SHOP MANUAL

KOMATSU

D85A-21

MACHINE MODEL SERIAL No.

D85A-21 **35001 and up**

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require. Materials and specifications are subject to change without notice.
- D85A-21 mount the S6D125-1 engine.
  For details of the engine, see the 6D125 Series Engine Shop Manual.

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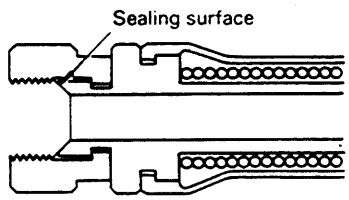
kgm

3. TIGHTENING TORQUE FOR NUTS OF FLARED

Use these torques for nut part of flared.



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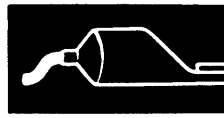
Thread diameter of nut part (mm)	Width across flats of nut part (mm)	Tightening torque	
		kgm	Nm
14	19	2.5±0.5	24.5±4.9
18	24	5±2	49±19.6
22	27	8±2	78.5±19.6
24	32	14±3	137.3±29.4
30	36	18±3	176.5±29.4
33	41	20±5	196.1±49
36	46	25±5	245.2±49
42	55	30±5	294.2±49



COATING MATERIALS

The recommended coating materials prescribed in Komatsu Shop Manuals are listed below.

Nomenclature	Komatsu code	Applications
Adhesives	LT-1A	Used to apply rubber pads, rubber gaskets, and cork plugs.
	LT-1B	Used to apply resin, rubber, metallic and non-metallic parts when a fast, strong seal is needed.
	LT-2*	Preventing bolts, nuts and plugs from loosening and leaking oil.
	LT-3	Provides an airtight, electrically insulating seal. Used for aluminum surfaces.
Gasket sealant	LG-1	Used with gaskets and packings to increase sealing effect.
	LG-3	Heat-resistant gasket for precombustion chambers and exhaust piping.
	LG-4	Used by itself on mounting surfaces on the final drive and transmission cases. (Thickness after tightening: 0.07 — 0.08 mm)
	LG-5	Used by itself to seal grease fittings, tapered screw fittings and tapered screw fittings in hydraulic circuits of less than 50 mm in diameter.
Antifriction compound (Lubricant including molybdenum disulfide)	LM-P	Applied to bearings and taper shafts to facilitate press-fitting and to prevent sticking, burning or rusting.
Grease (Lithium grease)	G2-LI	Applied to bearings, sliding parts and oil seals for lubrication, rust prevention and facilitation of assembling work.
Vaseline	—	Used for protecting battery electrode terminals from corrosion.

*LT-2 is also called LOCTITE in the shop manuals.

MEASURING COMPRESSION PRESSURE

★ If performance tests or troubleshooting shows that the piston, piston ring or cylinder liner may be worn, measure the compression pressure.

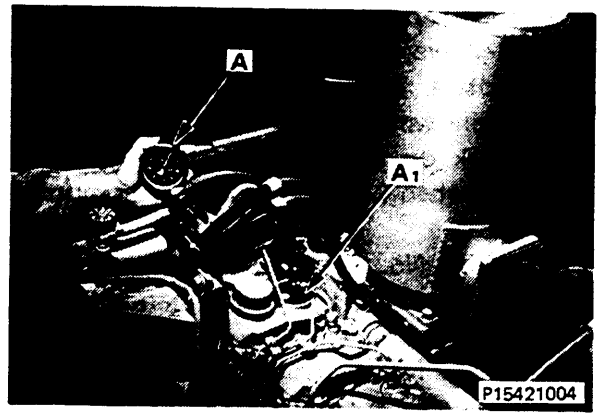
Special tools

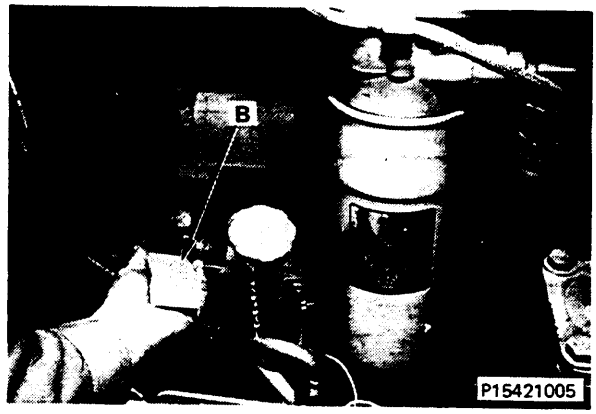
No.	Part No.	Part Name	Q'ty
A	795-502-1203	Compression gauge	1
A_1	795-502-1350	Adapter	1
B	799-203-8000	Multi-tachometer	1
B_1	(799-203-8900)	(Clamp set)	1

⚠ When measuring the compression pressure, be careful not to touch the turbocharger, or to get caught in rotating parts.

1. Adjust the valve clearance.
   ★ For details, see 12 ADJUSTING VALVE CLEARANCE.
2. Run engine to warm up the oil to 40 – 60°C.
3. Remove the nozzle holder assembly to be measured.
   ★ For details see 13 REMOVAL OF NOZZLE HOLDER ASSEMBLY.
4. Install tool A and A_1 (adapter, pressure gauge) in the mount of nozzle holder assembly.
5. Set tool B (multi-tachometer) in engine tachometer pick-up.
6. Place the fuel control lever in the NO INJECTION position.
   Crank the engine with the starting motor and measure compression pressure.
   ★ Measure the compression pressure at the point where the pressure gauge indicator remains steady.
   ★ When measuring the compression pressure, measure the engine speed to confirm that it is within the specified range.

★ For details of installing the nozzle holder assembly after measuring the compression pressure, see 13 INSTALLATION OF NOZZLE HOLDER ASSEMBLY.





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REMOVAL OF CYLINDER HEAD ASSEMBLY

1. **Draining water**
   Loosen radiator drain valve and drain cooling water.
   ★ If the coolant contains antifreeze, dispose of it correctly.

2. **Engine hood**
   1) Remove exhaust pipe.
   2) Remove air cleaner cap.
   3) Remove radiator hood.
   4) Remove off left and right engine side covers.
   5) Remove engine hood (1). (See P1)
   kg Engine hood: 55 kg

3. **Air cleaner assembly**
   1) Remove air cleaner assembly (2). (See P2)

4. **Oil filter assembly**
   1) Remove oil filter (3). (See P3)
      ★ Move the disconnected filter towards the frame.
   2) Remove bracket (4). (See P3)

5. **Heater switch**
   Disconnect switch (5) together with bracket. (See P4)

6. **Suction connector**
   1) Disconnect wiring (6). (See P4)
   2) Remove suction connector (7). (See P4)
   3) Remove electrical intake air heater (8). (See P4)

7. **Hose**
   Disconnect hose (9). (See P5)

8. **Tube**
   1) Disconnect tube (10). (See P5)
   2) Remove injection pipes (11). (See P5)

9. **Plate**
   1) Remove plate (12). (See P6)

10. **Fuel filter assembly.**
    Remove fuel filter assembly (13). (See P6)

11. **Corrosion resistor assembly.**
    Disconnect corrosion resistor assembly (14) together with bracket. (See P6)

12. **Intake manifold**
    Remove intake manifold (15). (See P7)

13. **Tube**
    1) Disconnect tube (16). (See P8)
    2) Remove drain tube (17). (See P8)

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REMOVAL OF RADIATOR GUARD ASSEMBLY

1. Remove left and right side covers, radiator hood, air cleaner cap, exhaust pipe, and engine hood (1). (See P1)
   kg Engine Hood: 55 kgm
2. Sling lift cylinder, and remove cap (2). (See P2)
   ★ Make match mark on the cap to show the mounting position before removing.
   ★ Check the number and thickness of the shims, and keep in a safe place.
3. Start engine, and retract piston rod of lift cylinder fully, then fit cylinder lock tool, and secure to guard.
   ★ Tie the piston rod with wire to prevent it from coming out.
   ★ Repeat Steps 2 and 3 to disconnect the piston rod on the opposite side from the blade.
4. Loosen radiator drain valve and drain cooling water.
   ★ If the coolant contains antifreeze, dispose of it correctly.
   Operate the control levers several times to release the remaining pressure in the hydraulic piping.
5. Disconnect tube (3). (See P3)
6. Disconnect hose (4). (See P3)
7. Disconnect hose (5). (See P4)
8. Loosen nut (7), and remove fan belt (8). (See P5)
9. Using transmission jack ① , remove underguard (9). (See P6)
   kg Underguard : 130 kg
10. Disconnect hose (10). (See P7)
11. Disconnect tube (11) and hose (12). (See P7)
12. Disconnect tube (13) and hose (14). (See P8)
13. Disconnect wiring connector (15). (See P8)
14. Remove mounting bolts, then remove radiator guard assembly (17). (See P9)
    kg Radiator guard : 1,300 kg

INSTALLATION OF RADIATOR GUARD ASSEMBLY

1. Set radiator guard assembly (17) in mounting position, and tighten mounting bolts. (See P9)
2. Connect wiring connector (15). (See P8)
3. Fit O-ring, and connect hose (14) and tube (13). (See P8)
4. Fit O-ring, and connect hose (12) and tube (11). (See P7)
5. Connect hose (10). (See P7)
6. Using transmission jack ① , install underguard (9). (See P6)
7. Fit fan belt (8) in pulley, and tighten nut (7) temporarily. (See P5)
8. Adjust tension of fan belt.
   For details, see TABLE OF STANDARD VALUES for engine related parts, "Fan belt tension"
9. Fit O-ring and connect hose (5). (See P4)
10. Connect hose (4). (See P3)
11. Fit O-ring and connect tube (3). (See P3)
12. Tighten radiator drain valve and add water through water filler to the specified level.
    ★ Run the engine to circulate the water through the system. The check the water level again.
13. Sling lift cylinder, and remove from cylinder lock tool, then start engine, extend piston lod gradually, and connect to blade.
14. Fit shim and install cap (2). (See P2)
    ★ Standard shim thickness: 4 mm
    ★ Repeat Steps 15 and 16 to connect the piston rod on the opposite side to the blade.
15. Install engine hood (1), exhaust pipe, air cleaner cap, radiator hood, and left and right side covers,

