SHOP MANUAL

KOMATSU

WA70-1

MACHINE MODEL SERIAL No.

WA70-1 **10001 and up**

Printed in Japan 05-93(03)00354

WEIGHT TABLE

⚠ This weight table is a guide for use when transporting or handling components.

(Unit: kg)

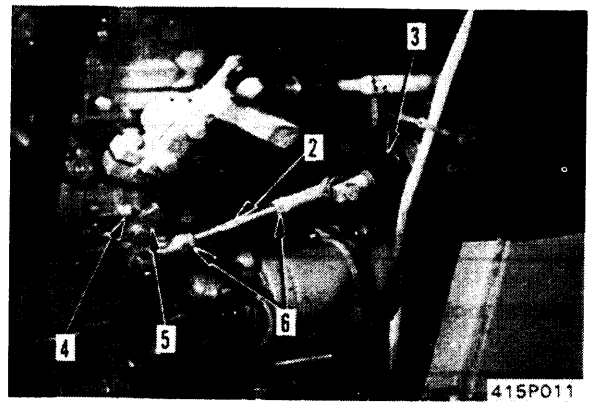
Machine model	WA70-1	
Serial numbers	10001 – 11999	12001 and up
Engine assembly	287	287
Radiator	22	14
Fuel tank (empty)	37	37
Torque converter assembly	33	33
Transmission (with torque converter)	291	291
Front drive shaft	7	7
Center drive shaft	6	6
Rear drive shaft	3	3
Front axle assembly (dry)	226	218
Rear axle assembly (dry)	223	219
Axle support	22	42
Wheel (1 piece)	33	33
Tire (17.5/65-20-10PR)	74	72
Steering valve	6	6
Steering cylinder	7	7
Engine hood	14	18
Front support	62	92
Operator seat assembly	25	25
Canopy	44	44
Counterweight	551	620
Front frame (without accessory)	361	346
Rear frame (without accessory)	427	350
Hydraulic tank (dry)	36	30
Hydraulic pump	10	10
Main control valve	8	9
Lift cylinder assembly (1 piece)	29	28
Dump cylinder assembly (1 piece)	23	22
Bucket link	9	9
Bellcrank	54	61
Lift arm (with bushing)	254	254
Bucket	289 (with teeth)	321 (with bolt on cutting edge)

ADJUSTING OF FUEL CUT SOLENOID

(Serial No. 10001 – 11999)

1. Stop engine

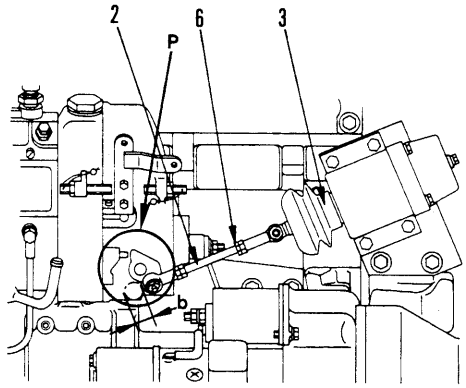
1) Check that stop lever (5) of fuel injection pump is NO INJECTION position.
   - ★ Lever is returned to NO INJECTION position by return spring of solenoid.
2) Adjust rod (2), so that travel of solenoid is 12 mm.
3) Pull rod (2) to solenoid end, adjust clearance between stop lever (5) of fuel injection pump and stopper (4) (full load end).
   - ★ Standard clearance between stop lever (5) and stopper (4) = 0.4±0.1 mm.
   - ★ Standard travel between lever (5) and stopper (4) = 12 mm.



415P011

2. Readjusting

1) Turn starting switch ON, and check that travel of solenoid and clearance are within standard value.
2) Measure travel and clearance 3 times, if necessary readjust with rod (2).
3) Lock with nut (6).
   - ★ When turning starting switch ON, clearance between stop lever and stopper (full load end) is 0, burn coil of solenoid due to extremly large electric current flows.
   - ★ When turning starting switch ON, clearance between stop lever and stopper (full load end) is more than 2.0 mm, does not generate rated power due to reduction of fuel injection amount.
   - ★ For Serial No. 12001 and up, see STRUCTURE AND FUNCTION, Engine stop circuit.



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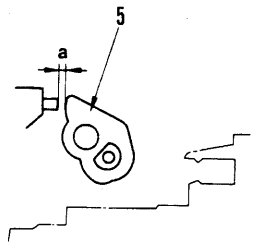

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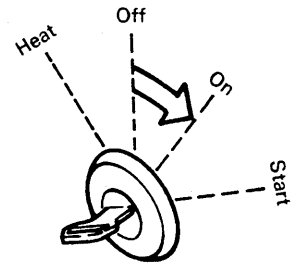

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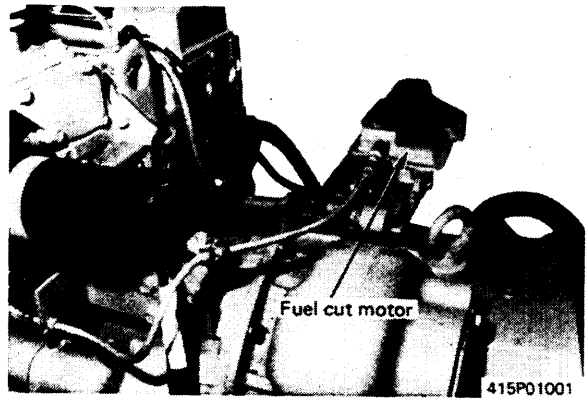
Serial No. 12001 and up



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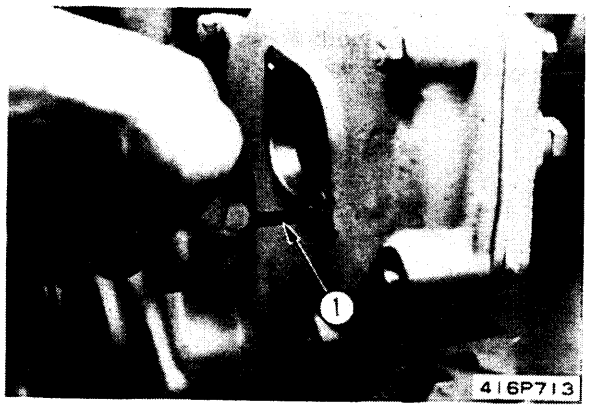
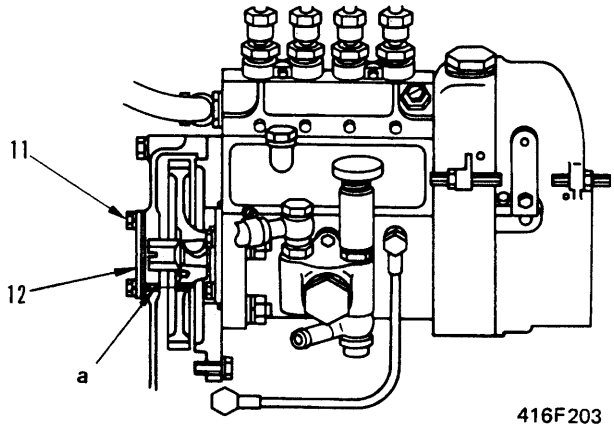
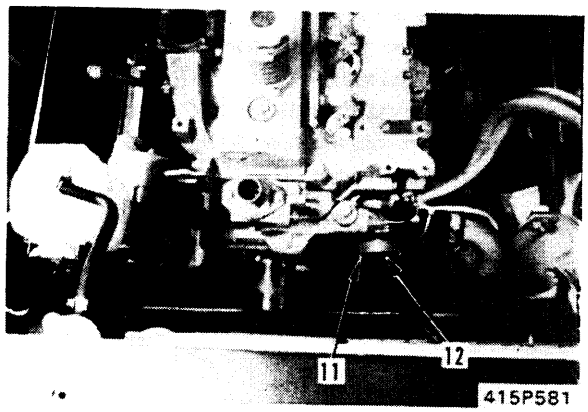
★ To check the position of the pump idler gear and engine idler gear, insert pin ① (∅4.0 – 4.5 mm, length = approx. 100 mm) from mounting bolt hole "a" of cover (12) through the fuel injection timing check hole in the idler gear. If the pin can be removed easily, the match marks are in the correct position.







4) Fit O-ring, install cover (12) with bolt (11).

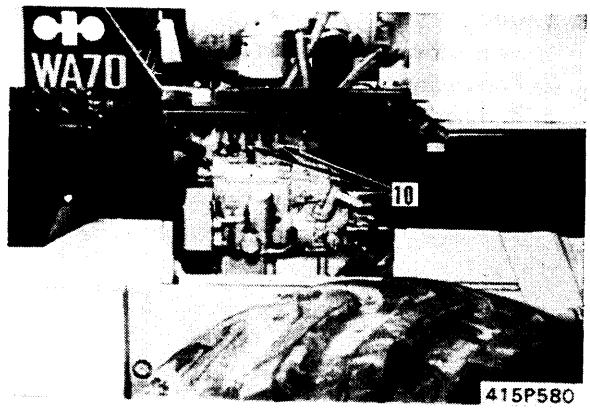
2. Fuel injection pipe

Install fuel injection pipes (10).

★ Before installing pipes, clean mounting surface of pipe and nozzle holder with compressed air.

★ Tighten middle clamp, then check that there is no looseness of nozzle holder mounting nut.

kgm Sleeve nut: **2.3±0.2 kgm**



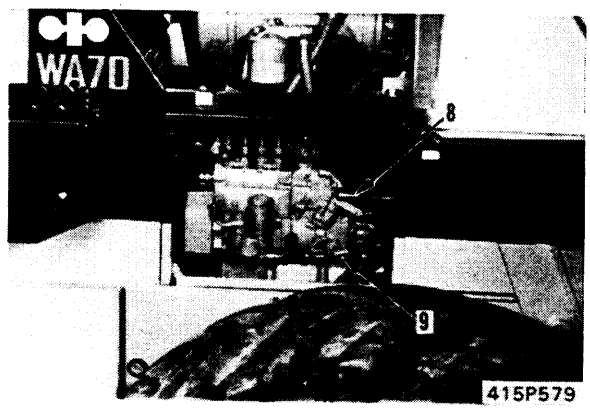
3. Fuel control rod

1) Connect fuel control rod (8).

2) Connect fuel cut solenoid rod (9).

★ For adjusting of fuel control rod, see 12 TESTING AND ADJUSTING.

★ Bend cotter pin securely, and mount lock nut securely.

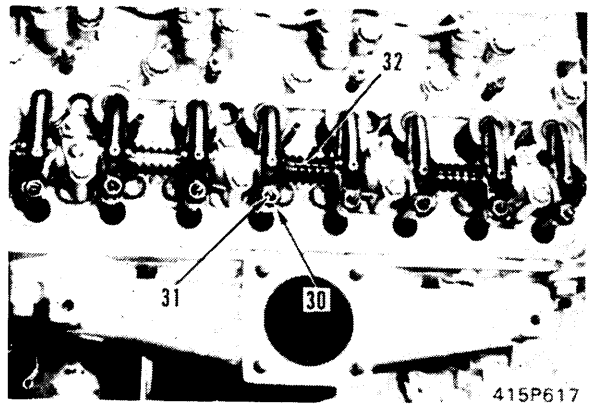


3. Rocker arm assembly

1) Install rocker arm assembly (32).
   ★ If there is tension from the valve spring on the rocker arm, loosen the adjustment screw to avoid excessive force on the push rod.

   kgm Mounting bolt: **1.7±0.2 kgm**

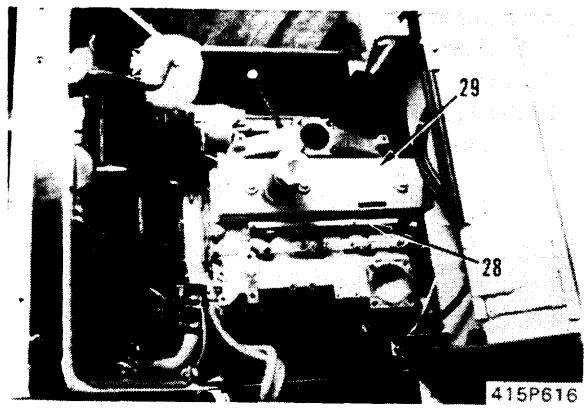
2) Adjust valve clearance.
   For details, see 12 ADJUSTING VALVE CLEARANCE.



4. Cylinder head cover

Fit O-ring and install cylinder head cover (29).

kgm Nut: **0.9±0.1 kgm**

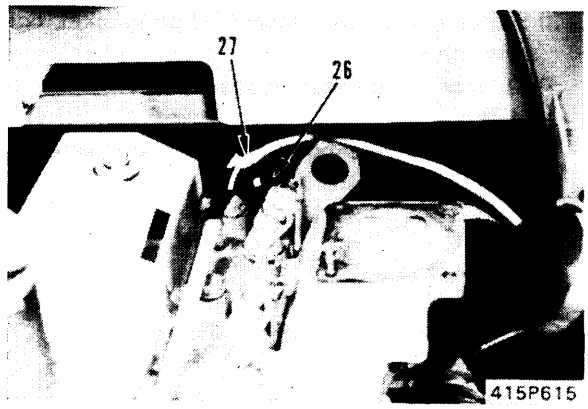


5. Wiring, plate

1) Install plate (28).

   kgm Nut: **0.15±0.05 kgm**

2) Connect glow plug wiring (27).



6. Spill hose

Connect spill hose (26).

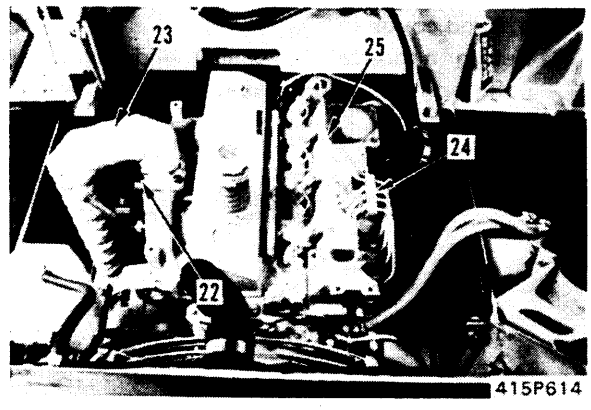
7. Water pump assembly

Install water pump assembly.
For details, see INSTALLATION OF WATER PUMP ASSEMBLY.

8. Fuel injection pipe

Install fuel injection pipe (25), then install clamp (24).
★ Before installing the fuel injection pipe, clean the mounting face of the nozzle holder and the pipe with compressed air.

kgm Sleeve nut: **2.3±0.2 kgm**



9. Exhaust pipe

1) Install exhaust pipe (23), and tighten 4 nuts (22).

8. Battery, battery box

1) Disconnect battery cable (20), then remove batteries (21).
2) Disconnect following wiring.
   - Disconnect cable (22) between battery and starting motor at starting motor side.
   - Disconnect cable (23) between battery and chassis ground at chassis ground.
3) Remove mounting bolts of battery box, then remove battery box (24).

kg Battery: **21 kg (1 pc)**

kg Battery box: **25.5 kg**

★ Two worker are needed this operation. Sign well and mutually, then remove carefully.

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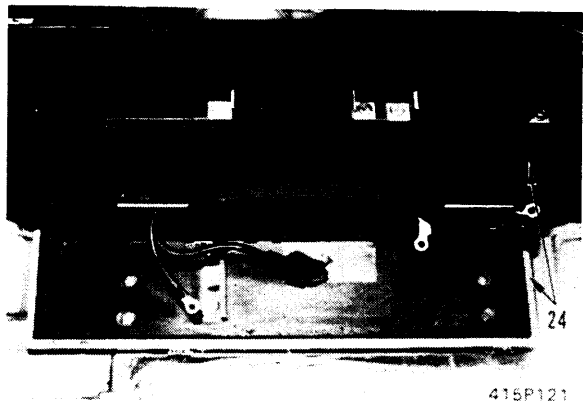

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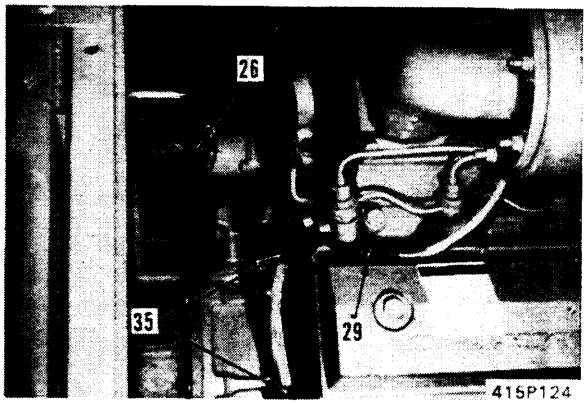

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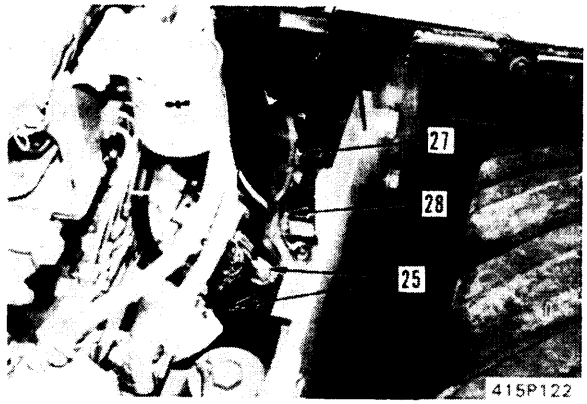
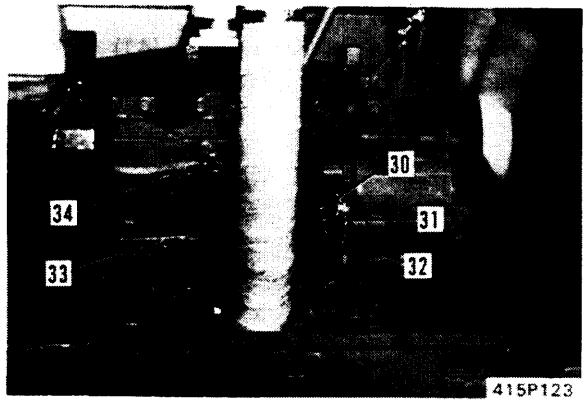


415P122

9. Electric wiring

Disconnect following electric wiring.

