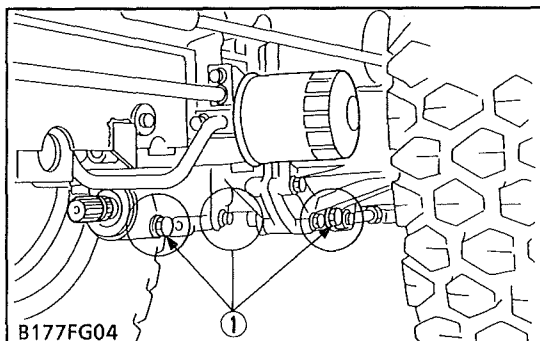


[2] BRAKE ASSEMBLY

DISASSEMBLING AND ASSEMBLING

(1) Separating Rear Axle Case with Brake Assembly

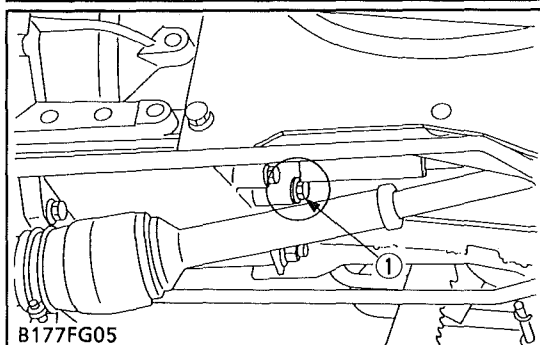


Drain the Transmission Fluid

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.

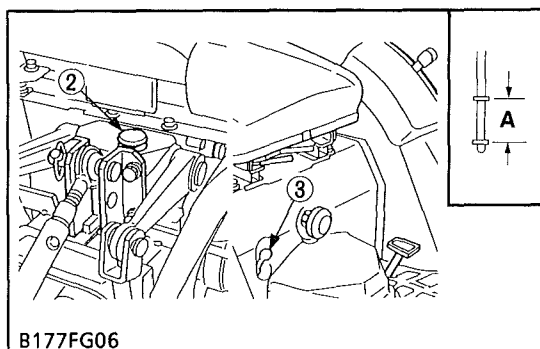


Transmission oil capacity	HST type	12 ℓ 3.17 U.S.gals 2.6 Imp.gals
	Manual transmission type	11 ℓ 2.9 U.S.gals 2.4 Imp.gals

■ IMPORTANT

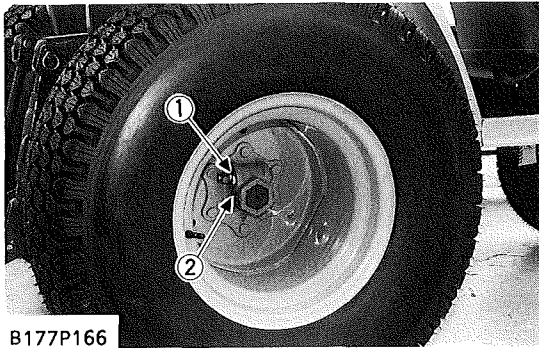
- Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS AND FLUID" (See page G-8).
- Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.
- Do not mix different brands 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

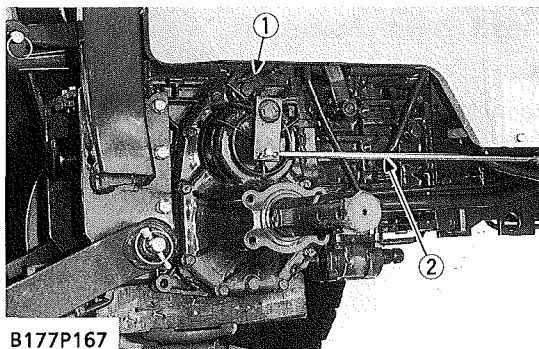
1. Place a jack under the transmission case.
2. Loosen the rear wheel cotter (1) setting bolt and nut.
3. Take out the wheel hub pin (2).
4. Take out the rear wheel.

IMPORTANT

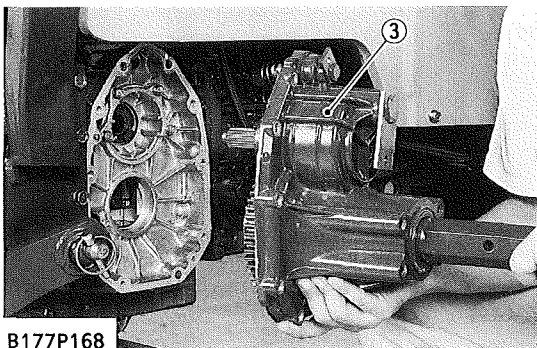
- When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service.

(When reassembling)

Tightening torque	Rear wheel cotter setting bolt and nut	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
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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 4.0 to 4.5 kgf·m 29 to 33 ft-lbs
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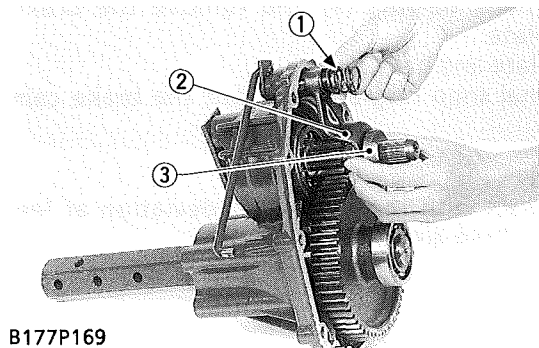
Differential Lock Shift Fork and Differential Lock Clutch

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

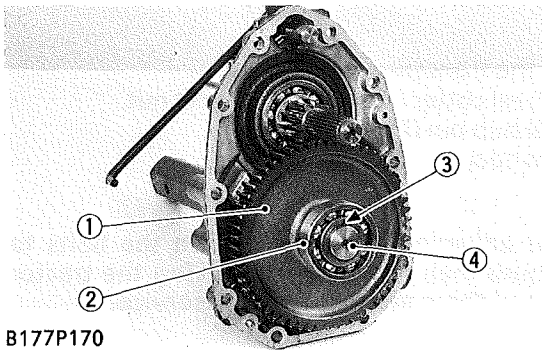
(1) Spring

(2) Differential Lock Shift Fork

(3) Differential Lock Clutch

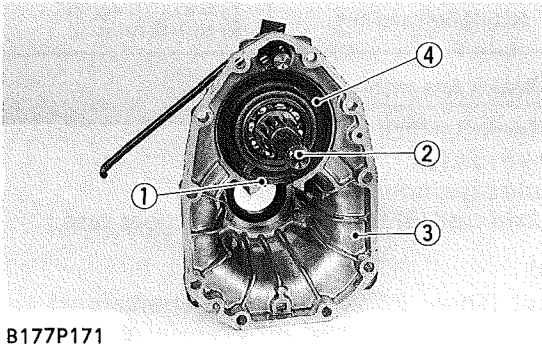


B177P169

**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 | (3) External Snap Ring |
| (2) Bearing | (4) Rear Axle |

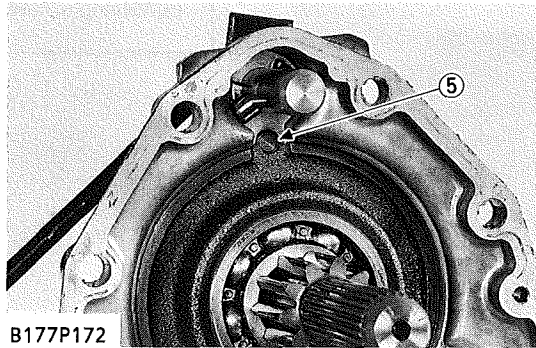
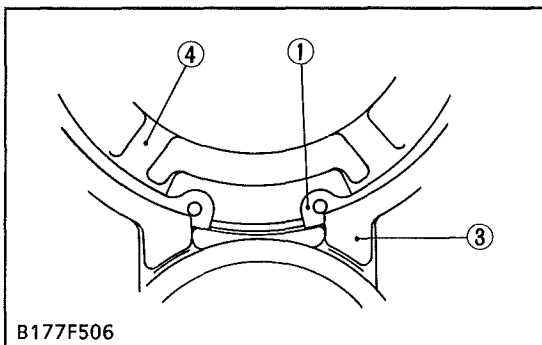
(2) Disassembling Brake Assembly**Brake Assembly**

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.)

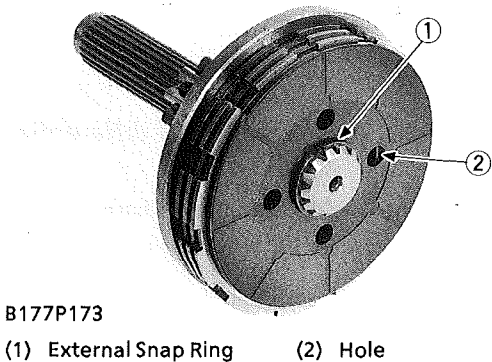
- | | |
|------------------------|--------------------|
| (1) Internal Snap Ring | (4) Bearing Holder |
| (2) Brake Shaft | (5) Straight Pin |
| (3) Rear Axle Case | |

**Brake Discs and Friction Plate**

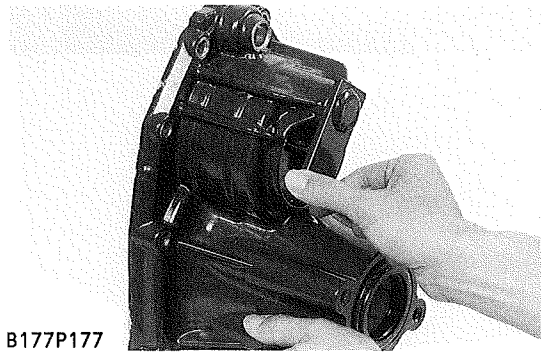
1. Remove the external snap ring (1) and remove the brake discs and friction plate.
2. Remove the cam plate and balls.
3. Remove the external snap ring and pull out the brake cam lever.

(When reassembling)

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



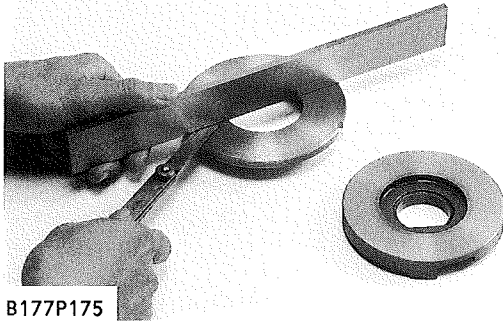
SERVICING



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.

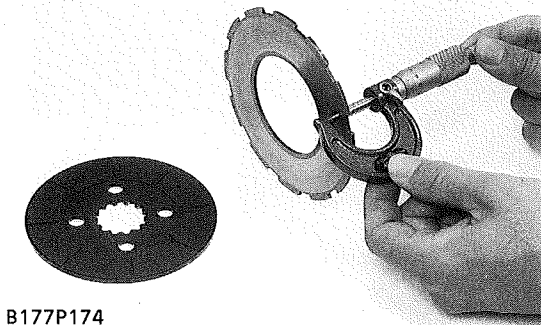
Height of cam plate and ball	Factory spec.	22.89 to 22.99 mm 0.9012 to 0.9051 in.
	Allowable limit	22.40 mm 0.8819 in.

Brake Disc and Friction Plate Wear

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

Brake disc thickness	Factory spec.	3.3 to 3.5 mm 0.130 to 0.138 in.
	Allowable limit	3.0 mm 0.118 in.

Plate thickness	Factory spec.	1.92 to 2.08 mm 0.0756 to 0.0819 in.
	Allowable limit	1.52 mm 0.0598 in.

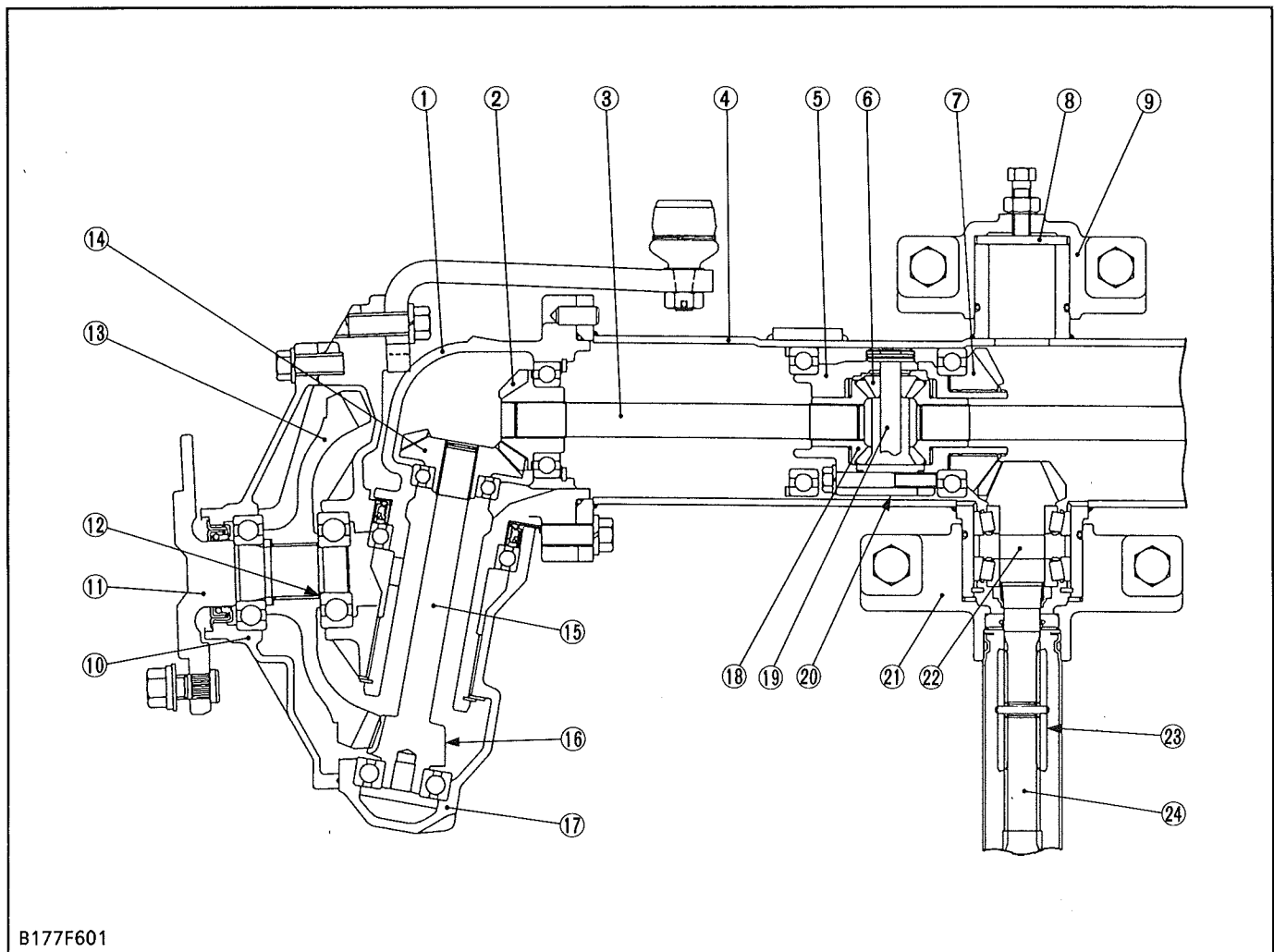


B177P174

MECHANISM

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[1] STRUCTURE	6-M1
[2] FRONT WHEEL ALIGNMENT	6-M2

[1] STRUCTURE

B177F601

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

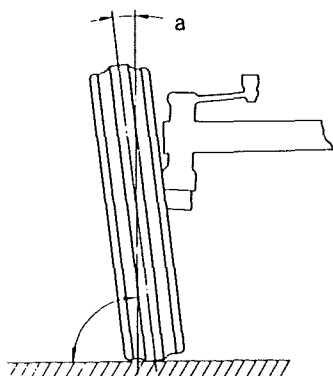
The differential system allows each wheel to rotate at a different speed to make turning easier.

[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]



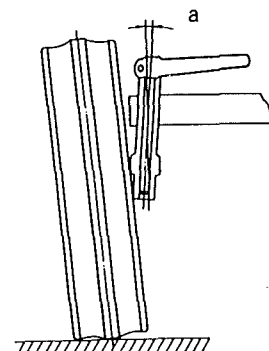
C045F051

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. 2°
--------	------------------

[Kingpin Angle]



C045F053

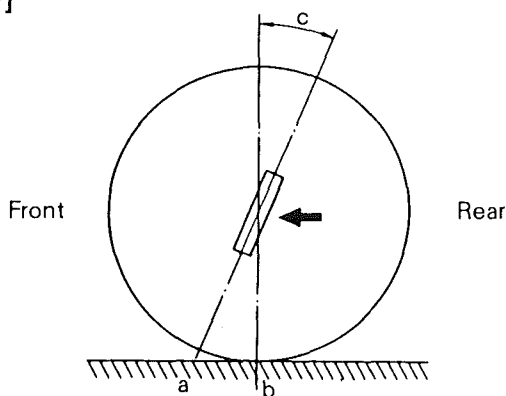
The kingpin is tilted from the vertical as viewed from the front.

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. 12°
---------------------	-------------------

[Caster]



C045F052

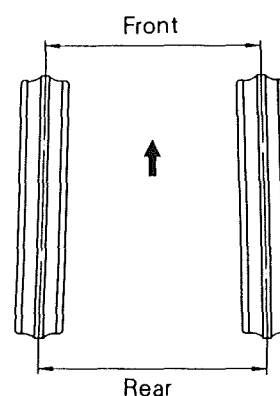
The kingpin is tilted forward as viewed from the side. The point (b) of the wheel center line is behind the point (a) of the kingpin shaft center line.

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

As with the kingpin inclination, caster reduces steering effort.

Caster	0 rad. 0°
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[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 0.04 to 0.39 in.
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SERVICING

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TROUBLESHOOTING	6-S1
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CHECKING AND ADJUSTING	6-S3
DISASSEMBLING AND ASSEMBLING	6-S5
(1) Separating Front Axle	6-S5
(2) Disassembling Front Axle	6-S6
SERVICING	6-S10

TROUBLESHOOTING

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

SERVICING SPECIFICATIONS

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

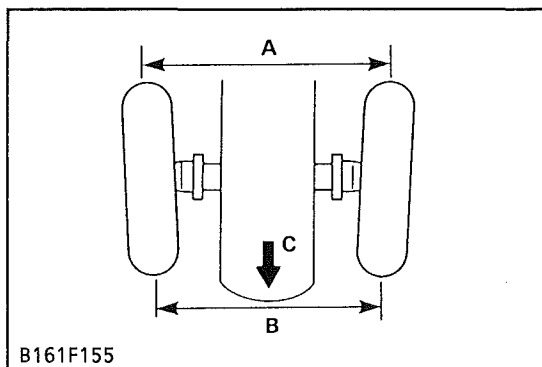
(Continued)

Item		Factory Specification	Allowable Limit
Front Axle Case Boss (Front)	O.D.	49.920 to 49.945 mm 1.96535 to 1.96634 in.	—
Front Axle Bracket (Front)	I.D.	50.150 to 50.200 mm 1.97441 to 1.97638 in.	—
Front Axle Case Boss (Rear)	O.D.	64.910 to 64.940 mm 2.55551 to 2.55669 in.	—
Front Axle Bracket (Rear)	I.D.	65.150 to 65.200 mm 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)

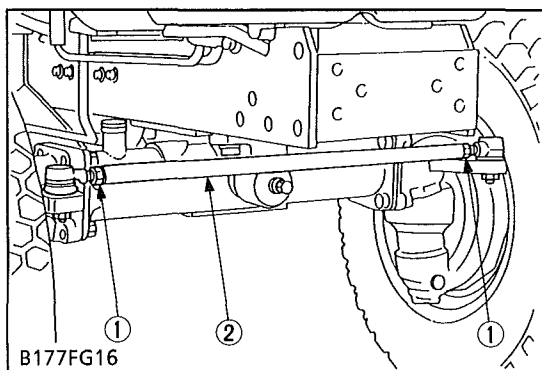
Item	N·m	kgf·m	ft-lbs
Lock nut of rocking force adjusting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Slotted nut of tie-rod end	17.7 to 34.3	1.8 to 3.5	13.0 to 25.3
Slotted nut of drag link end	17.7 to 34.3	1.8 to 3.5	13.0 to 25.3
Lock nuts of tie-rod	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
Front axle shaft 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****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 0.04 to 0.39 in.
--------------	---------------	--------------------------------

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

**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 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs
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(1) Lock Nut

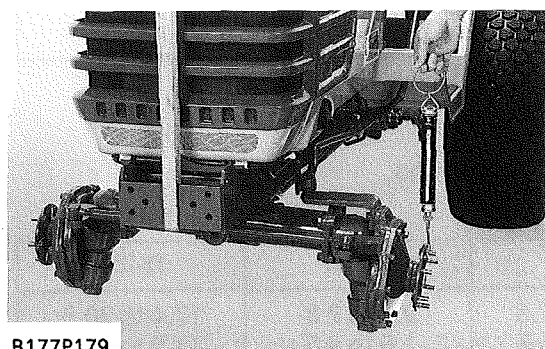
(2) Tie-rod



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 0.20 in.
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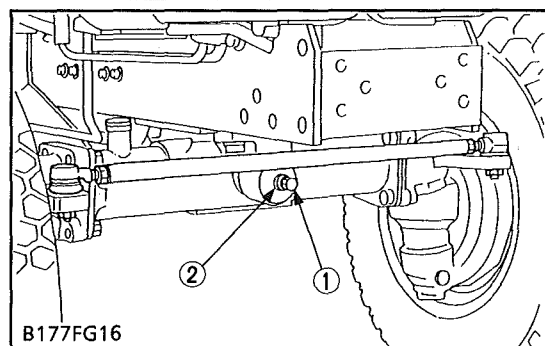


Front Axle Rocking Force

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

Front axle rocking force	Factory spec.	49.0 to 117.7 N 5.0 to 12.0 kgf 11.0 to 26.5 lbs
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Tightening torque	Lock nut	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
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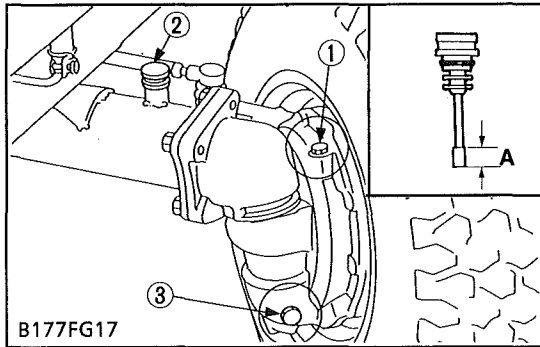


(1) Adjusting Screw

(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 acceptable within this range.

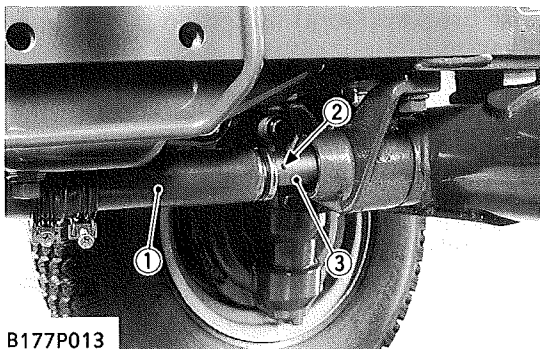
Draining Front Axle Case Oil

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

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



B177P013

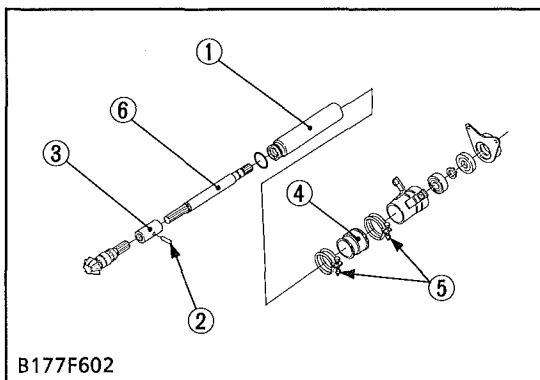
Propeller Shaft

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.

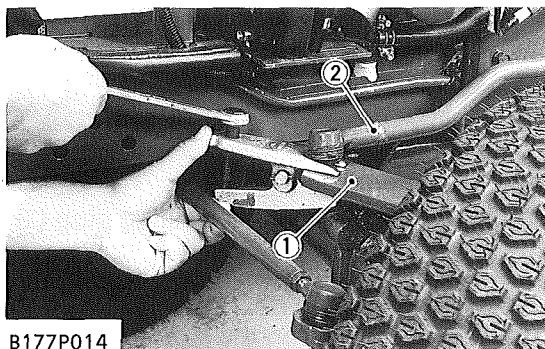
(When reassembling)

- Apply grease to the splines of the propeller shaft.

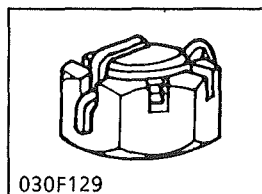
- | | |
|---------------------------|---------------------------|
| (1) Propeller Shaft Cover | (4) Propeller Shaft Cover |
| (2) Spring Pin | (5) Clamp |
| (3) Coupling | (6) Propeller Shaft |



B177F602



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).

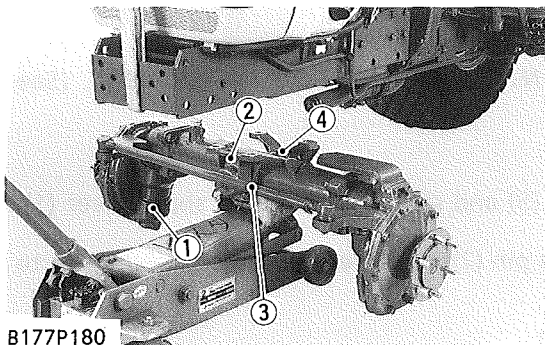
■ IMPORTANT

- 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 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs
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(1) Knuckle Arm

(2) Drag Link



B177P180

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

Front Axle

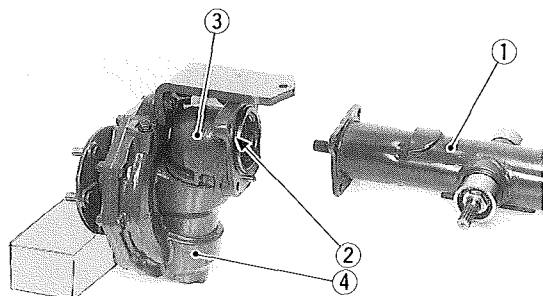
1. Place the jacks under the front axle, and hang up the front axle frame by the hoist to support it.
2. Remove the front wheels.
3. Remove the front axle bracket (Front) mounting screws and front axle bracket (Rear) mounting screws.
4. Separate the front axle from the front axle frame.
5. Remove the 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 12.6 to 15.0 kgf·m 91.1 to 108.5 ft-lbs
	Front wheel mounting nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Slotted nut	17.7 to 34.3 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs

(2) Disassembling Front Axle



B177P181

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

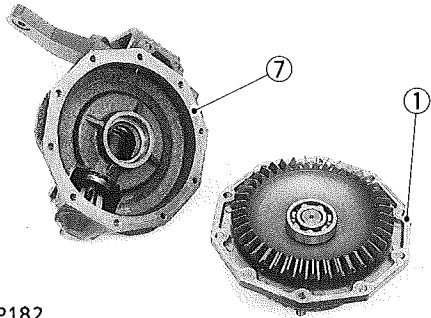
Bevel Gear Case and Front Gear Case

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).

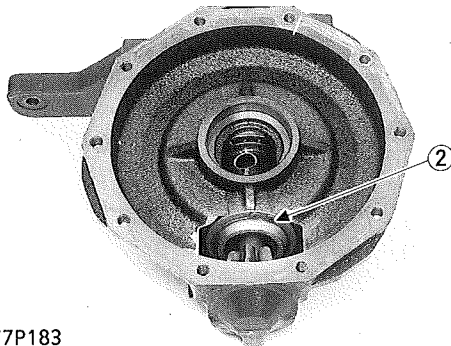
(When reassembling)

- 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.

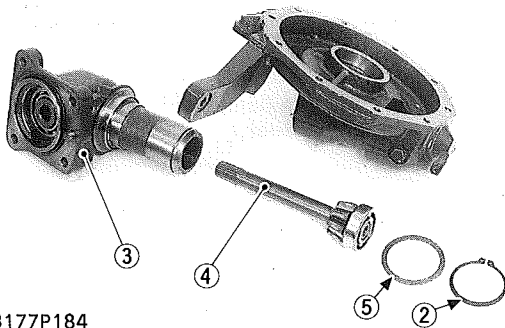
Tightening torque	Bevel gear case mounting screw	123.5 to 147.0 N·m 12.6 to 15.0 kgf·m 91.2 to 108.4 ft-lbs
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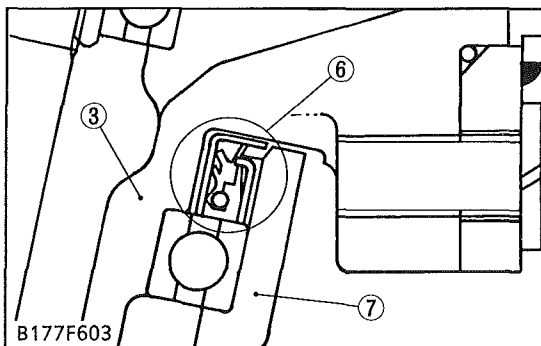
B177P182



B177P183



B177P184



B177F603

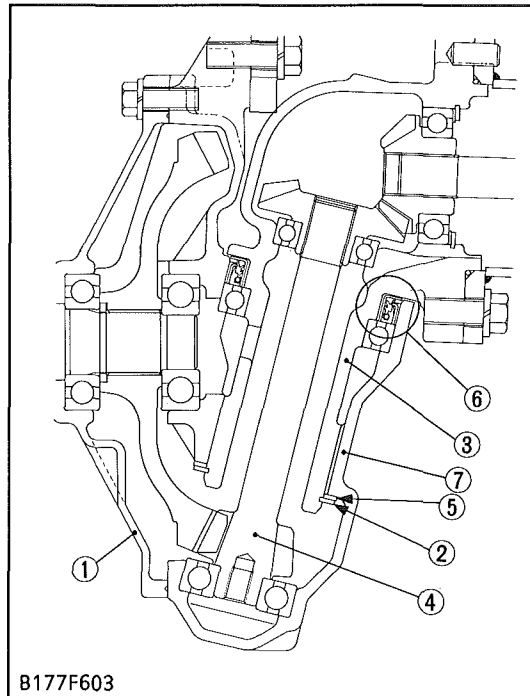
Bevel Gear Case, Axle Flange and Front Gear Case

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)

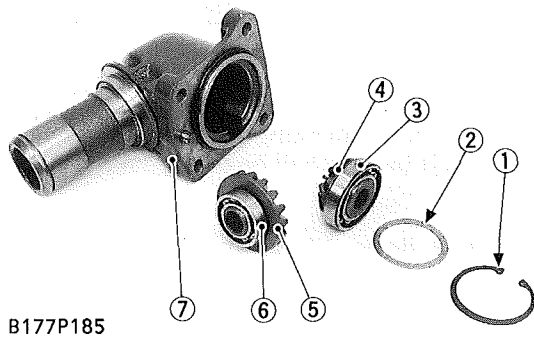
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the axle flange (1) and front gear case (7) after eliminate the water, oil and stuck liquid gasket.
- Tighten the axle flange mounting screws and nuts diagonally in several steps.
- Install the oil seal (6) of bevel gear case, noting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

Tightening torque	Axle flange mounting screws	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft·lbs
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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



Bevel Gear Case Gears

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

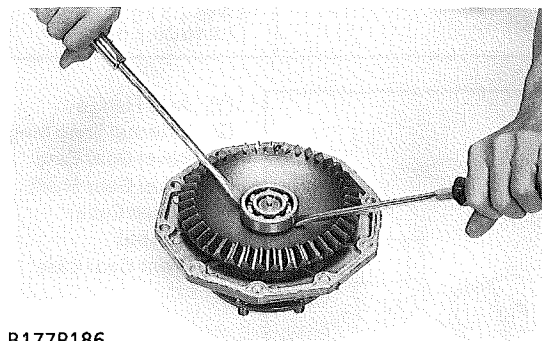
(When reassembling)

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

(Reference)

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

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



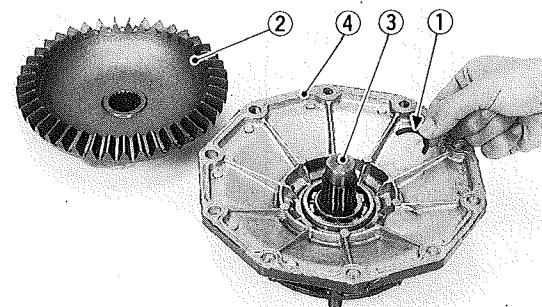
Axle

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

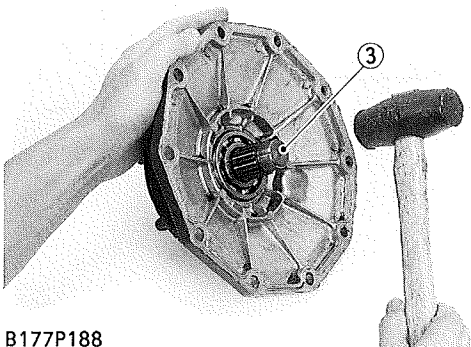
(When reassembling)

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

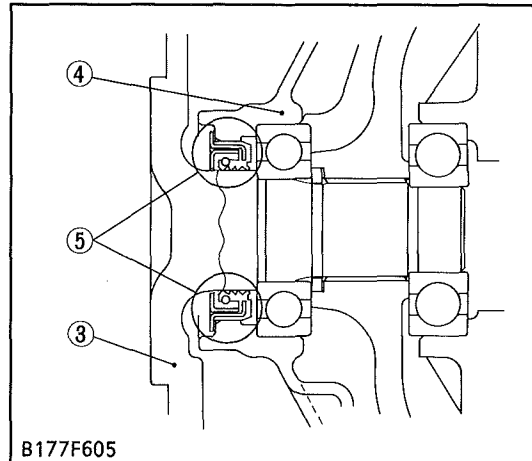
- | | |
|----------------|-----------------|
| (1) Collar | (4) Axle Flange |
| (2) Bevel Gear | (5) Oil Seal |
| (3) Axle | |



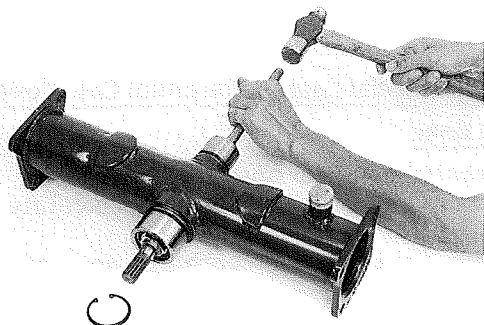
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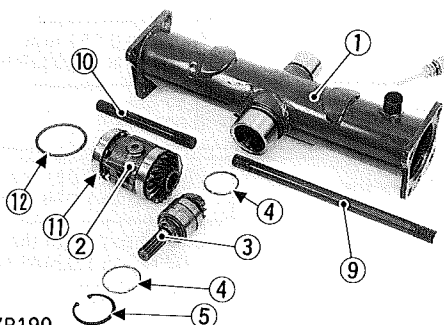
B177P188



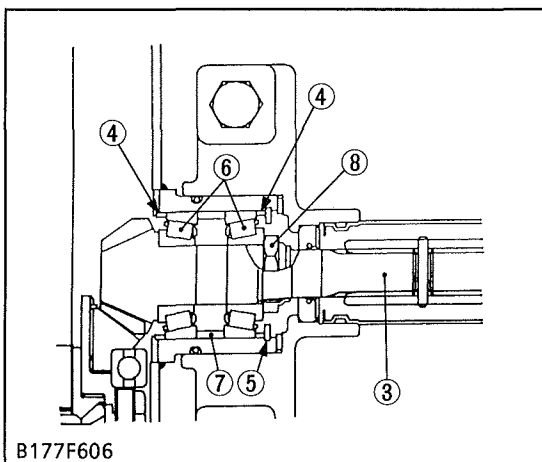
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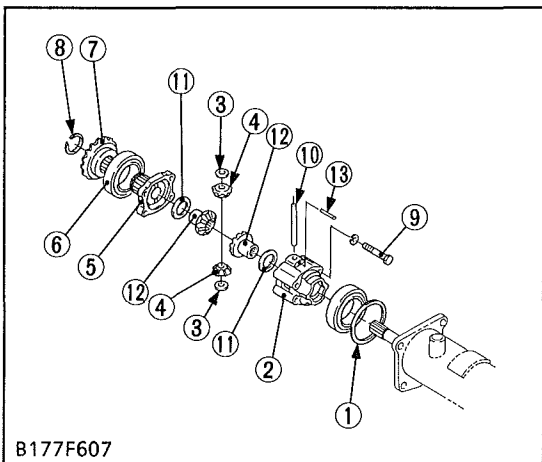
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B177F606



B177F607

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

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

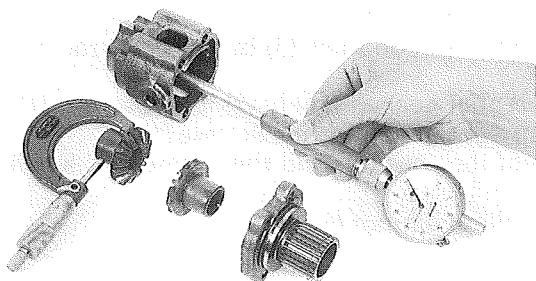
- Arrange the parts to know their original position.

(When reassembling)

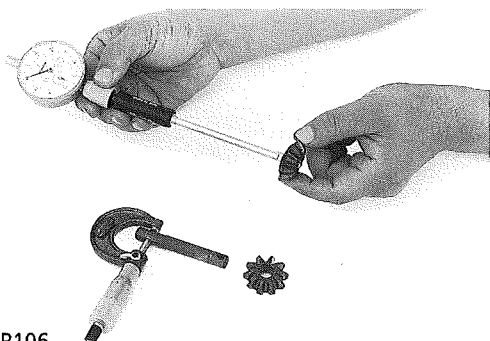
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (12) and differential pinions (4).
- Install the pinion shaft (10) so that the hole on it may align with the hole on differential case (2), and install the straight pin (13).

Tightening torque	Differential case cover mounting screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft·lbs
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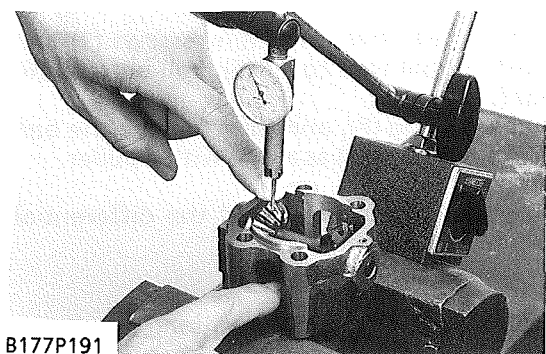
SERVICING



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B177P191

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 0.00157 to 0.00323 in.
	Allowable limit	0.17 mm 0.0067 in.
Differential case bore I.D.	Factory spec.	26.000 to 26.021 mm 1.02362 to 1.02445 in.
Differential case cover bore I.D.	Factory spec.	26.000 to 26.021 mm 1.02362 to 1.02445 in.
Differential side gear O.D.	Factory spec.	25.939 to 25.960 mm 1.02122 to 1.02205 in.

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 0.00252 to 0.00394 in.
	Allowable limit	0.25 mm 0.0096 in.
Pinion shaft O.D.	Factory spec.	13.950 to 13.968 mm 0.54921 to 0.54992 in.
Differential pinion I.D.	Factory spec.	14.032 to 14.050 mm 0.55244 to 0.55315 in.

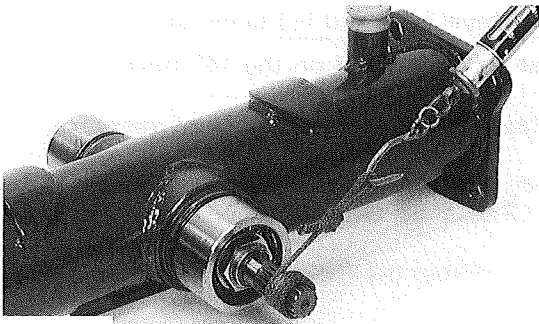
Backlash between Differential Pinion and Differential Side Gear

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 0.004 to 0.012 in.
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(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 13 to 17 kgf 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.

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.

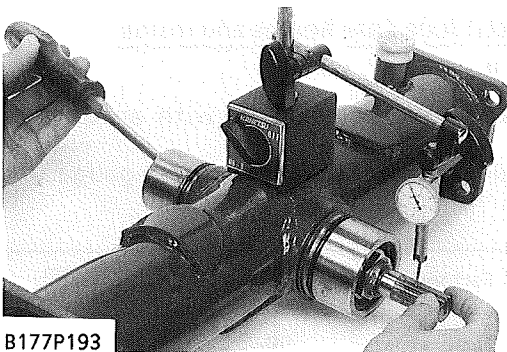
Backlash between spiral bevel pinion shaft and spiral bevel gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
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- (1) Spiral Bevel Gear (3) Adjusting Collar
(2) Spiral Bevel Pinion Shaft (4) Adjusting Collar

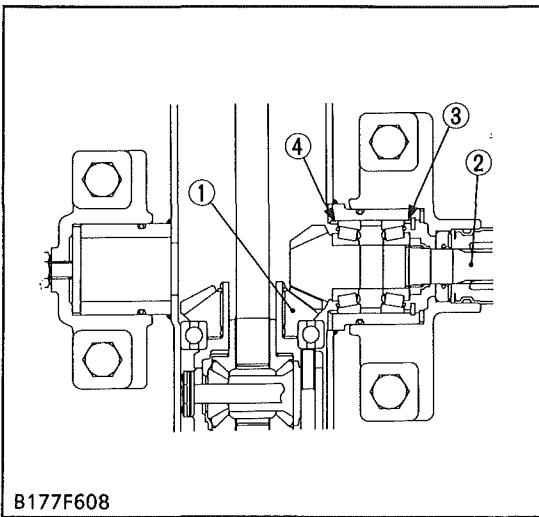
(Reference)

- 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) :

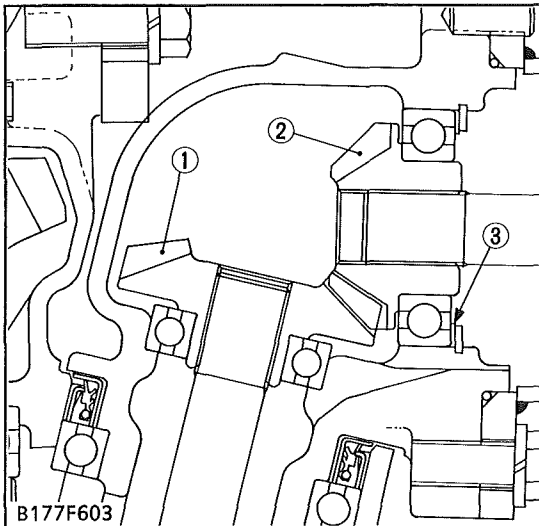
3.4 mm (0.134 in.)	4.1 mm (0.161 in.)
3.6 mm (0.142 in.)	4.2 mm (0.165 in.)
3.8 mm (0.150 in.)	4.4 mm (0.173 in.)
4.0 mm (0.157 in.)	4.6 mm (0.181 in.)



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B177F608



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

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 0.0039 to 0.0118 in.
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(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

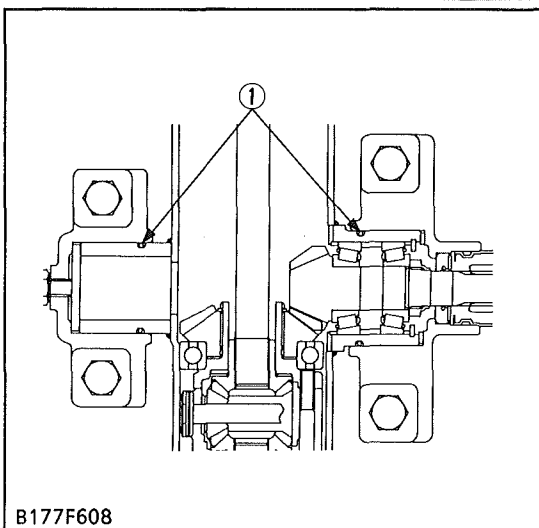
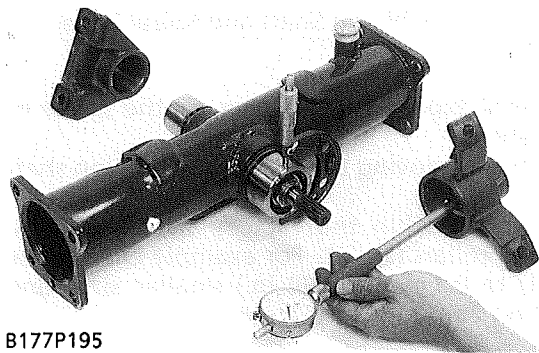
Diameter of Front Axle Bracket

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 1.96535 to 1.96634 in.
Front axle bracket (front) I.D.	Factory spec.	50.150 to 50.200 mm 1.97441 to 1.97638 in.

Front axle case boss (rear) O.D.	Factory spec.	64.910 to 64.940 mm 2.55551 to 2.55669 in.
Front axle bracket (rear) I.D.	Factory spec.	65.150 to 65.200 mm 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 6-54).

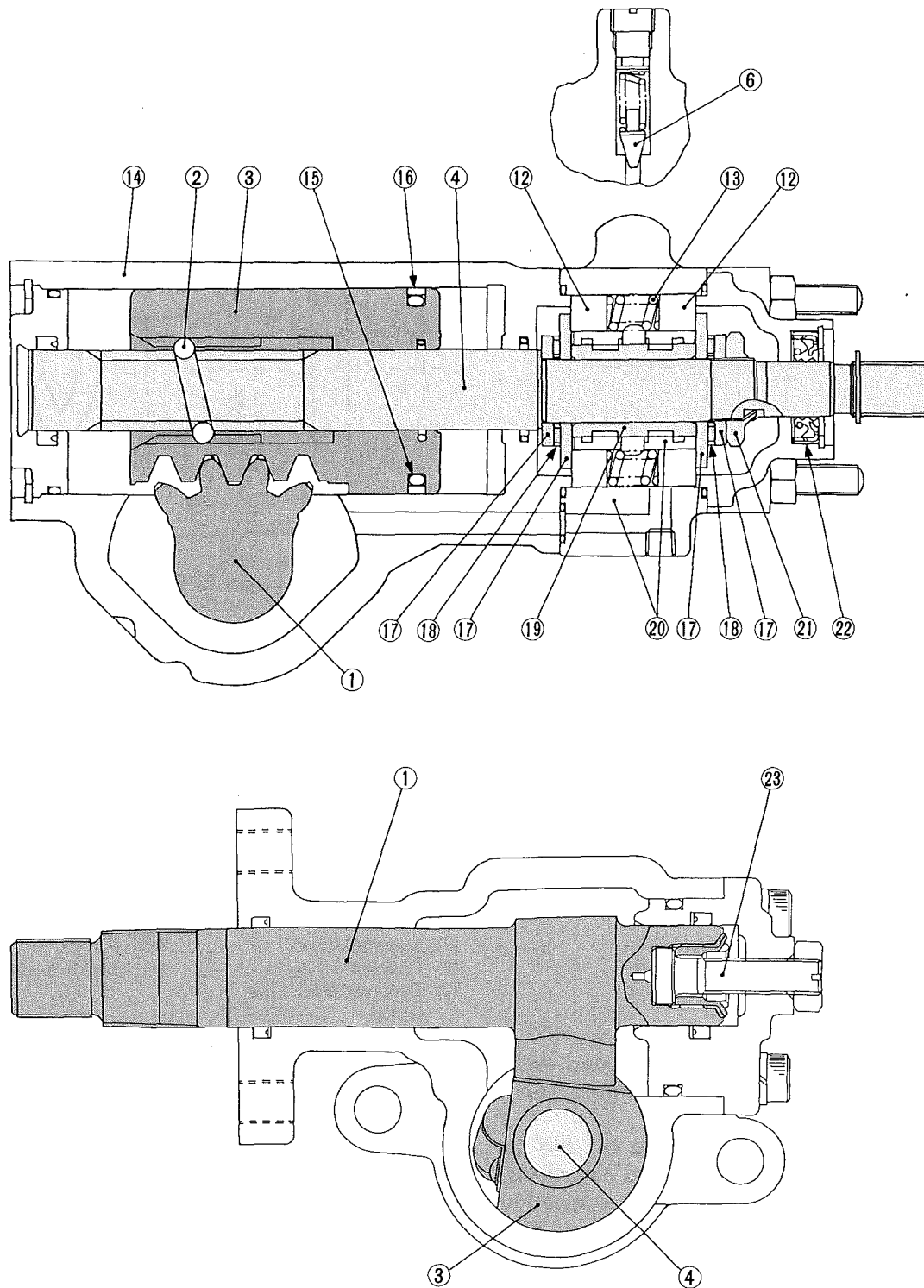
(1) O-ring

MECHANISM

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[1] HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM	7-M1
[2] POWER STEERING BODY	7-M2
[3] OIL FLOW	7-M3

[2] POWER STEERING BODY

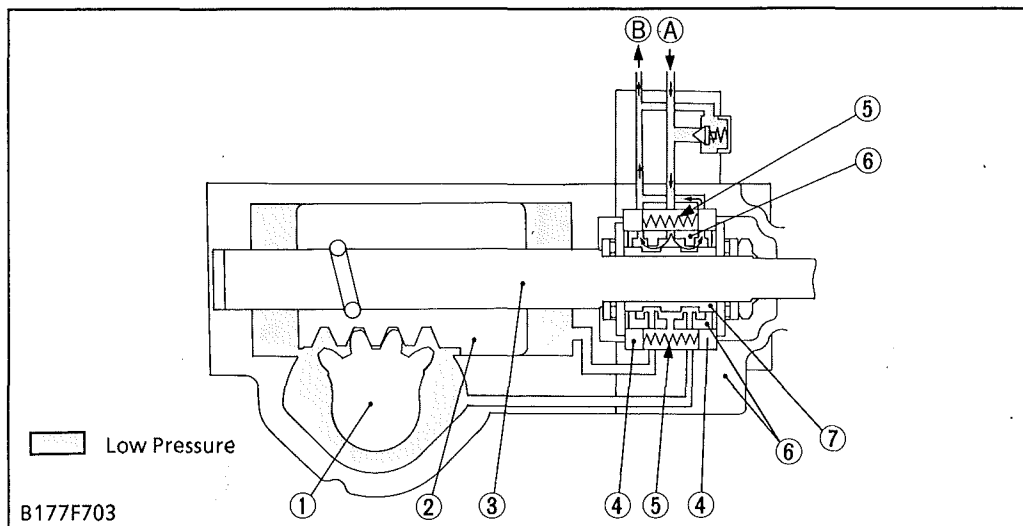


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- | | | | |
|-----------------------|------------------------|-----------------------------|-------------------------------|
| (1) Sector Gear Shaft | (12) Reaction Pistons | (16) Teflon Ring | (20) Valve Housing |
| (2) Balls | (13) Centering Springs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

[3] OIL FLOW

■ Neutral Position



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

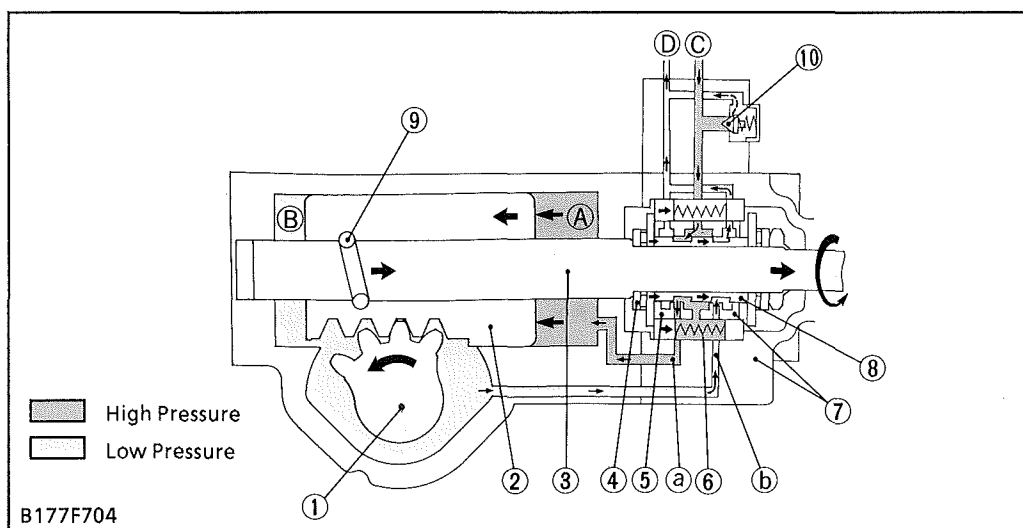
- (1) Sector Gear Shaft
 (2) Ball Nut
 (3) Worm Shaft
 (4) Reaction Pistons
 (5) Centering Spring
 (6) Valve Housing
 (7) Spool

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.

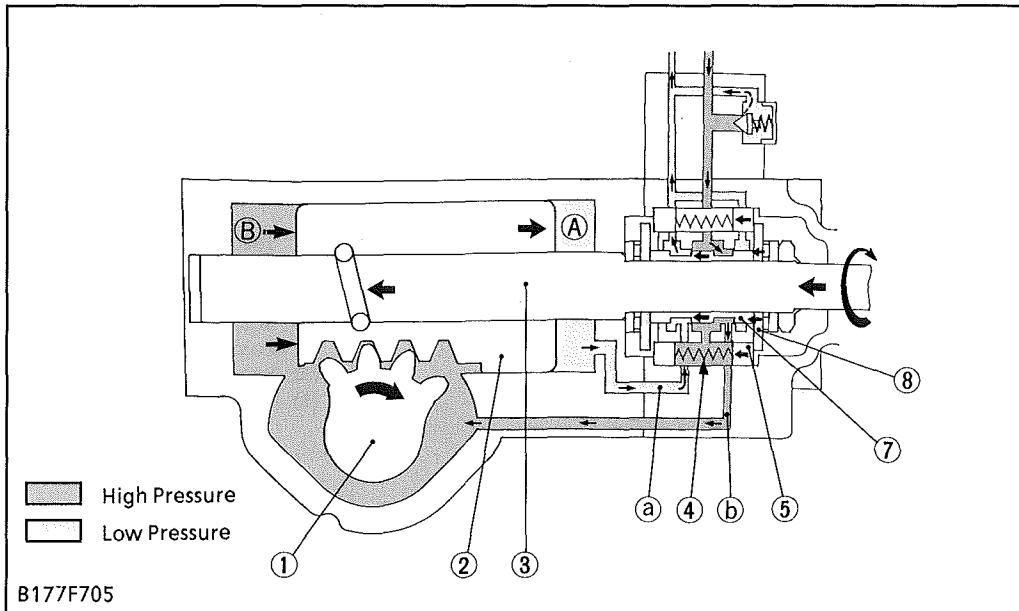
However, front wheel load stops sectors gear shaft (1) and ball nut (piston) (2) from moving, and only worm shaft (3) turns counterclockwise.

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

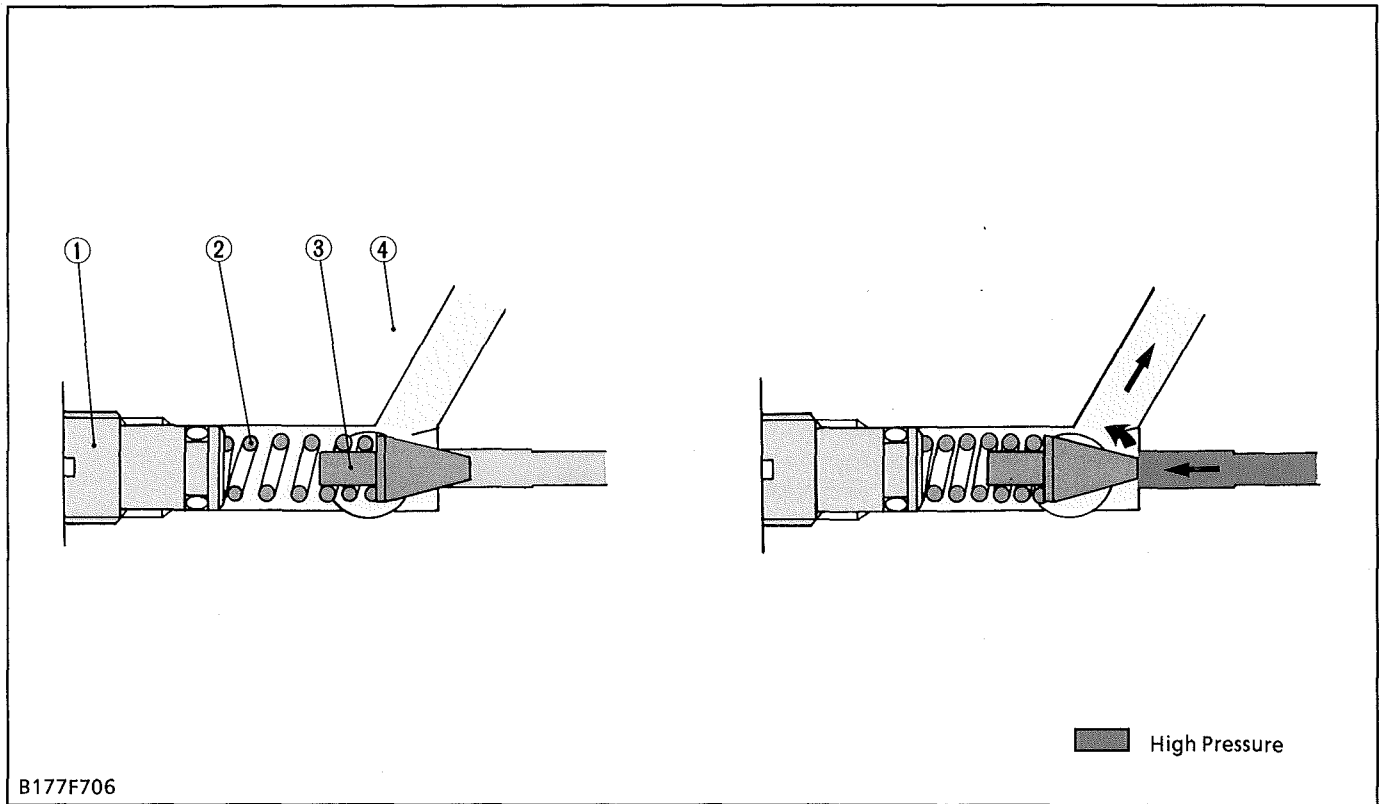
(When Engine Stops or Hydraulic Circuit Troubles)

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

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CHECKING, DISASSEMBLING AND SERVICING	7-S4
CHECKING	7-S4
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[2] POWER STEERING BODY	7-S7
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SERVICING	7-S11

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 ● Sector gear shaft worn	Replace Replace	— 7-S9
Tractor Pulls to Right or Left	● Tire pressure uneven ● Steering wheel play too small ● Improper toe-in adjustment	Adjust Adjust Adjust	G-36 7-S13 6-S3
Front Wheels Vibration	● Steering linkage worn ● Improper toe-in adjustment	Replace 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 0.2 to 1.2 in.	—
	Operation Force Condition: • Engine Speed Approx. 2600 rpm	Less than 49 N 5.0 kgf. 11 lbs.	—
Relief Valve	Setting Pressure Condition: • Engine Speed: Approx. 2600 rpm • Oil Temperature: 45 to 55°C 113 to 131°F	11.28 to 11.77 MPa 115 to 120 kgf/cm ² 1636 to 1707 psi	—
Steering Gear Box to Ball Nut	Clearance	0.035 to 0.079 mm 0.00138 to 0.00311 in.	0.15 mm 0.0059 in.
Gear Box Bore	I.D.	56.005 to 56.030 mm 2.20492 to 2.20591 in.	—
Ball Nut	O.D.	55.951 to 55.970 mm 2.20280 to 2.20354 in.	—
Bull Nut Assembly	Axial Play	0 to 0.12 mm 0 to 0.0047 in.	0.100 mm 0.00394 in.
Valve Housing to Spool	Clearance	0.005 to 0.015 mm 0.00020 to 0.00059 in.	0.025 mm 0.00098 in.
Spool	O.D.	24.995 to 25.000 mm 0.98406 to 0.98425 in.	—
Valve housing	I.D.	25.005 to 25.010 mm 0.98445 to 0.98465 in.	—
Valve housing to Piston	Clearance	0.005 to 0.030 mm 0.00020 to 0.00118 in.	0.06 mm 0.0024 in.
Piston	O.D.	9.990 to 10.005 mm 0.39331 to 0.39390 in.	—
Valve housing	I.D.	10.010 to 10.020 mm 0.39409 to 0.39449 in.	—
Sector Gear Shaft to Side Cover	Clearance	0.005 to 0.034 mm 0.00020 to 0.00206 in.	0.1 mm 0.0039 in.
Sector Gear Shaft	O.D.	27.987 to 28.000 mm 1.10185 to 1.10236 in.	
Side Cover Side	I.D.	28.005 to 28.021 mm 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 0.00158 to 0.00291 in.	0.20 mm 0.0078 in.
Sector Gear Shaft	O.D.	27.987 to 28.000 mm 1.10185 to 1.10236 in.	—
Steering Gear Box	I.D.	28.040 to 28.061 mm 1.10394 to 1.10476 in.	—
Sector Gear Shaft to Ball Nut	Backlash Deflection measured at piston arm end	Less than 0.30 mm 0.0118 in.	—
Worm Shaft	Turning Torque	Less than 0.78 N·m 0.08 kgf·m 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

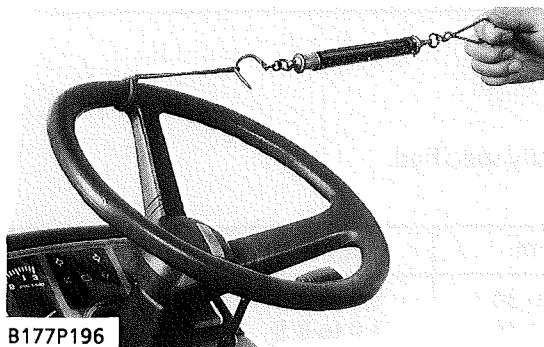
1. Refer to the backlash between sector gear shaft and ball nut on page 7-S13.

Power steering wheel play	Reference value	5.0 to 30.0 mm 0.2 to 1.2 in.
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Steering Wheel Operating Force

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.

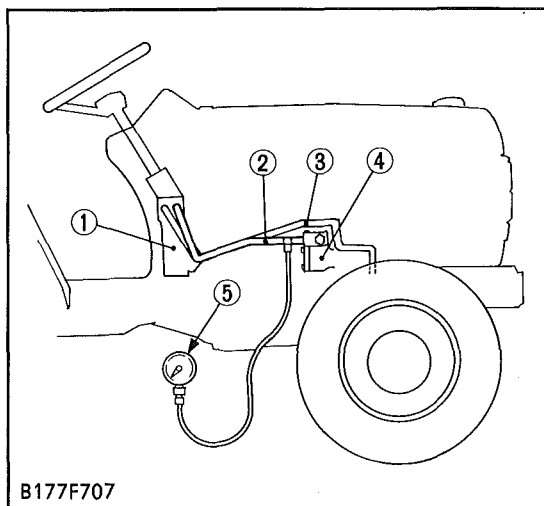
Steering wheel operating force	Factory spec.	Less than 49 N 5.0 kgf 11 lbs
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B177P196

Condition

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



B177F707

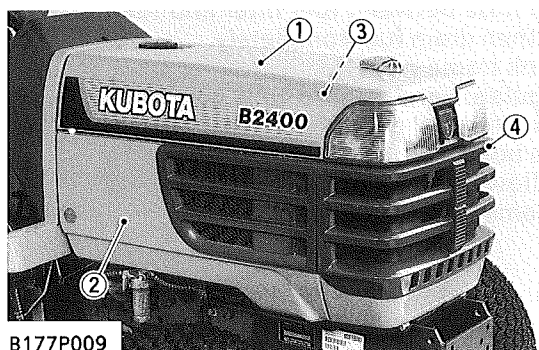
- (1) Power Steering Valve
(2) Delivery Pipe
(3) Return Pipe
(4) Hydraulic Pump
(5) Pressure Gauge

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 115 to 120 kgf/cm ² 1636 to 1707 psi
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[1] SEPARATING POWER STEERING BODY



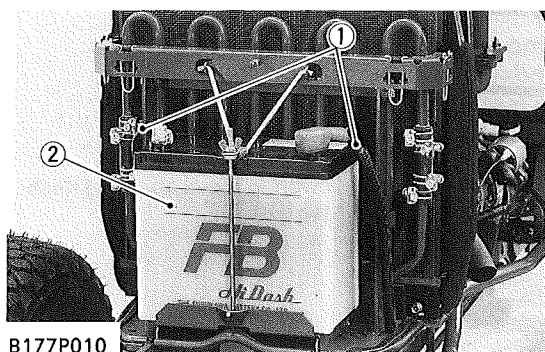
B177P009

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

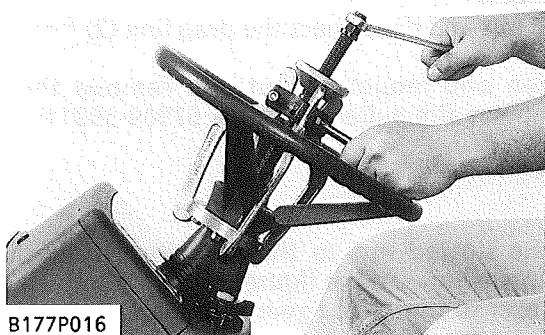
Battery

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



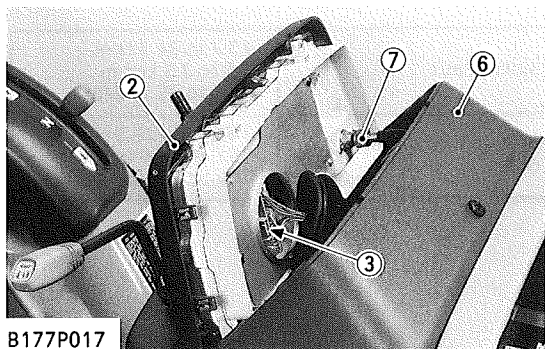
B177P016

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 3.0 to 5.0 kgf·m 21.7 to 36.2 ft·lbs
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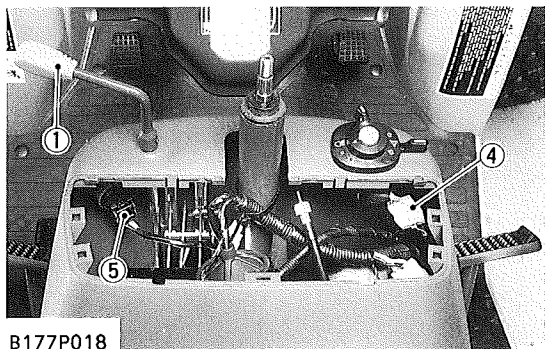
B177P017

Meter Panel and Panel Under Cover

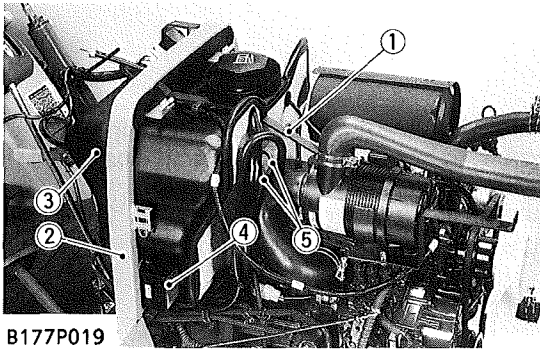
1. Remove the meter panel (2) and disconnect the meter panel connector (3) and hour-meter cable (7) from the meter panel. Then remove the meter panel.
2. Tap out the spring pin and remove the hand accelerator lever (1).
3. Disconnect the combination switch connector (4) and main switch connector (5).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

(1) Hand Accelerator Lever
(2) Meter Panel
(3) Meter Panel Connector
(4) Combination Switch Connector

(5) Main Switch Connector
(6) Panel Under Cover
(7) Hour-meter Cable



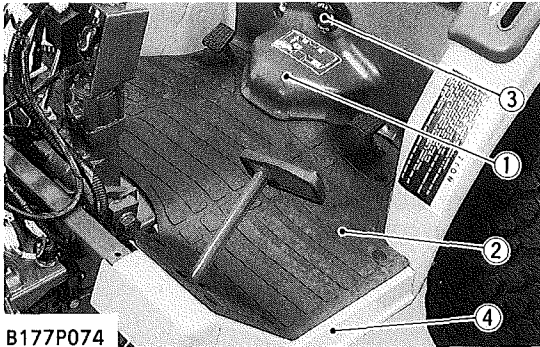
B177P018



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).

