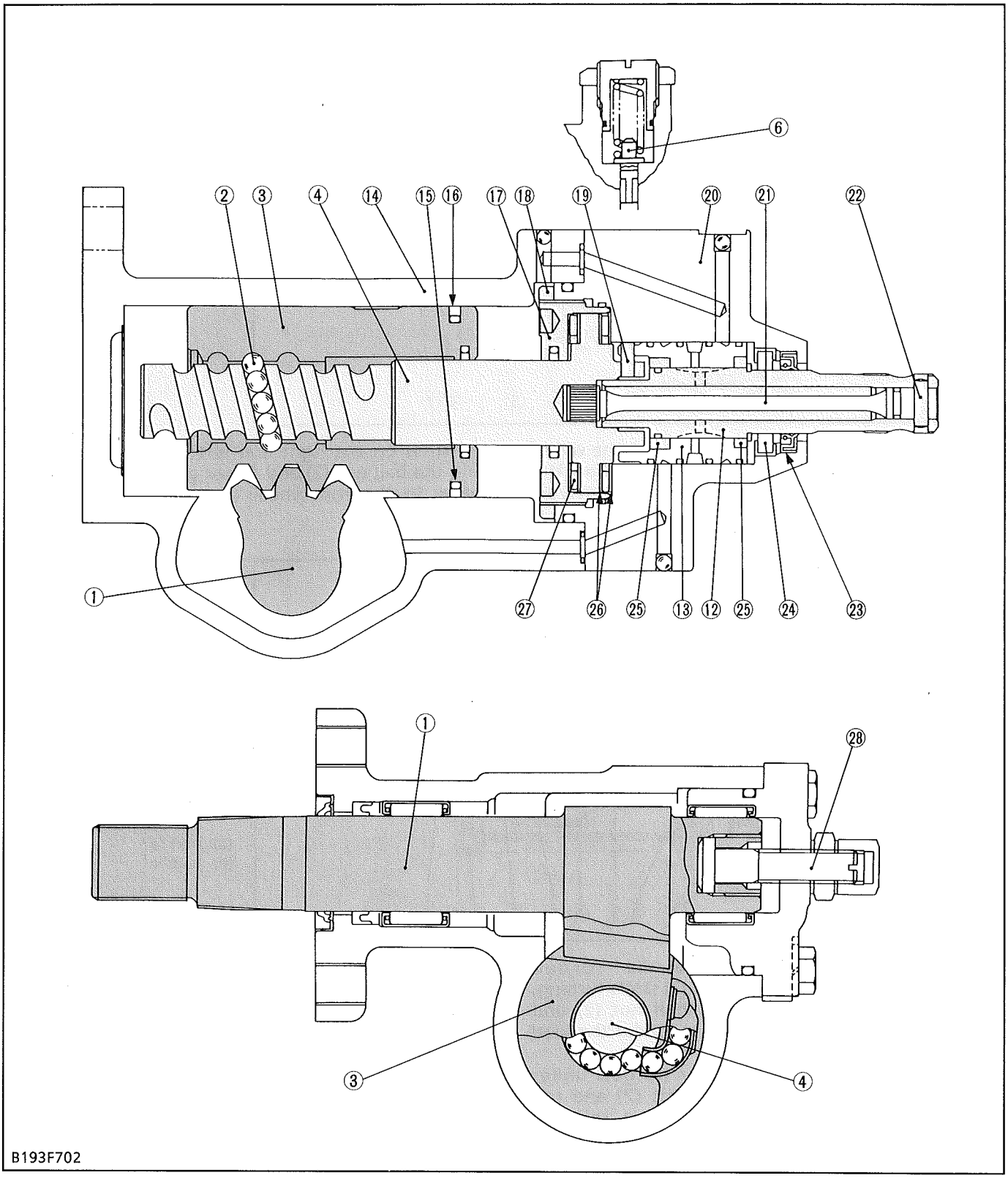
The mechanical gear section show in the next page operates in the same way as ordinary manual steering system.

The input shaft (stub shaft) (12) and the worm shaft (4), which can separate from each other, are jointed together via a torsion bar (21). One end of the torsion bar is fixed by a pin (22) with the stub shaft (12), where as the other end is press fitted to the end of the worm shaft (4).

The control valve (5) consists of a sleeve (13) and a spool (12). The sleeve is coupled by a pin (19) to the worm shaft (4), and the spool is provided on the stub shaft (12).

When a turning torque in either direction is given to the stub shaft (12), the counterforce of the tires is produced from the sector gear shaft (1) through the drag link, pitman arm and other parts. The torsion bar (21) then gets under torsional force. In this way, the positional relation between the sleeve (13) and spool (12) changes, thereby switching the direction of the oil flowing into the right and left cylinders.

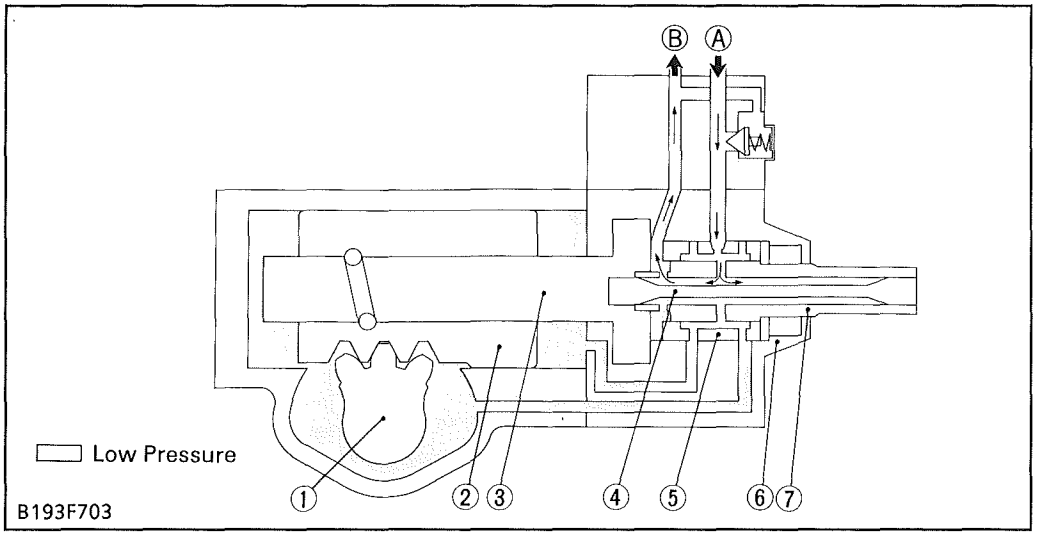
## [2] POWER STEERING BODY




(1) Sector Gear Shaft
(2) Balls
(3) Ball Nut
(4) Worm Shaft
(6) Relief Valve
(12) Stub Shaft
(13) Sleeve
(14) Gear Case
(15) O-Ring
(16) Seal Ring
(17) Plug
(18) Lock Nut
(19) Pin
(20) Valve Housing
(21) Torsion Bar
(22) Pin
(23) Oil Seal
(24) Roller Bearings
(25) Press Fitted Ring
(26) Thrust Races
(27) Thrust Bearings
(28) Adjusting Screw for Play

# [3] OIL FLOW

## ■ Neutral Position

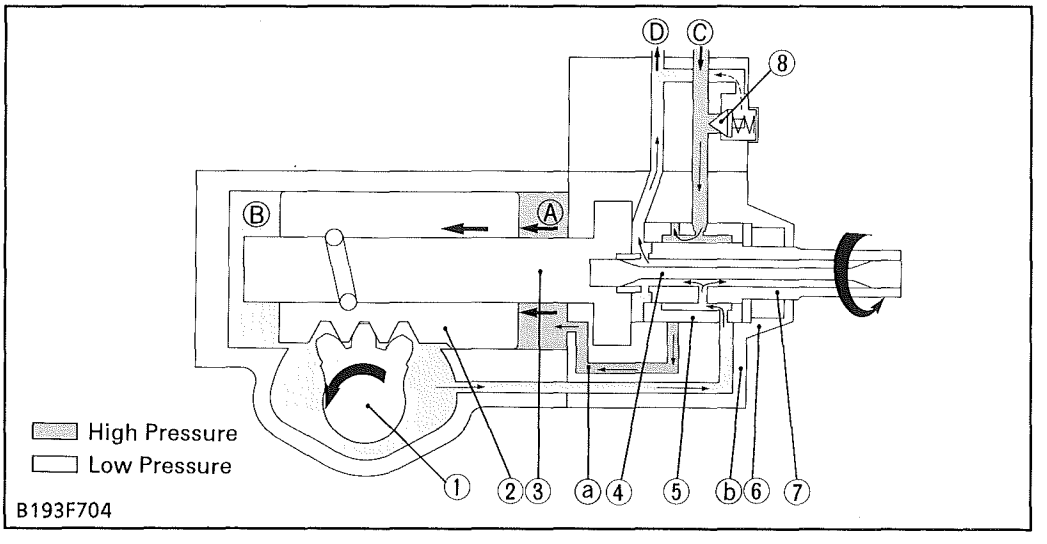



(A) From Pump (Through Flow Priority Valve)
(B) To HST Unit (HST Type) or Transmission Case (Manual Transmission Type)

(1) Sector Gear Shaft
(2) Ball Nut
(3) Worm Shaft
(4) Torsion Bar
(5) Sleeve
(6) Valve Housing
(7) Stub Shaft (Spool)

When the steering wheel is not turned, the valve is placed in the neutral position by the torsion bar (4).
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

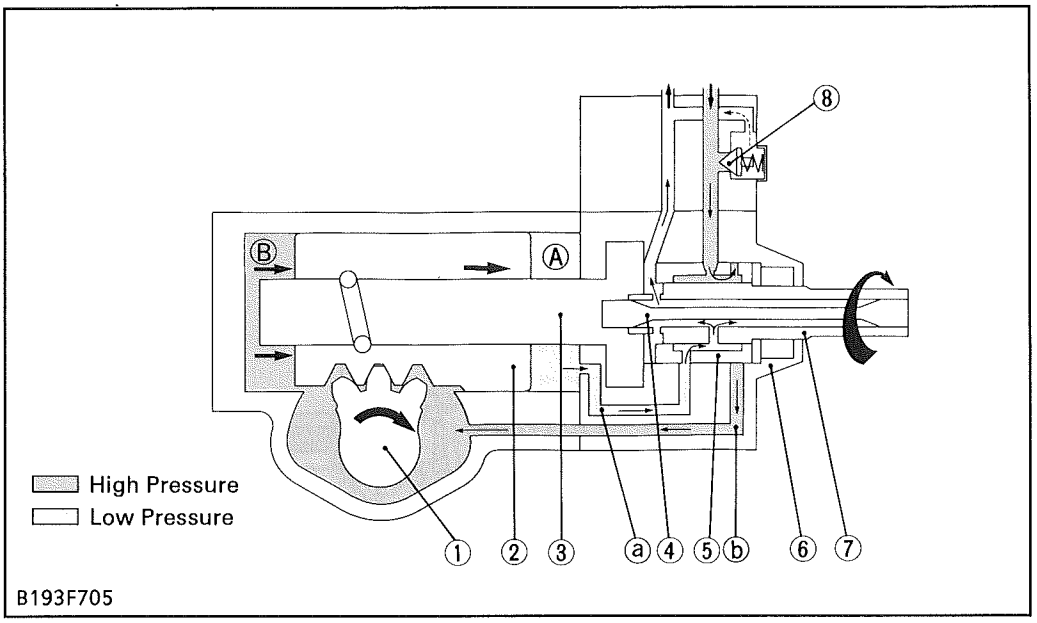



(1) Sector Gear Shaft
(2) Ball Nut
(3) Worm Shaft
(4) Torsion Bar
(5) Sleeve
(6) Valve Housing
(7) Stub Shaft (Spool)
(8) Relief Valve

(A) Chamber "A"
(B) Chamber "B"
(C) From Pump
(D) To HST Unit or Transmission Case
(a) Port "a"
(b) Port "b"

1. When the steering wheel is turned counterclockwise, the stub shaft (7) starts turning, but the sector gear shaft (1), ball nut (2) and worm shaft (3) remain motionless under the load of the tires.
   This means that the torsion bar (4) gets under torsional force and that stub shaft (7) and the worm shaft (3) start turning in a relative displacement, the spool part of the stub shaft (7) turns counterclockwise with respect to the sleeve (5).
2. At this time, the oil passage from pump to port "b" and oil passage from port "a" to 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 (1) is rotated in the direction of the arrow.

