

WSM

**WORKSHOP MANUAL
KUBOTA EXCAVATOR
MANUEL D'ENTRETIEN
EXCAVATEUR KUBOTA
WERKSTATTANLEITUNG
BAGGER KUBOTA
U-10,20,35,45**

Kubota

Record of Revisions
Rapport de Révision
 Inspektionsaufzeichnungen

Symbol <i>Symboles</i> Symbol	Date <i>Date</i> Datum	Main Revised Points & Corrective Measures <i>Principaux points de révision et mesures correctives</i> Hauptpunkte der Inspektion und korrektive Maßnahmen	Person-in-charge <i>Personne responsable</i> Verantwortlicher
△ 1	June 1999	1. Addition of U-10, 45 2. Design change information on U-20, 35.	M. Katayama
△ 2			
△ 3			
△ 4			

Additional Contents : U-10 α

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[1] Major change points

1-1 List of major change points

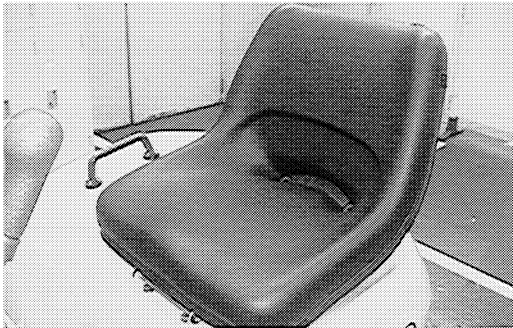
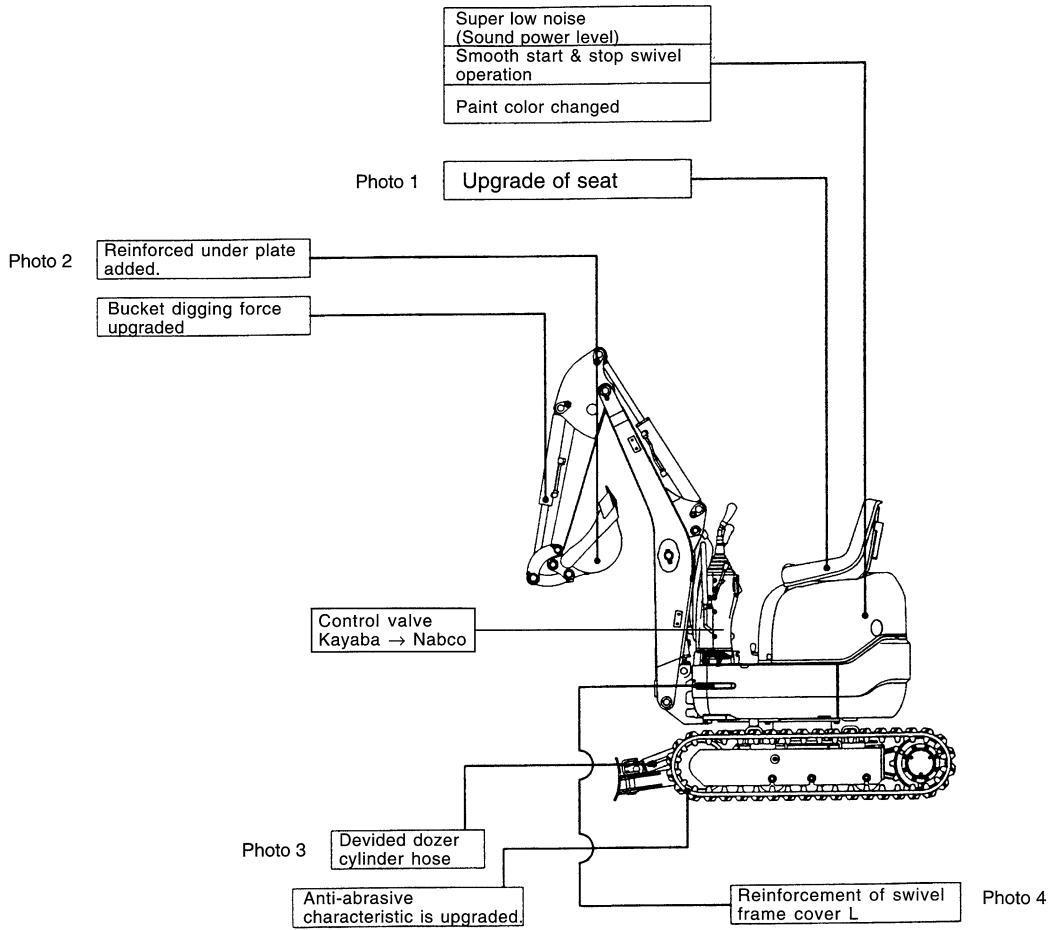


Photo 1

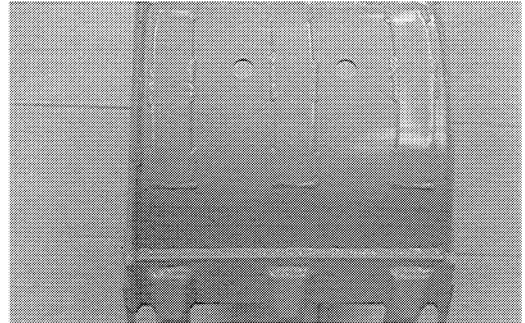


Photo 2

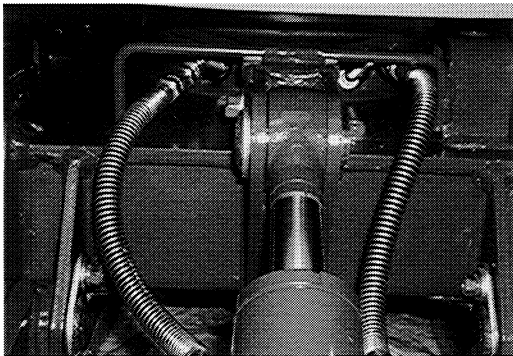


Photo 3

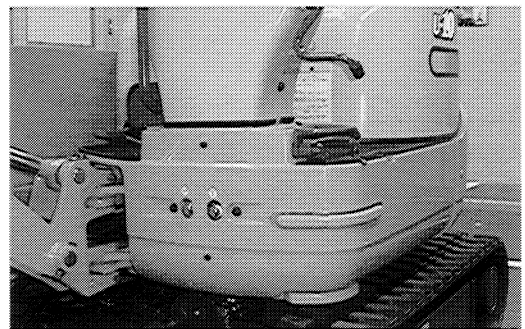
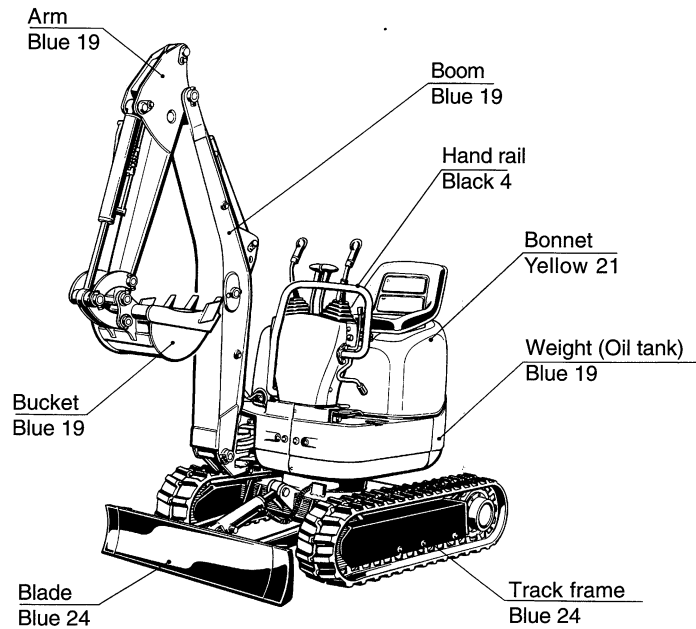


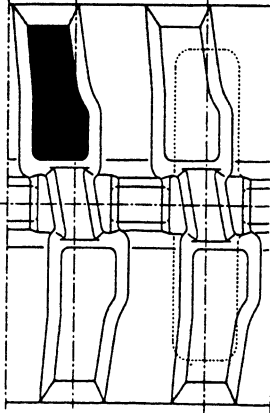
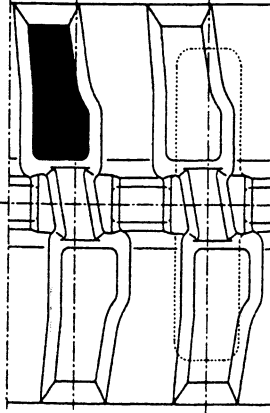
Photo 4

1-2 Paint color; EU-version



Color	Spot color	Lacquer (1k can)	Lacquer (4k can)	Super lacquer (4k can)	Super lacquer (16k can)
Blue 19	07935-50075	07913-01098	07913-04099	07913-44099	07913-16010
Blue 24	07935-50097	07913-01107	07913-04111	07913-44104	—
Black 4	07935-50064	07913-01096	07913-04098	—	—
Yellow 21	07935-50098	07913-01108	07913-04112	—	—