- Disconnect starting motor wiring from connector (25).
- Disconnect engine stop wiring (26).
- Disconnect connector (28) of rear, front connection wiring (27).
- Disconnect heater wiring (29).
- Disconnect alternator wirings (30), (31) and (32).
- Disconnect engine oil pressure wiring (33).
- Remove wiring from clamps (34) and (35) of engine cylinder block.



415P123

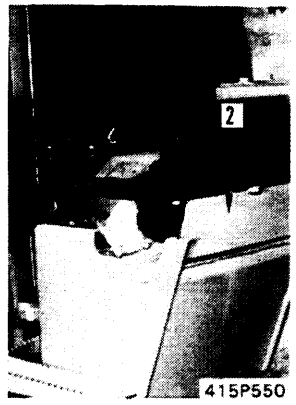
REMOVAL OF FUEL TANK

⚠ Stop the machine on level ground and install the safety bar on the frame. Lower the work equipment to the ground and stop the engine. The apply the parking brake and put blocks under the wheels to prevent the machine from moving.

1. Cover

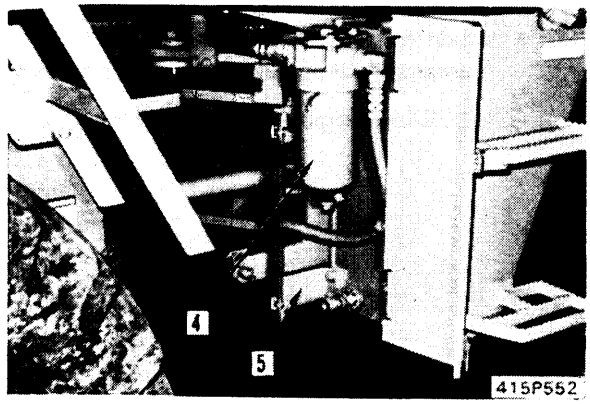
1) Open front cover (1).
2) Remove rear end plate (2).
3) Loosen drain valve (3), and drain fuel.

Fuel: **60 ℓ**



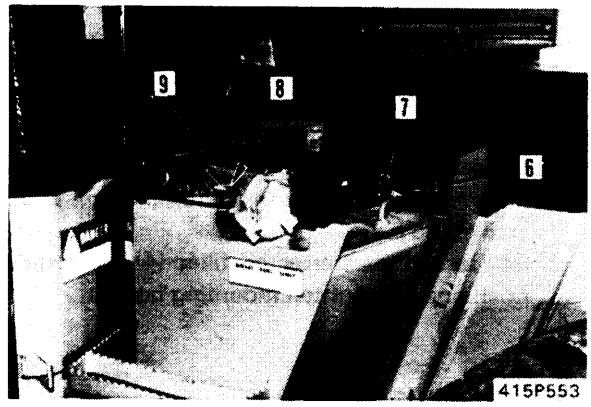
2. Oil filter

1) Remove torque converter oil filter (4), then move to left and lock with wire.
2) Remove guard plate (5).



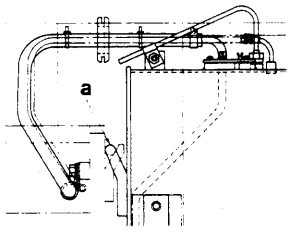
3. Fuel tube, electric wiring

1) Disconnect fuel hoses (6) and (7) from fuel tank.
2) Disconnect wirings (8) and (9) for fuel gauge unit from connector.



4. Fuel tank

1) Remove fuel tank (10) mounting bolts (11), set garage jack ① under fuel tank, then raising jack quietly, remove fuel tank from rear frame hook "a" part.



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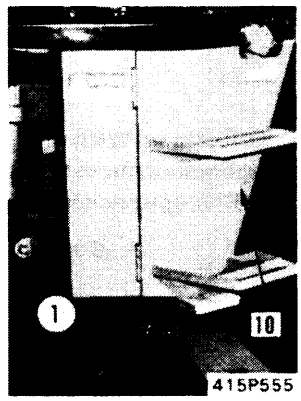
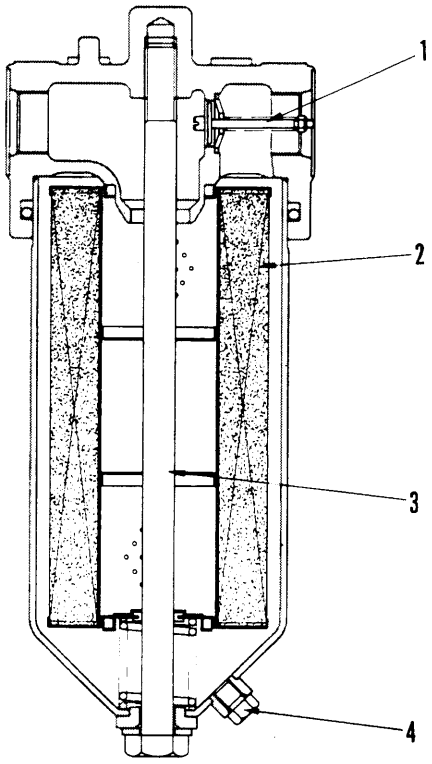
★ Set garage jack under fuel tank, lower fuel tank to maintain balance slowly.

kg Fuel tank (dry): **37 kg**



2) Pull out fuel tank from under machine.
★ Be careful not to hit breather tube against machine body.

TORQUE CONVERTER OIL FILTER



419F009

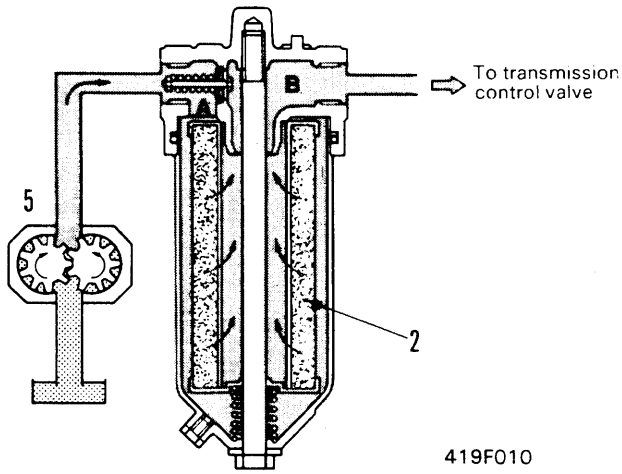
1. Relief valve
2. Element
3. Center bolt
4. Drain plug

Filtration area: 8,900 cm^2

Relief pressure: 3.25 kg/cm^2

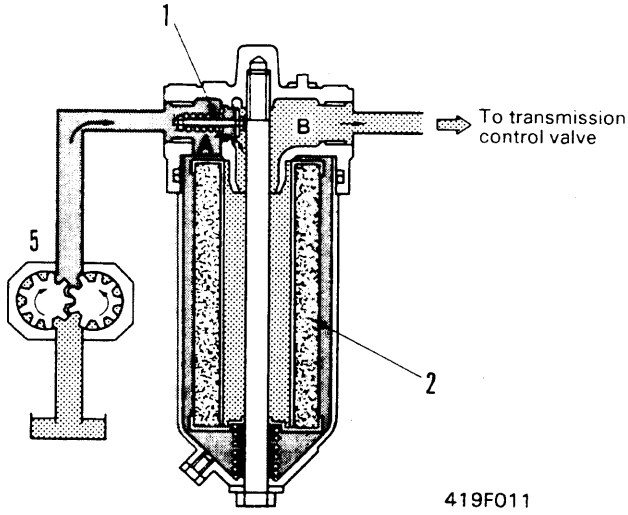
OPERATION

- The oil from the torque converter charging pump (5) enters the filter inlet port **A** and passes from the outside of element (2) to the inside. It then flows to the outlet port **B**.



419F010

- If the element is clogged with dirt, or the oil temperature is low, the pressure at the inlet port **A** rises. Then the oil from the inlet port **A** opens relief valve (1) and flows directly to the outlet port **B**. This prevents damage to the pump or filter (2) element.



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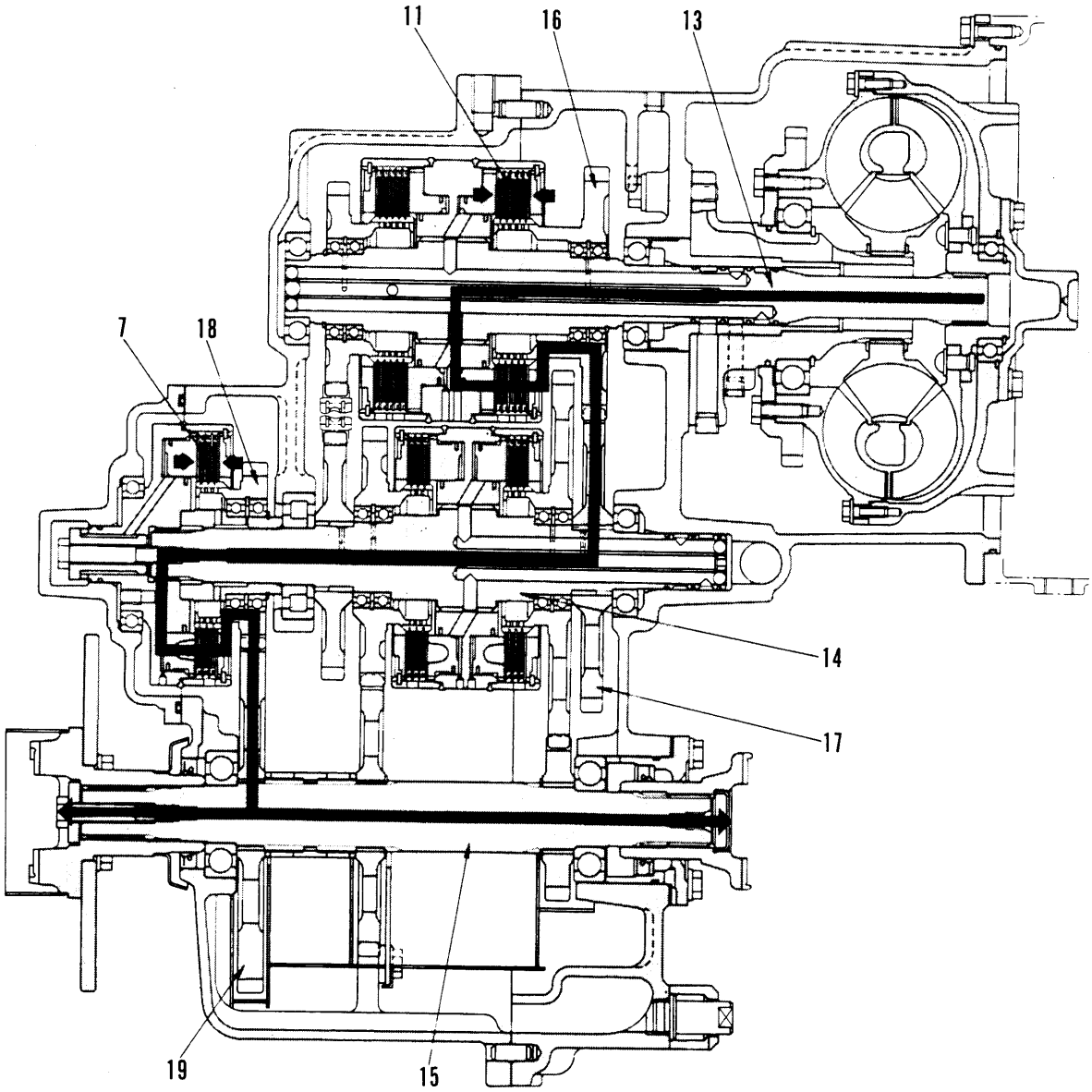
FORWARD 1ST

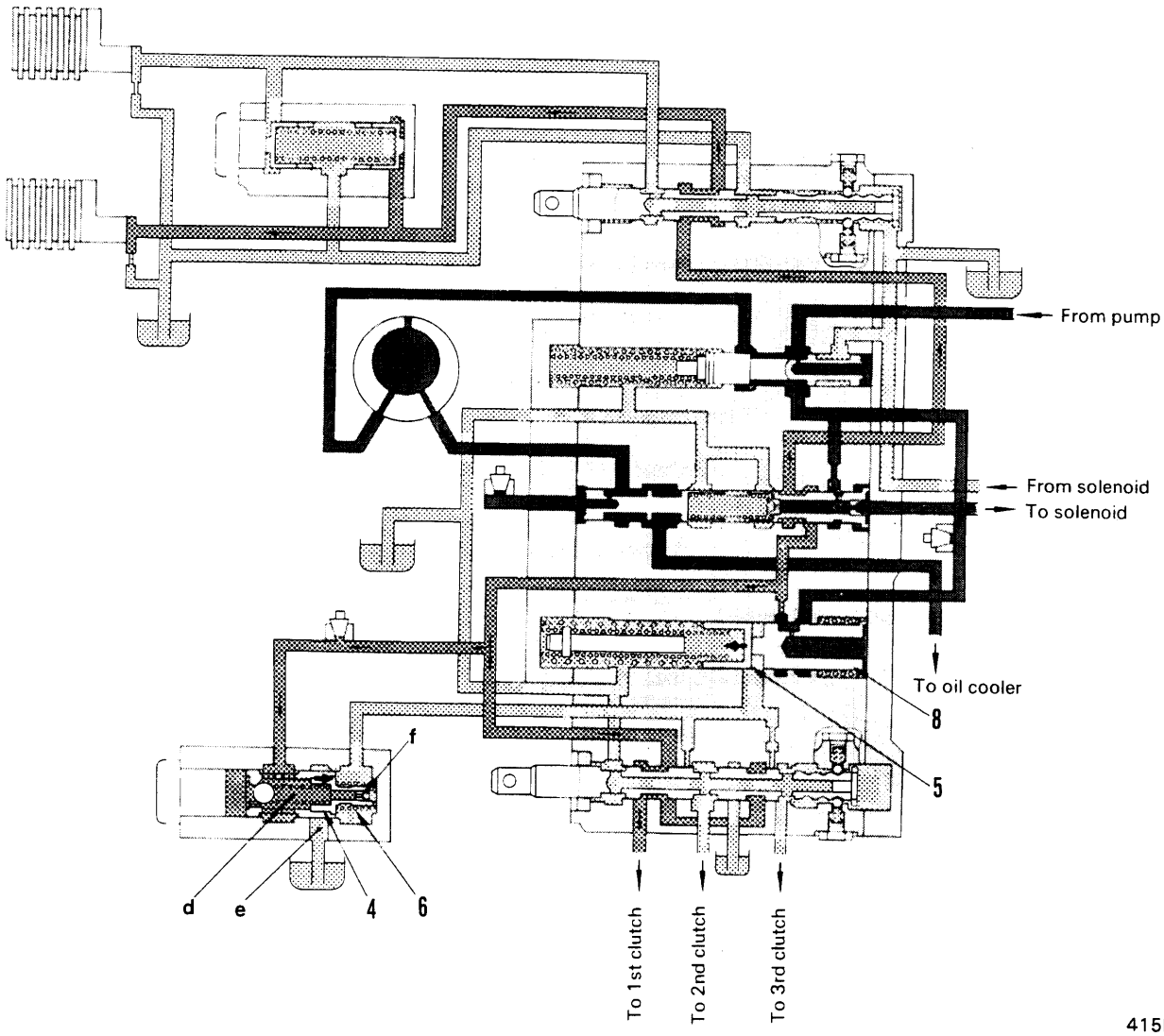


415F016

OPERATION

- In Forward 1st, Forward clutch (11) and 1st clutch (7) are engaged. The motive force transmitted to input shaft (13) from the torque converter is transmitted to output shaft (15).
- The clutch discs of Forward clutch (11) and 1st clutch (7) are held by the hydraulic pressure applied to the clutch piston.
- The motive force from torque converter is transmitted from input shaft (13) through Forward clutch (11) to Forward gear (16). From here it is transmitted to shaft (14) through gear (17).
- The 1st clutch (7) is engaged, so the motive force transmitted to shaft (14) is then transmitted through the 1st clutch and goes from 1st gear (18) through output gear (19), and is transmitted to output shaft (15).

3. When the clutch oil pressure begins rising:



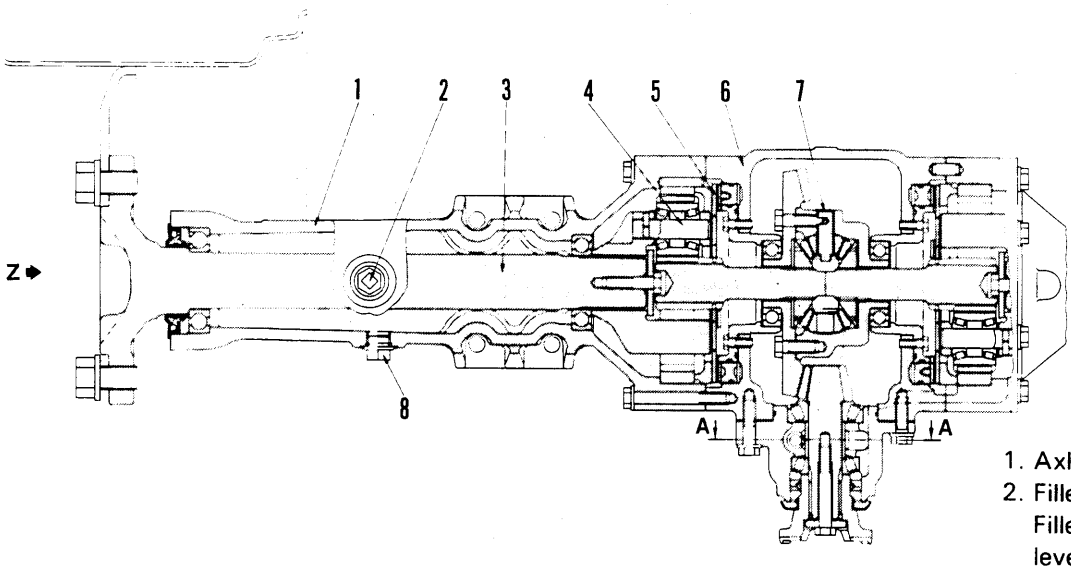
415F029

- When the oil from pump fills the Reverse clutch and accumulator, the oil pressure in the clutch circuit begins rising. For this reason, the oil pressure at port "d" goes up and moves the quick return valve (4) to the right, overcoming the force of spring (6). Thus, the drain port "e" is closed.
- The oil passing through the 1st speed orifice "f" under the differential pressure of the spring in the throttle poppet (8) flows into the accumulator (5) at a certain rate.
- Because of this inflow of oil, the accumulator slowly moves to the left, compressing the spring. Thereby, the accumulator oil pressure goes up. This accumulator oil pressure causes the throttle poppet (8) to reduce the main regulator oil pressure and increase the clutch oil pressure.
- In 2nd and 3rd speeds, the accumulator oil flows in not only from the 1st speed orifice but also from the 2nd and 3rd speed orifices, causing the modulation time to be shorter than that in 1st speed.