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9. Fit gasket and install cover (2). (See P1)
   Gasket : Liquid gasket (LG-1)

REMOVAL OF FUEL TANK ASSEMBLY

1. Remove rear cover.
2. Close fuel valve, and disconnect hose (1). (See P2)
3. Remove cover, then disconnect hose (2). (See P3)
4. Remove mounting bolts, then remove fuel tank assembly (3). (See P4)
   kg Fuel tank assembly : 550 kg

INSTALLATION OF FUEL TANK ASSEMBLY

1. Set fuel tank assembly (3) in mounting position, and tighten with mounting bolts. (See P4)
   Mounting bolt :
   Thread tightener (LT-2)
2. Connect hose (2), then install cover. (See P3)
3. Connect hose (1), and open fuel valve. (See P2)
4. Install rear cover.

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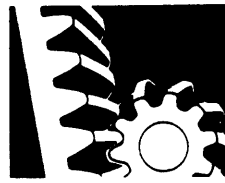
POWER TRAIN
21 STRUCTURE AND FUNCTION



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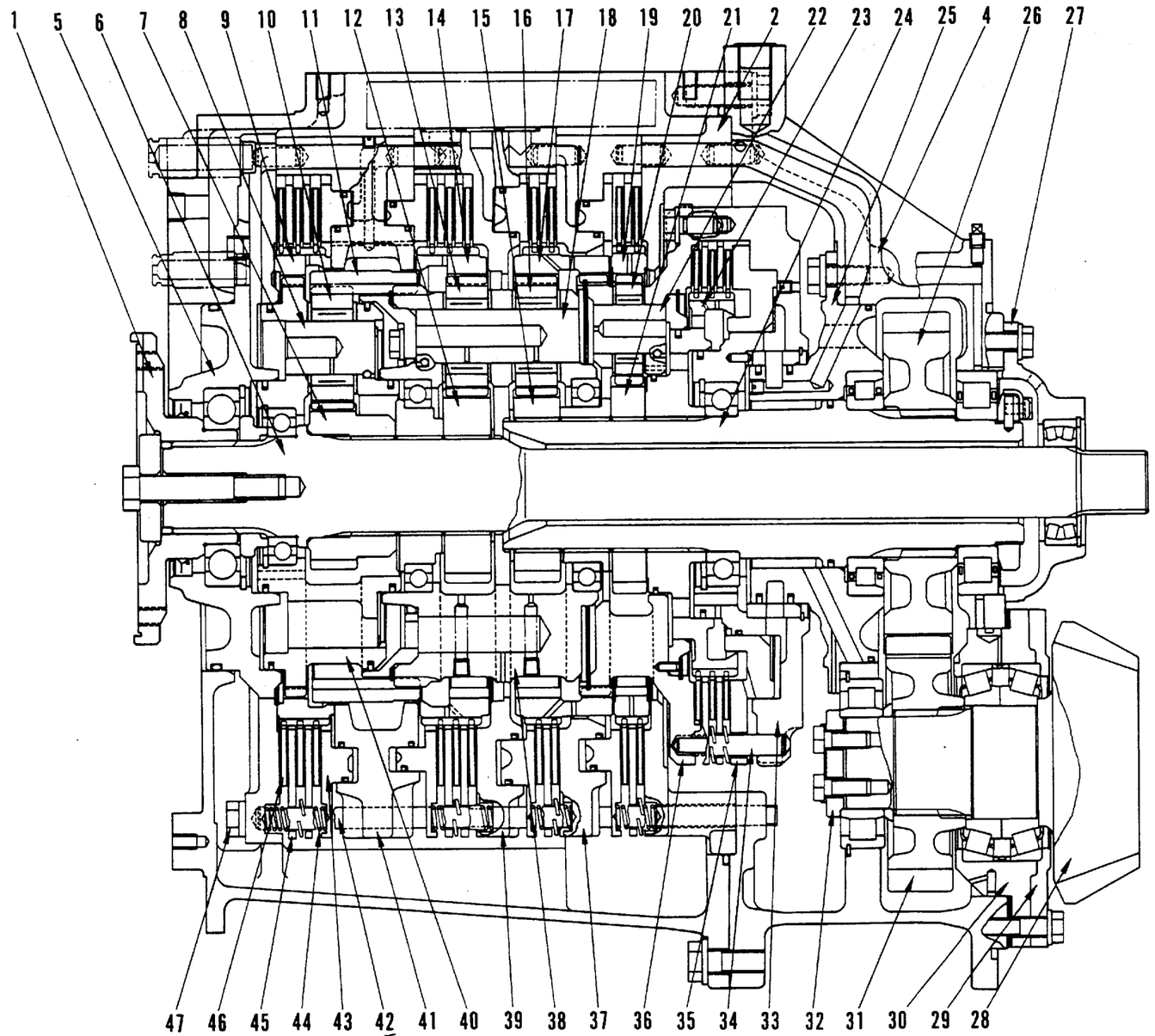

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1. Input coupling
2. Transmission case
3. Transmission valve
4. Transfer case
5. Front cover
6. Input shaft
7. No. 1 sun gear (37 teeth)
8. Pinion shaft
9. No. 1 ring gear (95 teeth)
10. No. 1 planet gear (27 teeth)
11. No. 1 ring gear (91 teeth)
12. No. 2 sun gear (43 teeth)
13. No. 2 planet gear (26 teeth)
14. No. 2 ring gear (95 teeth)
15. No. 3 sun gear (43 teeth)
16. No. 3 planet gear (26 teeth)
17. No. 3 ring gear (95 teeth)
18. Pinion shaft
19. No. 4 ring gear (95 teeth)
20. No. 4 planet gear (23 teeth)
21. No. 4 sun gear (49 teeth)
22. Pinion shaft
23. No. 5 gear
24. Output shaft
25. Bearing cage
26. Transfer drive gear (32 teeth)
27. Bearing cage
28. Bevel pinion (21 teeth)
29. Cover
30. Bearing cage
31. Transfer drive gear (25 teeth)
32. Retainer
33. No. 5 clutch housing
34. Connecting rod
35. No. 5 clutch piston
36. No. 4 carrier
37. No. 4 clutch housing
38. No. 2, 3 carrier
39. No. 3 clutch housing
40. No. 1 carrier
41. No. 1, 2 clutch housing
42. Connecting rod
43. Clutch piston
44. Clutch spring
45. Clutch plate
46. Clutch disc
47. Tie bolt

Speeds and operating clutches

Speed		Operating clutch
Forward	Neutral	No. 5 clutch
	First speed	No. 2 and No. 5 clutches
	Second speed	No. 2 and No. 4 clutches
	Third speed	No. 2 and No. 3 clutches
Reverse	Neutral	No. 5 clutch
	First speed	No. 1 and No. 5 clutches
	Second speed	No. 1 and No. 4 clutches
	Third speed	No. 1 and No. 3 clutches

Number of discs and plates on each clutch

Clutch No.	Number of discs	Number of plates
No. 1 clutch	3	2
No. 2 clutch	3	2
No. 3 clutch	2	1
No. 4 clutch	2	1
No. 5 clutch	3	2

1. Cover
2. Modulating valve spring
3. Modulating sleeve spring
4. Spring seat
5. Modulating valve spring
6. Valve body
7. Modulating valve spool
8. Modulating valve sleeve
9. Piston
10. Piston spring
11. Piston
12. Stopper
13. Cover
14. Quick return valve sleeve
15. Quick return valve
16. Piston
17. Reducing valve
18. Reducing valve spring
19. Stopper
20. Stopper
21. F-R valve
22. Valve body
23. Spacer
24. Collar
25. Cover
26. Speed valve spool

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A. To torque converter circuit
B. From transmission pump
C. To speed valve H
D. To speed valve K
E. To forward clutch port (No. 2)
F. To reverse clutch port (No. 1)
G. To 1st speed clutch port (No. 5)
H. From reducing valve C
J. To 2nd speed clutch port (No. 4)
K. From reducing valve D
L. To 3rd speed clutch port (No. 3)

MODULATING VALVE

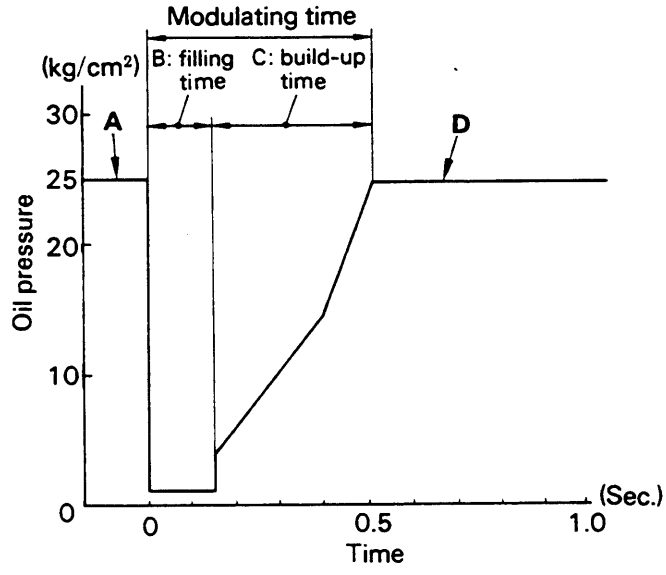
OUTLINE

- The modulating valve consists of a modulating relief valve and a quick return valve, and acts to modulates the pressure.
- When the gear shift lever is operated to shift gear, the clutch is pushed into close contact by the piston. However, if high pressure is suddenly applied, the piston will suddenly engage the clutch. This will make the machine suddenly start, and it will receive an excessive shock.

