

KOBELCO

SHOP MANUAL

HYDRAULIC EXCAVATOR

SK200 V SK200LC V

Issued 04-1994
Revised 11-1995

Applicable:
SK200 V YN18001~
SK200LC V YQ02301~

S5YN0007E-01

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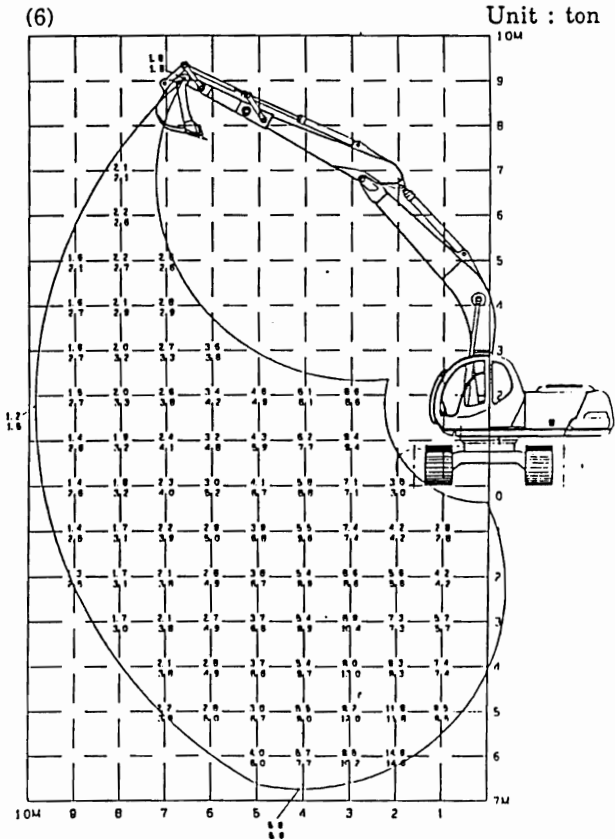
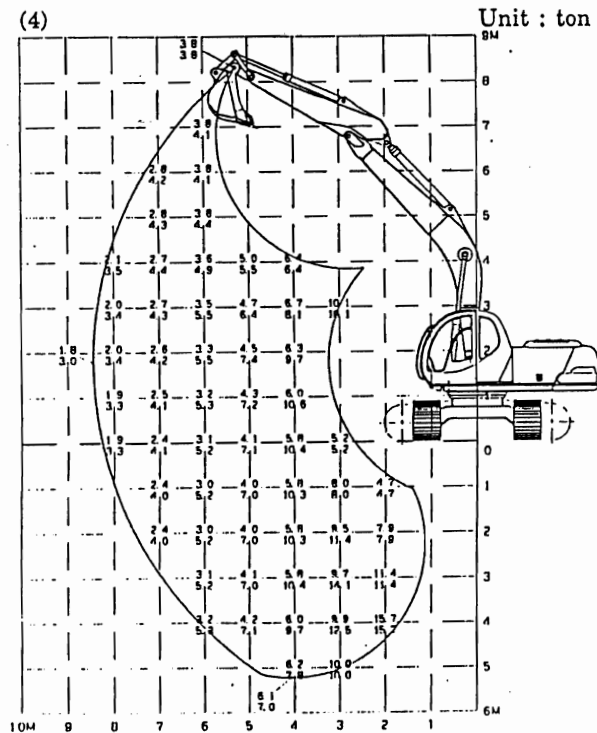
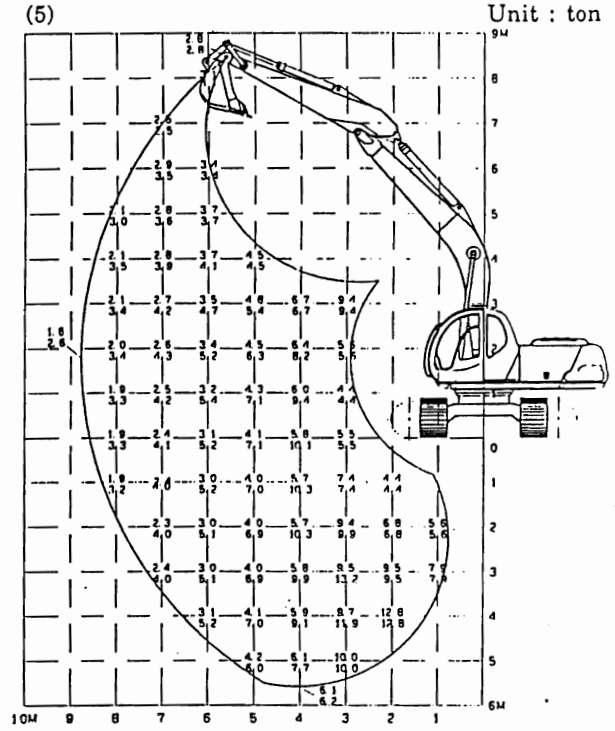
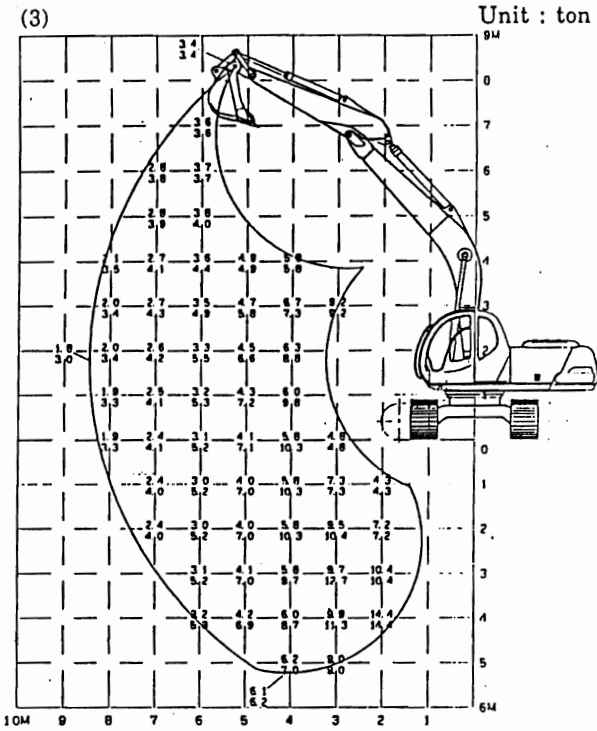
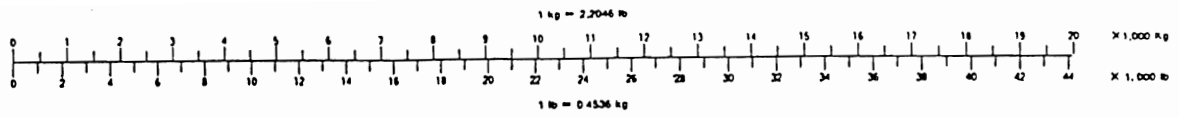


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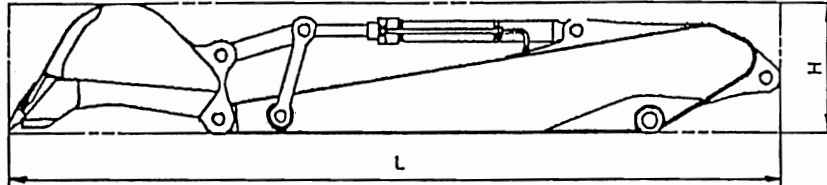
Applicable Machines
YN18001~
YQ02301~

Revision	Date of Issue	Remarks
First edition	April, 1994	S5YN0105E K



3.4 PRINCIPAL PARTICULARS OF ARM+BUCKET

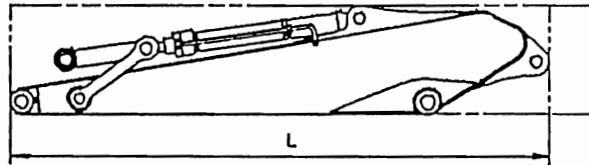
Combination	2.4m (7ft-10 in) Arm + 0.8m ³ (1.05cuyd) Bucket	2.94m (9ft-8 in) Arm + 0.7m ³ (0.92cuyd) Bucket	3.3m (10ft-10 in) Arm + 0.6m ³ (0.78cuyd) Bucket
Total length × Total height × Total width L×H×W m (ft-in)	4.74×0.89×1.28 (15'7"×2'11"×4'2")	5.27×0.89×1.16 (17'3"×2'11"×3'10")	5.63×0.89×1.06 (18'6"×2'11"×3'6")
Weight kg (lbs)	1560 (3440)	1620 (3570)	1650 (3640)



YN-5-8

3.5 PRINCIPAL PARTICULARS OF ARM

Arm Length	2.4m (7ft-10 in) Arm	2.94m (9ft-8 in) Arm	3.3m (10ft-10 in) Arm
Total length × Total height × Total width L×H×W m (ft-in)	3.38×0.79×0.48 (11'1"×2'7"×1'7")	3.91×0.79×0.48 (12'10"×2'7"×1'7")	4.27×0.79×0.48 (14'×2'7"×1'7")
Weight kg (lbs)	880 (1940)	980 (2160)	1050 (2310)



YN-5-9

3.6 PRINCIPAL PARTICULARS OF BUCKET

Type	Hoe Bucket			
Total length × Total height × Total width L×H×W m (ft-in)	1.34×1.28×0.84 (4'5"×4'2"×2'9")	1.34×1.28×1.06 (4'5"×4'2"×3'6")	1.34×1.28×1.16 (4'5"×4'2"×3'10")	1.34×1.28×1.28 (4'5"×4'2"×4'2")
Weight kg (lbs)	500 (1100)	600 (1320)	640 (1410)	680 (1500)
Bucket capacity m ³ (cuyd)	0.45 (0.59)	0.6 (0.78)	0.7 (0.92)	0.8 (1.05)
Type	Hoe Bucket	Hoe Bucket (Heavy digging)	Ripper	Ripper Bucket
Total length × Total height × Total width L×H×W m (ft-in)	1.34×1.28×1.41 (4'5"×4'2"×4'8")	1.37×1.28×1.16 (4'6"×4'2"×3'10")	1.42×0.83×0.51 (4'8"×2'9"×1'8")	1.83×1.08×0.95 (6'0"×3'6"×3'1")
Weight kg (lbs)	740 (1630)	660 (1450)	430 (950)	800 (1760)
Bucket capacity m ³ (cuyd)	0.9 (1.18)	0.7 (0.92)	—	0.45 (0.59)
Type	Slope Finishing Bucket	Scraper Bucket	—	—
Total length × Total height × Total width L×H×W m (ft-in)	1.25×0.90×2.20 (4'1"×2'11"×7'3")	1.43×0.99×1.31 (4'8"×3'3"×4'4")	—	—
Weight kg (lbs)	890 (1960)	680 (1500)	—	—
Bucket capacity m ³ (cuyd)	—	—	—	—



3.7 RELIEF VALVE ADJUSTING PROCEDURE

(1) Pilot Relief Valve Adjusting Procedure

Loosen and remove cap (1). Then loosen nut (2) and adjust the valve with adjust screw (3).

Table 1

No. of turns of adjust screw	Pressure change (kgf/cm ²)
1/2 turn	5.3 (75psi)




 ; 19mm,
tightening torque; 1.4~1.7kgf·m (10~12ft·lbs)
 ; 4mm

(2) Main Relief Valve Adjusting Procedure

For the adjustment of the 2nd stage relief valve, begin with the boost pressure side. Loosen nut (1), adjust the valve with adjust screw (3) and turn up nut (1). Next, loosen nut (2) and adjust the standard side of adjust screw (4).

Table 2

No. of turns of adjust screw	Pressure change (kgf/cm ²)
1/2 turn	about 90 (1300psi)



 ; 36mm,
tightening torque; 2.8~3.2kgf·m (20~23ft·lbs)
 ; 22mm
tightening torque; 2.8~3.2kgf·m (20~23ft·lbs)
 ; 6mm

(3) Port Relief Valve Adjusting Procedure

Loosen nut (1) and adjust it with adjust screw (2).

Table 3

No. of turns of adjust screw	Pressure change (kgf/cm ²)
1/2 turn	about 90 (1300psi)



 ; 22mm,
tightening torque; 2.8~3.2kgf·m (20~23ft·lbs)
 ; 6mm

(4) Swing Port Relief Valve Adjusting Procedure

Loosen nut (1) and adjust the valve with adjust screw (2).

Table 4

No. of turns of adjust screw	Pressure change (kgf/cm ²)
1/2 turn	about 51 (700psi)



 ; 41mm,
tightening torque; 13~19kgf·m (94~140ft·lbs)
 ; 27mm

(5) Travel Overload Relief Valve Adjusting Procedure

The valve can not be pressure adjusted externally. Loosen cap (5) and adjust it with shim (8). Increasing the shim thickness increases the pressure.

Table 5

O.D, I.D. and thickness of shims (mm)	Pressure change (kgf/cm ²)
∅17×∅10×1	about 50 (710psi)
∅17×∅10×0.5	about 25 (360psi)

 ; 35mm (1.38in),
tightening torque; 10~12kgf·m (72~87ft·lbs)
 ; 27mm (1.06in)

APPLY LOCKTITE #242.

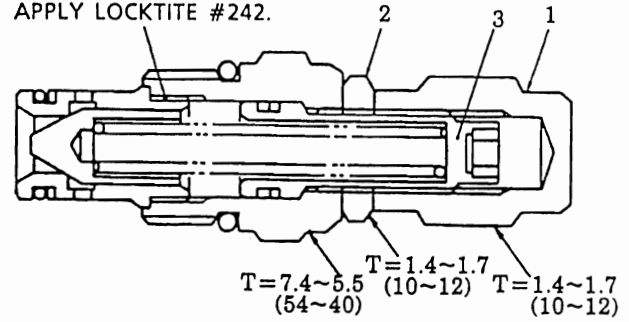


Fig. 8 Pilot relief valve

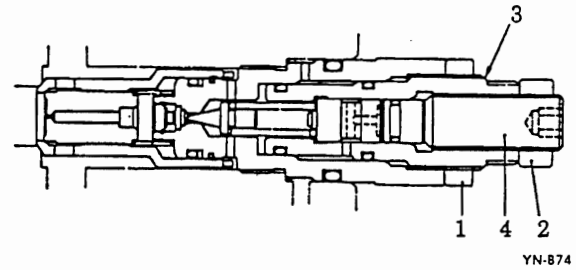


Fig. 9 Main relief valve (2nd stage relief)

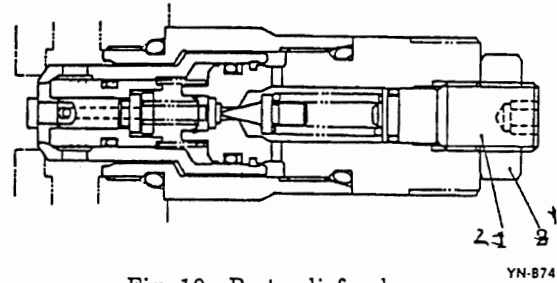


Fig. 10 Port relief valve

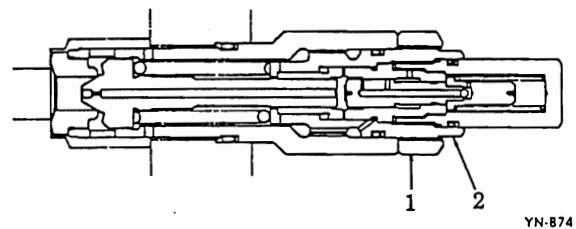


Fig. 11 Swing port relief valve

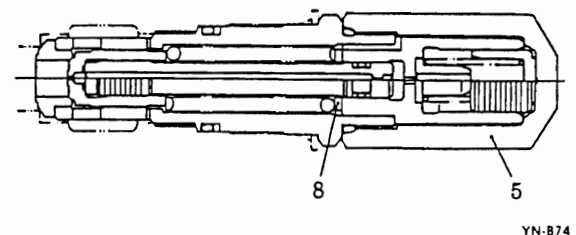


Fig. 12 Travel overload relief valve

2. TIGHTENING TORQUES FOR NUTS AND SLEEVES

Table 3 indicates standard tightening torques applicable to cases where no particular note is given.

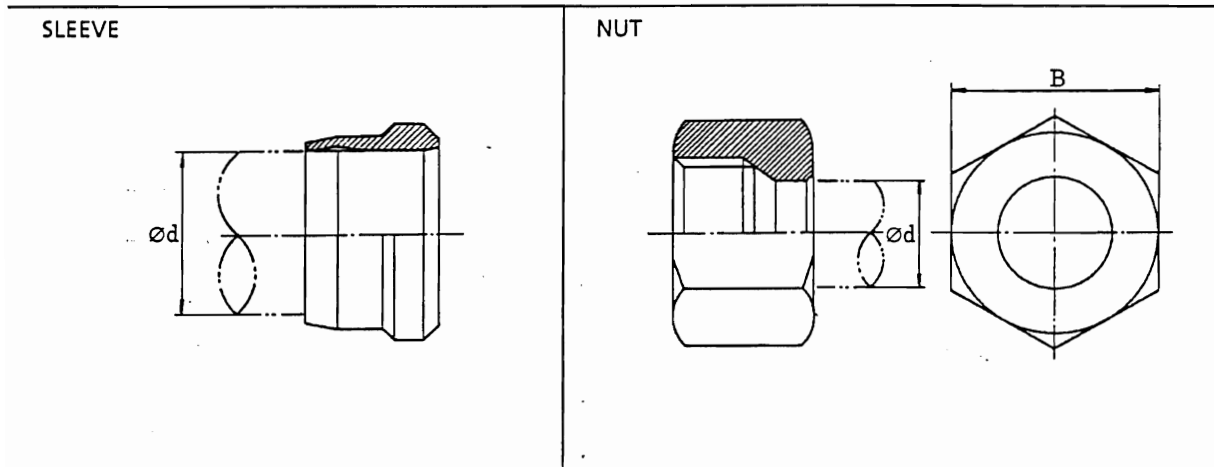
Overtightening or undertightening of nuts and

sleeves in bite type tube fittings may develop oil leaks through pipe connections. Always tighten nuts and sleeves to proper torques.

Table 3

Manufacturer's name	Working pressure kgf/cm ² (psi)	Tube size OD×thickness mm (in)	Opposing flats	Tightening torque kgf·m (ft·lbs)
Nippon A.M.C.	300 (4270)	10×1.5 (0.394×0.059)	19	5±1 (36±7)
		15×2.0 (0.591×0.079)	27	12±1.2 (87±9)
		18×2.5 (0.709×0.098)	32	15±1.5 (108±11)
		22×3.0 (0.866×0.118)	36	22±2.2 (159±16)
		28×4.0 (1.10×0.157)	41	28±2.8 (200±20)
Ihara Koatu	300 (4270)	35×5.0 (1.38×0.197)	55	45±4.5 (330±33)

Table 4



Tube size ød	Parts No.		Tube size ød	Opposing flats B	Parts No.	
	Ihara Koatu	Nippon A.M.C.			Ihara Koatu	Nippon A.M.C.
6	ZF93S06000	—	6	14	ZF93N06000	—
8	ZF93S08000	—	8	17	ZF93N08000	—
10	ZF93S10000	ZA93S10000	10	19	ZF93N10000	ZA93N10000
12	ZF93S12000	—	12	22	ZF93N12000	—
15	ZF93S15000	ZA93S15000	15	27	ZF93N15000	ZA93N15000
18	ZF93S18000	ZA93S18000	18	32	ZF93N18000	ZA93N18000
22	ZF93S22000	ZA93S22000	22	36	ZF93N22000	ZA93N22000
28	ZF93S28000	ZA93S28000	28	41	ZF93N28000	ZA93N28000
32	ZF93S32000	—	32	50	ZF93N32000	—
35	ZF93S35000	ZA93S35000	35	55	ZF93N35000	ZA93N35000
38	ZF93S38000	—	38	60	ZF93N38000	—

No.	CONTROL	LOCATION	WORK TO BE DONE	UNIT	REMARK	SK60 v	SK100 v	SK120 v	SK200 v	SK220 v
02	- 1	Operating lever stand	Detach/attach	One side		2.0	←	←	←	←
	- 2	Pilot valve (ATT swing)	Detach/attach	1		1.5	←	←	←	←
	- 3	Travel pilot valve	Detach/attach	1		1.0	←	←	←	←
	- 4	Operating lever	Replace	1		0.3	←	←	←	←
	- 5	Travel lever	Replace	1		0.3	←	←	←	←
	- 6	Dozer lever	Replace	1		0.3	←	←	-	-
	- 7	Solenoid valve	Detach/attach	1	Lever lock, FC, Travel 2-speed, Travel deflection, ATT boost pressure, Swing P/B	1.0	←	←	←	←
	- 8	Proportionate valve	Replace	1	QMIN, Travel straight valve, QMAX, cut valve P1, Cut valve P2	-	1.0	←	←	←
	- 9	Accumulator /pilot relief manifold	Adjust	1 set		0.5	←	←	←	←
	- 10	Multi control valve	Detach/attach	1 pc.		3.0	←	←	←	←
	- 11	Multi control valve	O/H	1 set	Excl.detachment/attachment	2.0	←	←	←	←
	- 12	Controller	Detach/attach	1 pc.	Top stage (for mechatronic control) Middle stage (for cluster gauge) Bottom stage (for power window)	- 1.0 1.0	0.5 ← ←	← ← ←	← ← ←	← ← ←
No.	HYDRAULIC LINE									
03	- 1	Hydraulic pump ASS'Y	Detach/attach	1 pc.		4.0	←	←	←	←
	- 2	Pump coupling	Replace	1 set		1.0	←	←	←	←
	- 3	Suction hose	Replace	1		1.5	←	←	←	←
	- 4	Delivery hose	Replace	1		1.0	←	←	←	←
	- 5	Pilot valve	Detach/attach	1 pc.		1.0	←	←	←	←
	- 6	Filter element (line filter)	Replace	1	SK60 is direct coupled with return filter.	-	0.5	←	←	←
	- 7	Dozer pump ASS'Y	Detach/attach	1 pc.	SK60 only	1.0	-	-	-	-
	- 8	Dozer flow divider			SK100/120 only	-	1.0	←	-	-
	- 9	Suction hose (for dozer)	Replace	1		0.5	←	←	-	-
	- 10	Delivery hose (for dozer)	Replace	1		1.5	←	←	-	-
	- 11	Main control valve	Detach/attach	1 pc.		6.0	←	←	←	←
	- 12	Main relief valve	Replace	1		1.0	←	←	←	←
	- 13	Overload relief valve	Replace	1		1.0	←	←	←	←
	- 14	Option valve	Detach/attach	1 pc.		2.0	←	←	←	←
	- 15	Main relief valve	Replace	1		1.0	←	←	←	←
	- 16	Overload relief valve	Replace	1		1.0	←	←	←	←

NAME OF WORK	NAME OF TROUBLE	MODEL		
		6DS (6D31-T)	6D1 (6D15-T)	6D2 (6D22-T) (6D22-TC)
Overhauling cylinder head ass'y. (1 set.) Incl. : (1) Detaching/attaching cylinder head. (2) Replacing combustion chamber. (3) Correcting valve seat ring. (4) Replacing valve guide. (5) Lapping valve. (6) Adjusting engine (A). (7) Adjusting nozzle.	Cylinder head is cracked. Cylinder head is distorted. Cylinder head is corroded. Cylinder head is porous. Area between cylinder head and valve is cracked. Cylinder head system in general is out of order.	10.5	11.5	13.5
Replacing cylinder head ass'y. (one side.) Incl. : (1) Adjusting engine (A). (2) Adjusting nozzle.	Cylinder head is cracked. Cylinder head is distorted. Cylinder head is corroded. Cylinder head is porous. Area between cylinder head and valve is cracked. Cylinder head system in general is out of order.	—	—	—
Overhauling cylinder head ass'y. (1 set.) Incl. : (1) Detaching/attaching cylinder head. (2) Correcting seat face. (3) Replacing valve guide. (4) Replacing combustion chamber. (5) Lapping valve. (6) Adjusting engine (A). (9) Adjusting nozzle.	Cylinder head is cracked. Cylinder head is distorted. Cylinder head is corroded. Cylinder head is porous. Area between cylinder head and valve is cracked. Cylinder head system in general is out of order.	—	—	—
Hydrostatic test of cylinder head. (1 set) (single)	Cylinder head is cracked. Cylinder head is porous. Cylinder head system in general is out of order.	1.5	1.5	1.5
Replacing cylinder gasket (1 pc.) (present machine) Incl. : Adjusting engine (A).	Water leaks from cylinder head. Oil leaks from cylinder head. Gas leaks from cylinder head. Cylinder head system in general is out of order.	6.5	7.0	8.0
Replacing cylinder head gasket. (one side) (present machine) Incl. : Adjusting engine (A).	Water leaks from cylinder head gasket. Oil leaks from cylinder head gasket. Gas leaks from cylinder head gasket.	—	—	—
Retightening cylinder head bolts. (1 unit) (present machine) Incl. : Adjusting valve clearance.		2.0	2.3	2.5
Replacing pre-combustion chamber. (1 pc.) Excl. : Detaching/attaching head. Incl. : (1) Detaching/attaching and cleaning glow plug (1 pc.). (2) Adjusting nozzle (1 pc.) for each nozzle increased : Medium size 0.4hr. Large size 0.5hr.	Pre-combustion chamber is broken. Water leaks from pre-combustion chamber gasket.	1.0	1.0	1.3
Locker cover 03-15				
Replacing locker cover packing. (1 pc.) Increase 0.1hr. as one direct injection increases.	Locker cover packing is cracked. Oil leaks from locker cover packing.	0.6	0.6	0.5
Replacing locker casing packing. (1 unit) Incl. : (1) Adjusting valve clearance. (2) Detaching/attaching locker casing.	Oil leaks from locker casing packing.	—	—	—
Cylinder block 03-20				
Replacing cylinder block Incl. : (1) Detaching and attaching engine. (2) Conditioning engine (B) and travel test. Excl. : Replacing associated parts.	Refer to fault code table.	50.0	55.0	65.0
Replacing cylinder liners. (all Q'y on present vehicle) Incl. : (1) Conditioning engine (A). (2) Adjusting nozzle.	Refer to fault code table.	25.0	27.0	31.0
Replacing side cover packing. (front side)	Oil leaks from side cover gasket.	—	0.4	0.4
Replacing side cover packing. (left)	Oil leaks from side cover gasket.	—	—	—

Applicable Machines
YN18709~
YQ02353~

Revision	Date of Issue	Remarks
First edition	April, 1994	S5YN1208E K

3.9 SINGLE BOOM UP ACTION (NORMALLY SWING MODE=BOOM CONFLUX QMAX)

(1) Converting Pilot Operating Pressure to Output Voltage Signals

If the boom up lever is operated, proportionate secondary pilot pressure is produced from port (2) of the pilot valve (11), acts upon port (PAb) of the control valve and changes over the boom spool.

At the same time, the pressure sensor (SE3) located halfway on the pilot line detects the proportionate secondary pilot pressure and converts it to an output voltage signal.

(2) Positive Control of Pump

An output voltage signal from the pressure sensor (SE3) is transmitted to proportionate valves E, F of the pump via the controller and discharges a flow according to lever strokes.

(3) Changing Over the Cut Valve and the Boom Conflux Valve

The controller sends out signals to ports A, D of the proportionate valve block (17) and changes over the cut valve (PCa) and the boom conflux valve (PB1) of the control valve according to lever strokes.

(4) Main Circuit (Boom Up Conflux)

When the boom spool is changed over, the oil discharged from port A1 of pump P1 enters port P1 of the control valve, passes through the boom spool and runs into the boom cylinder head (H). The oil discharged by pump P2 (conflux side) enters port P2 of the control valve, passes through the boom conflux valve, combines with other oil on the P1 side inside the control valve and runs into the boom cylinder head (H).

(5) Single Boom Up Action (Boom Conflux Qmin at Fine Swing Speed)

When the fine swing speed mode is selected, A and E of the proportionate valve block (17) is changed over. Then boom conflux occurs usually the same way as in the swing mode, though it does not occur when the boom conflux valve (PB2) is changed over.

3.10 ATTACHMENT BOOST PRESSURE

(1) Rise in the Set Pressure of Main Relief Valve

While the power-up switch attached to the right operating lever is pressed, electromagnetic selector valve G is changed over. Then primary pilot pressure acts upon the main relief valve (PL1) of the control valve and raises the set pressure of the relief valve to 380kgf/cm² (5400 psi) from a normally set 350 kgf/cm² (4980 psi).

(2) Releasing the Set Pressure of Main Relief Valve

If you detach your hand from the power-up switch, the set pressure of the relief valve returns to 350kgf/cm² (4980 psi).

