

HYDRAULIC EXCAVATOR

SHOP MANUAL

model

SK70SR

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MAINTENANCE SPECIFICATION

SYSTEM

DISASSEMBLING

E/G TROUBLESHOOTING

KOBELCO

Book code No. S5YT0001E①

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- (9) When water has entered in the waterproofed connector, the removing of water is not easy. So check the removed waterproofed connector with care to protect it from entry of water. If moisture adheres on it, dry it completely before connecting.



Battery electrolyte is dangerous.

The battery electrolyte is dilute sulfuric acid, and causes scald and loss of eyesight by adhering on eyes, skin and clothes. When the electrolyte has adhered on them, take an emergency measure immediately and see a doctor for medical advice.

- When it has adhered on skin;
Wash with soap and water.
- When it has got in eyes;
Wash in water for 10 minutes or more immediately.
- When it has spilled out in large quantity;
Use sodium bicarbonate to neutralize, or wash away with water.
- When it was swallowed;
Drink milk or water.
- When it has adhered on clothes;
Wash it immediately.



1.5 HYDRAULIC PARTS

1) O ring

- Check that O ring is free from flaw and has elasticity before fitting.
- Even if the size of O ring is equal, the usage differs, for example in dynamic and static sections, the rubber hardness also differs according to the pressure force, and also the quality differs depending on the materials to be seated. So, choose proper O ring.
- Fit O ring so as to be free from distortion and bend.
- Floating seal should be put in pairs.

2) Flexible hose (F hose)

- Even if the connector and length of hose are the same, the parts differ according to the withstanding pressure. Use proper parts.

- Tighten it to the specified torque, and check that it is free from distortion, over tension, interference, and oil leakage.

1.6 WELD REPAIR

- (1) The weld repair should be carried out by authorized personnel in the specified procedure after disconnecting the grounding cable of battery. If the grounding cable is not disconnected, the electrical equipment may be damaged.
- (2) Remove parts which may cause flame due to the entry of spark beforehand.
- (3) Repair attachments which are damaged, giving particular attention to the plated section of piston rod to protect it from sparks, and don't fail to cover the section with fire clothes.

1.7 ENVIRONMENTAL ISSUES

- (1) Engine should be started and operated in the place where air can be sufficiently ventilated.
- (2) Industrial waste disposal
The following parts follows the regulation.
Waste oil, waste container
Battery
- (3) Asbestos parts
Breathing dust that may be generated when handling components containing asbestos fibers raises danger of getting lung cancer. Don't raise dust by compressed air and breath it.

Parts to be handled with care :

Brake parts, gasket, etc.

(4) Precautions for handling hydraulic oil

Hydraulic oil may cause inflammation of eyes.

Wear goggles to protect eyes on handling it.

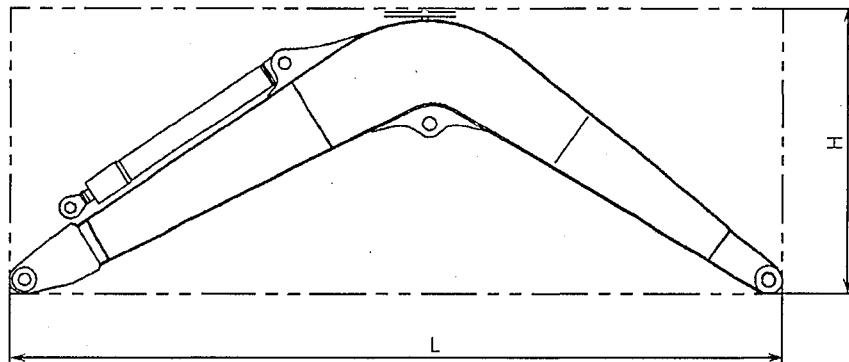
- When it has got in eyes;
Wash eyes with water until the stimulus is gone.
- When breathed dust;
Immediately see a doctor for medical advice.
- When it has adhered on skin;
Wash with soap and water.

(5) Others

For spare parts, grease and oil, use KOBELCO genuine ones.

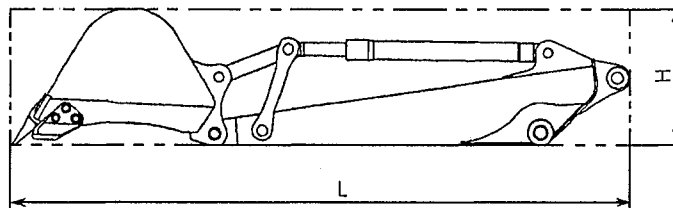
● OVERALL DIMENSIONS OF BOOM

Item	Type	3.72m (12ft-2in) Boom
Length×Height×Width L×H×W	m(ft-in)	4.09×1.57×0.56 (13'5"×5'2"×1'10")
Weight	kg (lbs)	500 (1,100)



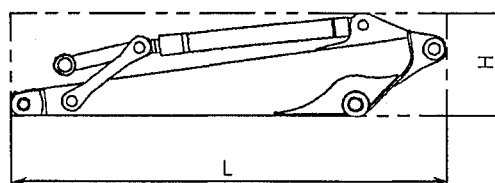
● OVERALL DIMENSIONS OF ARM+BUCKET

Item	Type	2.07m (6ft-9in) Arm+ 0.22m ³ (0.29cu-yd) Bucket	1.65m (5ft-5in) Arm+ 0.28m ³ (0.37cu-yd) Bucket
Length×Height×Width L×H×W	m(ft-in)	3.61×0.70×0.65 (11'10"×2'4"×2'2")	3.14×0.70×0.75 (10'4"×2'4"×2'6")
Weight	kg (lbs)	480 (1,100)	450 (990)



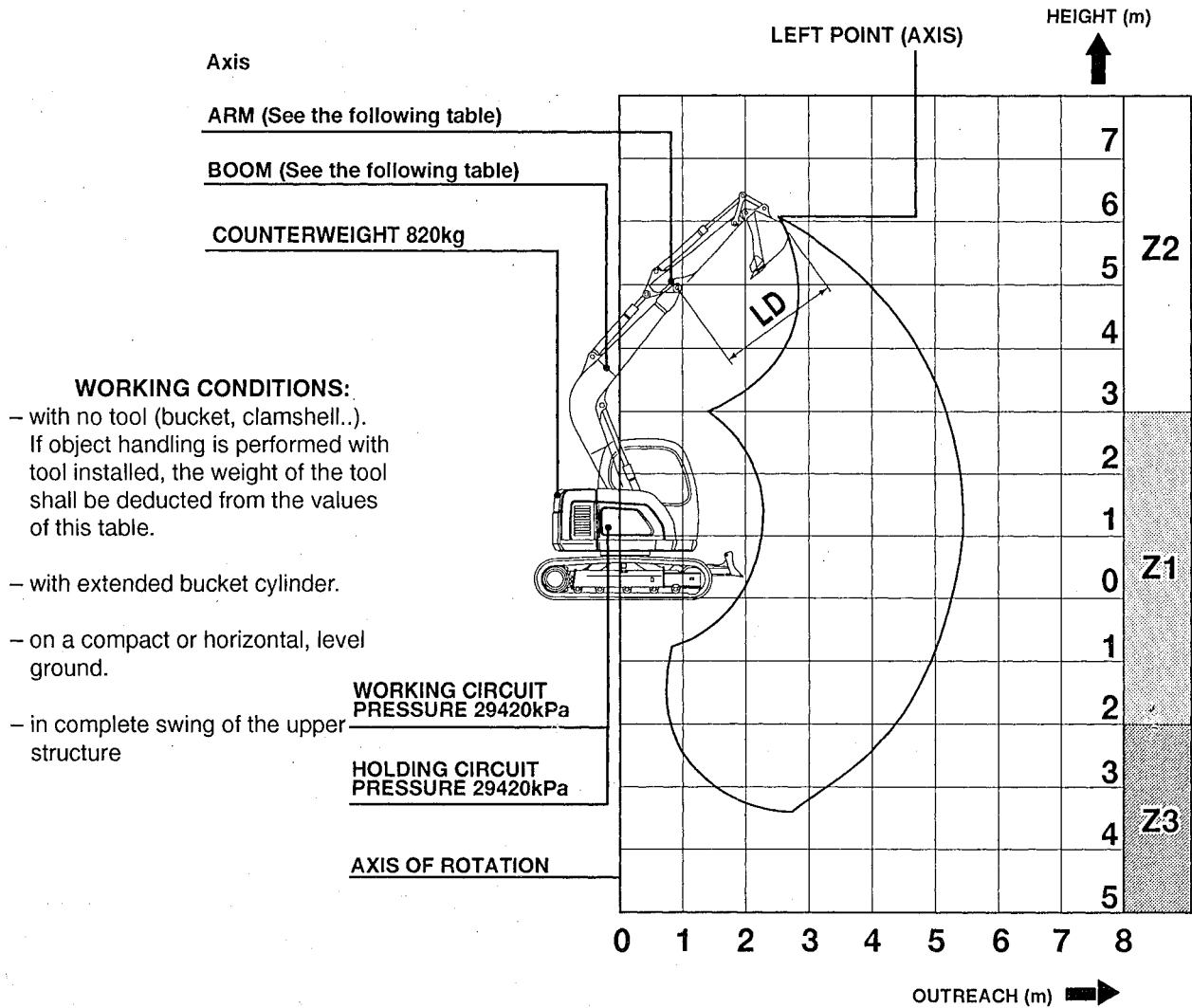
● OVERALL DIMENSIONS OF ARM

Item	Type	2.07 (6ft-9in) Arm	1.65m (5ft-5in) Arm
Length×Height×Width L×H×W	m(ft-in)	2.64×0.53×0.36 (8'8"×1'9"×1'2")	2.17×0.53×0.36 (7'1"×1'9"×1'2")
Weight	kg (lbs)	290 (640)	250 (550)



RATED OBJECT HANDLING CAPACITIES TABLE

KOBE STEEL, LTD.
SK70SR
SHOE WIDTH 600mm



THESE LOADS ARE VALID FOR THE HEIGHT OF THE CONSIDERED ZONE (Z.) FOR THE INTENDED OUTREACH

BOOM LENGTH 3.72m

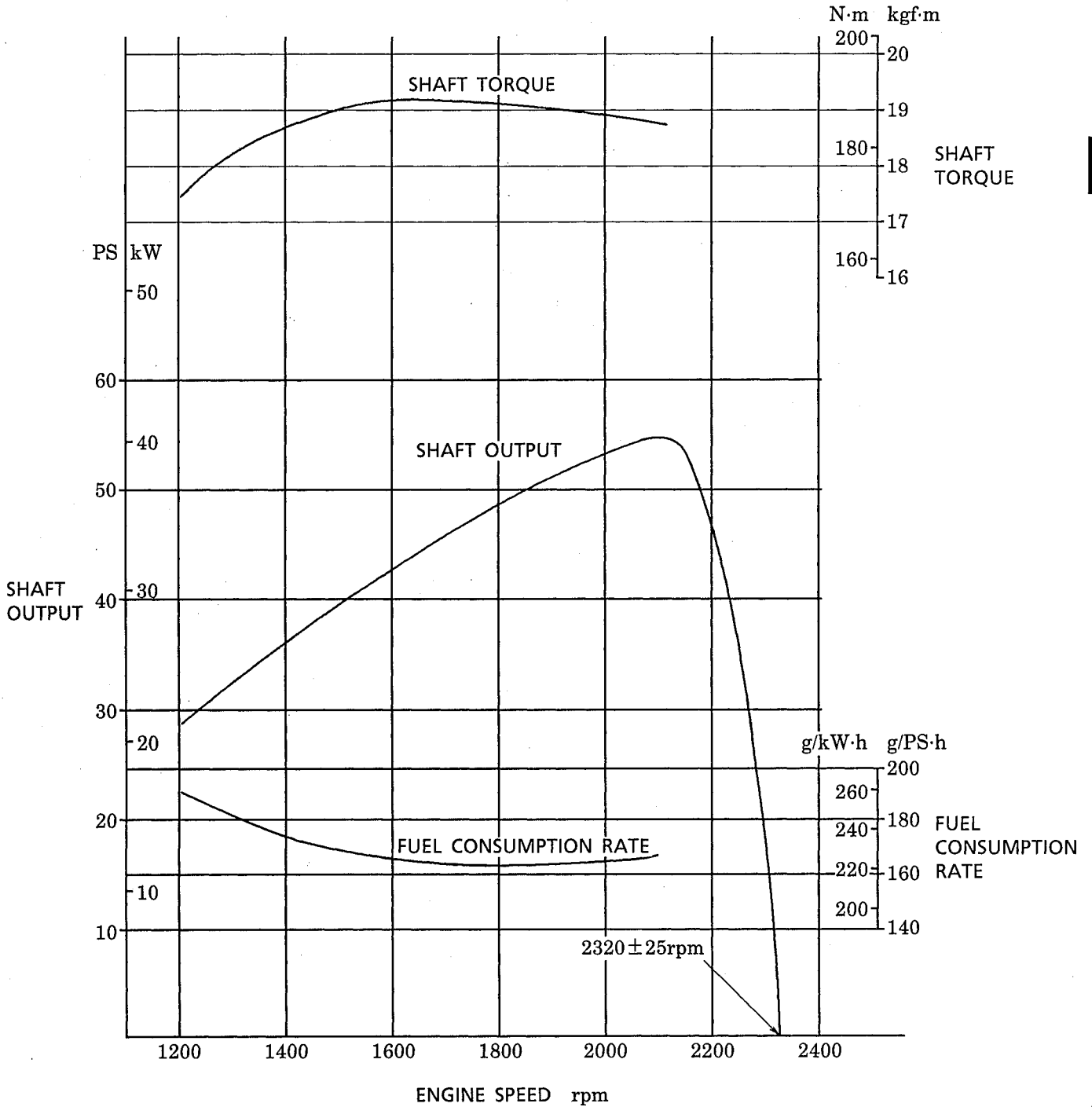
ARM LENGTH (m)	OUTREACH IN METERS					MAX REACH	
	OUTREACH (m)	3	4.5	6	7.5		
1.65	LD= 1.99	Z2	1800	1000	-	-	-
		Z1	2000		-	-	800 (5.42 m)
		Z3	1700		-	-	-
2.07	LD= 2.40	Z2	2000	1000	-	-	-
		Z1	1900		-	-	700 (5.83 m)
		Z3	1500		-	-	-

LD: BOOM POINT TO HOOK POINT DISTANCE

12.2 ENGINE CHARACTERISTIC CURVE (ISUZU 4JB1)

Condition to be measured : With fan and generator

Without muffler and air cleaner



$$\begin{aligned}
 \text{Fuel consumption volume} &= \frac{\text{Fuel consumption rate}}{0.835 \times 1000} \times \text{PS} \times \text{Load factor } (\alpha) \\
 &= \frac{166 \text{g/PS}\cdot\text{h}}{0.835 \times 1000} \times 55 \text{PS} \times \alpha \\
 &= 10.9\alpha \cdot \ell/\text{h}
 \end{aligned}$$

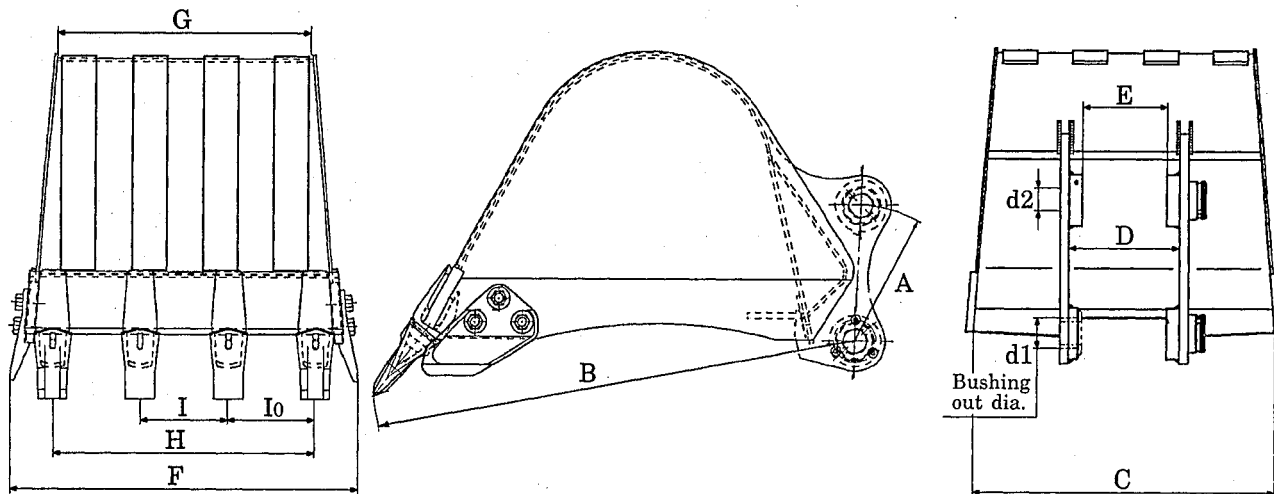
α : Standard load factor (0.60~0.70)

Fuel consumption in regular operation
(load factor : 0.60~0.70)
6.5~7.6ℓ/h

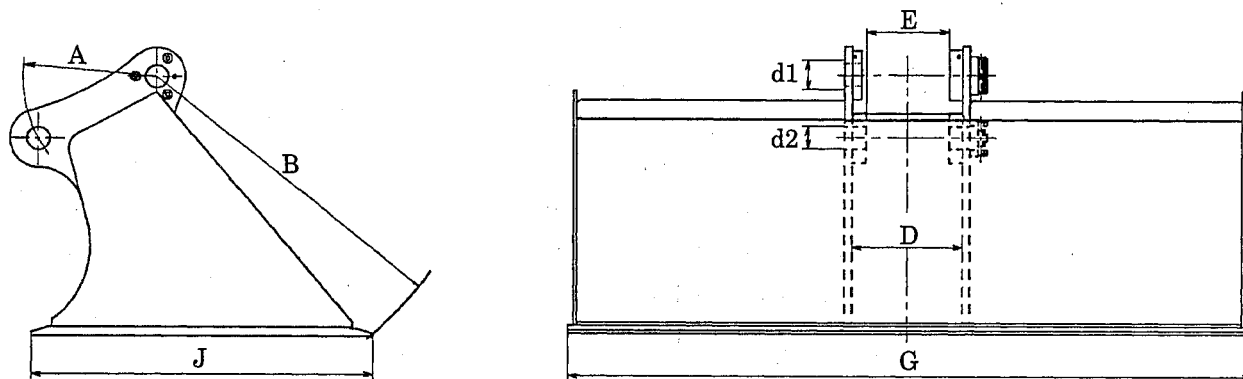
3. BUCKET

3.1 BUCKET DIMENSIONAL DRAWING

(1) Hoe bucket



(2) Slope finishing bucket



(3) V-shape bucket

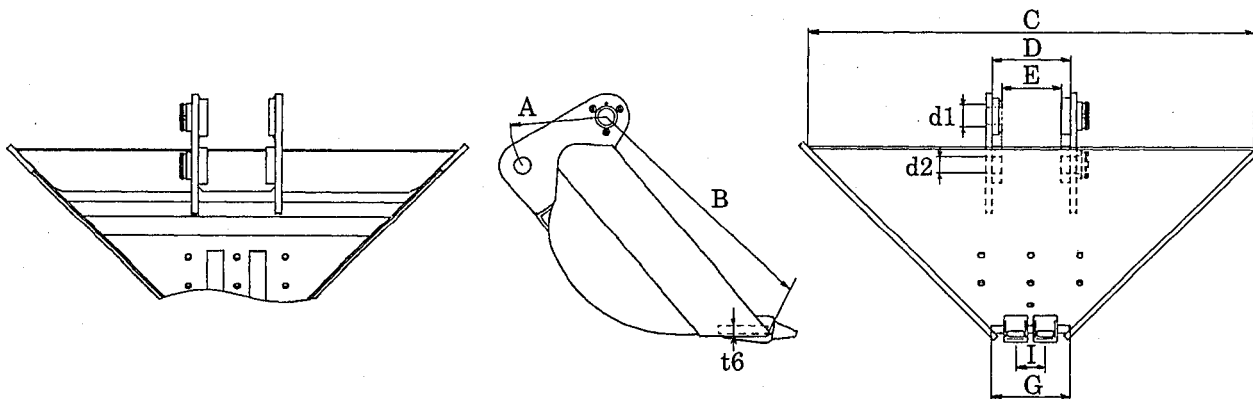


Fig. 3-1 Bucket dimensional drawing (1/2)

1. TIGHTENING TORQUES FOR CAPSCREWS AND NUTS

Tables 1-1 and 1-2 indicate tightening torques applicable to cases where no special note is given.

Overtightening of bolts may result in a twist-off

and a fracture under load.

Insufficient tightening may lead to a loosening or loss of bolts. Always tighten bolts to proper torques.

Table 1-1 Standard tightening torques for metric coarse screw threads unit: kgf-m (ft-lbs)

Classification	4		7		10	
	No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M 6 P=1	0.45±0.05 (3.3±0.4)	0.38±0.04 (2.7±0.3)	0.98±0.1 (7.1±0.7)	0.83±0.08 (6.0±0.6)	1.77±0.18 (13±1)	1.5±0.15 (11±1)
M 8 P=1.25	1.09±0.11 (7.9±0.8)	0.92±0.09 (6.7±0.7)	2.4±0.2 (17±1)	2.0±0.2 (14±1)	4.3±0.4 (32±3)	3.6±0.4 (26±3)
M10 P=1.5	2.2±0.2 (16±1)	1.83±0.18 (13±1)	4.7±0.5 (34±4)	4.0±0.4 (29±3)	8.5±0.9 (61±7)	7.2±0.7 (52±5)
M12 P=1.75	3.7±0.4 (27±3)	3.2±0.3 (23±2)	8.1±0.8 (59±6)	6.8±0.7 (49±5)	14.6±1.5 (110±11)	12.3±1.2 (89±9)
M14 P=2	5.9±0.6 (43±4)	5.0±0.5 (36±4)	12.8±1.3 (93±9)	10.8±1.1 (78±8)	23±2 (170±14)	19.5±1.9 (140±14)
M16 P=2	9.0±0.9 (65±7)	7.6±0.7 (55±5)	19.5±2.0 (140±14)	16.4±1.6 (120±12)	35±4 (250±29)	29±3 (210±22)
M18 P=2.5	12.4±1.2 (90±9)	10.5±1.0 (76±7)	27±3 (200±22)	23±2 (170±14)	49±5 (350±36)	41±4 (300±29)
M20 P=2.5	17.5±1.7 (130±12)	14.7±1.4 (110±10)	38±4 (270±29)	32±3 (230±22)	68±7 (490±51)	57±6 (410±43)
M22 P=2.5	23±2 (170±14)	19.6±2.0 (140±14)	51±5 (370±36)	43±4 (310±29)	92±9 (670±65)	77±8 (560±58)
M24 P=3	30±3 (220±22)	24±3 (170±22)	65±7 (470±51)	53±5 (380±36)	118±12 (850±87)	96±10 (690±72)
M27 P=3	44±4 (320±29)	36±4 (260±29)	96±10 (690±72)	78±8 (560±58)	173±17 (1300±120)	140±14 (1000±100)
M30 P=3.5	60±6 (430±43)	50±5 (360±36)	131±13 (950±94)	110±11 (800±80)	235±24 (1700±170)	198±20 (1400±140)
M33 P=3.5	81±8 (590±58)	68±7 (490±51)	176±18 (1300±130)	148±15 (1100±110)	317±32 (2300±230)	266±27 (1900±200)
M36 P=4	105±10 (760±72)	88±9 (640±65)	227±23 (1600±170)	190±19 (1400±140)	409±41 (3000±300)	343±34 (2500±250)

Table 1-2 Standard tightening torques for metric fine screw threads unit: kgf-m (ft-lbs)

Classification	4		7		10	
	No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M 8 P=1	1.15±0.11 (8.3±0.8)	0.97±0.1 (7.0±0.7)	2.5±0.2 (18±1)	2.1±0.2 (15±1)	4.5±0.4 (33±3)	3.8±0.4 (27±3)
M10 P=1.25	2.3±0.2 (17±1)	1.91±0.19 (14±1)	4.9±0.5 (35±4)	4.2±0.4 (30±3)	8.9±0.9 (64±7)	7.5±0.7 (54±5)
M12 P=1.25	4.0±0.4 (29±3)	3.4±0.3 (25±2)	8.7±0.9 (63±7)	7.3±0.7 (53±5)	15.7±1.6 (110±12)	13.2±1.3 (95±9)
M16 P=1.5	9.4±0.9 (68±7)	7.9±0.8 (57±6)	20±2 (140±14)	17.2±1.7 (120±12)	37±4 (270±29)	31±3 (220±22)
M20 P=1.5	19±1.9 (140±14)	15.8±1.6 (110±12)	41±4 (300±29)	34±3 (250±22)	74±7 (540±51)	62±6 (450±43)
M24 P=2	32±3 (230±22)	27±3 (200±22)	70±7 (510±51)	58±6 (420±43)	126±12 (910±87)	105±10 (760±72)
M30 P=2	65±6 (470±43)	54±5 (390±36)	142±14 (1000±100)	118±12 (850±87)	255±26 (1800±190)	212±21 (1500±150)
M36 P=3	109±11 (790±80)	91±9 (660±65)	238±23 (1700±170)	198±20 (1400±140)	428±43 (3100±310)	357±36 (2600±260)

9. COUNTER WEIGHT LIFTING JIG

Bracket for left side

Bracket for right side

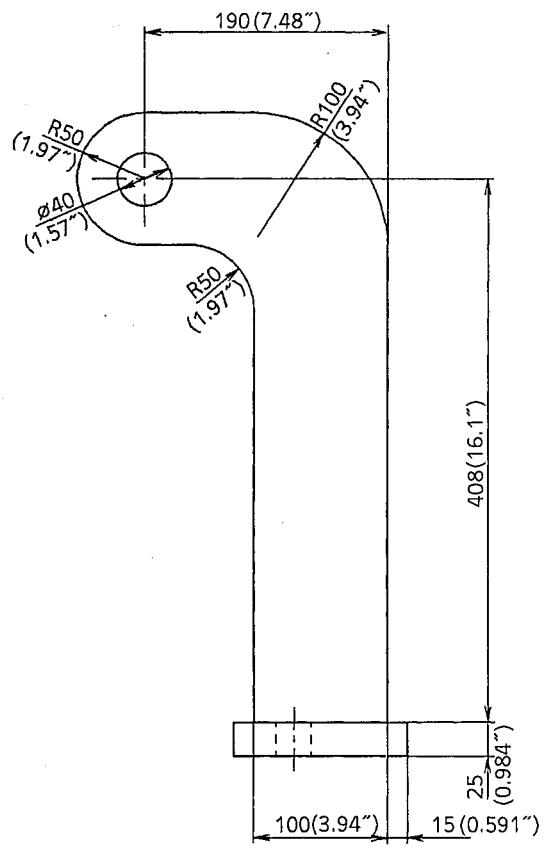
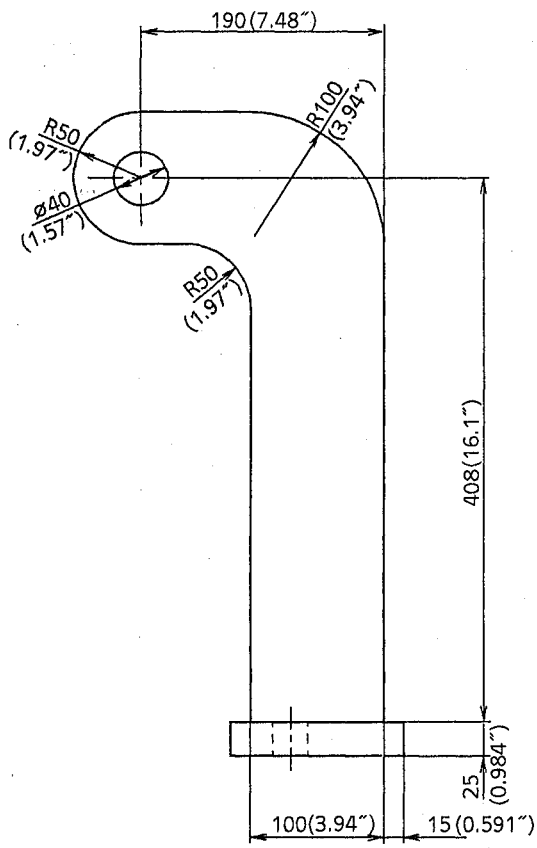
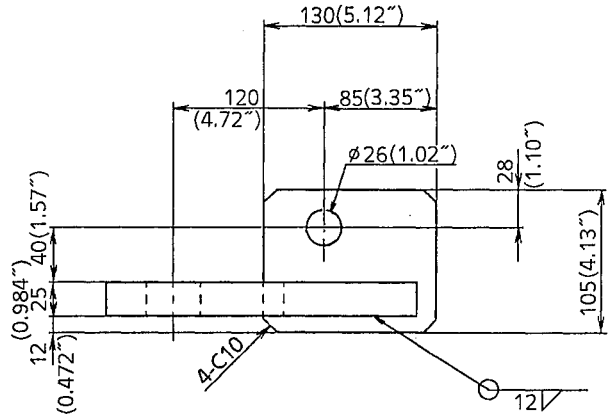
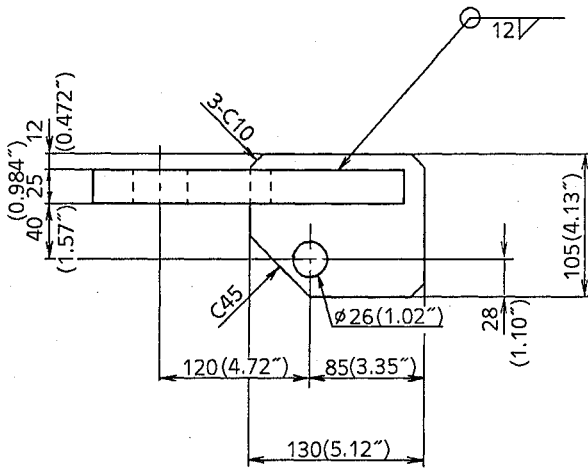


Fig. 9-1 Counter weight lifting bracket

Material : POK400(SS41)

Group	Location	Work to be done	Unit	Remark	Maintenance time		
					SK70SR		
02 Cab & Guard	28	● Bonnet assy slinging	Detach/attach	1 pc.		0.1	
	29	Cover (3)	Detach/attach	1 pc.		0.1	
	30	Bracket (44)	Detach/attach	1 pc.		0.1	
	31	Guard assy (7)	Detach/attach	1 pc.		0.1	
	32	Cover assy (60)	Detach/attach	1 pc.		0.1	
	33	Guard assy (11)	Detach/attach	1 pc.		0.2	
	34	Guard assy (9)	Detach/attach	1 pc.		0.1	
	35	Guard assy (8)	Detach/attach	1 pc.		0.2	
	36	● Guard assy (8) slinging	Detach/attach	1 pc.		0.1	
	40	Cover relation			7. Reference for cover		
	41	Cover (1)	Detach/attach	1 pc.		0.1	
	42	Cover (2)	Detach/attach	1 pc.		0.1	
	43	Cover (3)	Detach/attach	1 pc.		0.1	
	44	Cover (4)	Detach/attach	1 pc.		0.1	
	45	Cover (5)	Detach/attach	1 pc.		0.1	
	46	Cover (6)	Detach/attach	1 pc.		0.1	
50	Counter weight relation			5. Reference for counter weight			
51	Counter weight ASSY	Detach/attach	1 pc.		0.4		
52	● Counter weight lifting jig	Detach/attach	1 set		0.1		
53	● Counter weight temporary slinging	Preparation	1 pc.		0.1		
54	● Counter weight mounting bolt	Detach/attach	1 pc.		0.1		
55	● Counter weight slinging	Detach/attach	1 pc.		0.1		
03 Swing frame	00	Control relation					
	01	E/G control ASSY	Detach/attach	1 pc.	Include adjustment.	0.2	
	02	● Emergency stop knob (control) cable	Replace	1 pc.		0.1	
	10	Intake relation			8. Reference for Air cleaner		
	11	Air cleaner ASSY	Detach/attach	1 pc.		0.4	
	12	● Hose (2)	Detach/attach	1		0.1	
	13	● Hose (1)	Detach/attach	1		0.1	
	14	● Element	Replace	1		0.1	
	20	Exhaust relation			9. Reference for muffler		
	21	Muffler ASSY	Detach/attach	1 pc.		0.4	
	22	● U bolt	Detach/attach	1 pc.		0.1	
	23	● Clamp ASSY	Detach/attach	1 pc.		0.1	
	24	● Gasket	Replace	1 pc.		0.1	
	30	Radiator relation			13. Reference for Radiator		
	31	Radiator ASSY	Detach/attach	1 pc.		3.5	
	32	● Coolant (LLC)	Replace	1 pc.		0.2	
33	●● Concentration of coolant	Measuring	1 pc.		0.2		
34	● A/C condenser	Detach/attach	1 pc.		0.2		
35	● Stay	Detach/attach	1 pc.		0.1		
36	● Bracket	Detach/attach	1		0.2		
37	● Sub tank	Detach/attach	1 pc.		0.1		
38	● Fan guard	Detach/attach	1 pc.		0.2		
39	● Water hose (radiator→E/G)	Detach/attach	1		0.2		
40	● Radiator mounting bolts removing	Detach/attach	1 pc.		0.2		
41	● Under cover	Detach/attach	1 pc.		0.1		
42	● Hydraulic oil tank · suction stopper	Attach/detach	1 pc.		0.2		

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SHOP MANUAL SK70SR

MAINTENANCE STANDARD AND TEST PROCEDURE

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5. MEASURING TRAVEL PERFORMANCES

5.1 TRAVEL SPEED

(1) Purposes

Measure the travel sprocket revolution and confirm the performances between the hydraulic pump and the travel motor of the travel drive system.

(2) Conditions

Operating oil temperature ; 45~55°C (113~131°F)
Crawler on the right and left sides are tensioned evenly.

(3) Preparation

Install the reflection panel with a magnet to the travel motor cover.

Swing the swing frame through 90° as shown in Fig.17-1 and make the crawler on one side take off the ground, using the attachment.

(4) Measurement

Engine revolution ; Hi idle

2-speed travel switch ; 1-speed and 2-speed

Measuring points ; Right and left

Method, example 1 ;

Measure revolution with a stroboscope.

Method, example 2 ;

Measure the revolutions per minute visually.

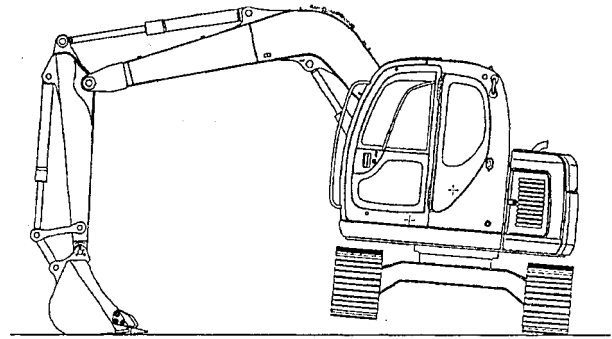
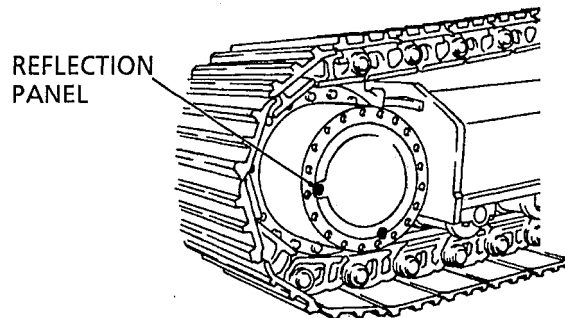


Fig. 17-1 One side lifted position



YN-B74

Fig. 17-2 Adhering position of reflection panel

Sprocket revolution		Table 6		Unit : rpm
Measurement item	Standard value	Reference value for remedy	Service limit	
RH & LH	H1	35.2~31.8	27.4~24.8	23.6~21.3
	H2	56.3~50.7	43.9~39.5	37.7~34.0
LH	S2	52.4~47.4	40.9~37.0	35.1~31.8
	FC2	44.9~40.5	35.0~31.6	30.0~27.1

5.2 DEVIATION OF TRAVEL

(1) Purpose

Measure the amount of deviation at 20m (66ft) travel and confirm the horizontal balance between the hydraulic pump and the travel motor of the travel drive system.

(2) Condition

Hydraulic oil temperature; 45~55°C (113~131°F)
RH and LH crawler are tensioned evenly.

Plain, level and solid ground

Engine revolution ; Hi idle

(3) Preparation

1) Straight course more than 30m (33yard)

2) Travel position in which the bottom of the bucket is lifted by about 30cm (1ft).

(4) Measurement

1) Measure the max. deviation distance of the circular arc in the 20m (22yard) length, excluding the preliminary run of 3~5m (10~16ft).

2) Operate the travel lever at the same time.