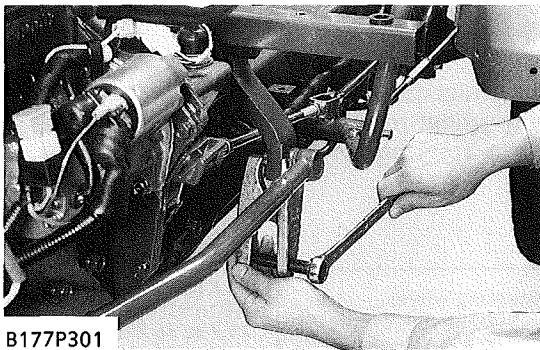
- (1) Fuel Tank Frame Stay (4) Fuse Box
(2) Fuel Tank Frame (5) Overflow Hose
(3) Fuel Tank



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 (3) Lowering Speed Adjusting Knob
(2) Rubber Mat (4) Step (LH)



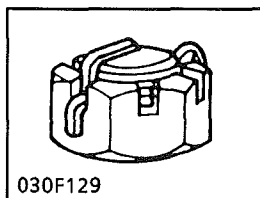
Drag Link and Pitman Arm

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

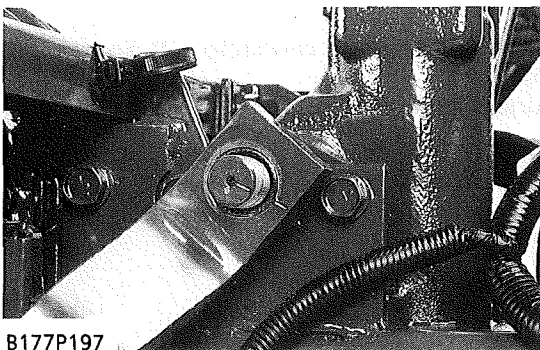
- After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.
- Install the pitman arm to the sector gear shaft so that their marks align.

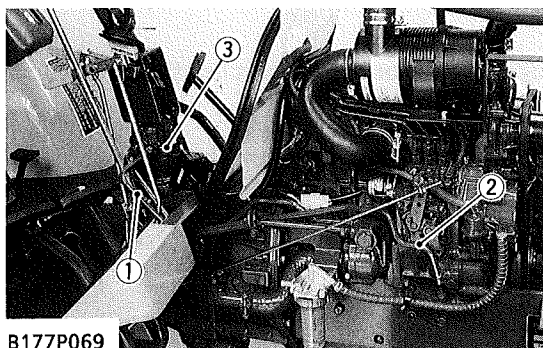


Tightening torque	Slotted nut	17.7 to 34.3 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft·lbs
	Pitman arm mounting nut	147.1 to 176.5 N·m 15.0 to 18.0 kgf·m 108.5 to 130.2 ft·lbs

(1) Pitman Arm

(2) Drag Link





B177P069
 (1) Power Steering Delivery Pipe
 (2) Power Steering Return Pipe
 (3) Power Steering Assembly

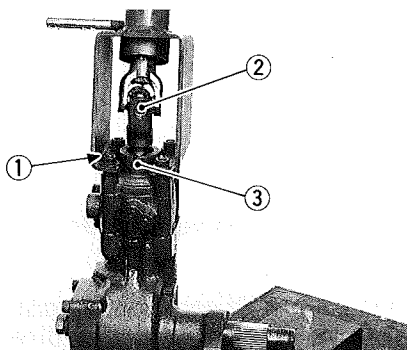
Power Steering Assembly

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.

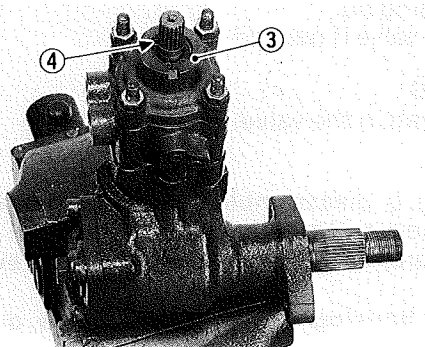
(When reassembling)

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

[2] POWER STEERING BODY DISASSEMBLING AND ASSEMBLING



B177P198



B177P199

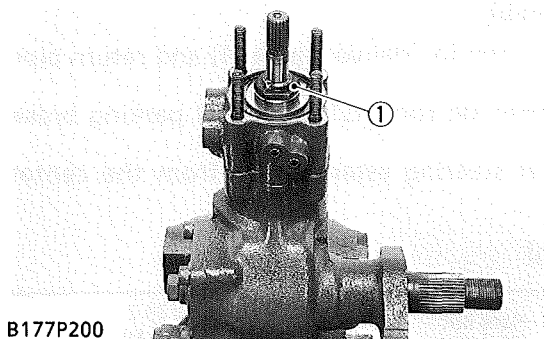
Steering Column and Top Cover

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).

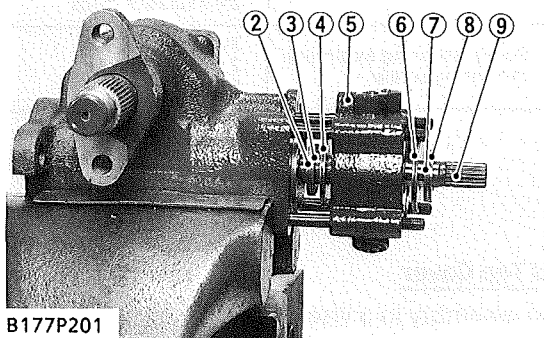
(When reassembling)

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

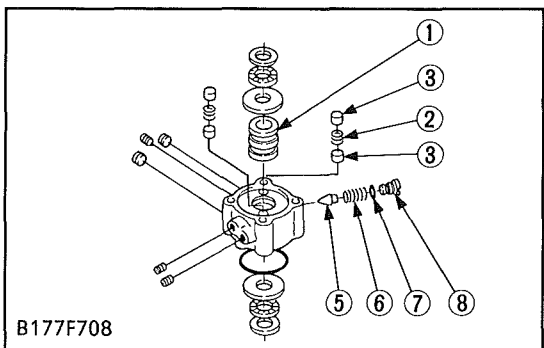
- (1) Steering Column Mounting Nut (3) Top Cover
 (2) Universal Joint (4) External Snap Ring



B177P200



B177P201



B177F708

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

Valve Assembly

1. Install the four top cover mounting nuts to the stud bolt temporarily 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 | (6) Thrust Race |
| (2) Thrust Race | (7) Thrust Needle Bearing |
| (3) Thrust Needle Bearing | (8) Thrust Race |
| (4) Thrust Race | (9) Worm Shaft |
| (5) Valve Housing | |

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.

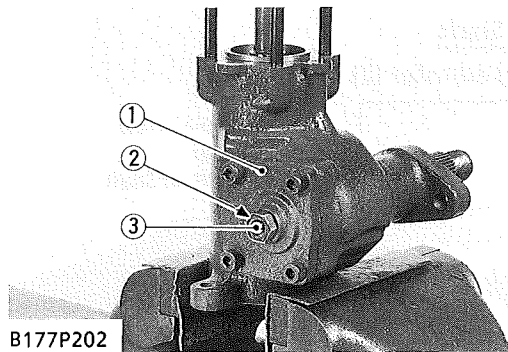
(When reassembling)

- Apply grease to seals in the valve.

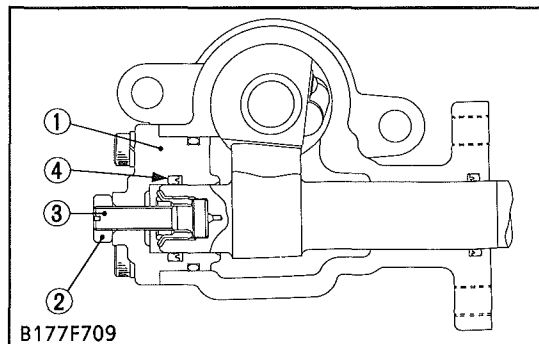
■ IMPORTANT

- 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.

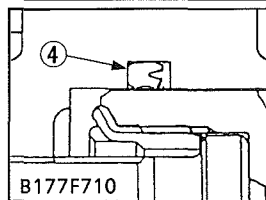
Power steering relief valve setting pressure	Factory spec.	11.28 to 11.77 MPa 115 to 120 kgf/cm ² 1636 to 1707 psi
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B177P202



B177F709



B177F710

(1) Side Cover
(2) Lock Nut

(3) Adjusting Screw
(4) U-Seal

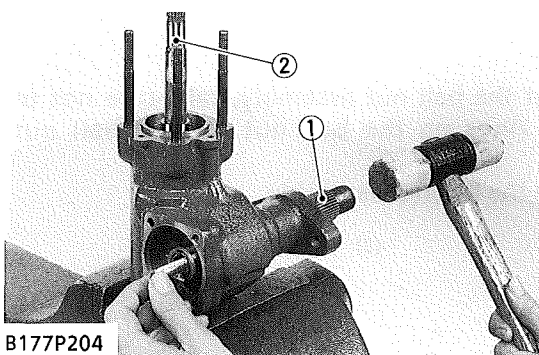
Side Cover

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).

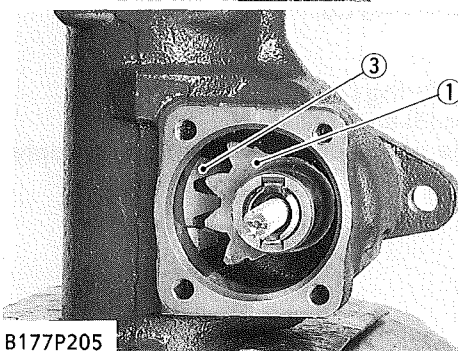
(When reassembling)

- 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 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
	Side cover mounting screw	37.3 to 56.9 N·m 3.8 to 5.8 kgf·m 27.5 to 42.0 ft-lbs



B177P204



B177P205

Sector Gear Shaft

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

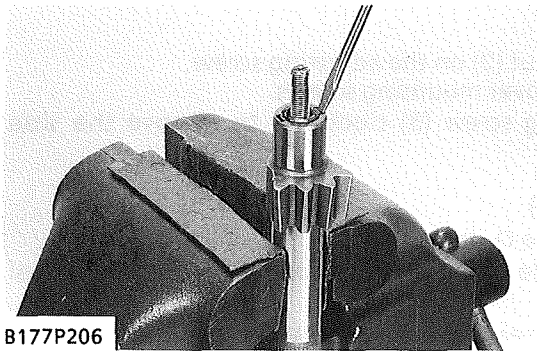
(When reassembling)

- 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

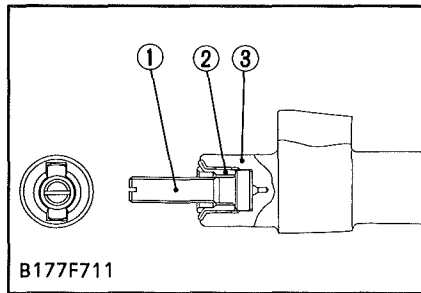
- When setting the sector gear shaft (1), take care not to damage the oil seal and U-seal in the gear box.

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



Adjuster of Sector Gear Shaft

1. Remove the stake and adjuster (2).



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

(When reassembling)

- Apply grease to the head of adjuster.

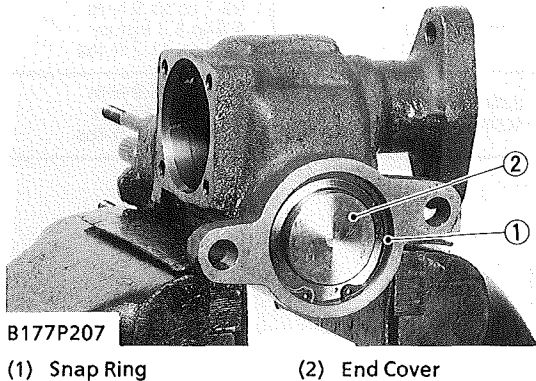
Snap Ring

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).

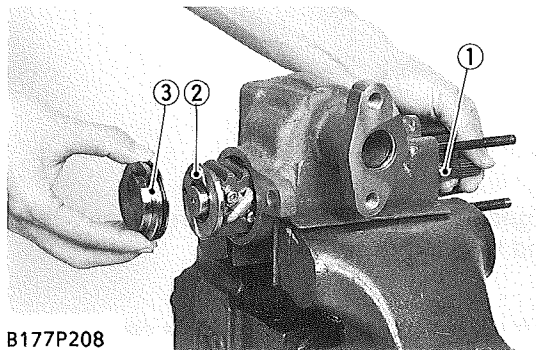


End Cover and Ball Nut Assembly

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.



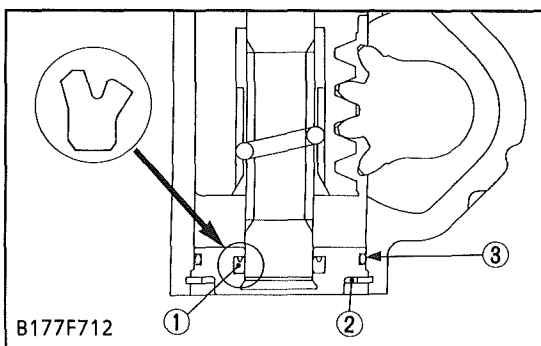
- (1) Worm Shaft (3) End Cover
(2) Ball Nut

Seal Rings on End Cover

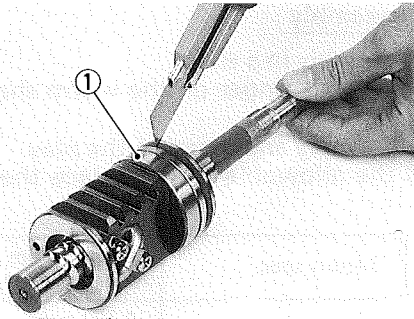
1. Remove the U-seal (1) and O-ring (3).

(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

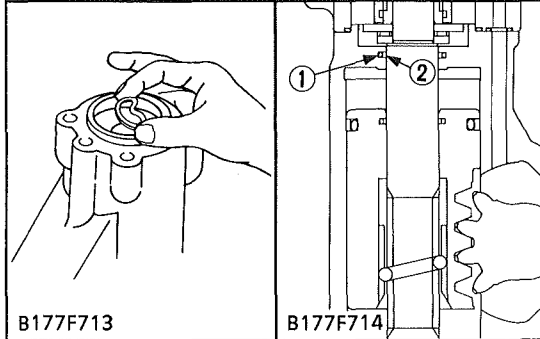
Seal Ring on Ball Nut

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

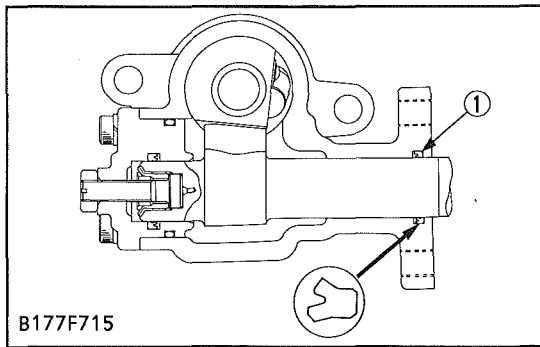
1. Remove the seal ring (1).
2. Remove the seal ring (2).

(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

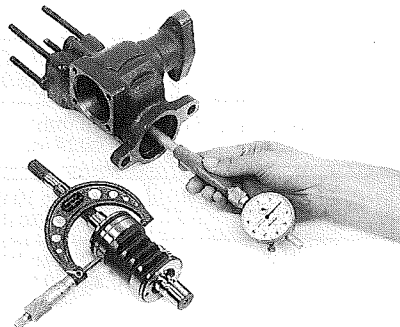
U-Seal on Gear Box

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

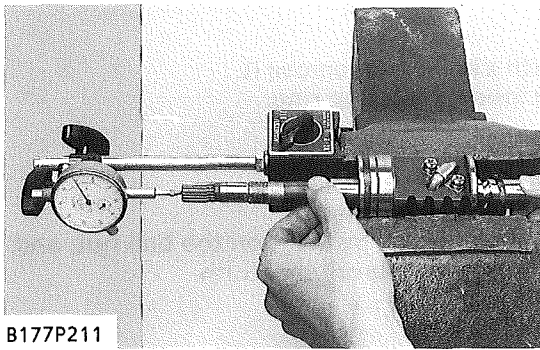
SERVICING

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 0.001 to 0.00311 in.
	Allowable limit	0.15 mm 0.0059 in.
Gear box bore I.D.	Factory spec.	56.005 to 56.030 mm 2.2049 to 2.20591 in.
Ball nut O.D.	Factory spec.	55.951 to 55.970 mm 2.20280 to 2.20354 in.

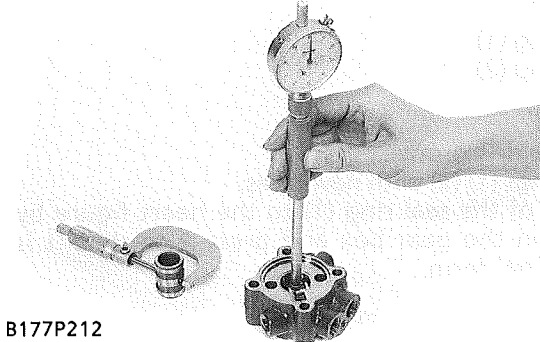


B177P211

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 0 to 0.0047 in.
	Allowable limit	0.100 mm 0.00394 in.



B177P212

Clearance between Valve Housing and Spool

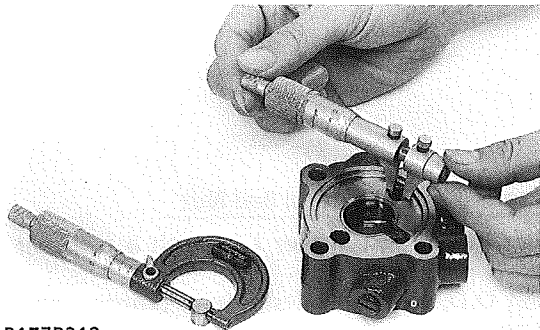
1. Measure the valve housing I.D. with a cylinder gauge and the spool O.D. with an outside micrometer, and calculate this clearance.
2. If the clearance exceeds the allowable limit, replace the spool and valve housing as a unit.

■ 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 0.00020 to 0.00059 in.
	Allowable limit	0.025 mm 0.00098 in.

Spool O.D.	Factory spec.	24.995 to 25.000 mm 0.98406 to 0.98425 in.
Valve housing I.D.	Factory spec.	25.005 to 25.010 mm 0.98445 to 0.98465 in.



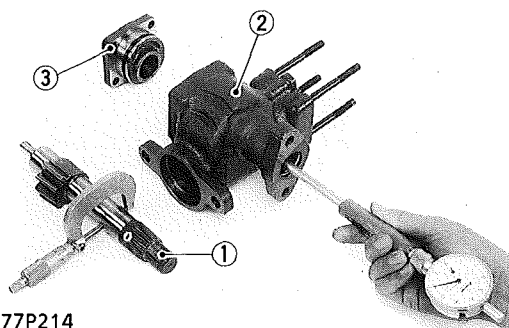
B177P213

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 0.00020 to 0.00118 in.
	Allowable limit	0.06 mm 0.0024 in.

Piston O.D.	Factory spec.	9.990 to 10.005 mm 0.39331 to 0.39390 in.
Valve housing I.D.	Factory spec.	10.010 to 10.020 mm 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

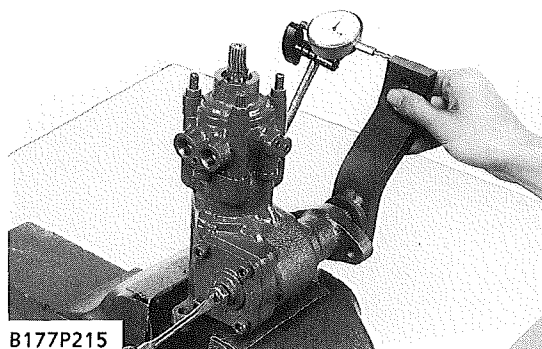
1. Measure the sector gear shaft O.D. with an outside micrometer and side cover I.D. with a cylinder gauge, and calculate the clearance.
2. If the clearance exceeds the allowable limit, replace the defective parts.

Clearance between side cover and sector gear shaft	Factory spec.	0.005 to 0.034 mm 0.00020 to 0.00206 in.
	Allowable limit	0.1 mm 0.0039 in.
Sector gear shaft O.D.	Factory spec.	27.987 to 28.000 mm 1.10185 to 1.10236 in.
Side cover I.D.	Factory spec.	28.005 to 28.021 mm 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 0.00158 to 0.00291 in.
	Allowable limit	0.20 mm 0.0078 in.
Sector gear shaft O.D.	Factory spec.	27.987 to 28.000 mm 1.10185 to 1.10236 in.
Steering gear box I.D.	Factory spec.	28.040 to 28.061 mm 1.10394 to 1.10476 in.

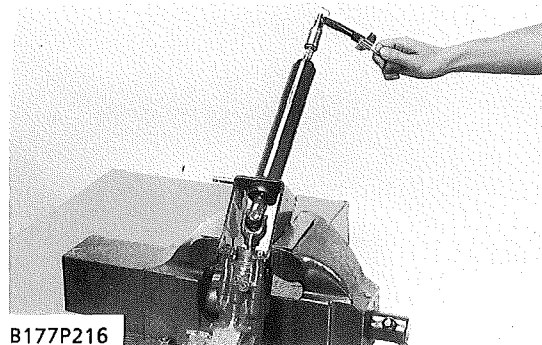


B177P215

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 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 0.58 kgf·m 0.58 ft·lbs
------------------------------	---------------	---

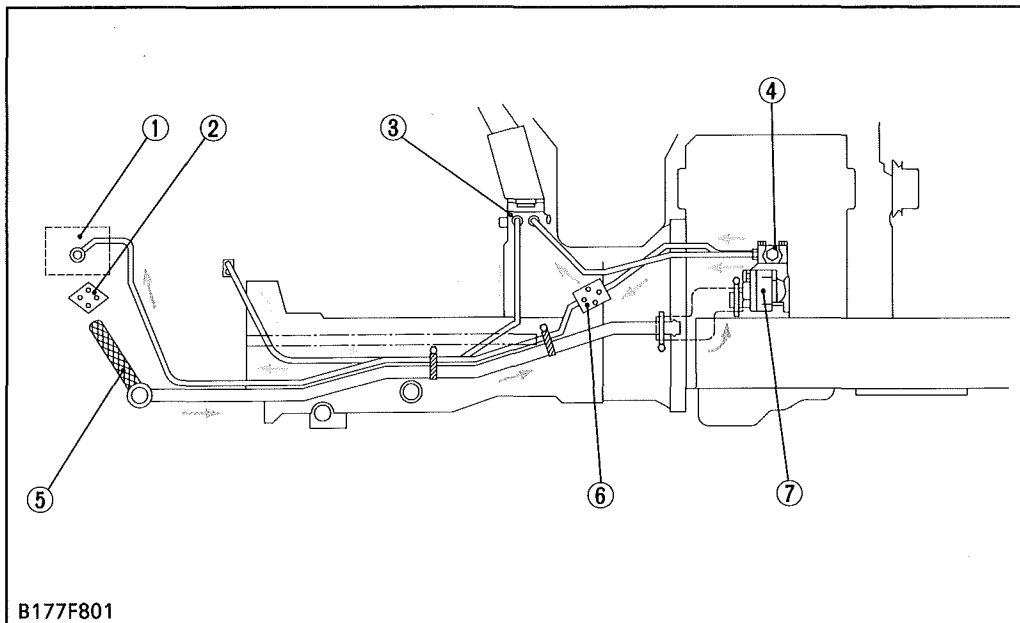
MECHANISM

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[1] HYDRAULIC CIRCUIT	8-M1
[2] HYDRAULIC PUMP	8-M3
[3] FLOW PRIORITY VALVE	8-M3
[4] POSITION CONTROL VALVE	8-M4
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[7] HYDRAULIC CYLINDER	8-M7
[8] HYDRAULIC BLOCK TYPE OUTLET	8-M8
[9] REAR HYDRAULIC OUTLET	8-M8

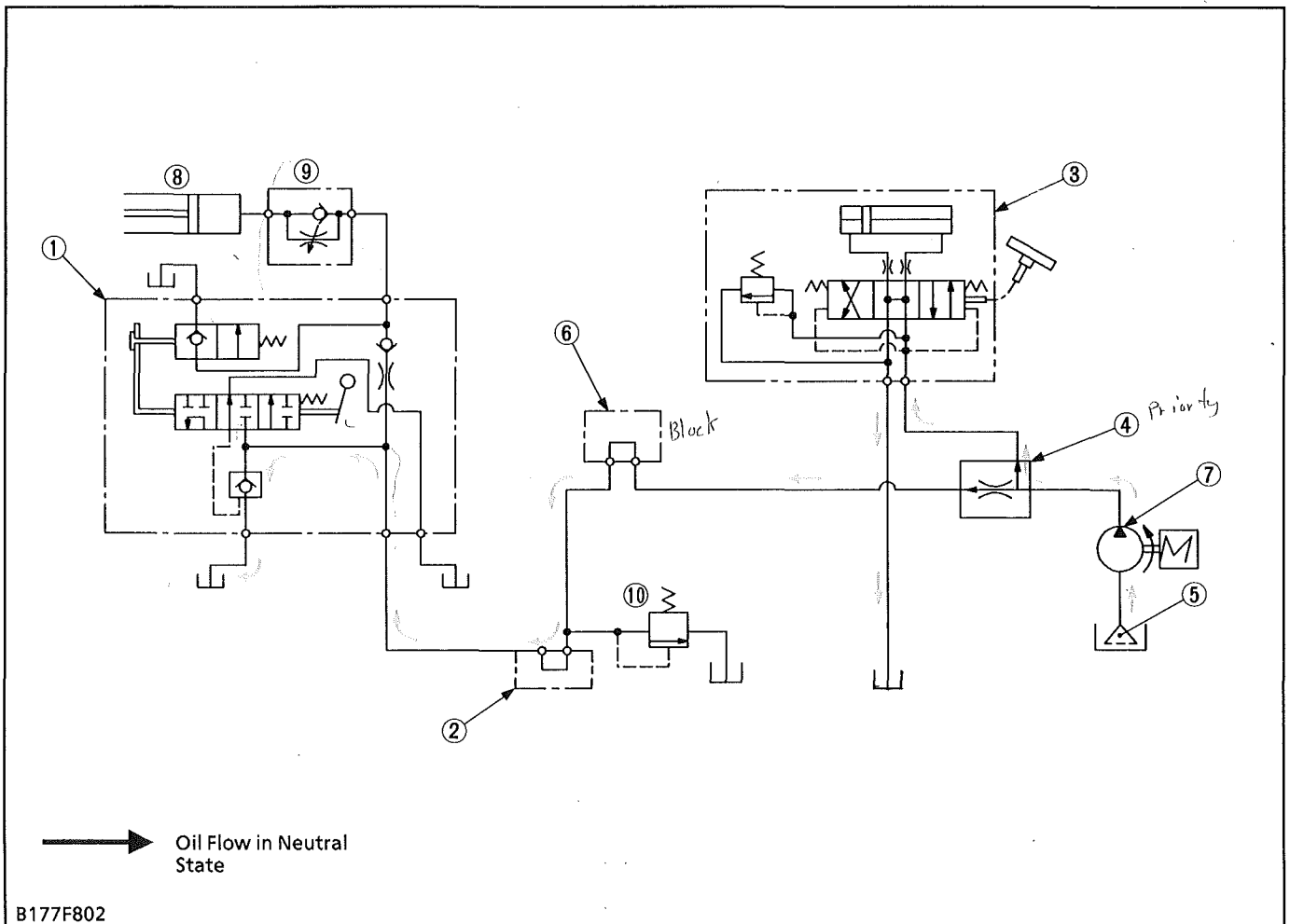
[1] HYDRAULIC CIRCUIT

MANUAL TRANSMISSION



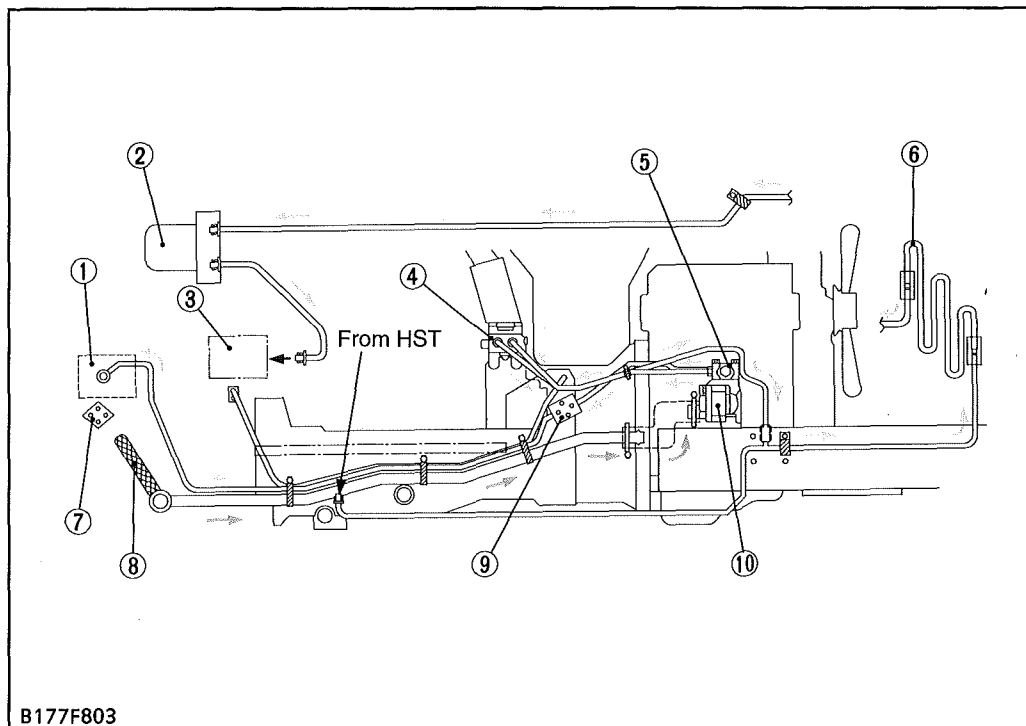
- (1) Position Control Valve
- (2) Rear Hydraulic Outlet
- (3) Power Steering
- (4) Flow Priority Valve
- (5) Oil Strainer
- (6) Hydraulic Block Type Outlet
- (7) Hydraulic Pump
- (8) Hydraulic Cylinder
- (9) Lowering Speed Adjusting Valve
- (10) Relief Valve

B177F801



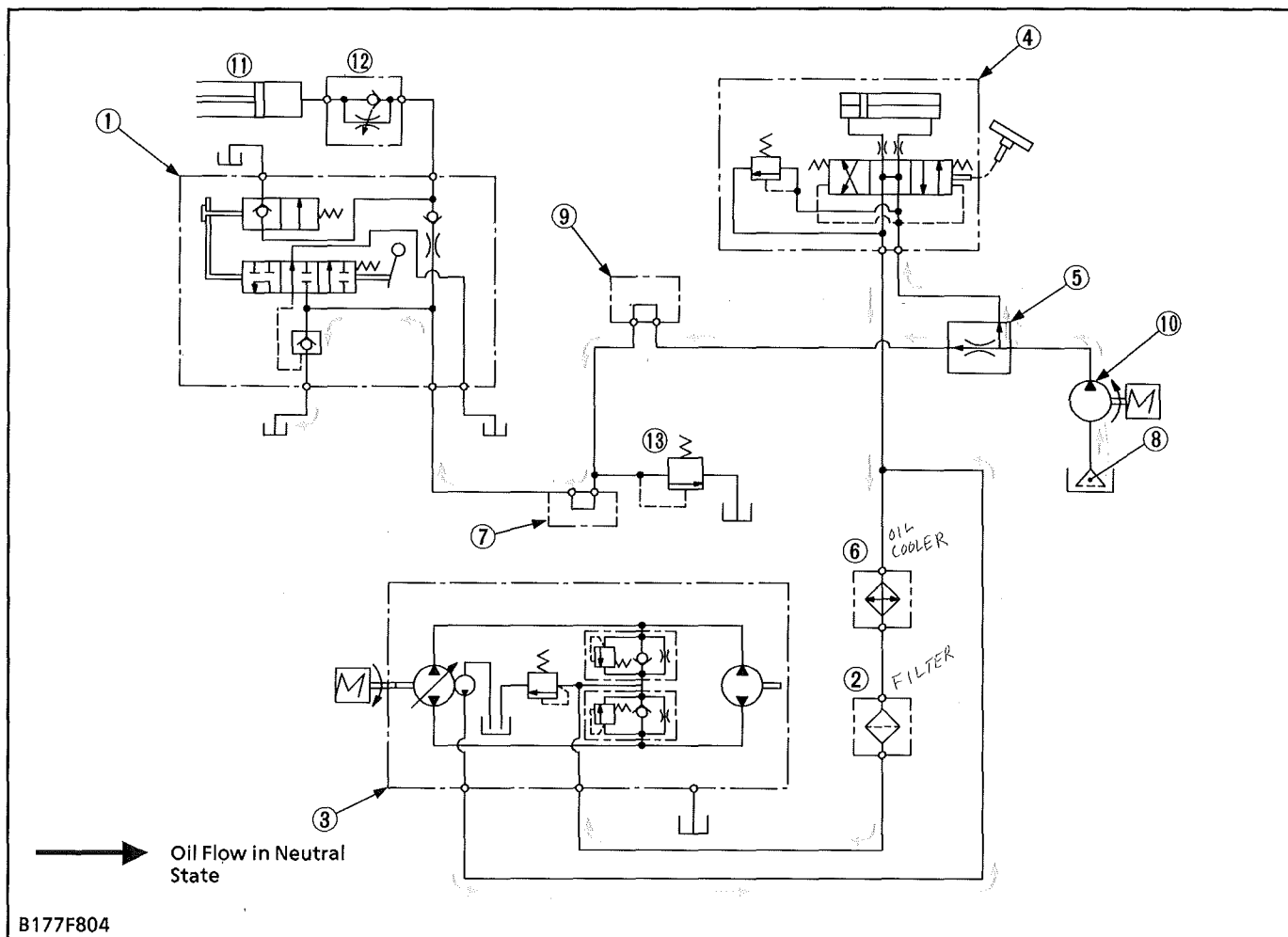
B177F802

■ HYDROSTATIC TRANSMISSION



- (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

B177F803



B177F804

Hydraulic System

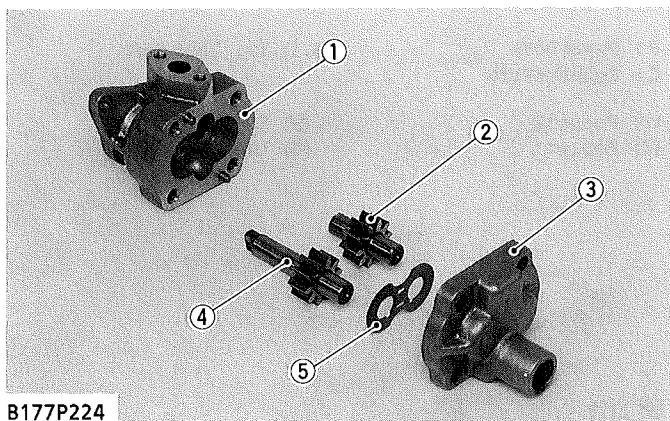
The hydraulic system of these tractors are composed of a hydraulic pump, hydraulic block type outlet, control valve, hydraulic cylinder, hydraulic oil filter and other components.

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

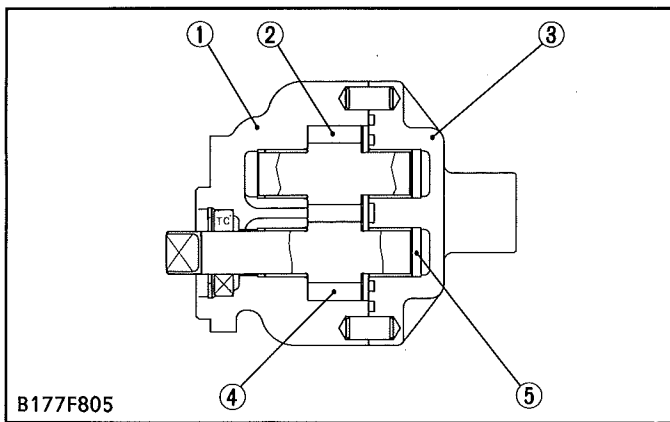
The hydraulic pump is composed of the casing (1), cover (3), side plate (5), and two spur gears (drive gear (4) and driven gear (2)) that are in mesh.

Hydraulic pump is driven by the fuel camshaft.

Maximum displacement is as follows.

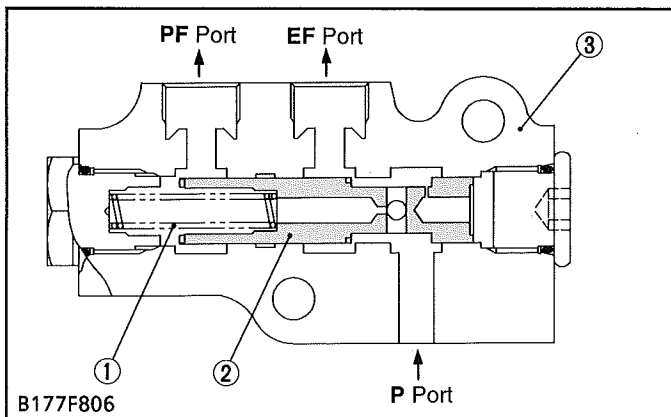
Displacement	Engine speed	Condition
22.0 l/min. 5.8 U.S. GPM 4.8 Imp. GPM	At 2600 rpm	13.2 to 13.7 MPa 135 to 140 kg/cm ² 1920 to 1991 psi

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



B177F805

[3] FLOW PRIORITY VALVE



B177F806

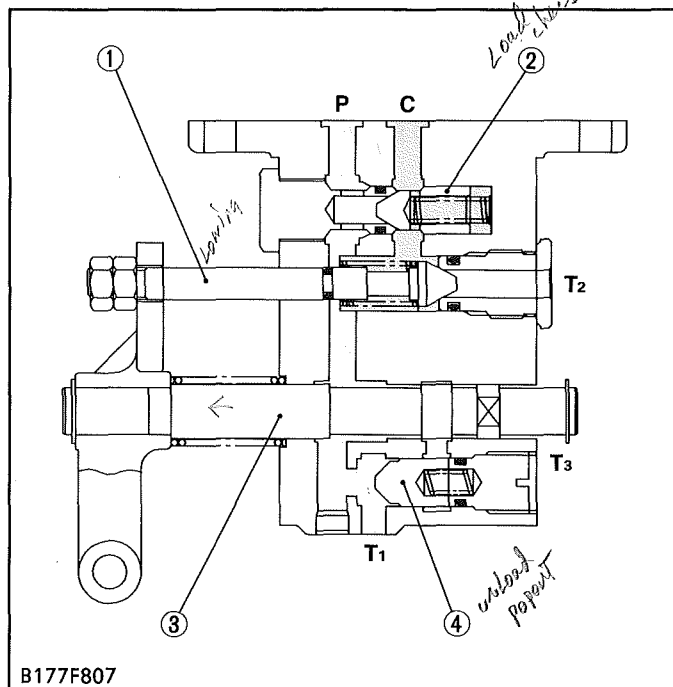
The flow priority valve is a flow divider that divides the flow from single hydraulic source (hydraulic pump) to actuates two circuits (position control circuit and power steering circuit) simultaneously.

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 | (3) Valve Body |
| (2) Spool | |

[4] POSITION CONTROL VALVE

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



■ 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.

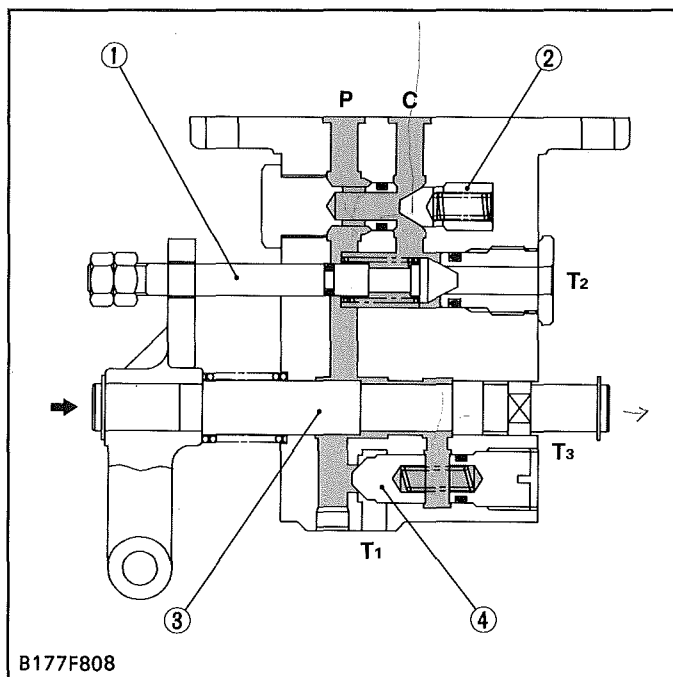
Since the poppet 2 (1) and poppet 1 (2) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

P : Pump Port
C : Cylinder Port

T1, T2, T3 : Tank Port

(1) Poppet 2
(2) Poppet 1

(3) Spool
(4) Unload Poppet



■ 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.

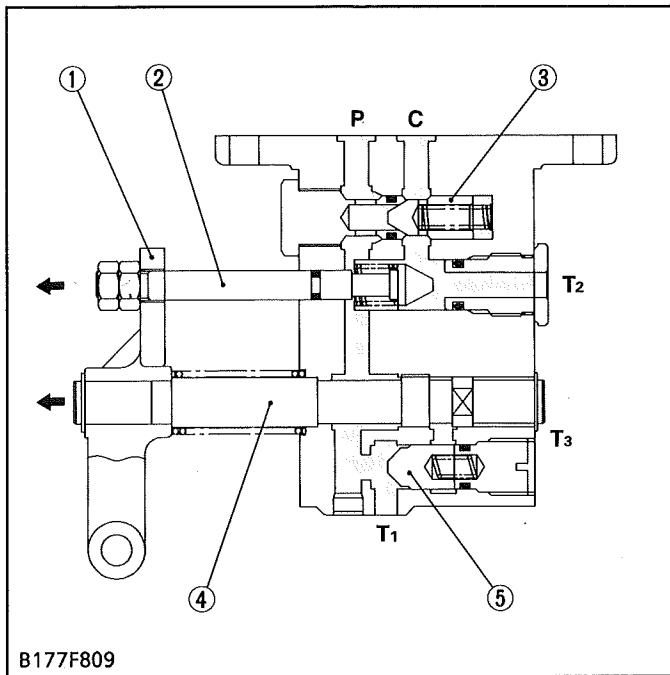
The oil pushes open the poppet 1 (2), and flows into the hydraulic cylinder through the C port to lift the implement.

P : Pump Port
C : Cylinder Port

T1, T2, T3 : Tank Port

(1) Poppet 2
(2) Poppet 1

(3) Spool
(4) Unload Poppet



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.

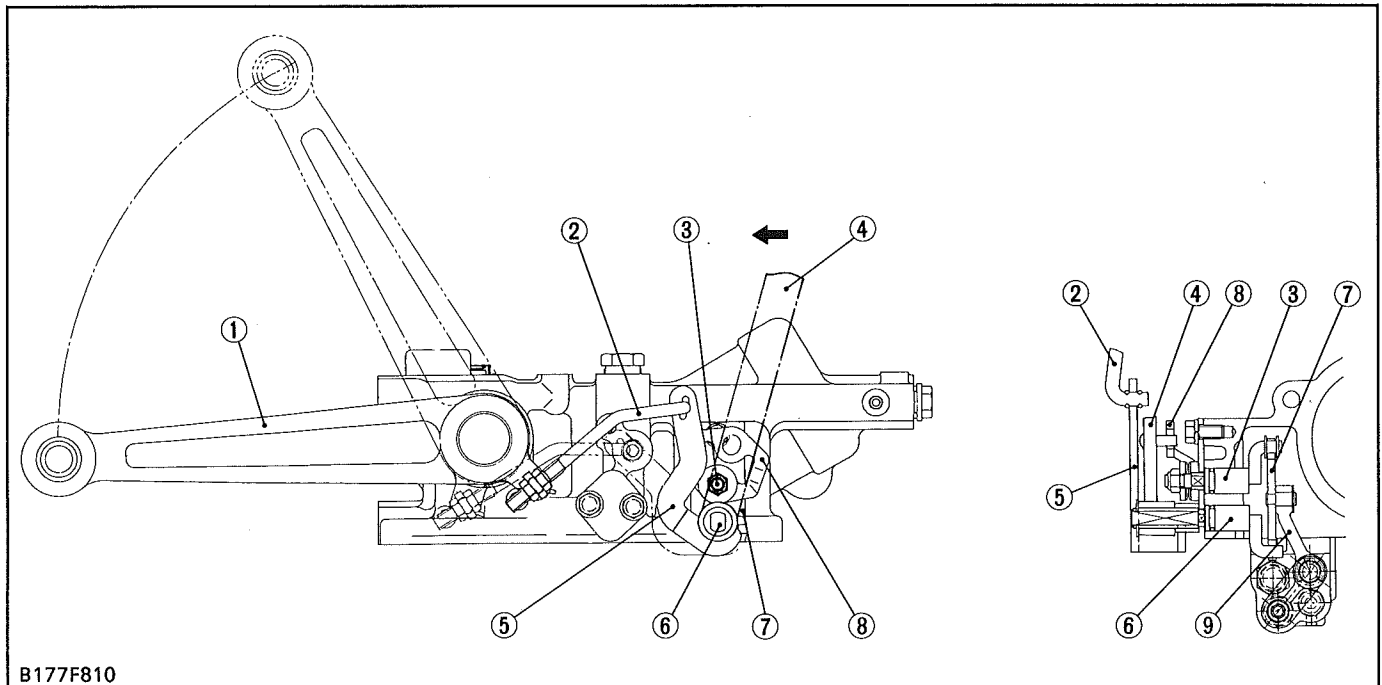
P : Pump Port
C : Cylinder Port

T1, T2, T3 : Tank Port

(1) Lever
(2) Poppet 2
(3) Poppet 1

(4) Spool
(5) Unload Poppet

[5] FEEDBACK LINKAGE FOR POSITION CONTROL



(1) Lift Arm RH
(2) Feedback Rod
(3) Control Lever Shaft

(4) Position Control Lever
(5) Feedback Arm

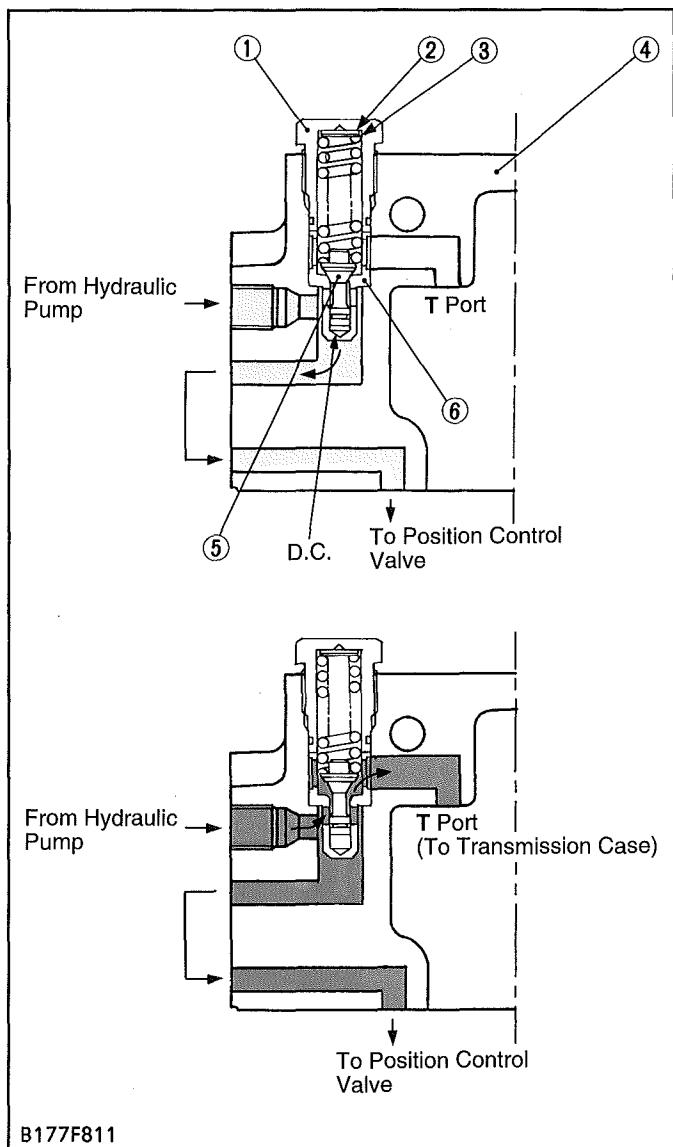
(6) Feedback Arm Shaft
(7) Connecting Link

(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

B177F811

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

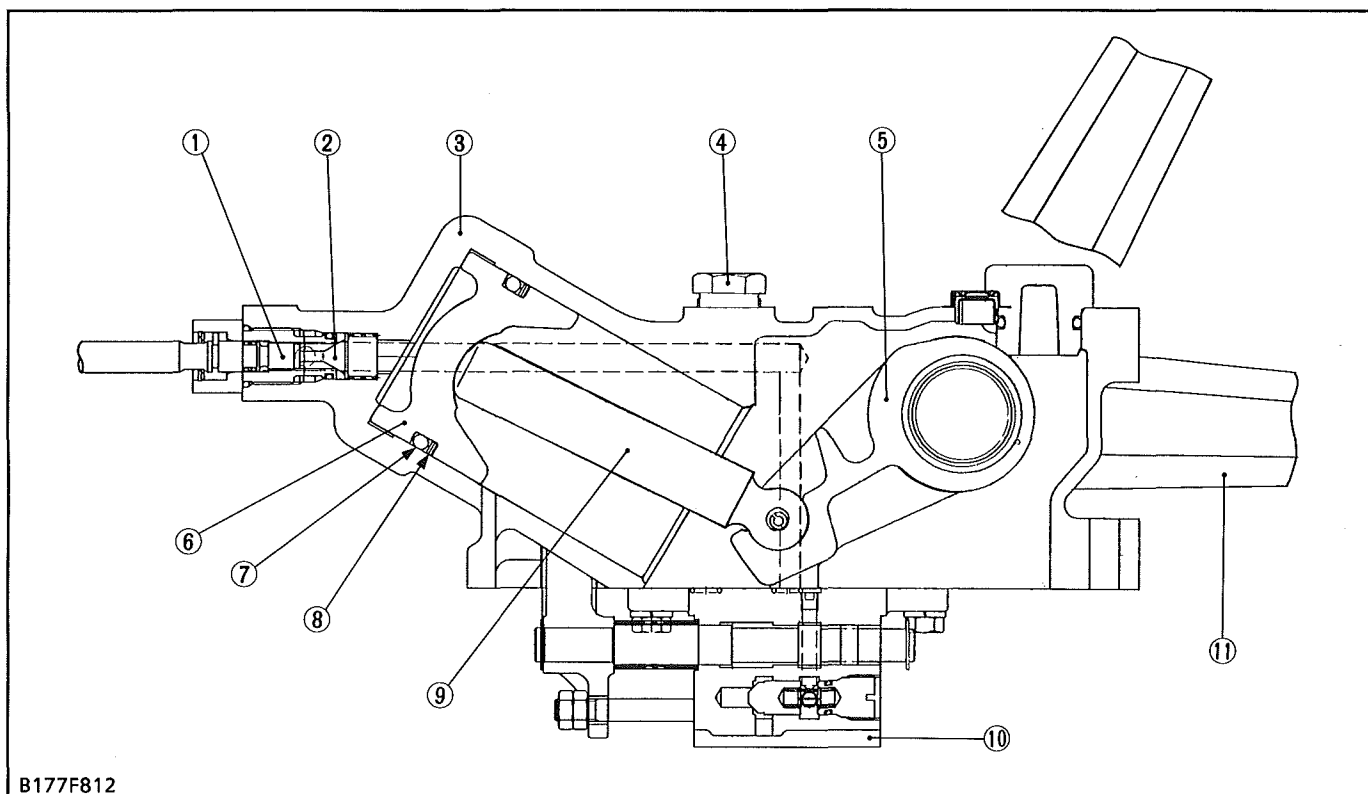
D.C. : Damping Chamber
P : Pump Port

C : Cylinder Port
T : Tank Port

- (1) Plug
- (2) Washer
- (3) Shim

- (4) Hydraulic Cylinder Body
- (5) Poppet
- (6) Seat

[7] HYDRAULIC CYLINDER



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

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

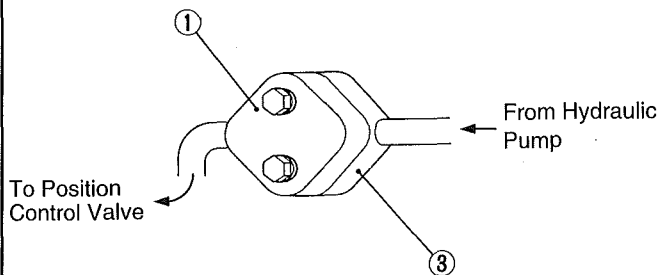
While the lift arm (11) is rising, oil from the hydraulic pump flows into the hydraulic cylinder through the position control valve (10). Then oil pushes out the piston (6).

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

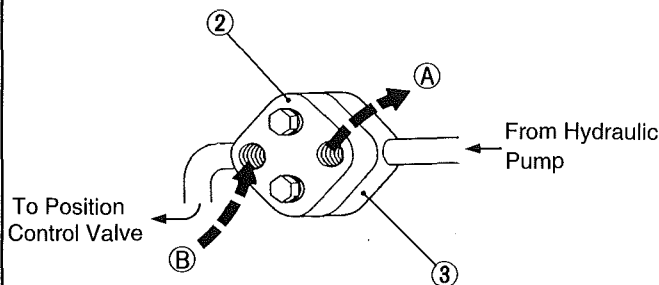
speed of the implement can be controlled by the lowering speed adjusting valve (2) attached to the hydraulic cylinder (3). Turning the lowering speed adjusting knob (1) clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve (2) is 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)

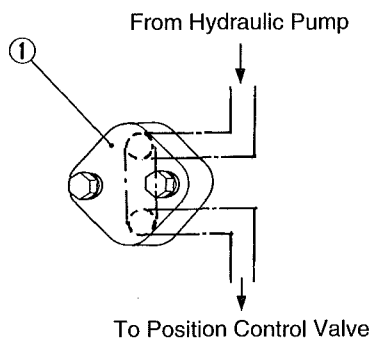
- (3) Hydraulic Block

- (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.

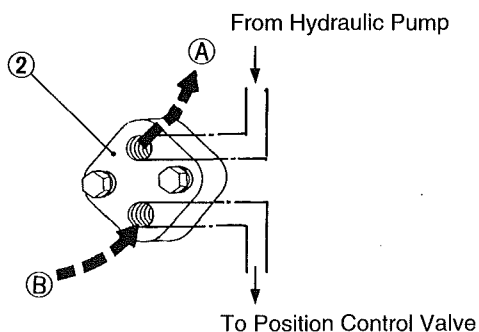
- (B) From Implement (Outlet)

[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

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TROUBLESHOOTING

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

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
[Hydraulic Pump] Pump Delivery at Engine 2600 rpm, Oil Temperature 50°C, 122°F			
	at no pressure	22.0 ℓ / min. 5.8 U.S. GPM 4.8 Imp.GPM	—
	at 14.7 MPa 150 kgf / cm ² 2133 psi	18.0 ℓ / min. 4.8 U.S.GPM 4.0 Imp.GPM	16.0 ℓ / min. 4.2 U.S. GPM 3.5 Imp.GPM
Gear Shaft to Bushing	Clearance	0.020 to 0.091 mm 0.0008 to 0.0036 in.	0.12 mm 0.0047 in.
Gear Shaft	O.D.	14.970 to 14.980 mm 0.5894 to 0.5898 in.	—
Bushing	I.D.	15.000 to 15.061 mm 0.5906 to 0.5930 in.	—
Side Plate	Thickness	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.
Gear to Casing	Clearance	—	0.15 mm 0.0059 in.
Lift Arm	Free Play	5 to 10 mm 0.20 to 0.40 in.	—
Relief Valve	Setting Pressure	13.2 to 13.7 MPa 135 to 140 kgf/cm ² 1920 to 1991 psi	—
Hydraulic Cylinder	I.D.	70.05 to 70.10 mm 2.7579 to 2.7598 in.	70.15 mm 2.7618 in.
Hydraulic arm shaft to Bushing	Clearance	0.020 to 0.110 mm 0.0008 to 0.0043 in.	0.30 mm 0.0118 in.
Hydraulic arm shaft Right	O.D.	37.925 to 37.950 mm 1.4931 to 1.4941 in.	—
Hydraulic arm shaft, Left	O.D.	33.925 to 33.950 mm 1.3356 to 1.3366 in.	—
Bushing, Right	I.D.	37.970 to 38.035 mm 1.4949 to 1.4974 in.	—
Bushing, Left	I.D.	33.970 to 34.035 mm 1.3374 to 1.3400 in.	—

TIGHTENING TORQUES

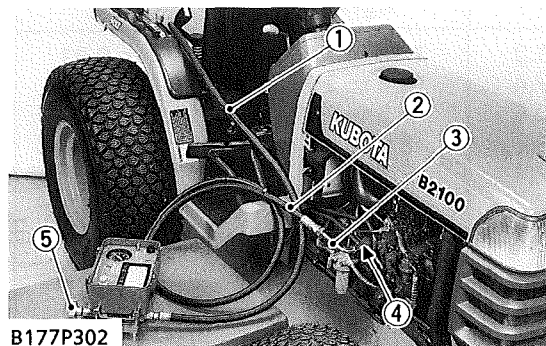
Tightening torques of screws and nuts on the table below is especially specified.
(For general use screws and nuts: See page G-8)

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 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 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

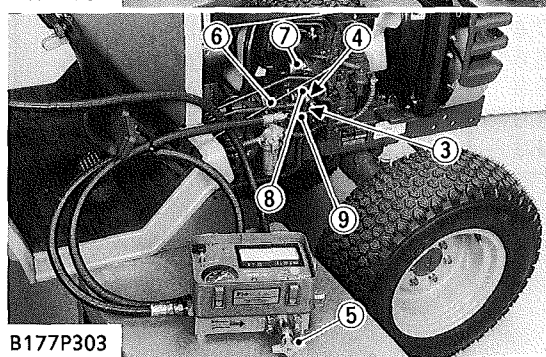
CHECKING, DISASSEMBLING AND SERVICING

[1] HYDRAULIC PUMP

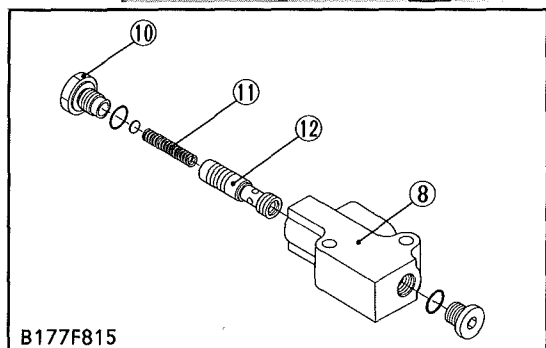
CHECKING AND ADJUSTING



B177P302



B177P303



B177F815

Flowmeter Connecting and Test Preparation

■ IMPORTANT

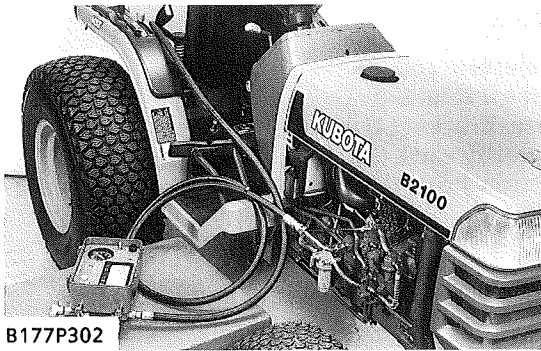
- When using a flowmeter other than KUBOTA specified flowmeter (Code No.: 07916-52791), be sure to use the instructions with that flowmeter.
- In this hook-up, there is no relief valve. Therefore while testing, do not close the flowmeter loading valve completely.

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 | (7) Fuel Cut Off Solenoid |
| (2) Hydraulic Test Hose | (8) Flow Priority Valve Body |
| (3) Adaptor 66 | (9) Hydraulic Pump |
| (4) Adaptor 69 | (10) Plug |
| (5) Loading Valve | (11) Spring |
| (6) Accelerator Rod | (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.	22 ℓ / min. Above 5.8 U.S. GPM 4.8 Imp. GPM
Hydraulic pump delivery at rated pressure	Factory spec.	18 ℓ / min. Above 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

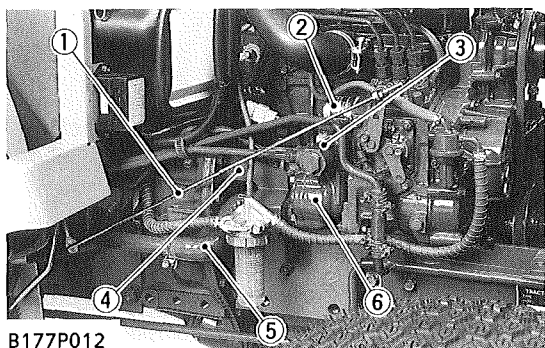
B177P009

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

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 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
-------------------	----------------------	---

- (1) Cover

Oil Seal

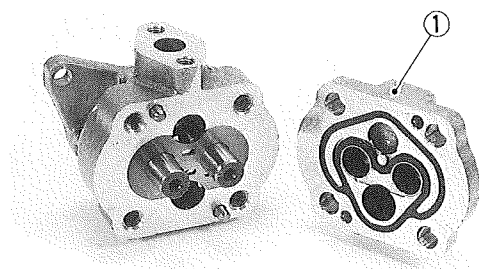
1. Remove the internal snap ring (2), and remove the oil seal (1).

(When reassembling)

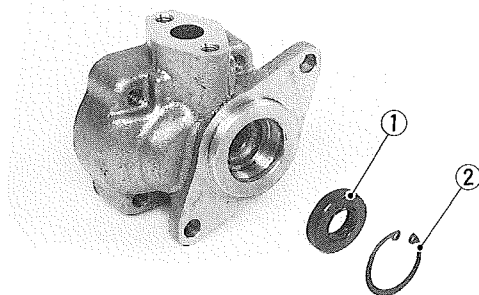
- If the oil seal is defective, worn or scratched, replace it.

- (1) Oil Seal

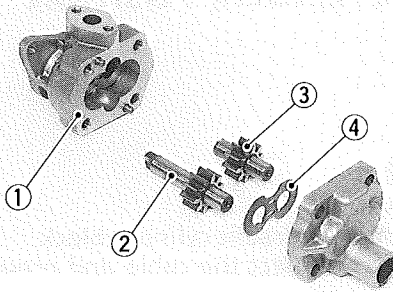
- (2) Internal Snap Ring



B177P222



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).

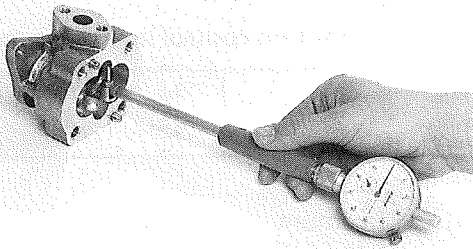
(When reassembling)

- 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

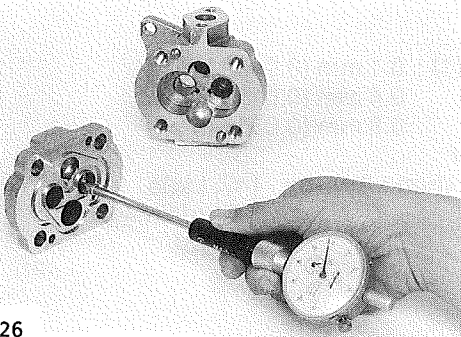


B177P225

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 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.