To prevent this, the modulating valve is installed. When the gear shift lever is operated to shift gear, the pressure on the piston gradually rises to the set pressure and the clutch is engaged smoothly. This allows the machine to start without any shock, thereby improving the durability of the power train and at the same time providing a comfortable ride for the operator.

- The figure shows the relationship between the time and the increase in the hydraulic pressure of the modulating valve.
  For example, when the gear is shifted from F1 to F2, the oil from the pump passes through the speed valve spool, flows to the second clutch and fills the circuit up to the clutch piston port.
  The time taken for the circuit to be filled up to the clutch piston port is called the "filling time", and the oil pressure during this time is 0 kg/cm^2.
  When the circuit up to the clutch piston port is filled with oil, the oil pressure starts to rise. The time taken for the pressure to rise to the set pressure is called the "build-up time". The filling time and build-up time together are called the "modulating time".

- **Modulating graph**



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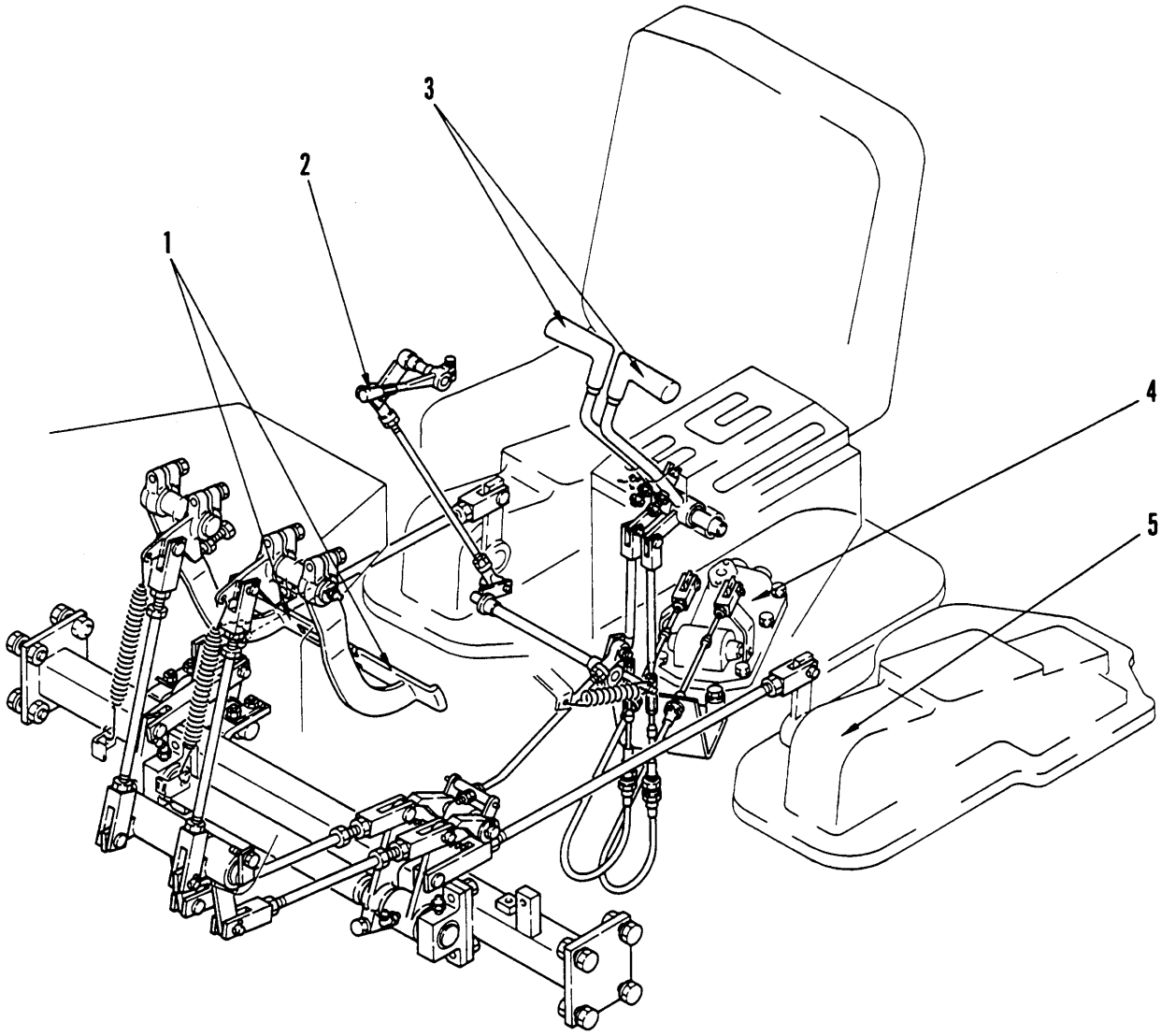
STEERING CONTROL



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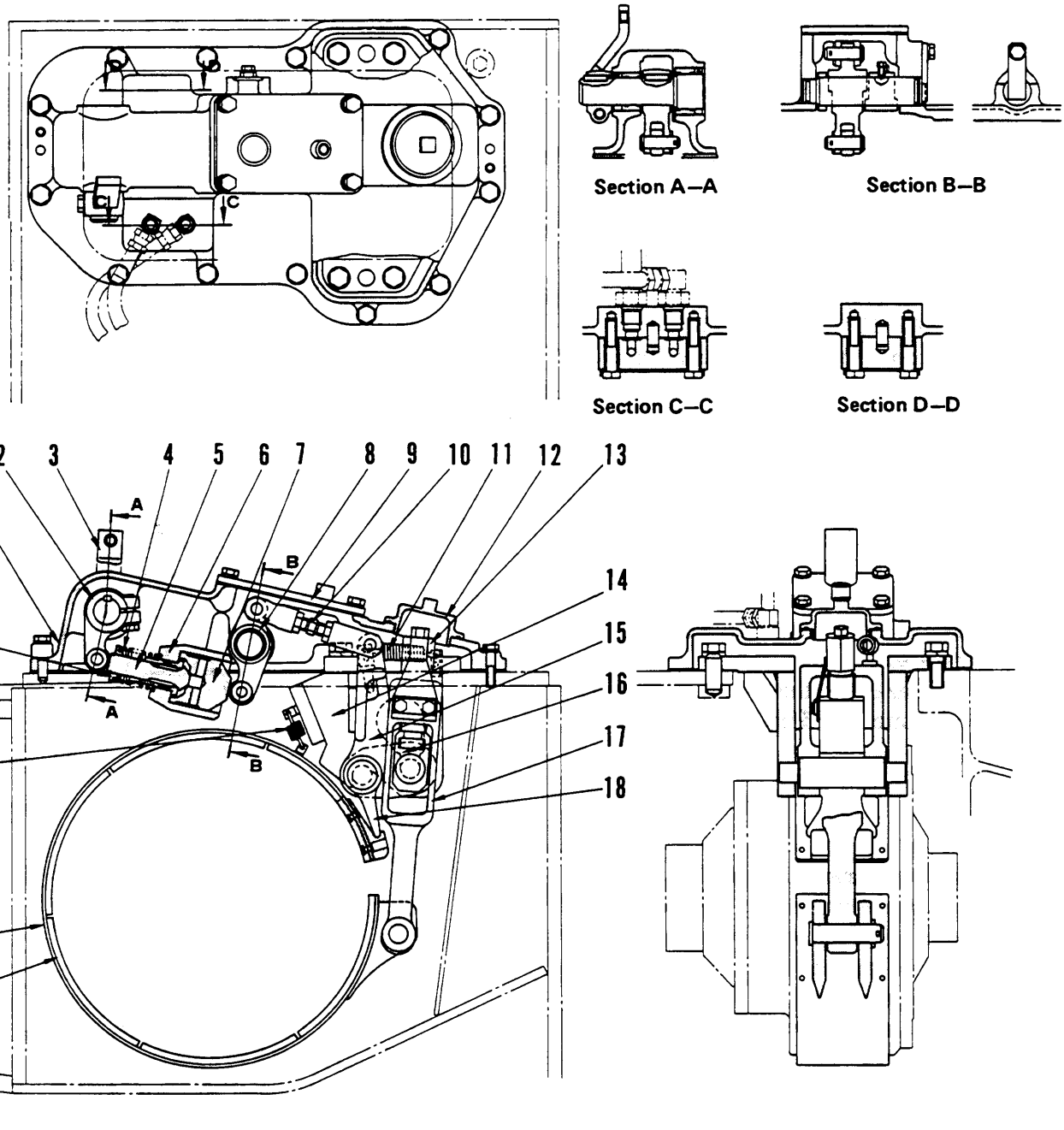
1. Brake pedal
2. Lock lever
3. Steering lever
4. Steering control valve
5. Steering brake

STEERING BRAKE



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1. Brake cover
2. Lever
3. Lever
4. Booster spring
5. Booster spool
6. Booster body
7. Booster piston
8. Lever
9. Cover
10. Rod
11. Return spring
12. Cover
13. Adjustment bolt
14. Bracket
15. Lever
16. Block
17. Rod
18. End
19. Brake lining
20. Brake band
21. Relief spring
22. Bushing
23. Retainer

MEASURING TORQUE CONVERTER STALL SPEED

Special tools

No.	Part No.	Part Name	Q'ty
A	799-203-8000	Multi-tachometer	1
A_1	(799-203-8900)	(Clamp set)	1

★ Measurement conditions
- Hydraulic oil temperature: Min. 50°C
- Engine water temperature: Within operating range

Procedure for measuring stall speed

1. Set tools A and A_1 to the fuel injection pipe.
2. After warming up the engine, depress the brake pedal fully and set the gear shift lever to F3 or R3. Stall the torque converter with the engine running at full throttle, and raise the torque converter oil temperature to the red range on the torque converter oil temperature gauge.

