SHOP MANUAL

KOMATSU

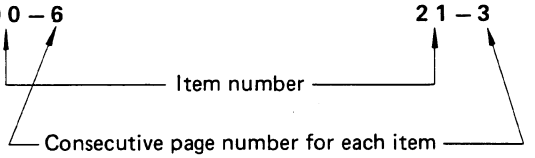
GD600-1 SERIES

MACHINE MODEL	SERIAL No.
GD600R-1	10002 and up
GD650R-1	20001 and up
GD605R-1	30002 and up
GD655R-1	40001 and up
GD605A-1	50002 and up
GD655A-1	60001 and up

Filing Method

1) File under the manual title file printed on the bottom of the page.
2) Method of taking out the pages for filing is as follows: First order each item number starting with the lowest, and next order according to the consecutive page number for each item.

Example: **0 0 – 6** **2 1 – 3**



3) Additional pages: Additional pages are indicated by a dash (–) and number after the page number. File as in the example.

Example: **21 – 4**
21 – 4 – 1
21 – 4 – 2
21 – 5

Pages added between **21 – 4** and **21 – 5**

Besides this, when necessary, information will be written in the filing ring hole's margin. Look when filing.

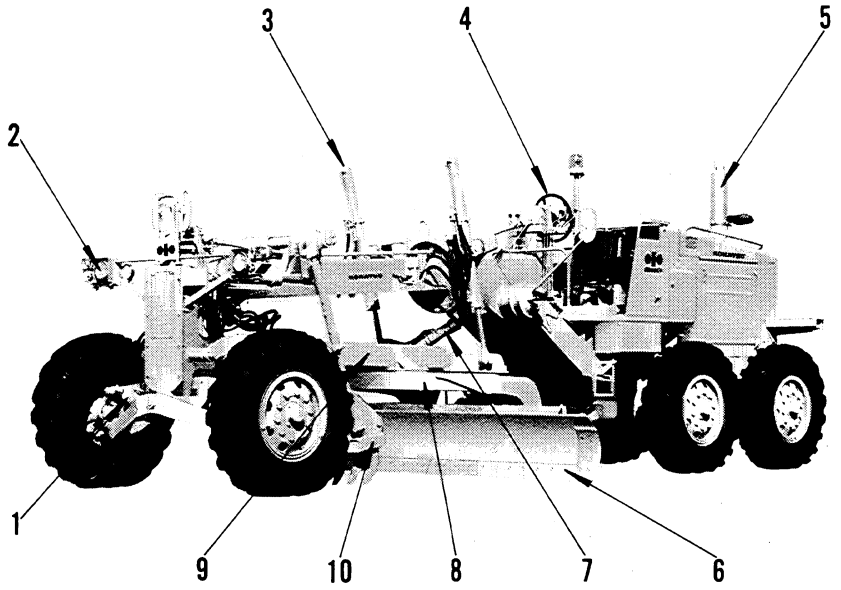
Revised Edition Mark

When a manual is revised, a revision number is placed within a circle and printed on the bottom inside corner of the pages to distinguish it from the old manual. Therefore, higher circled numbers supersede lower ones.

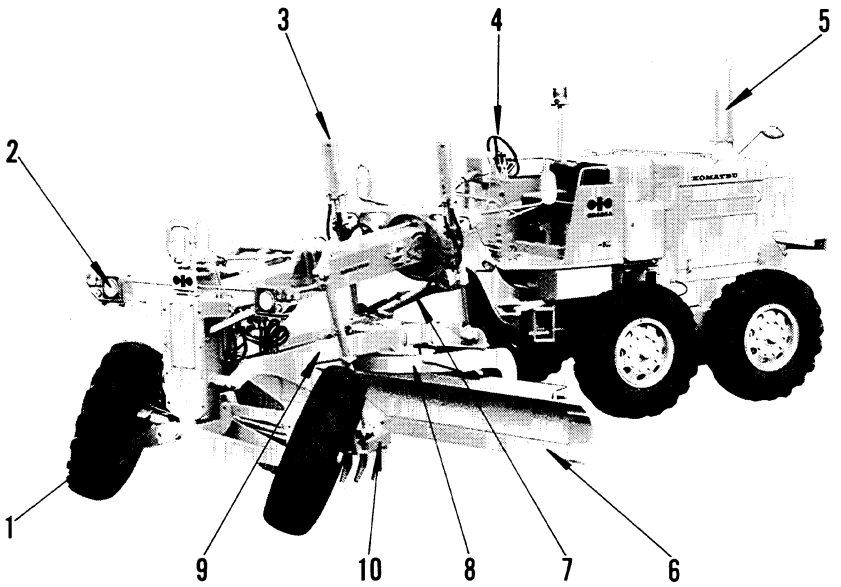
Revisions

A table listing revisions and revised pages to the present is printed on the back of the title page, so when there is a revision, revise the title page also, and use it to keep the file in order.

GD605R-1, GD655R-1



GD605A-1, GD655A-1



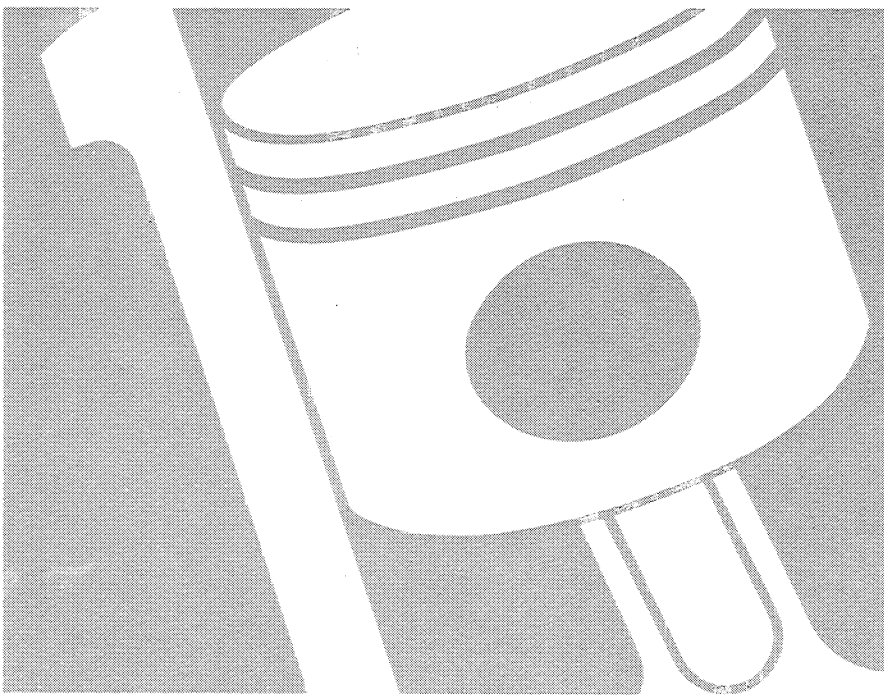
MODEL	GD605A-1	GD655A-1
SERIAL NUMBERS	50002 ~	60001 ~
Engine Assembly (dry)	1540	1540
Engine, Damper, HYDROSHIFT Transmission, Parking and piping assembly (dry)	2405	2405
Damper assembly	25	25
Transmission assembly (dry)	780	780
Radiator assembly	105	105
Fuel tank (incl. bracket) (dry)	112	112
Propeller shaft	12	12
Final drive, tandem drive, rear axle and brake assembly (dry)	2710	2710
Final drive assembly	920	920
Tandem drive assembly	845 x 2	845 x 2
Front axle assembly (incl. leaning cylinder)	415	415
Wheel assembly	153 x 6	153 x 6
Parking brake assembly	17	17
Steering gear box assembly	21	21
Tie rod assembly	30	30
Front frame assembly	1125	1125
Rear frame assembly	680	680
Operator's compartment assembly	420	420
Blade lift cylinder	48.5	48.5
Blade shift cylinder	53	53
Leaning cylinder	22	22
Steering cylinder	10	10
Scarifier cylinder (Option)	30	30
Articulation cylinder	26	26
Drawbar, circle, circle reverse and blade adjuster bracket	1250	1250
Circle reverse assembly	65	65
Drawbar with circle assembly	1000	1000
Blade assembly	750	950
Scarifier assembly (Option)	650	650
Hydraulic tank (dry)	60	60
Hydraulic pump	11	11
Steering pump	4.8	4.8
Transmission pump	10.5	10.5
Oil motor	37	37

SHOP MANUAL

GD600 SERIES

11 ENGINE

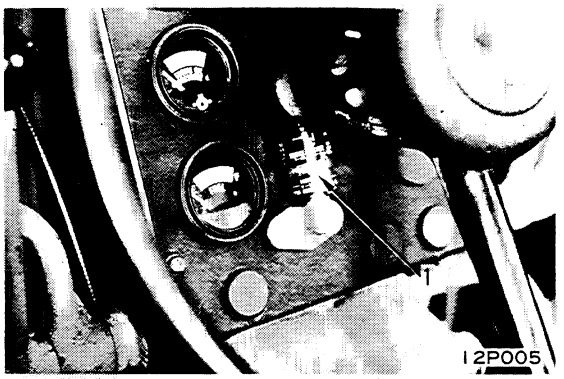
STRUCTURE AND FUNCTION



INTAKE AND EXHAUST SYSTEM

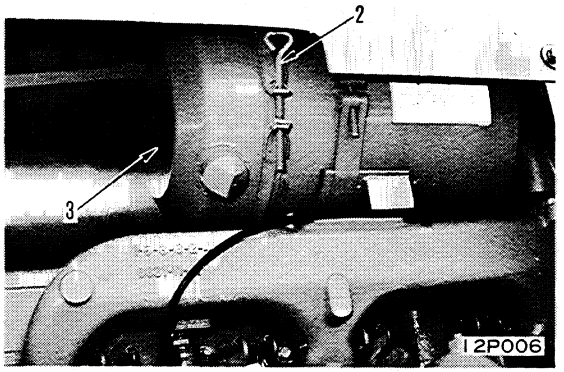
CHECKING AIR CLEANER ELEMENT FOR CLOGGING

1. Check whether the dust indicator (1) has reached the service level (red).
   ★ Because of clogging, etc. of the element, when air intake resistance increases and intake negative pressure becomes 635mm water column, the dust indicator works (shows red).



2. When the dust indicator shows red and exhaust is black, take out the element by loosening bolt (2) and removing cover (3).
   Then clean it.

   ★ Be careful no dust gets into the case when checking, cleaning and changing.

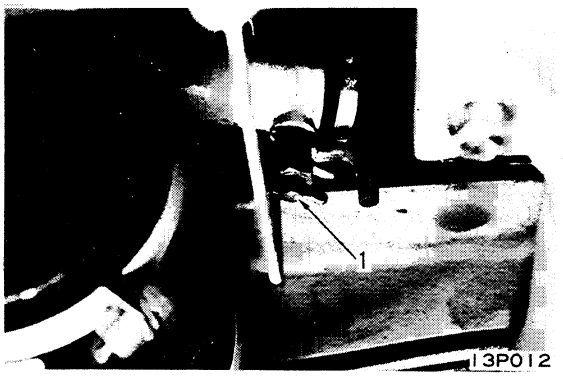


FUEL CONTROL LEVER STROKE 

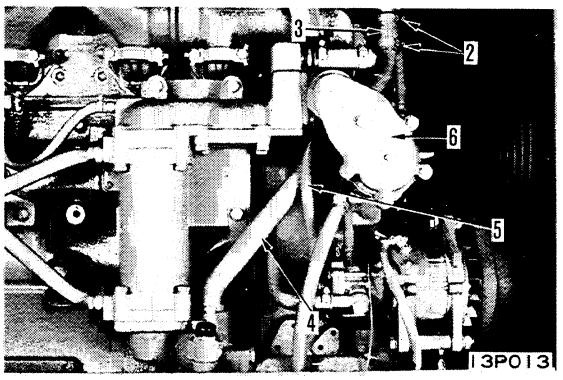
DISMOUNTING OIL COOLER

GD605A, GD655A, GD605R, GD655R

1. Loosen drain cock (1) to drain coolant.
   ★ If antifreeze solution is used, handle coolant with care as chemicals and do not discharge it thoughtlessly.
2. Remove L.H. engine side cover.
3. Loosen clamp (2) and move hose (3) downward to disconnect it.
4. Remove bypass tube (4).
5. Disconnect vacuum pump hose (5) from cooler.
6. Remove cover (6).
7. Remove oil cooler (7).
8. Remove retainer and O-ring from cylinder block mounting side of oil cooler and take out element from housing.



13P012

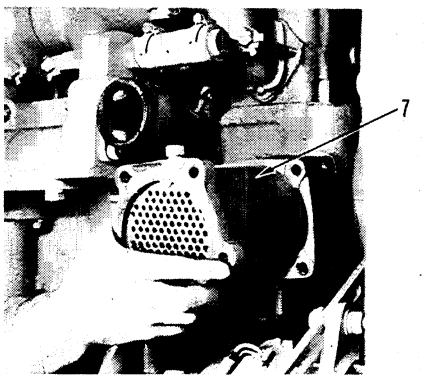


13P013

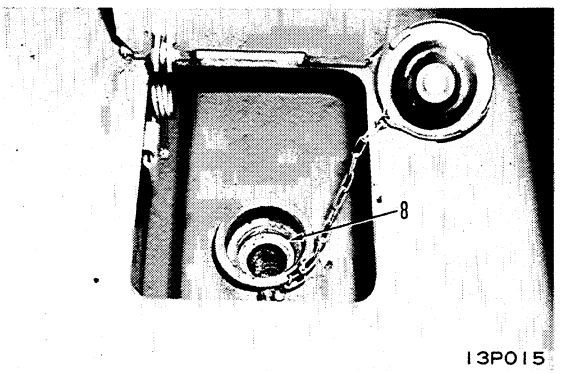
MOUNTING OIL COOLER

GD605A, GD655A, GD605R, GD655R

1. Install O-ring, element, O-ring and retainer on housing from its cylinder block mounting side.
2. Attach gasket and install oil cooler (7).
3. Attach gasket to cover and install cover (6).
4. Attach gasket to joint bolt and connect vacuum pump hose (5) to cooler.
5. Attach gasket to bypass tube and install bypass tube (4).
6. Move hose (3) upward to connect tube and fasten clamp (2).
7. Install L.H. engine side cover.
8. Tighten drain cock and feed water up to the specified level through water filling port (8).
   ★ Start engine to circulate water and recheck water level.



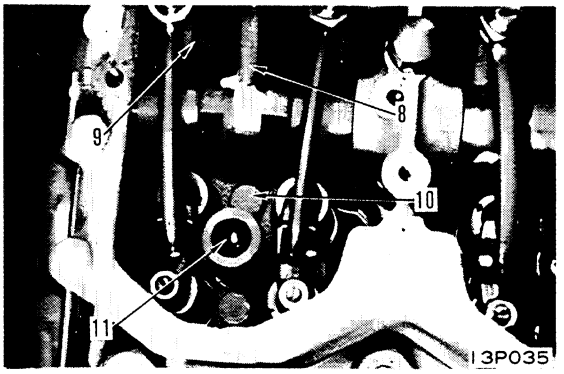
13P014



13P015

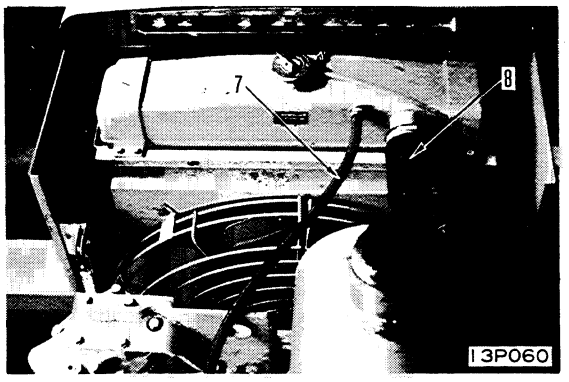
6. **Push rod**
   Loosen lock nut on injector lever (8) to remove adjustment screw, move push rod (9) aside, raise up injector lever.

7. **Injector**
   Remove bolt, remove injector (11).
   ★ Be careful so that a plunger does not come out when reversing an injector.

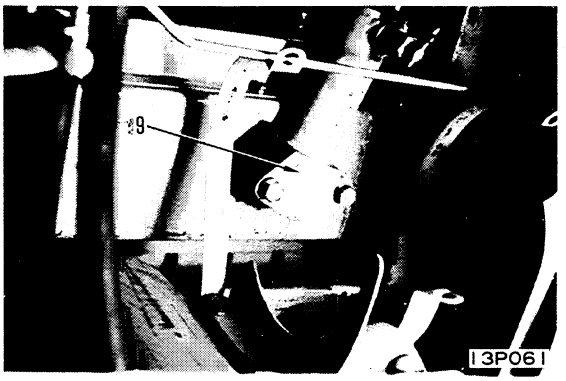


5. **Aeration hose**
   Disconnect aeration hose (7).

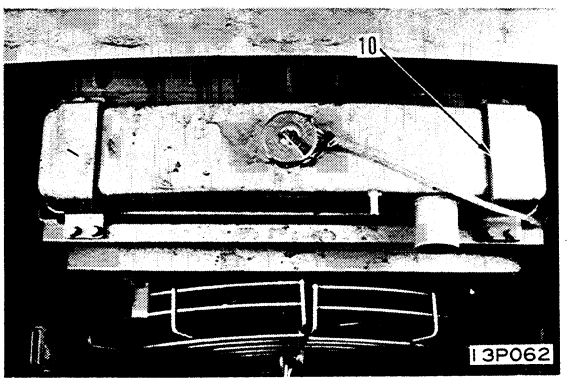
6. **Radiator inlet hose**
   Disconnect radiator inlet hose (8).

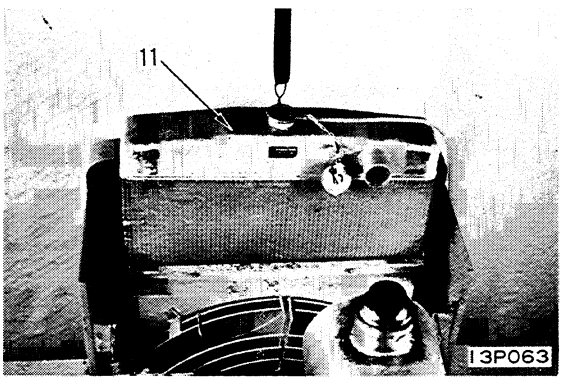


7. **Radiator outlet tube**
   Disconnect radiator outlet tube (9).



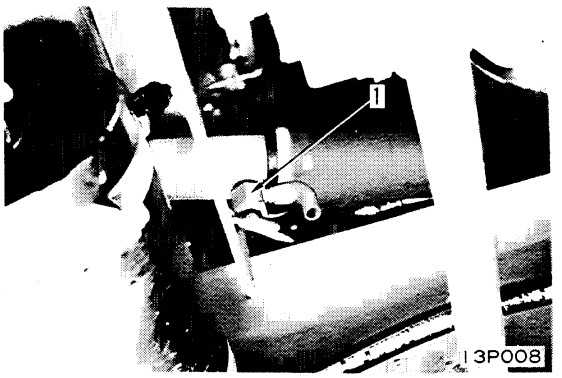
8. **Radiator**
   Remove fastening band (10), sling and remove radiator (11).
   kg Radiator: 53kg



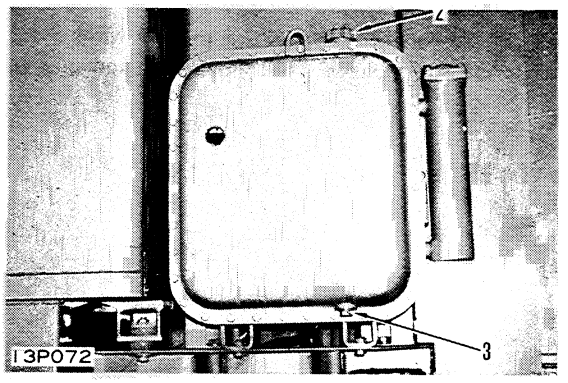


⚠ Disconnect negative terminals from battery.

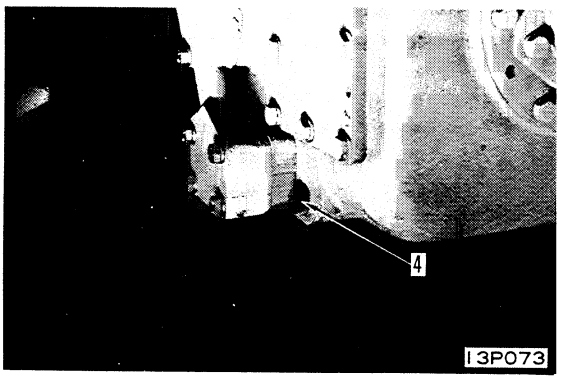
1. **Draining coolant**
   Loosen drain cock (1) to drain coolant.
   ★ If antifreeze solution is used, handle coolant with care as chemicals and do not discharge thoughtlessly.



2. **Draining oil from hydraulic tank and transmission**
   ⚠ Loosen oil filler cap (2) to remove residual pressure from tank.
   1) Remove drain plug (3) to drain oil from hydraulic tank.
      Hydraulic tank: Approx. 27ℓ



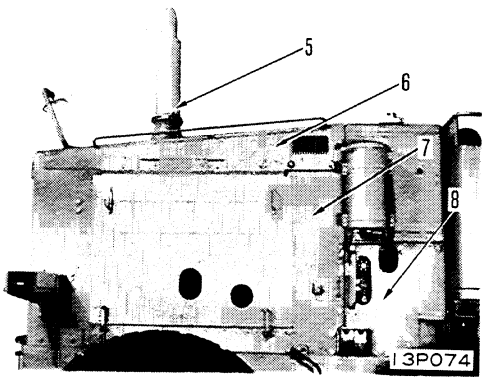
   2) Remove drain plug (4) to drain oil from transmission case.
      Transmission case: Approx. 30ℓ



3. **Engine side cover**
   Remove L.H. and R.H. engine side covers.

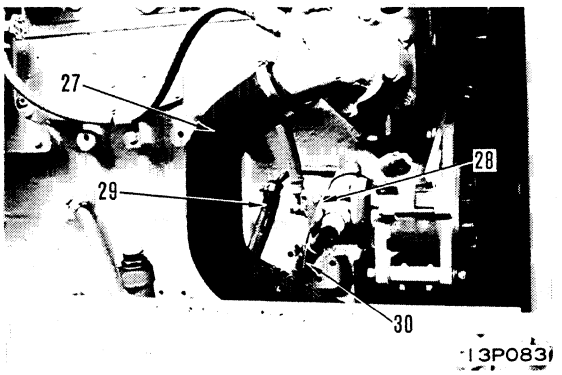
4. **Exhaust pipe, Hood**
   1) Remove exhaust pipe (5).
   2) Sling and remove hood (6).

5. **Cover**
   1) Remove L.H. and R.H. covers (7).
   2) Remove cover (8).