## ■ Right Turning




(1) Sector Gear Shaft
(2) Ball Nut
(3) Worm Shaft
(4) Torsion Bar
(5) Sleeve
(6) Valve Housing
(7) Stub Shaft
(8) Relief Valve

(A) Chamber "A"
(B) Chamber "B"
(a) Port "a"
(b) Port "b"

1. When the steering wheel is turned clockwise, the stub shaft (7) starts turning, but the sector gear shaft (1), ball nut (2) and worm shaft (3) remain motionless under the load of the tires. This means that the torsion bar (4) gets under torsional force and that stub shaft (7) and the worm shaft (3) start turning in a relative displacement, the spool part of the stub shaft (7) turns clockwise with respect to the sleeve (5).
2. At this time, the oil passage from pump to port "a" and oil passage from port "b" to 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.

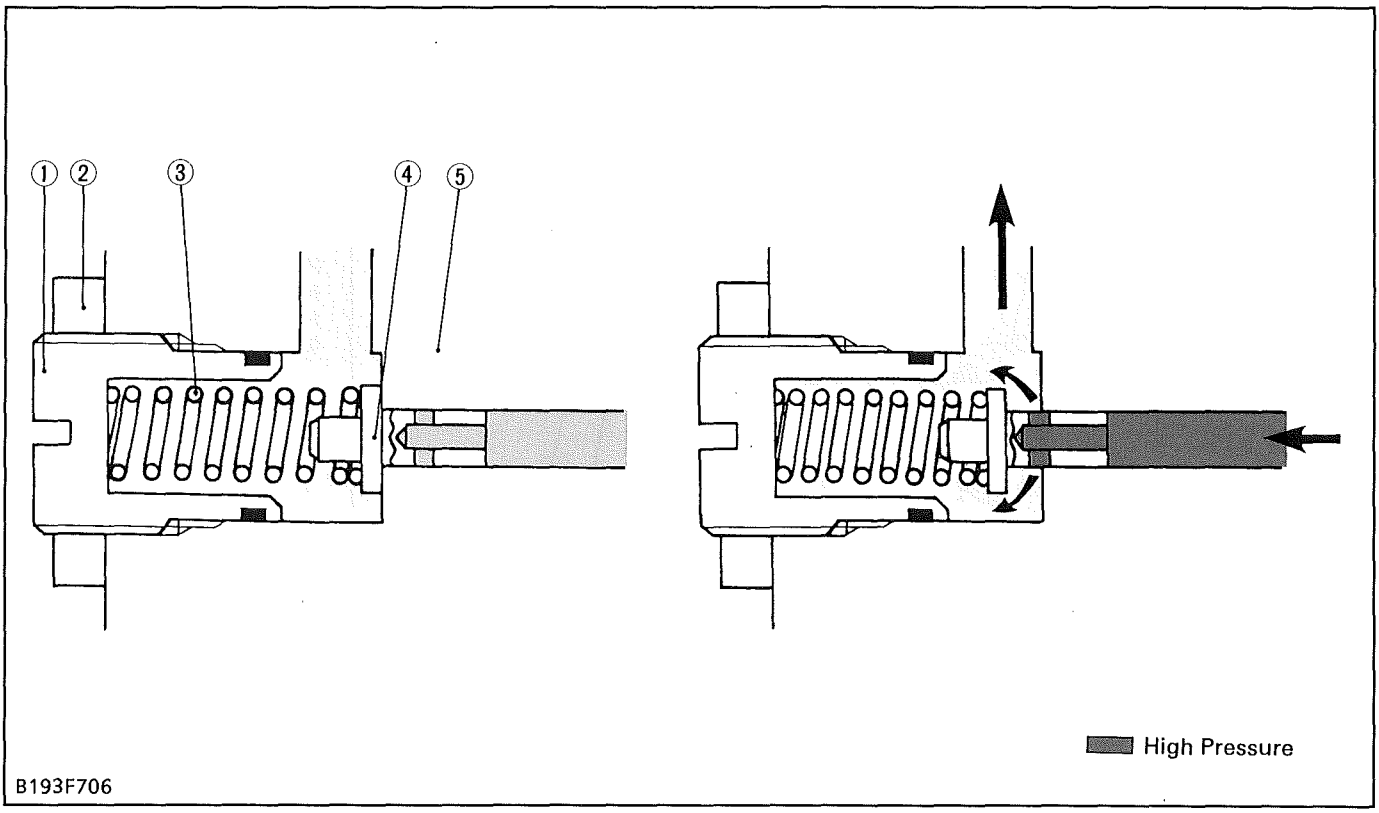
## ■ Manual Operation

**(When Engine Stops or Hydraulic Circuit Troubles)**

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

If the steering wheel is turned when hydraulic circuit ceases to operate, the worm shaft (3) which is connected with stub shaft (7) moves slightly by steering force, then the worm shaft (3) and ball nut (2) have same relationship with the manual steering gear.

## ■ Operation of 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).

# SERVICING
# TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Excessive Steering Wheel Play** | • Backlash between sector gear shaft and ball nut too large | Adjust | E7-S9 |
| | • Steering linkage worn | Replace | — |
| | • Sector gear shaft worn | Replace | E7-S5 |
| **Tractor Pulls to Right or Left** | • Tire pressure uneven | Adjust | G-36 |
| | • Steering wheel play too small | Adjust | E7-S9 |
| | • Improper toe-in adjustment | Adjust | 6-S4 |
| **Front Wheels Vibration** | • Steering linkage worn | Replace | — |
| | • Improper toe-in adjustment | Adjust | 6-S4 |
| **Hard Steering** | • Transmission fluid improper or insufficient | Change | G-8 |
| | • Oil leak from pipe joint | Retighten | — |
| | • Hydraulic pump malfunctioning | Replace | E8-S6 |
| | • Relief valve malfunctioning | Replace | E7-S7 |
| | • Valve housing and sleeve malfunctioning | Replace | E7-S6 |
| | • Seals in the steering gear box damaged | Replace | — |
| | • Backlash between sector gear shaft and ball nut too small | Adjust | E7-S9 |
| | • Air in the hydraulic pipes | Air vent | — |
| | • Low operating pressure | Refer to next item | — |
| | • Flow priority valve malfunctioning | Replace | E8-S4 |
| **Low Operating Pressure** | • Hydraulic pump malfunctioning | Replace | E8-S6 |
| | • Improper relief valve adjustment | Adjust | E7-S4, S9 |
| | • Relief valve malfunctioning | Replace | E7-S9 |
| | • Seals in the steering gear box damaged | Replace | — |
| | • Ball nut malfunctioning | Replace ball nut assembly | — |
| | • Oil leak from pipe or pipe broken | Replace | — |
| **Steering Wheel Does Not Return to Neutral Position** | • Valve housing and sleeve jammed | Repair or Replace | E7-S8, S10 |
| | • Valve housing oil seal damaged | Replace | — |
| **Steering Force Fluctuates** | • Insufficient oil | Replenish | G-8 |
| | • Insufficient bleeding | Bleed | — |
| | • Control valve malfunctioning | Replace | E7-S8 |
| **Noise** | • Insufficient oil | Replenish | G-8 |
| | • Air sucked in pump from suction circuit | Repair | — |
| | • Pipe deformed | Replace | — |

# SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| Steering Wheel | Play | 5.0 to 30.0 mm<br>0.2 to 1.2 in. | – |
| | Operation Force<br>Condition:<br>● Engine Speed Approx. 2600 rpm | Less than 49 N<br>5.0 kgf<br>11 lbs | – |
| Relief Valve | Setting Pressure<br>Condition:<br>● Engine Speed: Approx. 2600 rpm<br>● Oil Temperature: 45 to 55 °C 113 to 131 °F | 12.2 to 12.7 MPa<br>125 to 130 kgf/cm$^2$<br>1778 to 1849 psi | – |
| Steering Gear Box to Ball Nut | Clearance | 0.035 to 0.079 mm<br>0.00138 to 0.00311 in. | 0.15 mm<br>0.0059 in. |
| Gear Box Bore | I.D. | 56.005 to 56.030 mm<br>2.20492 to 2.20591 in. | – |
| Ball Nut | O.D. | 55.951 to 55.970 mm<br>2.20280 to 2.20354 in. | – |
| Bull Nut Assembly | Axial Play | 0 to 0.02 mm<br>0 to 0.00079 in. | 0.04 mm<br>0.00157 in. |
| Valve housing to Sleeve | Clearance | 0.17 to 0.28 mm<br>0.0067 to 0.0110 in. | 0.40 mm<br>0.0157 in. |
| Sleeve | O.D. | 35.77 to 35.83 mm<br>1.4083 to 1.4106 in. | – |
| Valve housing | I.D. | 36.00 to 36.05 mm<br>1.4173 to 1.4193 in. | – |
| Sector Gear Shaft to Ball Nut | Backlash Deflection measured at piston arm end | Less than 0.30 mm<br>0.0118 in. | – |

# TIGHTENING TORQUES

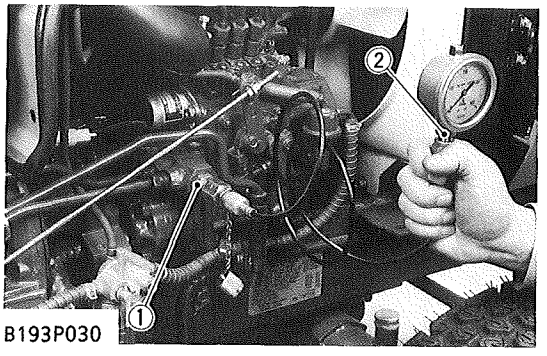
Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts: See page G-8)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Drag link end slotted nut | 17.7 to 34.3 | 1.8 to 3.5 | 13.0 to 25.3 |
| Pitman arm mounting nut | 98.0 to 118.0 | 10.0 to 12.0 | 72.3 to 86.8 |
| Power steering assembly mounting screw | 77.5 to 90.1 | 7.9 to 9.2 | 57.2 to 66.5 |
| Power steering delivery pipe | 34.0 to 39.0 | 3.5 to 4.0 | 25.3 to 28.9 |
| Power steering return pipe | 29.4 to 39.2 | 3.0 to 4.0 | 21.7 to 28.9 |
| Steering wheel mounting nut | 29.4 to 49.0 | 3.0 to 5.0 | 21.7 to 36.2 |
| Valve housing mounting hex head screw | 39.2 to 49.0 | 4.0 to 5.0 | 28.9 to 36.2 |
| Side cover mounting screw | 19.6 to 29.4 | 2.0 to 3.0 | 14.5 to 21.7 |
| Sector gear shaft adjust screw lock nut | 19.6 to 29.4 | 2.0 to 3.0 | 14.5 to 21.7 |
| Sector gear shaft adjust screw cap nut | 19.6 to 29.4 | 2.0 to 3.0 | 14.5 to 21.7 |
| Relief pressure adjusting screw lock nut | 49.1 to 78.5 | 5.0 to 8.0 | 36.2 to 57.8 |
| Plug | 8.8 to 10.8 | 0.9 to 1.1 | 6.5 to 8.0 |
| Plug lock nut | 88.3 to 107.9 | 9.0 to 11.0 | 65.1 to 79.6 |

# CHECKING, DISASSEMBLING AND SERVICING

## CHECKING

**■ IMPORTANT**
- **Use only the transmission fluid (See page G-8), in no case use mixture of oils of different brands.**
- **Do not disassemble the hydraulic pump and power steering needlessly.**
- **After installing or reassembling the power steering hydraulic components, be sure to bleed air.**




B193P030

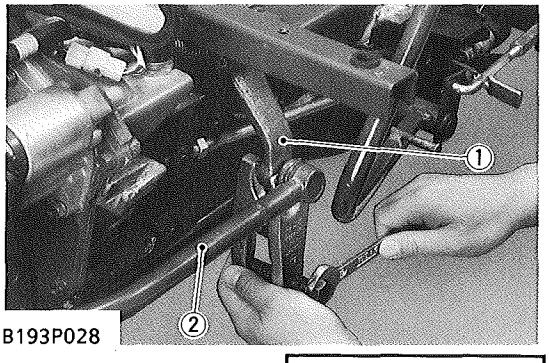
(1) PS Adaptor (2) Pressure Gauge

**Relief Valve Setting Pressure**

1. Open the bonnet and remove the right hand side cover.
2. Remove the outside plug of flow priority valve and then install the PS adaptor (Refer to EG-2) (1) to flow priority valve and connect the cable and pressure gauge (2) to PS adaptor.
3. Start the engine. After warming up, set the engine speed at approx. 2600 rpm.
4. Fully turn the steering wheel to the left or right end to read the relief pressure. After reading, stop the engine.
5. If the pressure is not factory specification, check the pump delivery line and adjust the relief valve setting pressure (Refer to E7-S7).