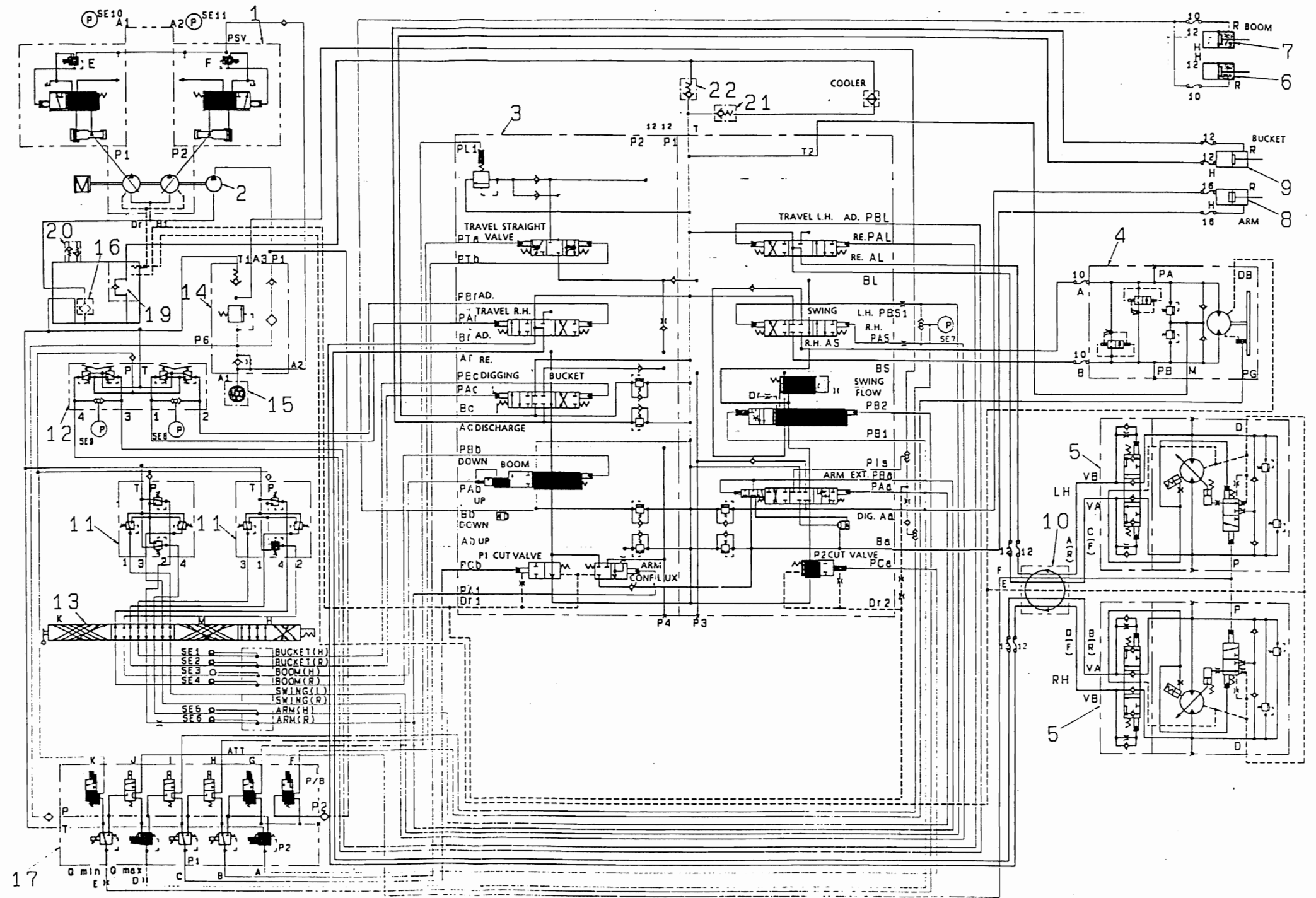
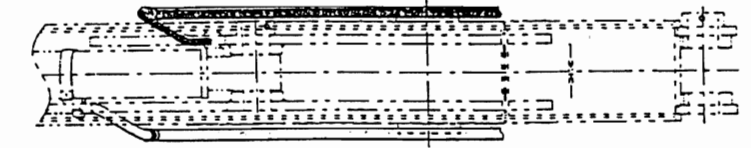
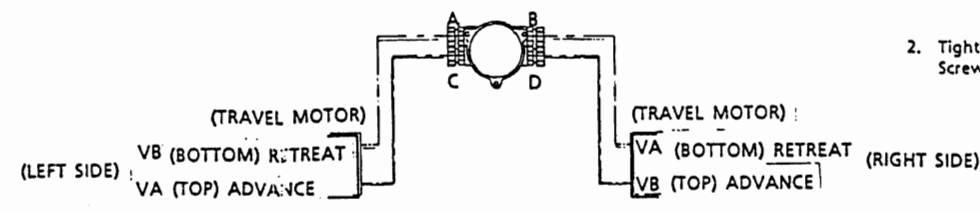
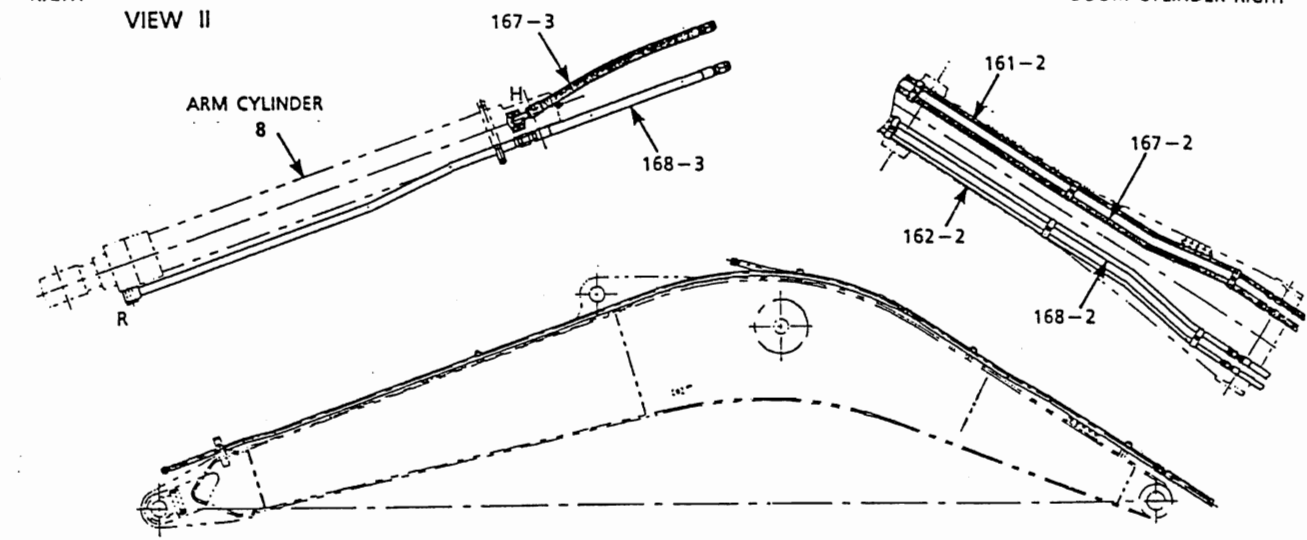
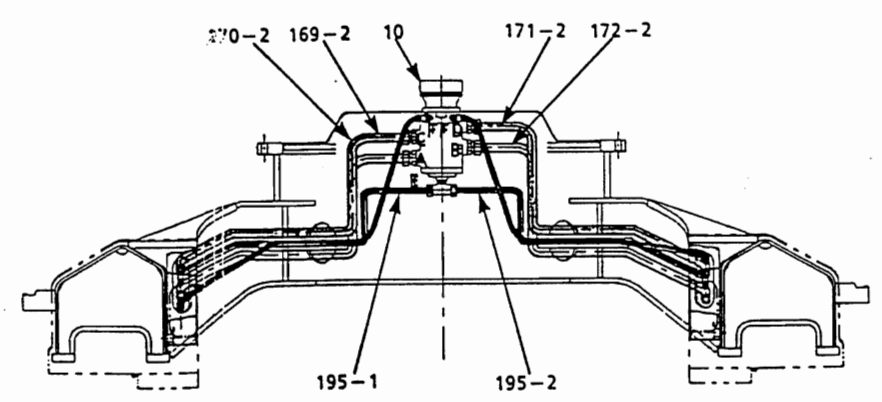
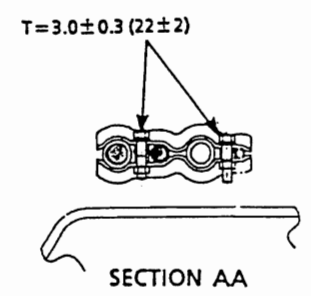
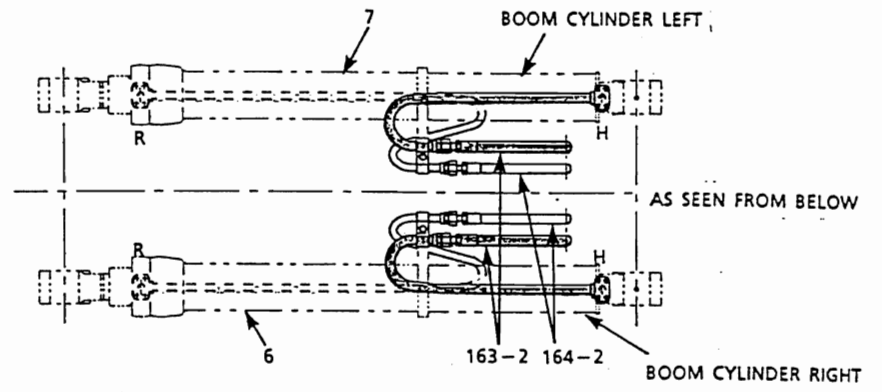
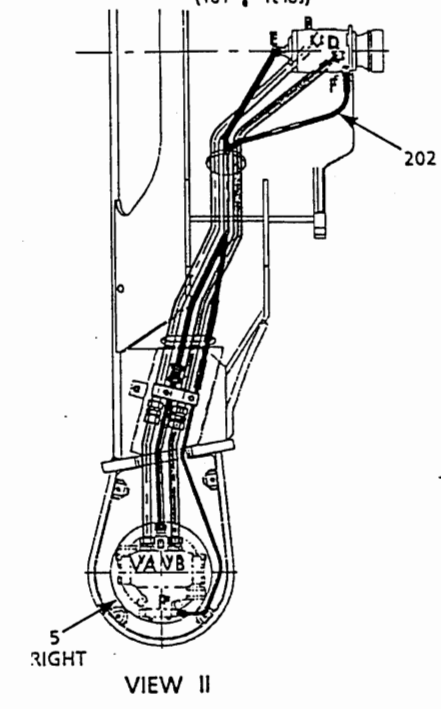
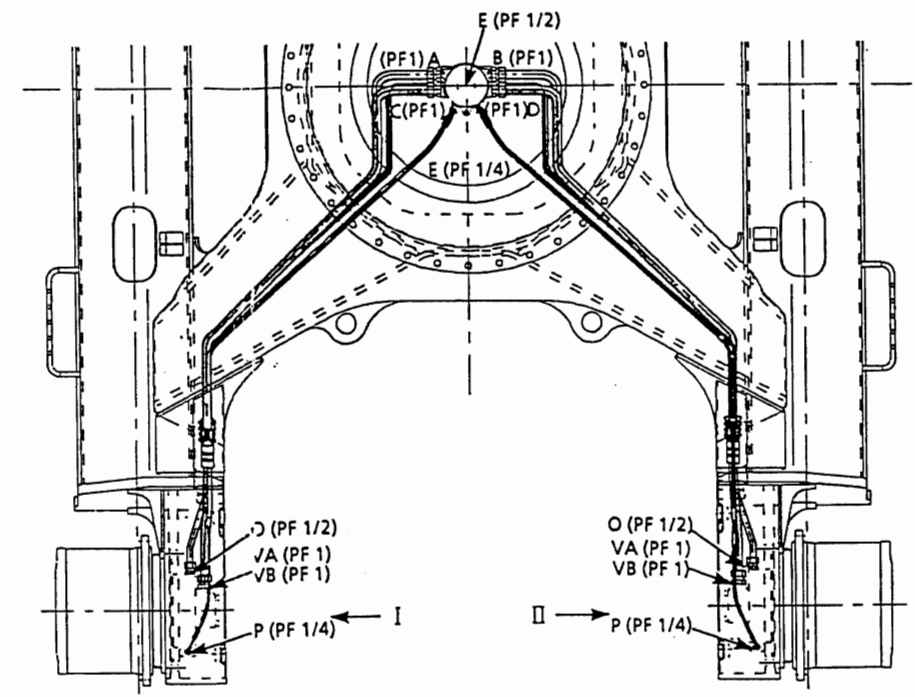
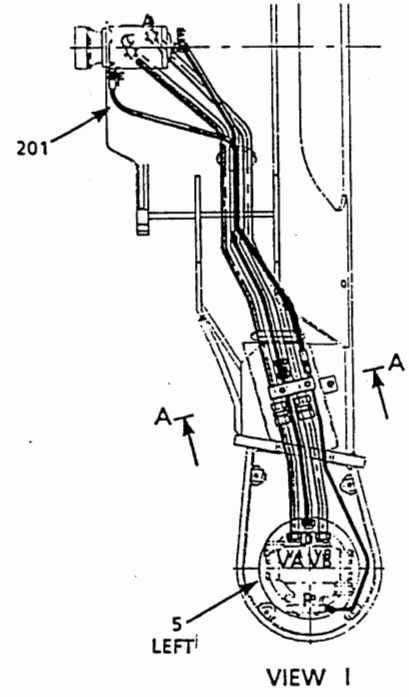
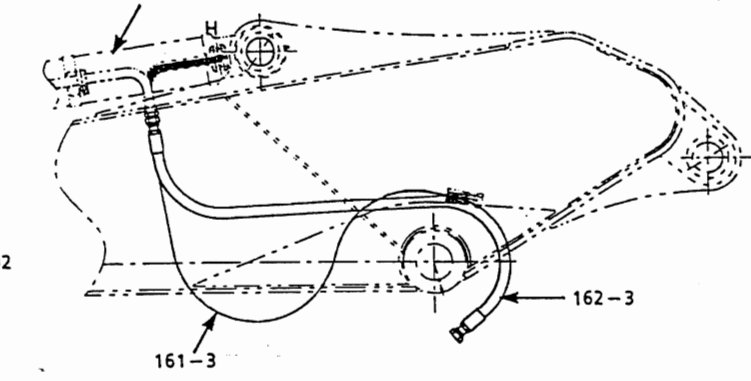


Fig. 8 Single Boom Up (Normally Swing Mode) + Attachment Boost Pressure Circuit)

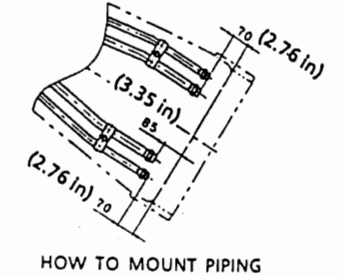
- Flareless joint nut, sleeve / tightening torque
 Piping size : $\varnothing 10 \times 1.5$ 6.5 ± 0.5 kgf-m
 (47 \pm 4 ft-lbs)
 : $\varnothing 15 \times 2.0$ 11.5 ± 0.5 kgf-m
 (83 \pm 4 ft-lbs)
 : $\varnothing 18 \times 2.5$ 18.0 ± 1.3 kgf-m
 (130 \pm 9 ft-lbs)
 : $\varnothing 22 \times 3.0$ 22.0 ± 2.0 kgf-m
 (159 \pm 14 ft-lbs)
 : $\varnothing 28 \times 4.0$ 28.0 ± 3.0 kgf-m
 (203 \pm 22 ft-lbs)
- Tightening torque of PF screw
 Screw size : PF 1/4 3.7 ± 0.2 kgf-m
 (27 \pm 1 ft-lbs)
 : PF 3/8 7.5 ± 0.5 kgf-m
 (54.2 \pm 4 ft-lbs)
 : PF 1/2 11.0 ± 1.0 kgf-m
 (80 \pm 7 ft-lbs)
 : PF 3/4 16.5 ± 1.5 kgf-m
 (119 \pm 11 ft-lbs)
 : PF 1 25.0 ± 1.0 kgf-m
 (181 \pm 14 ft-lbs)



9 BUCKET CYLINDER



• T=TIGHTENING TORQUE kgf-m (ft-lbs)



4. COUNTERWEIGHT


4.1 DETACHING AND ATTACHING COUNTERWEIGHT

In order to detach and attach the counterweight assembly, remove the bonnet at the back of the upper swing body and separate the flash lamp and the harness connector for the rear work lamp.

4.2 DETACHING AND ATTACHING COUNTERWEIGHT ASSY


(1) Detaching

- 1) Attach a wire in lifting bracket sling and tension it a little.
- 2) Pull the counterweight assy out by adjusting the tension of the wire sling while loosening four capscrews M24 × 180 (C1) fixed from outside.

 : 36mm

- 3) Separate the counterweight assy from the swing frame, using the wire sling.


Weight of counterweight assy : approx. 4 tons (8800 lbs).

 Make sure that the insulation is plastered securely and that the bumper (C8) is fixed properly.

Adjusting shims are located at the mounting part. Record these positions when removing them.

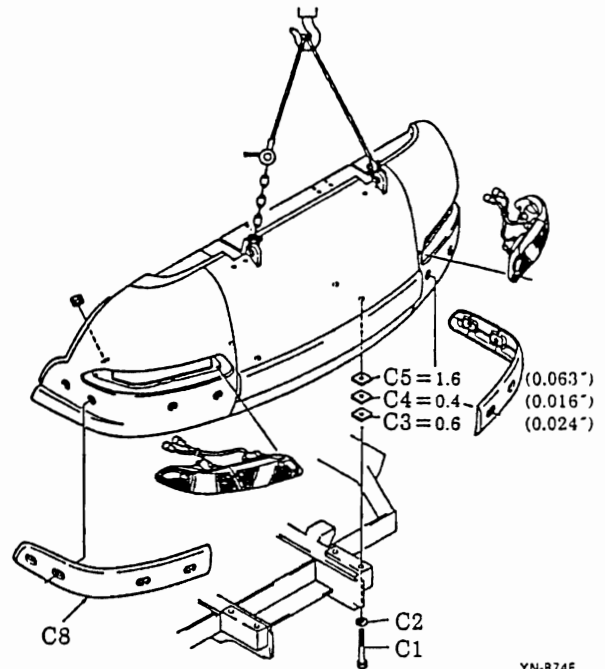
(2) Attaching

- 1) The counterweight is attached in the reverse order of detaching it. Get the recorded shims ready beforehand.
- 2) Place a wire sling in the lifting fixture fixed to the counterweight assy and lift the assy close to a specified position.
- 3) Tighten capscrews (C1) (Coat the screwed part with Loctite #242 beforehand.) with washer (C2), while inserting shims (C3, C4, C5).

 : 36mm

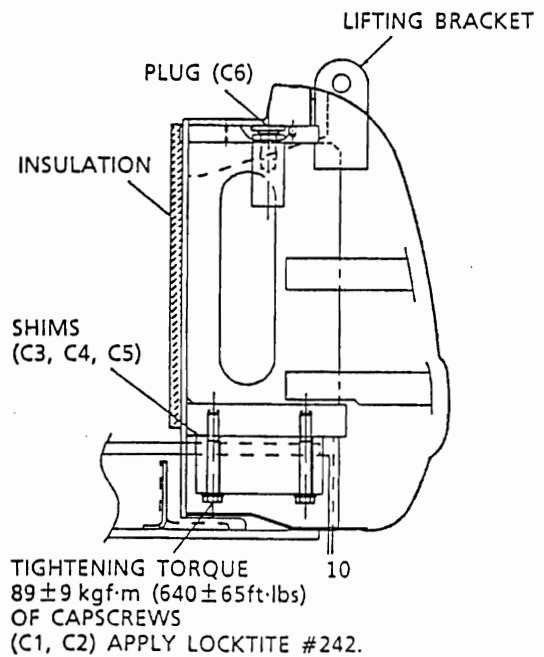
- 4) After confirming that the counterweight assy is positioned properly, fasten it to a tightening torque of 89 ± 9 kgf·m (640 ± 65 ft·lbs).

Remove the lifting fixture and attach plug (C6).



YN-B74E

Fig. 29 Counterweight assy



YN-B74E

Fig. 30 Detaching and attaching counterweight

13. RADIATOR


The radiator ass'y consists mainly of a cooling water radiator, an oil cooler and a sub tank.


13.1 PREPARATION FOR DISMANTLING AND MOUNTING RADIATOR

- 1) Dismantle the bonnet, panel and air cleaner around the radiator. (Refer to Dismantling and Mounting Guards and Air Cleaner.)
- 2) Open the cock under the radiator to let out the water in the radiator.
- 3) Attach the suction stopper to the hydraulic oil tank. (Refer to Dismantling and Mounting Power Takeoff.)
- 4) Where an air-conditioner is equipped, remove the condenser and the receiver tank.

13.2 DISMANTLING AND MOUNTING RADIATOR ASSY

(1) Dismantling


- 1) Disconnect all the hoses that are connected with the radiator and the oil cooler.
- 2) Remove capscrew (B4) and then stays (B1, B2).
 : 19mm
- 3) Remove the stays, fix eye bolts M12 in the holes, place a wire sling in the eye bolts and tension the wire sling so it does not slack.
- 4) Loosen and remove capscrews (B5) that fix the legs of the radiator assy to the frame. Then separate the radiator assy so the shroud does not interfere with the fan.


 : 24mm,

weight of radiator assy : 90kg (198 lbs)

(2) Mounting

- 1) Place a wire sling around the radiator, mount it in place and temporarily fasten it with capscrews (B5).

 : 24mm

 Make sure that the insulation is not damaged.

- 2) Temporarily fasten stays (B1, B2) with capscrews (B4).

 : 19mm

- 3) Adjust the clearance between the fan and the shroud to $15 \pm 3\text{mm}$ ($0.59 \pm 0.12\text{in}$). Also adjust the perpendicularity. Coat capscrews (B5) with Locktite #262 and fasten them to a tightening torque of $15 \pm 1.2\text{kgf}\cdot\text{m}$ ($108 \pm 9\text{ft}\cdot\text{lbs}$)
- 4) Refit all hoses. The length of the hose to be inserted must be 30mm (1.18in).

- 5) Fill in cooling water to a required level.
- 6) Run the engine for about ten minutes and confirm no water leakage.
- 7) Refill cooling water into sub tank (A4).

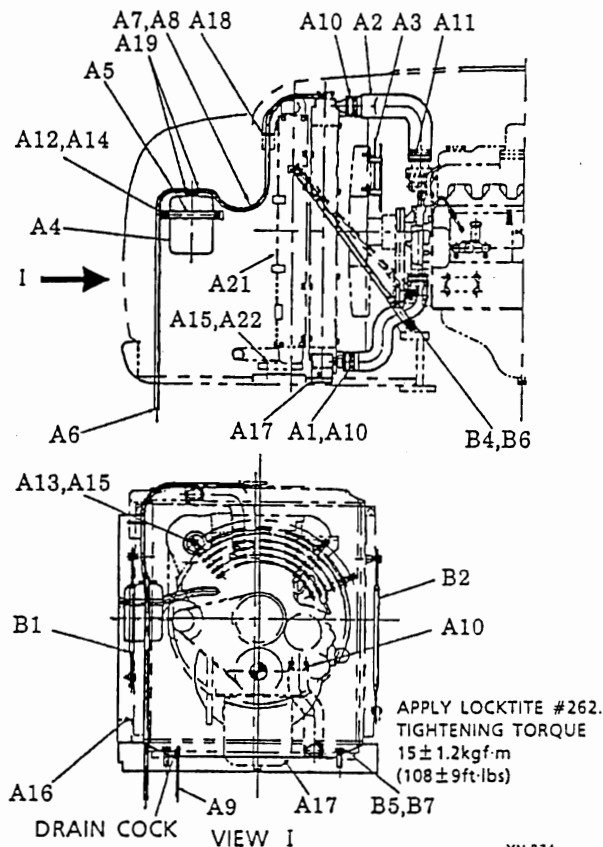


Fig. 47 Radiator assy

YN-B74

13.3 COMPONENT PARTS

No.	NAME	Q'ty	No.	NAME	Q'ty
A1	Radiator hose	1	A15	Washer	5
A2	Radiator hose	1	A16	Insulation	1
A3	Guard	1	A17	Insulation	1
A4	Sub tank assy	1	A18	Clip	1
A5	Bracket	1	A19	Clip	1
A6	Hose	1	A20	Cushion rubber	2
A7	Hose (accessories)	1	A21	Insect catch net	1
A8	Clip (accessories)	1	A22	Capscrew (M10×25)	2
A9	Hose (accessories)	1	B1	Stay	1
A10	Clip	3	B2	Stay	1
A11	Clip	1	B3	—	—
A12	Capscrew (M8×25)	2	B4	Capscrew (M12×25)	7
A13	Capscrew (M10×20)	3	B5	Capscrew (M16×50)	2
A14	Washer	2	B6	Washer	4
			B7	Washer	2

18. UPPER FRAME

The procedure of dismantling and mounting the upper frame differs with the condition of upper frame at disassembly and the capacity of the crane. For the capacity of the crane, the following information is available :


Upper swing body - cab
= about 8 tons (18000 lbs)

Upper swing body - (cab + counterweight)
= about 4 tons (8800 lbs)

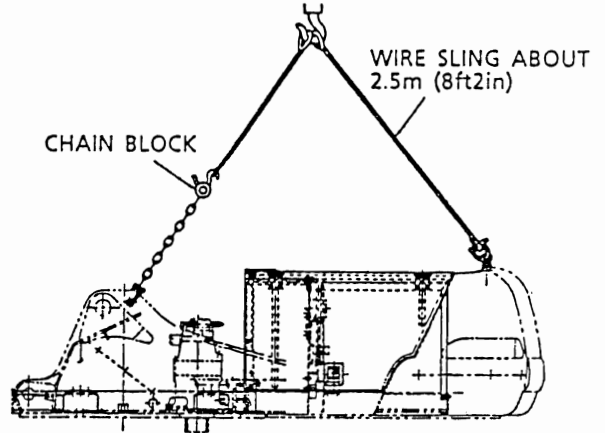
However, the above figures are without the attachment and a crane of 8 tons (18000 lbs) or over in capacity must be prepared.

18.1 PREPARATION FOR DISMANTLING AND MOUNTING UPPER FRAME

- (1) Dismantling Cab (Refer to Item 1. Cab.)
- (2) Preventing Leakage of Hydraulic Oil (Refer to 6. Hydraulic Oil Tank.)
 - 1) Let the pressure out of the hydraulic oil tank.
 - 2) Install suction stopper to the hydraulic oil tank.
- (3) Removing Piping
 - 1) Disconnect the boom, arm and bucket piping at their boom foot part.
 - 2) Put a plug into each hose opening. Also put a tag on each piping so as not to mistake it for other piping at reassembly.
 - 3) Remove the travel piping at its top of the swivel joint.
 - 4) Put a plug to each hose opening. Also put a tag on each piping so as not to mistake it for other piping at reassembly.
- (4) Loosen the locknut of the swivel joint and remove the capscrew.

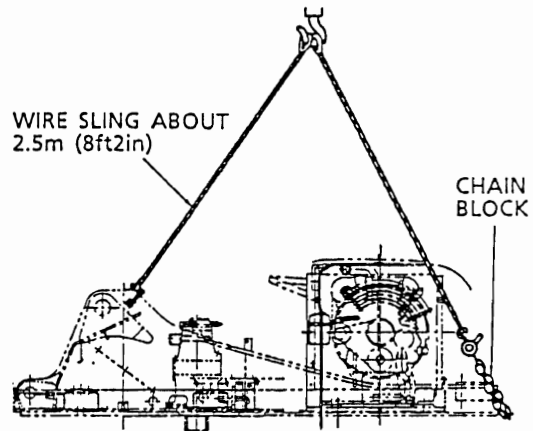
 : 24mm

- (5) Disconnecting the Harness for Boom Work Light



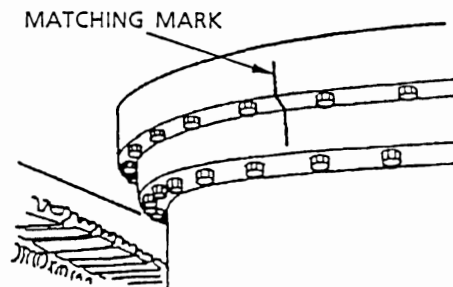
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Fig. 55 Lifting upper frame (with counterweight)



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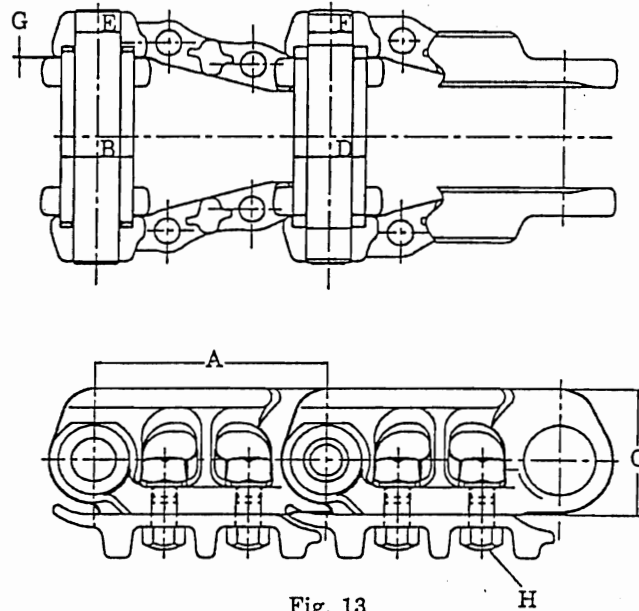
Fig. 56 Lifting upper frame (without counterweight)



YN-874

Fig. 57 Matching mark on swing bearing and upper frame

(2) LC type (same as the standard type)



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Table 2


Unit: mm (in)

No.	ITEM	STANDARD VALUE		REFERENCE VALUE FOR REMEDY	SERVICEABILITY LIMIT	REMEDY	
A	Link pitch	190±0.1 (7.480±0.004)		194.5 (7.66)	198 (7.80)	Replace	
B	O.D. of bushing	Ø58.72±0.05 (2.3118±0.0020)		Ø55 (2.17)	Ø53 (2.09)		
C	Link height	106±0.25 (4.1732±0.0098)		102 (4.02)	98 (3.86)	Replace	
D	Interference between bushing and link	Basic dimension	Tolerance		Interference	Interference	Replace
		Ø58.72 (2.3118)	Shaft	+0.05 (+0.0020) 0	0.10 (0.00394)	0	
E	Interference between track pin and link	Ø36.65 (1.4429)	Shaft	±0.05 (±0.0020)	0.14 (0.00551)	0	
F	Interference between master pin and link	Ø36.34 (1.4307)	Shaft	+0.04 (+0.0016) 0	0.05 (0.00197)	0	Replace with an oversize pin
G	Clearance between links (both sides)	3.0 (0.12)		8 (0.32)	10 (0.39)	Replace	
H	Tightening torque of shoe bolt	95±2 kgf·m (690±14ft·lbs)					Retighten

1.4 TOOLS AND JIGS

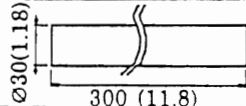
(1) Tightening Tool

Unit : mm


NAME	WIDTH ACROSS FLATS
 Socket	19, 30

(2) Jig

Unit : mm (in)

No.	NAME	SHAPE
a	Master pin drawing rod	

- 8) Place the roller assemblies in the vertically opposite directions and fit floating seal (5) to the roller.
- 9) Align collar (7) with the hole in pin (4) and press the collar into shaft (2).
- 10) Press pin (4) through the pin holes in collar (7) and in shaft (2).
- 11) Remove plug (8) and fill in 190cc (11.6cu-in) of engine oil API grade CD#30
- 12) Place seal tape around plug (8) or coat it with an anaerobic sealing compound for the blind plug use. Then fit the plug into the plug hole in the end face of collar (7) and tighten it up.