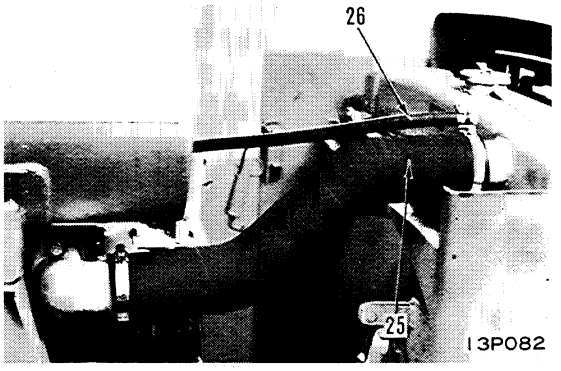
12. Piping, Wiring

1) Attach gaskets to both sides of joint bolt and connect tube (30).
2) Connect tube (29) and fasten it with clamp.
3) Connect ground wire (28).



13. Radiator piping

1) Connect radiator outlet hose (27).
2) Install aeration hose (26) and fasten it with clamp.
3) Install radiator inlet hose (25) and fasten it with clamp.

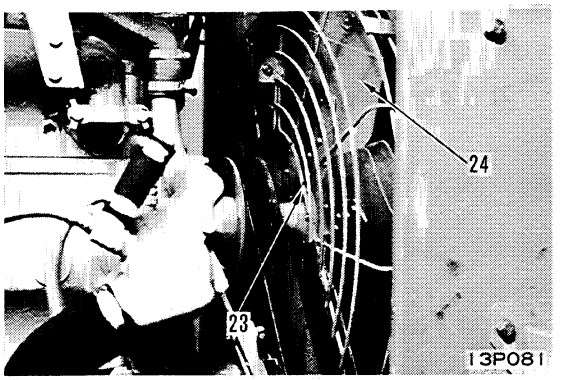


14. Fan

Install fan (24).

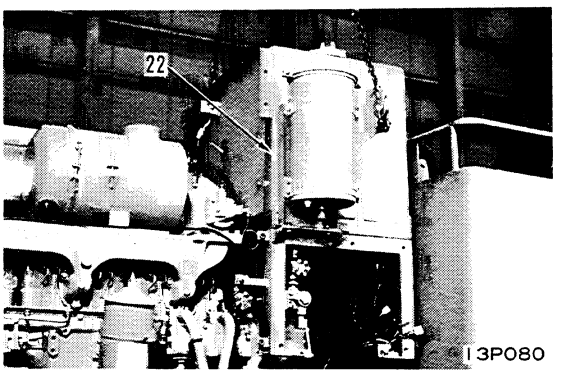
15. Fan guard

Install fan guard (23).



16. Fuel tank and frame assembly

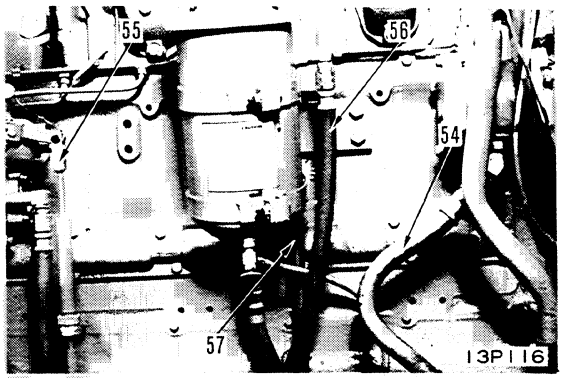
Sling fuel tank and frame assembly (22) into place and tighten R.H. and L.H. mounting bolts.



25. **Steering outlet hose**
Disconnect steering pump outlet hose (54).

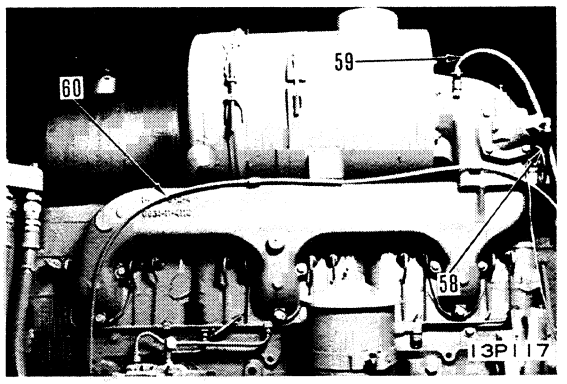
26. **Fuel control rod**
Disconnect fuel control rod (55).

27. **Fuel hose**
1) Disconnect fuel hose (56).
2) Disconnect fuel drain hose (57).

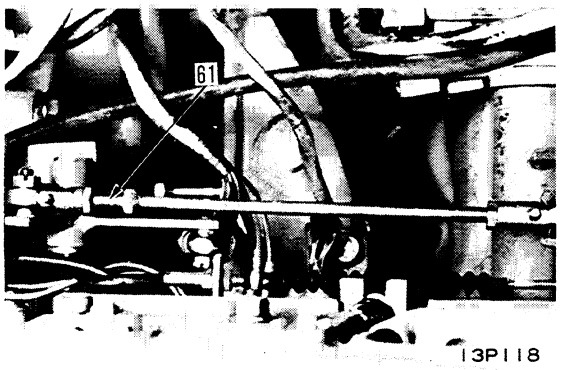


28. **Glow plug tube**
Disconnect glow plug tube (58).

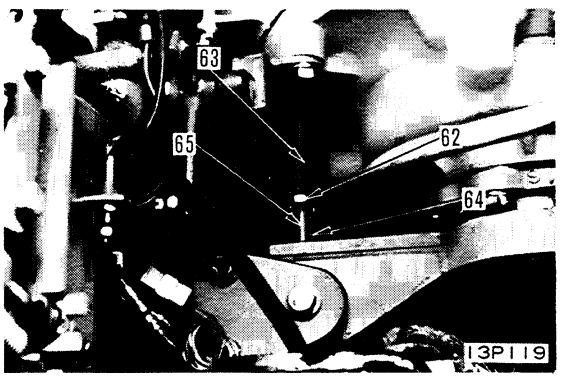
29. **Dust indicator hose, Tachometer cable**
1) Disconnect dust indicator hose (59).
2) Disconnect engine tachometer cable (60).



30. **Transmission control rod**
Disconnect control rod (61).

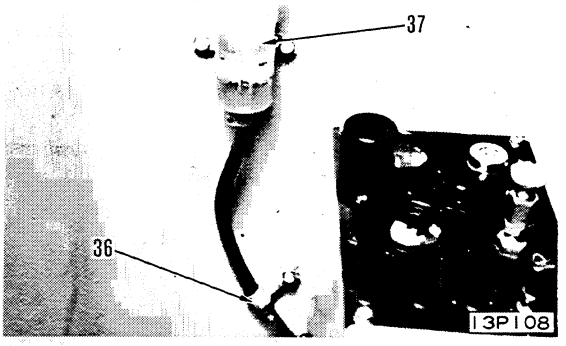


31. **F-R cable, Inching cable**
1) Loosen lock nut (62).
2) Remove coupling (63) and disconnect inching cable (64) and F-R cable (65).



24. Brake oil tank

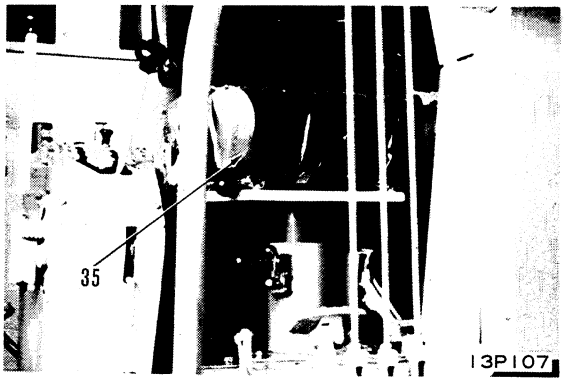
Install brake oil tank (37) and fasten hose with clamp (36).



25. Operator's seat

Sling and install operator's seat (35).

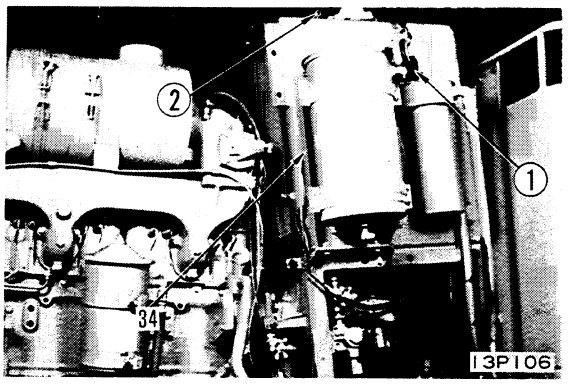
kg Operator's seat: 35kg



26. Fuel tank and frame assembly

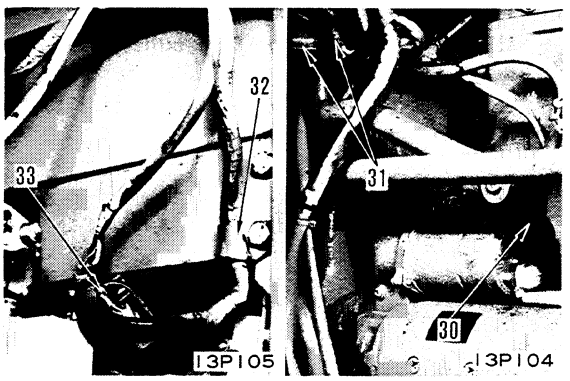
Screw in eye bolts ① (10mm, P = 1.5) and ② (12mm, P = 1.75), sling and install fuel tank and frame assembly (34) together with plate as an assembly.

kg Fuel tank and frame assembly: 200kg

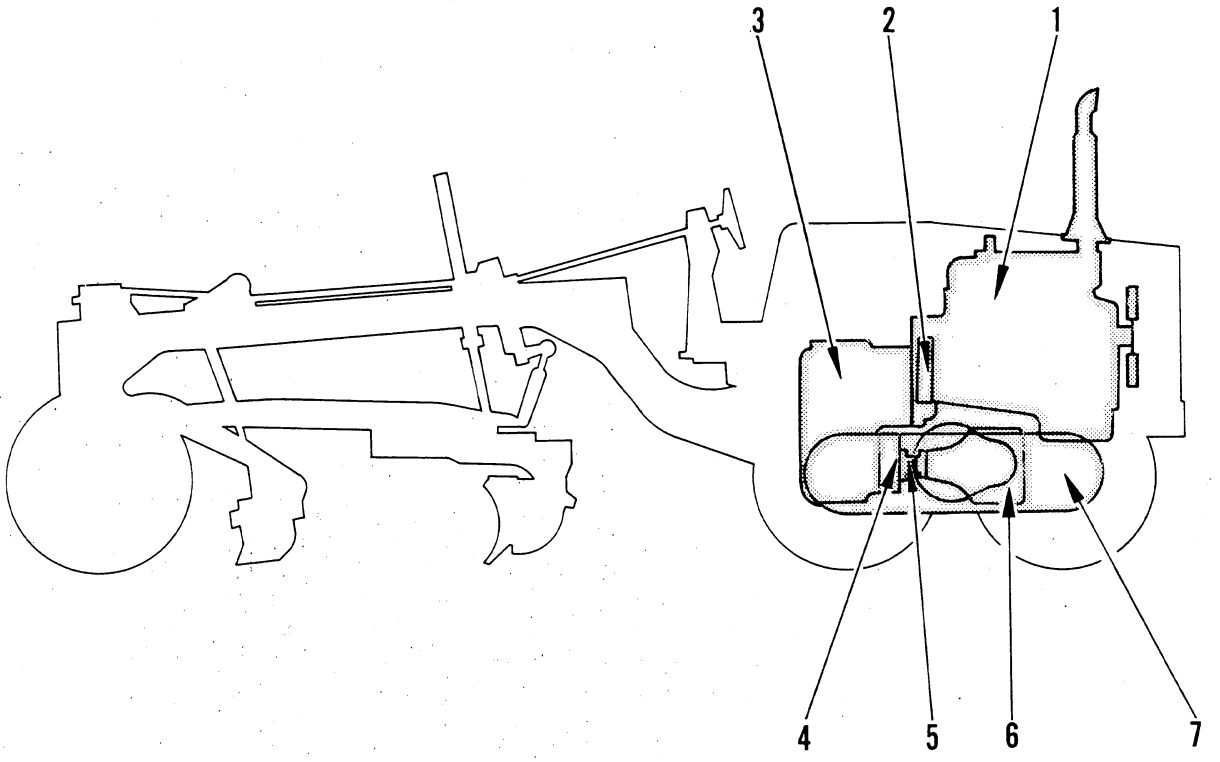


27. Wiring

1) Connect wire (33) to connector and fasten it with clamp (32).
2) Connect wire (31) to connector.
3) Connect starting motor wiring (30).



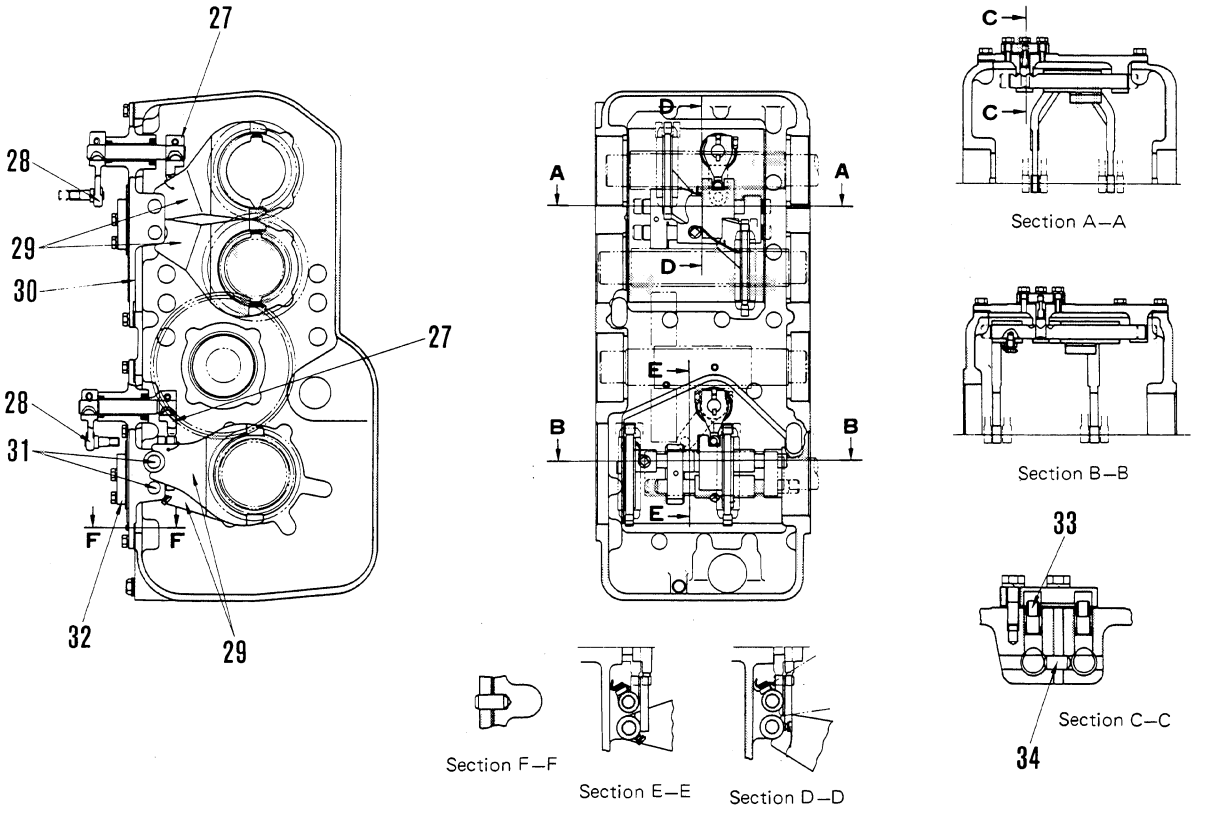
GD605A, GD655A, GD605R, GD655R



21F002

The power from diesel engine (1) is transmitted to the HYDROSHIFT transmission (3) through the damper (2). In the HYDROSHIFT transmission, in response to the load and the forward-reverse rotation direction, the clutch is selected and the power is transmitted to the final drive (6) through the universal joint (5).
Here, the power is separated into left and right perpendicular directions and transmitted to the tandem drive (7) through the rear axle.
The tandem drive transmits the power to the wheel by a chain and the machine travels.

1. Engine
2. Damper
3. HYDROSHIFT transmission
4. Parking brake
5. Universal joint
6. Fianl drive
7. Tandem drive



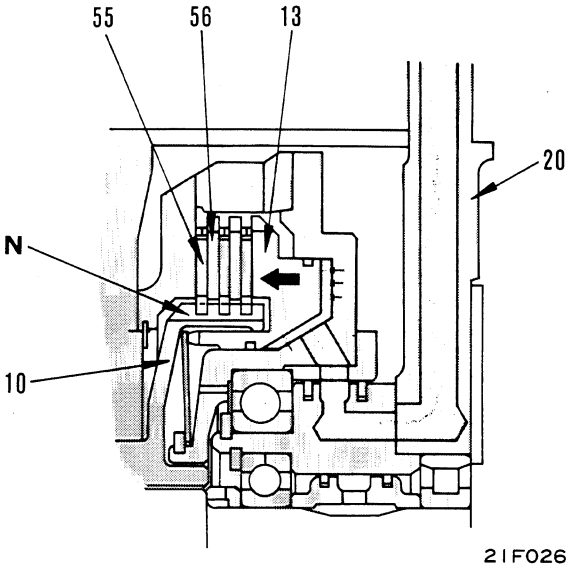
1. Intermediate 2nd shaft
2. 4th speed gear (41 teeth)
3. Gear
4. Shifter (dog) gear
5. 3rd speed gear (34 teeth)
6. Input (first) shaft
7. Coupling
8. 1st speed gear (45 teeth)
9. 2nd speed gear (39 teeth)
10. Intermediate 3rd shaft
11. Reverse gear
12. Output (5th) shaft
13. Coupling
14. Speedometer gear
15. Intermediate 4th shaft
16. Low speed gear
17. High speed gear
18. Speedometer gear
19. Cage
20. Front support
21. Shim
22. Oil level plug
23. Breather
24. Oil filler
25. Transmission case
26. Rear support
27. Shifter lever (IN)
28. Shifter lever (OUT)
29. Shifter fork
30. Cover
31. Shifter shaft
32. Cover
33. Detent
34. Interlock

1st CLUTCH

A revolving clutch is used for 1st clutch.

Clutch **"ENGAGED"** (Fixed)

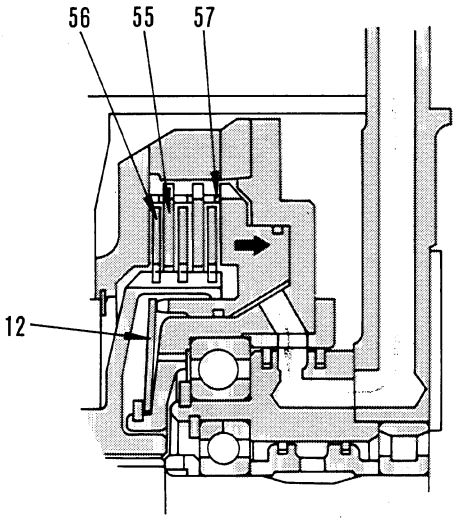
Hydraulic oil from the control valve goes to the back of the piston (13) through the port of the cage (20).
The piston force-presses disk (55) and plate (56).
The clutch is engaged by meshing the internal teeth of the disk and the external teeth of the gear **N** and the external teeth of the plate and the internal teeth of the drum (2nd carrier, (10)).
The gear and drum become one unit and revolve.



21F026

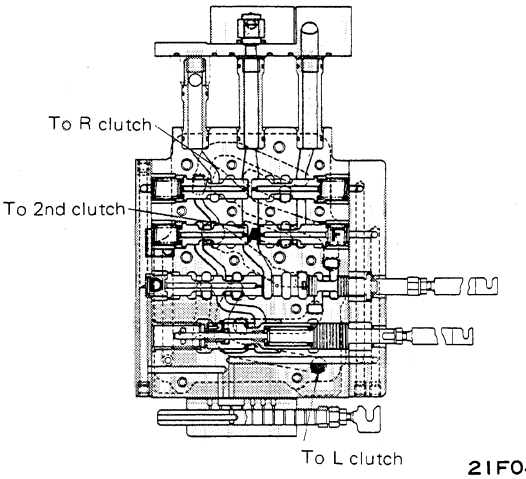
Clutch **"DISENGAGED"** (Released)

When the hydraulic oil from the control valve is interrupted the piston is returned by the disk spring (12). On the other hand, when the piston is returned to its original position, and the clutch is disengaged, the wave spring (57) between plates (56) separates plate and disk (55) completely, and prevents drag rotation.



21F027

4. **At reverse 2nd speed**
   Because the back pressure side of the shift valve (2nd), (H.L) is connected to the drain circuit, a difference in pressure arises between the A-chamber and D-chamber, and the A-chamber and F-chamber. The H.L spool is pushed to the left and the 2nd spool is pushed to the right. Since the F.R spool is set in the R position, the oil from the pump is led to the 2nd, L, R clutch.



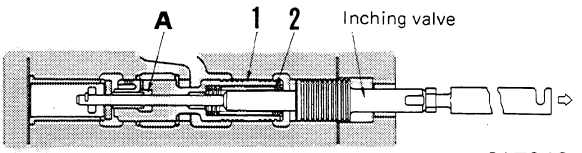
21F042

At other forward 2nd speed ~ 5th speed and reverse 1st speed and 3rd speed ~ 6th speed occur according to combinations in the above items 2 ~ 4. The combinations are as follows:

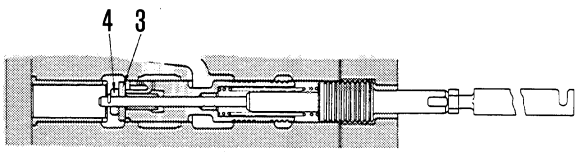
Forward 2nd speed:	2nd, L, F
Forward 3rd speed:	3rd, L, F
Forward 4th speed:	1st, H, F
Forward 5th speed:	2nd, H, F
Forward 6th speed:	3rd, H, F
Reverse 1st speed:	1st, L, R
Reverse 3rd speed:	3rd, L, R
Reverse 4th speed:	1st, H, R
Reverse 5th speed:	2nd, H, R
Reverse 6th speed:	3rd, H, R

INCHING VALVE

When the inching pedal is depressed, the inching valve moves in the direction ⇨ (right). At first because oil pressure force of chamber **A** is larger than spring force (2), the valve moves right.
Then port of "F" or "R" begins to close, because oil pressure is released spool (1) moves left by spring force. This state keeps until the washer (3) reaches the stopper (4) (Oil pressure of chamber **A** continues releasing.)
When the washer reaches the stopper, the spool moves right with the washer. Oil port of "F" or "R" clutch opens to drain circuit.