AXLE

FRONT

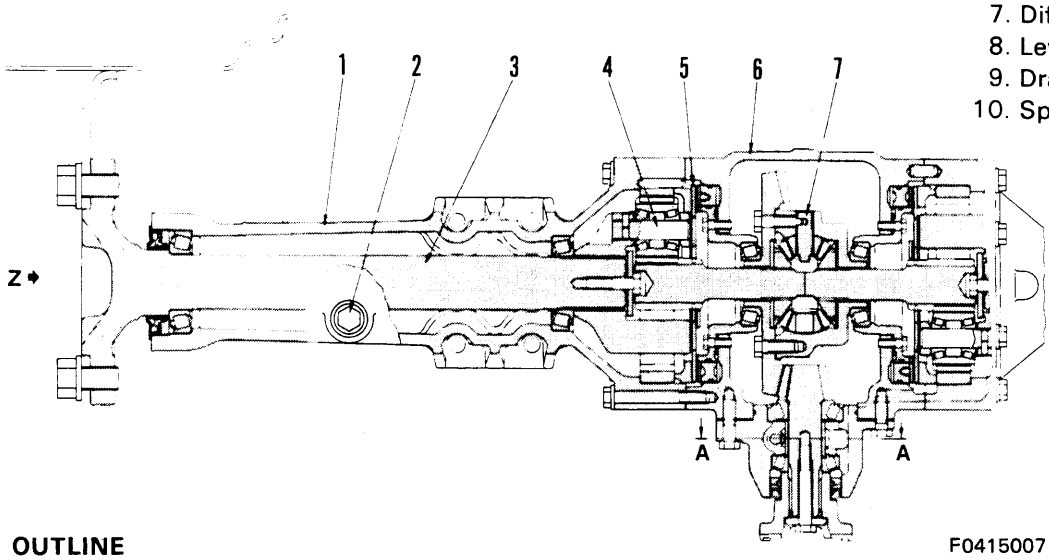
Serial No. 10001 – 11999



415F042

1. Axle housing
2. Filler plug
   Filler plug and level plug (Serial No. 12001 and up)
3. Axle shaft
4. Final drive
5. Brake
6. Differential housing
7. Differential
8. Level plug
9. Drain plug
10. Speedometer output

Serial No. 12001 and up



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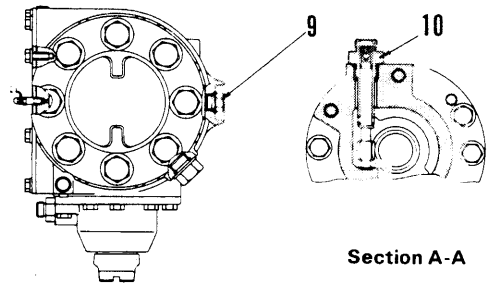
OUTLINE

- The motive force from the engine passes through the torque converter transmission and drive shaft and is transmitted to the front and rear axles.
- Inside the axle, the motive force is transmitted from the pinion gear to the bevel gear, and is sent at right angles. The speed is reduced and it passes through the differential and is transmitted to the sun gear shaft.
- The motive force of the sun gear is further reduced by the planetary-type final drive, and is transmitted to the axle shaft and wheel.



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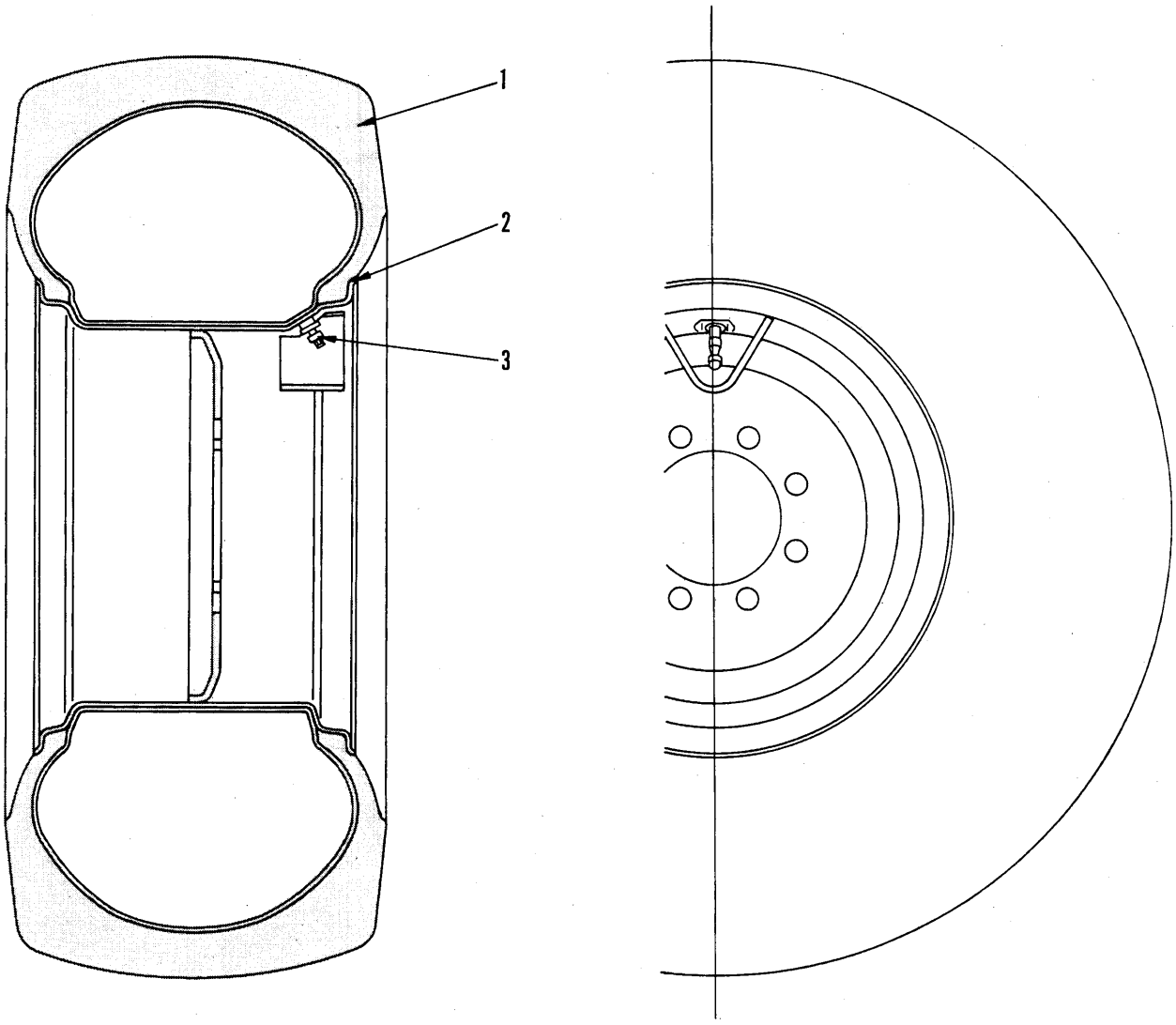
TIRE AND WHEEL

- The tire acts to absorb the shock from the ground surface to the machine, and at the same time they must rotate in contact with the ground to gain the power which drives the machine.
- Various types of tires are available to suit the purpose. Therefore it is very important to select the correct tires for the type of work and bucket capacity.



415F052

1. Tire
2. Rim
3. Air valve

Specification

- Tire size: 17.5/65-20-10PR
- TRA code: L2
- Type of wheel: W14L x 20
- Tire inflation pressure: 2.4 kg/cm^2

TROUBLESHOOTING

3. Large shock when moving off or changing gear.

Fault check

Because it is difficult to determine whether shock is abnormally large or normal, consider it large in the following cases.

- When a shock occurs which is clearly larger than any that has occurred so far.
- When the shock is large compared to that occurring on other machines of the same type.

Checks before troubleshooting

- Is the low-idling speed of the engine too high?
- Is there excessive play in each drive shaft?
- Was an unusual noise produced, when changing gear?

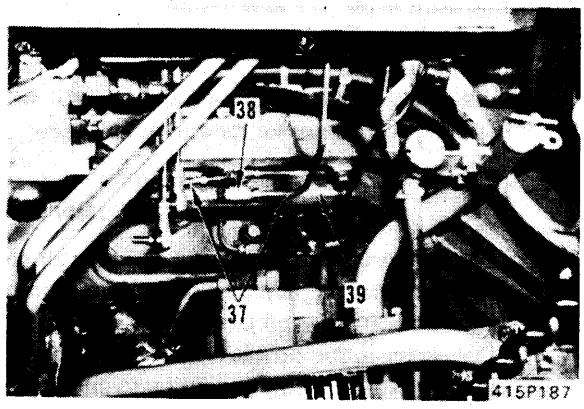
No.	Problems \ Remedy / Cause	Faulty transmission clutch pressure regulating valve	Stick of accumulator piston	Faulty modulation valve	Faulty quick retun valve	Faulty piston return due to broken or flattened return spring of clutch pack	Clogged oil drain hole in circumferential direction of clutch pack cylinder
		Control valve				Trans-mission	
		a	b	c	d	e	f
		△ X	△ X	△ X	△ X	△ X	C △
1	Large shock in all speed positions.		○				
2	Large shock in a certain speed position.					○	
3	Clutch pressure excessively high.	○					

The following symbols are used to indicate the action to be taken when a cause of failure is located.

X: Replace △: Repair
A: Adjust C: Clean

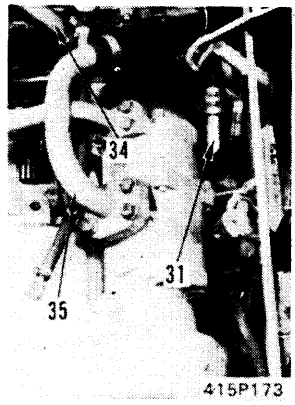
2. Brake tube

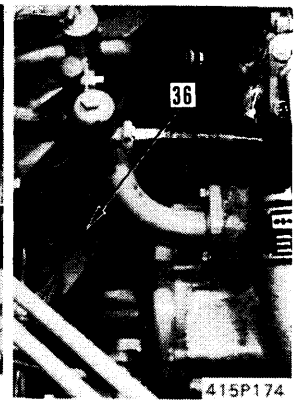
Connect connecting tee (38) of brake tube (37) to rear frame (39).



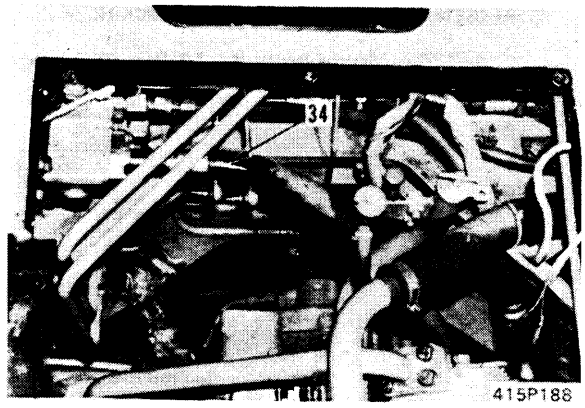
3. Hydraulic piping

- Install oil level tube (36).
- Install tube (35) between hydraulic tank and torque converter.
- Install hose (34) between hydraulic pump and flow divider valve.

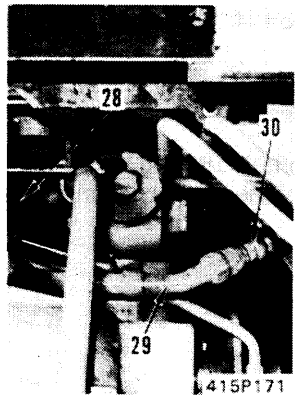


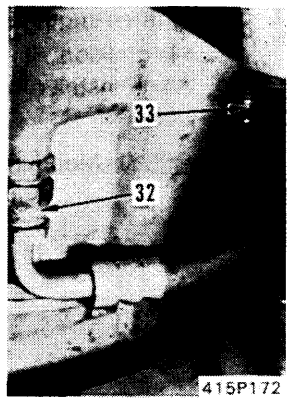


- Connect hose (33) between transmission and oil cooler.
- Connect hose (32) between oil cooler and transmission.
- Connect tube (31) between torque converter charging pump and oil filter.



- Connect tube (29) between oil filter and transmission valve (28) with hose (30).





DISASSEMBLY OF TRANSMISSION

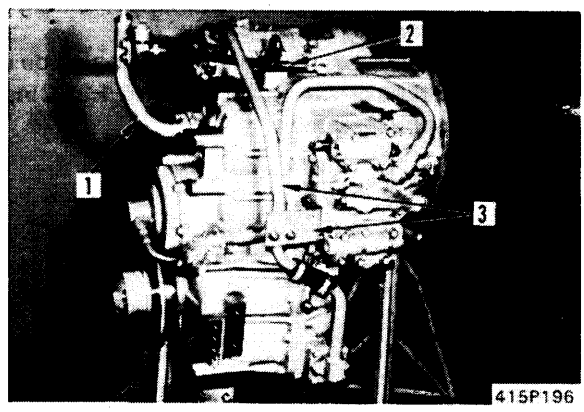
Special tools

	Part number	Part name	Q'ty
A	793-520-2800	Lifting tool	1
A_1	793-520-2810	Body	1
A_2	793-520-2840	Pin	1
A_3	793-520-2830	Sleeve	1

★ Install transmission on stand.

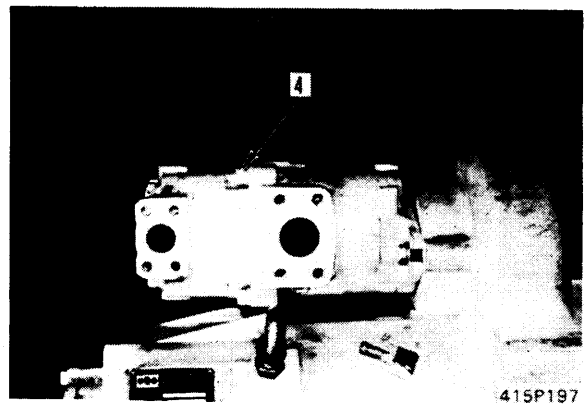
1. Oil filler tube

Remove oil filler tube (1) and breather hose (2).



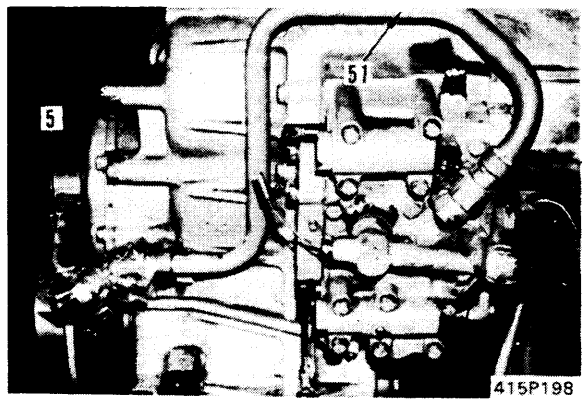
2. Pump

1) Disconnect tube (3) between strainer and pump, then remove tube with bracket.
2) Remove pump (4), then remove O-ring.



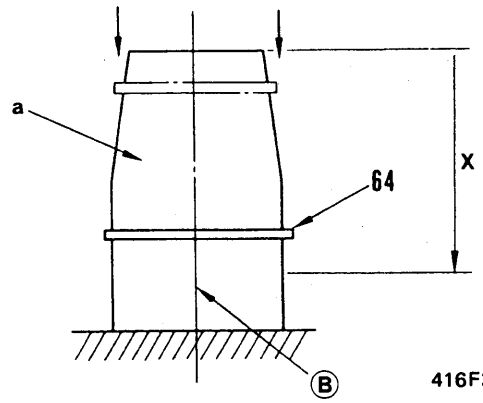
3. Hydraulic piping

1) Remove tube (5) between transmission valve and 1st clutch.
2) Remove tube (51) between oil filter and transmission valve.



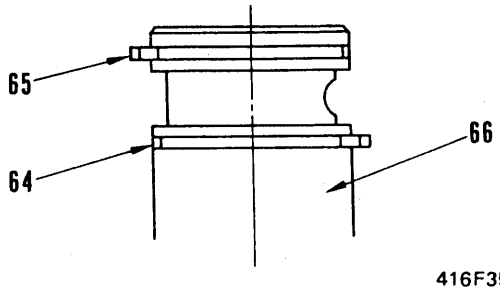
6A. Seal ring (Serial No. 12001 and up)

1) Coat seal ring (64) and outer circumference of expander (a) with transmission oil, then insert seal ring in expander Ⓑ to length "X". Be careful not to push in too far.
   - X = 100 mm
   - ★ If the seal ring is pushed in too far, it will expand too much.
   - ★ Pull seal ring up to remove. Never try to remove it to the bottom.