   ⚠ Depress the brake pedal fully, and do not let the machine move under any circumstances.

3. When the torque converter oil temperature gauge enters the red range, return the gear shift lever immediately to the "N" position to lower the torque converter oil temperature.
   When the torque converter oil temperature goes down to the green range, relieve the work equipment circuit to raise the hydraulic oil temperature.
4. Repeat Steps 2 and 3 three times.
5. When the torque converter stalls for the 4th time, measure the engine speed at the moment the torque converter oil temperature gauge goes into the red range.

(Reference)
- The stall speed differs according to the machine serial number because of the following differences.
  1) Variations between engine series numbers.
  2) Variations in engine output caused by differences in atmospheric pressure and ambient temperature.
  3) Differences in consumption torque of auxiliary equipment.
  4) Differences in torque converter properties.
  5) Differences occurring because of method of measuring stall.

  For these reasons, the stall speed must be measured extremely carefully.

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1. **Never attempt to disassemble thoughtlessly. Hasty disassembly will cause**
   - needless disassembly of unrelated parts, and hindrance of troubleshooting.

   Such faults will not only result in losses from unnecessary replacement parts and man-hour costs; but also in failure to prove yourself worthy of user's and operator's trust.
   Careful examination and systematic diagnosis should be made before disassembly.

2. **Inquire of the user and operator the following:**
   1) Are there trouble symptoms other than that you have already been informed of?
   2) Were any abnormal indications noticed previous to the trouble?
   3) Whether the trouble arose suddenly or gradually.
   4) What were the conditions under which the trouble arose?
   5) If repair of the machine was made previous to the trouble. When? and Who?
   6) Whether or not the same trouble has occurred before.

3. **Check the following before troubleshooting:**
   1) Oil level
   2) Oil leaking out from the piping and hydraulic devices.
   3) Control lever travel.
   4) Control valve spool travel
   5) Other necessary maintenance items which can be checked visually from the outside of the machine.

4. **Examine the trouble symptoms.**
   1) Ask the user and operator how they judged the machine is out of order on the basis of some data, in comparison with something, or by senses.
   2) Examine the magnitude of trouble by yourself in reference to critical values.
      - Be sure to confirm safety before testing the machine.
      - Never make any tests which would cause further trouble.
        (Consult with the user and operator about examination.)
   3) Roughly locate a possible cause of the trouble → Proceed to problems
      - Strictly observe the specified test conditions when inspecting matters largely dependent on oil temperature (such as spontaneous drift speed of work equipment supported by hydraulic cylinders).

5. **Problems**
   After finishing checks and inspections described in steps 2 to 4, proceed to problems, referring to the troubleshooting tables and using the following procedure:
   1) Start checking from a portion easy to check.
   2) Start checking from a portion where the trouble is most probable.
      - The concept of 1) and 2) above is incorporated in the compilation of the troubleshooting tables.
   3) Check related matters too.
   4) Check to see whether other trouble symptoms or faulty parts are noted.

   See the next pages for use of the troubleshooting tables.

6. **Removing the fundamental cause of trouble.**
   Dealing with the present trouble is not always enough to prevent repetition of the same trouble, if the fundamental cause of trouble is left.
   It is necessary to find out and remove the fundamental cause of trouble.
   For details, see the paragraph "Preventing Recurrence of the Same Trouble."

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8. Steering clutch does not disengage

Ask the operator the following points.

- Did the steering clutch suddenly become impossible to disengage?
  Yes = Component seized or damaged.

- Was there any abnormal noise when this happend?
  Yes = Component broken.

Checks before troubleshooting

- Is oil level in transmission and steering case correct?
- Is stroke of valve spool correct?
- Is steering control linkage properly adjusted?
- Do brakes work properly?

No.	Diagnosis \ Remedy	C	△ X	X	A △ X	△ X	X	X	X	A △ X
	Cause	Strainer clogged	Air leaking in at suction side of pump	Pump defective	Drop in relief valve set pressure or sealing defective	Operation of valve spool defective	Steering clutch seized	Seal ring portion of bevel gear shaft defective	Seal ring portion of clutch piston defective	Braking effect defective
		Tank to pump			Control valve		Steering clutch			
		a.	b.	c.	d.	e.	f.	g.	h.	i.
1	Oil pressure too low	○		○	○			○	○	
2	Pump makes abnormal noise when oil is cold	○								
3	Clutch does not disengage when oil temperature rises			○				○	○	
4	Oil pressure normal, but clutch does not disengage						○			
5	Sometimes disengages, sometimes does not disengage, and sometimes remains disengaged					○				
6	Clutch on one side (left or right) only does not disengage (oil pressure normal)							○	○	
7	Turning ability poor on flat surfaces or downhill slopes									○
8	Normal in item 6, but clutch does not disengage with oil temperature rises.			○						
9	Oil pressure becomes normal when relief valve is disassembled and cleaned, or shims are added				○					

★ In item 7, with cause "i", even if the clutch disengages, the machine will snake on slopes. If the brakes do not work, the machine will not turn.

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

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2) Remove seal ring (30), bearing (31) and outer race (32) from stator shaft assembly. (See P1, F1)

14. Scavenging pump drive gear

1) Remove snap ring (33), then tap shaft, and knock drive gear (34) inside case. (See P2, P3)

2) Remove bearing (35). (See P4)

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REMOVAL OF TRANSMISSION ASSEMBLY

1. **Draining transmission case, steering case.**
   Remove drain plug and drain off oil in steering case and transmission case.
   Steering case, transmission case: 90ℓ

2. **Under guard**
   Remove under guard (1) using mission jack ①. (See P1)
   ⚠ To prevent interference between under guard and diagonal brace, remove under guard by pushing it forward while gradually lowering transmission.
   kg Under guard: 120 kg

3. **Floor frame assembly**
   Remove floor frame assembly.
   For details, see 93 REMOVAL OF FLOOR FRAME ASSEMBLY.

4. **Hose**
   Disconnect hose (2). (See P2)

5. **Steering control cable**
   Disconnect cable (3) together with bracket. (See P3)

6. **Transmission control cable, rod**
   1) Disconnect rod (4) and rod (5). (See P4)
   2) Disconnect cable (6) together with bracket. (See P4)

7. **Rod**
   Disconnect rod (7). (See P5)

8. **Tube, switch**
   1) Disconnect tube (8). (See P5)
   2) Disconnect tube (9) together with bracket. (See P5)
   3) Disconnect switch (10) together with bracket. (See P5)

9. **Support assembly**
   Remove support assembly (11). (See P6)
   kg Support assembly: 40 kg

10. **Hose**
    1) Disconnect hose (12). (See P7)
    2) Disconnect hose (13). (See P7)

11. **Hose**
    Disconnect hose (14). (See P8)

12. **Steering relief valve assembly**
    Remove relief valve assembly (15). (See P8)

13. **Universal joint assembly**
    Remove joint assembly (16). (See P9)

14. **Transmission lubrication valve assembly**
    Remove lubrication valve assembly.
    For details, see 23 REMOVAL OF LUBRICATION VALVE ASSEMBLY.

15. **Tube**
    Disconnect tube (17) at steering case end. (See P10)

16. **Transmission assembly**
    Leaving 2 or 3 mounting bolts, sling transmission assembly, then remove remaining mounting bolts, and remove transmission assembly (18). (See P11)
    kg Transmission assembly: 650 kg
    ★ When removing, raise slowly and be careful not to hit any part.

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34. Shaft, gear assembly

1) Remove shaft and gear assembly (67). (See P1)

kg Shaft, gear assembly: 25 kg

2) Disassemble shaft and gear assembly as follows.

i) Remove plate (68). (See P2)

ii) Set in press, and remove pin (69), then using wrench ⑨, remove nut (70). (See P3, P4)

iii) Set in press, then using push tool ⑩ (outside dia.: 85 mm), push out shaft (71), then remove bearing (72) and gear (73). (See P5)

★ Set a block under the shaft to prevent the shaft from falling out and being damaged.

iv) Set in press, then using push tool ⑪ (inside dia. 110 mm), remove bearing (74). (See P6)

35. Bevel pinion assembly

1) Turn over tool A.

2) Remove mounting bolts and remove bevel Pinion assembly (75). (See P7)

kg Bevel pinion assembly

3) Remove shims (76). (See P7)

★ Measure the dimension between end face of case and end face of pinion gear.

★ Check the number and thickness of the shims, and keep in a safe place.