1-3 Rubber track; Upgraded anti-wear characteristic

		U-10	U-10 α	Remarks
Thickness	mm (inch)	18.0 (0.71)	21.0 (0.83)	Total upgrade
Iron core width	mm (inch)	140.0 (5.51)	160.0 (6.3)	
Steel cord	Q'ty	36	40	tensile strength is upgraded
Hardness of rubber	Rug side	60 \pm 5°	60 \pm 5°	
	Tread side	73 \pm 5°	73 \pm 5°	
Rug pattern				

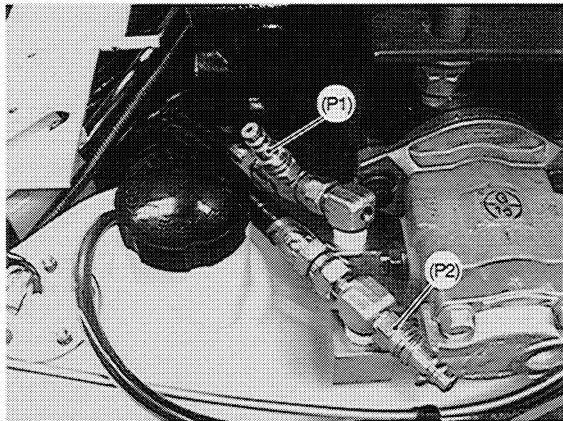
1-4 System pressure and control valve section sequence

1. Pressure setting

Unit : Mpa (kgf/cm²), psi

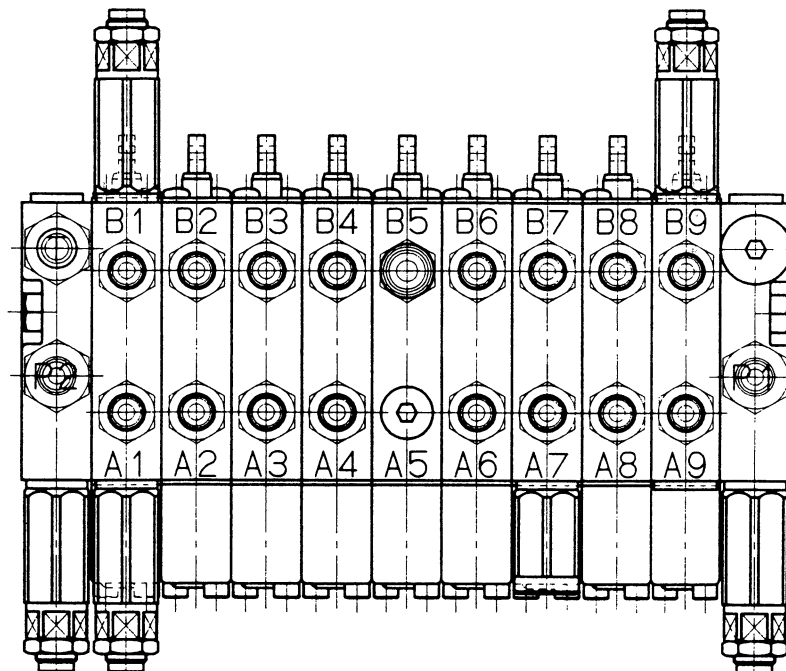
		U-10α	U-10	Test condition
Main relief valve				Engine Max. rpm At pump delivery port Oil temp. 50 ± 5°C 122 ± 41°F
P1	Actuator	Bucket	Bucket	
	Bench set pressure	17.7(180), 2560	17.2(175), 2489	
P2	Actuator	Arm	Arm	
	Bench set pressure	17.7(180), 2560	17.2(175), 2489	
Overload relief valve				
Boom up	Bench set pressure	22.5(230 ± 3), 3271 ± 42.7	22.5(230 ± 3), 3271 ± 42.7	
Swivel, right	Bench set pressure	7.1(72 ± 3), 1024 ± 42.7	7.1(72 ± 3), 1024 ± 42.7	
Swivel, left	Bench set pressure	7.1(72 ± 3), 1024 ± 42.7	7.1(72 ± 3), 1024 ± 42.7	

Relief pressure testing procedure



1. Remove the plug and install pressure testing quick coupler and gauge.
2. Start engine and confirm the testing circuit.
3. With engine max. RPM, control the lever to relieve the testing cylinder.
4. Repeat 2-3 time to get correct data.
5. Testing oil temp, 50 ± 5 °C (122 ± 41 °F)

2. Control valve section sequence



EU-version

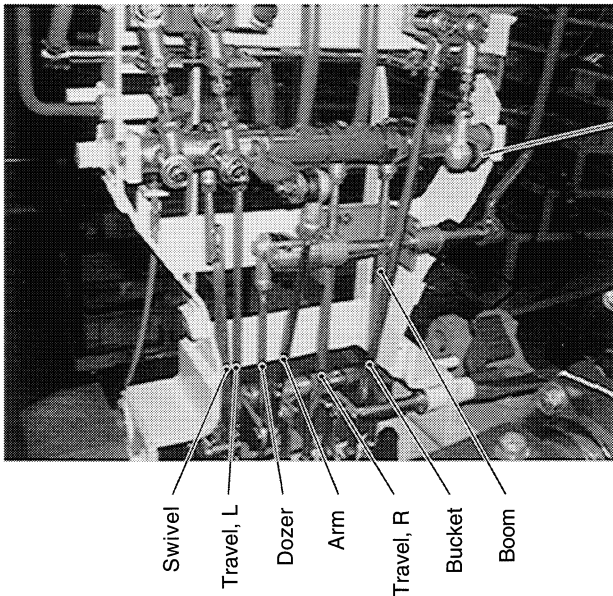
B1	Swivel R
B2	Arm crowd
B3	Travel Forward
B4	Dozer down
B5	Service port, IN
B6	Travel R Forward
B7	Swing L
B8	Bucket crowd
B9	Boom down
A1	Swivel L
A2	Arm extend
A3	Travel L Reverse
A4	Dozer up
A5	Service port, out
A6	Travel R Reverse
A7	Swing R
A8	Bucket dump
A9	Boom up

1-5 Noise level

		Unit	U-10 α	U-10
Noise level at ear (L/R)		dB(A)	73	73
Noise level, around	Conventional method (7m,39.4" away)	dB(A)	62	63
	New method (Sound power level)	dB(A)	90	—

1-6 Control device

1. Control rod layout



Rod end joint tightening torque
23.5 ~ 27.5N·m
(2.4 ~ 2.8 kgf·m)
* Apply screw locktite

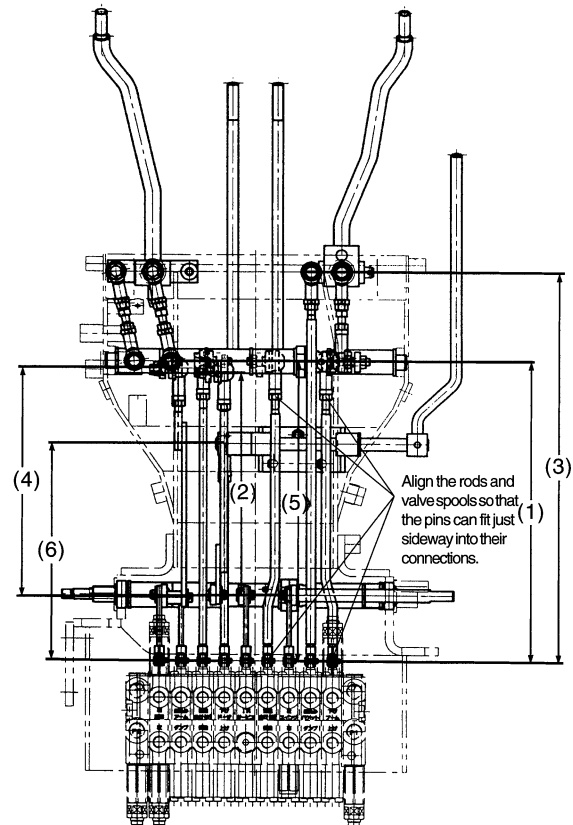
2. Adjusting procedure of travel levers

Align the rods and valve spools so that the pins can fit just sideways into their connections. Tighten up the lock nuts.

* If pins are not fit in at right angles, the operating load may be excessive, damaging the spools.