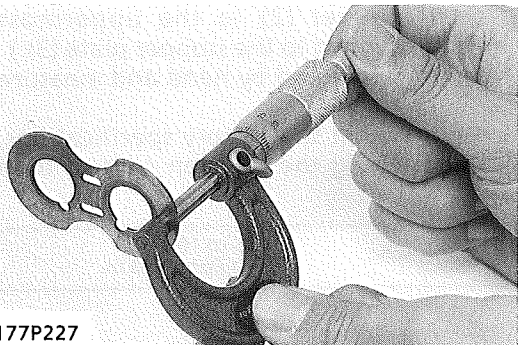
Clearance between bushing and shaft	Factory spec.	0.020 to 0.091 mm 0.0008 to 0.0036 in.
	Allowable limit	0.12 mm 0.0047 in.

Shaft O.D.	Factory spec.	14.970 to 14.980 mm 0.5894 to 0.5898 in.
Bushing I.D.	Factory spec.	15.000 to 15.061 mm 0.5906 to 0.5930 in.

Side Plate Thickness

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

Side plate thickness	Factory spec.	2.48 to 2.50 mm 0.0976 to 0.0984 in.
	Allowable limit	2.40 mm 0.0945 in.



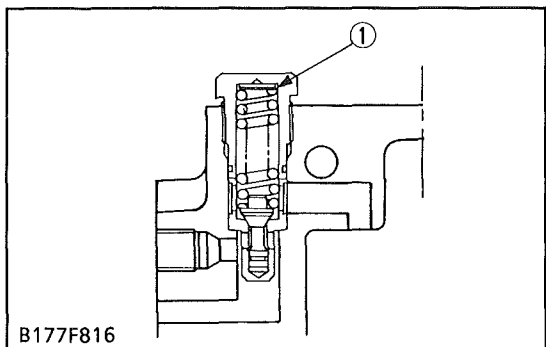
B177P227

[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 135 to 140 kgf/cm ² 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/cm²
21.3 psi

(1) Shim

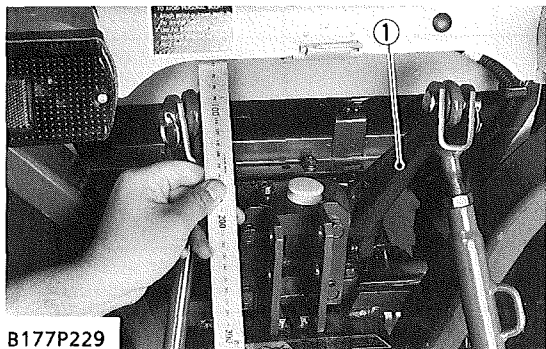
Lift Arm Free Play

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.

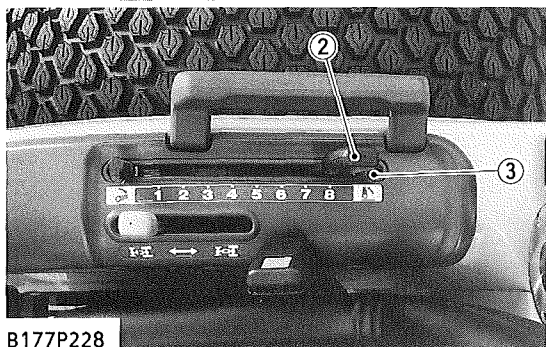
Lift arm free play	Factory spec.	5 to 10 mm 0.20 to 0.40 in.
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- (1) Lift Arm
(2) Position Control Lever

(3) Stopper Plate



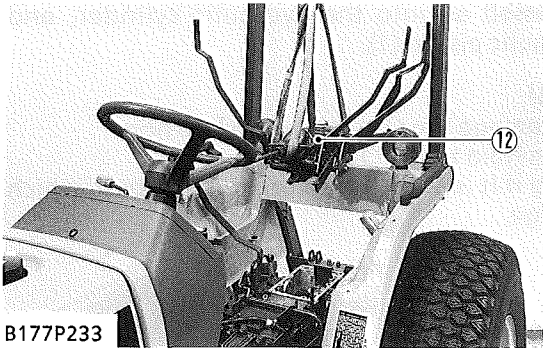
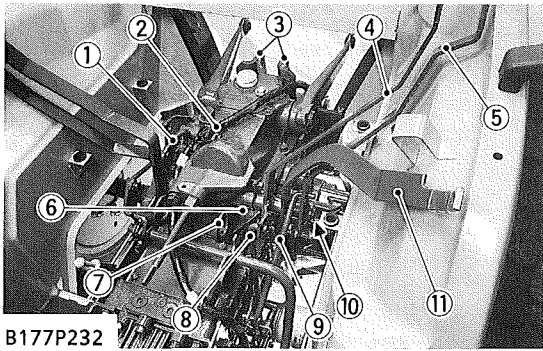
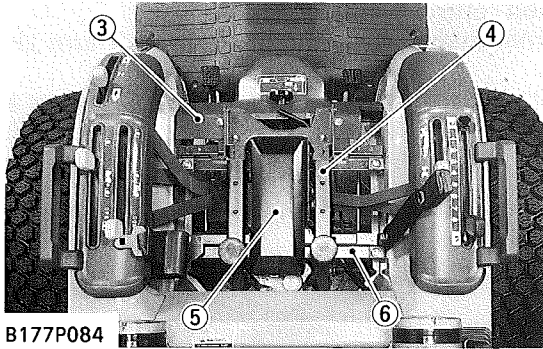
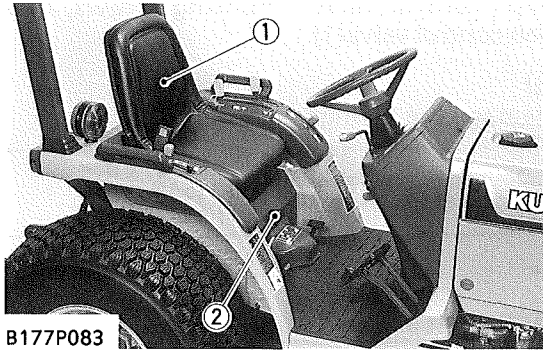
B177P229



B177P228

DISASSEMBLING AND ASSEMBLING

(1) Separating Hydraulic Cylinder Assembly



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

Hydraulic Cylinder Assembly

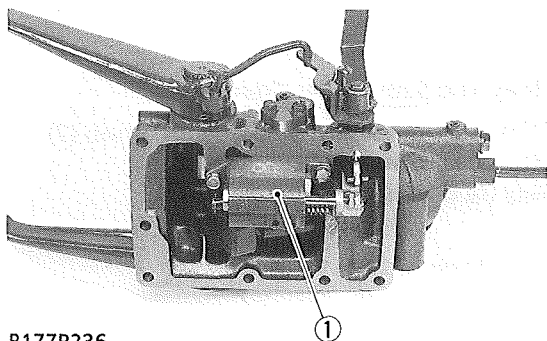
1. Remove the top link and disconnect the lift rods.
2. Disconnect the wiring harness (2) and delivery pipe (1).
3. Remove the external snap ring (10).
4. Move the levers (4), (5), (11) to outside and disconnect the rods (8), (9).
5. Remove the hook (7), connecting plate (6) and top link bracket (3).
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 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Top link bracket mounting screws	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Hydraulic cylinder assembly mounting screws and nuts	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

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

(2) Disassembling Hydraulic Cylinder Assembly



Position Control Valve

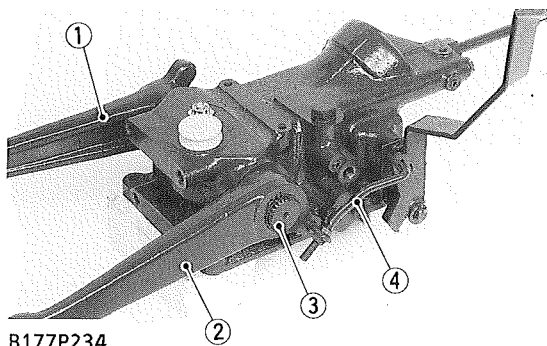
1. Remove the position control valve mounting screws, and remove the position control valve(1).

(When reassembling)

- Take care not to damage the O-rings.

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

(1) Position Control Valve

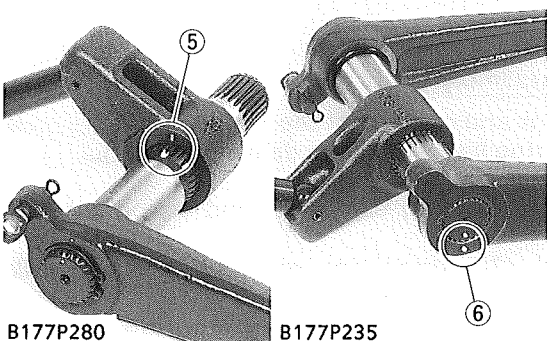


Lift Arm, Hydraulic Arm Shaft and Hydraulic Arm

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.

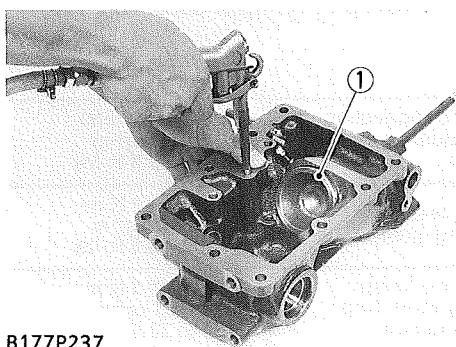
(When reassembling)

- 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.



- (1) Lift Arm LH
(2) Lift Arm RH
(3) Hydraulic Arm Shaft

- (4) Feedback Rod
(5) Alignment Marks
(6) Alignment Marks



Hydraulic Piston

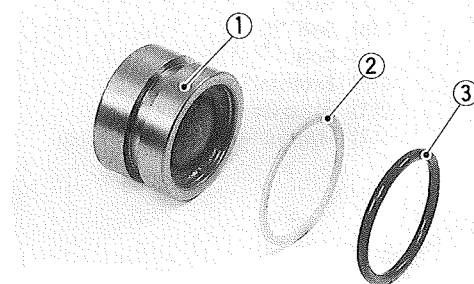
1. Inject the compressed air into the hydraulic cylinder, and take out the hydraulic piston (1).

(When reassembling)

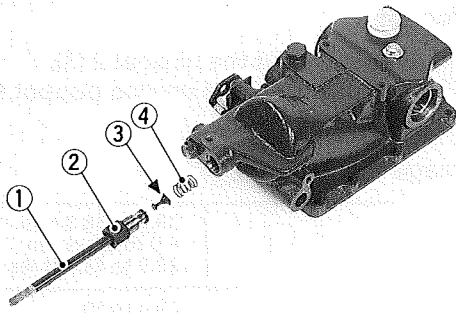
- Take care not to damage the O-ring and backup ring.
- Apply transmission fluid to the O-ring.
- Replace the O-ring if it is defective, worn or scratched, which may cause oil leakage.

- (1) Hydraulic Piston
(2) Backup Ring

- (3) O-ring



B177P238



B177P242

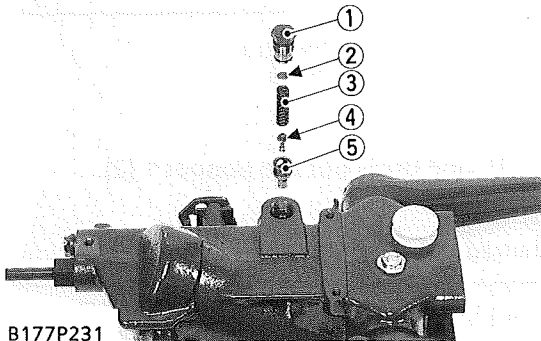
Lowering Speed Adjusting Valve

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 | (3) Poppet |
| (2) Lowering Speed Adjusting Valve Body | (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.

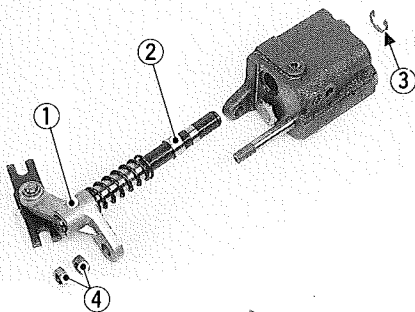
Tightening torque	Relief valve plug	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs
-------------------	-------------------	---

■ IMPORTANT

- After disassembling and assembling the relief valve, be sure to adjust the relief valve setting pressure.

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

(3) Disassembling Position Control Valve



B177P239

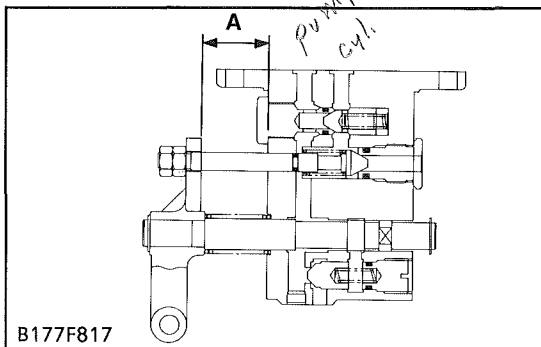
Spool

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.

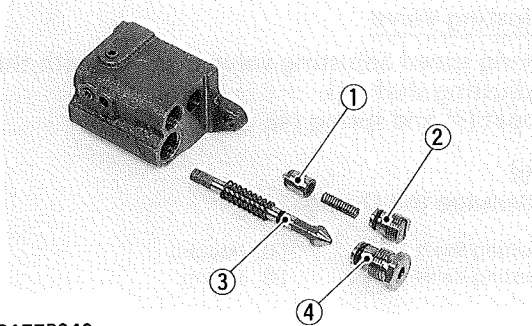
- | | |
|-----------|---------------|
| (1) Lever | (3) Snap Ring |
| (2) Spool | (4) Nuts |



B177F817

Adjustment

Screw down Nuts untill
Air shuts off then 1/2 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).

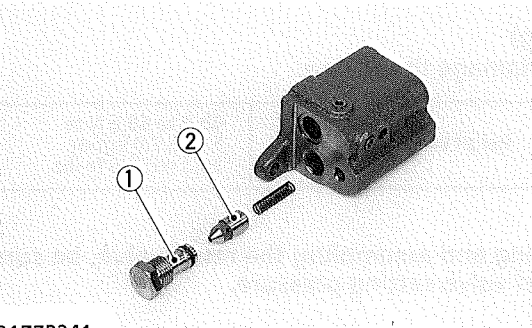
(When reassembling)

- Take care not to damage the O-ring.

Tightening torque	Plug 3	39.2 to 58.8 N·m 4.0 to 6.0 kgf·m 28.9 to 43.4 ft-lbs
	Plug 2	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 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)

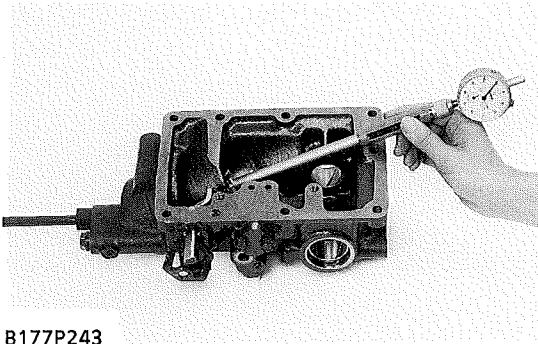
- Take care not to damage the O-ring.

Tightening torque	Plug 1	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs
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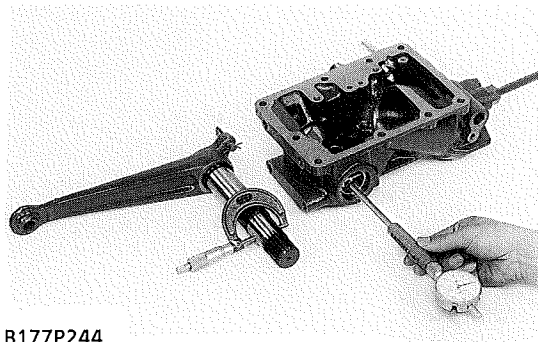
- (1) Plug 1

- (2) Poppet 1

SERVICING



B177P243



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 2.7579 to 2.7598 in.
	Allowable limit	70.15 mm 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 0.0008 to 0.0043 in.
		Allowable limit	0.30 mm 0.0118 in.
	Left	Factory spec.	0.020 to 0.110 mm 0.0008 to 0.0043 in.
		Allowable limit	0.30 mm 0.0118 in.
Hydraulic arm shaft O.D.	Right	Factory spec.	37.925 to 37.950 mm 1.4931 to 1.4941 in.
	Left	Factory spec.	33.925 to 33.950 mm 1.3356 to 1.3366 in.
Bushing I.D. (after press fitted)	Right	Factory spec.	37.970 to 38.035 mm 1.4949 to 1.4974 in.
	Left	Factory spec.	33.970 to 34.035 mm 1.3374 to 1.3400 in.

MECHANISM

CONTENTS

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[1] WIRING DIAGRAM AND ELECTRICAL CIRCUIT

■ With AC Dynamo

- **Main Switch**

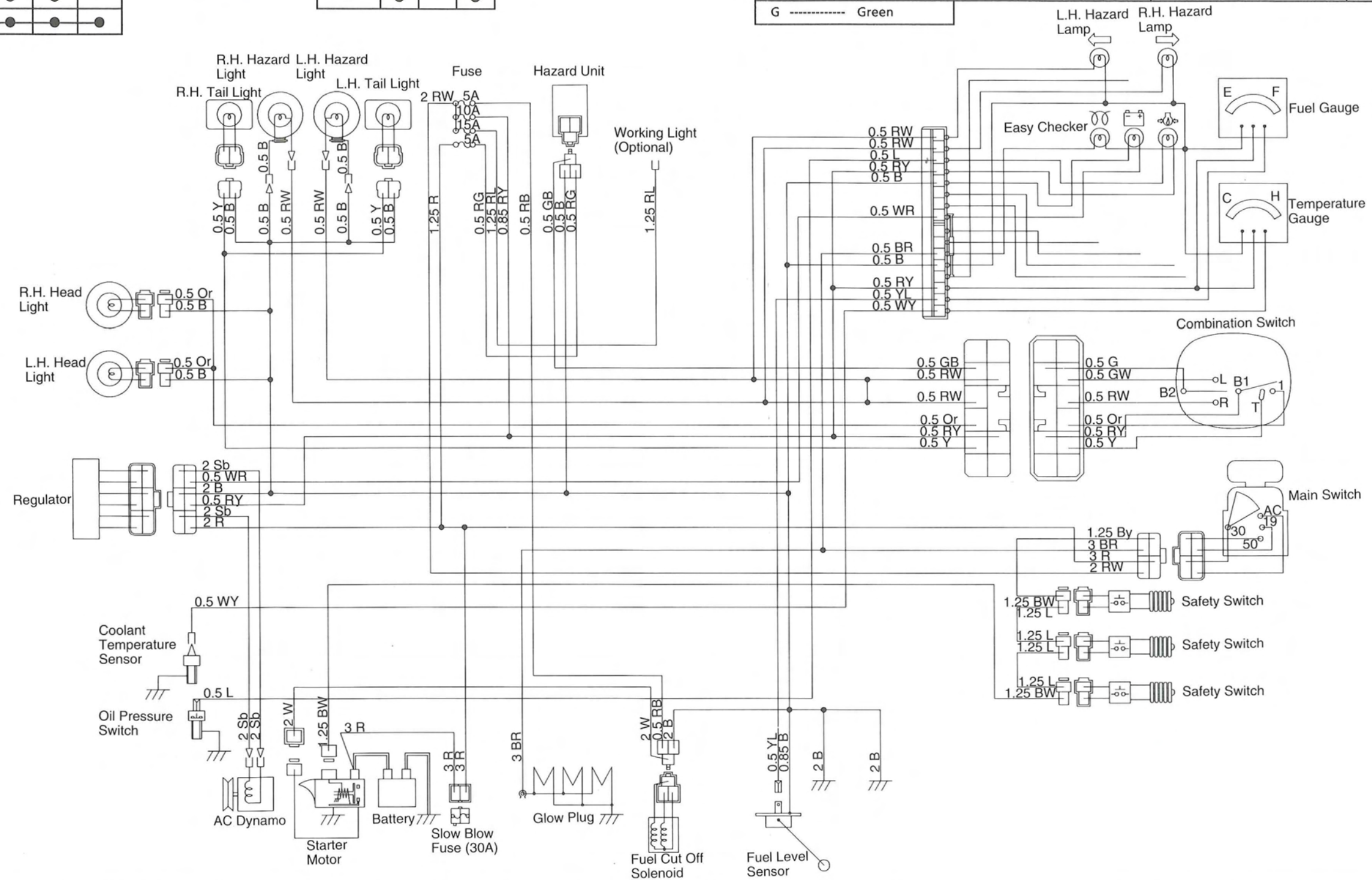
Terminal Key Position	30	AC	19	50
OFF	●			
ON	●	●		
PREHEAT	●	●	●	
START	●	●	●	●

- **Combination Switch**

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

- **Color of Wiring**

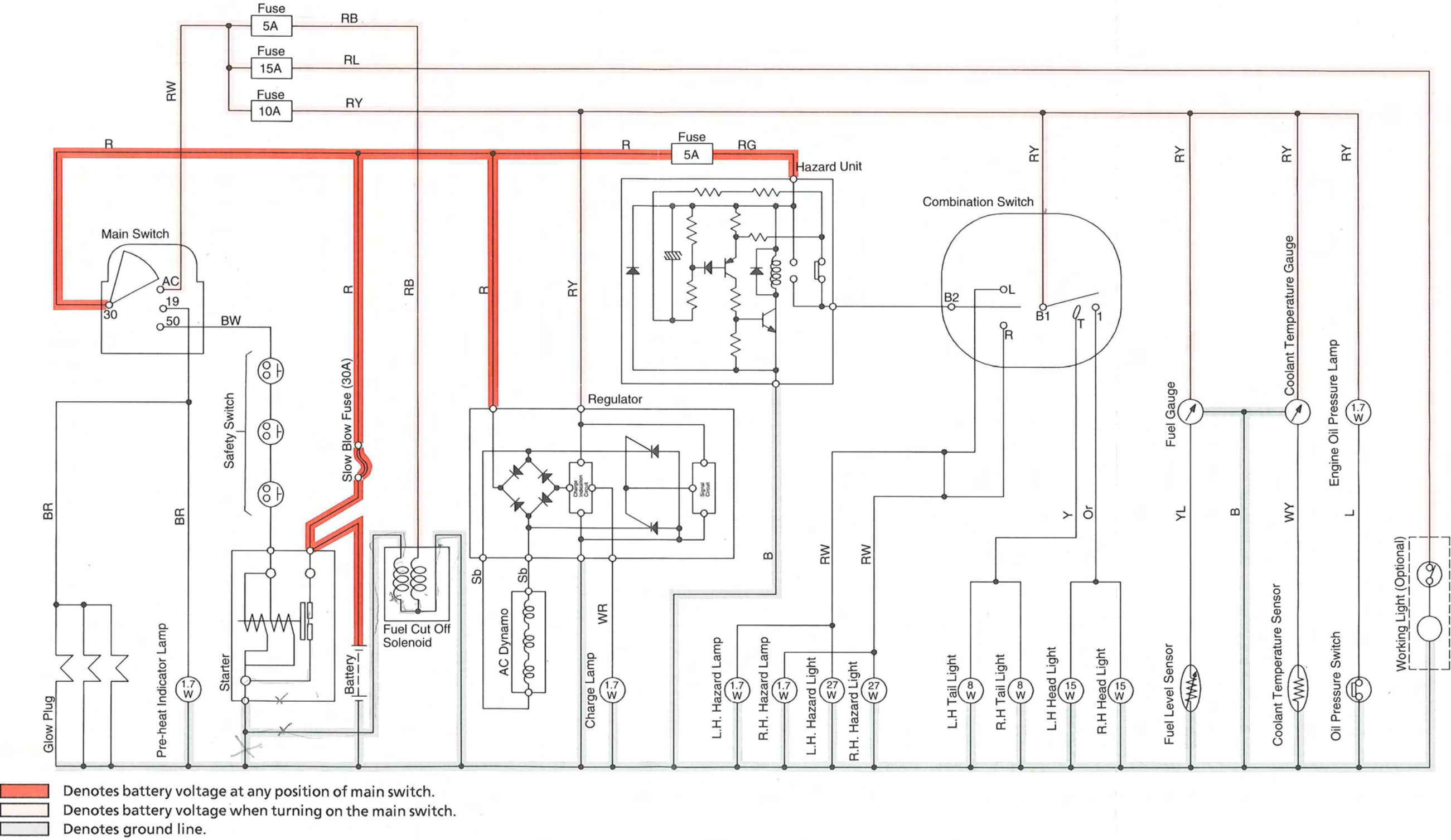
W ----- White	Or ----- Orange	RL ----- Red / Blue	BY ----- Black / Yellow
R ----- Red	WR ----- White / Red	RG ----- Red / Green	GW ----- Green / White
L ----- Blue	WY ----- White / Yellow	RY ----- Red / Yellow	GB ----- Green / Black
Y ----- Yellow	RB ----- Red / Black	BW ----- Black / White	Sb -----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



■ 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



B177F902

■ With Alternator

● Main Switch

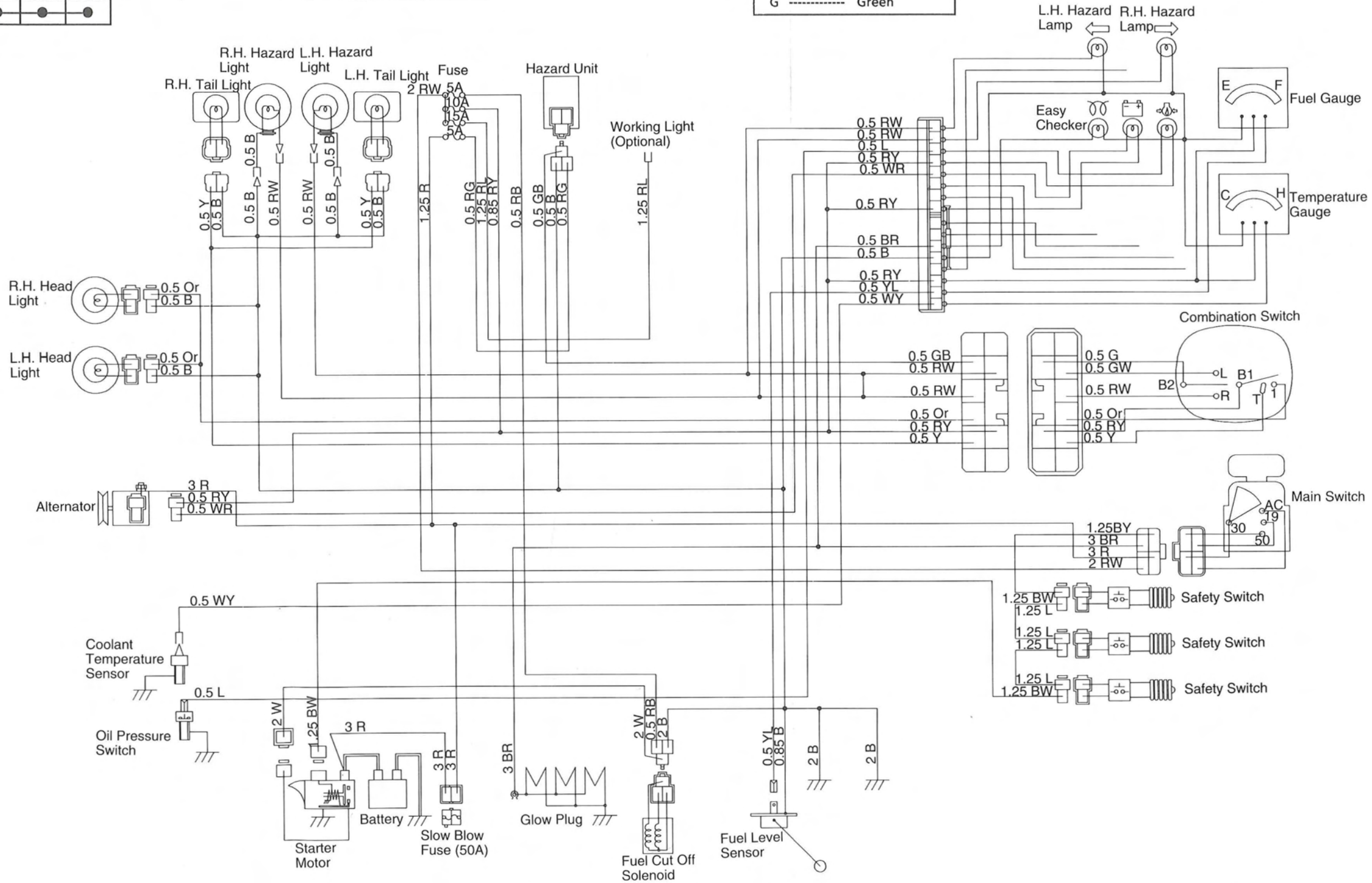
Terminal Key Position	30	AC	19	50
OFF	●			
ON	●	●		
PREHEAT	●	●	●	
START	●	●	●	●

● Combination Switch

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

● Color of Wiring

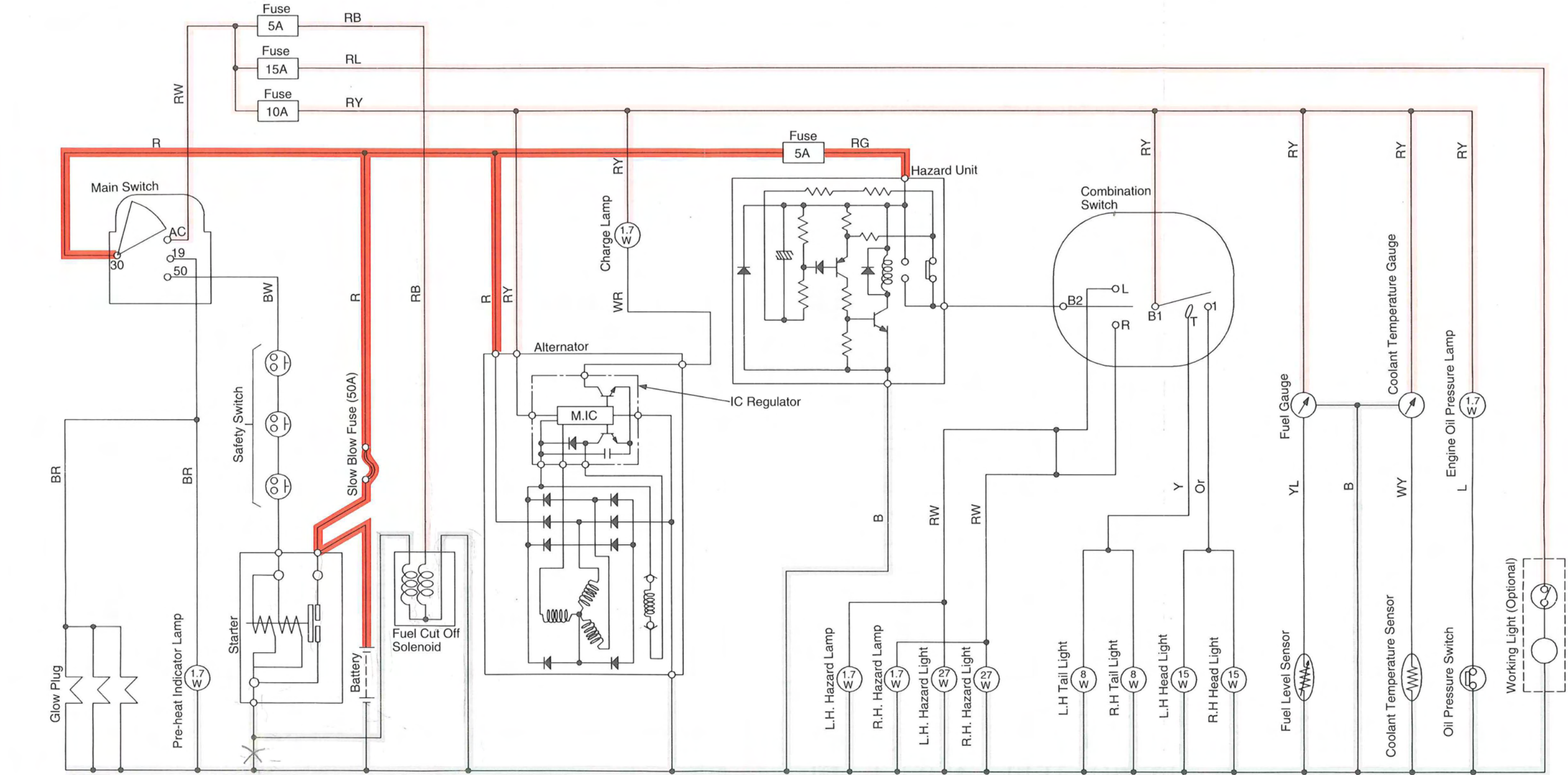
W ----- White	Or ----- Orange	RL ----- Red / Blue	BY ----- Black / Yellow
R ----- Red	WR ----- White / Red	RG ----- Red / Green	GW ----- Green / White
L ----- Blue	WY ----- White / Yellow	RY ----- Red / Yellow	GB ----- Green / Black
Y ----- Yellow	RB ----- Red / Black	BW ----- Black / White	Sb -----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



■ 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



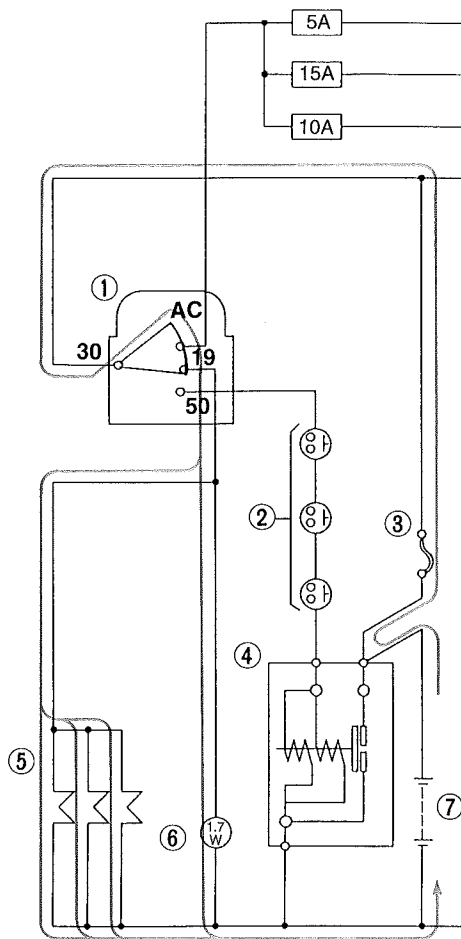
- Denotes battery voltage at any position of main switch.
- Denotes battery voltage when turning on the main switch.
- Denotes ground line.

B177F904

[2] STARTING SYSTEM

Main Switch Table					
Key Position \ Terminal	30	AC	19	50	
OFF	●				
ON	●	●			
PREHEAT	●	●	●		
START	●	●	●	●	

At the "PREHEAT" Position



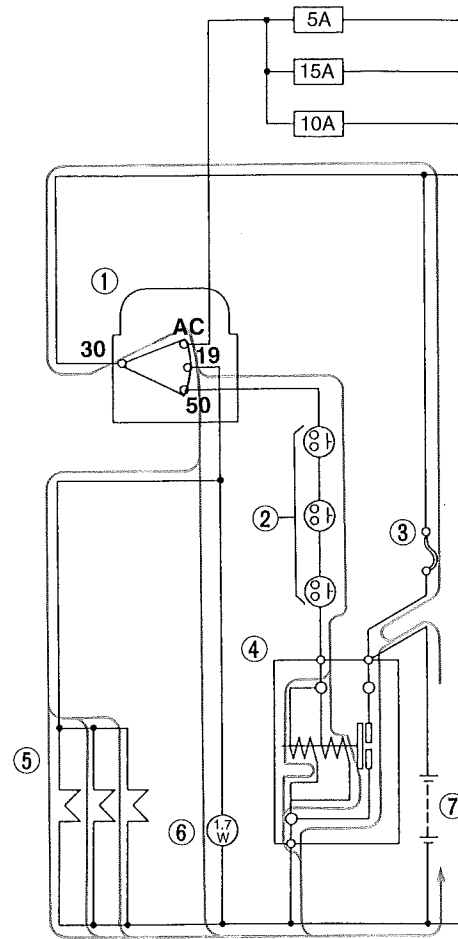
B177F905

- (1) Main Switch (3) Slow Blow Fuse
(2) Safety Switches (4) Starter Motor

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

At the "START" Position



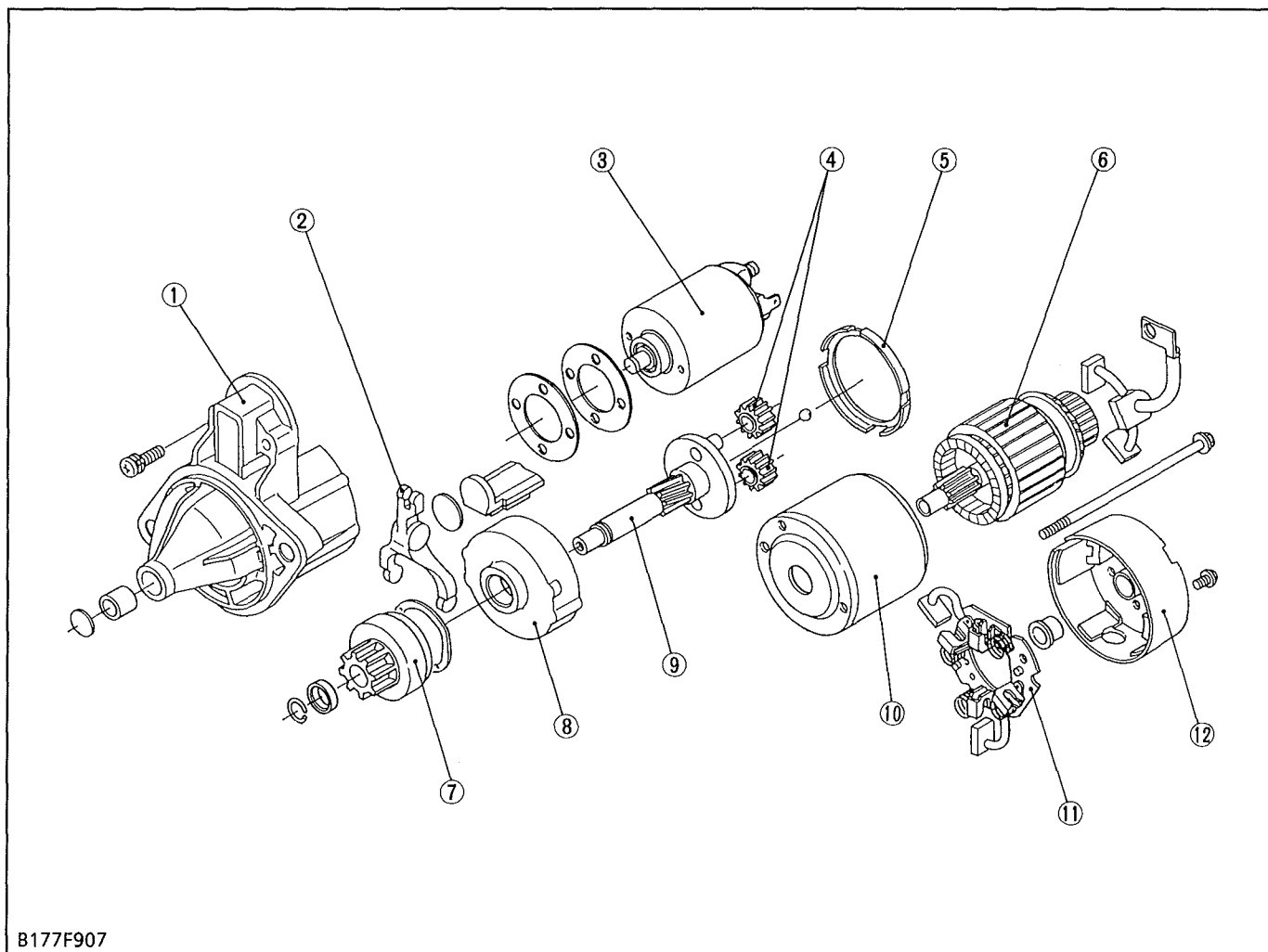
B177F906

- (5) Glow Plugs (7) Battery
(6) Pre-heat Indicator Lamp

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



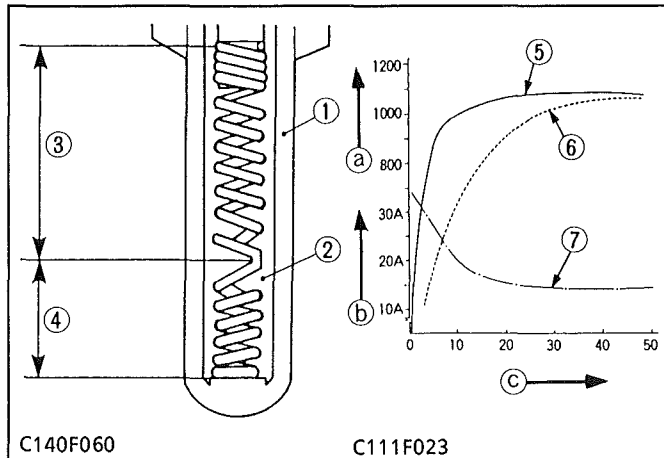
B177F907

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

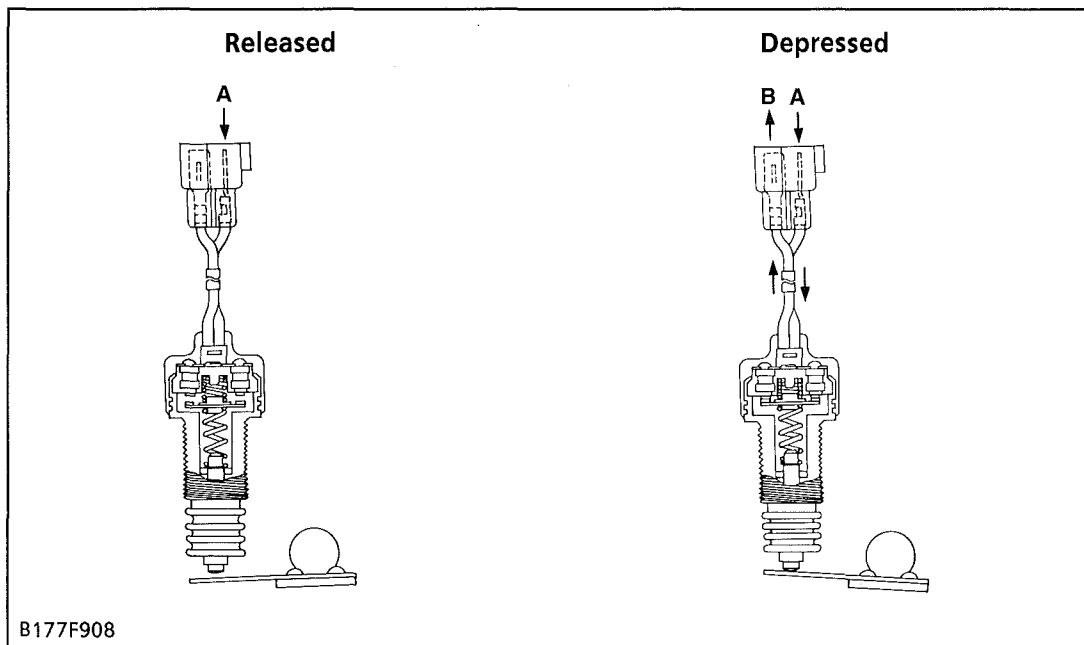
The heater (4) connected in series to the heater (3), which also functions as the resistor, is incorporated in the sheath tube (1) of the super glow plug.

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



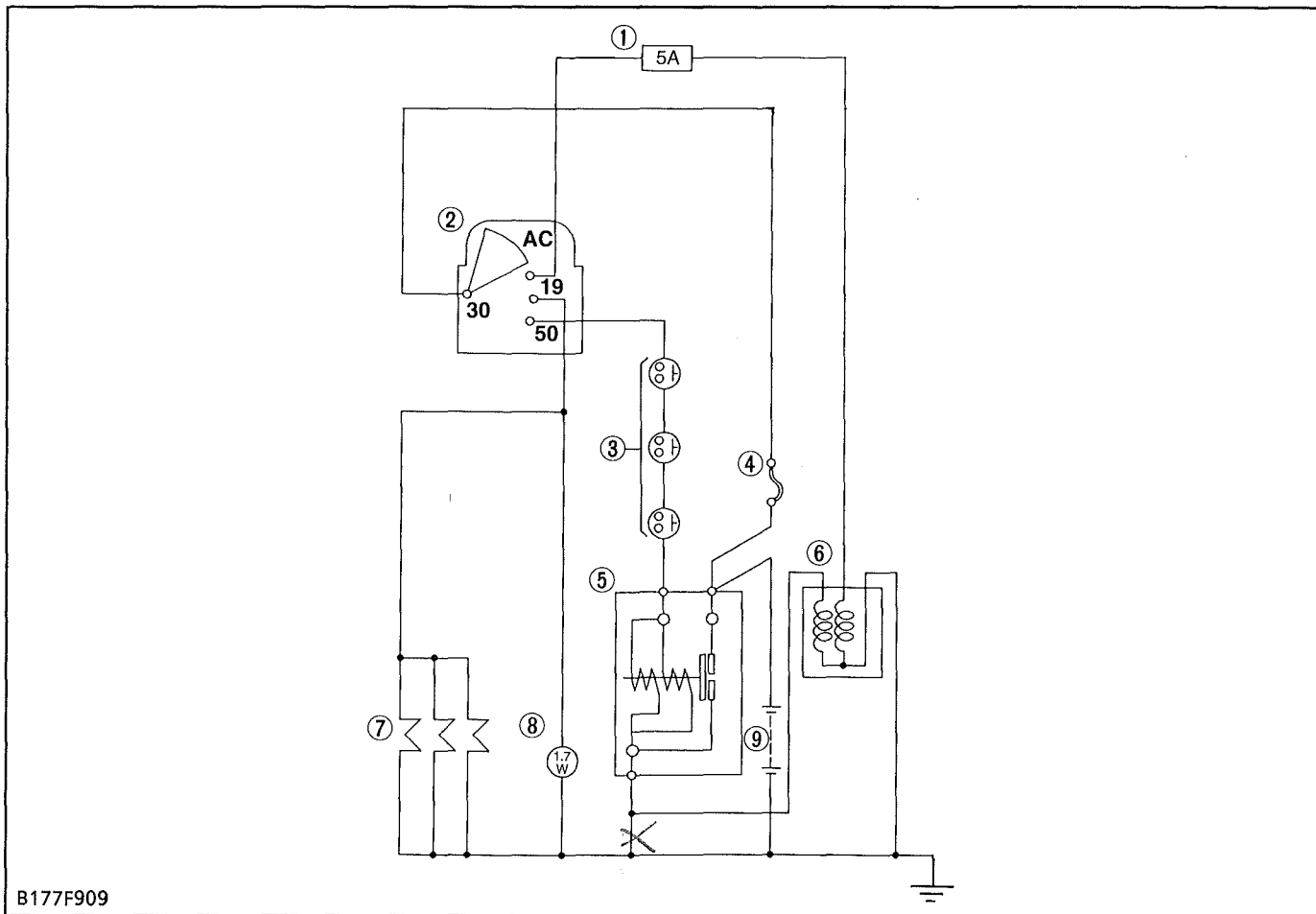
- A: From Main Switch
 B: To Starter

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



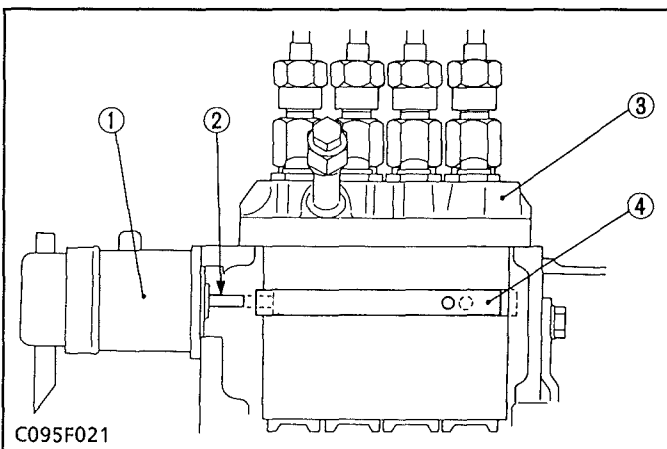
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- | | | | |
|---------------------|--------------------|---------------------------|-----------------------------|
| (1) Fuse | (4) Slow Blow Fuse | (6) Fuel Cut Off Solenoid | (8) Pre-heat Indicator Lamp |
| (2) Main Switch | (5) Starter Motor | (7)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

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



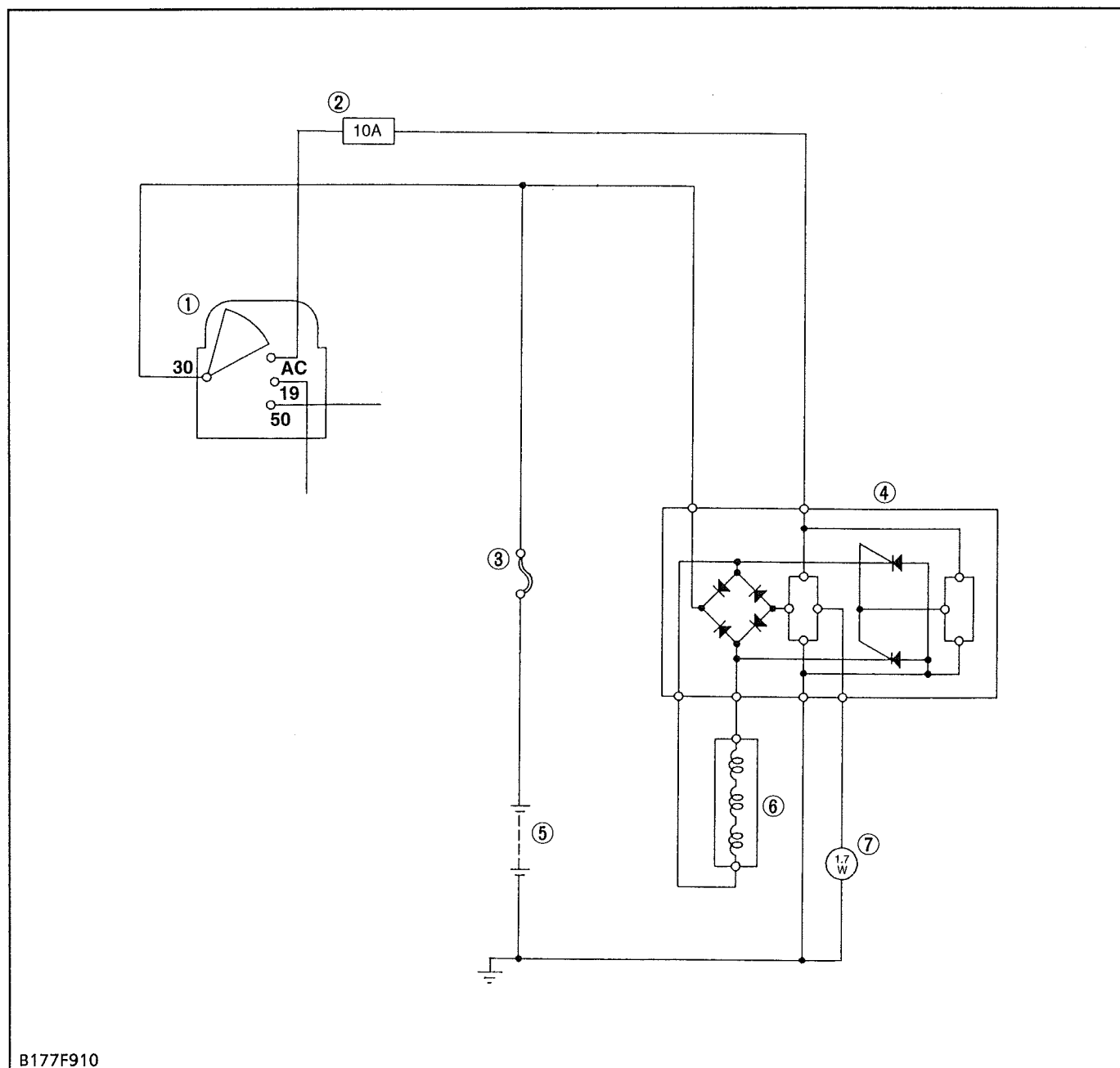
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Flowing of the battery current into the fuel cut off solenoid, the plunger (2) move to left side so that the movement of control rack (4) becomes free. When the battery current stops, the plunger (2) is returned to the original position by the spring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

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

[4] CHARGING SYSTEM

■ With AC Dynamo



B177F910

(1) Main switch
(2) Fuse

(3) Slow Blow Fuse
(4) Regulator

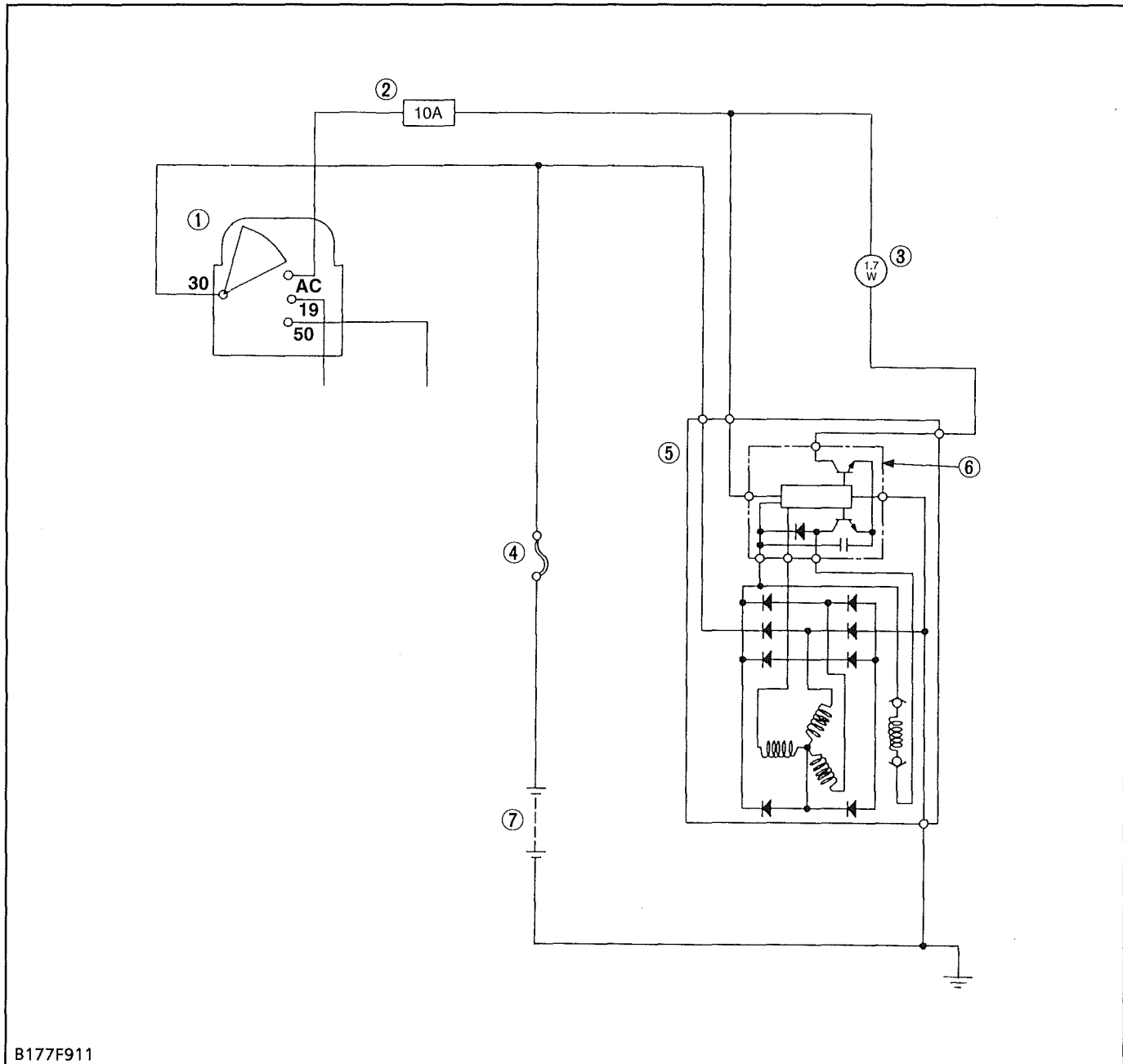
(5) Battery
(6) AC Dynamo

(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



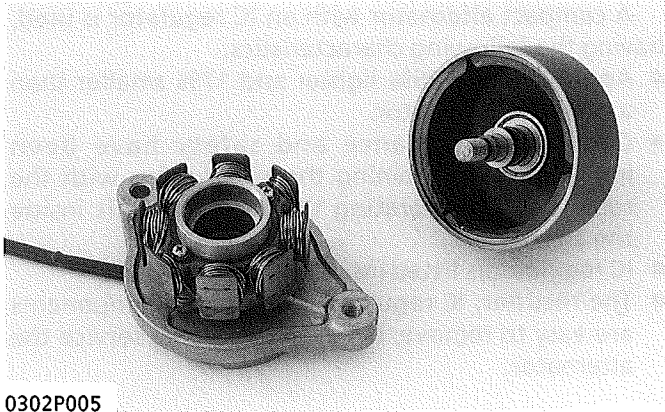
B177F911

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

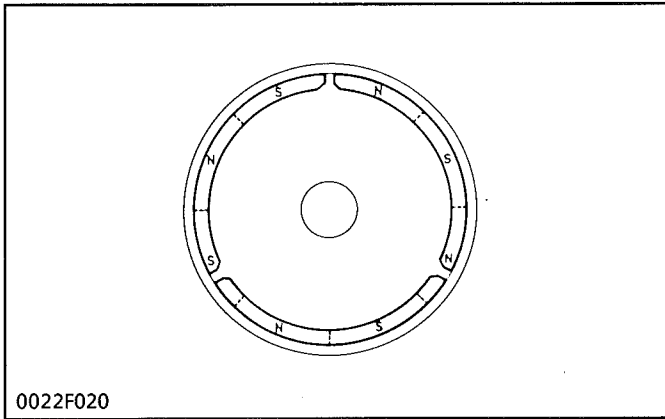
The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

This alternator has IC regulator.

(1) AC Dynamo



0302P005

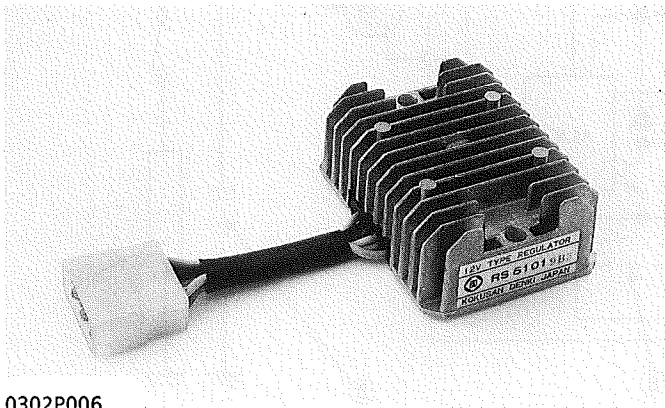


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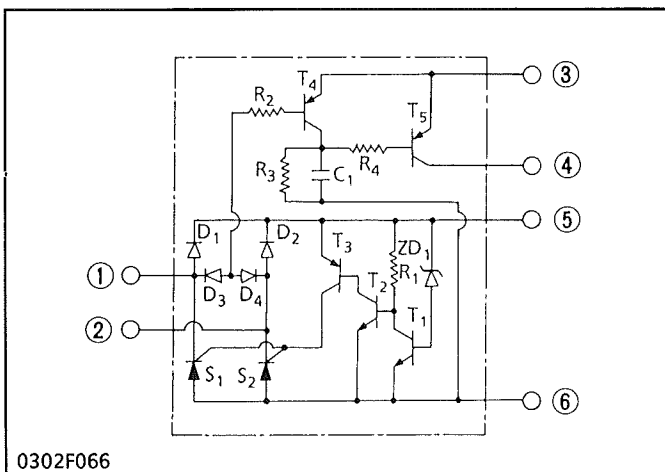
This dynamo is an 8-8 pole rotating magnet type generator. It is simple in construction, consisting of a stator and rotor. The rotor is made up of eight permanent magnet pole pieces assembled on a shaft and rotates on the center of the stator around which eight electromagnetic coils are provided for.

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

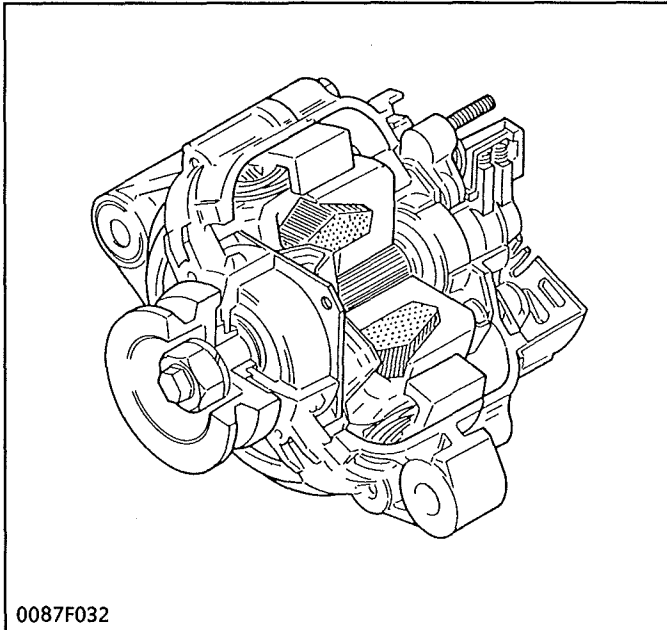
T3: Transistor

T4: Transistor

T5: Transistor

ZD1: Zener Diode

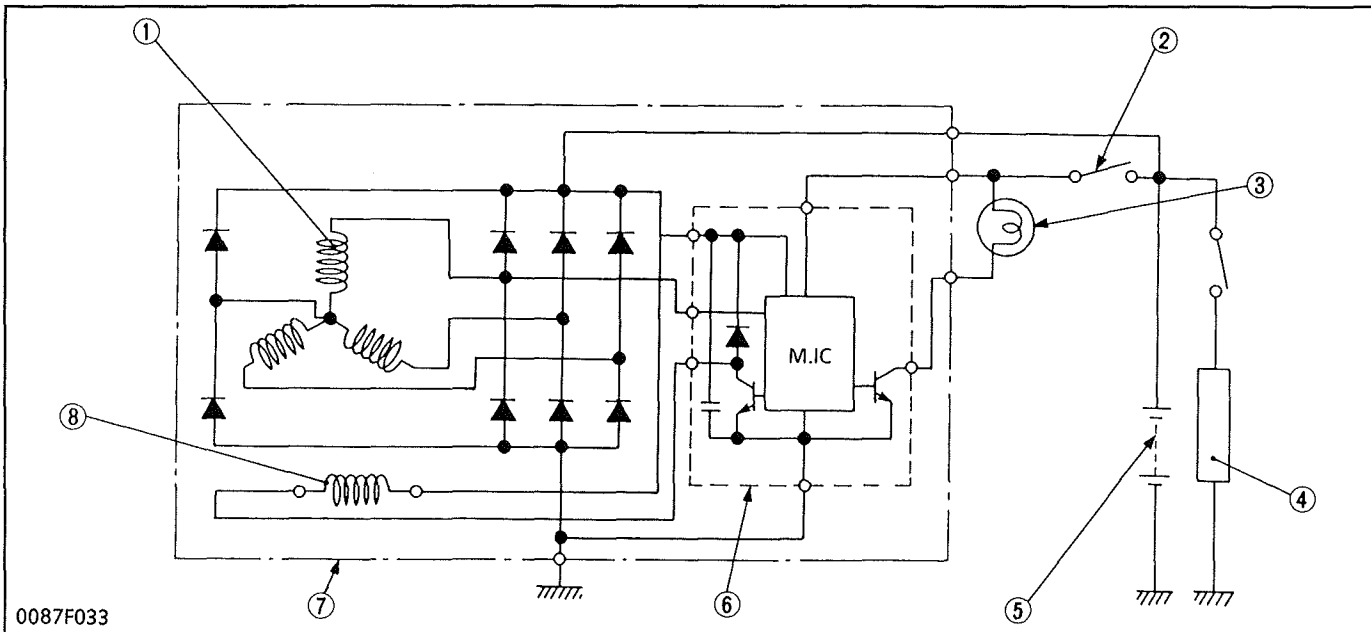
(3) Alternator



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.