 : 6mm,
 tightening torque 2.2~2.5kgf·m
 (16~18ft·lbs)

APPLY AN ANAEROBIC SEALING COMPOUND FOR BLIND PLUG USE.

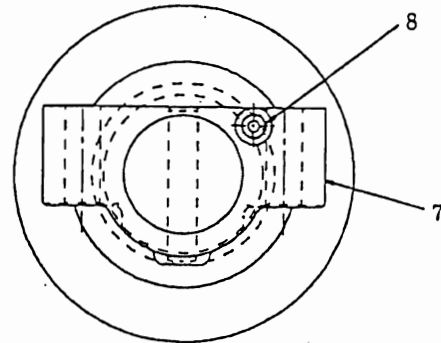



Fig. 42 Plug for fitting oil

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-  After assembling the lower roller, confirm that oil is not leaking and that the roller rotates smoothly by hand.

3.4 MAINTENANCE STANDARD

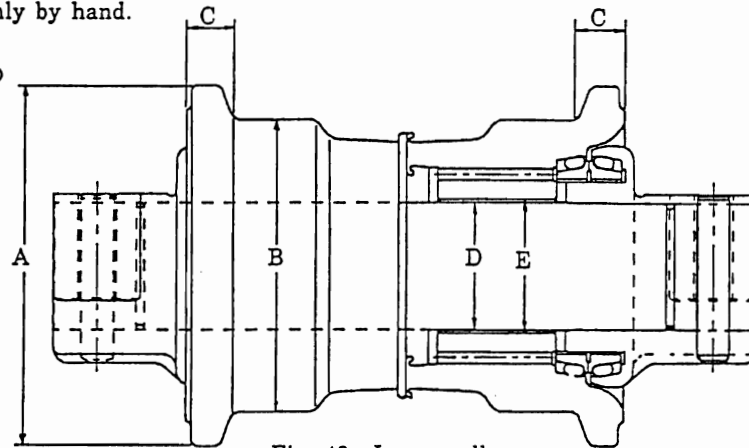


Fig. 43 Lower roller

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Table 4

Unit : mm (in)

No.	ITEM	STANDARD VALUE		REFERENCE VALVE FOR REMEDY	SERVICEABILITY LIMIT	REMEDY	
A	O.D. of flange	Ø185 (7.28)		—	—	Reinforcement weld, repair or replace.	
B	Tread dia.	Ø150 (5.91)		Ø134 (5.28)	Ø128 (5.04)		
C	Flange width	23.5 (0.925)		18 (0.709)	16.5 (0.650)		
D	Clearance between shaft and bushing (coiled bushing)	Basic dimension Ø65 (2.55905)	Tolerance		Fit	Fit	Replace bushing
			Shaft	-0.060 -0.090 (0.00236) (0.00354)		Clearance 0.7 (0.0276)	
E	Interference between the bore of roller and bushing	Ø69 (2.71653)		Hole	+0.030 -0.020 (0.00118) (0.00079)	Interference 0	
F	Oil	Engine oil API grade CD #30, 190cc (11.6cu-in)				Replenish	
	Roller rotation	Rotates smoothly by hand				Reassemble	

- 5) Take out the idler adjuster ass'y from the jig.
- 6) Attach oil seal (9) and O ring (8) coated with grease, to grease cylinder (1).
- 7) Fill up grease in grease cylinder (1), separate the grease nipple from piston (6) and discharge the entrapped air through the grease nipple mounting hole, while pushing in the piston (6) by hand. In that case, the entrapped air is easy to escape if the piston is pushed in with the grease nipple hole facing down.
- 8) Screw in a grease nipple into piston (6).
 Ⓣ : 19mm,
 tightening torque : $6 \pm 1 \text{ kgf}\cdot\text{m}$
 ($43 \pm 7 \text{ ft}\cdot\text{lbs}$)

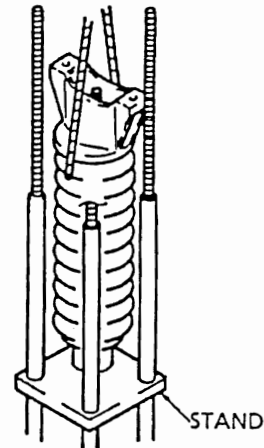


Fig. 68 Taking out idler adjuster ass'y

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5.4 MAINTENANCE STANDARD

Table 6

No.	ITEM	STANDARD VALUE
A	Installed length of spring mm	407 (16.0in)
B	Free length of spring mm	About 503 (19.8in)
C	Stroke mm	50 (1.97in)
D	Set length mm	608 (23.9in)
E	Outer circumference of piston	Nor scoring and rusting
F	Tightening torque of grease nipple	$6 \pm 1 \text{ kgf}\cdot\text{m}$ ($43 \pm 7 \text{ ft}\cdot\text{lbs}$)

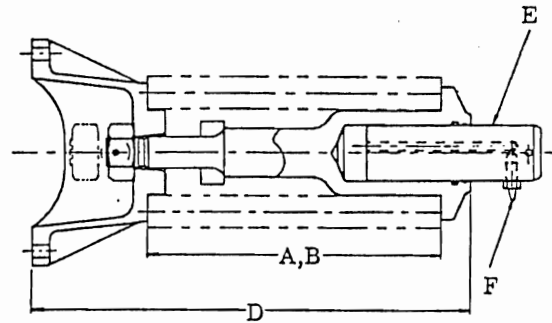


Fig. 69 Idler adjuster

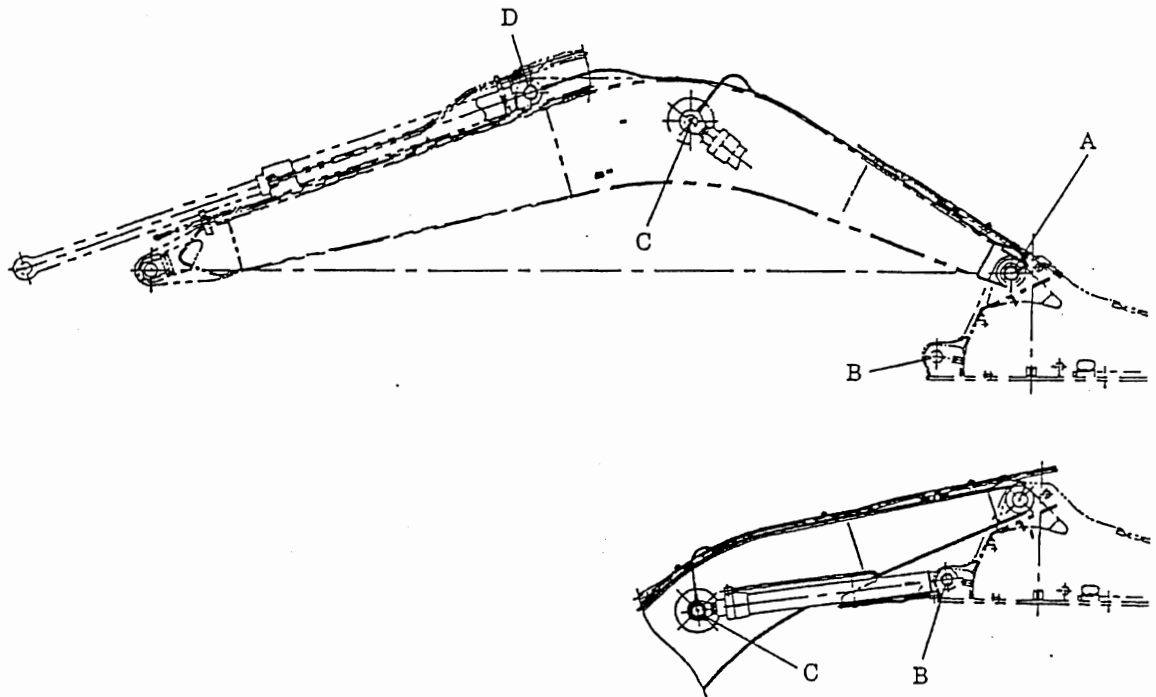
YN-874

Applicable Machines
YN18001~
YQ02301~

Revision	Date of Issue	Remarks
First edition	April, 1994	S5YN2106E K

3.4 MAINTENANCE STANDARD

(1) Clearance between Pin and Bushing



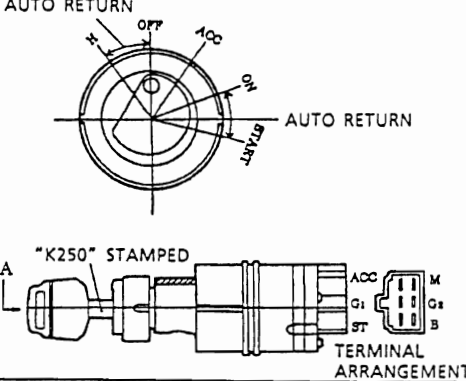
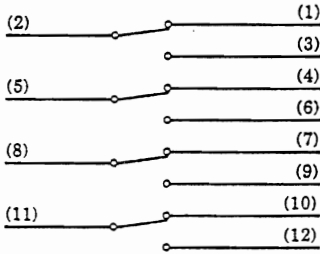
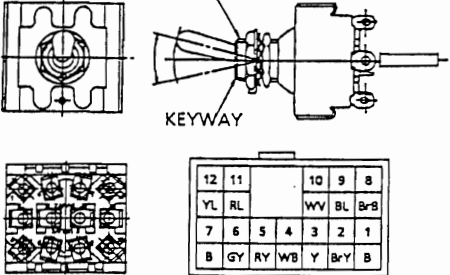
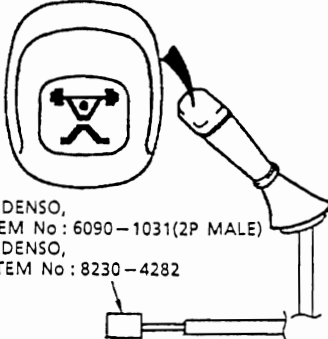
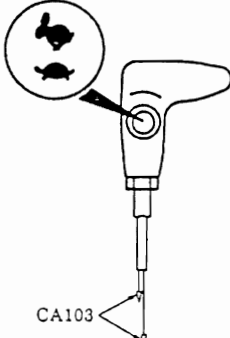
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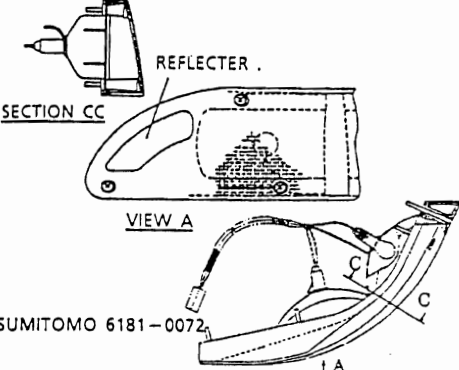
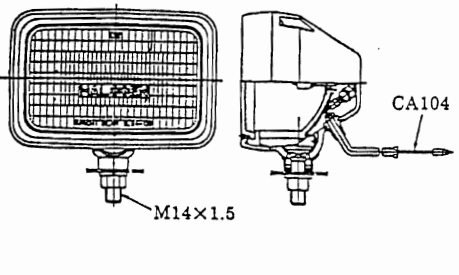
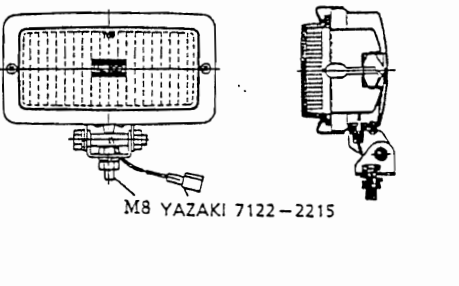
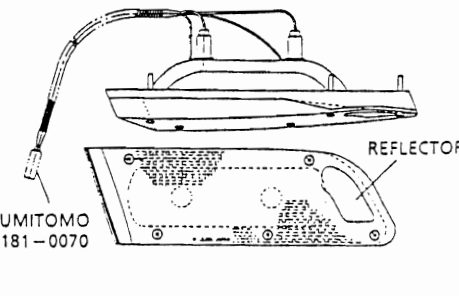
Fig. 13 Clearance between boom pin and bushing

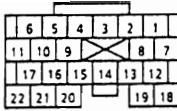
Table 4

Unit: mm (in)

No.	Item	Standard dimension			Clearance			Remedy
		Pin dia	Tolerance on pin dia	Tolerance on bushing bore dia	Standard value	Reference value for remedy	Serviceability limit	
A	Boom foot	Ø90 (Ø3.5433)		+0.230 (+0.0091) +0.151 (+0.0059)	0.13~0.25 (0.0051~0.0098)	2.0 (0.08)	2.5 (0.10)	Replace bushing or pin
B	Boom cylinder (Head side)	Ø90 (Ø3.5433)	+0.020 (+0.0008) -0.020 (-0.0008)					
C	Boom cylinder (Rod side)	Ø85 (Ø3.3465)		+0.230 (+0.0091) +0.150 (+0.0059)				
D	Arm cylinder (Head side)	Ø85 (Ø3.3465)	+0.030 (+0.0012) -0.030 (-0.0012)	0.12~0.26 (0.0047~0.0102)				

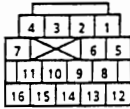
File No. Name of part Part No. Use Applicable Machine	Specification	Description																																																								
<p>SW-1</p> <p>Key switch</p> <p>YN50S00002F1</p> <p>Key</p> <p>YW06501~ LP11001~, YP02301~ YN18001~, YQ02301~ LQ03301~, LL02301~</p>	<p>Connection table</p> <table border="1" data-bbox="500 390 906 642"> <tr> <td></td> <td>T</td> <td>B</td> <td>G1</td> <td>G2</td> <td>ACC</td> <td>M</td> <td>ST</td> </tr> <tr> <td>P</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>H</td> <td>○</td> <td>○</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>OFF</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>ACC</td> <td>○</td> <td></td> <td></td> <td></td> <td>○</td> <td></td> <td></td> </tr> <tr> <td>ON</td> <td>○</td> <td></td> <td></td> <td></td> <td>○</td> <td>○</td> <td></td> </tr> <tr> <td>START</td> <td>○</td> <td></td> <td>○</td> <td></td> <td>○</td> <td>○</td> <td>○</td> </tr> </table>		T	B	G1	G2	ACC	M	ST	P								H	○	○						OFF								ACC	○				○			ON	○				○	○		START	○		○		○	○	○	<p>AUTO RETURN</p>  <p>TERMINAL ARRANGEMENT</p>
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<p>SW-2</p> <p>Switch</p> <p>YN50S01003F1</p> <p>KPSS release</p> <p>YW06501~ LP11001~, YP02301~ YN18001~, YQ02301~ LQ03301~, LL02301~</p>	<p>Type</p> <p>ST-425N</p> <p>Circuit diagram</p> 	<p>M12P1</p>  <p>KEYWAY</p> <table border="1" data-bbox="1170 915 1365 1031"> <tr> <td>12</td> <td>11</td> <td></td> <td>10</td> <td>9</td> <td>8</td> </tr> <tr> <td>YL</td> <td>RL</td> <td></td> <td>WV</td> <td>BL</td> <td>Br-B</td> </tr> <tr> <td>7</td> <td>6</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> </tr> <tr> <td>B</td> <td>GY</td> <td>RY</td> <td>WB</td> <td>Y</td> <td>BrY</td> </tr> </table> <p>12PAM-HD SUMITOMO 6098-0252 TERMINAL 8230-4282</p>	12	11		10	9	8	YL	RL		WV	BL	Br-B	7	6	5	4	3	2	B	GY	RY	WB	Y	BrY																																
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7	6	5	4	3	2																																																					
B	GY	RY	WB	Y	BrY																																																					
<p>SW-3</p> <p>Switch</p> <p>YN03M01164P1</p> <p>ATT boost pressure</p> <p>YN18001~, YQ02301~ LQ03301~, LL02301~</p>	<p>Type</p> <p>Buried in right grip</p>	 <p>SUMITOMO DENSO, HOUSING ITEM No: 6090-1031(2P MALE) SUMITOMO DENSO, TERMINAL ITEM No: 8230-4282</p>																																																								
<p>SW-4</p> <p>Switch</p> <p>YN03M01039P1</p> <p>Travel 1,2-speed</p> <p>YW06501~ LP11001~, YP02301~ YN18001~, YQ02301~ LQ03301~, LL02301~</p>	<p>Type</p> <p>Buried in travel lever</p>	<p>MARKS ON SWITCH PORTION</p>  <p>CA103</p>																																																								

File No. Name of part Part No. Use Applicable Machine	Specification		Description				
L-1,2 Light YN80S00006 F1(L) F2(R) Flasher YN18001~, YQ02301~ LQ03301~, LL02301~	<table border="1"> <tr> <td>Part No.</td> <td>DS-IL10/IR10</td> </tr> <tr> <td>Bulb</td> <td>24V, 25W</td> </tr> </table>	Part No.	DS-IL10/IR10	Bulb	24V, 25W		
Part No.	DS-IL10/IR10						
Bulb	24V, 25W						
L-3 Light YW80S00001F1 Boom work light YW06501~ LP11001~, YQ02301~ YN18001~, YQ02301~ LQ03301~, LL02301~	<table border="1"> <tr> <td>Model</td> <td>BL84-130</td> </tr> <tr> <td>Bulb</td> <td>24V, 70W</td> </tr> </table>	Model	BL84-130	Bulb	24V, 70W		
Model	BL84-130						
Bulb	24V, 70W						
L-4,5 Light YN80S00005F1 Work light YW06501~ LP11001~, YQ02301~ YN18001~, YQ02301~ LQ03301~, LL02301~	<table border="1"> <tr> <td>Part No.</td> <td>DS-TY50</td> </tr> <tr> <td>Bulb</td> <td>24V, 70W</td> </tr> </table>	Part No.	DS-TY50	Bulb	24V, 70W		
Part No.	DS-TY50						
Bulb	24V, 70W						
L-6,7 Light YN80S00007 F1(L) F2(R) Rear work light YN18001~, YQ02301~ LQ03301~, LL02301~	<table border="1"> <tr> <td>Part No.</td> <td>DS-JL10/JR10</td> </tr> <tr> <td>Bulb</td> <td>24V, 25W</td> </tr> </table>	Part No.	DS-JL10/JR10	Bulb	24V, 25W		
Part No.	DS-JL10/JR10						
Bulb	24V, 25W						



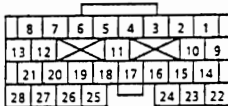
CN12 Mating part

PIN No.	PORT	DESCRIPTION	PIN No.	PORT	DESCRIPTION
1	A3	Max. travel speed variable condition input	12	A13	S mode input
2	A4		13	A14	FC mode input
3	A5		14	A21	Buzzer stop switch signal input
4	A6	Loading variable condition input	15	A17	E/G oil pressure switch input
5	A7		16	A19	Serial input RXD
6	A24	Spare 1 input	17	B8	Serial output TXD
7	A10	Travel 1-2 speed select switch	18	+24V	Power supply +24V
8	B7	CPU fault display signal input	19	+24V	
9	A2	Key switch Acc input	20	G	Cluster earth
10	A11	Auto accel select signal input	21	G	Power supply earth
11	A20	Fine swing speed condition input	22	G	



CN13 Mating part

PIN No.	PORT	DESCRIPTION	PIN No.	PORT	DESCRIPTION
1	+5V	OPT1 pressure sensor input limit switch input	11	A15	Governor motor
2	C13		12	+5V	P2 pump pressure sensor input
3	G		13	C12	
4	A22	Flow control signal input	14	G	Cutoff pressure switch input
5	+5V	OPT2 pressure sensor input	15	A25	
6	C14		16	A16	Adjust start switch input
7	G				
8	+5V	P1 pump pressure sensor input			
9	C11				
10	G				



CN14 Mating part

PIN No.	PORT	DESCRIPTION	PIN No.	PORT	DESCRIPTION
1	B1	Swing P/B selector valve output	17	B13	Full-operation neutral signal output
2	B2	Att boost pressure selector valve output	18	D4	Output of electromagnetic proportionate valve D for boom conflux valve
3	B3	Travel 1-2 speed selector valve output	19	D5	
4	B4	Battery relay excitation output	20	D6	Output of electromagnetic proportionate valve E for P1 pump
5	B5	Governor motor A phase output	21	D7	Output of electromagnetic proportionate valve F for P2 pump
6	B5'			22	D1'
7	B6	Governor motor B phase output	23	D2'	Output of electromagnetic proportionate valve for travel straight and single travel
8	B6'			24	D3'
9	B10	Travel deflection preventing selector valve output	25	D4'	Output of electromagnetic proportionate valve D for boom conflux valve
10	B11	Boom down stroke limit selector valve out put	26	D5'	Output of electromagnetic proportionate valve G for swing flow control
11	SHi	Governor motor shield	27	D6'	Output of electromagnetic proportionate valve E for P1 pump
12	B12	Swing neutral signal output	28	D7'	Output of electromagnetic proportionate valve F for P2 pump
13	B14	Spare 1 output			
14	D1	Output of electromagnetic proportionate valve for arm-side cut valve			
15	D2	Output of travel straight, single straight electromagnetic proportionate valve B			
16	D3	Output of electromagnetic proportionate valve C for boom- side cut valve			

5.3 CONTENTS OF DISPLAYS ON CLUSTER GAUGE

The contents of displays are mainly grouped as follows :

MAIN ITEM	NAME OF FUNCTION	DESCRIPTION	DETAILED DISPLAY
Fault information	Warning display function	Machine body conditions such as engine and fault conditions are displayed.	Contents of warning displays and order of displays (5.5).
	Mechatronic self diagnosis display function	Input/output systems for mechatronic controller such as, pressure sensors, governor motor and proportionate valves are displayed.	Mechatronic self diagnosis function (5.6)
	Fault history display function	Faults which occurred in mechatronic self diagnosis are stored in memory.	Contents of displays of fault history
Service information	Service diagnosis display function	Information from mechatronic controller, such as the inspected values of pressure sensors and the command values of proportionate valves is displayed.	Service diagnosis display (5.8)
	Mechatronic E/G revolution adjusting/display function	Information for each process during E/G revolution adjustment is displayed.	Mechatronic E/G revolution adjustment procedure (5.9)
	Cumulative E/G oil feed time and E/G revolution display function	Cumulative E/G oil feed time and present E/G revolution are displayed.	Cumulative E/G oil feed time and E/G revolution display (5.10)

5.4 CONTENTS OF WARNING DISPLAYS AND ORDER OF DISPLAYS

Higher order Lower order

A.....J





※ Blowing of buzzer

◎ : High risk (0.3sec.blow, 0.2sec. stop)

○ : Low risk (0.5sec. blow,0.5sec. stop)

● : Continuous blow:(high risk): stop after 5sec.

※ Those marked (W) are warning display functions.

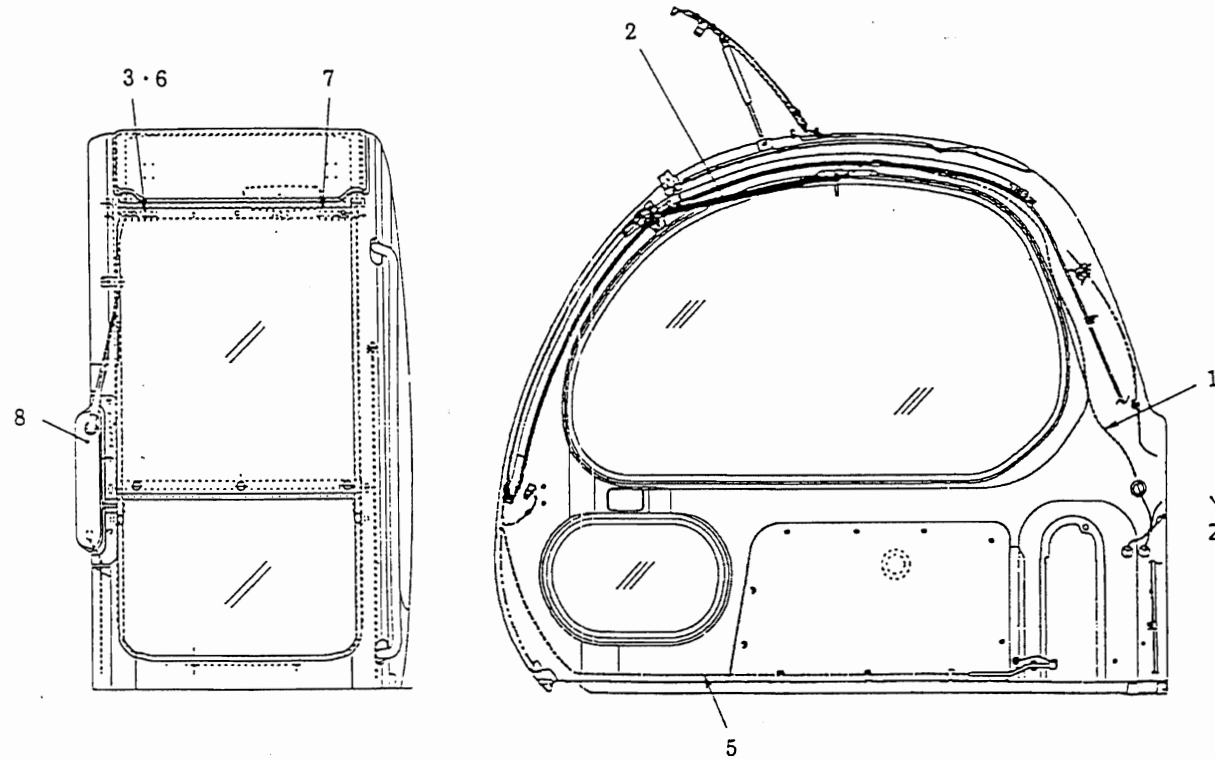
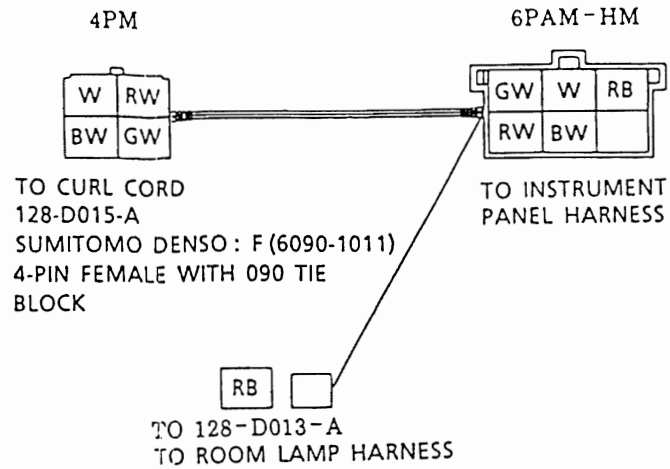
ORDER OF DISPLAY	CONTENTS	DESCRIPTION				CLUSTER DISPLAY	CONTROLLER/CONNECTOR INPUT PIN TERMINAL WIRE No. WIRE COLOR
		SIGNAL LEVEL	JUDGMENT CONDITION	BUZZER BLOW	CAUTION		
A	(W) Cluster self diagnosis NG		The signal line between the cluster controller and the cluster gauge is checked when power is thrown and judged to be faulty ;	◎	○	1  MONITOR FAIL	
B	(W) Fault on mechatronic controller	Earth/open	CPU fault signal (2-14) is at earth level when mechatronic controller gets out of order ;	◎	○	17 CPU MECHATRO CONT. FAIL	C-2/CN1 1-14 111 PG
	(W) Swing brake redundancy switch	Earth/open	Swing brake redundancy switch input (3-18) is at earth level when swing brake redundancy switch is turned to the release side.	●	○	 SWING BRAKE DISENGAGE	C-2/CN1 1-18 162 BrW
C	(W) Preheating underway	24V/open	Preheat signal (1-7) is by 24V input when key switch is turned to the preheat position :			3  E/G PREHEAT	C-2/CN1 1-7 280 BR
	(W) Preheating prohibited	24V/open	25 seconds passed after the key switch is turned to PREHEAT position. (25 sec. or 40 sec. selectable by dip switch ② of cluster controller)	◎		4  FINISH PREHEAT	C-2/CN1 1-7 280 BR