Rod length (For your information)

No.	Function	Length mm (inch)
1	Boom	334 (13.1)
2	Arm	255 (10.0)
3	Bucket	440 (17.3)
4	Swivel	260 (10.2)
5	Travel, R	334 (13.1)
	Travel, L	334 (13.1)
6	Dozer	236-238 (9.3-9.4)



1-7 Oil hose list

No	Code No.	Q'ty/Unit	Hose			Joint		Location
			Mark	Size	Total length mm,inch	Left	Right	
1	RA011-6351-2	2	-	3/16	200 , 7.9	G1/4	G1/4	Dozer cylinder-R/J
2	RA121-6352-4	2	-	1/4	380 , 15.0	G1/4	G1/4	R/J-dozer cylinder
3	RA111-6347-1	1	Red	1/4	410 , 16.1	G1/4	G1/4	C/V R travel(upper)-R/J, A
4	RA111-6348-2	1	Blue	1/4	450 , 17.7	G1/4	G1/4	C/V R travel(lower)-R/J, I
5	RA111-6349-1	1	Green	1/4	465 , 18.3	G1/4	G1/4	C/V L travel(upper)-R/J, B
6	RA111-6369-1	1	-	1/4	465 , 18.3	G1/4	G1/4	C/V L travel(lower)-R/J, C
7	RA121-6341-1	1	White	5/16	510 , 20.1	G1/4	G1/4	C/V-Pump (P1)
8	RA121-6342-1	1	Gray	5/16	535 , 21.1	G1/4	G1/4	C/V-Pump (P2)
9	RA121-6355-2	1	White	1/4	650 , 25.6	G1/4	G1/4	C/V swing(upper)L-swing cylinder(bottom)
10	RA121-6356-2	1	-	1/4	670 , 26.4	G1/4	G1/4 90°	C/V swing(lower)R-swing cylinder(rod)
11	RA111-6366-1	1	Brown	1/4	425 , 16.7	G1/4	G1/4	Swivel motor L-C/V upper
12	RA111-6365-1	1	Pink	1/4	455 , 18.0	G1/4	G1/4	Swivel motor R-C/V lower
13	RA111-6357-1	1	White	1/4	1700 , 67.0	G1/4	G1/4	Boom cylinder bottom-C/V upper
14	RA111-6358-1	1	-	1/4	1610 , 63.4	G1/4	G1/4	Boom cylinder rod-C/V lower
15	RA111-6353-1	4	-	1/4	660 , 26.0	G1/4	G1/4	Travel motor-R/J
16	RA111-6395-2	1	-	1/4	365 , 14.4	G1/4	G1/4 90°	Truck cylinder rod-R/J upper F
17	RA111-6394-1	1	-	1/4	460 , 18.1	G1/4	G1/4 90°	Truick cylinder bottom-R/J lower R
18	RA121-6345-1	1	-	1/4	485 , 19.1	G1/4	G1/4 90°	C/V dozer lower-R/J H
19	RA111-6392-3	1	-	1/4	660 , 26.0	G1/4	G1/4 90°	R/J G-change valve A
20	RA111-6393-1	1	-	1/4	460 , 18.1	G1/4	G1/4	R/J F-change valve B
21	RA121-6391-1	1	-	1/4	695 , 27.4	G1/4	G1/4 90°	C/V dozer lower-change valve P, center
22	RA111-6373-2	1	Blue	1/4	2150 , 84.6	G1/4	G1/4	Arm cylinder rod-C/V lower
23	RA111-6374-2	1	Red	1/4	2150 , 84.6	G1/4	G1/4	Arm cylinder bottom-C/V upper
24	RA111-6375-2	1	Green	1/4	2910 , 114.6	G1/4	G1/4	Bucket cylinder bottom-C/V upper
25	RA111-6376-2	1	Yellow	1/4	2910 , 114.6	G1/4	G1/4	Bucket cylinder rod-C/V lower
26								
27								
28								
29								
30								

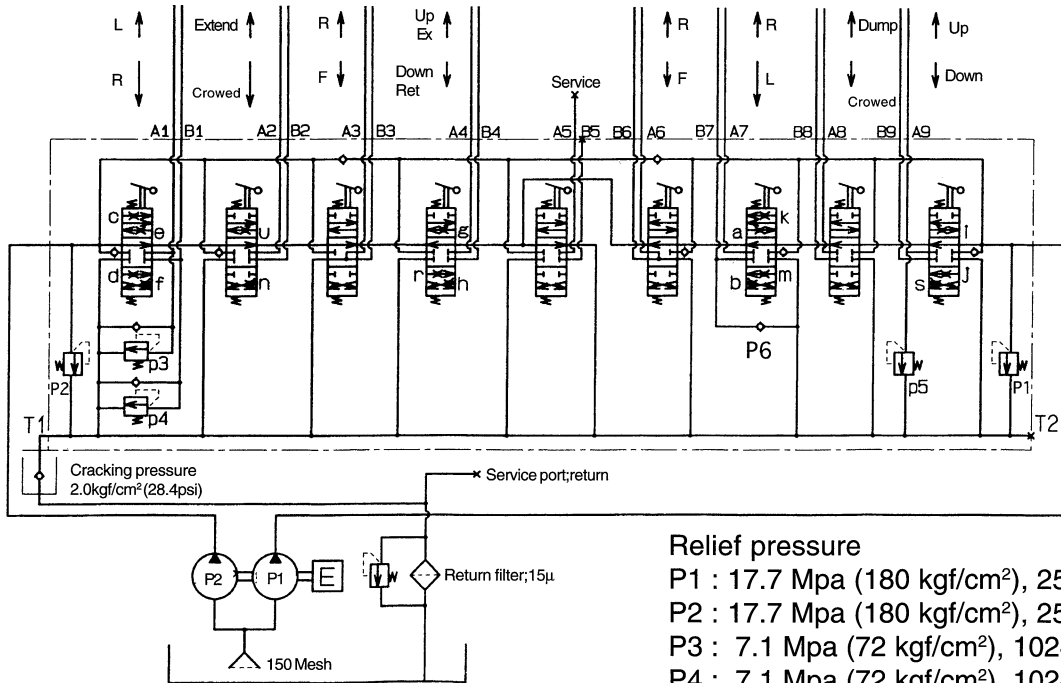
Note: G means straight type screw, previously indicated by PF. In a same way, F is equal to PS and R is PT.

[2] Hydraulic components

1. Control valve

1-1 Outline of control valve

1. Hydraulic circuit diagram



Relief pressure

P1 : 17.7 Mpa (180 kgf/cm²), 2560 psi

P2 : 17.7 Mpa (180 kgf/cm²), 2560 psi

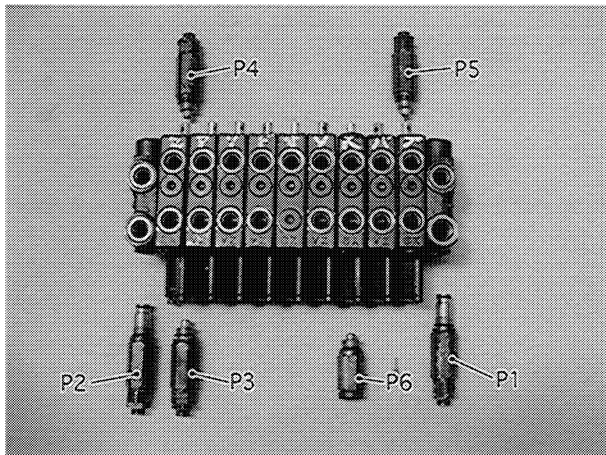
P3 : 7.1 Mpa (72 kgf/cm²), 1024 psi

P4 : 7.1 Mpa (72 kgf/cm²), 1024 psi

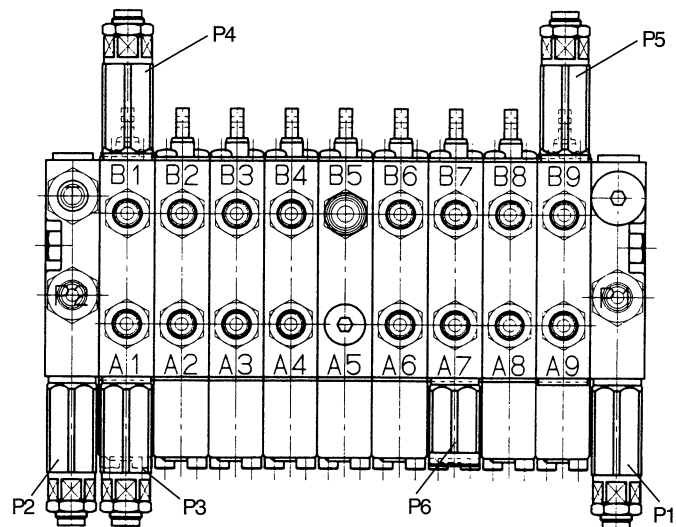
P5 : 22.5 Mpa (230 kgf/cm²), 3271 psi

P6 : Anti-cavitation valve

2. Section sequence

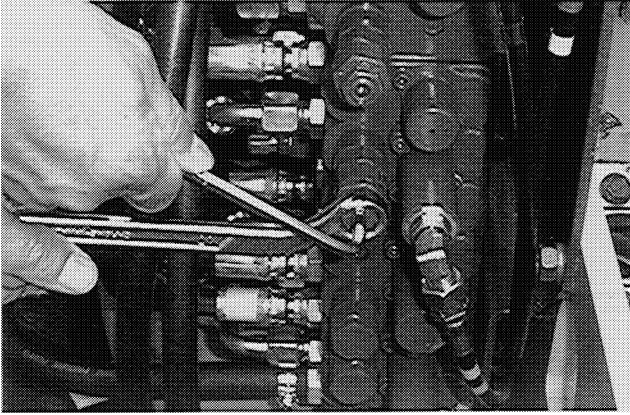


(Sample photo)



