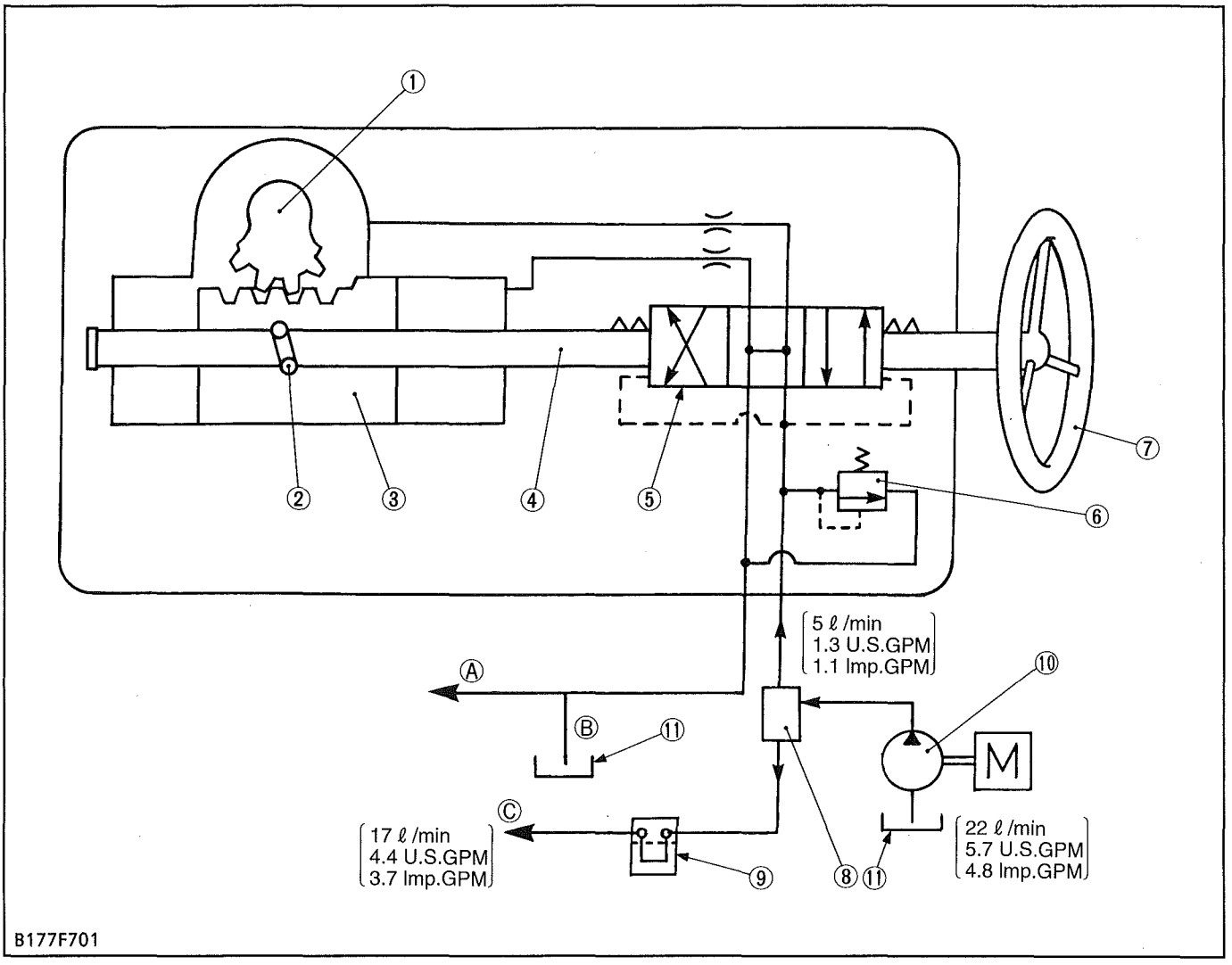
MECHANISM

CONTENTS

[1] HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM



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

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

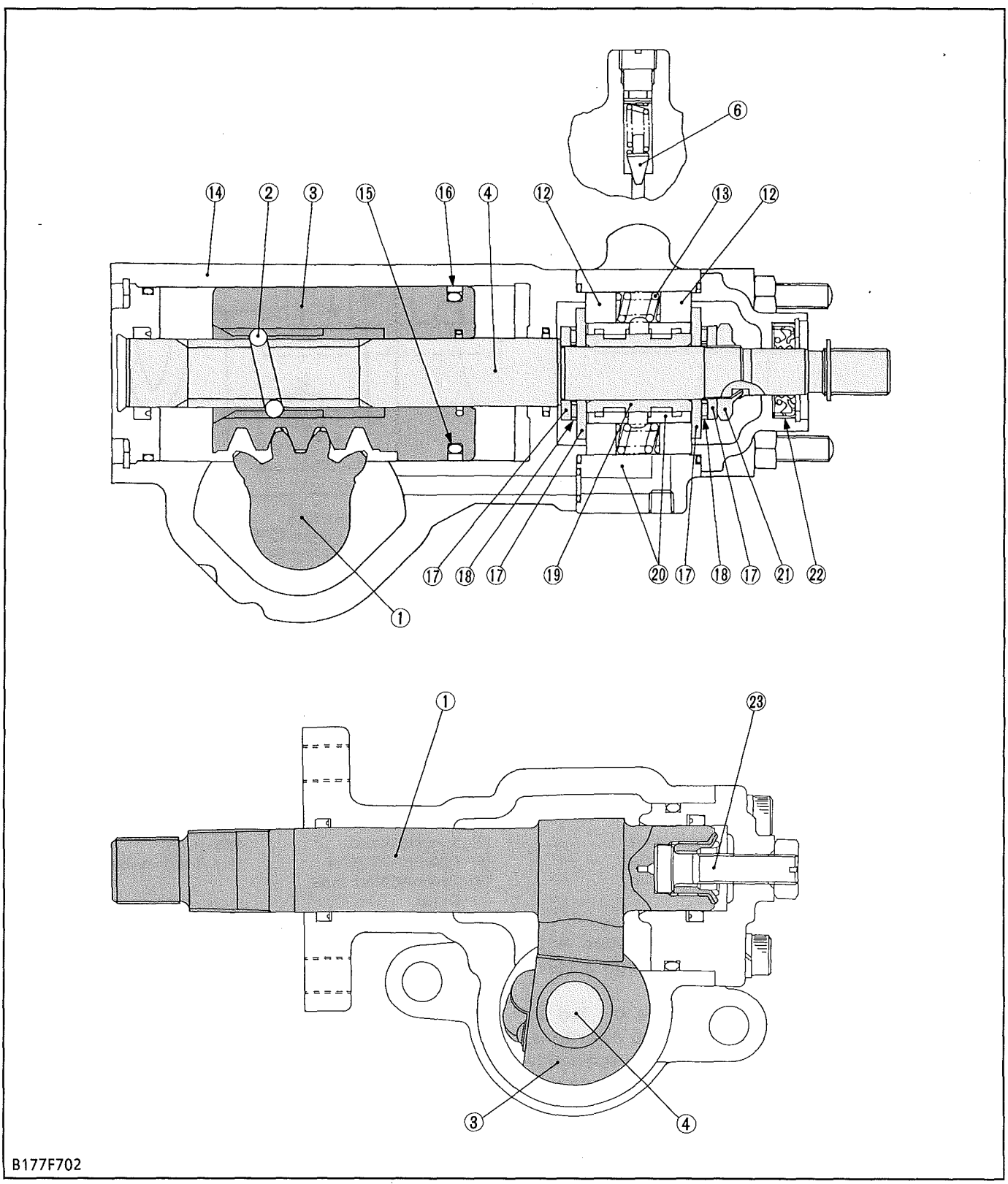
All models are available to be equipped with integral type power steering that of sliding valve with centering spring type.