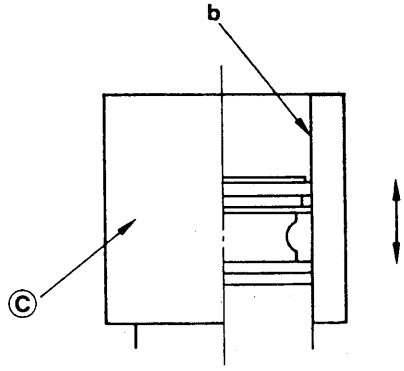
416F353

2) Install remove seal rings (64) and (65) to shaft (66) quickly.
   - ★ When installing the seal rings, install the seal ring in the bottom groove first.



416F354

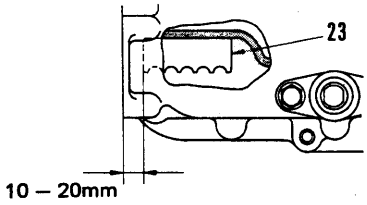
3) Coat inner circumference of installer (b) with transmission oil, then move installer Ⓒ up and down to settle the seal ring.
   - ★ After assembling the seal ring, check that there is no damage.



416F355

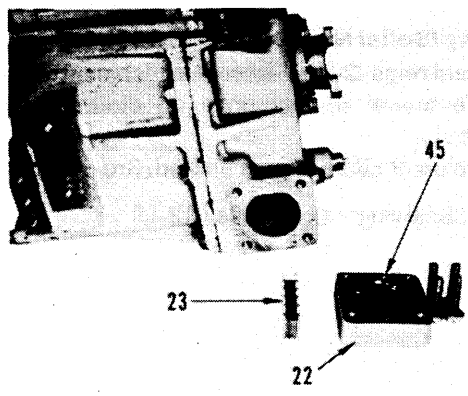
7. Magnet (Serial No. 10001 – 11999)

1) Install magnet (23) in rear housing.
   - ★ Installation position of magnet refers to illustration below.



415F178

2) Fit O-ring (45), then install cover (22).

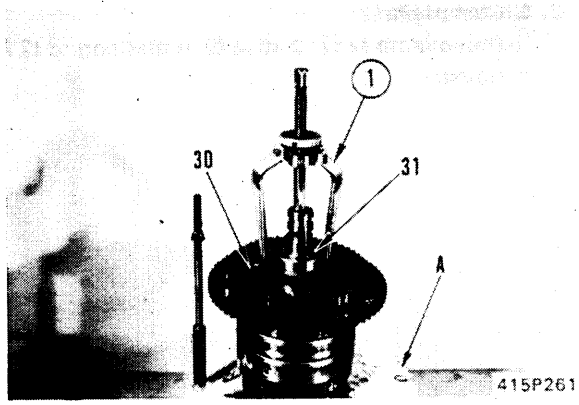


415P232

DISASSEMBLY OF 2ND, 3RD CLUTCH PACK

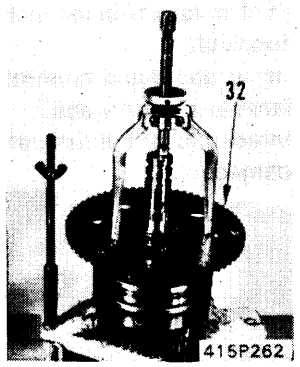
★ Set the clutch pack on tool **A** with the 3rd side at the top.

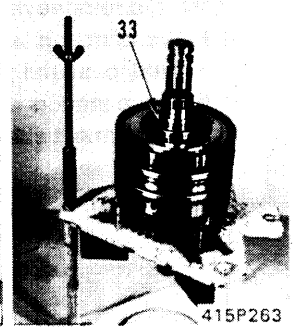
1. Bearing
Using puller ①, remove gear (30) together with bearing (31).



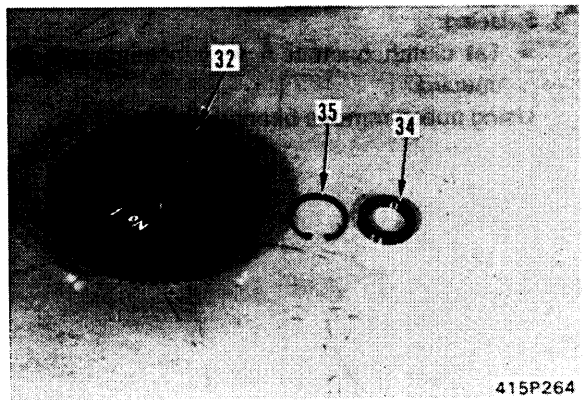
2. 3rd gear
1) Using puller, remove 3rd gear (32).
★ Remove bearing (33) from shaft.

2) Remove 3rd gear (32), bearing (34) and snap ring (35).

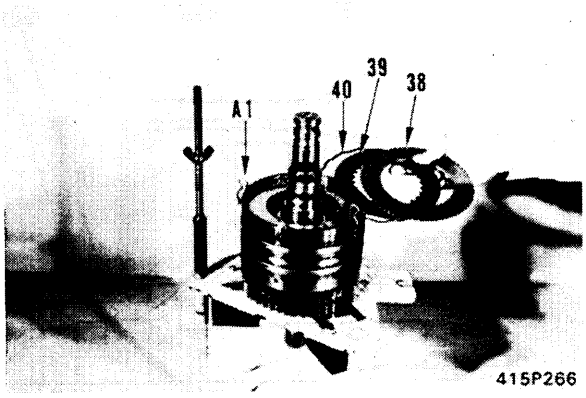


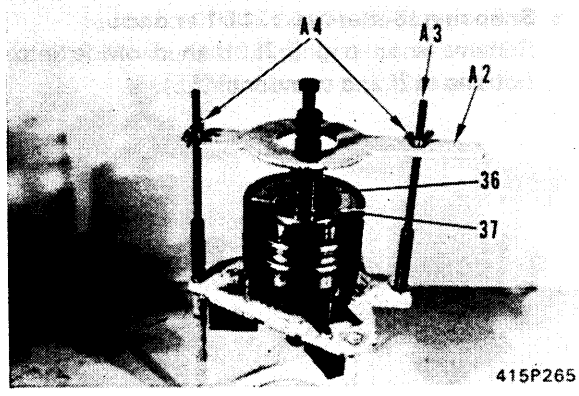


3. End plate
1) Install tool A_2 and A_3, and tighten tool A_4, then remove ring (36).
★ After removing the ring, remove tools A_2, A_3 and A_4.
2) Remove end plate (37).



4. Clutch plate
Remove plate (38), disc (39) and spring (40) from housing.
★ Insert tool A_1 in housing.





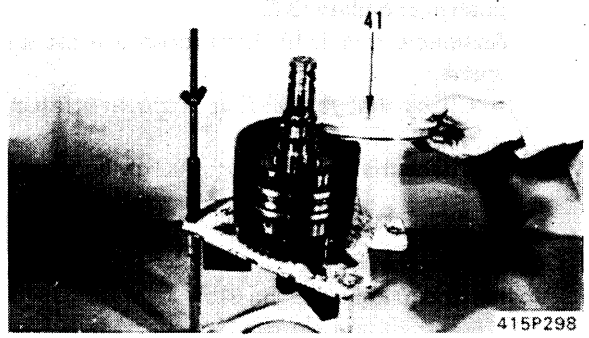
7. 3rd piston

1) Turn over clutch pack.

⚠ When turning over the clutch pack, be careful not to get your fingers caught between the stand and the clutch pack.

★ Set a block on top of the stand.

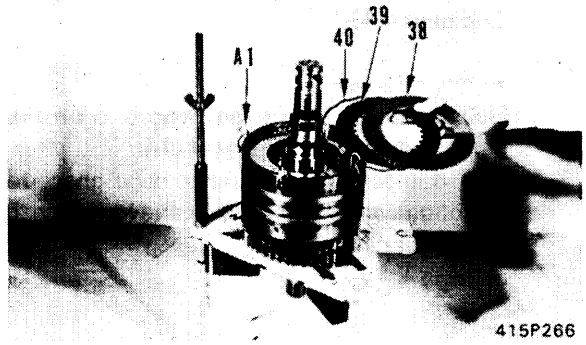
2) Install piston (41) in the same way as 2nd piston.



8. Clutch plate

Insert tool A_1 in housing, and assemble plates (38), discs (39) and springs (40) in turn.

★ Assemble in the same way as for the 2nd side.

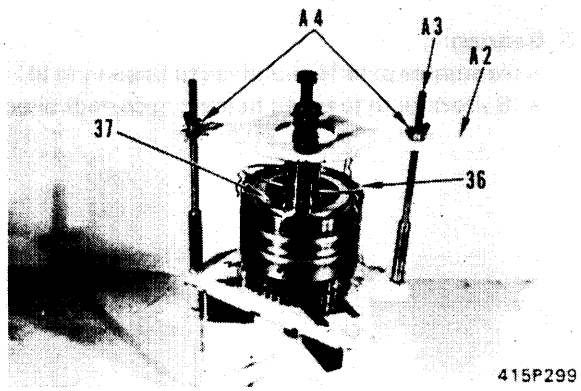


9. End plate

1) Install tools A_2 and A_3. While tightening tool A_4, push in end plate (37).

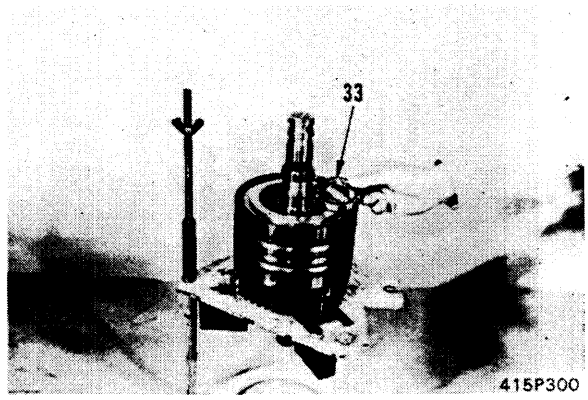
2) Assemble ring (36), then remove tools A_2, A_3 and A_4.

★ Assemble in the same way as for the 2nd side.

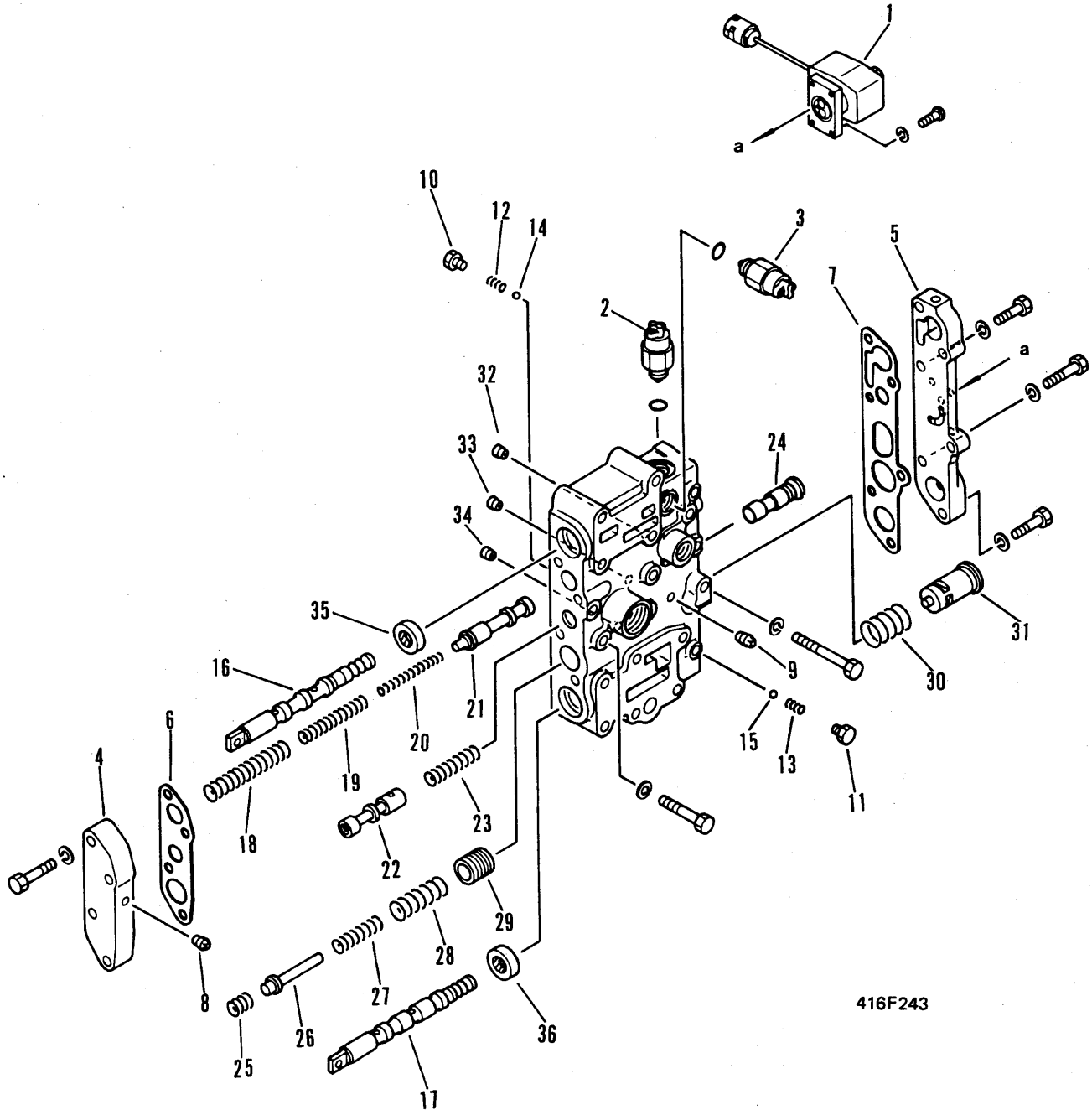


10. 3rd gear bearing

Install 3rd gear bearing (33).



DISASSEMBLY OF LOWER VALVE

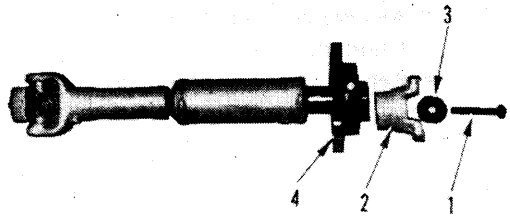


3) Install coupling (2) and retainer (3), then tighten mounting bolt (1).
★ Tighten the bolts to the specified tightening torque after installing on the machine.

Spline: Grease (G2-LI)

Mounting bolt: **11.5±1.0 kgm**

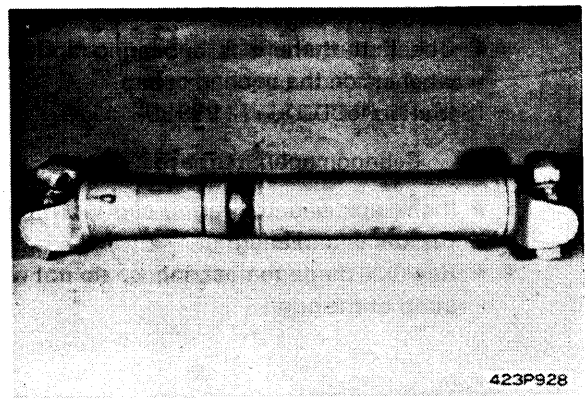
★ Check that lock bolt (5) is tightened securely.
★ Check that the couplings are facing in the same direction.



415P01016

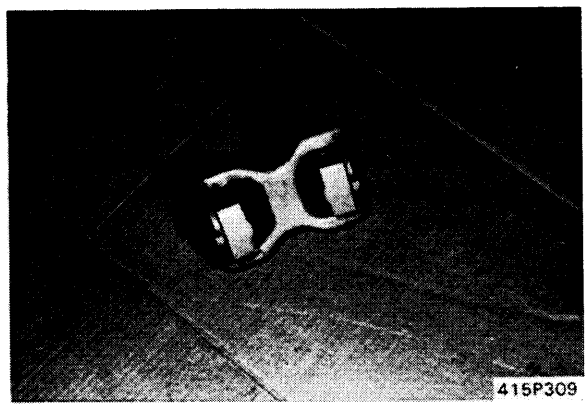
4. Center drive shaft, rear drive shaft
★ Install in same way as the front drive shaft in steps 1 and 2.

Center drive shaft



423P928

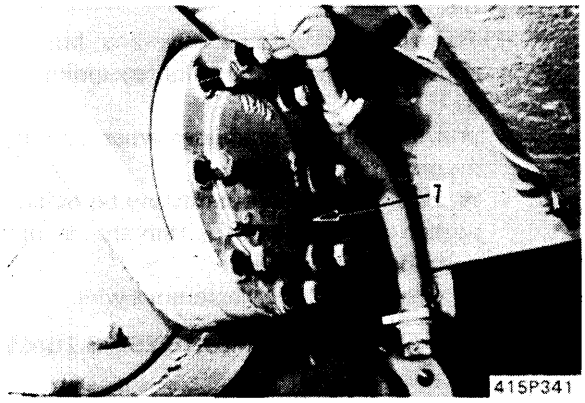
Rear drive shaft



415P309

4) Install trunnion cap (7). (Serial No. 10001 – 11999)

kgm Mounting bolt: **11.25±1.25 kgm**



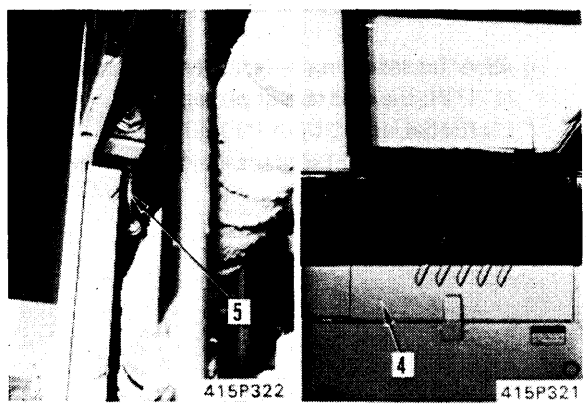
4. Brake hose

1) Connect brake hoses (5).