(1) Type	CP CV NSC10-9 KA
(2) Maker	Nabco
(3) Weight	Approx. 10.5kg (23.1lbs)
(4) Tie-rod tightening torque(Hex. nut M8)	13.7~14.7N·m (1.4~1.5kgf·m) 10.1~10.8ft.lbs
(5) Relief valve tightening torque	39.2N·m (4kgf·m) 28.9ft.lbs

3. Pressure adjusting procedure



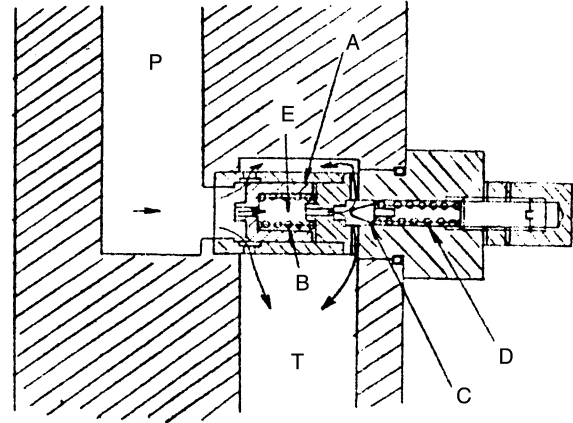
- (1) Loosen lock nut of relief valve.
Adjust the pressure valve by turning the adjusting screw with allen wrench.
After setting, tightening lock nut.
To increase pressure, turn to clockwise and vise versa.
- (2) Finally check pressure setting with max. engine RPM.

1-2 Structure and function

1. Relief valve function

(Operating mechanism of the relief valve)

The higher the working load rises, the higher the circuit pressure goes up. At a preset pressure level, however, the relief valve gets activated. When the circuit pressure has reached the setting of the pilot valve spring (D), the oil flows through the orifice of the main poppet (A) into the main poppet spring chamber (E). This pushes up the pilot poppet (C) and lets the oil flow into the tank. Now a pressure difference takes place across the orifice of the main poppet (A), and the main poppet (A) gets released from the main poppet spring (B) and pushed up off the seat. In this way, the pressure oil starts flowing out of the circuit to the tank, which keeps the circuit pressure at a preset level.

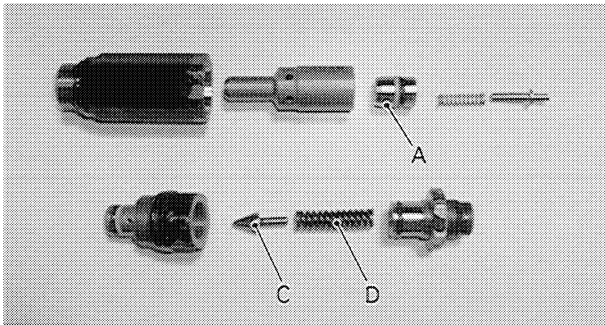


(Sample photo)

Check point

- (1) To see if the relief valve itself is in trouble, replace it with new one of the same pressure level and check for similar symptom.
- (2) The relief valve malfunctions probably due to foreign matters that are caught in between the poppet (A or C) and the seat. Carefully check these parts for dust, metal chippings and the like. Check also the seat for dents and repair it as required.
- (3) Check the springs for looseness and the seals for degrading.

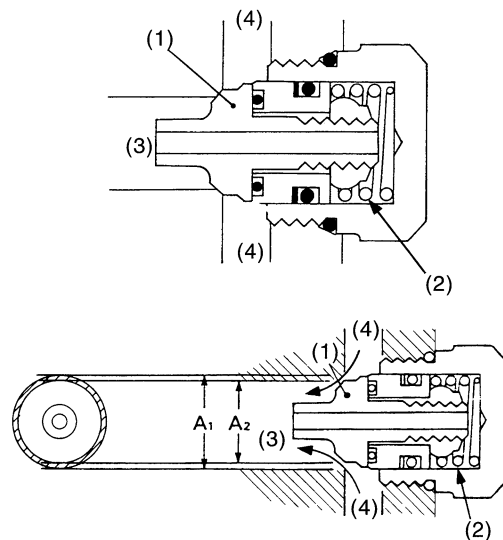
Inner parts, relief valve



2. Anti-cavitation valve function

If the pressure (3) at the cylinder causes cavitation, the anti-void valve opens itself, feeding the oil from the tank and filling the space.

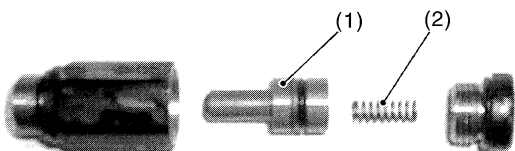
- (1) The cylinder port pressure (3) is applied over the large area at the back of the O-ring, which activates the poppet (3) and its seat.
- (2) When the pressure (3) drops below the atmospheric pressure, the tank pressure (4) applies upon the circular area between A1 and A2. This pressure will overcome the cylinder port pressure and the force of the spring (2), thereby opening the poppet (1).
- (3) With the space full of oil, the spring forces back the poppet and the cylinder port pressure (3) works tightly upon the seat.



Check point

- (1) Check the poppet seat for scratches, the springs for looseness and the seals for degrading.

Inner parts, anti-void valve



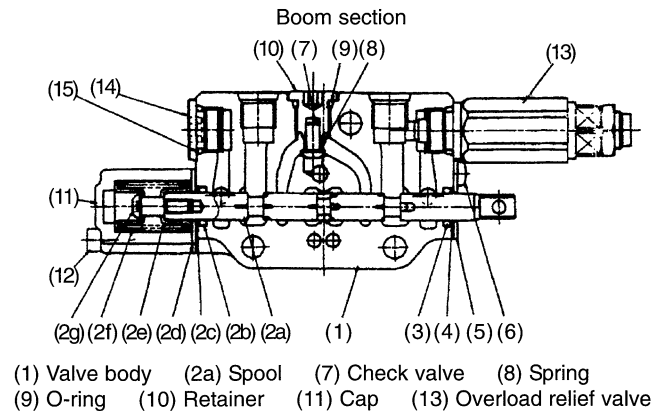
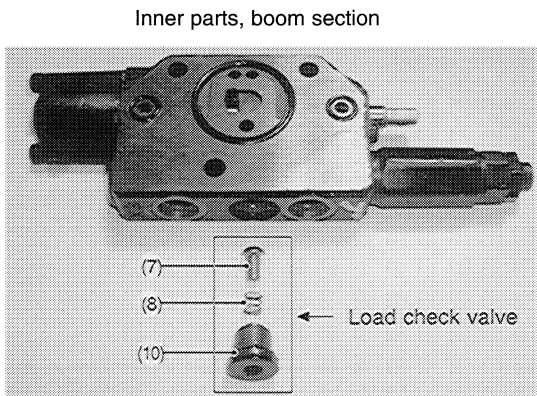
3. Load check valve function

For smooth movement and easy inching adjustment of the spool, the passages of the hydraulic source, working section and tank are all interconnected while the spool is switched over.

Let's suppose that there is no check valve installed and that the working load keeps on forcing the working section in the opposite direction. In such situation, the working section passage, pump passage and tank passage are all interconnected while the spool is switched over. This causes a pressure drop and the working load invites a back flow. This is very hazardous.

With this reason, the check valve is added in halfway along the working section passage. Even if the passage pressure drops too low, the working section's oil is blocked by the check valve and the working load is safely maintained.

This function therefore provides for some advantages. The spool switches over smoothly, and the working section does not suffer any reverse motion. What's more, if the spools are activated at once with different working section pressures, the oil flows back from the high-pressure side to the low-pressure one. This design leads to ease of operation.



Check point

- (1) Check the poppet (check valve) seat for scratches, the springs for looseness, and the seals for degrading.
- (2) Check the spool for scratches, and heavy or unsteady motion along the valve body. If the outer surface of the spool is found scratched by foreign matters, smoothen the surface using fine sandpaper. Be careful not to polish it leaving no scratch marks, but to deburr around the scratch mark.
- (3) Use a flashlight or a fiberscope to check the valve body for scratches. If burrs are found in the holes, remove them using a nylon brush or oilstone.
- (4) Check the spool's throttle hole for dust deposits.