34

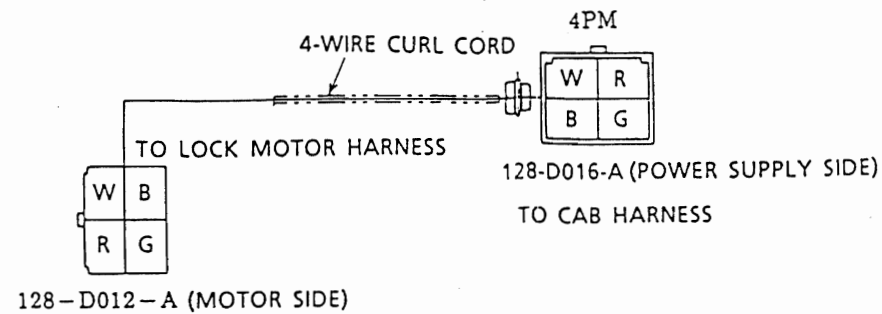
2.5 CAB HARNESS

No.	NAME	Q'ty
1	CAB HARNESS	1
2	CURL CORD HARNESS	1
3	LOCK MOTOR HARNESS	1
4	ROOM LAMP HARNESS	1
5	WIPER MOTOR HARNESS	1
6	LOCK MOTOR RH	1
7	LOCK MOTOR LH	1
8	WIPER MOTOR	1

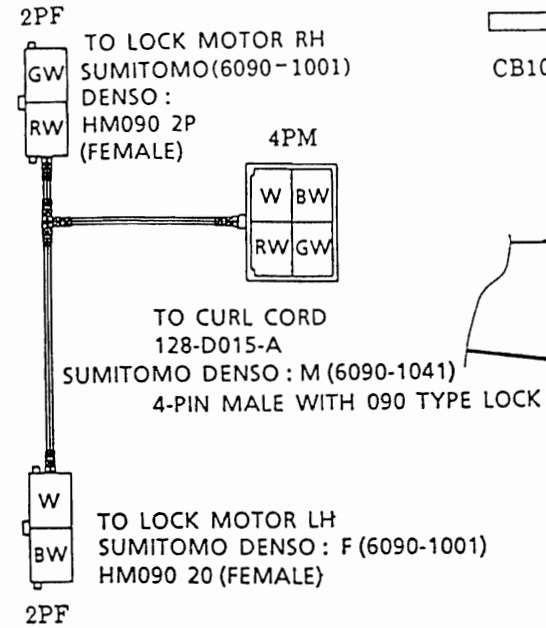
2.5.1 CAB HARNESS



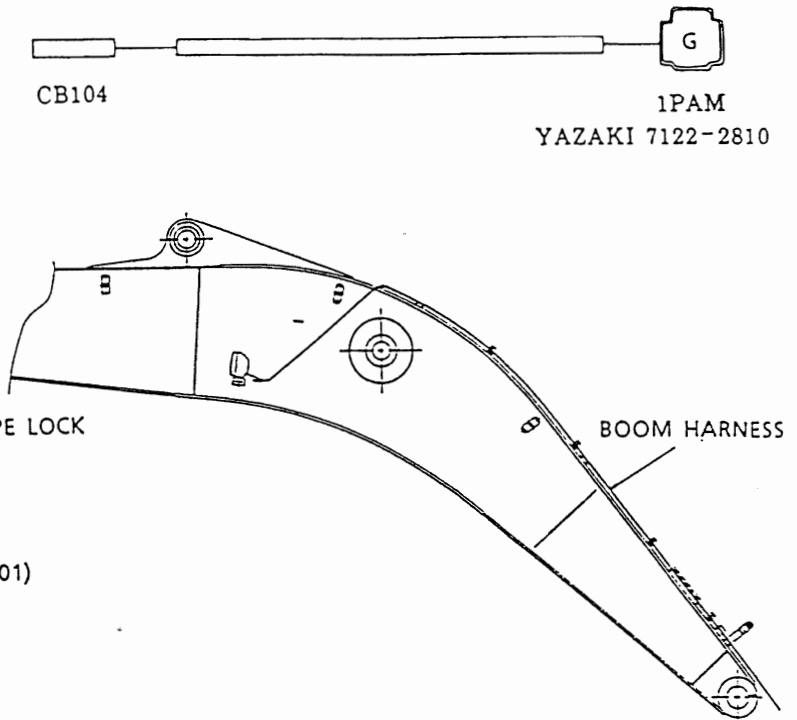
2.5.2 CURL CORD HARNESS



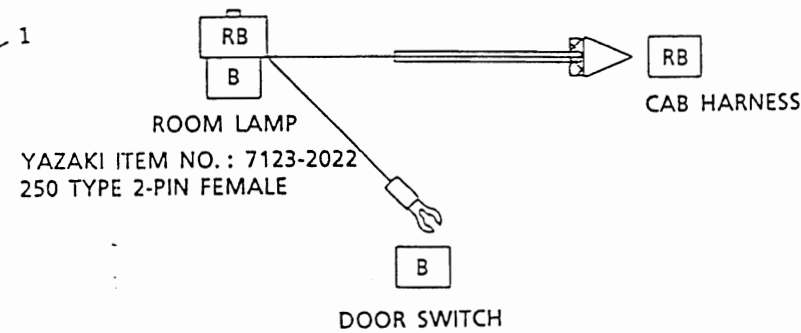
2.5.3 LOCK MOTOR HARNESS



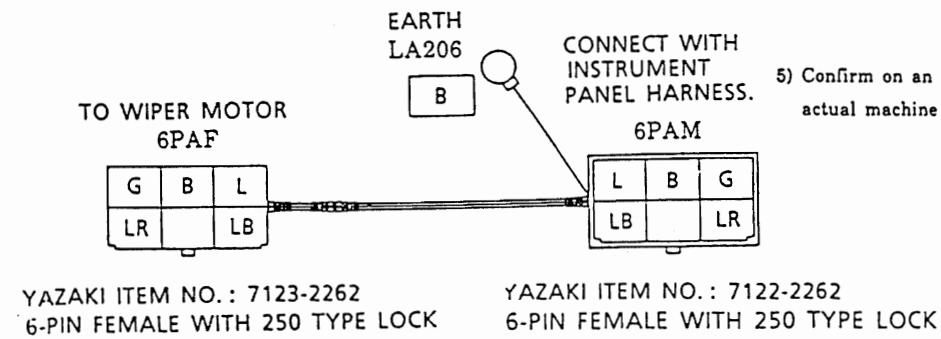
2.6 BOOM HARNESS



2.5.4 ROOM LAMP HARNESS



2.5.5 WIPER MOTOR HARNESS



⚠ How to use the electric wiring diagram, harnesses and connection table of numerically numbered harnesses

- 1) Search a wire number — Search the failed electric device in the electric diagram and find the wire number.
- 2) Search a harness number — Find the wire number in the harness connection table of numerically numbered harnesses. Then search the name of the harness and the harness number.
- 3) Search a connector number — Search the connector No. in the connection table of numerically numbered harnesses, the same way as above.
- 4) Search the location of a wire number — Search the location of the wire number in the connector and check the pin No. to be engaged with.
- 5) Confirm on an actual machine — In case power and signals are not on the device, check the upstream and if the upstream side is all right, measure the resistance of the devices and check it with the list of components in the control system.

Function	Wire No.					Upper Stream				Lower Stream			
	Power	Drive	Signal	Earth	Cable size Wire color	Name of Device Code	Name of Harness (№)		Name of Harness (№)		Name of Device Code		
							IN	OUT	IN	OUT			
Travel deflection prevention SV-3		121			LgR	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	Travel deflection prevention SV-3		
FC mode SV-4		122			LgB	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	FC mode SV-4		
Travel 2-speed SV-5		123A			OL	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → J/B-15PAF					
		123B			OL			J/B-15PAF →		Instrument panel (3-1) → 18PAM-HD	TO Floor down (2-1)		
			123C		OL			J/B-15PAF →		Instrument panel (3-1) → 18PAF-APEX	Cluster C-2		
		123B			OL	FROM Instrument panel (3-1)	18PAF-HD	Floor down (2-1) → 2PAF-HM			Travel 2-speed SV-5		
Proportionate valve (A) Bypass cut		124			VW	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	P1 bypass cut PSV-A		
				125	LW	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	P1 bypass cut PSV-A		
Proportionate valve (B) (Independent travel)		126			VG	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	Independent travel proportionate valve PSV-B		
				127	GrG	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	Independent travel proportionate valve PSV-B		
Proportionate valve (C) (P2 Bypass cut)		128			GrB	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	P2 bypass cut PSV-C		
				129	YB	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	P2 bypass cut PSV-C		
Proportionate valve (D) (Boom conflux)		130			GW	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	Boom conflux proportionate valve PSV-D		
				131	BrW	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	Boom conflux proportionate valve PSV-D		
Proportionate valve (E) (Swing variable)		132			RG	Governor C-1	28PAF-040 II	Instrument panel (3-1) → 18PAM-HD	18PAF-HD	Floor down (2-1) → 2PAF-HM	Swing fine speed PSV-E		
				133	BG	Swing fine speed PSV-E	2PAM-HW	Floor down (2-1) → 18PAF-HD	18PAM-HD	Instrument panel (3-1) → 28PAF-040 II	KPSS C-1		
Release SW (KPSS)		134			GY	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 12PAF-HD			Release SW-2		
				135	Y	Release SW-2	12PAF-HD	Instrument panel (3-1) → 28PAF-040 II			KPSS C-1		
Release SW (KPSS)		136			YL	KPSS C-1	28PAF-040 II	Instrument panel (3-1) → 12PAF-HD			Release SW-2		
				137	BL	Release SW-2	12PAF-HD	Instrument panel (3-1) → 28PAF-HD			KPSS C-1		
Proportionate valve (E) Pump P1		138			RY	Release SW-2	12PAF-HD	Instrument panel (3-1) → 20PAM-HD	20PAF-HD	LH side (1-5) → 8PAF-MK II	TO E/G sub		

2. CONSTRUCTION OF MAIN COMPONENTS

2.1 INTAKE UNIT

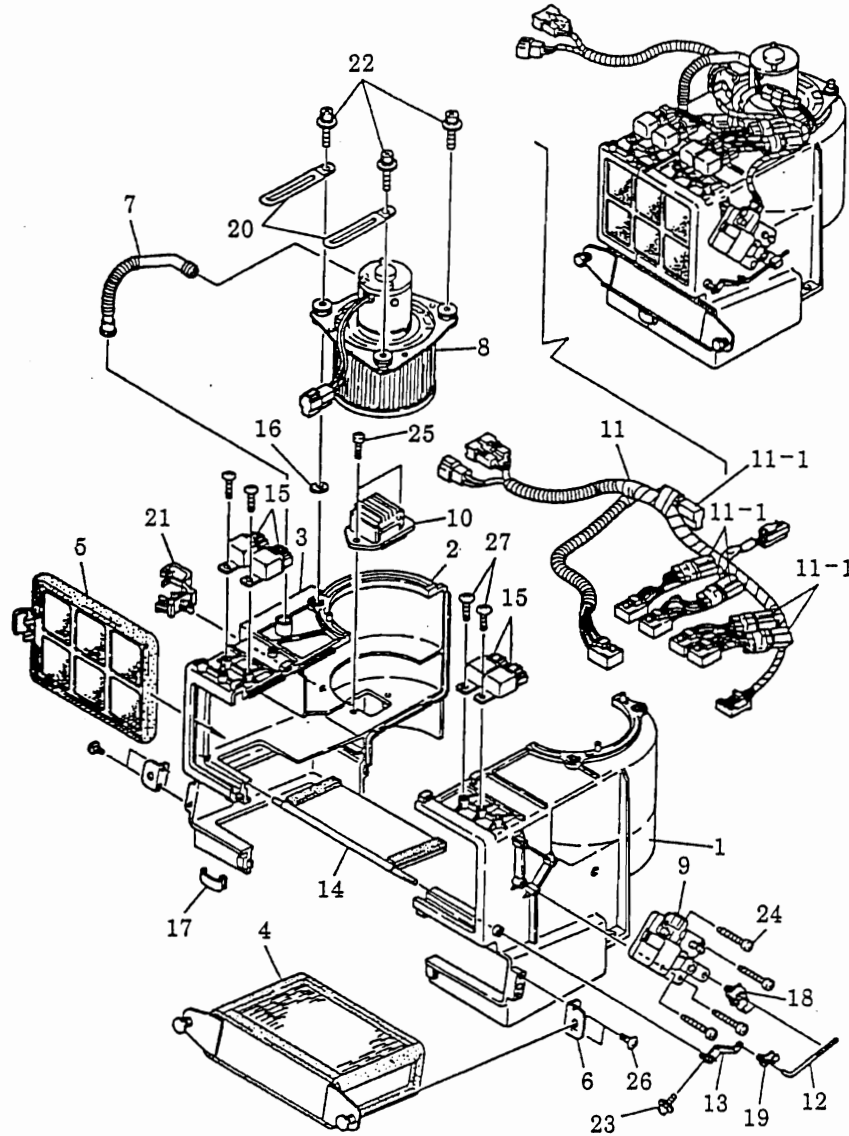


Fig. 2

No.	NAME	Q'ty	No.	NAME	Q'ty	No.	NAME	Q'ty
1	FAN CASING LH	1	11	HARNESS	1	20	CLAMP	2
2	FAN CASING RH	1	11-1	DIODE 1B	5	21	HARNESS CLAMP	1
3	CONNECTING OPENING	1	12	LINK ROD	1	22	SEMS BOLT	3
4	OUTER AIR FILTER	1	13	DAMPER LEVER	1	23	SEMS BOLT	1
5	INNER AIR FILTER	1	14	INTAKE DAMPER	1	24	MACHINE SCREW	4
6	HOLDER	2	15	RELAY	4	25	MACHINE SCREW	2
7	COOLING HOSE	1	16	WASHER	3	26	MACHINE SCREW	4
8	BLOWER MOTOR	1	17	CLAMP	9	27	MACHINE SCREW	4
9	ACTUATOR	1	18	ROD CLAMP	1			
10	RESISTER	1	19	ROD HOLDER	1			

4. DISASSEMBLY AND REASSEMBLY

4.1 Precautions to be Exercised in Operation

(1) Special Refrigerator Oil

This air-conditioner uses special refrigerator oil SP20 for use with new refrigerant R134a. Oils other than SP20 may not be used. Since SP20 tends to absorb moisture and may corrode paint and resin, the following points must be noted:

- 1) Keep open all pipe connections on a new compressor and the component parts of the installed refrigeration circuit
(Remove valves and caps at the pipe openings of the compressor, just before connecting pipes. If you have removed a pipe joint for repair, put a cap to both ports immediately.)
- 2) Use care so SP20 does not adhere to the painted surface and resin parts. In case SP20 has adhered to such surfaces, wipe it off immediately.
- (2) The receiver dryer is filled with desiccant to absorb moisture in the circuit. Therefore, remove the valve at the pipe port immediately before connecting pipes.
- (3) Tightening Torque
 - 1) Pipe Joints (See Table 2.)
When connecting pipe joints, coat the O ring with special oil (SP20) and fasten to the tightening torque indicated in the table, using a double spanner.
 - 2) Screws and Bolts (See Table 3.)
- (4) Amount of Oil for Compressor (See Table 4.)
The compressor SD7H (HD type) is filled with 240cc (15cu.in) of oil. If the oil volume is small, seizure at high revolution and shortening of service life will occur. If the oil volume is large, the cooling ability will be deteriorated.
Once the air-conditioner is operated, part of the oil is dispersed in the refrigeration circuit. Therefore, when replacing the parts in Table 4, adjust the oil level to that of table.
- (5) Before performing operation, stop the engine and turn off all power supplies to the equipment related to the air-conditioner.
- (6) After the operation is over, confirm that all faults have been repaired completely, by operating the air-conditioner.

Table 2 Unit : kgf·cm (ft·lbs)

Pipe Fastening Part	Tightening Torque
D hose and compressor (M8 bolt)	200~250 (14~18)
D hose and condenser	200~250 (14~18)
L hose and condenser	120~150 (8.7~11)
L hose and receiver dryer (M6 bolt)	80~120 (5.8~8.7)
L hose and air-conditioner unit	120~150 (8.7~11)
S hose and air-conditioner unit	300~350(22~25)
Inlet of expansion valve	120~150 (8.7~11)
Outlet of expansion valve	200~250 (14~18)
Pressure sensing part of expansion valve	70~90 (5.0~6.5)

Table 3 Unit : kgf·cm (ft·lbs)

Screw Size	Tightening Torque
N4, T4 machine screw, M4	8~12 (0.58~0.87)
N5, T5 machine screw, M5	20~25 (1.4~1.8)
M6 (mounting part of L hose joint)	80~120 (5.8~8.7)
M6 (except mounting part of L hose joint)	100~120 (7.2~8.7)
M8 (mounting parts of S, D hose joints)	200~250 (14~18)
M8 (mounting part of A/C unit)	100~120 (7.2~8.7)
M8 (other than those mentioned above)	120~160 (8.7~12)
M10	400~550 (29~40)

Table 4

Part to be Replaced	Amount to be filled in
Evaporator	40cc (2.4cu.in)
Condenser	40cc (2.4cu.in)
Compressor	Drain out the volume of oil left in the compressor to be replaced, from the new compressor.

(3) Filling from Low Pressure Side (See Fig.28.)

- 1) Make sure that the high-pressure and low-pressure valves of the gauge manifold and the service can valve are closed.
- 2) Start the engine and run the revolution to 1500 ± 100 rpm and fully open the cab door and the windows.
- 3) Turn on the air-conditioner switch, set the fan switch to Max and the temperature control switch to cool Max.
- 4) When filling gas, set the discharge pressure of the compressor to $14 \sim 16 \text{ kgf/cm}^2$ ($200 \sim 230 \text{ psi}$).
- 5) Open the low pressure valve of the gauge manifold and the service can valve and fill in refrigerant till air bubbles of the sight glass of the receiver go away. (See Fig.29.)

[Total amount of gas to be charged: 1000^{+50}_0 g ($2.2^{+0.1}_0 \text{ lbs}$)]

- 6) When refrigerant charge is over, close the low pressure valve of the gauge manifold and the service can valve.



- Do not open the high pressure valve of the gauge manifold in any circumstances.
- Never place the service can upside down. (The compressor valve may be scored because the refrigerant is sucked in a liquid state.)

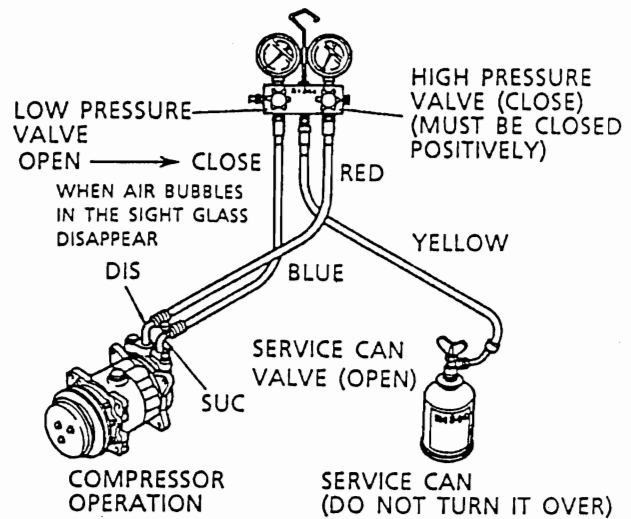


Fig. 28 Gas filling operation (Low pressure side)

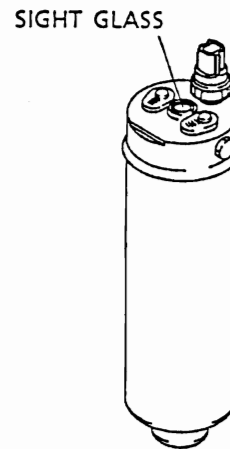


Fig. 29 Receiver dryer

3.3 INSPECTION BEFORE ASSEMBLY

Inspect disassembled parts for contamination and flaw and then wash them with hydraulic oil light oil.

Do not immerse rubber parts in light oil.

Inspect the following parts and if any abnormality is found, repair or replace them.

1) Gear plate

In order to improve efficiency the gear pump is so constructed that the gear tooth ends run in slight contact with the gear plate in run-in state. Therefore the gear pump once run has a contact mark near the suction port.

A normal contact mark is not longer than half the inner circumference of the gear hole and not deeper than 0.1mm(0.0039in).

In case of $a \geq 0.15\text{mm}(0.0059\text{in})$, replace the gear plate with a new one.

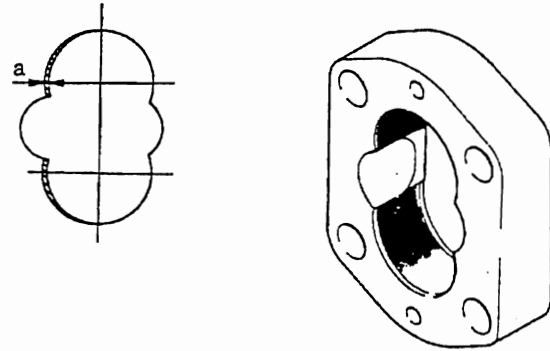


Fig. 13 Measuring the gear plate

2) Drive gear and driven gear

The shaft and gear side faces take on a smooth contact state with little deterioration of surface roughness as long as the hydraulic oil is clean. If the shaft and gear side faces are roughened to the extent that you can not slide your nail smoothly on the surfaces, replace them with new ones.

If the shaft diameter ($\varnothing D$) is less than 14.96mm(0.59in), replace the with a new one.

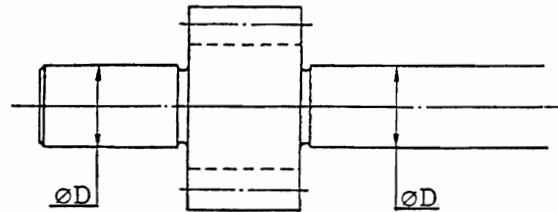



Fig. 14 Measuring the gear

3) Side plates A and B

The side plates are normal if the copper alloy side shows a lustrous contact mark.

Replace the side plate with a new one if you have found any scratch in radial direction that may be scratched with your nail.

 The non-contact face of the copper alloy side takes on a lustless pear-skin state. This is not unusual.

4) O ring

Always replace with new ones once removed.

5) Balance seal

Always replace with new ones once removed.

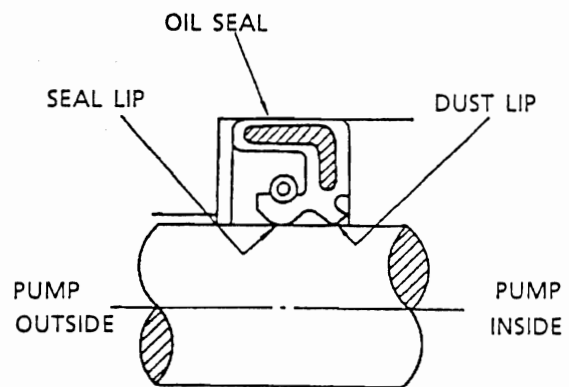


Fig. 15 Checking the oil seal

2. CONSTRUCTION AND FUNCTION

2.1 CONSTRUCTION

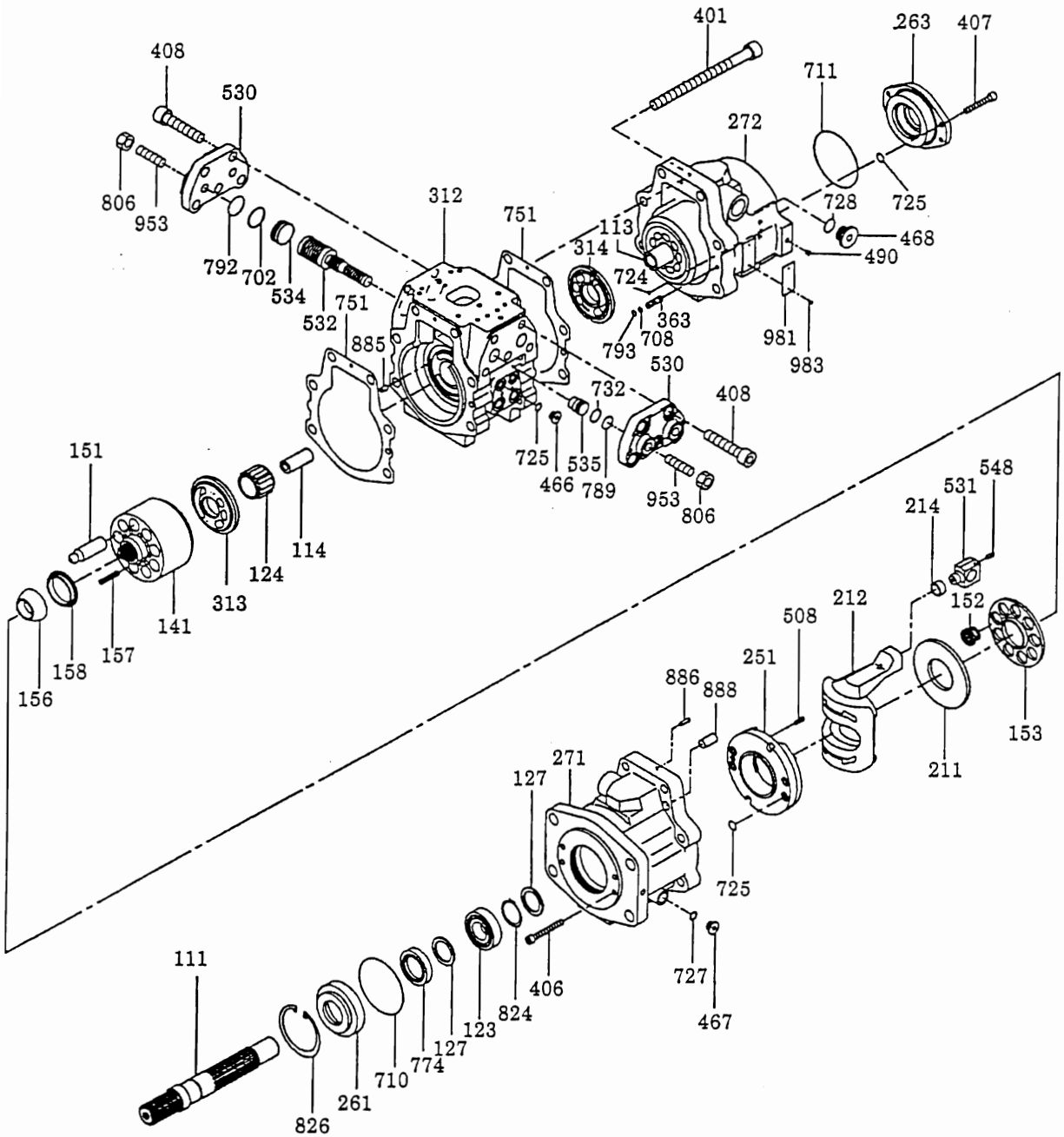
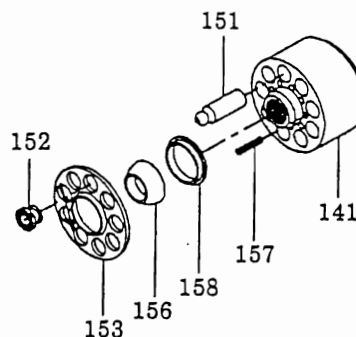


Fig. 2 Construction of hydraulic pump

YN-874

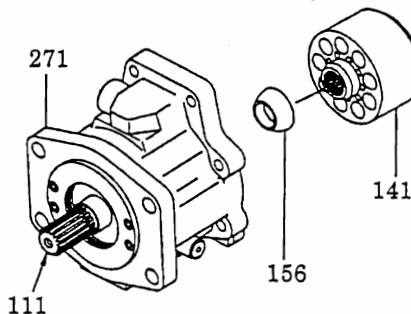
- 10) Fit piston (151), shoe (152), cylinder block (141), retainer (153), spherical bush (156), cylinder spring (157) and spacer (158) to the piston cylinder assembly .



YN-874

Fig. 26 Assembling piston cylinder sub assy

- 11) Match the phases of spherical bush (156) and the spline of cylinder block (141). Then match it the spline of the drive shaft (111) and put the piston cylinder sub into pump casing (271).

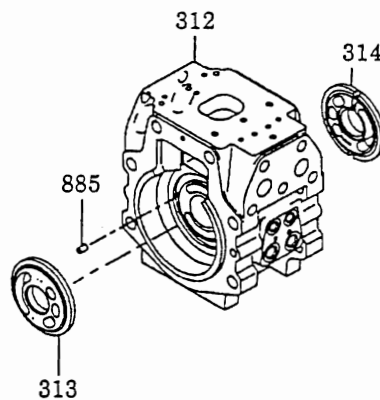


YN-874

Fig. 27 Inserting piston cylinder sub assy

- 12) Install valve plate (R)(313) and valve plate (L)(314) to valve block (312) by aligning valve plate pin (885).


⚠ Do not mistake the suction and discharge sides of the valve plate .



YN-874

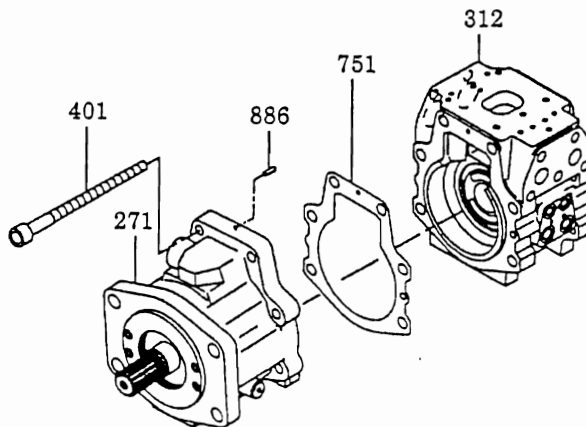
Fig. 28 Mounting valve plates (313,314)

- 13) Attach seat packing (751) and pump casing (271) to valve block (312) so spring pin (886) is aligned and fasten them with socket bolt (401).