★ Be careful not to tighten brake hose too much.

kgm Hose nut: **1.2±0.3 kgm**

2) Install left and right engine inspection covers (4).

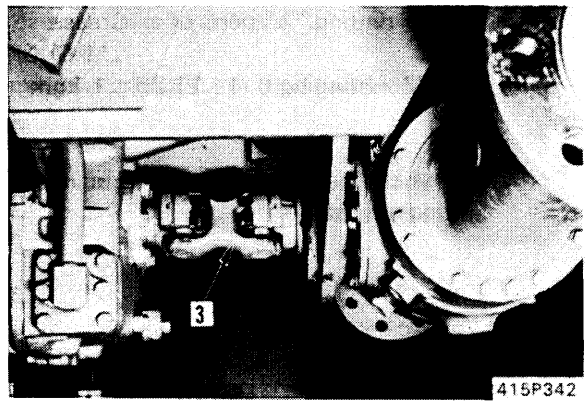


5. Drive shaft

Install rear drive shaft (3).

★ Align the pilot correctly and install with the yoke facing in the correct direction.

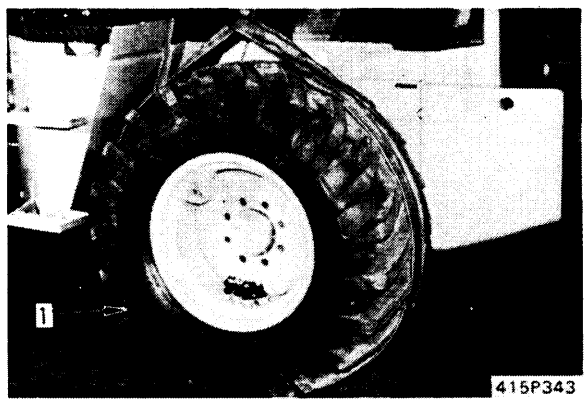
kgm Mounting bolt: **3.0±0.2 kgm**



6. Tire, wheel

Sling tire and wheel (1), set in mounting position, and tighten mounting bolts.

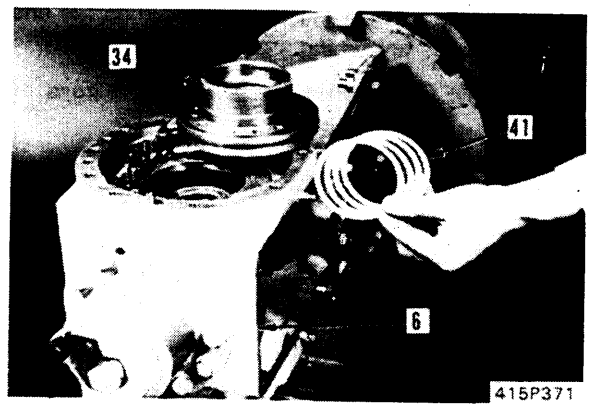
kgm Mounting bolt: **94.5±10.5 kgm**
(Width across flats: **36 mm**)



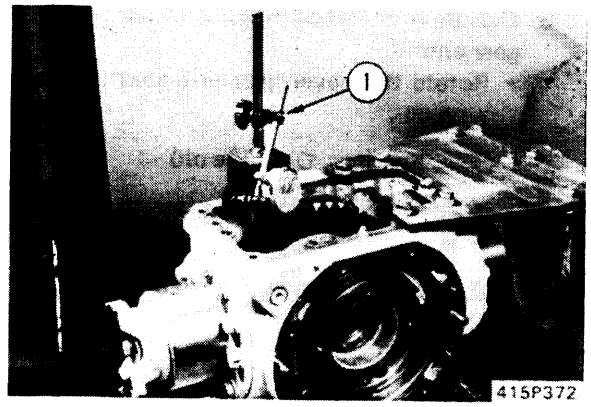
2) Remove bearing carrier of bevel gear end, and assemble selected shim (41), then fit O-ring in bearing carrier (34), install to differential housing (6).
   ★ Combine following shims to give necessary shim thickness.
   0.05 mm, 0,20 mm, 0,30 mm, 0.50 mm

   kgm Mounting bolt: **3.2±0.3 kgm**

3) Using dial gauge ①, measure backlash of bevel gear.
   ★ Standard backlash: 0.15 — 0.30 mm
   ★ Measure backlash at 3 place around circumference of bevel gear.
   Variation between measurements must be within 0.1 mm.
   ★ When backlash is large, increase shim. When backlash is small, decrease shim.



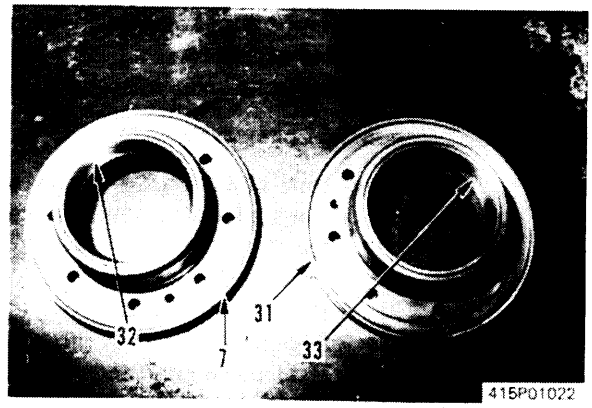
415P371



415P372

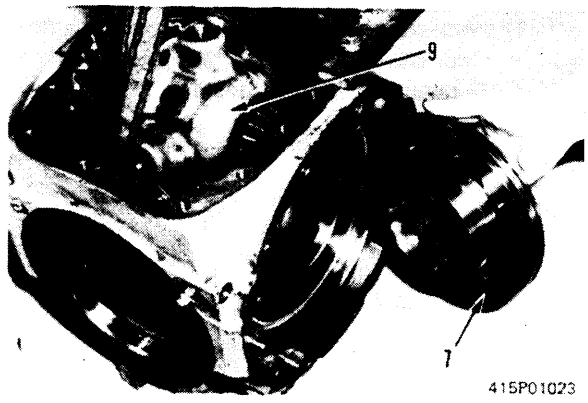
8. Bearing carrier (Serial No. 12001 and up)
Press fit bearing cups (32) and (33) in bearing carrier (7) and (31).

Press-fitting portion of bearing cup:
Oil (axle oil)



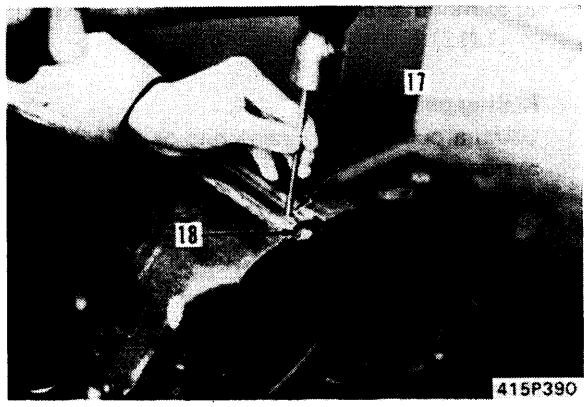
415P01022

9. Adjusting bearing carrier shims (Serial No. 12001 and up)
1) Raise differential carrier assembly (9), set in mounting position, then install left and right bearing carriers (7) temporarily.
   ★ Assemble the differential carrier assembly with the bevel gear on the right as seen from the cage mount.
   ★ Assemble the bearing carrier and adjust without the angle ring and shim.

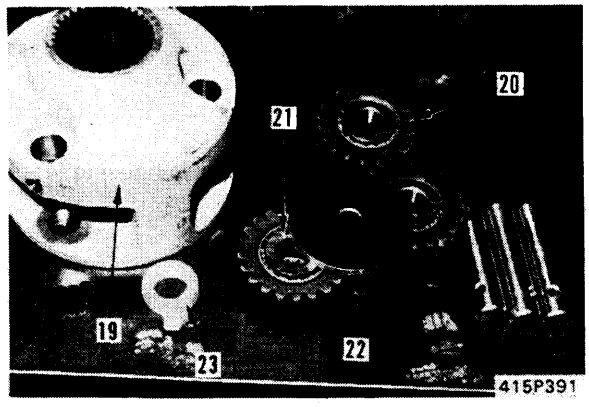


415P01023

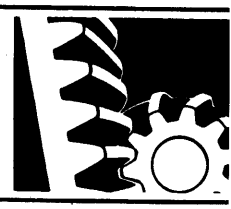
3) Remove spring pin (17) from shaft (18).



4) Remove pinion gear (20) from planetary carrier (19), then remove bearing cone (21), spacer (22) and shims (23).
   - ★ Check the number and thickness of the shims, and keep them in a safe place.
   - ★ On Serial No. 12001 and up, shim adjustment is unnecessary (no shim).



POWER TRAIN
24 MAINTENANCE STANDARD



Unit: mm

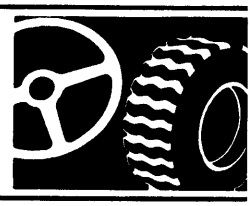
No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between output shaft bearing and housing	90	+0.005 −0.020	+0.022 −0.013	−0.018 – 0.042	–	Replace
2	Clearance between output shaft and bearing	40	+0.013 +0.002	+0.003 −0.015	−0.028 – 0.001	–	
3	Clearance between output shaft bearing and housing	90	+0.005 −0.020	+0.022 −0.013	−0.018 – 0.042	–	
4	Clearance between output shaft and bearing	40	+0.013 +0.002	+0.003 −0.015	−0.028 – 0.001	–	
5	Clearance between Forward-Reverse clutch bearing and housing	80	+0.004 −0.017	+0.018 −0.012	−0.016 – 0.035	–	
6	Clearance between 1st clutch bearing and cover	110	+0.005 −0.020	+0.022 −0.013	−0.018 – 0.042	–	
7	Clearance between 1st clutch bearing and housing	90	+0.005 −0.020	+0.022 −0.013	−0.018 – 0.042	–	
8	Clearance between 2nd · 3rd clutch bearing and housing	80	+0.004 −0.017	+0.018 −0.012	−0.016 – 0.035	–	
9	Wear of diameter (Seal ring contact surface)	Standard size	Tolerance		Repair limit		
		40	+0.05 0		39.95		
	Wear of seal ring groove width	3.2	+0.08 0		3.5		
	Wear of seal ring width	3.14	0 −0.02		2.7		
	Wear of seal ring thickness	1.8	±0.1		1.6		
10	Outside diameter of coupling (Oil seal contact surface)	55	0 −0.074		54.95		
11	Clearance between output shaft oil seal and cover	78	+0.046 0		–		
12	Tightening torque of coupling mounting bolt	11.2±1.3 kgm					Retighten
13	Tightening torque of torque converter mounting bolt	11.2±1.3 kgm					
14	Tightening torque of shroud mounting bolt	6.7±0.8 kgm					

Unit: mm

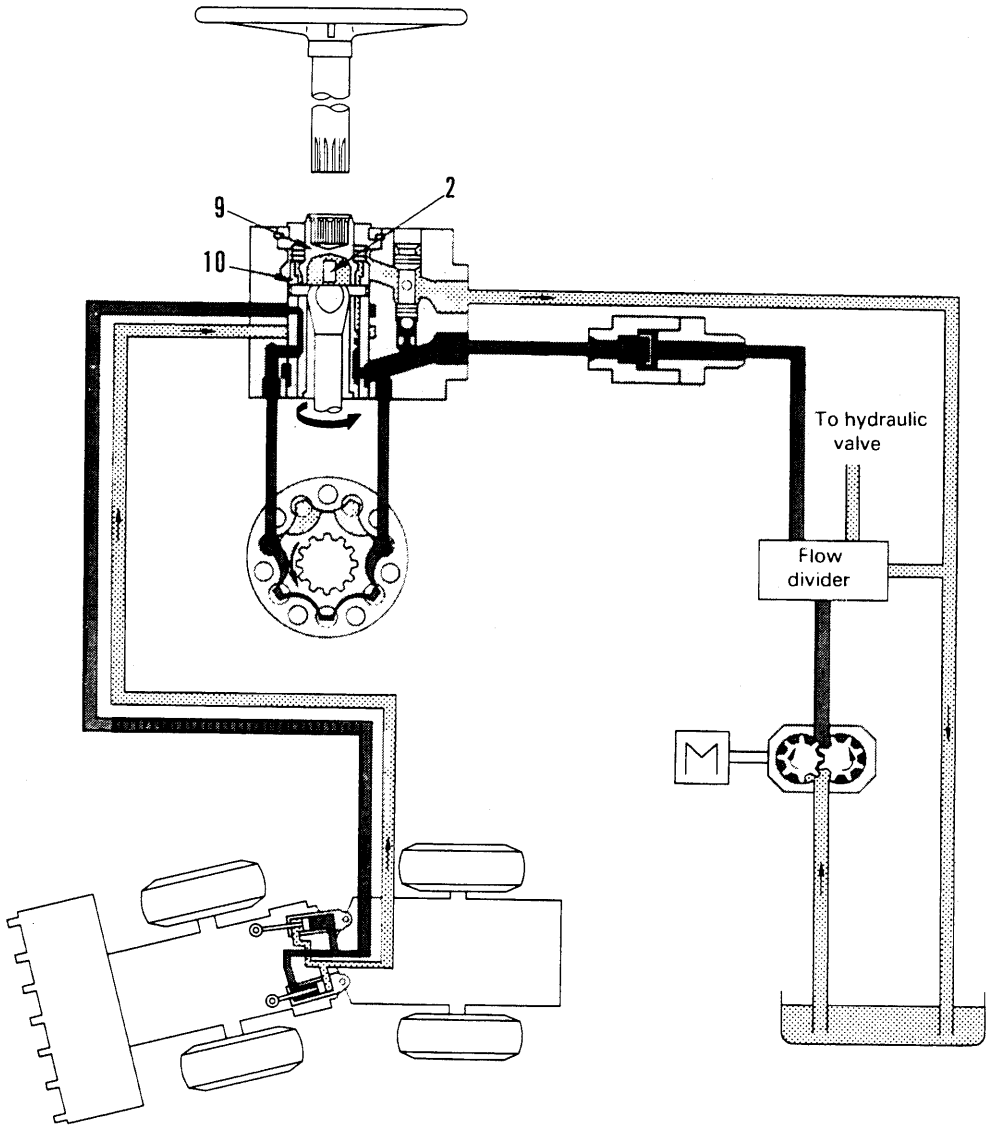
No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance of bearing at differential side (outer race)	90	0 −0.015	−0.024 −0.059	−0.059 – −0.009	–	Replace
2	(inner race)	50	+0.042 +0.026	0 −0.012	−0.054 – −0.026	–	
3	Clearance of pinion shaft bearing at pinion side (outer race)	90	0 −0.015	−0.038 −0.073	−0.073 – −0.023	–	
4	(inner race)	40	+0.033 +0.017	0 −0.012	−0.045 – −0.017	–	
5	Clearance of pinion shaft bearing at coupling side (outer race)	80	0 −0.013	−0.032 −0.062	−0.062 – −0.019	–	
6	(inner race)	35	+0.033 +0.017	0 −0.012	−0.045 – −0.017	–	
7	Clearance between pinion gear and pinion pin	18	0 −0.018	+0.195 +0.160	0.160 – 0.213	0.3	
8	Clearance between piston and differential housing	208	−0.200 −0.400	+0.046 0	0.200 – 0.446	–	
9	Clearance between bearing carrier and piston	164	−0.043 −0.106	+0.400 +0.300	0.343 – 0.506	–	
10	Backlash of bevel gear	Standard clearance					Adjust
		0.15 – 0.30					
11	Backlash of differential gear	0.14 – 0.18					Replace
12	Axial play of pinion gear	Maximum 0.108					
13	Thickness of side gear washer	Standard size		Repair limit			
		2±0.05		1.8			
14	Spacer height between pinion shaft and bearing	36.465		–			
15	Outside diameter of axle mounting place (Rear axle)	Standard size	Tolerance	Repair limit			
		120	0 −0.035	119.6			
16	Outside diameer of axle mounting place (Rear axle)	120	0 −0.035	119.6			

STEERING SYSTEM

41 STRUCTURE AND FUNCTION



When steering wheel is manipulated (Turning to the left)



E4150060

- When the steering wheel is turned to the left, the rotation causes the spool spline-fitted to the steering wheel shaft to turn to the left. As the sleeve is joined to the spool with the center sping, the spring contracted by the spool causes a difference in turning angle between the spool and the sleeve depending on contraction of the spring. As the result, each port in the sleeve is connected to lengthwise slit in the spool.

- Under this condition, the hand pump port in the sleeve and the steering cylinder port (on the left-steering side) in the sleeve are connected to each other through the lengthwise slits in the spool. Also, the steering cylinder port (on the right-steering side) in the sleeve is connected to the valve outlet port in the sleeve.

- Oil from the pump enters the hand pump through the valve inlet port and returns to the sleeve. The oil, in turn, flows from a legthwise slit in the spool, through the steering cylinder port in the sleeve to the steering cylinder. While, oil from the steering cylinder is forced to flow through the port in the sleeve and a lengthwise slit in the spool and returns to the tank.

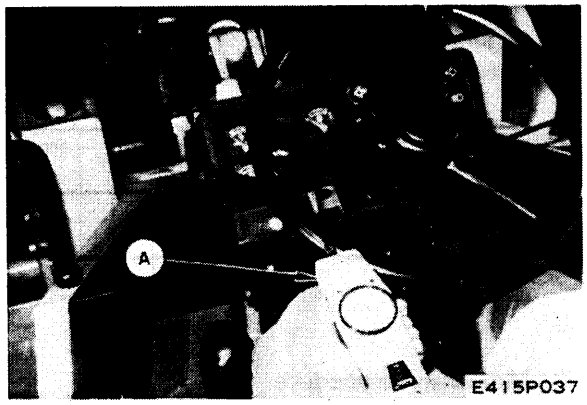
- Under such a condition as mentioned above, the hand pump is rotated by hydraulic oil from the pump and acts as an oil motor to lighten steering wheel manipulating force. When the steering wheel is stopped turning, difference in turning angle between the sleeve and the spool is removed by return force of the center spring. The same condition as mentioned before under "When steering wheel is not manipulated" is recovered.