21F043

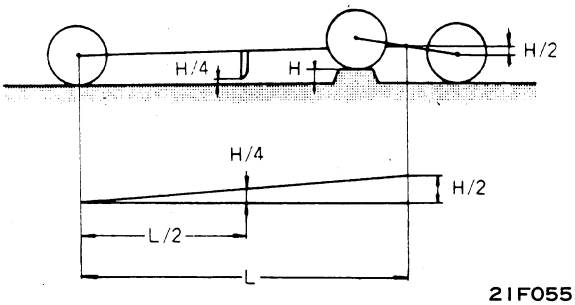


21F044

Power from the final drive is transmitted to the front and back rear wheels by chain.
The tandem cases (12) can swing up and down 13° each. All four rear wheels are in contact with the ground even when the ground is rough restricting the up-and-down movement of the blade to a minimum.

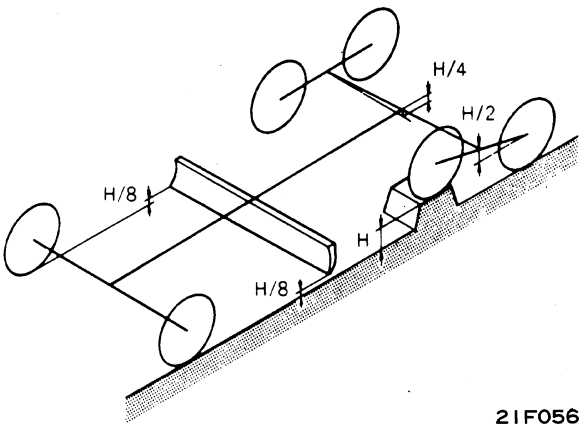
The movement of the blade of a motor grader when its rear wheels ride over an obstacle is as follows:

1. When both left and right wheels ride over on object (height: H) at the same time, the center of the rear axle rise H/2 as right figure shows, and because the blade is situated about halfway between the front and rear axles, its movement further becomes H/4.



21F055

2. When only one left rear wheel rides over an object (height: H), the rise at the center of rear axle is H/2 at its left end as right figure shows and H/4 at the center line of machine and on the real axle.
The movement of the center part of the blade is half of that, which is H/8.



21F056

Driving force is transmitted from the final drive sprocket to sprocket (6) throgh the chain (3).
Hub (11) and rear wheel shaft (5) are joined by taper selation.
Shim (4) is for adjusting preload of bearing (10).
Cover (7) is the lubircating oil resevoir for bearing (10).
The chain can be changed by removing covers (1), (13).
Oil level of all machines other than those with wet type brakes is checked at plug (16), and of those with wet type brakes at plug (17). Plug (14) is used for replenishment of oil. It is quicker to remove cover (13) for oil changes, etc.

5. Time lag is excessive when starting the machine or shifting transmission speed.

☞ Check the following before diagnosis:
- Check the oil level in the transmission case.
- Check for oil leakage from pipe or valve linkages.
- Check functioning of the control valve.

▲ Refer to the table of criteria and check whether the time lag for the machine is really excessive.

No.	Diagnosis \ Causes / Remedy	a Clogged strainer	b Pump intake sucking air	c Fault pump	d Fatigued modulating valve or malfunctioning valve spool	e Clogged quick return valve nozzle	f Malfunctioning quick return valve spool	g Transmission clutch seal ring groove defective	h Faulty rotating clutch (Insufficient oil sealing)	i Defective rotating clutch seal
		C	Δ	X	Δ X	Δ	Δ X	X	X	X
1	Noisey pump or filter	○		○						
2	Long time lag for every transmission speed	○		○	○	○	○			
3	Machine starts normally at a specific transmission speed							○		
4	Long time lag especially at F_1, F_4, R_1 and R_4 speeds								○	○
5	Low modulation pressure at every transmission speeds	○		○	○		○	○		
6	Pressure gauge pointer defects largely and unsteadily.	○		○						

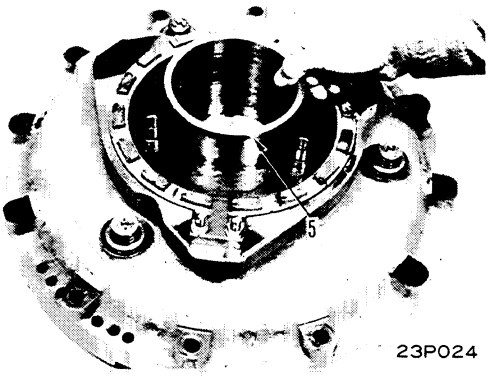
Diagnosis No.	Testing implements
5, 6	Hydraulic tester

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

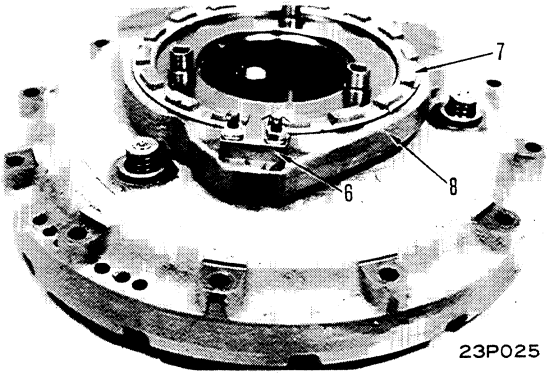
X: Replace Δ: Repair
A: Adjust C: Clean

MOUNTING CLUTCH 

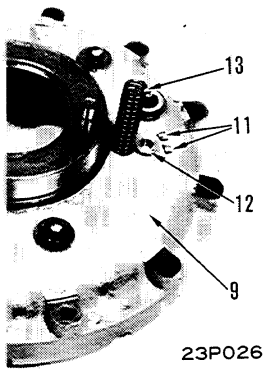
3. **Guide**
   Remove guide (5).

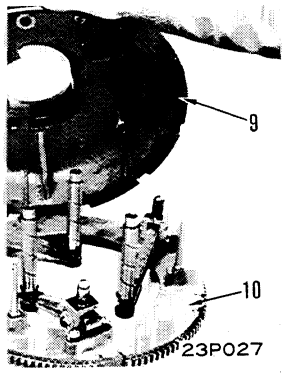


4. **Ring**
   1) Remove nut, remove lock (6).
   2) Remove adjustment nut (7).
   3) Put match mark to ring (8) and cover before removing them.
      ★ Match mark is for bringing lock position right below when lock is installed.



5. **Cover**
   1) Put match mark to cover (9) and pressure plate (10).
      ⚠ Be careful since guide is applied 29.5kg spring tension.
   2) Compress spring and remove collar (11), guide (12) and spring (13).
   3) Remove cover (9).

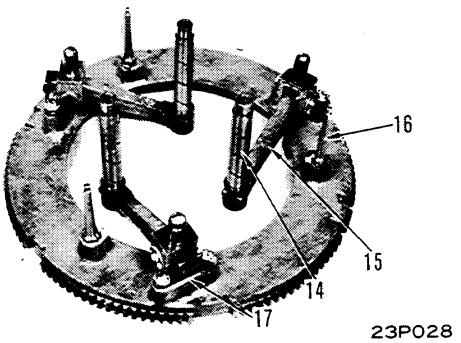




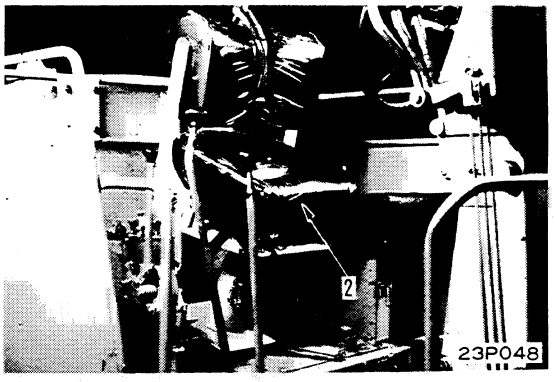
6. **Rod, Lever**
   Remove rod (14) and lever (15).

7. **Guide**
   Remove guide (16).

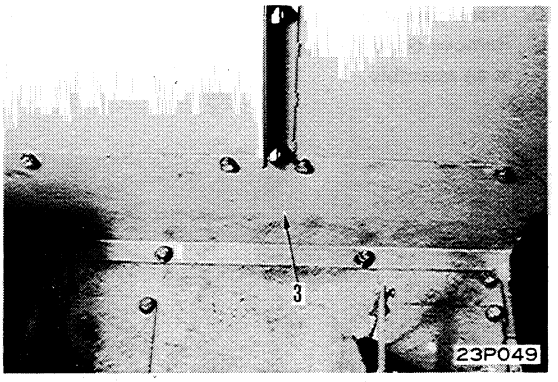
8. **Seat**
   Remove seat (17).



2. **Operator's seat**
Sling and remove operator's seat (2).
kg Operator's seat: 35kg

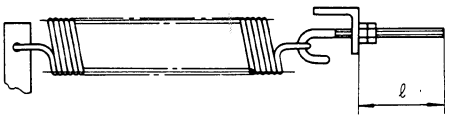


3. **Cover**
Remove cover (3).

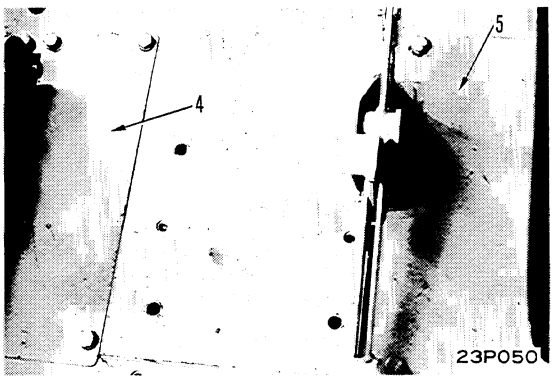


4. **Plate**
Remove plates (4) and (5).

5. **Spring**
Measure installed length of springs (6) and (7). Loosen lock nut and remove springs.

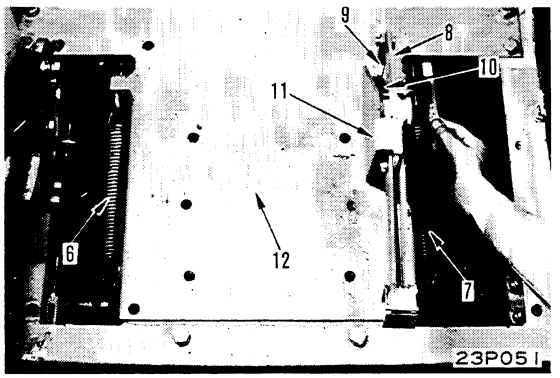


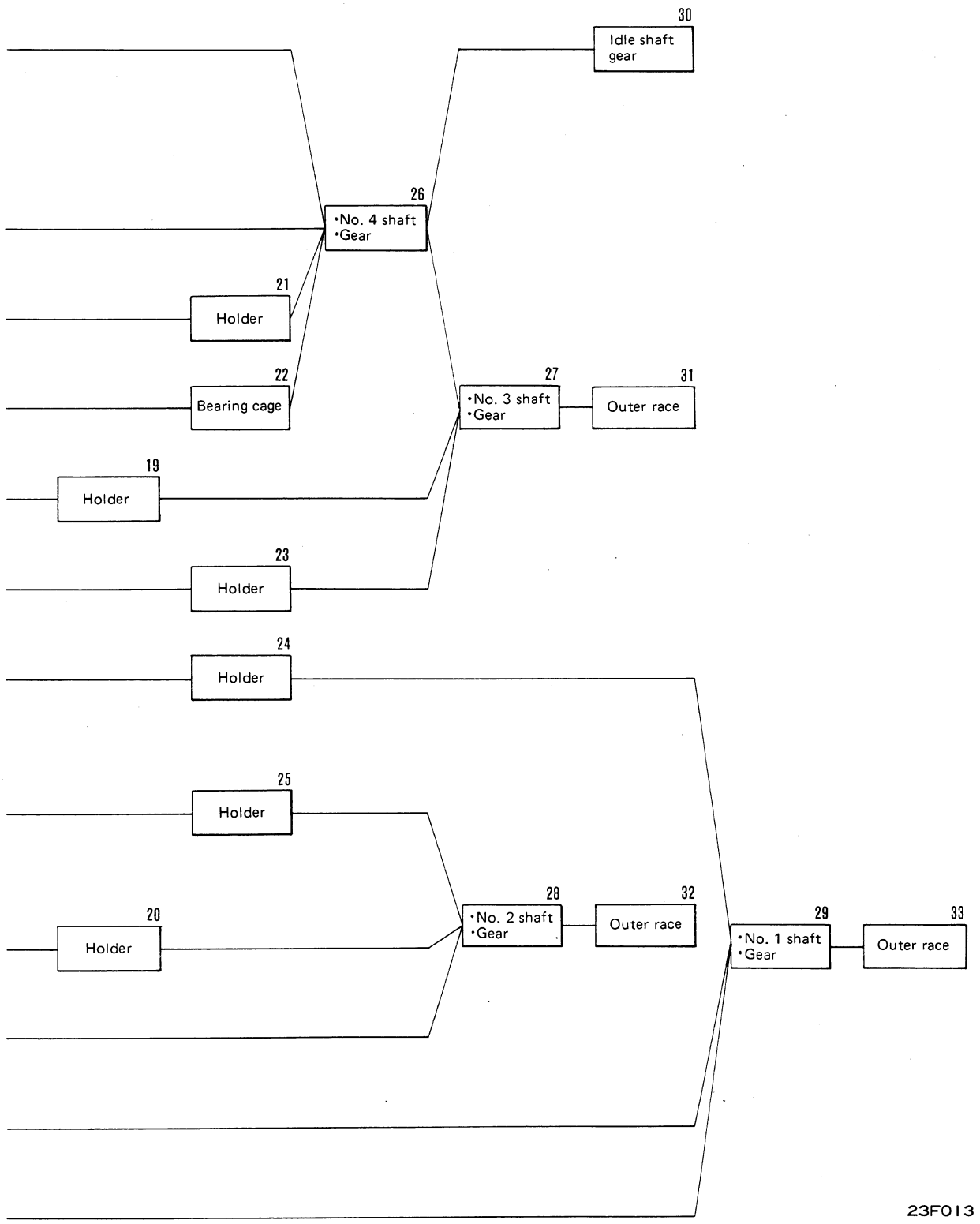
23F010



6. **Compression release bracket**
1) Disconnect compression release wire (9) from lever (8) and loosen lock nut (10).
2) Remove compression release bracket (11).

7. **Plate**
Remove plate (12).





★ Transmission shafts are called No. 1, No. 2, No. 3 and No. 4 from input slide, and front and rear when they are mounted on machine.

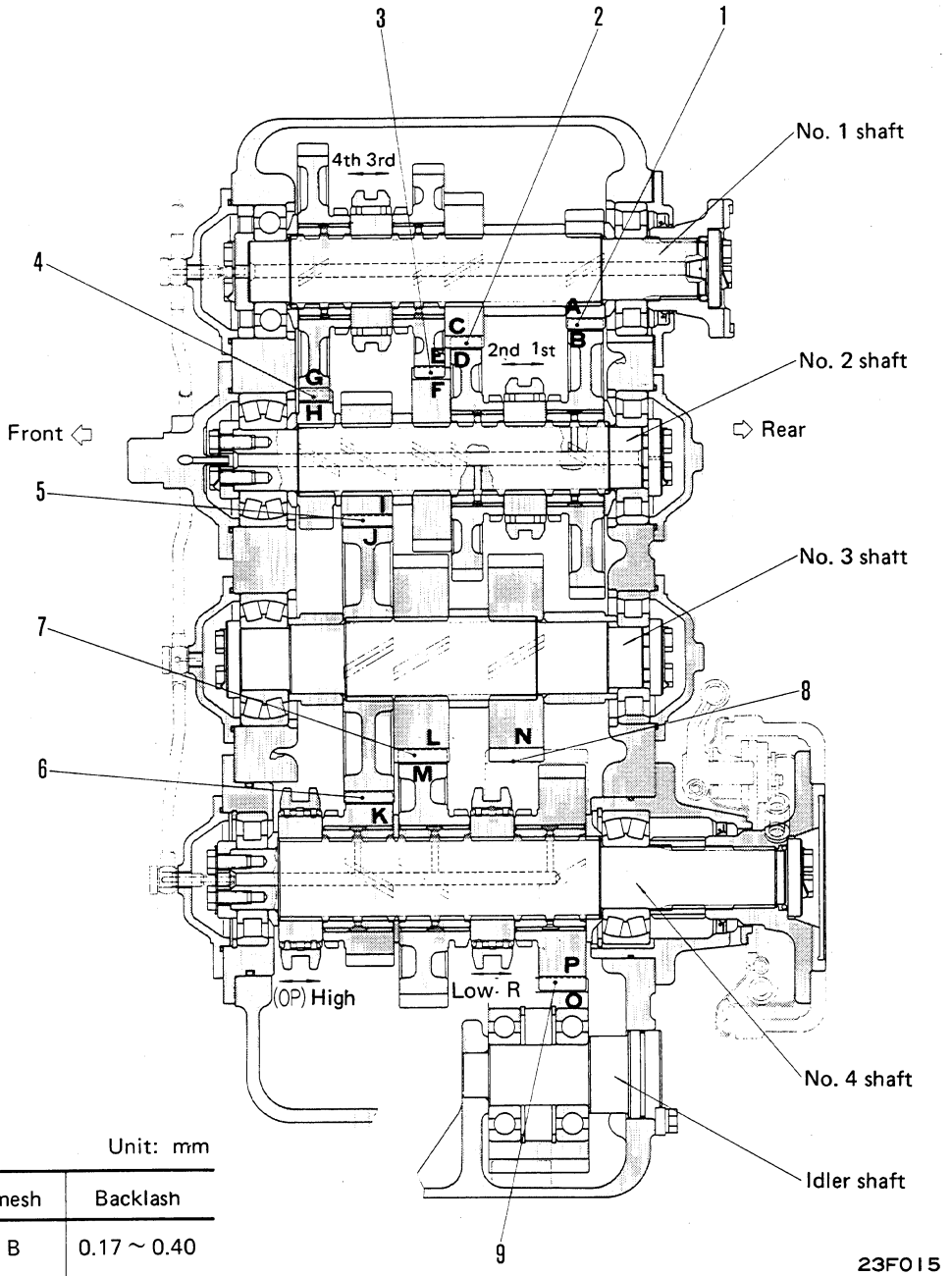
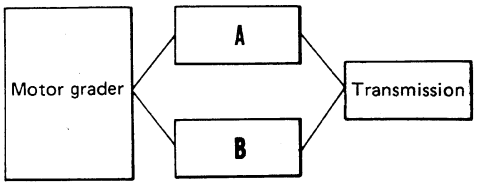
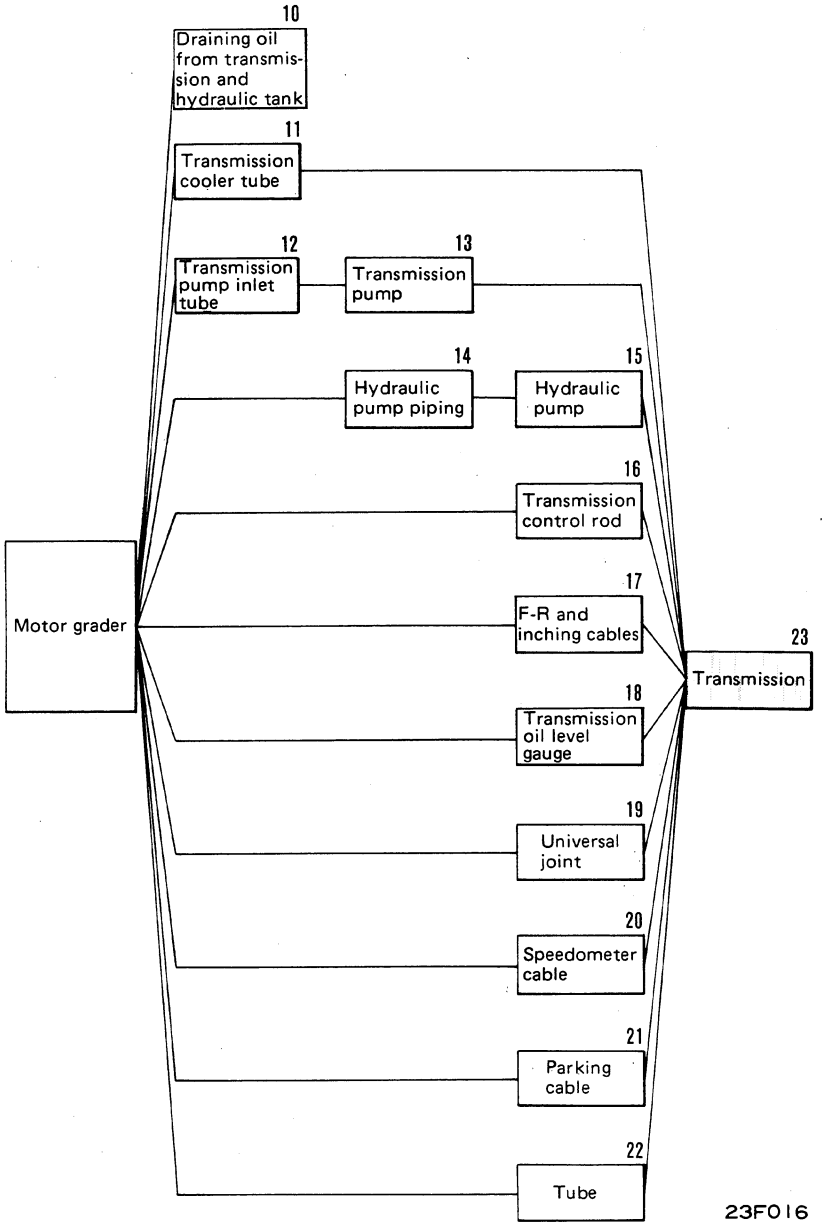


Fig. 1

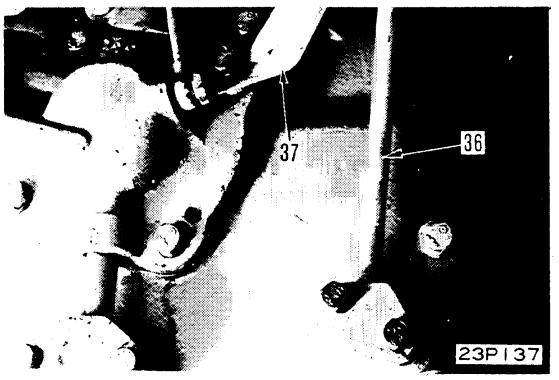
Unit: mm

No.	Gear mesh	Backlash
1	A – B	0.17 ~ 0.40
2	C – D	0.18 ~ 0.42
3	E – F	0.17 ~ 0.39
4	G – H	0.18 ~ 0.42
5	I – J	0.18 ~ 0.42
6	J – K	0.18 ~ 0.42
7	L – M	0.2 ~ 0.44
8	N – O	0.19 ~ 0.41
9	O – P	0.19 ~ 0.41

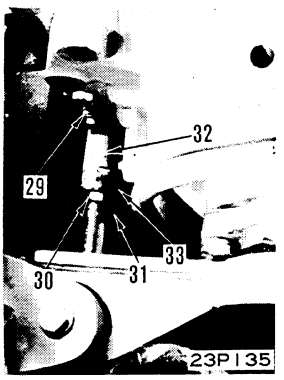

Motor grader
A
B
Transmission


10
Draining oil from transmission and hydraulic tank
11
Transmission cooler tube
12
Transmission pump inlet tube
13
Transmission pump
14
Hydraulic pump piping
15
Hydraulic pump
16
Transmission control rod
17
F-R and inching cables
18
Transmission oil level gauge
19
Universal joint
20
Speedometer cable
21
Parking cable
22
Tube
23
Transmission
Motor grader
23F016

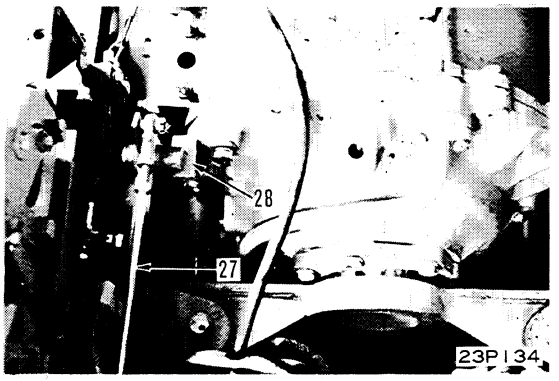
6. **Transmission oil level gauge**
Install transmission oil level gauge (36) with bracket (37) installed.
★ Bracket mounting bolts are also used for mountig cage.