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

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

When the worm thrust force (turning force of the ball screw section) exceeds centering spring setting load, the worm shaft (4) axially shifts by a specified displacement (Stroke: about 0.4 mm (0.016 in.)). When a load is applied to tires and worm thrust force required for operation is greater than the centering spring setting load, turning the steering wheel does not rotate the sector gear shaft (1), but rather axially moves the worm shaft (4). The valve spool (19), fixed on the worm shaft (4) by the nut (21), changes the condition of the three-position, four-way open center (all ports open) valve (5) by sliding in the valve housing (20), to generate pressure as required.

[2] POWER STEERING BODY



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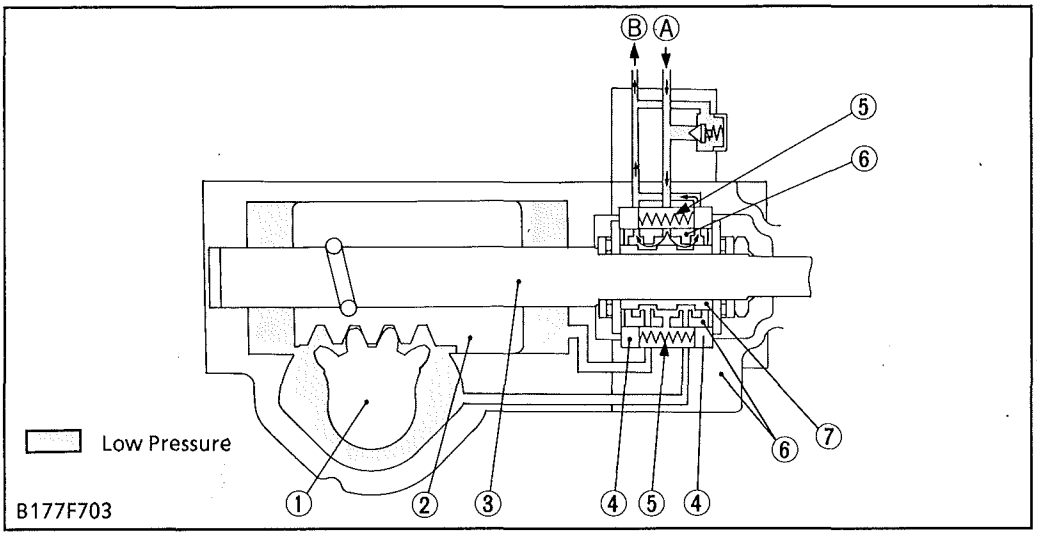
(1) Sector Gear Shaft
(2) Balls
(3) Ball Nut
(4) Worm Shaft
(6) Relief Valve
(12) Reaction Pistons
(13) Centering Springs
(14) Gear Case
(15) O-Ring
(16) Teflon Ring
(17) Thrust Races
(18) Thrust Needle Bearings
(19) Spool
(20) Valve Housing
(21) Nut
(22) Oil Seal
(23) Adjusting Screw for Play

[3] OIL FLOW

■ Neutral Position



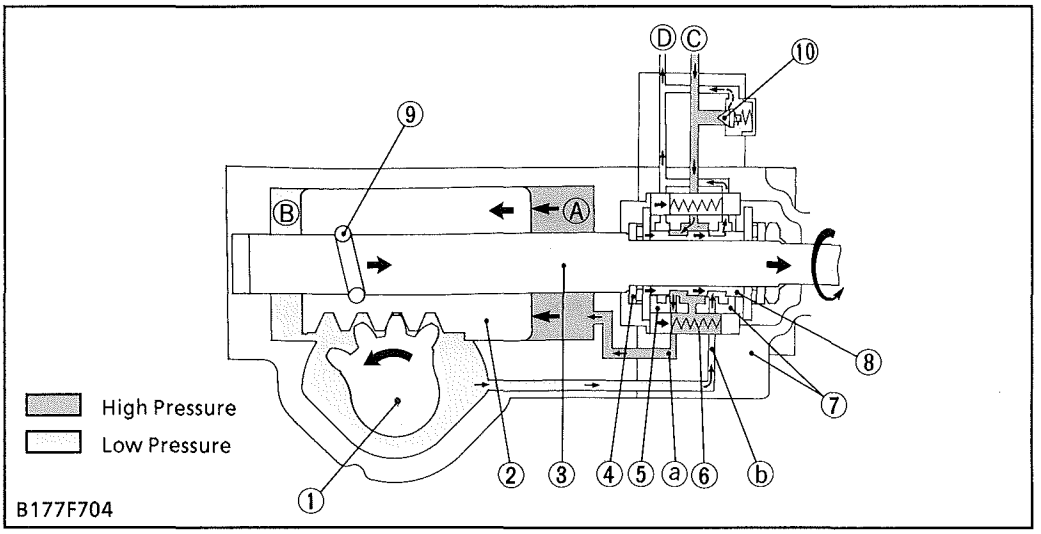
(A) From Pump (Through Flow Priority Valve)
(B) To HST Unit (HST Type) or Transmission Case (Manual Transmission Type)

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

When the steering wheel is not turned, the valve is placed in the neutral position by the centering springs (5) and pressurized reaction pistons (4).