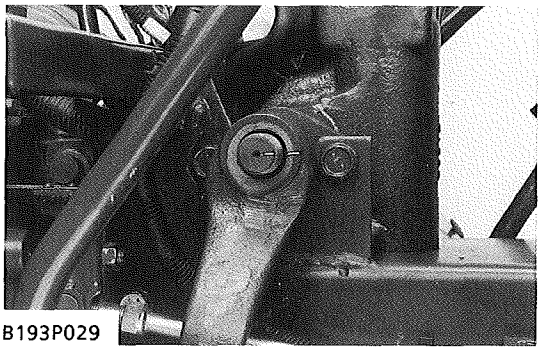
| | | |
|---|---|---|
| Power steering relief valve setting pressure | Factory spec. | 12.2 to 12.7 MPa<br>125 to 130 kgf/cm$^2$<br>1778 to 1849 psi |

## [1] SEPARATING POWER STEERING BODY




B193P028

030F129



B193P029

**Drag Link and Pitman Arm**

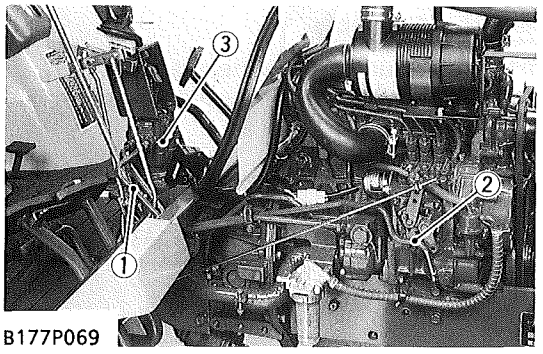
1. Remove the slotted nut and disconnect the drag link (2) from the pitman arm (1).
2. Remove the pitman arm mounting nut and remove the pitman arm with pitman arm puller (Code No. 07909-39011).

**(When reassembling)**

**■ IMPORTANT**
- **After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.**
- **Install the pitman arm to the sector gear shaft so that their marks align.**

| | | |
|---|---|---|
| Tightening torque | Slotted nut | 17.7 to 34.3 N·m<br>1.8 to 3.5 kgf·m<br>13.0 to 25.3 ft-lbs |
| | Pitman arm mounting nut | 98.0 to 118.0 N·m<br>10.0 to 12.0 kgf·m<br>72.3 to 86.8 ft-lbs |

(1) Pitman Arm (2) Drag Link



B177P069

(1) Power Steering Delivery Pipe
(2) Power Steering Return Pipe
(3) Power Steering Assembly

### Power Steering Assembly

1. Remove the power steering delivery pipe (1) and return pipe (2).
2. Disconnect the speed set rod (HST type) and parking brake rod.
3. Remove the power steering assembly (3) from the center frame.

**(When reassembling)**

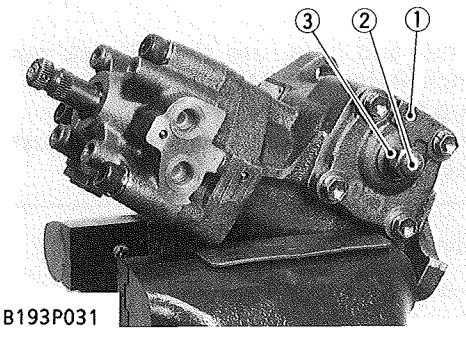
| | | |
|---|---|---|
| Tightening torque | Power steering delivery pipe | 34.0 to 39.0 N·m<br>3.5 to 4.0 kgf·m<br>25.3 to 28.9 ft-lbs |
| | Power steering return pipe | 29.4 to 39.2 N·m<br>3.0 to 4.0 kgf·m<br>21.7 to 28.9 ft-lbs |
| | Power steering assembly mounting screw | 77.5 to 90.1 N·m<br>7.9 to 9.2 kgf·m<br>57.2 to 66.5 ft-lbs |

## [2] POWER STEERING BODY

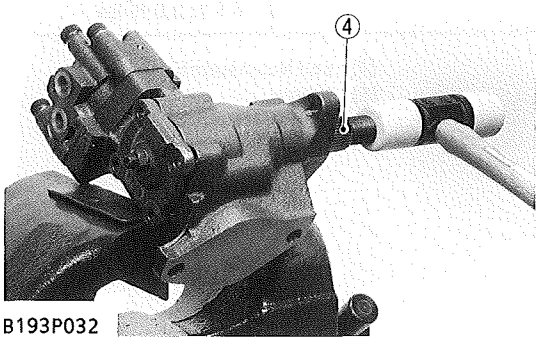
## DISASSEMBLING AND ASSEMBLING

**■ NOTE**

- **Carefully clean up the disassembled parts and sub-assemblies with fresh oil. Blow them dry with compressed air.**
- **Replace all the disassembled sealing parts (O-ring, U-seal, oil seal, slipper seal, etc.) with new ones.**
- **Check all the cleaned-up parts for scratches, excessive wear, cracks and other defects. Place them in order on a clean workbench. Be also careful to keep off dust and dirt.**



B193P031



B193P032

(1) Side Cover
(2) Cap Nut
(3) Lock Nut
(4) Sector Gear Shaft

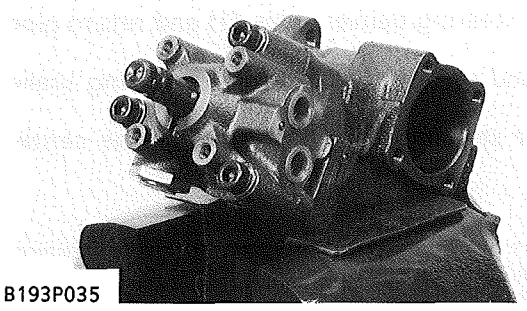
### Side Cover and Sector Gear Shaft

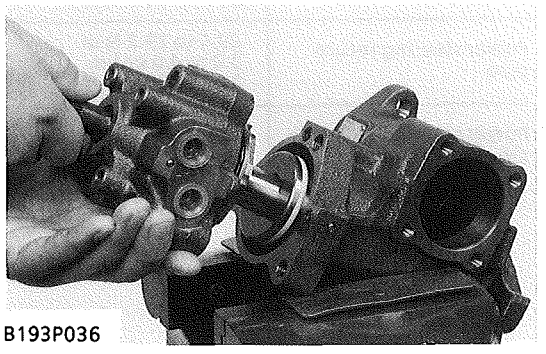
1. Remove the cap nut (2) and loosen the lock nut (3).
2. Remove the side cover mounting screws.
3. Tap out the sector gear shaft (4) and side cover (1) as a unit toward the side cover.

**(When reassembling)**

- Turn the worm shaft so that the ball nut is centered in its travel. Then, install the sector gear shaft so that the center of its teeth engages the center teeth of the ball nut.

| | | |
|---|---|---|
| Tightening torque | Cap nut | 19.6 to 29.4 N·m<br>2.0 to 3.0 kgf·m<br>14.5 to 21.7 ft-lbs |
| | Lock nut | 19.6 to 29.4 N·m<br>2.0 to 3.0 kgf·m<br>14.5 to 21.7 ft-lbs |
| | Side cover mounting screw | 19.6 to 29.4 N·m<br>2.0 to 3.0 kgf·m<br>14.5 to 21.7 ft-lbs |


B193P035

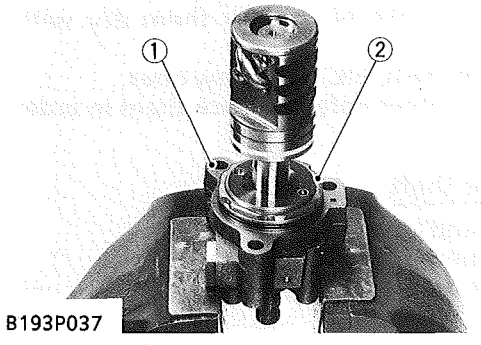

B193P036

## Valve Assembly and Ball Nut Assembly

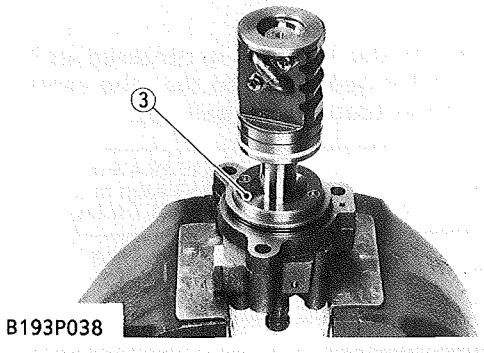
1. Remove the valve housing mounting hex. head screws.
2. Draw out the valve assembly and ball nut assembly as a unit.

**(When reassembling)**

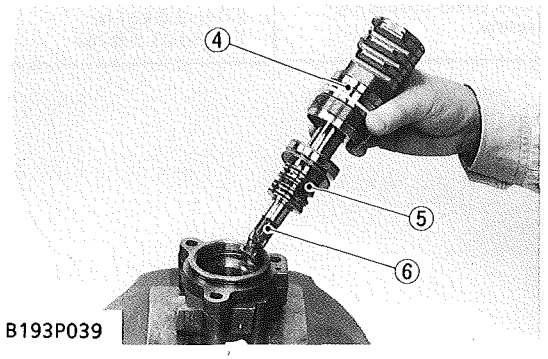
| | | |
|---|---|---|
| Tightening torque | Valve housing mounting hex. head screw | 39.2 to 49.0 N·m<br>4.0 to 5.0 kgf·m<br>28.9 to 36.2 ft-lbs |



B193P037



B193P038



B193P039

## Ball Nut Assembly

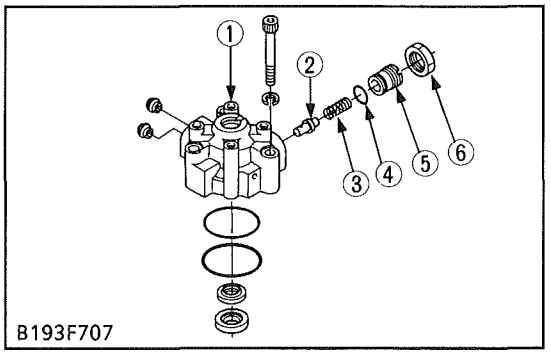
1. Remove the lock nut (2).
2. Remove the plug (3).
3. Pull out the ball nut assembly (4) with sleeve (5) and stub shaft (6) from valve housing (1).