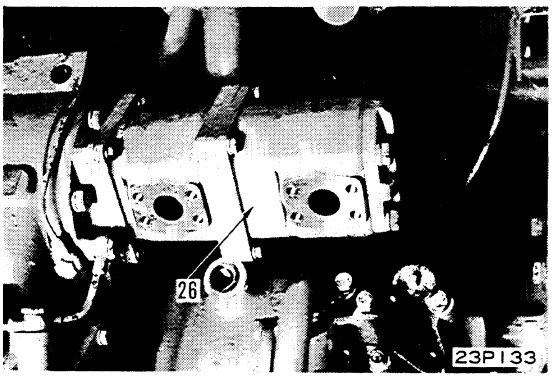
7. **F—R and inching cables**
1) Connect F—R cable (34) and inching cable (35) to yoke of spool.
2) Fit O-rings, connect couplings (32) and (33) to transmission case, install cover (29).
★ Confirm that F—R cable and inching cable are connected firmly before connecting couplings.
3) Tighten lock nuts (30) and (31) to fix cables.



8. **Transmission control rod**
1) Connect bracket (28) to transmission case.
2) Connect transmission control rod (27) to lever at transmission control valve.
⊕ Bend down cotter pin firmly.

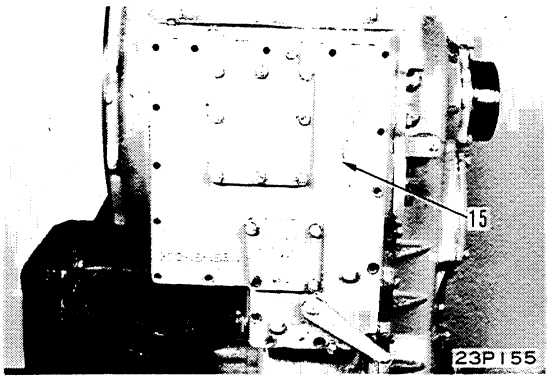


9. **Hydraulic pump**
Fit O-ring and install hydraulic pump (26).



9. Cover

Screw in jack bolt and remove cover (15).



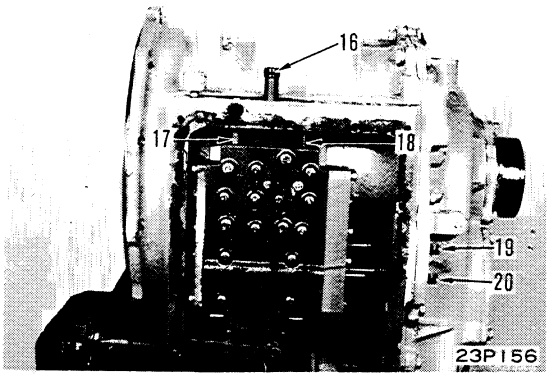
10. Sleeve

Screw in jack bolts (16mm, P = 2.0) and remove sleeves (16), (17) and (18).

★ Since there are two kinds of sleeves, confirm their location before removal.

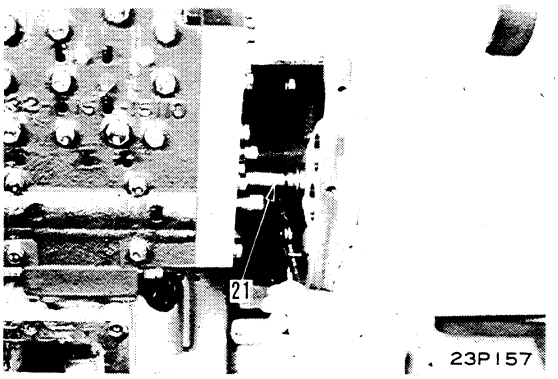
11. Yoke

Loosen lock nut and remove F—R yoke (19) and inching yoke (20) from spool.



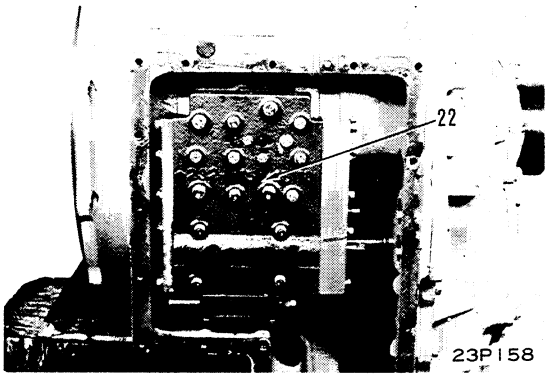
12. Sleeve

Remove snap ring and move sleeve (21) to the right side to disconnect from control valve.



13. Transmission control valve

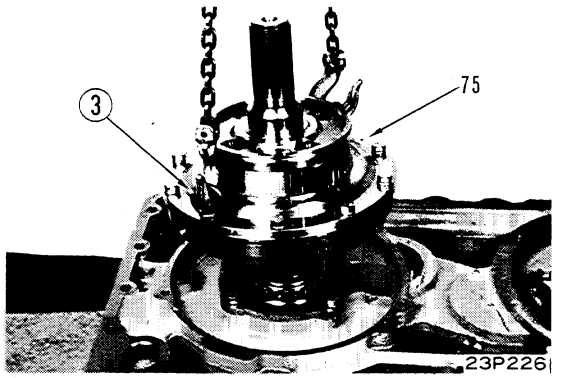
Remove four mounting bolts (10mm) and lift transmission control valve (22) to remove.



ASSEMBLY OF HYDROSHIFT TRANSMISSION 

15. High speed rotary clutch

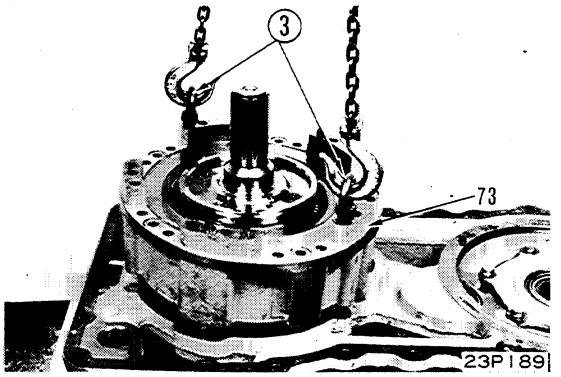
1) Fix transfer case with its mounting face up.
2) Install eye bolts ③ (14mm, P = 2.0). Sling and remove high speed rotary clutch (75).
   kg High rotary clutch: 70kg



16. Housing

Install eye bolts ③ (14mm, P = 2.0). Sling and install housing (73).

kg Housing: 23kg



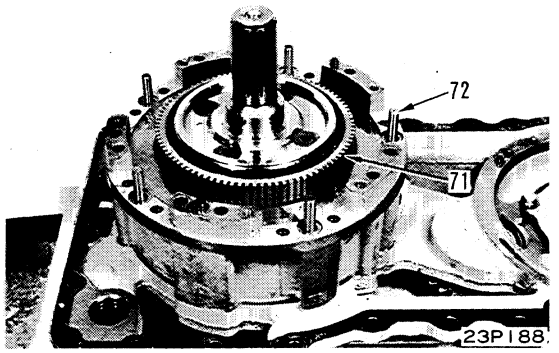
17. Pin

Install pin (72).

18. Low ring gear

Install low ring gear (71).

★ Install ring gear with its recessed inner teeth side up.



19. Spring, Disc, Plate

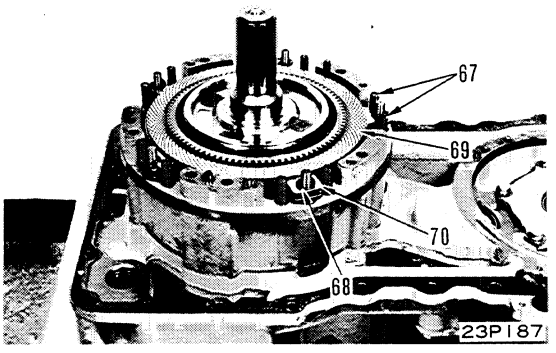
Install spring (68), discs (69) and plates (70).

★ Install discs aligning their notches in the same position.

★ Disc: 3 pcs. Plate: 2 pcs.

20. Spring

Install spring (67).



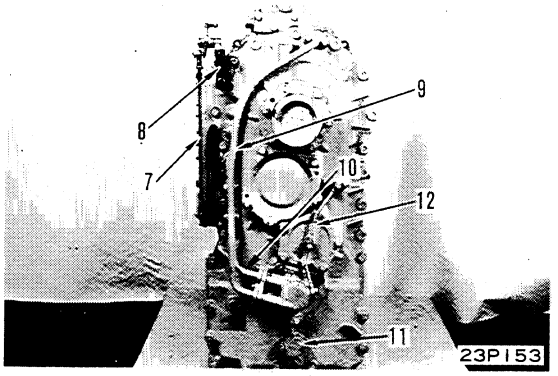
64. Lubricating tube

Attach gaskets to both ends and install lubricating tube (12).

kgm Joint bolt: 11.5 ± 2.5kg.m

65. Piping

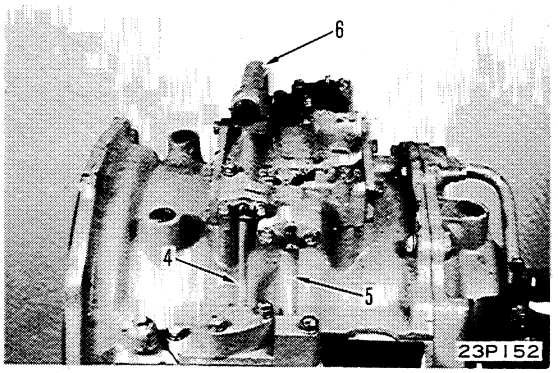
Fit O-rings to both ends and install tubes (9), (10) and (11).



66. Transmission control rod

Fit bracket (8) and connect the transmission control rod (7) on lever (control valve side).

⊕ Bend down cotter pin firmly.



67. Transmission control valve piping

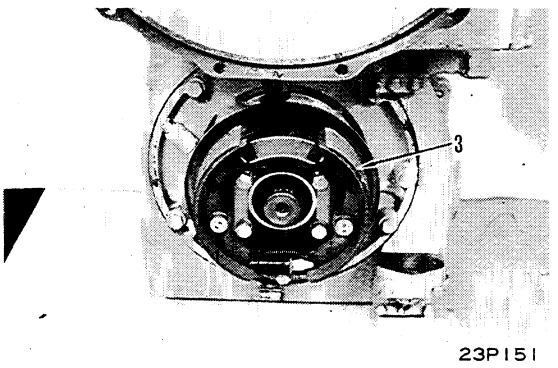
1) Fit O-rings to both ends and install control valve tubes (4) and (5).
   ★ Install strainer in tube (4).
2) Fit O-ring and install control valve tube (6).
   kgm Control valve common tightening bolt: 4.5 ± 1kg.m

68. Parking brake

Install parking brake (3).

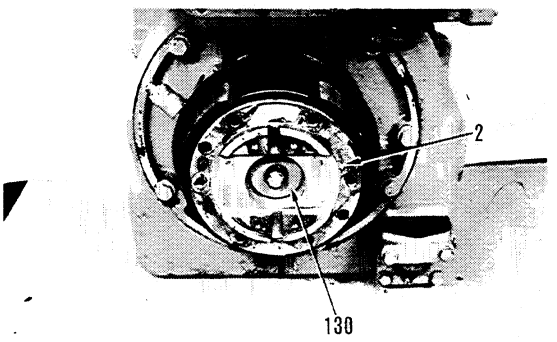
kgm Mounting bolt: 18 ± 2kg.m

★ Bend down lock plate firmly.

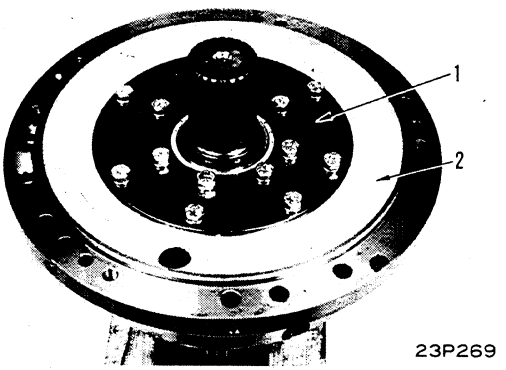


69. Flange

1) Install flange (2) on shaft.
2) Fit O-ring and install holder (130) and tighten center bolt.
   Center bolt: Thread tightener (LT-2)
   kgm Center bolt: 23.5 ± 2.5kg.m

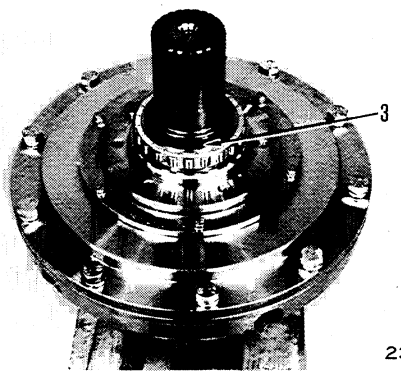


1. **Housing assembly**
   1) Remove plate (1).
   2) Remove housing (2).



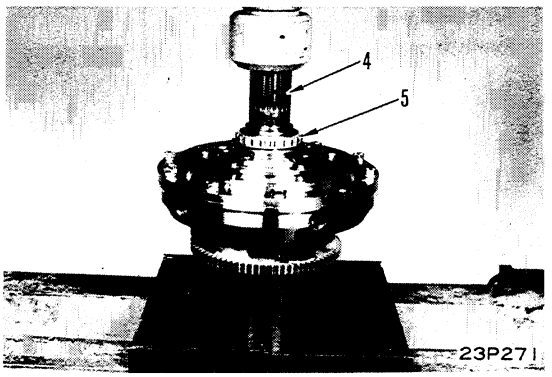
23P269

2. **Snap ring**
   Remove snap ring (3).



23P270

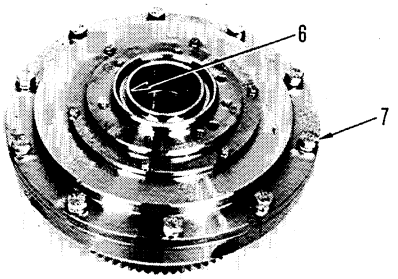
3. **Shaft, Bearing**
   Set shaft (4) and bearing (5) in press and pull out them.



23P271

4. **Collar**
   Pull out collar (6).

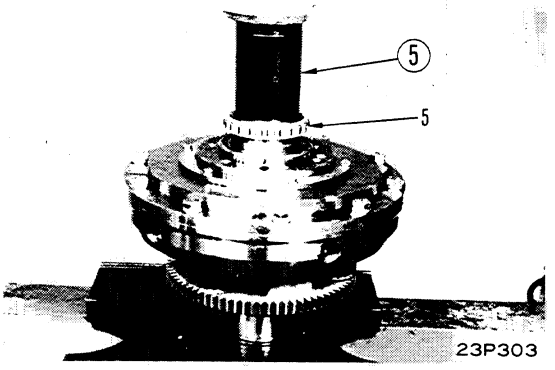
5. **2nd speed carrier assembly**
   1) Remove mounting bolts (7) leaving two bolts unremoved.



23P272

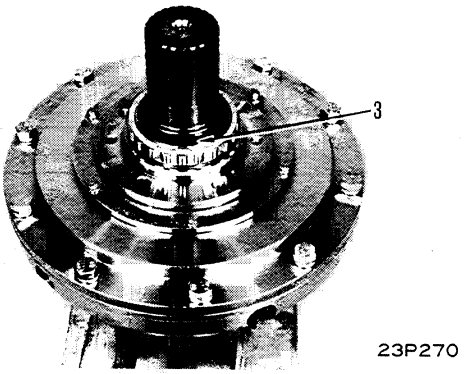
13. Bearing

Using press-fitting tool ⑤ (ϕ76) press-fit bearing (5).



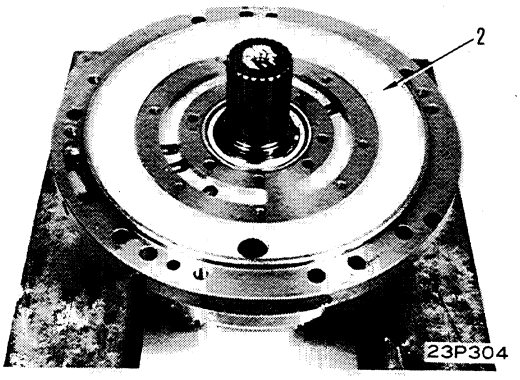
14. Snap ring

Install snap ring (3).



15. Housing assembly

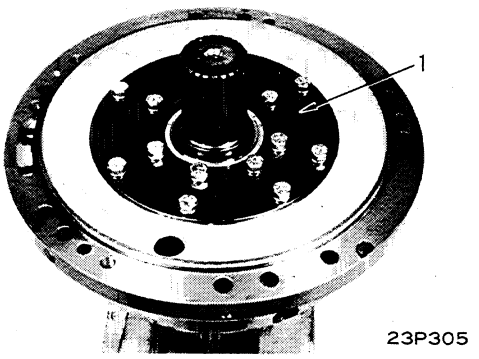
1) Install housing assembly (2).



2) Install plate (1).

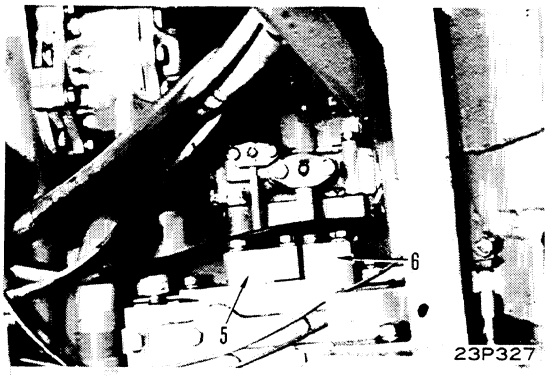
Mounting bolt: Thread tightener (LT-2)

kgm Mounting bolt: 6.5 ± 1.0kg.m

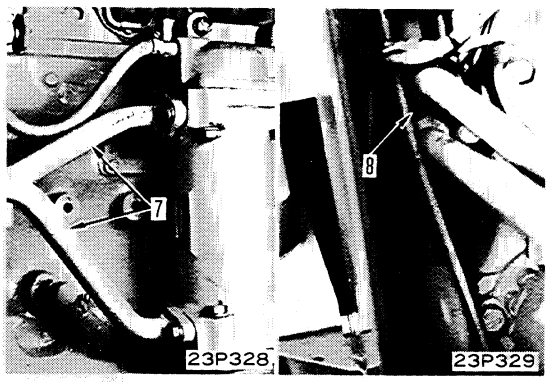


4. **L.H. engine side cover**
   Remove L.H. engine side cover.

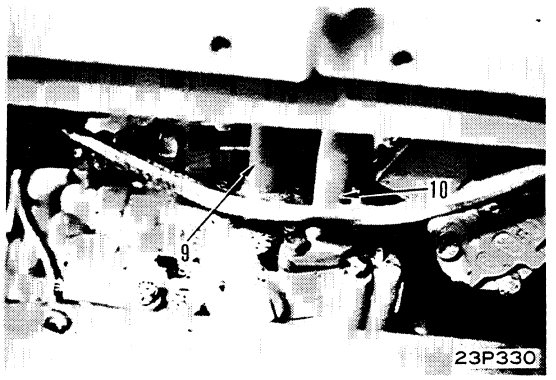
5. **Control valve piping**
   1) Remove control valve tube (5).
      ★ Care should be taken not to allow strainer to fall off, which is installed in tube.
   2) Remove control valve tube (6).



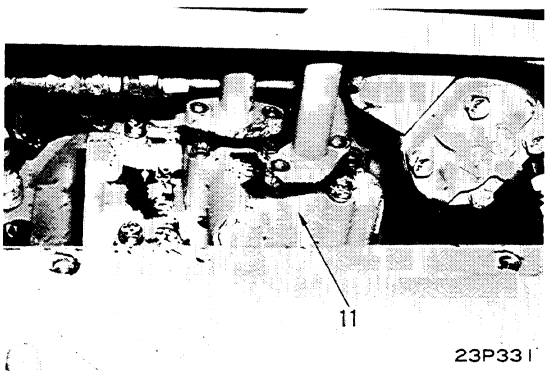
6. **Cooler piping**
   1) Disconnect transmission cooler tube (7) from cooler.
   2) Loosen bolt mounting block (8) connecting cooler tube.
      ★ This work is required for facilitating the next work of disconnecting cooler tubes.



   3) Disconnect cooler bypass valve outlet tube (9) and cooler bypass valve inlet tube (10) from cooler bypass valve.

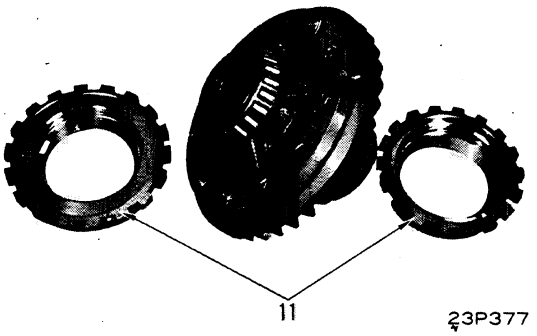


7. **Cooler bypass valve assembly**
   Remove cooler bypass valve assembly (11).