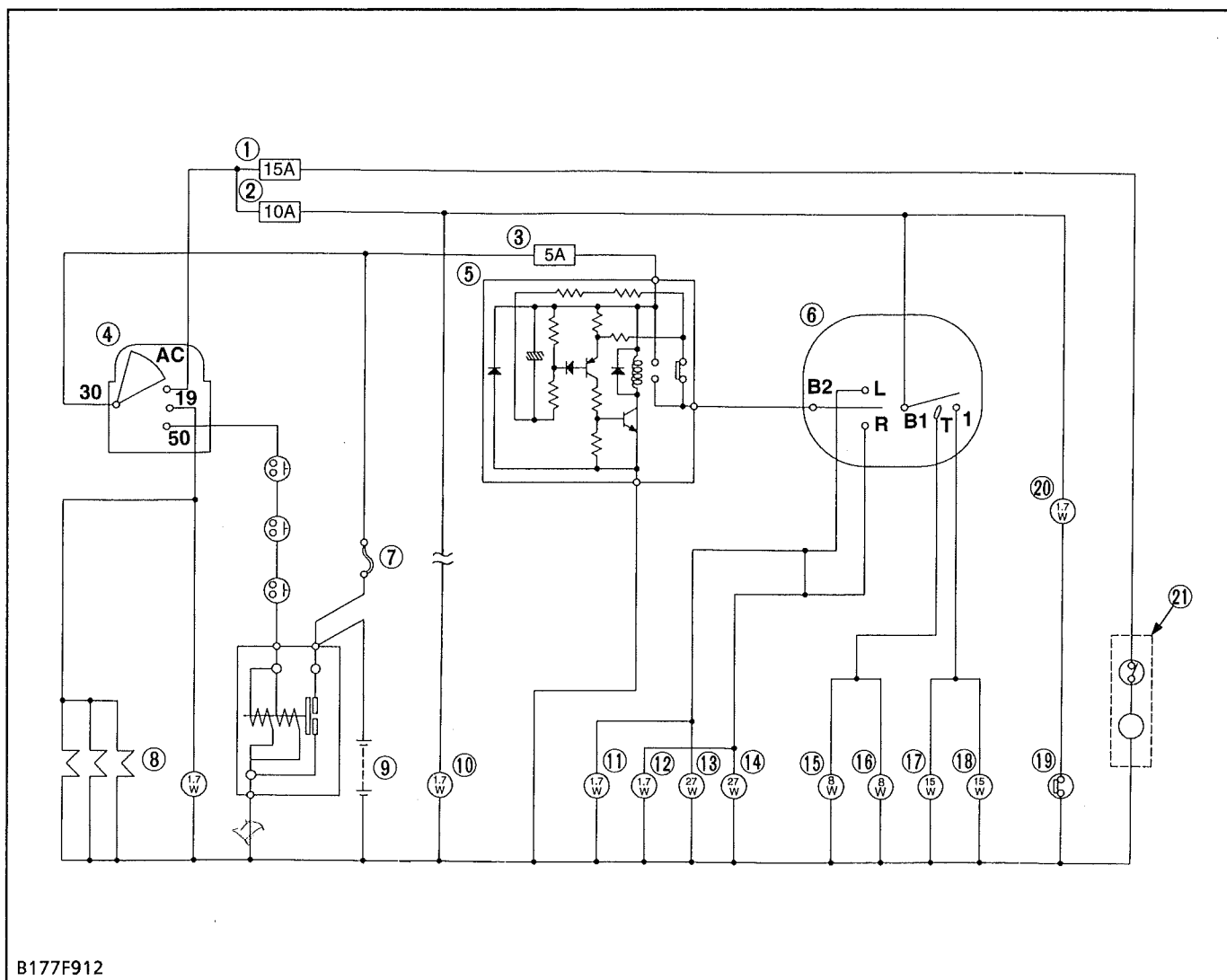
IC regulators have the following characteristics:

- 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.I.C 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.

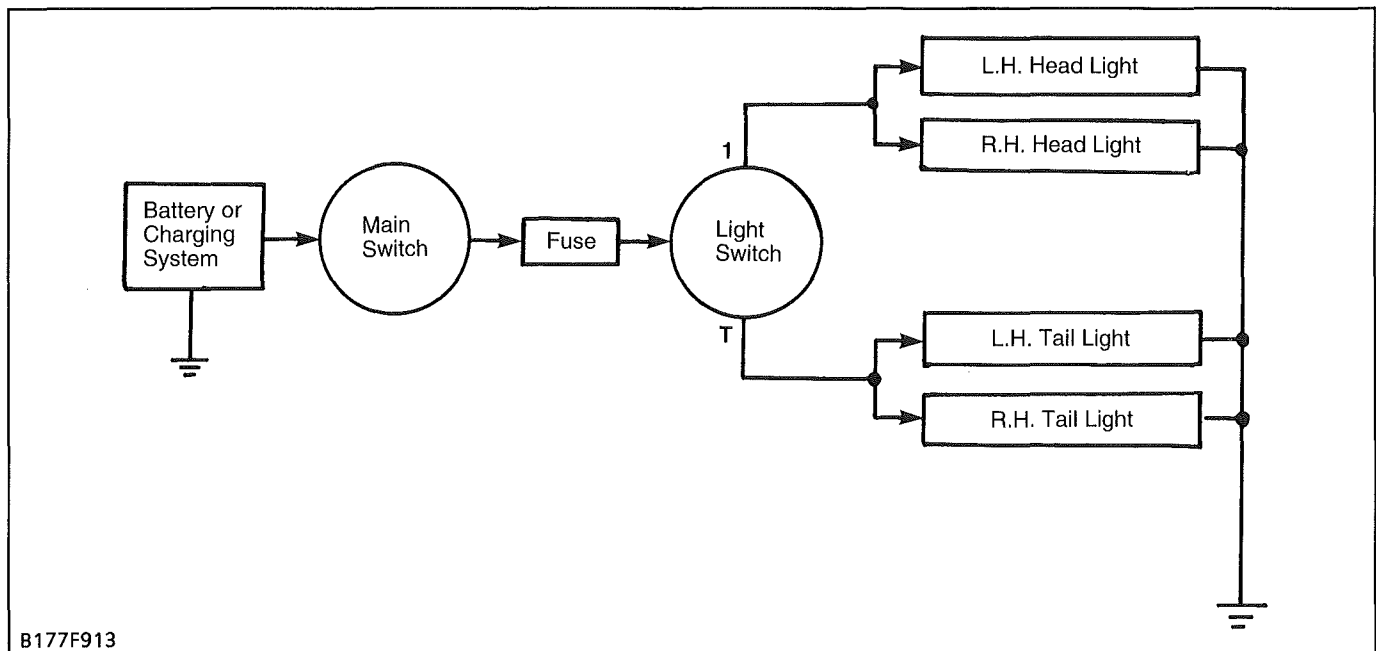
The M.I.C circuit controls Tr1 and Tr2, and monitors the alternator output voltage, and detects any drop in L terminal voltage or breaks in the rotor coil.

[5] LIGHTING SYSTEM

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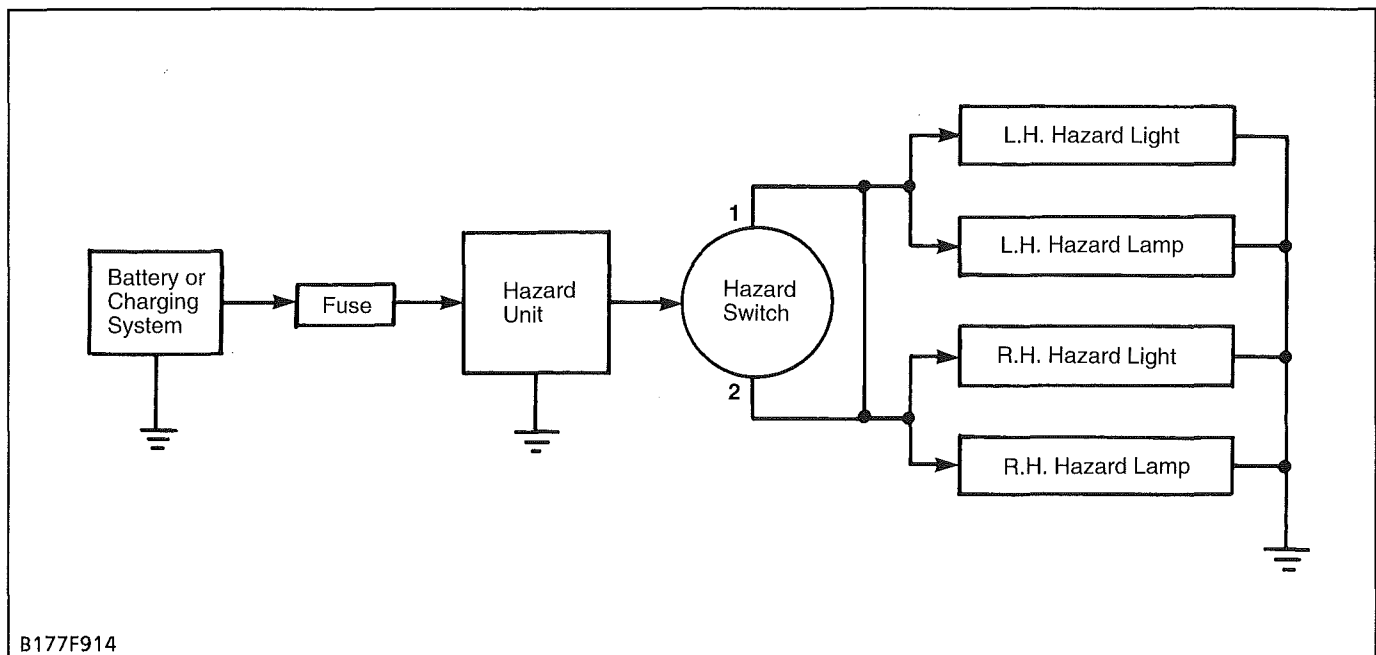
- | | | | |
|------------------------|-----------------------------|------------------------|-------------------------------|
| (1) Fuse | (7) Slow Blow Fuse | (12) R.H. Hazard Lamp | (17) L.H. Head Light |
| (2) Fuse | (8) Pre-heat Indicator Lamp | (13) L.H. Hazard Light | (18) R.H. Head Light |
| (3)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

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

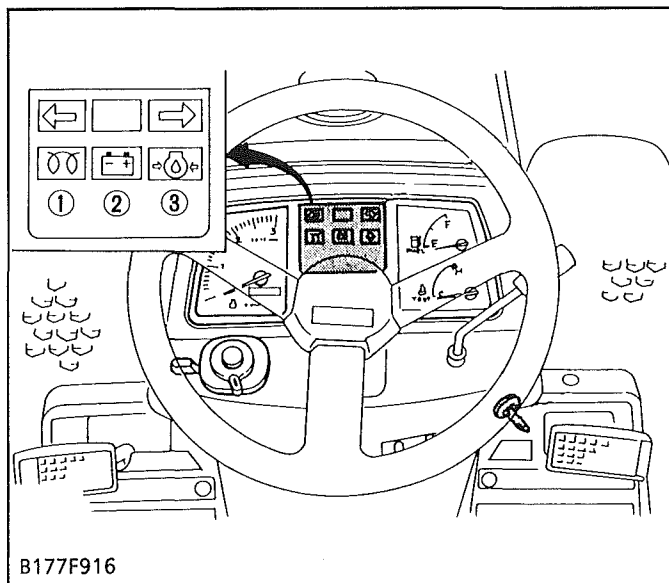
The hazard switch, which forms a combination switch with the light switch, has three positions; **OFF**, **1** and **2**. At either switch lever position of **1** or **2**,

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



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.



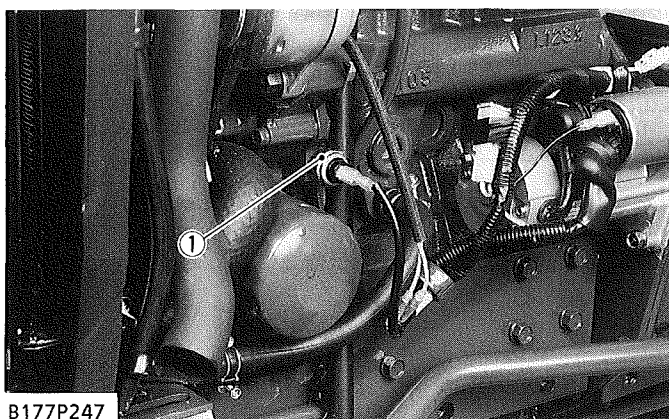
Oil Pressure Lamp

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

- (1) Pre-heat Indicator Lamp
(2) Charge Lamp

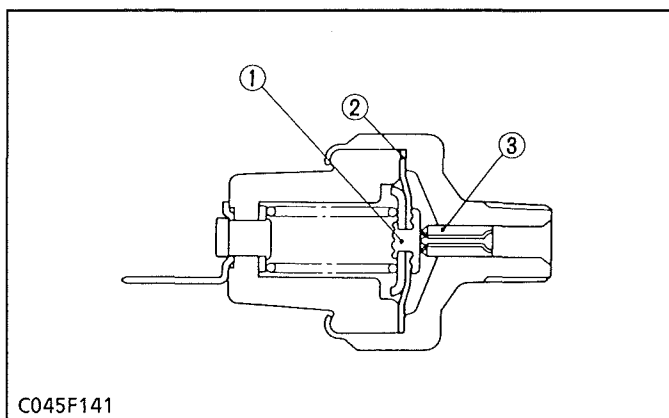
- (3) Oil Pressure Lamp

(2) Low Engine Oil Pressure



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

- (1) Oil Pressure Switch



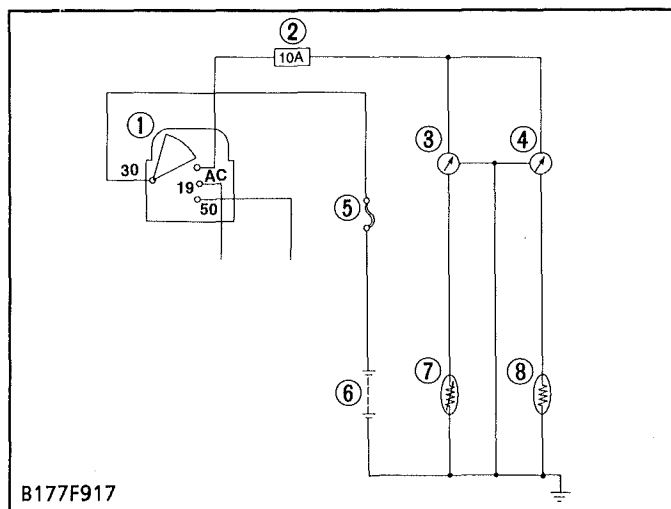
Oil Pressure Switch

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

- (1) Terminal Contact
(2) Diaphragm

- (3) Body Contact

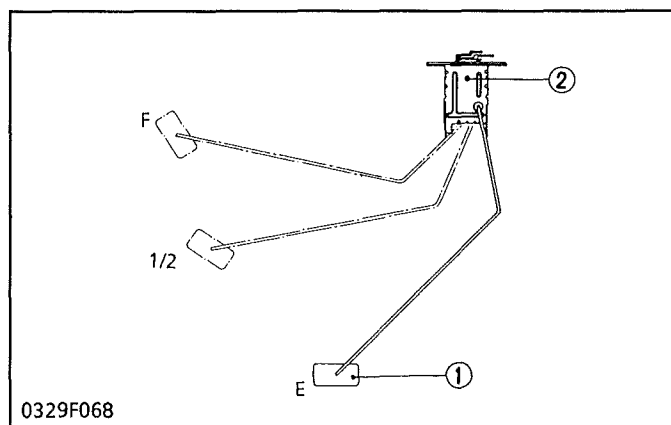
[7] GAUGE



- (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

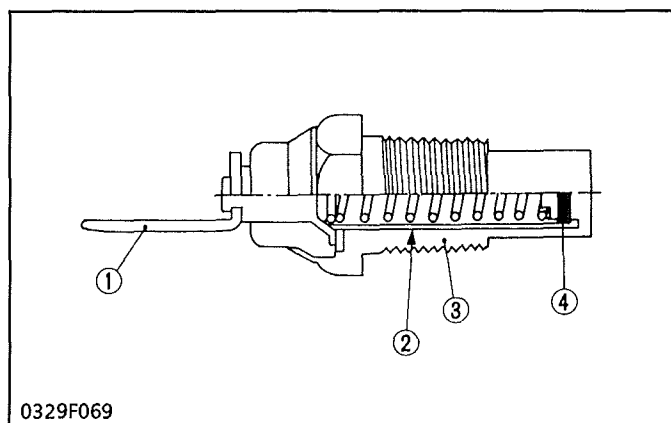
■ Fuel Level Sensor

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

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CHECKING	9-S25

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 disconnected 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) ● Wiring harness disconnected or improperly connected (between main switch AC terminal and fuel cut off solenoid) ● Fuel cut off solenoid defective	Replace Repair or Replace	— 9-S13
		Replace	—
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) ● Wiring harness disconnected or improperly connected (between main switch AC terminal and panel board, between panel board and regulator, between dynamo and regulator) ● Regulator defective ● Dynamo defective ● Wiring harness disconnected or improperly connected (between main switch AC terminal and panel board, between panel board and alternator) ● Alternator defective	Replace	—
		Repair or Replace	9-S14
		Replace	—
		Repair or Replace	9-S16
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) ● Dynamo defective ● Regulator defective ● Wiring harness disconnected or improperly connected (between main switch 30 terminal and alternator, between panel board and alternator) ● Alternator defective	Repair or Replace	9-S14
		Repair or Replace	9-S16
		Replace	—
		Repair or Replace	9-S15
		Repair or Replace	9-S15

LIGHTING SYSTEM

Head Light Does Not Light	● Fuse blown (10A) ● Bulb blown ● Wiring harness disconnected or improperly connected (between main switch AC terminal and combination switch B1 terminal, between combination switch 1 terminal and headlight)	Replace Replace Repair or Replace	— — 9-S20
Tail Light Does Not Light	● Fuse blown (10A) ● Bulb blown ● 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 Replace Repair or Replace	— — 9-S21

Symptom	Probable Cause	Solution	Reference Page
Hazard Light Does Not Light	● Fuse blown (10A) ● Bulb blown ● 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)	Replace Replace Repair or Replace	— — 9-S21
	● Hazard unit defective ● Combination switch defective	Replace Replace	9-S22 9-S20
Hazard Indicator Lamp Does Not Light	● Bulb blown ● Wiring harness disconnected or improperly connected (between combination switch R or L terminal and panel board)	Replace Repair or Replace	— 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 ● Engine oil insufficient ● Oil pressure switch defective ● Short circuit between oil pressure switch lead and chassis ● Circuit in panel board defective	Repair engine Replenish Replace Repair	— G-8 — 9-S24
		Replace	9-S23
Oil Pressure Lamp Does Not Light When Main Switch is Turned ON and Engine is Not Running	● Bulb blown ● Oil pressure switch defective ● Wiring harness disconnected or improperly connected (between panel board and oil pressure switch) ● Circuit in panel board defective	Replace Replace Repair or Replace	— — 9-S24
		Replace	9-S23

GAUGES

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

SERVICING SPECIFICATIONS

STARTER MOTOR

Item		Factory Specification	Allowable Limit
Mica	Undercut	0.5 to 1.0 mm 0.020 to 0.039 in.	0.2 mm 0.0079 in.

ALTERNATOR

Slip Ring	O.D.	14.4 mm 0.567 in.	12.8 mm 0.504 in.
Brush	Length	10.5 mm 0.413 in.	8.4 mm 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

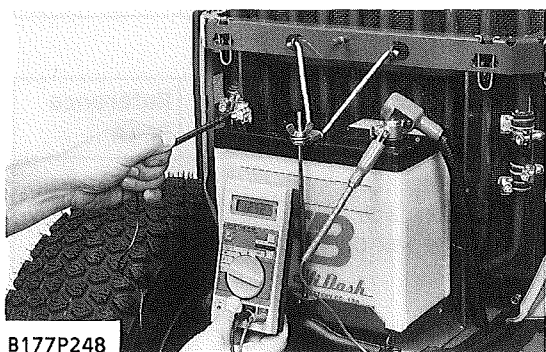
- If the tractor is to be operated for a short time without battery (using a slave battery for starting), use additional current (lights) while engine is running and insulate terminal of battery. If this advice is disregarded, damage to alternator or dynamo and regulator may result.

■ NOTE

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

[1] BATTERY

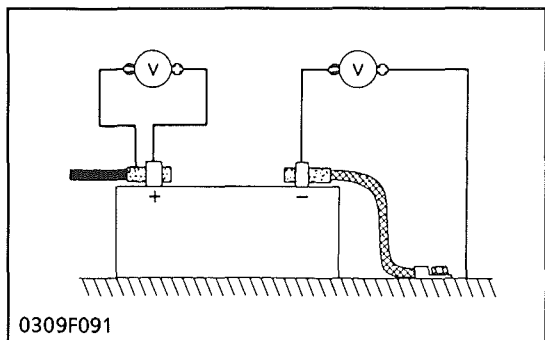
CHECKING



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.)

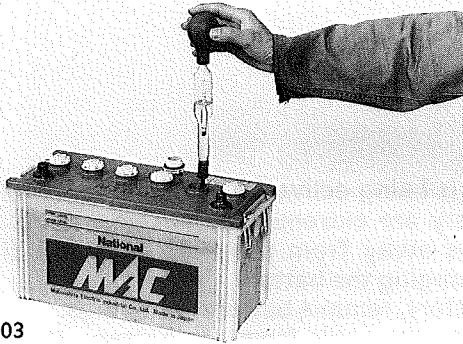
Battery voltage	Factory spec.	More than 12 V
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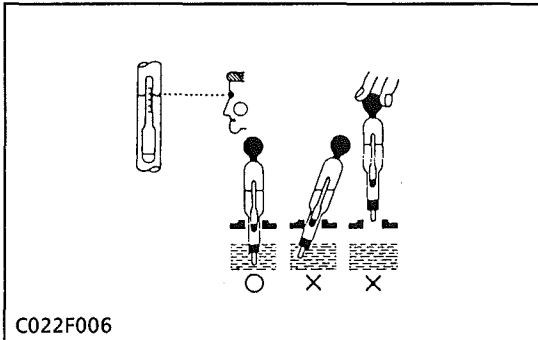
Battery Terminal Connection

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

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



0321P303



C022F006

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 splattered 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 move freely and hold the hydrometer at eye level.
- The hydrometer reading must be taken at the highest electrolyte level.

(Reference)

- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1 °C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with a decrease 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

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.

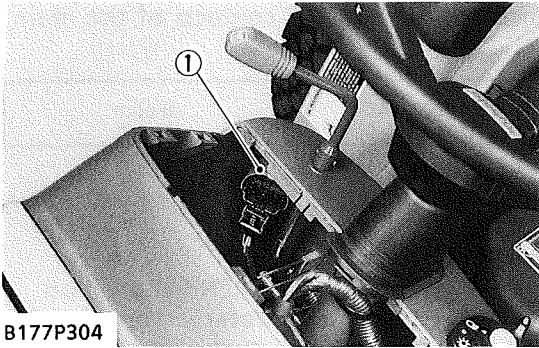
(Reference)

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

[2] STARTING SYSTEM

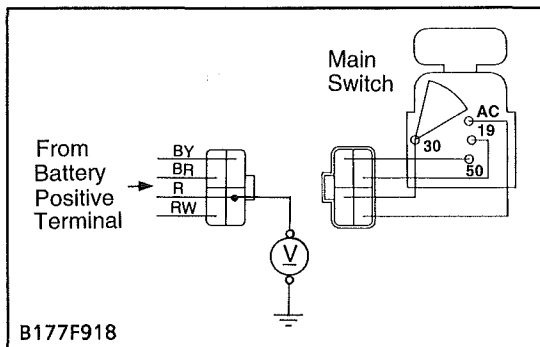
CHECKING



Main Switch

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

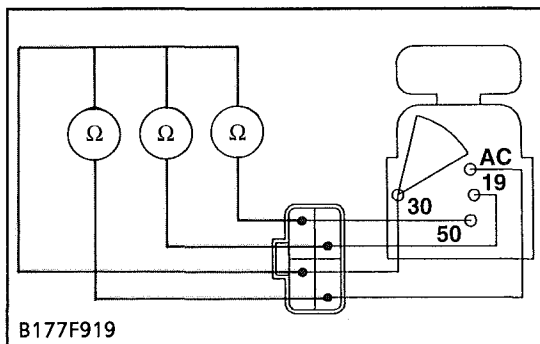
(1) Main Switch



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.

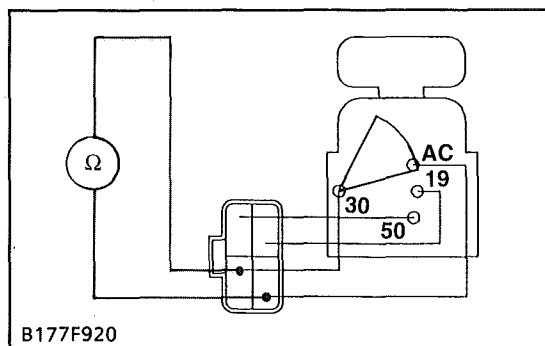
Voltage	Connector 30 terminal – chassis	Approx. battery voltage
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2) Main Switch Key at Off Position

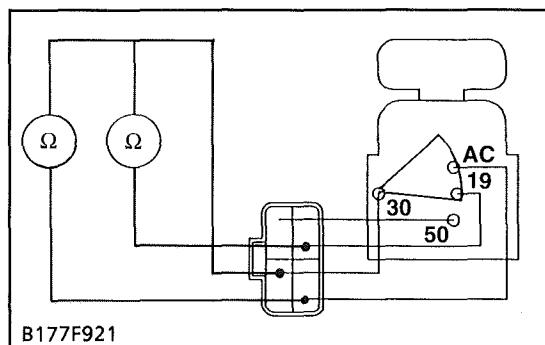
1. Turn the main switch off.
2. Measure the resistance with an ohmmeter across the 30 terminal and the AC terminal, 30 terminal and 50 terminal, 30 terminal and 19 terminal.
3. If infinity is not indicated, the contacts of the main switch are faulty.

Resistance	30 – AC	Infinity
	30 – 50	Infinity
	30 – 19	Infinity

**3) Main Switch Key at ON Position**

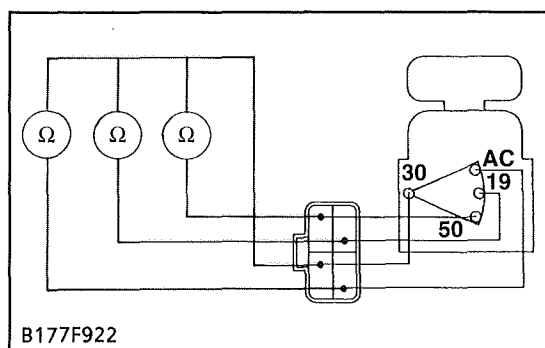
1. Turn the main switch on.
2. Measure the resistance with an ohmmeter across the 30 terminal and the AC terminal.
3. If 0 ohm is not indicated, the 30 – AC contacts of the main switch are faulty.

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.

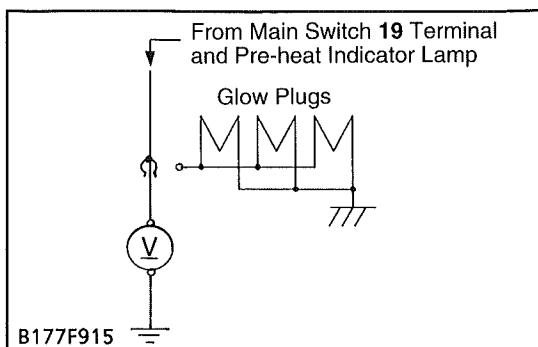
Resistance	30 – 19	0 ohm
	30 – AC	

**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	

Key position \ Terminal	30	AC	19	50
OFF	•			
ON	•	•		
PREHEAT	•	•	•	
START	•	•	•	•



Pre-heating

1) Lead Terminal Voltage

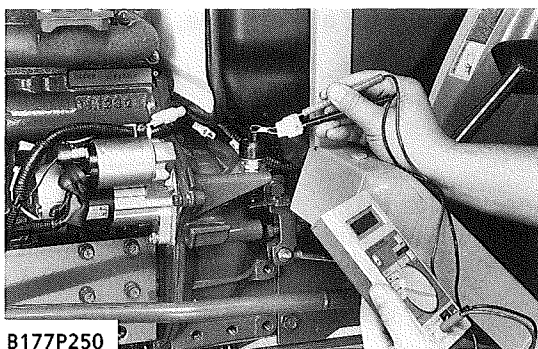
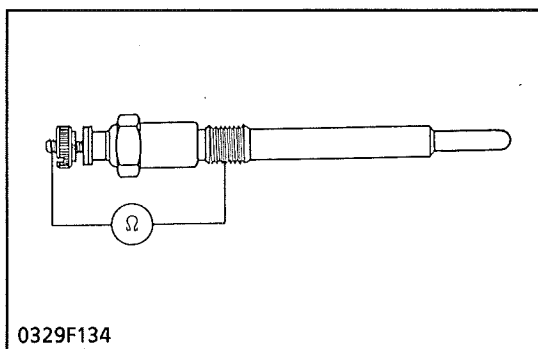
1. Disconnect the wiring lead from the glow plug terminal after turning the main switch off.
2. Turn the main switch key to the **PREHEAT** position, and measure the voltage across the lead terminal and the chassis.
3. Turn the main switch key to the **START** position, and measure the voltage with a 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.

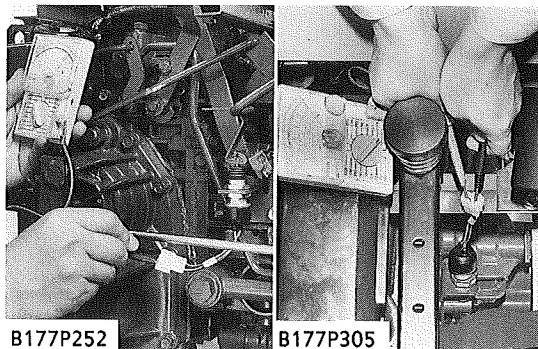
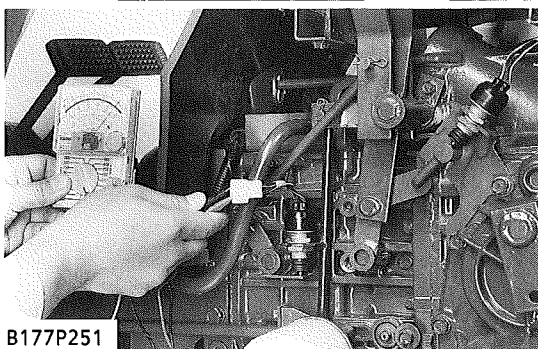
Glow plug resistance	Reference value	Approx. 0.9 ohms
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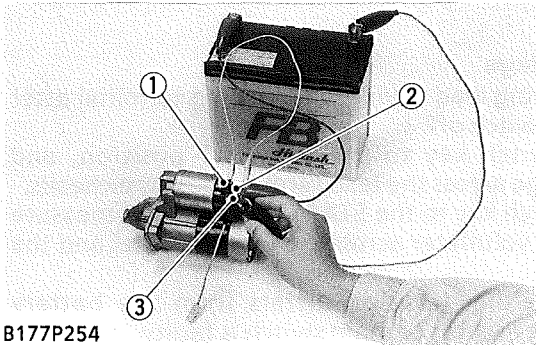


Safety Switch

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





B177P254

Motor Test

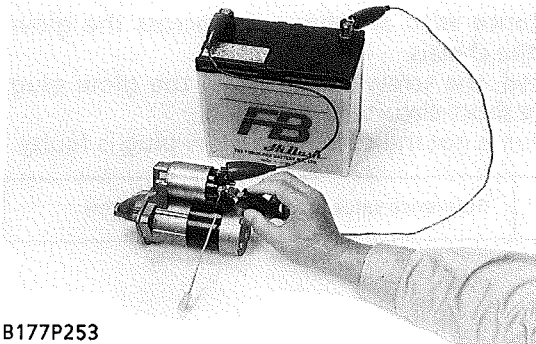
1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter.
3. Remove the starter from the engine.
4. Connect the jumper lead from the battery positive terminal post to the **B** terminal (2), and from the **B** terminal (2) to the **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



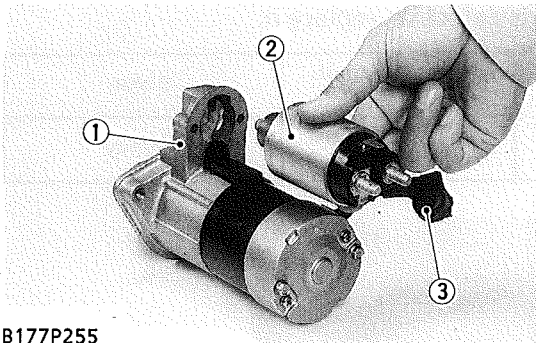
B177P253

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

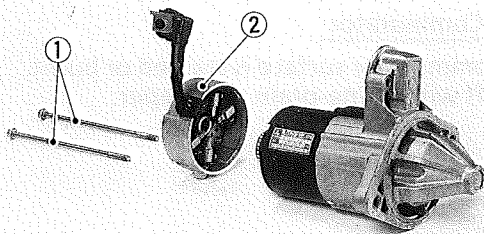
B177P255

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



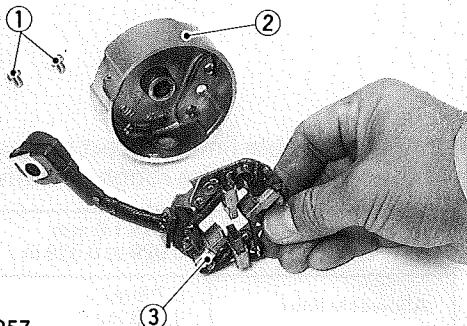
B177P256

Rear Bracket

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

(1) Screw

(2) Rear Bracket



B177P257

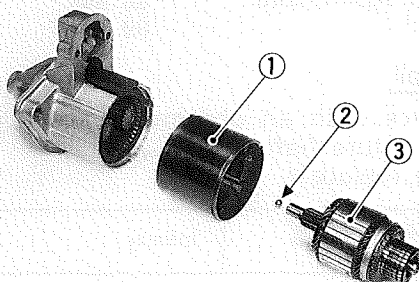
Brush Holder

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

(1) Screw

(3) Brush Holder

(2) Rear Bracket



B177P258

Armature and Yoke

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

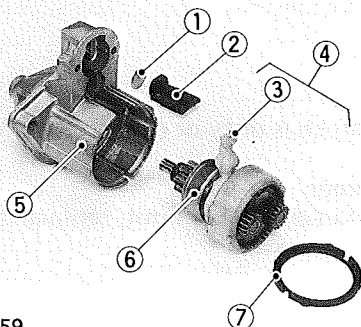
■ NOTE

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

(1) Yoke

(3) Armature

(2) Ball



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

(5) Front Bracket

(2) Gasket B

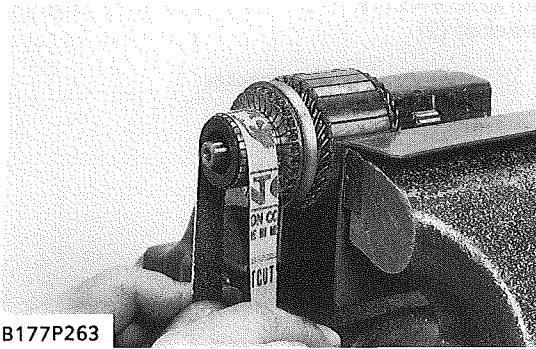
(6) Overrunning Clutch

(3) Lever

(7) Gasket A

(4) Shaft Assembly

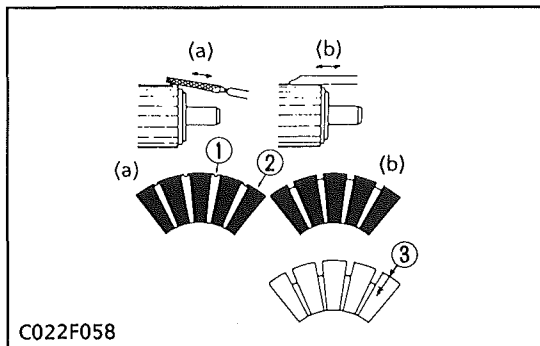
SERVICING



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 0.020 to 0.039 in.
	Allowable limit	0.2 mm 0.008 in.

(1) Mica

(3) Depth of Mica

(a) Bad

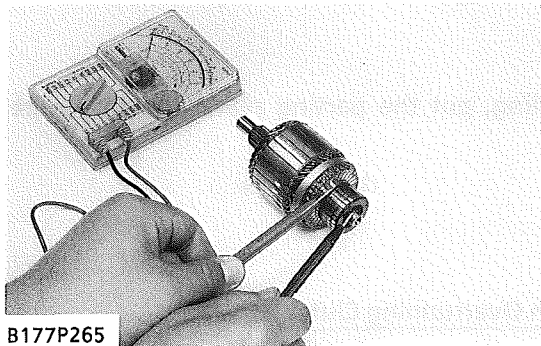
(2) Segment

(b) Good

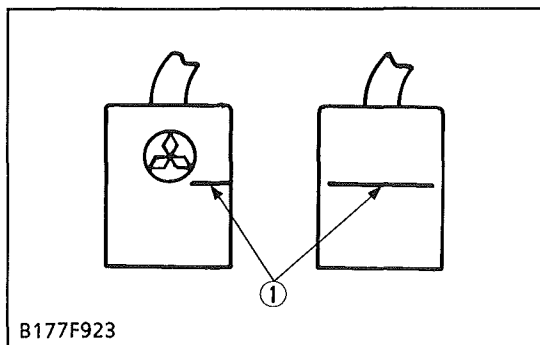
Grounding of Armature Coil

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
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B177P265



B177F923

Brush Wear

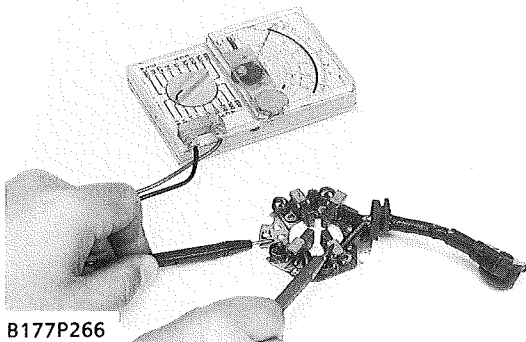
1. If the conduct face of the brush is dirty or dusty, clean it with sandpaper.
2. Visually inspect the brush wear.
3. If the brush is worn more than allowable limit, replace it.

(1) Allowable Limit Line

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.

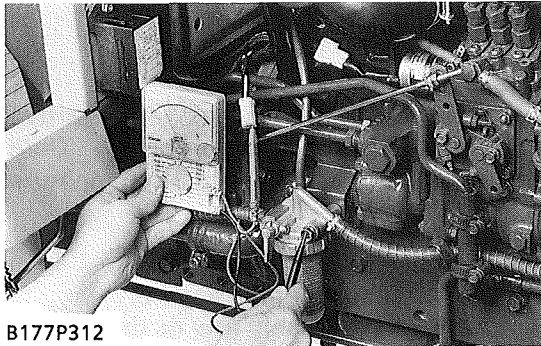
Resistance	Brush holder – Holder support	Infinity
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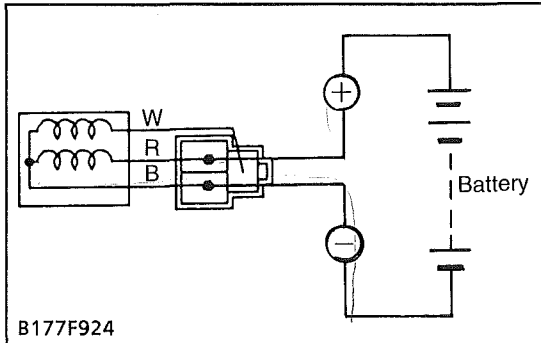
B177P266

[3] ENGINE KEY SWITCH SHUT-OFF SYSTEM

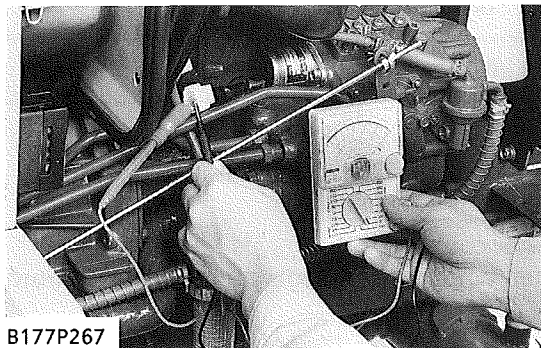
CHECKING



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
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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

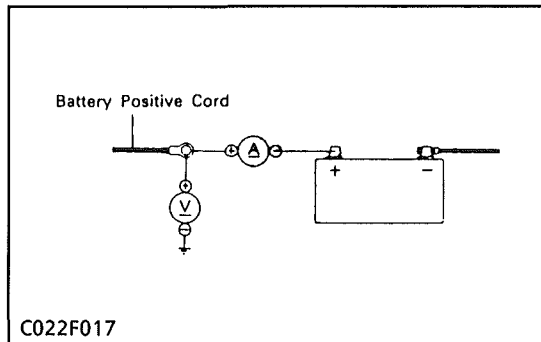
1. Disconnect the connector of fuel cut-off solenoid.
2. Measure the resistances with an ohmmeter across the terminal 3 (white) and terminal 2 (black), across the terminal 1 (red) and terminal 2 (black).
3. If the resistances are 0 ohm or infinity, fuel cut-off solenoid is faulty.

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



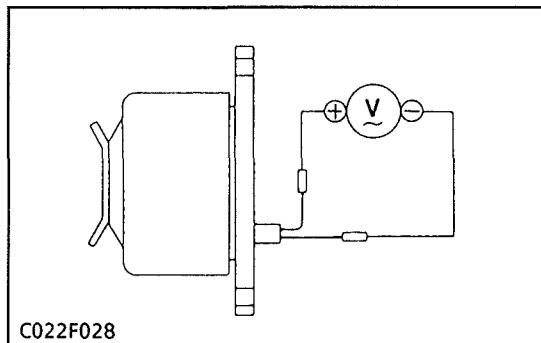
Battery Charging Current

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.

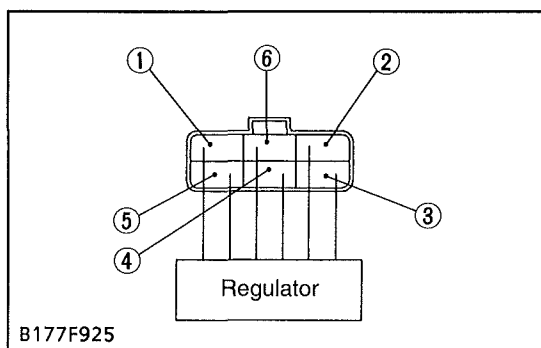
Factory spec.	Current	14 to 15 A
	Dynamo speed	5200 r.p.m



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



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

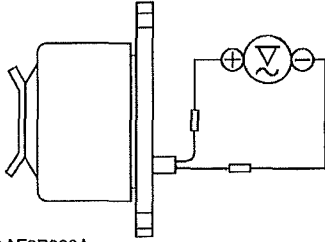
■ NOTE

- 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

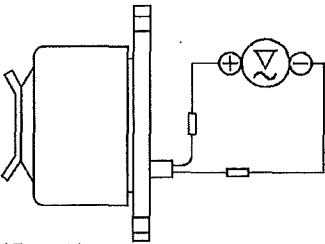
Dynamo No-load Voltage

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]



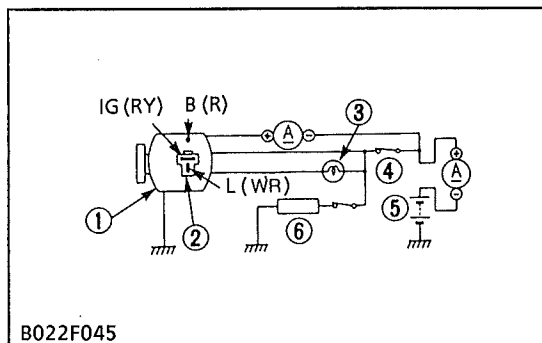
3TBAAAF9P020A

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



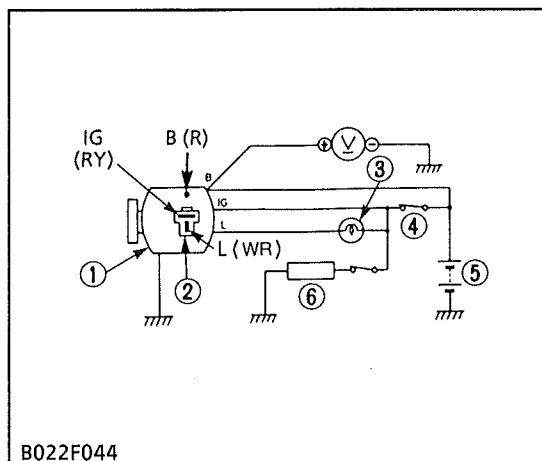
- (1) Alternator
(2) Alternator 2P Connector
(3) Bulb
(4) Main Switch
(5) Battery
(6) Load

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
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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).



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

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.

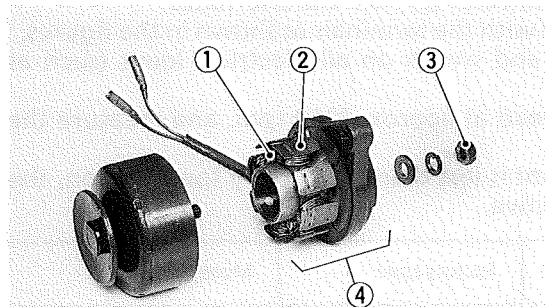
Voltage	Factory spec.	14.2 to 14.8 V (at 25°C, 77°F)
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(Reference)

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

DIASSEMBLING AND ASSEMBLING

■ AC Dynamo



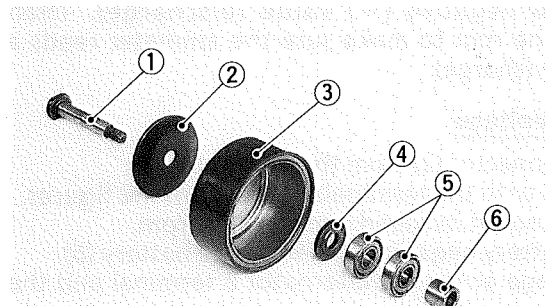
B177P306

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).

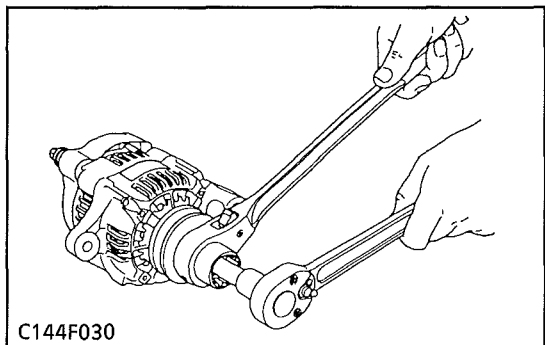
(When reassembling)

- 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

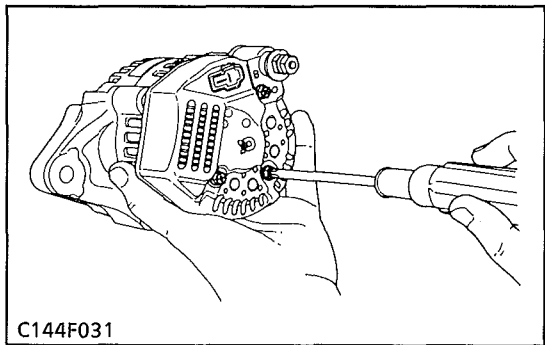


C144F030

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.

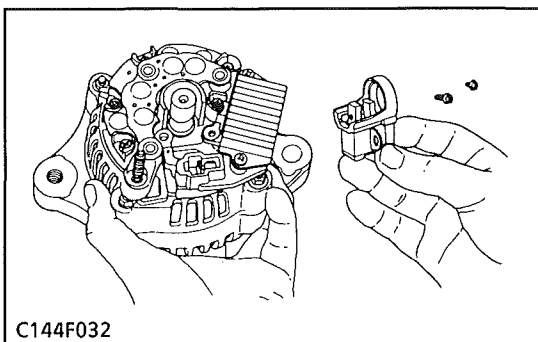
Tightening torque	Pulley lock nut	58.3 to 78.9 N·m 5.95 to 8.05 kgf·m 43.0 to 58.2 ft·lbs
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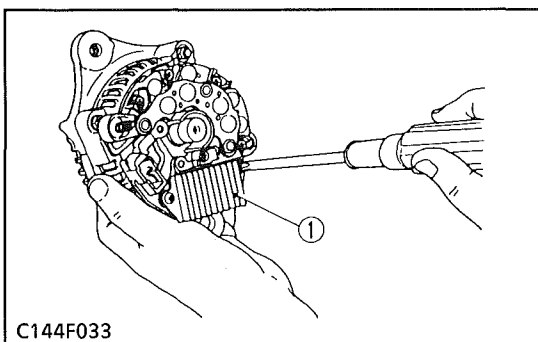
C144F031

Rear End Cover

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

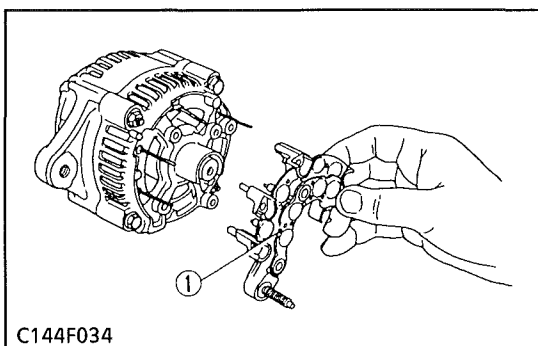
**Brush Holder**

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

**IC Regulator**

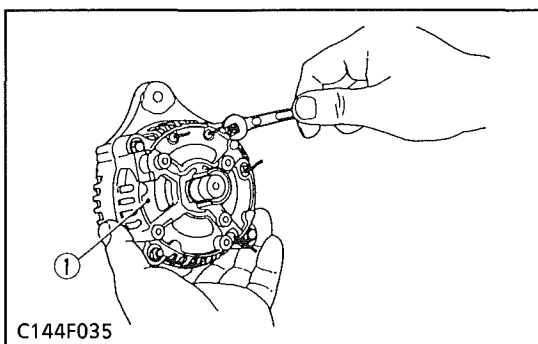
1. Unscrew the three screws holding the IC regulator (1) and remove it.

(1) IC Regulator

**Rectifier**

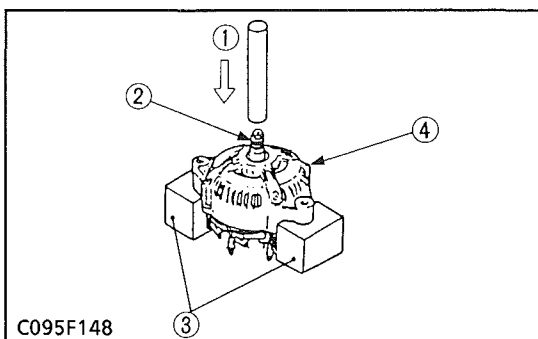
1. Remove the four screws holding the rectifier (1) and the stator lead wires.

(1) Rectifier

**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

**Rotor**

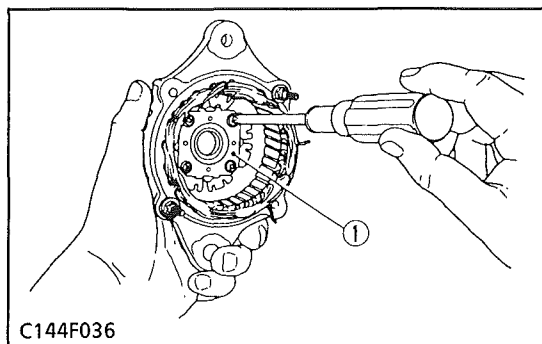
1. Press out the rotor (2) from drive end frame (4).

■ IMPORTANT

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

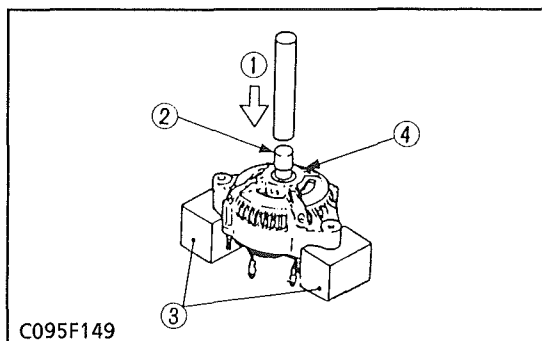
(1) Press
(2) Rotor

(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**

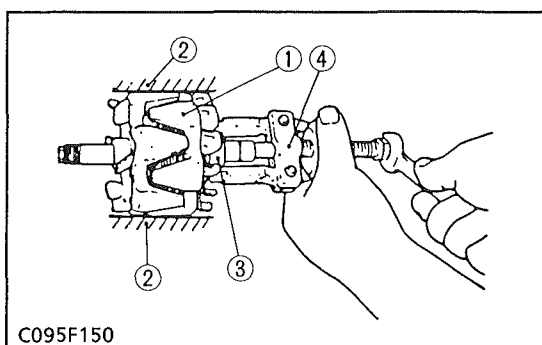
1. Press out the bearing from drive end frame (4) using with press (1) and jig (2).

(1) Press

(2) Jig

(3) Block

(4) Drive End Frame

**Bearing at the Slip Ring Side**

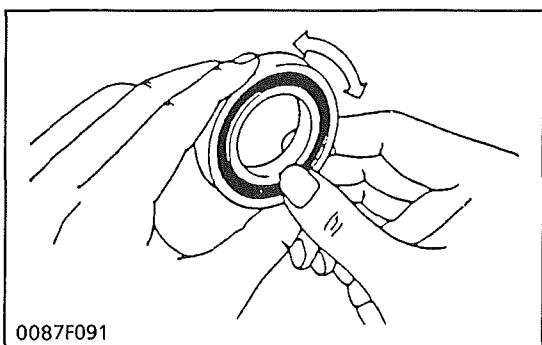
1. Lightly secure the rotor (1) with a vise (2) to prevent damage and remove the bearing using with puller (4).

(1) Rotor

(2) Vise

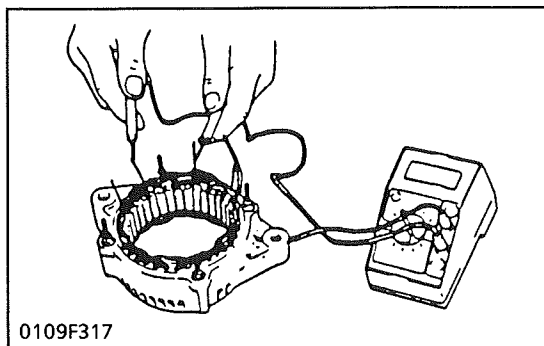
(3) Bearing

(4) Puller

SERVICING**Bearing**

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

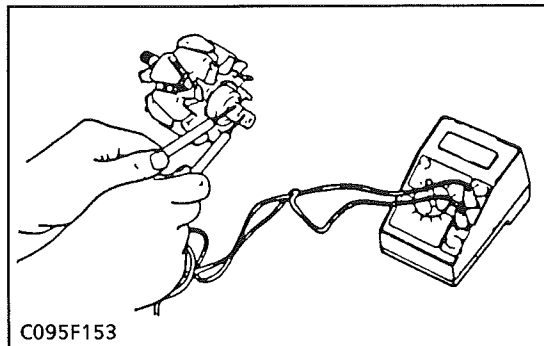
■ Alternator



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.

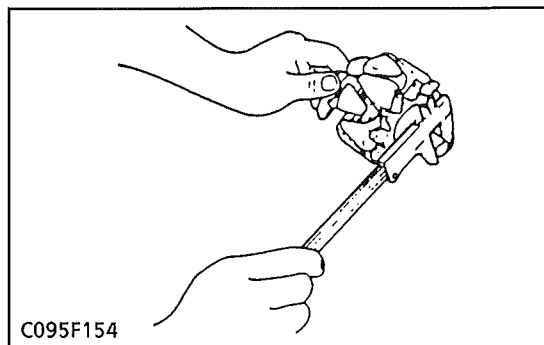
Resistance	Factory spec.	Less than 1.0 ohms
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Rotor

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.

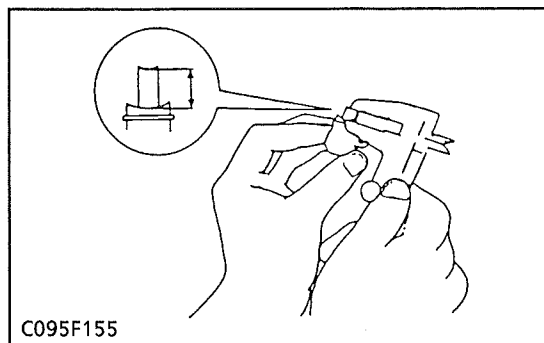
Resistance	Factory spec.	2.9 ohms
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Slip Ring

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.

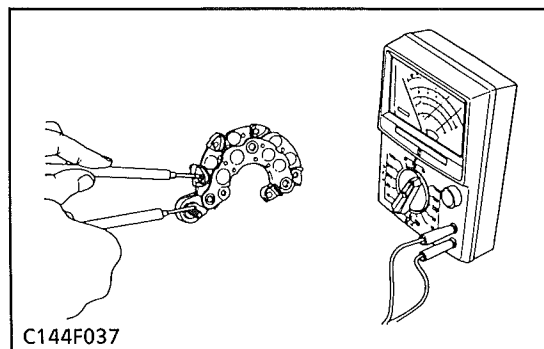
Slip ring O.D.	Factory spec.	14.4 mm 0.567 in.
	Allowable limit	12.8 mm 0.504 in.



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 0.413 in.
	Allowable limit	8.4 mm 0.331 in.

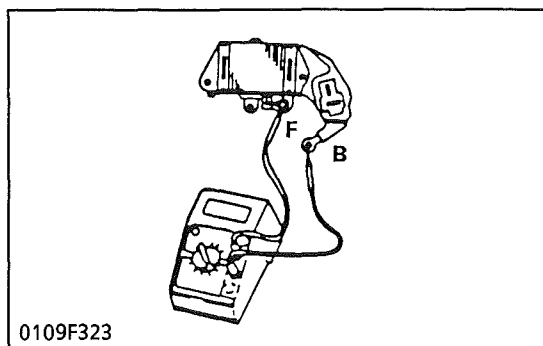


Rectifier

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

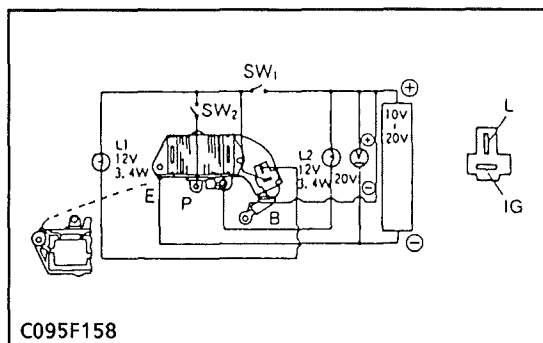
- Do not use a 500 V megger for measuring because it will destroy the rectifier.

**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.

**IC Regulator Test**

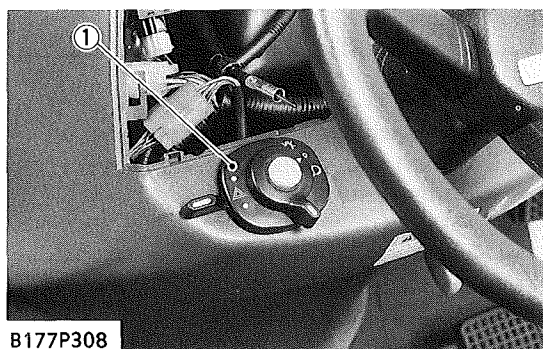
1. Connect the IC regulator unit, variable DC source, voltmeter, lamps and etc. so that they form a circuit as shown in the figure. (**SW1** and **SW2** shall be kept in the "OFF" position.)
2. Adjust the source voltage to 12 V.
3. Turn **SW1** "ON" check if **L1** (charge lamp substitution) is lit brilliantly 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

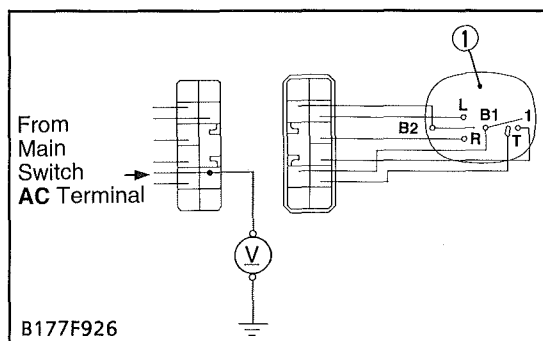
- A wrong connection in the IC regulator may destroy the regulator in a short time, therefore, inspection of the IC regulator is to be done only after the wiring diagram in the maintenance standard has been thoroughly studied.

[5] LIGHTING SYSTEM

CHECKING

**Combination Switch**

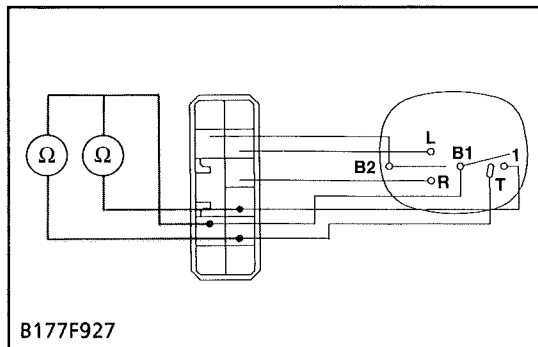
1. Remove the panel board, and disconnect the combination switch connector.
2. Remove the combination switch (1) and perform the following checkings 1) to 6).

(1) Combination Switch**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
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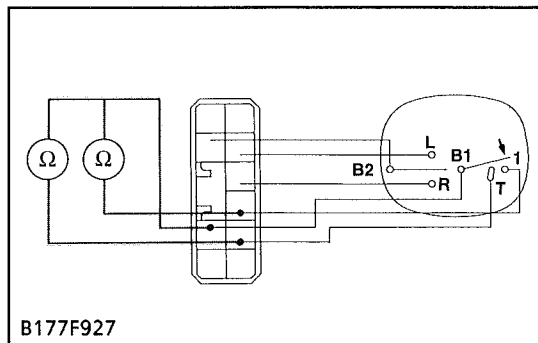
(1) Combination Switch



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.

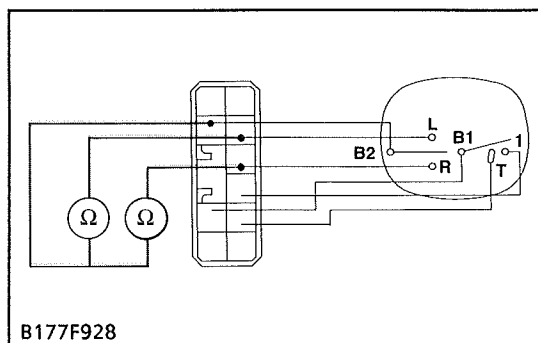
Resistance (Switch knob at OFF position)	B1 - 1	Infinity
	B1 - T	



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.

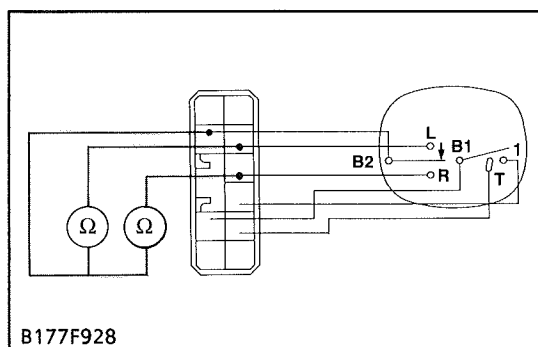
Resistance (Switch knob at ON position)	B1 - 1	0 ohm
	B1 - T	



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.

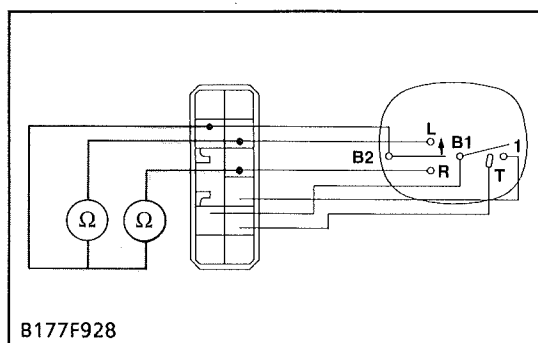
Resistance (Switch knob at OFF position)	B2 - L	Infinity
	B2 - R	



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.

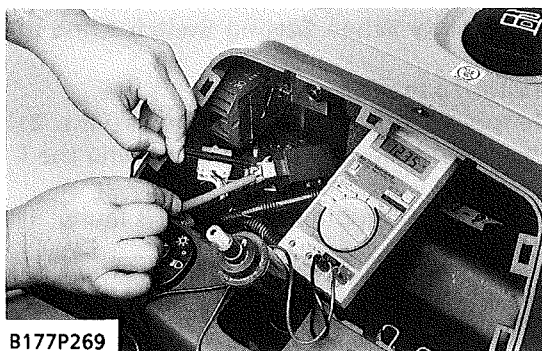
Resistance (Switch knob at 1 position)	B2 - R	0 ohm
	B2 - L	Infinity



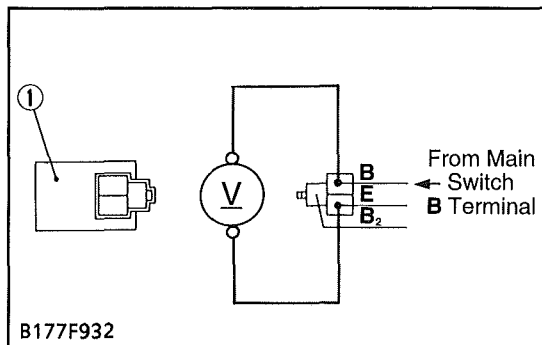
6) Hazard Switch Continuity When Setting Switch Knob at 2 Position

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.