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

■ Left Turning

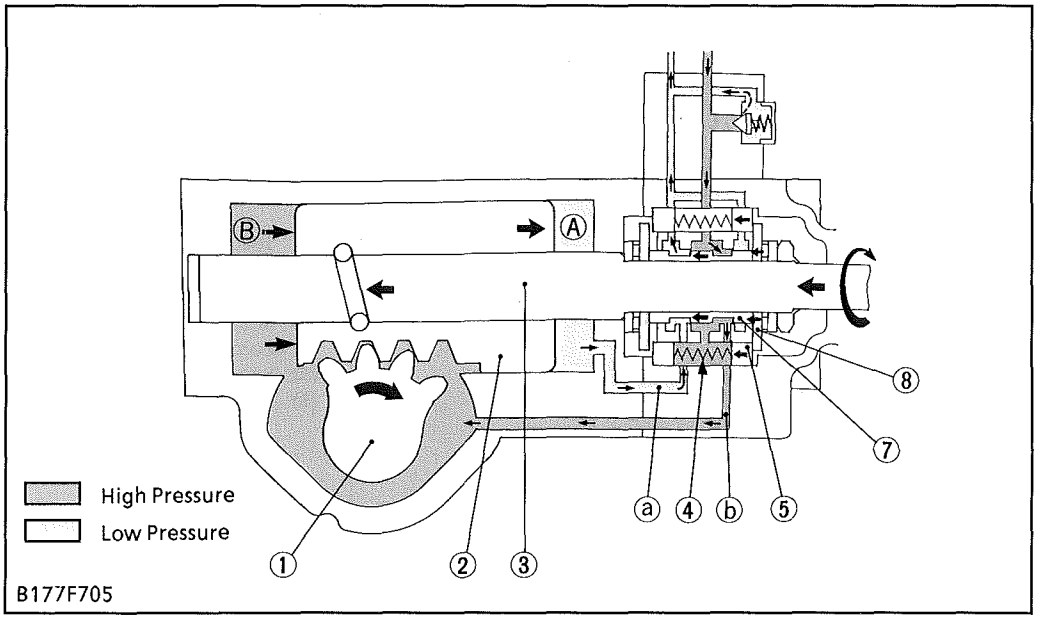


(1) Sector Gear Shaft
(2) Ball Nut
(3) Worm Shaft
(4) Thrust Race
(5) Reaction Piston
(6) Centering Spring
(7) Valve Housing
(8) Spool
(9) Ball
(10) Relief Valve

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

1. When the steering wheel is turned counterclockwise, the worm shaft (3) is also turned.
   However, front wheel load stops sectors gear shaft (1) and ball nut (piston) (2) from moving, and only worm shaft (3) turns counterclockwise.
   Then, due to the reaction, the worm shaft (3) moves upward a little. And the thrust race (4) pushes the spool (8), reaction piston (5) and centering springs (6).
2. At this time, the oil passage from pump to port "b" and oil passage from port "a" are closed.
   Therefore, the pressure-fed oil from pump flows to the chamber "A" through port "a". Thus, the ball nut (piston) (2) is pushed , and the sector gear shaft (5) is rotated in the direction of the arrow.

■ Right Turning



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

(A) Chamber "A"
(B) Chamber "B"
(a) Port "a"
(b) Port "b"

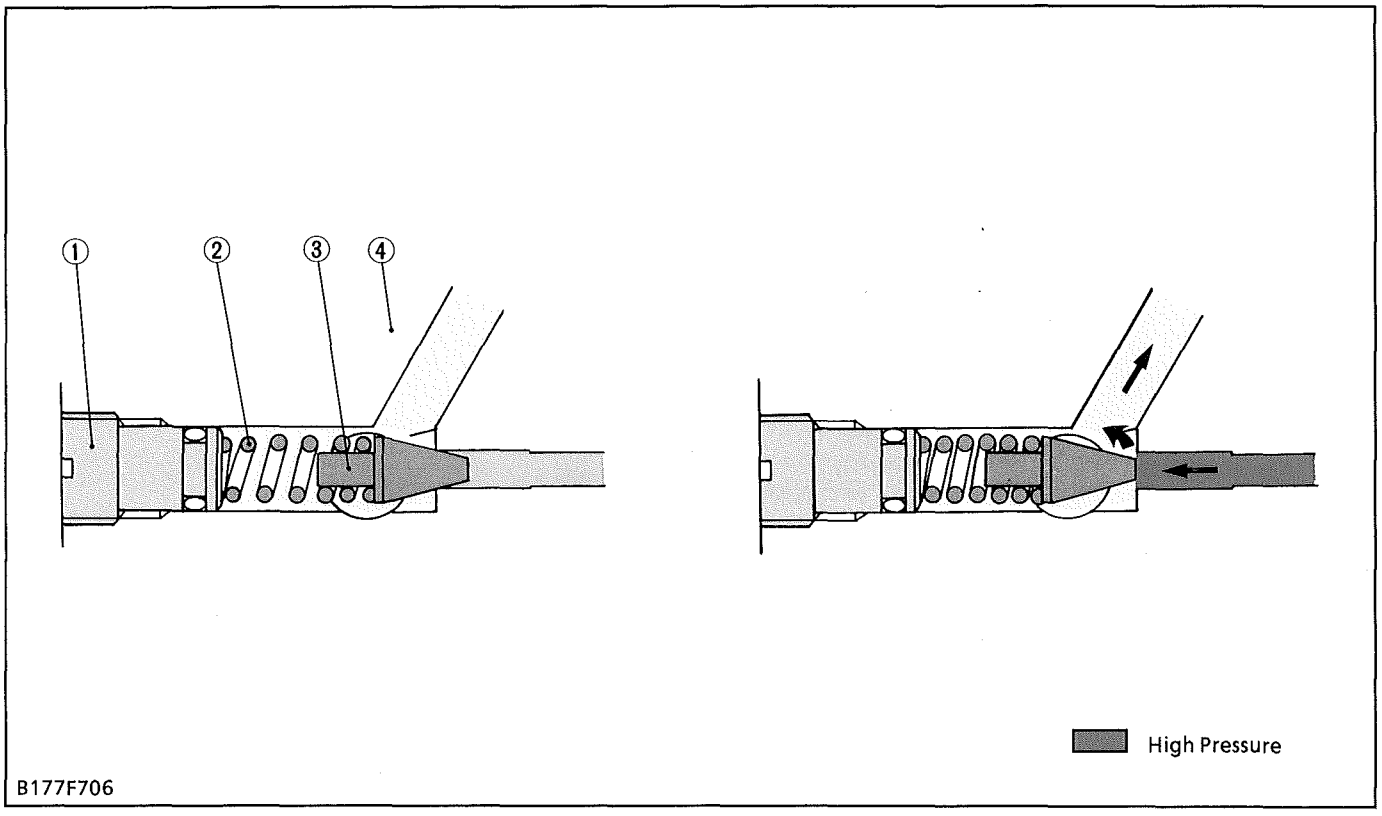
1. When the steering wheel is turned clockwise, the worm shaft (3) is also turned. However, front wheel load stops sector gear shaft (1) and ball nut (2) from moving, and only worm shaft (3) turns clockwise.
   Then due to the reaction, the worm shaft (3) moves downward a little. And the thrust race (8) pushes the spool (7), reaction piston (5) and centering springs (4).
2. At this time, the oil passage from pump to port "a" and oil passage from port "b" to are closed. Therefore, the pressure-fed oil from pump flows to the chamber "B" through port"b". Thus, the ball nut (piston) (2) is pushed, and the sector gear shaft (1) is rotated in the direction of the arrow.