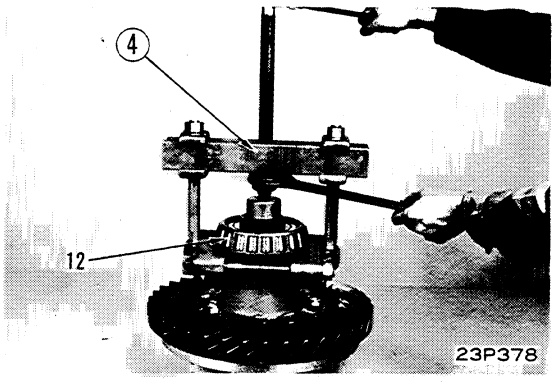


DISASSEMBLY OF BEVEL PINION

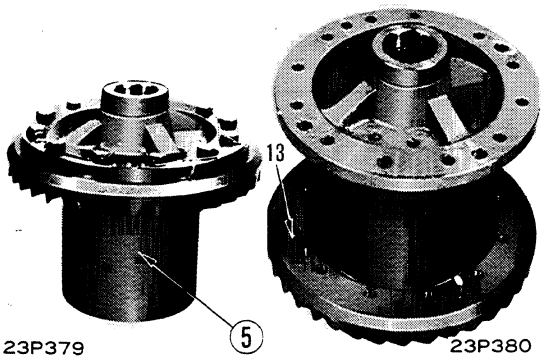
9. **Joint side and retainer side cage assembly**
   Remove joint side and retainer side cages (11) from bevel gear assembly.



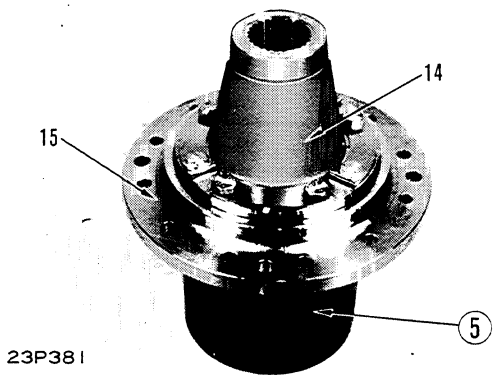
10. **Joint side and retainer side bearings**
    Using bearing separator ④ take out joint side and retainer side bearings (12).



11. **Bevel gear**
    1) Place bevel gear, with its joint side down, on stand ⑤ (ϕ200).
    2) Remove bolt and remove bevel gear (13).

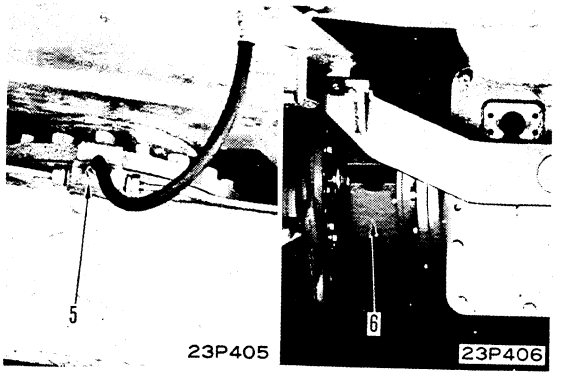


12. **Joint**
    1) Place joint, with its retainer side down, on stand ⑤ (ϕ200).
    2) Remove bolt and separate joint (14) and retainer (15).

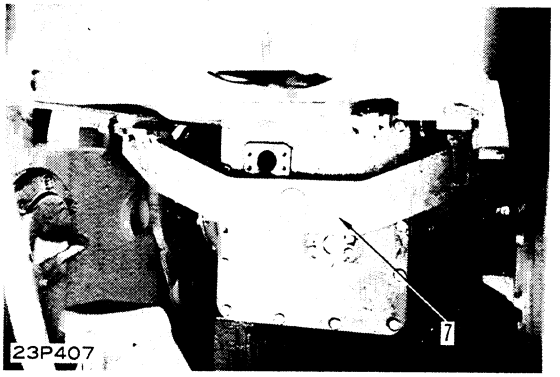


5. **L.H. and R.H. joints**
   Remove L.H. and R.H. brake oil joints (5).

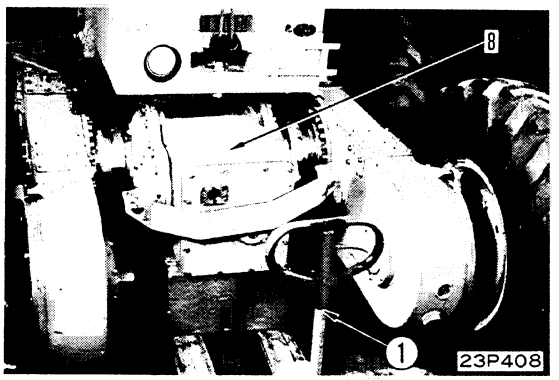
6. **L.H. and R.H. caps**
   Remove L.H. and R.H. caps (6).
   kg Cap (one): 30kg



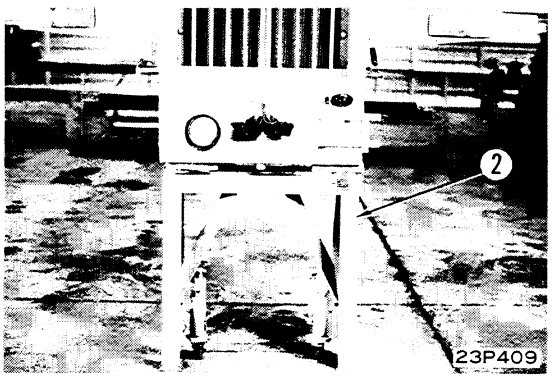
7. **Hanger**
   Remove bolt and remove hanger (7) from frame.



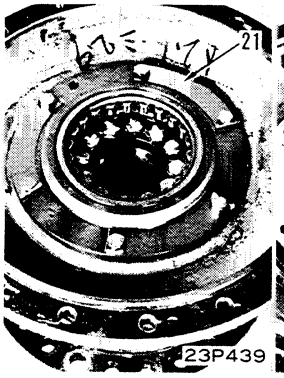
8. **Tandem and final drive assembly**
   1) Holding final drive case bottom with garage jack ① , sling and disconnect machine body from frame.
   2) Remove tandem and final drive assembly (8) rearward while rotating wheel.
      kg Tandem and final drive assembly: 3.5 tons

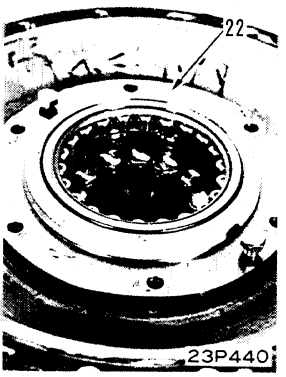


   3) After removing tandem and final drive assembly, support machine body with block ② .

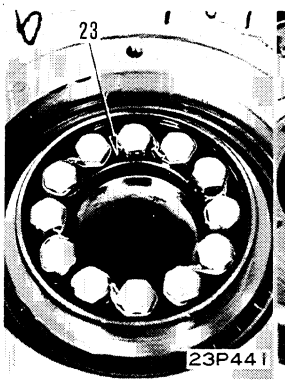


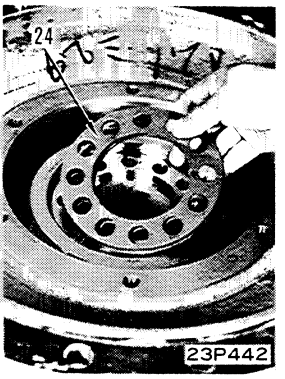
13. **Bearing cage**
    1) Remove lock (21).
    2) Screw in jack bolt and remove bearing cage (22).
    3) After removing cage, remove bearing.



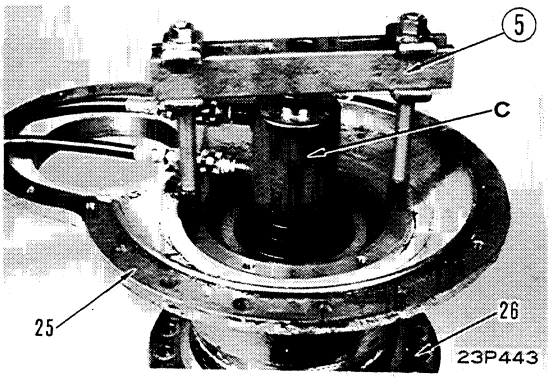


14. **Holder, Shim**
    1) Remove lock and remove holder (23).
    2) Remove shims (24).



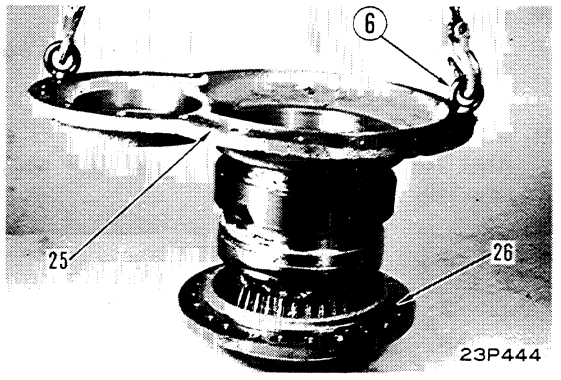


15. **Housing assembly**
    1) Using tool **C** and push-puller ⑤ separate housing assembly (25) from joint (26).
       ★ When pulling out housing, pull out bearing at the same time.



    2) Install eye bolts ⑥ (16mm, P = 2.0) and remove housing assembly.
       kg Housing assembly: 80kg

    3) After removing housing assembly, remove upper and lower outer races.

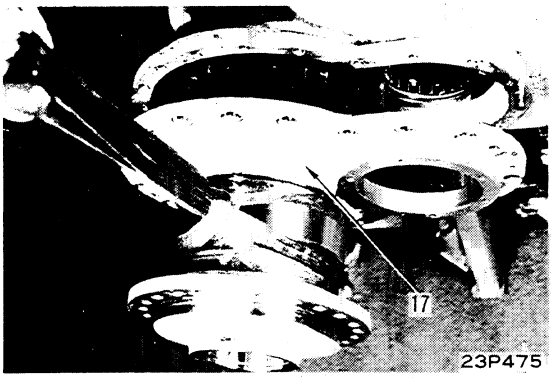


15. Final drive cover assembly

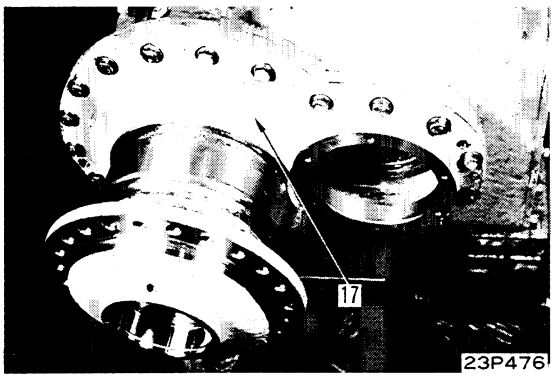
1) Attach gasket to final cover assembly (17).

Gasket: Gasket sealant (LG-1)

kg Final drive cover assembly: 170kg

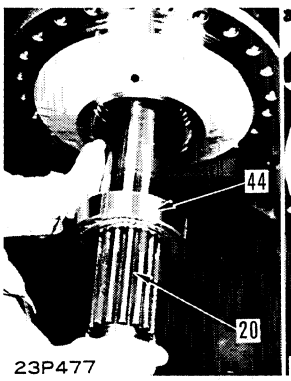


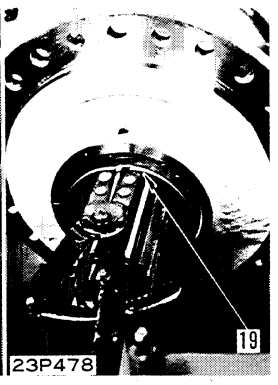
2) Sling and install final cover assembly (17).



16. Shaft, Snap ring

1) Press-fit bearing (44) to shaft (20).
2) Apply grease (G2-LI) to oil seal and install shaft.
   ★ Install shaft together with bearing by lightly tapping with a plastic hammer.
3) Install snap ring (19).





17. Spacer

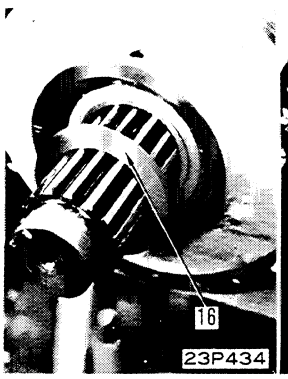
Install spacer (16).

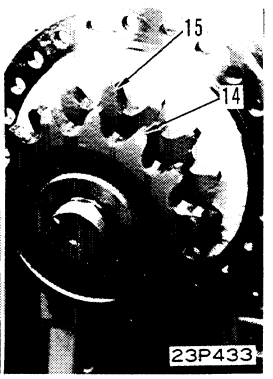
★ Install spacer with its R side faced inside.

18. Sprocket

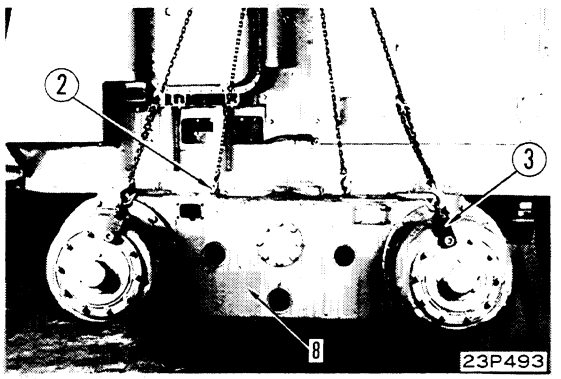
Install sprockets (15) and (14).

★ Install sprockets with their boss sides facing inside.

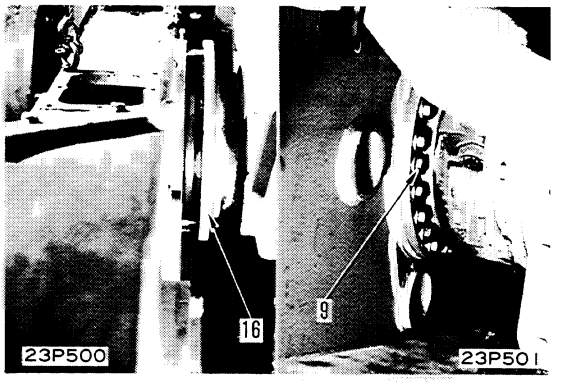




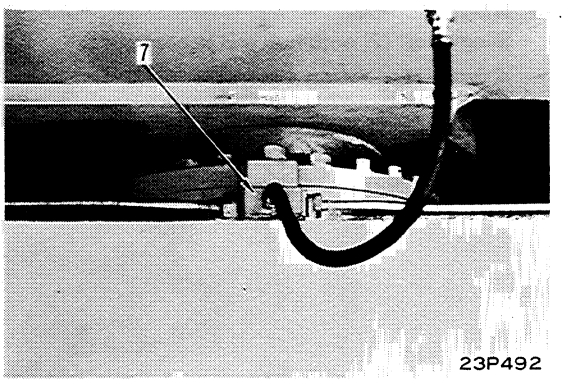
3. **Tandem case assembly**
   1) Fit O-ring to joint (16) and face oil vent up.
   2) Install two eye bolts ② (12mm, P = 1.75) on tandem case and plate ③ on hub stud bolt. Sling tandem case assembly (8) onto joint.



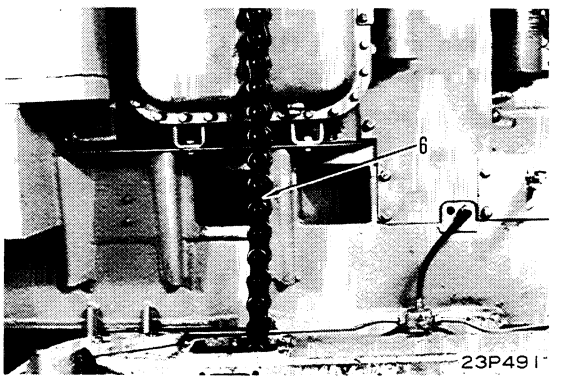
   3) Tighten mounting bolts (9).
      Mounting bolt: Gasket sealant (LG-1)



4. **Joint**
   Install brake oil joint (7).



5. **Chain**
   1) Install chains (6) on sprockets and secure it while rotating hub.
      ★ As for installing chains, starting with chain at driven side sprocket is easier.
      ★ Install chains with their front end on body outside and rear end on body inside.



DISASSEMBLY OF WHEEL BRAKE AND SPROCKET ASSEMBLY

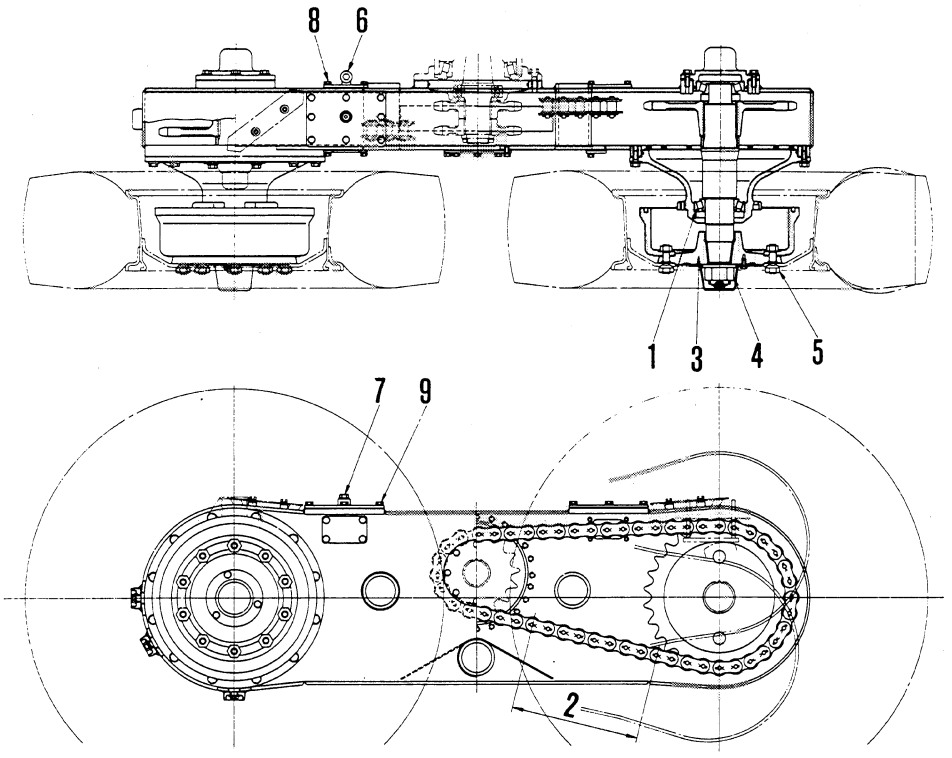
MAINTENANCE STANDARD

Unit: mm

No.	Check Item	Criteria			Remedy
		Serial No.	Standard clearance	Clearance limit	
1	R Sun gear-to-R Planetary gear backlash	GD605R: 30002~ GD655R: 40001~ GD605A: 50002~ GD655A: 60001~	0.11 ~ 0.29		
2	F Sun gear-to-F Planetary gear backlash		0.12 ~ 0.33	–	
3	3rd Sun gear-to-3rd Planetary gear backlash		0.12 ~ 0.33	–	
4	2nd Sun gear-to-2nd Planetary gear backlash		0.12 ~ 0.33	–	
5	Transfer input shaft gear-to-Transfer input side idler gear backlash		0.19 ~ 0.45	–	
6	Transfer input side idler gear-to-Transfer output side idler gear backlash		0.19 ~ 0.44	–	
7	Transfer output side idler gear-to-Transfer output shaft gear backlash		0.19 ~ 0.44	–	
8	L Sun gear-to-L Planetary gear backlash		0.11 ~ 0.29	–	
9	R Planetary gear-to-R Ring gear backlash		0.13 ~ 0.42	–	
10	F Planetary gear-to-F Ring gear backlash		0.13 ~ 0.42	–	
11	3rd Planetary gear-to-3rd Ring gear backlash		0.13 ~ 0.42	–	
12	2nd Planetary gear-to-2nd Ring gear backlash		0.13 ~ 0.42	–	
13	L Planetary gear-to-L Ring gear backlash		0.13 ~ 0.42	–	
14	R Ring gear-to-R Carrier backlash		0.18 ~ 0.54	–	
15	R Ring gear-to-F Carrier backlash		0.18 ~ 0.54	–	
16	3rd Ring gear-to-3rd Carrier backlash		0.18 ~ 0.54	–	
17	R, F, 3rd, 2nd, L Ring gears-to-Clutch disc backlash		0.34 ~ 0.84	–	
18	Clutch disc-to-1st, H Hub backlash		0.19 ~ 0.55	–	

No.	Check Item	Serial No.	Standard size			Repair limit		Remedy
			Free length x O.D.	Installed length	Installed load	Free length	Load	
19	R, L Clutch springs	GD605R: 30002~	53 x 15.3	44	8.2kg	51.7	7.0kg	Replace
20	F Clutch spring	GD655R: 40001~	53 x 15.3	47	8.2kg	51.7	7.0kg	
21	3rd Clutch spring	GD605A: 50002~	39.6 x 15.3	33	8.4kg	38.6	7.1kg	
22	2nd Clutch spring	GD655A: 60001~	39.6 x 15.3	35	5.9kg	38.9	5.0kg	

TANDEM DRIVE

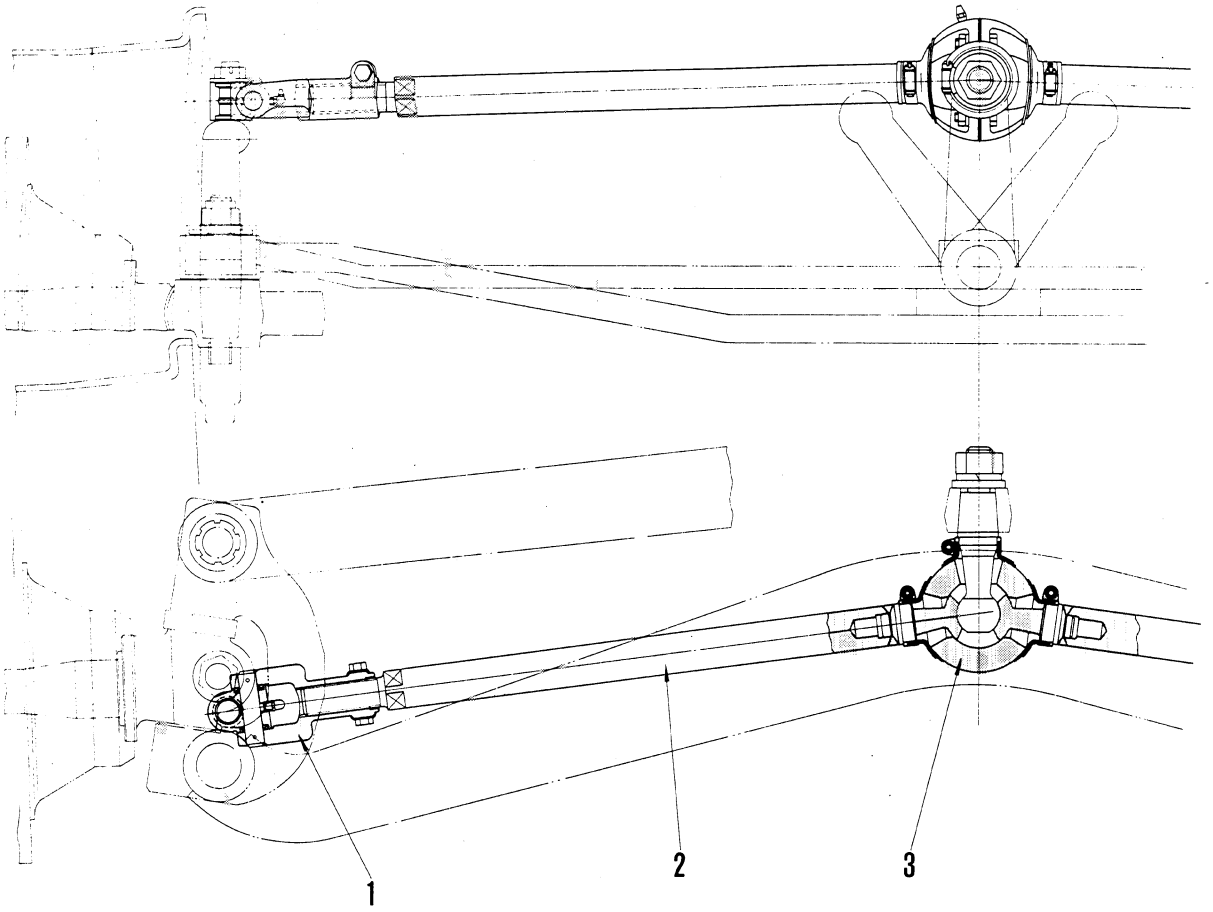


24F011

Unit: mm

No.	Check Item	Criteria			Remedy
1	Hub bearing preload	2.0 ~ 2.5 kg.m			Adjust
2	Extention of chain (10 links)	Serial No.	Standard size	Repair limit	Replace
		GD600R: 10002~ GD655R: 40001~ GD650R: 20001~ GD605A: 50002~ GD605R: 30002~ GD655A: 60001~	508.0	515.62	
3	Hub press-fit force	37.5 ± 2.5 ton			
4	Hub nut tightening torque	280 ± 20kg.m			
5	Wheel nut tightening torque	50 ± 5 kg.m			
6	Breather tightening torque	0.9 ± 0.3 kg.m			
7	Filler plug tightening torque	7 ± 1 kg.m			
8	Inspection cover tightening torque	11.5 ± 1.0 kg.m			
9	Inspection cover tightening torque	11.5 ± 1.0 kg.m			