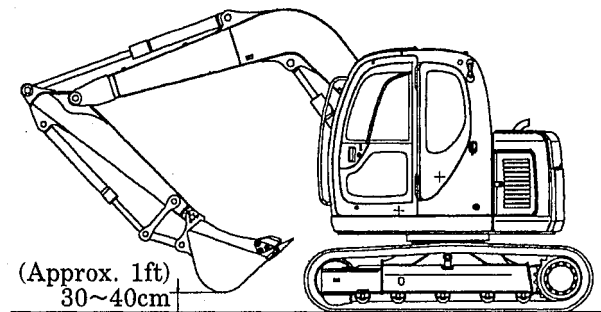


Fig. 18 Travel position

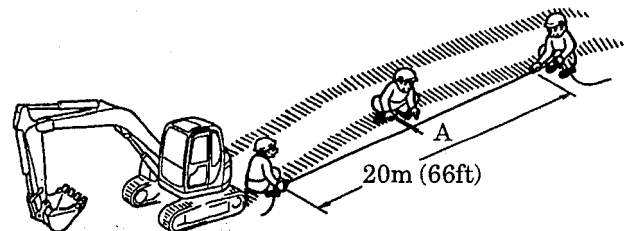


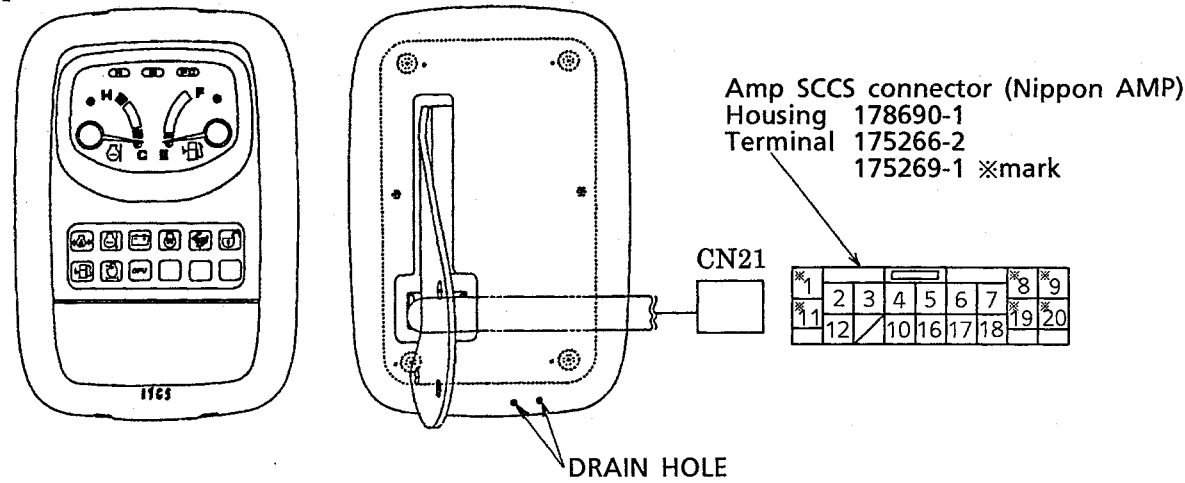
Fig. 19 Measuring method

Travel deviation		Table 7		Unit : m/20m
Measuring position	Standard value	Reference value for remedy	Service limit	
A	0.8 (2'7") or less	1.60 (5'3")	2.40 (7'10")	

- (5) When adjustment of mechatro controller can not be performed;
- 1) After execution of procedure ⑦, H→S→FC is displayed, CPU lamp flickers, and adjustment can not be executed. ("E01" is indicated on controller display.)
 - Ⓐ (Display condition)
 - While reading engine speed, the engine speed after stepping of governor motor is lower than that before stepping in condition of engine speed 850rpm or high.
 (Cause)
 - The read-out of engine speed sensor is wrong.
 (Corrective action)
 - After measurement and adjustment of speed sensor voltage, carry out "A" adjustment.
High idling 3V or high (AC) (Voltage available for controller to read)
(When adjusting in factory, the voltage is set to 3V (AC) or high at high idling.)
 - Ⓑ (Display condition)
 - When abnormal rotation(step-out) occurs on high idling side;
 (Cause)
 - Wrong connection of link rod of governor motor
 (Corrective action)
 - After verification of connection of link rod, perform "A" adjustment. [Rod length : 204mm (0.031in)]
※ When step-out occurs after adjustment, press buzzer stop switch once before stepping out as a temporary repair, and it is switched to high idling temporarily.
 - 2) The error code "E02" is indicated on the display of mechatro controller, but the adjustment cannot be executed.
 - (Display condition)
 - Engine speed is 300rpm or lower, or 3000rpm or higher.
 (Cause)
 - The read-out of engine speed sensor is wrong.
 (Corrective action)
 - After measurement and adjustment of speed sensor voltage, carry out "A" adjustment.
High idling 3V or high (AC)
 - 3) When buzzer stop switch is pressed once to proceed from procedure ⑥ to ⑦, it does not proceed to procedure ⑦, but procedure ⑧ directly, and CPU lamp flickers and error code "E01" is indicated on the display on mechatro controller.
 - (Display condition)
 - Engine speed is 420rpm or low.
 (Cause)
 - Buzzer stop switch is pressed once before starting engine.
 - The read-out of engine speed sensor is wrong. (or disconnection)
 (Corrective action)
 - Adjust mechatro controller again as the procedure.
 - After measurement and adjustment of speed sensor voltage, perform "A" adjustment.
High idling 3V or high (AC)
 - 4) When buzzer stop switch is pressed once to proceed from procedure ④ to ⑤, but it does not proceed to procedure ⑤.
 - (Display condition)
 - Limit switch signal (grounding) is not input from governor motor to controller.
 (Cause)
 - Failure of limit switch in governor motor
 - Disconnection of connector or harness on governor motor
 (Corrective action)
 - Check that limit switch of governor motor goes ON and OFF.
 - Check connector and harness from possible damage, and adjust it.
 - 5) Others

Error code "E02" is indicated on the display of controller, and engine stops.
Engine oil pressure switch and harness are short-circuited.
 - (6) CPU lamp on gauge cluster flickers, or error code "E01" is indicated on display of controller.
When mechatro controller is replaced, and the adjustment of controller has failed, this display appears.
When the adjustment is completed normally, CPU lamp goes off, and error code "E01" also disappears.
To perform the adjustment of mechatro controller again, press starter switch once to turn the power OFF, and turn starter switch on and perform the adjustment again.

(2) Gauge cluster



Connector 21

No.	NAME	Line color	No.	NAME	Line color
1	Fuel sensor	BrR	11	CPU trouble	PG
2	Engine coolant temp. sensor	YR	12	Swing parking release switch	Lg
3	Alternator (charge)	WR	13	Over load	
4	Glow switch	BrY	14	Spare 1	
5	Engine oil pressure switch	O	15	Spare 2	
6	Engine coolant temp. switch	GB	16	Mode display (Main controller)	LO
7	Remaining fuel volume switch	BrB	17	Mode display (Main controller)	L
8	Air cleaner clogged switch	BrL	18	Work light switch	WB
9	Travel 1-2speed switch	LgB	19	Power supply (+24V)	W
10	Buzzer signal	Br	20	GND	B

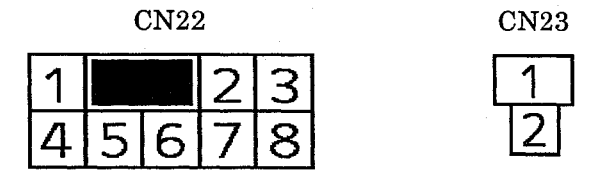
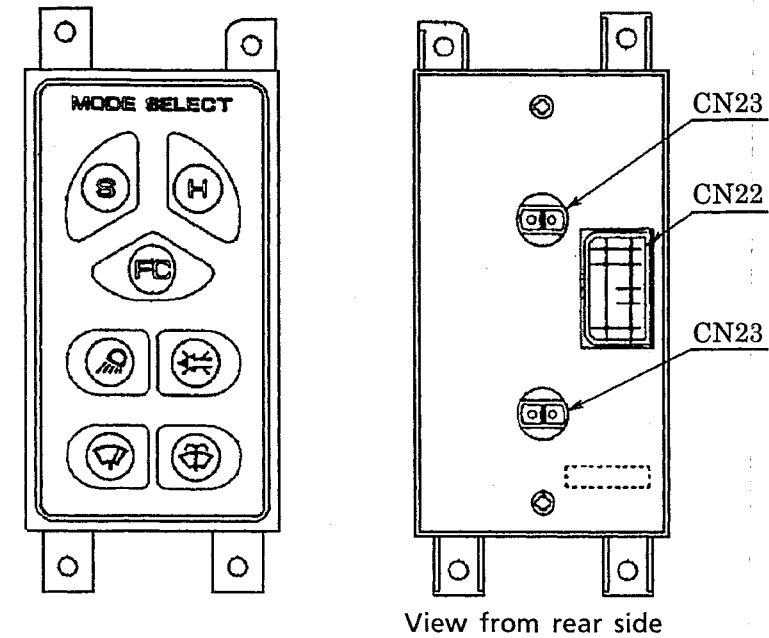
Performances, lamp display and alarm

No.	Display contents Function	Input terminal No.	Input signal condition		Buzzer sounds or not. *Note 1
			Normal (OFF)	Abnormal (ON)	
1	Battery charge faulty	CN21-3	1	0	No
2	Glow operation	CN21-4	—	1	No
3	Engine oil pressure low	CN21-5	—	0	Yes
4	Engine coolant temp. high temp.	CN21-6	—	0	Yes
5	Fuel down	CN21-7	800Ω or more	150Ω or less	No
6	Air cleaner clogged	CN21-8	—	0	No
7	Travel 2-speed operation	CN21-9	—	1	No
8	Buzzer *Note 2	CN21-10	—	0	Yes
9	CPU trouble	CN21-11	0	—	No
10	Swing parking	CN21-12	—	34Ω	No
11	Over load alarm	CN21-13	—	0	Yes
12	Spare 1	CN21-14	—	0	No
13	Spare 2	CN21-15	—	0	No
14	Work light (Back light)	CN21-19	—	1	No

Note 1. The buzzer sounds intermittently, 0.5±0.2sec ; ON and 0.5±0.2sec ; OFF when the battery charge is short, or error Nos. 3, 4, 11 in the above Table occurred during normal operation.

Note 2. The buzzer in error No.8 sounds only, and mechatro controller controls it.

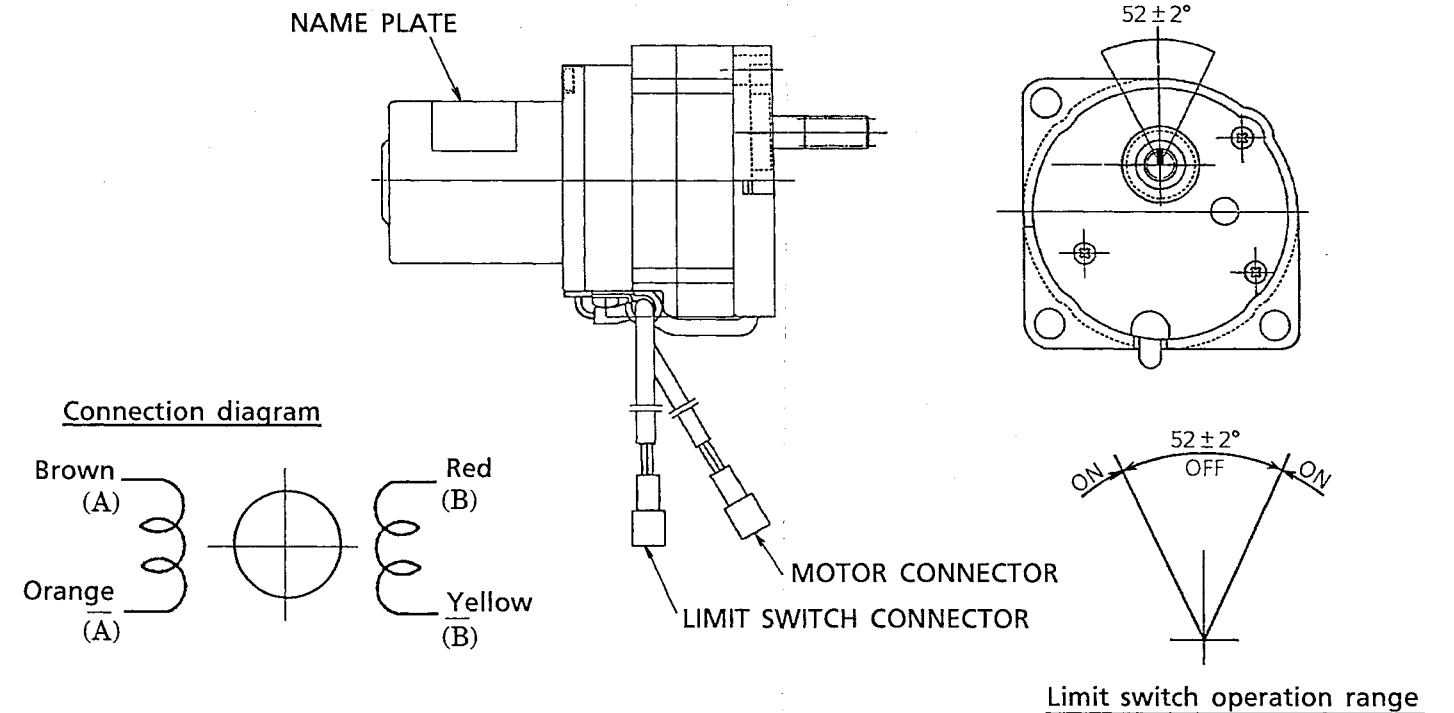
(3) Switch assy



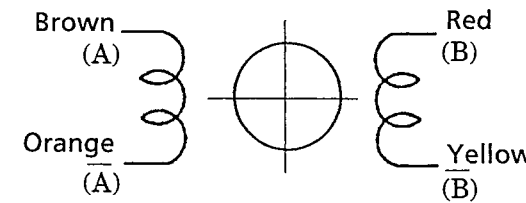
No.	NAME	Line color	
CN22	1	Power supply +5V	G
	2	Address input Di1	LgR
	3	Address input Di2	LG
	4	Address input Di3	VG
	5	Date output DO1	BrW
	6	GND	B
	7	NC	—
	8	NC	—

No.	NAME	Line color	
CN23	1	Back light +	WB
	2	Back light -	B

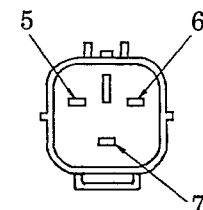
(4) Governor motor (M-2)



Connection diagram

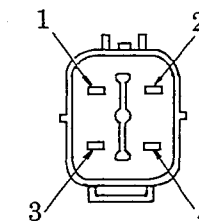


Limit switch connector wiring diagram



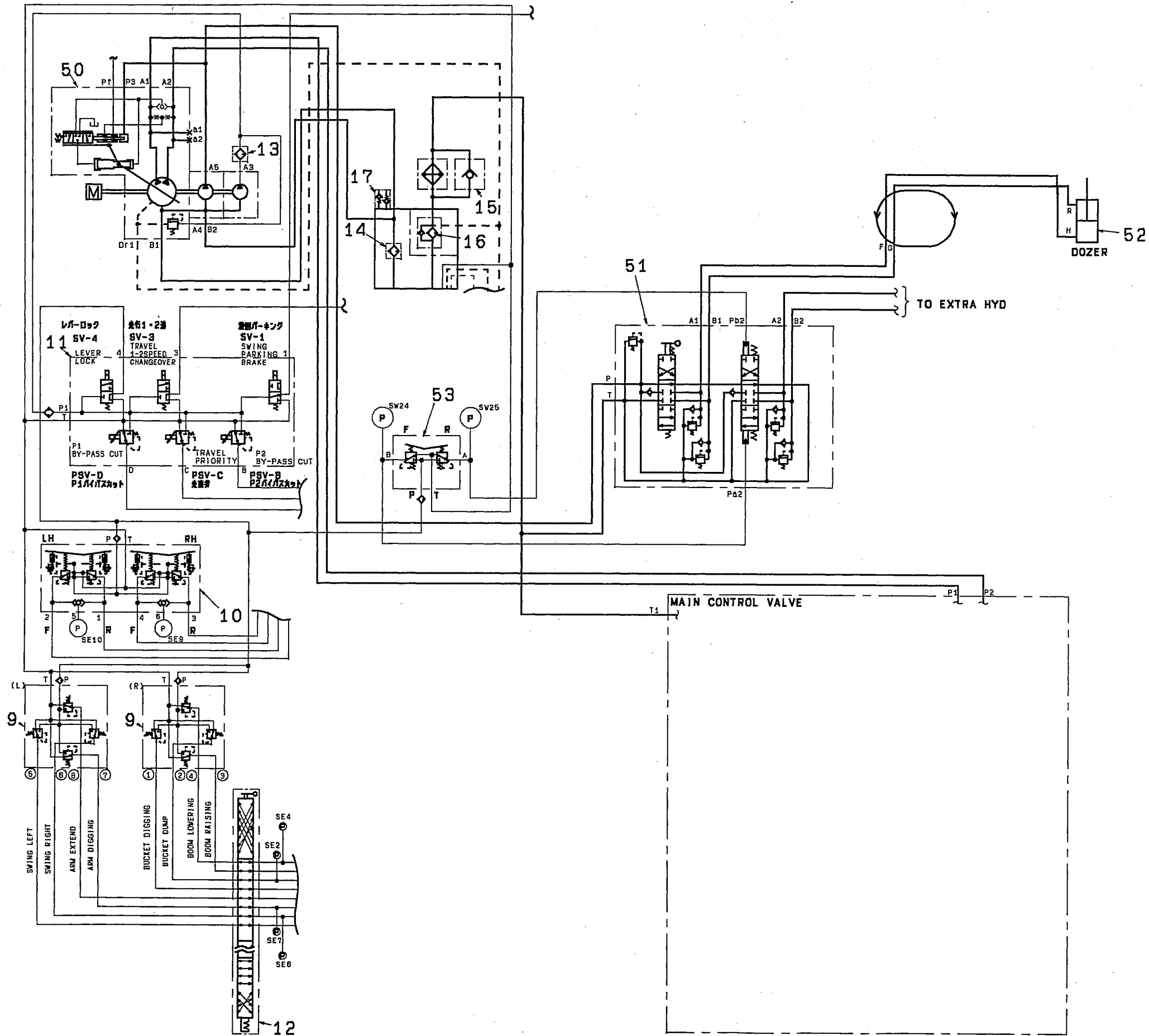
No.	Lead color	Connection line
5	White	COM
6	Red	NO
7	Yellow	NC

Motor connector wiring diagram



No.	Lead color	Connection line
1	Brown	A
2	Orange	A̅
3	Red	B
4	Yellow	B̅

2.5 EXTRA & DOZER SPEC.



Extra & Dozer spec.			YT01Z00017P1
No.	NAME	PART No.	MODEL No.
50	PUMP ASSY (WITH 2 GEAR PUMPS)	YT10V00002F1	K3SP36B
51	CONTROL VALVE	YT30V00021F1	KVS-65-2
52	DOZER CYLINDER	YR01V00015F1	120-70-150
53	PILOT VALVE	YR30V00013F1	07515-00000

9. ARM CIRCUIT

This section describes the following operations.

- 1) Arm control pilot circuit
- 2) Arm in(digging) 2 pumps conflux main circuit

9.1 ARM CONTROL PILOT CIRCUIT

Operation:

- 1) Start arm in operation, and pilot proportional secondary pressure is output through port(7) of left pilot valve(9), and acts on low pressure sensor(SE7), and at the same time the pressure branches into 2 circuits and acts on Pc3 and Pc3' ports of C/V(2).
- 2) The voltage output by low pressure sensor(SE7) is input into mechatro controller and the controller executes signal processing, and outputs command current to P1 by-pass cut valve(PSV-D) and solenoid valve outputs proportional secondary pressure and the pressure acts on C/V(2) Pb4 port.
- 3) Then, the secondary pressure fed into C/V(2) Pc3 port switches arm conflux spool. And the solenoid proportional secondary pressure fed into Pc3' port releases arm lock valve. In addition, solenoid proportional secondary pressure switches P1 by-pass cut valve.

9.2 ARM IN 2 PUMPS CONFLUX MAIN CIRCUIT

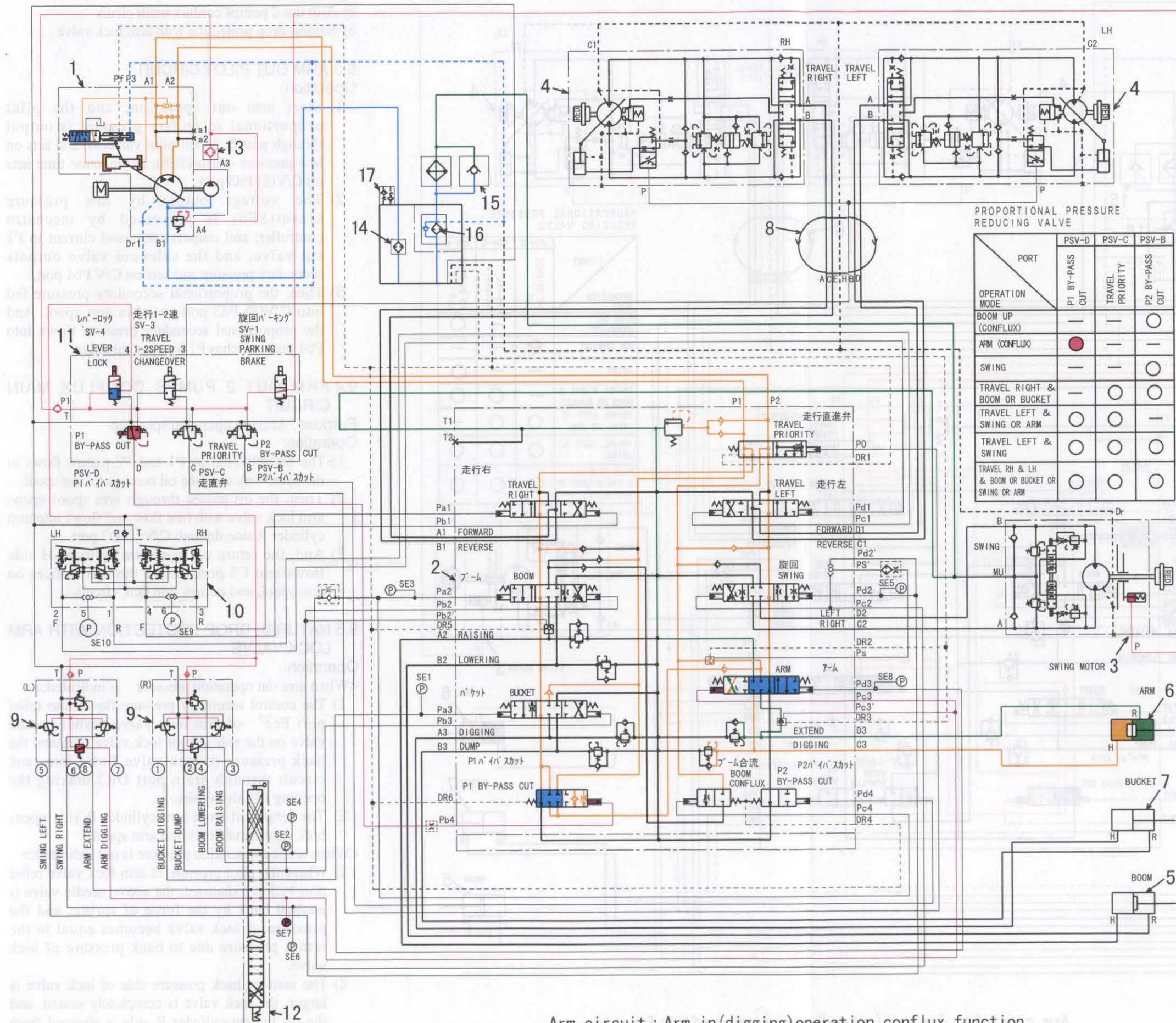
Purpose: Arm in speed up

Principle:

Confluing oil from 2 pumps in C/V(2)

Operation:

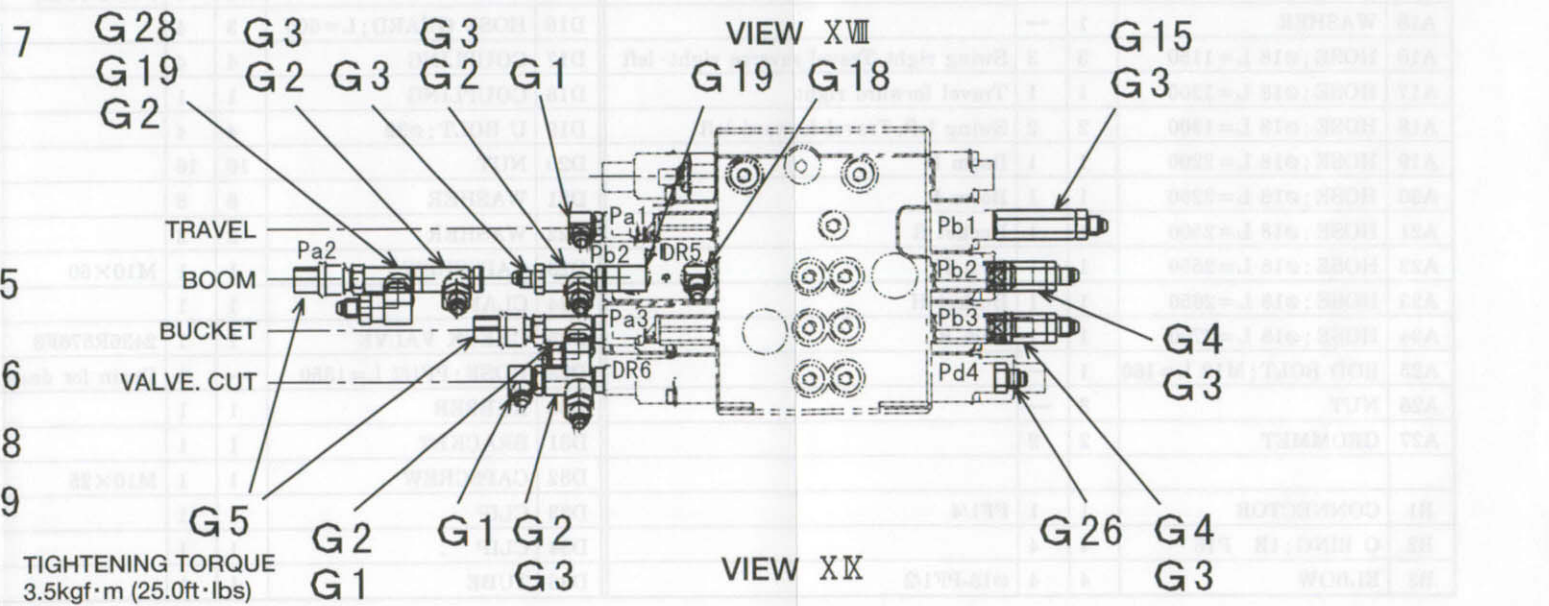
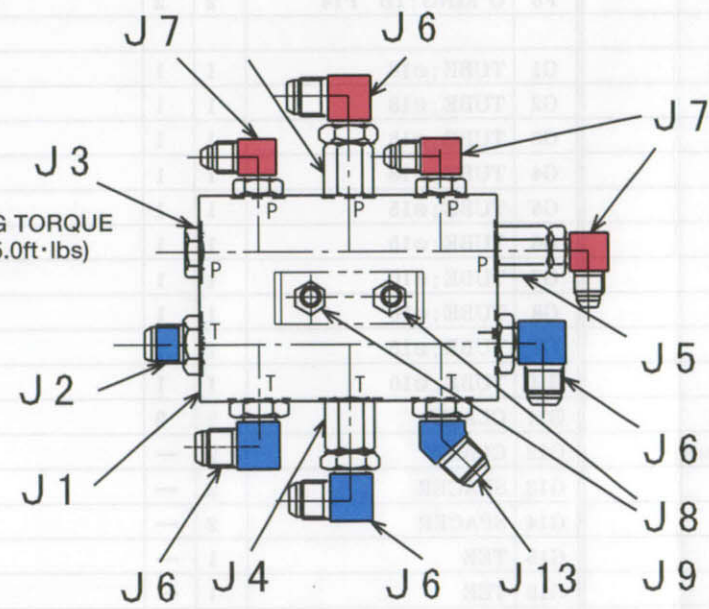
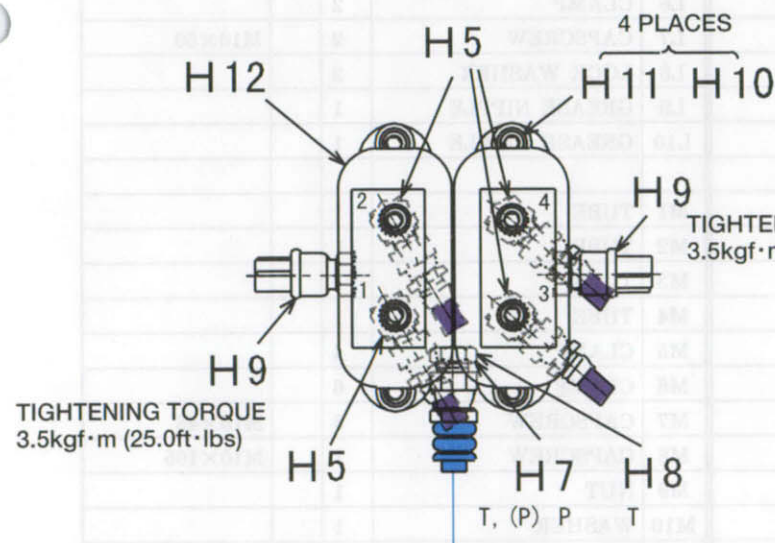
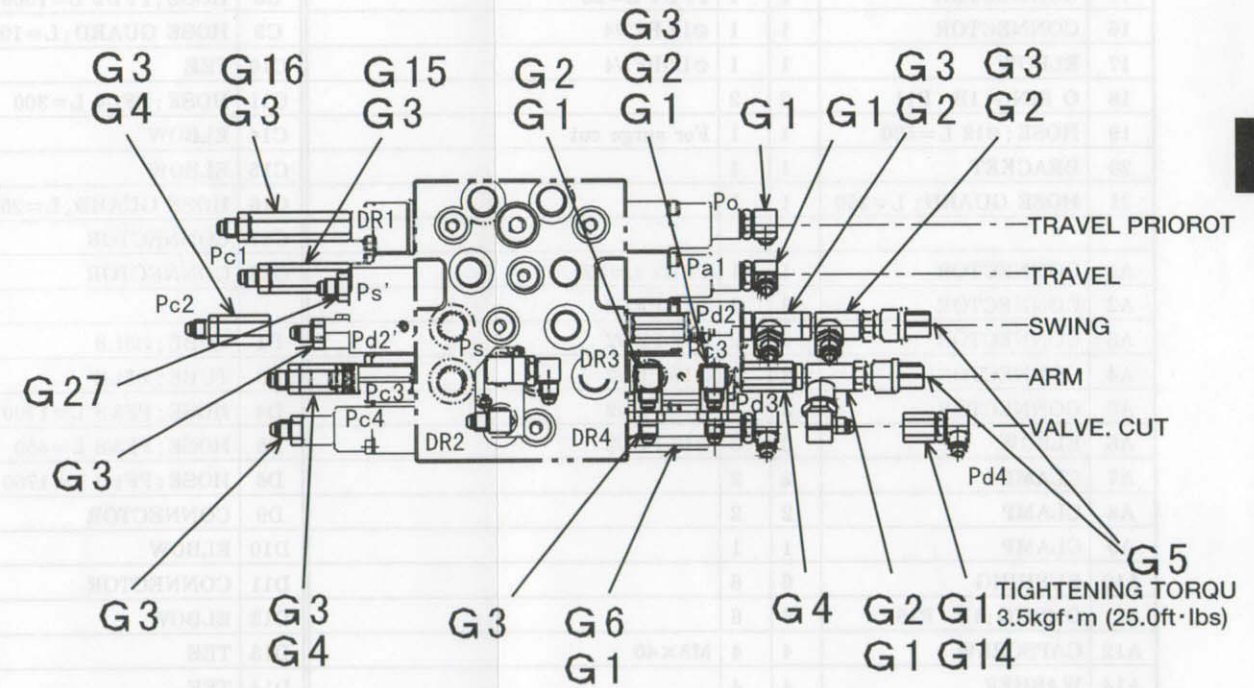
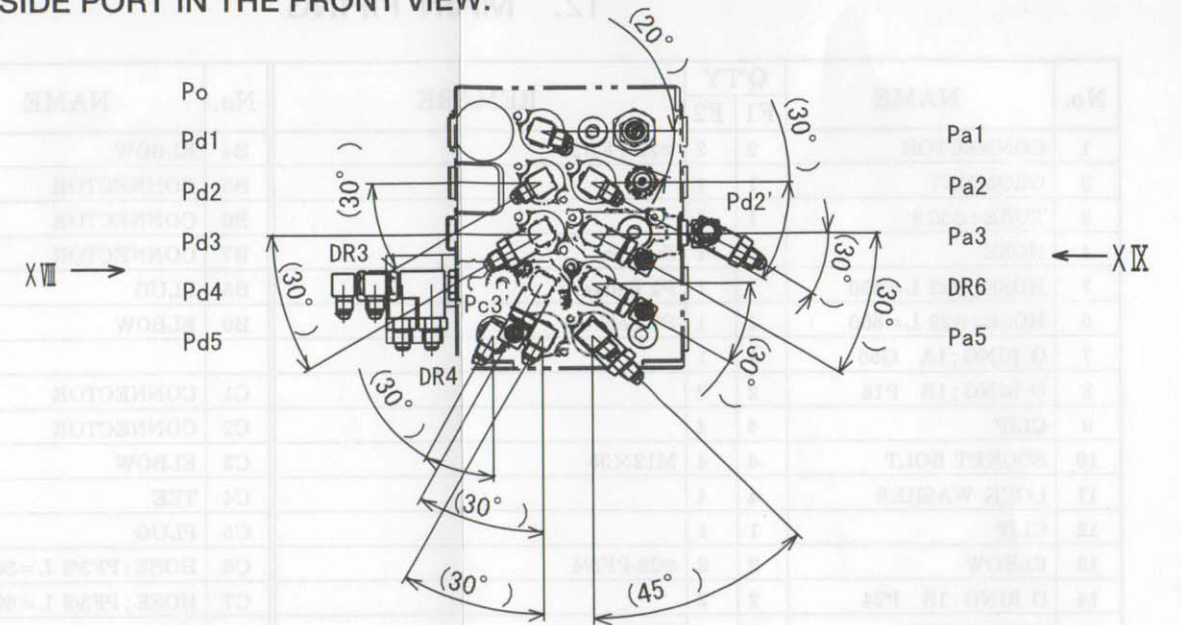
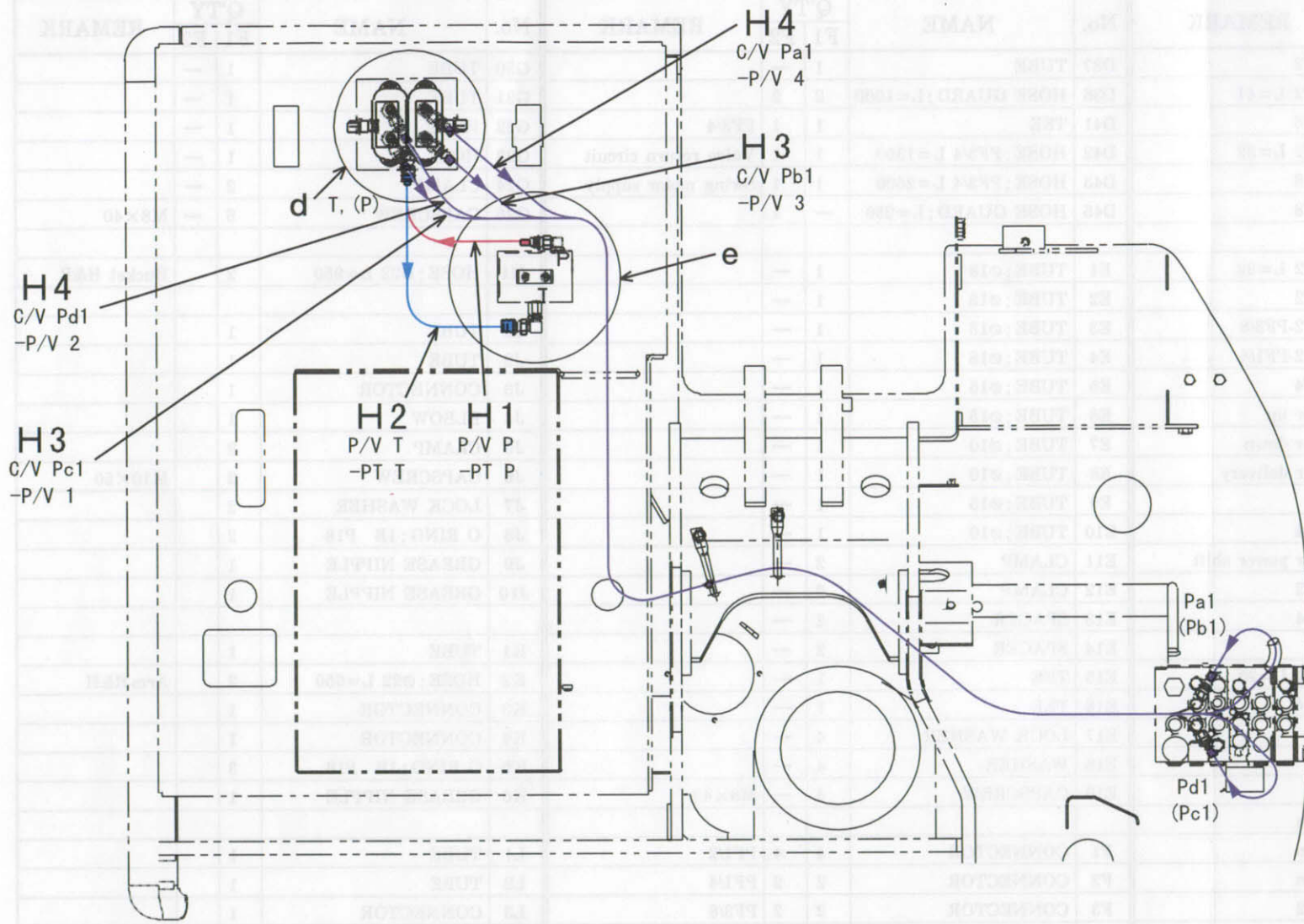
- 1) The oil delivered by P2 pump flows into travel straight section through C/V(2) P2 port, and branches into by-pass circuit and parallel circuit. However since the arm spool is moved and by-pass circuit is closed, the oil opens load check valve and flows into arm spool.
- 2) On the other hand, the oil delivered by P1 pump passes through C/V(2) P1 port and flows into travel straight section, and branches into by-pass circuit and parallel circuit. However, since P1 by-pass cut valve is switched and low pressure circuit is closed, the oil opens load check valve and conflues with oil delivered from load check valve on P2 parallel circuit, and flows into arm spool.
- 3) Then, the conflued oil is fed into arm cylinder H side through C/V(2) C3 port from arm spool.
- 4) In addition, the return oil from arm cylinder R side flows into arm lock valve through D3 port, but since the arm lock valve is open, it flows into arm spool.
- 5) Then, the oil passes through orifices on arm spool and returns into tank while restricting.



Arm circuit : Arm in(digging) operation, conflux function

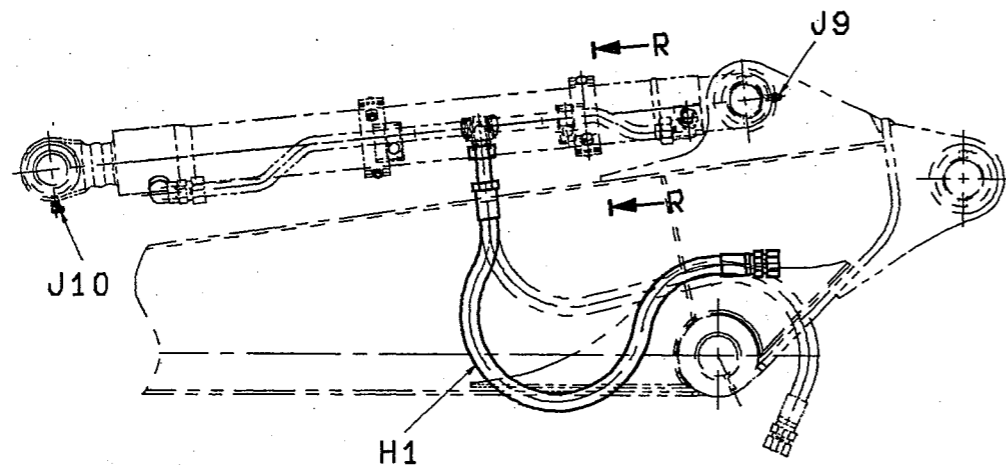
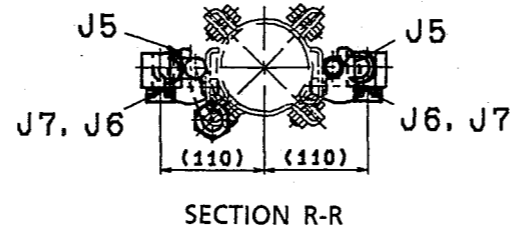
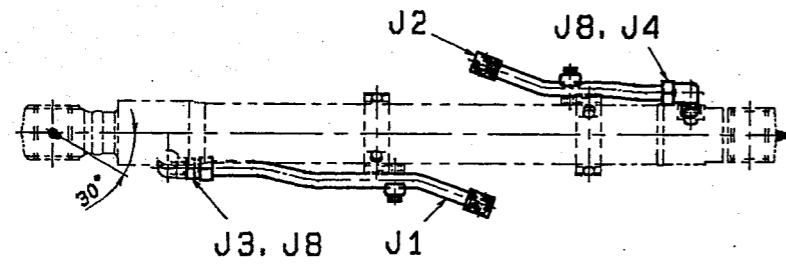
NOTE

1.() ON THE VALVE. CONTROL SHOWS LOWER SIDE PORT IN THE FRONT VIEW.