 : 14mm

tightening torque : 24 kgf·m (170 ft·lbs)

- ⚠**
- Work will be promoted if assembly is started from the rear pump.
 - Exercise care so as not to mistake the direction of the valve block (312). (Install it so the regulator comes up as seen from the front side and the discharge flange comes on the left.)



YN-874

Fig. 29 Installing pump casing (271)

2. CONSTRUCTION AND FUNCTION

2.1 CONSTRUCTION

2.1.1 REGULATOR PROPER

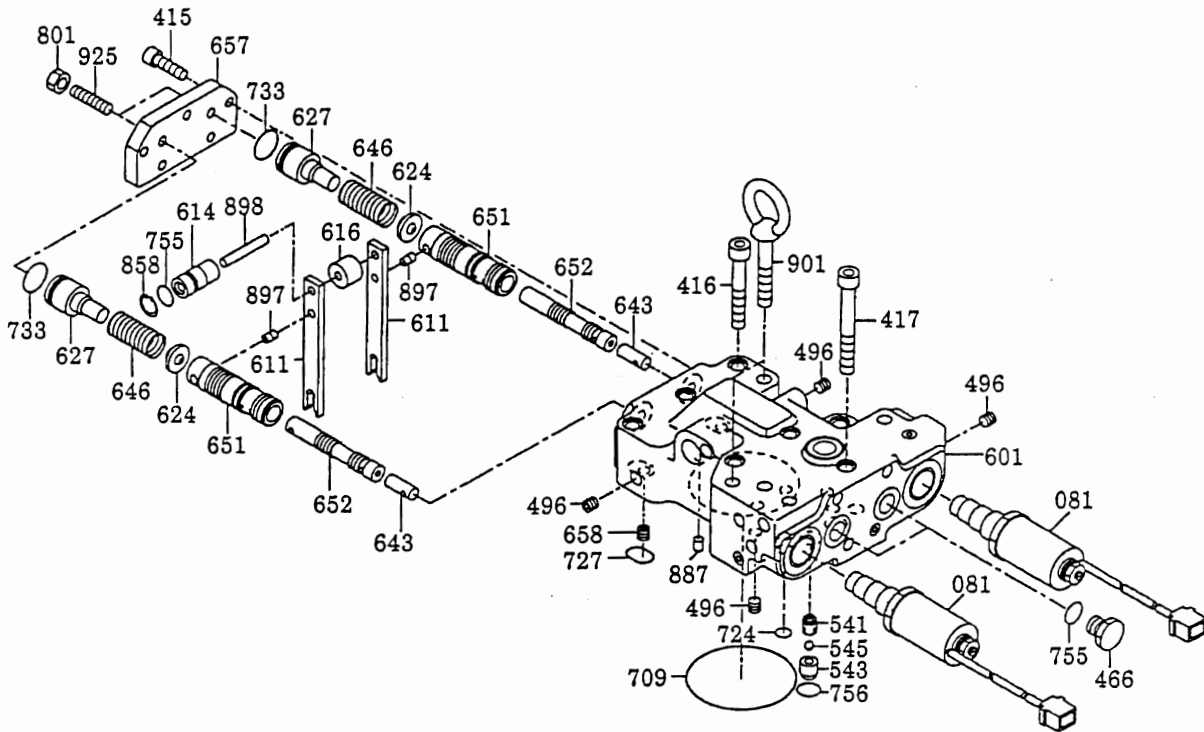


Fig. 2 Regulator proper

YN-874

Tightening torque kgf·m (ft·lbs)	No.	NAME	Q'ty	Tightening torque kgf·m (ft·lbs)	No.	NAME	Q'ty
	081	SOLENOID PROPORTIONATE REDUCING VALVE	2		652	SPOOL	2
1.2 (8.7)	415	SOCKET BOLT (M6×15)	5	0.9 (6.5)	657	COVER	1
3.0 (22)	416	SOCKET BOLT (M8×60)	4		658	TAPER SCREW WITH RESTRICTOR(NPTF1/16)	2
3.0 (22)	417	SOCKET BOLT (M8×75)	3		709	O RING	1
3.7 (27)	466	VP PLUG (PF1/4)	2		724	O RING	2
0.9 (6.5)	496	PLUG (NPTF 1/16)	28		727	O RING	1
	541	SEAT	2		733	O RING	2
	543	STOPPER	2		755	O RING	3
	545	STEEL BALL	2		756	O RING	2
	601	CASING	1	1.6 (12)	801	HEX NUT (M8)	2
	611	FEEDBACK LEVER	2		858	LOCKING RING	1
	614	FULCRUM PLUG	1		887	PIN	1
	616	SPACER	1		897	PIN	2
	624	SPRING SEAT	2		898	PIN	1
	627	ADJUST SEAT	2		901	EYE BOLT (M10)	2
	643	PILOT PISTON	2		925	SOCKET HEAD LOCK SCREW (M8)	2
	646	PILOT SPRING	2				
	651	SLEEVE	2				

NOTES

NOTES

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2. CONSTRUCTION AND OPERATION

2.1 CONSTRUCTION

(1) Control valve

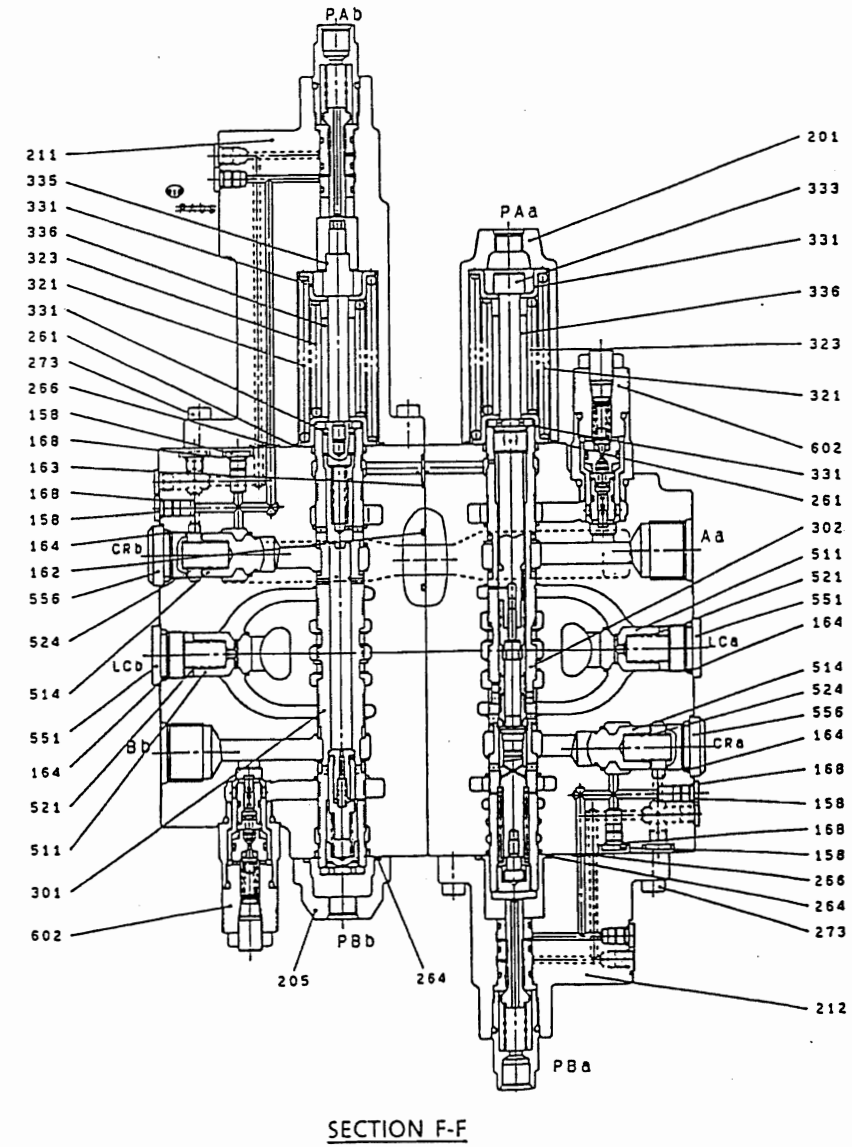
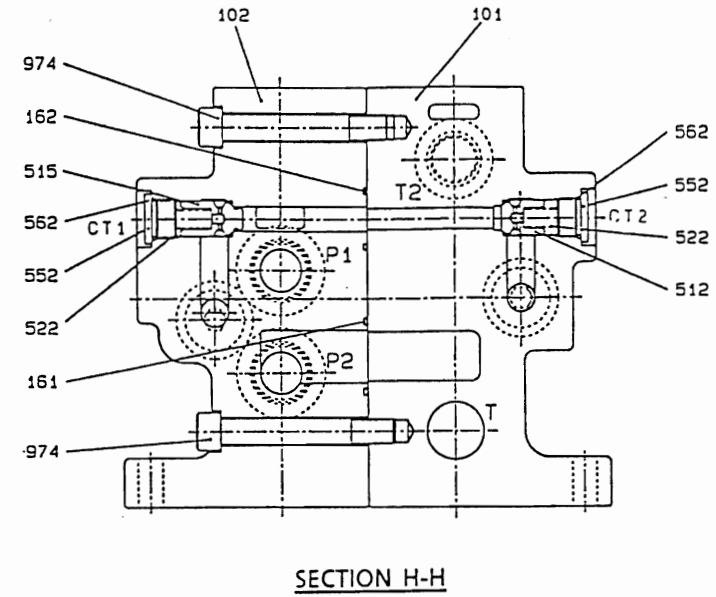
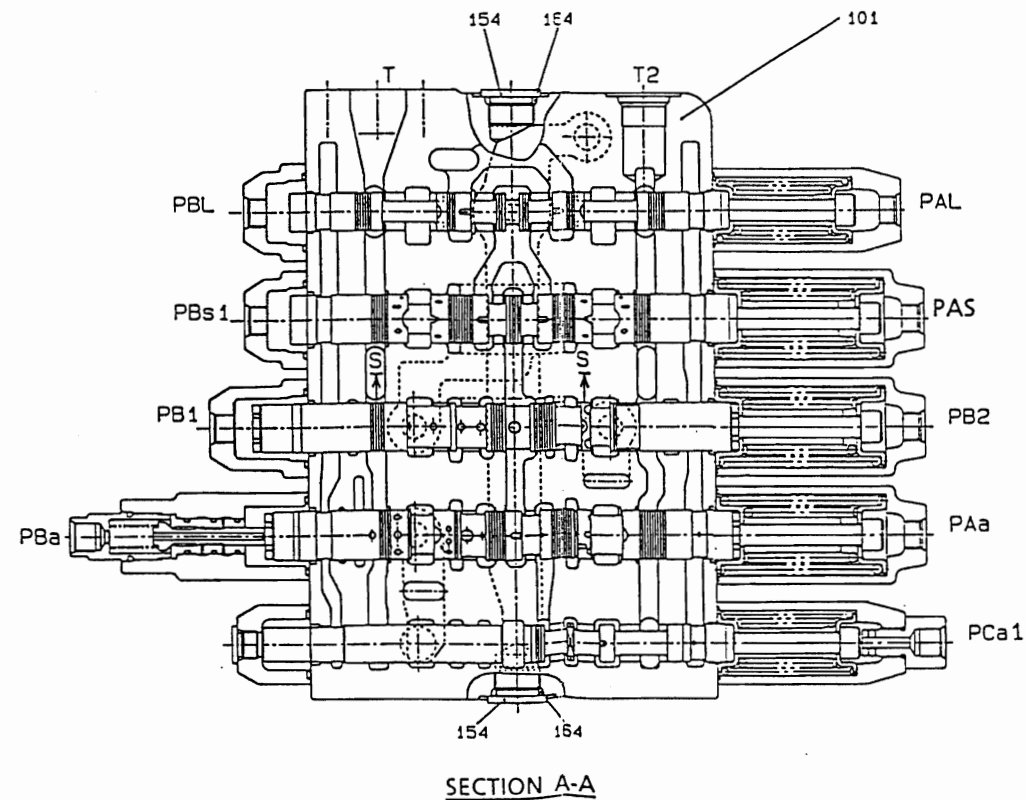
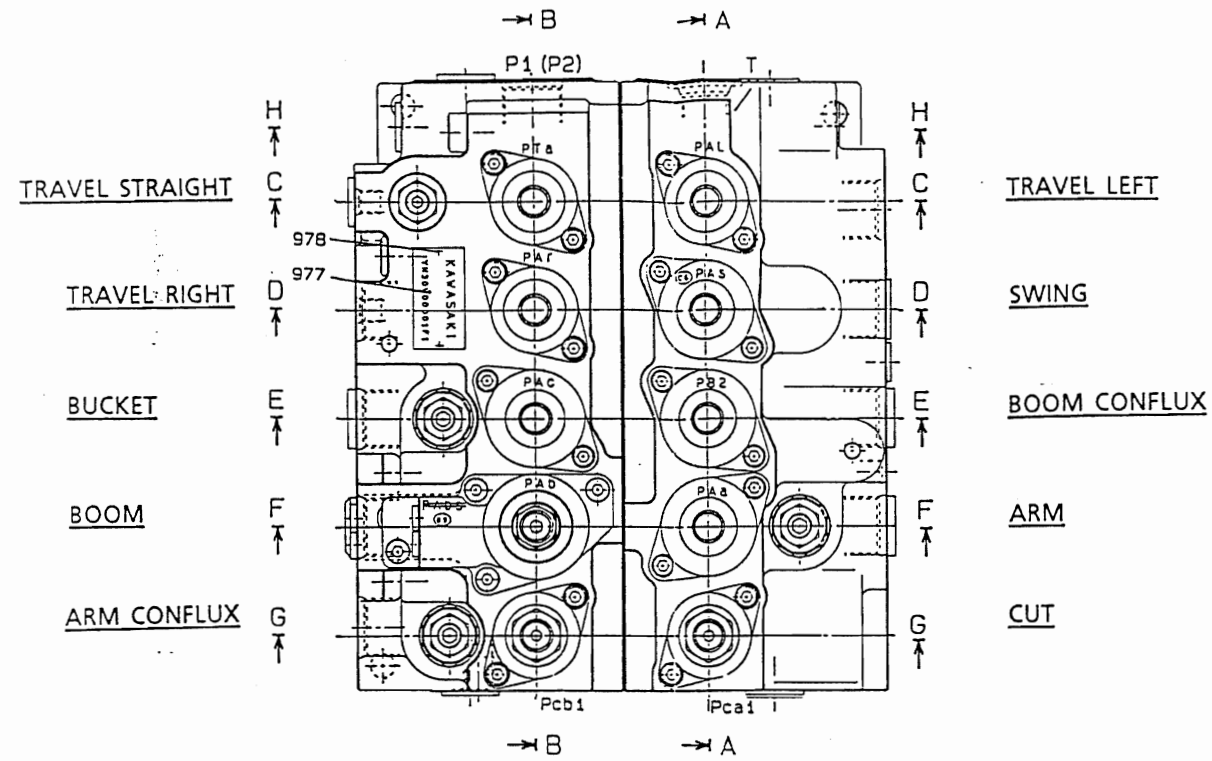


Fig. 2(1/2) Construction of Control Valve

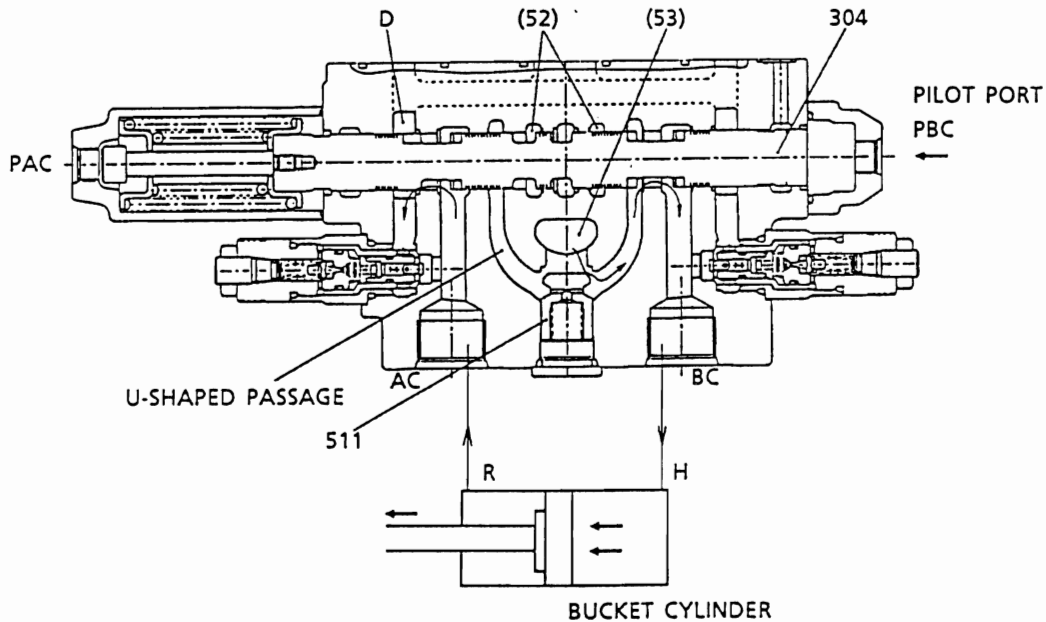
2.3.3 BUCKET

(1) When the bucket is digging

When the bucket is digging, secondary pilot pressure coming from port PA2 of the pilot valve enters port PBC of the control valve and moves the bucket spool (304) to the right. The pressure oil discharged by pump (P1) flows to the bypass circuit (52) past the main path (51), but since it is blocked by the bucket spool (304) that has shifted, it pushes the check valve open, enters the parallel circuit (53), pushes the load check valve (511) open, goes between the outer circumference of the bucket spool (304) and the casing by way of the U-shape path and is supplied to the bucket cylinder head (H) via port (Bc).

In the meantime, the oil which has returned from the bucket cylinder rod side goes between the outer circumference of the bucket spool (304) and the casing past the port (Ac) and returns to the hydraulic oil tank by way of the low pressure circuit (D) and the tank port (T).

Meanwhile, the secondary pressure of the electromagnetic proportionate valves [B], [A] acts upon ports PTb and Pca of the control valve, changes over the travel priority spool (307) and the neutral cut spool (309), admits the pressure oil discharged by the pump (P2) to the parallel circuit (53) where it is combined with the pressure oil discharged by the pump (P1). The oil is ultimately supplied to the bucket cylinder head (H). (bucket conflux)



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Fig. 14 When bucket is digging

2.3.6 SWING ACTION

(1) Where the Swing Spool Limit is "OFF" ;

If swing action is performed, the secondary pilot pressure from port PB4 or PA4 of the pilot valve acts upon port PAS or PBS1 of the control valve and shifts the swing spool (303) rightward or leftward. At the same time, while the secondary pilot pressure is acting upon PBS1, it also acts upon port PBS2 through the external piping. During swing operation, therefore, the secondary pilot pressure passes through the shuttle valve and external piping is connected with port Pis. The secondary pilot pressure acts upon the sub spool (312) in the arm spool (302) as a swing priority signal when both the arm digging and swing motions are done at the same time, in order to throttle the arm cylinder return circuit. (swing priority circuit) The pressurized oil discharged by the pump (P2) enters the bypass circuit (55) through the main path (54), but since it is blocked by the swing spool (303), it pushes the check valve open and enters the parallel circuit (56).

First of all, it pushes open the load check valve (511) of the boom conflux spool (305), passes between the outer circumference of the boom conflux spool (305) and the casing through the B side of the U-shape path and enters the chamber SW.

Then the pressure oil pushes open the load check valve (511) for swing action, passes through the path (S) and is admitted to the U-shape path of the swing spool (303). Then the pressurized oil which has entered the U-shape path of the swing spool (303) passes between the outer circumference of the swing spool (303) and the casing and is supplied to the A or B side of the swing motor of the swing motor through port AS or BS.

In the meantime, the oil which has returned from the B or A side of the swing motor passes between the outer circumference of the swing spool (303) and the casing through the port (BS) or (AS), flows from the low pressure circuit (D) to the tank port (T) and returns to the hydraulic oil tank.

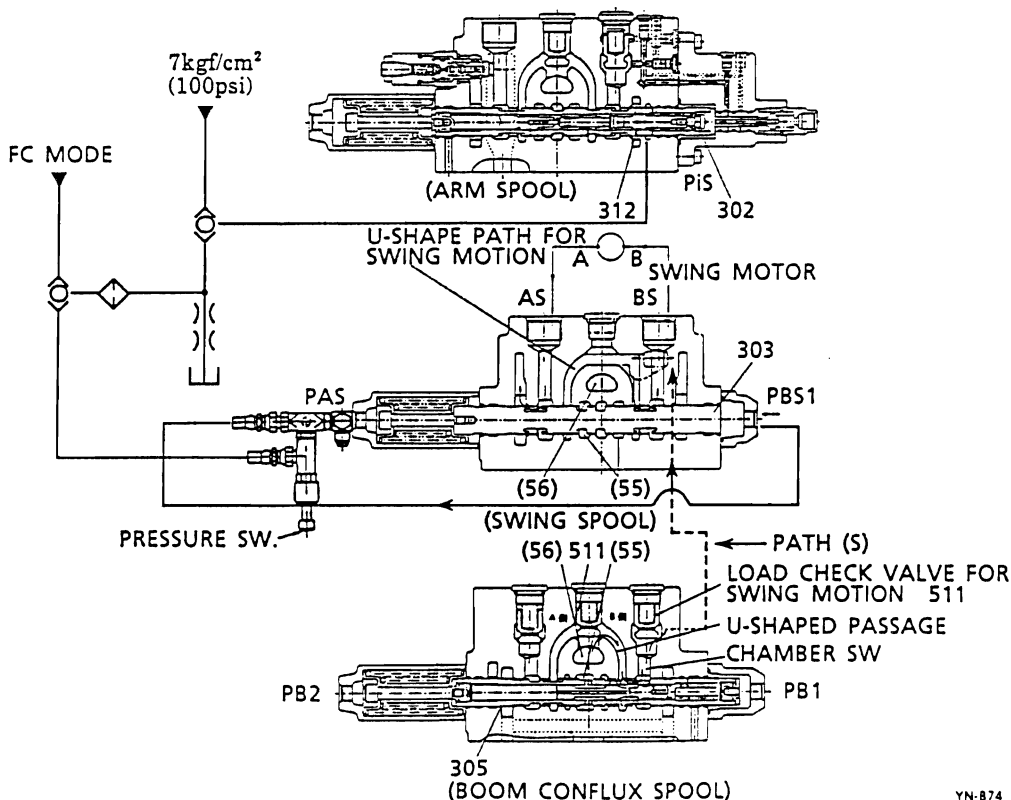
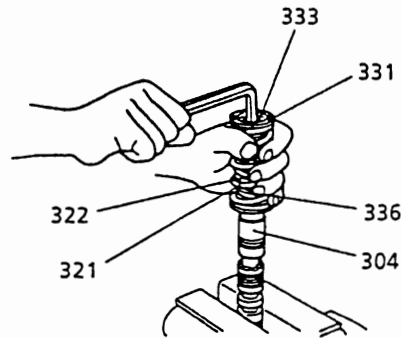


Fig. 24 Swing operation (when the swing speed limit is off)

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- 3) Pinch the bucket spool assy in a vise via a protective plate (aluminum plate, etc.) and remove bolt (333). Then separate spring seat (331), springs (321), (322) and stopper (336) from bucket spool (304).

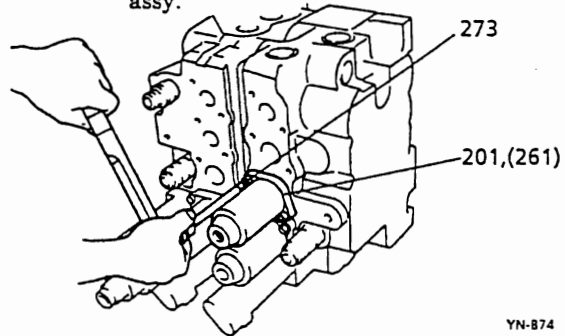


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Fig. 49 Disassembling the bucket spool (304) assy.

3.3.5 DISASSEMBLING THE BOOM CONFLUX SPOOL


- 1) Loosen socket head capscrew (273) and remove spring cover (201) for boom confluc and O ring (261).

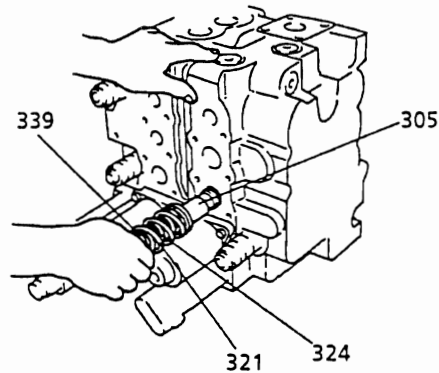


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Fig. 50 Removing the spring cover (201) for boom confluc spool.

- 2) Draw out the assembly of boom confluc spool (305), spring seat (331), springs (321), (324), stopper (339) and bolt (333) from casing A (101).

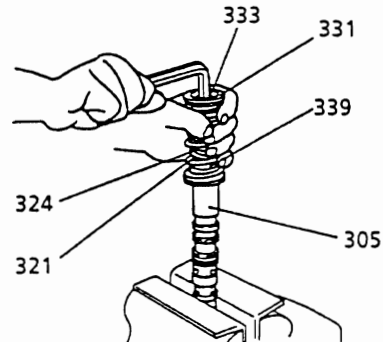
 When drawing out the spool assy, use care so as not to score casing A (101).



YN-874

Fig. 51 Removing the boom confluc spool (305) assy.

- 3) Pinch the boom confluc spool in a vise via a protective plate (aluminum plate, etc.) and remove bolt (333). Then separate spring seat (331), springs (321), (324) and stopper (339) from boom confluc spool (305).



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Fig. 52 Disassembling the boom confluc spool (305) assy.

3.3.18 INSPECTION AFTER DISASSEMBLY

Thoroughly clean all disassembled parts with clean mineral oil, and dry them with compressed air. Place each part on a clean sheet of paper or cloth for inspection.

(1) Control valve

- 1) Inspect the entire surface of each part for burrs, scratches, cuts, and other defects.
- 2) Confirm that the O ring groove surface of the casing or the block is free of foreign matter, dents or rust.
- 3) If the check valve seat of the casing or the block has dents or damage on its surface, smooth it by lapping.

 Take care not leave lapping compound behind in the casing or block.

- 4) Confirm that O ring or the outer circumference of the sliding part of a manual spool is free of scratches, dents, and the like. Remove any small defects with an oil stone or rags moistened with lapping compound.
- 5) Manually confirm that all sliding and fitted parts move smoothly. Confirm that all grooves and passages are free of foreign matter.
- 6) Replace any broken or deformed spring with a new one.
- 7) Of a relief valve malfunctions, repair it by following the relief valve disassembly and reassembly procedures.
- 8) Replace all O ring with new ones.

(2) Relief valve

- 1) Confirm that the seating face of each poppet and each seat edge is free of defects and is a uniform contact surface.
- 2) Manually confirm that the main poppet slides smoothly onto and off the seat.
- 3) Confirm that the outer circumference of the main poppet and the inner circumference of its seat are free of defects such as scratches.
- 4) Confirm that each spring is free of breakage, deformation, and excessive wear.
- 5) Confirm that the orifices of the main poppet and its seat are not clogged.
- 6) Replace all O rings with new ones.
- 7) Remove any slight defects found during the above inspection by lapping.
- 8) If any abnormal part is found, replace the relief valve as an assembly.

3.4 REASSEMBLY

(1) Here, only the reassembly procedures are described. Regarding drawings, refer to the disassembly procedures.


(2) The number in parentheses after part names in this manual correspond to those in structural drawings 2-9.

(3) Precautions on reassembling O ring

- 1) Confirm that O rings are free of forming defects or defects caused by poor handling.
- 2) Apply an adequate coat of grease or hydraulic oil to O rings and their mating parts.
- 3) Do not stretch O rings to the extent that they become permanently set.
- 4) When installing O rings, do not roll them into place. Twisted O rings do not easily untwist by themselves after installation, and can cause oil leaks.
- 5) Use a torque wrench to tighten each mounting bolt. Tighten to the torque in "Maintenance Standards."

3.4.1 CASING

- 1) Fix O rings (161,162,163) to casing B (102). Then fasten socket head capscrews (973,974) against casing A (101) to a specified torque.

 Confirm that the mating surface is free of foreign matter such as dust, and that each O ring is securely installed in its O ring groove.