■ Manual Operation
(When Engine Stops or Hydraulic Circuit Troubles)

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

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

■ Operation of Relief Valve



(1) Adjusting Screw (2) Spring (3) Poppet (4) Valve Housing

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

When the pressure in the hydraulic circuit exceeds the relief valve setting pressure in such a case that the maximum steering angle of the front wheels is reached or road resistance to the front tires is too great, the spring (2) is compressed to generate a gap between the poppet (3) and the valve housing (4). The pressure-fed oil flows to tank port through the gap so that pressure rise is restricted.

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

SERVICING

CONTENTS

TROUBLESHOOTING

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

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Steering Wheel	Play	5.0 to 30.0 mm 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 too 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

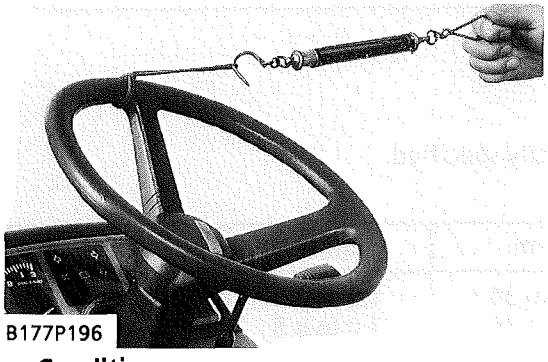
■ IMPORTANT
- **Use only the transmission fluid (See page S.G-3), in no case use mixture of oils of different brands.**
- **Do not disassemble the hydraulic pump and power steering needlessly.**
- **After installing or reassembling the power steering hydraulic components, be sure to bleed air.**

(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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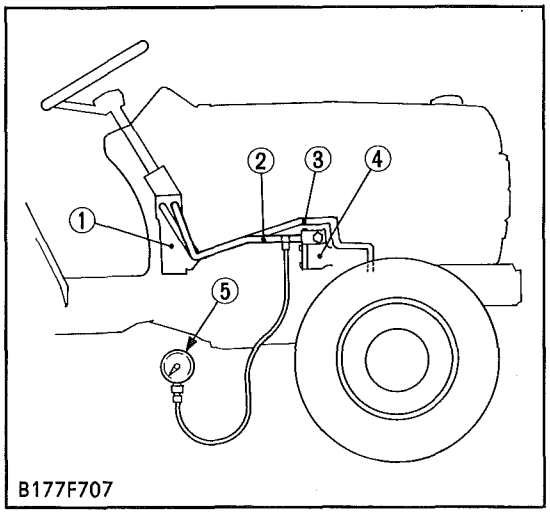
Steering Wheel Operating Force

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.

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

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



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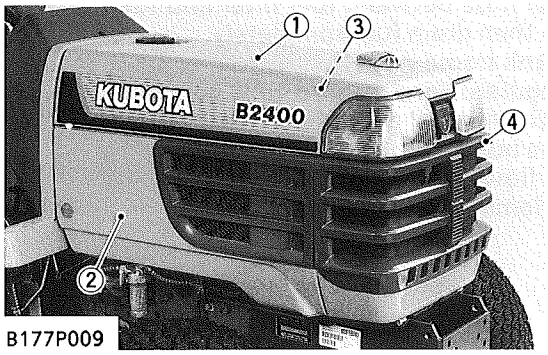
(1) Power Steering Valve
(2) Delivery Pipe
(3) Return Pipe
(4) Hydraulic Pump
(5) Pressure Gauge

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/cm² 1636 to 1707 psi

[1] SEPARATING POWER STEERING BODY



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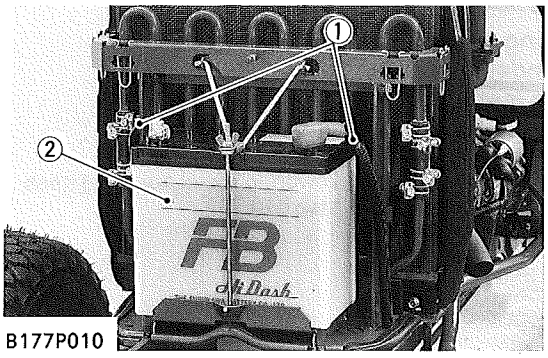
Hood and Side Cover