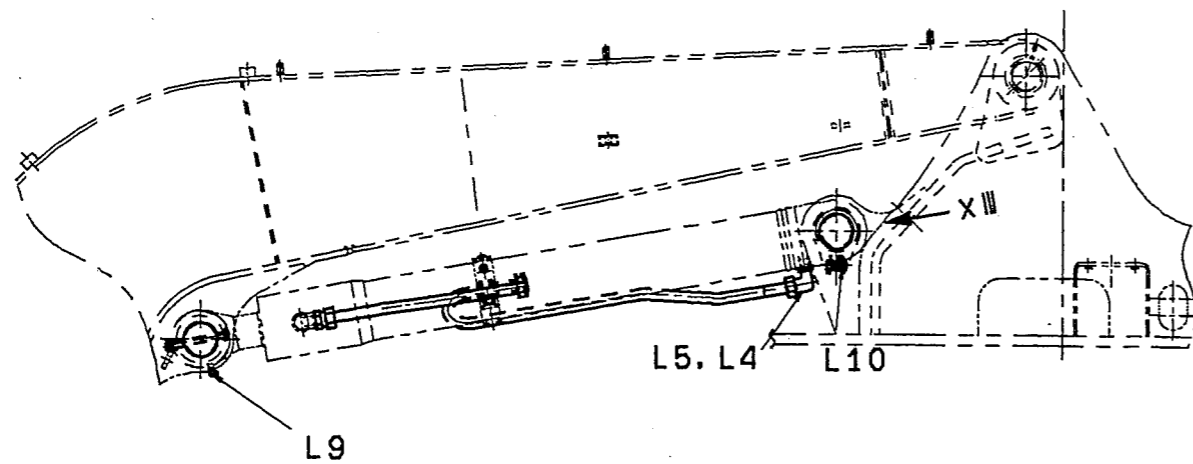
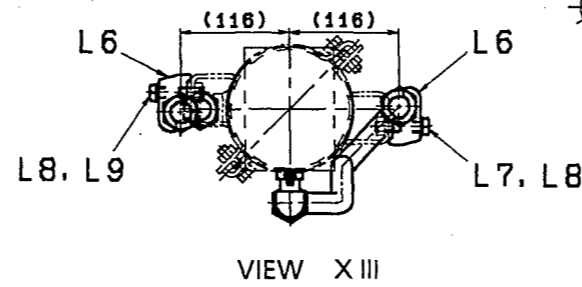
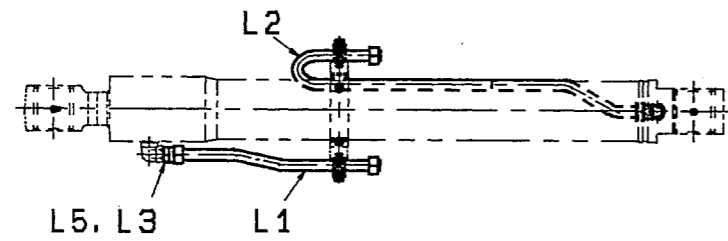


ATTACHMENT PIPING

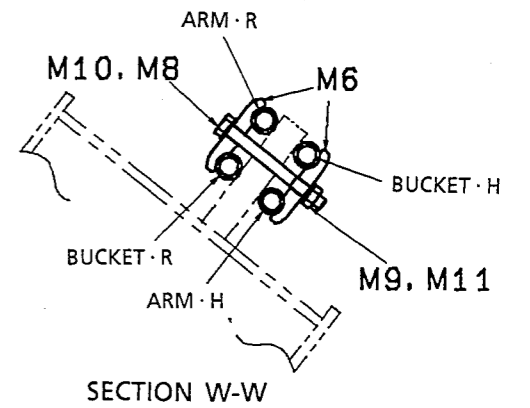
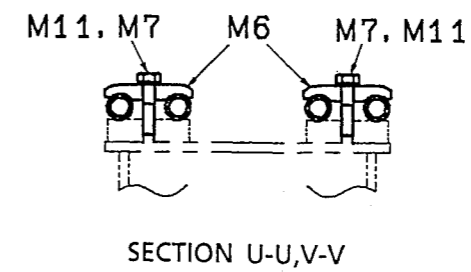
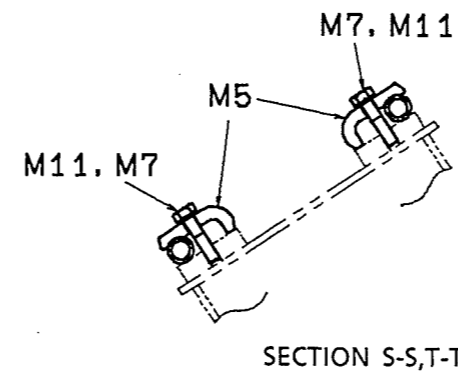
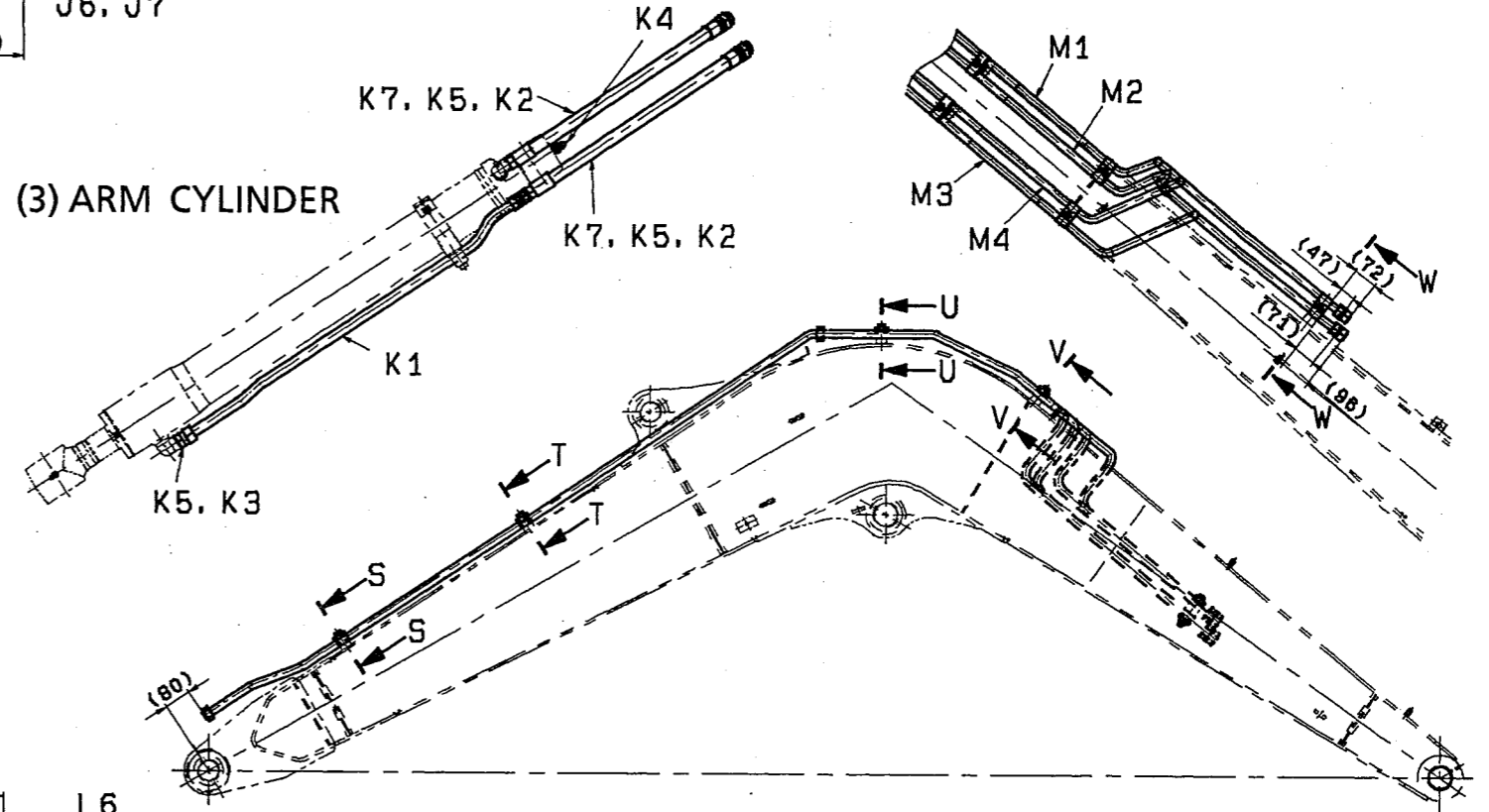
(1) BUCKET CYLINDER

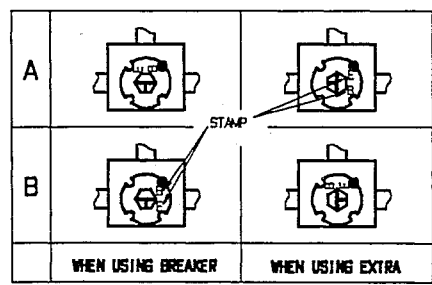
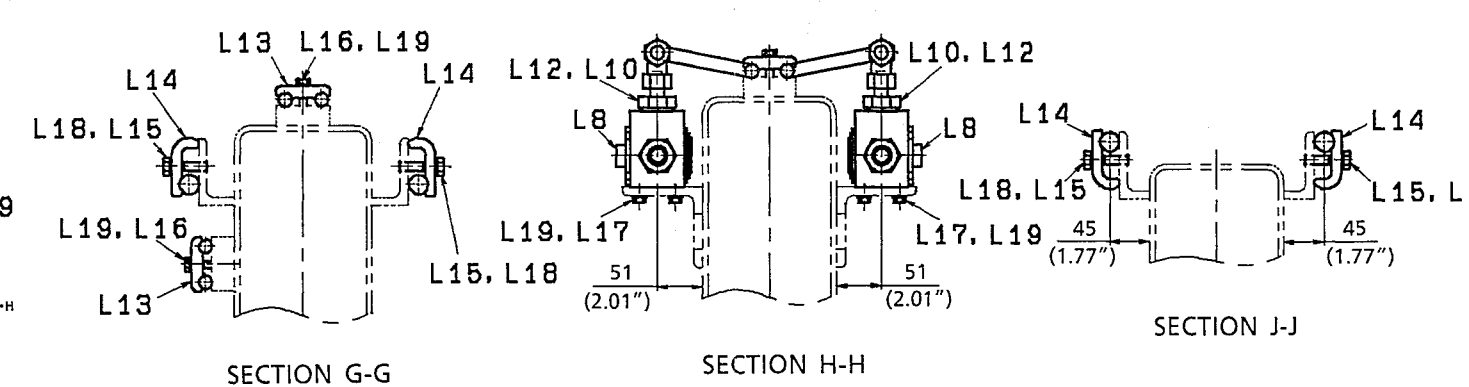
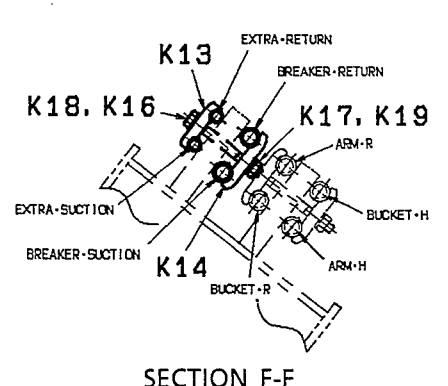
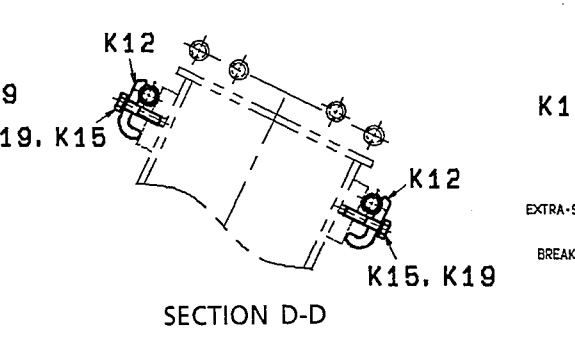
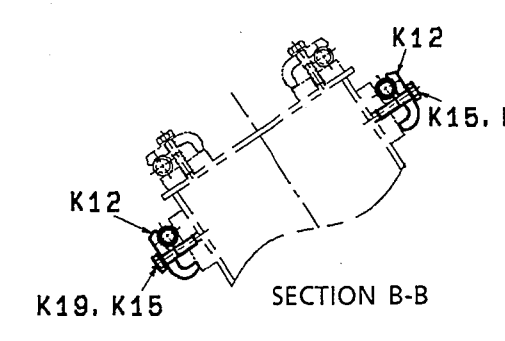
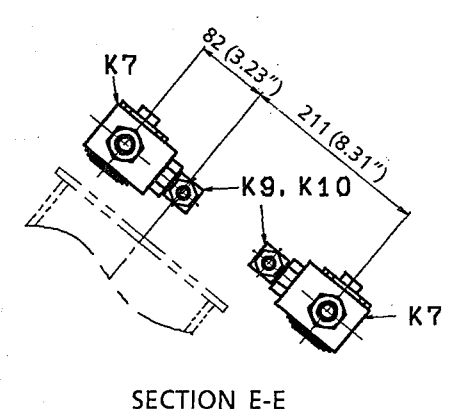
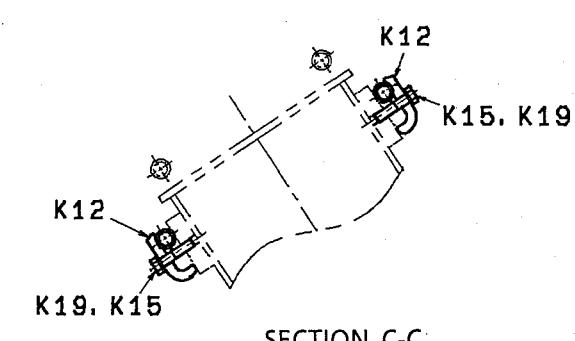
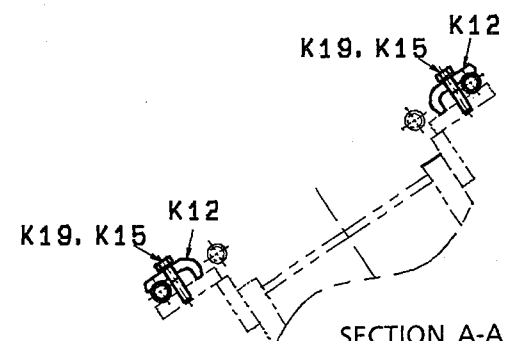
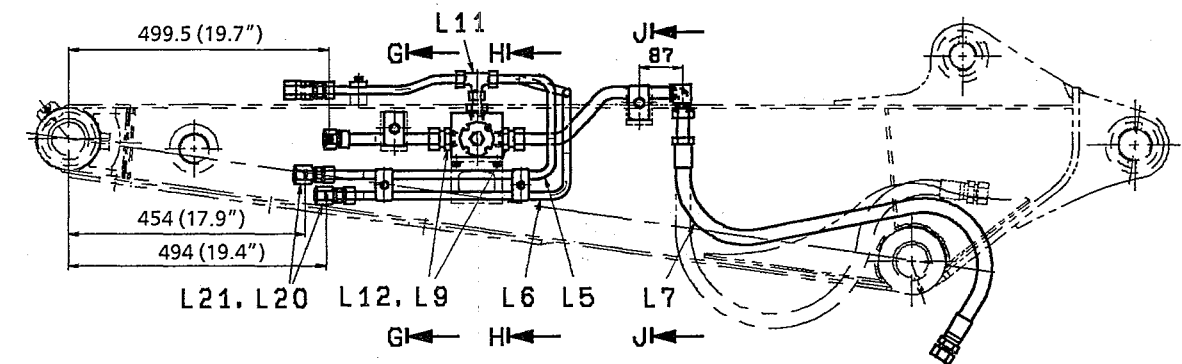
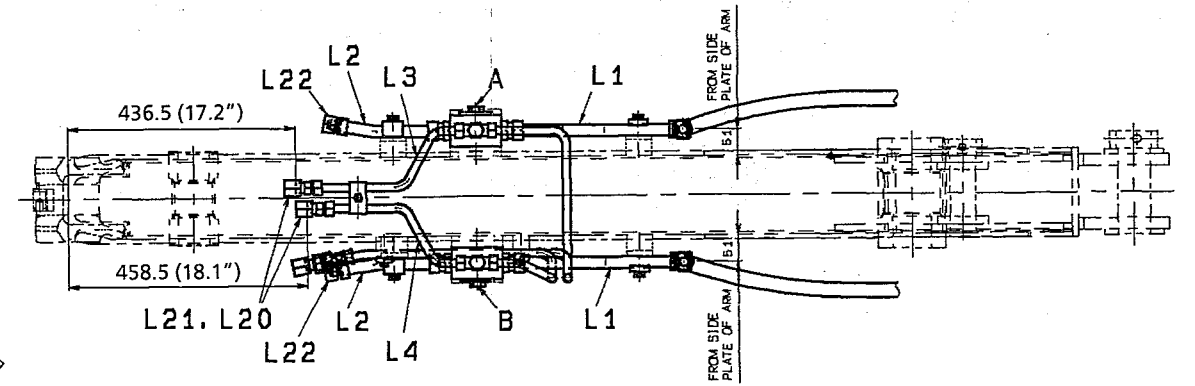
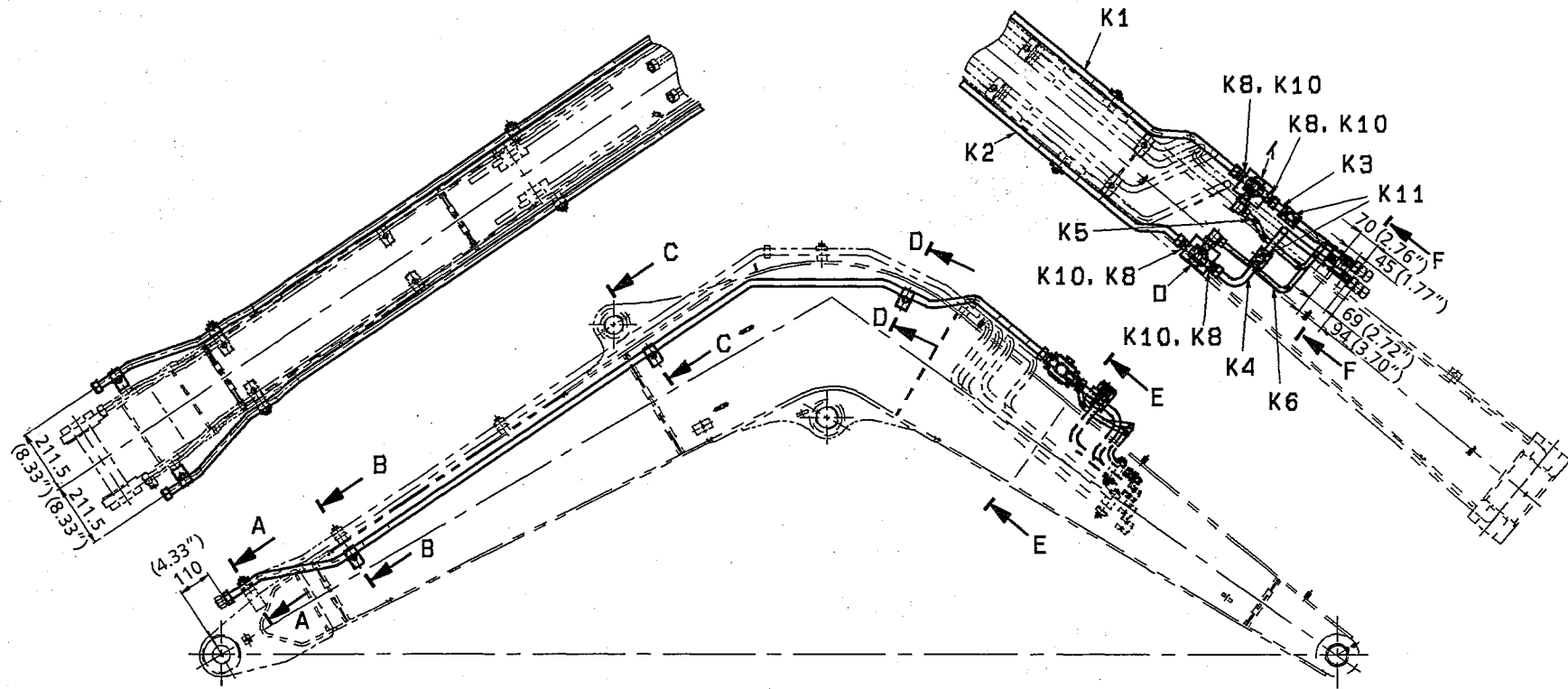


(2) BOOM CYLINDER



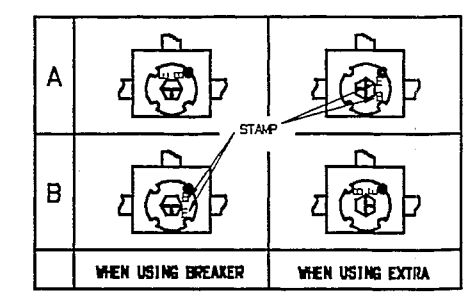
(3) ARM CYLINDER





HOW TO CHANGE THE SELECTOR VALVE

NOTES
 APPLY LOCKTITE #242 AT THE SETTING BOLTS OF CLAMP.
 TIGHTENING TORQUES FOR M-THREADS
 THREADS SIZE TIGHTENING TORQUES
 M 8 83.8N·m (3.4kgf·m)
 M10 88.7N·m (6.7kgf·m)
 TIGHTENING TORQUES FOR PF, PT-THREADS
 THREADS SIZE TIGHTENING TORQUES
 1/2 108N·m (11.0kgf·m)
 3/4 162N·m (16.5kgf·m)
 TIGHTENING TORQUES FOR NUTS AND SLEEVES
 THREADS SIZE TIGHTENING TORQUES
 #18x2.0 118N·m (12.0kgf·m)
 #22x3.0 216N·m (22.0kgf·m)
 PAY ATTENTION TO DROPPING OFF O-RING AT ASSEMBLING.



HOW TO CHANGE THE SELECTOR VALVE

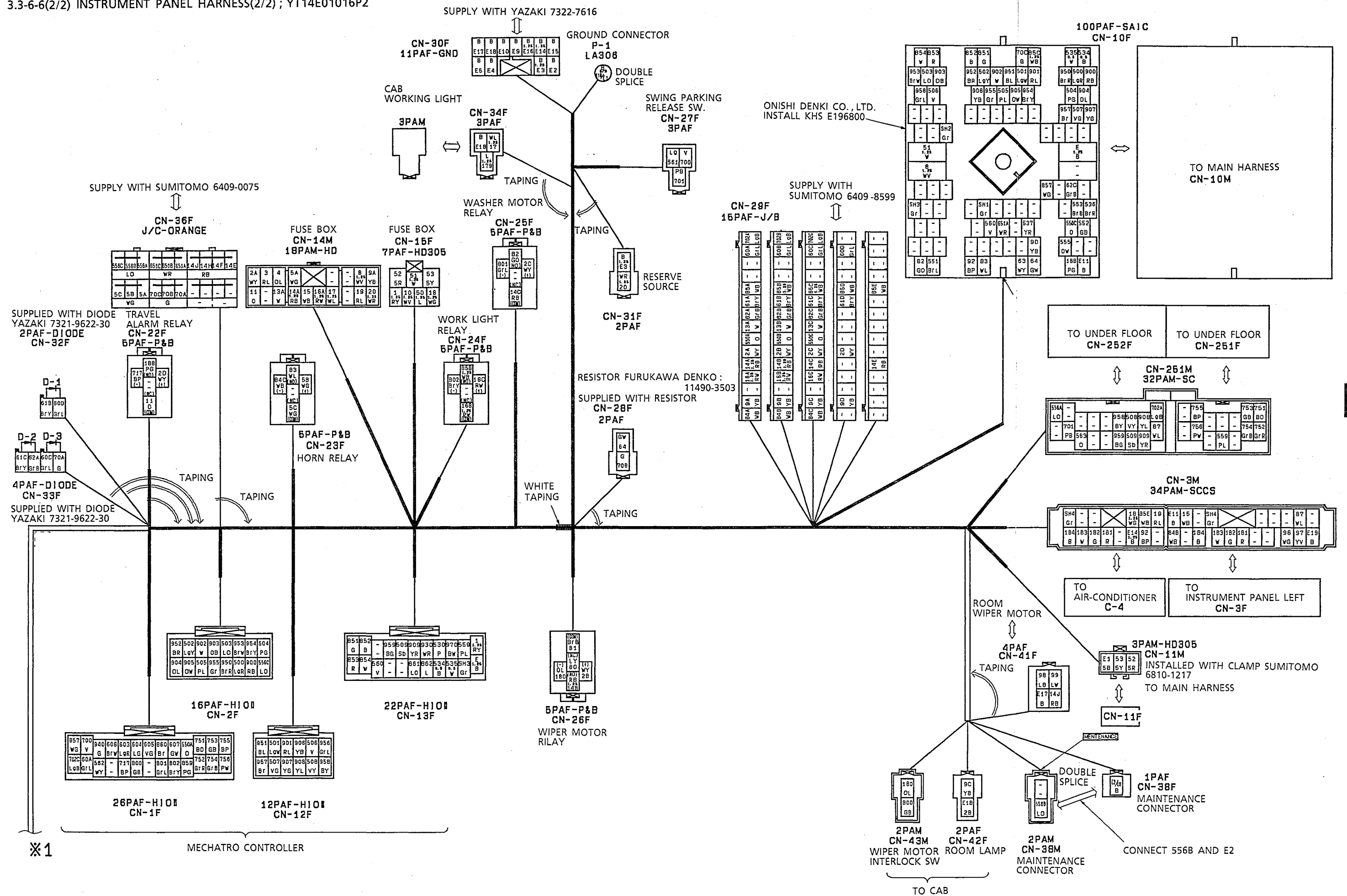
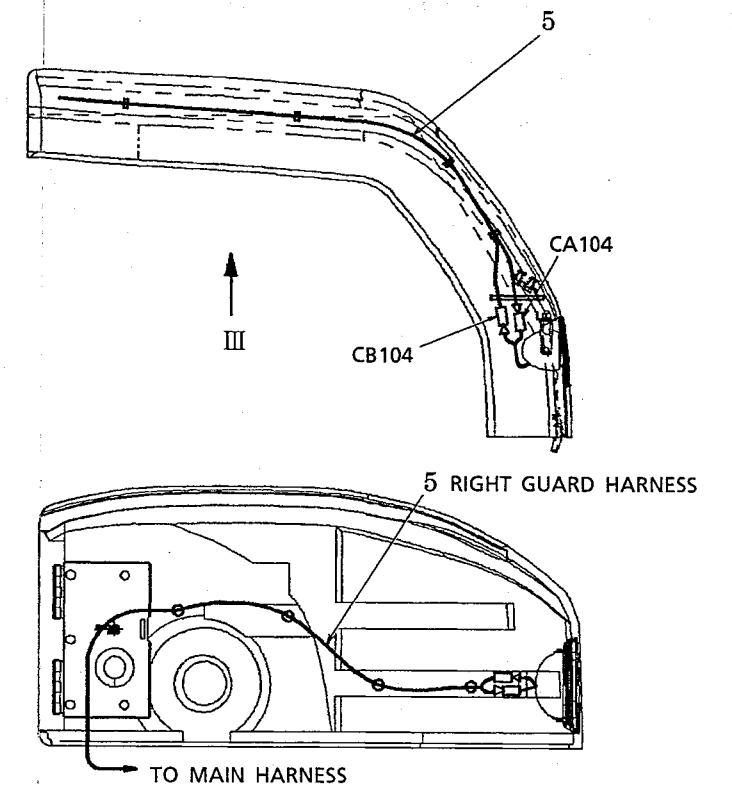
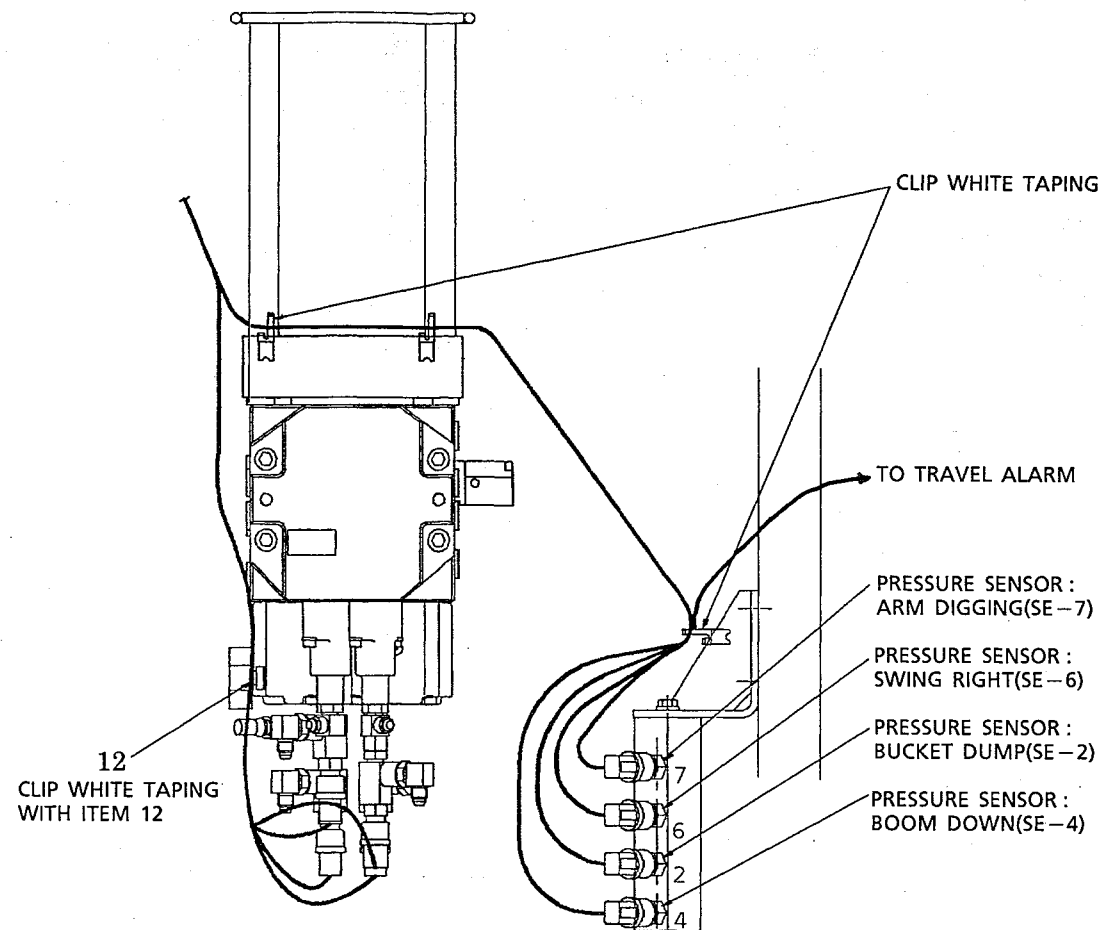
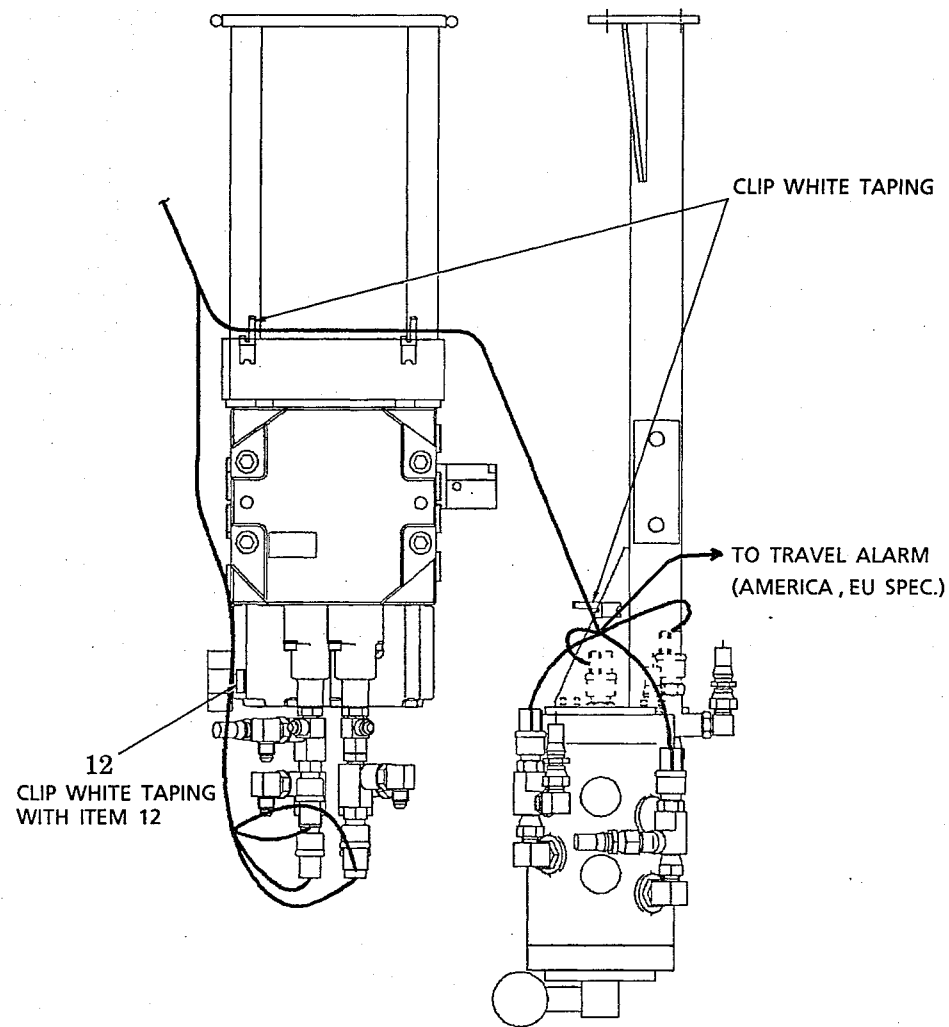
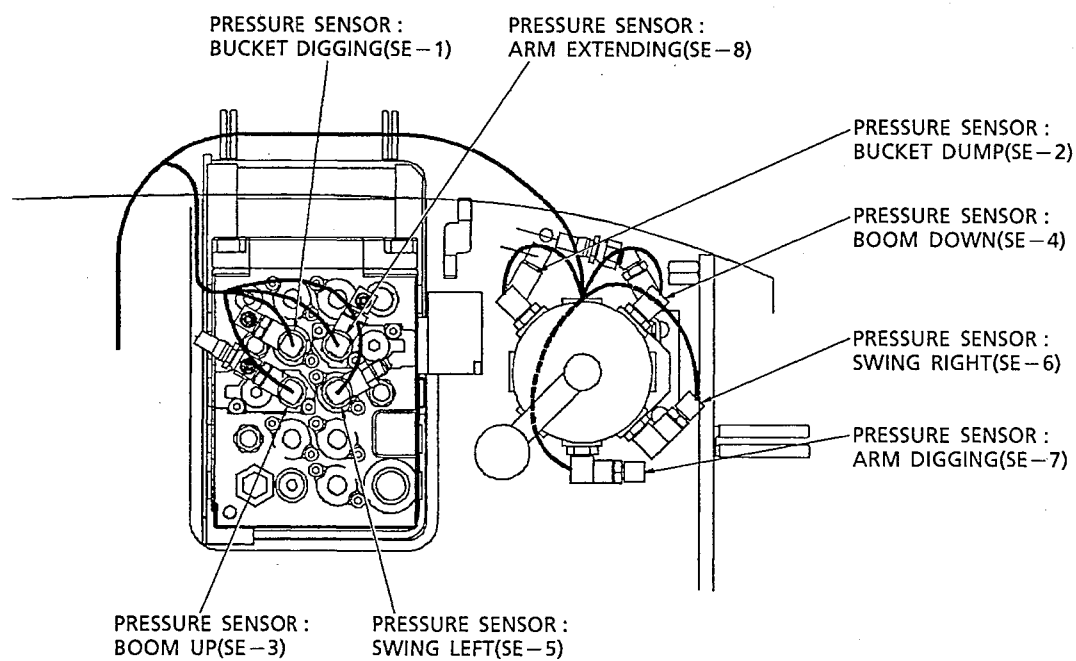


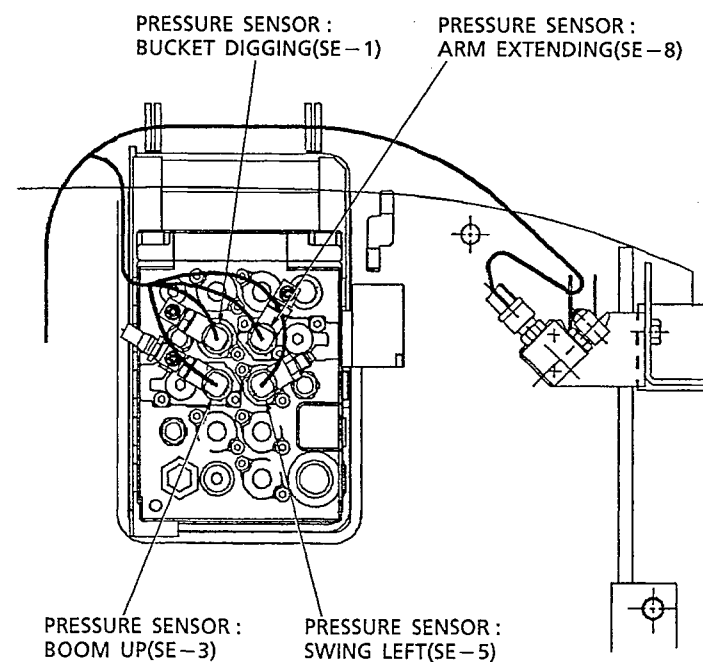
Fig. 3(2/2) Instrument panel harness



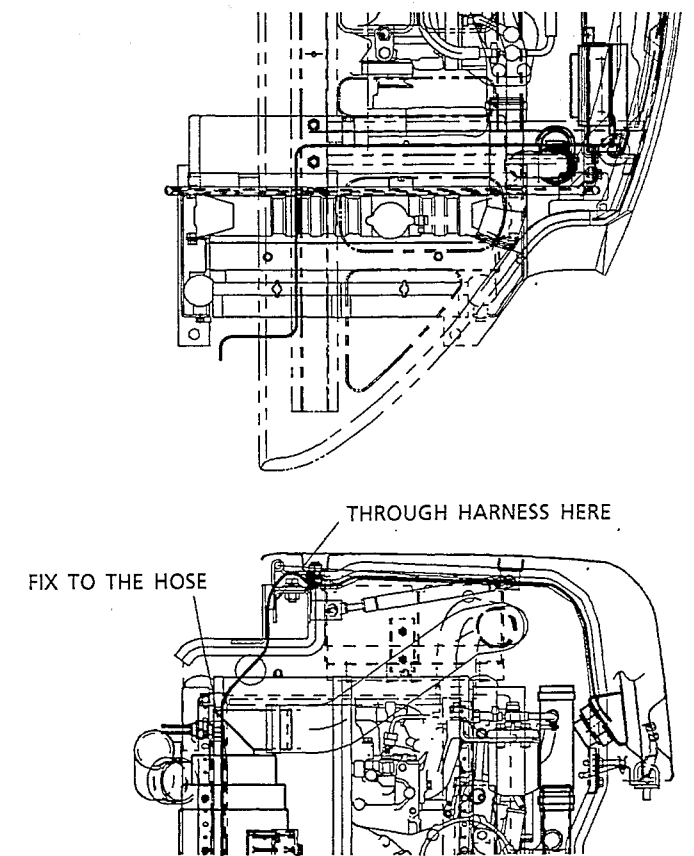
DETAIL OF RIGHT GUARD (VIEW III)