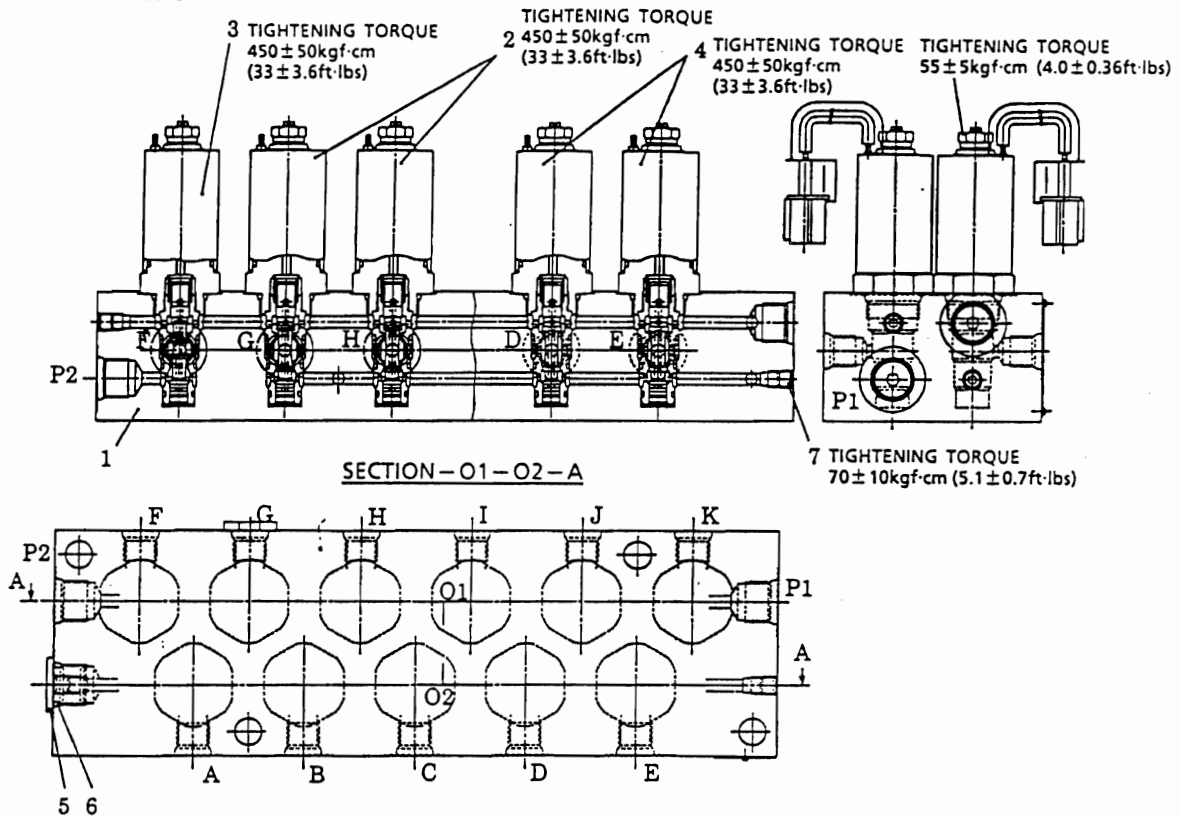
Trouble	Cause	Remedy
6. Swing priority function does not occur.	1) Clogged orifice in pilot circuit.	1) Remove foreign matter.
7. Boom or arm oil recirculation does not occur.	1) Malfunctioning conflux valve. Refer to item 2. 3) above.	1) Measure pilot pressure. Refer to item 2. 3) above.

5.2 RELIEF VALVE

Trouble	Cause	Remedy
1. No pressure rise whatsoever.	Main or pilot poppet of relief valve is sticking and valve is open, or there is foreign matter on valve seat.	<ul style="list-style-type: none"> ● Check for foreign matter on each poppet. ● Confirm that each component slides smoothly. ● Clean all components thoroughly.
2. Unstable relief pressure.	Damaged pilot poppet seat of relief valve. Pilot piston sticks against main poppet.	<ul style="list-style-type: none"> ● Replace damaged component. ● Clean all components thoroughly. ● Smooth surface damage.
3. Irregular relief pressure.	1) Wear due to foreign matter.	1) Disassemble and clean.
	2) Loosened lock nut or adjusting screw.	2) Adjust pressure.
4. Oil leak.	1) Damaged seat. Worn out O ring.	1) Replace damaged or worn component. Confirm that each component operates smoothly before reassembling.
	2) Sticking component due to foreign matter.	2) Confirm that there are no scratches, nicks, or foreign matter present before reassembling.

2. CONSTRUCTION AND FUNCTION

2.1 CONSTRUCTION



2.2 OPERATION

The solenoid proportionate valve performs the following functions :

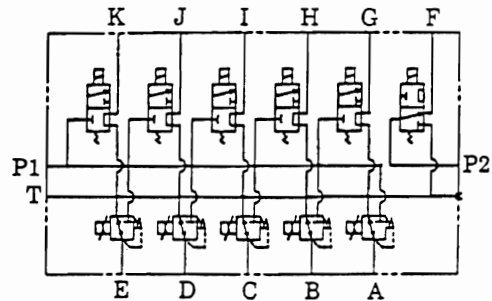
- A : Changing over Arm bypass cut valve
- B : Changing over travel straight valve
- C : Changing over of boom bypass cut valve
- D : Boom conflux selection (max. flow)
- E : Selection of boom conflux valve & flow control during fine swing operation

The solenoid selector valve performs the following functions :

- F : Releasing swing parking brake
- G : Attachment boost pressure
- H : Selection of travel straight valve for travel deflection prevention
- I : Forced recycle for arm digging and boom down 2 steps at FC mode
- J : Selection of travel 2-speed
- H : Operating lever lock

No.	NAME	Q'ty
1	MANIFOLD	1
2	SOLENOID SELECTOR VALVE	5
3	SOLENOID SELECTOR VALVE	1
4	SOLENOID PROPORTIONATE VALVE	5
5	PLUG PF3/8	1
6	O RING P14	1
7	PLUG	8

K : OPERATING LEVER LOCK
J : TRAVEL TWO-SPEED SELECT
I : BOOM DOWN 2STEP SELECT
H : TRAVEL DEFLECTION PREVENTION
G : ATT BOOST PRESSURE
F : SWING PARKING BRAKE



E : SWING FLOW CONTROL
D : BOOM CONFLUX VALVE
C : CUT VALVE FOR BOOM SIDE
B : SINGLE TRAVEL
A : CUT VALVE FOR ARM SIDE

Hydraulic SYMBOLS


(4) Abnormal sound comes out.

Trouble	Cause	Remedy
Violent vibration and sound come out when brake is operated slowly or when motor is actuated with circuits other than motor circuit.	Spool function is out of order. ● Air remains in valve in the circuit.	Bleed air inside.
	Spool is stuck.	Correct or replace.


(5) Hunting while descending a slope.

Trouble	Cause	Remedy
Hunting is excessive in inching operation.	Spool function is out of order. ● Spool and body are stuck together. ● Restrictor seat is faulty.	Correct or replace.
	Interference with mechanical brake ● Spring is fatigued or broken.	Correct or replace.


- 3) Loosen relief valve (051) and separate it from valve cover (303).

 : 36mm

- 4) Loosen swing reactionless valve (052) and separate it from valve cover (303).


 : 6mm

- 5) Separate RO plug (469) from valve cover (303) and draw out spring (355) and plunger (351).

 : 14mm

- 6) Loosen socket bolt (401) and separate valve cover (303) from casing (301). (If the socket bolt (401) are take off, the valve cover floats off casing (301) by the action of brake spring (712).)

Then separate valve plate (131) from valve cover (303).

 : 17mm


- 7) Draw out brake spring (712) from brake piston (702).

- 8) Put two M10×75 bolts through the $\varnothing 9$ (0.354") holes, using the brake piston removing jig and screw them into the removing bolt holes in brake piston (702).

Grasp the cylindrical part of the jig and pull it straight up in a breath.

Draw the brake piston with the jig out of the casing.

- 9) Place the motor level and draw out the cylinder (111) from the drive shaft (101). Then draw out piston (121), retainer plate (123), spherical bush (113), spacer F (117) and shoe plate (124).

 Handle cylinder block (111), spherical bush (113) and shoe (122) so as not to prevent the sliding surfaces from being damaged.

- 10) Draw out friction plate (742) and separator plate (743) from casing (301).

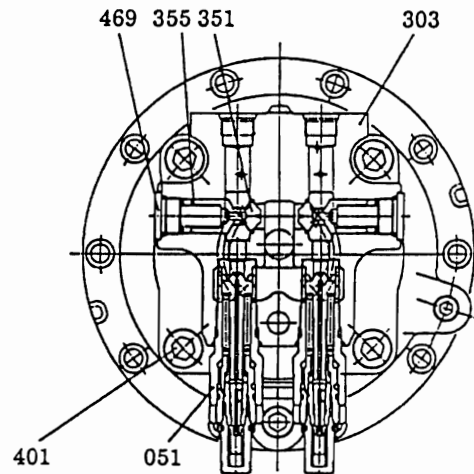


Fig. 9

YN-B74

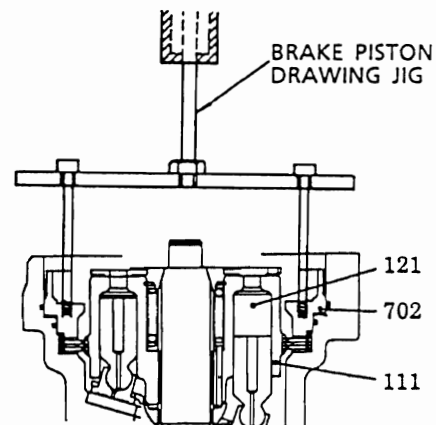


Fig. 10 Drawing out the brake pistons

YN-B74

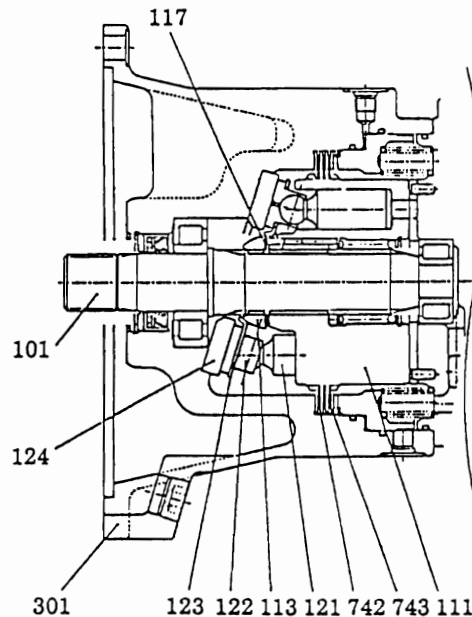
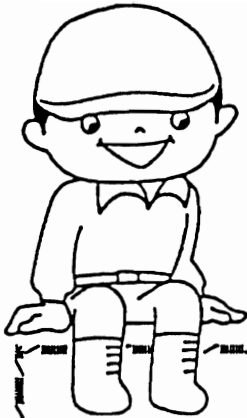


Fig. 11

YN-B74



PREFACE

The hydraulic travel motor is used as crawler drive motor. Used integral with the brake valve and the reduction gear, the hydraulic motor works as travel 2-speed motor that prevents automatic 1st-speed return under overload and also the machine prevents from free-rotating by mechanical parking brake. Regarding the roles and functions of Brake valve and Reduction unit (travel), refer to other shop manual.

Models	Applicable Machines	Notes	Models	Applicable Machines	Notes
SK200 v	YN18001~				
SK200LC v	YQ02301~				
SK200 v	YN23301~				
SK200LC v	YQ02801~				

Revision	Date of Issue	Remarks
First edition	April, 1994	S5150501E K
First revision	November, 1995	S5150501E① K

- 8) Remove shoe plate (11).
- 9) Hold down piston (21) by hand and blow air through the air blow hole (See Fig .13) to extrude the piston.
- 10) Remove coupling (10)
- 11) Remove snap ring (19) and draw out shaft (9), lightly tapping the end face on the side of the oil seal by means of a plastic mallet.

⚠ Do not remove pivot (23). In case it must be removed for an unavoidable reason, give a matching mark to the shoe plate.

The shaft can be drawn out without blowing it hard. Note that a hard blow may distort snap ring (20) or bearing (31) to an unserviceable extent.

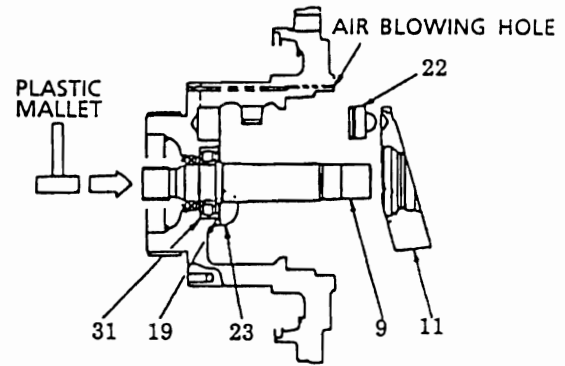


Fig. 13 Removing shoe plate

YN-B74

- (3) Replacing the Shaft Seal
When replacing the shaft seal only, perform the following operations :

- 1) Dismantle snap ring (18).
- 2) Remove oil seal (27) from inside casing (1) by lightly tapping over all the surface of the oil seal means of a flat-bladed screwdriver.

⚠ Do not disport oil seals (27) for inspection purpose. Always replace oil seals (27) once detached with new ones.

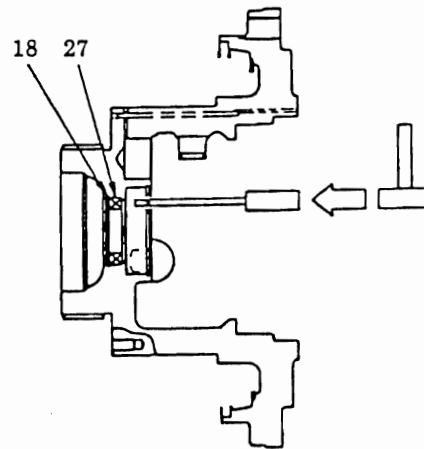



Fig. 14 Replacing shaft

YN-B74

- (4) Disassembling overload valve section
1) Disassembling the Overload Valve
Remove the overload valve and motor rear cover (2) as an assembly, utilizing the opposing flats of the hexagonal part of socket (40-1).

 : 35mm

- 2) The overload valve is handled as an assembly in principle, but in case it must be separated for an unavoidable reason, remove plug (40-5) from the socket and take out the inner parts.

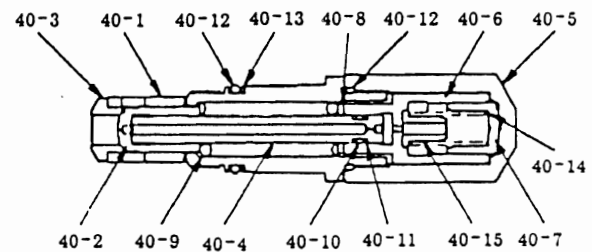
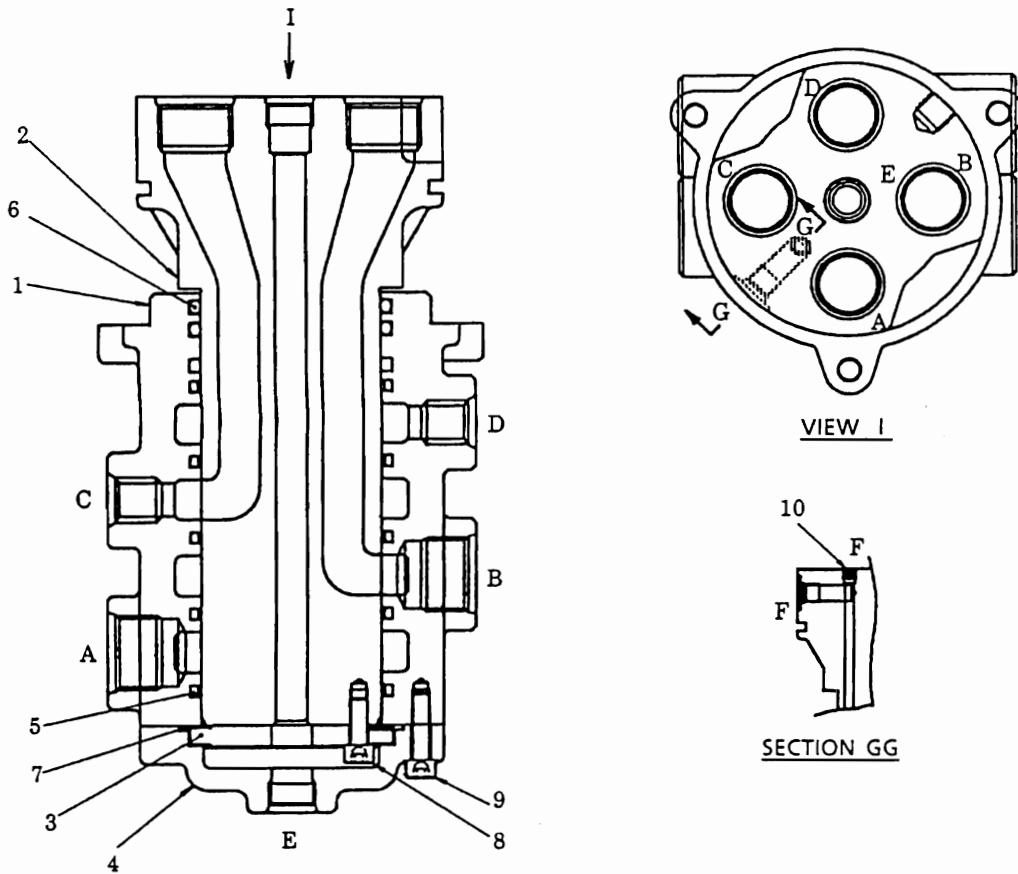


Fig. 15 Disassembling overload valve

YN-B74

⚠ Valve seat (40-3) is shrinkage fitted to the deep end of the socket bore hole. Do not separate the valve seat as much as possible as it may roughen the socket bore surface.

2. CONSTRUCTION AND FUNCTION



NO.	NAME	Q'TY	NO.	NAME	Q'TY
1	BODY	1	6	O RING	2
2	STEM	1	7	O RING (G95 1A)	1
3	THRUST PLATE	1	8	CAPSCREW (M8×20)	2
4	COVER	1	9	CAPSCREW (M8×30)	4
5	SEAL ASS'Y	5	10	PLUG	1

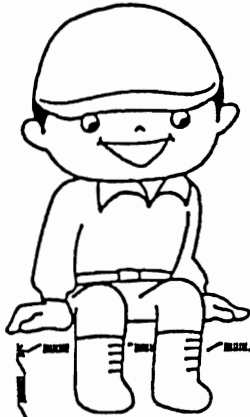
Fig.2 Cross-sectional view of swivel joint

Main portion of the swivel joint consists of body (1) which rotates freely, swivel stem (2), thrust plate (3) which prevents disconnection of body and stem, cover (4) which closes one side of swivel body (1), slipper seal sets (5), which divide circuits, and O rings (6,7), which prevent external oil leakage.

Four ports for the main circuits are provided on body (1) and stem (2), four oil passage grooves are machined on the inner face of the body (1), and seal sets (5) are provided at top and bottom of circumferential grooves.

Body (1) and stem (2) rotate freely. Oil from body (1) or stem (2) flows into stem (2) or body (1) through circumferential grooves between body (1) and stem (2) ; Oil flow is thus not obstructed by swiveling. Lubricating oil groove to drain port is also provided to prevent seizure of body (1) or stem (2) by swiveling.

With this construction, swivel joint assures circuit connection between the lower body and the revolving upper body.



PREFACE

Hydraulic cylinders are equipments that convert the energy of the pressurized oil fed by the pump to reciprocating motions. The cylinder is composed of a cylinder head, cylinder tube, piston rod and others. Hydraulic cylinders vary in the piston diameter, rod diameter, stroke, sealing method and cylinder bearing method, depending upon their service conditions, but are identical in terms of fundamental construction.

Models	Applicable Machines	Notes	Models	Applicable Machines	Notes
SK200 v	YN18001~	Spec. 1			
SK200LC v	YQ02301~	Spec. 1			
SK200 v	YN23301~	Spec. 2			
SK200LC v	YQ02801~	Spec. 2			

Revision	Date of Issue	Remarks
First edition	April, 1994	S5170178E K
First revision	November, 1995	S5170178E① K

⚠ If the piston is dropped with a bang, the O ring seal face on the piston interior may be damaged with the threads.

5) Remove the cylinder head assembly from piston rod (4). If it is too heavy to move, move it by striking the flanged part or the rod cover (13) with a plastic hammer. Pull it straight with the cylinder head assembly lifted with a crane or the like.

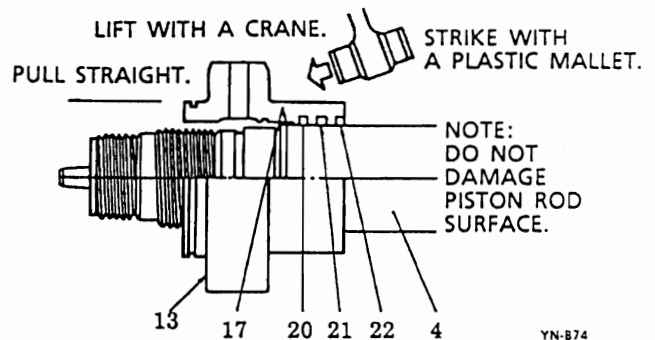


Fig. 19 Removing rod cover (13)

⚠ Exercise care so rod bushing (17) and the lip of pistons (20), (21), (22) may not be damaged by screw the piston rod (4).

6) Separate O ring (7) and backup ring (6) from piston (5).

After removing two backup rings (6), remove O ring (7). The backup ring (6) comes off easily if the slit on its circumference is extended. O ring (7) can be taken off by stretching it with an earpick-like spatula.

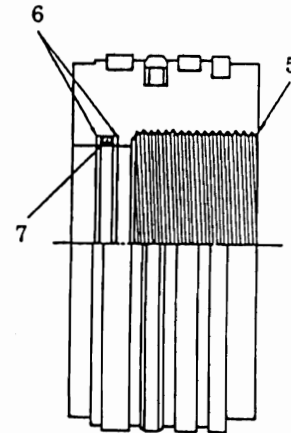


Fig. 20 Removing backup ring (6) and O ring (7)

3.2.3 DISASSEMBLING PISTON ASSEMBLY

1) Remove piston seal (27).

First of all, remove backup ring (27-3) on both sides of slipper seal (27-1). Then dismantle slipper seal (27-1) and backup ring (27-2)

⚠ Cut the slipper seal (27-1) by tapping it with a screwdriver or a chisel. Take care not to strike it too hard, otherwise the groove may be damaged.

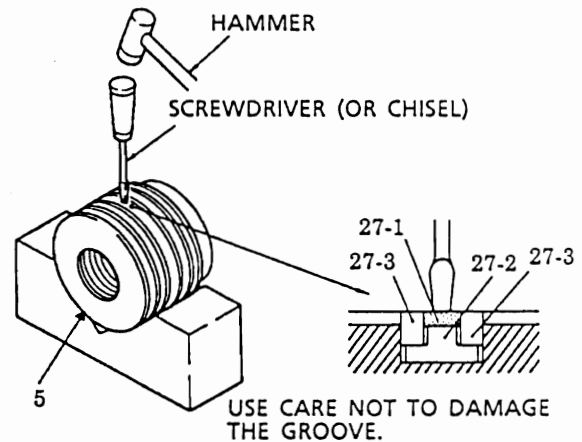
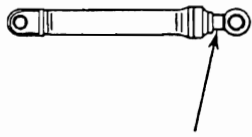
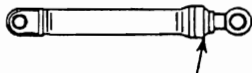
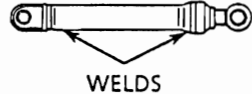


Fig. 21 Removing piston seal (27)

5. TROUBLESHOOTING

Table 8

Trouble	Faulty Part	Cause	Remedy	
<p>1. Oil leaks through the sliding surface of piston rod. (Oil ring is formed on piston rod and drops spreading.)</p>  <p>OIL LEAKS FROM HERE.</p>	1. Rod packing	1. Foreign matter is included in the bore of rod packing	1. Remove foreign matter.	
		2. Lips on outer and inner diameter surfaces of rod packing are scored.	2. Replace rod packing.	
		3. Other rod packing are faulty.	3. Replace rod packing.	
	2. Buffer seal	1. Foreign matter is caught in the bore of buffer seal.	1. Remove foreign matter.	
		2. Flaw is present on the bore of buffer seal.	2. Replace buffer seal.	
		3. Other buffer seals are faulty.	3. Replace buffer seal.	
	3. Dust seal	1. Foreign matter is include in the bore of dust seal.	1. Remove foreign matter.	
		2. Lip on the bore of dust seal is scored.	2. Replace dust seal.	
		3. Other dust seals are faulty	3. Replace dust seal.	
	4. Piston rod	1. Flaw is present on the sliding surface of piston rod.	1. Smooth out the sliding surface with an oilstone. If leakage occurs even if the sliding surface is finished below 1.6s, rod packings may be scored. Disassemble and inspect it and replace rod packings as required. If leakage will not stop by that treatment, replace piston rod.	
		2. Hard chromium plating has peeled off	2. Replate.	
	2. Oil leaks from the perimeter of cylinder head	1. O ring	1. O ring is damaged.	1. Replace O ring.
		2. Backup ring	1. Backup ring is damaged.	1. Replace backup ring.
	 <p>OIL LEAKS FROM HERE.</p>			
	3. Oil leaks from welds.	1. Cylinder tube	1. Welds of cylinder are fractured.	1. Replace cylinder tube.
	 <p>WELDS</p>			
4. Cylinder falls by itself. [When the rod is subject to a static load equal to the maximum working pressure multiplied by the area of the cylinder, the maximum travel of the piston is more than 0.5mm (0.02") in ten minutes.]	1. Piston seal	1. Foreign matter is caught on the sliding surface of slipper seal	1. Remove foreign matter.	
		2. Flaw is present on the sliding surface of slipper seal.	2. Replace slipper seal.	
		3. Other back rings are faulty.	3. Replace back ring.	
	2. Wear ring	1. Sliding surface of wear rings is scored.	1. Replace wear ring.	
	3. O ring	1. O ring is scored.	2. Replace O ring.	

3. DISASSEMBLY AND ASSEMBLY

3.1 TOOLS

		Table 2	Unit : mm (in)
Symbol	Tool name	Remarks	
a	Jig (for press fitting bearing)	Material : SS41	
b	Snap ring plier	For shaft	
c	Oil seal fitting jig	Material : SS41	
d	Torque wrench	Class 14kgf·m (100ft·lbs)	
e	Plastic hammer (Wood hammer)		
f	Press	Class 10ton (22000 lbs)	
h	Flat screwdriver		
i	Metal bar	3 pcs.	
j	General tools	Allen key wrench and steel rod	
k	Screw lock compound	Three-Bond 1360K	
	Sealing compound	Locktite #515	

3.2 DISASSEMBLY

The numbers in parentheses correspond to the ones in construction drawings (Fig. 2).

3.2.1 PREPARATION

- (1) Before disassembly, clean the outside of the reduction unit thoroughly and check for no damage and scoring.
- (2) Drain gear oil from the reduction unit.
- (3) Disconnect the drain pipe.
- (4) Matching Mark
To facilitate the reassembly of the unit, put matching mark on the joining parts of the housing before disassembly.

4.3 MAINTENANCE STANDARDS

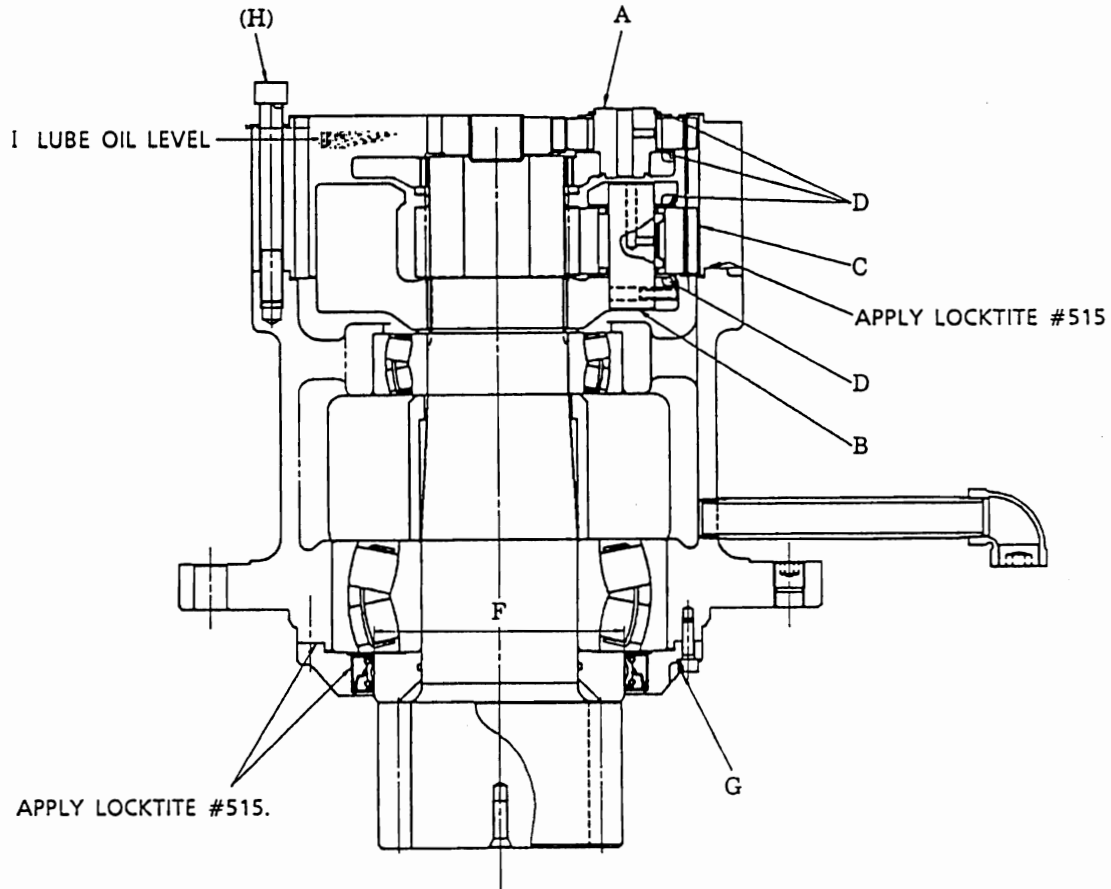


FIG 30

Table 3

Unit: mm (in)

Symbol	Item	Standard Value	Serviceability Limit	Remedy
A	Wear in #1 planetary shaft	$\begin{matrix} \text{Ø}39.45 & -0.021 \\ & -0.032 \\ (1.55315 & -0.00083 \\ & -0.00126) \end{matrix}$	No flaking	Replace entire spider assembly.
B	Wear in #2 planetary shaft	$\begin{matrix} \text{Ø}29 & 0 \\ & -0.009 \\ (1.14173 & 0 \\ & -0.00035) \end{matrix}$		Replace four shafts as a set.
C	Gears	Condition of tooth face	There should be no pitching exceeding 1.6mm (0.0630in) dia, abnormal wear or seizure.	Replace worn gear. (Planetary pinion should be replaced in a set of three.)
		Condition of tooth flank		
D	Thickness of thrust washer	$\begin{matrix} 2.0 \pm 0.1 \\ (0.079 \pm 0.004) \end{matrix}$	1.8 (0.0709")	Replace worn thrust washer.
F	Wear in sleeve (Diameter of part coming in contact with oil seal)	$\begin{matrix} \text{Ø}160 & 0 \\ & -0.063 \\ (6.29920 & 0 \\ & -0.00248) \end{matrix}$	$\begin{matrix} \text{Ø}159.5 \\ (6.28) \end{matrix}$	Replace worn sleeve.
G (H)	CapscREW tightening torque	$\begin{matrix} \text{M}8 - 3.4 \pm 0.35 \text{kgf}\cdot\text{m} (25 \pm 2.5 \text{ft}\cdot\text{lbs}) \\ \text{M}14 - 18.5 \pm 2 \text{kgf}\cdot\text{m} (130 \pm 14 \text{ft}\cdot\text{lbs}) \end{matrix}$		Apply Three-Bond 1360K and tighten to specified torque.
I	Lube oil : Extreme pressure gear oil #90 (API Service Grade GL-4)		7.5ℓ (2.0gal)	Replenish or replace.