**(When reassembling)**

- When tighten the lock nut and plug, use the PS lock nut wrench and PS plug wrench (Refer to G-34).
- Be sure to tighten the plug to specified torque.
  If the plug is tightened to excessive torque, it may cause damage to the thrust races and thrust bearings.

| | | |
|---|---|---|
| Tightening torque | Lock nut | 88.3 to 107.9 N·m<br>9.0 to 11.0 kgf·m<br>65.1 to 79.6 ft-lbs |
| | Plug | 8.8 to 10.8 N·m<br>0.9 to 1.1 kgf·m<br>6.5 to 8.0 ft-lbs |

(1) Valve Housing
(2) Lock Nut
(3) Plug
(4) Ball Nut Assembly
(5) Sleeve
(6) Stub Shaft



B193F707

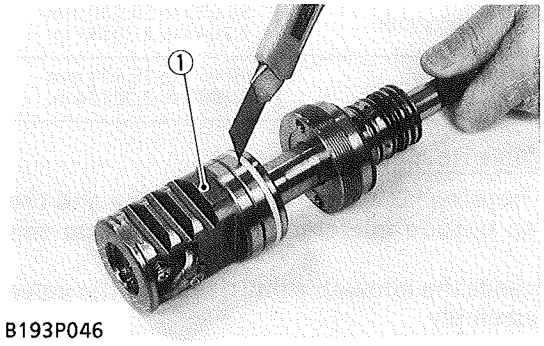
(1) Valve Housing
(2) Relief Valve Poppet
(3) Relief Spring
(4) O-ring
(5) Adjusting Screw
(6) Lock Nut

## Disassembling Valve Housing

**■ IMPORTANT**

- **Do not disassemble the relief valve needlessly, since it has been factory-adjusted.**
- **If the relief valve is disassembled, replace the adjusting screw with new one, and after reassembly, be sure to adjust the setting pressure, then stake the adjusting screw with a punch.**

| | | |
|---|---|---|
| Tightening torque | Relief pressure adjusting screw lock nut | 49.1 to 78.5 N·m<br>5.0 to 8.0 kgf·m<br>36.2 to 57.8 ft-lbs |



B193P046

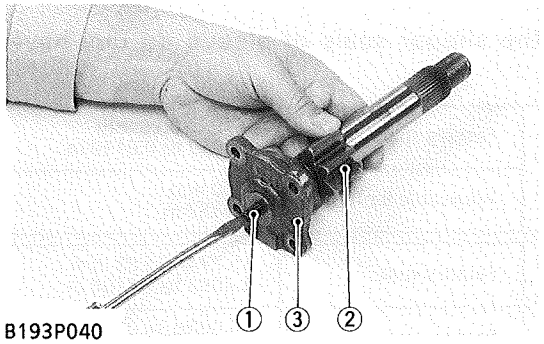
## Seal Ring on Ball Nut

1. Cut the seal ring with a knife and remove it.
2. Remove the O-ring inside the seal ring.

**(When reassembling)**

- Apply grease to the ring groove.
- Replace the seal rings with new ones.
- Stretch the seal ring by hand, install it on the ball nut, and press it so that it is restored to its original form.

(1) Ball Nut

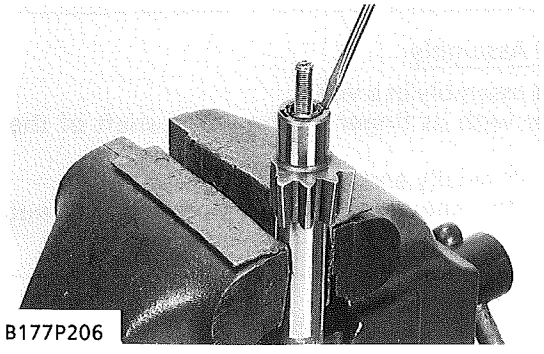


B193P040

## Sector Gear Shaft

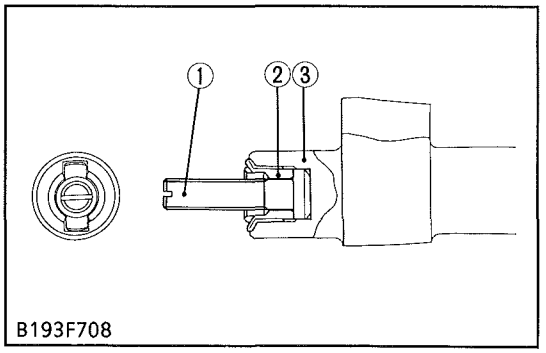
1. Turn the adjusting screw (1) to counterclockwise then separate the side cover (3) and sector gear shaft (2).

(1) Adjusting Screw
(2) Sector Gear Shaft
(3) Side Cover


B177P206

## Adjuster of Sector Gear Shaft

1. Remove the stake and adjuster (2).



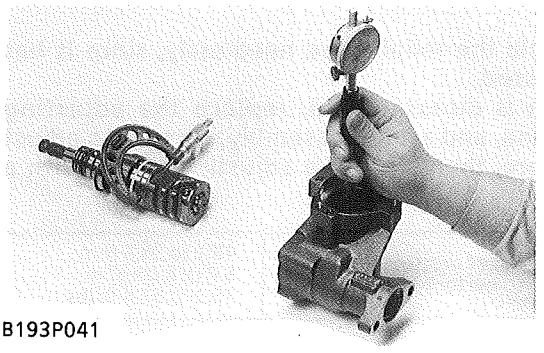
B193F708

(1) Adjusting Screw
(2) Adjuster
(3) Sector Gear Shaft

**(When reassembling)**

- Replace the adjuster with new one.

# SERVICING

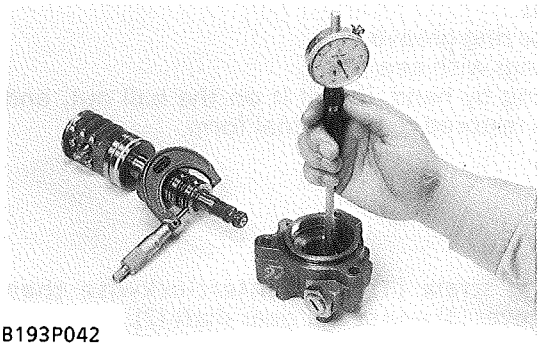


B193P041

### Clearance Between Steering Gear Box and Ball Nut

1. Measure the steering gear box cylinder I.D. with a cylinder gauge.
2. Measure the ball nut O.D. with an outside micrometer, and calculate this clearance.
3. If the clearance exceeds the allowable limit, replace the steering gear box or ball nut assembly.

| | | |
|---|---|---|
| Clearance between steering gear box and ball nut | Factory spec. | 0.035 to 0.079 mm<br>0.001 to 0.00311 in. |
| | Allowable limit | 0.15 mm<br>0.0059 in. |
| Gear box bore I.D. | Factory spec. | 56.005 to 56.030 mm<br>2.2049 to 2.20591 in. |
| Ball nut O.D. | Factory spec. | 55.951 to 55.970 mm<br>2.2080 to 2.20354 in. |



B193P042

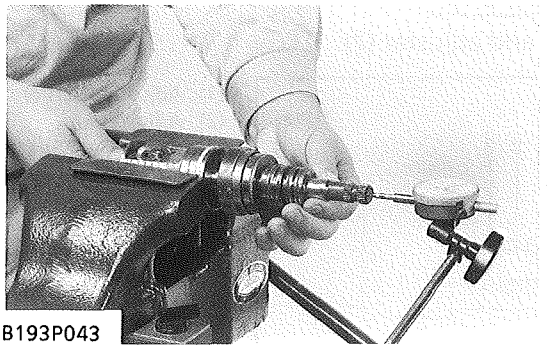
### Clearance Between Valve Housing and Sleeve

1. Measure the valve housing I.D. with a cylinder gauge and the sleeve O.D. with an outside micrometer, and calculate this clearance.
2. If the clearance exceeds the allowable limit, replace the valve housing or sleeve assembly.

**■ IMPORTANT**

- **Check to see if the slipper seals of sleeve do dot have excessive wear.**

| | | |
|---|---|---|
| Clearance between valve housing and sleeve | Factory spec. | 0.17 to 0.28 mm<br>0.0067 to 0.0110 in. |
| | Allowable limit | 0.40 mm<br>0.0157 in. |
| Sleeve O.D. | Factory spec. | 35.77 to 35.83 mm<br>1.4083 to 1.4106 in. |
| Valve housing I.D. | Factory spec. | 36.00 to 36.05 mm<br>1.4173 to 1.4193 in. |

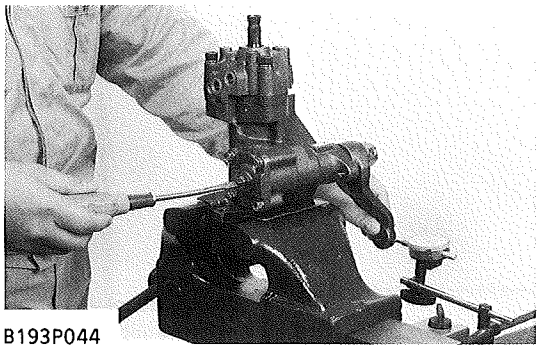


B193P043

### Axial Play of Ball Nut Assembly

1. Secure the ball nut assembly in a vise.
2. Set a dial indicator with its finger on the worm shaft of the ball nut assembly.
3. Move the worm shaft axially and measure the play.
4. If the play exceeds the allowable limit, replace the ball nut assembly.

| | | |
|---|---|---|
| Axial play of ball nut assembly | Factory spec. | 0 to 0.02mm<br>0 to 0.00079 in. |
| | Allowable limit | 0.04 mm<br>0.00157 in. |



B193P044

## Backlash between Sector Gear Shaft and Ball Nut

1. Attach the pitman arm having no play.
2. Set a dial indicator with its finger on the pitman arm.
3. Move the pitman arm lightly, and measure the deflection.
4. If the measurement is not within the factory specification, adjust the backlash with the adjusting screw.

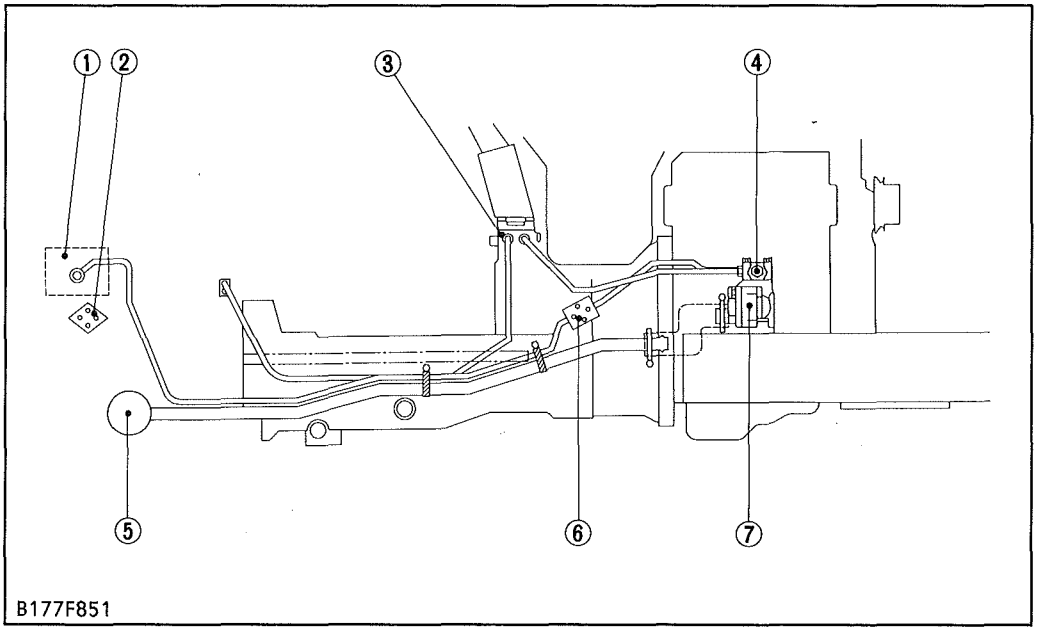
| | | |
|---|---|---|
| Backlash between sector gear shaft and ball nut | Factory spec. | Less than 0.30 mm<br>0.018 in. |