DETAIL OF PRESSURE SENSOR (CASE OF MULTI)



DETAIL OF PRESSURE SENSOR (CASE OF MULTILESS)



DETAIL ENGINE ROOM LIGHT HARNESS

Fig. 8(2/2) Upper harness

3.9 CAB HARNESS ASSY

(1) Without power window

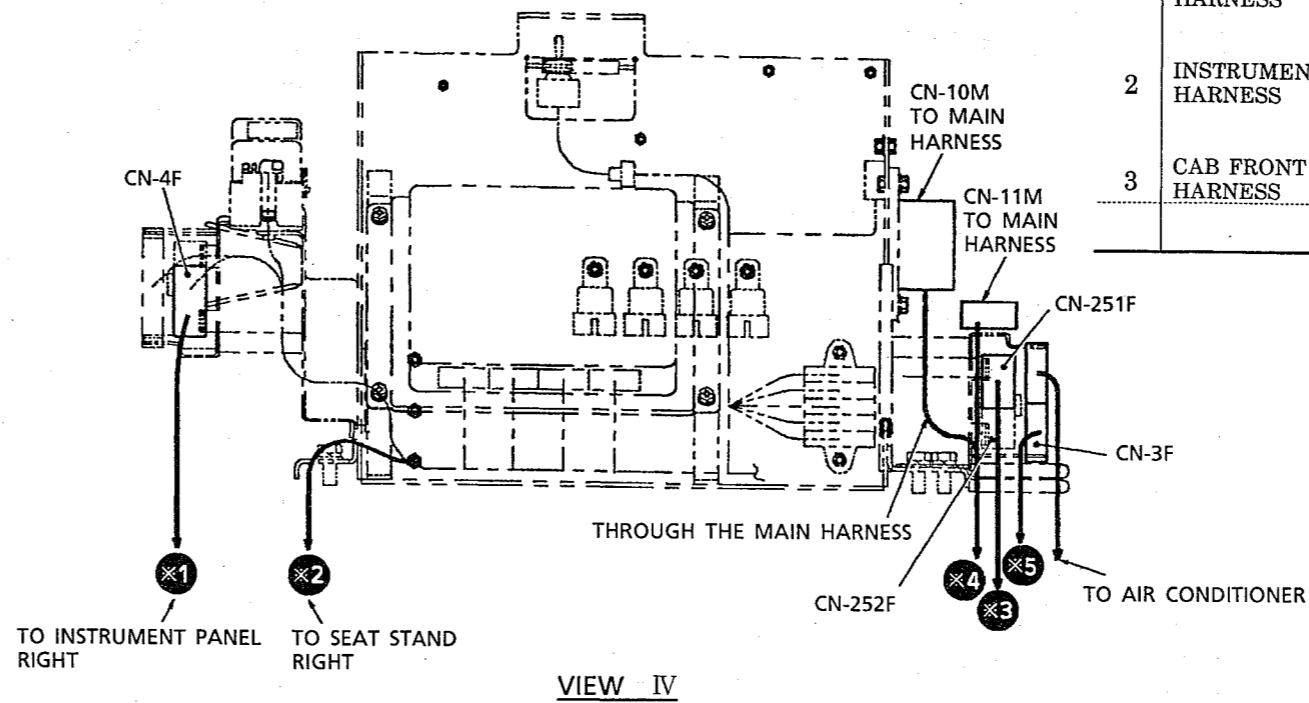
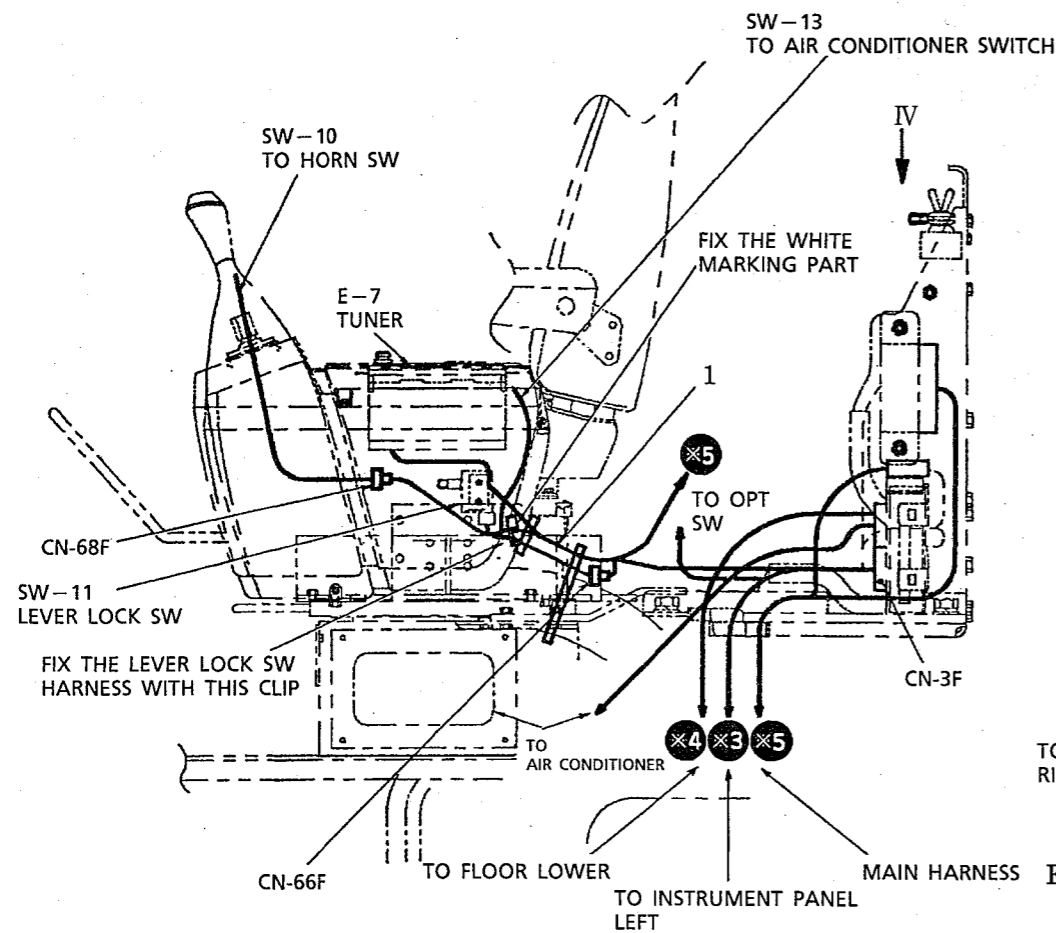


Fig. 24(1/2) Cab harness (without P/W)

CAB HARNESS ASSY (EXPORT)		YT14E00006F1	↓		
(AMERICA)		YT14E00008F1		↓	
(EU)			↑		↓
No.	NAME	PART No.	EXP	KAI	EU
1	INSTRUMENT LEFT HARNESS	YT14E01011P2	1	—	—
		YT14E01020P1	—	1	1
2	INSTRUMENT RIGHT HARNESS	YT14E01012P1	1	—	—
		YT14E01021P1	—	1	1
3	CAB FRONT RIGHT HARNESS	YT14E01013P1	1	—	—
		YT14E01022P1	—	1	1

CONNECTORS SELECTION TABLE

CONNECTOR NAME (PIN NUM)	MAKER	PART NO	
		HOUSING	TERMINAL
2PAF	YAZAKI	7123-2228	7116-2090
6PAF	YAZAKI	7123-2262	7116-2090
8PAF-PA	YAZAKI	7119-3090	7116-1050
J/C-ORANGE	SUMITOMO	6400-0016	8240-4422
		6409-0075	
20PAF-SCCS	AMP	316010-2	176289-1 (070M PLATING)
2PAF-HM	SUMITOMO	8090-1001	8240-4422
8PAF-070	AMP	176113-8	173891-2
2PAF-BLACK	YAZAKI	7123-2228-90	7116-2090

3.9-1 INSTRUMENT PANEL LEFT HARNESS ; YT14E01011P2 (EXPORT SPEC.)

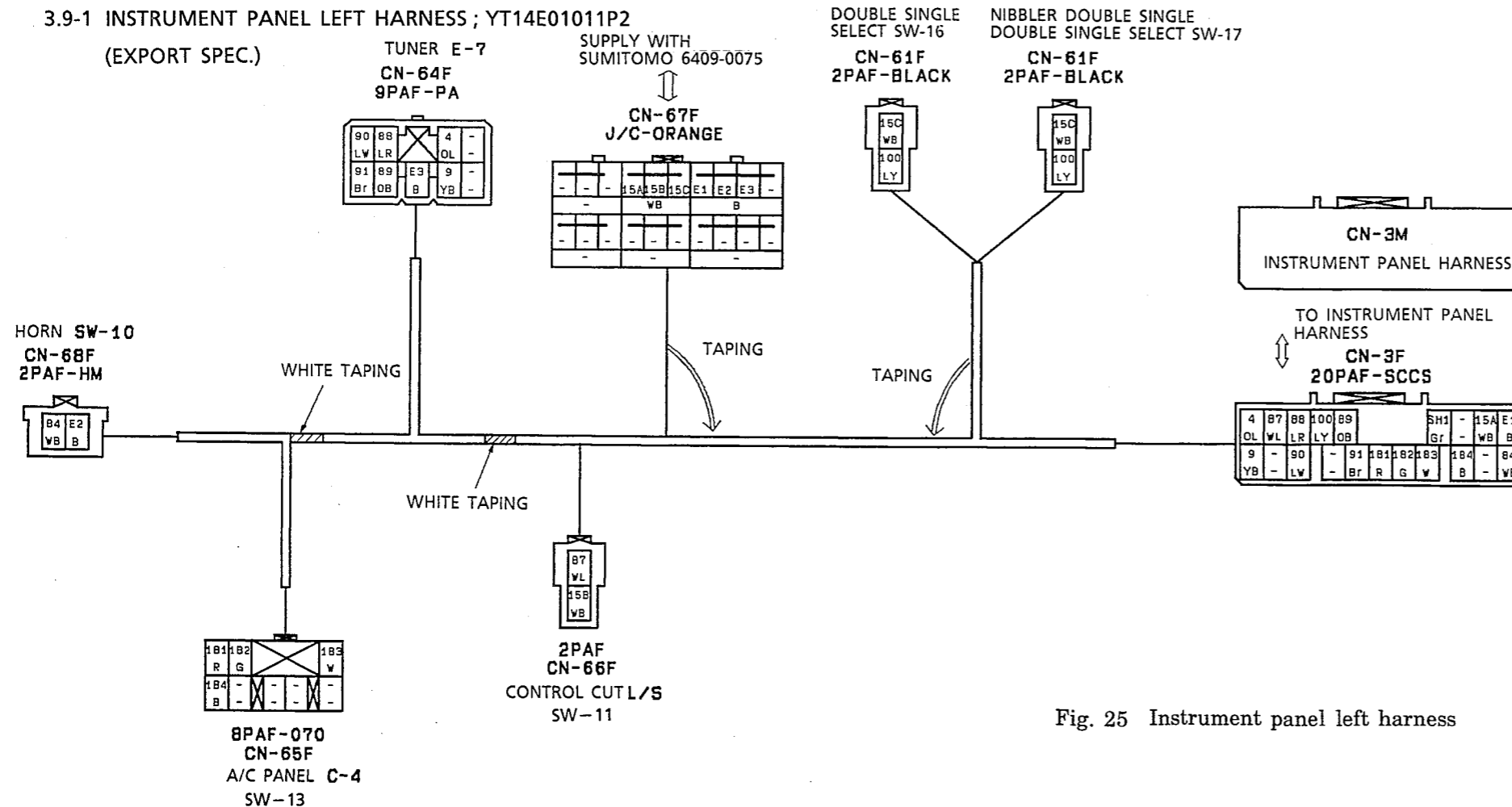
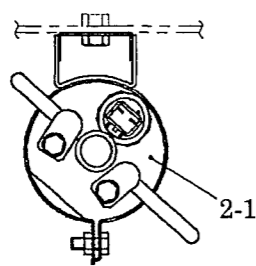
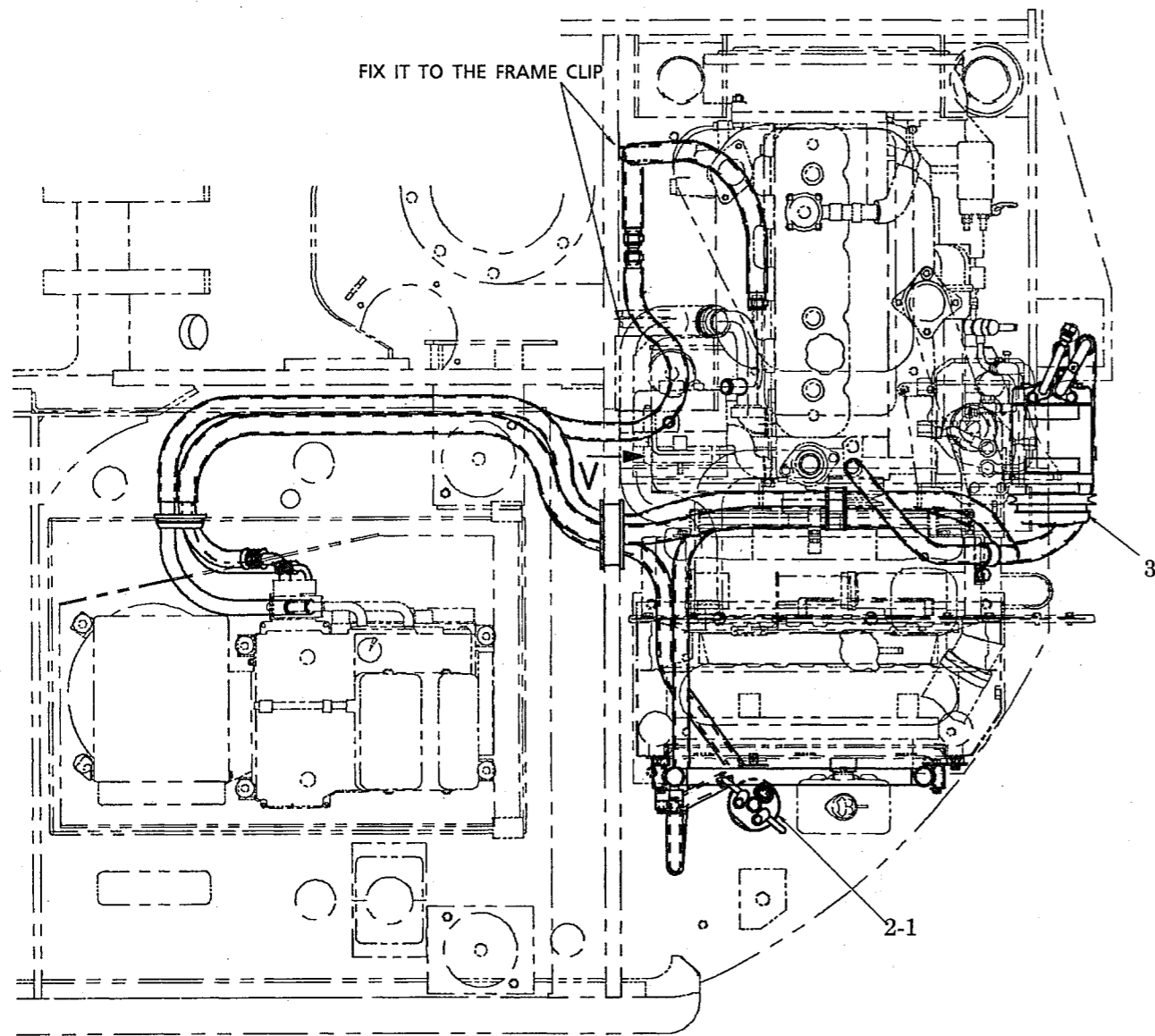


Fig. 25 Instrument panel left harness

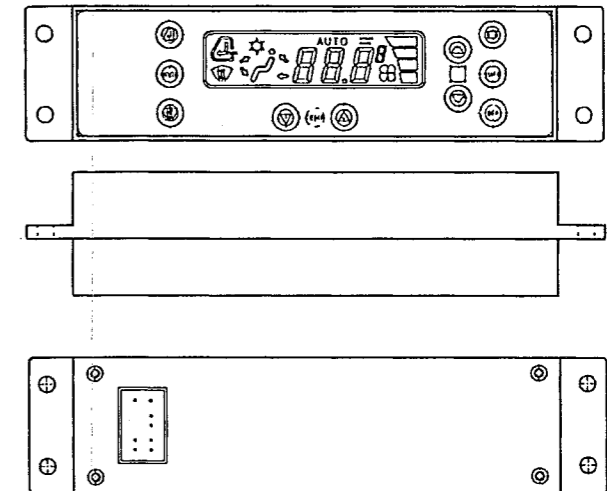
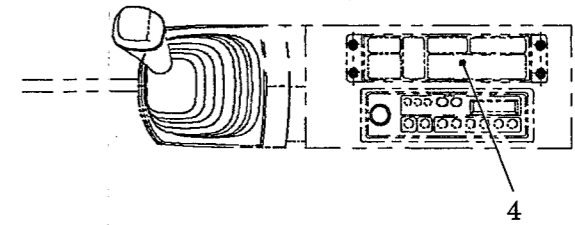
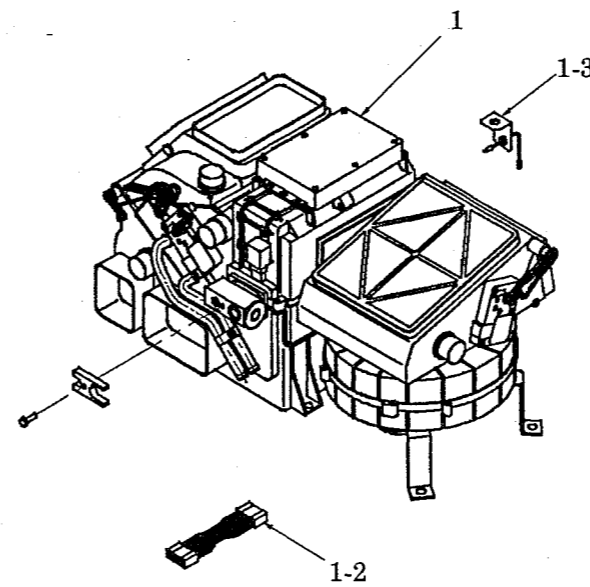
WIRE NO	WIRE COLOR	WIRE SIZE	FROM	CONNECTION	TO	FUNCTION
4	OL	AVSS0.75sq	CN-3F	—	CN-64F	FUSE BOX → TUNER
9	YB	AVSS0.75sq	CN-3F	—	CN-64F	FUSE BOX → TUNER
15A	WB	AVSS0.75sq	CN-3F	—	CN-67F	FUSE BOX → J/C-ORANGE
15B	WB	AVSS0.75sq	CN-66F	—	CN-67F	CONTROL CUT LIMIT SW → J/C-ORANGE
15C	WB	AVSS0.75sq	CN-61F	—	CN-67F	SINGLE SELECT SW → J/C-ORANGE
84	WB	AVSS0.75sq	CN-3F	—	CN-68F	HORN RELAY → HORN SW
87	WL	AVSS0.75sq	CN-3F	—	CN-66F	OPERATING LEVER LOCK SOL. → CONTROL CUT LIMIT SW
88	LR	AVSS0.75sq	CN-3F	—	CN-64F	SPEAKER RIGHT → TUNER
89	OB	AVSS0.75sq	CN-3F	—	CN-64F	SPEAKER RIGHT → TUNER
90	LW	AVSS0.75sq	CN-3F	—	CN-64F	SPEAKER LEFT → TUNER
91	Br	AVSS0.75sq	CN-3F	—	CN-64F	SPEAKER LEFT → TUNER
100	LY	AVSS0.75sq	CN-3F	—	CN-61F	SINGLE SELECT SOL. → SINGLE SELECT SW
181	R	4-CORE SHIELDED CABLE	CN-3F	—	CN-65F	A/C CONTROLLER → A/C SW PANEL
182	G		CN-3F	—	CN-65F	A/C CONTROLLER → A/C SW PANEL
183	W		CN-3F	—	CN-65F	A/C CONTROLLER → A/C SW PANEL
184	B		CN-3F	—	CN-65F	A/C CONTROLLER → A/C SW PANEL
SH1	Gr		CN-3F	—	CN-65F(OPEN)	SHIELD
E1	B	AVSS0.75sq	CN-3F	—	CN-67F	EARTH → J/C-ORANGE
E2	B	AVSS0.75sq	CN-68F	—	CN-67F	HORN SW → J/C-ORANGE
E3	B	AVSS0.75sq	CN-64F	—	CN-67F	TUNER → J/C-ORANGE

3.15 AIR CODITIONER(A/C)



DETAIL OF RECEIVER TANK SETTING PORTION

Fig. 50 Air conditioner



DETAIL OF PANEL

3.16-3 AIR COMPRESSOR ; YT19V00001F1

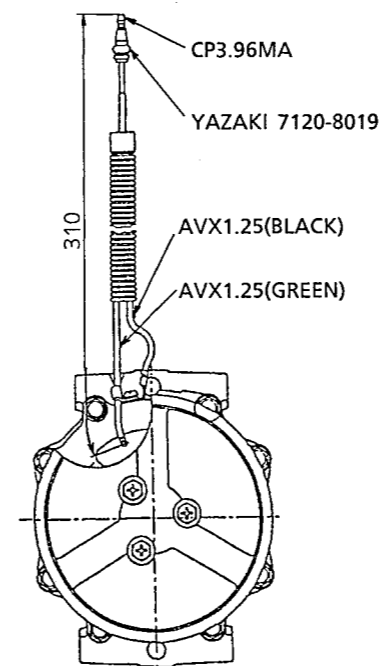


Fig. 51 Detail of compressor wiring

AIR CONDITIONER(A/C)		YT20M00008F1	
No.	NAME	PART No.	Q'TY
1	A/C ASSY	YT20M00009F1	1
1-1	A/C CONDITIONER	YT20M00004F1	1
1-2	A/C HARNESS	YT20M00009S002	1
1-3	SENSOR	YT52S00003F1	1
2	AIR DRYER ASSY	YT96V00001F2	1
2-1	RECEIVER TANK	YT54S00002P1	1
3	AIR COMPRESSOR	YT91V00001F1	1
4	PANEL	YT20M01079F1	1

(4) Regulator group

1) Summary (See Fig.1-5 and 1-6.)

The regulator group consists of feedback lever (611), compensating piston (621), springs (625, 626), pilot sleeve (651), and pilot spool (652). Thus it makes up a hydraulic servo mechanism consisting of servo piston (532) and a positional feedback.

The delivery pressures P1, P2 of the pump are combined in the regulator and changes the delivery rate of the pump according to the level of the pressure as shown in Fig.1-5. For this reason, the input torque is kept nearly constant which realizes a total horsepower control, in order to prevent the engine from being overloaded. This pump system is equipped with one or two gear pumps at its rear end. The load pressures P3, Pf of the pump enables power shift control that shifts the horsepower set as illustrated in the figure on the right.

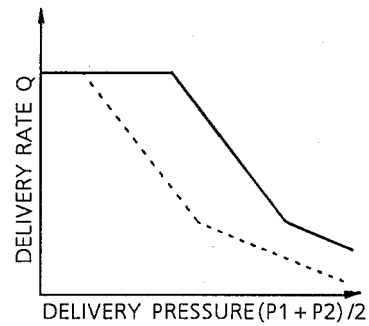


Fig. 1-5 Power shift control chart

2) Function of added full horsepower control (See Fig.1-6.)

If pump delivery pressure P1 or delivery pressure P2 rises, the mean pressure $(P1+P2)/2$ acts upon the stepped section of compensating piston (621) by the action of four orifices (508). In this case, spool (652) is pushed to the right and moves till the action of spring (625) and spring (626) balances the hydraulic force. As the spool moves to the right, the oil path to the larger diameter part of servo piston (532) consisting of the sleeve and the spool opens. This admits the delivery pressure to push the spool to the left. The delivery pressure enters the check valve [seat (541), stopper (543), and ball (545)] from which the higher of the pressures P1, P2 is put out selectively to the smaller diameter side of the servo piston so that the delivery pressure is admitted at all times. In the meantime, swash plate (212) and servo piston (532) are linked together by tilting pin (531). This decreases the tilting angle which in turn decreases the delivery rate of the pump, in order to prevent the engine from being overloaded. The action of the servo piston is transmitted to feedback lever (611) via the feedback pin (548). The feedback lever turns on pin (653) that is fixed to casing (271) and moves sleeve (651) to the right. The sleeve

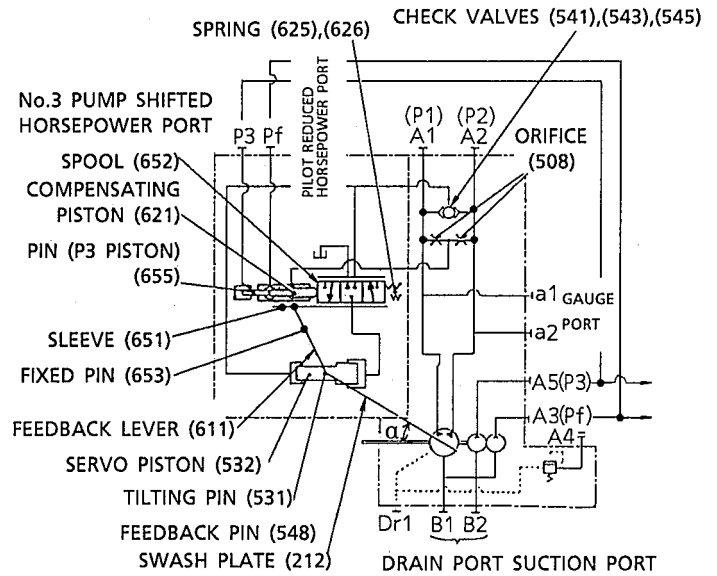


Fig. 1-6 Functional explanation of regulator

moves till the opening of the path to the larger diameter part of the servo piston closes and stops just when the opening is closed. If the pump delivery pressures P1, P2 decrease, the spool is pushed back by the action of springs (625, 626). This connects the oil path for the larger diameter of the servo piston to the tank. This moves the servo piston to the right by the oil pressure from the smaller diameter side. The result is that the tilting angle (α) increases which in turn increases the delivery rate of the pump. Then the feedback lever turns on the pin which moves the sleeve to the left till it closes the opening of the spool-sleeve.

3. PILOT VALVE (TRAVEL)

3.1 OUTLINE

(1) Outside view

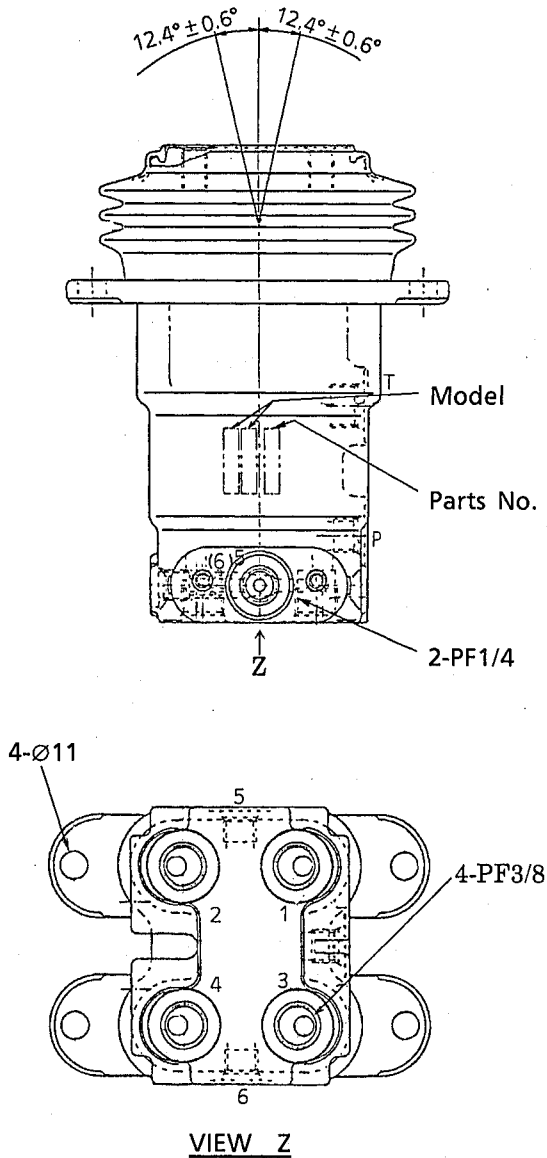


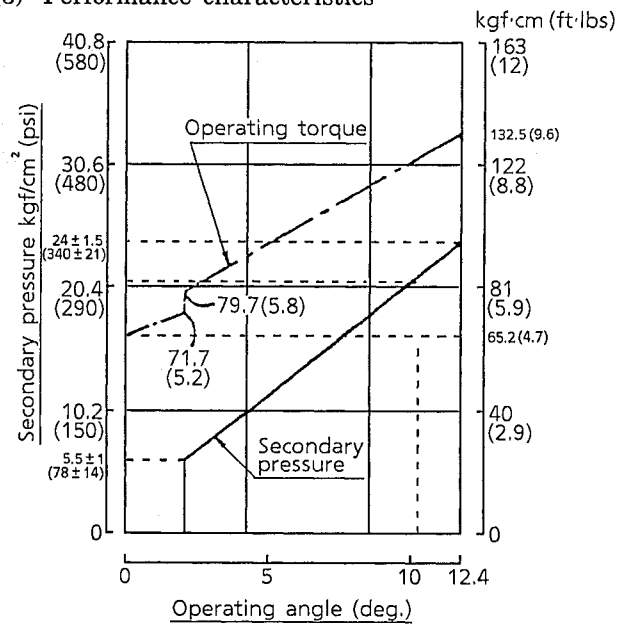
Fig. 3-1 Out side view of travel pilot valve

(2) Specification

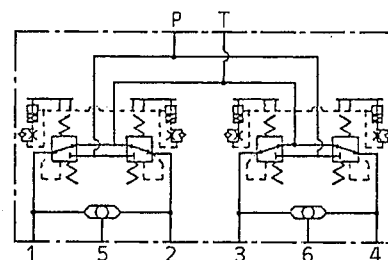
Item	Specification
Parts No.	YT30V00009F1
Type	RCVD8C
Max. primary pressure	50kgf/cm ² (710psi)
Primary pressure	50kgf/cm ² (710psi)
Rated flow	10ℓ/min (2.6gal/min)
Weight	Approx. 10kg (22 lbs)

Port size	Tightening torque kgf·m (ft·lbs)	Port Name	Function
PF3/8	7.5 ± 0.5 (54 ± 3.6)	1	LH travel reverse port
		2	LH travel forward port
		3	RH travel reverse port
		4	RH travel forward port
		T	Tank port
PF1/4	3.7 ± 0.2 (27 ± 1.4)	5	Travel pressure sensor port
		6	Travel pressure sensor port
		P	Pilot primary pressure port

(3) Performance characteristics



Control diagram



Hydraulic diagram

4.4 FUNCTIONAL EXPLANATION

(1) Neutral

The oil discharged from port A1 of the hydraulic pump enters port P1. It then flows into the control valve (C/V), passes through the land of travel straight spool (7) and flows into the P1 parallel path (53) and the travel spool. In the neutral position, the bypass path (52) on the P1 side is not shut off by travel

straight spool (7). Therefore, the oil passes through the travel (right)→boom→bucket→the bypass path (52) of the P1 side of the P1 bypass cut spool, in that order, and flows out of the T1 port past the tank passage (60). (Fig.4-5)

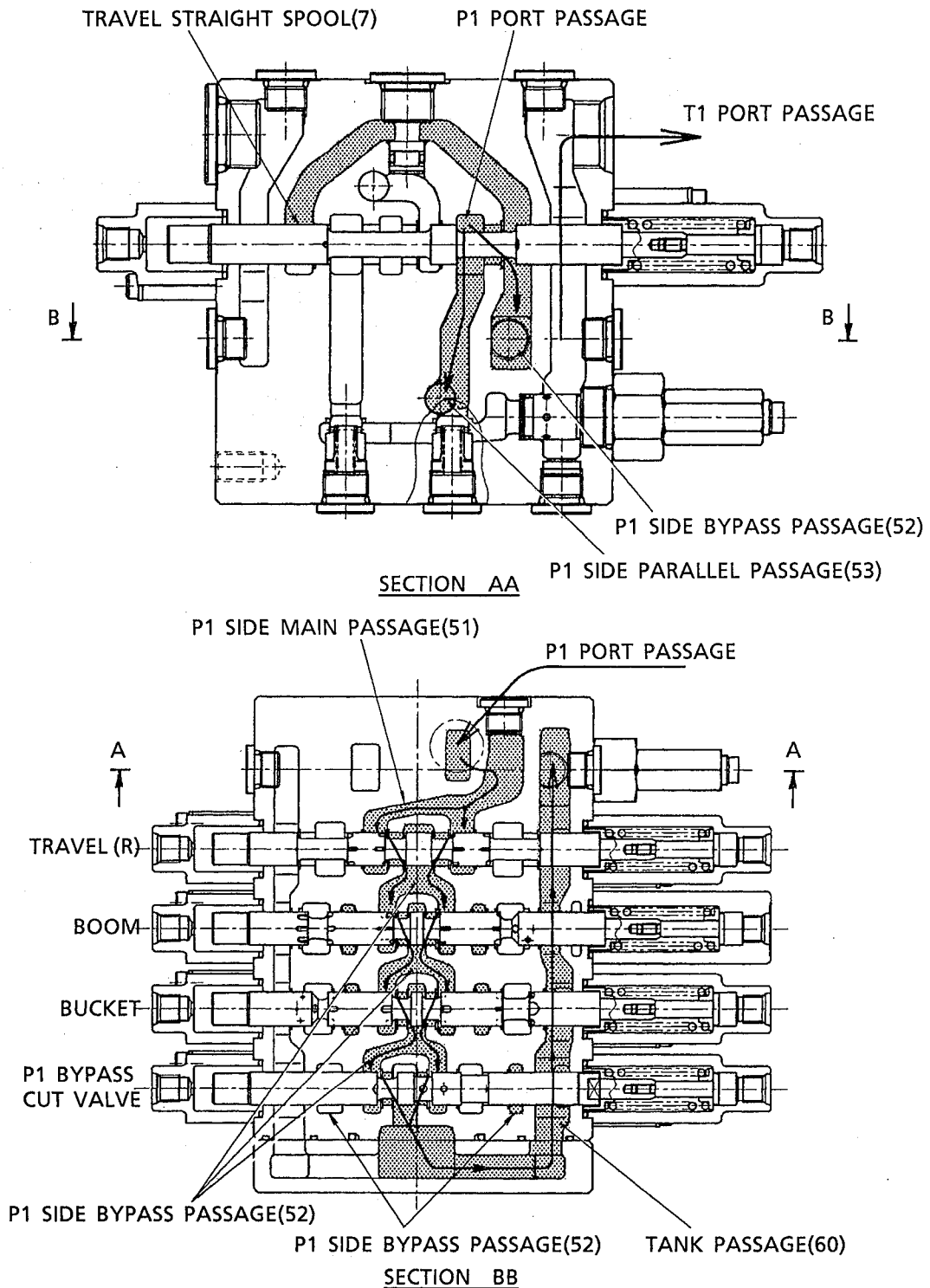


Fig. 4-5 Operation (1) at neutral

(7) Swing operation

1) Swing left operation

If the swing left operation is performed, the secondary pilot pressure from the pilot valve enters the spring chamber of the Pd2 port of the C/V and shifts the swing spool (9).

At the same time, the secondary pressure from the pilot valve enters the Pd2 port through the external piping and flows into the swing preference section via the shuttle valve. (Refer to Fig.4-23 for the swing preference section.)

When the swing spool (9) is shifted, the P2 bypass path (55) is shut off by the swing spool (9). The oil which has flowed in from the P2 port flows into the P2 parallel path (56) provided in the travel straight spool.

Part of the oil passes through the notch in the swing spool (9) and the P2 bypass path (55), and flows out to the tank passage.

Then, the proportionate secondary pressure of the P2 bypass cut solenoid valve shifts the P2 bypass cut spool (14) in the lower stream and cuts off the oil path. This causes all the oil flowing out to the P2 bypass path to be fed to the swing motor, in order to soften the swing speed.

If the swing spool (9) is shifted, the line between the D2 port and the bridge path is opened by the spool notch. As the result, the oil which has flowed into the P2 parallel path (56) passes through the load check valve (21) in the swing select part, and is fed to the swing motor via the bridge path and the D2 port.

In the meantime, the oil which has returned from the swing motor flows into the C2 port and flows into the tank path (60) from the spool notch which is now open as the swing spool (9) is shifted. Consequently, the swing motor rotates counterclockwise.