(5) Replacing Bearing (3)

- 1) Separate floating seal (2) from motor assembly (1) and hub (46).
- 2) Remove capscrew (48) and ring gear (6). Sealing agent is applied to the mating area between hub (46) and ring gear (6). Therefore it may be a little difficult to remove ring gear (6) in some cases.

⚠ The circumference of bearing (3) and hub (46) are put together to a very hard fit. Do not disassemble them, except when it becomes really necessary.

- 3) To replace bearing (3), mount hub (46) on hub fixing jig (1) and remove bearing (3) by putting bearing disassembling jig (j) against the inner race of bearing through hub (46) and knocking the inner race lightly with plastic mallet (f).

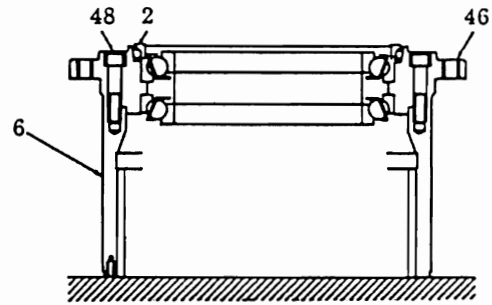


Fig. 12 Removing hub (46)

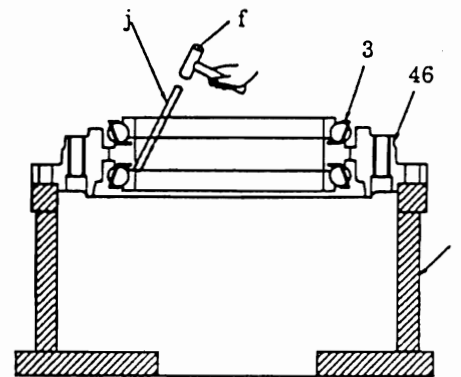


Fig. 13 Replacing bearing (3)

(6) Disassembling #1 Spider Ass'y

- 1) Hold #1 spider ass'y in mouth-piece attached vise (c), place spring pin drawing jig (h) to spring pin (23) and extract shaft (14) by tap it with plastic mallet (f).
- 2) If shaft (14) is removed, planetary pinion (13), thrust washer (17) and needle bearing (16) come off.

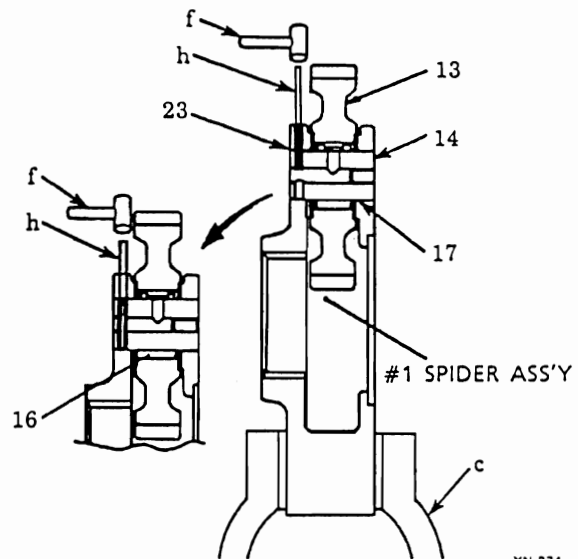


Fig. 14 Disassembling #1 spider ass'y

- 3) Hold shaft (14) in mouth-piece attached vise (c), place spring pin removing jig (h) to spring pin (23) and draw out spring pin (23) by lightly tapping the shaft with a plastic mallet (f).

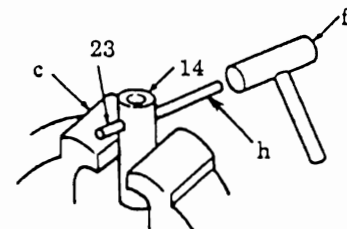


Fig. 15 Drawing out spring pin (15)

NOTES

NOTES

Group 16 Engine Electrical

(1) Starter

Unit: mm

Maintenance item	Nominal value	Limit	Remedy and remarks	
Starter <M2T78381>	Commutator O.D.	32	31.4	Replace
	Commutator runout on periphery	0.03 or less	0.1 or less	Correct or replace
	Depth of grooves between segments	0.7 to 0.9	0.2	Correct or replace
	Brush length	18	11	Replace
	Brush spring pressure	26 to 32 N {2.7 to 3.3 kgf}	20 N {2 kgf}	Replace
	Pinion gap	0.5 to 2.0	–	Adjust with washer
	Pinion shaft thrust gap	0.1 to 0.5	–	Adjust with washer
	No-load characteristics	Voltage	23V	–
Current		65A or less	–	
Rotating speed		4250 rpm or more	–	
Magnetic switch operating voltage	16V or less	–	Check	

(2) Alternator

Unit: mm

Maintenance item	Nominal value	Limit	Remedy and remarks		
30A alternator	Slip ring O.D.	40.8 to 41.2	40.4	Replace	
	Brush spring pressure	3.1 to 4.3 N {0.32 to 0.44 kgf}	2 N {0.2 kgf}	Replace	
	Brush length	23	8	Replace	
	Field coil resistance (20°C)	8.7 Ω	–	Replace	
	Load characteristics (when cold)	Current (1500 rpm, 27V)	17A or more	–	Check
		Current (2500 rpm, 27V)	26A or more	–	
	IC regulator regulated voltage range (5000 rpm, 5 A or less)	28 to 29V	–	Replace	

(3) Safety relay (R8T30171)

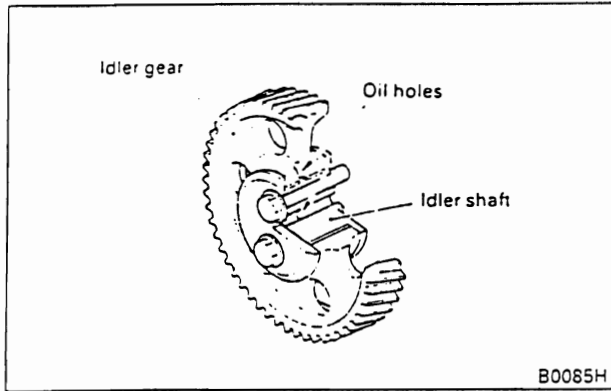
Maintenance item	Nominal value	Limit	Remedy and remarks
Resistance across terminals L and R	Approx. 200 Ω	–	Replace

(4) Intake air heater

Maintenance item	Nominal value	Limit	Remedy and remarks
Time required for indicator to become red hot	20 to 30 secs.	–	Check

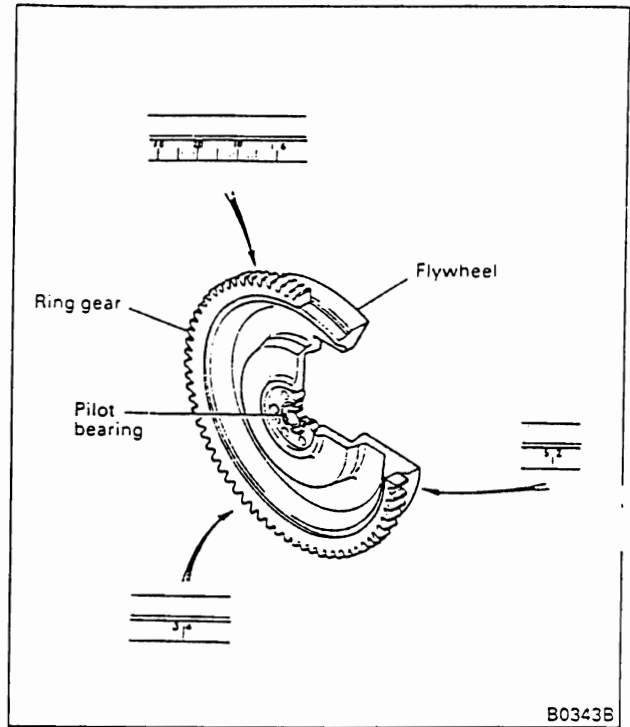
(5) Glow plug

Maintenance item	Nominal value	Limit	Remedy and remarks
Time required for indicator to become red hot	10 to 15 secs.	–	Check
Glow plug resistance at normal temperature	3.8 Ω	–	Replace



A bushing is press-fitted into the idler gear which turns on the idler shaft. The oil hole drilled through the idler shaft and gear provides an oil passage for lubrication of bushing and gears.

(8) Flywheel



The flywheel is made of cast iron. The pilot bearing of the transmission drive pinion is installed at its center. On its periphery, the ring gear is shrink-fitted that meshes with the starter pinion. The ring gear tooth crests are induction-hardened for greater durability. At the same time, one side of the crests is chamfered to ensure that the starter pinion meshes easily when starter is operated.

5.2 Cylinder Head and Valve Mechanism

5.2.1 Removal and installation

BD ... Basic Diameter
 NV ... Nominal Value
 L ... Limit

175 N·m (18 kgf·m) (Wet)

2 175 N·m (18 kgf·m) (Wet)

Wear, damage runout
 L 0.4

Locating pins

5 Cracks

Apply engine oil

Water leaks, oil leaks, gas leaks

Install with "UP" mark up

Wear, damage 6

Clearance between tappet and tappet hole of crankcase	
NV (BD)	0.06 to 0.10
L	0.2

Locating pins

<Removal sequence>

1 Rocker cover	4 Push rod
2 Cylinder head bolt	5 Cylinder head assembly
3 Rocker and bracket assembly	6 Tappet

For parts with an encircled number, see Removal and Inspection Procedures given later.
 Reassembly is in the reverse order of disassembly.

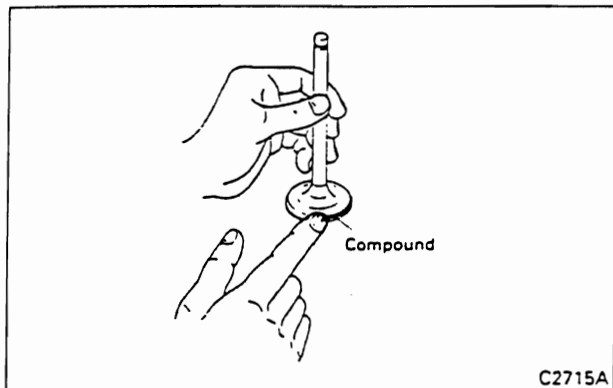
NOTE:
 Disassemble the cylinder head on a work bench without the injection nozzle assembly and glow plugs removed.
 If the cylinder head is placed on a work bench with the injection nozzle assembly and glow plugs as mounted, the tips of the nozzles and glow plugs will be damaged.

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(j) Seating of valve and valve seat

The valve and valve seat must be in even contact throughout the surfaces.

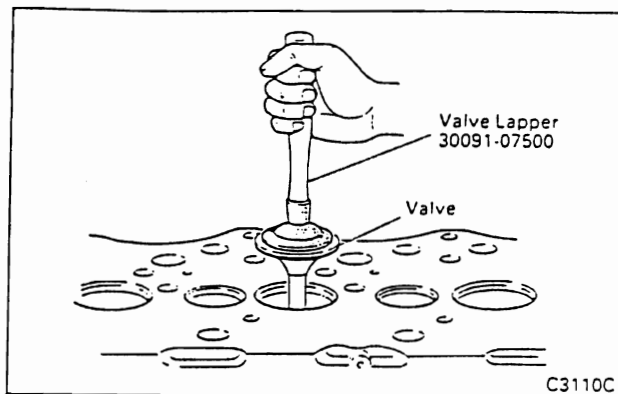
Whenever the valve or valve seat is corrected or replaced, they must be seated.



- 1) Apply a thin coat of compound evenly to the seating surface of the valve.

NOTE:

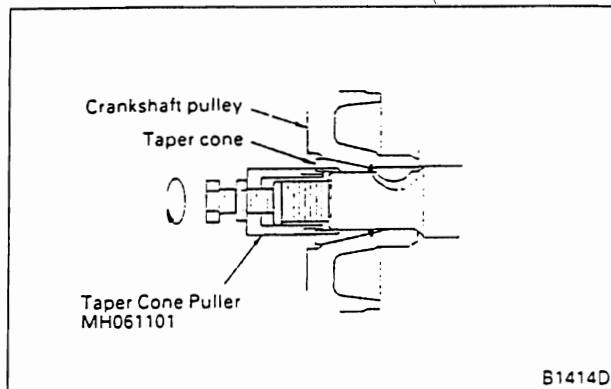
1. Make sure that there is no compound on the stem of the valve.
2. Use intermediate mesh compound (120 to 150 meshes) first and then use fine mesh compound (200 meshes or more) for the finish.
3. Mix the compound with a small amount of engine oil and the compound can be applied evenly.



- 2) Using Valve Lapper (special tool), seat the valve on valve seat.
While turning the valve slightly at a time, strike it against the valve seat.
- 3) Wash off the compound with gas oil or similar object.
- 4) Seat the contact surfaces with engine oil.
- 5) Check if they are properly seated.

Disassembly and Inspection Procedures

(1) Removal of taper cone

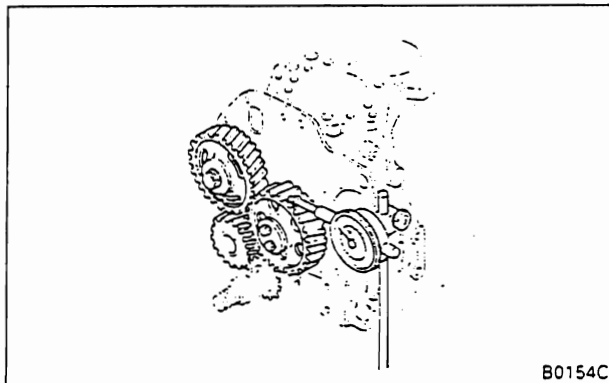


To remove, use Taper Cone Puller (special tool).

(2) Removal of crankshaft pulley

If the crankshaft pulley is hard to remove, use Gear Puller (special tool).

(3) Measurement of backlash

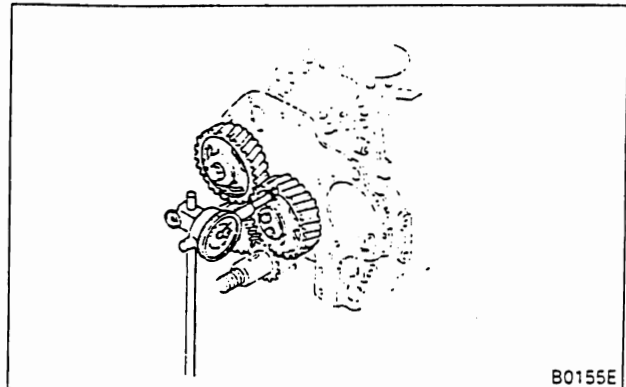


Measure the backlash between gears and replace if the limit is exceeded.

NOTE:

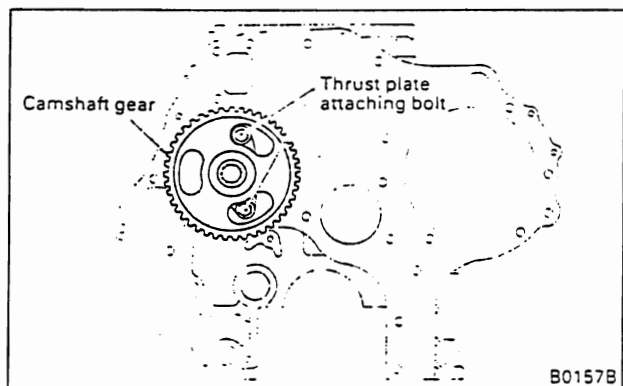
1. For a pair of gears, the backlash must be measured at three points or more to determine the condition.
2. When measuring the backlash in injection pump gears, keep the pump fixed onto the front plate.

(4) Measurement of end play



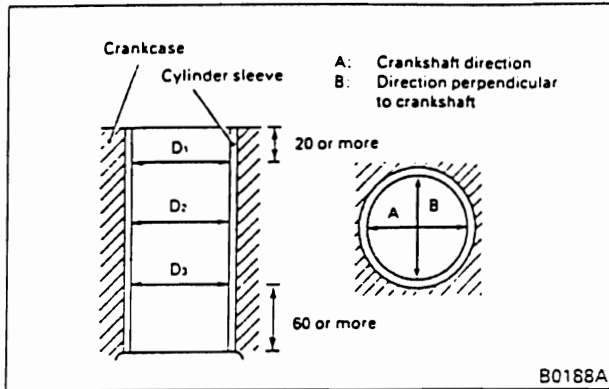
Measure the end play of the idler gear and camshaft gear with a thickness gauge or dial indicator. If the measurements exceed the limit, replace the parts.

(5) Removal of camshaft gear



- (a) Accessing through the holes in camshaft gear, loosen the thrust plate attaching bolts. Then remove the gear together with the camshaft.

(1) Measurement of cylinder sleeve I.D.



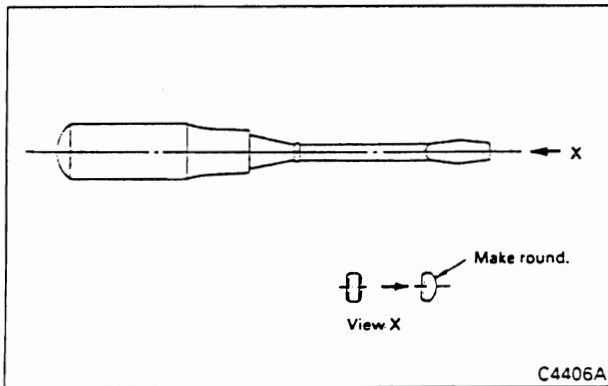
Measure the cylinder sleeve I.D. at the six points shown in illustration.

If the I.D. exceeds the limit, replace or bore to oversize.

If the cylinder sleeve is to be used without being bored, correct the ring ridge wear at its top by grinding with a ring reamer.

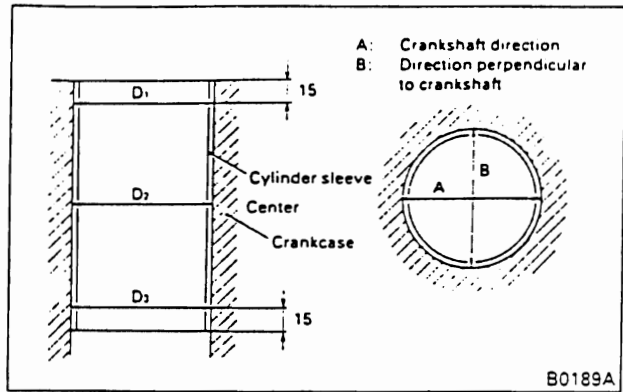
(2) Replacement of cylinder sleeve

(a) Removal



- 1) With a boring machine fixed in the crankcase, center the machine. Make sure that the machine is centered at the bottom of the cylinder sleeve which develops uneven wear least.
- 2) Bore until the wall thickness is reduced down to approximately 0.5 mm.
- 3) Insert a screwdriver (machined as illustrated) between the crankcase and cylinder sleeve. Tap the screwdriver to break and remove the sleeve. Make sure that the rounded part of the screwdriver faces to the case.

(b) Installation



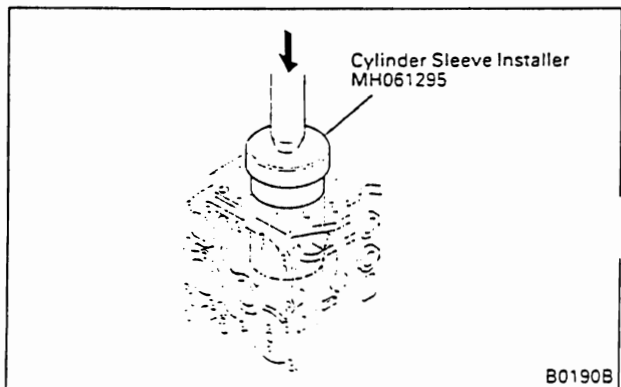
After the cylinder sleeve has been removed, check the crankcase sleeve hole for damage and proper interference.

If defects are evident, bore the crankcase sleeve hole. For measurement of interference, measure the cylinder sleeve O.D. and crankcase sleeve hole I.D. at the positions indicated in illustration. Calculate the average value of the measurements in the vertical (D1, D2, D3) and diametrical (A, B) directions.

If the interference exceeds the limit, bore the crankcase sleeve hole to oversize.

NOTE:

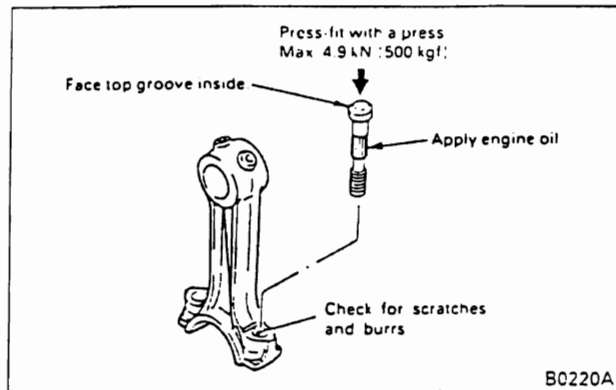
Be sure to use a dial indicator for measurement.



(c) When crankcase sleeve hole interference is sufficient:

- 1) Using Cylinder Sleeve Installer (special tool) and a hydraulic press (sleeve installation load: 4.7 to 9 t), install the STD cylinder sleeve into the crankcase. During installation, ensure that the chamfered side of the sleeve faces down and the sleeve top surface is flush with the crankcase top surface.
- 2) After installing the cylinder sleeve, obtain the nominal dimension for I.D. and finish to 3.2-S by honing operation.

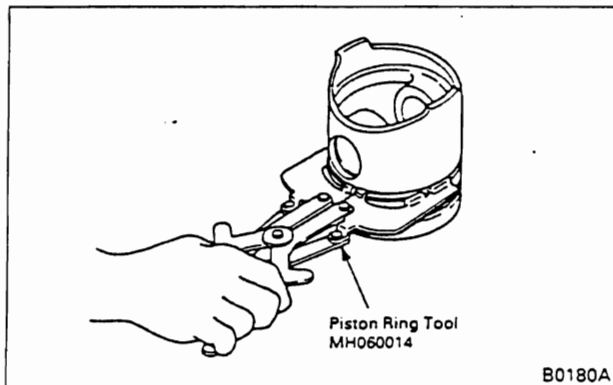
(C) Installation of connecting rod bolts



The connecting rod bolts do not normally need removal; however, where replacement is necessary for damaged bolt, install new bolts by using the following procedures.

Make sure that the connecting rod bolt hole is free from damage and burrs. Then, with engine oil applied to the connecting rod bolt, press it into position with a press. (Pressing load: Max. 4.9 kN (500 kgf);)

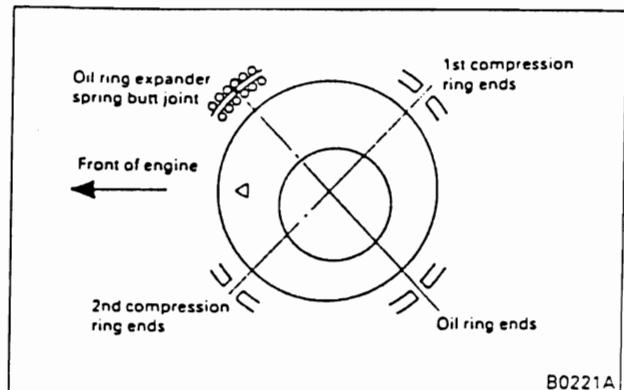
(6) Installation of piston rings



To install piston rings, use Piston Ring Tool (special tool).

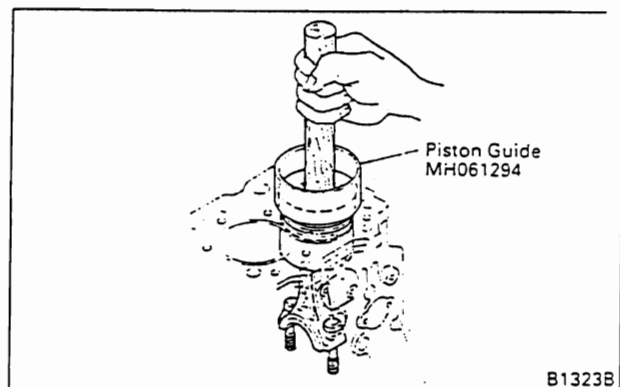
NOTE:

A manufacturer's mark or symbol is stamped near the ends of the 1st and 2nd piston rings. Install the piston rings with their manufacturer's marks facing up.



Direct the open ends of piston ring as shown.

(7) Installation of piston and connecting rod assembly

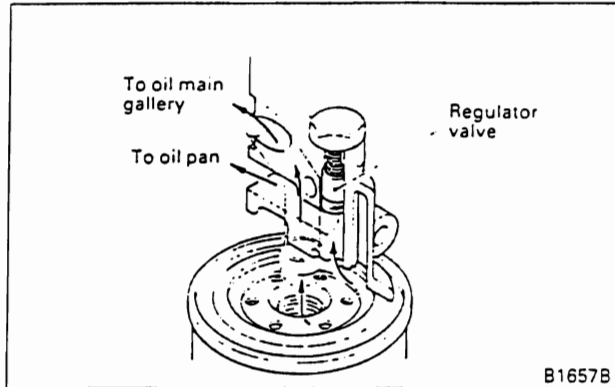


Fit the upper connecting rod bearing into the connecting rod and install the piston into the crankcase with Piston Guide (special tool).

NOTE:

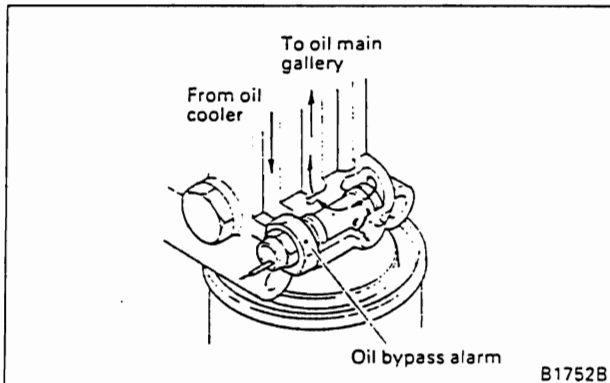
1. Face the front mark on top of the piston toward front of engine.
2. Make sure that the piston ring ends position does not change during installation.
3. Cover the connecting rod bolt with a vinyl hose so as not to damage the crankshaft pins.
4. Use care not to damage the piston cavity.

2) Regulator valve



The regulator valve regulates the pressure of engine oil that is supplied to the oil main gallery. When the oil pressure in the main gallery rises to the specified level or higher, the valve opens to return part of the engine oil to the oil pan, preventing excessively high pressure in the lubrication system.

3) Oil bypass alarm



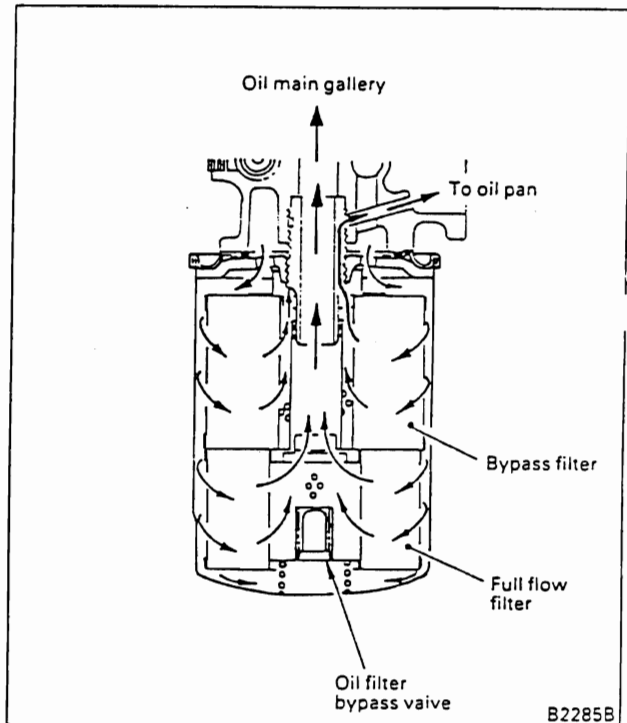
The oil bypass alarm is so designed that when the difference in oil pressure between the engine oil before filtration and that after filtration increases more than the specified value, the valve opens automatically to send engine oil before filtration to the inside of the engine.