# 8 HYDRAULIC SYSTEM

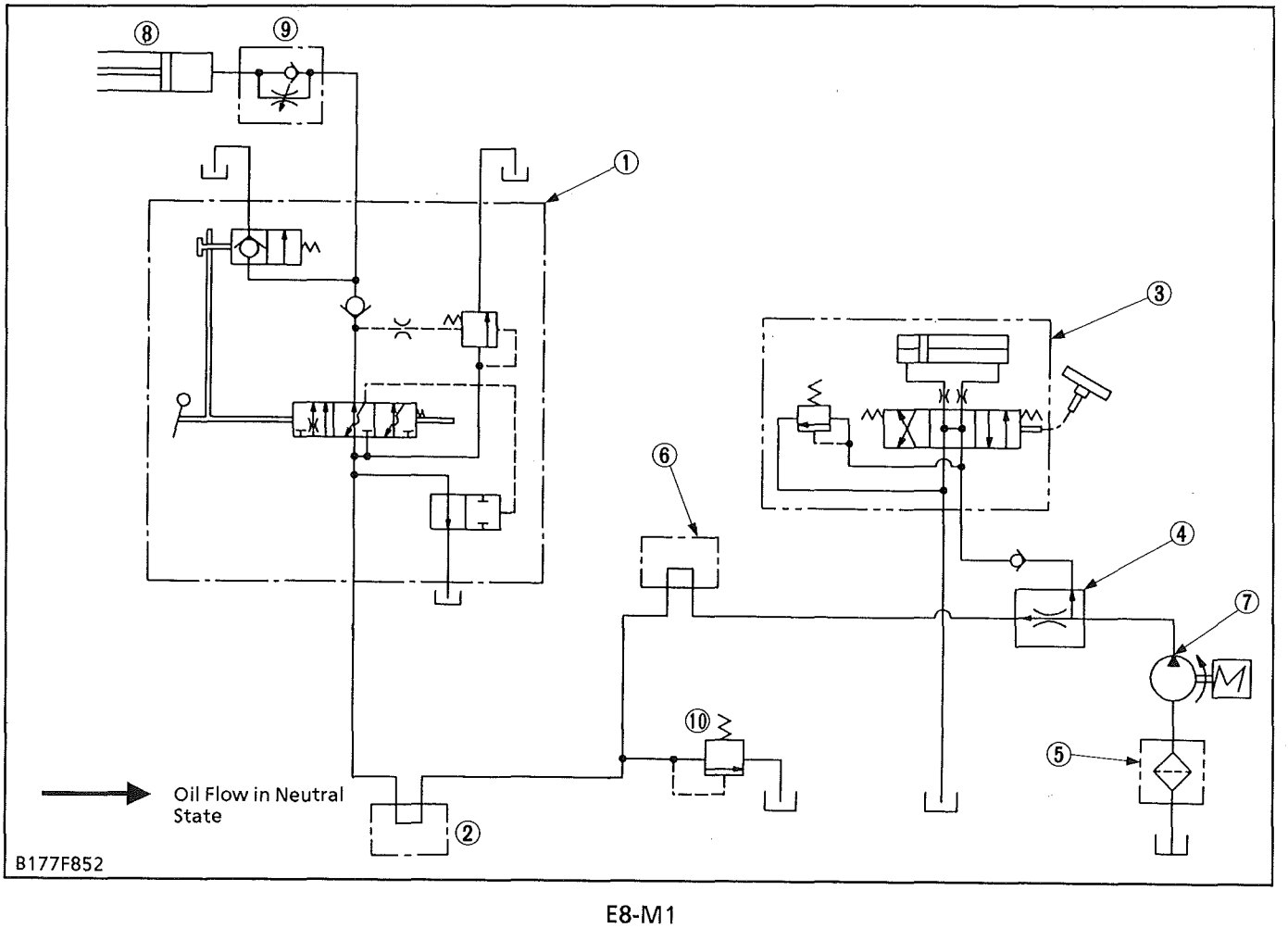
## MECHANISM

### [1] HYDRAULIC CIRCUIT

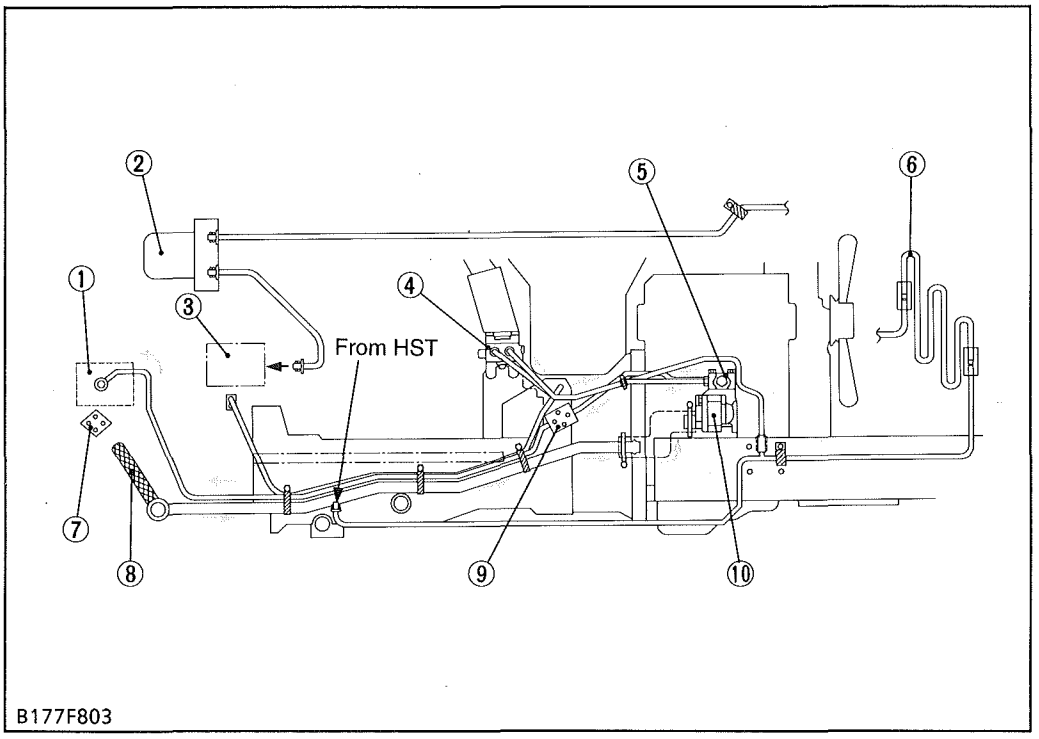
#### ■ MANUAL TRANSMISSION




(1) Position Control Valve
(2) Rear Hydraulic Outlet
(3) Power Steering
(4) Flow Priority Valve
(5) Oil Filter
(6) Hydraulic Block Type Outlet
(7) Hydraulic Pump
(8) Hydraulic Cylinder
(9) Lowering Speed Adjusting Valve
(10) Relief Valve

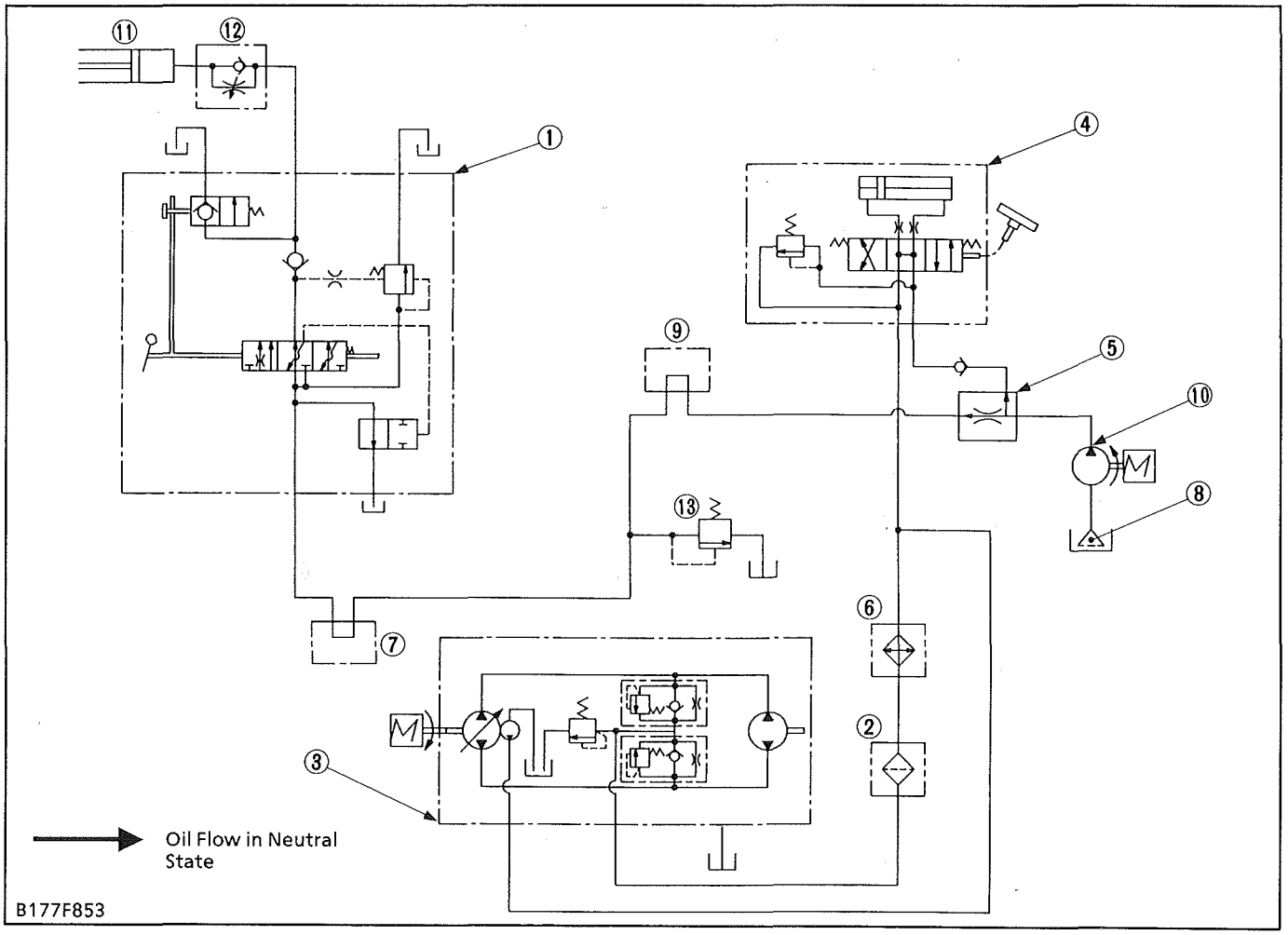


## HYDROSTATIC TRANSMISSION




B177F803

(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




B177F853

■ **Hydraulic System**

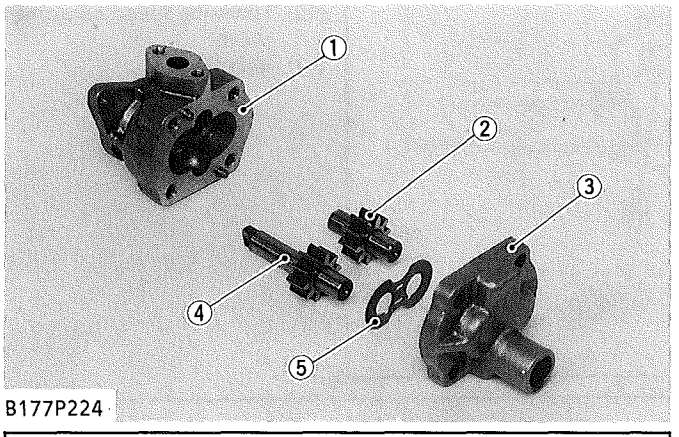
The hydraulic system of these tractors are composed of a hydraulic pump, hydraulic block type outlet, control valve, hydraulic cylinder, hydraulic oil filter and other components.

This system has the following functions.

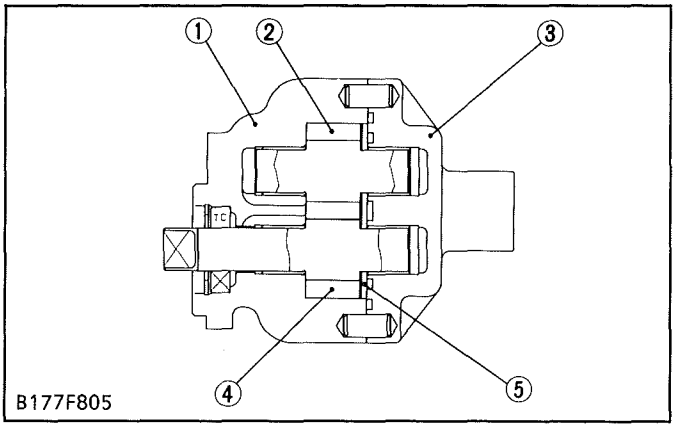
1. Position control of the rear implement connected to the 3-point hitch.
2. Hydraulic power take off from the hydraulic block type outlet to operate the implements such as a front loader, front blade and etc.