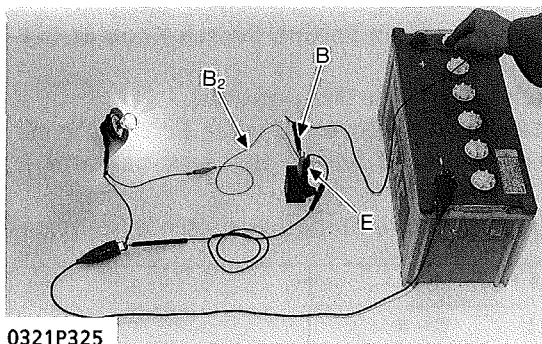
Resistance (Switch knob at 2 position)	B2 - L	0 ohm
	B2 - R	Infinity



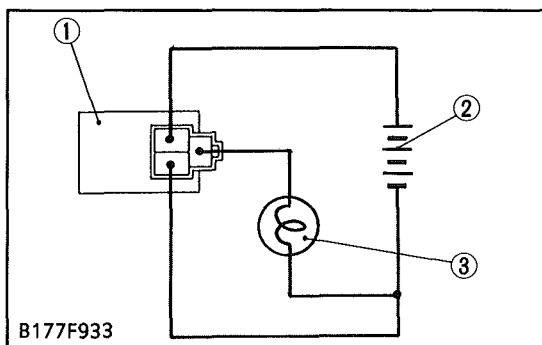
B177P269



B177F932



0321P325



B177F933

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
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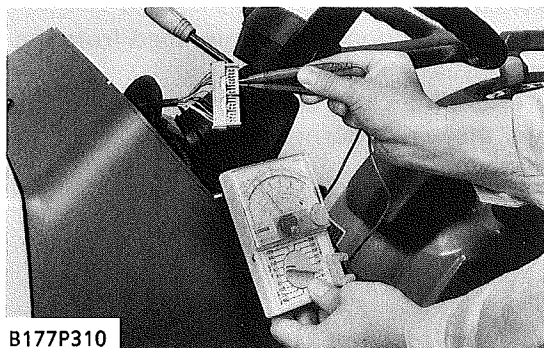
(1) Hazard Unit

2) Hazard Unit Test

1. Remove the panel board.
2. Disconnect 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.

Charging Circuit (Panel Board and Wiring Harness)

■ AC Dynamo

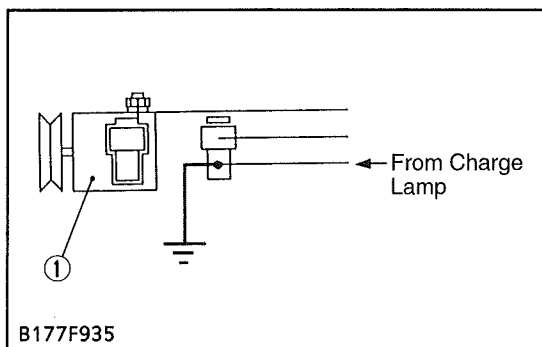
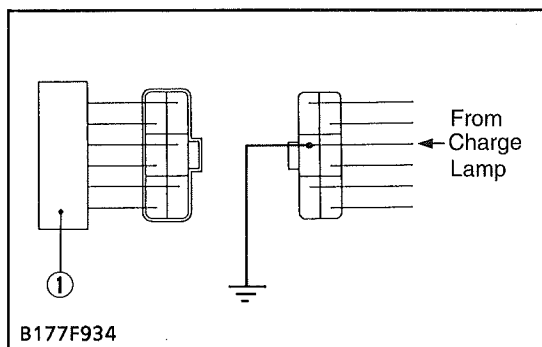
1. Remove the panel board from tractor.
2. Disconnect the 6-P connector from the regulator after turning the main switch off.
3. Turn the main switch on and connect a jumper lead from the wiring harness connector terminal (Black) to the chassis.
4. If the charge lamp does not light, the panel board circuit,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

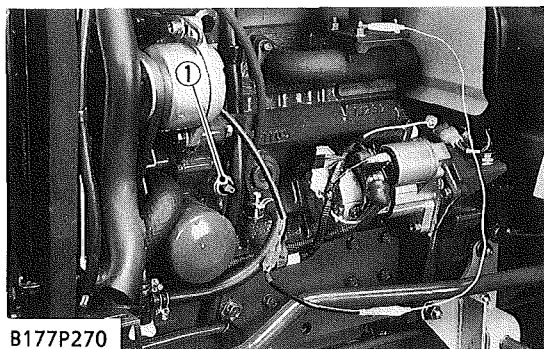
(1) Regulator

■ 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



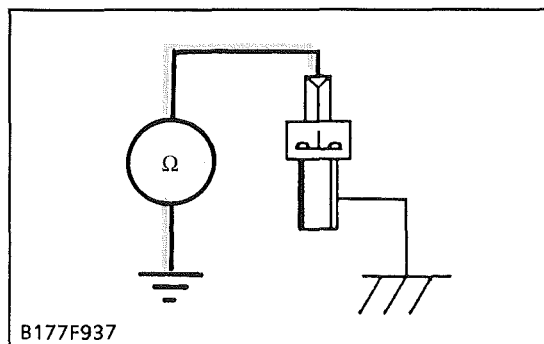
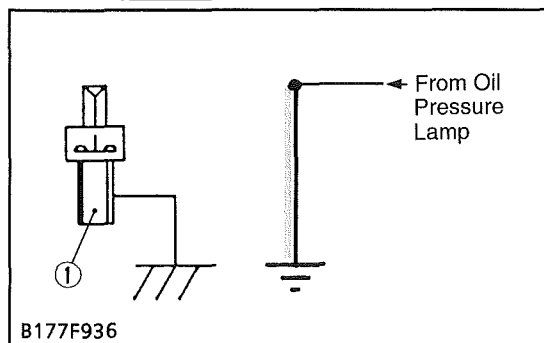


Engine Oil Pressure Switch

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.

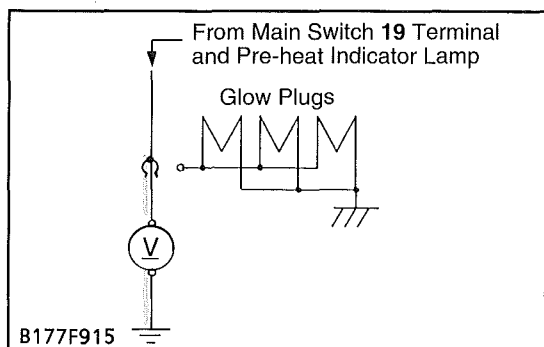
(1) Engine Oil Pressure Switch



2) Switch Continuity

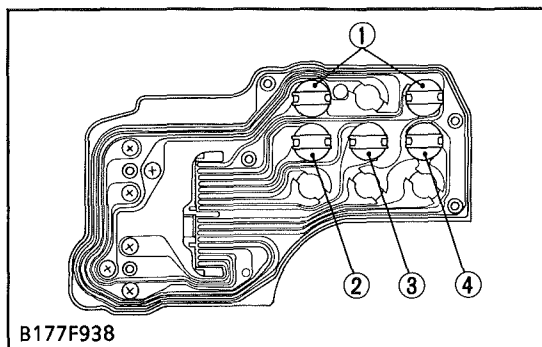
1. Measure the resistance with an ohmmeter across the switch terminal and the chassis.
2. If 0 ohm is not indicated in the normal state, the switch is faulty.
3. If infinity is not indicated at pressure over 4.9 kPa (0.5 kg/cm², 7 psi), the switch is faulty.

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.



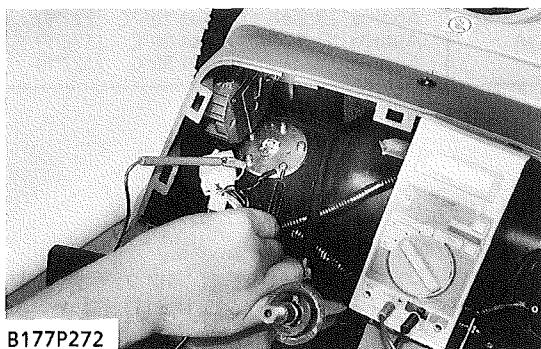
- (1) Hazard (3) Charge
(2) Engine Oil Pressure (4) Pre-heat

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
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[7] GAUGE CHECKING



Fuel Level Sensor

1) Lead Terminal Voltage

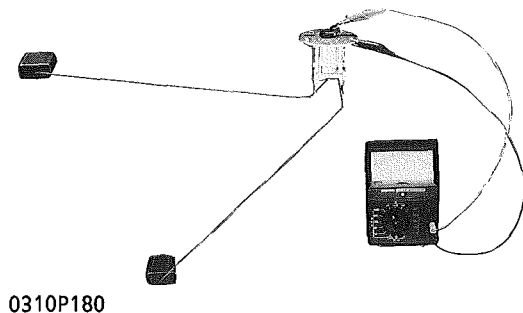
1. Remove the panel board and disconnect the connector from the fuel gauge unit after turning the main switch off.
2. Turn the main switch on and measure the voltage with a voltmeter across the connector terminal and the chassis.
3. If the voltage differs from the battery voltage, the wiring harness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

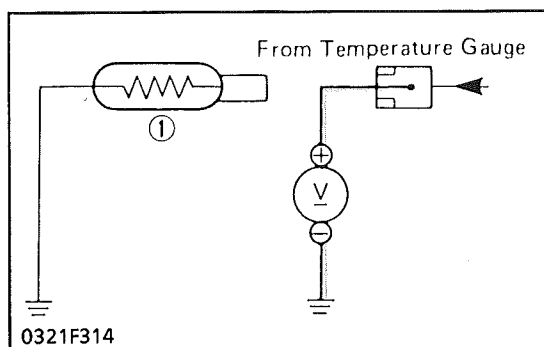
Voltage	Lead terminal - Chassis	Approx. battery voltage
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2) Sensor Continuity

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.

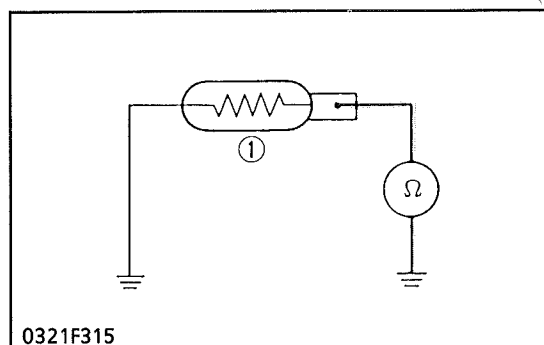
Resistance (Sensor terminal - its body)	Reference value	Float at upper- most position	1 to 5 ohms
		Float at lower- most position	103 to 107 ohms



**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.

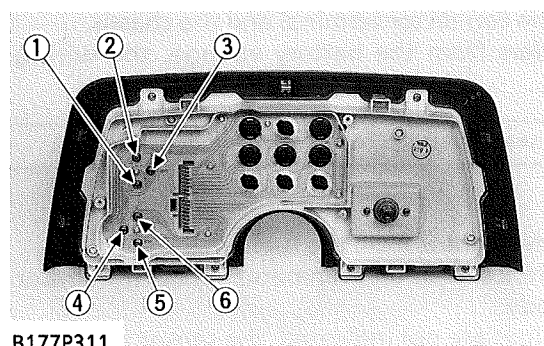
Voltage	Lead terminal – Chassis	Approx. battery voltage
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**2) Sensor Continuity**

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

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

(1) Coolant Temperature Sensor

**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.

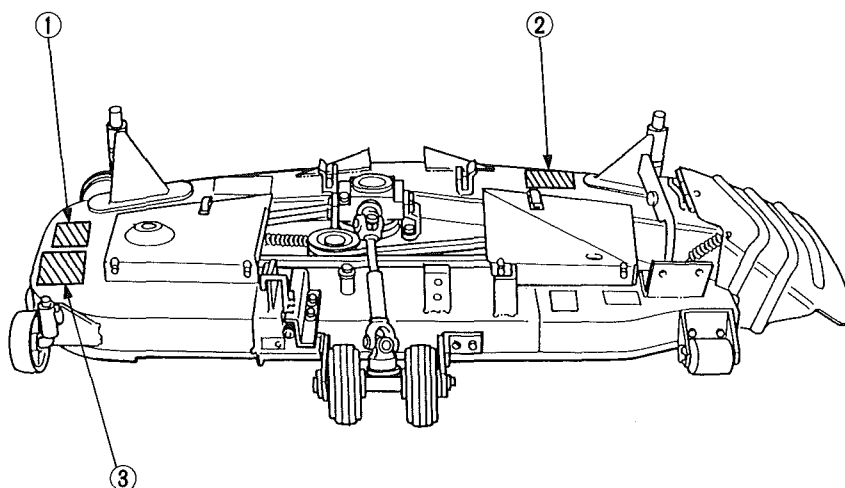
[TRANSPORTING]

- (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.

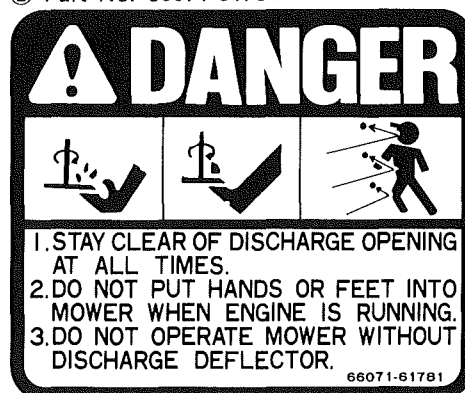
If a decal becomes damaged, illegible or is not on the mower, replace it. The decal part number is listed in the parts list.



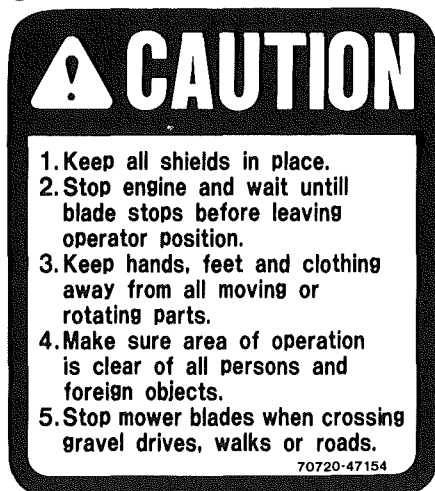
① Part No. 66071-61791



② Part No. 66071-61781



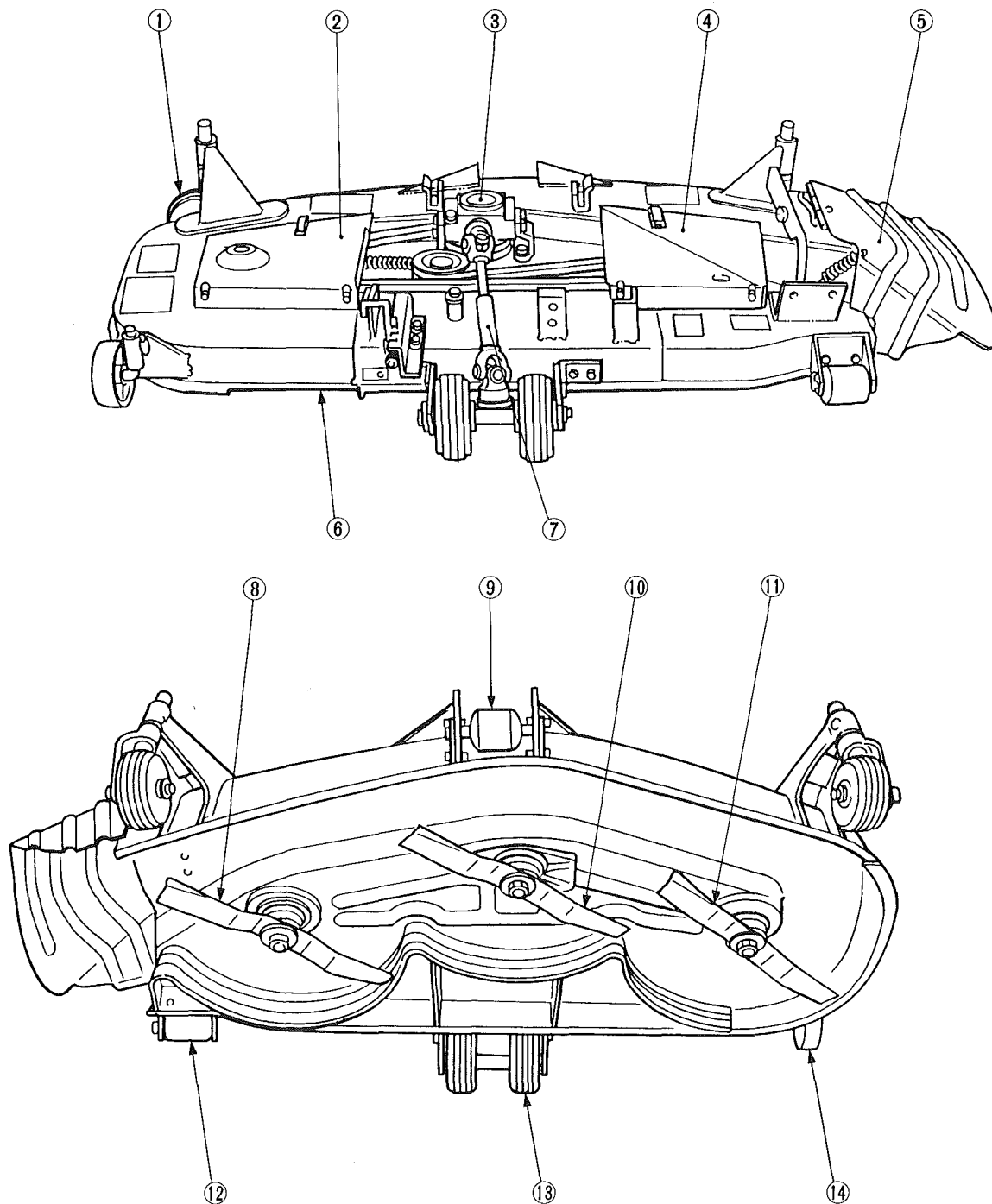
③ Part No. 70720-47154



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

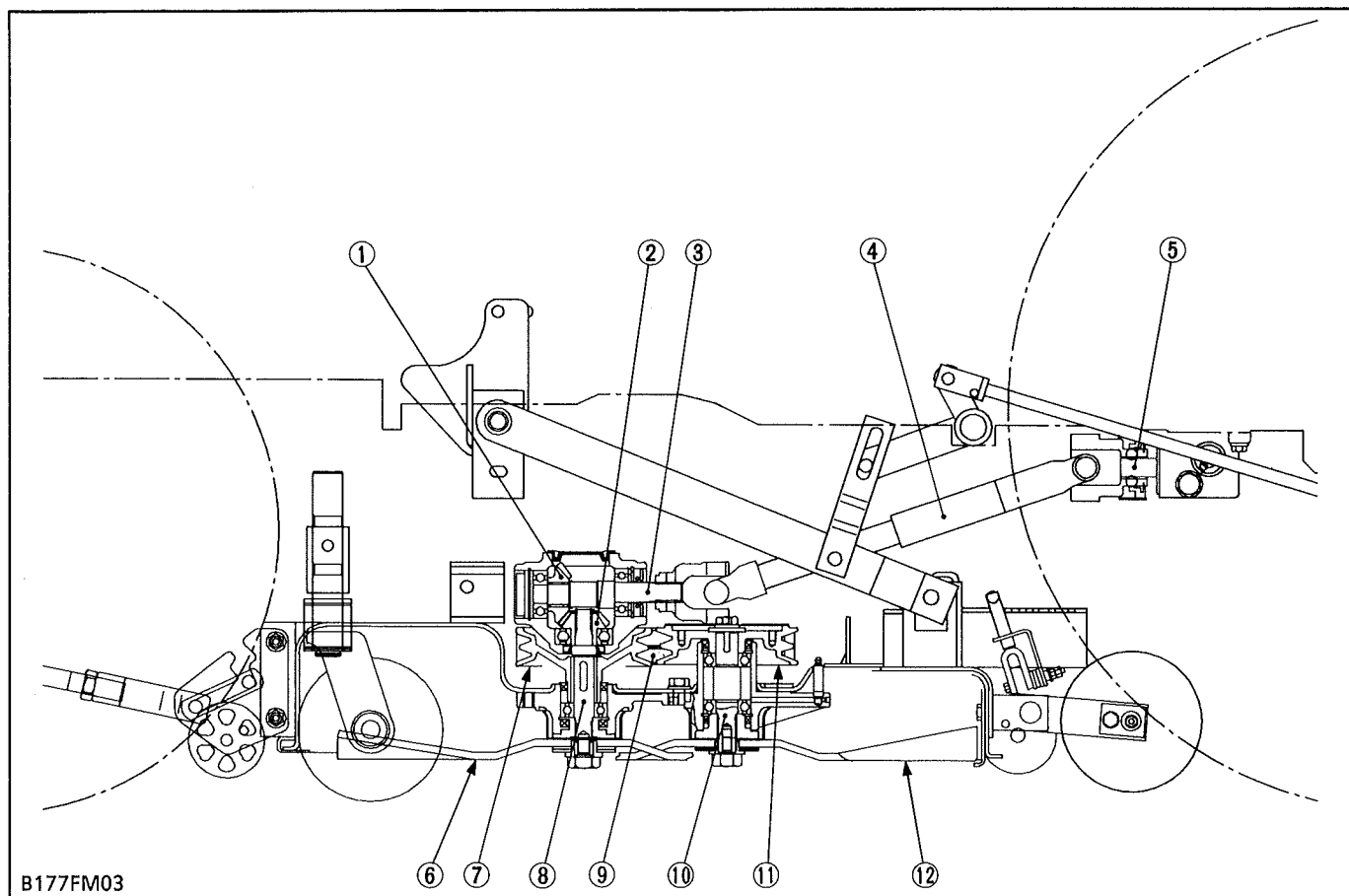
- | | | | |
|------------------------|-------------------------|-----------------------------|-----------------------------|
| (1) Front Gauge Wheel | (5) Discharge Deflector | (9) Front Anti-scalp Roller | (12) Rear Anti-scalp Roller |
| (2) Belt Cover (Left) | (6) Deck | (10) Center Blade | (13) Rear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

MECHANISM

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[1] POWER TRANSMISSION	M-M1
[2] LIFTING MECHANISM	M-M2

[1] POWER TRANSMISSION



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

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

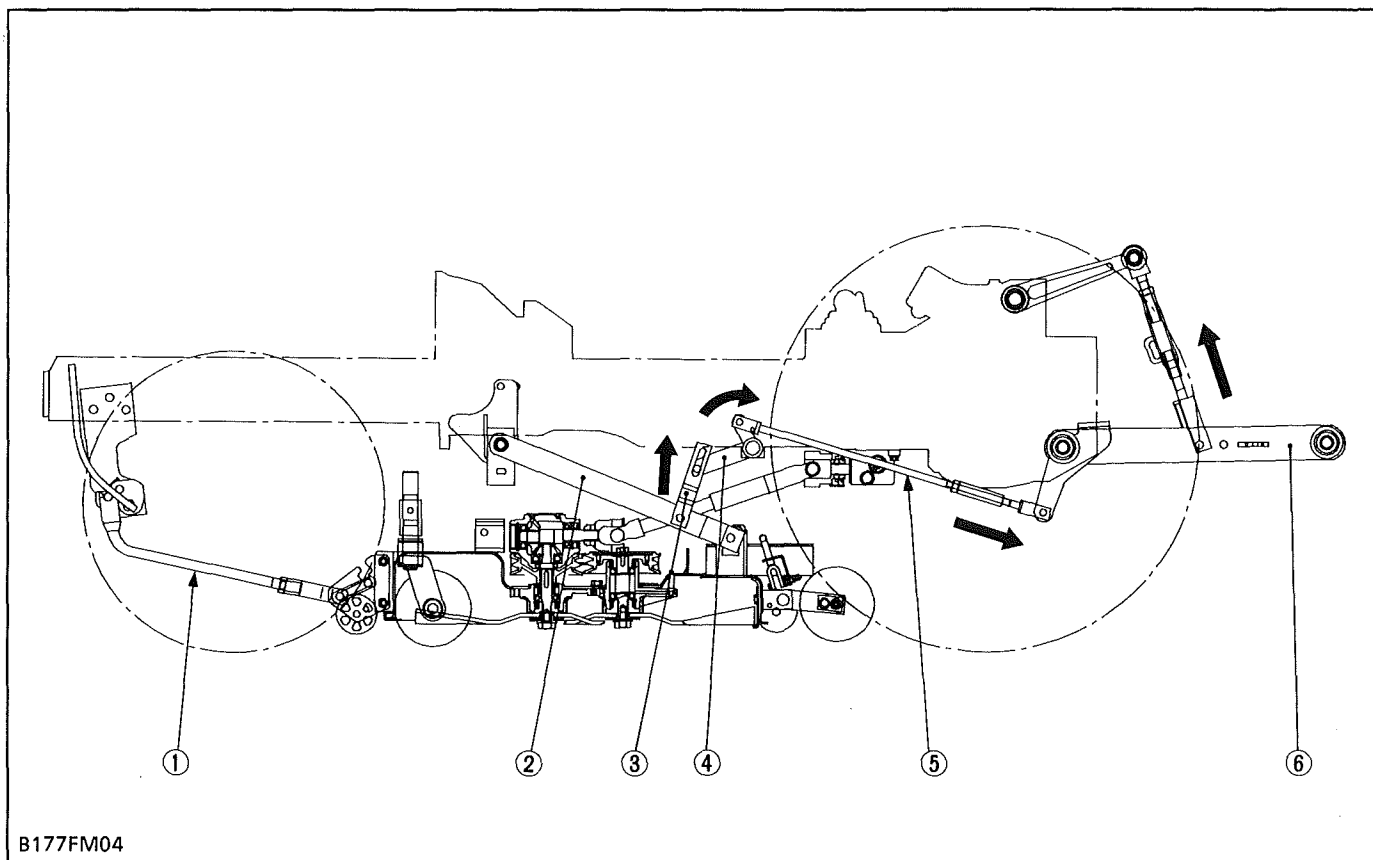
■ Center Blade

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



(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.

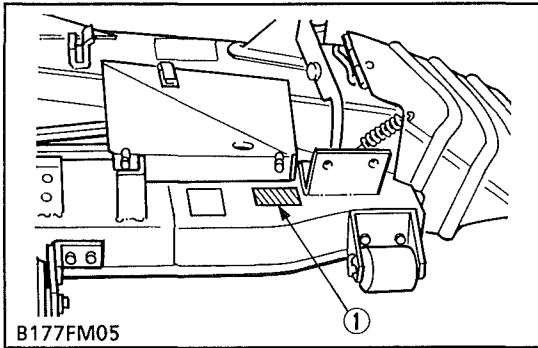
SERVICING

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[2] GENERAL PRECAUTION	M-S1
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GENERAL

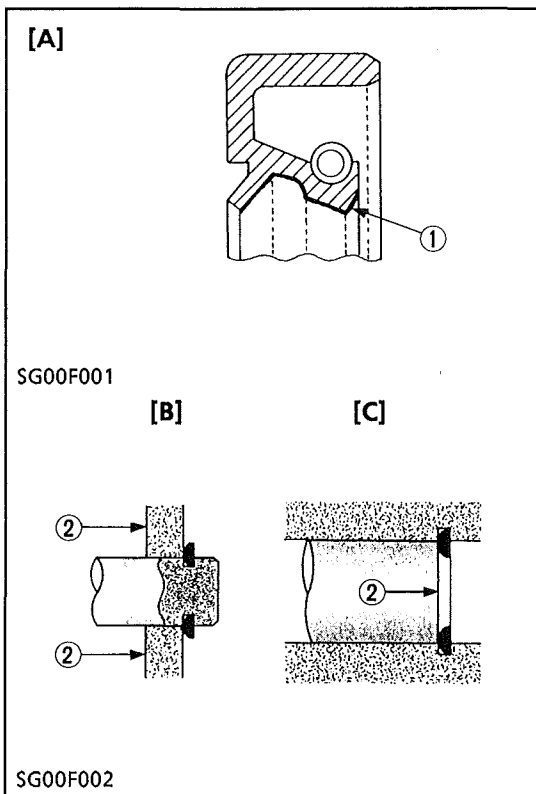
[1] MOWER IDENTIFICATION



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 0.38 U.S.qts. 0.32 Imp.qts.	SAE 90 gear oil (API Service GL-5 gear oil)
Greasing		
Universal joint	Until grease overflows	SAE multi-purpose type grease
Spindle shafts (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 )			7T * ()		
	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.

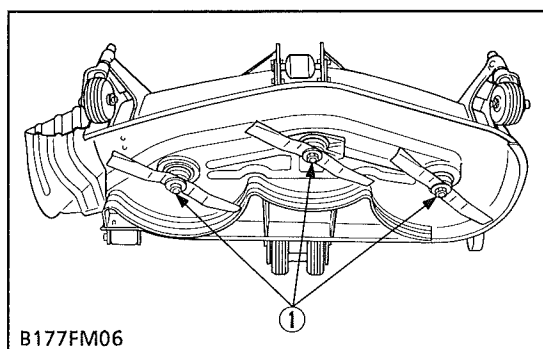
[5] MAINTENANCE CHECK LIST

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 ● Check mower blades for wear or damage ● Check gear box oil level ● Check oil leaks ● Check all hardware ● Make sure all pins are in place ● Clean mower deck ● Apply grease to universal joint ● Apply grease to spindle shafts (Bevel gear shaft and blade shafts) ● Apply grease to belt tension pulley ● Apply grease to belt tension pivot ● Apply grease to lift arms	- M-S3 M-S14 M-S4 - - - - M-S4 M-S4 M-S5 M-S5 M-S5
Initial 50 hours	● Change gear box oil	M-S5
Every 50 hours	● Apply grease to front gauge wheels ● Apply grease to rear gauge wheels ● Check mower belt	M-S6 M-S6 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

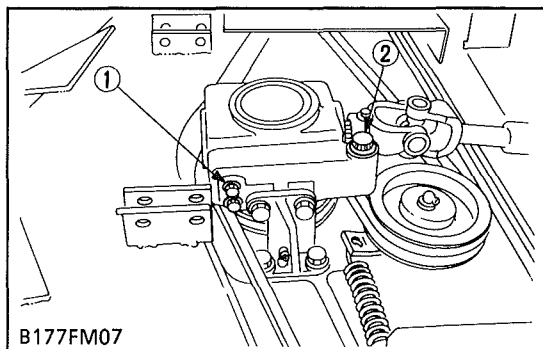
- To avoid injury, always handle the mower blade with care.

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 10.0 to 12.0 kgf·m 72.3 to 86.8 ft-lbs
-------------------	-------------------	--

Checking Mower Blade

1. See page M-S14.



Checking Gear Box Oil Level

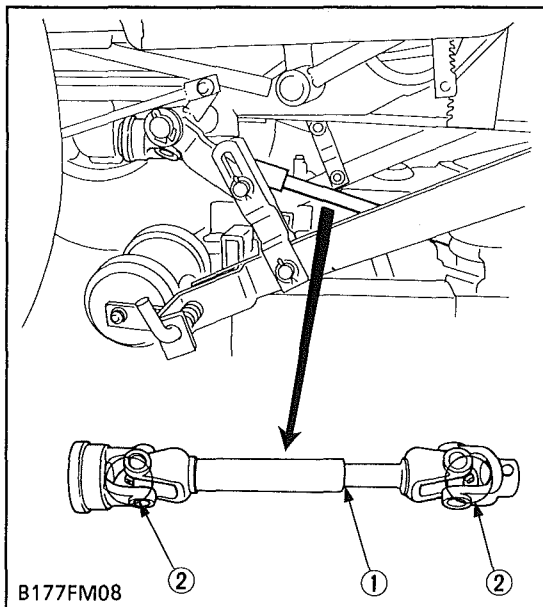
1. Place the mower on level ground.
2. Loosen the check plug (1), and check to see if oil seep from the opening.
3. If the oil level is low, remove the oil filler plug (2) and add new gear oil.

■ IMPORTANT

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

(1) Check Plug

(2) Oil Filler Plug

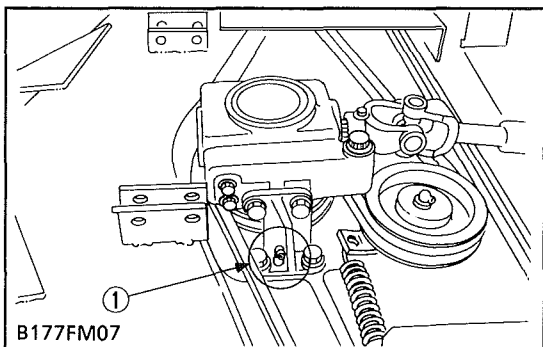


Greasing Universal Joint

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

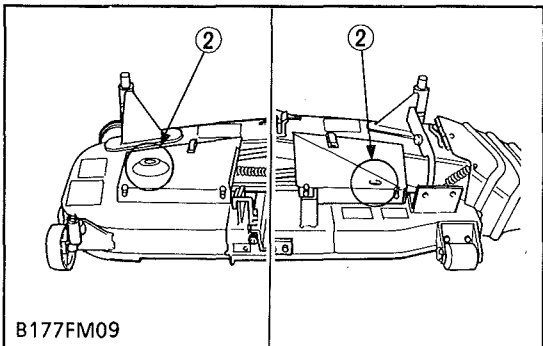


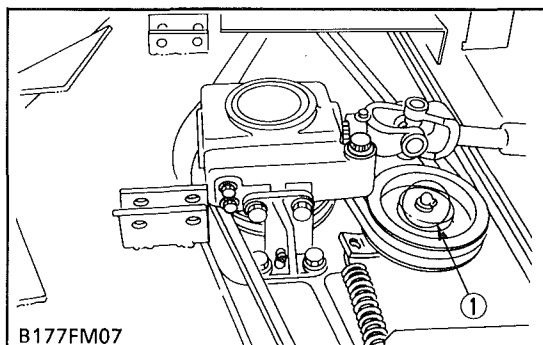
Greasing Spindle Shafts

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)

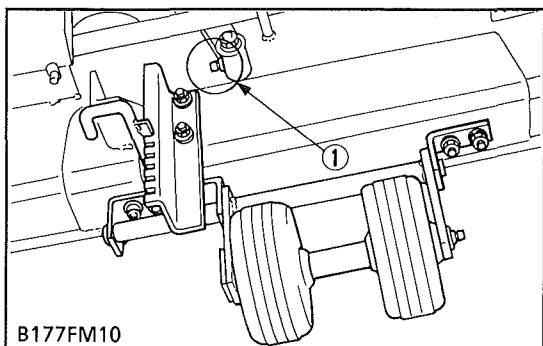




Greasing Belt Tension Pulley

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

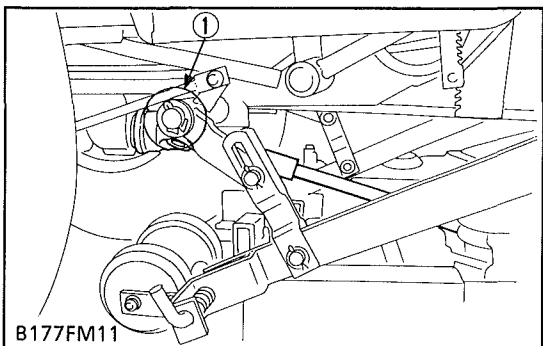
(1) Grease Nipple



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

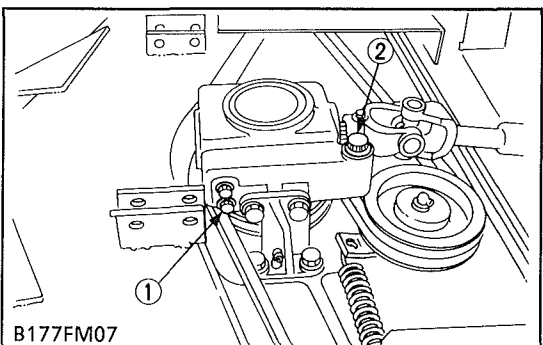


Greasing Lift Arms

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.

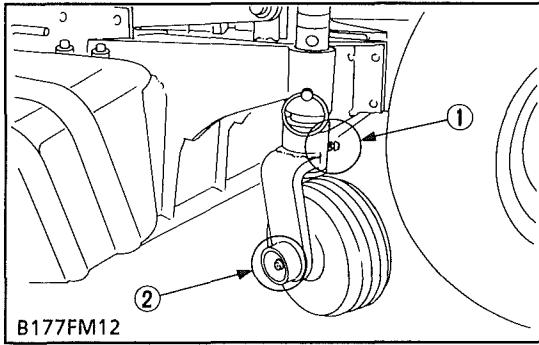
■ IMPORTANT

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

(1) Drain Plug

(2) Oil Filler Plug

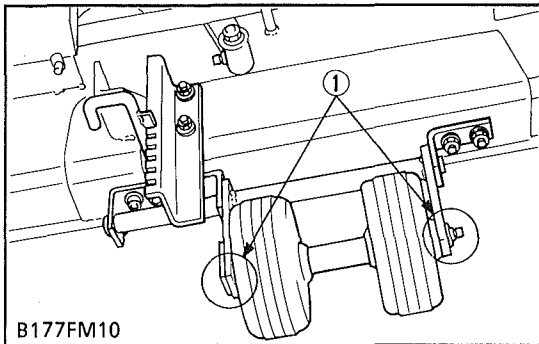
(3) Check Points of Every 50 Hours



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 |
|-------------------|

(4) Check Point of Every 150 Hours

Checking Mower Belt

1. See page M-S14.

(5) Check Point of Every 2 Years

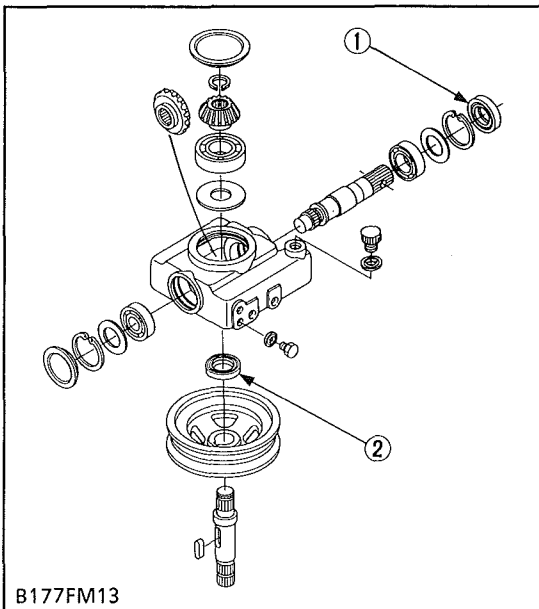
Changing Gear Box Oil

1. See page M-S5.

Replacing Gear Box Oil Seal

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

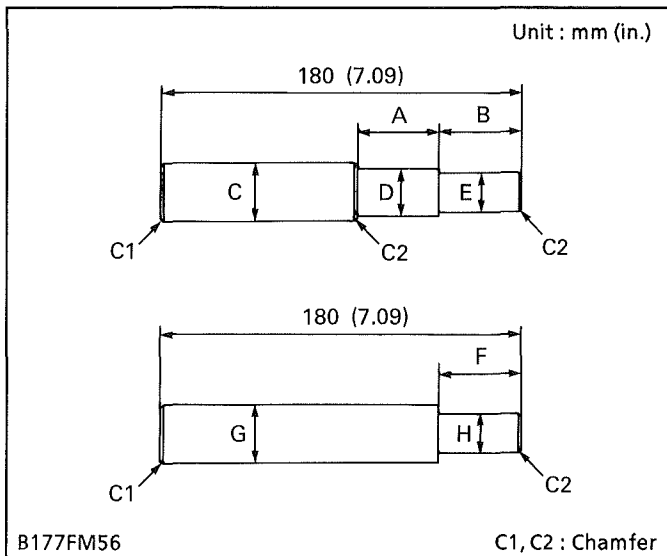
- | | |
|--------------|--------------|
| (1) Oil Seal | (2) Oil Seal |
|--------------|--------------|



[7] SPECIAL TOOLS

■ NOTE

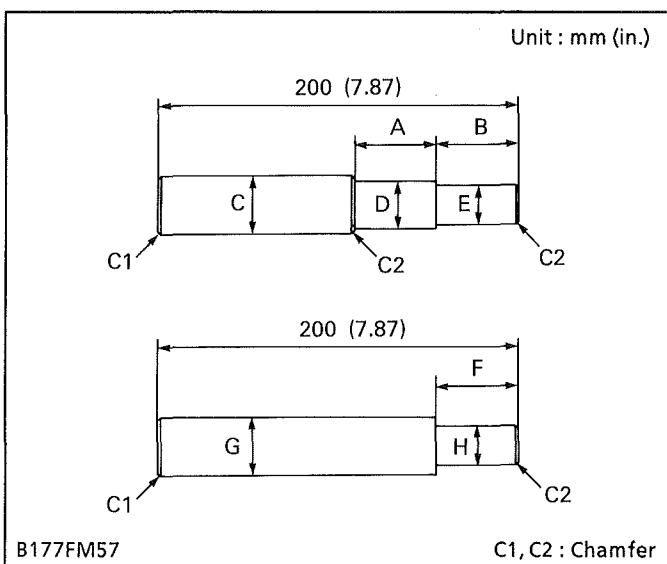
- The following special tools are not provided, so make them referring to the figures.



Tension Arm Bushing Replacing Tool

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

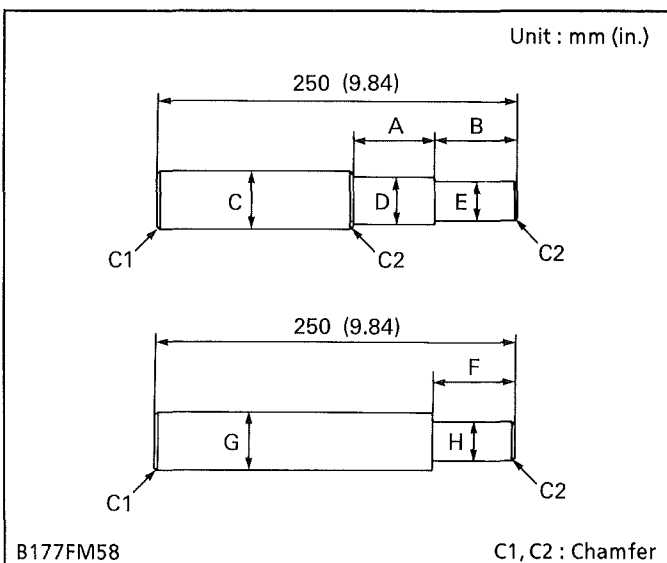
A	43 mm	1.69 in.
B	42 mm	1.65 in.
C	28 mm Dia.	1.10 in. Dia.
D	22.90 to 22.95 mm Dia.	0.9016 to 0.9035 in. Dia.
E	19.90 to 19.95 mm Dia.	0.7835 to 0.7854 in. Dia.
F	42 mm	1.65 in.
G	28 mm Dia.	1.10 in. Dia.
H	19.90 to 19.95 mm Dia.	0.7835 to 0.7854 in. Dia.
C1	2.0 mm	0.079 in.
C2	1.0 mm	0.039 in.



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.

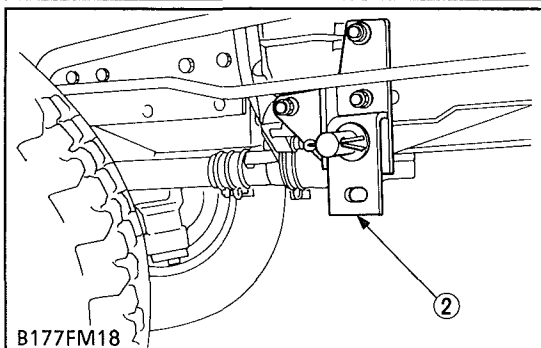
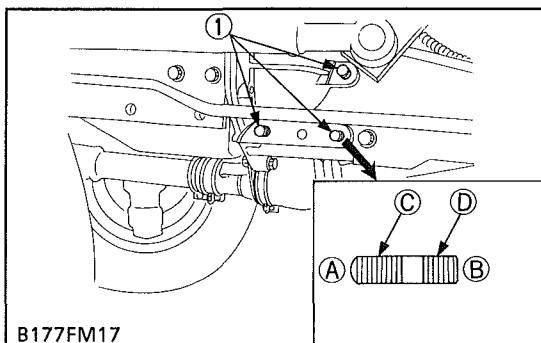
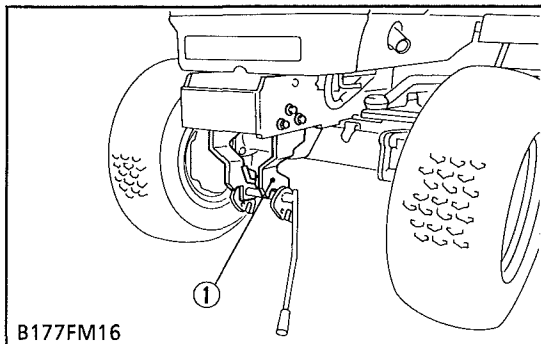
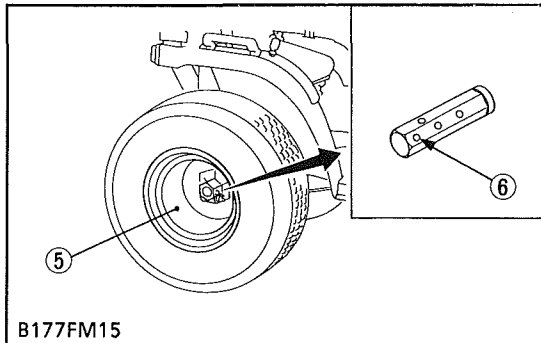
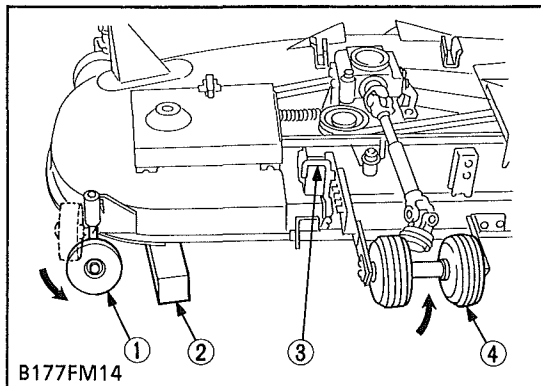


Rear Link Bushing Replacing Tool

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



Assembling Mower

⚠ CAUTION

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

- Take out all mower components from the case, and assemble the mower.
- Support the mower deck with a block (2) as shown in the figure.
- Turn the anti-scalp wheel (1) sideways position, and set the rear gauge wheel (4) on the lowest cutting height.
- Remove the a block.
- 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 | (4) Rear Gauge Wheel |
| (2) Block | (5) Rear Wheel |
| (3) Rear Gauge Wheel Adjusting Lever | (6) Outer Position |

Front Hanger Bracket

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

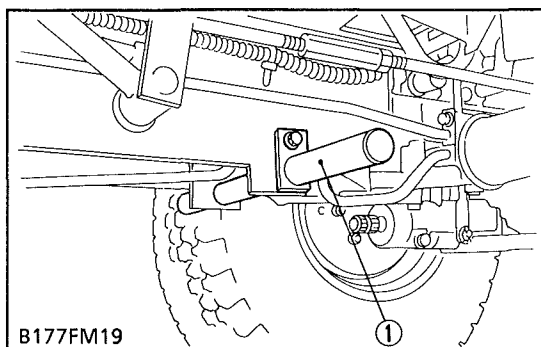
- (1) Front Hanger Bracket

Mid Hanger Bracket

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

Tightening torque	Stud bolt	31.4 N·m 3.2 kgf·m 23.1 ft·lbs
	Nut	68.6 N·m 7.0 kgf·m 50.6 ft·lbs

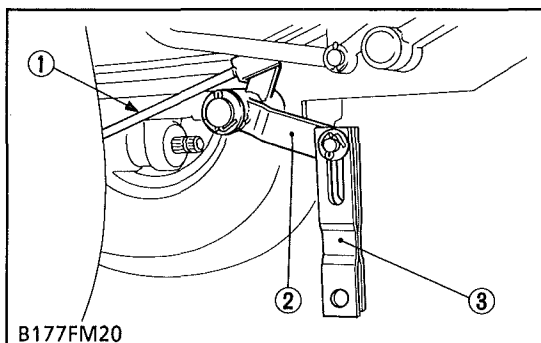
- | | |
|------------------------|------------------------------------|
| (1) Stud Bolt | (A) Outside |
| (2) Mid Hanger Bracket | (B) Inside |
| | (C) Thread Size : M12 x Pitch 1.25 |
| | (D) Thread Size : M12 x Pitch 1.75 |



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

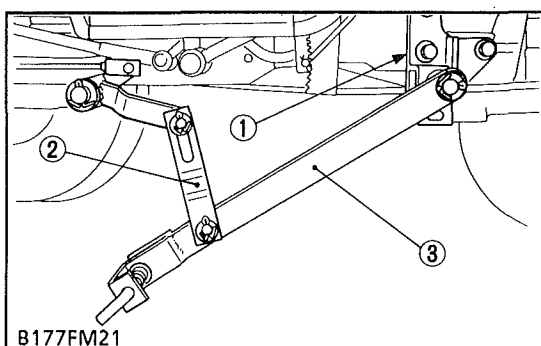


Lift Arm, Lift Link and Connecting Rod

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)

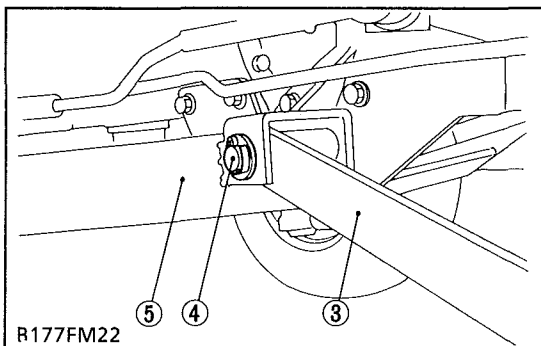
1. Install the rear links (3) to the mid hanger brackets (1) with plain washers and cotter pins.
2. Attach the lift links (2) to the rear links (3) with clevis pins, plain washers and cotter pins.

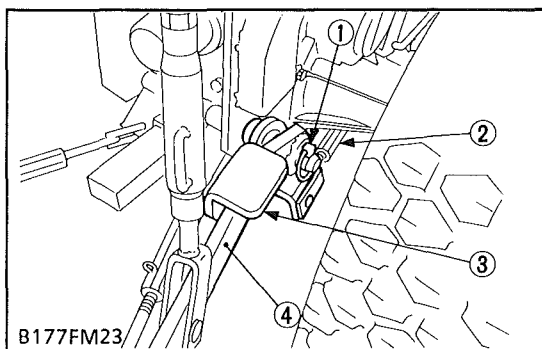
(When mounting the mower with front loader)

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





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.

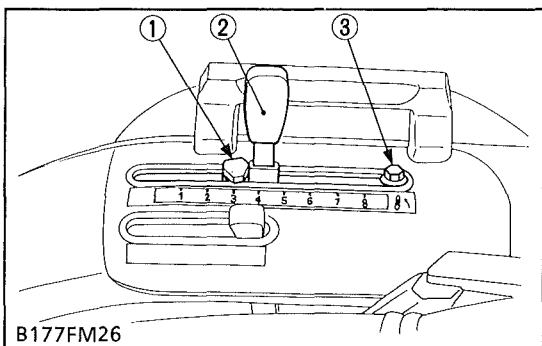
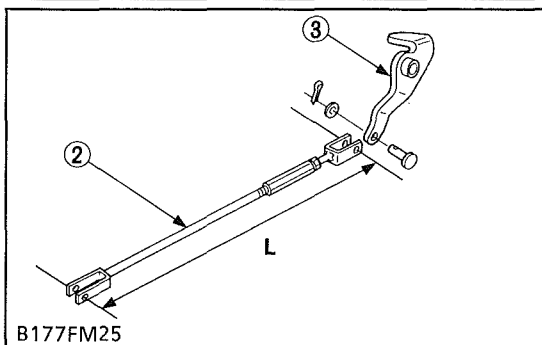
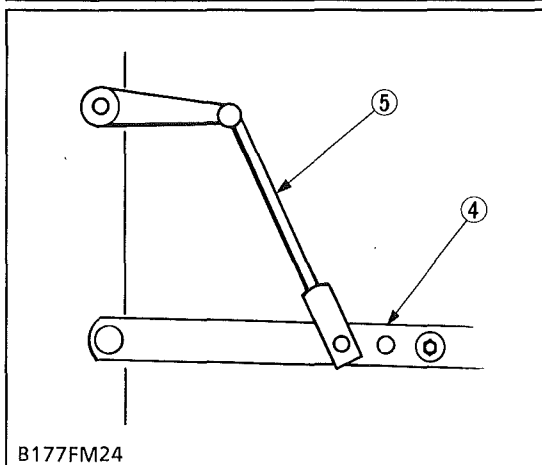
■ IMPORTANT

- 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.).

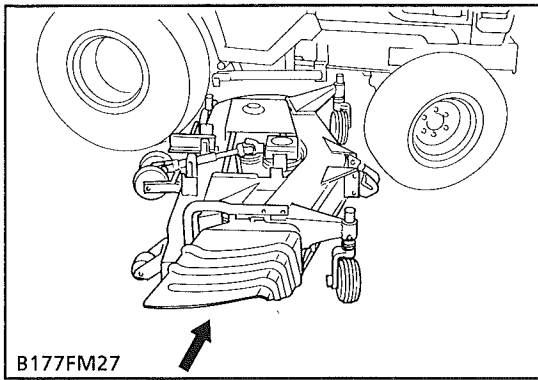
- | | |
|--------------------|----------------|
| (1) Lower Link Pin | (4) Lower Link |
| (2) Connecting Rod | (5) Lift Rod |
| (3) Lift Bracket | |



Setting Position Control Lever

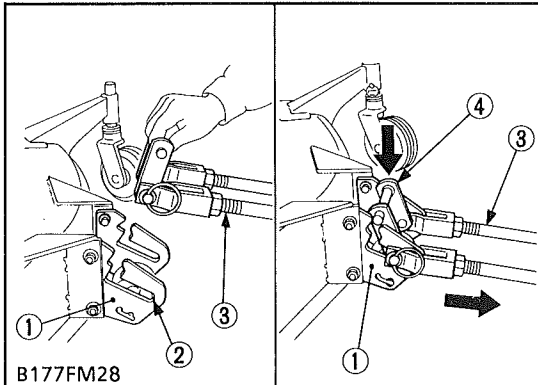
1. Set the stop screw (3) at the top of the range to pull the position control lever (2) back fully.
2. Set the stop knob screw (1) at the "3" range as shown in the figure.

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



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.



Front Link

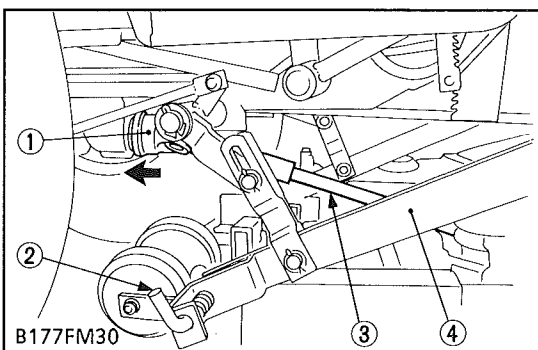
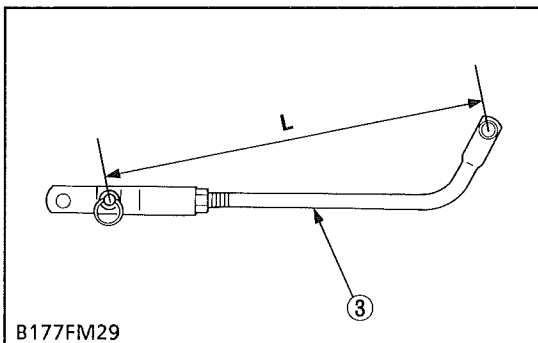
1. Hook the front link (3) with the clevis pin section to front end of the groove (2), and then turn the stopper (4) as shown in the figure.

(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

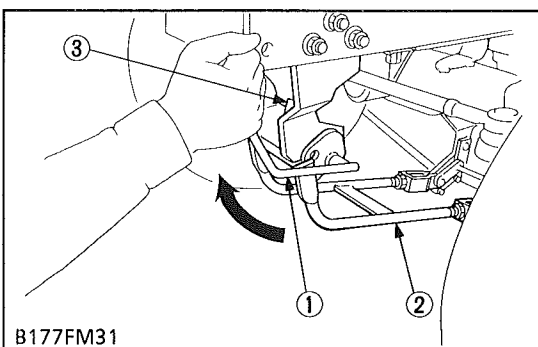


Mounting Universal Joint and Rear Link

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



Mounting Front Link

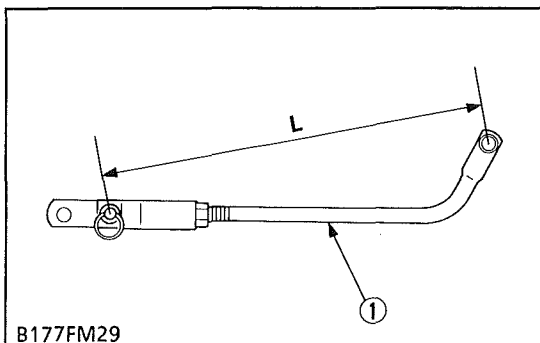
1. Push down the link fixing lever, pulling the L-pin.
2. Hook the front link (2) to the lever fulcrum, and turn the link fixing lever (1).
3. Return the L-pin (3).

■ NOTE

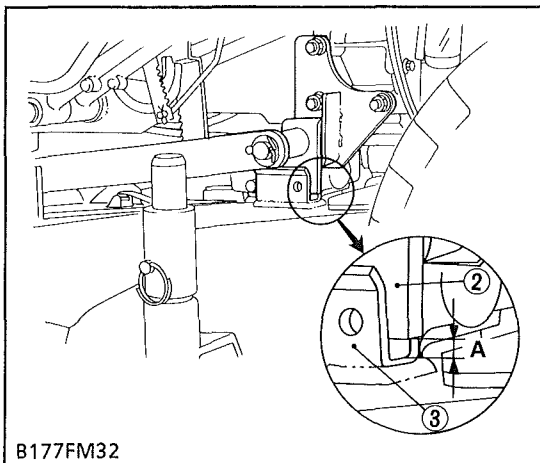
- Make sure the link fixing lever (1) is fixed with L-pin (3) securely.

- (1) Link Fixing Lever
(2) Front Link

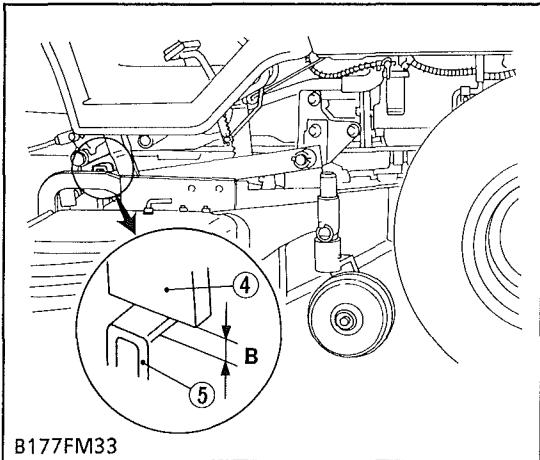
- (3) L-pin



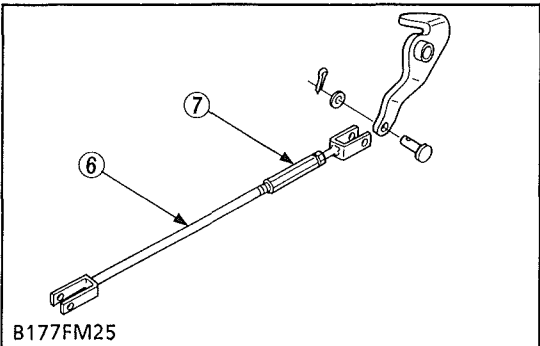
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B177FM33



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Adjusting Front Link and Connecting Rod

⚠ CAUTION

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

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

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

■ IMPORTANT

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

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

TROUBLESHOOTING

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

SERVICING SPECIFICATIONS

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

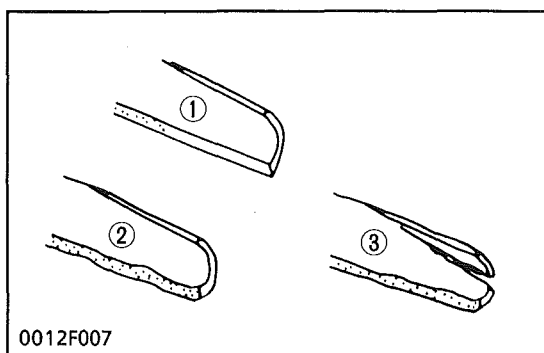
TIGHTENING TORQUES

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



0012F007
(1) New Blade
(2) Worn Blade

(3) Cracked Blade

Checking Mower Blade

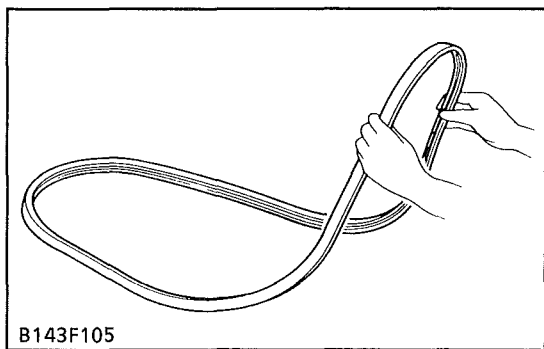
1. Check the cutting edge of mower blade.
2. Sharpen the cutting edges, if the mower blades are as shown in figure ②.
3. Replace the mower blades, if they are as shown in figure ③.

■ IMPORTANT

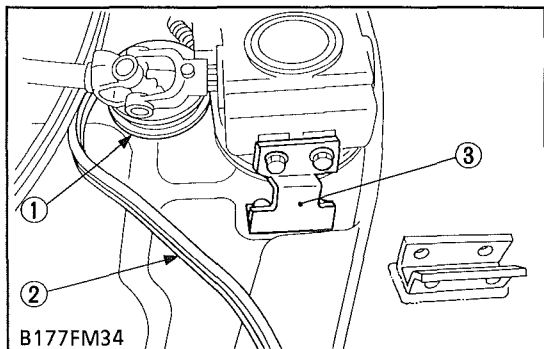
- Never forget to set the two cup washers between mower blade and spline boss, when reassembling the mower blades.

■ 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.

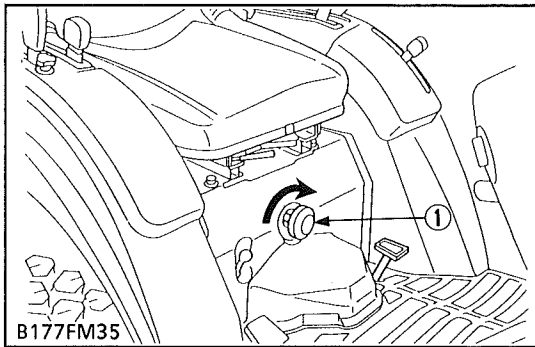
Tightening torque	Gear box bracket mounting screw	78.5 to 88.2 N·m 8.0 to 9.0 kgf·m 57.9 to 65.1 ft-lbs
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■ IMPORTANT

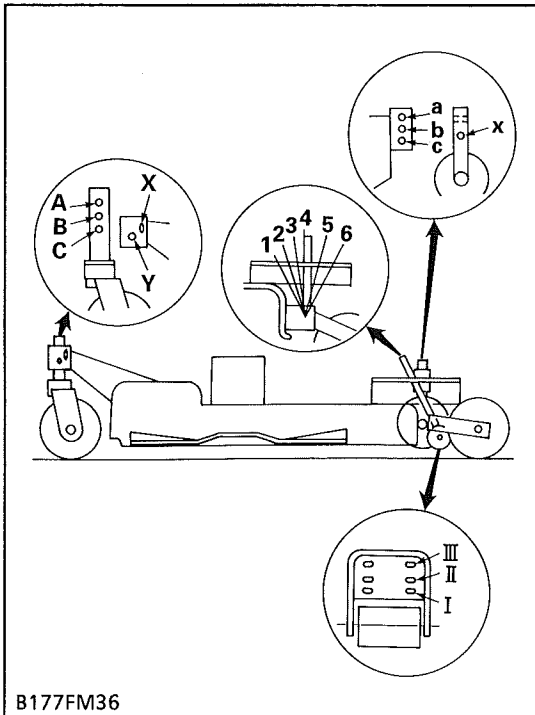
- After setting the gear box bracket mounting screws on the deck without tightening, then mount the other screws on the gear box. And finally tighten them.

(1) Tension Pulley
(2) Mower Belt

(3) Gear Box Bracket (Right)



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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.

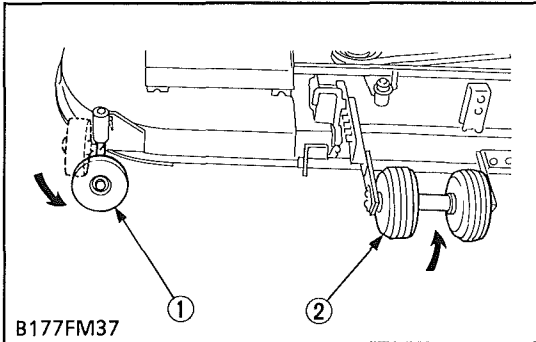
DISASSEMBLING AND ASSEMBLING

(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

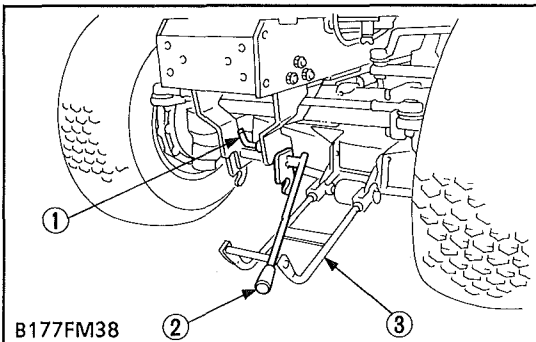
- Start the engine, and lift the mower.
- Turn the anti-scalp wheel (1) sideways position and set the rear gauge wheel (2) on the lowest cutting height.
- Lower the mower, and stop the engine.

(When reassembling)

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

(1) Anti-scalp Wheel

(2) Rear Gauge Wheel



Front Link

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

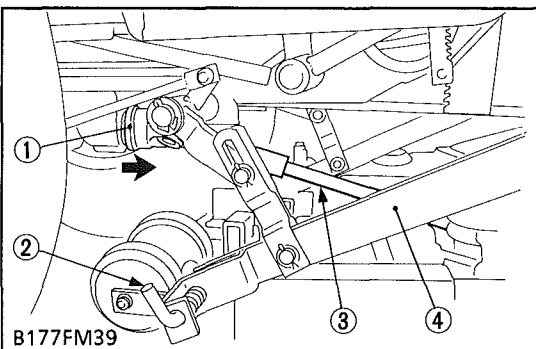
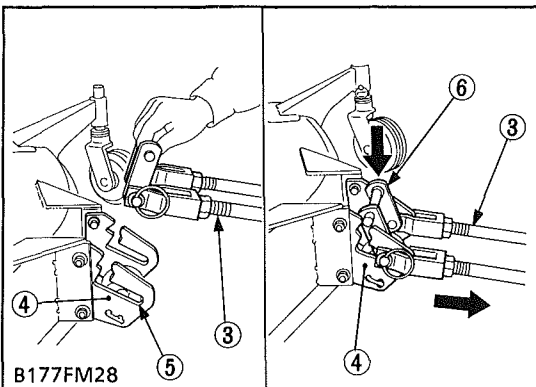
(2) Link Fixing Lever

(3) Front Link

(4) Stay

(5) Groove

(6) Stopper



Rear Link and Universal Joint

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

(When reassembling)

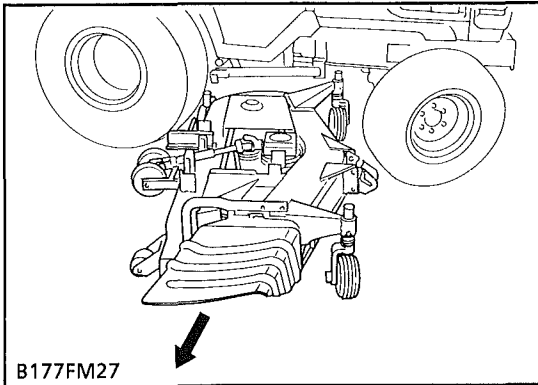
- Apply grease to the splines and grease nipples of the universal joint.
- Slide the universal joint back and forward to make sure the universal joint is locked securely.