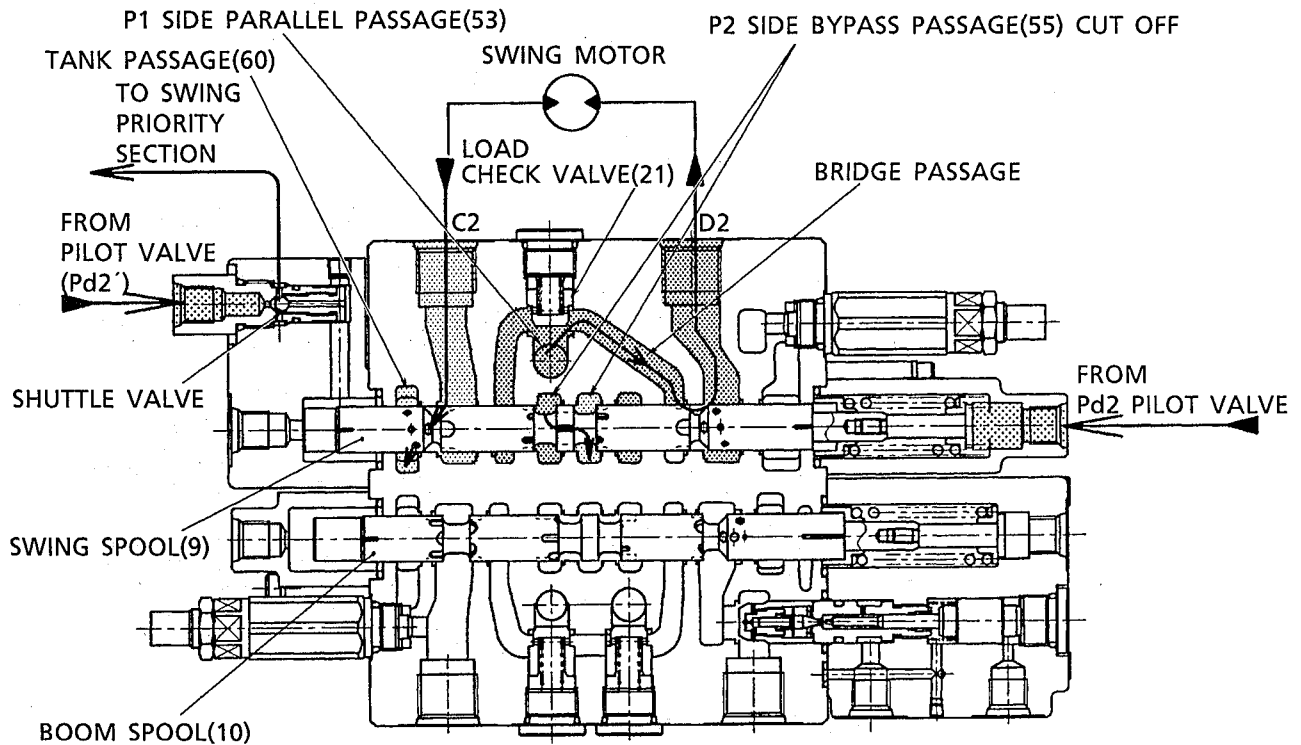


Fig. 4-16 Function at swing left operation

5. SWING MOTOR UNIT

5.1 SPECIFICATION

(1) Appearance

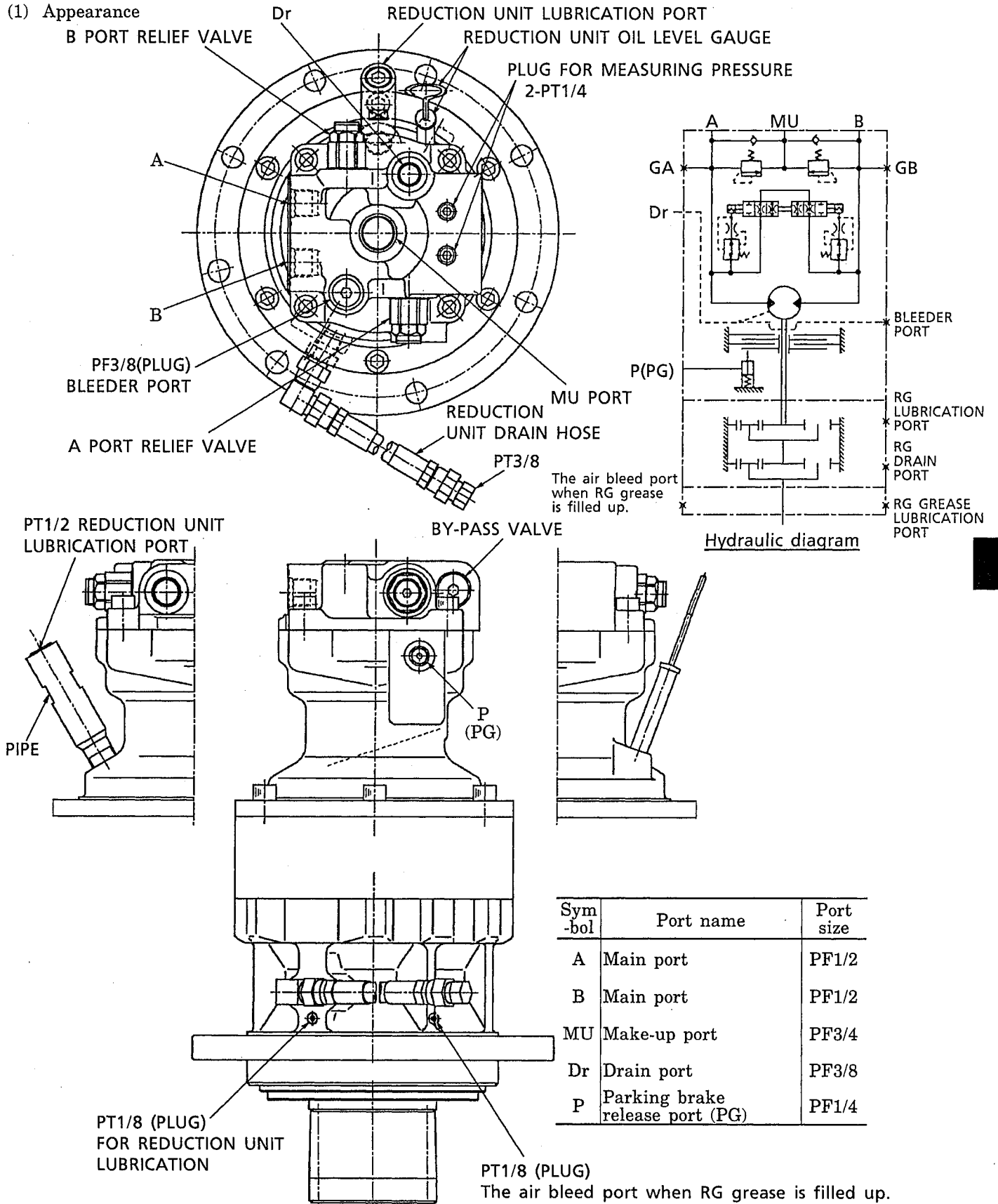


Fig. 5-1 Appearance of swing motor unit

(2) Hydraulic motor

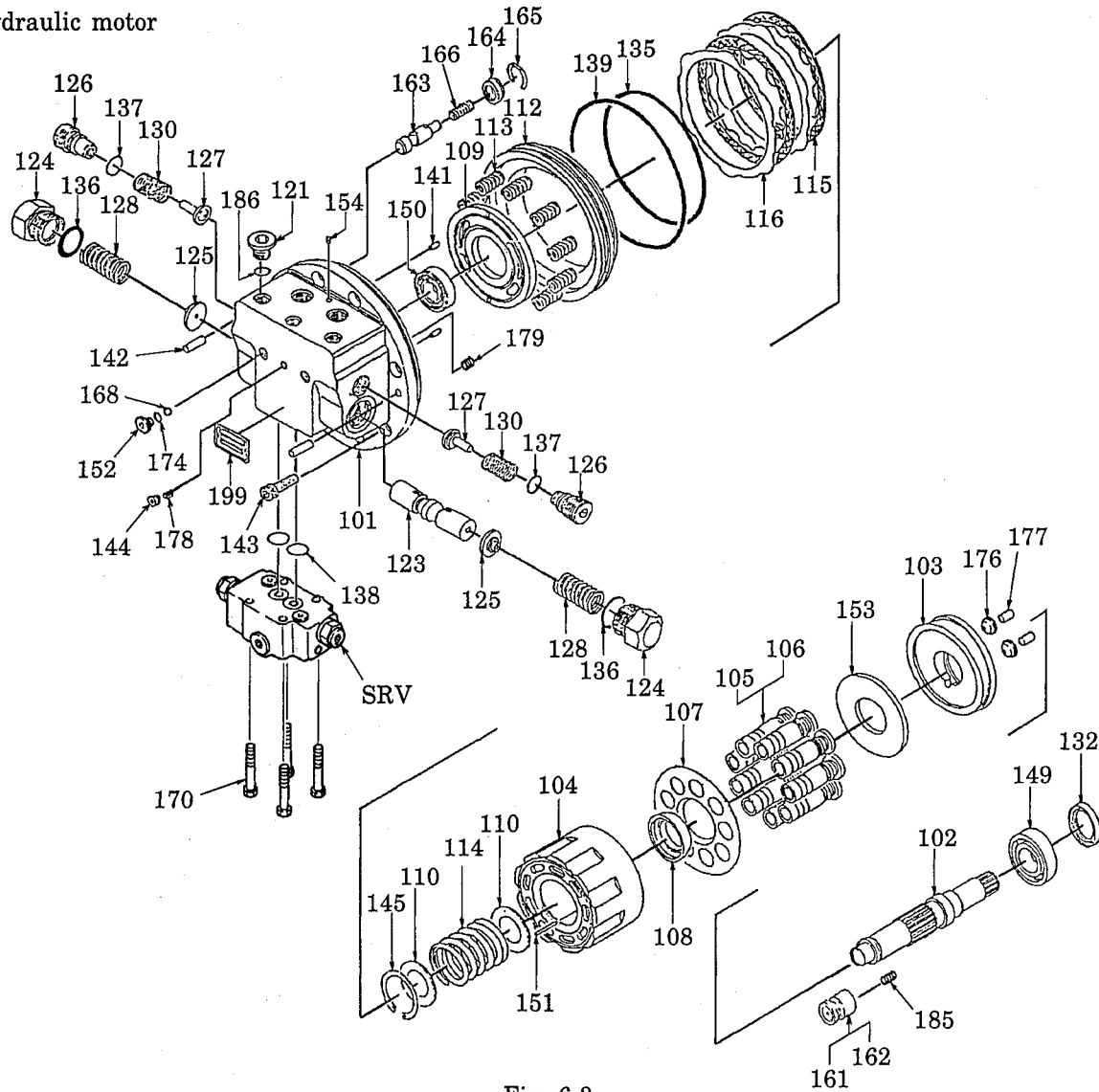


Fig. 6-3

No.	NAME	Q'TY	No.	NAME	Q'TY	No.	NAME	Q'TY
101	REAR FLANGE	1	126	PLUG	2	153	THRUST PLATE	1
102	(DRIVE) SHAFT	1	127	ANTICAVITATION VALVE	2	154	PLUG	7
103	(SWASH) PLATE	1	128	SPRING	2	161	PISTON	1
104	CYLINDER BLOCK	1	130	SPRING	2	162	SHOE	1
105	PISTON	9	132	OIL SEAL	1	163	PILOT VALVE	1
106	SHOE	9	135	O RING	1	164	STOPPER	1
107	RETAINER PLATE	1	136	O RING ;1B P26	2	165	RING	1
108	THRUST BALL	1	137	O RING ;1B P16	2	166	SPRING	1
109	PLATE	1	138	O RING ;1B P18	2	168	BALL	2
110	WASHER	2	139	O RING ;1B G140	1	170	SOCKET BOLT ;M8×50	4
112	PISTON	1	141	PARALLEL PIN	2	174	O RING ;1B P8	2
113	SPRING	8	142	PARALLEL PIN	2	176	PIVOT	2
114	SPRING	1	143	SOCKET BOLT ;M10×30	8	177	PIN	2
115	PLATE (FRICTION PLATE)	2	144	PLUG	1	178	ORIFICE	1
116	PLATE (SEPARATOR PLATE)	2	145	SNAP RING	1	179	FILTER	1
121	PLUG	1	149	BEARING	1	185	SPRING	1
123	BRAKE VALVE SPOOL	1	150	BEARING	1	186	O RING ;1B P14	1
124	PLUG	2	151	NEEDLE ROLLER	3			
125	SPRING RETAINER	2	152	PLUG	2			

7. SWIVEL JOINT

7.1 GENERAL VIEW

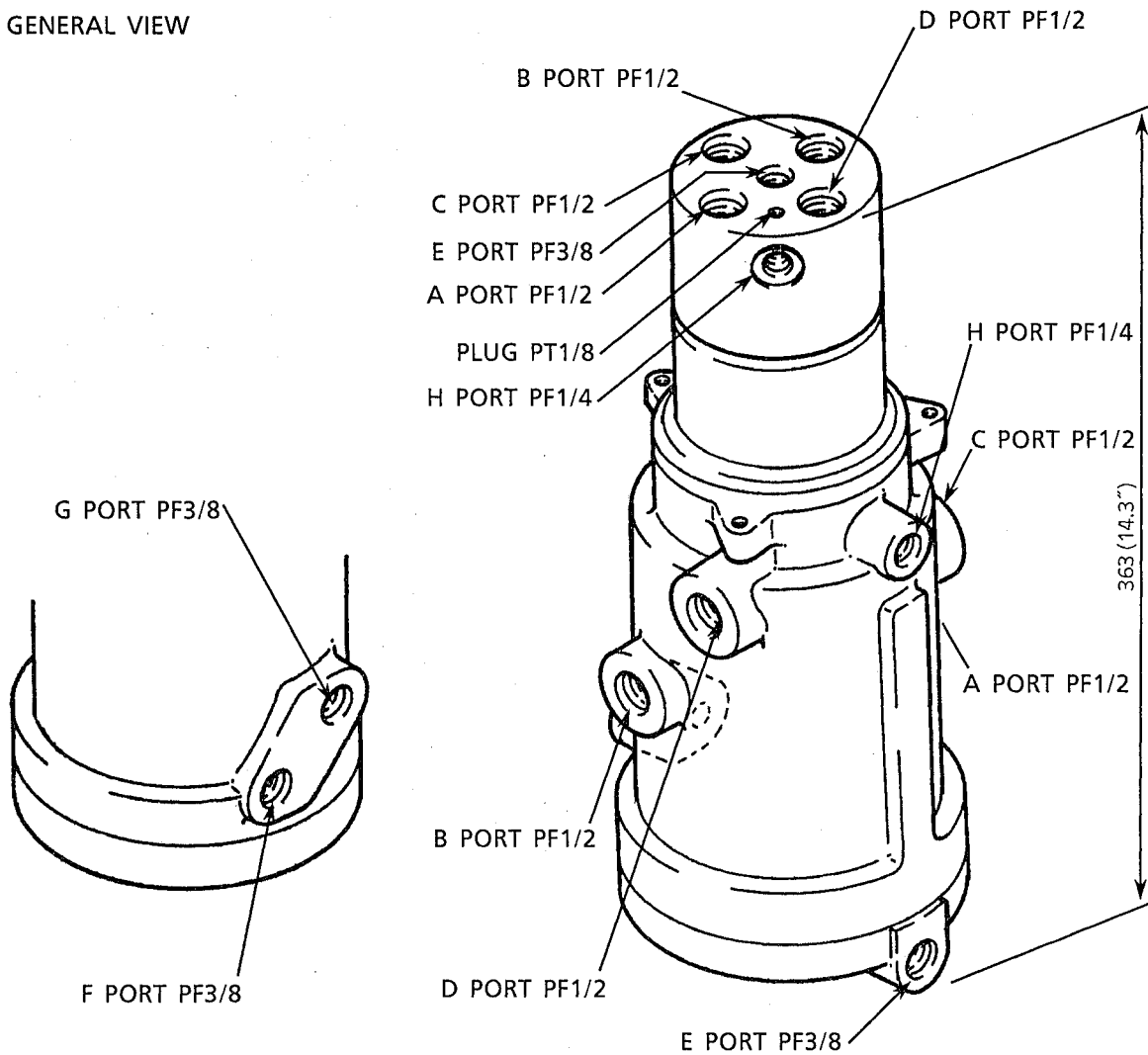


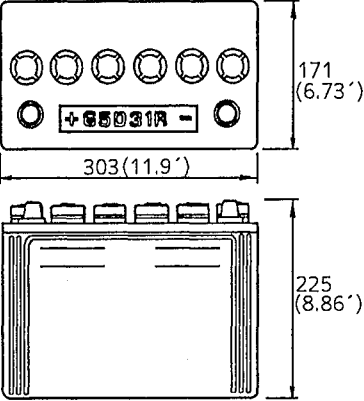
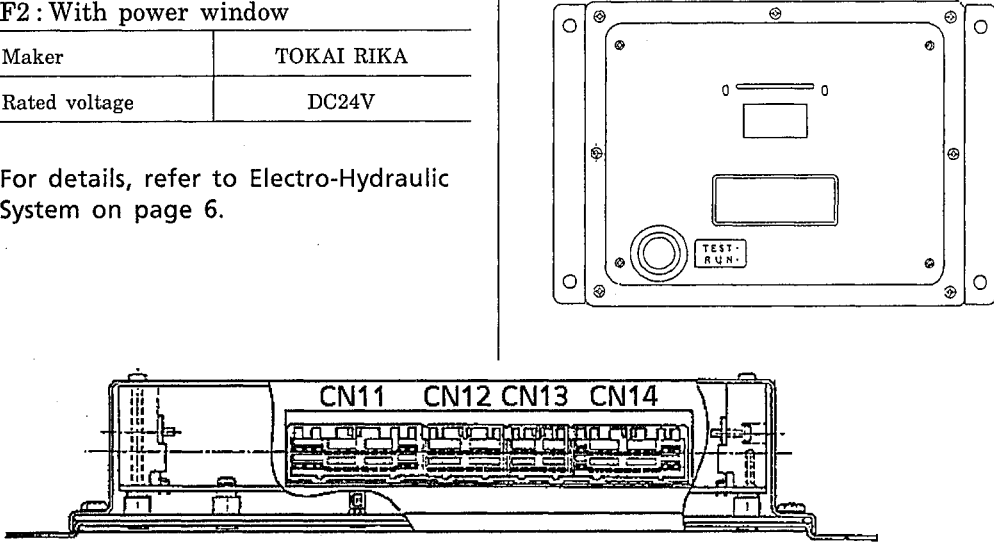
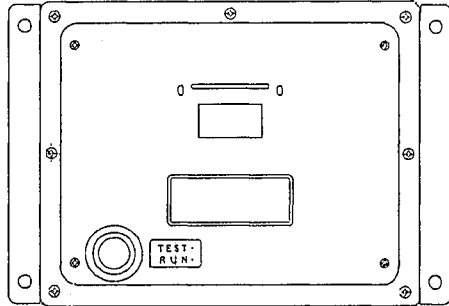
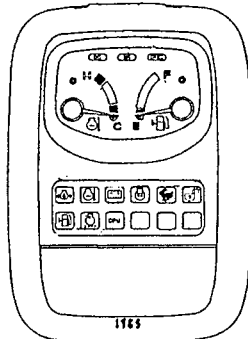
Fig. 7-1 General view of swivel joint

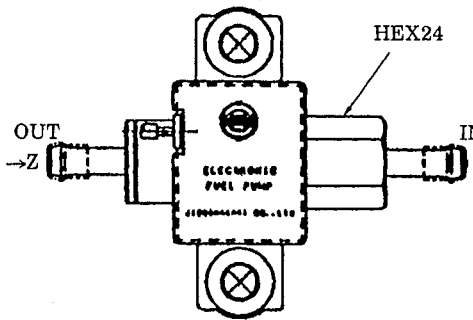
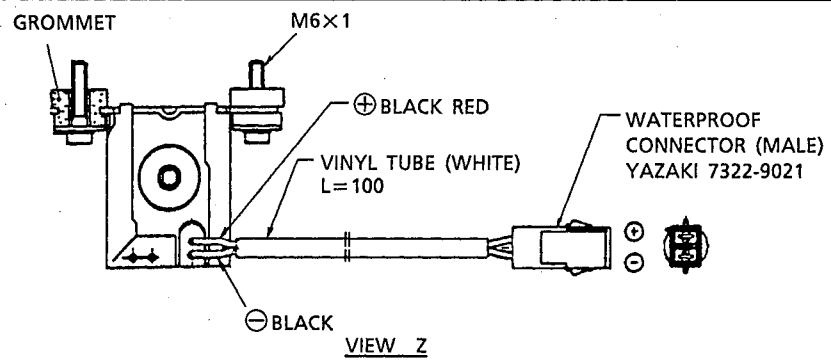
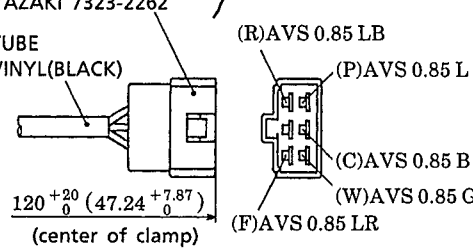
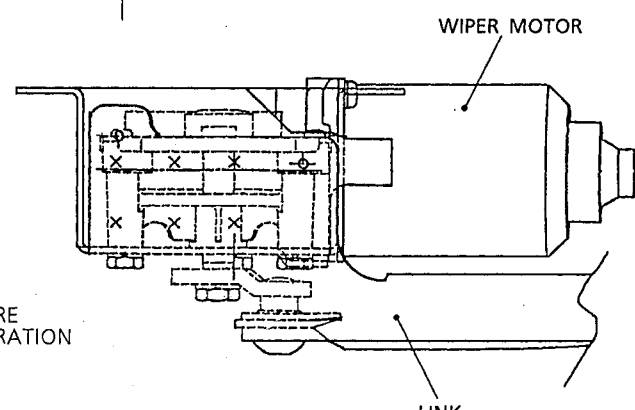
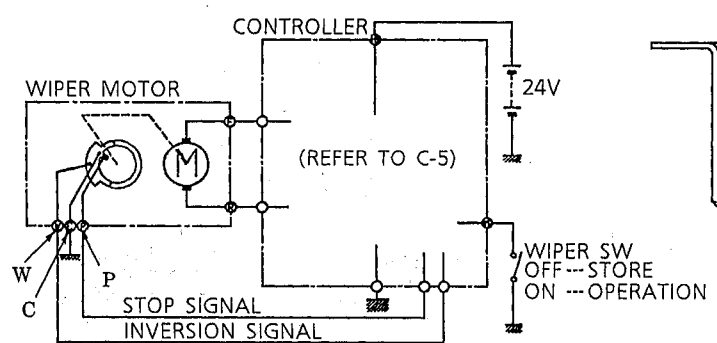
7.2 SPECIFICATION

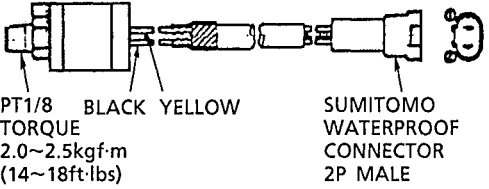
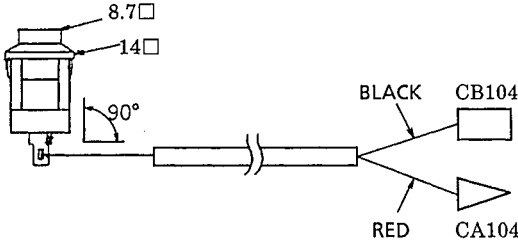
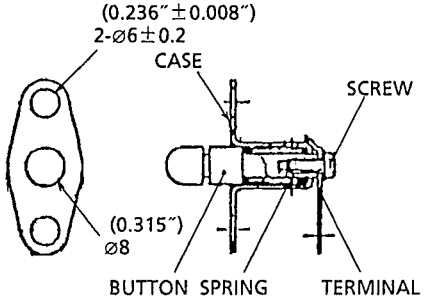
Table 7-1

Parts No.	24100J12125F1	
Travel main port A, B, C, D	Working pressure	260kgf/cm ² (3700psi)
	Max. impact pressure	390kgf/cm ² (5550psi)
Dozer port F, G	Working pressure	210kgf/cm ² (2990psi)
	Max. impact pressure	390kgf/cm ² (5550psi)
Drain port E	Max. working pressure	5kgf/cm ² (71psi)
Pilot port H	Working pressure	50kgf/cm ² (711psi)
Revolution	15rpm	
Weight	21kg (46lbs)	

2.3 SPECIFICATION OF ELECTRIC EQUIPMENTS

File No. Name of part Part No. Use Applicable Machine	Specification	Description																																																																																																														
<p>B-1</p> <p>Battery</p> <p>2484U179 2411U25 (EU)</p> <p>Power</p> <p>YT00101~</p>	<table border="1"> <tr> <td>Type</td> <td>65D31R-N70</td> </tr> <tr> <td>Capacity</td> <td>12V 56Ah (5h) 70Ah (20h)</td> </tr> <tr> <td>Weight</td> <td>About 19kg (42 lbs)</td> </tr> <tr> <td>EU Type</td> <td>95D31R</td> </tr> <tr> <td>Capacity</td> <td>12V 64Ah (5h)</td> </tr> <tr> <td>Weight</td> <td>About 20.5kg (45 lbs)</td> </tr> </table>	Type	65D31R-N70	Capacity	12V 56Ah (5h) 70Ah (20h)	Weight	About 19kg (42 lbs)	EU Type	95D31R	Capacity	12V 64Ah (5h)	Weight	About 20.5kg (45 lbs)																																																																																																			
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<p>C-1</p> <p>Controller</p> <p>YT22E00005F1,F2</p> <p>Mechatronics controller</p> <p>YT00101~</p>	<p>F1 : STD</p> <p>F2 : With power window</p> <table border="1"> <tr> <td>Maker</td> <td>TOKAI RIKA</td> </tr> <tr> <td>Rated voltage</td> <td>DC24V</td> </tr> </table> <p>For details, refer to Electro-Hydraulic System on page 6.</p>  <table border="1"> <tr> <th colspan="11">CN11</th> <th colspan="7">CN12</th> <th colspan="5">CN13</th> <th colspan="7">CN14</th> </tr> <tr> <td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td> <td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td> <td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td> <td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td> </tr> <tr> <td>26</td><td>25</td><td>24</td><td>23</td><td>22</td><td>21</td><td>20</td><td>19</td><td>18</td><td>17</td><td>16</td><td>15</td><td>14</td> <td>16</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td> <td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td> <td>22</td><td>21</td><td>20</td><td>19</td><td>18</td><td>17</td><td>16</td><td>15</td><td>14</td><td>13</td><td>12</td> </tr> </table>	Maker	TOKAI RIKA	Rated voltage	DC24V	CN11											CN12							CN13					CN14							13	12	11	10	9	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	6	5	4	3	2	1	11	10	9	8	7	6	5	4	3	2	1	26	25	24	23	22	21	20	19	18	17	16	15	14	16	15	14	13	12	11	10	9	12	11	10	9	8	7	22	21	20	19	18	17	16	15	14	13	12	
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13	12	11	10	9	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	6	5	4	3	2	1	11	10	9	8	7	6	5	4	3	2	1																																																																											
26	25	24	23	22	21	20	19	18	17	16	15	14	16	15	14	13	12	11	10	9	12	11	10	9	8	7	22	21	20	19	18	17	16	15	14	13	12																																																																											
<p>C-2</p> <p>Controller</p> <p>YT59S00001F1</p> <p>Gauge cluster</p> <p>YT00101~</p>	<table border="1"> <tr> <td>Maker</td> <td>KANSEI</td> </tr> <tr> <td>Rated voltage</td> <td>DC24V</td> </tr> <tr> <td>Insulation resistance</td> <td>More than 3MΩ at 500V megger</td> </tr> </table>	Maker	KANSEI	Rated voltage	DC24V	Insulation resistance	More than 3MΩ at 500V megger																																																																																																									
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Rated voltage	DC24V																																																																																																															
Insulation resistance	More than 3MΩ at 500V megger																																																																																																															

File No. Name of part Part No. Use Applicable Machine	Specification	Description										
<p>M-9</p> <p>Motor (pump)</p> <p>YR22P00001P1</p> <p>Fuel pump (OPT)</p> <p>YR02801~ YT00101~</p>	<table border="1"> <tr> <td>Maker's part No.</td> <td>375-01016</td> </tr> <tr> <td>Rated voltage</td> <td>DC24V</td> </tr> <tr> <td>Current</td> <td>Less than 1.5A</td> </tr> <tr> <td>Operating fluid</td> <td>Light oil</td> </tr> <tr> <td>Discharge rate (open circuit)</td> <td>More than 200cc/min</td> </tr> </table>	Maker's part No.	375-01016	Rated voltage	DC24V	Current	Less than 1.5A	Operating fluid	Light oil	Discharge rate (open circuit)	More than 200cc/min	
Maker's part No.	375-01016											
Rated voltage	DC24V											
Current	Less than 1.5A											
Operating fluid	Light oil											
Discharge rate (open circuit)	More than 200cc/min											
												
<p>M-10</p> <p>Motor</p> <p>YT53C00004P1</p> <p>For wiper (power window)</p> <p>YT00101~</p>	<table border="1"> <tr> <td>Motor kind</td> <td>Ferrite magnet type</td> </tr> <tr> <td>Nominal torque</td> <td>1.8kgf·m (13ft·lbs)</td> </tr> <tr> <td>Rated voltage</td> <td>DC24V</td> </tr> <tr> <td>Operatin revolution</td> <td>35±4rpm</td> </tr> </table>	Motor kind	Ferrite magnet type	Nominal torque	1.8kgf·m (13ft·lbs)	Rated voltage	DC24V	Operatin revolution	35±4rpm	<p>(YAZAKI PART No. : 7322-2262 CONNECTION ON MATED SIDE PART No. YAZAKI 7323-2262)</p>  		
Motor kind	Ferrite magnet type											
Nominal torque	1.8kgf·m (13ft·lbs)											
Rated voltage	DC24V											
Operatin revolution	35±4rpm											
	 <p>CONNECTION DIAGRAM</p>											

File No. Name of part Part No. Use Applicable Machine	Specification	Description								
SW-18,19 Switch 2479U2010 Option pedal press YT00101~	<table border="1"> <tr> <td>Type</td> <td>Normal open</td> </tr> <tr> <td rowspan="2">Specification</td> <td>ON : $6 \pm 0.6 \text{ kgf/cm}^2$ ($85.3 \pm 8.5 \text{ psi}$)</td> </tr> <tr> <td>OFF : $4 \pm 0.4 \text{ kgf/cm}^2$ ($56.9 \pm 5.7 \text{ psi}$)</td> </tr> <tr> <td>Insulation resistance</td> <td>More than $100 \text{ M}\Omega$ (500V megger)</td> </tr> </table>	Type	Normal open	Specification	ON : $6 \pm 0.6 \text{ kgf/cm}^2$ ($85.3 \pm 8.5 \text{ psi}$)	OFF : $4 \pm 0.4 \text{ kgf/cm}^2$ ($56.9 \pm 5.7 \text{ psi}$)	Insulation resistance	More than $100 \text{ M}\Omega$ (500V megger)		
Type	Normal open									
Specification	ON : $6 \pm 0.6 \text{ kgf/cm}^2$ ($85.3 \pm 8.5 \text{ psi}$)									
	OFF : $4 \pm 0.4 \text{ kgf/cm}^2$ ($56.9 \pm 5.7 \text{ psi}$)									
Insulation resistance	More than $100 \text{ M}\Omega$ (500V megger)									
SW-23 Switch YT50E00003P1 Wiper inter lock YT00101~	<table border="1"> <tr> <td>Maker's type</td> <td>DS-431</td> </tr> <tr> <td>Contact configuration</td> <td>SPST ON-(OFF) momentary</td> </tr> <tr> <td>Insulation resistance</td> <td>More than $100 \text{ M}\Omega$ (500V megger)</td> </tr> </table>	Maker's type	DS-431	Contact configuration	SPST ON-(OFF) momentary	Insulation resistance	More than $100 \text{ M}\Omega$ (500V megger)			
Maker's type	DS-431									
Contact configuration	SPST ON-(OFF) momentary									
Insulation resistance	More than $100 \text{ M}\Omega$ (500V megger)									
SW-A Switch YT50S00004P1 Cab door YT00101~	<table border="1"> <tr> <td>Maker's part No.</td> <td>166225-0002</td> </tr> <tr> <td>Rated voltage</td> <td>DC 12V, 24V</td> </tr> <tr> <td>Insulation resistance</td> <td>More than $5 \text{ M}\Omega$ (500V megger)</td> </tr> <tr> <td>Max. stroke</td> <td>7.1mm (0.28")</td> </tr> </table>	Maker's part No.	166225-0002	Rated voltage	DC 12V, 24V	Insulation resistance	More than $5 \text{ M}\Omega$ (500V megger)	Max. stroke	7.1mm (0.28")	
Maker's part No.	166225-0002									
Rated voltage	DC 12V, 24V									
Insulation resistance	More than $5 \text{ M}\Omega$ (500V megger)									
Max. stroke	7.1mm (0.28")									

3. FUNCTION

3.1 MECHANISM OF COOLING CIRCUIT

(1) Mechanism of Cooling

In the cooling process, the refrigerant that flows through the cooling circuit changes its phases from liquid to gas and vice versa during which process heat is transferred from the low temperature part (compartment) to the high temperature part (outside of the vehicle).

1) Kind of Refrigerant

Many kinds of refrigerants that change in that way are available, but the following requirements are needed for use in such applications:

- Latent heat of vaporization (heat of vaporization) is large.
- It is easy to liquefy (condense). (It dose not require very high pressure for condensation.)
- It is easy to gasify (evaporate). (It evaporates sufficiently at not too low pressure, i.e. cools down an object.)
- It has small specific heat. (Since the refrigerant itself is cooled by the expansion valve, the loss resulting from it must be held down to a minimum.)
- It has a high critical temperature and a low solidification point.
- It is stable chemically and does not corrode and permeate into the circuit parts.
- It is free from toxicity, objectionable odor, flammability and explosiveness and excels in thermal conductivity and electric insulation.
- It has small specific volume.
- It is easy to find out leakage.

Out of refrigerants meeting the above-mentioned requirements, ones having characteristics that suit the intended cooling unit are chosen and used. If a refrigerant other than those designated is used, sufficient refrigeration will not be performed or the equipment in which the refrigerant is used may be broken. Therefore, always use a designated refrigerant for the cooling unit.

Table 1 shows the principal characteristics of the R134a refrigerant that is used in this machine.

(2) Characteristics of Refrigerant (See Fig.6.)

In general, the fluid (general term of gas and liquid) has the following qualities:

- 1) As a gas under certain pressure is cooled down, it begins to condensate at a certain temperature to take a liquid state. The temperature at which condensation begins is unique to each substance (fluid) at a given pressure. The temperature determined by a given pressure is called saturation temperature.

Table 1

Item	HFC-134a (R134a)
Chemical formula	CH ₂ FCF ₃
Molecular weight	102.03
Boiling point	-26.19°C (-15.14°F)
Critical temperature	101.14°C (214.05°F)
Critical pressure	4.065MPa (41.45kgf/cm ² *1)
Critical density	511kg/m ³ (31.9 lb/ft ³)
Density of saturated liquid [25°C (77.0°F)]	1206kg/m ³ (75.3 lb/ft ³)
Specific volume of saturated vapor [25°C (77°F)]	0.0310m ³ /kg (0.496ft ³ /lb)
Latent heat of vaporization [0°C (32°F)]	197.5KJ/kg {47.19kcal/kg}
Flammability	Nonflammable
Ozone destruction coefficient	0

*1 : 1MPa (mega pascal) equals 10.1972kgf/cm² (145psi)

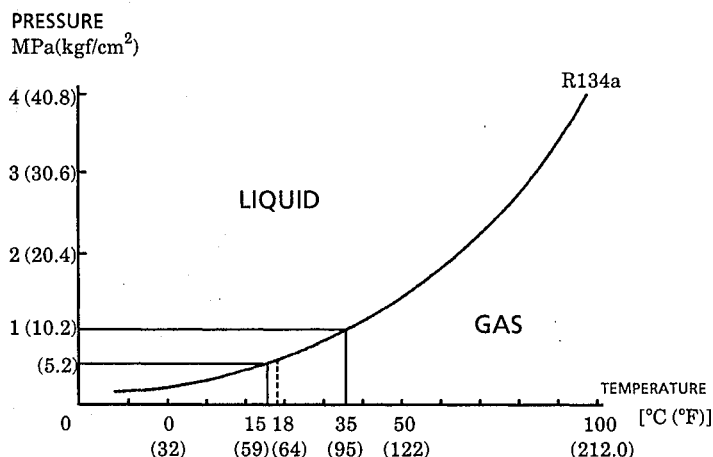


Fig. 6 Pressure-temperature characteristics of R134a

2) Replacing the air mix motor actuator

Disconnect the connector connected with the motor actuator.

Separate the rod 67 linking the motor actuator with the lever AM, from the rod holder.

Remove three cross-recessed screws T4×14 (T1) fastening the motor actuator. Then remove the motor actuator with the rod holder and the lever MAL1, from the unit. Remove the rod holder and the lever MAL1 from the motor actuator and install them to a new motor actuator. Assembly is the reverse order of disassembly.

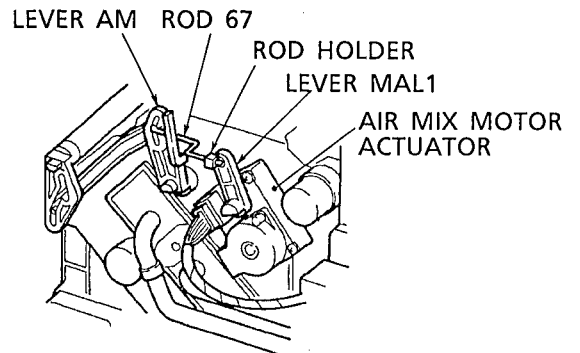


Fig. 23

3) Replacing the inner/outer air select motor actuator

Disconnect the connector connected with the motor actuator.

Separate the motor actuator with lever MAL2 from the unit.

Remove the lever MAL2 from the motor actuator and install it to a new motor actuator, in the reverse order of disassembly.

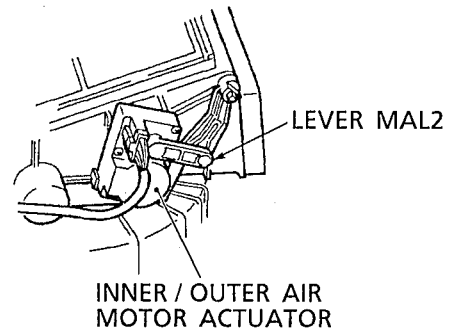


Fig. 24

6.2 INSPECTING FUNCTIONAL PARTS

(1) Relay (24-4PE)

- 1) Coil resistance : 320Ω (across 1 and 2)
- 2) Operating voltage : DC20~30V
- 3) The coil of the relay has polarity : Care is needed.
- 4) Turn on and off the power to the blower motor by controlling the controller.
- 5) Check: Check conductance across 3 and 4 in the following condition :
 Apply 20~30V across terminals 1 and 2 : through
 No voltage applied across terminals 1 and 2 : not through

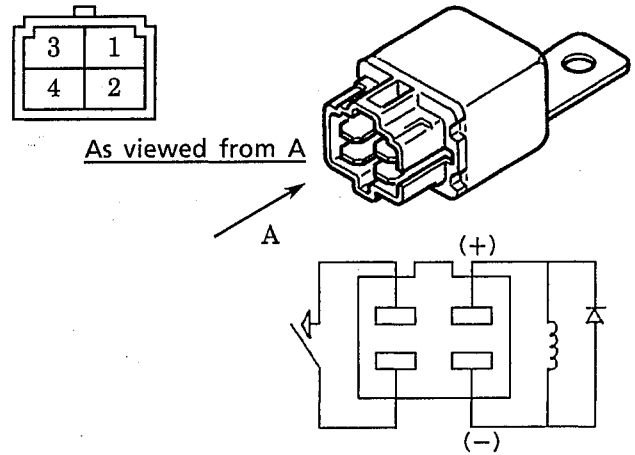


Fig. 33 Relay

(2) Inner air sensor (C44)

Resistance across terminals :

at 0°C (32°F) : $7.2\text{K}\Omega$

at 25°C (77°F) : $2.2\text{K}\Omega$

The inner air sensor is installed to the sensor bracket under the operator's seat. The temperature in the cab is sensed by the thermistor. Changes in the resistance according to temperature variations are transmitted to the controller.

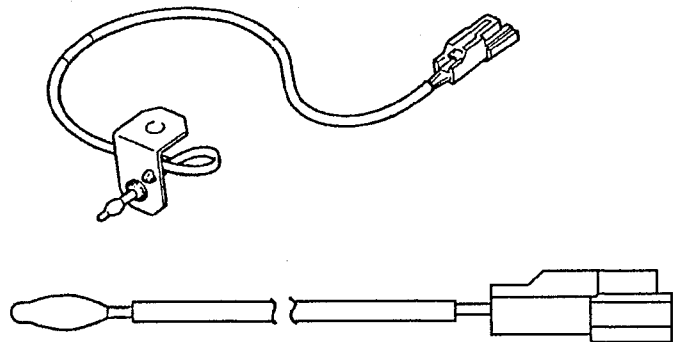


Fig. 34 Inner air temperature sensor

(3) Blower controller

The blower controller changes output voltages for the motor according to signals emitted by the controller.