36. Bearing

1) Remove bearing (77). (See P8)

2) Remove outer race (78). (See P9)

DISASSEMBLY OF SHAFT, NO. 1 CARRIER ASSEMBLY

1. Shaft, No. 1 carrier assembly

1) Remove coller (1). (See P10)

2) Remove shaft assembly (3) from carrier assembly (2). (See P11)

2. Shaft assembly

1) Remove snap ring (4), then remove gear (5), bearing, coller assembly (6) and gear (7). (See P12)

2) Using push tool ① (outside dia. 105 mm), remove coller (9) from bearing (8). (See F1)

3. No. 1 carrier assembly

1) Remove snap ring (10), then remove bearing (11). (See P13, P14)

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ASSEMBLY OF TRANSMISSION ASSEMBLY

1. Set transmission case (13) on special tools A, A_1. (See P1)

2. **Bearing**
   1) Press fit outer race (78) using push tool (outside dia. 155 mm). (See P2)
   2) Press fit bearing (77) using push tool (outside dia.: 115 mm). (See P3)

3. **Bevel pinion assembly**
   Fit shims (76) and install bevel pinion assembly (75). (See P4)
   ★ Standard shim thickness: 2.0 mm
   ★ Standard shim: t = 1.0 mm, t = 0.3 mm, t = 0.2 mm

4. **Shaft, gear assembly**
   1) Assemble shaft and gear assembly as follows.
      i) Set in press, and using push tool ⑪ (inside dia. 110 mm), press fit bearing (74). (See P5)
      ii) Set in press, and fit gear (73), then using push tool ⑫ (inside dia. 95 mm), press fit bearing (72) to shaft (71). (See P6)
      iii) Set in press, then using wrench ⑨, tighten nut (70), and insert pin (69). (See P7, P8)
      iv) Install lock plate (68). (See P9)
      ★ Bend lock plate securely.

      kgm Mounting bolt: 2.8 ± 0.4 kgm

   2) Turn over tool A, and install shaft and gear assembly (67). (See P10)

5. **Cage assembly**
   Fit seal ring and install cage assembly (66) and tighten mounting bolts (65). (See P11)

6. **No. 4 carrier, No. 5 clutch assembly**
   1) Using eye bolts ⑤ (Dia. = 10 mm, Pitch = 7.5 mm) install carrier, clutch assembly (64). (See P12)

7. **Sun gear**
   Install sun gear (63), using push tool ⑬ (inside dia. 100 mm) press fit carrier clutch assembly. (See P13)

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REMOVAL OF TRANSMISSION CONTROL VALVE ASSEMBLY

1. Remove floor frame assembly.
   For details, see 93 REMOVAL OF FLOOR FRAME ASSEMBLY.
2. Disconnect rod (1), and remove bracket (2), then move cable (3) towards left side of chassis. (See P1)
3. Remove rod (4). (See P1)
4. Remove switch (5) together with bracket. (See P2)
5. Disconnect tube (6). (See P2)
6. Disconnect tube (7) together with bracket. (See P2)
7. Remove sleeve, cover assembly (8). (See P3)
8. Remove cover (9). (See P3)
   ★ Remove plug (10), check that the yoke and lever come off, then remove the cover. (See P3)
9. Remove mounting bolts (11), then remove control valve assembly (12). (See P4)

INSTALLATION OF TRANSMISSION CONTROL VALVE ASSEMBLY

1. Fit O-ring and set valve assembly (12) in mounting position, then tighten with mounting bolts (11). (See P4)
   ★ When installing the valve assembly, there is danger that the O-ring may be damaged, so align the bolt holes to set in position.
   kgm Mounting bolt: 5 ± 0.5 kgm
2. Fit gasket and install cover (9). (See P3)
   ★ Align the position of the yoke and lever from the plug hole, fit the cover, then fit the O-ring and tighten plug (10). (See P3)
3. Fit gasket and O-ring, and install sleeve, cover assembly (8). (See P3)
4. Fit O-ring and connect tube (7) together with bracket. (See P2)
5. Fit O-ring and connect tube (6). (See P2)
6. Install switch (5) together with bracket. (See P2)
7. Connect rod (4). (See P1)
8. Set cable (3) in mounting position, fit bracket (2), then connect rod (1). (See P1)
9. Install floor frame assembly.
   For details, see 93 INSTALLATION OF FLOOR FRAME ASSEMBLY.

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13. Remove bevel gear (11). (See P1)

kg Bevel gear: 30 kg

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★ Put jack ③ in contact with track shoe grouser, then remove mounting bolts while rotating track shoe. (See P1)

11. Install pin to brake band, sling with wire, then remove remaining mounting bolts, move inner drum towards inside, and remove steering clutch assembly (14). (See P2)

kg Steering clutch assembly: 125 kg

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DISASSEMBLY OF BRAKE BOOSTER ASSEMBLY

1. **Brake booster assembly**
   Flatten out lugs on lock plate (1) and remove mounting bolts (2). Remove brake booster assembly (3) from housing (4). (See P1)

2. **Spring**
   Remove snap ring (5). Remove retainer (6) and spring (7) from spool (8). (See P2)

   ⚠ Remove snap ring while firmly holding retainer. If this is not done, retainer and spring will fly out due to spring compression force when snap ring is removed.

   ★ Spring mounting load: 10 kg

3. **Piston**
   Extract piston (9) from valve body (10). (See P3)
   ★ When extracting piston, be careful not to damage sliding parts of piston or valve body.

4. **Spool**
   Remove spool (8) from valve body (10). (See P4)

ASSEMBLY OF BRAKE BOOSTER ASSEMBLY

★ Before assembly, thoroughly clean various constituent parts and apply engine oil (EO30-CD) thereto.

1. **Spool**
   Install valve body (10) and spool (8). (See P4)
   ★ Install spool so that taper seal face is on piston side.

2. **Piston**
   Install piston (9) on valve body (10). (See P3)

3. **Spring**
   Fix valve body. Install spring (7) and retainer (6) on spool and secure assembly with snap ring (5). (See P2)

4. **Brake booster assembly**
   1) Fit O-ring to booster mounting face and fix booster assembly (3) to housing (4). (See P1)
   2) Fit lock plate (1) and tighten up mounting bolts (2). (See P1)
      ★ Bend lock plate securely.

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DISASSEMBLY OF FINAL DRIVE ASSEMBLY

Special tools

No.	Part No.	Part Name	Q'ty
A	791-560-5300	Wrench	1
B	791-575-1400	Wrench	1
C	791-576-1003	Remover	1
D	790-401-1800	Lifting tool	1
E	791-575-3003	Remover	1
F	791-475-6000	Remover & installer	1
G	791-480-3001	Remover	1

1. **Draining oil**
   Remove drain plugs and drain oil from bevel gear case and final drive case.
   Bevel gear case: Approx. 90 ℓ
   Final drive case: Approx. 36 ℓ

2. **Track frame assembly**
   Remove track frame assembly.
   For details, see 33 REMOVAL OF TRACK FRAME ASSEMBLY.

3. **Cover**
   Remove sprocket cover.

4. **Nut**
   Remove lock plate (1), then using tool A, remove nut. (See P1, P2)

5. **Support**
   Remove support (2). (See P3)

6. **Sprocket nut**
   Remove lock (3), then using tool B, remove sprocket nut (4). (See P4, P5)

7. **Sprocket**
   1) Remove retainer (5). (See P6)
   2) Remove collar (6). (See P7)
   3) Using tools C, C_1, and C_2, pull out sprocket (7). (See P8)
      ★ When pulling out the sprocket, be careful not to damage the thread at the tip of the shaft.
      kg Sprocket: 245 kg

8. **Case assembly**
   1) Using tool D, sling case assembly (8), then bolt in forcing bolts ① (Thread dia. = 20 mm, Pitch = 2.5 mm), and remove case assembly. (See P9)
      kg Case assembly: 210 kg
   2) Remove bearings (9) and (10) from case. (See P10)

9. **Hub assembly**
   1) Using tool E, pull out hub assembly (11). (See P11)
      kg Hub assembly: 250 kg

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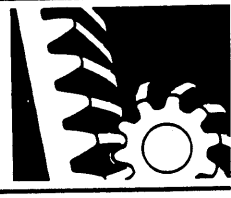
POWER TRAIN
24 MAINTENANCE STANDARD



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Unit: mm

No.	Check item	Criteria				Remedy
1	Face runout of back of bevel gear	Max. 0.1 (Measure after mounting on bevel gear shaft)				Repair or replace as assembly
2	Backlash between bevel gear and pinion	Standard clearance		Clearance limit		
		0.25 – 0.33		0.75		
3	Preload of taper roller bearing on bevel gear shaft	Standard rotating torque: 1) 0.4 – 1.2 kgm. 2) 2 – 6 kg (Measure at tip of bevel gear under condition of bevel pinion gear is disengaged.)				Adjustment
4	Interference between bevel gear and reamer bolt	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		18	0 –0.015	+0.027 0	0 – 0.042	0.1	
5	Inside diameter of seal ring contact surface in bearing cage	Standard size		Repair limit		
		145.0		145.3		
6	Width of seal ring	4.5		4.0		
	Width of seal ring groove	4.5		5.0		
7	Fitting pressure of bevel gear shaft hub	30 – 40 ton				Adjustment
8	Dimension between end surfaces of bevel gear shaft and hub	6 ± 0.5				
9	Face runout of bevel gear shaft hub	0.15				
10	Radial runout of bevel gear shaft hub	0.15				