In addition, the oil bypass alarm is provided with electric contact points. When the valve opens, the contact points close to turn on the warning lamp, indicating the driver that the full-flow oil filter element is clogged.

4) Oil pressure switch

The oil pressure switch closes the built-in electric contacts when the pressure of engine oil to be delivered to the oil main gallery falls below the specified value, thereby lighting the warning lamp to alert the driver to the abnormal oil pressure.

(b) Oil filter

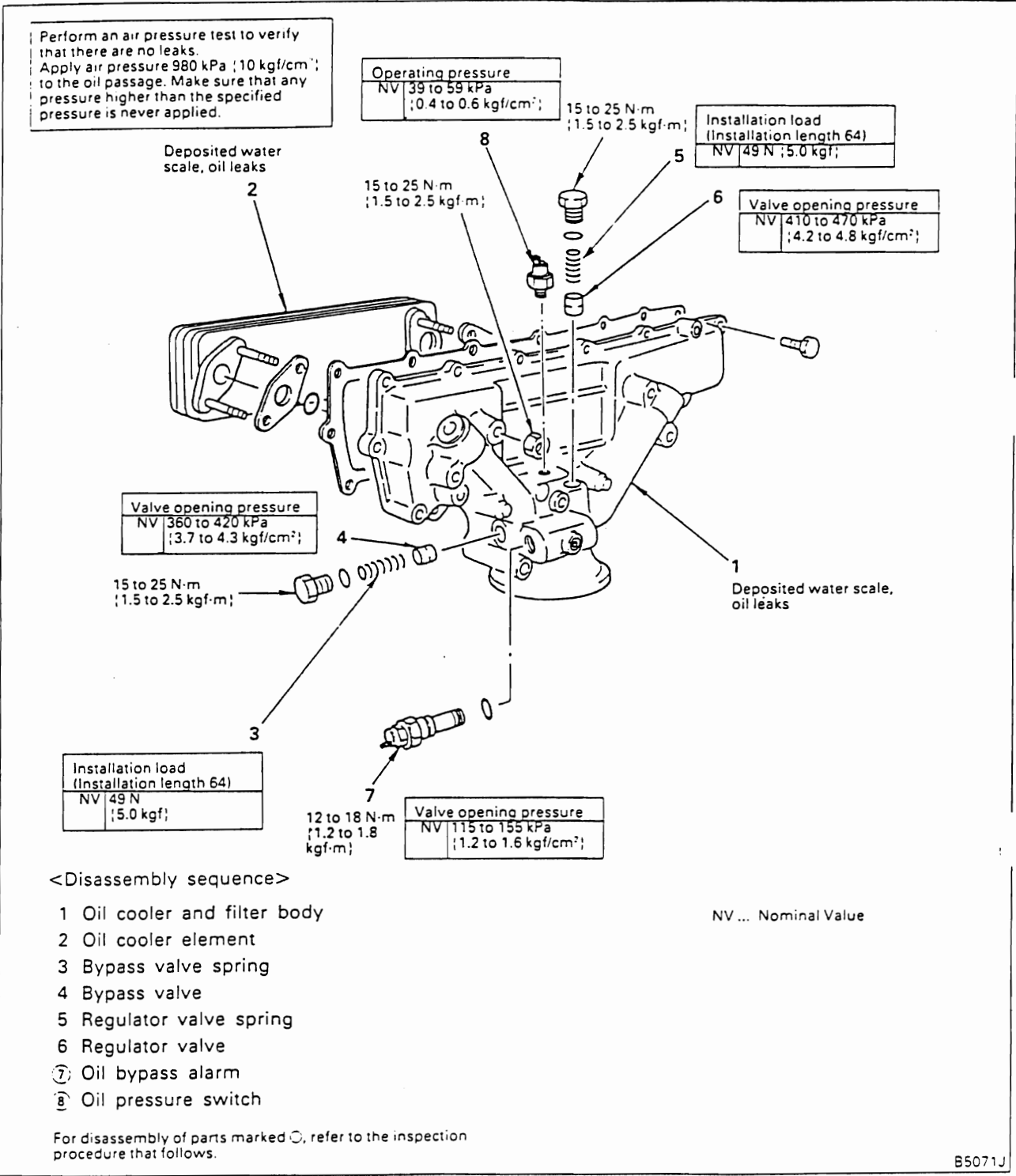


The oil filter uses a filter paper type integrated element in which a full flow filter and bypass filter are integrated and is a SPIN ON type designed for ease of replacement.

The engine oil passed through the full flow filter is routed to the oil main gallery to lubricate all components of the engine. The engine oil passed through the bypass filter is returned to the oil pan.

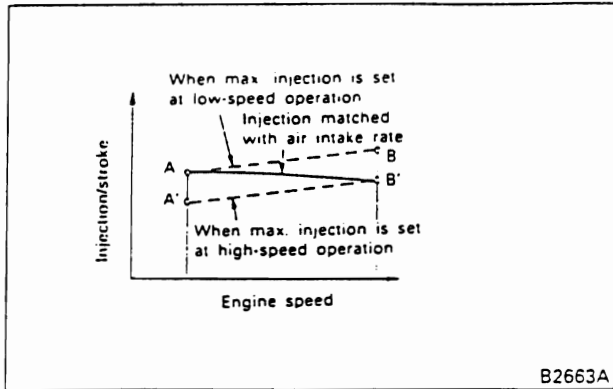
An oil filter bypass valve is provided at the bottom of the filter. When the element is clogged, the valve opens, allowing the oil to be fed to the oil main gallery without passing through the element to prevent seizure of the engine.

5.2.2 Disassembly, inspection and reassembly of oil cooler



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4) Ungleich operation

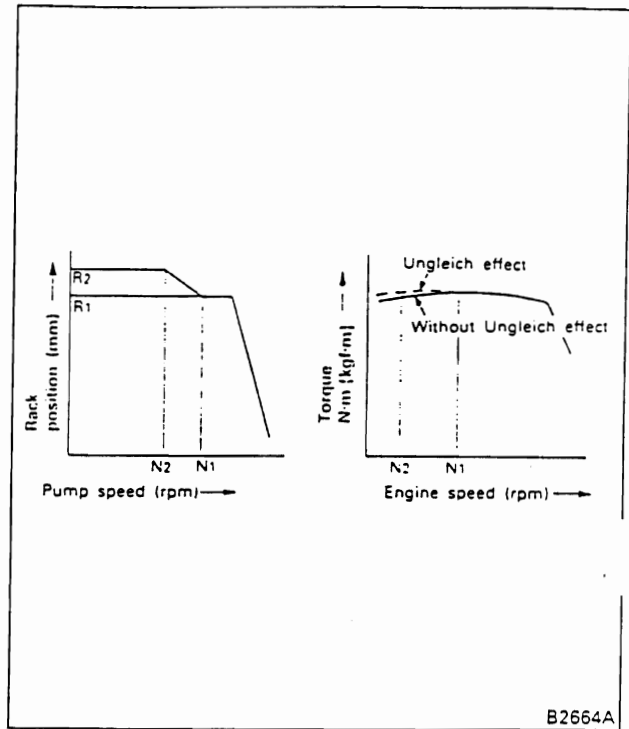


The air intake rate of the engine falls as the engine speed increases. The injection pump, on the other hand, increases the per-stroke injection as the speed increases, even with the control rack at the same position.

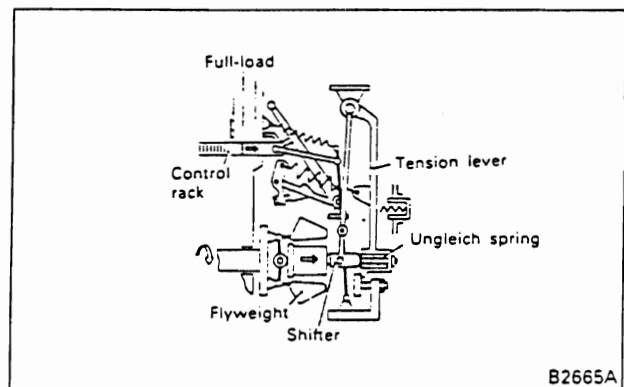
Therefore, if full load is set at point A to derive enough output at low speeds, the injection will reach B as the speed increases, and the engine will produce black smoke.

If full load is set at point B' to prevent black smoke, the low speed injection will come down to A', allowing combustion of more fuel.

So the Ungleich device accomplishes the function of setting full load at point A to derive the largest possible torque in the low speed range, and changing it to adjust the injection to point B' in the high speed range.



When the engine speed is low (N2) and the centrifugal force of flyweight smaller than the set tension of the Ungleich spring, the shifter is moved as much as the Ungleich stroke to the left, so the control rack moves in the direction (R2) that fuel is increased to increase the torque of the engine at low speeds.



As the engine speed increases (N1), the centrifugal force of flyweight increases. If it becomes larger than the set tension of the Ungleich spring, the Ungleich spring is slowly compressed before the start of high speed control, and the control rack moves in the direction that fuel is reduced. The Ungleich stroke is completed at the position where the shifter directly touches the tension lever (R1).

5.2.1 Disassembly

*** Sliding resistance (when stationary)**
NV 1.5 N {0.15 kgf; or less

*** End play**
NV 0.02 to 0.06

Overflow valve opening pressure
NV 155 kPa {1.6 kgf/cm²}

NV ... Nominal Value

<Disassembly sequence>

1 Timer case	13 Control pinion
2 Cover plate	14 Lock plate
③ Screw plug	⑮ Delivery valve holder
④ Center bearing	16 Stopper
⑤ Bearing cover	17 Delivery valve spring
⑥ Camshaft	18 Delivery valve
⑦ Tappet	19 Delivery valve seat
⑧ Lower spring seat	20 Plunger barrel
⑨ Plunger	21 Control rack cover
10 Plunger spring	22 Rack guide screw
11 Upper spring seat	23 Control rack
12 Control sleeve	24 Pump housing

NOTE:

1. Keep the disassembled parts in order on a per cylinder basis.
2. The paired parts such as the plunger and plunger barrel, and the delivery valve and delivery valve seat should be kept in gas oil without changing their pairs.

For the circled parts, refer to the disassembly procedure that follows. Take the readings marked * before disassembly.

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5.2.4 Adjustment after reassembly

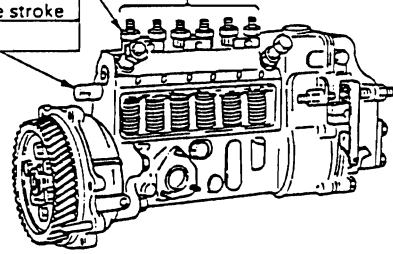
For fuel injection rate adjustment standard, see Service Information published separately.

Measuring conditions

Nozzle and nozzle holder assembly		105780-8140
Nozzle		105780-0000
Nozzle holder		105780-2080
Nozzle injection pressure		21.6 MPa {220kgf/cm ² }
Oil feed pressure		155 kPa {1.6 kgf/cm ² }
Pipe	O.D.	6 mm
	I.D.	2 mm
	Length	600 mm
Test oil		JIS No. 2 gas oil or equivalent
Test oil temperature		40 to 45°C

Prestroke	
NV	Remarks
3.5 ± 0.05	With RSV governor

Injection start interval
 NV | 60° ± 30°



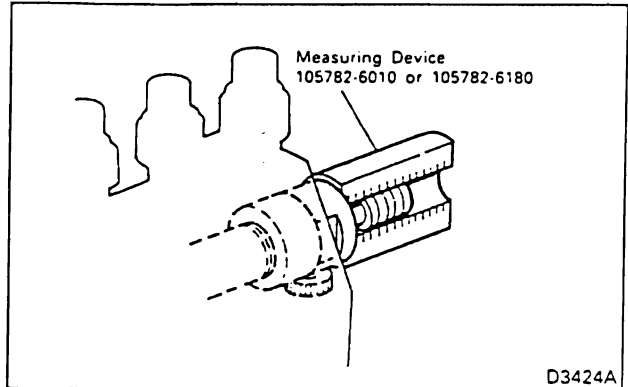
Control rack entire stroke
 NV | 18 to 21

NV ... Nominal Value

NOTE:
Fill the injection pump cam chamber with engine oil.

B1818C

(1) "0" position setting of control rack



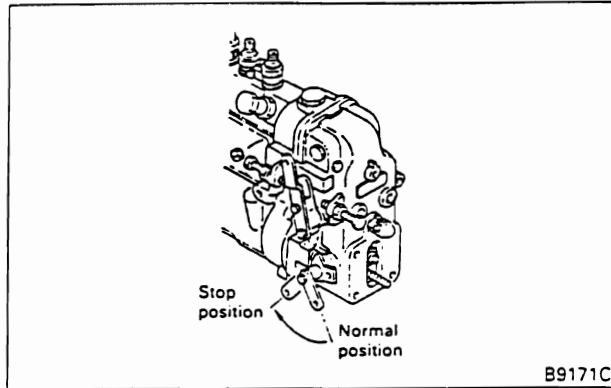
<RSV type governor>

- (a) Keep the pump speed at 750 rpm.
- (b) Loosen the stopper bolt and pull the adjusting lever in the non-injection direction.
- (c) Push the tip of the measuring device all the way toward the governor and set the "0" position of the measuring device scale.

NOTE:

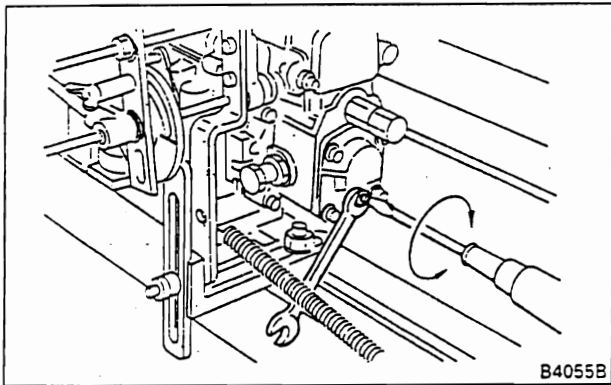
Failure to turn the injection pump at the specified speed does not allow "0" position setting even with the control pinion pushed hard; also a governor linkage damage could result.

(10) Stop lever operation check



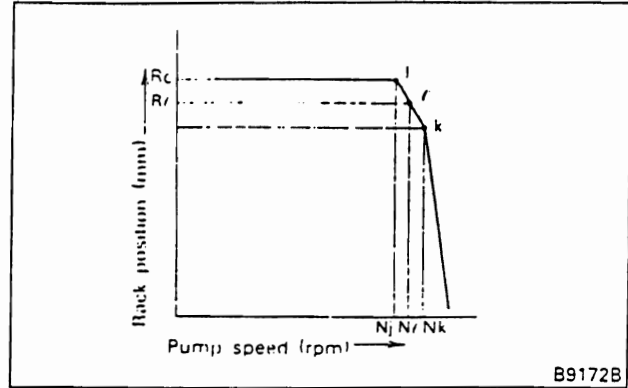
With the adjusting lever fixed at the full position, pull the stop lever all the way to the stop side and check that the rack is positioned at 0 mm.

(11) Adjustment of full-load



- (a) Install the cover to the governor cover.
- (b) With the adjusting lever at the full position, adjust the full-load stopper bolt so that the rack is positioned at "Rc".

(12) Adjustment of torque spring

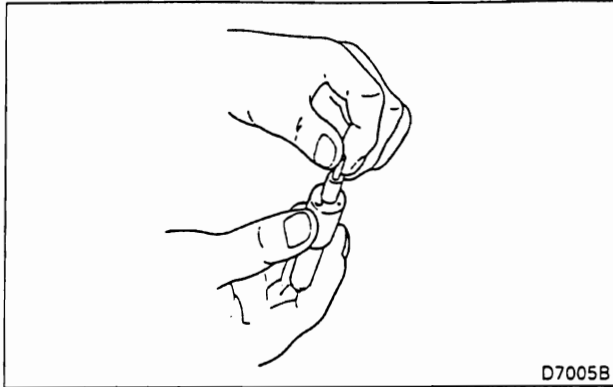


- (a) Fix the adjusting lever at the full position and set the pump speed at "Nk".
- (b) Screw in until the torque spring contacts the lever and fix temporarily.
- (c) Adjust the torque spring so that the rack is positioned at "Rl" when the pump speed is lowered to "Nl".
- (d) Check that the pump speed is "Nj" when the pump speed is lowered to position the rack at "Rc".
- (e) After the adjustment, check that the rack position is as specified at each pump speed.
If the rack position is out of specification, readjust the torque spring and full-load stopper bolt.

(13) Adjustment of adaptation to engine

After the governor has been adjusted, measure overall injection amount at the same lever angle as in the high speed control and in accordance with the adjustment standard and readjust as necessary.

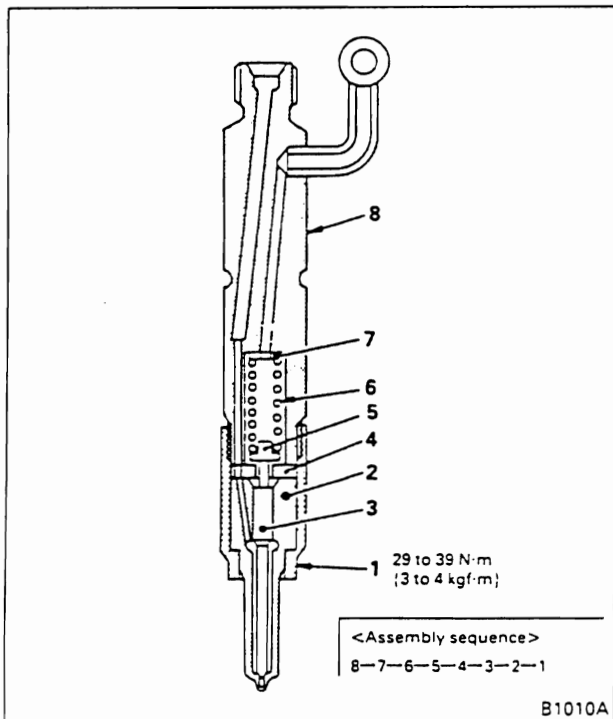
(2) Inspection



Clean and immerse the nozzle in gas oil, slide the needle valve, and ensure that it moves smoothly. Next, pull up the needle valve vertically about 1/3 of its entire stroke and check if it falls under its own weight. If it does not fall, replace the nozzle.

5.10.4 Reassembly and adjustment

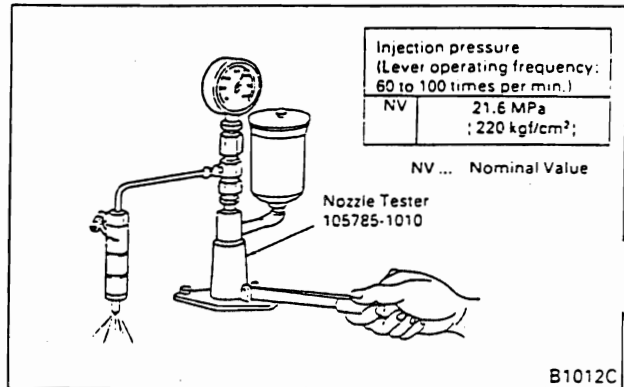
(1) Reassembly



NOTE:

1. Never touch the sliding surfaces of the needle valve by hand.
2. When replacing the nozzle tip with a new one, remove the seal peel (synthetic resin film) and move the needle valve in nozzle in a clean gas oil to completely remove the anti-rust oil.

(2) Injection pressure adjustment



- (a) Install a nozzle tester to the nozzle.
- (b) Operate the nozzle tester to inject several times. This allows the tester to be bled of air.
- (c) Operate the nozzle tester at the specified speed. Then, vary shims to obtain the specified injection pressure.

Shim Thickness

- 0.95 to 1.25 mm in 0.05 increments
- 1.275 to 1.775 mm in 0.025 increments
- 1.80 to 2.15 mm in 0.05 increments

A 0.05 mm variation in shim thickness varies the injection pressure by 490 kPa {5 kgf/cm²}.

NOTE:

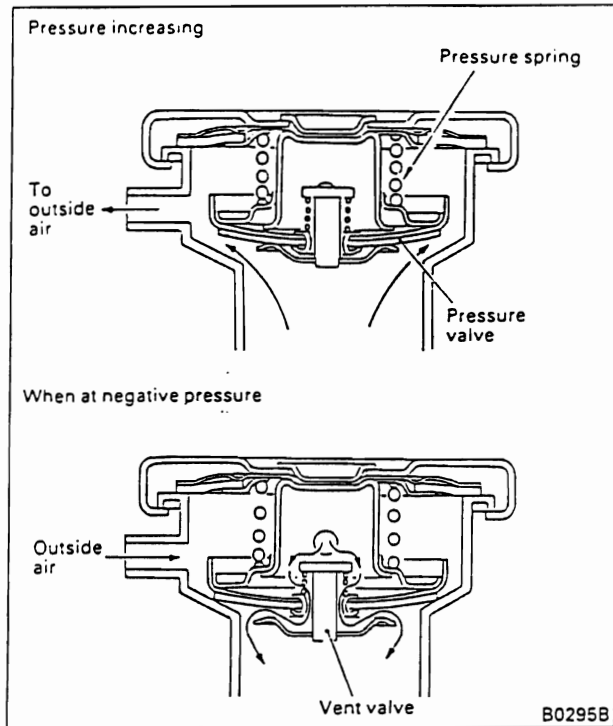
Adjust the injection pressure to fall within a range from 21.6 to 22.6 MPa {220 to 230 kgf/cm²} for the injector of 21.6 MPa {220 kgf/cm²} nominal injection pressure. This means that the injection pressure should be adjusted to a value somewhat higher than the nominal injection pressure.

- (d) With a correct shim selected, recheck the injection pressure.

NOTE:

Never let yourself exposed directly to the atomized fuel injected from the nozzle.

<Operation of pressure valve>

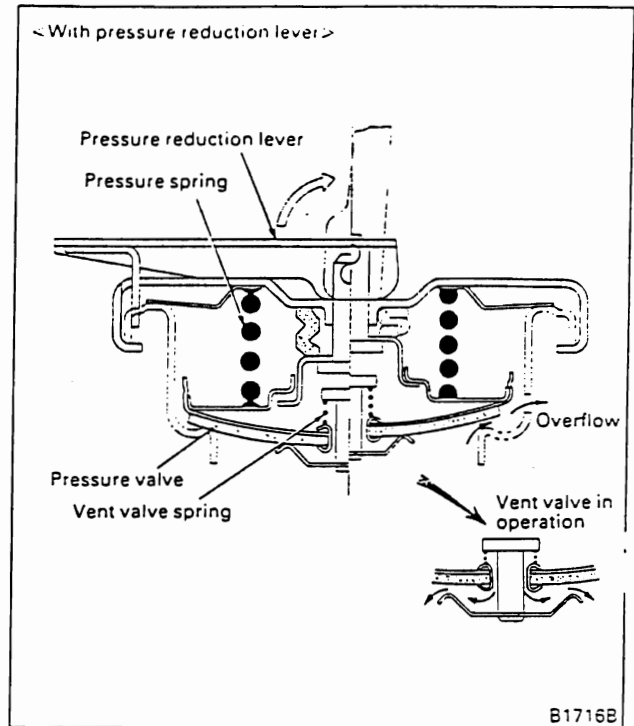


- Pressure increasing

When the pressure in the radiator exceeds the specified level, the pressure valve opens against the pressure spring to allow inside air to escape to the atmosphere, thereby decreasing the pressure.

- When at negative pressure

When the coolant temperature drops and a negative pressure develops inside the radiator, the vent valve opens to insert air, thereby preventing deformation of the radiator.



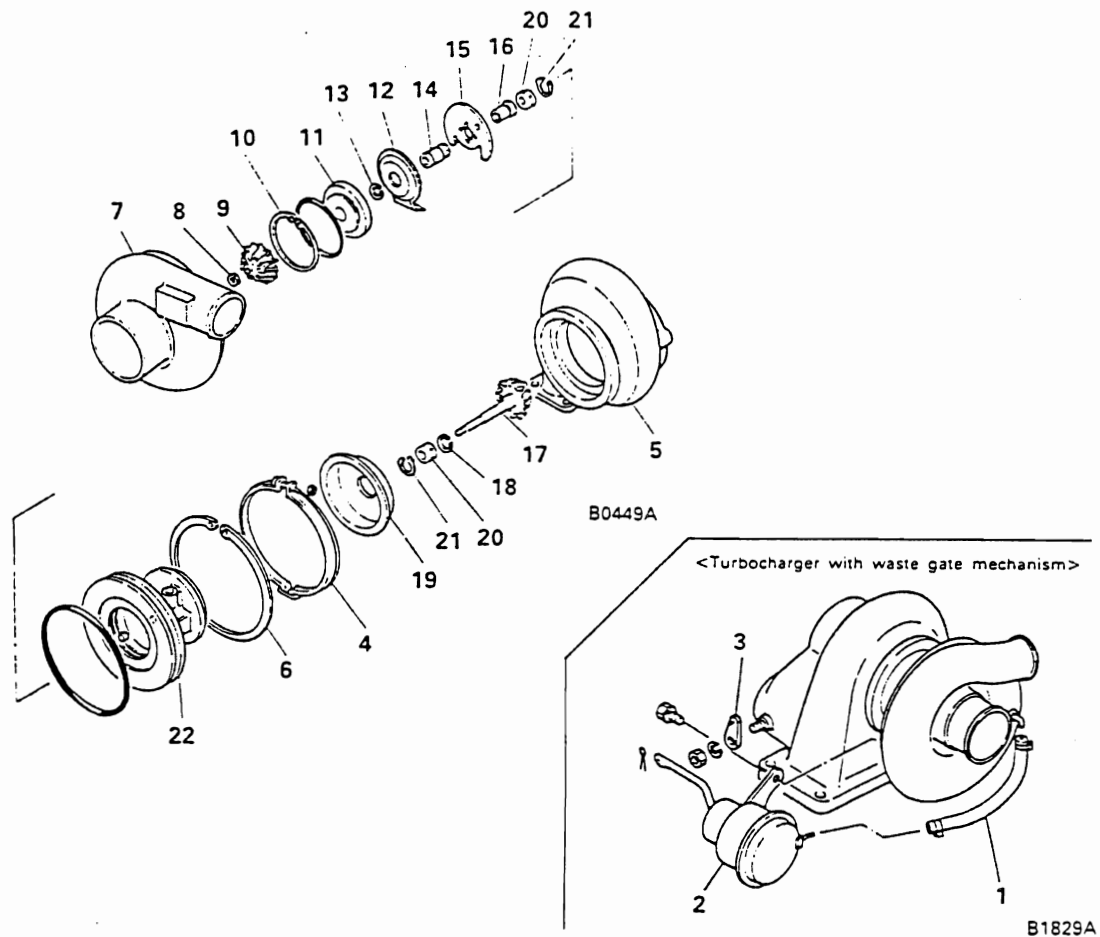
For the pressure cap with a pressure reduction lever, pulling up the pressure reduction lever opens the pressure valve, thereby reducing the pressure in the cooling system.

6. TROUBLESHOOTING

Symptom	Probable cause	Remedy	Ref. group	
Overheat	Defective V-belt <ul style="list-style-type: none"> • Incorrect tension 	Adjust	Group 11	
	<ul style="list-style-type: none"> • Broken belt 	Replace		
	Clogged cooling system	Clean		
	Defective thermostat	Replace		
	Defective water pump	Replace		
	Clogged radiator fins	Clean		
	Damaged cooling fan	Replace		
	Low coolant level	Replenish		
Overcool	Defective thermostat	Replace		
Quick loss of coolant	Defective radiator hose <ul style="list-style-type: none"> • Loose hose connection 	Correct		
	<ul style="list-style-type: none"> • Cracked or damaged hose 	Replace		
	Defective radiator <ul style="list-style-type: none"> • Radiator proper not tight • Pressure cap not tight 	Replace		
	Defective water pump <ul style="list-style-type: none"> • Defective unit seal • Pump mounted improperly (defective O-ring) 	Replace		
	Defective oil cooler	Replace		Group 12
	Thermostat case mounted improperly (defective gasket)	Replace		
	Thermostat cover mounted improperly (defective gasket)			
	Bypass pipe mounted improperly			
	Defective heater hose <ul style="list-style-type: none"> • Loose hose connection • Cracked or damaged hose 	Correct		
		Replace		
	Defective cylinder head gasket	Replace		Group 11

4.4 Turbocharger <TD06H>

4.4.1 Disassembly



<Disassembly sequence>

- | | | |
|---------------------|--------------------|---------------------------|
| 1 Hose | ⑨ Compressor wheel | 16 Thrust ring |
| 2 Actuator | ⑩ Snap ring | ⑰ Shaft and turbine wheel |
| 3 Lever | ⑪ Insert | 18 Piston ring |
| ④ Coupling assembly | 12 Oil deflector | 19 Turbine back plate |
| ⑤ Turbine housing | 13 Piston ring | 20 Bearing |
| ⑥ Snap ring | 14 Thrust sleeve | 21 Snap ring |
| ⑦ Compressor cover | 15 Thrust bearing | ⑳ Bearing housing |
| 8 Lock nut | | |

For disassembly of parts with an encircled number, see following items.

NOTE:
For models with waste gate mechanism, do not remove the waste gate valve inside the turbine housing.

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