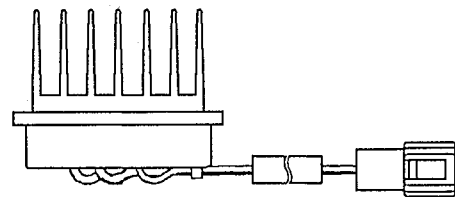


Fig. 35 Blower controller

(4) Motor actuator

- 1) Operating voltage : DC20~30V
- 2) Operating temperature range : -30°C (-22°F) to $+75^{\circ}\text{C}$ (167°F)

The motor is controlled by signals (pulses) put out by the controller.

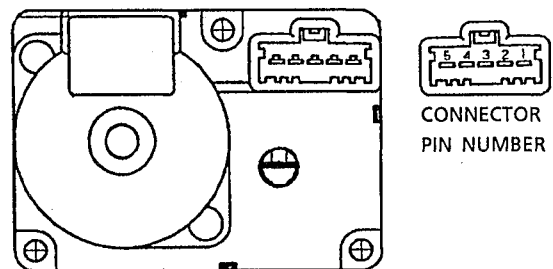
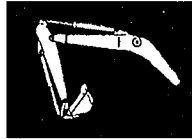


Fig. 36 Motor actuator

1. DISASSEMBLING AND ASSEMBLING PROCEDURE AND PARTS MANUAL

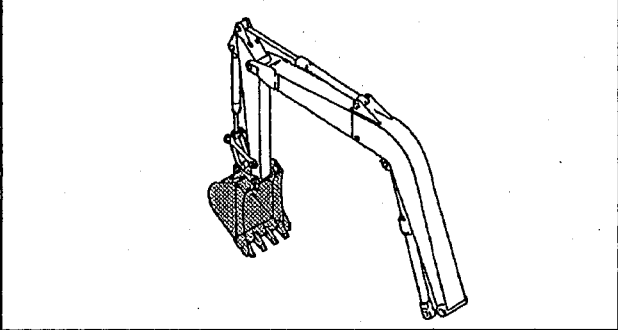
1.1

アタッチメント
ATTACHMENTS



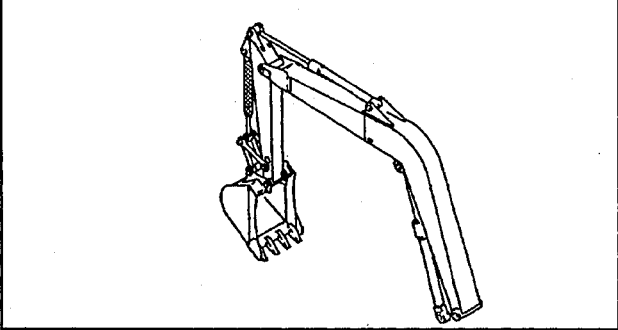
(1) Bucket YT32-1-1

Bucket assy..... FIG 436-50



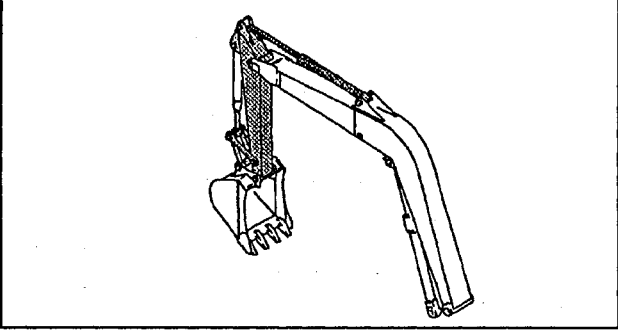
(2) Bucket cylinder YT32-1-4

Bucket cylinder..... FIG 418-50



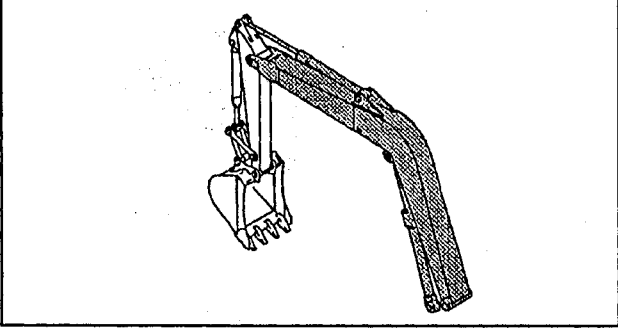
(3) Arm YT32-1-4

Arm, arm cylinder..... FIG 414-50



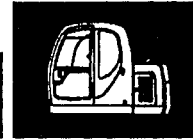
(4) Boom & Boom cylinder YT32-1-6

Boom, boom cylinder..... FIG 390-50



1.2

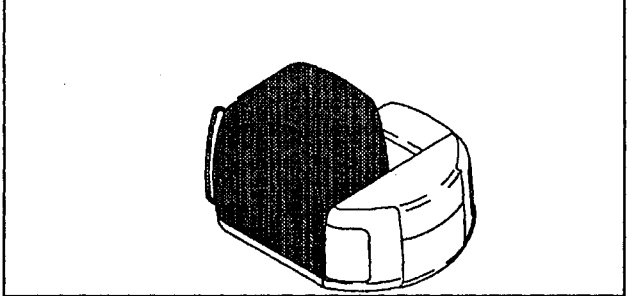
上部旋回体
UPPERSTRUCTURE



(1) Cab YT33-1-1

Cab install..... FIG 166-49

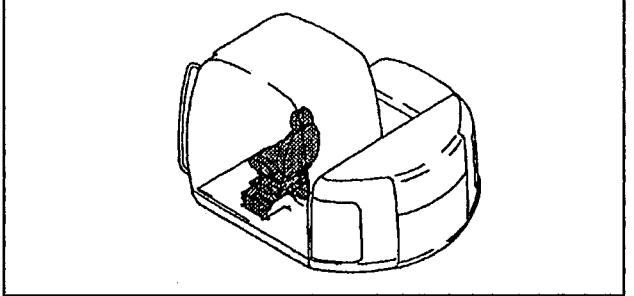
Cab assy..... FIG 170-49



(2) Operator seat YT33-1-2

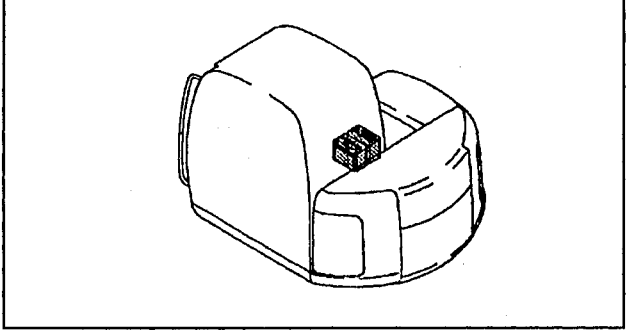
Seat group..... FIG 178-50

Seat assy..... FIG 180-50



(3) Battery YT33-1-3

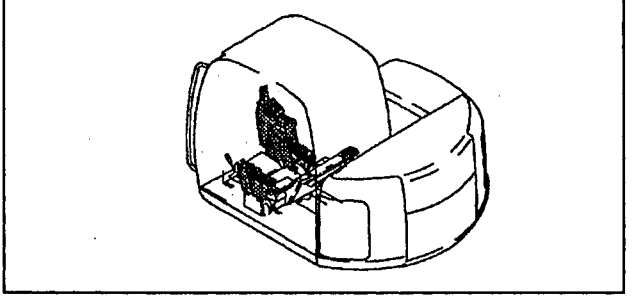
Battery install..... FIG 254-50



(4) Instrument panel YT33-1-4

Panel assy, instrument..... FIG 230-49

Panel assy, instrument..... FIG 230-50



- (5) Removing bucket cylinder
 Sling tube of bucket cylinder with nylon sling, and remove it.
 Bucket cylinder weight : 44kg (97 lbs)

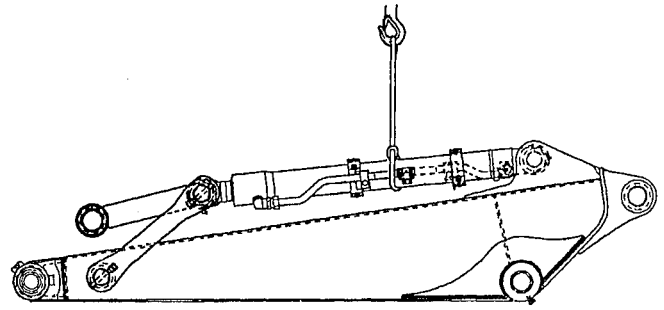


Fig. 3-5 Slings bucket cylinder

- (6) Removing arm cylinder rod pin (E)
 Loosen nut (4), remove capscrew (3), and push out arm cylinder rod pin (E).
 Wrench : 22mm
 Retract arm cylinder rod, and return pin (E) to the original position (hole).

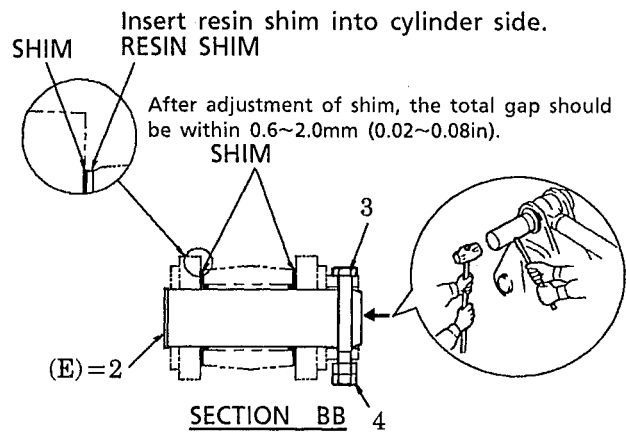
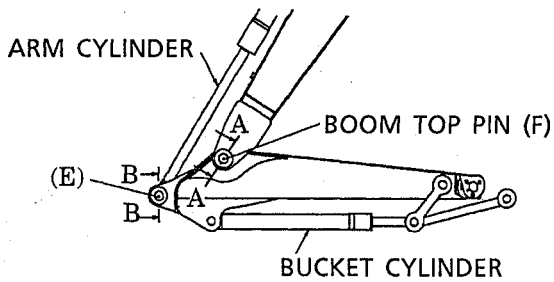


Fig. 3-6 Detail of arm cylinder rod pin (E)

- (7) Removing boom top pin (F)
 Loosen remove capscrew (12), and pull out boom top pin (F).
 Put block between arm cylinder and boom.
 Wrench : 19mm
 Insert pin (F) into the original hole.

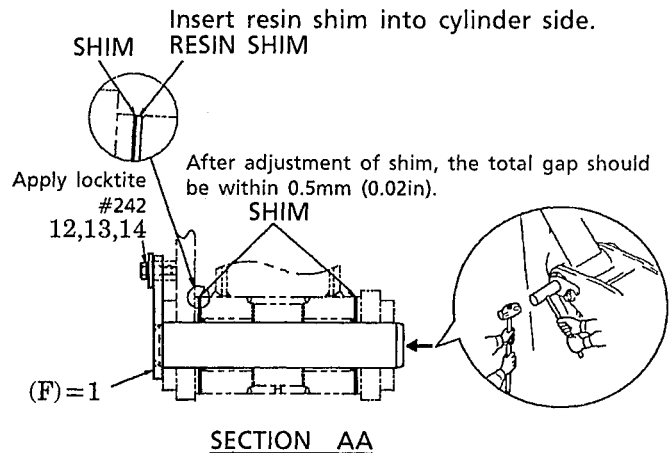


Fig. 3-7 Detail of boom top pin (F)

- (8) Slings arm assy
 Sling arm with nylon sling and remove it.
 Arm weight: 200kg (440 lbs)
 (with bucket cylinder)
 : 150kg (330 lbs)
 (without bucket cylinder)

3.2 ATTACHING ARM

- 1) Attaching boom top pin (F)
 Attach boom top pin (F) first, and continue in the reverse procedure of the removing.

- ⚠
- When aligning the pin holes, do not put your finger in the pin holes in any circumstances, but align them visually.
 - Check that the dust seals is not scored and replace a faulty one if necessary.
 - When inserting the pin, coat the shaft with grease.

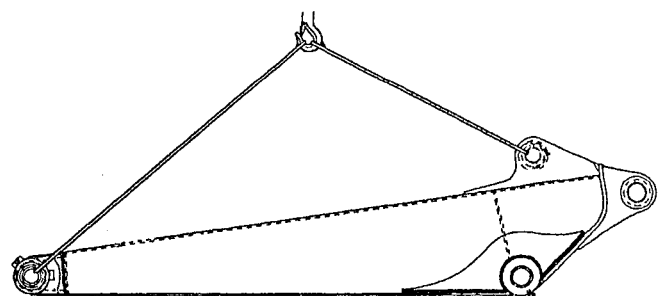
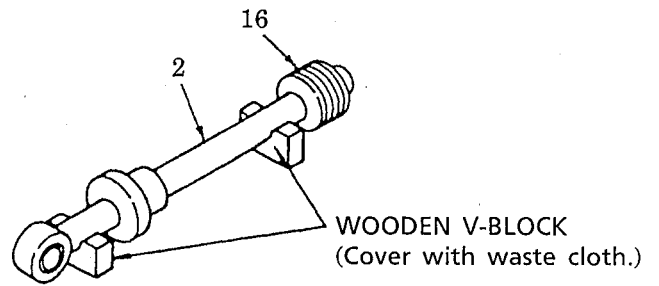


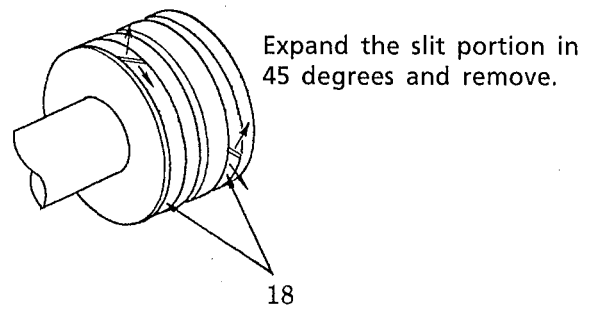
Fig. 3-8 Slings arm assy

- (7) Place pulled out piston rod assy (2) on the wooden V-block horizontally.



Fig, 1-8 Placing piston rod assy

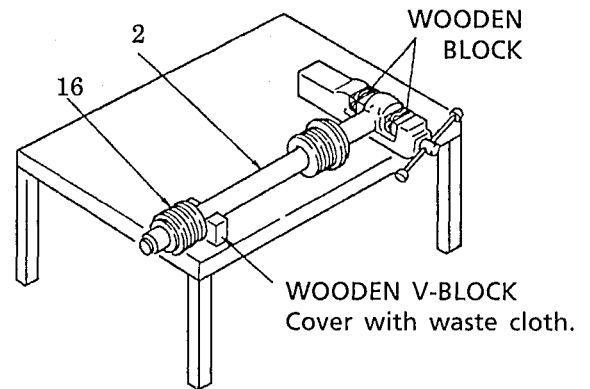
- (8) Remove slide ring (18)



Fig, 1-9 Removing slide ring

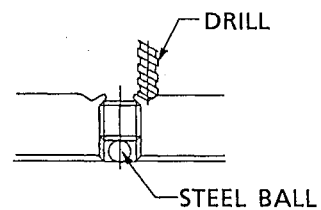
1.3.2 REMOVING PISTON ASSY

- (1) Fix piston rod (2) grasping the installing pin portions with vise. Then fix it in strength so that it can withstand the tightening torque for piston rod (2) because the piston rod (2) is secured with large tightening torque.



Fig, 1-10 Fixing piston rod assy

- (2) Shave off the caulked section on set screw (20) with hand drill, loosen setscrew and take out steel ball (21).



Fig, 1-11 Removing setscrew

1.4.6 OVERALL INSTALL

(1) Place a V-block on a rigid work bench (A wooden V-block is preferable.). Mount the cylinder tube assy (1) on it and fix the assy by barring a bar through the attaching pin hole to lock the assy. (Fig. 1-36)

(2) Insert piston rod (2) into cylinder tube (1) while hanging and moving it with crane. Then, apply hydraulic oil on tube lip inner side and piston outer surface and insert horizontally aligning the center of piston rod and center of cylinder tube.

- Also, the use of fork lift makes inserting easier.
- Insert piston into tube being careful that seal ring and slide ring are not caught in the stepped section of tube.

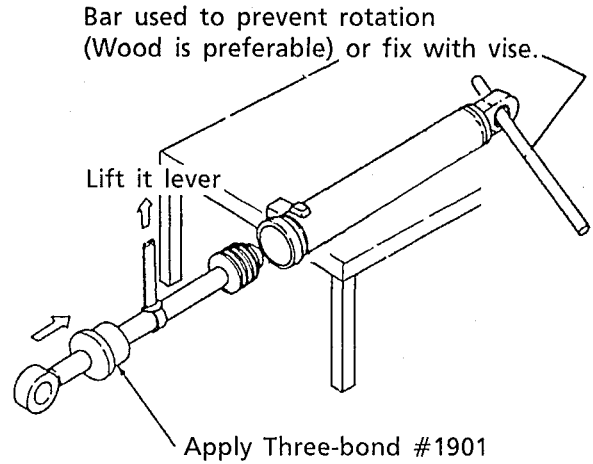


Fig. 1-36 Installing piston rod

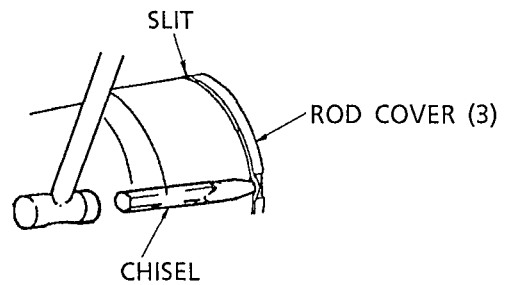


Fig. 1-37 Bending lock of slit

(3) Apply Three Bond #1901 on thread section of rod cover and hydraulic oil on O ring (12), rotate rod cover assy (3) by hand. Screw in 2 or 3 threads first, then tighten it to the specified torque with hook spanner wrench.

(4) Bend slit of cylinder tube toward cutout of rod cover (3) to lock.

(5) Tighten band for piping on both sides equally to the specified torque in order not to have a set space.

Tightening torque : See II-1-18.

- Fix port section of cylinder pipe with wrench, etc. on main body and install pipe for cylinder, and rubber hose, nipple, etc. Installation without fixation may cause bending of port plate, consequently oil leakage, and interference with body.

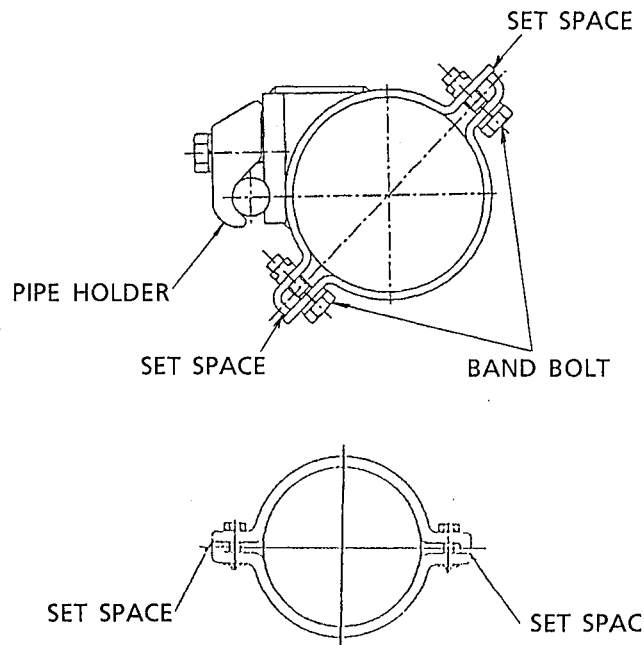




Fig. 1-38 Installing band for piping

Items	Phenomenon	Related parts	Abnormalities	Measures and corrective actions
2	Oil leakage from rod cover set section	O ring	Foreign matter is caught in inner bore and outer surface.	① Remove foreign matter. ② Replace damaged O ring. ③ Inspect inner surface of tube. If flaw and rust are detected, make it smooth with oil stone. ④ Inspect groove of rod cover. - do - ⑤ Inspect backup ring. Replace deformed or incompletely fit O ring. Check O ring for above failure. If failed, replace it.
		Backup ring	Deformed and incomplete fitting	① Replace it with O ring
		Rod cover	Loosen	① Disassemble rod cover, check O ring and backup ring for possible damage. If damaged, replace it. ② Check thread ridges of tube and rod cover for possible damage. ③ After inspection, tighten it to the specified torque. (See Item 1.4 "Assembling Procedure".)
		Bolt	Loosen, elongation and damage	① Replace all bolts, and tighten them to the specified torque.
		Cylinder tube	Abnormal expansion	① Replace it with new one. The oil leakage from set section may be caused by the production of extraordinary high pressure. Check tube for expansion and deformation, and also circuit pressure for possible error.
3	Oil leakage from pipe and cylinder tube weld zone	Cylinder tube, pipe (hollow piston rod)	Crack on weld zone	① Replace it with new one.  <ul style="list-style-type: none"> ● Crack is progressed and ruptured mechanically. ● The rupture is very dangerous. So when crack has been detected, stop operating immediately and replace the parts with new one. ● The weld on crack for repair is ineffective.

5. COUNTERWEIGHT

5.1 PREPARATION FOR REMOVAL

- (1) Removing bonnet assy.
Remove bonnet on engine. (See Fig. 6-7.)
- (2) Remove cover (3) (See GUARD Fig. 6-8.)
- (3) Preparing slinging jig
Remove C7 plug, and attach weight slinging jig (See Item Tools.) to counterweight.
 : 36mm

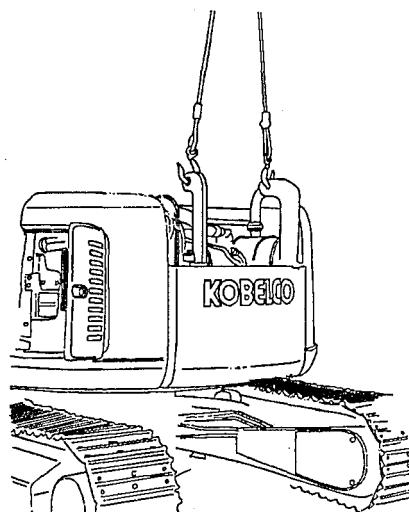



Fig. 5-1 Lifting up counter weight

5.2 REMOVAL

- (1) Lifting up counter weight temporarily
Hook wire rope to slinging jig, and lift it and stretch wire rope to the degree where it is providing no slack temporarily.
Weight of counterweight;
Approx. 850kg (1870 lbs)
Wire more than $\varnothing 10$ (0.394");
1.5m (4ft 11in) \times 2 pcs.

- (2) Removing counterweight

- 1) Remove 1 capscrew (C1) M20 \times 70.
- 2) Remove 2 capscrews (C3) M20 \times 130.
 : 30mm
- 3) Remove shim.

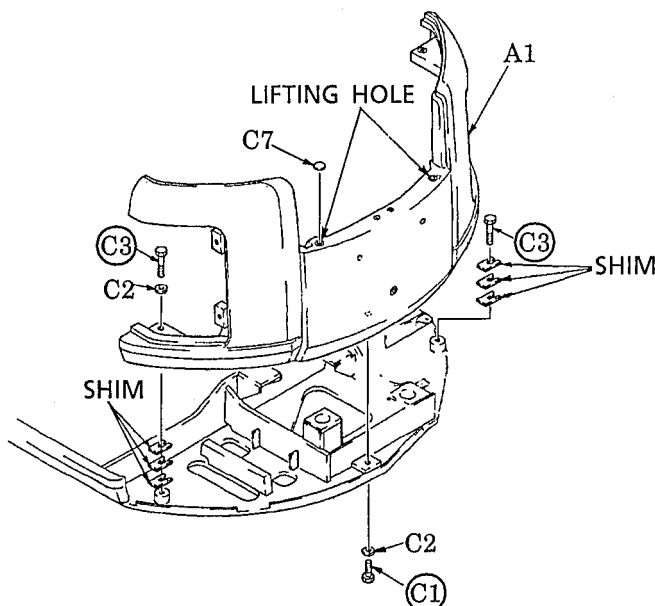



Fig. 5-2 Removing counterweight

5.3 INSTALLATION

- (1) Install counterweight in the reverse procedure of removing.
- (2) Install shim as it was.
- (3) Slinging counterweight
Check that the attaching bolts can be screwed in by hand.
- (4) Apply Loctite #242 on capscrews (C1, C3), and tighten them with washers (C2).
 : 30mm
Tightening torque : 57kgf·m (410ft·lbs)
- (5) Remove slinging tools, and attach plugs (C7).

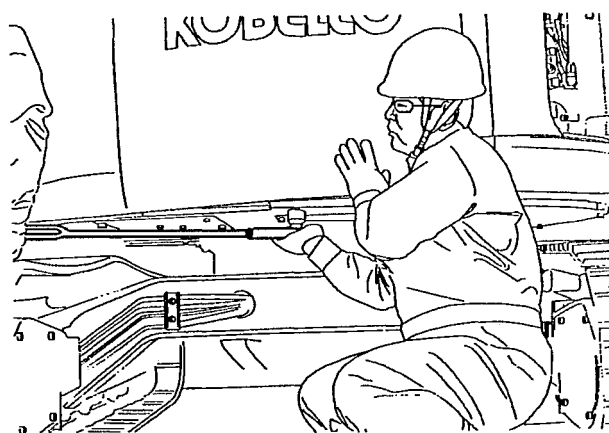


Fig. 5-3 Attaching bolts for counterweight

- (3) Remove hydraulic tank attaching bolt
Remove four capscrews (1)M16×35.
⊙ : 24mm

- (4) Slinging hydraulic oil tank
Hook wire to neck of tank upper cover.
Tank weight : Approx. 65kg (143 lbs)

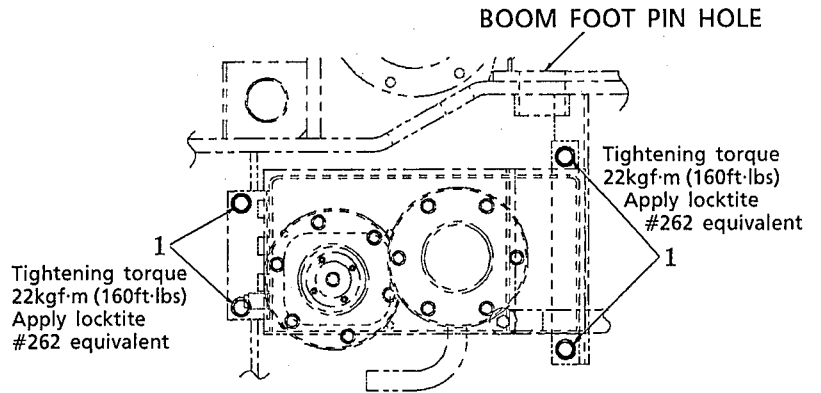


Fig.11-8 Removing hydraulic tank attaching bolt

11.3 INSTALLATION

- (1) Cleaning hydraulic oil tank
- (2) Cleaning suction hose
- (3) Cleaning mount of tank.
Installing is done in the reverse order of removing.

- (4) Attaching bolt
Apply locktite #262
⊙ : 24mm
Tightening torque : 22kgf·m (160ft·lbs)

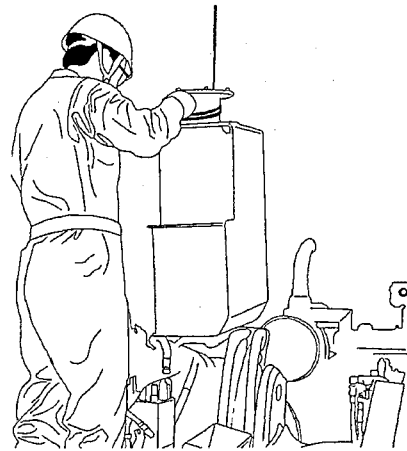


Fig. 11-9 Slinging hydraulic oil

- (5) Connection of suction hose
Apply PERMATEX on pipe side of hose connection and insert it.
- (6) Clip (9),
Tightening torque : 0.55kgf·m (4.0ft·lbs)
- (7) Tank cover attaching bolt
M10 Tightening torque : 4.7kgf·m (34ft·lbs)

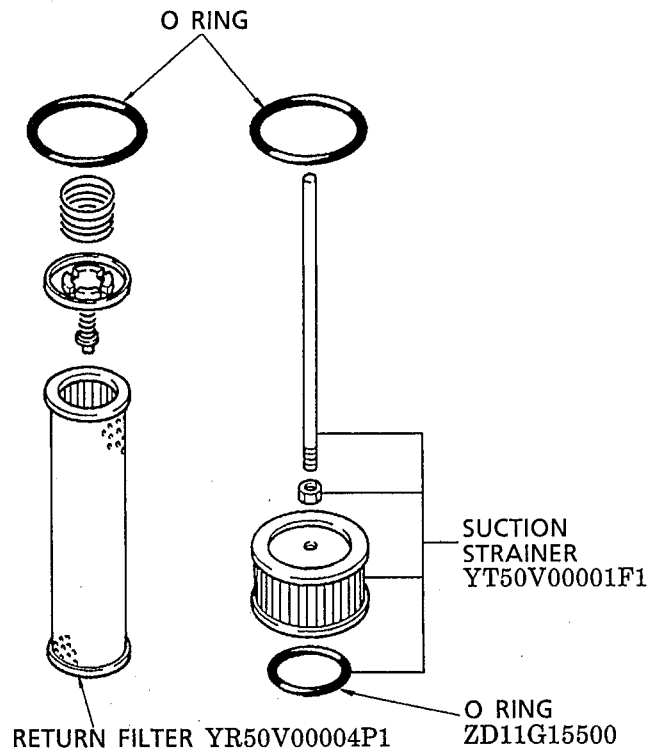
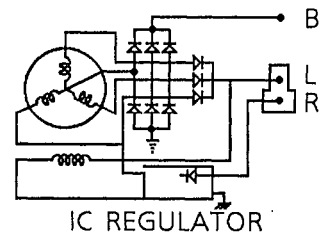
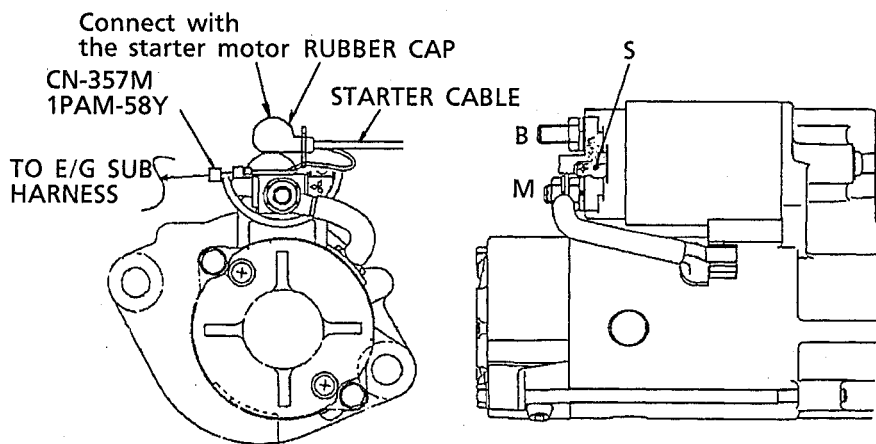
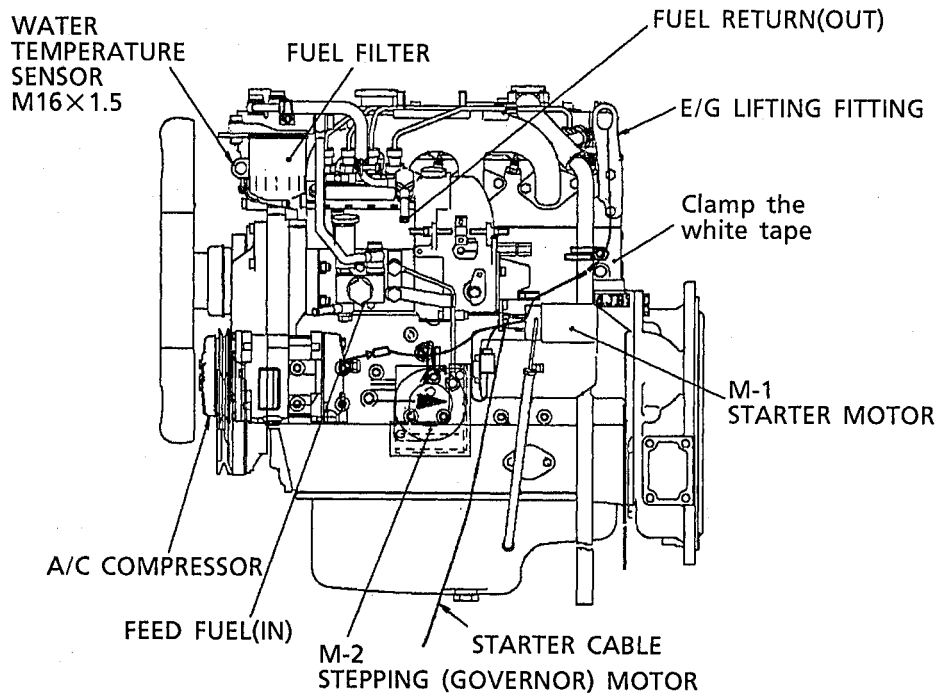
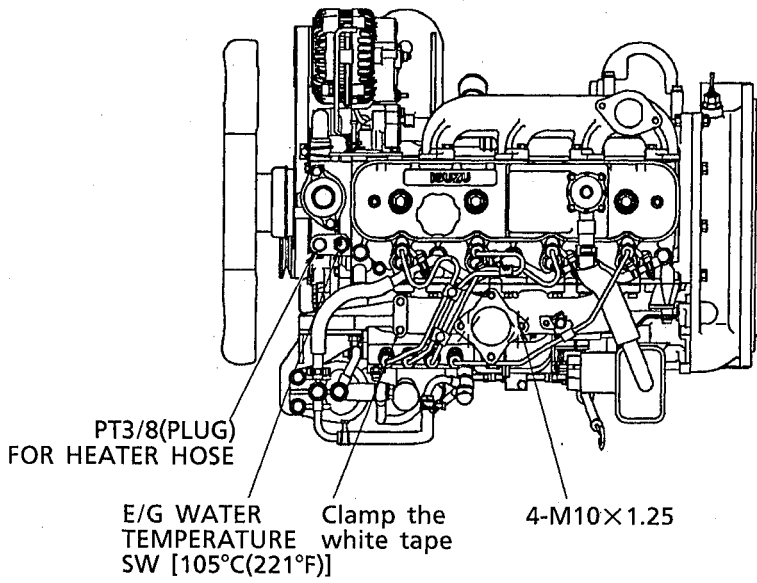


Fig. 11-10 Element & filter



DETAIL OF STARTER MOTOR TERMINAL

20. SWIVEL JOINT

20.1 PREPARATION FOR REMOVE

- (1) Remove attachment assy
(Refer to 1. section : Attachment)
- (2) Remove cab (Refer to 1. CAB)
- (3) Remove guard (Refer to 6. GUARD)
- (4) Removing hoses on undercarriage
(Refer to section : Undercarriage)
- (5) Remove swing reduction unit if necessary.
(Refer to 19. SWING MOTOR UNIT)

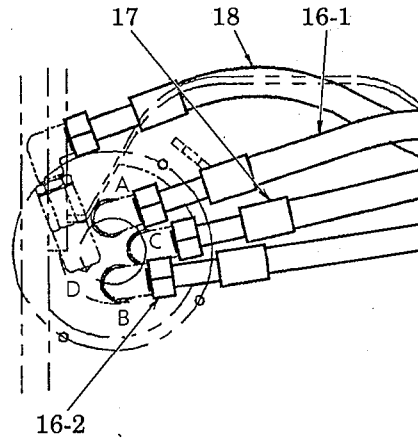






Fig. 20-1 Removing piping

20.2 REMOVAL

- (1) Remove travel motor hose
 - 1) Remove hose (18). (D port)
 - 2) Remove hose (16-1). (A port)
 - 3) Remove hose (17). (C port)
 - 4) Remove hose (16-2). (B port)
- (2) Disconnect drain hose from pipe (6).
- (3) Disconnect 2-speed travel hose from joint 1.
- (4) Remove dozer hose. (OPT) (Port F,G)
- (5) Remove whirl-stop of swivel joint.
 - 1) Loosen the nut (C5)M16.
 - 2) Remove a capscrew (C3)M16×110.
 : 24mm
- (6) Remove joint for piping
 - 1) Remove elbow (3).
 - 2) Remove connector (4).
 - 3) Remove connector for travel 2-speed change over (1).
 : 27mm, 19mm
- 4) Remove plug (8) if attached. (Machine not equipped with dozer)
 : 22mm
- (7) Remove dust cover (1)
 - 1) Remove four capscrews (4)M8×25.
 - 2) Remove plate (B2).
 - 3) Remove dust cover (B1).
 : 13mm

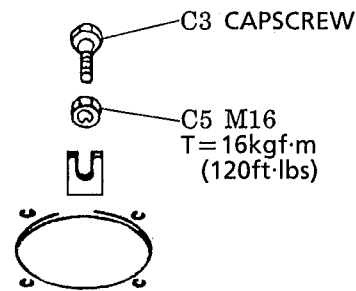


Fig. 20-2 Removing whirl-stop nut & the capscrew

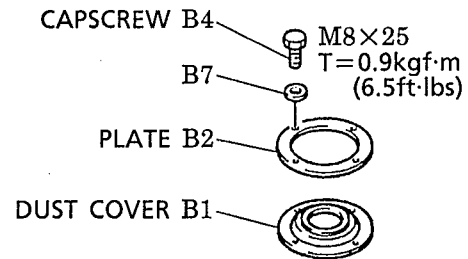
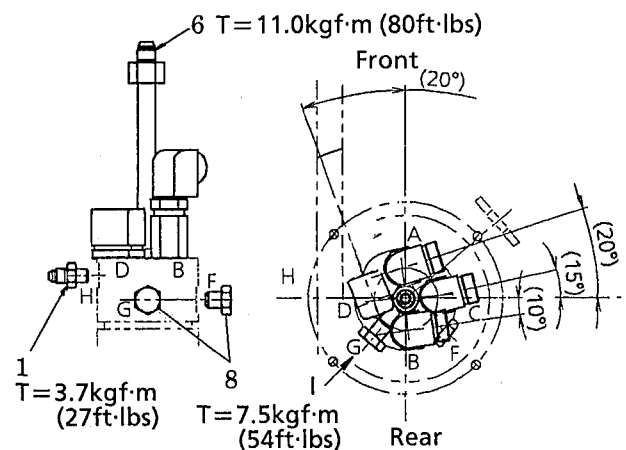


Fig. 20-3 Removing dust cover (B1)



VIEW I

Fig. 20-4 Removing joint for piping

- 11) Remove pin (655)
Remove plug (468), then remove pin (655).
🔧 : 6mm

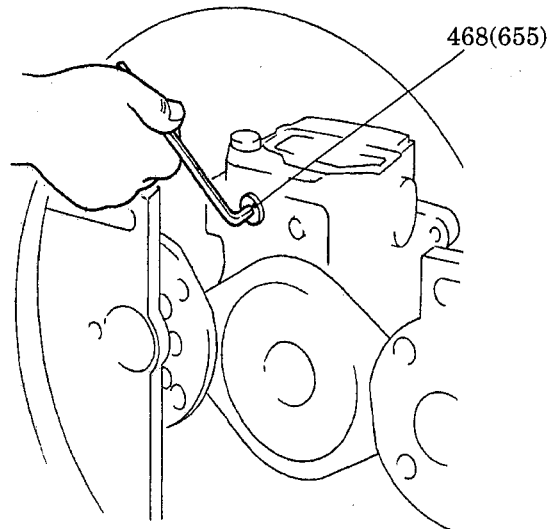


Fig. 1-12 Remove pin (655)

- 12) Remove servo piston sub assy
Since the set screw (534) installed on servo piston sub-assy is a screw used to regulate flow rate of regulator, it should not be removal if not required.
If required to removal, remove set screw (534) with lock nut (803), stopper (535), servo piston (532) and tilt pin (531).