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Unit: mm

No.	Check item	Criteria					Remedy
		Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
1	Clearance between sprocket shaft and diagonal brace bushing	90	−0.036 −0.071	+0.035 0	0.036 – 0.106	0.5	Replace bushing
2	Clearance between shaft support collar and bushing	110	−0.036 −0.071	+0.199 +0.084	0.120 – 0.270	0.5	
3	Backlash between No. 1 pinion and No. 1 gear	Standard clearance			Clearance limit		Replace
		0.39 – 0.83			1.5		
4	Backlash between No. 2 pinion and No. 2 gear	0.45 – 0.99			1.5		
5	Outside diameter of oil seal contact surface of final drive flange	Standard size			Repair limit		
		120					
6	Fitting pressure of final drive flange	30 – 40 ton					Adjustment
7	Dimension between end surface of final drive flange and No. 1 pinion shaft	3					
8	Face runout of final drive flange	0.08					
9	Radial runout of final drive flange	0.08					
10	Fitting pressure of No. 1 gear	5 – 16 ton					
11	Fitting pressure of sprocket boss	50 – 60 ton					
12	Dimension between end surfaces of sprocket hub and sprocket boss	39 – 41					
13	Fitting pressure of sprocket shaft	12 – 46 ton					
14	Dimension of floating seal guides	4.3 ± 1.0					
15	Dimension between end surfaces of sprocket nut and support	22.8 ± 1.2					
16	Wear on sprocket tooth top surface	Standard size		Tolerance		Repair limit	Repair or replace
17	Wear on sprocket tooth bottom surface						
18	Wear on sprocket tooth top surface width	Standard size				Repair limit	
19	Wear on sprocket tooth bottom surface width	90					

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REMOVAL OF TRACK FRAME ASSEMBLY

1. Remove blade assembly.
   For details, see 73 REMOVAL OF BLADE ASSEMBLY.

2. Remove track shoe assembly.
   For details, see 33 REMOVAL OF TRACK SHOE ASSEMBLY.

3. Jack up chassis and set stands ① (height: approx. 500 mm) on left and right at bottom of steering case, and stand ② (height: approx. 850 mm) in center at bottom of radiator guard. (See P1, P2)

4. Sling track frame assembly, and remove diagonal brace cap (1). (See P3)
   ★ Make match marks on the cap and diagonal brace before removing.

5. Remove cover, then remove cap (2). (See P4)
   ★ Before removing the cap, check that the position of the center of gravity of the machine is shown.

6. Lower track frame assembly (3) gradually, and disconnect from diagonal brace and sprocket shaft. (See P5)
   ★ Lower the rear of the track frame assembly and pull it out to the front.
   kg Track frame assembly: 2300 kg

INSTALLATION OF TRACK FRAME ASSEMBLY

1. Raise track frame assembly (3), and set in position on diagonal brace and sprocket shaft. (See P5)

2. Fit cap (2) and install cover. (See P4)
   kgm Cap mounting bolt: 94 ± 10 kgm
   kgm Cover mounting bolt:
   (16 mm) 25 ± 5 kgm
   (12 mm) 11 ± 2 kgm
   Cover mounting bolt:
   Thread tightener (LT-2)

3. Align match marks of cap and diagonal brace, and install cap (1). (See P3)
   kgm Cap mounting bolt: 94 ± 10 kgm

4. Jack up chassis, remove stands ① on left and right at bottom of steering case, and stand ② in center at bottom of radiator guard, then lower chassis. (See P1, P2)

5. Install track shoe assembly.
   For details, see 33 INSTALLATION OF TRACK SHOE ASSEMBLY.

6. Install blade assembly.
   For details, see 73 INSTALLATION OF BLADE ASSEMBLY.

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UNDERCARRIAGE
34 MAINTENANCE STANDARD

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Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diamter of flange (outside)	Standard size		Repair limit			Build-up welding or replace
		257.0		247.0			
2	Outside diameter of flange (inside)	249.0		239.0			
3	Outside diameter of track roller tread face	222.0		198.0			
4	Overall width of track roller	251.2		–			
5	Width of track roller tread face (single flange)	55.6		66.6			
6	Width of track roller tread face (double flange)	51.6		68.6			
7	Width of flange (single flange)	21.0		6.0			
8	Width of flange (double flange, outside)	21.0		6.0			
9	Width of flange (double flange, inside)	21.0		6.0			
10	Width of collar on shaft	20.0		18.5			
11	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		70	–0.210 –0.260	+0.130 +0.100	0.31 – 0.39	1.0	
12	Interference between outside bushing and track roller	Standard size	Tolerance		Standard interference	Allowable interference	
			Shaft	Hole			
		115	+0.094 +0.040	+0.027 –0.027	0.013 – 0.121	–0.35	
13	Free play of shaft in the axial direction	Standard clearance			Clearance limit		
		0.40 – 0.80			1.5		

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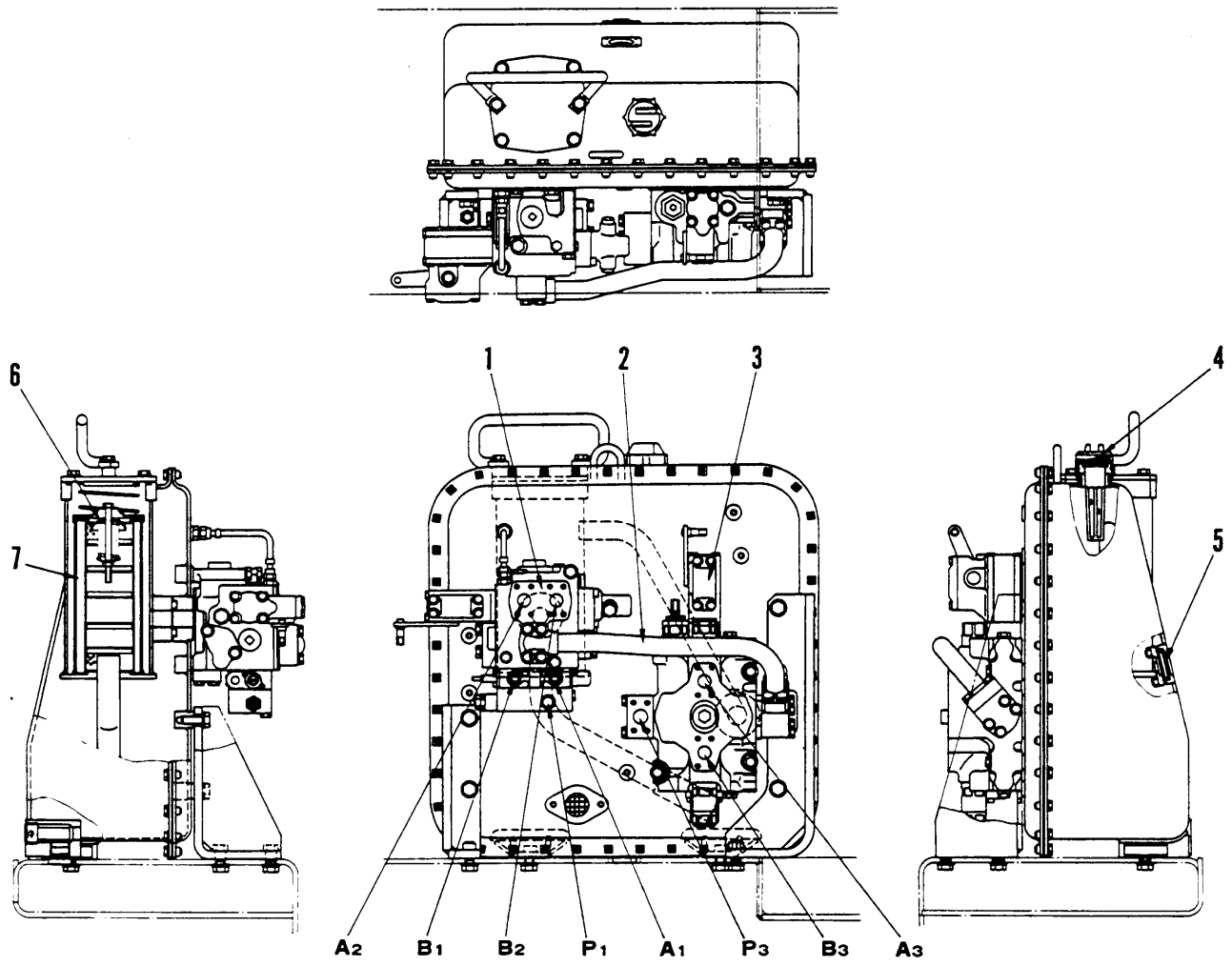
HYDRAULIC TANK



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CAPACITY

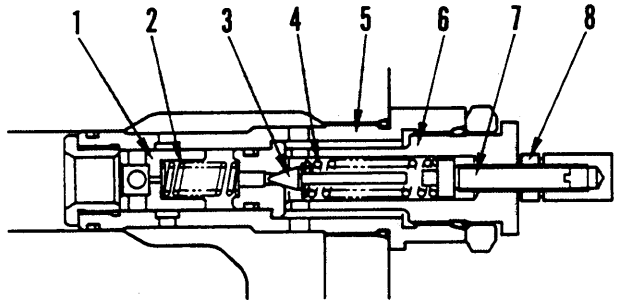
- 58 ℓ (Amount of oil inside tank)

1. Blade control valve
2. Tube
3. Ripper control valve
4. Oil filler
5. Oil level gauge
6. Valve
7. Oil filter

P_1: From small pump
P_3: From large pump
A_1: To blade tilt cylinder head
B_1: To blade tilt cylinder bottom
A_2: To blade lift cylinder head
B_2: To blade lift cylinder bottom
A_3: To ripper lift cylinder bottom
B_3: To ripper lift cylinder head

MAIN RELIEF VALVE
(For brade tilt circuit)

- The main relief valve is in the circuit between the hydraulic small pump and the blade tilt control valve. When the control valve is operated, the main relief valve sets the pressure of the oil flowing from the hydraulic small pump to the blade tilt cylinder to 195 kg/cm^2.
- The set pressure of the main relief valve can be adjusted by adjustment screw (7).
  One turn of the adjustment screw adjusts the pressure by 35.7 kg/cm^2.