(1) Coupler

(2) L-pin

(3) Universal Joint

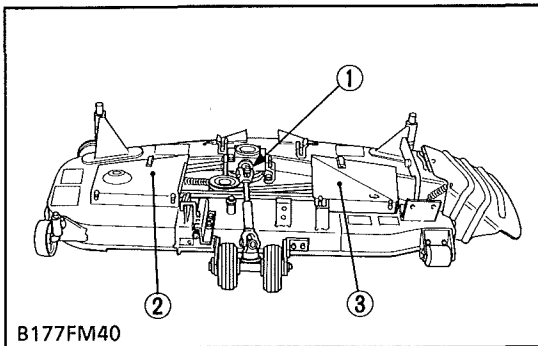
(4) Rear Link



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

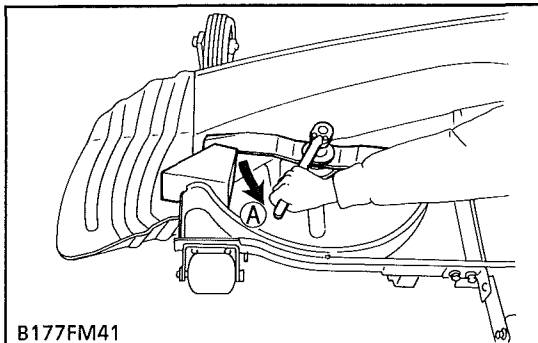


Universal Joint and Belt Cover

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)



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

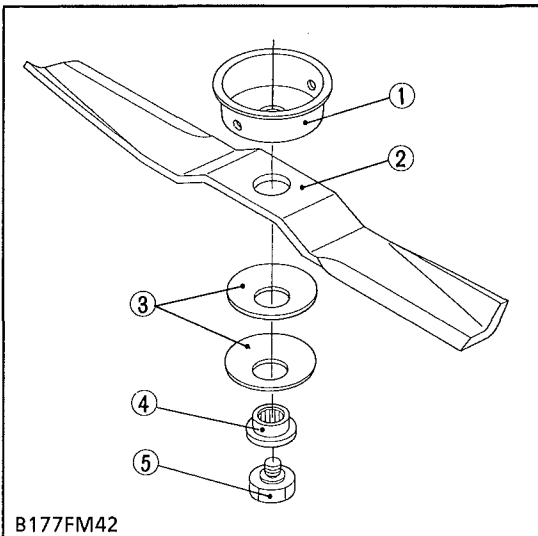
- To remove the blade securely, wedge a block of wood between one blade and the mower deck in such position that it will hold the blade safely while loosening or tightening the blade screw.

(When reassembling)

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

■ IMPORTANT

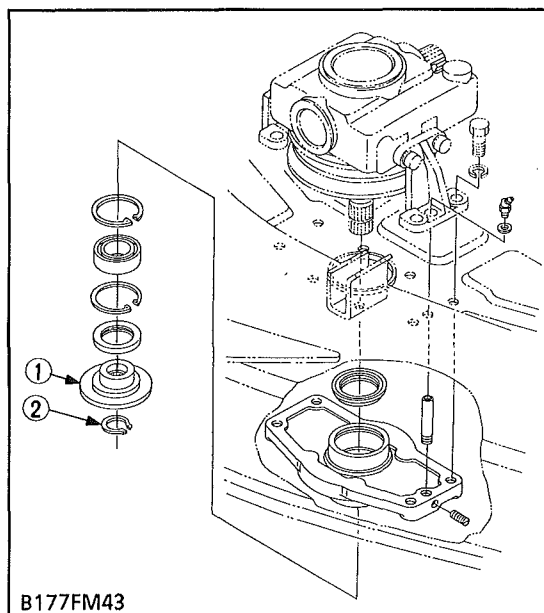
- Make sure the cup washer is not flattened out or worn, causing blade to slip easily. Replace two cup washers if either is damaged.



Tightening torque	Mower blade screw	98.1 to 117.7 N·m 10.0 to 12.0 kgf·m 72.3 to 86.8 ft-lbs
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- (1) Dust Cover
(2) Mower Blade
(3) Cup Washer
(4) Spline Boss
(5) Mower Blade Screw

(A) Loosen

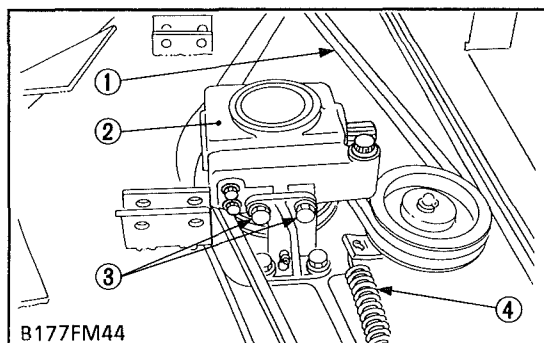


Blade Boss

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

(1) Blade Boss

(2) External Snap Ring



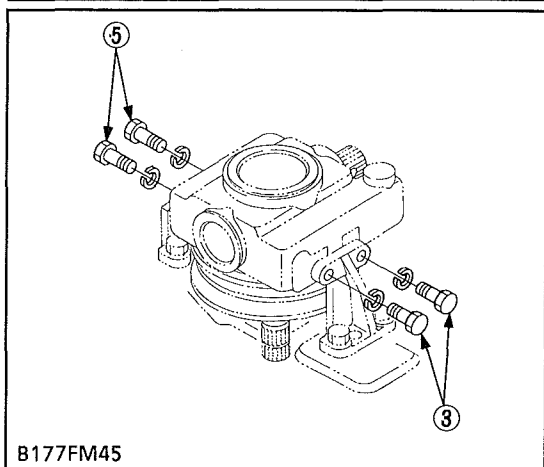
Gear Box and Mower Belt

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

(When reassembling)

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

Tightening torque	Gear box mounting screw	78.5 to 88.2 N·m 8.0 to 9.0 kgf·m 57.9 to 65.1 ft-lbs
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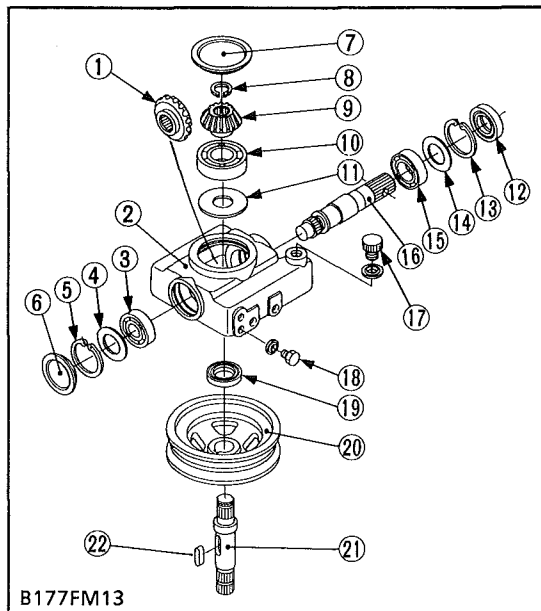
(1) Mower Belt

(4) Tension Spring

(2) Gear Box

(5) Gear Box Mounting Screw

(3) Gear Box Mounting Screw
(Reamer Screw)



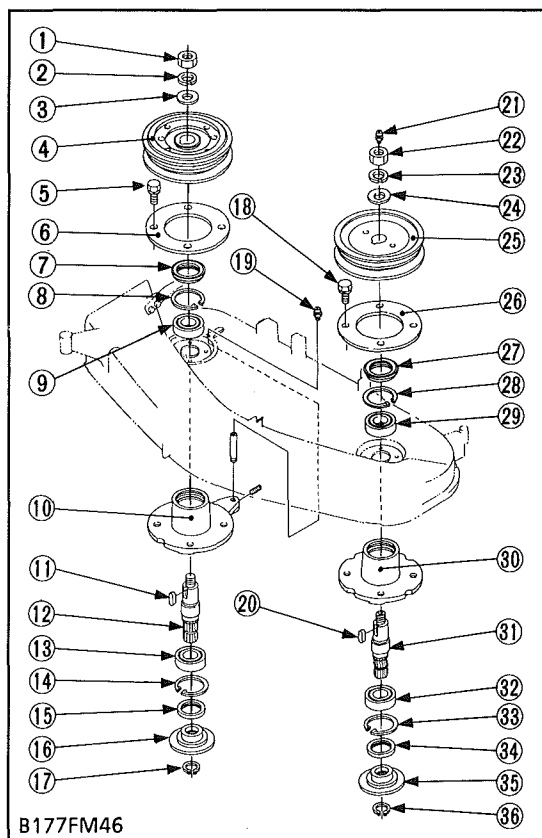
Disassembling Gear Box

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

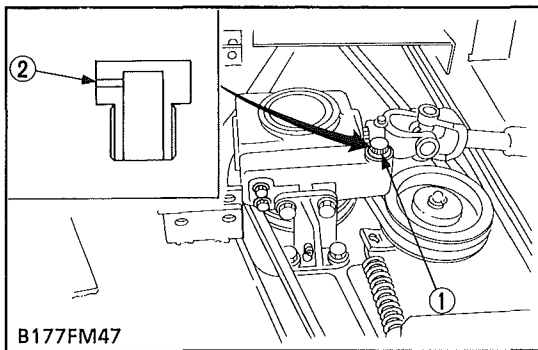
(When reassembling)

- 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 17.0 to 19.0 kgf·m 123.0 to 137.4 ft-lbs
	Pulley holder mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

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

SERVICING

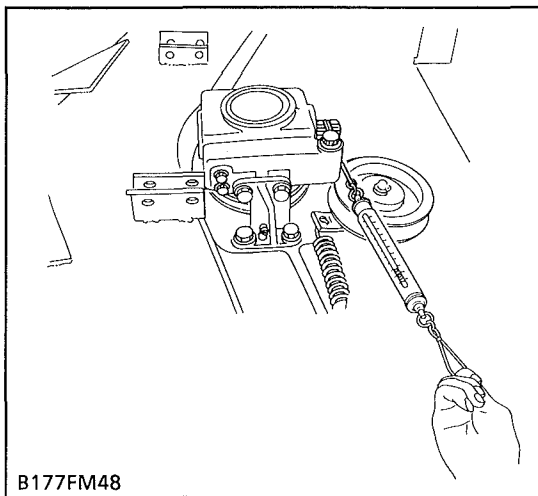


Oil Filler Plug

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 12.0 kgf 26.5 lbs
Turning torque	Factory spec.	Less than 1.47 N·m 0.15 kgf·m 1.08 ft·lbs

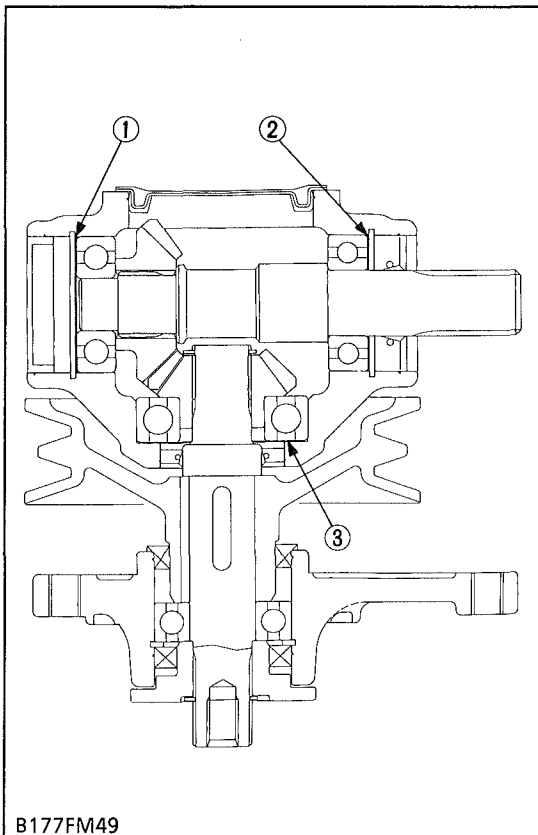
(Reference)

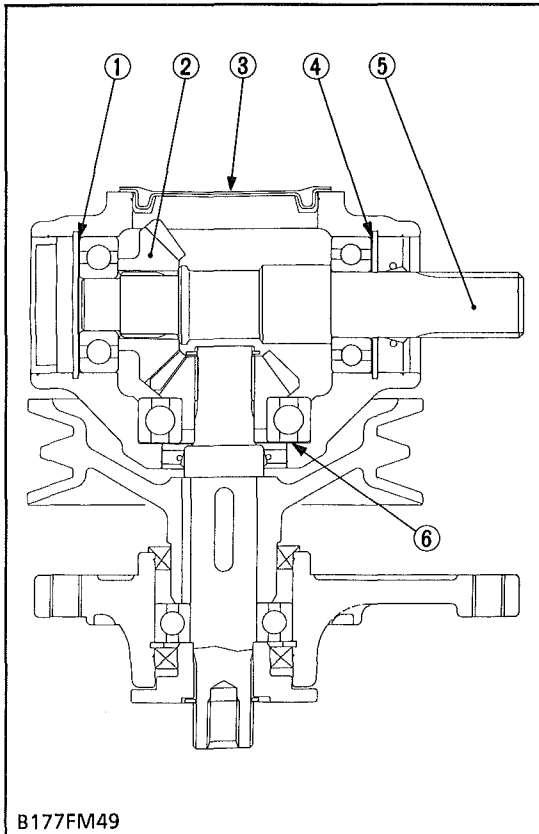
- Thickness of adjusting shims (1), (2), (3) : 0.2 mm (0.0079 in.)
0.3 mm (0.0118 in.)

(1) Adjusting Shim

(2) Adjusting Shim

(3) Adjusting Shim





Backlash between Bevel Gears

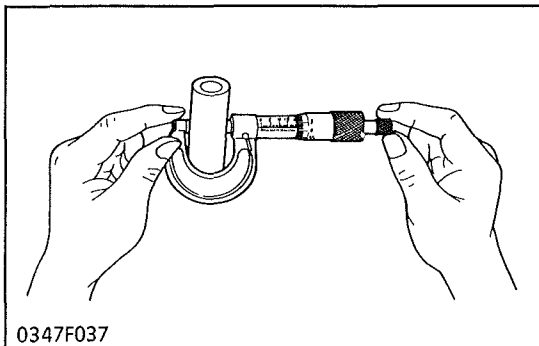
1. Remove the gear box cap (3).
2. Place fuses the 21T bevel gear (or 19T bevel gear) (2) on the pinion shaft (5).
3. Turn the pinion shaft.
4. Take out the fuses, and measure the thickness of fuses with an outside micrometer. (Backlash equal thickness of fuse)
5. If the backlash exceeds the allowable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

Backlash between bevel gears	Factory spec.	0.10 to 0.20 mm 0.0039 to 0.0079 in.
	Allowable limit	0.4 mm 0.0157 in.

(Reference)

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

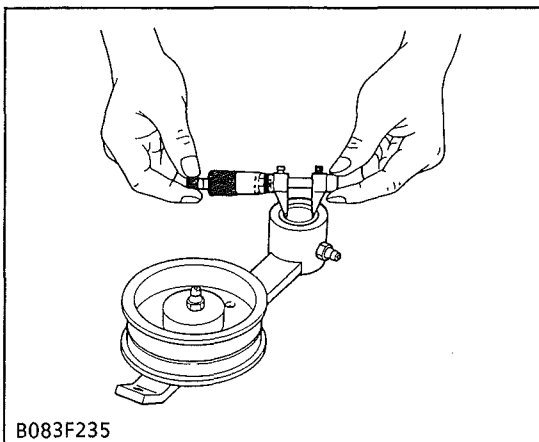
- | | |
|-------------------------------|------------------|
| (1) Shim | (4) Shim |
| (2) 21T Bevel Gear (RC54-24B) | (5) Pinion Shaft |
| 19T Bevel Gear (RC60-24B) | (6) Shim |
| (3) Gear Box Cap | |



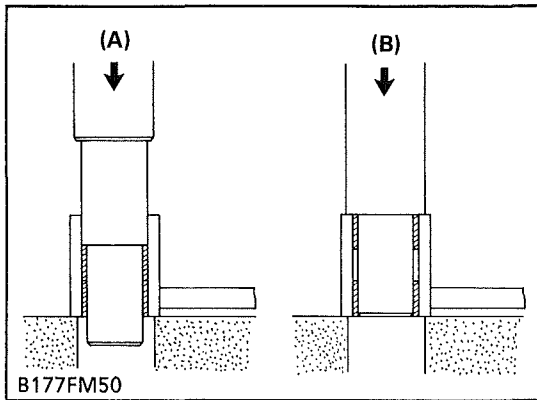
Clearance between Tension Collar and Tension Arm Bushing

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 0.00098 to 0.00500 in.
	Allowable limit	0.30 mm 0.0118 in.



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



Replacing Tension Arm Bushing

(When removing)

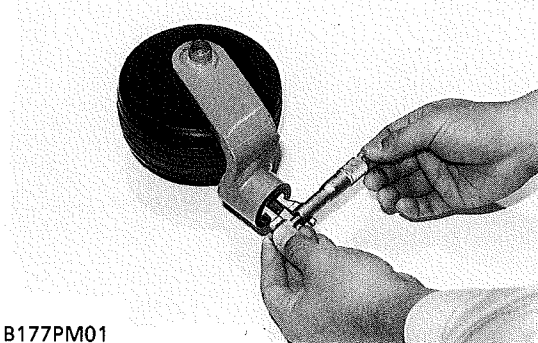
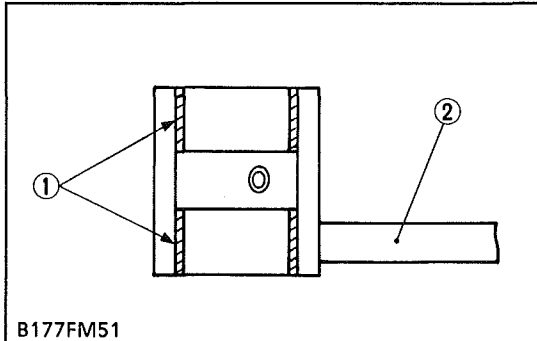
1. Remove the grease nipple from the tension arm.
2. Using a tension arm bushing replacing tool (see page M-S7), press out the used bushings.

(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

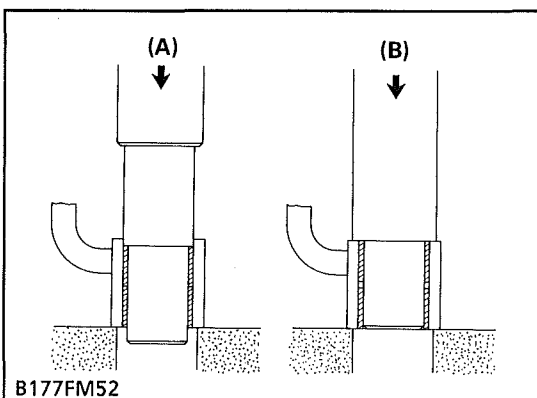
- (A) When Removing
(B) When Installing



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 1.18110 to 1.18445 in.
	Allowable limit	31.000 mm 1.22047 in.



Replacing Front Gauge Wheel Bushing

(When removing)

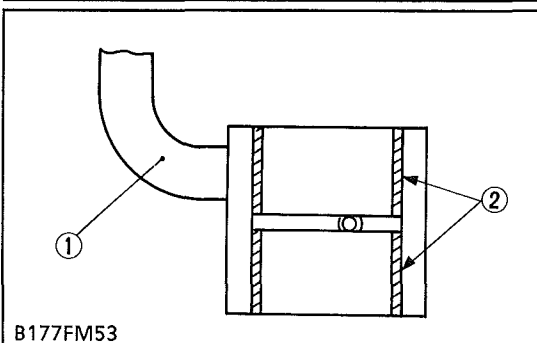
1. Using a front gauge wheel bushing replacing tool (see page M-S7), press out the used bushings.

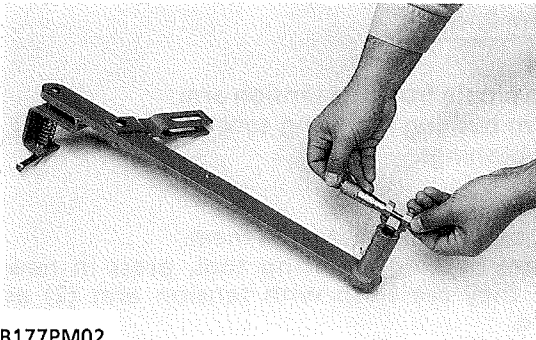
(When installing)

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



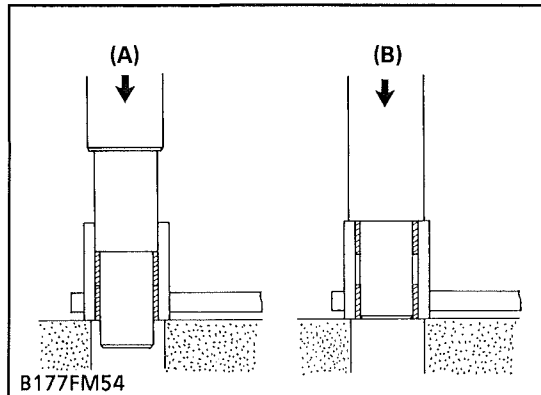


B177PM02

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 0.78740 to 0.79059 in.
	Allowable limit	21.000 mm 0.82677 in.



B177FM54

Replacing Rear Link Bushing

(When removing)

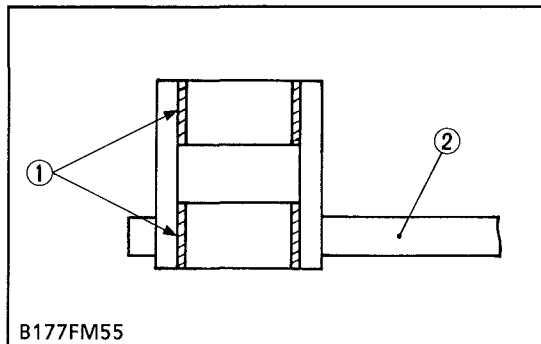
1. Using a rear link bushing replacing tool (see page M-57), press out the used bushings.

(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



B177FM55

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 cm ³ (54.8 cu.in.)	1001 cm ³ (61.1 cu.in.)	1123 cm ³ (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]

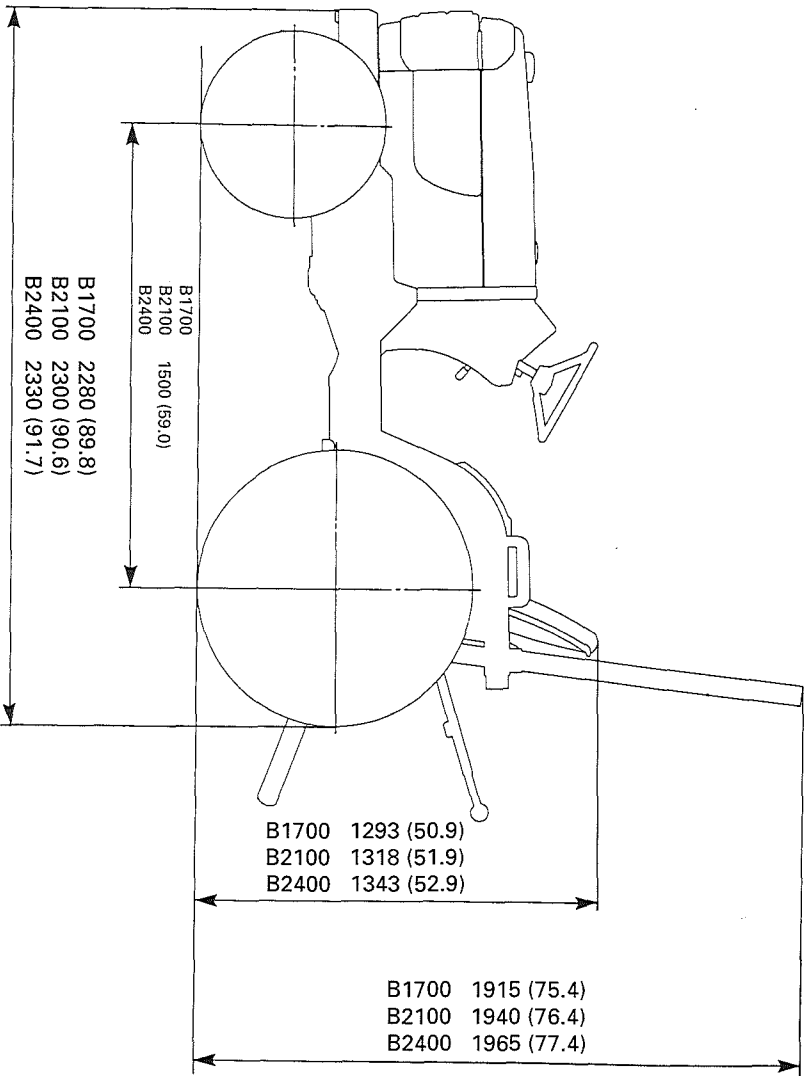
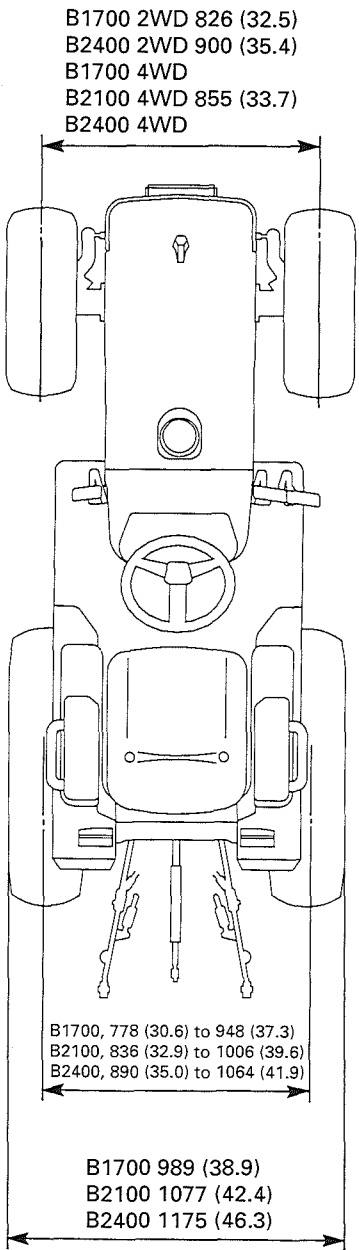
Model		B1700 E (Manual Transmission Type)	B2400 HSE (HST Type)
PTO power		10.5 kW (14.0 HP)*	13.4 kW (18.0 HP)*
Engine	Maker	KUBOTA	
	Model	D905-D10	D1105-D10
	Type	Indirect Injection. Vertical, water-cooled, 4-cycle diesel	
	Number of cylinders	3	
	Bore and stroke	72 x 73.6 mm (2.83 x 2.90 in.)	78 x 78.4 mm (3.07 x 3.09 in.)
	Total displacement	898 cm ³ (54.8 cu.in.)	1123 cm ³ (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.) Rear: 778 to 948 mm (30.6 to 37.3 in.)	900 mm (35.4 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	
Hydraulic system	Min. turning radius (with brake)	2.0 m (6.6 feet)	
	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.

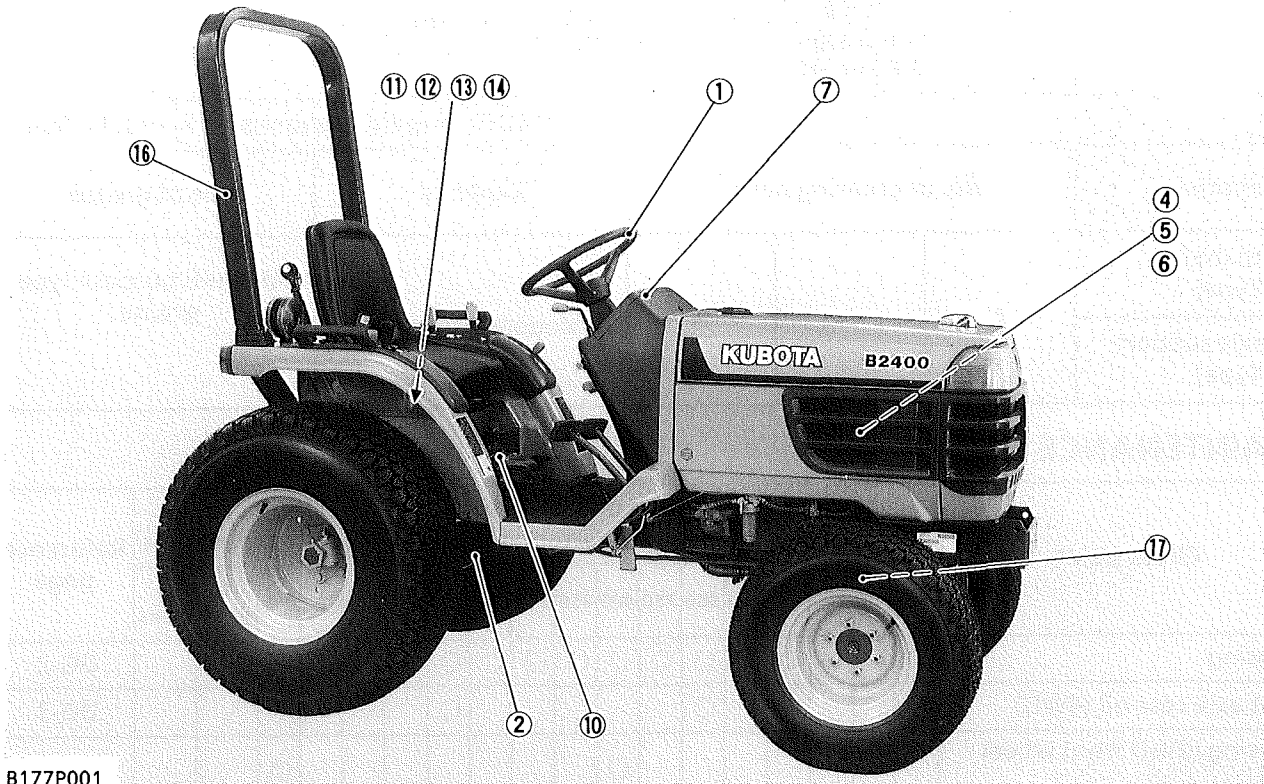
Unit: mm (in.)



B177F003

G GENERAL

[1] FEATURES



B177P001

- | | |
|--|--|
| (1) Integral Power Steering | (8) Main Shift Lever Located in the Right Side of Transmission |
| (2) Standard Mid PTO | (9) New Design |
| (3) Simultaneous Mounting of Both the Mid Mount Mower and Front Loader | (10) Variation of Transmission |
| (4) E-TVCS Diesel Engine | (11) Wet Disc Brake |
| (5) Engine Key Shut-Off System | (12) Position Control Valve |
| (6) Large Hydraulic Pump | (13) Hydraulic Block Type Outlet |
| (7) Combination Panel of Easy Checker | (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 4.8 U.S.qts. 4.0 Imp.qts.			KUBOTA SUPER UDT fluid * or 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



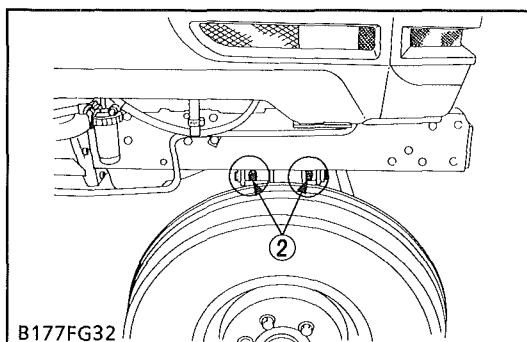
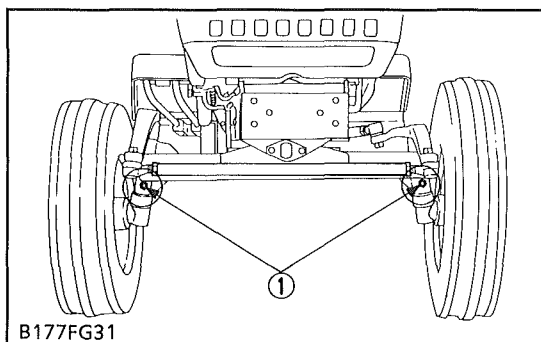
CAUTION

- 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

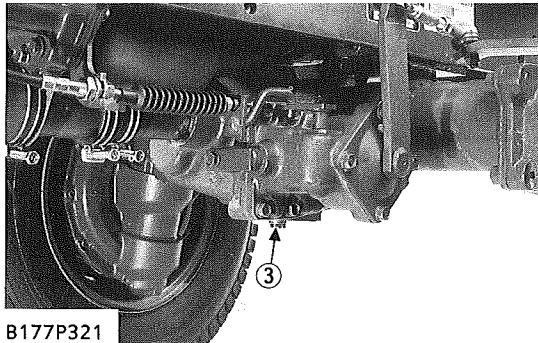
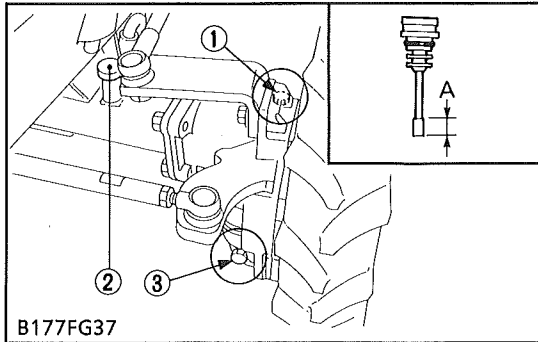
Greasing

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



- Knuckle Shaft
Grease Nipple
- Front Axle Support
Grease Nipple

(2) Check Point of Every 300 Hours



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

(A) Oil level is acceptable within this range.

Changing Front Axle Case Oil

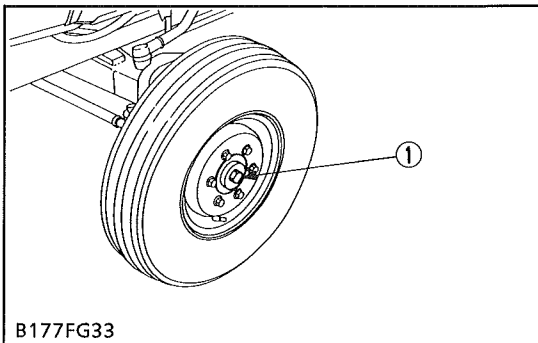
1. Place the oil pans underneath the front axle case.
2. Remove the both right and left hand side drain plugs (3) and filling plug (2) to drain the oil.
3. Remove the right and left breather plugs.
4. After draining, reinstall the drain plugs (3).
5. Fill with new oil up to the upper notch on the dipstick.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

(3) Check Point of Every 400 Hours



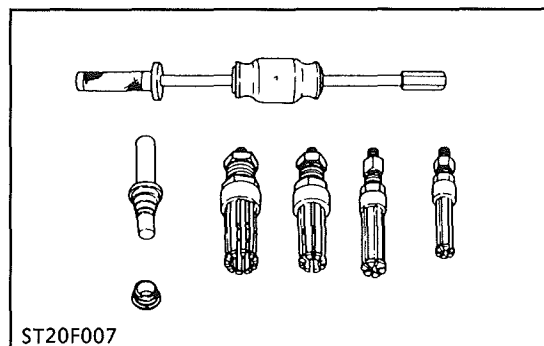
- (1) Front Wheel Hub Cover

Lubricate Grease Fitting

1. Detach the cover, and apply bearing grease.

[5] SPECIAL TOOLS

(1) Special Tools for Tractor



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.

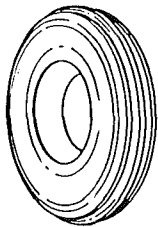
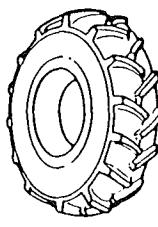
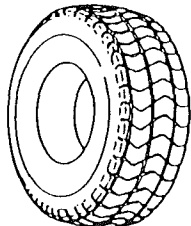
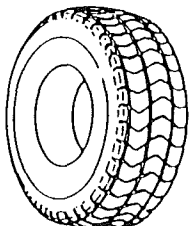
[6] TIRES

(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 [B2400] 6.50-10	 C045F070	[B1700] 8.3-16 [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

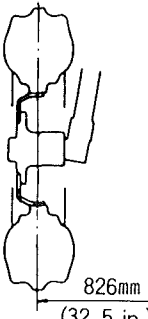
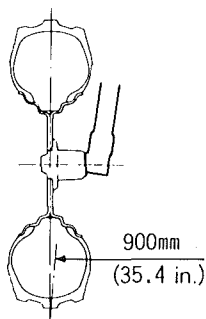
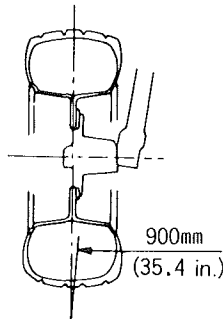
Front Wheel

Front tread cannot be adjusted.

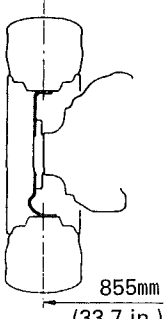
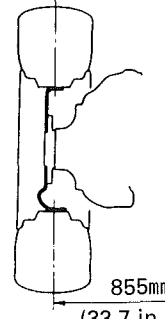
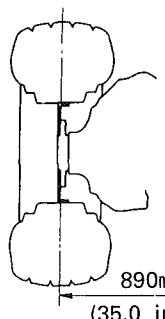
■ IMPORTANT

- Do not turn front discs to obtain wider tread.

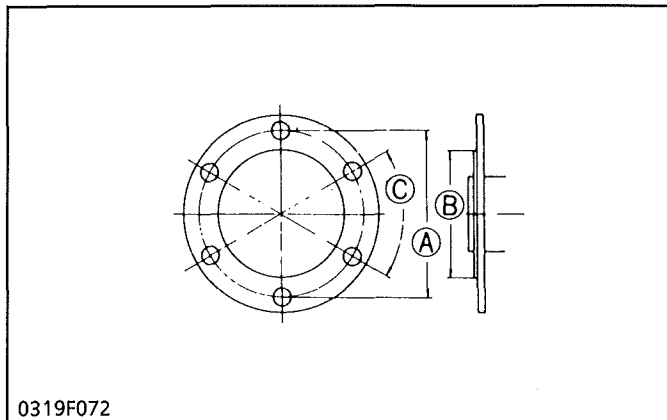
[2WD Type]

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

[Bi-speed Turn Type]

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

(3) Wheel Hub



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

(4) Tire Pressure

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

	Tire sizes	Inflation Pressure
Front	5.00 – 12, 4PR 6.50 – 12, 4PR	270 kPa (2.8 kgf/cm ² , 40 psi) 200 kPa (2.0 kgf/cm ² , 28 psi)

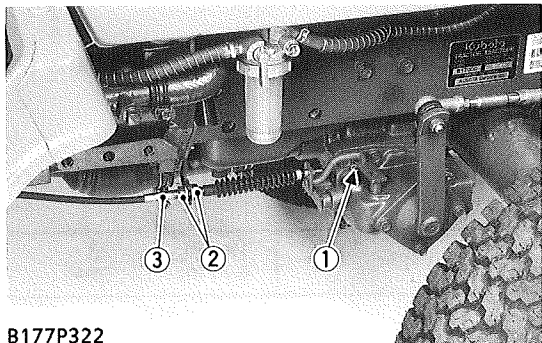
■ NOTE

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

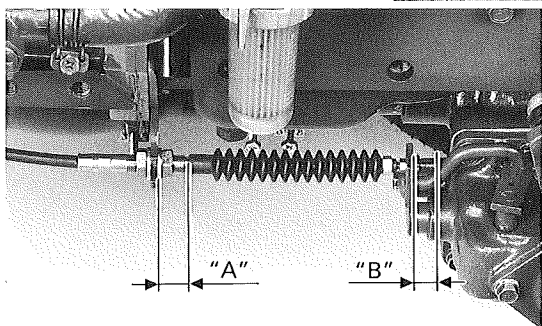
1 ENGINE

SERVICING

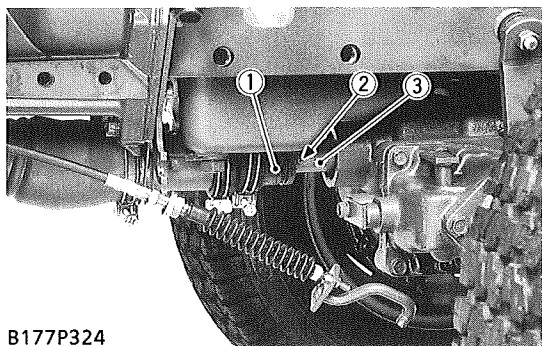
Propeller Shaft Cover and Coupling and Drag Link on page 1-S13 are altered as explained below.



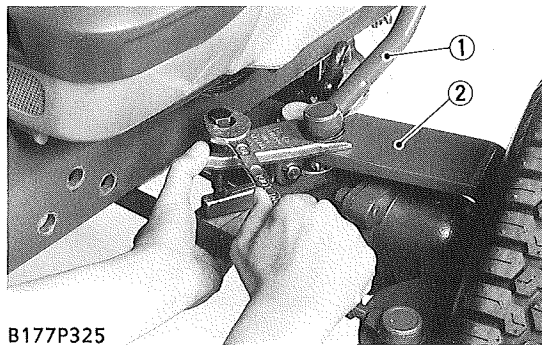
B177P322



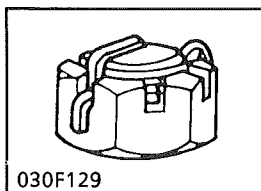
B177P323



B177P324



B177P325



030F129

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 0.71 in.
----------------	---------------	-------------------

(Reference)

Distance : "B"	Factory spec.	10 mm 0.39 in.
----------------	---------------	-------------------

- (1) Spring Lock Pin
(2) Lock Nut

- (3) Bi-speed Turn Cable

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

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 1.8 to 3.5 kgf·m 13 to 25.3 ft·lbs
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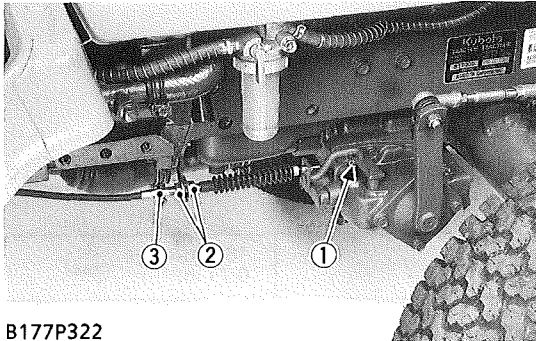
- (1) Drag Link

- (2) Knuckle Arm

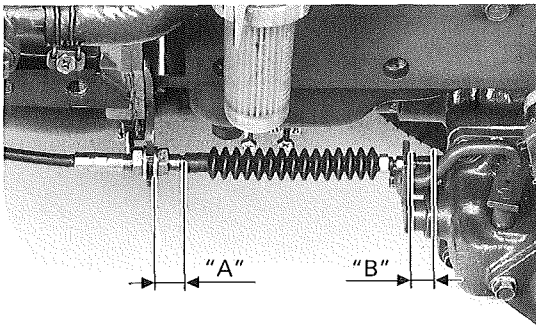
2 CLUTCH

SERVICING

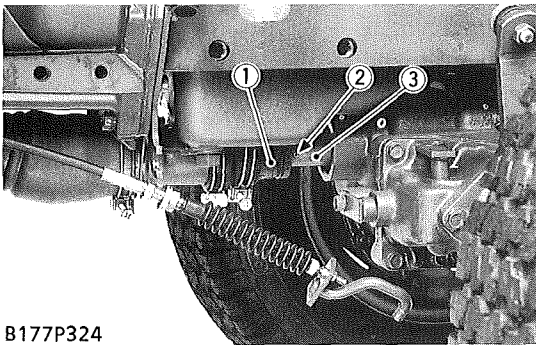
Propeller Shaft Cover and Coupling on 2-S6 are altered as explained below.



B177P322



B177P323



B177P324

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 0.71 in.
----------------	---------------	-------------------

(Reference)

Distance : "B"	Factory spec.	10 mm 0.39 in.
----------------	---------------	-------------------

- (1) Spring Lock Pin
- (2) Lock Nut

- (3) Bi-speed Turn Cable

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.

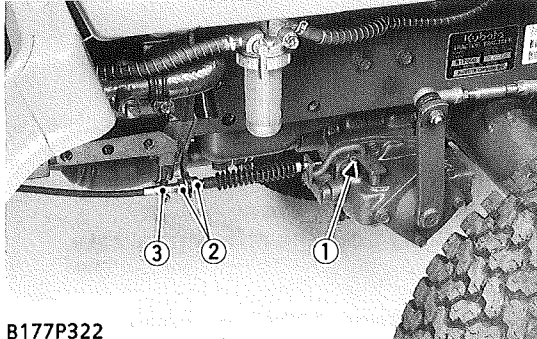
- (1) Propeller Shaft Cover
- (2) Spring Pin

- (3) Coupling

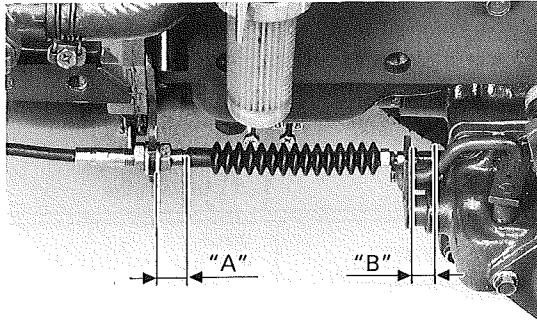
3 TRANSMISSION

SERVICING

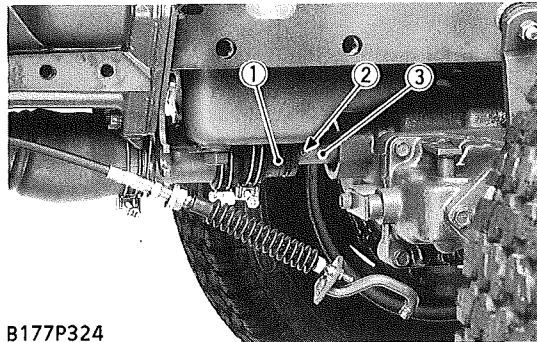
Propeller Shaft Cover and Coupling on page 3-S13 and 3-S20 are altered as explained below.



B177P322



B177P323



B177P324

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 0.71 in.
----------------	---------------	-------------------

(Reference)

Distance : "B"	Factory spec.	10 mm 0.39 in.
----------------	---------------	-------------------

- (1) Spring Lock Pin
(2) Lock Nut

- (3) Bi-speed Turn Cable

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.

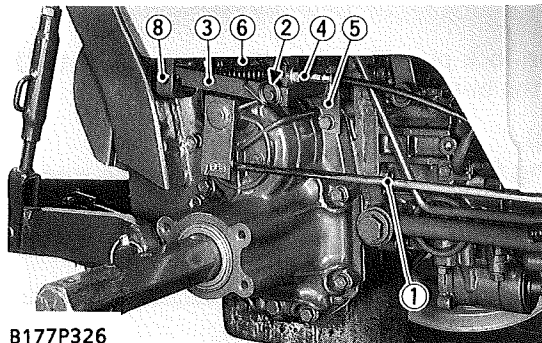
- (1) Propeller Shaft Cover
(2) Spring Pin

- (3) Coupling

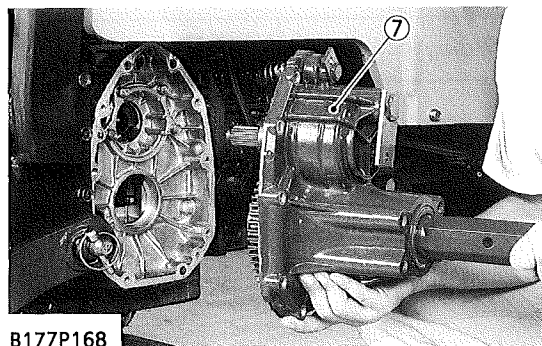
4 REAR AXLE

SERVICING

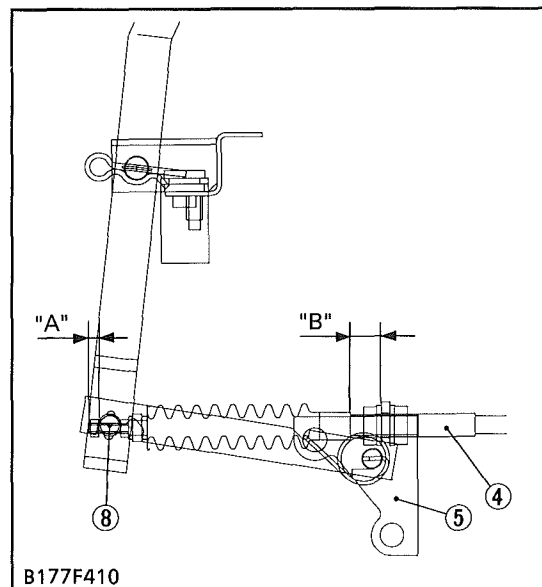
Rear Axle Case on page 4-S2 is altered as explained below.



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 4.0 to 4.5 kgf·m 29 to 33 ft·lbs
-------------------	--------------------------------	---

Distance : "A"	Factory spec.	8 mm 0.31 in.
----------------	---------------	------------------

(Reference)

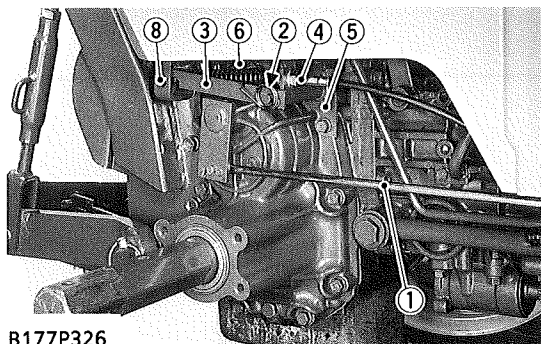
Distance : "B"	Factory spec.	19 mm 0.75 in.
----------------	---------------	-------------------

- | | |
|-------------------------|-----------------------------|
| (1) Brake Rod | (5) Cable Support |
| (2) Spring | (6) Differential Lock Rod |
| (3) Lever Holding Plate | (7) Rear Axle Case |
| (4) Bi-speed Turn Cable | (8) Bi-speed Turn Lever Rod |

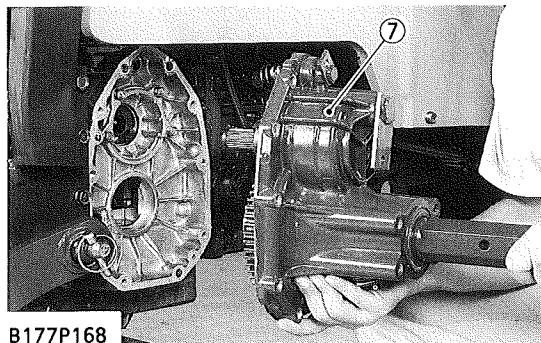
5 BRAKES

SERVICING

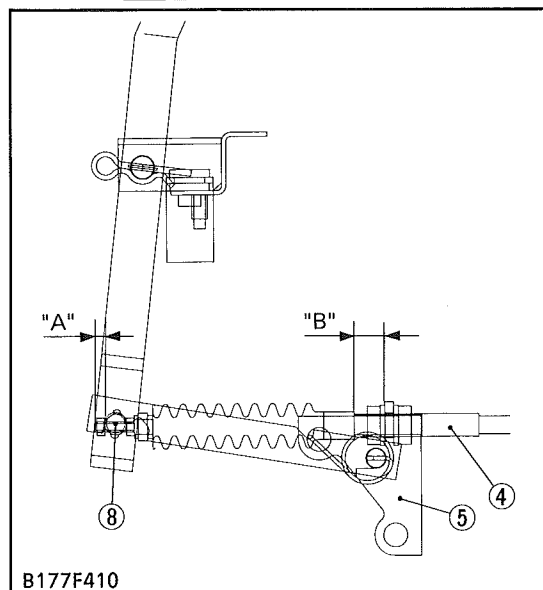
Rear Axle Case with Brake Assembly on page 5-S5 is altered as explained below.



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 case 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 4.0 to 4.5 kgf·m 29 to 33 ft·lbs
-------------------	--------------------------------	---

Distance : "A"	Factory spec.	8 mm 0.31 in.
----------------	---------------	------------------

(Reference)

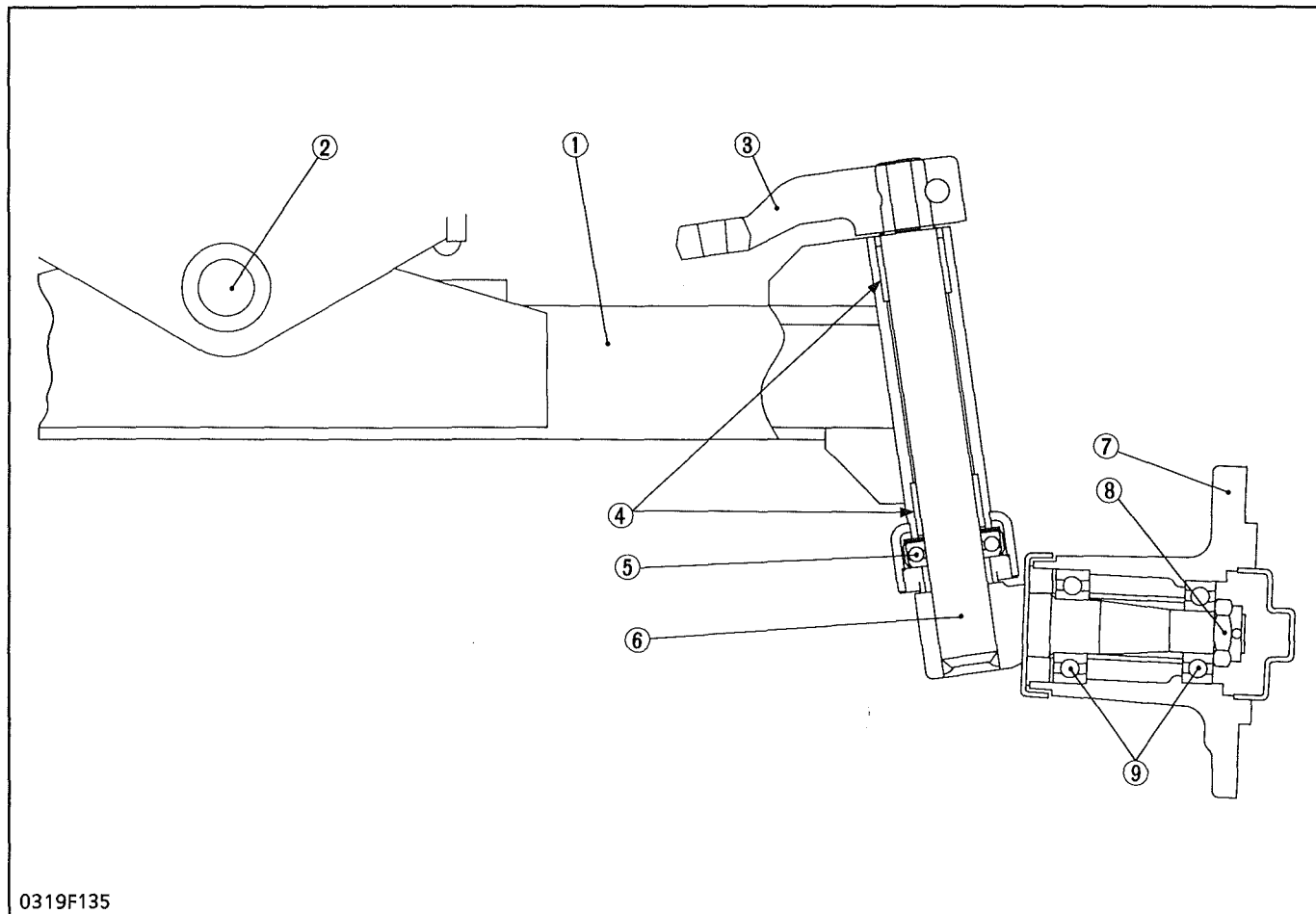
Distance : "B"	Factory spec.	19 mm 0.75 in.
----------------	---------------	-------------------

- | | |
|-------------------------|-----------------------------|
| (1) Brake Rod | (5) Cable Support |
| (2) Spring | (6) Differential Lock Rod |
| (3) Lever Holding Plate | (7) Rear Axle Case |
| (4) Bi-speed Turn Cable | (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

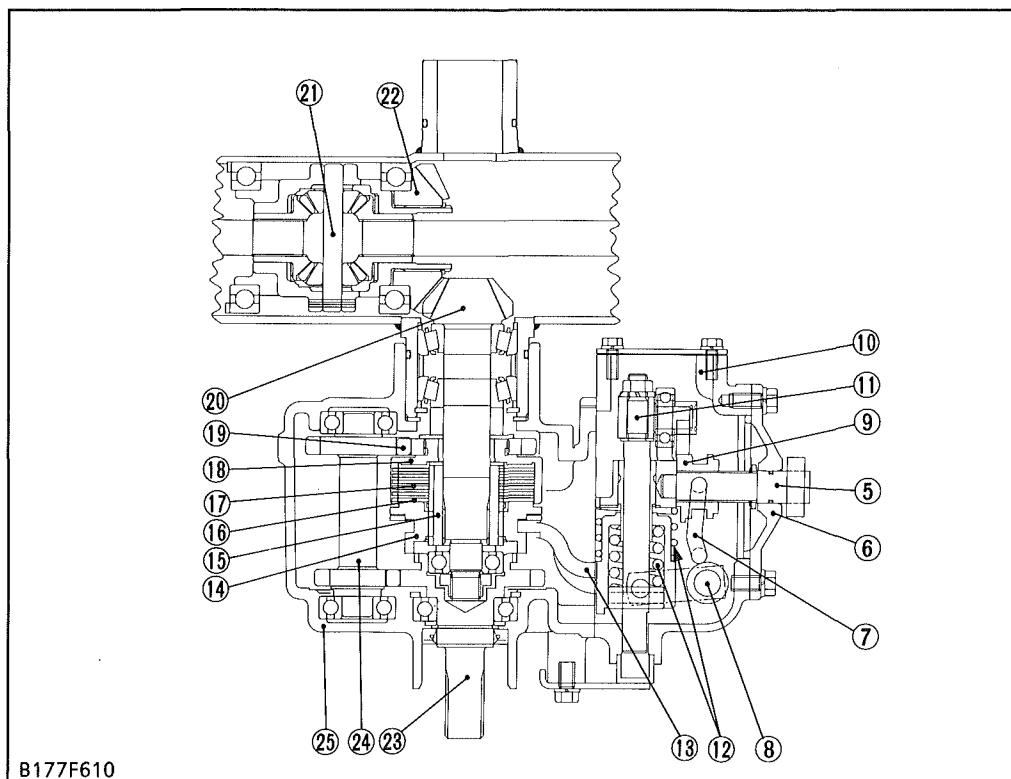
The front axle of the 2WD type is constructed as shown above.

The knuckle shaft (6) is attached to the front axle (1) by the "RUMOAN" method.

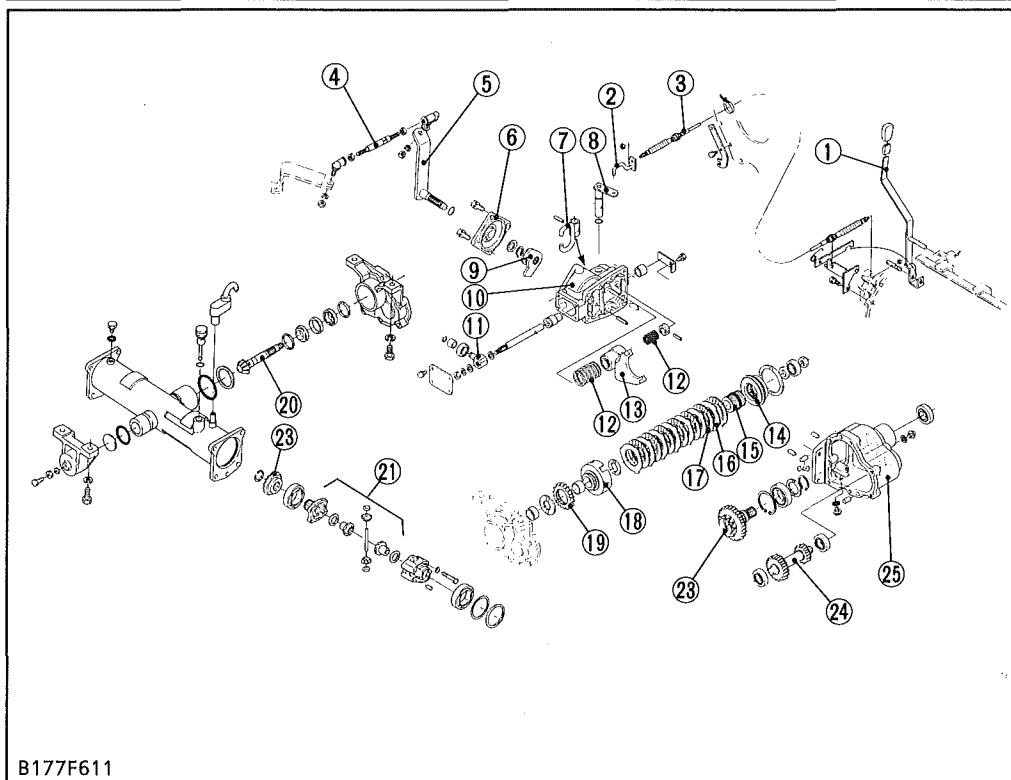
With this method, the shape of the front axle is

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



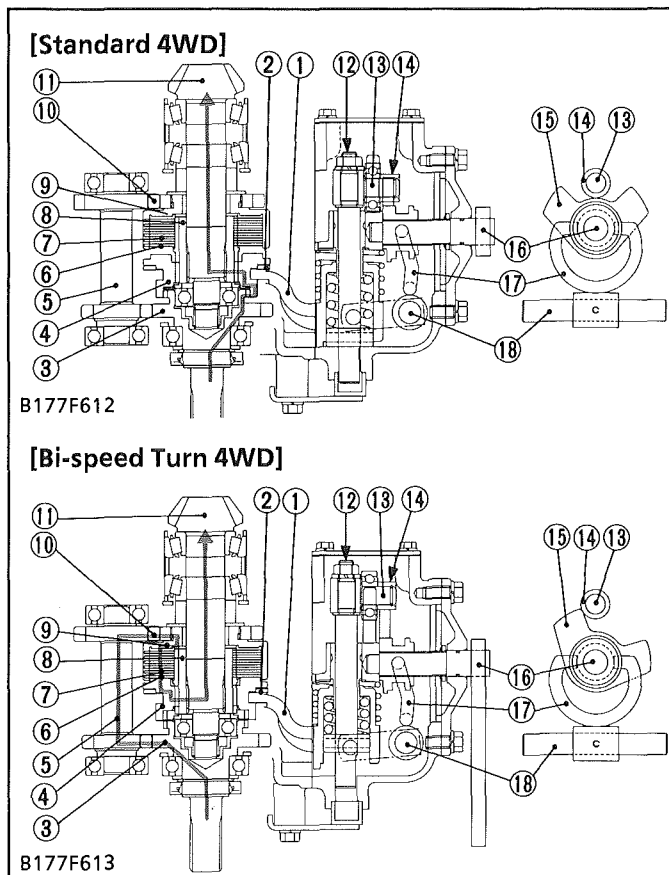
- (1) Bi-speed Turn Lever
- (2) Bi-speed Turn Rod
- (3) Bi-speed Turn Change Cable
- (4) Shift Rod
- (5) Shift Lever
- (6) Shift Lever Fulcrum
- (7) Change Fork
- (8) Change Lever
- (9) Shift Cam
- (10) Bi-speed Turn Case
- (11) Shift Roller Shaft
- (12) Spring
- (13) Bi-speed Turn Shift Fork
- (14) 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



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

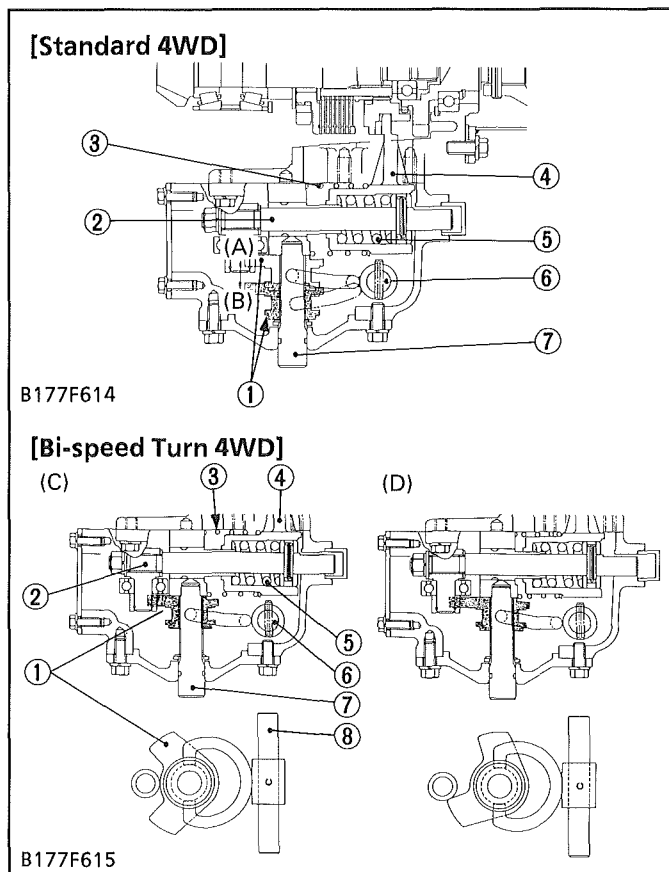
21T Gear Shaft (3) → Shifter (4) → Bi-speed Turn Coupling (8) → Spiral Bevel Pinion Shaft (11) → Front Axle.