MEASURING OPERATING FORCE OF STEERING WHEEL

★ Measurement condition
- Road surface: Flat, horizontal, dry, paved surface.
- Coolant temperature: Inside operating range
- Hydraulic oil temperature: 45 — 55°C
- Tire inflation pressure: Specified pressure
- Engine speed: Low idling (bucket unload)

Special tool

	Part number	Part name	Q'ty
A	7A0-262-0020	Push-pull scale	1



Measuring procedure

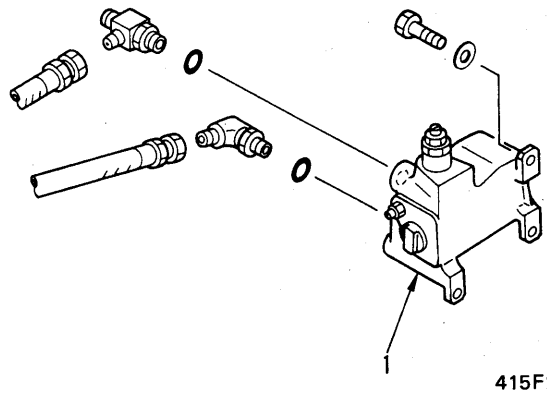
1. Hook push-pull scale **A** to the knob of the steering wheel.
   ★ Hook push-pull scale to center of the knob of the steering wheel.
2. Start the engine.
   ★ After starting the engine, raise the bucket about 400 mm and remove the safety bar.
3. Pull push-pull scale **A** at a tangent, and read the value when the steering wheel is moving smoothly.
   ★ Do not read the value at the time, the steering wheel starts to move.

DISASSEMBLY OF FLOW DIVIDER VALVE

1. Remove nut (2) from valve body (1), then remove screw (3).

2. Remove plug (4), then pull out spring (5) and spool (6).

3. **Relief valve assembly**
   1) Remove nut (7), then pull out screw (8), spring (9), and poppet (10).
   2) Remove sleeve (11) from valve body (1).
   3) Remove snap ring (12) from sleeve (11), then pull out valve (13) and spring (14).



415F220

ASSEMBLY OF FLOW DIVIDER VALVE

★ Clean all parts, and check for dirt or damage. Coat rotating and sliding surface of all ports with engine oil before installing.

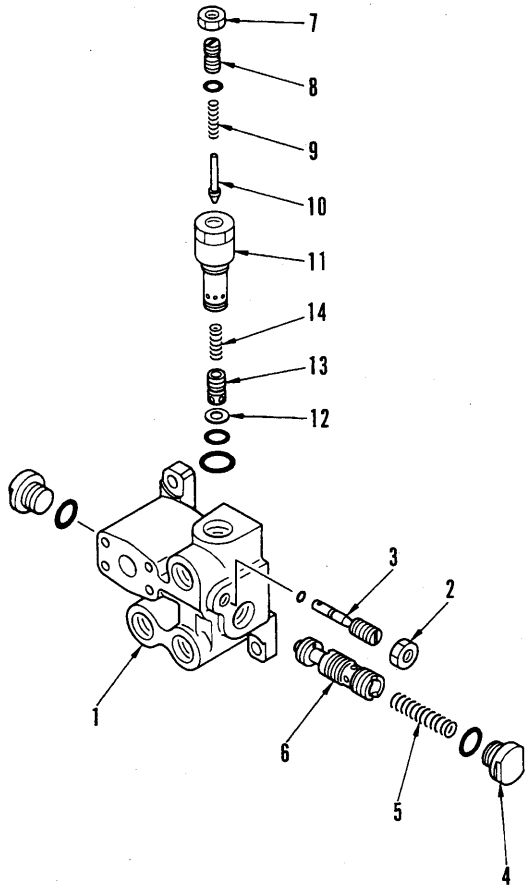
1. **Relief valve assembly**
   1) Install snap ring (14) and valve (13), to sleeve (11), and lock with snap ring (12) , then fit O-ring, assemble to valve body (1).

      kgm Sleeve: **5.75±0.75 kgm**

   2) Set poppet (10) and spring (9) in sleeve (11), fit O-ring and install screw (8), then lock with nut (7) after adjusting pressure.

2. Set spring (5) in spool (6) and install to valve body (1), fit O-ring in plug (4), then install to valve body.

3. Fit O-ring to screw (3), set screw (3) in valve body (1), then install nut (2). After adjusting, lock screw (3) with nut (2).



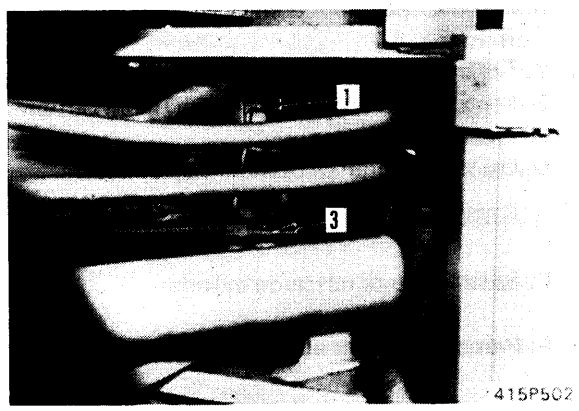
415F221

REMOVAL OF CENTER HINGE PIN

⚠ Stop the machine on level ground and install the safety bar on the frame. Lower the bucket to the ground and stop the engine. Then apply the parking brake and put blocks under the wheels to prevent the machine from moving.

⚠ Loosen the oil filler cap slowly to release the preassure inside the hydraulic tank. Then operate the steering wheel several times to the left and right to release the remaining pressure in the hydraulic piping.

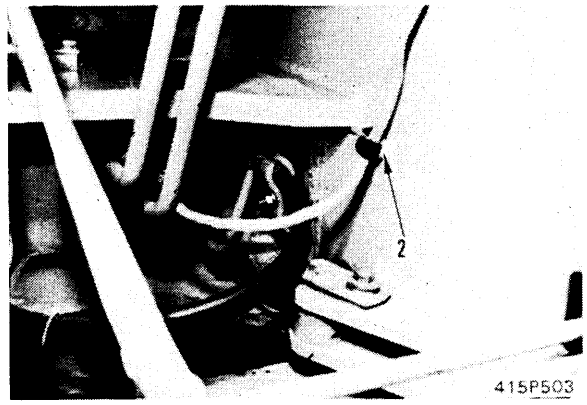
★ Disconnect cable from negative (−) terminal of battery.



1. Electric wiring

Remove clamp (1) of front frame end wiring.

★ Remove wiring of front frame left end from clamp (2).



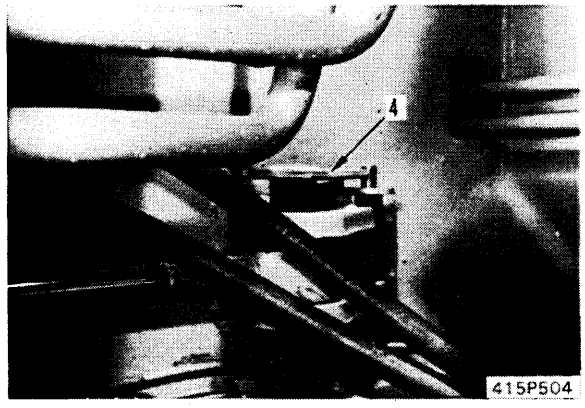
2. Brake hose

Disconnect brake hose (3) for front axle.

3. Steering cylinder

Remove left and right rod end pins (4).

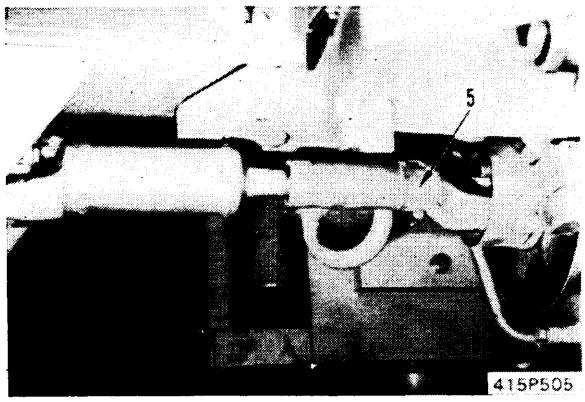
★ Be careful not to damage piston rod.



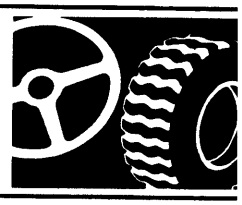
4. Drive shaft

Disconnect center drive shaft (5).

★ Disconnect it from transmission end.

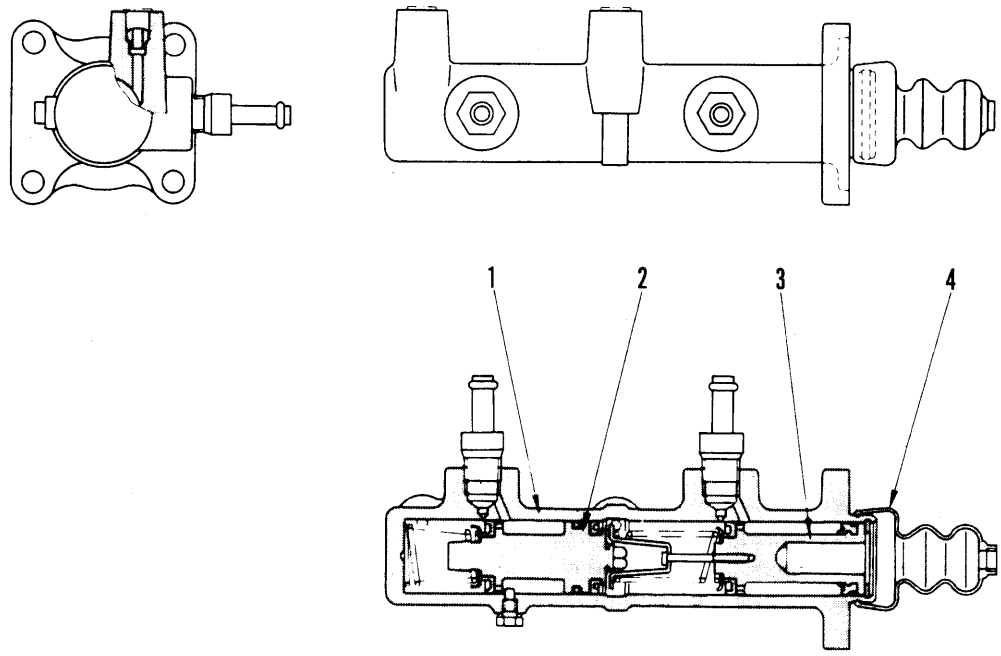


STEERING SYSTEM
44 MAINTENANCE STANDARD



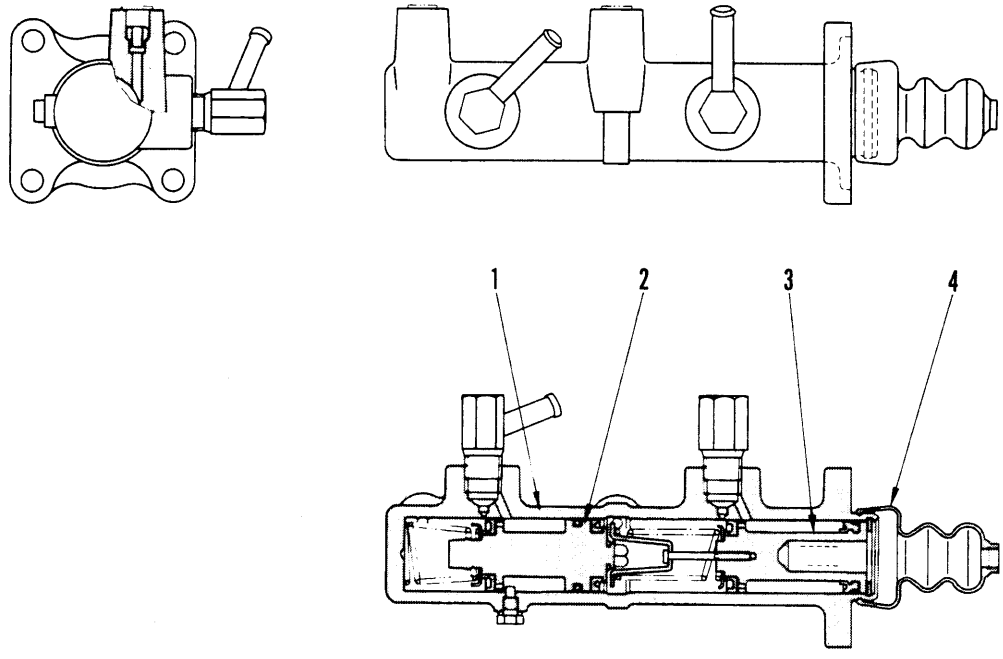
BRAKE MASTER CYLINDER

Serial No. 10001 – 11999



F0415028

Serial No. 12001 and up



F0415029

OUTLINE

- The brake master cylinder is connected to the brake cylinder with tube, and structured so that a large braking effect is obtained by a small pedal operating effort.

1. Body
2. Primary piston
3. Secondary piston
4. Boot

TOOL LIST FOR TESTING AND ADJUSTING

No.	Testing and measuring item	Tool	Part number	Remark
1	Brake pedal operating force	Push gauge	799-101-1001	0 – 110 kg
2	Brake oil pressure	Hydraulic tester Pump assembly	793-520-1801 790-101-1102	0 – 100 kg
3	Wear of brake disc	Vernier calipers	Commercially available	150 – 200 mm
4	Brake distance	Tape measure	Commercially available	30 m
5	Clearance of pad	Feeler gauge	Commercially available	0.1 – 3.0 mm

⚠ When carrying out testing, adjusting or troubleshooting, stop the machine on level ground, install the safety bar on the frame, lower the bucket to the ground, and stop the engine.
Then apply the parking brake and block the tires.

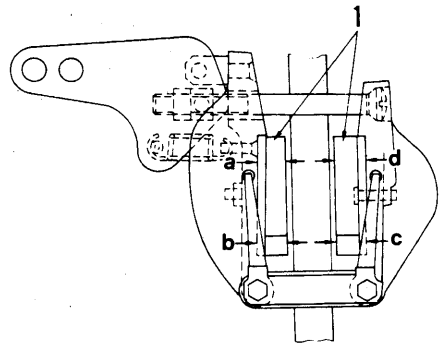
⚠ When working in groups, use agreed signals and do not allow unauthorized persons near the machine.

CHECKING AND ADJUSTING PARKING BRAKE

⚠ Block the tires securely.

Special tool

	Part number	Part name	Q'ty
A	Commercially available	Vernier calipers	1



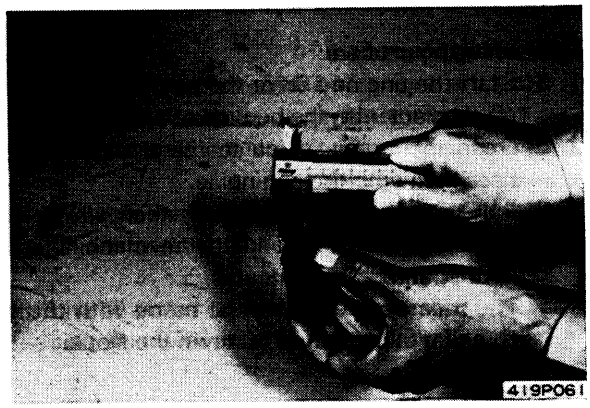
419F309

1. Measuring pad

1) Stop the engine and operate the parking brake lever to release the brake.
2) Remove pad (1) from the caliper, and measure the thickness of the pad to the backing plate.

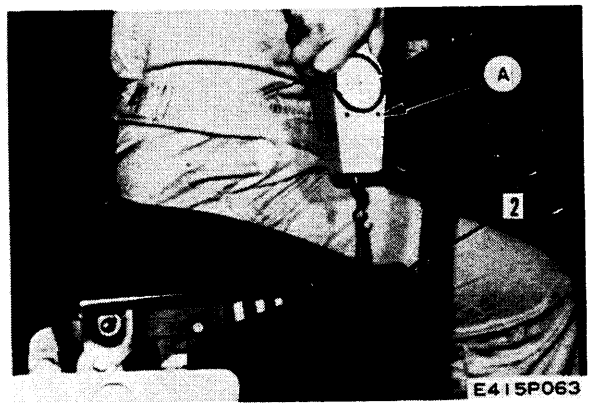
★ If the measurement is not within the permissible value, replace the two pads as a set.

★ For details of replacing the pads, see DISASSEMBLY AND ASSEMBLY.



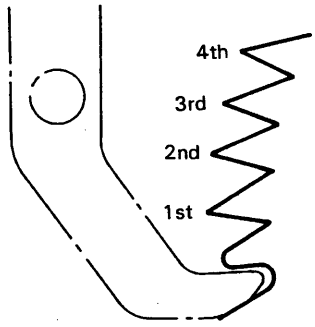
Special tool

	Part number	Part name	Q'ty
A	Commercially available	Push-pull scale	1
		Convex scale	1



2. Measuring lever

1) Install a push pull scale 50 mm from the tip of lever (2), and measure operating force.
2) Measure the movement of the lever tooth when the lever is operated at the specified operating force.



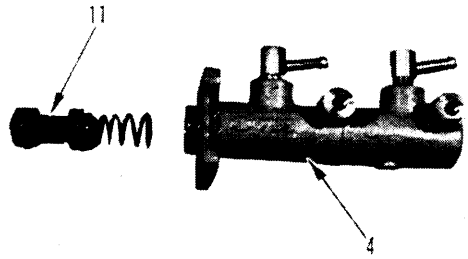
415F146

ASSEMBLY OF MASTER CYLINDER

1. Piston assembly

1) Insert primary piston (11) in body (4).
   ★ Insert carefully and be careful not to damage the seal cup. Never try to force the piston in.