- Oil is supplied by a hydraulic pump connected to the engine. When an engine is started, a hydraulic pump starts running, sucks oil from a transmission case. The hydraulic pump forces out the oil to power steering, hydraulic block type outlet, control valve, hydraulic cylinder and hydrostatic transmission (only for HST).

## [2] HYDRAULIC PUMP



B177P224



B177F805

The hydraulic pump is composed of the casing (1), cover (3), side plate (5), and two spur gears (drive gear (4) and driven gear (2)) that are in mesh.

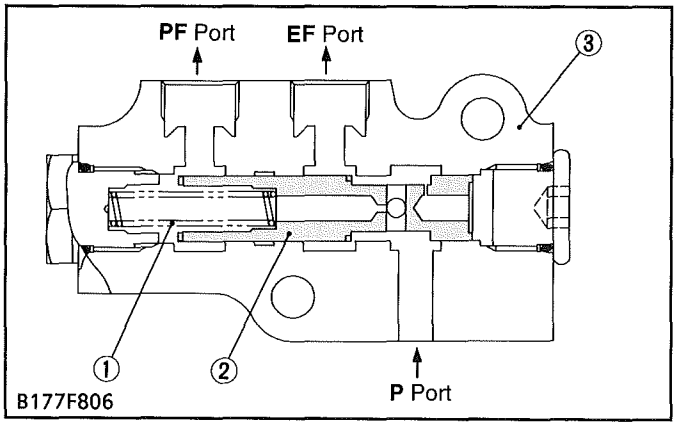
Hydraulic pump is driven by the fuel camshaft.

Maximum displacement is as follows.

| Displacement | Engine speed | Condition |
|---|---|---|
| 22.0 ℓ/min.<br>5.8 U.S. GPM<br>4.8 Imp. GPM | At 2600 rpm | 13.2 to 13.7 MPa<br>135 to 140 kg/cm$^2$<br>1920 to 1991 psi |

(1) Casing
(2) Driven Gear
(3) Cover
(4) Drive Gear
(5) Side Plate

## [3] FLOW PRIORITY VALVE



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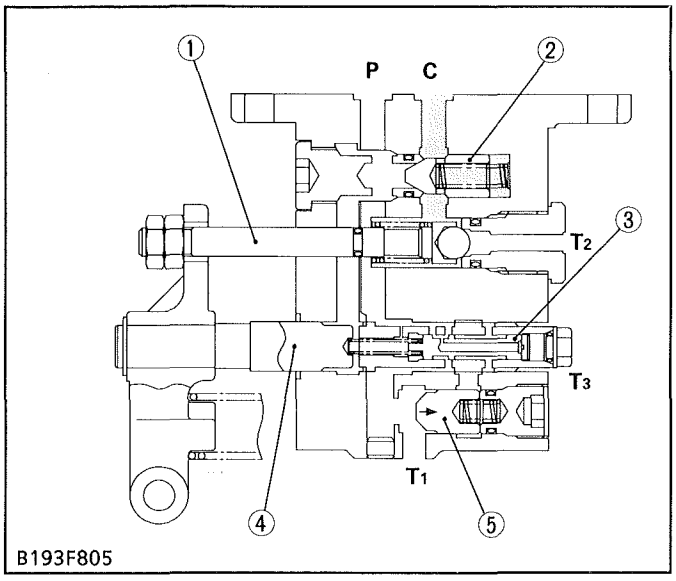
The flow priority valve is a flow devider that devides the flow from single hydraulic source (hydraulic pump) to actuates two circuits (position control circuit and power steering circuit) simultaneously.

This valve feeds fixedly controlled flow (5 ℓ/ min, 1.3 U.S. GPM, 1.1 Imp. GPM) to the **PF** port with priority and excessive flow to the **EF** port.

(1) Spring
(2) Spool
(3) Valve Body

# [4] POSITION CONTROL VALVE

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



B193F805

## ■ Neutral

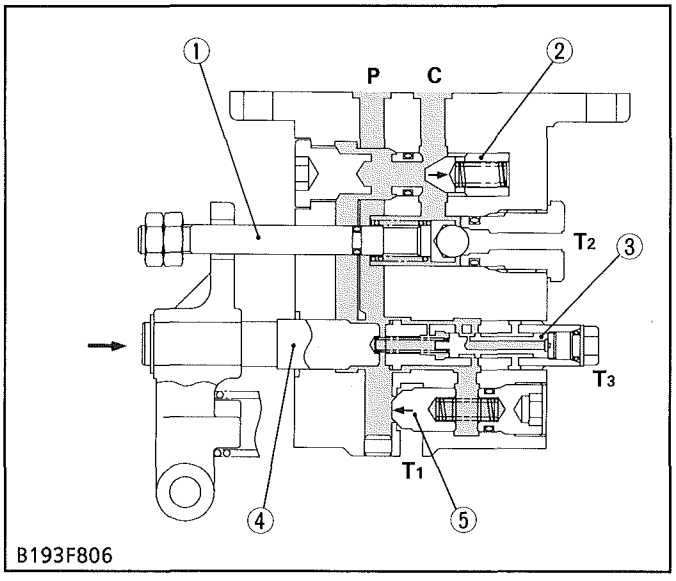
Oil forced into the control valve through the **P** port pushes open the unload poppet (5) and then returns to the transmission case through the **T1** port.

Oil behind the unload poppet (5) returns to the transmission case through the spool (4) and the **T3** port.

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

**P : Pump Port** **T1, T2, T3 : Tank Port**
**C : Cylinder Port**

(1) Poppet 2
(2) Poppet 1
(3) Plunger
(4) Spool
(5) Unload Poppet



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## ■ Lift

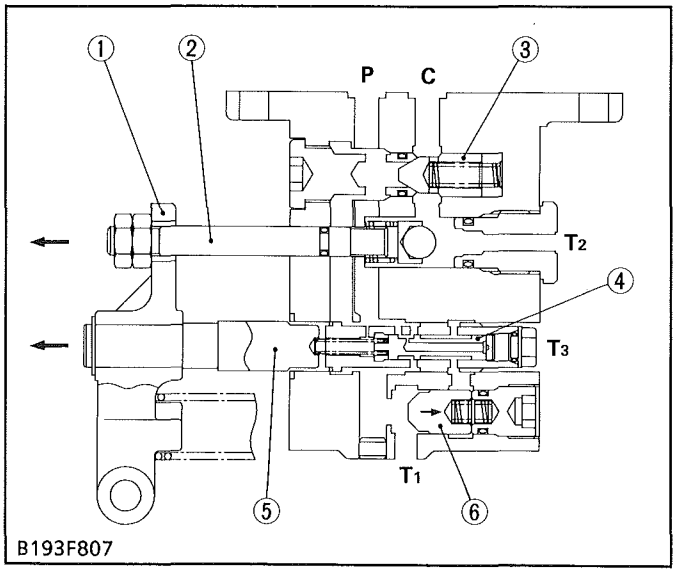
When the control lever is set to the **LIFT** position, the spool (4) is move to the right.

The oil forced into the control valve through the **P** port flows to the back of the unload poppet (5) to close it.

The oil pushes open the poppet 1 (2), and flows into the hydraulic cylinder through the **C** port to lift the implement.

**P : Pump Port** **T1, T2, T3 : Tank Port**
**C : Cylinder Port**

(1) Poppet 2
(2) Poppet 1
(3) Plunger
(4) Spool
(5) Unload Poppet



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## ■ Down

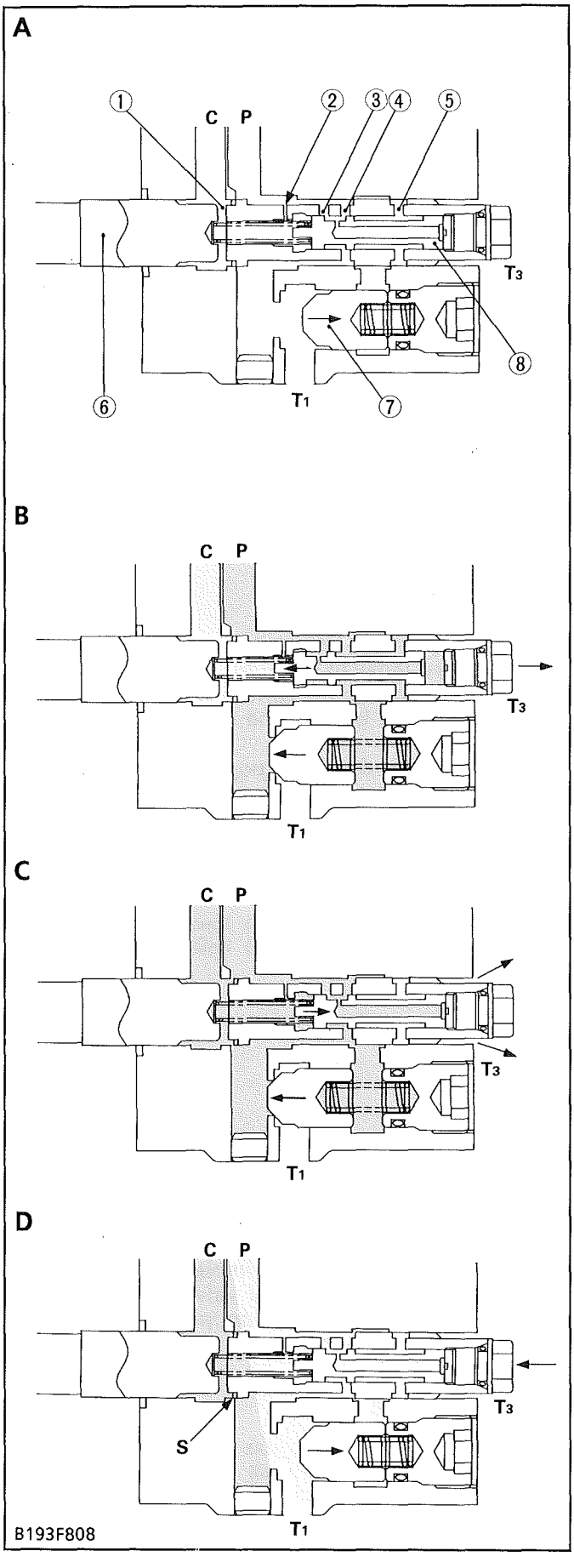
When the control lever is moved to **DOWN** position, the spool (5) is move to the left , and the poppet 2 (2) is also move to the left by the lever (1).

Oil in the hydraulic cylinder is forced out to the transmission case through the **T2** 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 (6) and returns to the transmission case through the **T1** port.