🔧 : 19mm, 🗝️ : 41mm

- ⚠️ • Lock nut (803) and set screw (534) are not allowed to be removal unnecessarily. A set flow rate changes.
- Since servo piston (532) and tilt pin (531) are applied Three Bond, it is not allowed to removal them.
- Care must be taken not to damage servo piston fixing tilt pin when remove.

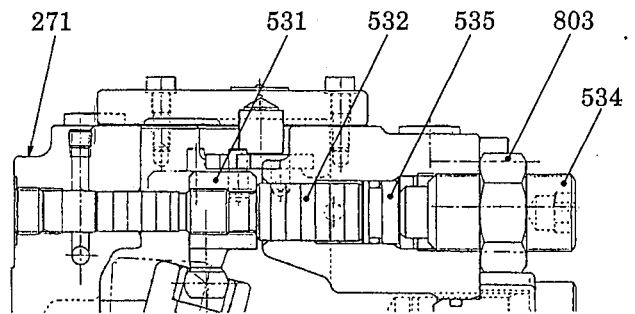
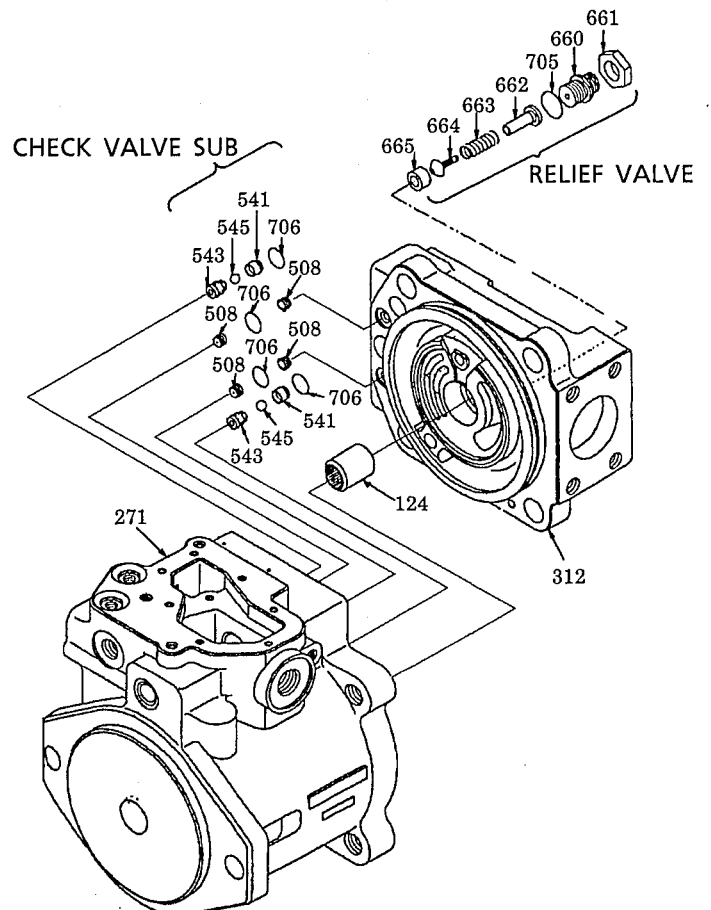


Fig. 1-13 Remove servo piston sub assy

- 13) Remove valve cover (312)
If necessary, remove relief valve lock nut (661), adjusting screw (660), spring seat (662), spring (663), poppet (664), seat (665) and needle bearing (124).

🗝️ : 22mm

- ⚠️ • Relief valve are not allowed to be removal unnecessarily. A set pressure relief rate changes.
- Strictly prohibited to pull out needle bearing other than when the life time is exceeded.



- 14) Remove check valve sub and orifice thread (508)
Remove check valve sub (541), (543), (545) and orifice thread (508) from casing (271)

🔧 : 4mm

- Use wrench taking care not to damage orifice thread (508) when remove.

Fig. 14 Remove valve cover (312), and remove check valve sub-assy and orifice thread (508).

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(7) Disassembling swing priority section
(See Fig. 2-9.)

1) Remove two places socket bolts (74).


 : 5mm

2) Remove pilot cover F (66), spring (70), piston D (67) and pilot body (68).

! Then, special care must be taken that O ring (71) and piston D (67) of pilot cover F (66) does not slip out.

3) Take out stopper pin (65) with tweezers or magnet.


4) Removing pin guide (69).

 : 13mm

5) Take out load check valve (21) and spring (22) with tweezers or magnet.

(8) Disassembling load check valve (21)
(See Fig. 2-10.)

1) Hold control valve body and remove 10 plugs (20).

 : 8mm

2) Take out load check valve (21) and spring (22) with pin set or magnet.

! For load check valve (21) of arm switching section, disassemble swing priority section first. [Refer to (7) Disassembling swing priority section.]

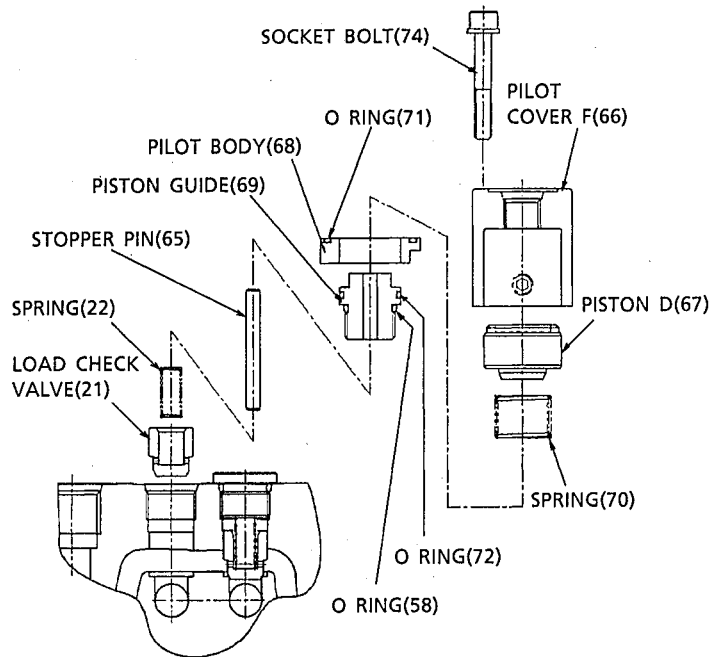


Fig. 2-9 Disassembling swing priority section

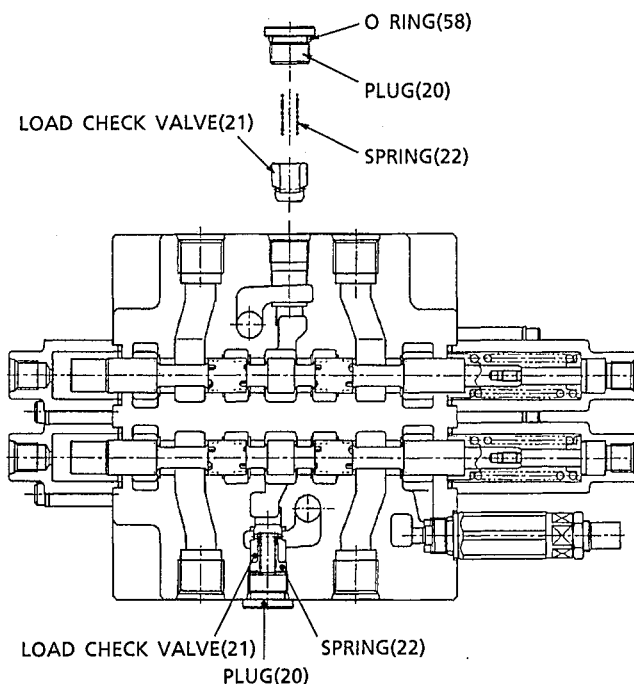


Fig. 2-10 Removing load check valve
(Example of section BB)

3.2 DISASSEMBLY


(1) Plug each port of pilot valve, and clean it.

P port : PF1/4


1~4 and T port : PF3/8

(2) Hold pilot valve with vise, and remove boots (501).

(3) Remove adjusting nut (312) applying spanners to adjusting nut (312) and circular plate (302).


 : 22mm, 32mm


(4) Remove circular plate (302)

 : 32mm

(5) Turn joint (301) in counterclockwise with Jig A to remove.

Jig A : Refer to 3.7 Detail of jig

 : 24mm

 When the force of return springs (221-1), (221-2) is high, never loosen joint (301). If loosened, it might result in jumping out of plate (151), plug (211) and push rod (212).

Remove joint (301) pressing plate (151) downward with two fingers.

(6) Remove plate (151)

● When the force of return spring is high, press plate to let it come up slowly.

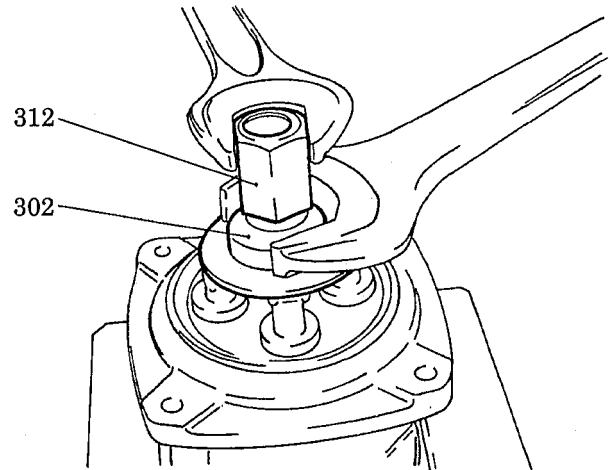


Fig. 3-3 Removing adjusting nut (312)

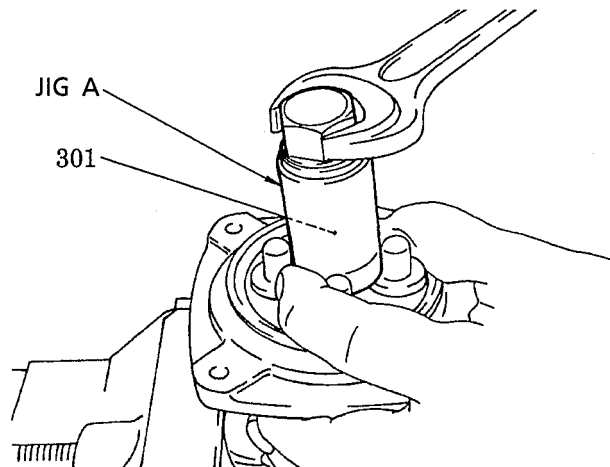


Fig. 3-4 Removing joint (301)

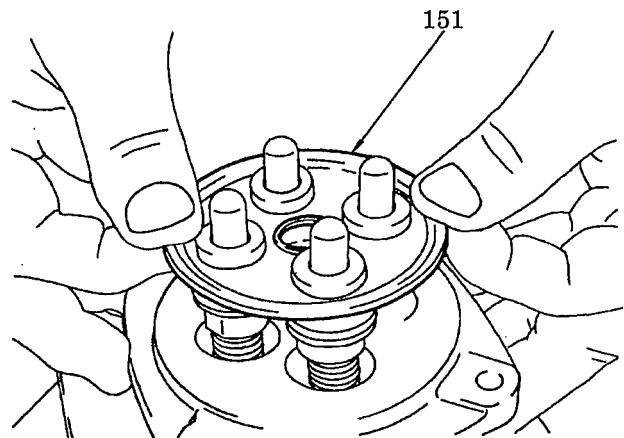


Fig. 3-5 Removing plate (151)

4.2 DISASSEMBLY

(1) Preparation for disassembly


Plug each port, and clean it with wash oil.
Hold casing with vise applying a protecting plate.

(2) Disassembly

⚠ Take care not to change combination of sliding parts.

1) Remove boots (501) from cover (201).

2) Loosen setscrew (423).

 : 3mm


⚠ The loosening torque is larger because Locktite #241 is applied.

3) Apply round bar $\varnothing 8$ (0.315in) or less to cam shaft (413), and remove it striking lightly.

4) Remove cam together with setscrew (471) and lock nut (472) as a assy.

⚠ Lift up slowly to avoid the push rod (214) projecting.

5) Remove socket bolts M12 \times 55 (271).

 : 10mm

6) Remove cover (201).

Record positions of cover (201) and casing (101).

⚠ Lift up slowly to avoid push rod (214) and plug (202) projecting.

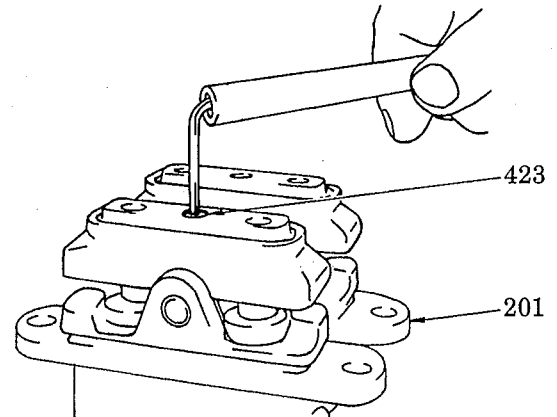


Fig. 4-3 Loosen set screw (423)

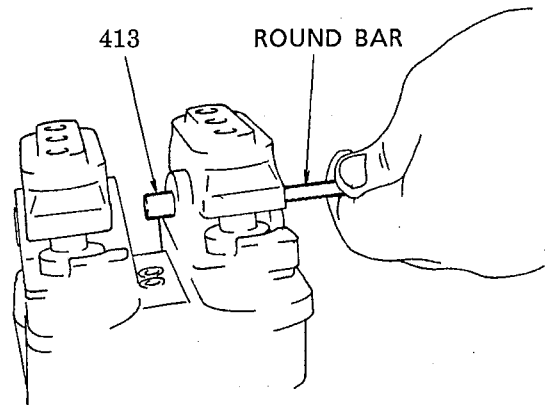


Fig. 4-4 Pulling out cam shaft (413)

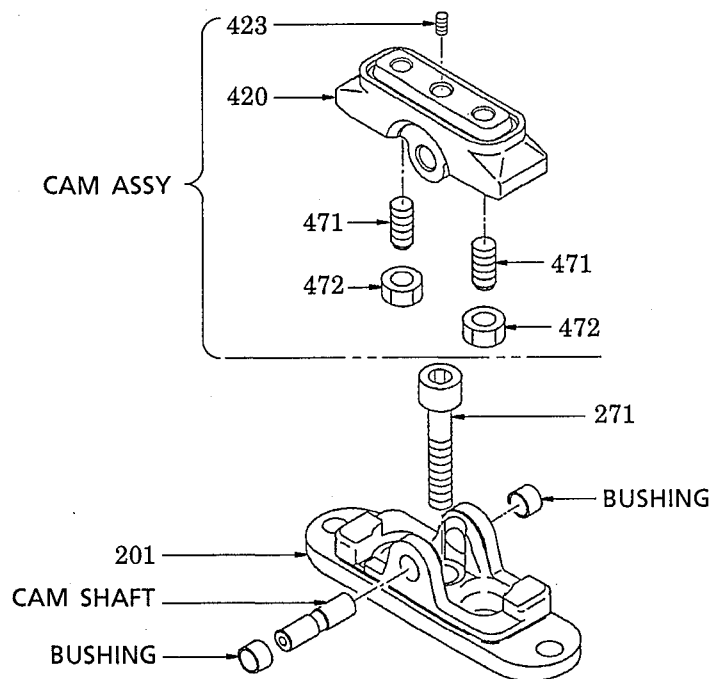


Fig. 4-5 Removing cam assy and cover (201)

5. SWING MOTOR UNIT

5.1 CONSTRUCTION

(1) Swing motor
Composition Slewing motor assy
SG025E-096

Swash plate type
axial piston
motor MFB40-330 Two-stage planetary
gear reduction unit
RG025S-155-38

Mechanical brake

Relief valve

Makeup valve

Bypass valve

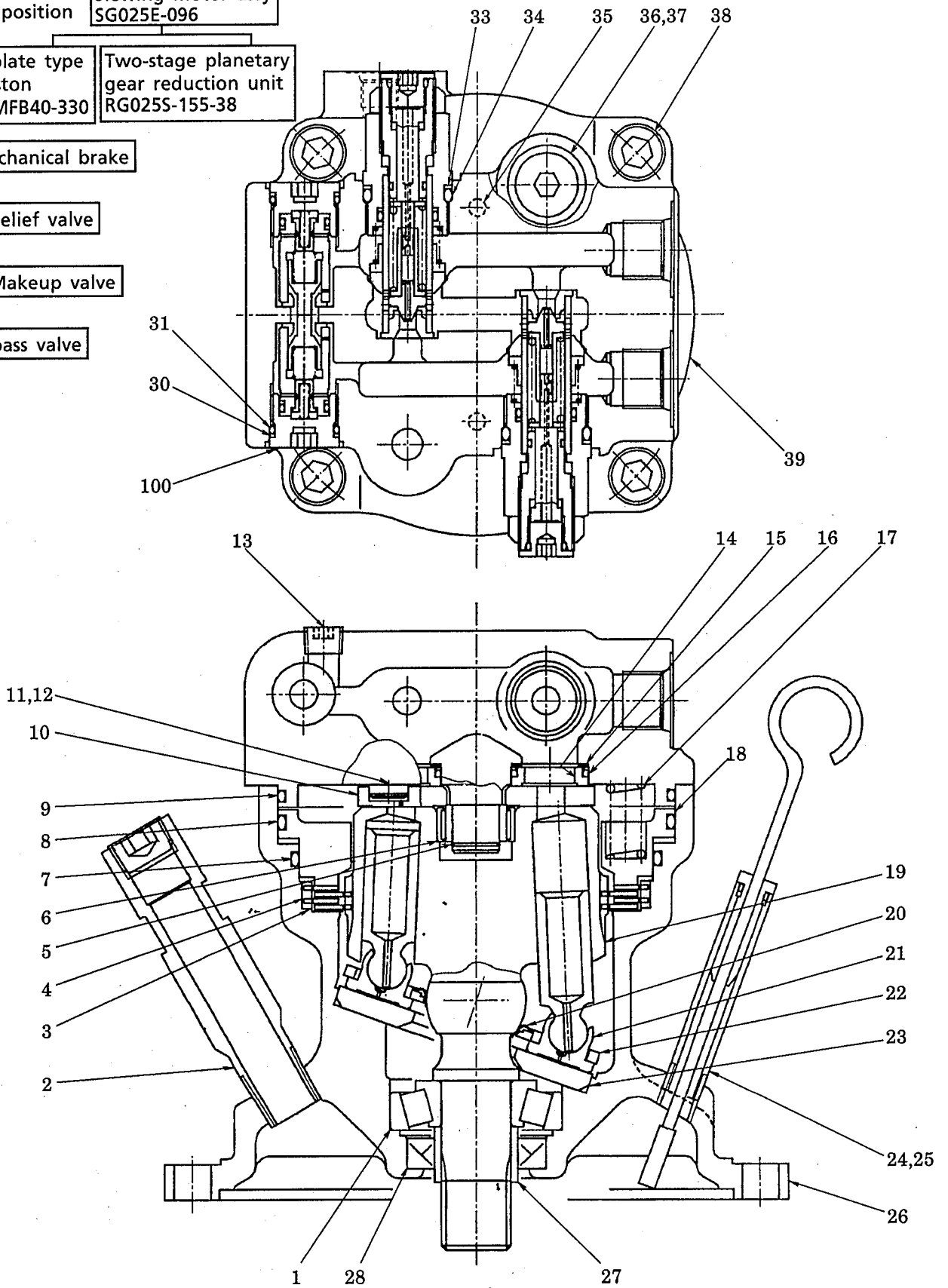


Fig. 5-1 Swing motor

(2) Installation

- The jigs to be used for installation are shown below.

mm

Oil seal (7) press-fitting jig	Seal protector	Remarks
		<ul style="list-style-type: none"> • Heat vinyl chloride tube in hot water and inset it onto the pinion shaft to form a seal protector.

- 1) Apply grease to the rollers of the taper roller bearing (4).

- Grade: SHELL ALVANIA EP2 or equivalent (grease for extreme pressure duty)
- Quantity : About 150cc

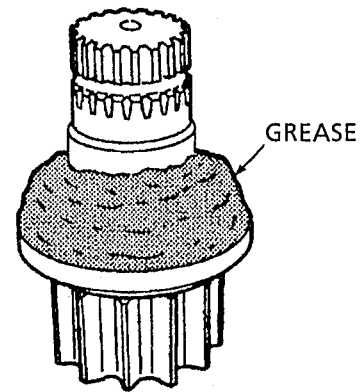


Fig. 5-27 Applying grease to taper roller bearing (4)

- 2) Press-fitting the oil seal (7)

Degrease the oil seal position on the gear case (5) and the oil seal (7). Apply liquid packing (Three Bond #1211, white) to the outside of the oil seal. Using the seal press-fitting jig and a hand press, install the oil seal (7) on the gear case (5).

- After press-fitting, apply grease to the oil seal lips.

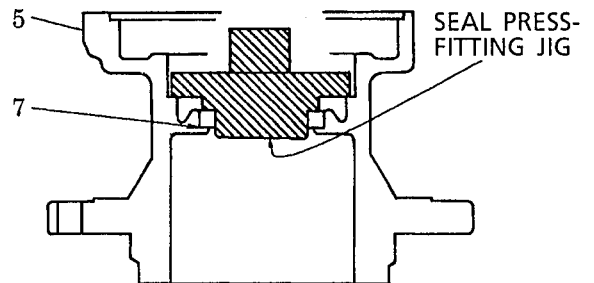


Fig. 5-28 Press-fitting oil seal (7)

- 3) Place the gear case (5) with the output shaft side facing upward, and install the pinion shaft (1) assy into the gear case (5).

- Use the seal protector to prevent the spline of the pinion shaft (1) from damaging the lips of the oil seal (7).

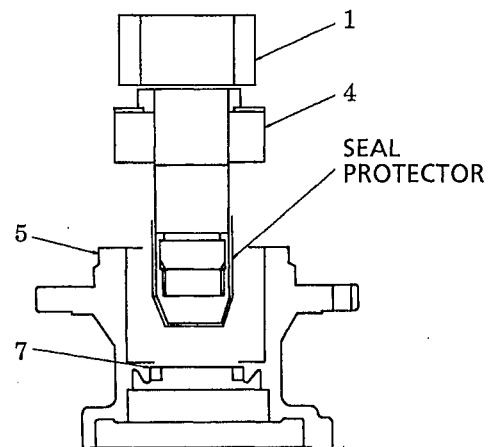


Fig. 5-29 Installing pinion shaft (1) assy

6.3.2 INSPECTION AFTER ASSEMBLY

After completion of assembly, inspection for oil leakage, pressure resistance, etc., using a device as shown in the figure right.

(1) High pressure port

Install a changeover valve and pressure gauge to the stem side port and body side port respectively, and while watching the pressure gauge (for high pressure) installed on the body side and also by regulating high pressure relief valve (7), gradually increase the pressure and when the pressure has reached 1.5 times the maximum working pressure, close stop valve (3) and lock in the hydraulic oil in the swivel. Keep stop valve (6) on the low pressure relief valve side closed at this time.

(2) Low pressure port

(Drain port, return port, etc.)

Similar to the high pressure port, install a changeover valve and pressure gauge on each port of the stem side and body side.

Open stop valve (6) on the side of low pressure relief valve (5) and while watching the pressure gauge (for low pressure) connected to the body side and also by regulating low pressure relief valve (5), gradually increase the pressure and check for outside leakage with a color check at a pressure of 5 kgf/cm² (71psi).

- The maximum working pressure stands for pressure of hydraulic excavator equipped with swivel joint.

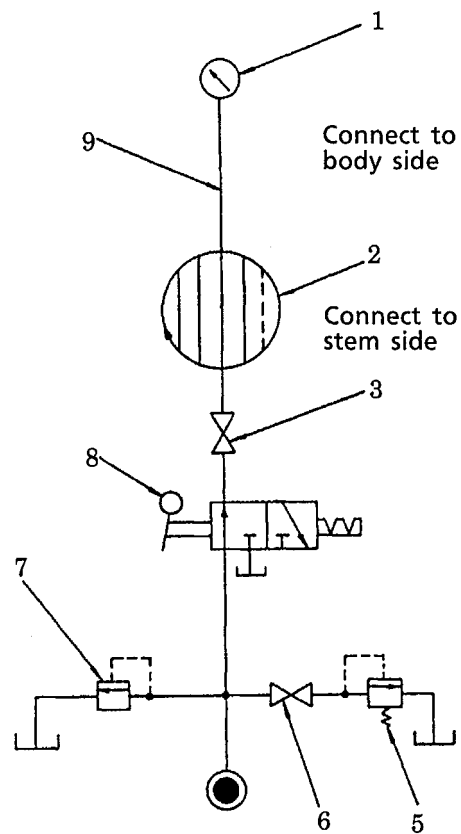


Fig. 6-12 Hydraulic circuit for inspection equipment

Table 6-3

Item	Description	Remarks
1	Pressure Gauge	High and Low Pressures are required.
2	Swivel Joint	
3	Stop Valve	
5	Relief Valve for low pressure	Setting Pressure : 5kgf/cm ² (71psi)
6	Stop Valve	
7	Relief Valve for high pressure	Setting Pressure : [Max. operating pressure 260kgf/cm ² (3700psi) × 1.5times]
8	Changeover Valve	
9	Piping, etc.	

- 7) Removing floating seal (6).
Take out floating seal (6) from upper roller (1).

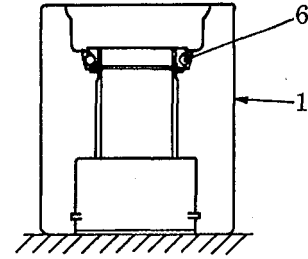


Fig. 3-8 Taking out floating seal (6)

- 8) Removing floating seal (6).
Take out, from retainer, floating seal (6) that is located on the side from which shaft (2) was disparted.

⚠ Retainer is press fitted into shaft (2).
Therefore do not disassemble it.

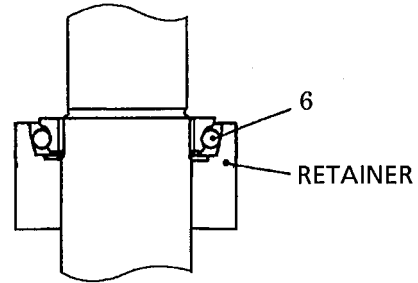


Fig. 3-9 Taking out floating seal (6)

- 9) Removing bushing (5).
Since the thickness of bushing is thin, remove it through lathe or strip it. When the wear of busing is too small, place upper roller(1) on jig(f) for repair stand and apply push-out bar on the end face of bushing(5), and push it out by striking it with mallet.

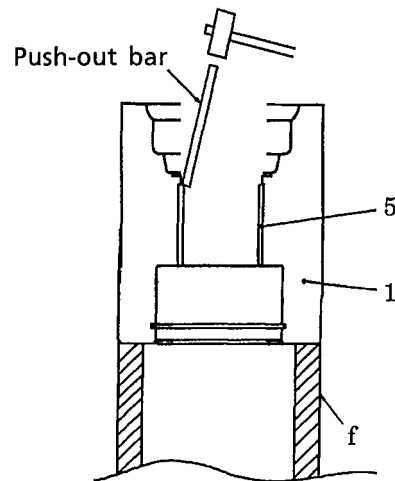


Fig. 3-10 Extruding bushing (5)

- (2) Assembly
Assembly of the upper roller is done in the reverse order of disassembly.

- 1) Pressing the bushing (5).
Align inner hole of roller(1) and busing(5) and press fit it vertically with press so that jig(h) for bushing push-in jig(h) is inserted into bushing(5).

⚠ If you fail in this operation by pressing the bushing unevenly, the bushing is distorted and gets unserviceable. In that case, do not re-use the bushing as it may develop malfunctioning after assembly.

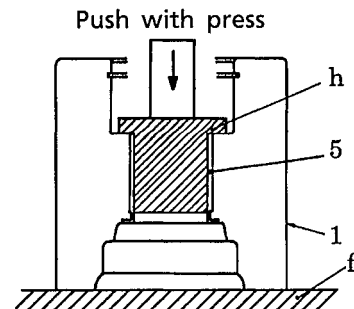


Fig. 3-11 Pushing in bushing (5)

5. FRONT IDLER (IDLER ADJUSTER ASSY)

5.1 FRONT IDLER ASSY

ASSY PART NO.		YT52D00001F1	
No.	NAME	Q'TY	REMARKS
1	IDLER ASSY	2	YT52D00002F1
2	IDLER ADJUSTER	2	YR54D00002F1
3	GREASE NIPPLE	2	2444P803
4	CAP SCREW	4	M12×30

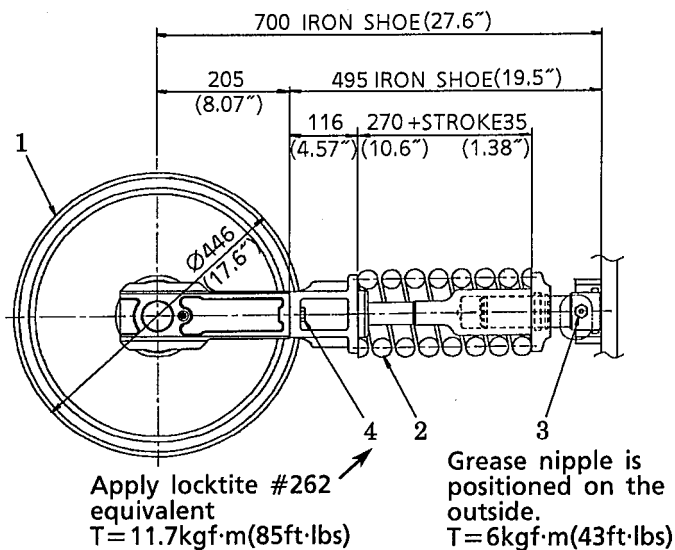


Fig. 5-1 Front idler assy

5.2 REMOVING

- (1) Preparation for removal
Remove crawler.

- (2) Removing crawler idler assy (5)
Sling idler assy, and push it forward with bar.
Weight of crawler idler assy : 146kg (320 lbs)

- ⚠ Keep well away from the front side of front idler.

- (3) Installing
Installing is done in the reverse order of removing.

- (4) Where idling assy (1) has to be separated
Loosen capscrew (4), and separate idler assy (1) from idler adjuster assy (2).

⌀ : 19mm

Weight of idler assy : 45kg (99 lbs)

Weight of idler adjuster assy : 49kg (110 lbs)

- The separated idler assy should be placed on square timbers.

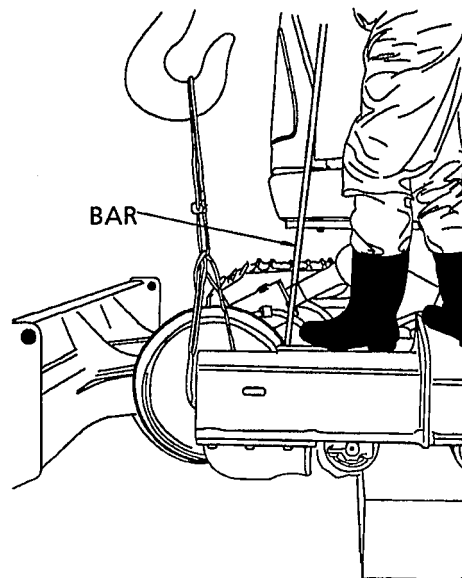


Fig. 5-2 Removing and installation the front idler

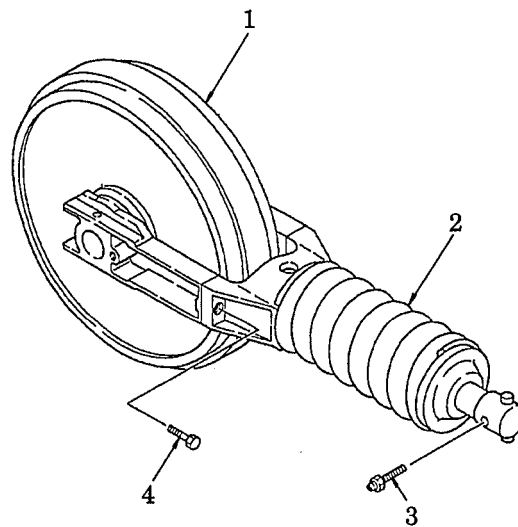


Fig. 5-3 Separating idler assy (1) from idler adjuster assembly

6.3 MAINTENANCE STANDARD (2407N267)

Table 6-1

PRINCIPAL PARTICULARS	PITCH	78.7mm (3.10in)	NUMBER OF TEETH	21
	ROLLER DIA.	ø41 (1.61in)	PITCH DIA.	527.9 (20.78in)

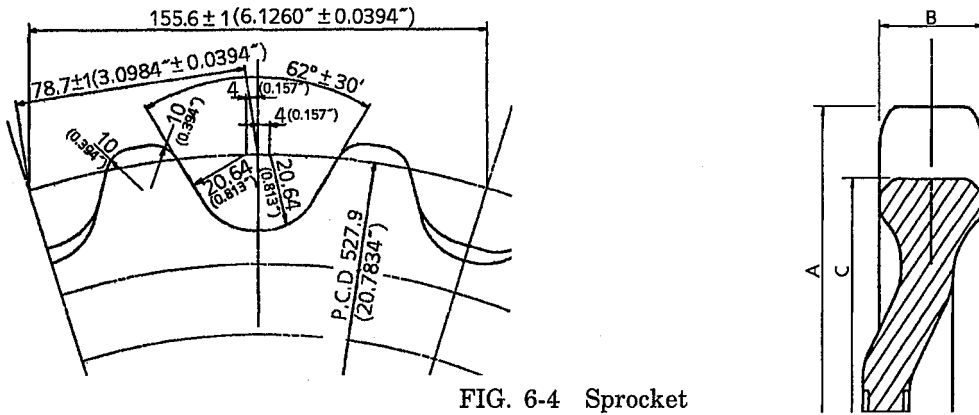


FIG. 6-4 Sprocket

Table 6-2

Unit : mm (in)

No.	NAME	STANDARD VALUE	REFERENCE VALUE FOR REMEDY	SERVICEABILITY LIMIT	REMEDY
A	O.D. of sprocket	ø540 ⁺³ ₀ (21.260 ^{+0.118} ₀)	534 (21.0)	532 (20.9)	Reinforcement weld, repair or replace.
B	Width of sprocket teeth	38 ^{+0.5} _{-2.5} (1.4961 ^{+0.0197} _{-0.0984})	32 (1.26)	30 (1.18)	Replace.
C	I.D. of sprocket	ø487 (19.2)	32 (1.26)	30 (1.18)	Reinforcement weld, repair or replace.

6.4 SPROCKET TOOTH PROFILE GAUGE

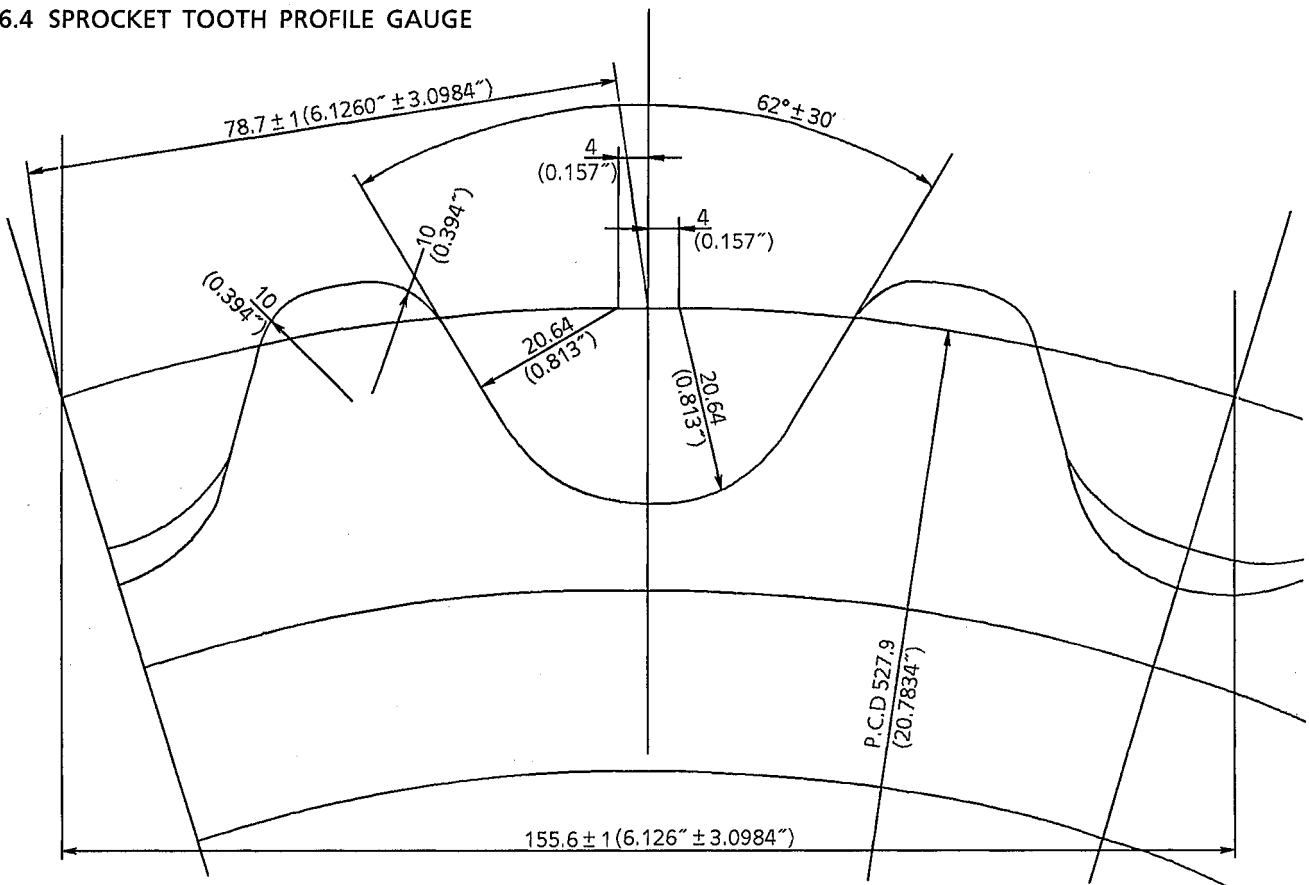


Fig. 6-5 Tooth profile gauge

(2) Tightening torque

APPLICATION ITEM (No.)	BOLT-NUT		OPPOSING FLATS (mm)	TIGHTENING TORQUE kgf·m (ft·lbs)
	NAME	SIZE		
19	Reamer bolt	M20 P2.5	30	42 (300)
33	Plug	PT3/8	8	4 (29)
124	Plug	M30 P1.5	36	36 (260)
126	Plug	M24 P1.5	10	13 (94)
143	Socket bolt	M10 P1.5	8	5.9 (43)
144	Plug	PT1/8	5	1.25 (9.1)
121	Plug	PF3/8	8	6 (43)
152	Plug	PF1/8	5	1.25 (9.1)
154	Plug	GDL-1/16-S	4	0.6 (4.3)
170	Socket bolt	M8 P1.25	6	3 (22)
204	Plug	—	10	8 (58)
214	Plug	PF1/2	10	10 (72)

(3) Tools

NAME	SIZE	APPLICATION ITEM (No.)
General work bench		Disassembly and assembly
Cleaning bath	For rough cleaning and finish cleaning	Cleaning the parts
Work bench for press	Pressing capacity 200kg (441 lbs) or over	104,149
Heating bath	Heating capacity 100°C (212 °F) or over volume 500×500×500 (20"×20"×20")	149
Electric drill	Portable electric drill (Max. drill depth Ø10 (0.394"))	1
Drill	Ø2 (0.0787")	1
Compressed air	Pressure 3~5kgf/cm ² (43~71psi)	Disassembly 161,162,163, Drying after cleaning
Lathe		3

(4) Measuring instrument

NAME	SIZE	APPLICATION ITEM
Thickness gauge × 2	Measurement 0.04~0.3mm (0.00016~0.0118in)	For snap ring (20) thickness adjustment
Outside micrometer	Measured value: 0~25mm (0~0.984in) Minimum graduation: 0.01 (0.00039in)	For snap ring (20) thickness adjustment
Single depth micrometer	Measured value: 0~25mm (0~0.984in) Minimum graduation: 0.01 (0.00039in)	For bearing (21) pre-load adjustment

4) Remove bearing (150) from rear flange (101).