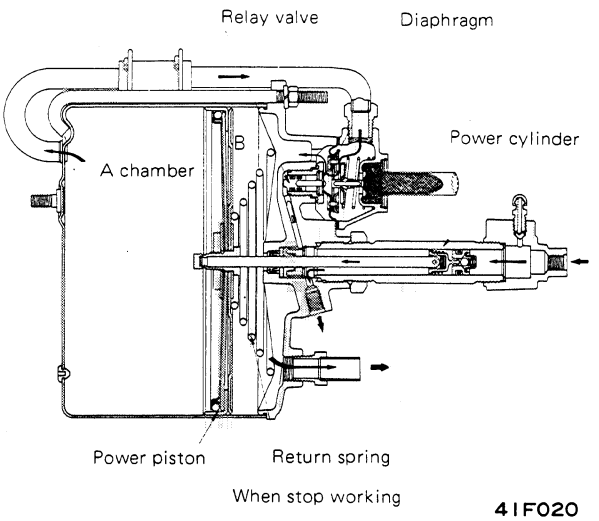
TIE ROD



41F008

1. Yoke
2. Rod
3. Socket

3. **When brake is released.**
(When foot is removed from brake pedal and braking stops.)
When the brake pedal is released, hydraulic pressure in the relay piston section drops. Then the air valve adheres tightly to its seat and cuts off air flow from outside. Next, the diaphragm separates from the vacuum chamber and opens the passage of both chambers **A** and **B** in the power cylinder, and air from **A** chamber flows into **B** chamber. Futhermore, because of the suction of the engine vacuum pump inside the hydromaster once again becomes vacuum. The power piston returns, being pushed to the left by a return spring, and at the same time the hydraulic piston also returns to its original position before operation.
Also, atmospheric pressure, applying on the relay valve (vacuum valve, air valve) and the diaphragm during operation, can be felt normally through the brake pedal as a direct hudraulic pressure reaction. Therefore, the operator, being aware of the degree of brake engagement, can brake freely.



41F020

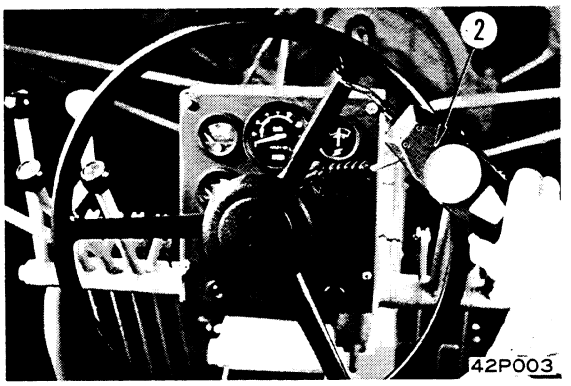
STEERING WHEEL STROKE CHECK

1. Start the engine and use the blade or scarifier to raise up the front wheels.

2. Turn the steering wheel fully to either right or left and measure the number of revolutions.
   ★ Measure with the engine idling.

STEERING WHEEL OPERATING FORCE

1. Use the push-pull scale ② to measure the steering wheel operating force.
   ★ Measurement of operating force is done with the engine idling and all wheels of the machine touching the ground.



BLEEDING AIR INSIDE BRAKE PIPING

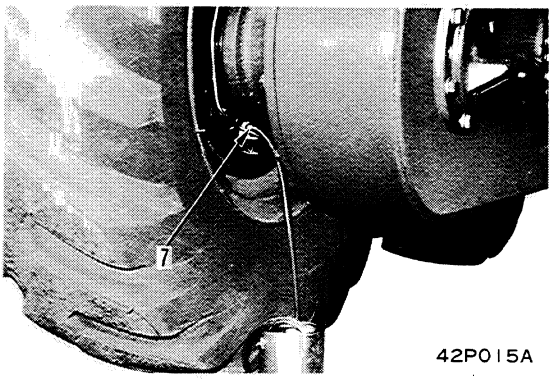
★ Use 2 people for air bleeding. One of supply brake fluid to the brake tank while repeatedly depressing the brake pedal to forward the brake fluid, the other to bleed air from each part.
★ Prepare extra brake fluid so that it will not run out during the work.

⚠ Air bleeding is done with engine stopped.

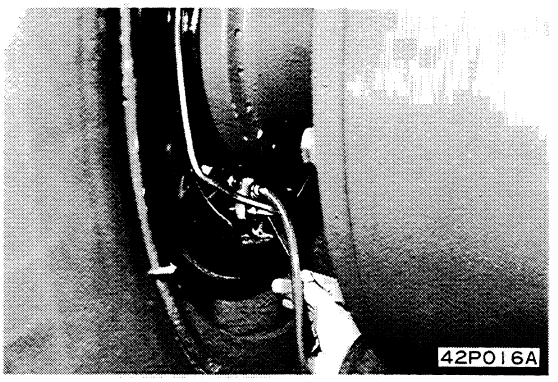
1. Attach a vinyl tube to the breather (7) and put the other end in a container half filled with brake fluid.

2. Depress the brake pedal a number of times, and loosen the breather plug with the pedal depressed. Tighten it before hydraulic pressure in the cylinder gives out. Repeat this process until air bubbles disappear from the brake fluid.

   ★ Brake pedal operation rate is about 3 seconds per one operation.

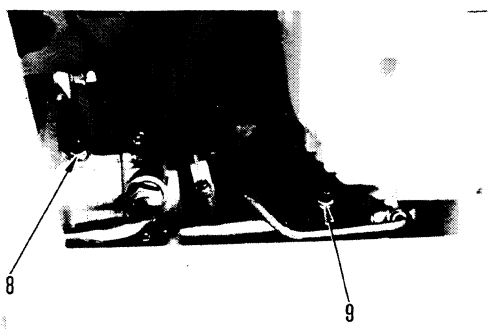


42P015A


42P016A

3. Bleed air from the hydromaster plugs (8), (9) in that order according to the same procedure as stated above.

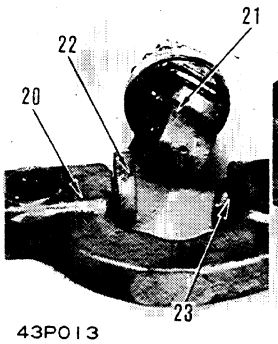
4. Bleed air from four wheel brakes.



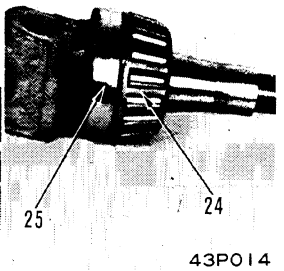
42P017

11. Axle

1) Remove axle (21), bearing (22) and spacer (23) from bracket (20).
2) Remove bearing (24) and spacer (25).



43P013



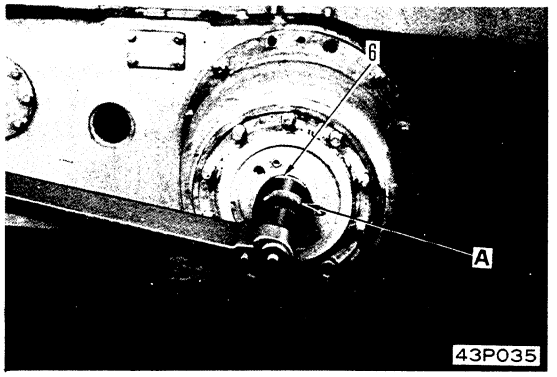
43P014

3. **Nut**
Install washer (6) and tighten nut (5) using tool A.

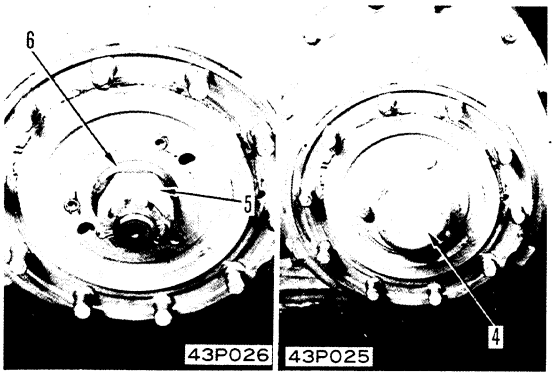
kgm Nut: 280 ± 20kg.m

⊕ Bend down cotter pin firmly.

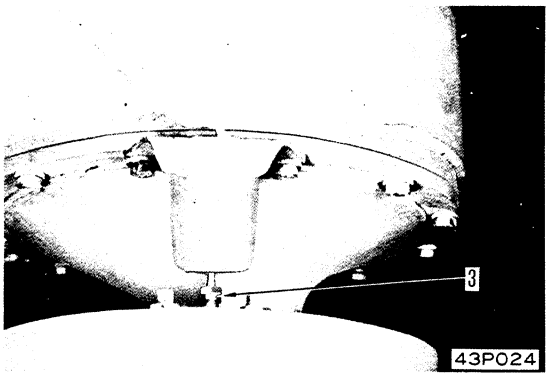
★ Install cotter pin with its ends spread open to prevent interfering with cover.



4. **Cover**
Install cover (4).



5. **Brake tube**
Connect brake tube (3).

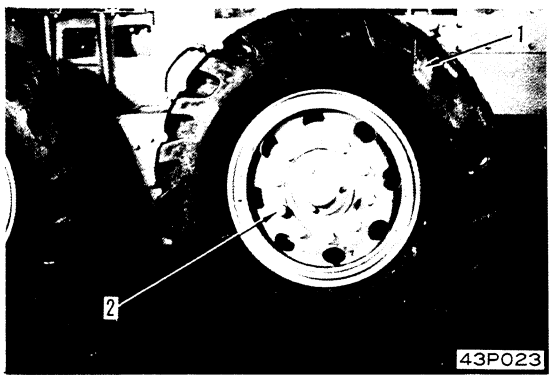


6. **Wheel**
Sling wheel (1) onto hub and tighten nuts (2).

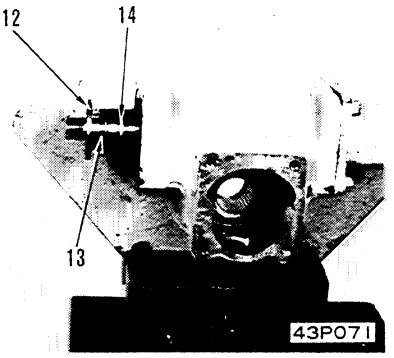
kgm Nut: 50 ± 5kg.m

★ Retightening nut is easier after lowering machine.

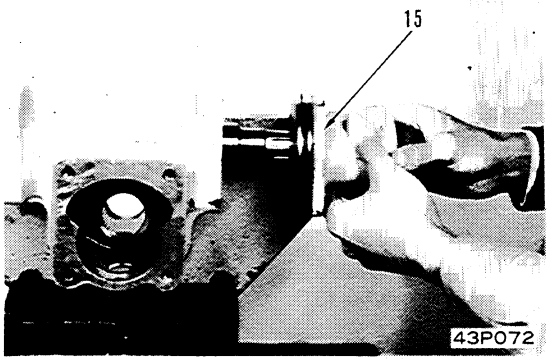
7. **Lowering body**
Sling body and remove block ①



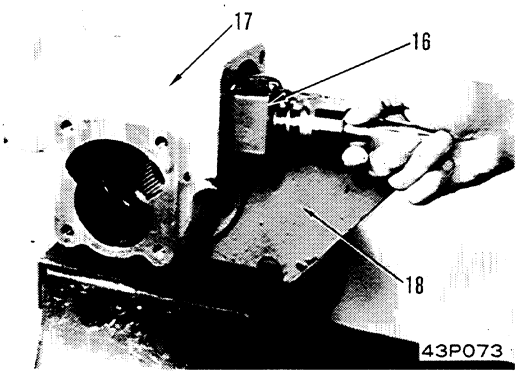
8. **Thrust, Bearing**
   Remove thrust (12), bearing (13) and thrust (14).

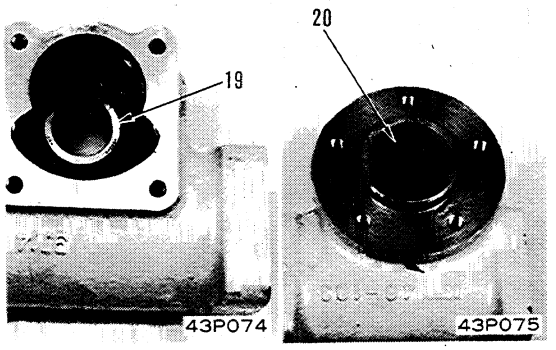


9. **Rear cover**
   Remove rear cover (15).

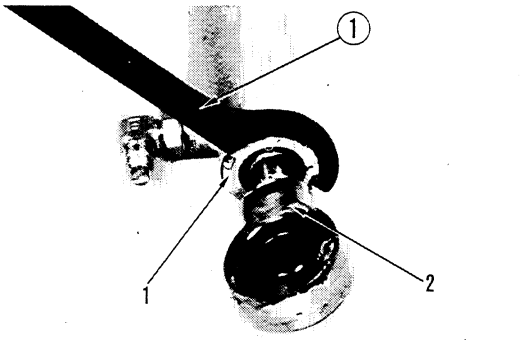


10. **Ball nut assembly**
    1) Pull out ball nut assembly (16) from gear box (17).
    2) Remove gear box from bracket (18).
    3) Remove bearing (19) and oil seal (20).





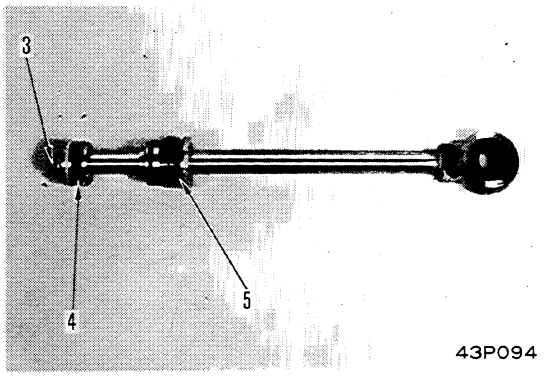
DISASSEMBLY OF STEERING CYLINDER



43P093

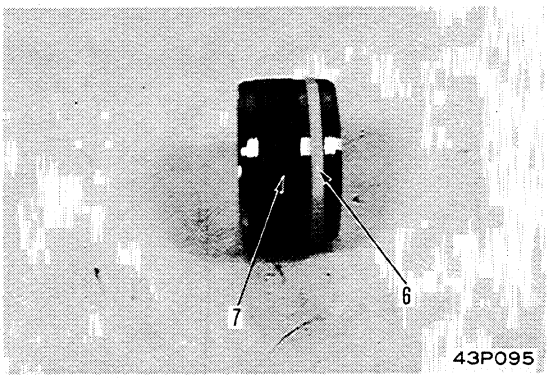
1. Raise up two locks and remove nut (1) using nut wrench ① (60 to 65cm).
2. Pull out rod (2).
3. Remove nut (3) and remove piston (4) and head (5).
4. Remove tefron ring (6) and wear ring (7).

ASSEMBLY OF STEERING CYLINDER

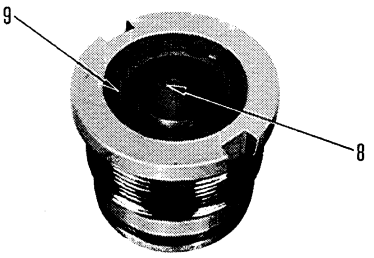


43P094

1. Press-fit bushing (8) and oil seal (9) and secure them with snap ring.
2. Install wear ring (7) and tefron ring (6) on piston.
3. Fit O-ring and install head (5) on rod (2).
4. Install piston (4) on rod and secure it with nut (3).
   - kgm Piston nut: 140 ± 1.0kg
   - ⊕ Bend down cotter pin firmly.
5. Using nut wrench ① (60 to 65cm) tighten nut (1) and secure it with two locks.



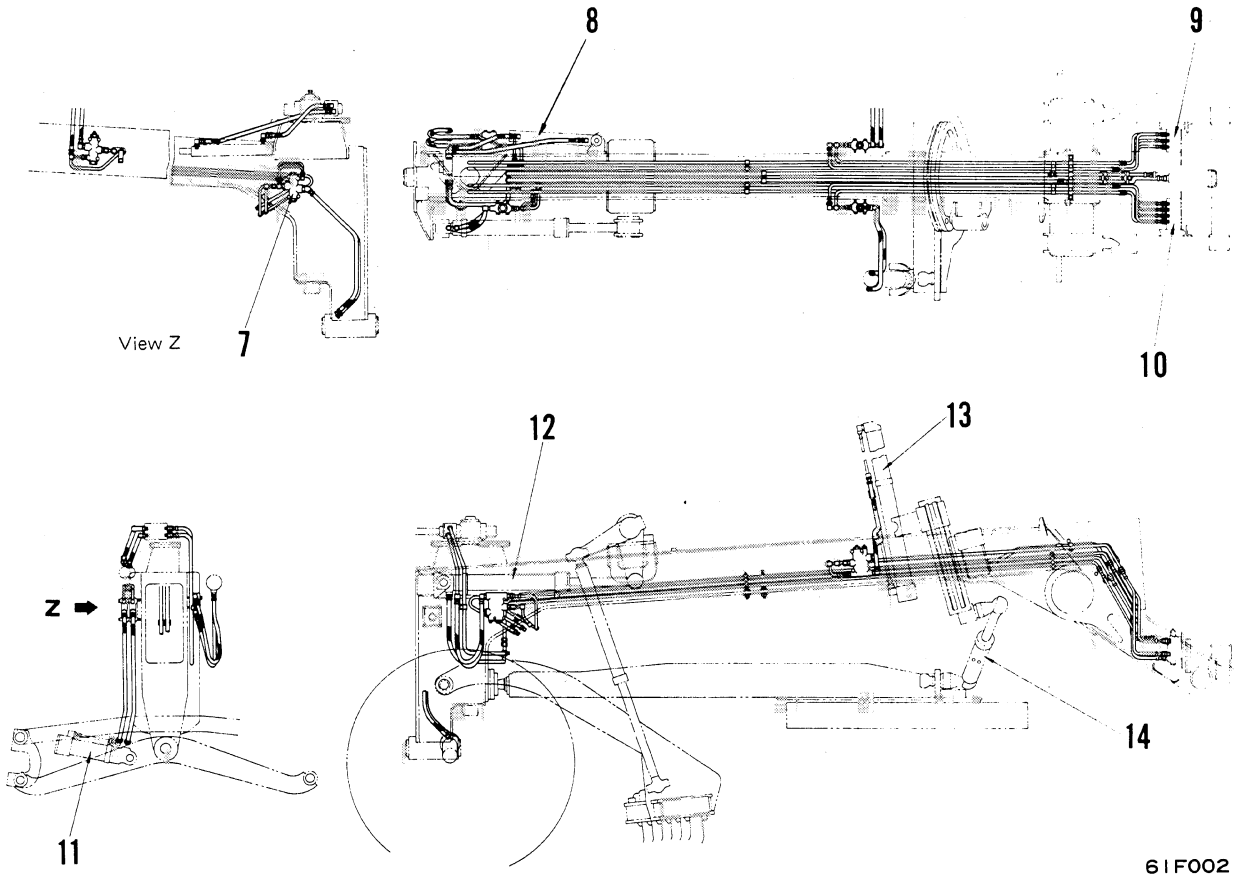
43P095



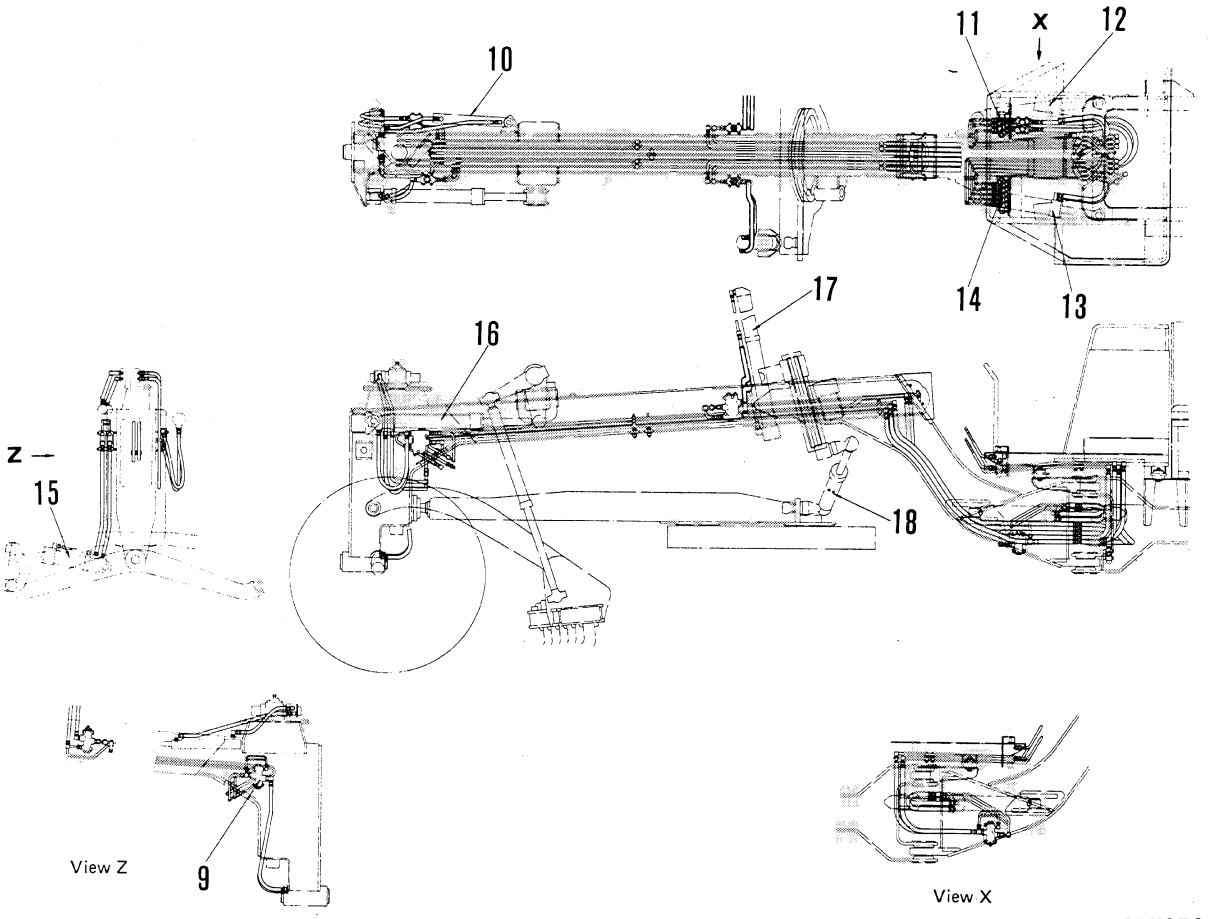
43P096

Unit: mm

No.	Check Item	Criteria			Remedy
		Serial No.	Standard size	Repair limit	
1	Wear of brake drum I.D.	GD600R: 11001~ GD655R: 41001~ GD650R: 21001~ GD605A: 51001~ GD605R: 31001~ GD655A: 61001~	$438.2\ ^{+0.3}_{0}$	441	Replace drum
2	Out of roundness of drum I.D.	Repair limit: 0.2			
		Serial No.	Standard size	Repair limit	
3	Wear of lining	GD600R: 11001~ GD655R: 41001~ GD650R: 21001~ GD605A: 51001~ GD605R: 31001~ GD655A: 61001~	6	0.5	Replace lining
		Serial No.	Standard size		Repair limit	
			Free length x O.D.	Installed length	Installed load	
4	Brake shoe return spring	GD600R: 11001~ GD655R: 21001~ GD605R: 31001~	146 x 28.5	159	42 kg	Replace spring
5	Brake shoe return spring	GD655R: 41001~ GD605A: 51001~ GD655A: 61001~	169.5 x 30	178	50 kg	
6	Mounting bolt tightening torque	10 ~ 12.5kg.m				
7	Mounting bolt tightening torque (※ mark)	6 ~ 7.5kg.m				
8	Wheel cylinder mounting bolt tightening torque	1.8 ~ 2.7kg.m				
9	Wheel cylinder breather tightening torque	0.7 ~ 1.2kg.m				
10	Brake tube tightening torque	2.5 ~ 3.0kg.m				