**P : Pump Port** **T1, T2, T3 : Tank Port**
**C : Cylinder Port**

(1) Lever
(2) Poppet 2
(3) Poppet 1
(4) Plunger
(5) Spool
(6) Unload Poppet




## Shockless Mechanism

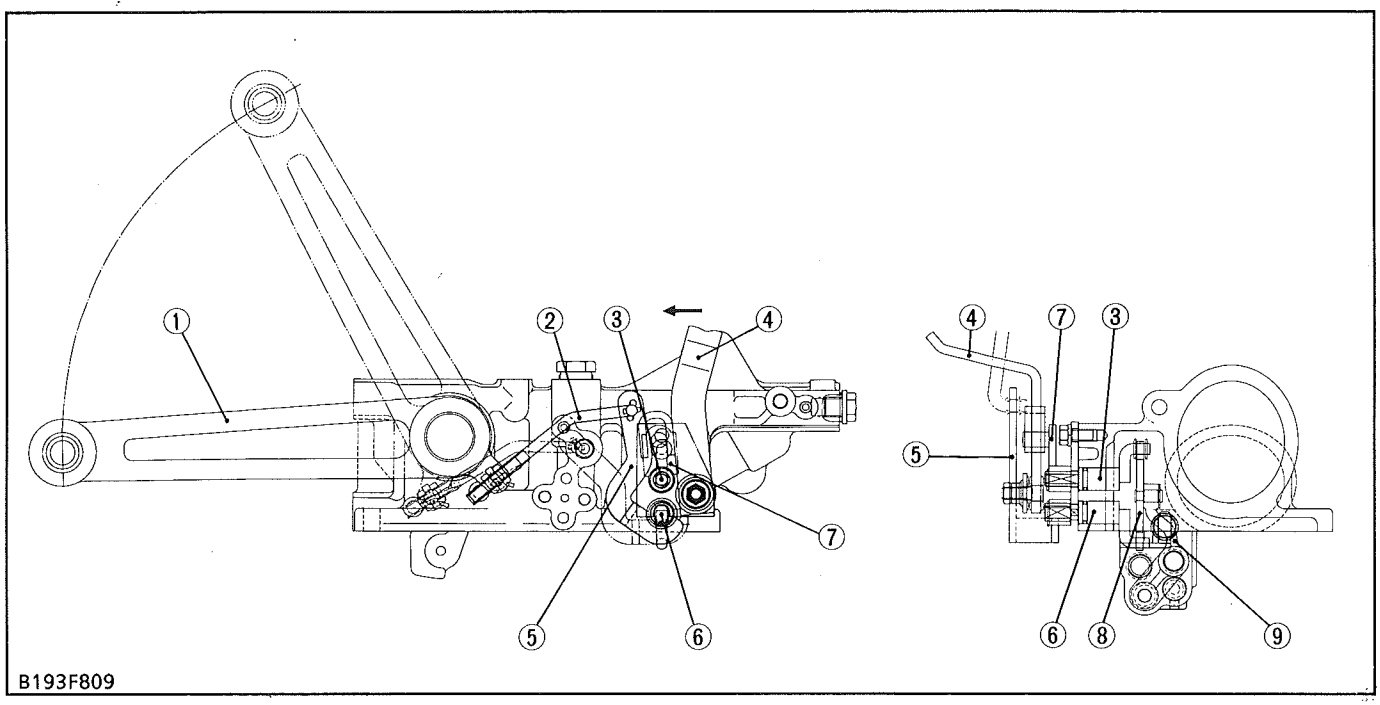
The control valve is provided with a shockless mechanism. This is intended to reduce a sudden change of the oil pressure and flow when the three point linkage system begins to going up or stop going up. As a result, operator does not feel the unpleasant shock.

1. When the three point linkage system starts going up, the spool (6) is located slightly at the right from the neutral position. (Fig. **B**)
2. The oil fed from hydraulic pump flows in passages 3 (3) and 4 (4) by the difference of the hole diameter, and pushes the plunger (8) to the left. Then the passages 4 (4) and 5 (5) connect to each other, and the oil between them return to the transmission case through the clearance between the valve body and the spool (6) and through the **T3** port. In this way, the plunger (8) returns to the rightmost position. ( Fig. **B** and **C**)
3. As a result, the oil pressure is controlled not to rise suddenly. The shock at the start of lifting is thus reduced.
4. When the spool (6) comes close to the neutral position by the motions of feedback linkage, the oil pressure gradually drops by the slit provided in the spool (6). Therefore the shock at the stop of lifting is reduced. (Fig. **D**)

**P : Pump Port**
**C : Cylinder Port**
**S : Slit**
**T1, T3 : Tank Port**

(1) Passage 1
(2) Passage 2
(3) Passage 3
(4) Passage 4
(5) Passage 5
(6) Spool
(7) Unload Poppet
(8) Plunger

# [5] FEEDBACK LINKAGE FOR POSITION CONTROL



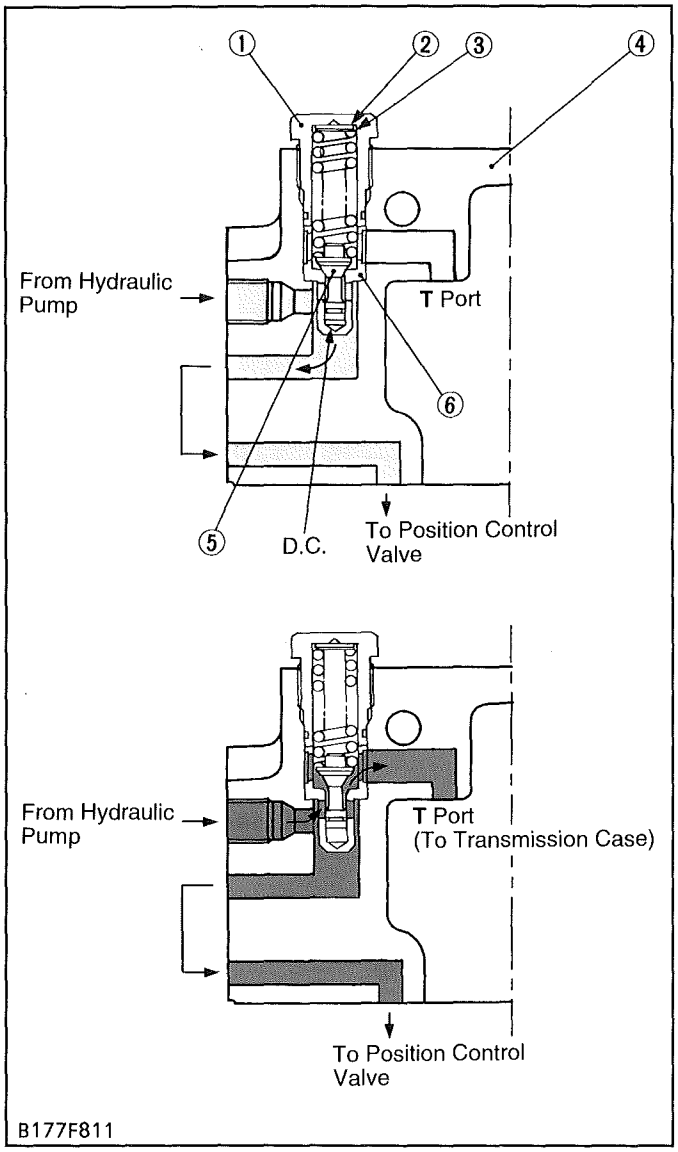

B193F809

(1) Lift Arm RH
(2) Feedback Rod
(3) Control Lever Shaft
(4) Position Control Lever
(5) Feedback Arm
(6) Feedback Arm Shaft
(7) Connecting Link
(8) Control Lever Arm
(9) Lever

When the position control lever (4) moved to rearward to lift the implement, the spool of the position control valve is pushed in to form a raising circuit by the motions of control lever arm (7), control lever shaft (3), connecting link (8) and the lever (9). And after the lift arm (1) moves upward, the spool is pulled out and return to form a neutral circuit by the motions of feedback rod (2), feedback arm (5), feedback arm shaft (6), connecting link (8) and the lever (9).

As a result,the implement height can be easily determined in proportion to the set position of the position control lever (4).

# [6] RELIEF VALVE




The Three point hydraulic system circuit has a relief valve to restrict the maximum pressure in the circuit. The relief valve is located top of the hydraulic cylinder body.

The relief valve is of the guide piston type with damping effect.

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

As shown in the figure, the guide is attached to the poppet (5) and a valve chamber **D.C.** (called the damping chamber) is formed at the bottom of the guide piston. The inlet of the valve leads to the chamber via a clearance between the sliding portion of the guide and the seat (6), minimizing valve vibration with the damping effect of the chamber.

When the oil pressure in the circuit is lower than the setting pressure of the relief valve, the relief valve is not operated and the oil fed to the relief valve from the hydraulic pump flows into the position control valve.

As the oil pressure in the circuit increases, so does the pressure in the damping chamber **D.C.** When the pressure rises above the valve setting and overcomes the spring force, the valve opens. Oil then flows out to the transmission case through **T** port, preventing any further rise in pressure. The valve closes again when enough oil is released to drop pressure below the valve setting.

**(Reference)**

- Relief Valve setting pressure : 13.2 to 13.7 MPa
  135 to 140 kgf/cm$^2$
  1920 to 1991 psi
  Engine speed : Maximum
  Oil temperature : 45 to 55 °C
  113 to 131 °F

**D.C. : Damping Chamber**
**P : Pump Port**
**C : Cylinder Port**
**T : Tank Port**

(1) Plug
(2) Washer
(3) Shim
(4) Hydraulic Cylinder Body
(5) Poppet
(6) Seat

# SERVICING
# TROUBLESHOOTING

| Symptom | Probable Cause | Solution | Reference Page |
|---|---|---|---|
| **Implement Does Not Rise (No Noise)** | ● Control valve broken | Replace | E8-S5 |
| | ● Control valve improperly adjusted | Adjust | E8-S6 |
| | ● Control valve improperly assembled | Repair | E8-S5 |
| | ● Relief valve spring damaged | Replace | 8-S11 |
| | ● Spool sticks | Repair | E8-S6 |
| | ● Piston O-ring or cylinder damaged | Replace | 8-S10 |
| **(Noise)** | ● Oil strainer or oil filter cartridge clogged | Clean or Replace | — |
| | ● Suction pipe loosen or broken | Repair or Replace | — |
| | ● Suction pipe connecting hose loosen or broken | Repair or Replace | — |
| | ● Suction pipe O-ring broken | Replace | — |
| | ● Insufficient transmission oil | Refill | G-8 |
| | ● Relief valve setting pressure too low | Adjust or Replace | 8-S8 |
| | ● Hydraulic pump broken | Replace | E8-S4 |
| **Implement Does Not Reach Maximum Height** | ● Feedback rod improperly adjusted | Adjust | 8-S8 |
| **Implement Does Not Lower** | ● Control valve malfunctioning | Repair or Replace | E8-S5 |
| **Implement Drops by Its Weight** | ● Hydraulic cylinder worn or damaged | Replace | E8-S5 |
| | ● Piston O-ring worn or damaged | Replace | E8-S5 |
| | ● Control valve malfunctioning | Replace | E8-S5 |
| **Implement Hunts** | ● Control valve improperly adjusted | Adjust | E8-S6 |

# SERVICING SPECIFICATIONS

| Item | | Factory Specification | Allowable Limit |
|---|---|---|---|
| **[Hydraulic Pump]**<br>Pump Delivery at Engine 2600 rpm,<br>Oil Temperature 50°C, 122°F | at no pressure | 22.0 ℓ / min.<br>5.8 U.S. GPM<br>4.8 Imp.GPM | —— |
| | at 14.7 MPa<br>150 kgf / cm²<br>2133 psi | 18.0 ℓ / min.<br>4.8 U.S.GPM<br>4.0 Imp.GPM | 16.0 ℓ / min.<br>4.2 U.S. GPM<br>3.5 Imp.GPM |
| Gear to Casing | Clearance | —— | 0.15 mm<br>0.0059 in. |
| Gear Shaft to Bushing | Clearance | 0.020 to 0.091 mm<br>0.0008 to 0.0036 in. | 0.12 mm<br>0.0047 in. |
| Gear Shaft | O.D. | 14.970 to 14.980 mm<br>0.5894 to 0.5898 in. | —— |
| Bushing | I.D. | 15.000 to 15.061 mm<br>0.5906 to 0.5930 in. | —— |
| Side Plate | Thickness | 2.48 to 2.50 mm<br>0.0976 to 0.0984 in. | 2.40 mm<br>0.0945 in. |
| Relief Valve | Setting Pressure | 13.2 to 13.7 MPa<br>135 to 140 kgf/cm²<br>1920 to 1991 psi | —— |
| Lift Arm | Free Play | 5 to 10 mm<br>0.20 to 0.40 in. | —— |
| Hydraulic Cylinder | I.D. | 70.05 to 70.10 mm<br>2.7579 to 2.7598 in. | 70.15 mm<br>2.7618 in. |
| Hydraulic Arm Shaft to Bushing | Clearance | 0.020 to 0.110 mm<br>0.0008 to 0.0043 in. | 0.30 mm<br>0.0118 in. |
| Hydraulic Arm Shaft, Right | O.D. | 37.925 to 37.950 mm<br>1.4931 to 1.4941 in. | —— |
| Hydraulic Arm Shaft, Left | O.D. | 33.925 to 33.950 mm<br>1.3356 to 1.3366 in. | —— |
| Bushing, Right | I.D. | 37.970 to 38.035 mm<br>1.4949 to 1.4974 in. | —— |
| Bushing, Left | I.D. | 33.970 to 34.035 mm<br>1.3374 to 1.3400 in. | —— |