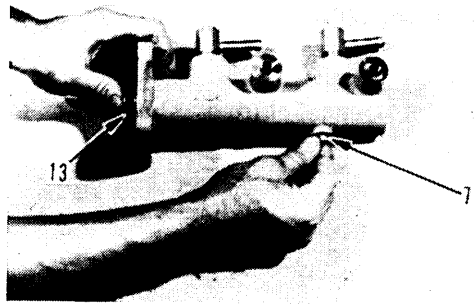
   Body and piston: Oil (brake oil)



416P560

2) Press piston (13) and tighten stopper bolt (7) by hand.
   ★ Tighten as far as possible by hand, then tighten fully.

   Stopper bolt: **1.1±0.2 kgm**



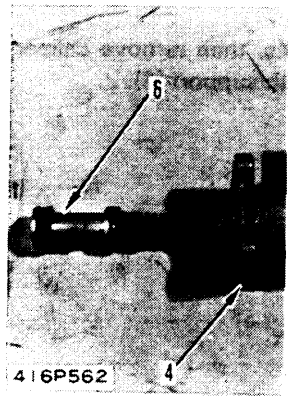
416P561

3) Insert secondary piston (6) in body (4).

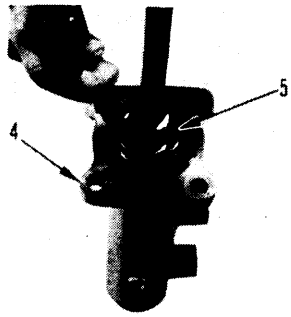
   Body and piston: Oil (brake oil)

   ★ When inserting the piston, be careful not to damage the inside diameter of the body or the outside of the piston.
   ★ Be careful not to let the O-ring get caught.

4) Push in secondary piston (6), and install snap ring (5).
   ★ Fit the snap ring securely in the groove.



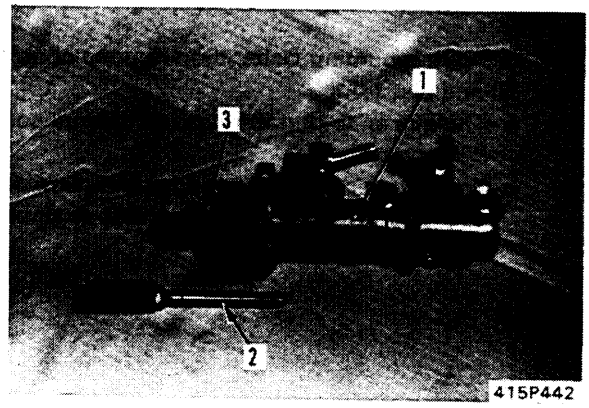
416P562



416P556

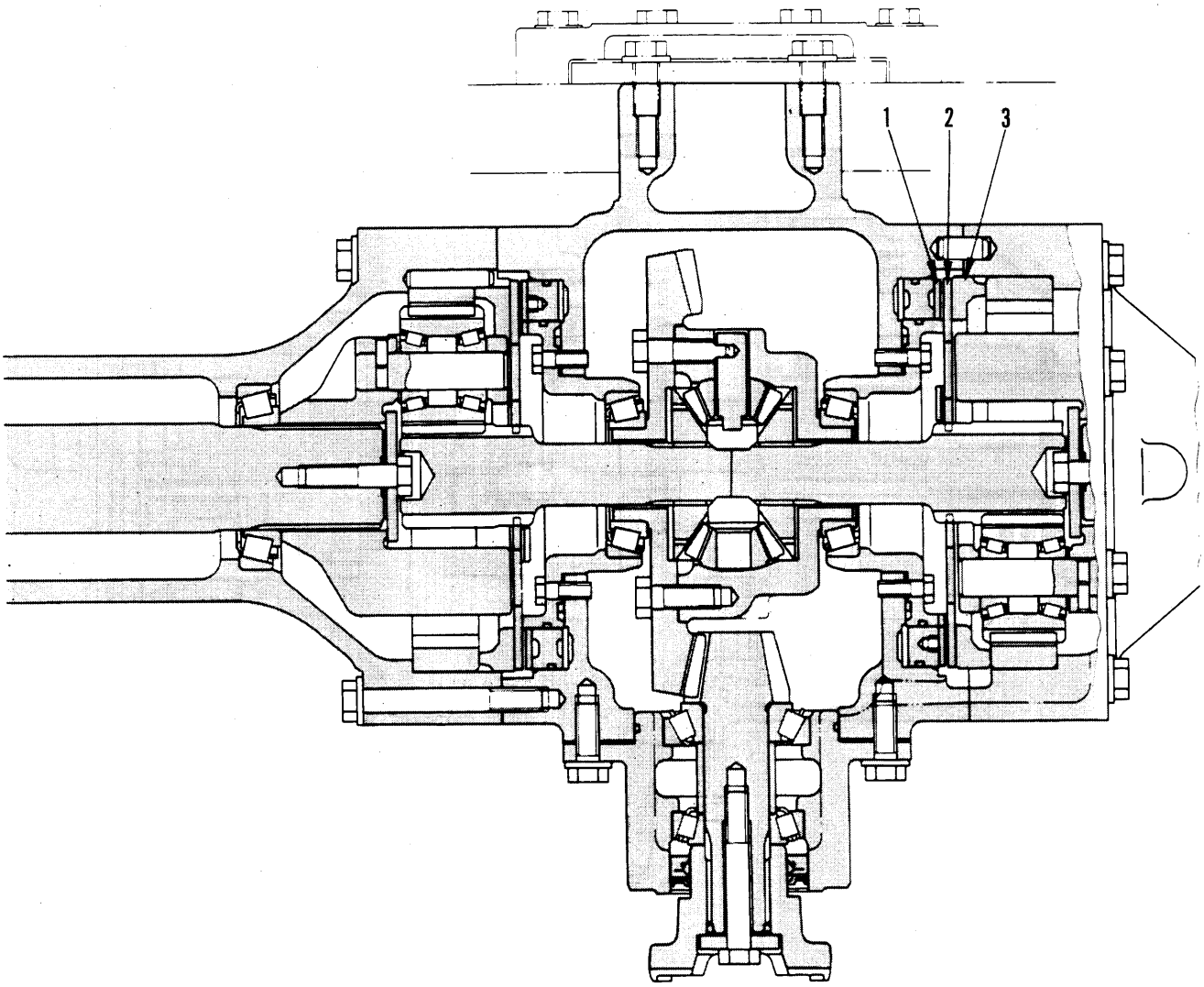
2. Dust cover

Insert linkage rod (2) in master cylinder (1) and assemble dust cover (3).
★ For details of adjusting brake linkage, see 52 TESTING AND ADJUSTING.



415P442

Serial No. 12001 and up



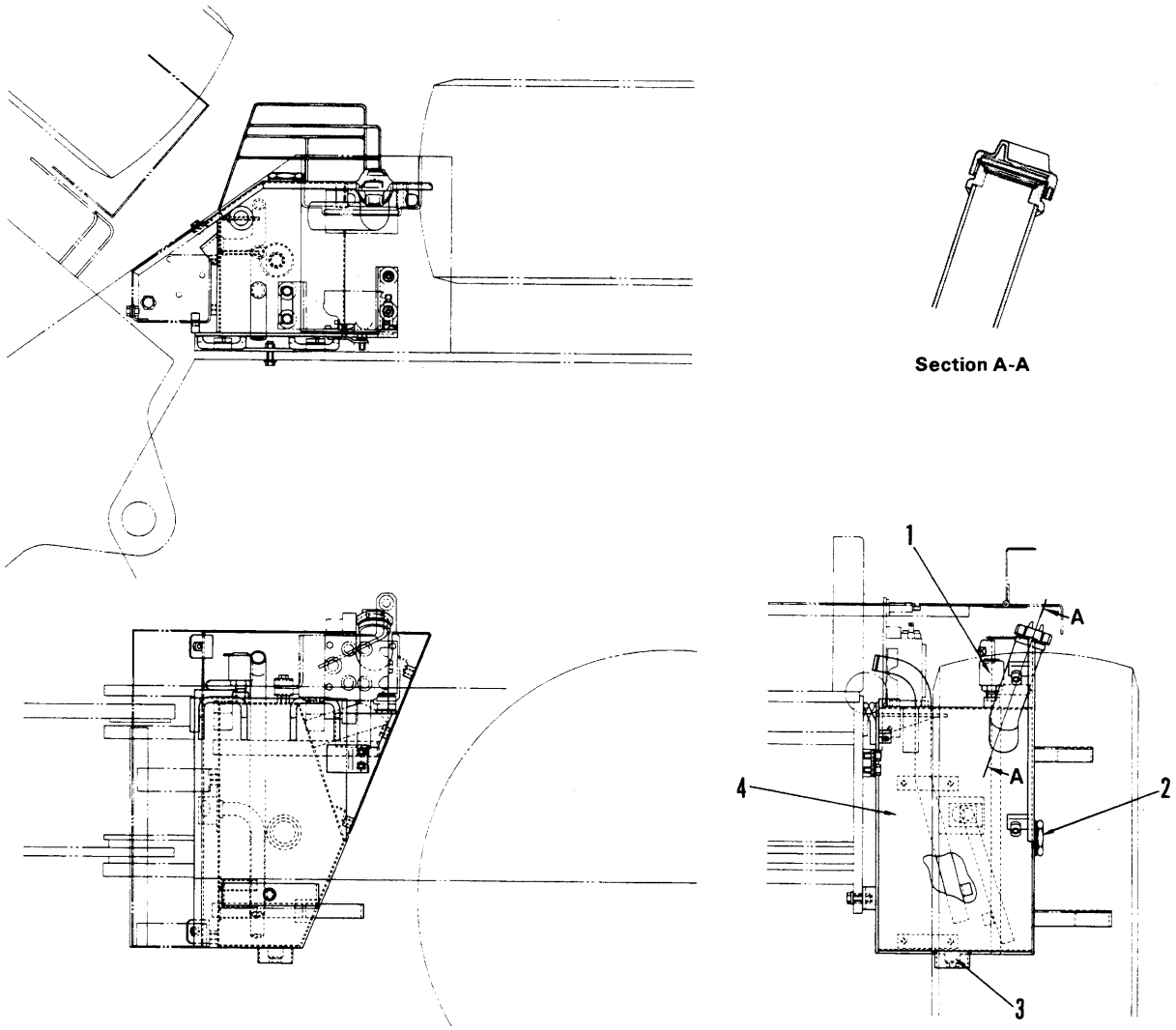
F0415037

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Thickness of inner ring	3.8	±0.1	3.3	Replace
2	Thickness of brake disc	6.65	±0.1	5.85	
	Groove depth of brake disc	0.838	±0.2	0.4	
	Thickness of brake disc lining	1.075	more than 0.9	–	
3	Wear of contact surface of brake outer ring	0	–	0.3	

HYDRAULIC TANK

Serial No. 10001 – 11999



415F069

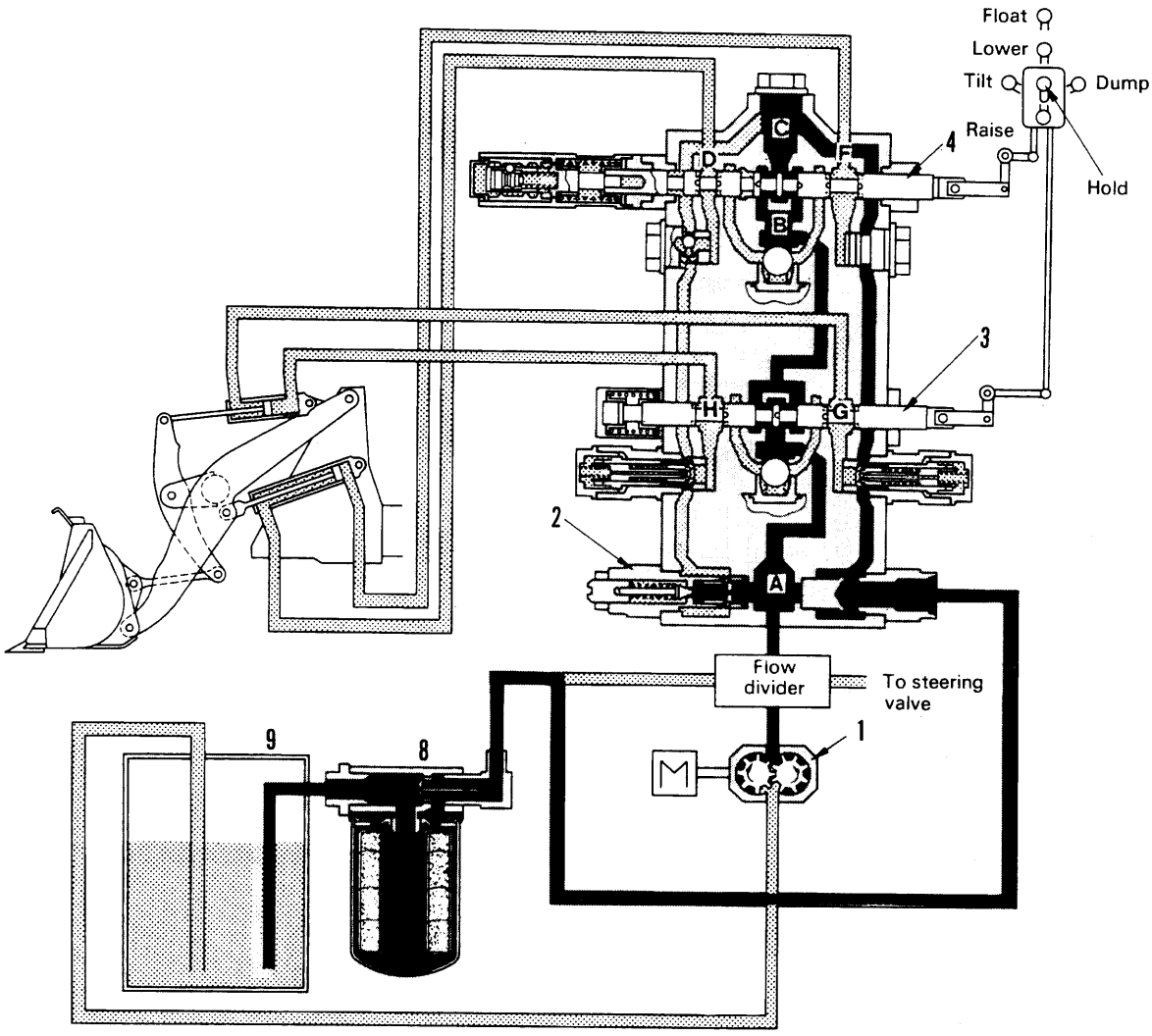
OUTLINE

- The oil from the hydraulic tank is sent from the pump through the control valve to the cylinders. In the return circuit, the oil from various parts merges, and passes through the oil filter and returns to the tank.

1. Breather
2. Oil level gauge
3. Drain plug
4. Hydraulic tank

Lift and dump spools at "HOLD position"

Serial No. 10001 – 11999



415F084

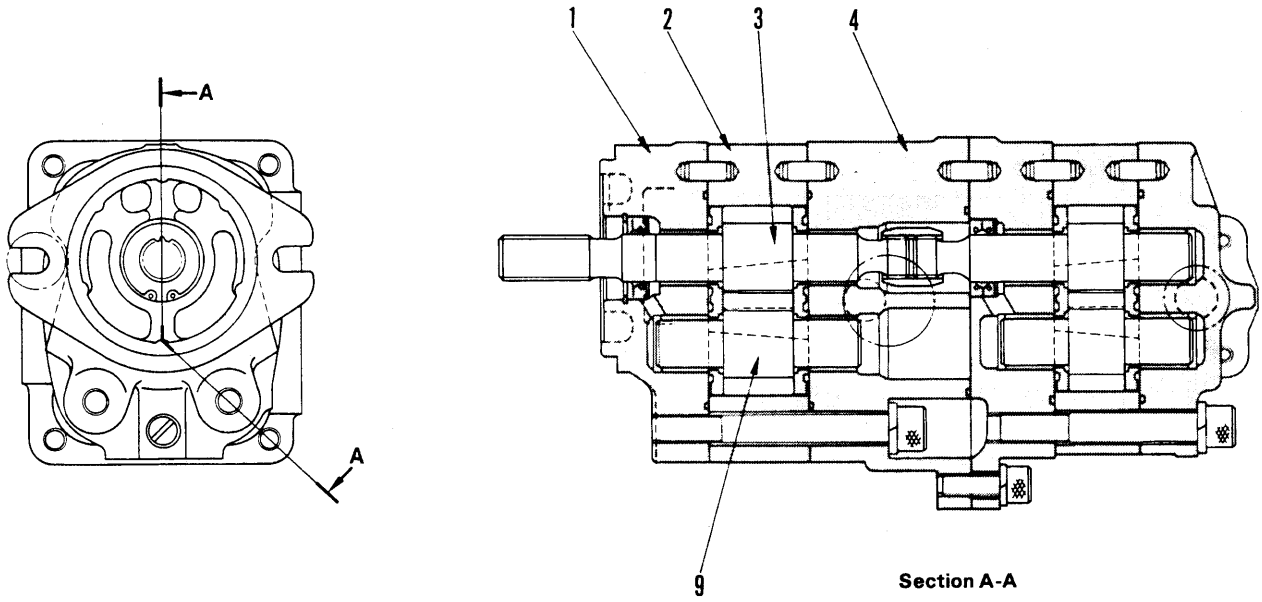
OPERATION

- The oil flows from pump (1) through the flow divider valve and enters port **A**.
- Dump spool (3) is at hold, so the bypass circuit is open and the oil from port **A** passes around the spool and flows to port **B**.

The lift spool (4) is also at hold, so the bypass circuit is open. The oil from port **B** passes around the spool, flows from the drain port **C** through the filter (8), and goes back to the tank (9).