4. Fail symptom causes by control valve







Symptom	Suspected causes	Remedy
All functions fail.	Main relief valve malfunctions	Adjust or replace
Weak power, slow speed	Main relief valve malfunctions	Adjust or replace
Oil temp. rises.	Main relief valve malfunctions	Adjust or replace
Cylinder has weak power and slow speed.	1. Spool stroke is not enough. 2. Main relief pressure is low. 3. Control valve malfunction.	1. Adjust or repair 2. Adjust or replace 3. Replace
Excessive free fall.	Excessive leakage through control valve.	Replace
Weak swivel force Speed is low Too much drifting	1. Overload pressure is low. 2. Spool stroke is not enough.	1. Adjust pressure 2. Adjust or replace
Travel malfunction.	Control valve spool malfunction	Replace
Weak traction force Speed is low.	Spool stroke is not enough.	Adjust or replace
Oblique travelling	1. Main relief pressures, R&L are different. 2. Spool stroke, R&L are different.	Adjust Adjust or replace

2. Hydraulic pump

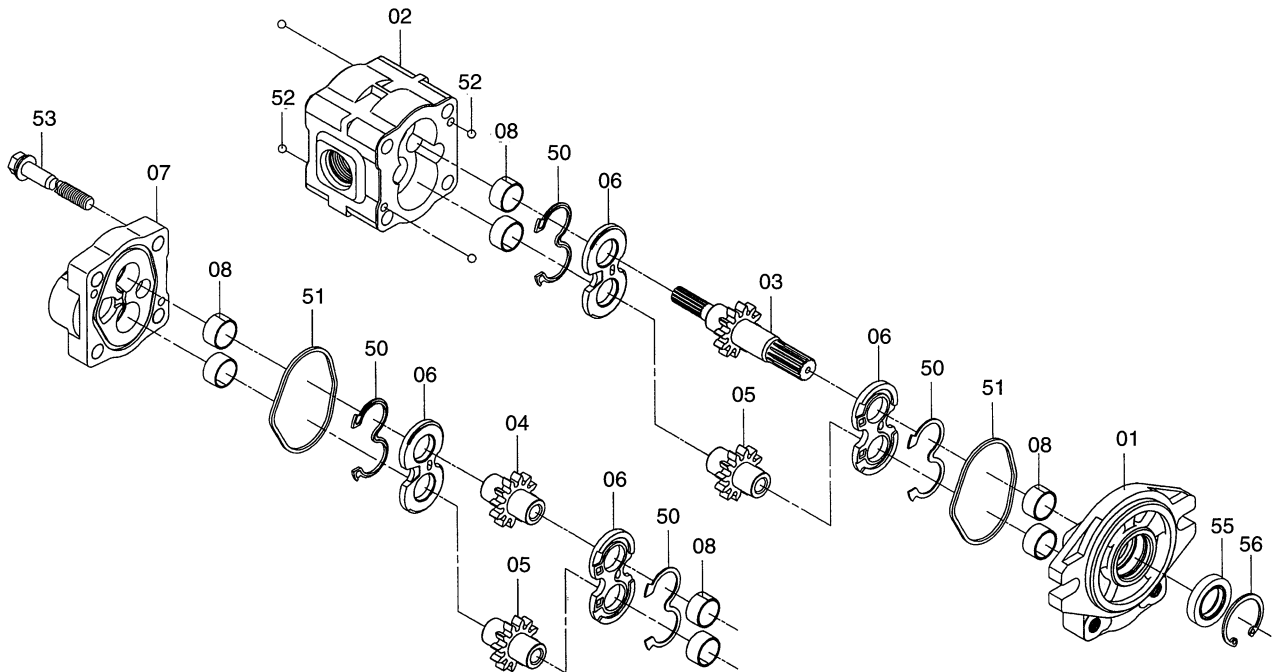
2-1 Disassembly and reassembly

1. Tools

Required tools are as shown below. Get ready before repair work. Clean tools, working table and the surrounding to prevent foreign materials from getting into pump.

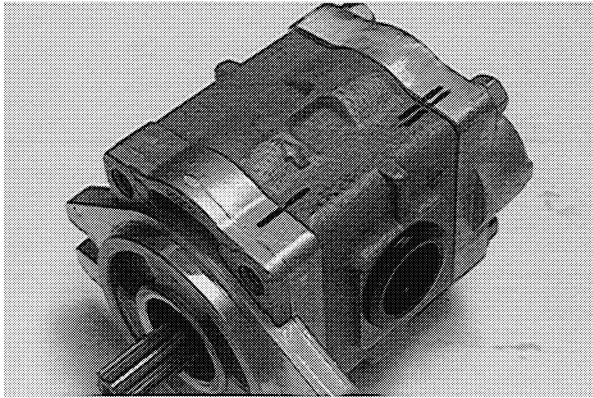
Tool name	Fig.	Remarks
Torque wrench		
Socket wrench		
Socket		14mm (0.55 inch)
Snap ring plier (Hole)		
Resin hammer		
Minus driver		

2. Figure of disassembled parts



No.	Part name	Qty	No.	Part name	Qty
01	Front cover	1	50	Gasket	4
02	Body	1	51	Gasket	2
03	First drive gear	1	52	Steel ball	4
04	2nd drive gear	1	53	Bolt	4
05	3rd drive gear	2	55	Oil seal	1
06	Side plate	4	56	C-circlip	1
07	Rear cover	1			
08	Bush	8			

3. Procedure

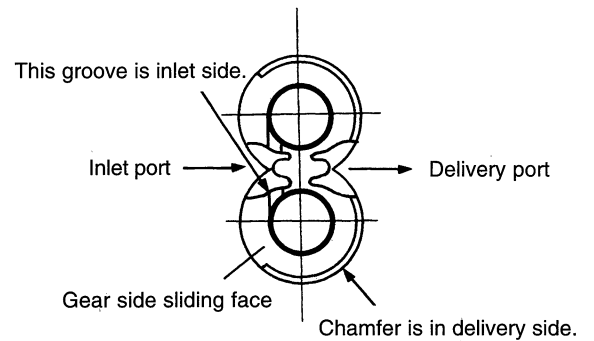
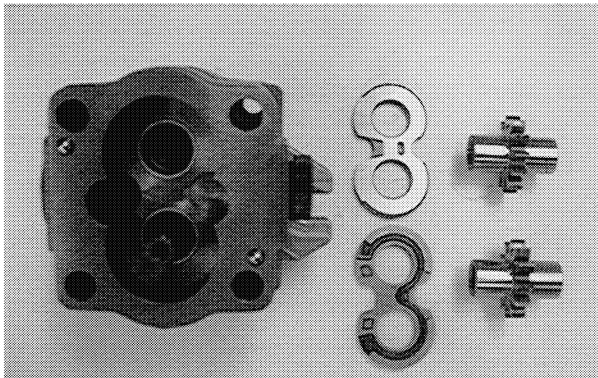
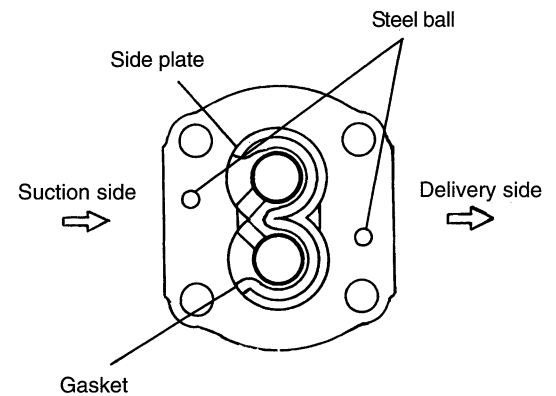
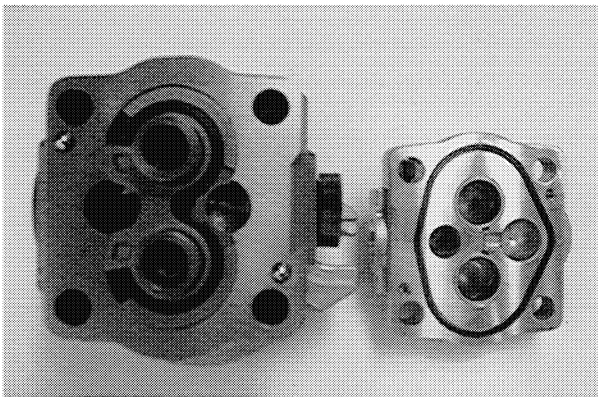


- (1) Before disassemble, put alignment mark on front cover, body and rear cover and remove bolts.

Bolt lightening torque : 48.1~51.0 N·m (4.9~5.2 kgf·m) , 35.5~37.6 ft·lbs

- (2) Remove rear cover, gasket, side plate, 2nd drive gear, 2nd driven gear and steel ball. Bush cannot come out.

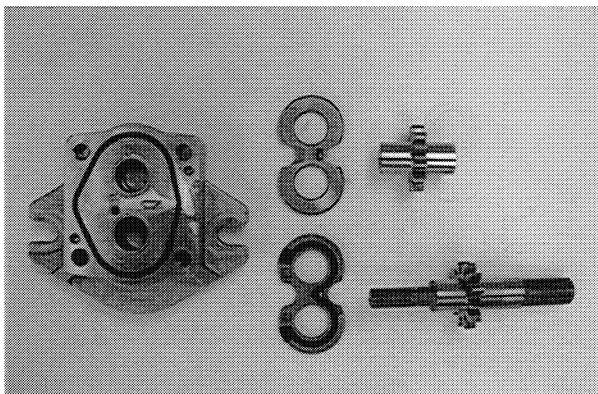
* Watch steel ball not to loose.