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

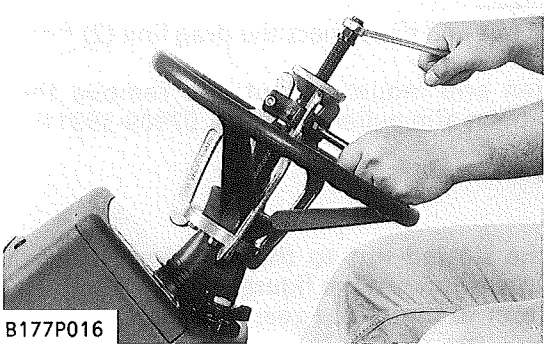
Battery

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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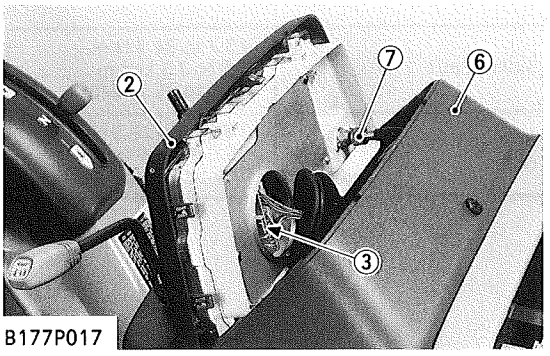
Steering Wheel

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

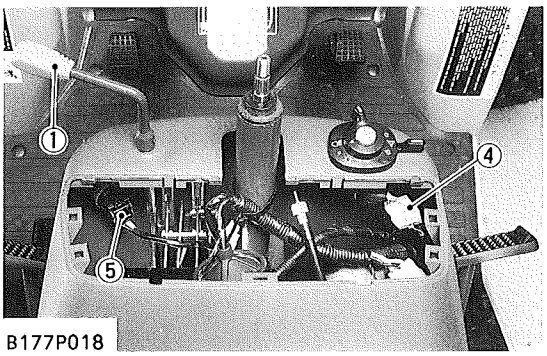


B177P017

Meter Panel and Panel Under Cover

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

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



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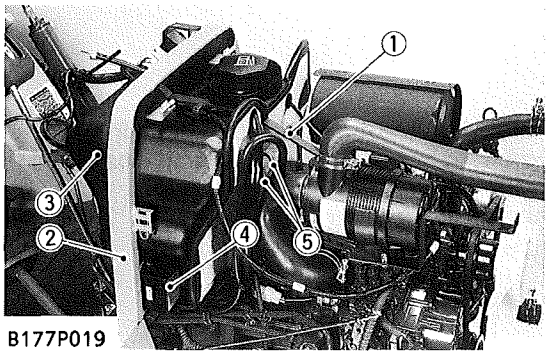
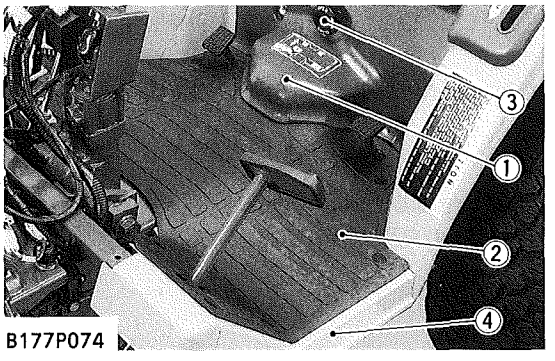


B177P019

Fuel Tank

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

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

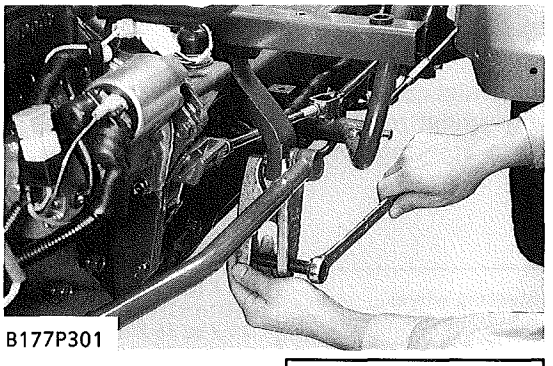


B177P074

Step

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

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


B177P301

Drag Link and Pitman Arm

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

(When reassembling)

■ IMPORTANT

- **After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.**
- **Install the pitman arm to the sector gear shaft so that their marks align.**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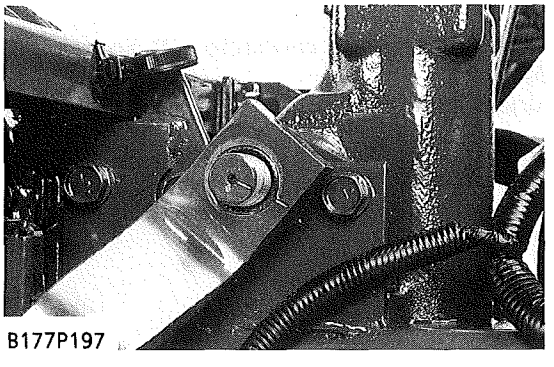
Tightening torque	Slotted nut	17.7 to 34.3 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs
	Pitman arm mounting nut	147.1 to 176.5 N·m 15.0 to 18.0 kgf·m 108.5 to 130.2 ft-lbs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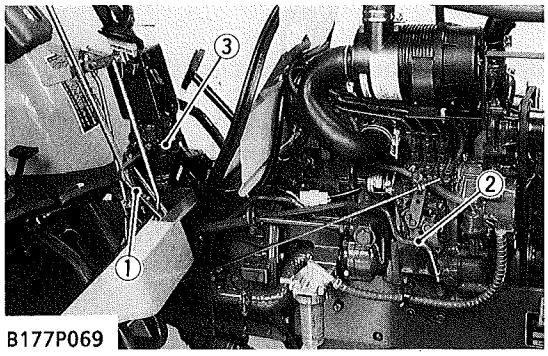
(1) Pitman Arm
(2) Drag Link



B177P069

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

Power Steering Assembly

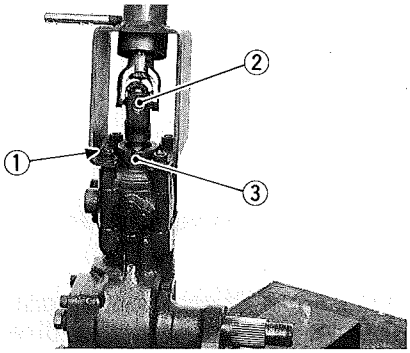
1. Remove the power steering delivery pipe (1) and return pipe (2).
2. Disconnect the speed set rod (HST type) and parking brake rod.
3. Remove the power steering assembly (3) from the center frame.