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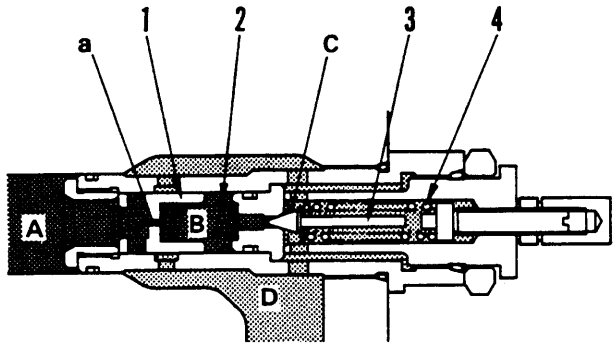
OPERATION

- Chamber A forms the circuit from the small pump to the blade tilt cylinder. Chamber D forms the tank drain circuit. The oil flows into chamber B through orifice a to keep the chamber filled. If the pressure in chamber B is less than the poppet spring force (set pressure), the pilot poppet sits in the seat of the body.



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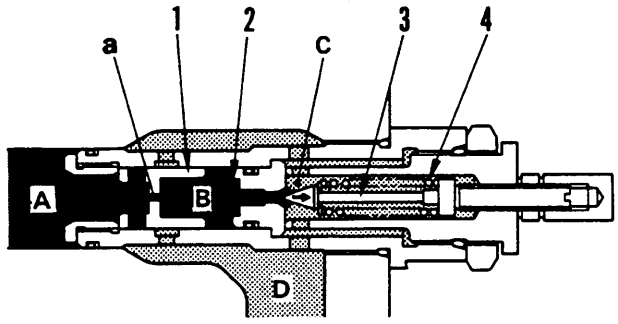
- If the pressure in chamber B reaches the poppet spring (4) force (set pressure), the pilot poppet (3) moves, allowing the oil in chamber B to flow into chamber D through chamber C. In addition, the oil flows from chamber A to B through orifices.



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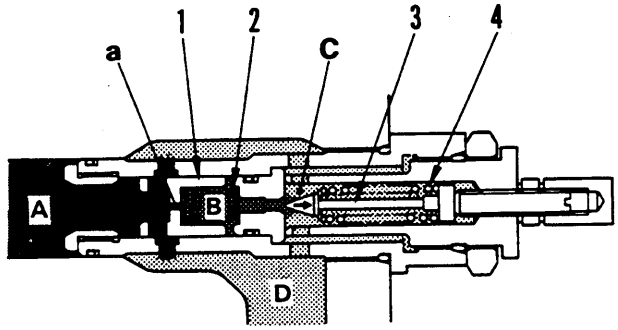
- If the oil flows through the orifice a, a differential pressure occurs between the chambers A and B, moving valve (2) to the right. This allows the oil in chamber A to flow into chamber D.



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PISTON VALVE

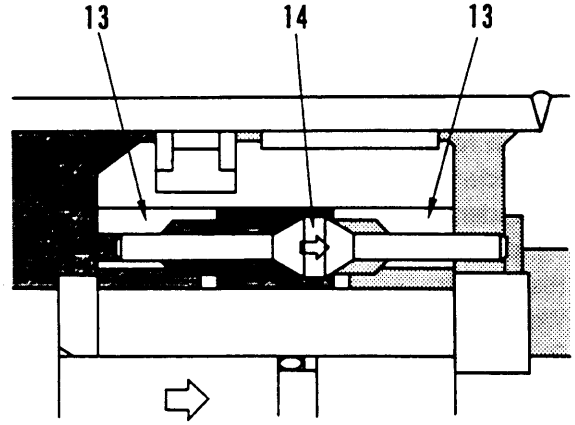
OUTLINE

- The piston valve is installed to the piston of the blade lift cylinder. When the piston reaches the end of its stroke, the piston valve releases the oil from the hydraulic pump and lowers the hydraulic pressure acting on the piston.
  With the straight tiltdozer, when the blade is tilted, the pistons of the left and right cylinders become out of line. As a result, when one of the pistons is at the end of its stroke, the other piston is not at the end of its stroke, so a twisting force is applied to the blade.
  The piston valve is installed to prevent this twisting. When one piston reaches the end of it stroke, the piston valve opens to relieve the hydraulic pressure.
  The piston valve also acts to release the oil before the piston contacts the bottom or head of the cylinder. This reduces the shock when the piston contacts the end of the cylinder, and also acts to relieve the surge pressure that is generated when this happens.

OPERATION

1. **Piston valve CLOSED**
   The oil from the hydraulic pump acts on piston (5) and piston valve (14).
   The piston valve is pushed to the right, and seals the tapered part of piston valve seat (13). Therefore, the pressure inside the cylinder rises, and piston (5) is moved to the right.

2. **Piston valve OPEN**
   Immediately before piston rod (2) reaches the end of its stroke, the tip of piston valve (14) contacts the cylinder bottom (or cylinder head). The piston valve then stops moving, and only piston (5) continues to move.
   When this happens, the oil at the cylinder head, which was sealed by the piston valve, escapes through piston valve seat (13) and the hydraulic pressure inside the cylinder stops rising.



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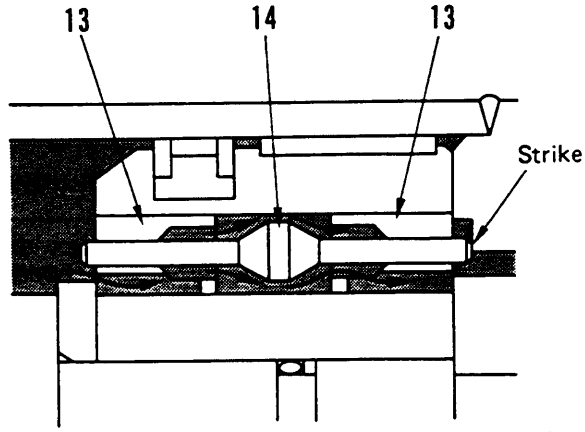

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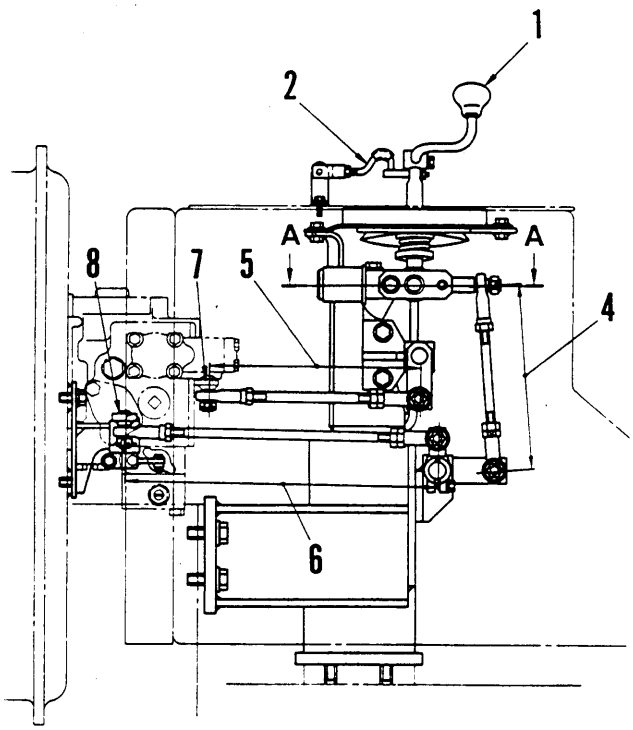
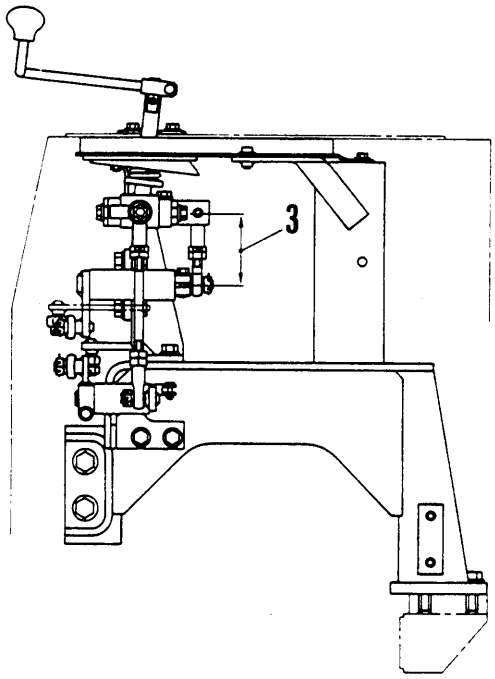
ADJUSTING BLADE CONTROL LINKAGE





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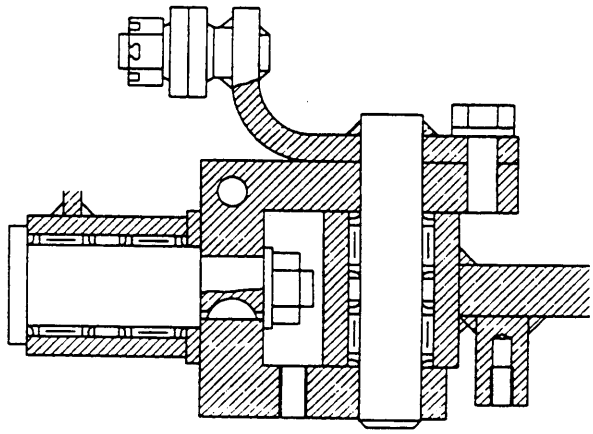
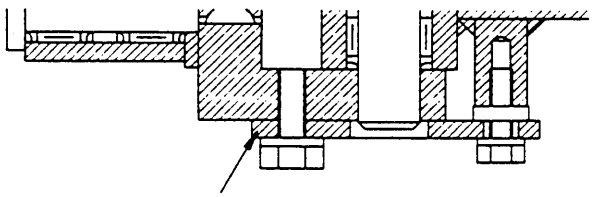
1. Set blade control lever (1) at HOLD position, and set blade lock lever (2) at LOCK position to hold blade lever in position.
2. In this position, interconnect rods (3), (4), (5) and (6).
   - ★ Standard length of rod (3): 92 mm
     (4): 237 mm
     (5): 265 mm
     (6): 396 mm
   - ★ Adjust the rods with the turnbuckles of rods (5) and (6), and adjust without moving levers (7) and (8) installed to the control valve.
3. After interconnecting all parts of the linkage, move lock lever (2) between the LOCK and FREE positions in turn, and check that rods (5), (6) do not move.