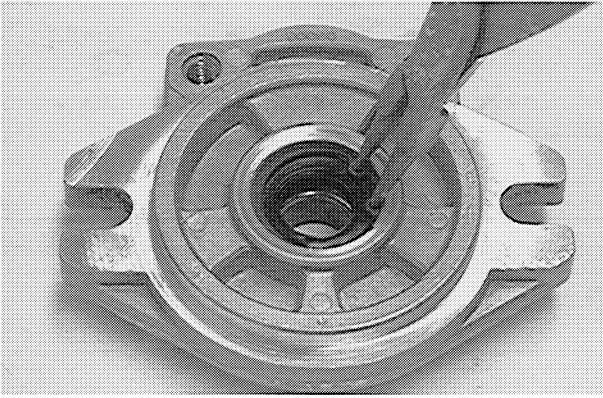


[Renew seal]

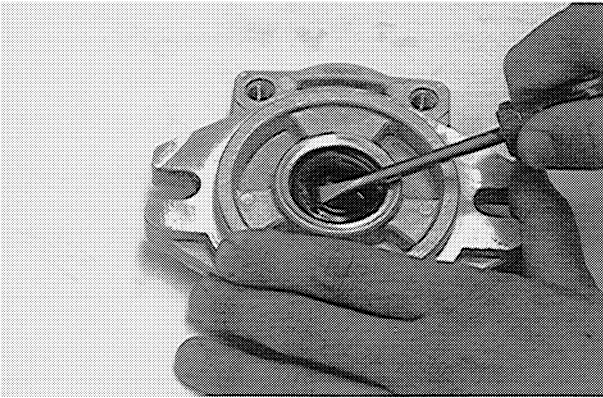
When replacing seals, apply grease on seals and fit them in the groove.

- (3) Remaining oil seal and C-clip in the front cover, remove gaskets, side plate, 1st drive gear, 1st driven gear and steel balls.



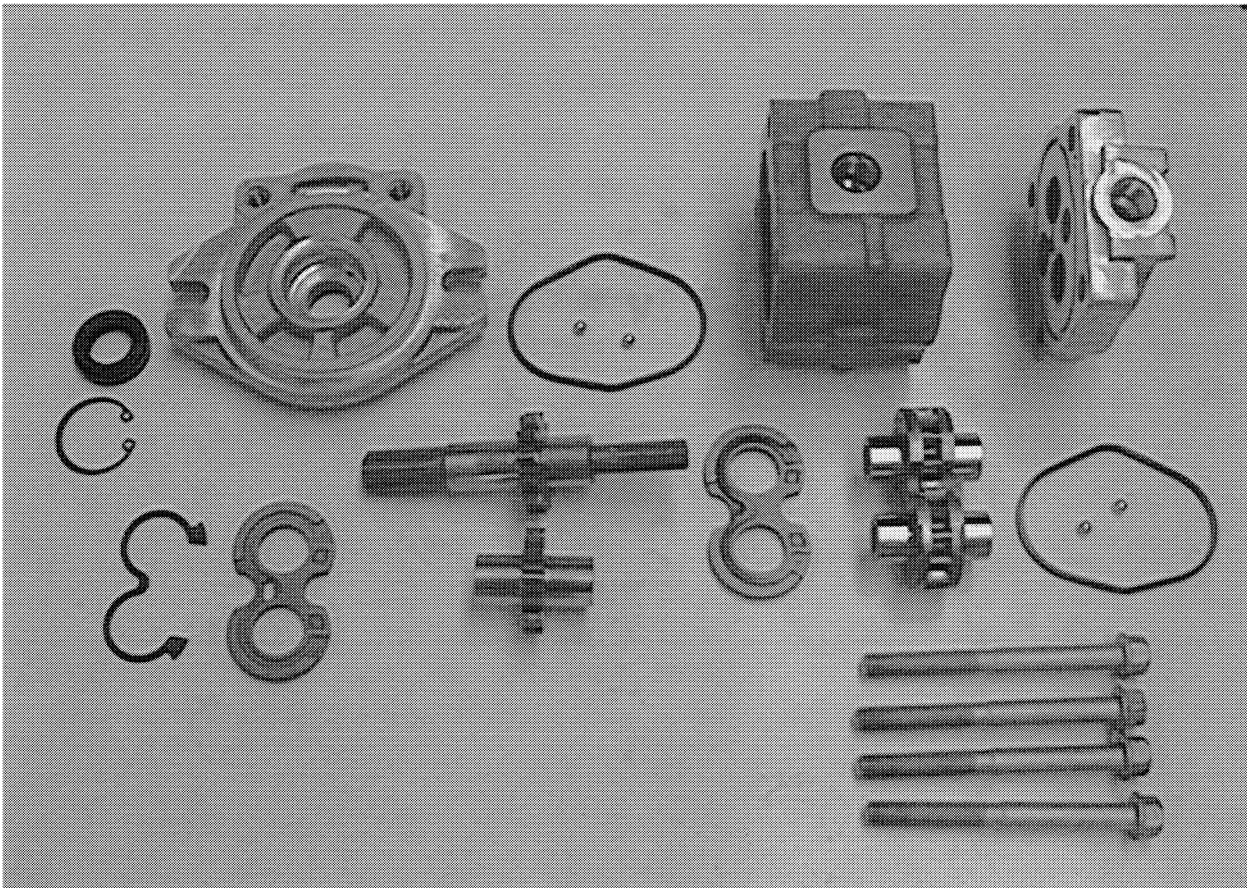


- (4) Remove C-clip and oil seal.
Oil seal is difficult to remove, care should be taken not to damage machining surface.



- (5) Apply grease on oil seal housing.
- [Replacement of oil seal]
Apply grease on lips of oil seal.
Wound vinyl tape around spline of 1st drive gear.
Apply gease on the tape to smooth the oil seal.
Press fit the oil seal and set the C-clip.

4. Structural parts



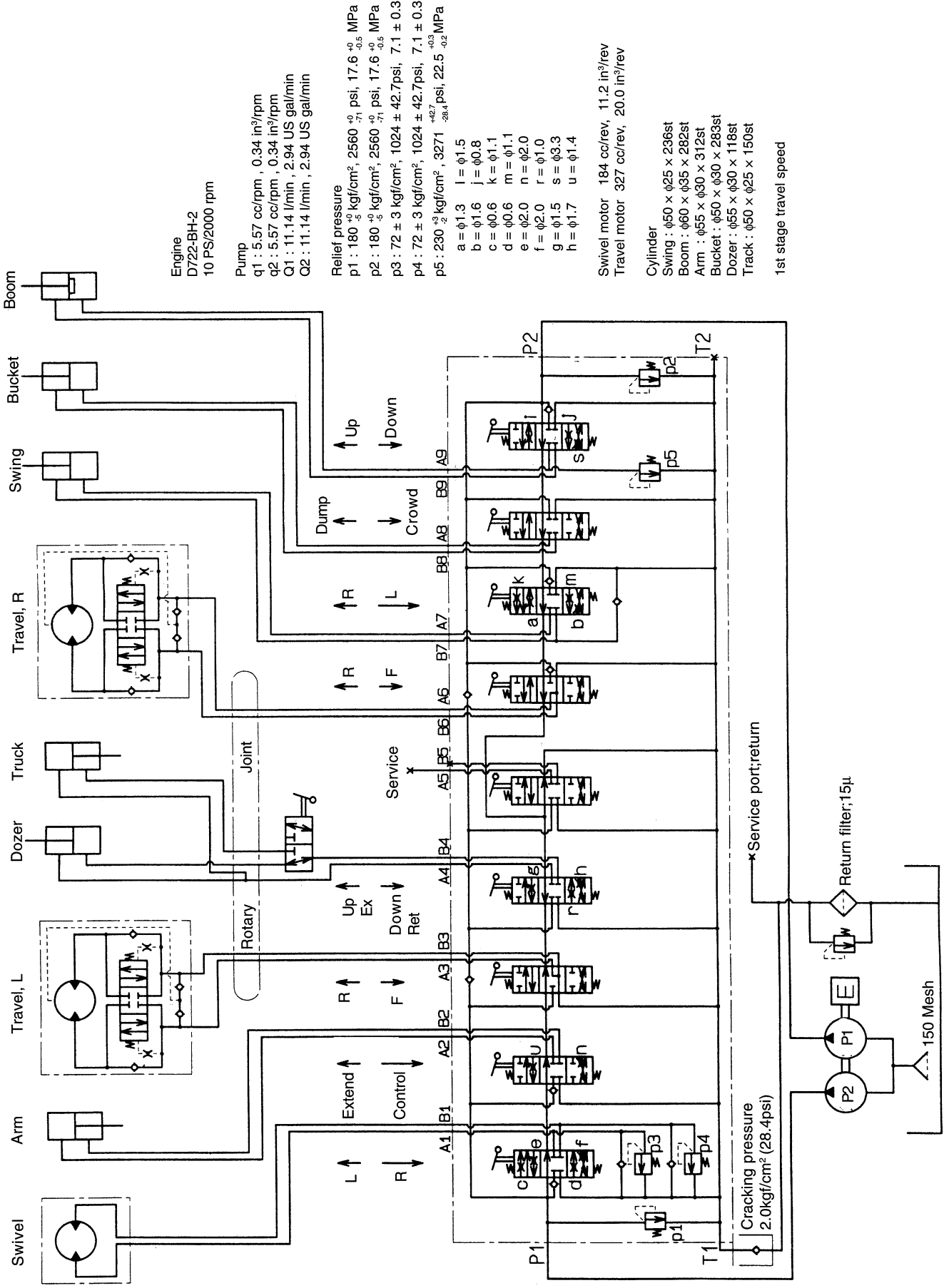
3. List of hydraulic components and circuit diagram