(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



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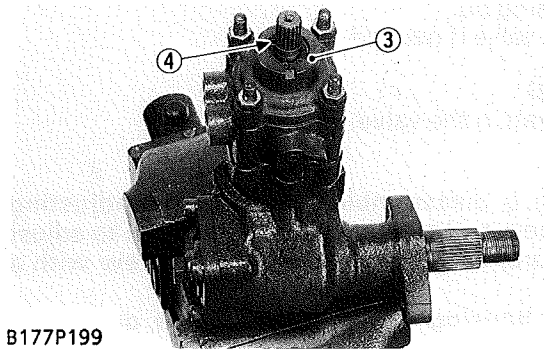


B177P199

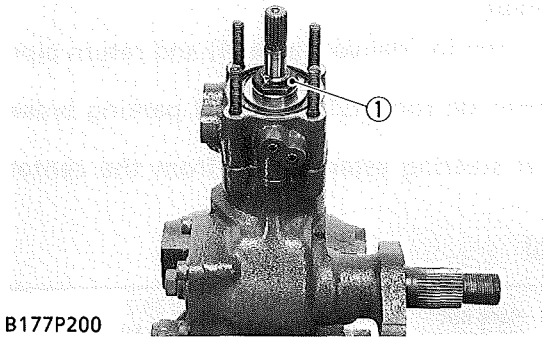
Steering Column and Top Cover

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

(When reassembling)

Tightening torque	Steering column mounting nut	23.5 to 27.5 N·m 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
(2) Universal Joint
(3) Top Cover
(4) External Snap Ring



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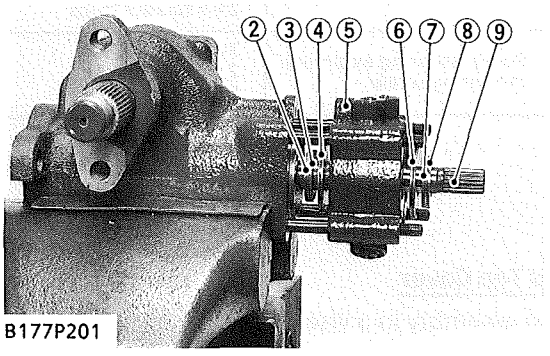

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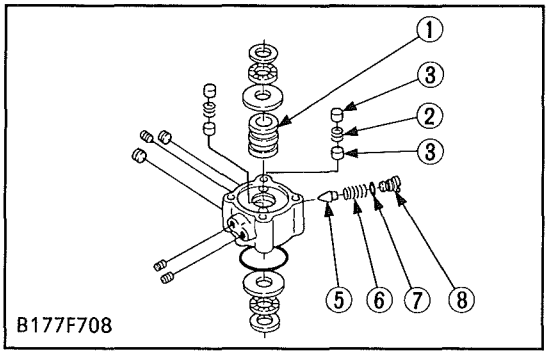


B177F708

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

Valve Assembly

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

(When reassembling)

■ IMPORTANT

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

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

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.

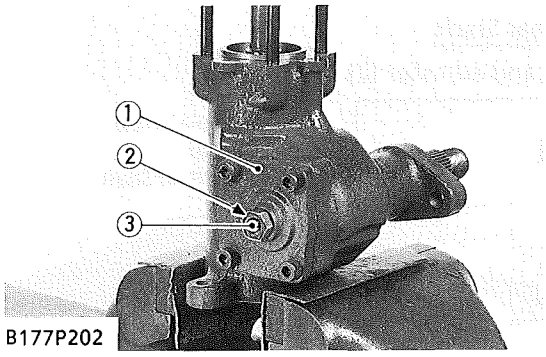
(When reassembling)

- Apply grease to seals in the valve.

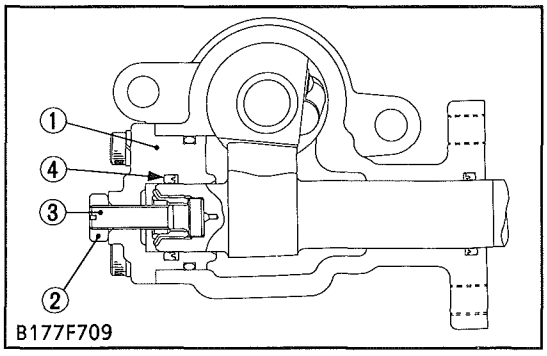
■ IMPORTANT

- **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.**

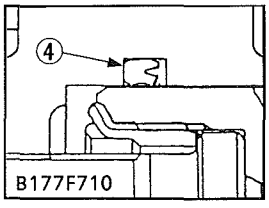
Power steering relief valve setting pressure	Factory spec.	11.28 to 11.77 MPa 115 to 120 kgf/cm^2 1636 to 1707 psi



B177P202



B177F709



B177F710

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

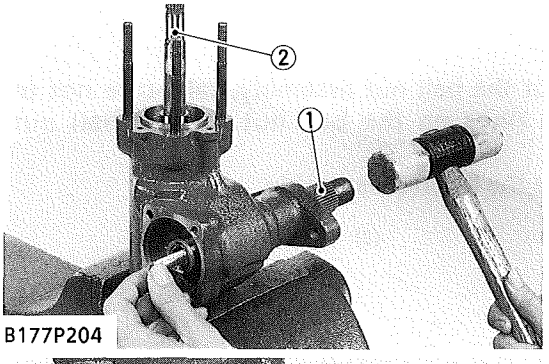
Side Cover

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).