■ 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 | (10) 18T Gear |
| (2) Shifter Collar | (11) Spiral Bevel Pinion Shaft |
| (3) 21T Gear Shaft | (12) Shift Rod |
| (4) Shifter | (13) Shift Roller Shaft |
| (5) 13T-10T Gear Shaft | (14) Shift Roller |
| (6) Clutch Disk | (15) Shift Cam |
| (7) Friction Plate | (16) Shift Lever |
| (8) Bi-speed Turn Coupling | (17) Change Fork |
| (9) Bi-speed Turn Clutch Drum | (18) Change Lever |

■ Bi-speed Cam



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.

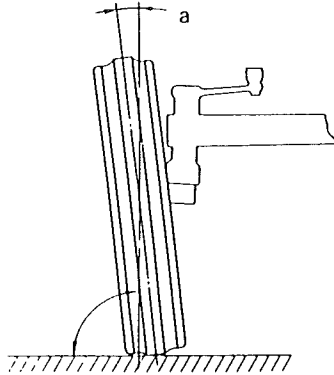
- | | |
|---|---|
| (1) Shift Cam | (5) Spring |
| (2) Shift Rod | (6) Change Lever |
| (3) Spring | (7) Shift Lever |
| (4) Shift Fork | |
| (A) Bi-speed turn "ON" | (B) Bi-speed turn "OFF" |
| (C) Less than 0.40 rad. (23°) turning angle | (D) More than 0.44 rad. (25°) turning angle |

[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]



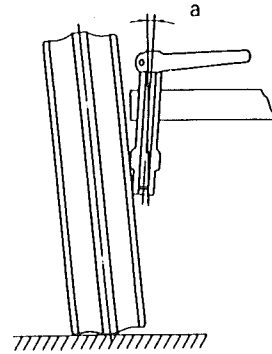
C045F051

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 4WD	0.035 rad. 2°
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[Kingpin Angle]



C045F053

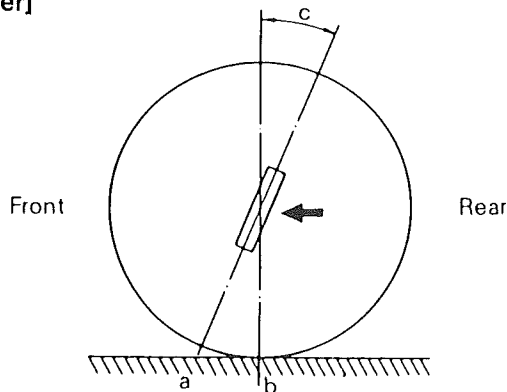
The kingpin is tilted from the vertical as viewed from the front.

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

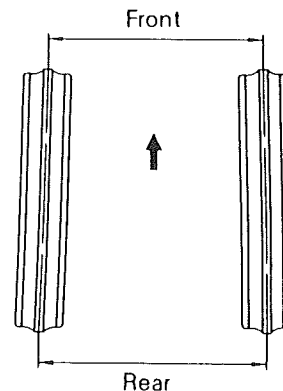
The kingpin is tilted forward as viewed from the side. The point (b) of the wheel center line is behind the point (a) of the kingpin shaft center line.

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

As with the kingpin inclination, caster reduces steering effort.

Caster	2WD 4WD	0 rad. 0°
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[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 4WD	1 to 10 mm 0.04 to 0.39 in.
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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
	● 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 0.0020 to 0.0098 in.	0.70 mm 0.0276 in.
Center Pin	O.D.	24.90 to 25.00 mm 0.9803 to 0.9842 in.	—
Pin Support	I.D.	25.05 to 25.15 mm 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 0.0016 to 0.0041 in.	0.50 mm 0.0197 in.
Knuckle Shaft	O.D.	24.948 to 24.980 mm 0.9822 to 0.9835 in.	—
Bushing	I.D.	25.020 to 25.053 mm 0.9850 to 0.9863 in.	—
Front Wheel Alignment	Toe-in	0 to 10 mm 0 to 0.39 in.	—
	Camber Angle	0.035 rad. 2.0°	—
	Caster Angle	0 rad. 0°	—
	King Pin Inclination	0.209 rad. 12°	—
Front Wheel	Steering Angle	0.84 to 0.87 rad. 48° to 50°	—
	Axial Sway	0 to 3 mm 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 45 to 50 kgf·m 325.5 to 361.7 ft-lbs	—
Shift Fork to Shifter Groove (with Shifter Collar)	Clearance	0.1 to 0.7 mm 0.004 to 0.028 in.	1.0 mm 0.04 in.
Bi-speed Turn Spring (short) Bi-speed Turn Spring (long)	Free Length	32.5 to 33.5 mm 1.280 to 1.319 in.	—
	Maximum Setting Length	25.5 mm, 1.00 in. (load 1613 N, 164.5 kgf·m, 362.7 lbs)	25.5 mm, 1.00 in. (load 1411 N, 143.9 kgf, 317.4 lbs)
	Free Length	52.0 mm, 2.047 in.	—
	Setting Length	35.0 mm, 1.378 in. (load 86.3 N, 8.8 kgf, 19.4 lbs)	35.0 mm, 1.378 in. (load 75.5 N, 7.7 kgf, 17.0 lbs)
Bi-speed Turn Clutch Disc	Thickness	1.7 to 1.9 mm 0.067 to 0.075 in.	1.4 mm 0.055 in.
Bi-speed Turn Friction Plate	Thickness	0.95 to 1.05 mm 0.037 to 0.041 in.	0.8 mm 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

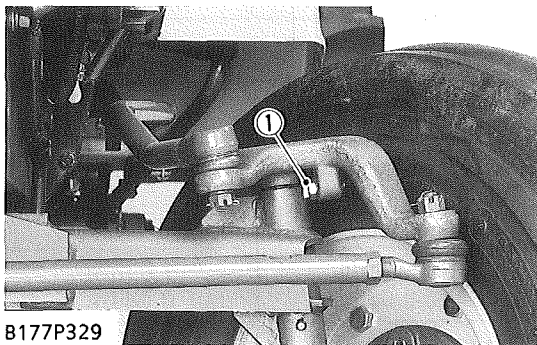
[BI-SPEED TURN TYPE]

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



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).

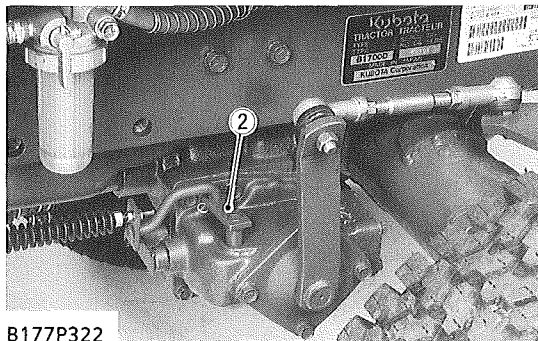
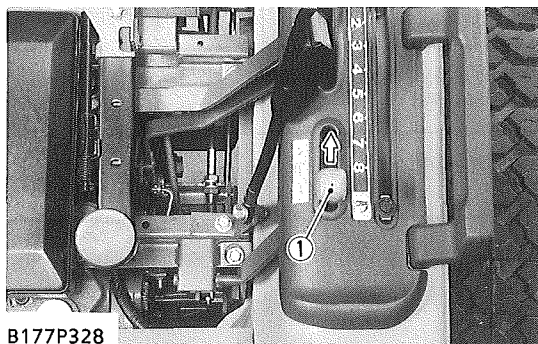
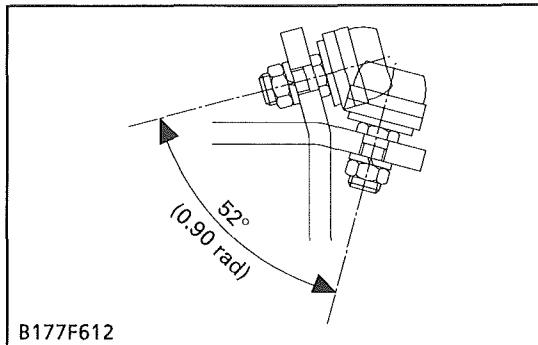
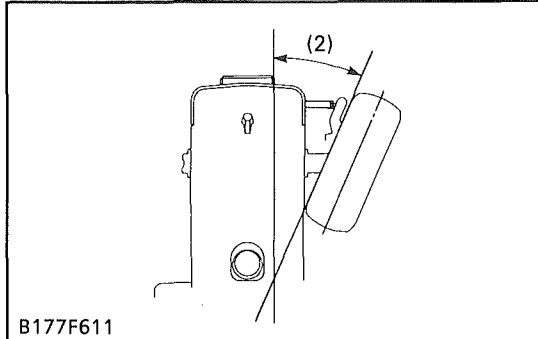
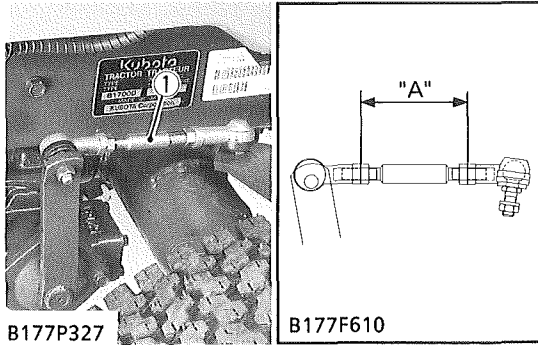
Front wheel steering angle	Factory spec.	2WD	0.84 to 0.87 rad. 48° to 50°
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NOTE

- 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



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 3.3 in.
Steering inner angle* (When bi-speed turn neutral)	Factory spec.	0.40 to 0.44 rad. 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

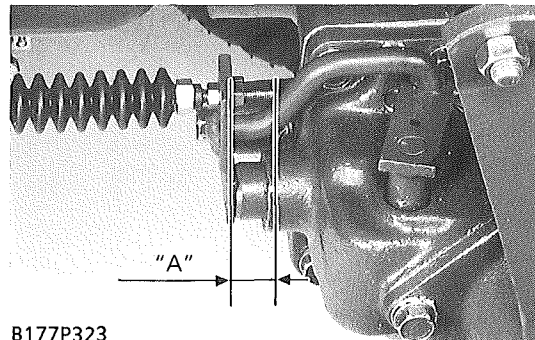
(2) Steering Inner Angle

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 0.39 in.
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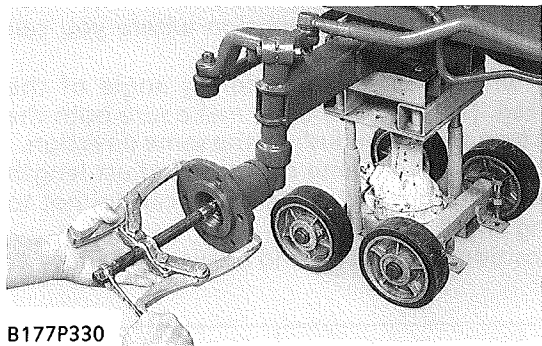
B177P323

(1) Bi-speed Turn Lever

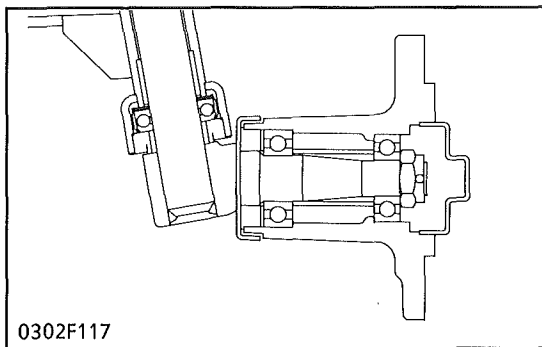
(2) Bi-speed Case Change Lever

DISASSEMBLING AND ASSEMBLING

[1] 2WD TYPE



B177P330



0302F117

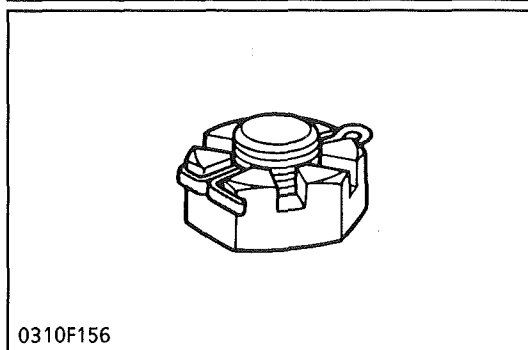
Front Wheel Hub

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.

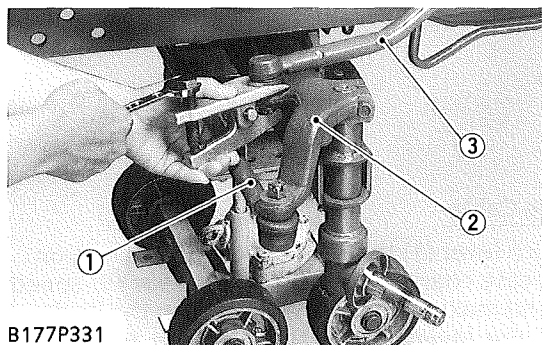
(When reassembling)

- Bend the cotter pin as shown in the figure below.

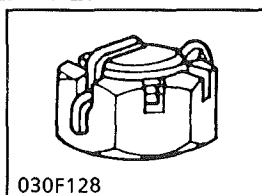
Tightening torque	Front wheel mounting screw	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Slotted nut	118 to 157 N·m 12 to 16 kgf·m 86.8 to 115.7 ft-lbs



0310F156



B177P331



030F128

Tie-rod and Knuckle Arm

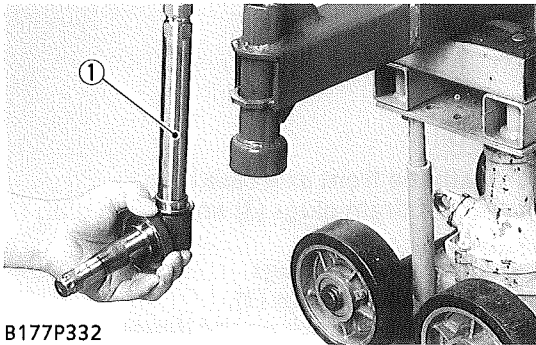
1. Pull out the cotter pins, and loosen the slotted nuts.
2. Remove the tie-rod (1) and drag link (3) with the tie-rod end lifter. (Code No. 07909-39021)
3. Remove the knuckle arm (2).

(When reassembling)

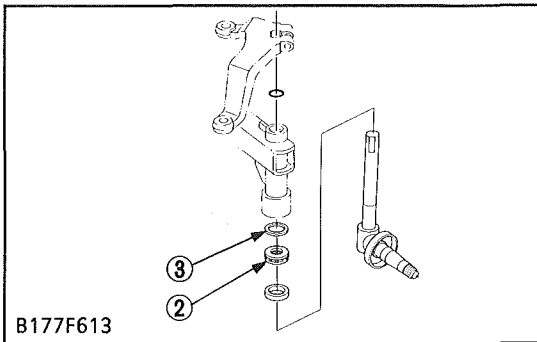
Tightening torque	Knuckle arm mounting bolt and nut	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Slotted nut for tie-rod end	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

- (1) Tie-rod
(2) Knuckle Arm

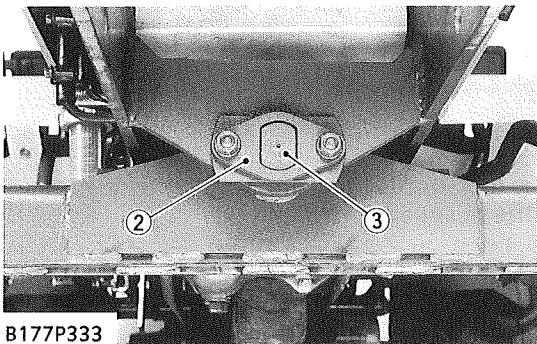
- (3) Drag Link



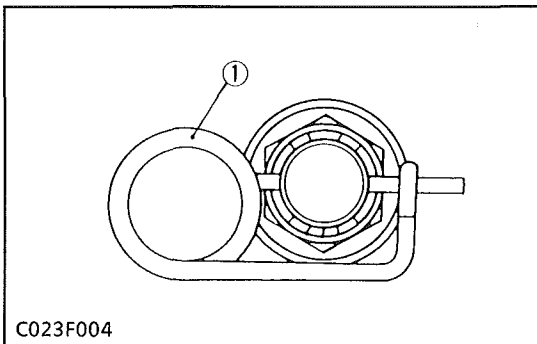
B177P332



B177F613



B177P333



C023F004

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

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 1.0 kgf·m 7.23 ft-lbs
	Lock plate mounting nut	17 to 19.6 N·m 1.8 to 2.0 kgf·m 13.0 to 14.5 ft-lbs

■ NOTE

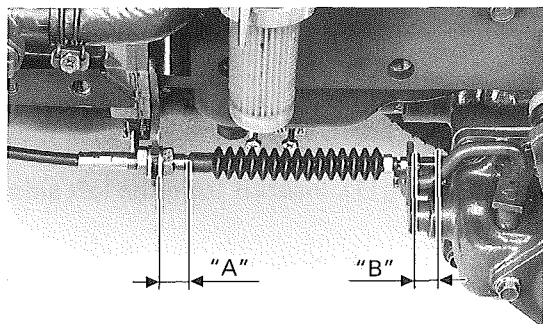
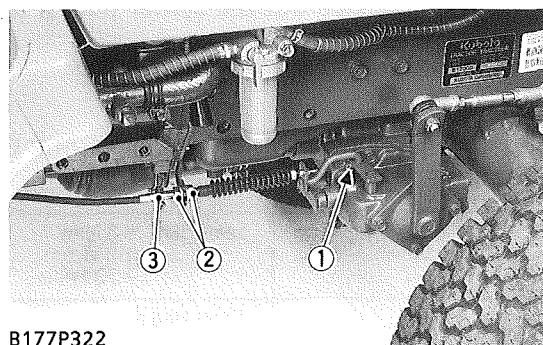
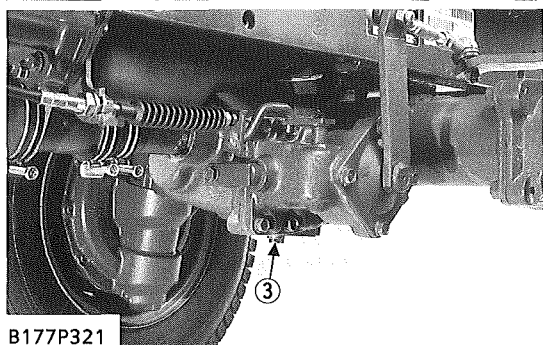
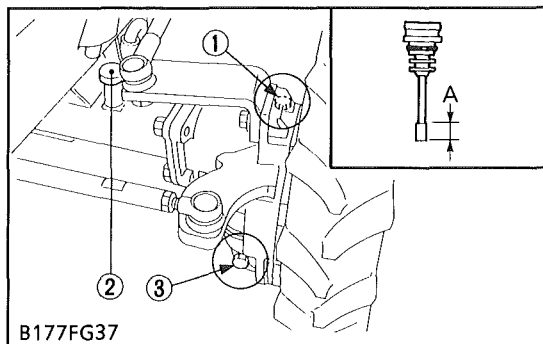
- Tighten the slotted nut to 9.8 N·m (1.0 kgf·m, 7.23 ft-lbs). If the slot and pin hole do not meet, loosen the nut until they do meet, and then install the set spring.
- When installing the set spring (1), insert it from the left side, as shown in figure.

- (1) Set Spring
(2) Lock Plate

- (3) Center Pin

[2] BI-SPEED TURN TYPE

(1) Separating Front Axle



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 4.8 U.S.qts. 4.0 Imp.qts.
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■ 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)

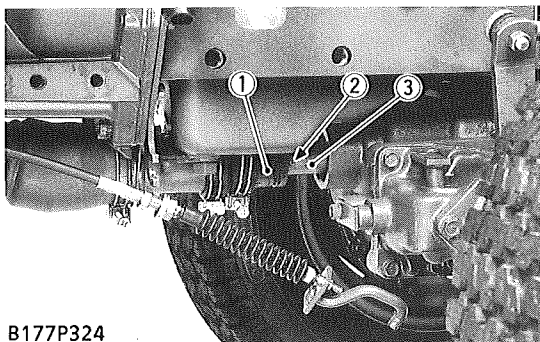
- When reassembling the bi-speed turn cable (3), make sure the distance "A".

Distance : "A"	Factory spec.	18 mm 0.71 in.
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(Reference)

Distance : "B"	Factory spec.	10 mm 0.39 in.
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- (1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable



B177P324

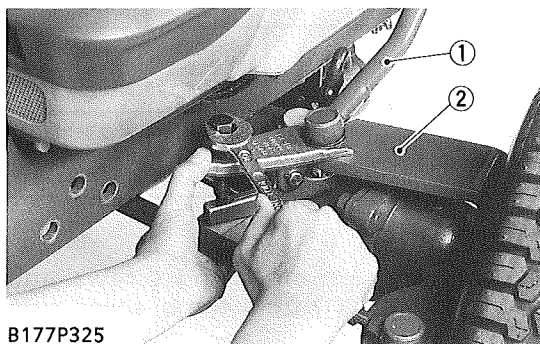
Propeller Shaft

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 | (3) Coupling |
| (2) Spring Pin | (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).

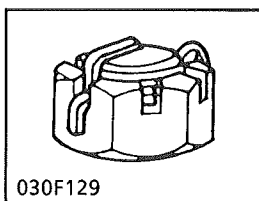
■ IMPORTANT

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

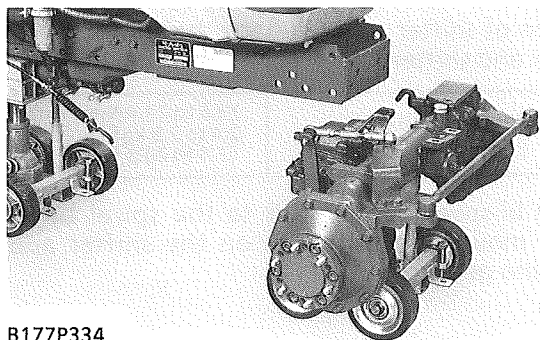
Tightening torque	Slotted nut	17.7 to 34.3 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs
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(1) Knuckle Arm

(2) Drag Link



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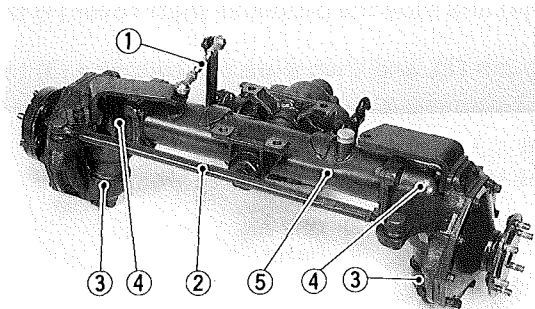
B177P334

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 12.6 to 15.0 kgf·m 91.1 to 108.5 ft-lbs
	Front wheel mounting screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

(2) Disassembling Front Axle



B177P329

- (1) Bi-speed Turn Rod (4) Bevel Gear Case
 (2) Tie-rod (5) Front Axle Case
 (3) Front Gear Case

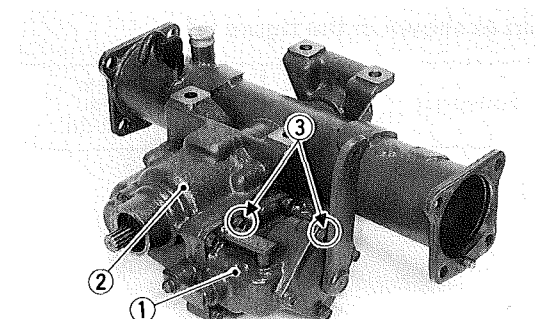
Tie-rod and Bevel Gear Case Assembly

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 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs
	Bevel gear case mounting screw	123.5 to 147.0 N·m 12.6 to 15.0 kgf·m 91.2 to 108.4 ft-lbs



B177P335

- (1) Bi-speed Turn Case (3) Screws with Adhesive
 (2) Bi-speed turn Gear Case

Separation of Bi-speed Turn Case

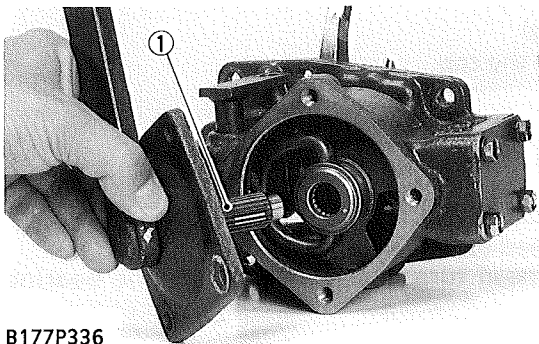
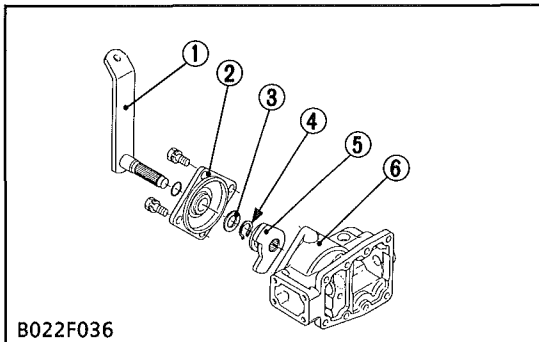
1. Remove the bi-speed turn case mounting screws and separate the bi-speed turn case (1) from the bi-speed turn gear case (2).

(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 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
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- 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.



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

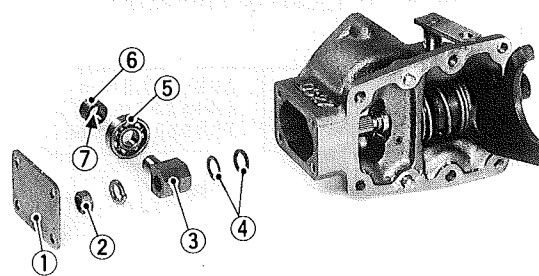
- The white marks is painted on the shift lever (1) for aligning the shift cam.

(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 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
-------------------	---------------------------	---

- | | |
|-----------------|------------------------|
| (1) Shift Lever | (4) External Snap Ring |
| (2) Case Cover | (5) Shift Cam |
| (3) Collar | (6) Bi-speed Turn Case |



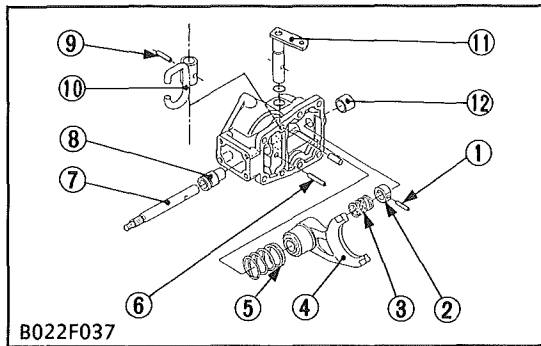
Shift Roller Shaft

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 | (5) Ball Bearing |
| (2) Nut | (6) Shift Roller |
| (3) Shift Roller Shaft | (7) Retainer Ring |
| (4) Adjusting Shim | |



- | | |
|---------------------|----------------------|
| (1) Spring Pin | (7) Shift Rod |
| (2) Pressure Collar | (8) Shift Rod Collar |
| (3) Spring | (9) Spring Pin |
| (4) Shift Fork | (10) Change Fork |
| (5) Spring | (11) Change Lever |
| (6) Spring Pin | (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.

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).

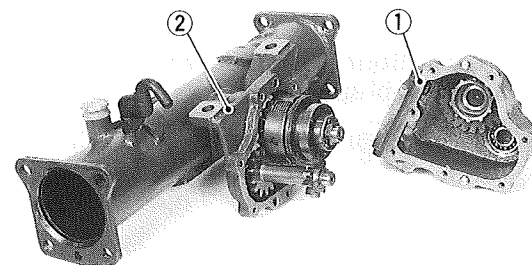
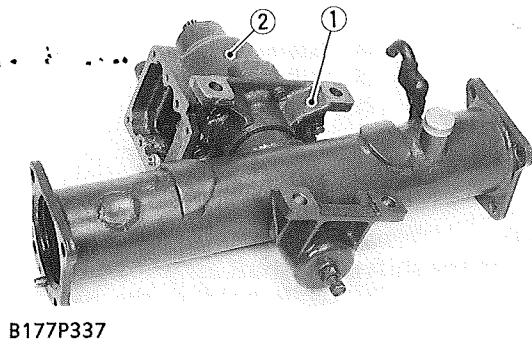
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the bi-speed turn gear case.

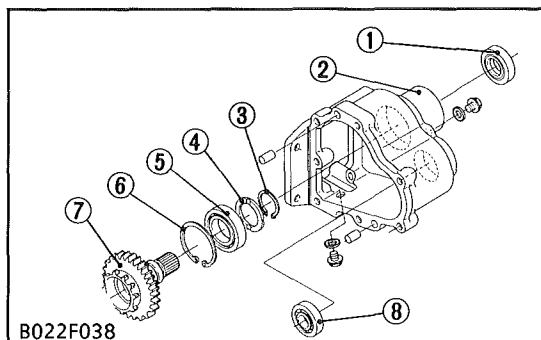
Tightening torque	Bi-speed turn gear case mounting screw	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft·lbs
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(1) Bi-speed Turn Gear Case

(2) Bearing Holder



B177P343



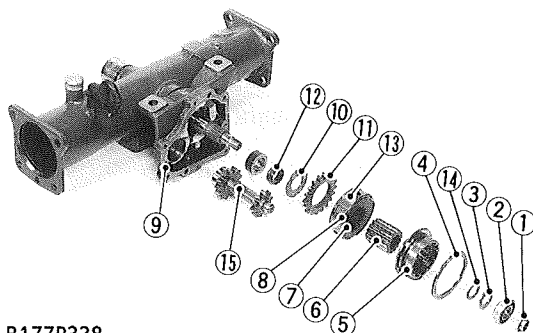
Ball Bearing and Oil Seal

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 | (5) Ball Bearing |
| (2) Bi-speed Turn Gear Case | (6) Internal Snap Ring |
| (3) External Snap Ring | (7) Gear Shaft |
| (4) Thrust Collar | (8) Ball Bearing |



B177P338

- | | |
|----------------------------|--------------------------------|
| (1) Nut | (9) Bearing Holder |
| (2) Ball Bearing | (10) Thrust Collar |
| (3) Plain Washer | (11) Bi-speed Turn Gear |
| (4) Shifter Collar | (12) Inner Ring |
| (5) Shifter | (13) Bi-speed Turn Clutch Drum |
| (6) Bi-speed turn Coupling | (14) Collar |
| (7) Clutch Disc | (15) Gear Shaft |
| (8) Friction Plate | |

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.

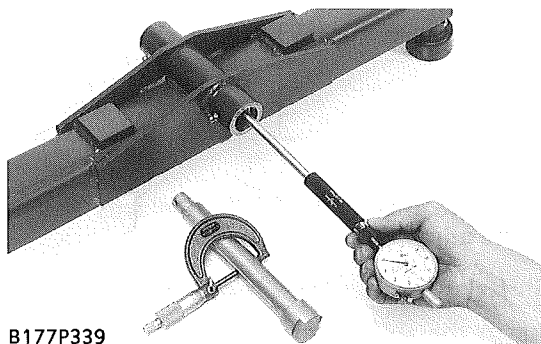
See D6-515

Tightening torque	Staking nut	127 to 167 N·m 13 to 17 kgf·m 94.0 to 123.9 ft·lbs 21.7-25.3 Ft-Lbs
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- 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

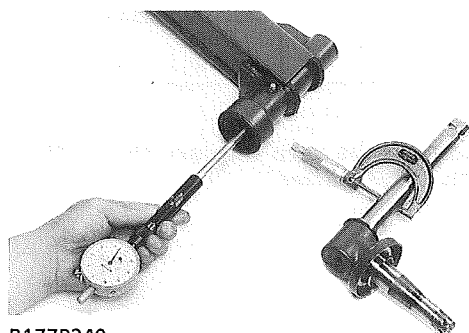
1. Measure the center pin O.D. with an outside micrometer.
2. Measure the pin support I.D. of the front axle with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between center pin and pin support	Factory spec.	0.05 to 0.25 mm 0.0020 to 0.0098 in.
	Allowable limit	0.70 mm 0.0276 in.
Center pin O.D.	Factory spec.	24.90 to 25.00 mm 0.9803 to 0.9842 in.
Pin support I.D.	Factory spec.	25.05 to 25.15 mm 0.9862 to 0.9901 in.

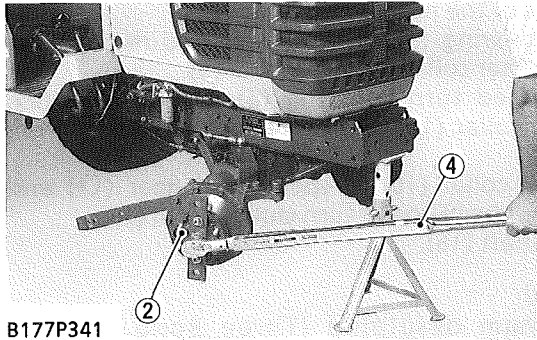
Clearance between Knuckle Shaft and Bushing

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.

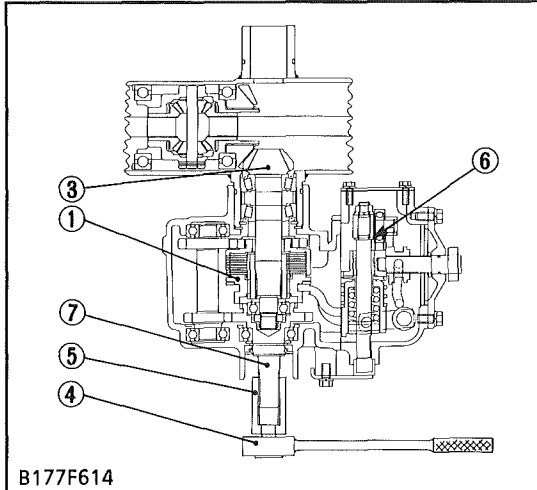
Clearance between knuckle shaft and bushing	Factory spec.	0.040 to 0.105 mm 0.0016 to 0.0041 in.
	Allowable limit	0.50 mm 0.0197 in.
Knuckle shaft O.D.	Factory spec.	24.948 to 24.980 mm 0.9822 to 0.9835 in.
Bushing I.D.	Factory spec.	25.020 to 25.053 mm 0.9850 to 0.9863 in.



B177P340

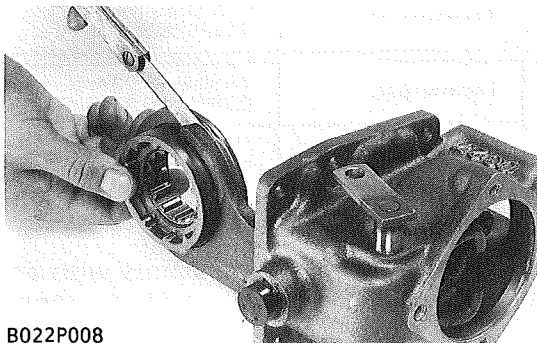
[BI-SPEED TURN TYPE]

B177P341



B177F614

- | | |
|-------------------------------|-------------------|
| (1) Bi-speed Turn Clutch | (4) Torque Wrench |
| (2) Front Wheel Hub | (5) Jig |
| (3) Spiral Bevel Pinion Shaft | (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 45 to 50 kgf·m 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 8.81 to 9.79 kgf·m 63.65 to 70.81 ft-lbs
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NOTE

- Check the springs, clutch discs and friction plates if the correct torque can't be adjusted.

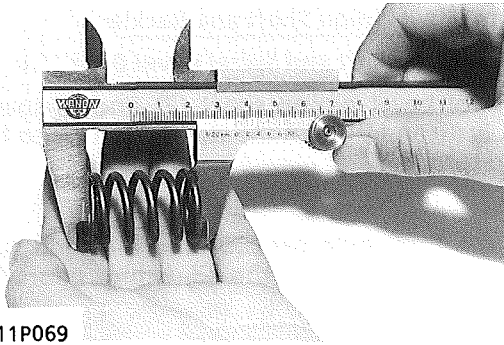
Clearance between Shift Fork and Shifter Groove

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 0.004 to 0.028 in.
	Allowable limit	1.0 mm 0.04 in.

NOTE

- When measuring the clearance, be sure to place the shifter collar between the shift fork and shifter.

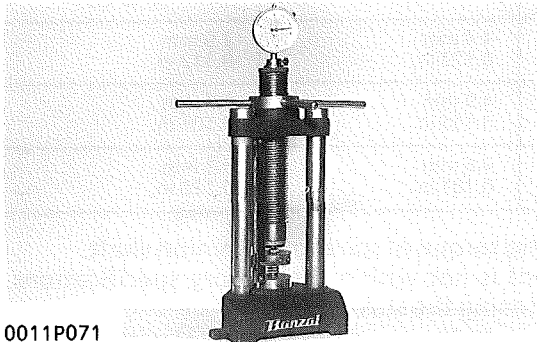


0011P069

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 1.280 to 1.283 in.
	Allowable limit	28.5 mm 1.22 in.
Free length of bi-speed turn spring (long)	Factory spec.	52.0 mm 2.047 in.
	Allowable limit	45.5 mm 1.791 in.



0011P071

Working Load of Bi-speed Turn Spring

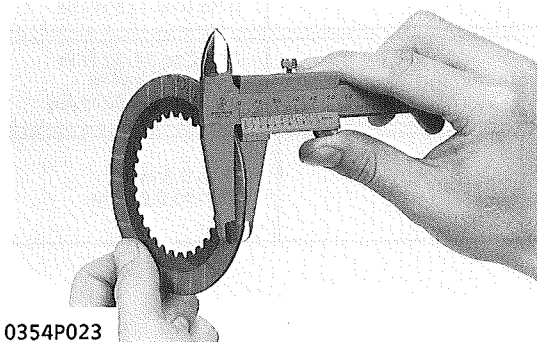
1. Put the spring on the spring tester and compress it to the specified length.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace it.

Working load of bi-speed turn spring (short)	Factory spec.	Load 1613 N/Setting length 25.5 mm 164.5 kgf/25.5 mm 362.7 lbs/1.00 in.
	Allowable limit	Load 1411 N/Setting length 25.5 mm 143.9 kgf/25.5 mm 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 8.8 kgf/35.0 mm 19.4 lbs/1.378 in.
	Allowable limit	Load 75.5 N/Setting length 35.0 mm 7.7 kgf/35.0 mm 17.0 lbs/1.378 in.

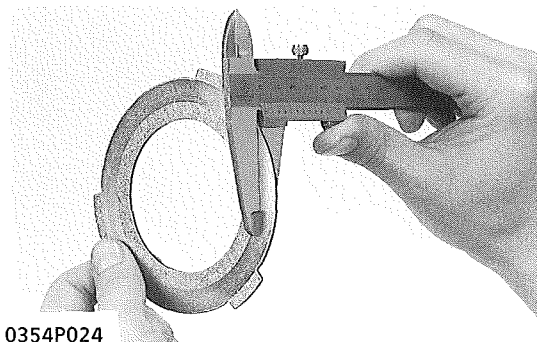
Clutch Disc Wear and Friction Plate Wear

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 0.067 to 0.075 in.
	Allowable limit	1.4 mm 0.055 in.
Thickness of friction plate	Factory spec.	0.95 to 1.05 mm 0.037 to 0.075 in.
	Allowable limit	0.8 mm 0.0315 in.



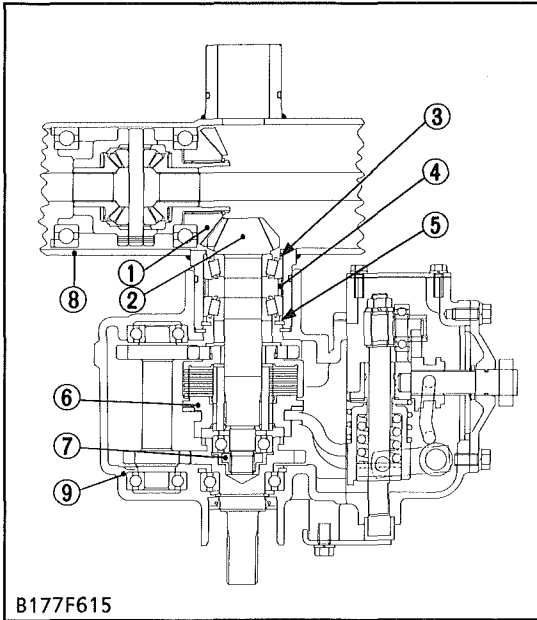
0354P023



0354P024

(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 0.173 in.	2.9 mm 0.112 in.
Combination 2	4.2 mm 0.165 in.	2.7 mm 0.106 in.
Combination 3	4.6 mm 0.181 in.	3.1 mm 0.122 in.

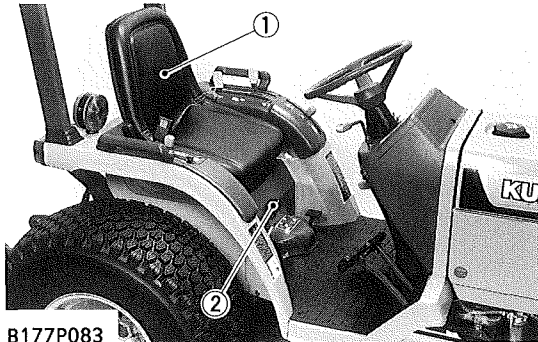
2. Measure the turning torque of spiral bevel pinion shaft.
3. If the measurement is not within the factory specifications, adjust with retightening the staking nut.
4. Stick the strip of fuse on the spiral bevel gear (1) with grease.
5. Carefully rotate the spiral bevel pinion shaft (2) one full turn.
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 0.08 to 0.10 kgf·m 0.58 to 0.723 ft-lbs
Tightening torque	Staking nut	29.42 to 34.32 N·m 3.0 to 5.0 kgf·m 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 0.004 to 0.012 in.

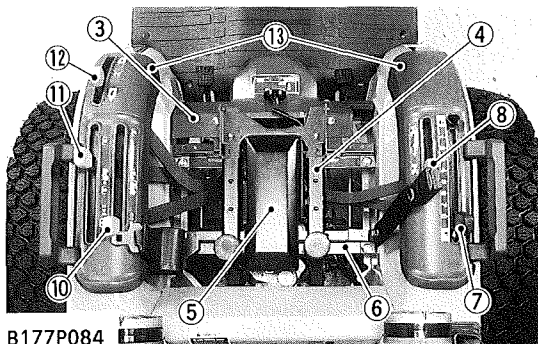
8 HYDRAULIC SYSTEM

SERVICING

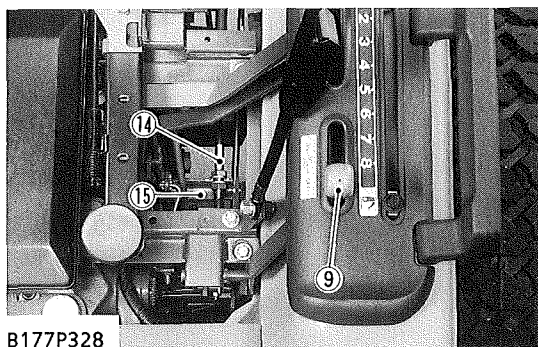
Seat, Seat Rail, Seat Stay and Seat Under Cover on page 8-59 is altered as explained below.



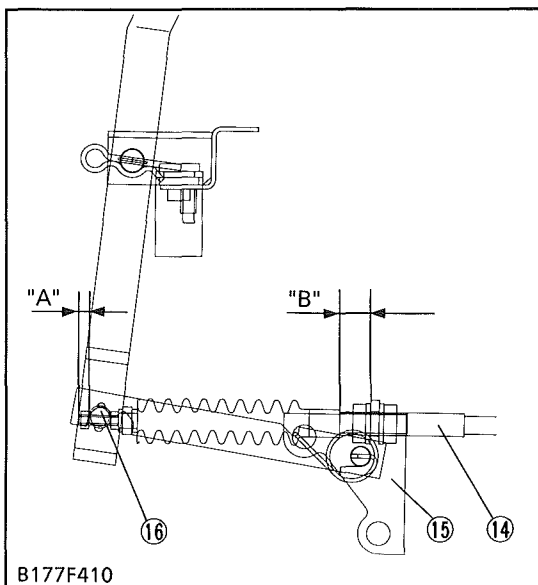
B177P083



B177P084



B177P328



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 0.31 in.
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(Reference)

Distance : "B"	Factory spec.	19 mm 0.75 in.
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- | | |
|-----------------------------------|-------------------------------------|
| (1) Seat | (9) Bi-speed Turn Lever Grip |
| (2) Lowering Speed Adjusting Knob | (10) Mid-PTO Gear Shift Lever Grip |
| (3) Seat Under Cover | (11) Rear-PTO Gear Shift Lever Grip |
| (4) Seat Rail | (12) Hi-Lo Gear Shift Lever Grip |
| (5) Tool Box | (13) Lever Guide |
| (6) Seat Stay | (14) Bi-speed Turn Cable |
| (7) Position Control Lever Grip | (15) Cable Support |
| (8) Front Wheel Drive Lever Grip | (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

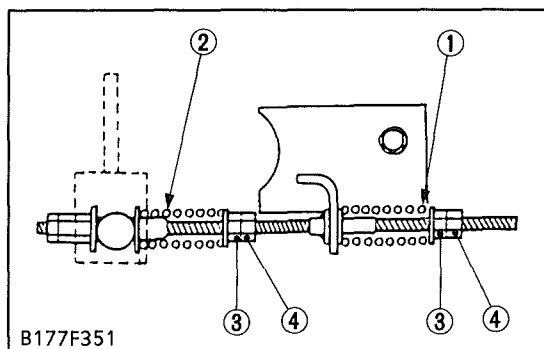
No.	Check point	Indication on hour meter (Change or check every interval shown below)																After purchase		Reference page
		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1 year	2 years	
1	HST pedal return spring		○		○		○		○		○		○		○		○			EG-1

[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



- B177F351
- (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.

- Set the engine speed to 1500 rpm.
- Shift the range gear shift lever to the high position.
- 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.
- 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.).

(1) Special Tools for Tractor

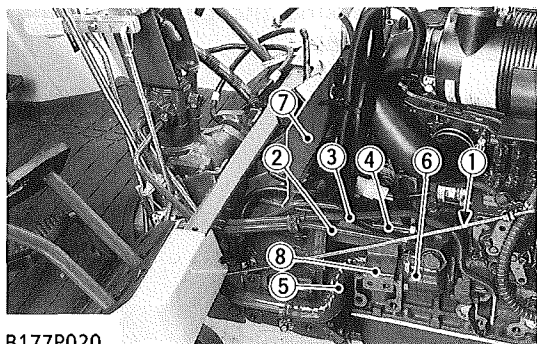
Application: Use for checking the power steering relief pressure.

Application: Use for tighten the lock nut for plug.

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 clamp of suction hose (5) and remove the suction hose from the hydraulic pump (6).
7. Remove the shutter plate (7).

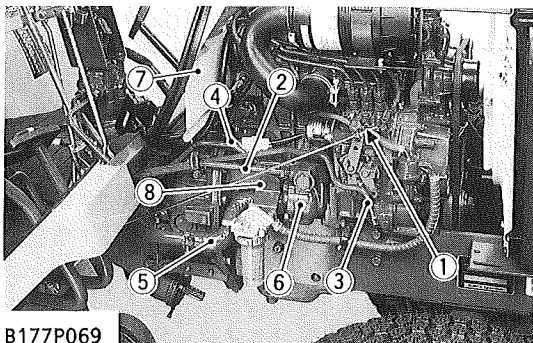
(When reassembling)

Tightening torque	Power steering delivery pipe	34.0 to 39.0 N·m 3.5 to 4.0 kgf·m 25.0 to 28.8 ft-lbs
	Flare nut (P.S. return pipe and 3-point hitch delivery pipe)	29.4 to 39.2 N·m 3.0 to 4.0 kgf·m 21.7 to 28.9 ft-lbs
	Joint bolt	34.3 to 44.1 N·m 3.5 to 4.5 kgf·m 25.3 to 32.5 ft-lbs
	Fuel filter bracket mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs

- | | |
|----------------------------------|-------------------------|
| (1) Foot Accelerator Rod | (5) Suction Hose |
| (2) Power Steering Delivery Pipe | (6) Hydraulic Pump |
| (3) Power Steering Return Pipe | (7) Shutter Plate |
| (4) 3-Point Hitch Delivery Pipe | (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)

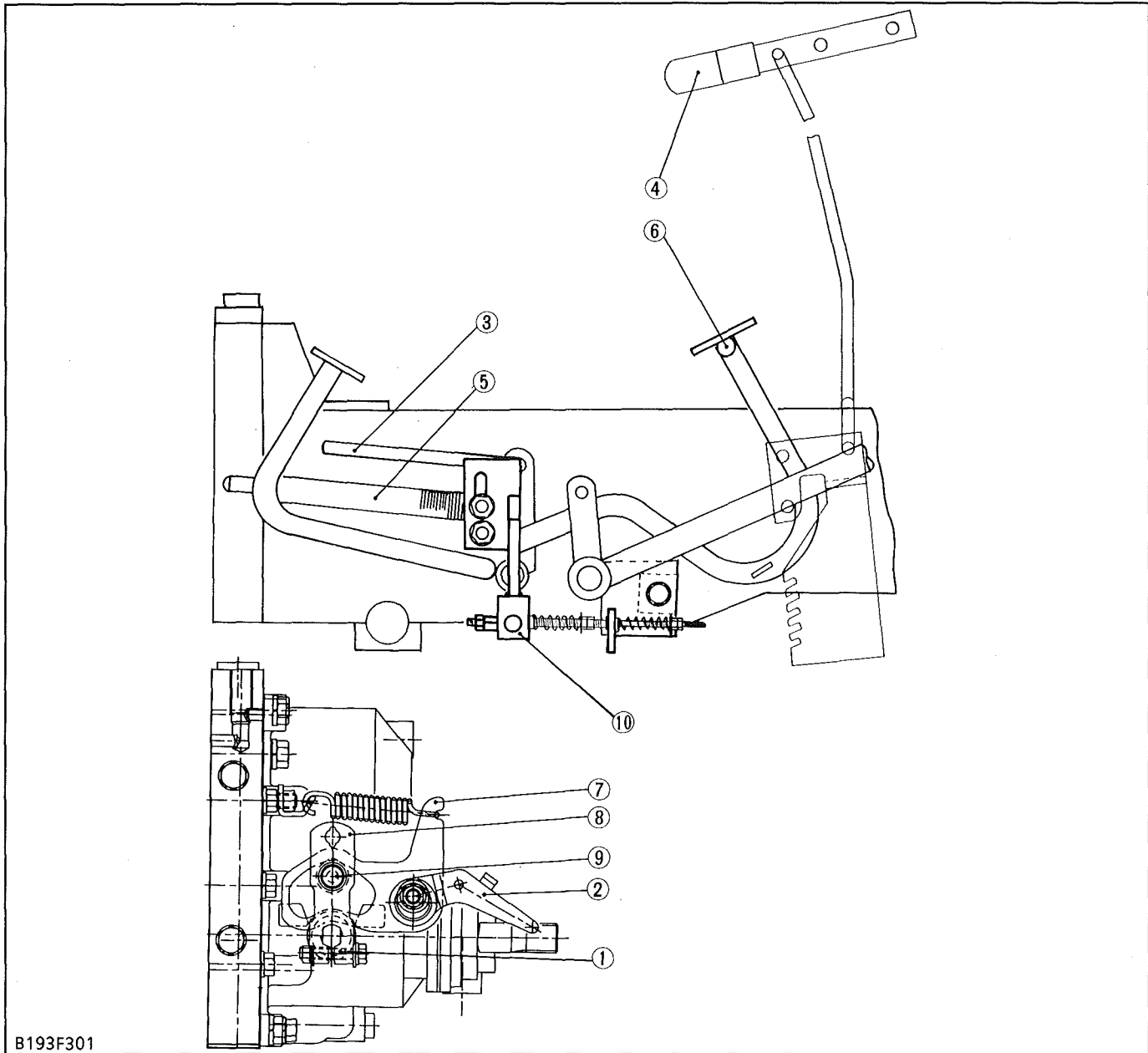
Tightening torque	Power steering delivery pipe	34.0 to 39.0 N·m 3.5 to 4.0 kgf·m 25.0 to 28.8 ft-lbs
	Flare nut (P.S. return pipe and 3-point hitch delivery pipe)	29.4 to 39.2 N·m 3.0 to 4.0 kgf·m 21.7 to 28.9 ft-lbs
	Joint bolt	58.8 to 78.5 N·m 6.0 to 8.0 kgf·m 43.4 to 57.9 ft-lbs
	Fuel filter bracket mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs

- | | |
|----------------------------------|-------------------------|
| (1) Foot Accelerator Rod | (5) Suction Hose |
| (2) Power Steering Delivery Pipe | (6) Hydraulic Pump |
| (3) Power Steering Return Pipe | (7) Shutter Plate |
| (4) 3-Point Hitch Delivery Pipe | (8) Fuel Filter Bracket |

3 TRANSMISSION

MECHANISM

(1) Control Linkage



B193F301

- | | | | |
|-------------------------------------|-----------------------|-------------------------------------|--------------------------------|
| (1) Trunnion Control Lever Assembly | (3) Speed Control Rod | (6) Speed Control Pedal (HST Pedal) | (8) Trunnion Lever |
| (2) Neutral Adjuster | (4) Speed Set Lever | (7) Trunnion Arm | (9) Roller |
| | (5) Damper | | (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.

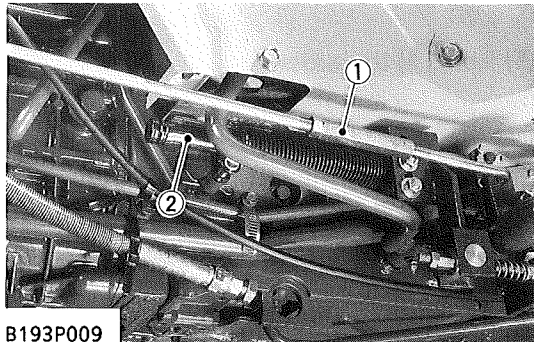
The roller (9) on the trunnion lever (8) held with spring seats the detent of the trunnion arm (7) so that the trunnion lever returns to neutral. Then, the

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.

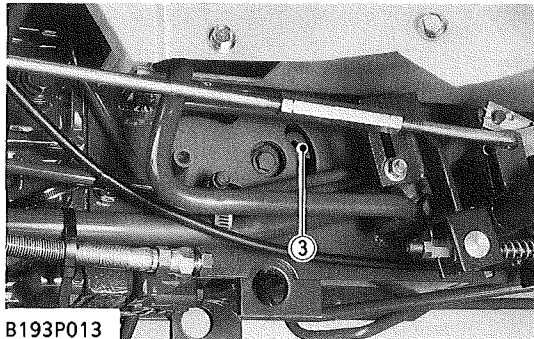
The speed set lever (4) linked to the speed control pedal enables the linkage not to return to neutral and to keep a certain forward speed while the speed control pedal is released.

SERVICING

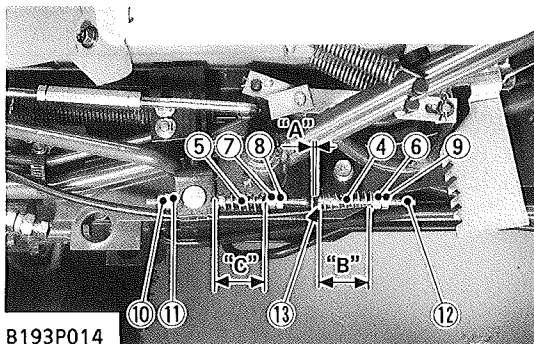
CHECKING AND ADJUSTING



B193P009



B193P013



B193P014

- | | |
|--|-------------------------------------|
| (1) Brake Rod (RH) | (7) Adjusting Nut |
| (2) HST Pedal Damper | (8) Lock Nut |
| (3) Neutral Adjuster | (9) Lock Nut |
| (4) Return Spring (for forward adjustment) | (10) Lock Nut |
| (5) Return Spring (for reverse adjustment) | (11) Neutral Position Adjusting Nut |
| (6) 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.

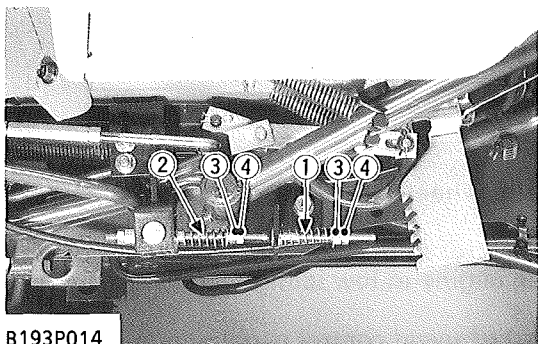
(When rear wheels tend to turn reverse)

1. Rotate the neutral adjusting lever counterclockwise so that the rear wheels turn forward.
2. Then rotate it clockwise until wheels stop completely.

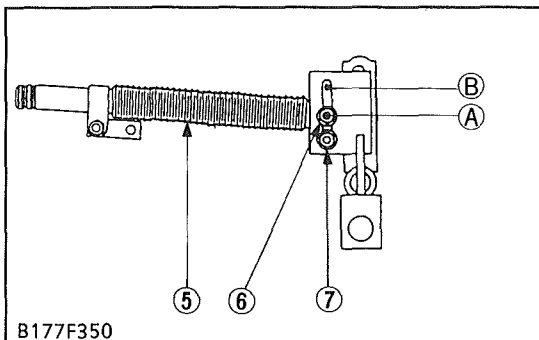
(After adjusting neutral)

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.

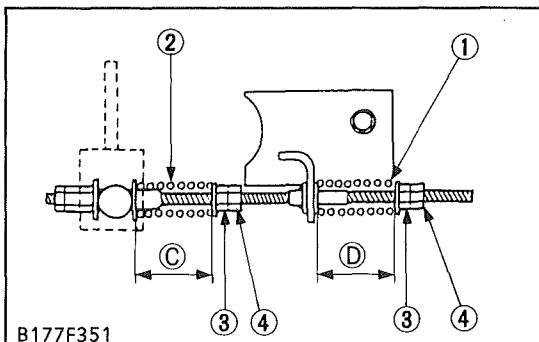
	Length (B)	Length (C)
Normal compression	50 mm (2.0 in.)	50 mm (2.0 in.)
Max. compression	42 mm (1.7 in.)	42 mm (1.7 in.)
Tightening torque	Neutral adjuster setting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft·lbs



B193P014



B177F350



B177F351

- | | |
|--|-----------------------------|
| (1) Return Spring (for forward adjustment) | (A) Normal Setting Position |
| (2) Return Spring (for reverse adjustment) | (B) Slower Setting Position |
| (3) Adjusting Nut | (C) Spring Length |
| (4) Lock Nut | (D) Spring Length |
| (5) Damper | |
| (6) Nut for Fixing the damper | |
| (7) Nut | |

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 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 from HST pedal.

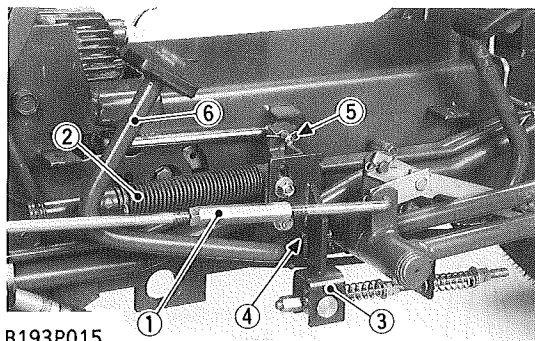
	Length (C)	Length (D)
Normal compression	50 mm (2.0 in.)	50 mm (2.0 in.)
Max. compression	42 mm (1.7 in.)	42 mm (1.7 in.)

■ IMPORTANT

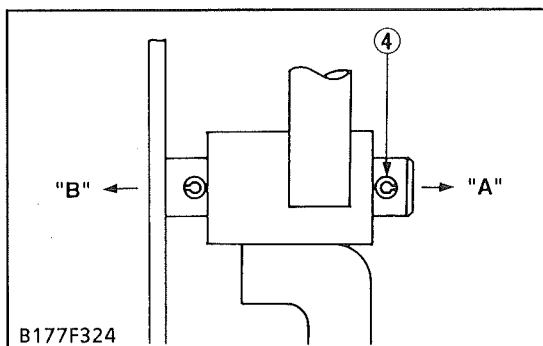
- Do not compress the Return Spring shorter than Max. compression length.

DISASSEMBLING AND ASSEMBLING

[1] SEPARATING CENTER FRAME AND TRANSMISSION ASSEMBLY



B193P015



- (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)

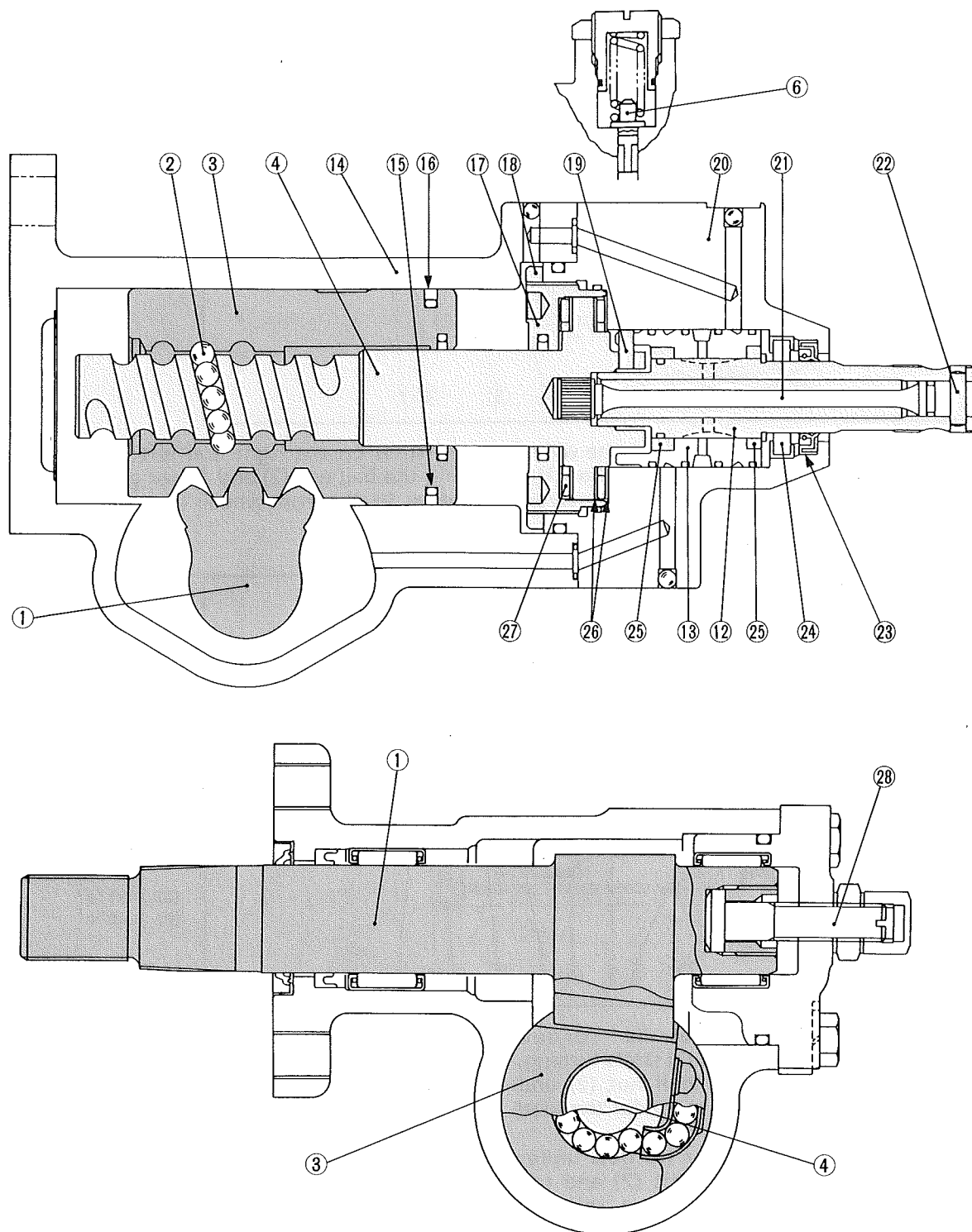
- Tap in the spring pin (4) as shown in the figure.