7. Pilot check valve
8. Steering cylinder
9. Hydralic control valve (3 spools)
10. Hydraulic control valve (4 spools)
11. Leaning cylinder
12. Scarifier cylinder
13. Blade lift cylinder
14. Drawbar shift cylinder

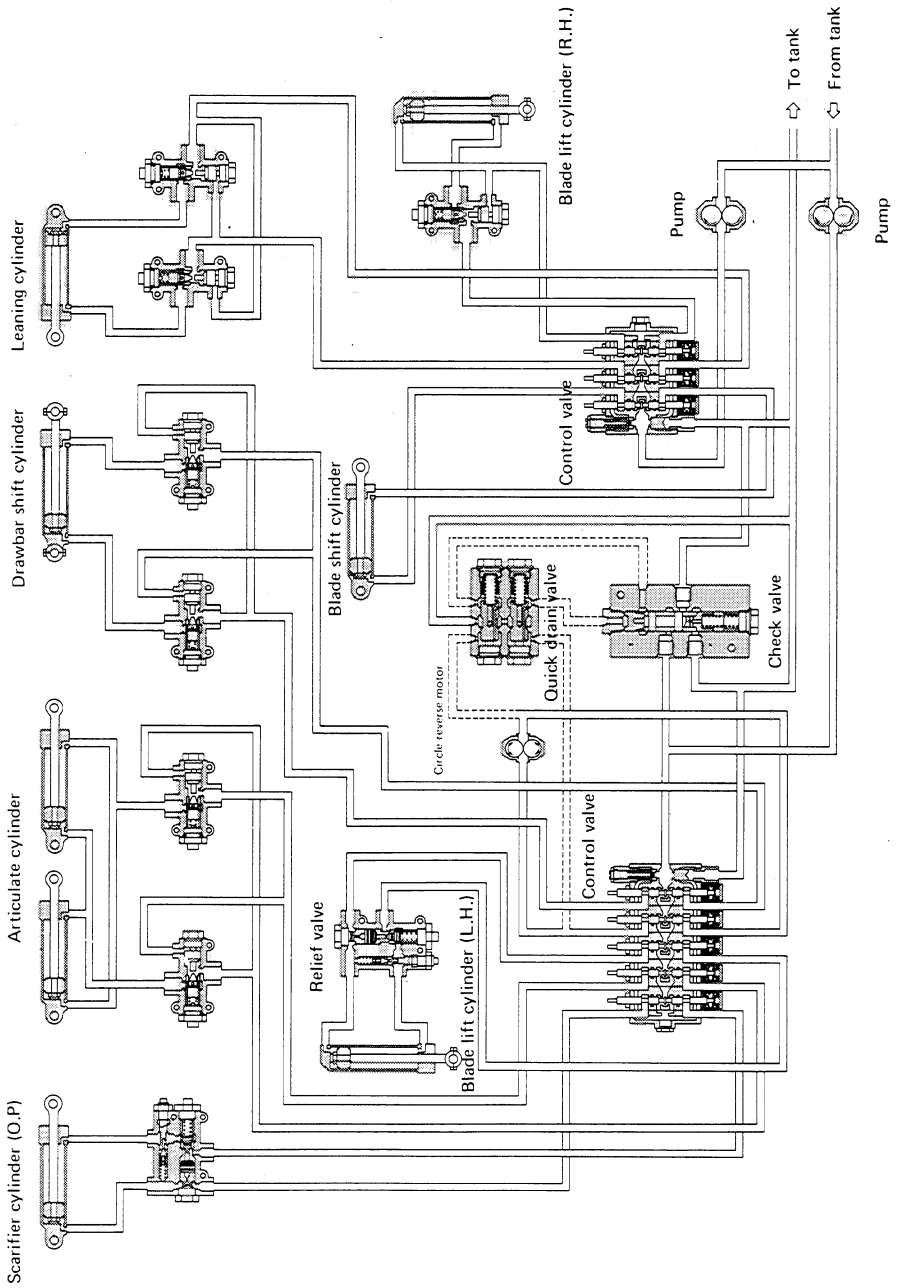


61F050

9. Pilot check valve
10. Steering cylinder
11. Hydraulic check valve (3 spools)
12. Articulate cylinder
13. Articulate cylinder
14. Hydraulic control valve (5 spools)
15. Leaning cylinder
16. Scarifier cylinder
17. Blade lift cylinder
18. Drawbar shift cylinder

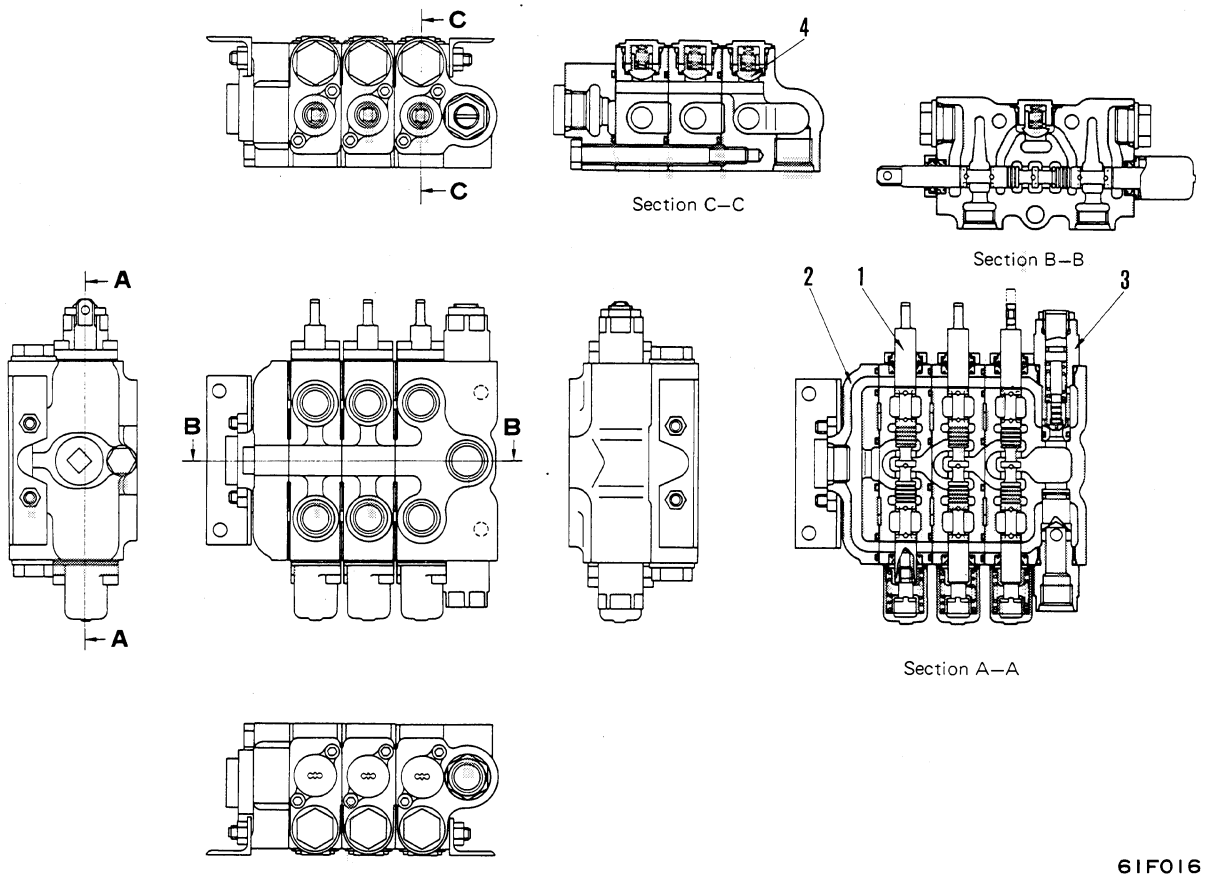
PIPING DIAGRAM

Serial No. GD600R-1 10238, 10246 ~
GD650R-1 20015 ~
GD605R-1 31304 ~
GD655R-1 41036 ~
GD605A-1 50119, 50134, 50155 ~
GD655A-1 60002, 60006, 60016, 60030, 61002, 60041 ~



61F055

TRIPLE VALVE (Blade shift, leaning, right blade lift)

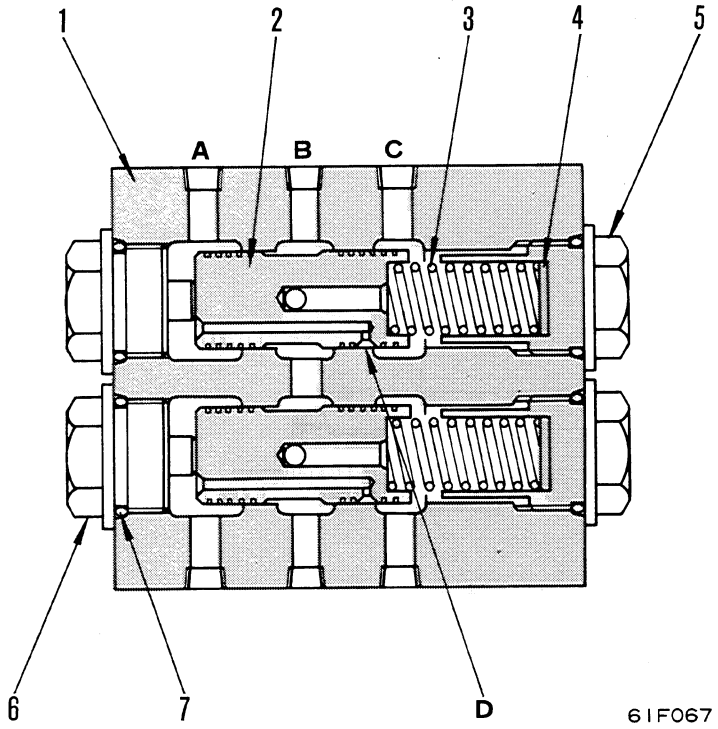


61F016

1. Spool
2. Body
3. Main relief valve
4. Check valve

QUICK DRAIN VALVE

Serial No. (GD600R-1 10238, 10246 ~
GD650R-1 20015 ~
GD605R-1 31304 ~
GD655R-1 41036 ~
GD605A-1 50119, 50134, 50155 ~
GD655A-1 60002, 60006, 60016, 60030, 61002, 60041 ~)



61F067

1. Body
2. Valve
3. Spring
4. Plate
5. Plug
6. Plug
7. O-ring

The quick drain valve is designed to quickly operate the check valve when the motor stops. To this end it employs a pilot pressure which abruptly drops when the motor stops.

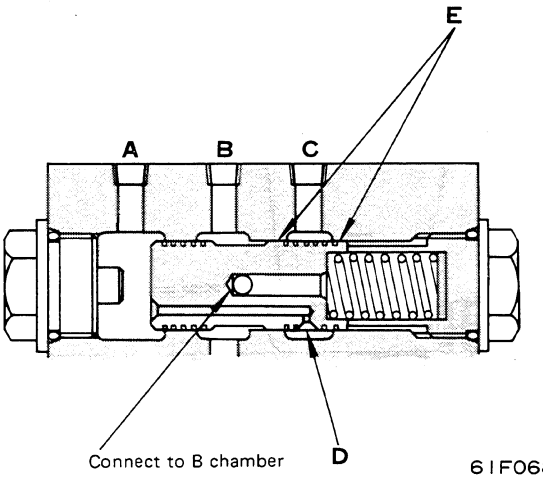
OPERATION

The oil which flows into the motor is conneced to chamber **A**. Throttle **D** inside the valve causes a pilot pressure to be generated in chamber **A**, so that the valve is pushed to the right. As a result, both chambers **A** and **C** will be connected to chamber **B** (drain).

When the valve is pushed to the extreme right, chambers **A** and **C** will be connected together and the connection with chamber **B** (drain) will be broken. The pressure inside chambers **A** and **C** will become the same as the operating pressure of the motor, causing the check valve to operate. When this happens, the seal around the outside of the spool of part **E** will cause a small amount of oil to leak into chamber **B** (drain) from chamber **C**.

When the motor stops, the oil in chambers **A** and **C** will pass through part **E** into chamber **B** (drain), so that the pressure drops.

Once the pressure drops to a certain level, the spring will push back valve (2) so that the oil in chambers **A** and **C** abruptly escapes into chamber **B** (drain). As a result, the selector valve switches over, diverting the oil from the inlet of the left hand control valve.



61F068

TROUBLE SHOOTING

1. Steering wheel drags or in hard to turn.

Ask operator the following:

- Did the steering wheel suddenly drag?

  ↓

  If so, dust jamming a valve or damage to a part is suspected.

- Did the steering wheel gradually drag?

  ↓

  If so, wear of parts is suspected.

Check the following before diagnosis:

- Check the oil level in the hydraulic tank.
- Confirm that no oil leaks from pipes between the pump and cylinder.

No.	Diagnosis \ Remedy	C	X	X	X	X	X	X	X	X	Δ
	Causes	a	b	c	d	e	f	g	h	i	j
		Clogged strainer	Pump sucking air	Defective pump drive shaft	Relief valve set pressure is low or valve is malfunctioning.	Defective cylinder packing	Faulty hand pump	Faulty steering valve (center spring fatigued)	Faulty steering valve (check whether valve is faulty or spring is fatigued.)	Malfunctioning pump	Air mixing with oil in cylinder
1	Noisy pump	○								○	
2	Pump delivery flow is too low.	○								○	
3	Relief oil pressure is too low.			○	○					○	
4	Relief oil pressure is low when either turning right or left with the steering wheel.							○			
5	Front wheels are unsteady during traveling.					○					○
6	Relief pressure is normal.						○				
7	Pump delivery flow is normal, but steering wheel drags.								○		
8	Tires do not respond to the steering wheel.						○		○		○
9	Steering wheel drags on one side only.							○			
10	Steering wheel rotates swiftly after the cylinder reaches its stroke end.										

Measures to be taken.

Diagnosis No.	Testing impelements
2	Flowmeter kit
3, 4, 6	Hydraulic tester

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

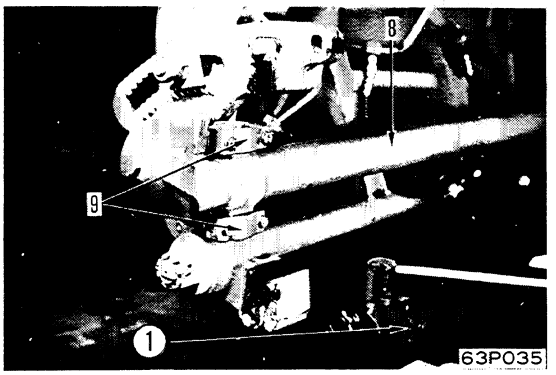
X: Replace Δ: Repair
A: Adjust C: Clean

DISASSEMBLY AND ASSEMBLY

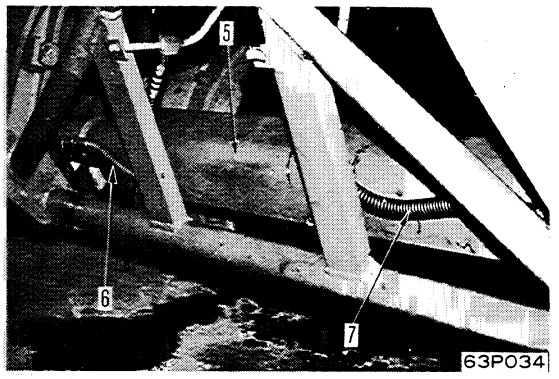
DISMOUNTING FLOW DIVIDER VALVE

MOUNTING BLADE SIDE SHIFT CYLINDER

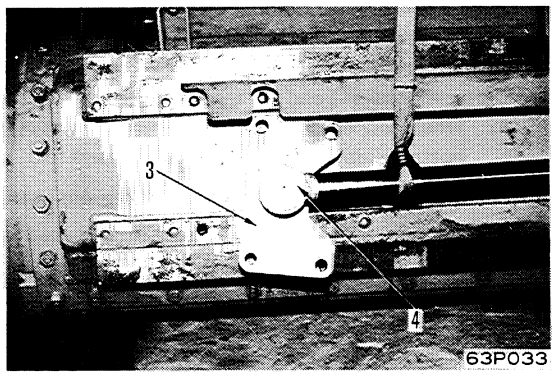
1. Place blade side shift cylinder assembly (8) on jack ① and position it on yoke (10), with shims inserted. Align dowel pins and install cap (9).



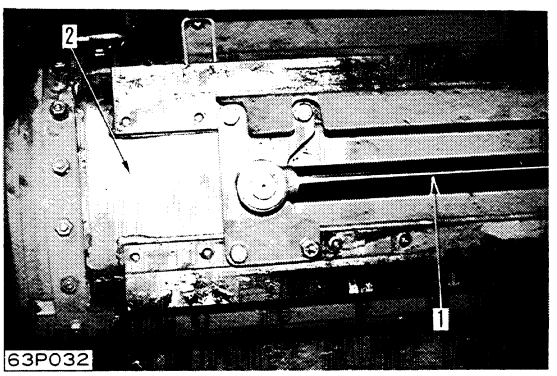
2. Connect hoses (7) and (6) to cylinder.
   ⊕ Install hoses using care to avoid twisting.
3. Install cover (5).



4. Sling blade (2) and fully extend piston rod to the installable position.
5. Sling piston rod (1) and start engine to extend piston rod fully.
6. Install bracket (3) and install snap ring (4).
7. Connect bracket to blade.



8. Raise blade to remove block.
   ★ Control lever to circulate oil into cylinder and feed engine oil to hydraulic tank up to the specified level.