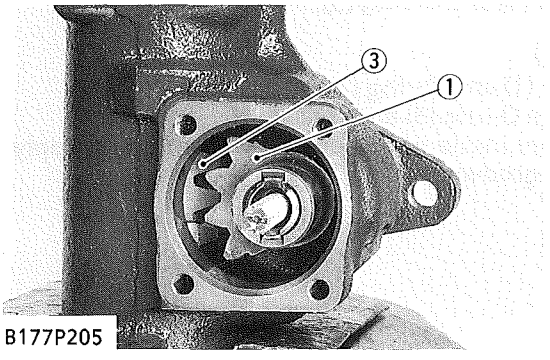
(When reassembling)

- 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.

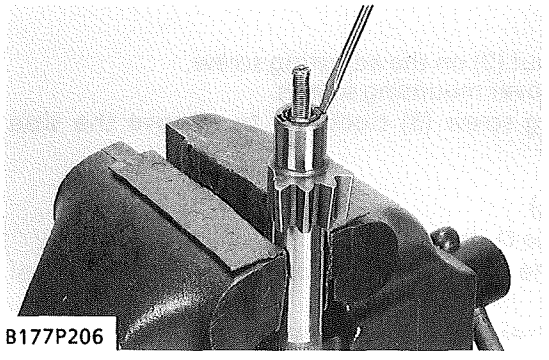
(When reassembling)

- 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

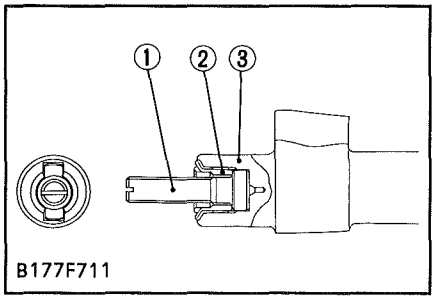
- **When setting the sector gear shaft (1), take care not to damage the oil seal and U-seal in the gear box.**

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


B177P206

Adjuster of Sector Gear Shaft

1. Remove the stake and adjuster (2).



B177F711

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

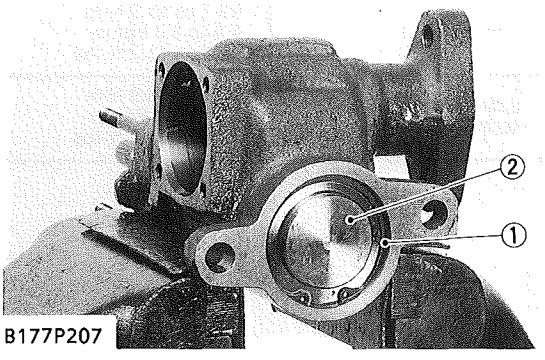
(When reassembling)
- Apply grease to the head of adjuster.

Snap Ring

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

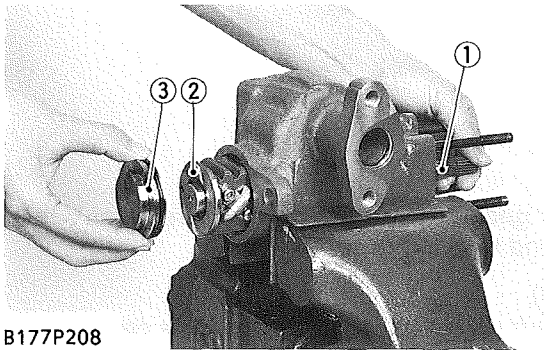
(When reassembling)