HYDRAULIC PUMP
(Torque converter charging pump, steering and work equipment control pump)

OUTLINE
- Hydraulic pump is tamdem type gear pump (SAL25 + SAL20).
  Hydraulic pump is installed to torque converter case. It is driven by motive power from engine and supplies oil to torque converter and transmission circuit, steering circuit and work equipment control circuit.



Section A-A

415F071

1. Front cover
2. Gear case
3. Drive gear (12 teeth)
4. Rear cover
5. Driven gear (12 teeth)

Specifications

	Torque converter charging pump	Steering and work equipment control pump
Type	SAL20	SAL25
Theoretical delivery	20.5 cc/rev.	25.7 cc/rev.
Maximum delivery pressure	30 kg/cm^2	210 kg/cm^2
Maximum speed	3500 rpm	3500 rpm

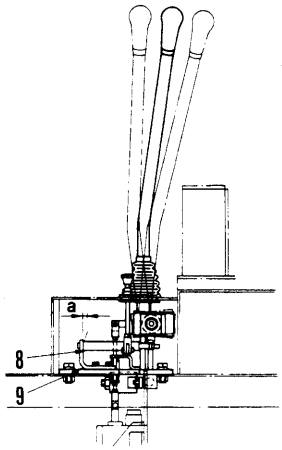
ADJUSTING DUMP AND LIFT CONTROL LEVERS

Serial No. 10001 – 11999

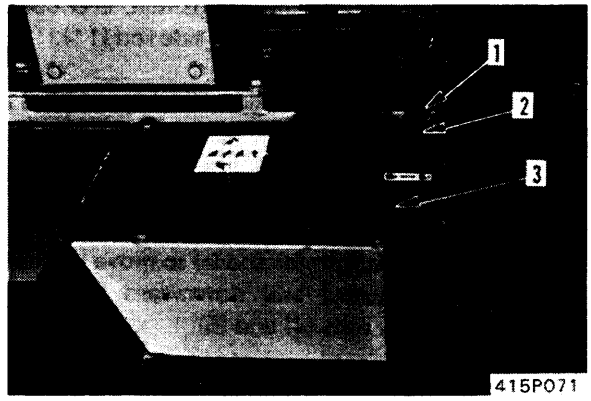
★ If the travel of each lever is not within the standard value at every position, adjust linkage as follows.

1. Adjustment of the linkage rods of the dump and lift control lever

1) Remove dump and lift control lever stopper knob (1) and nut (2), then remove cover (3).
2) Loosen lock nuts (4) and (5) on linkage (2) of the dump and lift control lever.
3) Disconnect ball joints (7) and yoke (6) from lever (13).
4) Move lever stopper (8) upward and downward on free position, and adjust clearance "a" to minimize axial play, then secure plate (9).



415F148



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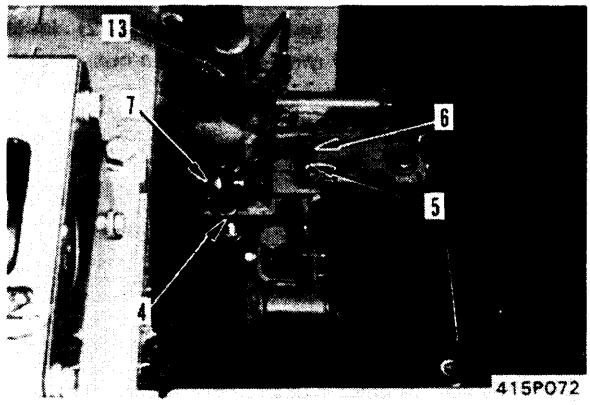

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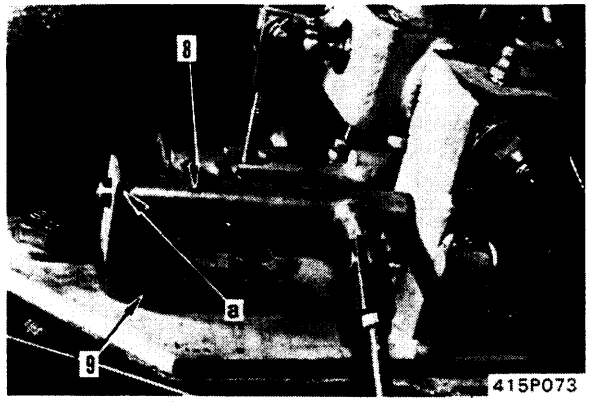


415P073

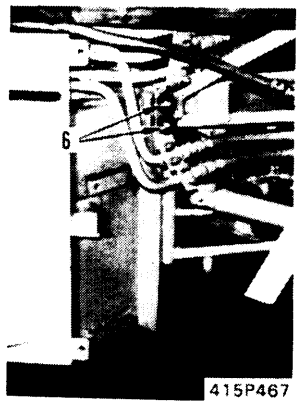
TROUBLESHOOTING

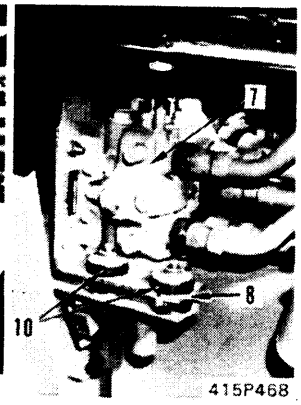
Troubleshooting table

★ Before carrying out the troubleshooting in this section, read "PRECAUTIONS WHEN TROUBLESHOOTING" page 22-12, "METHOD OF READING TROUBLESHOOTING TABLE" page 22-14 and "PREVENTING RECURRENCE OF TROUBLE" page 22-16.

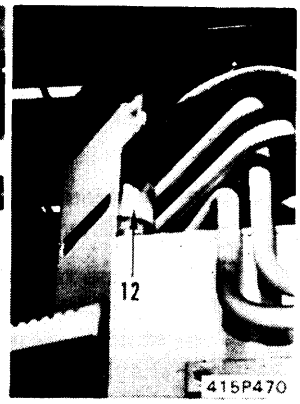
3. Support cushion

1) Remove cushion (6) of hydraulic piping support.
2) Remove cushions (10) and (11) for main control valve (7) and mounting brackets (8) and (9).





3) Remove breather (12).

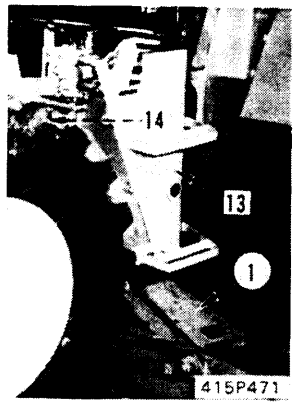


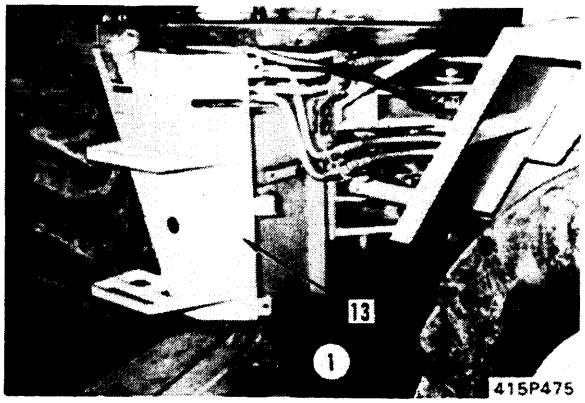
4. Hydraulic tank

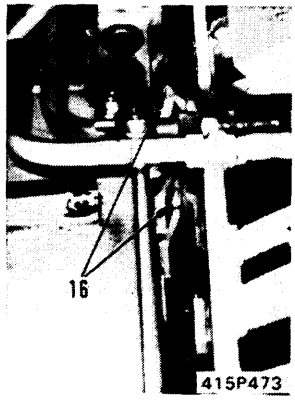
Set garage jack ① under hydraulic tank (13), remove mounting bolts (14) and (15), then raise tank until tank remove from hook (16), and lower garage jack ①.

★ Pull out hose loosened in STEP 1).
★ Move dump and lift control lever (17) to right, and secure with wire.
★ When removing hydraulic tank, remove the tank from hook (16) being careful not to raise too much.

kg Hydraulic tank (dry): **36 kg**



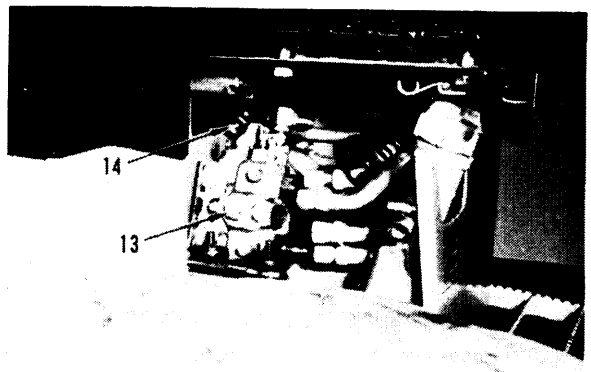




INSTALLATION OF MAIN CONTROL VALVE

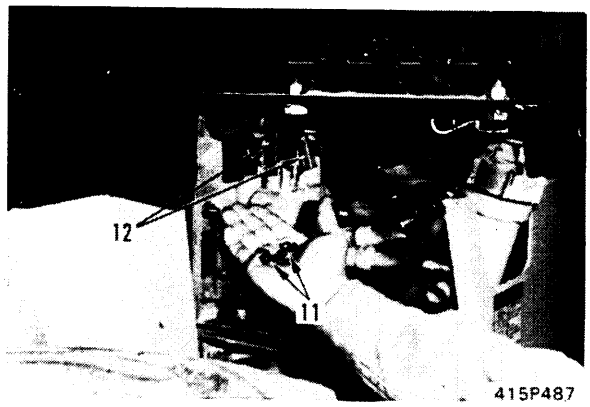
1. Main control valve

1) Set main control valve (13) in mounting position, then connect hose (14) between flow divider valve and main control valve.
2) Tighten main control valve (13) mounting bolts.



415P486

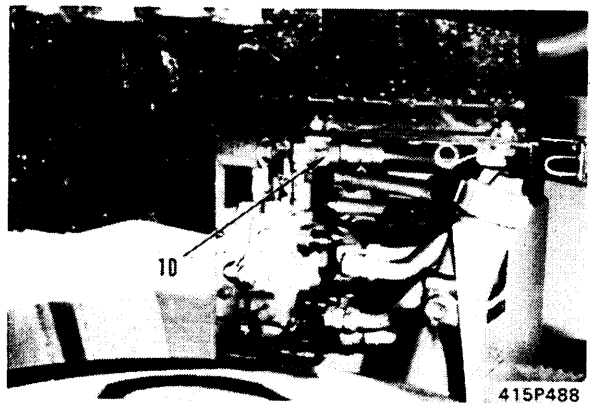
3) Set work equipment linkage (12) on spool of main control valve, assemble pin (11), then install cotter pin.



415P487

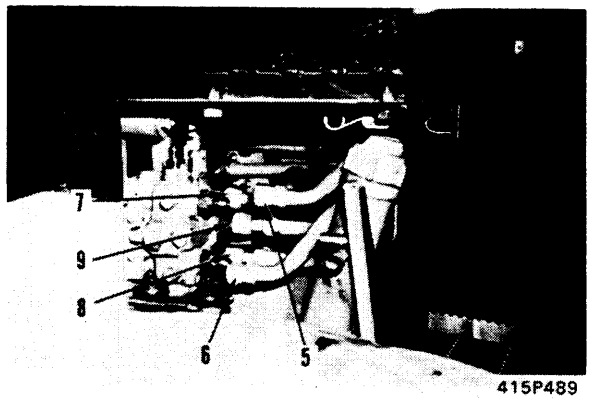
2. Hydraulic piping (Serial No. 10001 – 11999)

1) Connect hose (10) between main control valve and hydraulic filter.



415P488

2) Connect tube (9) between flow divider valve and main control valve.
3) Connect tubes (7) and (8) between main control valve and dump cylinder at main control valve.
4) Connect tubes (5) and (6) between main control valve and lift cylinder at main control valve.



415P489

8. Disassembly of main relief valve

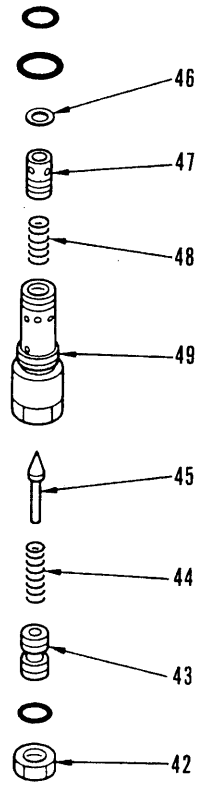
★ If lock nut (42) is loosened and adjustment screw (43) is turned, set pressure will change, so do not disassemble unless necessary.

1) Loosen lock nut (42), remove adjustment screw (43), spring (44) and poppet (45) from main relief valve assembly (40).
2) Remove snap ring (46), then remove valve (47) and spring (48) from sleeve (49).

9. Safety valve with suction valve assembly

★ The set pressure of the safety valve with suction is higher than that of the main relief valve, so do not disassemble it.

Main relief valve



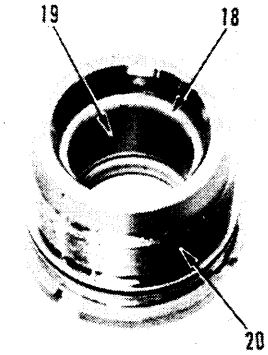
415F219A

ASSEMBLY OF LIFT AND DUMP CYLINDER

Special tools

	Part number	Part name	Q'ty
A	790-502-1001	Cylinder repair stand	1
B	790-102-2301	Wrench	1
C	790-702-1000	Expander	1
D	796-720-1640	Ring	1

★ Coat the sliding surface of all parts with engine oil. Take care not to damage rod packings, dust seals or O-rings.



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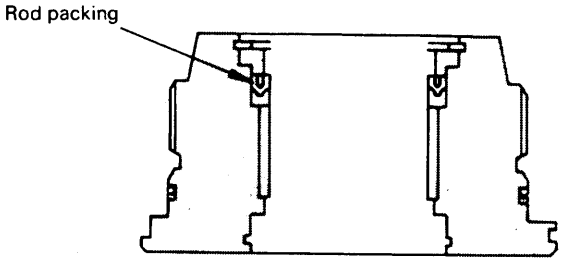
1. Assemble cylinder head assembly as follows;
1) Using a push tool, press fit bushing (19) on cylinder head (20).
★ Take particular care not to deform the bushing when press fitting.
2) Assemble rod packing (18).
★ Be careful to install the rod packing facing in the correct direction.



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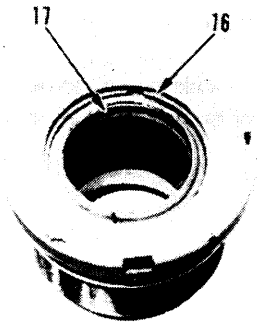

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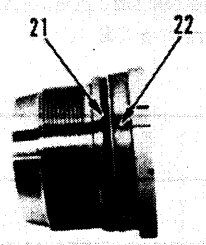
3) Using a push tool, install dust seal (17) on head (20).
4) Install snap ring (16).
5) Install backup ring (22) and O-ring (21).
★ Do not force backup ring. Heat in hot water (50 — 60°C) before inserting.



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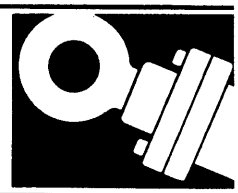
WORK EQUIPMENT SYSTEM
64 MAINTENANCE STANDARD



Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between pin and bushing at boss ends of bucket link	45	-0.025 -0.064	$+0.142$ $+0.080$	0.105 – 0.206	1.0	Replace also if other parts are biting into pin
2	Clearance between pin and bushing at joint of lift arm and bucket	45	-0.025 -0.064	$+0.142$ $+0.080$	0.105 – 0.206	1.0	
3	Clearance between pin and bushing at joint of lift arm and frame	45	-0.025 -0.064	$+0.142$ $+0.080$	0.105 – 0.206	1.0	
4	Clearance between pin and bushing at joint of dump cylinder bottom and frame	45	-0.025 -0.064	$+0.142$ $+0.080$	0.105 – 0.206	1.0	
5	Clearance between pin and bushing at joint of dump cylinder rod and lever	45	-0.025 -0.064	$+0.142$ $+0.080$	0.105 – 0.206	1.0	
6	Clearance between pin and bushing at joint of tilt lever and lift arm	60	-0.030 -0.076	$+0.105$ $+0.075$	0.105 – 0.181	1.0	
7	Clearance between pin and bushing at joint of lift cylinder bottom and frame	45	-0.025 -0.064	$+0.142$ $+0.080$	0.105 – 0.206	1.0	
8	Clearance between pin and bushing at joint of lift cylinder rod and lift arm	45	-0.025 -0.064	$+0.142$ $+0.080$	0.105 – 0.206	1.0	
		Width between bosses		Width of hinge		Standard clearance (clearance a + b)	
9	Joint of dump cylinder and frame	$55^{+0.8}_{0}$		59.5±1.5		2.2 – 6	Insert shims on both side to make clearance on both left and right sides less than 1.0 mm
10	Joint of lift arm and frame	63±2.2		68±1.5		1.3 – 8.7	
11	Joint of lift arm and bucket	57±2.2		$61.5^{+2.5}_{-0.5}$		1.8 – 9.2	
12	Joint of bucket link and bucket	$57^{+2.1}_{-0.5}$		61.5±1.5		0.9 – 6.5	
13	Joint of lift cylinder and frame	$55^{+0.8}_{0}$		62±1.5		4.7 – 8.5	
14	Joint of tilt lever and bucket link	$57^{+2.1}_{-0.5}$		61.5±1.5		0.9 – 6.5	
15	Joint of tilt lever and lift arm	120±1.5		124.5±1.5		1.5 – 7.5	
16	Joint of dump cylinder and tilt lever	$55^{+0.8}_{0}$		57.5±1.5		0.2 – 4	
17	Joint of lift cylinder and lift arm	57±2.2		$60^{+0.8}_{0}$		0.8 – 6	