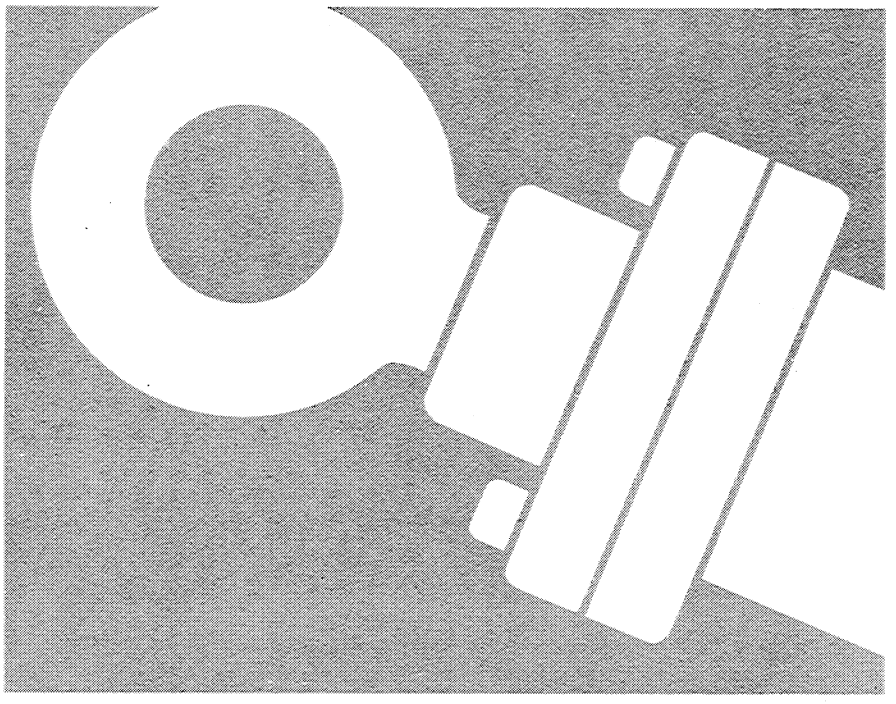


SHOP MANUAL

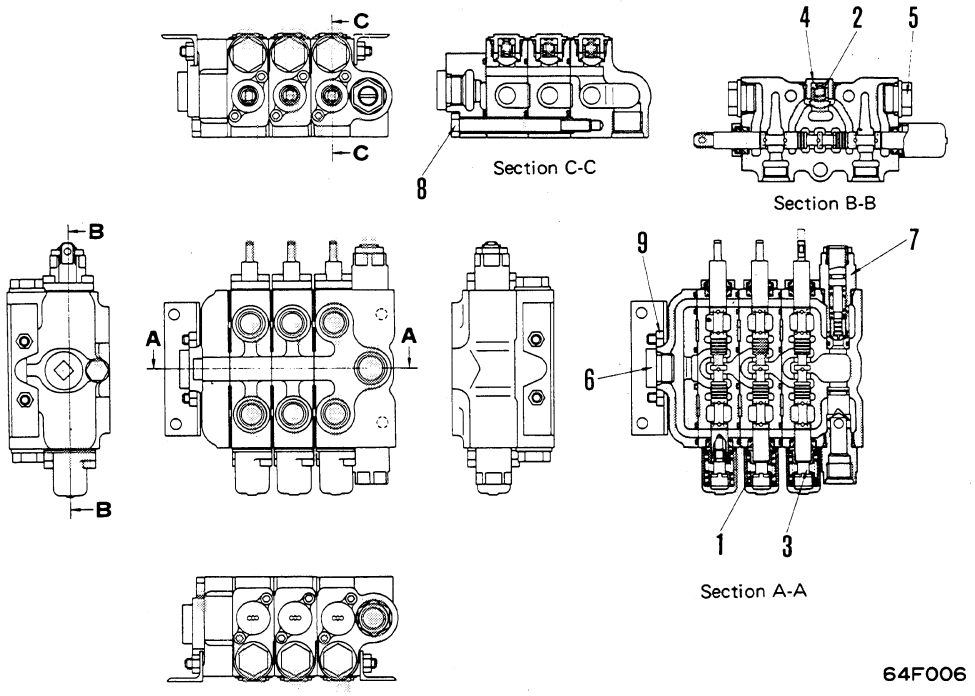
GD600 SERIES

64 HYDRAULIC SYSTEM

MAINTENANCE STANDARD



TRIPLE VALVE (Blade shift, leaning and right blade lift)



64F006

Unit: mm

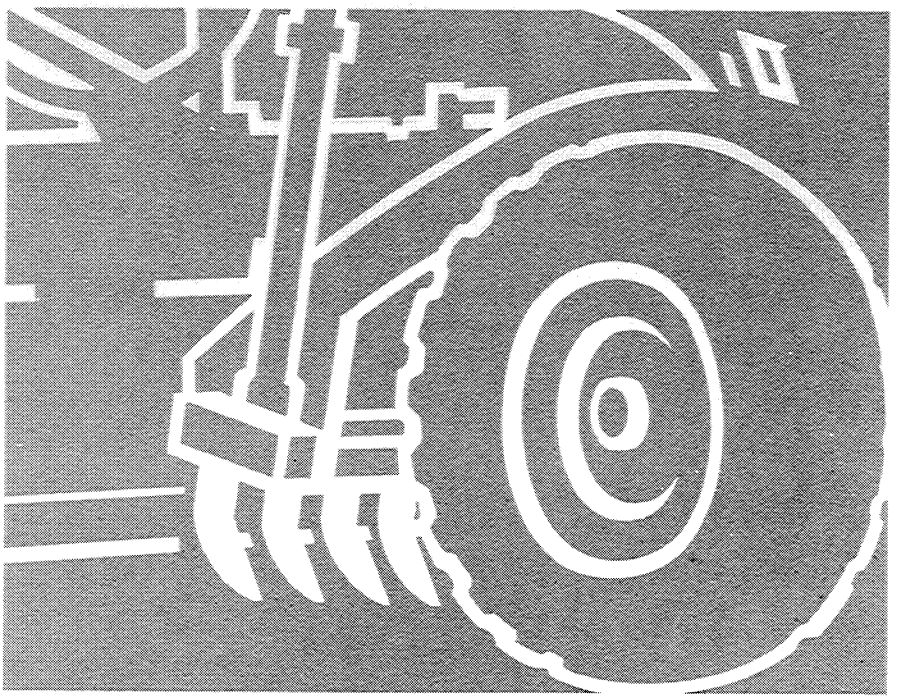
No.	Check Item	Criteria					Remedy
		Serial No.	Standard size			Repair limit		
			Free length x O.D.	Installed length	Installed load	Free length	Load	
1	Spool return spring	GD605A: 50002~		26.5	11kg			Replace spring
2	Check valve spring	GD655A: 60001~		18	0.2kg			
3	Plug tightening torque	2.5 ± 0.5kg.m						
4	Plug tightening torque	7 ± 1 kg.m						
5	Plug tightening torque	7 ± 1 kg.m						
6	Plug tightening torque	7 ± 1 kg.m						
7	Main relief valve tightening torque	5.5 ± 0.5kg.m						
8	Body joint bolt tightening torque	5.5 ± 0.5kg.m						
9	Body joint bolt tightening torque	3.0 ± 0.5kg.m						

SHOP MANUAL

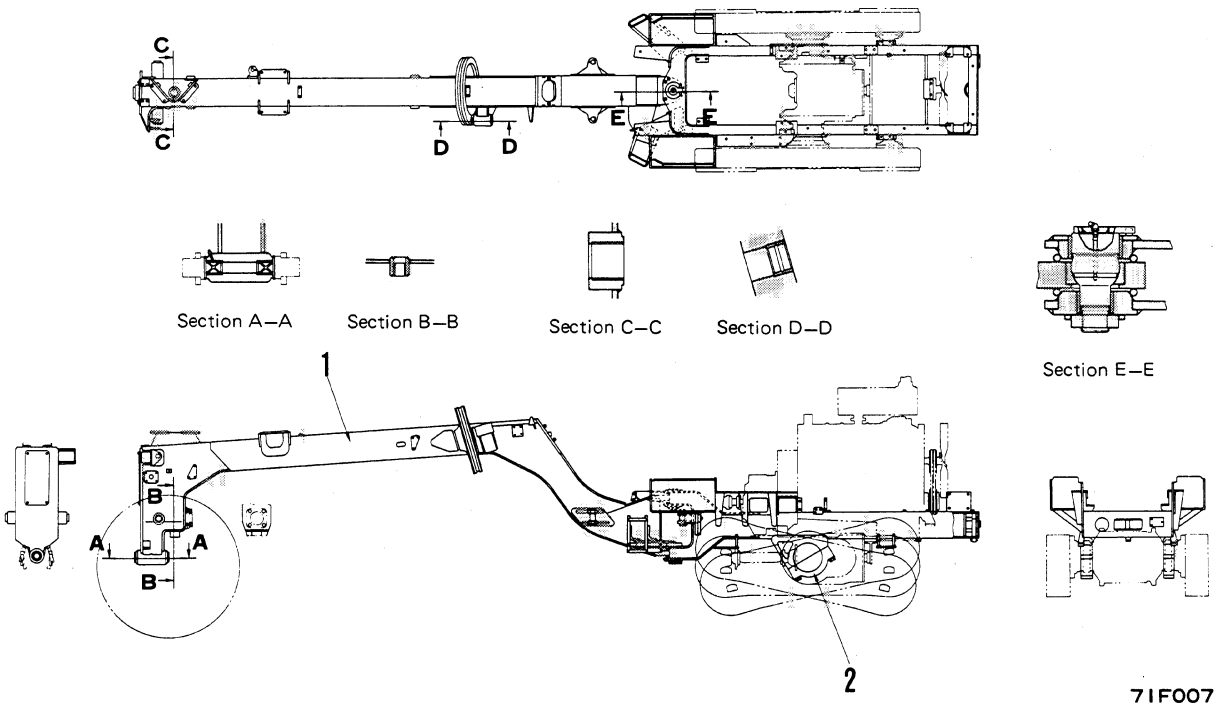
GD600 SERIES

71 WORK EQUIPMENT

STRUCTURE AND FUNCTION



GD605A, GD655A

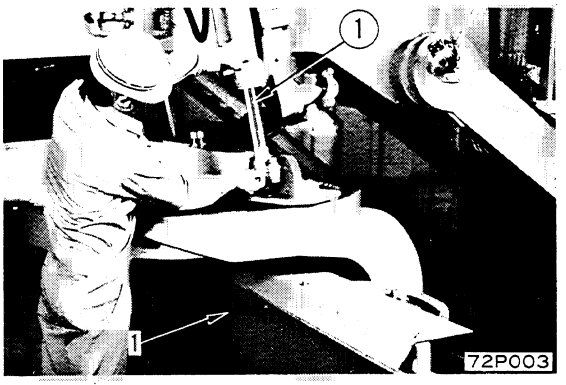


The frame can be articulated 25° both to right and left of the center by the articulate cylinder. (The articulater stopper is on the side of the frame.) Articulation is useful for reducing turning radius, for offset work, for getting out of mud and for the various corner operations.
Also, because the front frame is one unit the visibility of the work equipment is good.

1. Frame
2. Cap

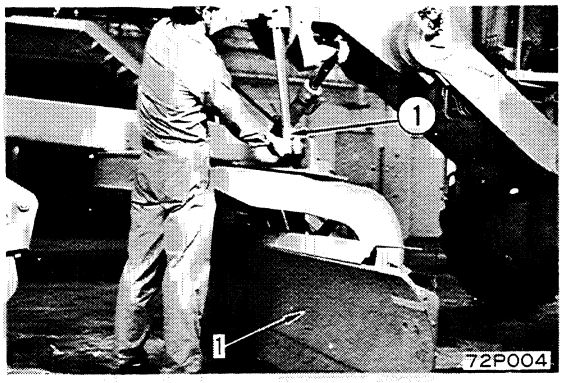
MEASURING BLADE NATURAL LOWERING RATE

1. Start the engine and after the pressure test, bring hydraulic oil temperature to the 40 ± 5°C range.
2. Raise the blade (1) 300mm from the ground and at right angles to the machine and equidistant to right and left.
3. Stop the engine and leave for 10 minutes.
   Use a convex rule ① to measure the amount the cylinder piston rod has dropped.



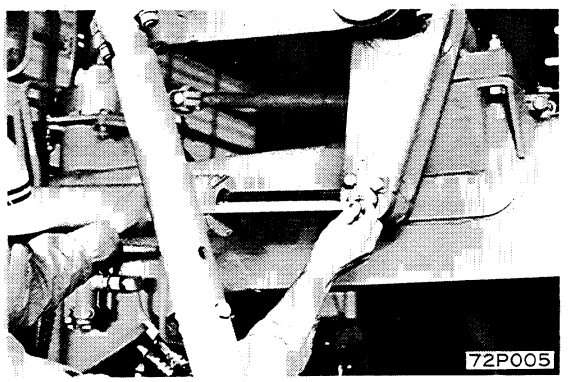
MEASURING BLADE SINKING AMOUNT

1. Start the engine and after the pressure test, bring hydraulic oil temperature to the 40 ± 5°C range.
2. Lower blade (1) until its bottom edge touches the ground, push the cylinder and float the front wheels about 300mm off the ground.
3. Stop the engine and leave for ten minutes. Use a convex rule ① to measure at the cylinder the amount of sinkage.



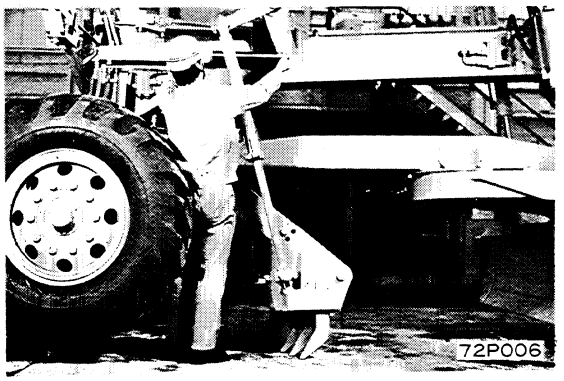
MEASURING SCARIFIER NATURAL LOWERING RATE

★ Measure according to the same procedure as used in the item on measuring blade natural lowering rate.

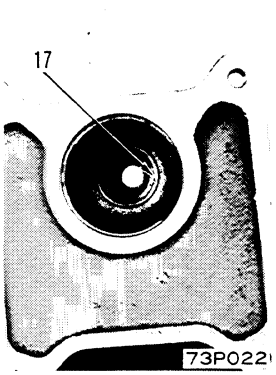


MEASURING SCARIFIER SINKING AMOUNT

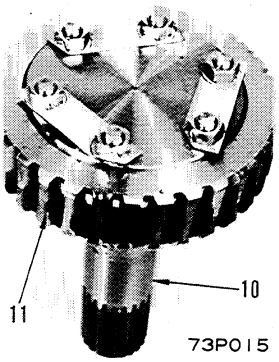
★ Measure according to the same procedure as used in the item on measuring blade sinking amount.

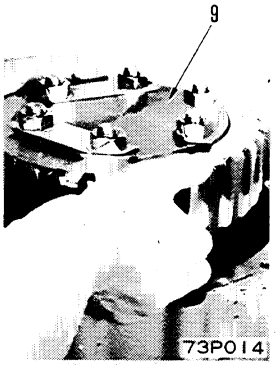


4) Using push tool kit ④ press-fit oil seal (17) in case.
★ Coat seal lip surface with grease (G2-LI).



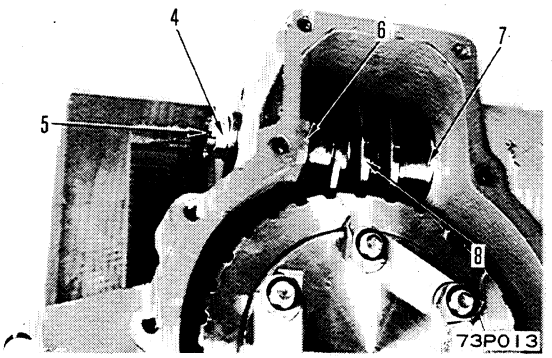
5) Install gear (10) on shaft (11) and secure with lock plate.
★ Bend down lock plate firmly.
6) Install worm wheel shaft assembly (9).





2. Worm gear, Thrust

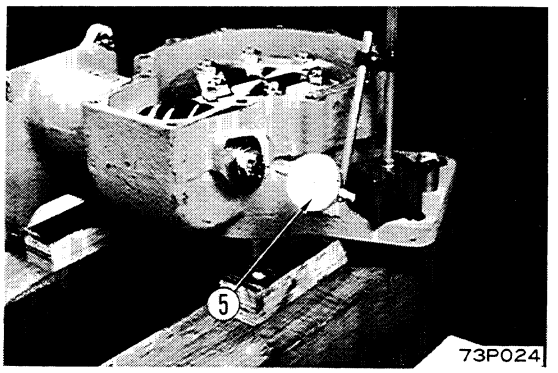
1) Put spacer in worm gear (8) and put thrust plates (7) and (6) in case.



3. Shaft

1) Pass shaft (5) through worm gear and thrust plates and tighten washer and nut (4).
★ Charge grease (G2-LI) to involute splines.

2) Using dial gauge⑤measure shaft end play.
★ Shaft end play: 0.5 ~ 0.8mm

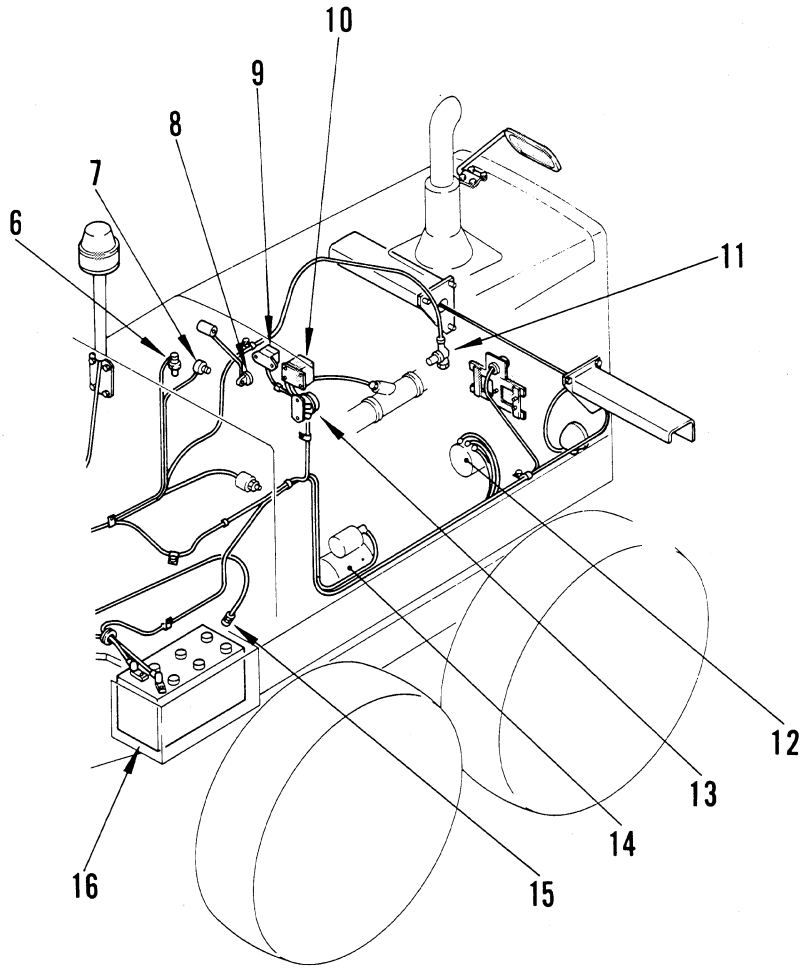


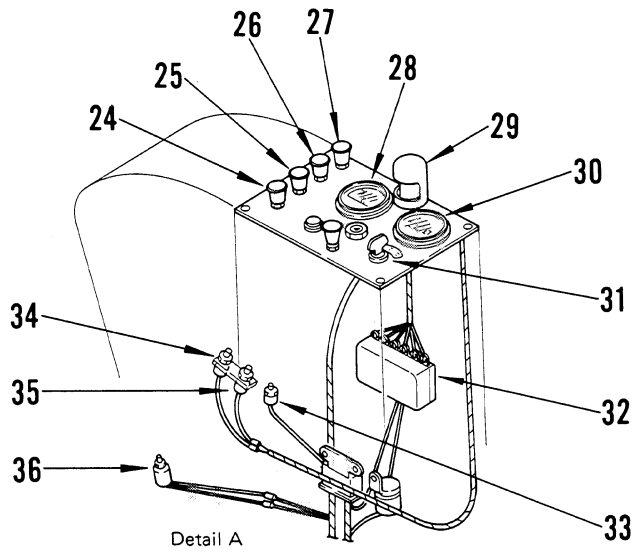
SHOP MANUAL

GD600 SERIES

91 OTHERS

ELECTRICAL SYSTEM





1. Head lamp
2. Parking lamp
3. Front combination lamp (O.P)
4. Work lamp (O.P)
5. Buzzer (O.P)
6. Glow plug
7. Dust indicator pick-up port
8. Fuel gauge pick-up port
9. Regulator
10. Safety relay
11. Service meter pick-up port
12. Alternator
13. Battery relay switch
14. Starting motor
15. Battery relay
16. Battery
17. Fuel gauge
18. Engine oil pressure gauge
19. Water temperature gauge
20. Speedometer (O.P)
21. Ammeter
22. Dust indicator
23. Parking brake indicator lamp (O.P)
24. Head lamp switch
25. Parking lamp switch
26. Work lamp switch (O.P)
27. Yellow rotating lamp switch (O.P)
28. Priming pump fuel pressure gauge
29. Panel lamp
30. Service meter
31. Starting switch
32. Fuse box
33. Back-up lamp switch
34. Parking brake switch (for lamp)
35. Parking brake switch (for buzzer)
36. Safety switch
37. Brake fluid level warning lamp (O.P)

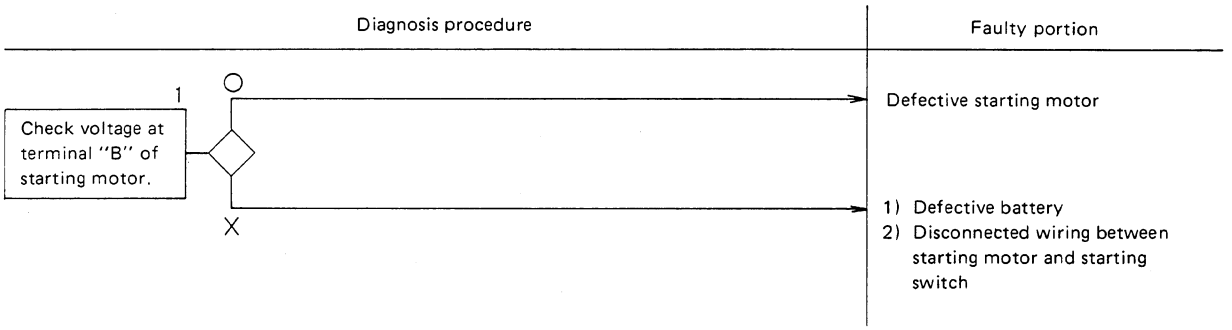
(O.P): Optional parts

4. Cranking speed is too low to start the engine.

Possible causes:
- Starting motor load is too large. (Due to high oil viscosity in cold weather for instance.)
- Battery lacks charge.
- Defective starting motor.

Check the following before diagnosis:
- Check for loose battery cable terminals.
- Check the battery exterior for abnormality.
  (Try relacing with a fully charged battery if one is at hand.)
- Check the battery electrolyte specific gravity.

- Keep the starting switch in "START" position during diagnosis.

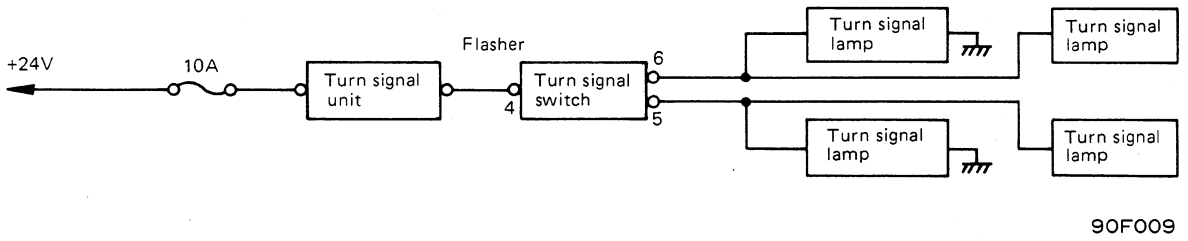


Standard voltage for diagnosis No. 1: 18V or more

14. Turning signal lamp does not blink.

Check the following before diagnosis:
- Confirm that other electrical devices operate normally.
  (If necessary, check in accordance with diagnosis procedure 1-1.)
- Confirm that the fuse is not burnt-out.
- Replace the lamp which does not light if one or more lamps blink.
- Check the lamps for burnt-out bulbs.

Circuit diagram



Reference: Functional diagram of the turn signal switch is shown below.

Connection / Lever position	From turn signal unit	To R.H. signal lamps	To L.H. signal lamps
R	○	○	
N			
L	○		○
Cord color	Green	Green & Black	Green & Red
Terminal No.	4	6	5