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



B177P207

(1) Snap Ring (2) End Cover



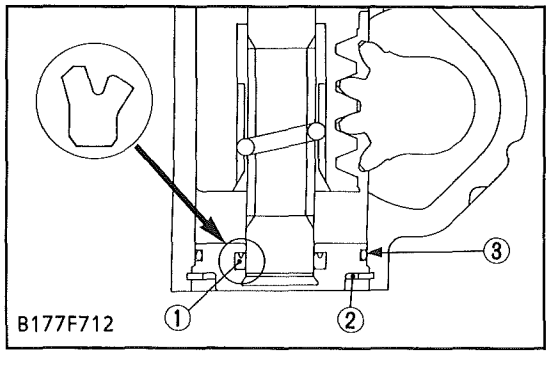
B177P208

End Cover and Ball Nut Assembly

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

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

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



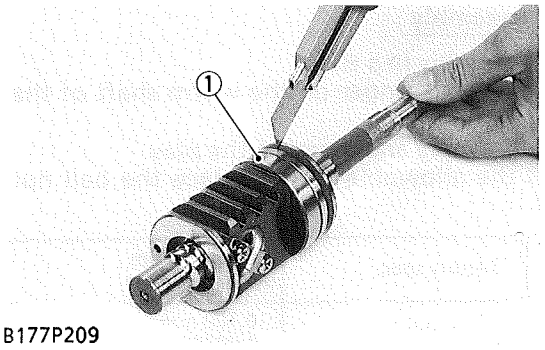
B177F712

Seal Rings on End Cover

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

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

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



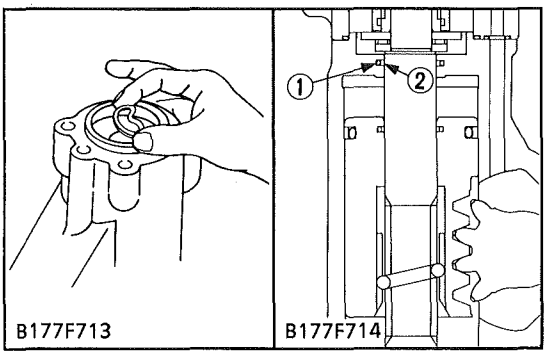
B177P209

Seal Ring on Ball Nut

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

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

(1) Ball Nut



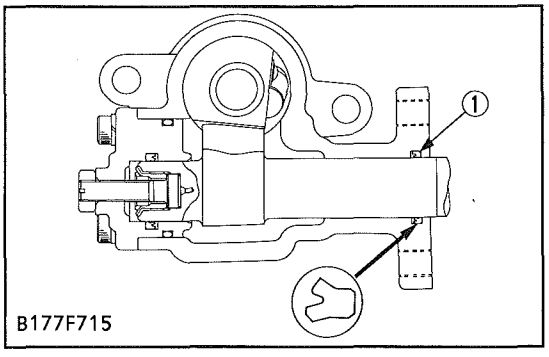
B177F713 B177F714

Seal Rings on Gear Box

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

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

(1) Seal Ring (2) Seal Ring



B177F715

U-Seal on Gear Box

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

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

(1) U-Seal

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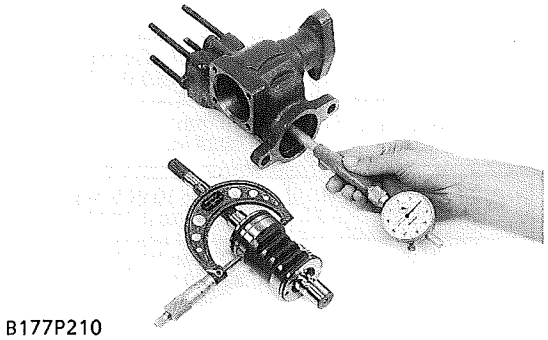
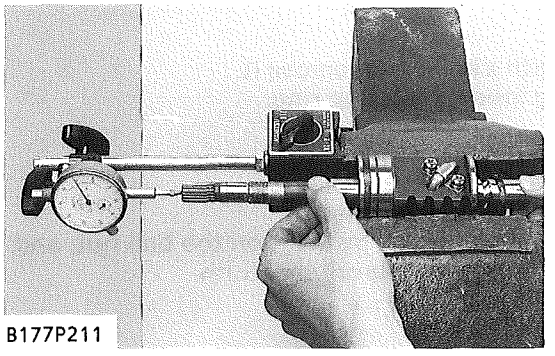

B177P210

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.

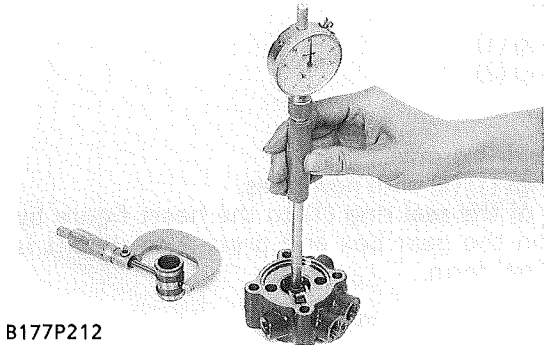
Clearance between steering gear box and ball nut	Factory spec.	0.035 to 0.079 mm 0.001 to 0.00311 in.
	Allowable limit	0.15 mm 0.0059 in.
Gear box bore I.D.	Factory spec.	56.005 to 56.030 mm 2.2049 to 2.20591 in.
Ball nut O.D.	Factory spec.	55.951 to 55.970 mm 2.20280 to 2.20354 in.


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

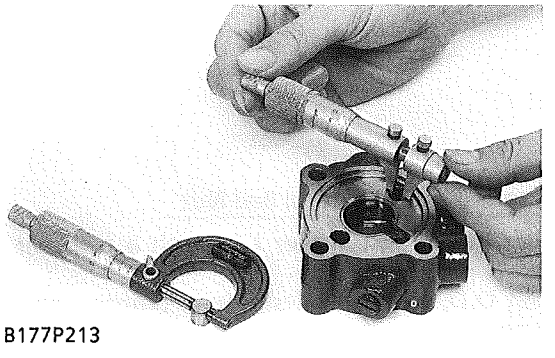
Clearance between Valve Housing and Spool

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.**

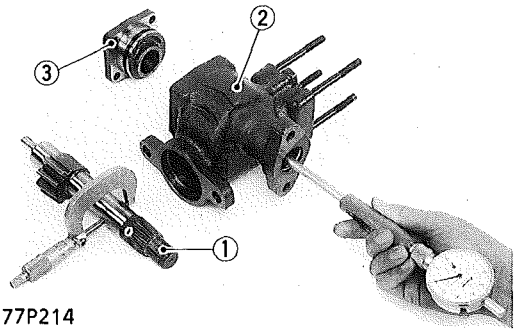
Clearance between valve housing and spool	Factory spec.	0.005 to 0.015 mm 0.00020 to 0.00059 in.
	Allowable limit	0.025 mm 0.00098 in.
Spool O.D.	Factory spec.	24.995 to 25.000 mm 0.98406 to 0.98425 in.
Valve housing I.D.	Factory spec.	25.005 to 25.010 mm 0.98445 to 0.98465 in.


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

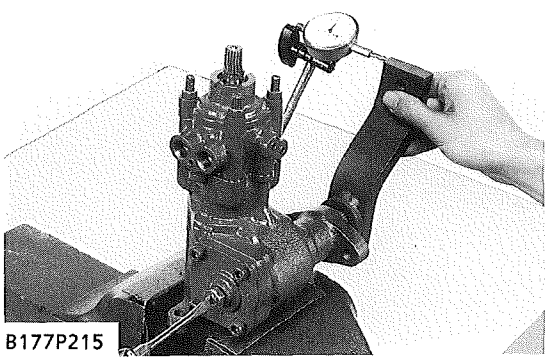
1. Measure the sector gear shaft O.D. with an outside micrometer and side cover I.D. with a cylinder gauge, and calculate the clearance.
2. If the clearance exceeds the allowable limit, replace the defective parts.

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.

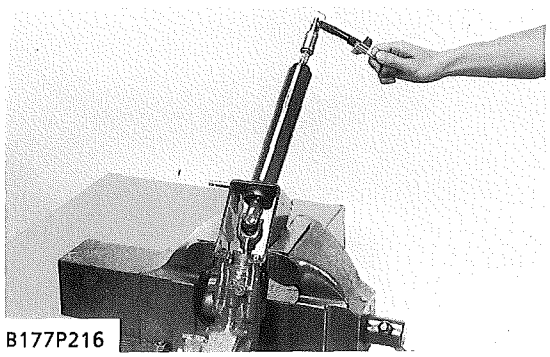


B177P215

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 0.08 kgf·m 0.58 ft-lbs