3-1 List of hydraulic components

Applied models

Pump	Maker		Shimazu		U-10
	Type		Two tandem gear pump		
	Delivery amount L/min (Us gal/min)	P1	11.0 (2.91)		
		P2	11.0 (2.91)		
Control valve Main relief pressure Mpa(kgf/cm ²),psi	Maker		Nabuco		U-10
	P1		17.7 (180), 2560		
	P2		17.7 (180), 2560		
Travel motor	Maker		Sumitomo Eaton		U-10
	Type		Orbit motor ; 1 stage		
	Displacement cc/rev (in ³)		327 (10.1)		
	Relief pressure Mpa(kgf/cm ²), psi		17.7 (180), 2560		
Swivel motor	Maker		Sumitomo Eaton		U-10 K-008
	Type		Orbit motor		
	Displacement cc/rev (in ³)		184 (5.7)		
	Relief pressure Mpa(kgf/cm ²), psi		7.1 (72), 1024		
Cylinder	Boom	Bore dia. × Rod dia.	mm (inch)	60×35 (2.4×1.4)	U-10
		Stroke	mm (inch)	282 (11.1)	K-008
	Arm	Bore dia. × Rod dia.	mm (inch)	55×30 (2.2×1.1)	U-10
		Stroke	mm (inch)	312 (12.3)	
	Bucket	Bore dia. × Rod dia.	mm (inch)	50×30 (2.0×1.1)	U-10
		Stroke	mm (inch)	283 (11.1)	
	Swing	Bore dia. × Rod dia.	mm (inch)	50×25 (2.0×1.0)	U-10
		Stroke	mm (inch)	236 (9.3)	
	Dozer	Bore dia. × Rod dia.	mm (inch)	55×30 (2.2×1.1)	U-10
		Stroke	mm (inch)	118 (4.6)	
	Track	Bore dia. × Rod dia.	mm (inch)	50×25 (2.0×1.0)	U-10
		Stroke	mm (inch)	150 (5.9)	

3-2 Hydraulic circuit diagram



Engine
D722-BH-2
10 PS/2000 rpm

Pump
q1 : 5.57 cc/rpm, 0.34 in³/rpm
q2 : 5.57 cc/rpm, 0.34 in³/rpm
Q1 : 11.14 l/min, 2.94 US gal/min
Q2 : 11.14 l/min, 2.94 US gal/min

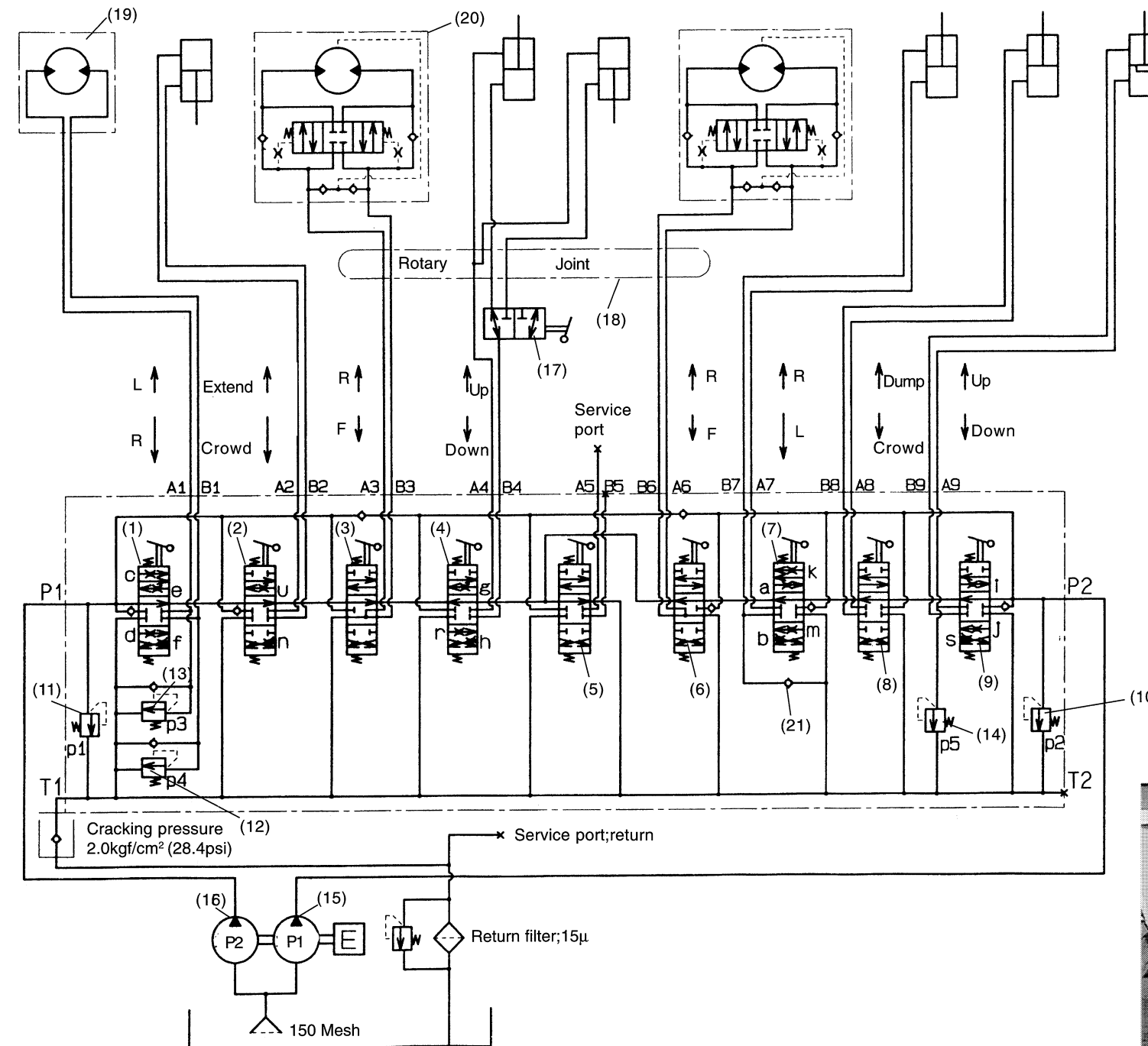
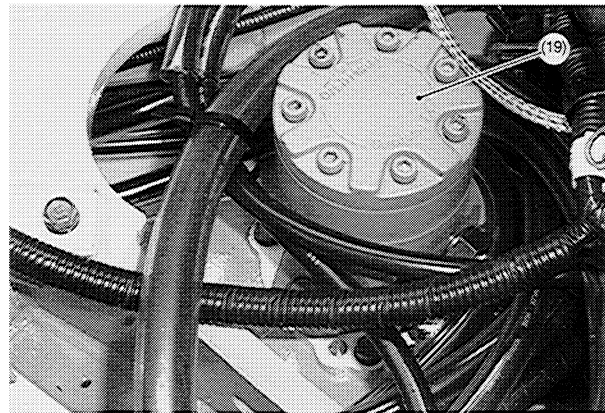
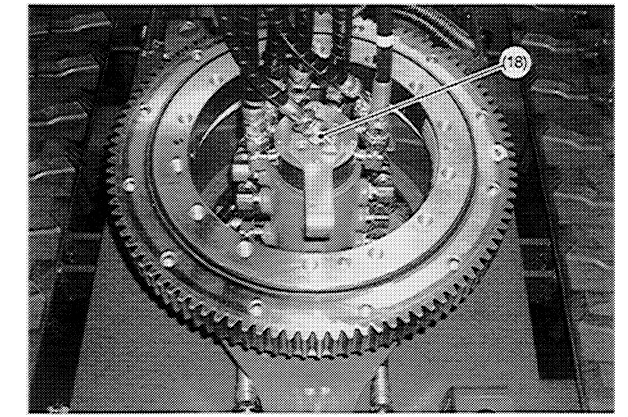
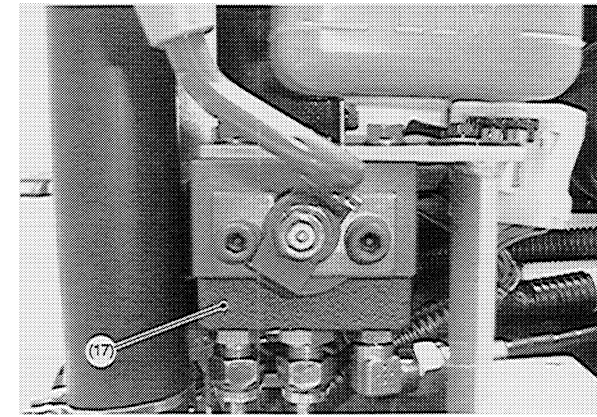
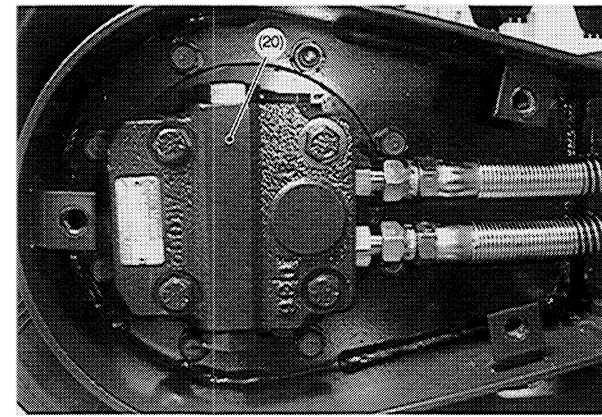
Relief pressure
p1 : 180⁺⁰₋₅ kgf/cm², 2560⁺⁰₋₇₁ psi, 17.6⁺⁰_{-0.5} MPa
p2 : 180⁺⁰₋₅ kgf/cm², 2560⁺⁰₋₇₁ psi, 17.6⁺⁰_{-0.5} MPa
p3 : 72 ± 3 kgf/cm², 1024 ± 42.7psi, 7.1 ± 0.3 MPa
p4 : 72 ± 3 kgf/cm², 1024 ± 42.7psi, 7.1 ± 0.3 MPa
p5 : 230⁺³₋₂ kgf/cm², 3271^{+42.7}_{-28.4} psi, 22.5^{+0.3}_{-0.2} MPa