· When attached straight tiltdozer



A – A

· When attached angledozer



Lock plate (lock the movement of tilting direction)

A – A

F15C21032

015C21

10. Hydraulic drift of tilt cylinder is large.

Ask the operator the following questions

- Did the hydraulic drift of tilt cylinder suddenly become large? → Damaged parts.
- Did the hydraulic drift of tilt cylinder gradually become large → Worn parts.

Check before troubleshooting

- If the rod of control lever is disconnected from the control valve spool, is the hydraulic drift of tilt cylinder proper?
  → Bend of rod or seizure of rod bushing or faulty of servo oil circuit.
- Is there oil leakage from piping between control valve and tilt cylinder?

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No.	Diagnosis / Remedy	Cause: Oil leakage from tilt spool (by damaged spool) — Hydraulic control valve (a): △ X	Cause: Packing on the tilt cylinder defective. — Tilt cylinder (b): X
1	Oil does not issues when removing the piping from tilt cylinder head.		○
2	Hydraulic drift of tilt cylinder is large even if the piping of tilt cylinder head is blocked.		○
3	If Items 1 and 2 are normal.	○	

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

REMOVAL OF RIPPER CONTROL VALVE ASSEMBLY

Lower the work equipment completely to the ground and stop the engine. Operate the control levers several times to release the remaining pressure in the hydraulic piping. Then loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

1. Remove drain plug of hydraulic tank and drain oil from tank.
   Hydraulic tank: Approx. 58 ℓ
2. Remove floor frame assembly.
   For details, see 93 REMOVAL OF FLOOR FRAME ASSEMBLY.
3. Remove tube (1). (See P1)
4. Disconnect hose (2) and tube (3). (See P2)
5. Sling ripper control valve assembly, remove mounting bolts, then remove ripper control valve assembly (4). (See P2)

INSTALLATION OF RIPPER CONTROL VALVE ASSEMBLY

1. Fit O-ring and set ripper control valve assembly (4) in mounting position, then tighten with mounting bolts. (See P2)
2. Fit O-rings and connect tube (3) and hose (2). (See P2)
3. Fit O-rings to both sides, and install tube (1). (See P1)
4. Install floor frame assembly.
   For details, see 93 INSTALLATION OF FLOOR FRAME ASSEMBLY.
5. Tighten drain plug and add engine oil through oil filler to hydraulic tank to the specified level.
   Hydraulic tank: Approx. 58 ℓ
6. Bleed air from piping.
   For details, see 62 TESTING AND ADJUSTING, Bleeding air from hydraulic cylinder.
   ★ After bleeding the air, check the oil level again.

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- Tilt, ripper cylinder
  i) Remove wear ring (21). (See F1)
  ii) Remove piston ring (22). (See F1)

5. **Head cover assembly**
   - Blade cylinder
     i) Remove O-ring (23), backup ring (24), and O-ring (25). (See F2)
     ii) Remove rod packing (26) and bushing (27). (See F2)
     iii) Remove snap ring (28), then remove dust seal (29). (See F2)

   - Tilt, ripper cylinder
     i) Remove O-ring (30) and backup ring (31). (See F3)
     ii) Remove rod packing (32) and bushing (33). (See F3)
     iii) Remove snap ring (34), then remove dust seal (35). (See F3)

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Unit: mm

No.	Check item	Criteria					Remedy
		Standard size			Repair limit		
		Free length	Installation length	Installation load	Free length	Installation load	
1	Lift spool return spring	45.5	36.8	7.5 kg	43.9	6.0 kg	Replace
2	Detent spring	21.6	16.5	7.0 kg	20.6	5.6 kg	
3	Check valve spring	72.5	35.0	1.2 kg	65.0	0.96 kg	
4	Check valve spring	23.2	20.0	3.17 kg	22.6	2.54 kg	
5	Suction valve spring	43.3	23.0	0.65 kg	39.2	0.52 kg	
6	Suction valve spring	44.5	34.0	0.39 kg	42.3	0.31 kg	
7	Demand valve spring	71.9	46.0	15.2 kg	66.8	12.2 kg	
8	Tilt spool return spring	50.0	26.5	14.1 kg	45.3	11.3 kg	
9	Check valve spring	17.5	7.5	0.2 kg	15.5	0.16 kg	
10	Main relief valve spring	23.3	19.0	2.0 kg	18.7	1.6 kg	
11	Poppet spring for main relief valve	29.3	24.1	24.5 kg	23.5	19.6 kg	
12	Height of main relief pressure adjustment screw	40.8 (One turn of the screw oil charge the pressure: 56 kg/cm^2)					Adjustment

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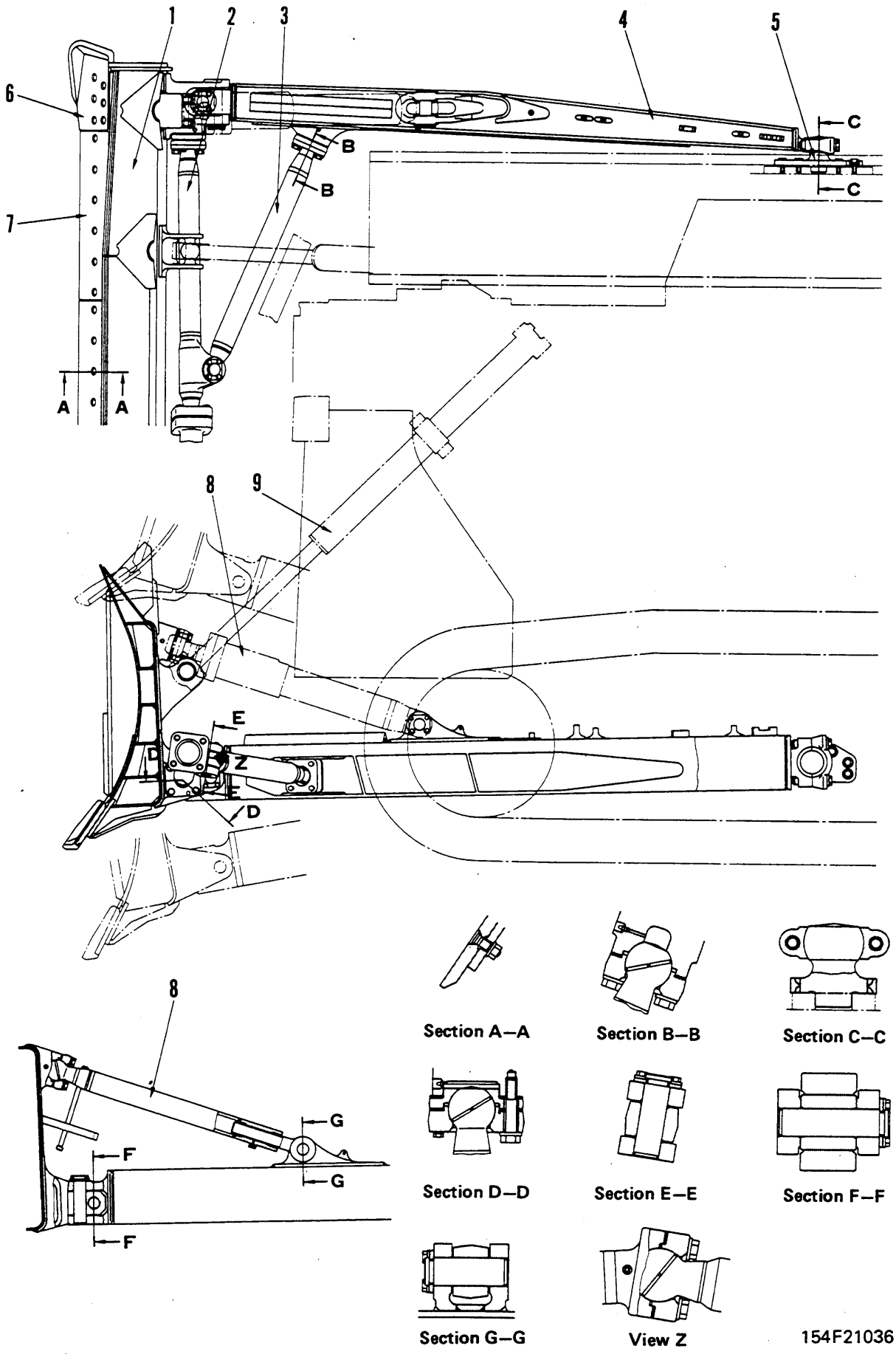
STRAIGHT TILTDOZER



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WORK EQUIPMENT
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