# TIGHTENING TORQUES

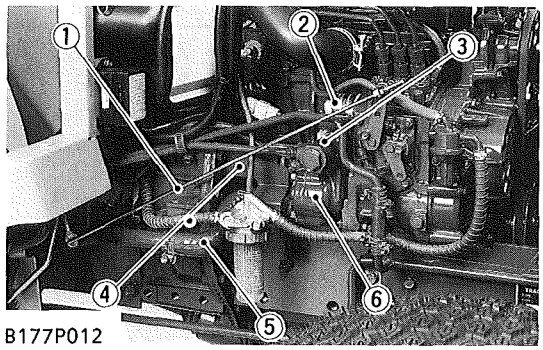
Tightening torques of screws and nuts on the table bellow is especially specified.
(For general use screws and nuts: See page G-8)

| Item | N·m | kgf·m | ft-lbs |
|---|---|---|---|
| Fuel cut off solenoid mounting screws | 9.80 to 11.2 | 1.00 to 1.15 | 7.24 to 8.32 |
| Fuel filter bracket mounting screws | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Flow priority valve mounting screws | 17.7 to 20.6 | 1.8 to 2.1 | 13.0 to 15.2 |
| Delivery pipe flare nuts | 29.4 to 39.2 | 3.0 to 4.0 | 21.7 to 28.9 |
| Hydraulic pump mounting screw and nut | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Cover mounting screw | 34.3 to 39.2 | 3.5 to 4.0 | 25.3 to 28.9 |
| Connecting plate mounting screws and nuts | 39.2 to 44.1 | 4.0 to 4.5 | 28.9 to 32.5 |
| Top link bracket mounting screws | 77.5 to 90.1 | 7.9 to 9.2 | 57.2 to 66.5 |
| Hydraulic cylinder assembly mounting screws and nuts | 39.2 to 44.1 | 4.0 to 4.5 | 28.9 to 32.5 |
| Position control valve mounting screws | 23.6 to 27.4 | 2.4 to 2.8 | 17.4 to 20.2 |
| Relief valve plug | 49.0 to 68.6 | 5.0 to 7.0 | 36.2 to 50.6 |
| Plug 1 | 29.4 to 49.0 | 3.0 to 5.0 | 21.7 to 36.2 |
| Plug 2 | 29.4 to 49.0 | 3.0 to 5.0 | 21.7 to 36.2 |
| Plug 3 | 39.2 to 58.8 | 4.0 to 6.0 | 28.9 to 43.4 |
| Plug 4 | 7.85 to 11.77 | 0.8 to 1.2 | 5.79 to 8.68 |

# CHECKING, DISASSEMBLING AND SERVICING

## [1] HYDRAULIC PUMP

## DISASSEMBLING AND ASSEMBLING



B177P012

### Removing Hydraulic Pump

1. Disconnect the accelerator rod (1).
2. Remove the fuel cut off solenoid (2).
3. Remove the fuel filter bracket (4) mounting screws.
4. Remove the flow priority valve (3).
5. Disconnect the suction hose (5) and remove the hydraulic pump (6).

**(When reassembling)**

- Apply grease to O-ring and take care not to damage it.
- Apply liquid gasket (Three Bond 1208D or equivalent) to the engine stop solenoid gasket.

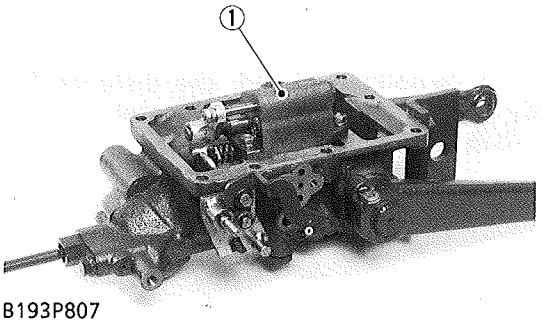
| | | |
|---|---|---|
| Tightening torque | Fuel cut off solenoid mounting screws | 9.80 to 11.2 N·m<br>1.00 to 1.15 kgf·m<br>7.24 to 8.32 ft-lbs |
| | Fuel filter bracket mounting screws | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |
| | Flow priority valve mounting screws | 17.7 to 20.6 N·m<br>1.8 to 2.1 kgf·m<br>13.0 to 15.2 ft-lbs |
| | Delivery pipe flare nuts | 29.4 to 39.2 N·m<br>3.0 to 4.0 kgf·m<br>21.7 to 28.9 ft-lbs |
| | P.S. delivery pipe nut | 34.0 to 39.0 N·m<br>3.5 to 4.0 kgf·m<br>25.0 to 28.8 ft-lbs |
| | Hydraulic pump mounting screw and nut | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |

(1) Accelerator Rod
(2) Fuel Cut Off Solenoid
(3) Flow Priority Valve
(4) Fuel Filter Bracket
(5) Suction Pipe
(6) Hydraulic Pump

# [2] HYDRAULIC CYLINDER ASSEMBLY (HYDRAULIC CYLINDER, POSITION CONTROL VALVE, RELIEF VALVE AND ETC)

## DISASSEMBLING AND ASSEMBLING

### (1) Disassembling Hydraulic Cylinder Assembly

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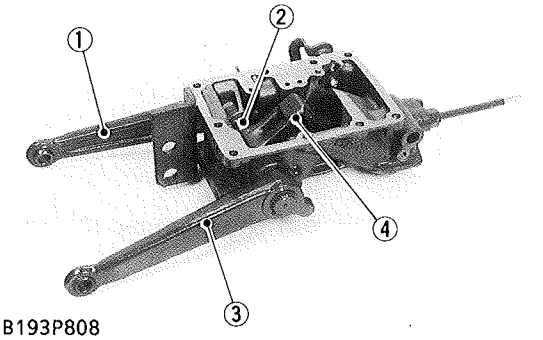


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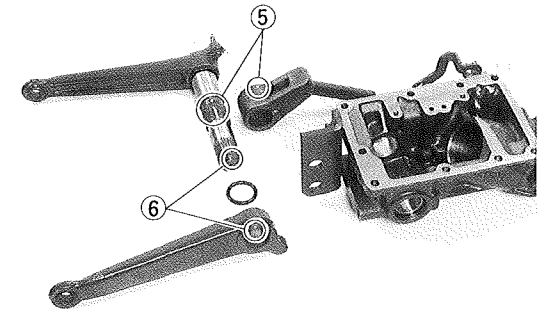



B193P809

**Position Control Valve**

1. Remove the position control valve mounting screws, and remove the position control valve (1).

**(When reassembling)**

- Take care not to damage the O-rings.

| | | |
|---|---|---|
| Tightening torque | Position control valve mounting screws | 23.6 to 27.4 N·m<br>2.4 to 2.8 kgf·m<br>17.4 to 20.2 ft-lbs |

(1) Position Control Valve

**Lift Arm, Hydraulic Arm Shaft and Hydraulic Arm**

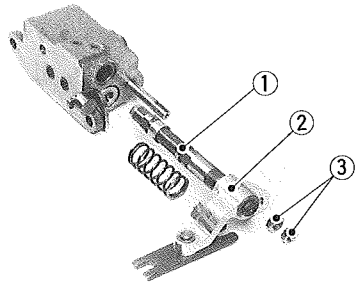
1. Remove the external snap ring, and remove the lift arm LH (3).
2. Draw out the hydraulic arm shaft (2) and lift arm RH (1) as a unit.

**(When reassembling)**

- Align the alignment marks (5) of the hydraulic arm and hydraulic arm shaft.
- Align the alignment marks (6) of the lift arm LH and hydraulic arm shaft.
- Apply grease to the right and left bushings and O-rings.
- Take care not to damage the O-rings.

(1) Lift Arm RH
(2) Hydraulic Arm Shaft
(3) Lift Arm LH
(4) Hydraulic Arm
(5) Alignment Marks
(6) Alignment Marks

## (2) Disassembling Position Control Valve

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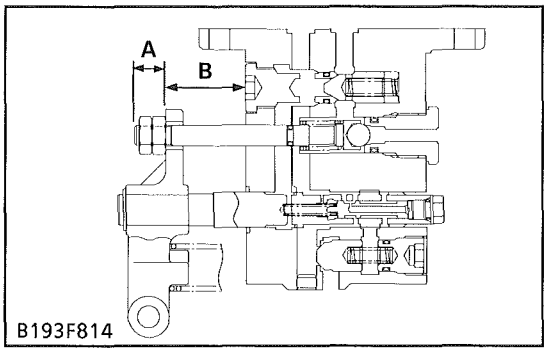


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### Spool

1. Remove the nuts (3).
2. Draw out the spool (1) with the lever (2).

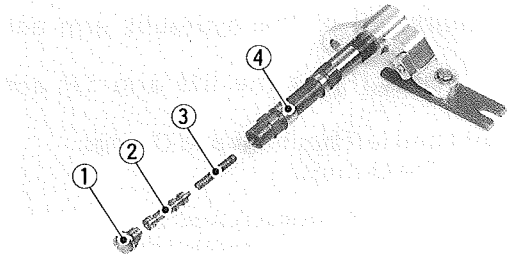
**■ IMPORTANT**

- **Measure the length (A) before disassembling, and make sure to reset it when reassembling.**

**(Reference)**

- When the poppet 2 is completely closed, the distance **(B)** between valve body and nut becomes approximately 32.3 to 32.5 mm (1.27 to 1.28 in.).

(1) Spool
(2) Lever
(3) Nuts




B193P811

### Plunger

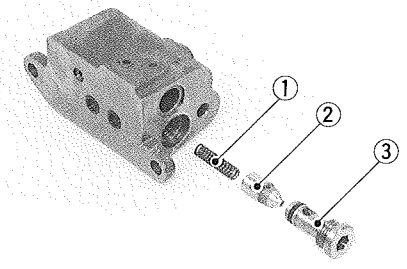
1. Remove the plug 4 (1), and draw out the plunger (2) and spring (3) from the spool (4).

**(When reassembling)**

- Take care not to damage the O-ring.

| | | |
|---|---|---|
| Tightening torque | Plug 4 | 7.85 to 11.77 N·m<br>0.8 to 1.2 kgf·m<br>5.79 to 8.68 ft-lbs |

(1) Plug 4
(2) Plunger
(3) Spring
(4) Spool




B193P812

### Poppet 1

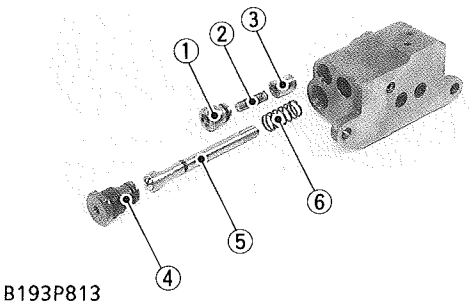
1. Remove the plug 1 (3), and draw out the poppet 1 (2) and spring (1).

**(When reassembling)**

- Take care not to damage the O-ring.

| | | |
|---|---|---|
| Tightening torque | Plug 1 | 29.4 to 49.0 N·m<br>3.0 to 5.0 kgf·m<br>21.7 to 36.2 ft-lbs |

(1) Spring
(2) Poppet 1
(3) Plug 1



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## Poppet 2 and Unload Poppet

1. Remove the plug 3 (4), and draw out the poppet 2 (5) and spring (6).
2. Remove the plug 2 (1), and draw out the unload poppet (2) and spring (3).

**(When reassembling)**

- Take care not to damage the O-ring.

| | | |
|---|---|---|
| Tightening torque | Plug 3 | 39.2 to 58.8 N·m<br>4.0 to 6.0 kgf·m<br>28.9 to 43.4 ft-lbs |
| | Plug 2 | 29.4 to 49.0 N·m<br>3.0 to 5.0 kgf·m<br>21.7 to 36.2 ft-lbs |

(1) Plug 2
(2) Unload Poppet
(3) Spring
(4) Plug 3
(5) Poppet 2
(6) Spring

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