a = φ1.3 i = φ1.5
b = φ1.6 j = φ0.8
c = φ0.6 k = φ1.1
d = φ0.6 m = φ1.1
e = φ2.0 n = φ2.0
f = φ2.0 r = φ1.0
g = φ1.5 s = φ3.3
h = φ1.7 u = φ1.4

Swivel motor 184 cc/rev, 11.2 in³/rev
Travel motor 327 cc/rev, 20.0 in³/rev

Cylinder
Swing : φ50 × φ25 × 236st
Boom : φ60 × φ35 × 282st
Arm : φ55 × φ30 × 312st
Bucket : φ50 × φ30 × 283st
Dozer : φ55 × φ30 × 118st
Track : φ50 × φ25 × 150st
1st stage travel speed

3-3 Hydraulic components and layout



Engine
D722-BH-2
10 PS/2000 rpm

Pump
q1 : 5.57 cc/rpm , 0.34 in³/rpm
q2 : 5.57 cc/rpm , 0.34 in³/rpm
Q1 : 11.14 l/min , 2.94 US gal/min
Q2 : 11.14 l/min , 2.94 US gal/min

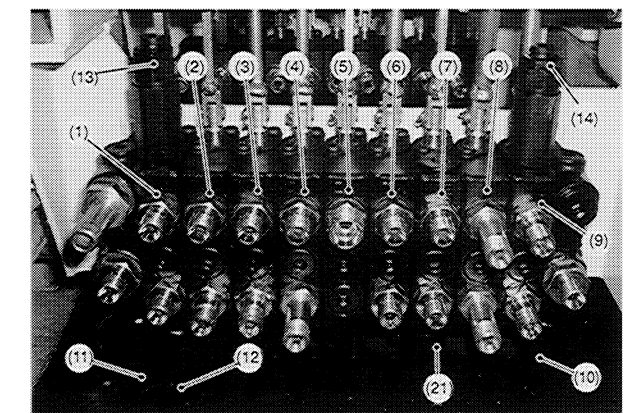
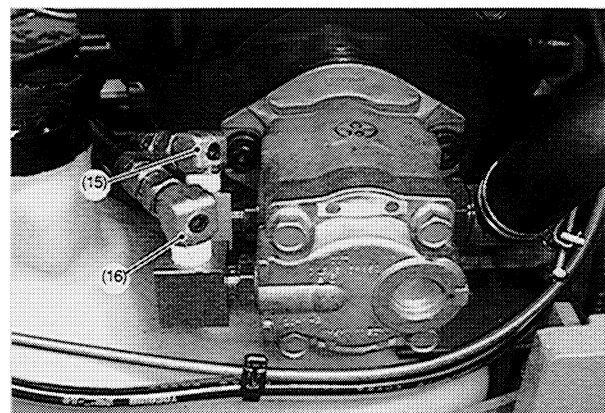
Relief pressure
p1 : 180 ⁺⁰/₋₅ kgf/cm², 2560 ⁺⁰/₋₇₁ psi, 17.6 ⁺⁰/_{-0.5} MPa
p2 : 180 ⁺⁰/₋₅ kgf/cm², 2560 ⁺⁰/₋₇₁ psi, 17.6 ⁺⁰/_{-0.5} MPa
p3 : 72 ± 3 kgf/cm², 1024 ± 42.7psi, 7.1 ± 0.3 MPa
p4 : 72 ± 3 kgf/cm², 1024 ± 42.7psi, 7.1 ± 0.3 MPa
p5 : 230 ⁺³/₋₂ kgf/cm², 3271 ^{+42.7}/_{-28.4} psi, 22.5 ^{+0.3}/_{-0.2} MPa

a = φ1.3 l = φ1.5
b = φ1.6 j = φ0.8
c = φ0.6 k = φ1.1
d = φ0.6 m = φ1.1
e = φ2.0 n = φ2.0
f = φ2.0 r = φ1.0
g = φ1.5 s = φ3.3
h = φ1.7 u = φ1.4

Swivel motor 184 cc/rev, 11.2 in³/rev
Travel motor 327 cc/rev, 20.0 in³/rev

Cylinder
Swing : φ50 × φ25 × 236st
Boom : φ60 × φ35 × 282st
Arm : φ55 × φ30 × 312st
Bucket : φ50 × φ30 × 283st
Dozer : φ55 × φ30 × 118st
Track : φ50 × φ25 × 150st

1st stage travel speed



[3] Electric system

3-1 Engine starting device

1. Starting principle

- (1) When starter SW is off : Battery voltage is always applied at B-terminal of starter motor, slow blow fuse and 30-terminal of starter SW.
- (2) When starter SW is at starting position : Battery current flows 30-terminal to 50-terminal of starter SW and to S-terminal of starter motor. Then pinion gear rotates and starts engine.

2. Five basic principles of troubleshooting in electric circuit

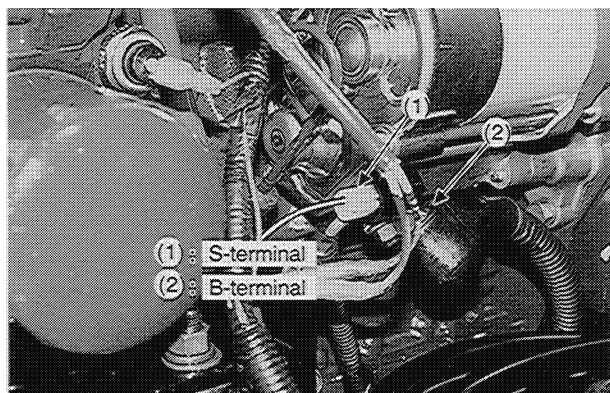
- (1) Check to see if battery voltage is being applied on positive (+) terminal of electrical components.
- (2) Continuity test between positive (+) terminal and (-, earth) terminal of electrical components.
- (3) Continuity test of wire harness.
- (4) Continuity test of line to ground.
- (5) Insulation test of each component.

3. Troubleshooting of starting system malfunction

- When starter switch is at 'start' position, check if battery voltage is on S-terminal of starter. (Photo 4)
- If battery voltage doesn't exist, check the following items.
 - (1) Breakage of slow blow fuse (Photo 3)
 - (2) Starter switch discontinuity
(Check continuity between 30 and 50 terminals start position.)
 - (3) Contact failure of coupler or wire harness
 - (4) Cutting of wire harness
(Check continuity test by circuit tester.)
- In case battery voltage exists, check the following items.
 - (5) Contact failure of S-terminal
(Check continuity between S-terminal and body earth.)
 - (6) Starter body earth failure
(Check continuity between starter and body earth.)
 - (7) Cutting of pull-in coil and holding coil.
(Check continuity test between S-terminal and body.)

4. Troubleshooting of engine starting malfunction

- * First check battery charging amount and earth line condition.
- * Second check if battery voltage is on S-terminal of starter when starter switch is at 'start' position.



(Photo 1)



(Photo 2)