■ NOTE

- After reassembling the HST pedal spring assembly, must adjust the spring force and check the pedal performance (See page 3-S7, S8)

Tightening torque	Stay mounting screw (M12)	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Arm mounting bolt and nut (M8)	23.5 to 29.8 N·m 2.4 to 2.8 kgf·m 17.3 to 20.5 ft-lbs
	Damper adjusting nut	23.5 to 29.8 N·m 2.4 to 2.8 kgf·m 17.3 to 20.5 ft-lbs

[2] POWER STEERING BODY

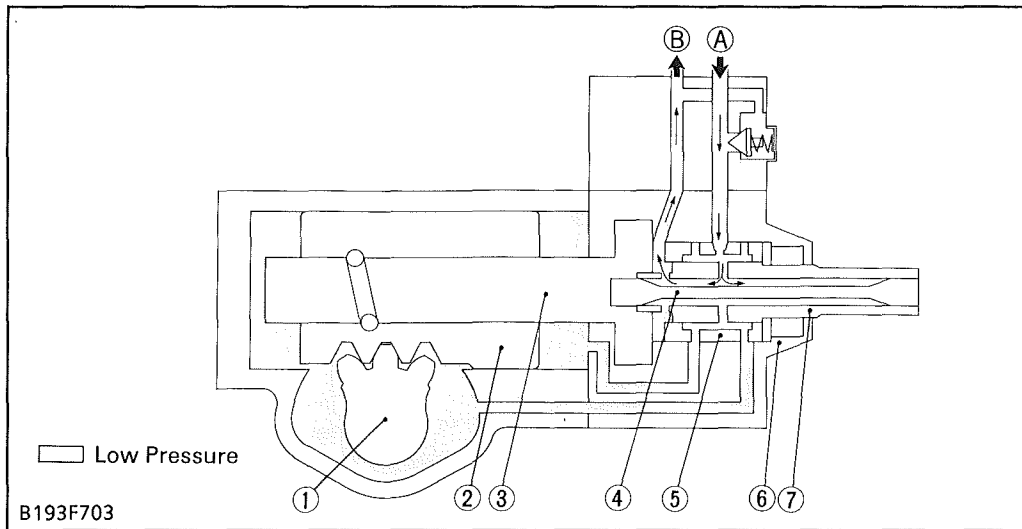


B193F702

- | | | | |
|-----------------------|----------------|--------------------|-------------------------------|
| (1) Sector Gear Shaft | (13) Sleeve | (19) Pin | (24) Roller Bearings |
| (2) Balls | (14) Gear Case | (20) Valve Housing | (25) Press Fitted Ring |
| (3) Ball Nut | (15) O-Ring | (21) Torsion Bar | (26) Thrust Races |
| (4) Worm Shaft | (16) Seal Ring | (22) Pin | (27) Thrust Bearings |
| (6) Relief Valve | (17) Plug | (23) Oil Seal | (28) Adjusting Screw for Play |
| (12) Stub Shaft | (18) Lock Nut | | |

[3] OIL FLOW

■ Neutral Position



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

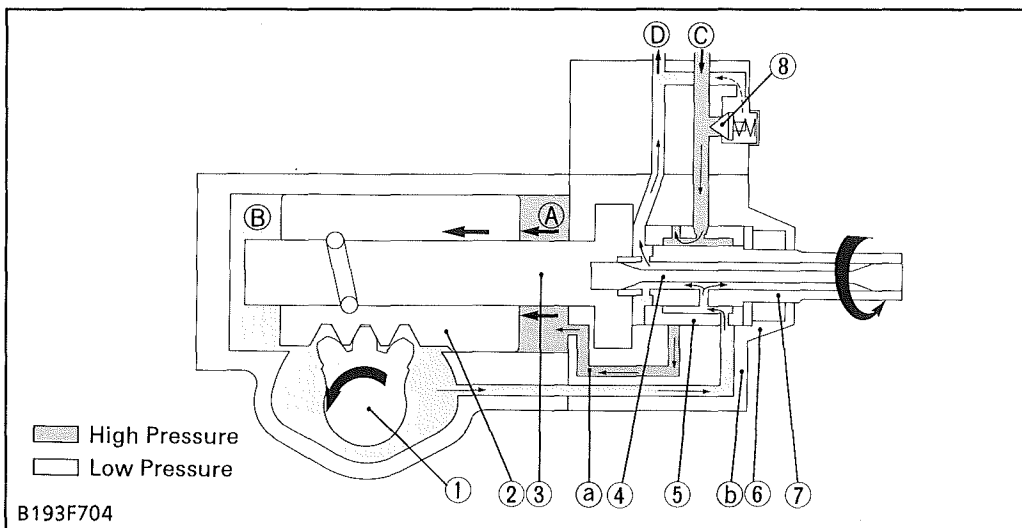
- (1) Sector Gear Shaft
 (2) Ball Nut
 (3) Worm Shaft
 (4) Torsion Bar
 (5) Sleeve
 (6) Valve Housing
 (7) Stub Shaft (Spool)

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

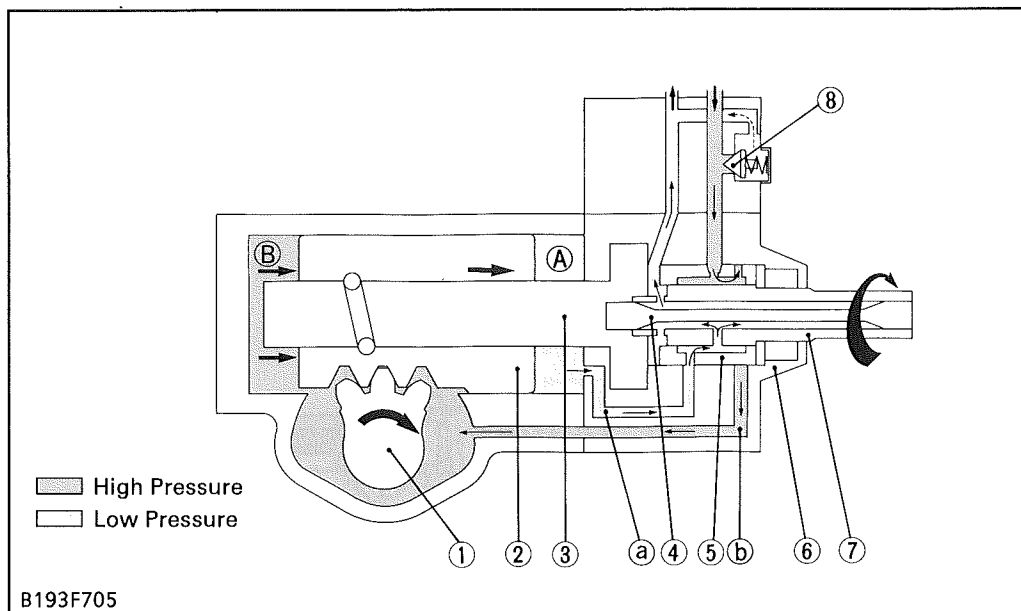
- (A) Chamber "A"
 (B) Chamber "B"
 (C) From Pump
 (D) To HST Unit or Transmission Case
 (a) Port "a"
 (b) Port "b"

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. 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

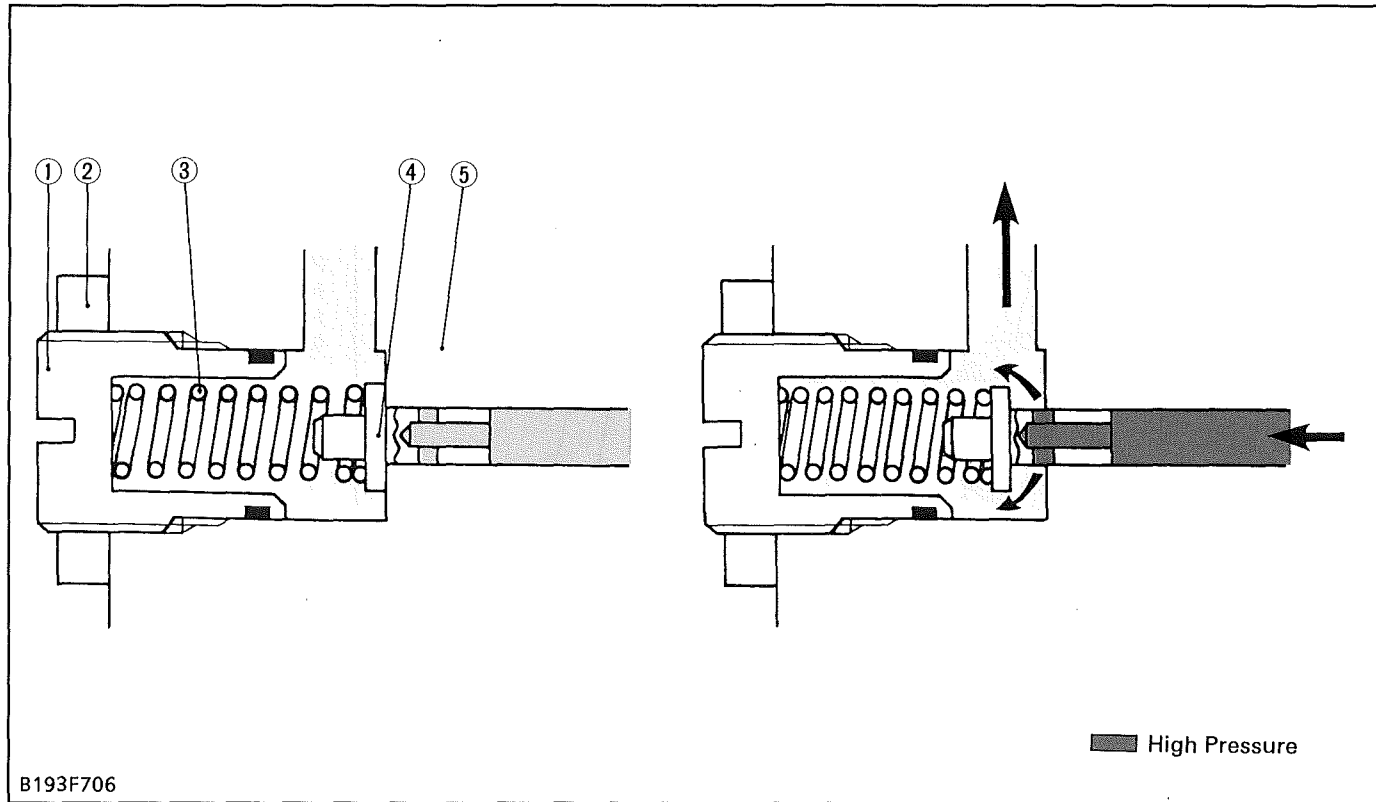
(When Engine Stops or Hydraulic Circuit Troubles)

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 ● Steering linkage worn ● Sector gear shaft worn	Adjust Replace Replace	E7-S9 — E7-S5
Tractor Pulls to Right or Left	● Tire pressure uneven ● Steering wheel play too small ● Improper toe-in adjustment	Adjust Adjust Adjust	G-36 E7-S9 6-S4
Front Wheels Vibration	● Steering linkage worn ● Improper toe-in adjustment	Replace Adjust	— 6-S4
Hard Steering	● Transmission fluid improper or insufficient ● Oil leak from pipe joint ● Hydraulic pump malfunctioning ● Relief valve malfunctioning ● Valve housing and sleeve malfunctioning ● Seals in the steering gear box damaged ● Backlash between sector gear shaft and ball nut too small ● Air in the hydraulic pipes ● Low operating pressure ● Flow priority valve malfunctioning	Change Retighten Replace Replace Replace Replace Adjust Air vent Refer to next item Replace	G-8 — E8-S6 E7-S7 E7-S6 — E7-S9 — — E8-S4
Low Operating Pressure	● Hydraulic pump malfunctioning ● Improper relief valve adjustment ● Relief valve malfunctioning ● Seals in the steering gear box damaged ● Ball nut malfunctioning ● Oil leak from pipe or pipe broken	Replace Adjust Replace Replace Replace ball nut assembly Replace	E8-S6 E7-S4, S9 E7-S9 — — —
Steering Wheel Does Not Return to Neutral Position	● Valve housing and sleeve jammed ● Valve housing oil seal damaged	Repair or Replace Replace	E7-S8, S10 —
Steering Force Fluctuates	● Insufficient oil ● Insufficient bleeding ● Control valve malfunctioning	Replenish Bleed Replace	G-8 — E7-S8
Noise	● Insufficient oil ● Air sucked in pump from suction circuit ● Pipe deformed	Replenish Repair Replace	G-8 — —

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Steering Wheel	Play	5.0 to 30.0 mm 0.2 to 1.2 in.	—
	Operation Force Condition: • Engine Speed Approx. 2600 rpm	Less than 49 N 5.0 kgf 11 lbs	—
Relief Valve	Setting Pressure Condition: • Engine Speed: Approx. 2600 rpm • Oil Temperature: 45 to 55 °C 113 to 131 °F	12.2 to 12.7 MPa 125 to 130 kgf/cm ² 1778 to 1849 psi	—
Steering Gear Box to Ball Nut	Clearance	0.035 to 0.079 mm 0.00138 to 0.00311 in.	0.15 mm 0.0059 in.
Gear Box Bore	I.D.	56.005 to 56.030 mm 2.20492 to 2.20591 in.	—
Ball Nut	O.D.	55.951 to 55.970 mm 2.20280 to 2.20354 in.	—
Bull Nut Assembly	Axial Play	0 to 0.02 mm 0 to 0.00079 in.	0.04 mm 0.00157 in.
Valve housing to Sleeve	Clearance	0.17 to 0.28 mm 0.0067 to 0.0110 in.	0.40 mm 0.0157 in.
Sleeve	O.D.	35.77 to 35.83 mm 1.4083 to 1.4106 in.	—
Valve housing	I.D.	36.00 to 36.05 mm 1.4173 to 1.4193 in.	—
Sector Gear Shaft to Ball Nut	Backlash Deflection measured at piston arm end	Less than 0.30 mm 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)

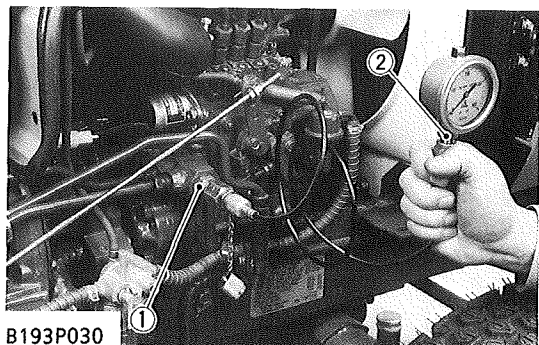
Item	N·m	kgf·m	ft-lbs
Drag link end slotted nut	17.7 to 34.3	1.8 to 3.5	13.0 to 25.3
Pitman arm mounting nut	98.0 to 118.0	10.0 to 12.0	72.3 to 86.8
Power steering assembly mounting screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Power steering delivery pipe	34.0 to 39.0	3.5 to 4.0	25.3 to 28.9
Power steering 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

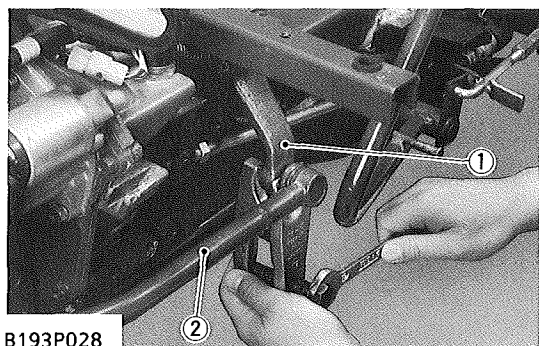
(2) Pressure Gauge

Relief Valve Setting Pressure

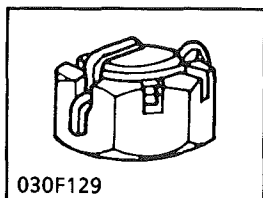
1. Open the bonnet and remove the right hand side cover.
2. Remove the outside plug of flow priority valve and then install the PS adaptor (Refer to EG-2) (1) to flow priority valve and connect the cable and pressure gauge (2) to PS adaptor.
3. Start the engine. After warming up, set the engine speed 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 125 to 130 kgf/cm ² 1778 to 1849 psi
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[1] SEPARATING POWER STEERING BODY



B193P028



030F129

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)

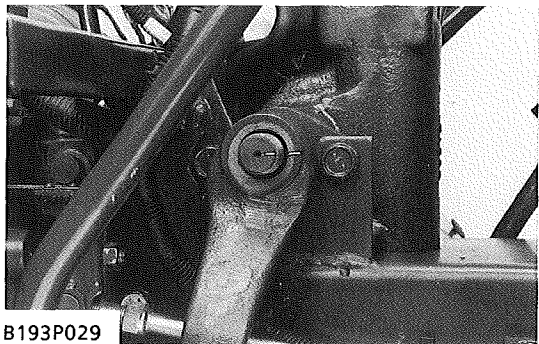
■ IMPORTANT

- 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.

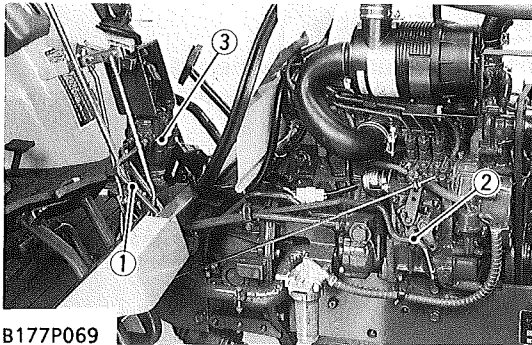
Tightening torque	Slotted nut	17.7 to 34.3 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs
	Pitman arm mounting nut	98.0 to 118.0 N·m 10.0 to 12.0 kgf·m 72.3 to 86.8 ft-lbs

(1) Pitman Arm

(2) Drag Link



B193P029



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)

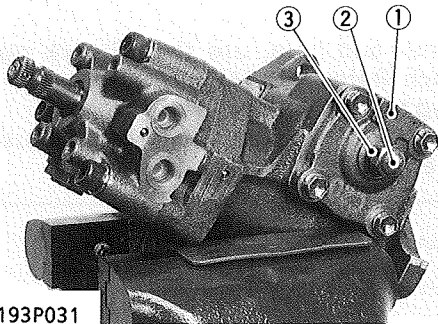
Tightening torque	Power steering delivery pipe	34.0 to 39.0 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Power steering return pipe	29.4 to 39.2 N·m 3.0 to 4.0 kgf·m 21.7 to 28.9 ft-lbs
	Power steering assembly mounting screw	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

[2] POWER STEERING BODY

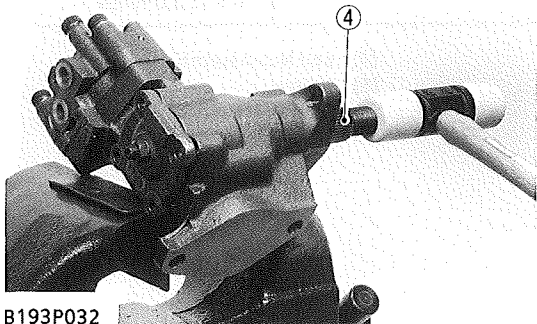
DISASSEMBLING AND ASSEMBLING

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

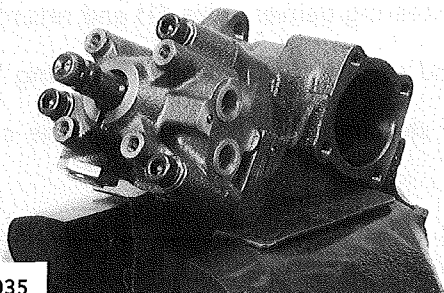
1. Remove the cap nut (2) and loosen the lock nut (3).
2. Remove the side cover mounting screws.
3. Tap out the sector gear shaft (4) and side cover (1) as a unit toward the side cover.

(When reassembling)

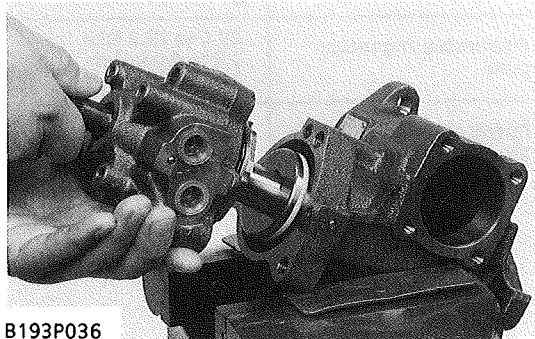
- Turn the worm shaft so that the ball nut is centered in its travel. Then, install the sector gear shaft so that the center of its teeth engages the center teeth of the ball nut.

Tightening torque	Cap nut	19.6 to 29.4 N·m 2.0 to 3.0 kgf·m 14.5 to 21.7 ft-lbs
	Lock nut	19.6 to 29.4 N·m 2.0 to 3.0 kgf·m 14.5 to 21.7 ft-lbs
	Side cover mounting screw	19.6 to 29.4 N·m 2.0 to 3.0 kgf·m 14.5 to 21.7 ft-lbs

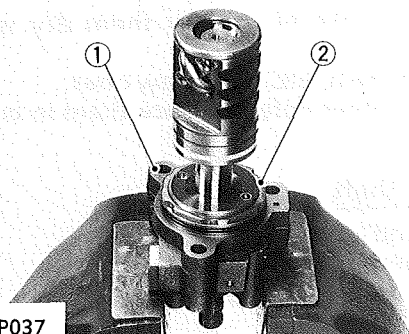
7 STEERING



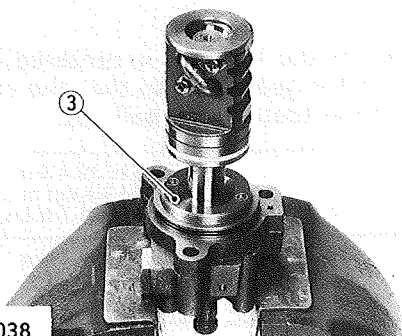
B193P035



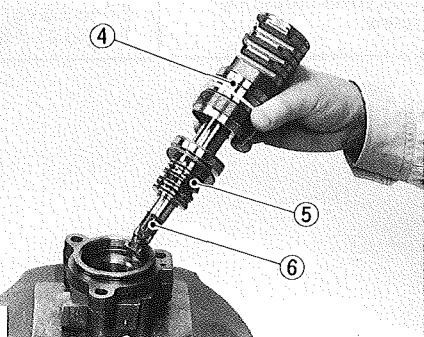
B193P036



B193P037



B193P038



B193P039

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 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs
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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).

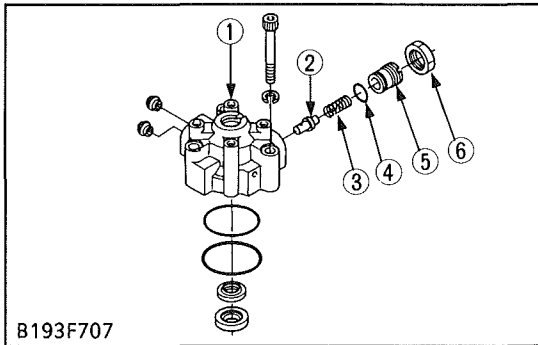
(When reassembling)

- 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 9.0 to 11.0 kgf·m 65.1 to 79.6 ft-lbs
	Plug	8.8 to 10.8 N·m 0.9 to 1.1 kgf·m 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

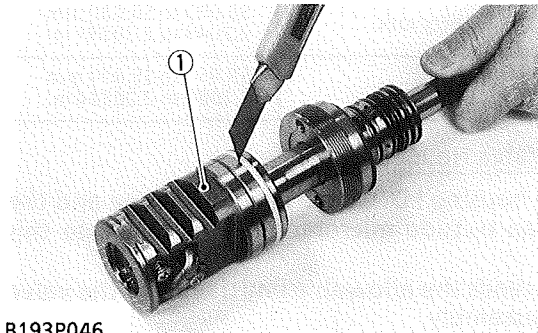
- (1) Valve Housing (4) O-ring
(2) Relief Valve Poppet (5) Adjusting Screw
(3) Relief Spring (6) Lock Nut

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 5.0 to 8.0 kgf·m 36.2 to 57.8 ft-lbs
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B193P046

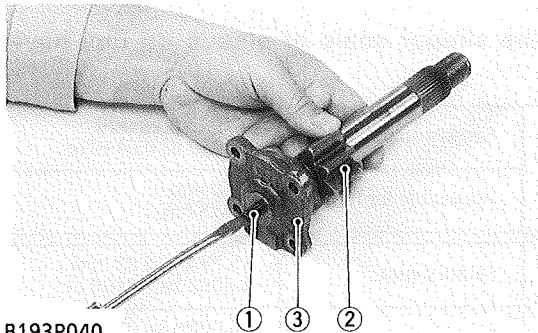
Seal Ring on Ball Nut

- Cut the seal ring with a knife and remove it.
- 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

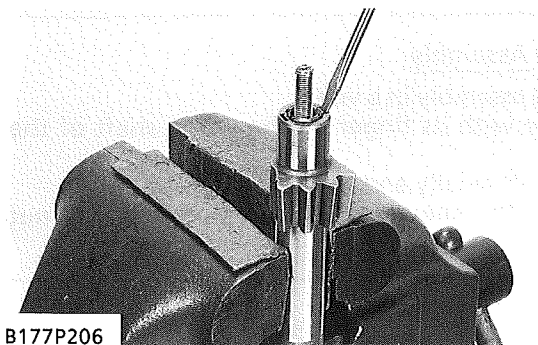


B193P040

Sector Gear Shaft

- Turn the adjusting screw (1) to counterclockwise then separate the side cover (3) and sector gear shaft (2).

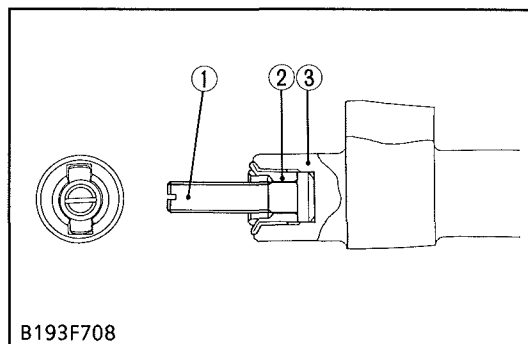
- (1) Adjusting Screw (3) Side Cover
(2) Sector Gear Shaft



B177P206

Adjuster of Sector Gear Shaft

- Remove the stake and adjuster (2).



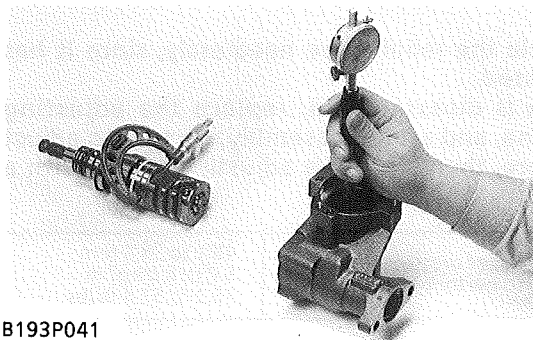
B193F708

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

(When reassembling)

- Replace the adjuster with new one.

SERVICING

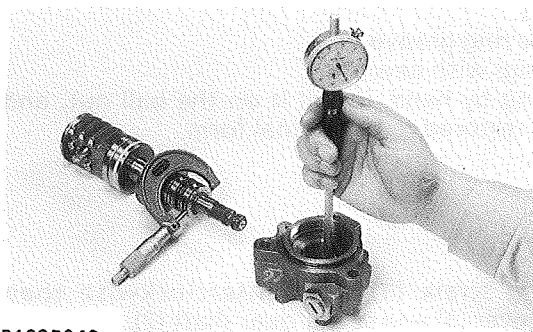


B193P041

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 0.001 to 0.00311 in.
	Allowable limit	0.15 mm 0.0059 in.
Gear box bore I.D.	Factory spec.	56.005 to 56.030 mm 2.2049 to 2.20591 in.
Ball nut O.D.	Factory spec.	55.951 to 55.970 mm 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 not have excessive wear.

Clearance between valve housing and sleeve	Factory spec.	0.17 to 0.28 mm 0.0067 to 0.0110 in.
	Allowable limit	0.40 mm 0.0157 in.
Sleeve O.D.	Factory spec.	35.77 to 35.83 mm 1.4083 to 1.4106 in.
Valve housing I.D.	Factory spec.	36.00 to 36.05 mm 1.4173 to 1.4193 in.

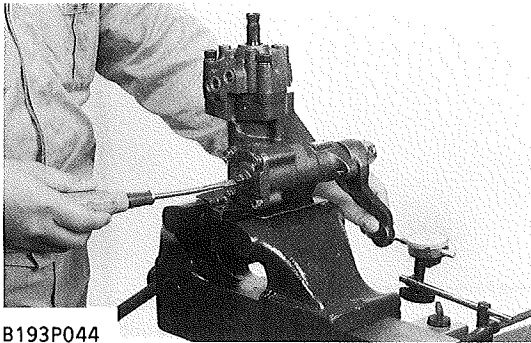


B193P043

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 0 to 0.00079 in.
	Allowable limit	0.04 mm 0.00157 in.



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.

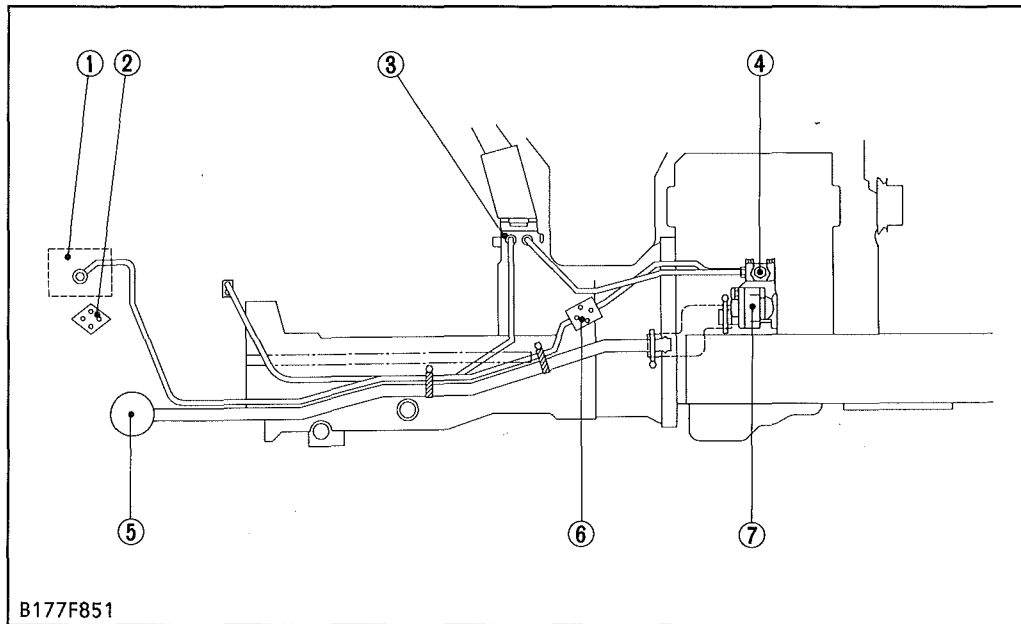
Backlash between sector gear shaft and ball nut	Factory spec.	0.30 mm
		Less than 0.018 in.

8 HYDRAULIC SYSTEM

MECHANISM

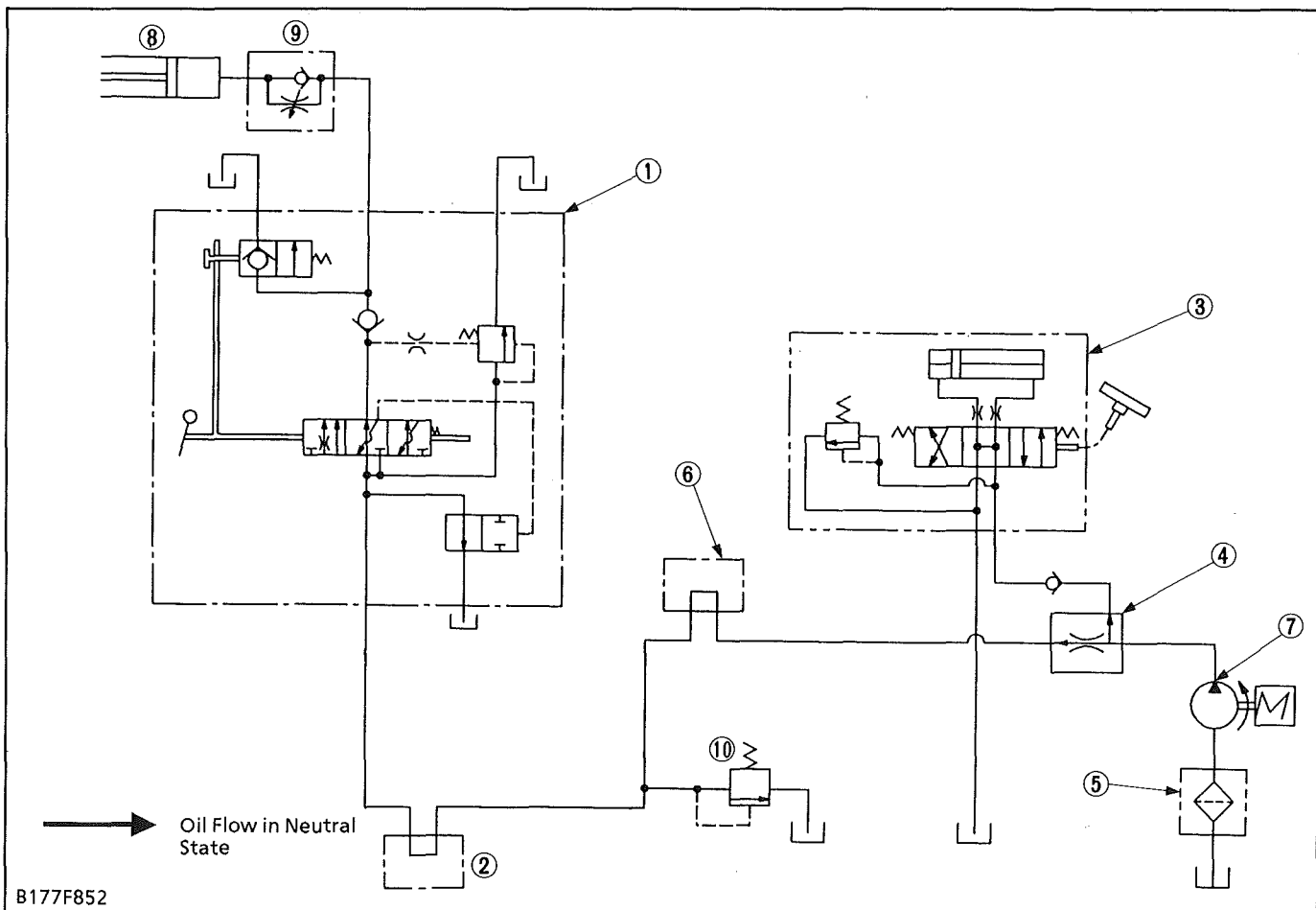
[1] HYDRAULIC CIRCUIT

MANUAL TRANSMISSION



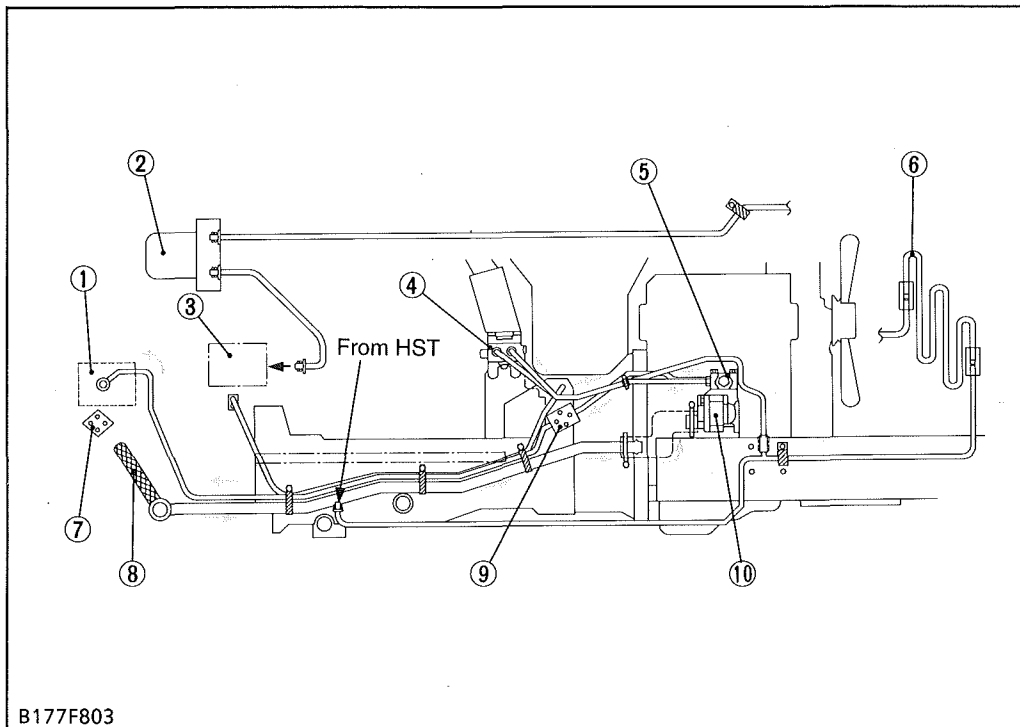
- (1) Position Control Valve
- (2) Rear Hydraulic Outlet
- (3) Power Steering
- (4) Flow Priority Valve
- (5) Oil Filter
- (6) Hydraulic Block Type Outlet
- (7) Hydraulic Pump
- (8) Hydraulic Cylinder
- (9) Lowering Speed Adjusting Valve
- (10) Relief Valve

B177F851



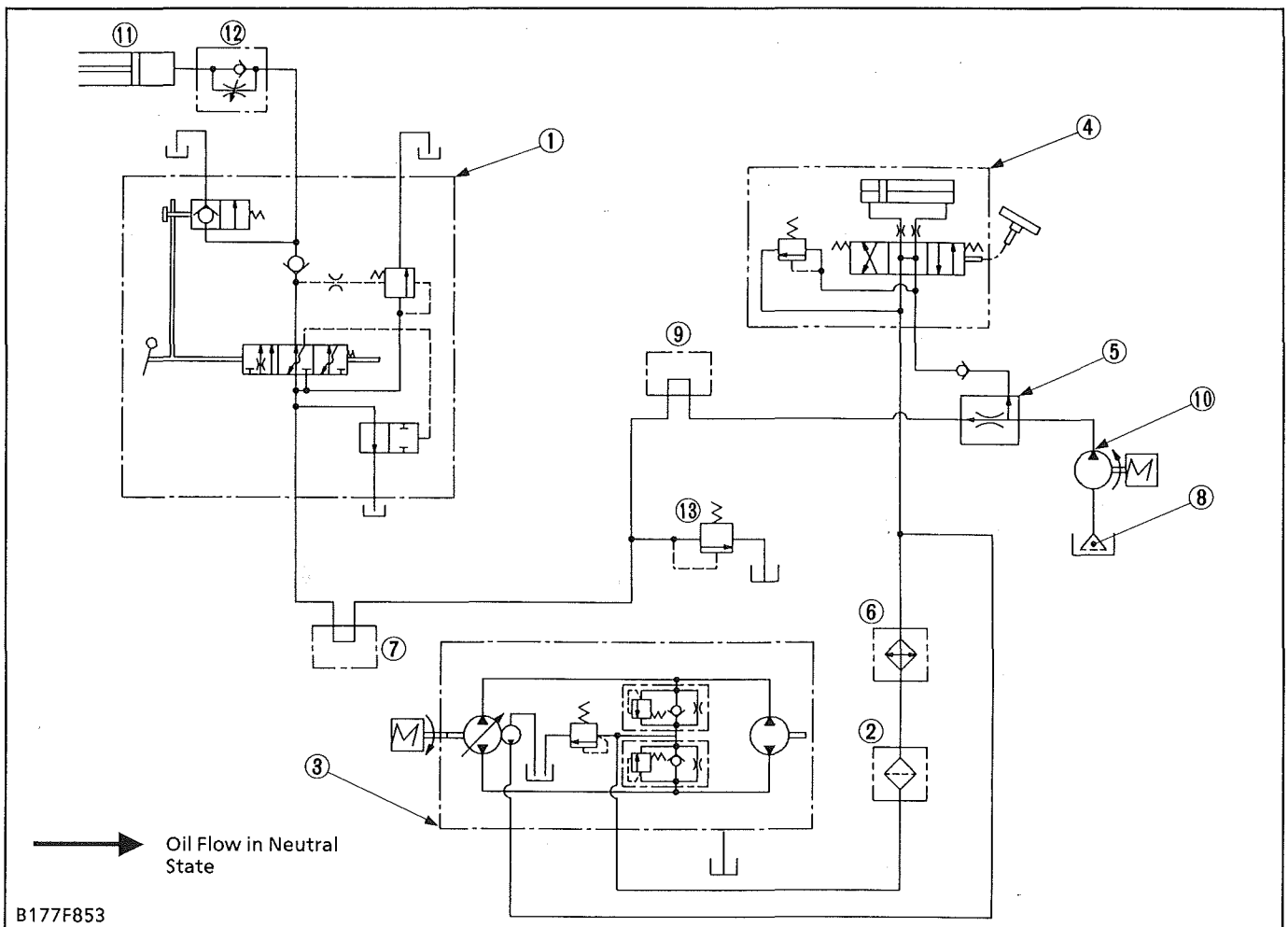
B177F852

■ HYDROSTATIC TRANSMISSION



- (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

B177F803



B177F853

Hydraulic System

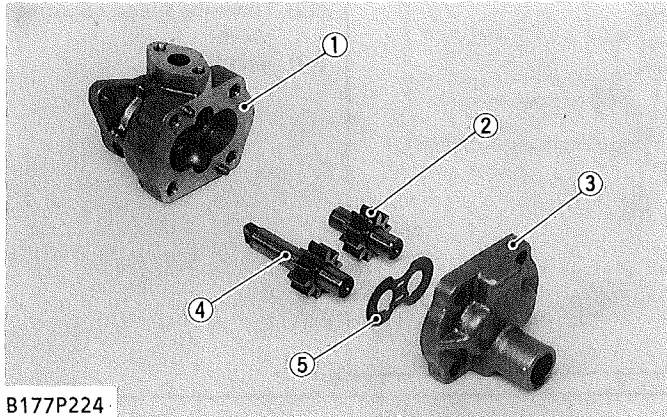
The hydraulic system of these tractors are composed of a hydraulic pump, hydraulic block type outlet, control valve, hydraulic cylinder, hydraulic oil filter and other components.

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

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.

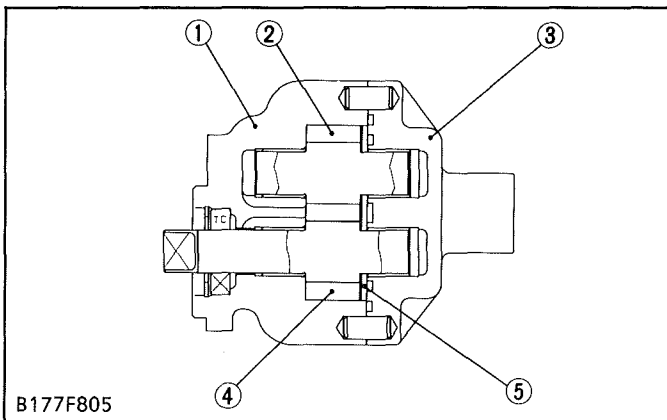
Hydraulic pump is driven by the fuel camshaft.

Maximum displacement is as follows.

Displacement	Engine speed	Condition
22.0 l/min. 5.8 U.S. GPM 4.8 Imp. GPM	At 2600 rpm	13.2 to 13.7 MPa 135 to 140 kg/cm ² 1920 to 1991 psi

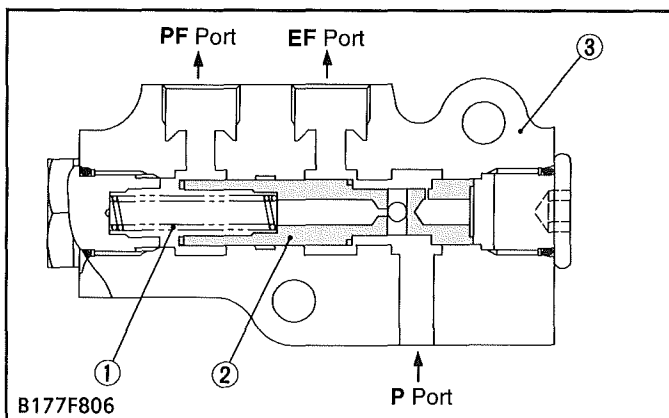
- (1) Casing
(2) Driven Gear
(3) Cover

- (4) Drive Gear
(5) Side Plate



B177F805

[3] FLOW PRIORITY VALVE



B177F806

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

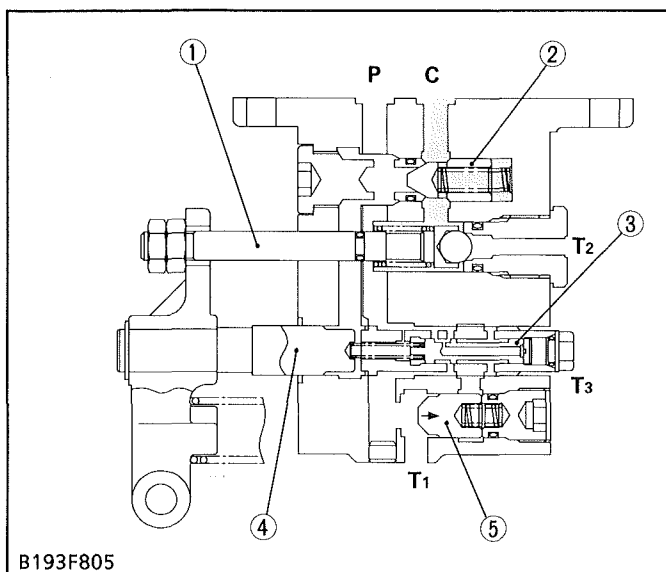
This valve feeds fixedly controlled flow (5 l/min, 1.3 U.S. GPM, 1.1 Imp. GPM) to the PF port with priority and excessive flow to the EF port.

- (1) Spring
(2) Spool

- (3) Valve Body

[4] POSITION CONTROL VALVE

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



■ 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.

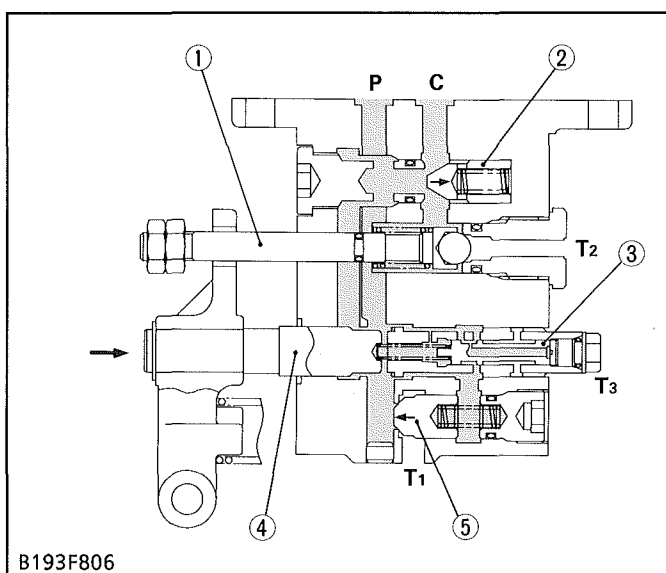
Oil behind the unload poppet (5) returns to the transmission case through the spool (4) and the **T3** port.

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
C : Cylinder Port

T1, T2, T3 : Tank Port

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



■ Lift

When the control lever is set to the **LIFT** position, the spool (4) is move to the right.

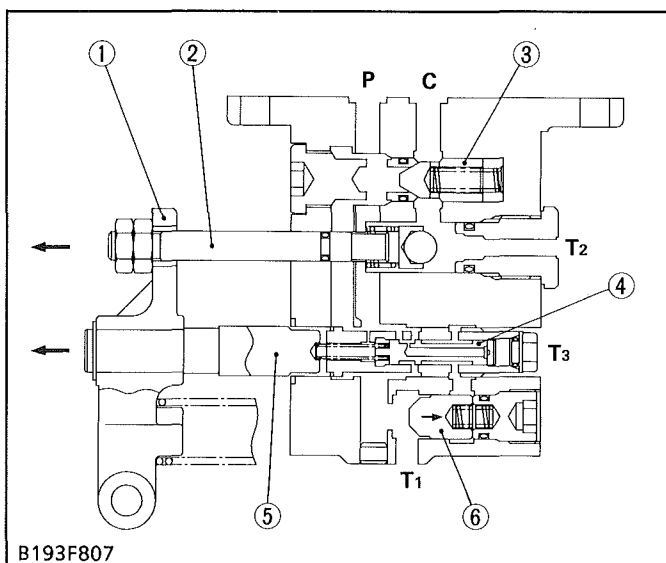
The oil forced into the control valve through the **P** port flows to the back of the unload poppet (5) to close it.

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
C : Cylinder Port

T1, T2, T3 : Tank Port

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



■ 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).

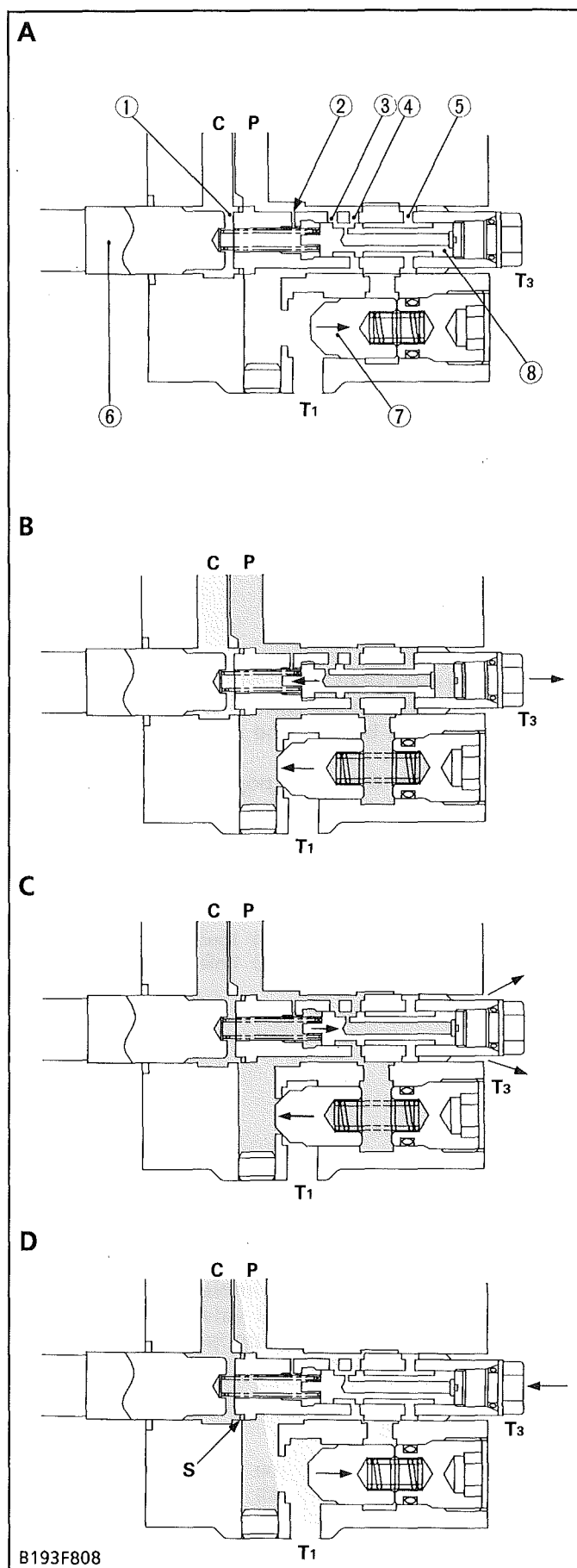
Oil in the hydraulic cylinder is forced out to the transmission case through the **T2** port by the weight of the implement, causing the implement to lower.

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
C : Cylinder Port

T1, T2, T3 : Tank Port

- | | |
|--------------|-------------------|
| (1) Lever | (4) Plunger |
| (2) Poppet 2 | (5) Spool |
| (3) Poppet 1 | (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.

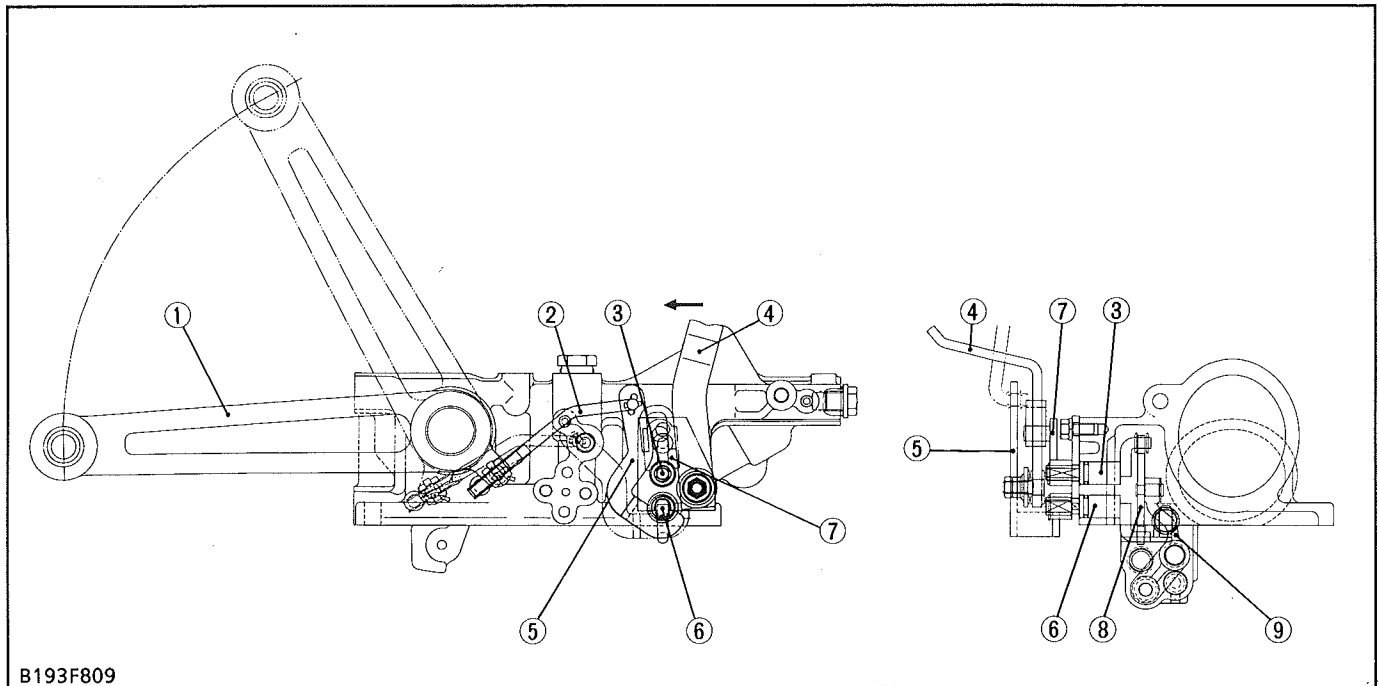
1. When the three point linkage system starts going up, the spool (6) is located slightly at the right from the neutral position. (Fig. B)
2. The oil fed from hydraulic pump flows in passages 3 (3) and 4 (4) by the difference of the hole diameter, and pushes the plunger (8) to the left. Then the passages 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 | (5) Passage 5 |
| (2) Passage 2 | (6) Spool |
| (3) Passage 3 | (7) Unload Poppet |
| (4) Passage 4 | (8) Plunger |

B193F808

[5] FEEDBACK LINKAGE FOR POSITION CONTROL

B193F809

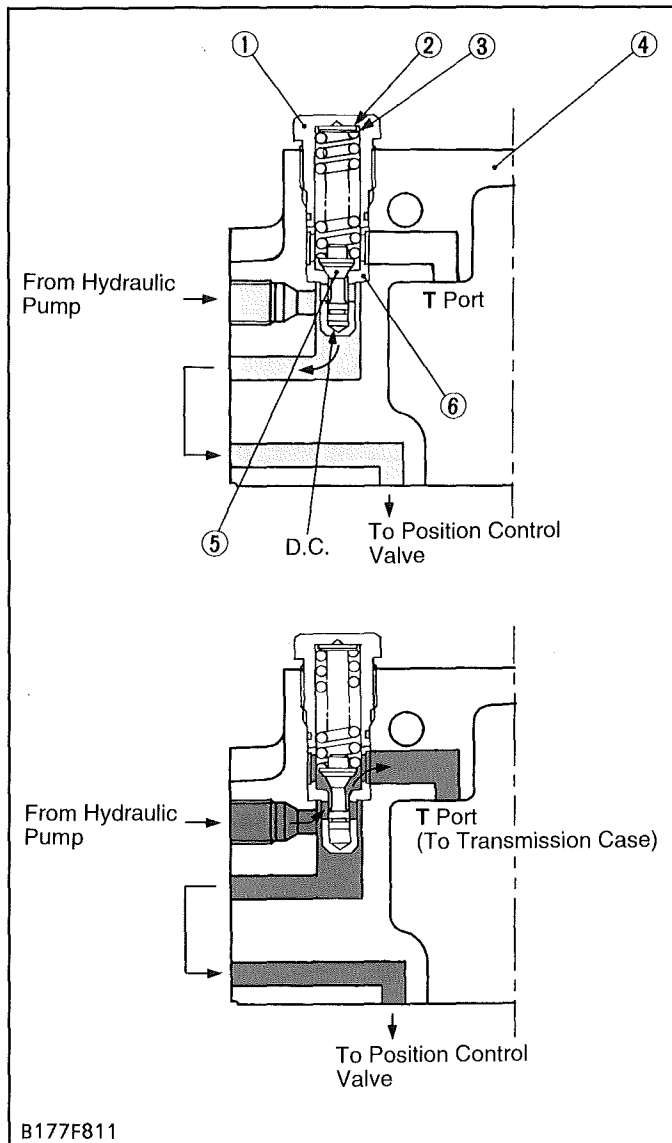
- | | | | |
|-------------------------|----------------------------|------------------------|-----------------------|
| (1) Lift Arm RH | (4) Position Control Lever | (6) Feedback Arm Shaft | (8) Control Lever Arm |
| (2) Feedback Rod | (5) Feedback Arm | (7) Connecting Link | (9) Lever |
| (3) Control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

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/cm²
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 ● Control valve improperly adjusted ● Control valve improperly assembled ● Relief valve spring damaged ● Spool sticks	Replace Adjust Repair Replace Repair	E8-S5 E8-S6 E8-S5 8-S11 E8-S6
(Noise)	● Piston O-ring or cylinder damaged ● Oil strainer or oil filter cartridge clogged ● Suction pipe loosen or broken ● Suction pipe connecting hose loosen or broken ● Suction pipe O-ring broken ● Insufficient transmission oil ● Relief valve setting pressure too low ● Hydraulic pump broken	Replace Clean or Replace Repair or Replace Repair or Replace Replace Refill Adjust or Replace Replace	8-S10 — — — — G-8 8-S8 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 ● Piston O-ring worn or damaged ● Control valve malfunctioning	Replace Replace Replace	E8-S5 E8-S5 E8-S5
Implement Hunts	● Control valve improperly adjusted	Adjust	E8-S6

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
[Hydraulic Pump] Pump Delivery at Engine 2600 rpm, Oil Temperature 50°C, 122°F			
	at no pressure	22.0 ℓ / min. 5.8 U.S. GPM 4.8 Imp.GPM	—
	at 14.7 MPa 150 kgf / cm ² 2133 psi	18.0 ℓ / min. 4.8 U.S.GPM 4.0 Imp.GPM	16.0 ℓ / min. 4.2 U.S. GPM 3.5 Imp.GPM
Gear to Casing	Clearance	—	0.15 mm 0.0059 in.
Gear Shaft to Bushing	Clearance	0.020 to 0.091 mm 0.0008 to 0.0036 in.	0.12 mm 0.0047 in.
Gear Shaft	O.D.	14.970 to 14.980 mm 0.5894 to 0.5898 in.	—
Bushing	I.D.	15.000 to 15.061 mm 0.5906 to 0.5930 in.	—
Side Plate	Thickness	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.
Relief Valve	Setting Pressure	13.2 to 13.7 MPa 135 to 140 kgf/cm ² 1920 to 1991 psi	—
Lift Arm	Free Play	5 to 10 mm 0.20 to 0.40 in.	—
Hydraulic Cylinder	I.D.	70.05 to 70.10 mm 2.7579 to 2.7598 in.	70.15 mm 2.7618 in.
Hydraulic Arm Shaft to Bushing	Clearance	0.020 to 0.110 mm 0.0008 to 0.0043 in.	0.30 mm 0.0118 in.
Hydraulic Arm Shaft, Right	O.D.	37.925 to 37.950 mm 1.4931 to 1.4941 in.	—
Hydraulic Arm Shaft, Left	O.D.	33.925 to 33.950 mm 1.3356 to 1.3366 in.	—
Bushing, Right	I.D.	37.970 to 38.035 mm 1.4949 to 1.4974 in.	—
Bushing, Left	I.D.	33.970 to 34.035 mm 1.3374 to 1.3400 in.	—

TIGHTENING TORQUES

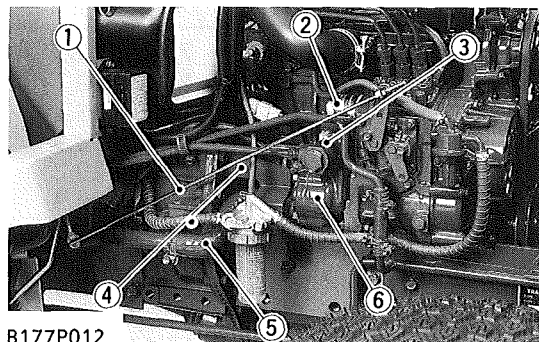
Tightening torques of screws and nuts on the table bellow is especially specified.
(For general use screws and nuts: See page G-8)

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 1.00 to 1.15 kgf·m 7.24 to 8.32 ft-lbs
	Fuel filter bracket mounting screws	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
	Flow priority valve mounting screws	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
	Delivery pipe flare nuts	29.4 to 39.2 N·m 3.0 to 4.0 kgf·m 21.7 to 28.9 ft-lbs
	P.S. delivery pipe nut	34.0 to 39.0 N·m 3.5 to 4.0 kgf·m 25.0 to 28.8 ft-lbs
	Hydraulic pump mounting screw and nut	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

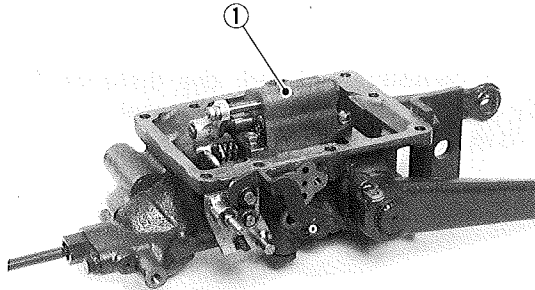
- (1) Accelerator Rod
(2) Fuel Cut Off Solenoid
(3) Flow Priority Valve

- (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



B193P807

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 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
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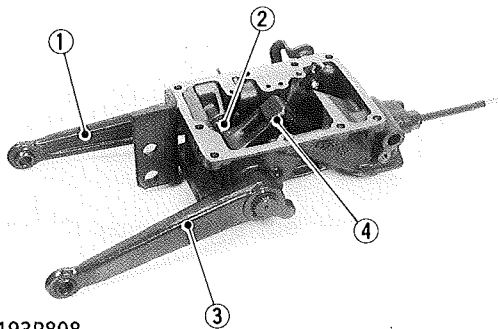
(1) Position Control Valve

Lift Arm, Hydraulic Arm Shaft and Hydraulic Arm

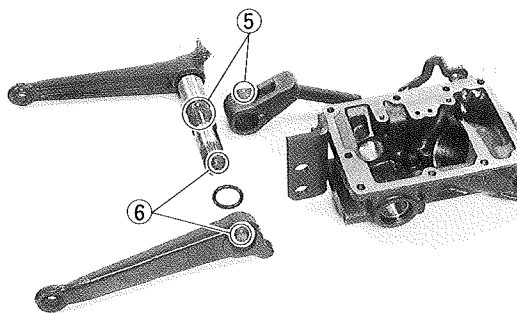
1. Remove the external snap ring, and remove the lift arm LH (3).
2. Draw out the hydraulic arm shaft (2) and lift arm RH (1) as a unit.

(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.



B193P808



B193P809

(1) Lift Arm RH

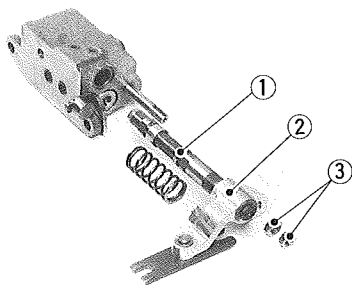
(2) Hydraulic Arm Shaft

(3) Lift Arm LH

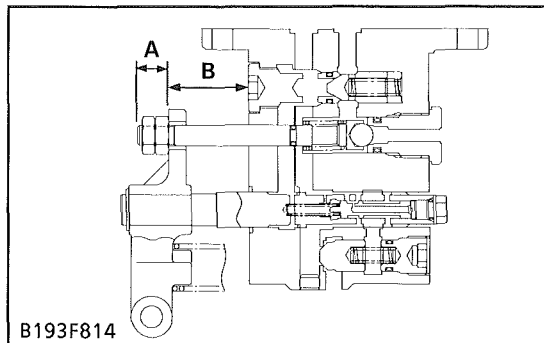
(4) Hydraulic Arm

(5) Alignment Marks

(6) Alignment Marks

(2) Disassembling Position Control Valve

B193P810



B193F814

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

Plunger

1. Remove the plug 4 (1), and draw out the plunger (2) and spring (3) from the spool (4).

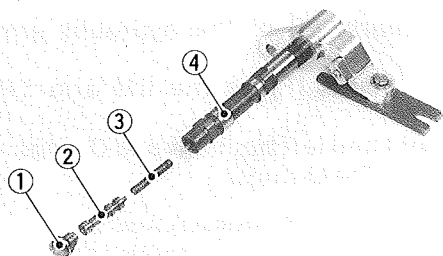
(When reassembling)

- Take care not to damage the O-ring.

Tightening torque	Plug 4	7.85 to 11.77 N·m 0.8 to 1.2 kgf·m 5.79 to 8.68 ft-lbs
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- (1) Plug 4
(2) Plunger

- (3) Spring
(4) Spool



B193P811

Poppet 1

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

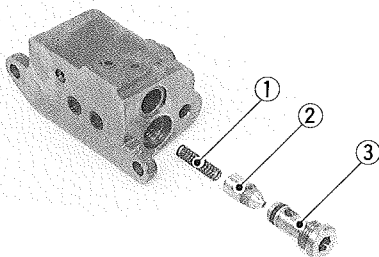
(When reassembling)

- Take care not to damage the O-ring.

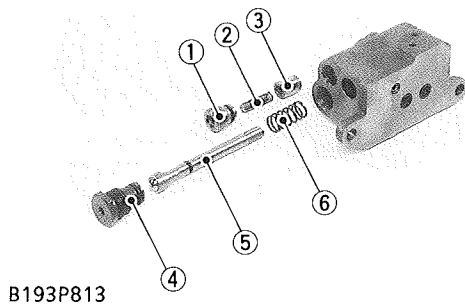
Tightening torque	Plug 1	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs
-------------------	--------	---

- (1) Spring
(2) Poppet 1

- (3) Plug 1



B193P812

**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 4.0 to 6.0 kgf·m 28.9 to 43.4 ft-lbs
	Plug 2	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 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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