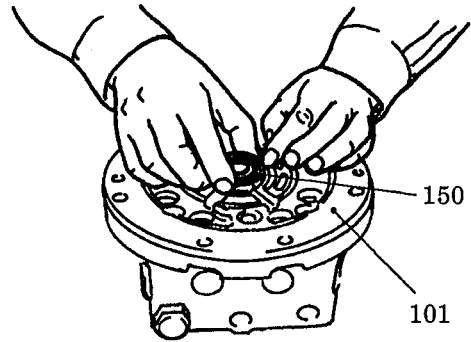


Fig. 1-28 Removing bearing (150)

(8) Removing the brake valve parts from the rear flange.

1) Remove two plugs (124) of rear flange (101).

 : 36mm

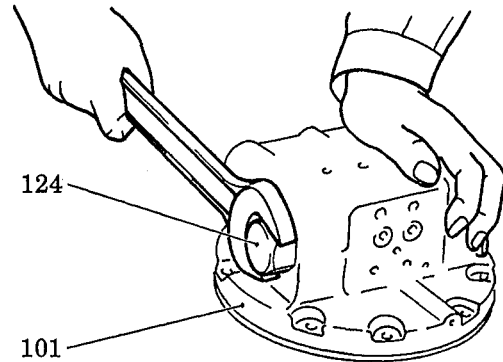


Fig. 1-29 Removing plug (124)

2) Remove two spring retainer (125) and two springs (128) from rear flange (101).

3) Remove spool (123) from rear flange (101).

● To remove spool (123), place your hand on one part of the plug port of rear flange (101) and tilt it down. Then spool (123) falls down. Hold the tip and remove it.

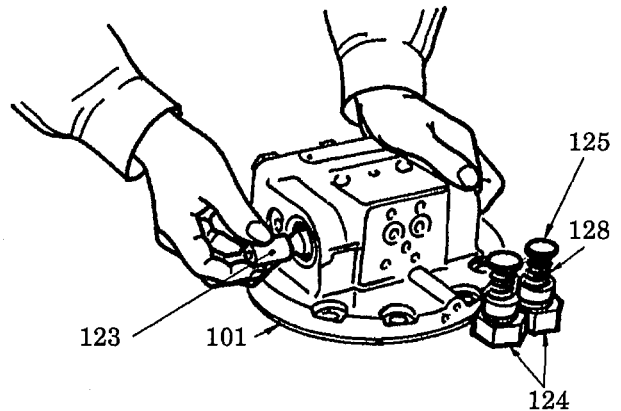


Fig. 1-30 Removing spring retainer (125), spring (128), spool (123)

4) Remove two plugs (126) from rear flange (101).

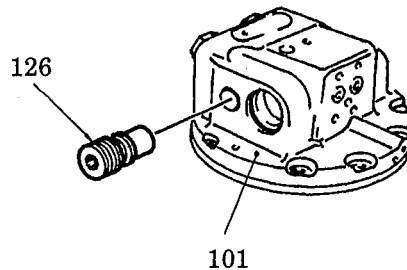


Fig. 1-31 Removing plug (126)

(16) Removing bearing (149).

- Remove it only when replacing the ball bearing. Place the retainer metal (II) on a press bench and put the shaft (102) in it. Hold down the tip of the shaft by press and remove the bearing (149) from the shaft.
- Do not reuse the bearing.

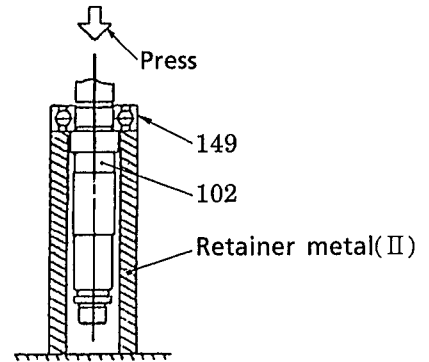


Fig. 1-63 Removing bearing (149)

(17) Removing spur gear (7)

- 1) Turn over the travel motor.

⚠ When the snap ring is removed, the tip of the pliers slips from the snap ring hole and the snap ring pops up in some cases. Be careful not to slip the ring of it.

- 2) Remove three snap rings (25) from crank-shaft (9).
- 3) Remove three spur gears (7) from crank-shaft (9).

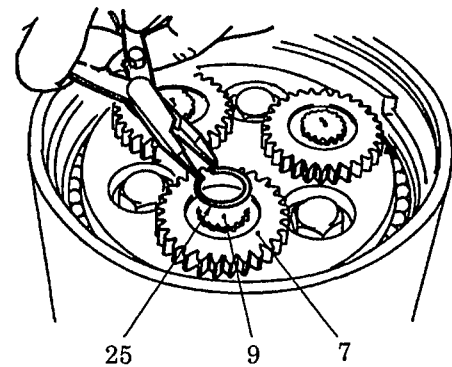


Fig. 1-64 Removing snap ring (25)

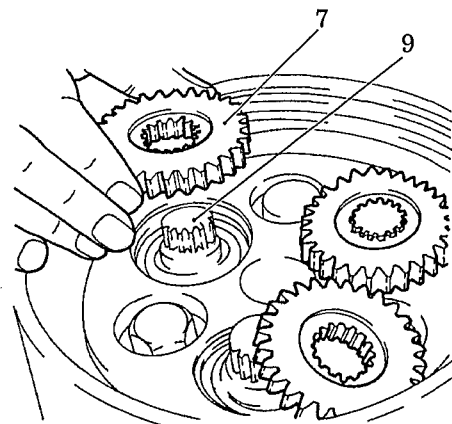


Fig. 1-65 Removing spur gear (7)

- 4) Remove three distance pieces (14) from crank-shaft (9).

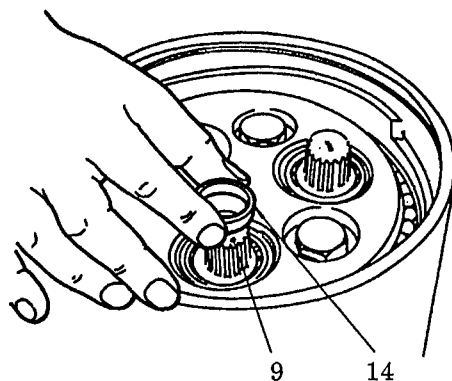


Fig. 1-66 Removing distance pieces (14)

- 4) Fix hub (1) and spindle (2) with fixing metal in symmetrical position.

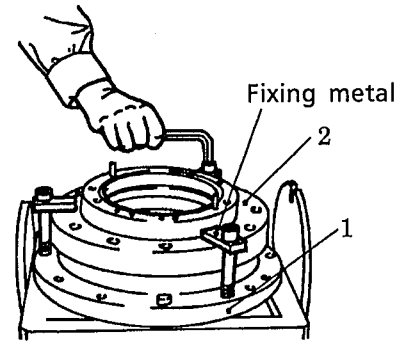


Fig. 1-93 Fixing hub (1) and spindle (2)

- 5) Turn over the travel motor.
- 6) Insert three outer races of bearing (22) in holes of spindle (2) respectively.

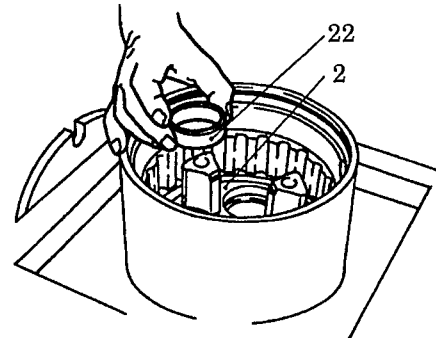


Fig. 1-94 Inserting the outer race of bearing (22)

- 7) Install RV gear assy.
 1. Insert RV gear A (4) to hub (1).

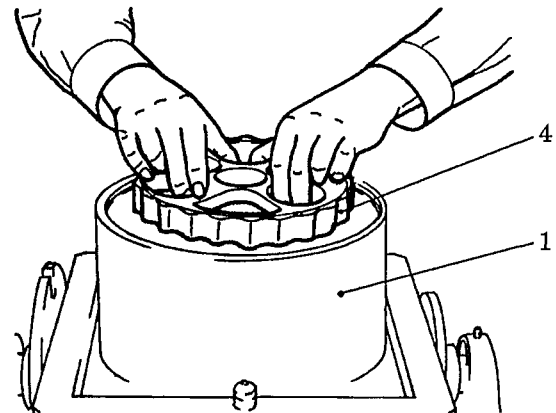


Fig. 1-95 Inseting the RV gear A (4)

2. Fit three crankshafts (9) in holes for bearing (22) inside of spindle (2).

● Then, bearing (22), bearing (23) and spacer (12) are already fitted in crankshaft.

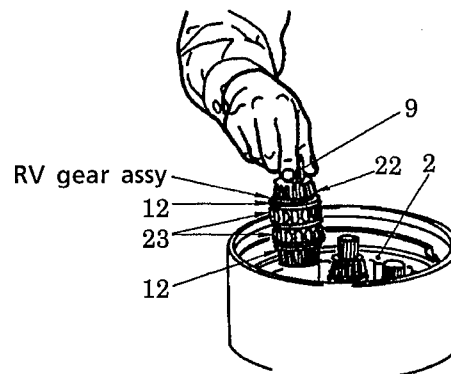


Fig. 1-96 Fitting crankshaft (9)

- 2) Apply hydraulic oil to bearing (150), and install it in rear flange (101).

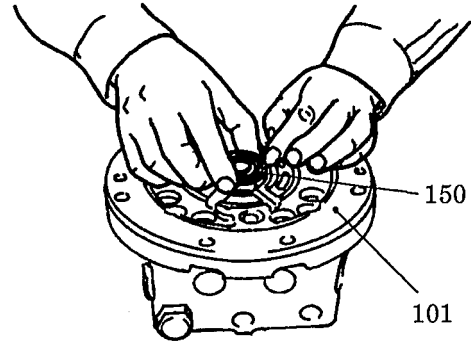


Fig. 1-131 Installing bearing (150)

- 3) Drive two parallel pins (141) in pin holes of rear flange (101).

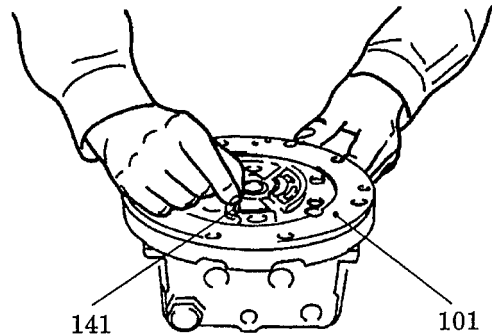


Fig. 1-132 Installing parallel pin (141)

- 4) Apply the surface of timing plate (109) in contact with rear flange (101).

- 5) Install timing plate (109) on rear flange (101) taking parallel pin (141) as a guide.

- Install timing plate (109) until it is completely contacted with rear flange (101). Grease film is used to protect them from dropping.

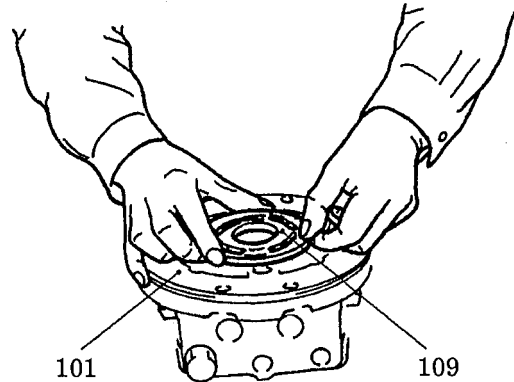


Fig. 1-133 Installing timing plate (109)

- (14) Connecting rear flange with spindle.

- 1) Fix O ring (27),(30) into the O ring groove of spindle (2).

- Fit O ring (30) without application of grease. Application of grease may cause taking the seeped grease out of contact face of rear flange and spindle for the leaking oil. So never apply grease on O ring (30).

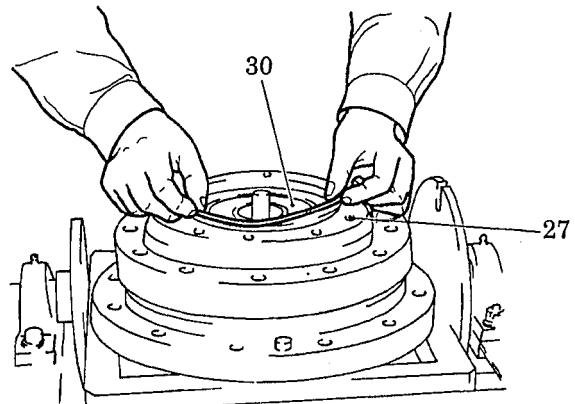


Fig. 1-134 Installing O ring (27),(30)

1.4.5 PROCEDURE OF AXIAL CLEARANCE ADJUSTMENT OF BEARING (22)

⚠ When the following parts have been replaced, it is necessary to adjust the axial clearance of taper roller bearing (22) to a specified value by adjusting the thickness of snap ring (20).
If it is installed without adjustment, malfunction of hydraulic motor may be caused and the life may be shortened.

Spindle (2), hold flange (3), crankshaft (9), spacer (12), spindle (20), bearing (22).

- When the above parts are not replaced, the adjustment of thickness of snap ring is unnecessary. Proceed to the regular assembly shown in Item (5) in page II-1-37.
- The clearance adjustment procedure in shaft direction is described below.

(1) Adjustment procedure.

1) Lightly tap the outer race of bearing (22) attached to crankshaft (9).

- Put the RV gear assy in spindle (2) securely.

2) Fix the thinnest snap ring (20) into the snap ring groove in hold flange (3).

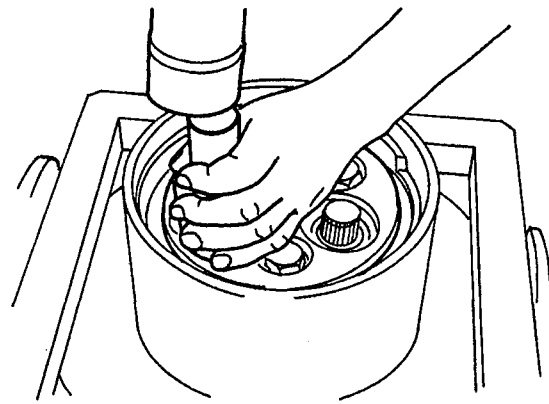


Fig. 1-165 Putting the RV gear assy in spindle (2) securely

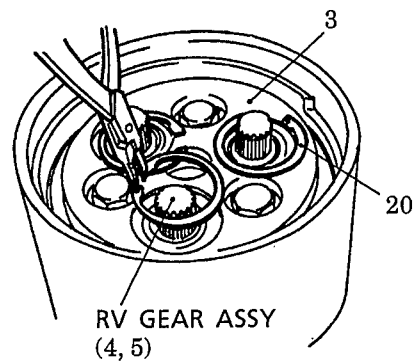


Fig. 1-166 Installing snap ring (20)

KOBELCO

SHOP MANUAL SK70SR

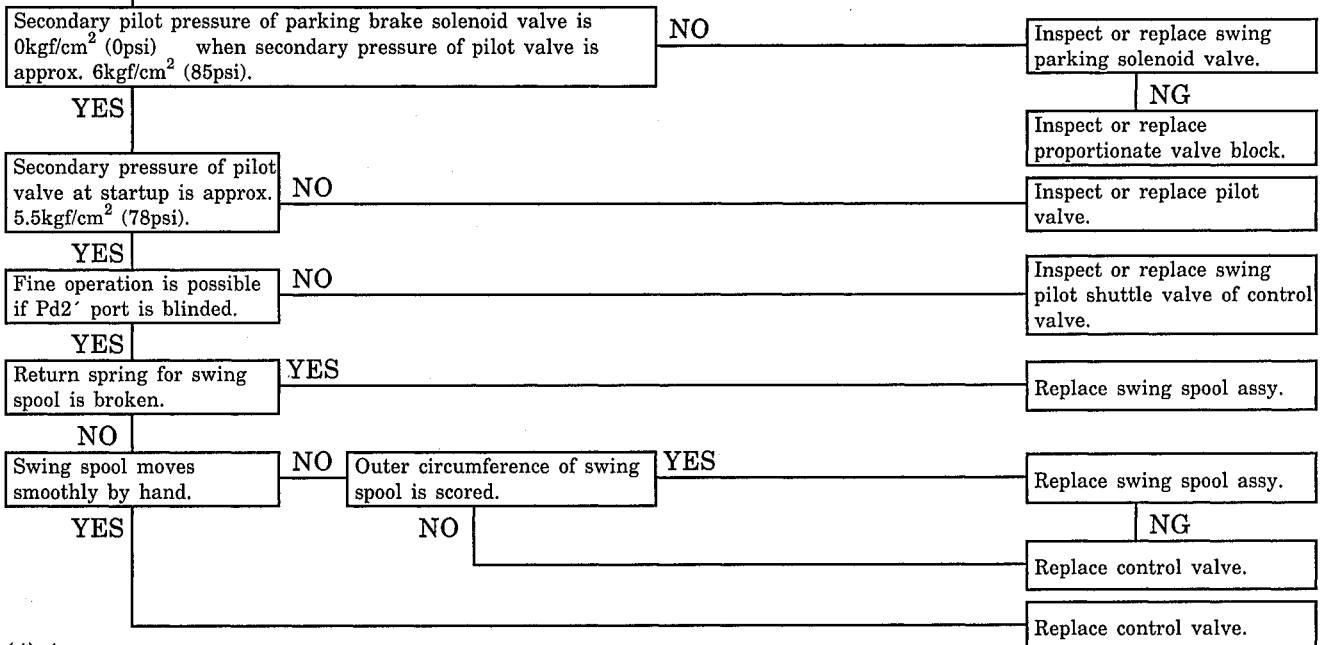
TROUBLESHOOTING (MECHATRO CONTROL)

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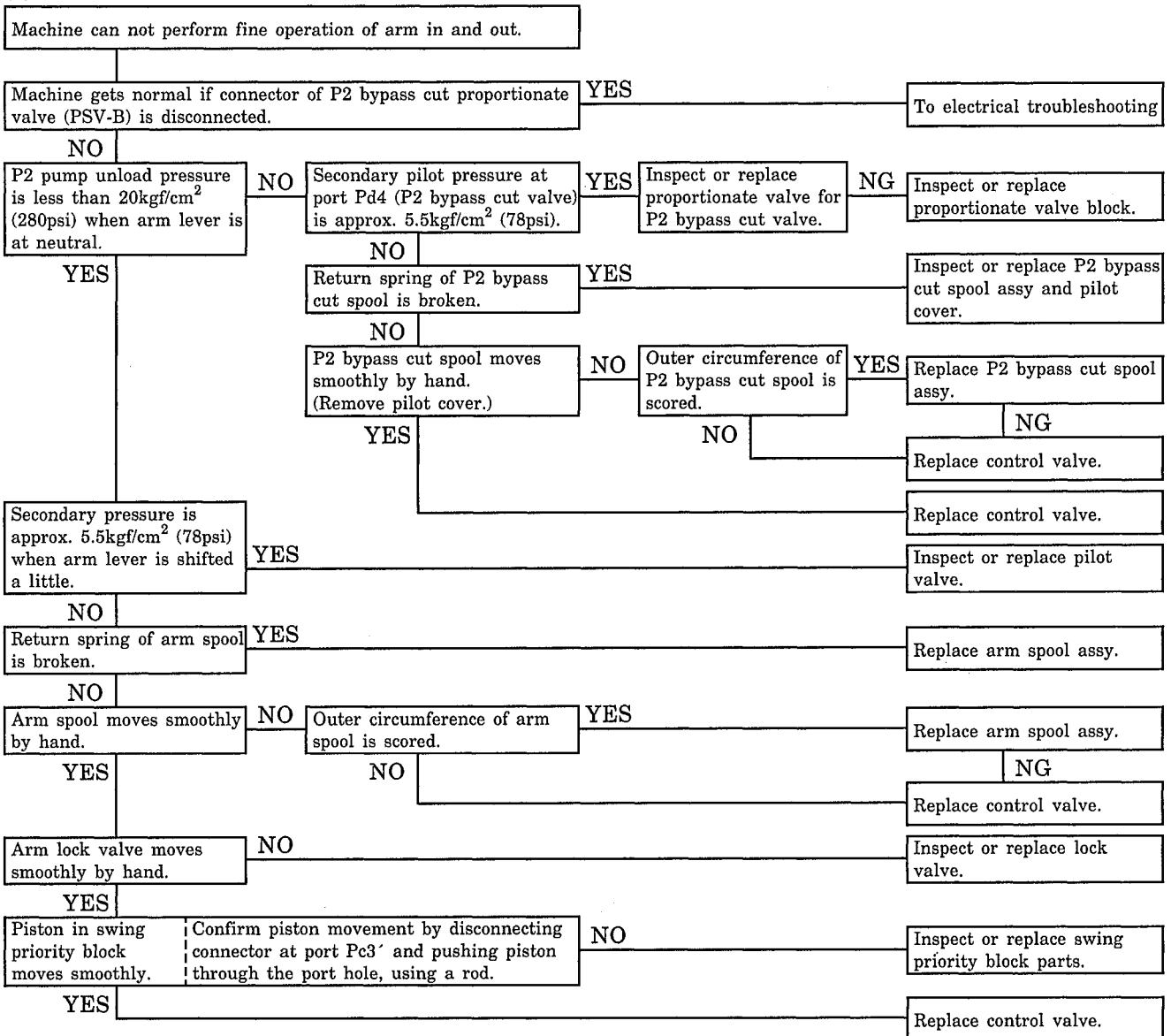
1. OUTLINE	1
2. TABLE OF ACTUATOR FOR TROUBLESHOOTING	3
3. TROUBLESHOOTING SUMMARIZED	4
4. CHECK POINT FOR MECHATRO SYSTEM	6

YT41

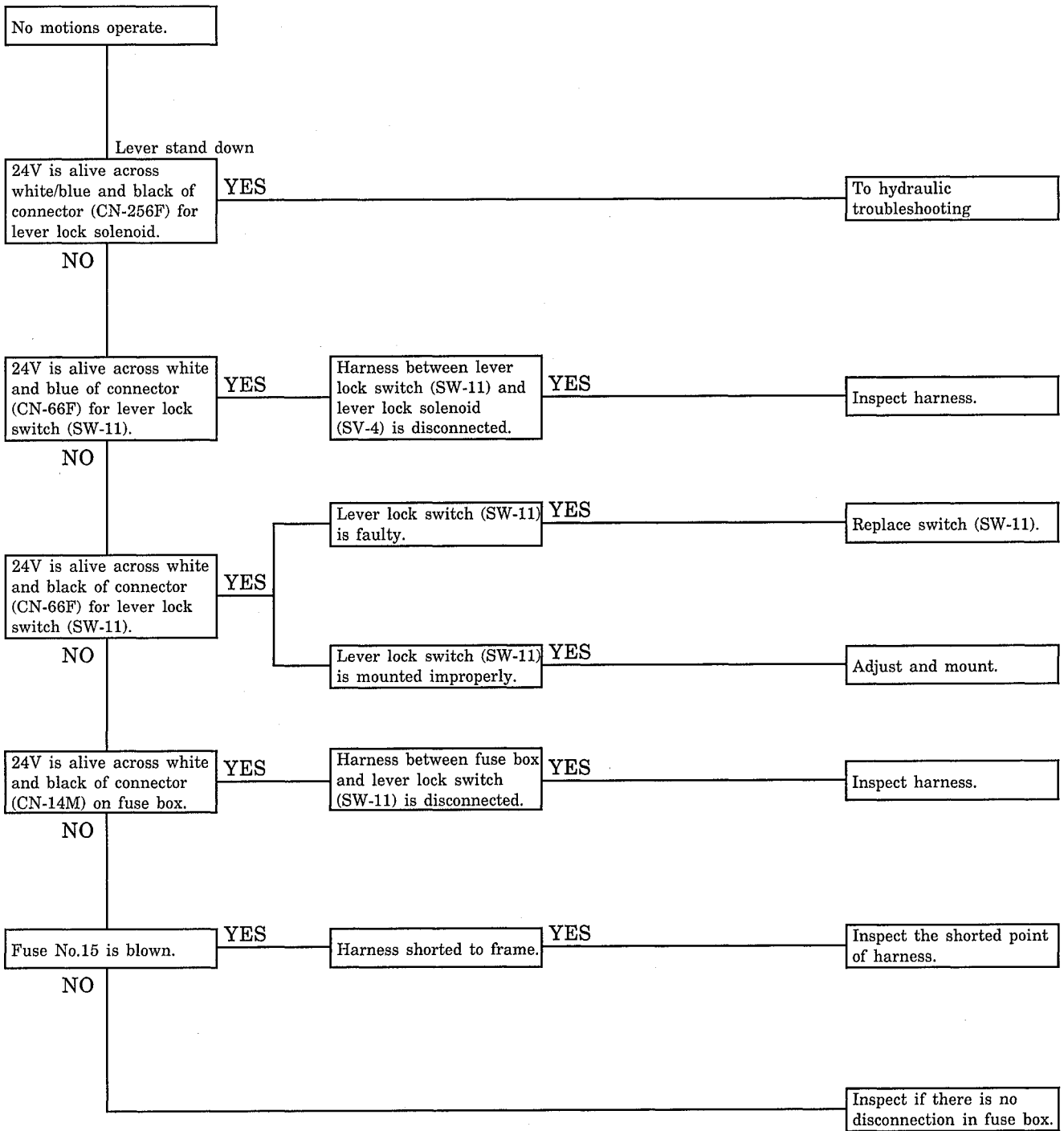
Continued from P10.



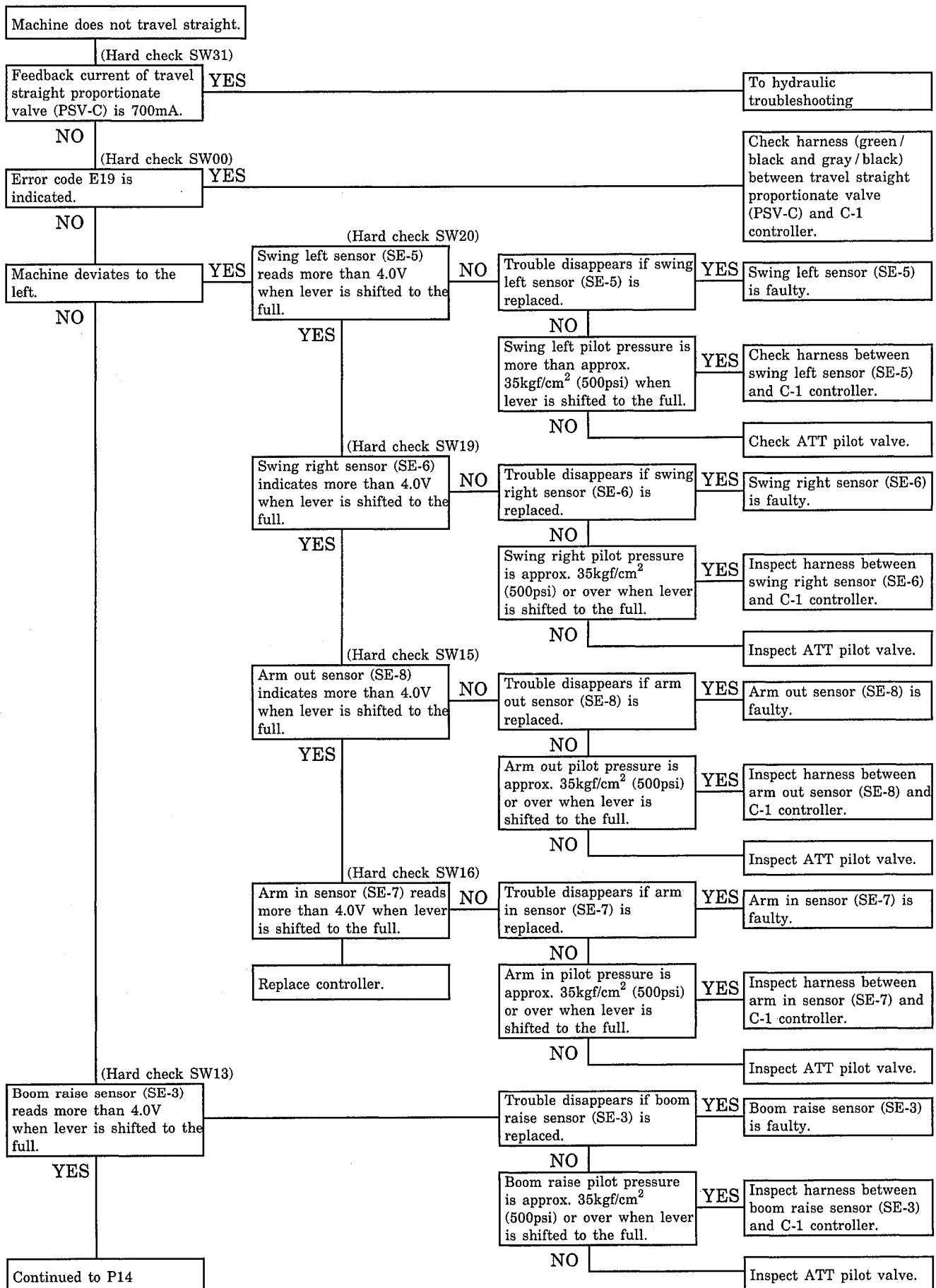
(4)-4



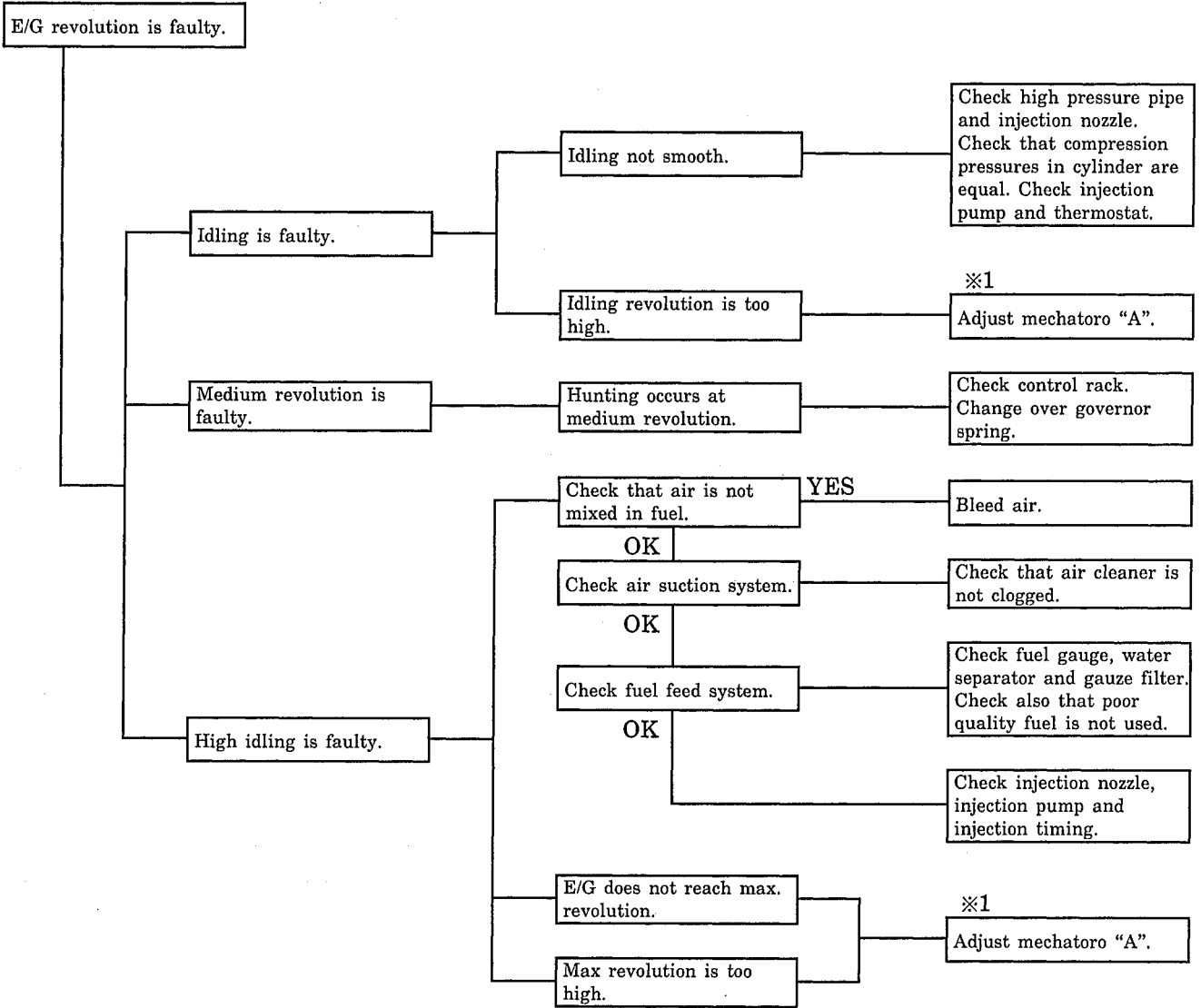
(1)-1



(8)



(3)



Checking condition ; E/G water temperature is more than $50 \pm 5^{\circ}\text{C}$ ($122 \pm 41^{\circ}\text{F}$).

※1 ; Refer to Electric Troubleshooting.

SECTION 1

GENERAL INFORMATION

TABLE OF CONTENTS

ITEM	PAGE
General repair instructions	1- 2
Notes on the format of this manual	1- 2
Main data and specifications	1- 6
Tightening torque specifications	1- 7

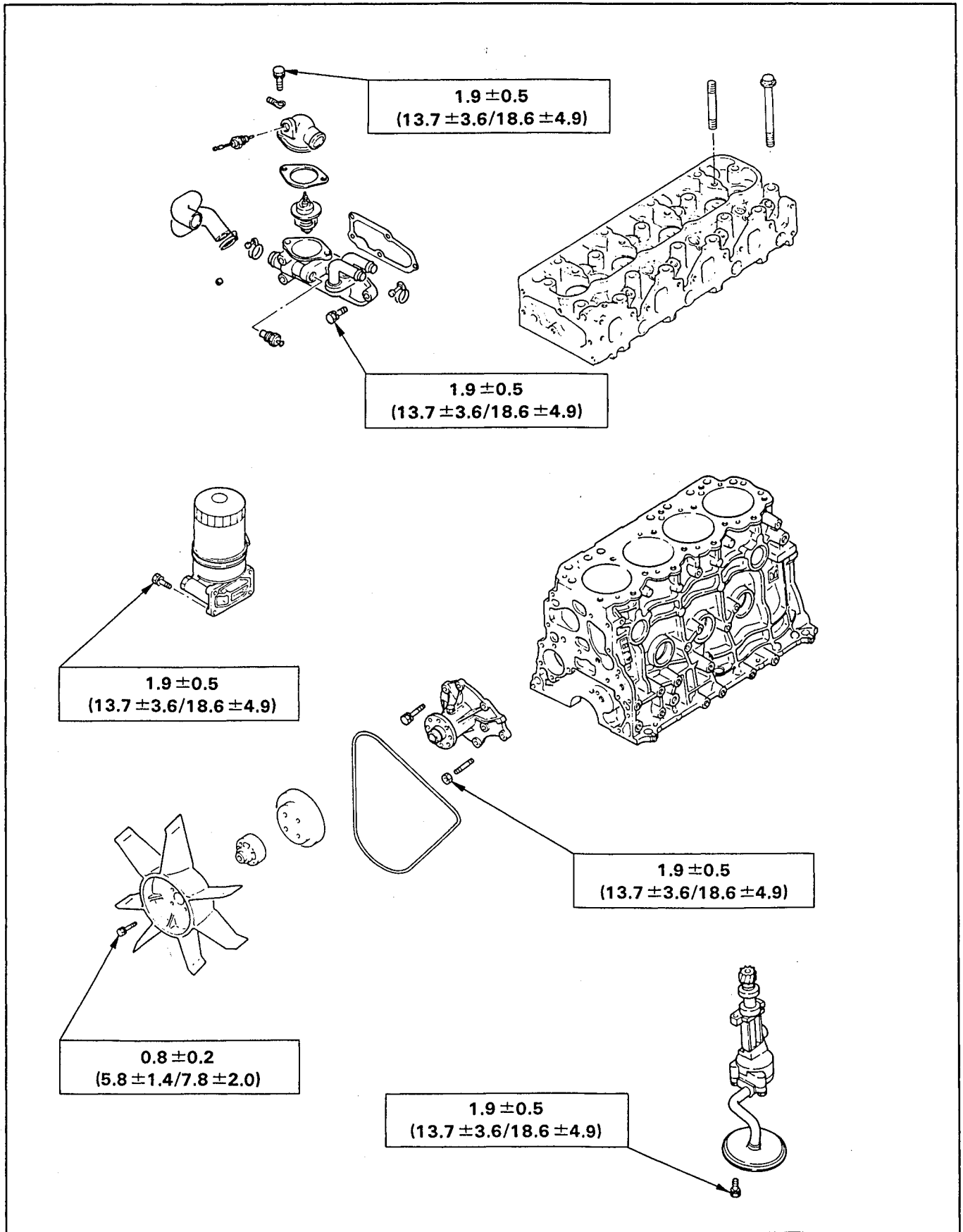
NOTICE

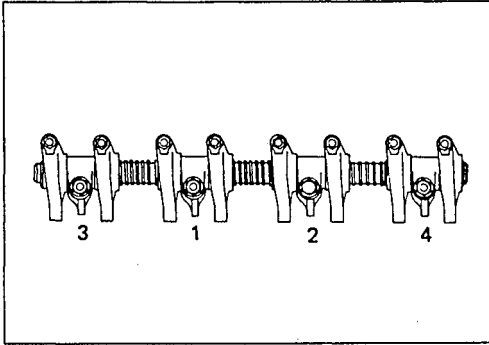
Before using this Workshop Manual to assist you in performing engine service and maintenance operations, it is recommended that you carefully read and thoroughly understand the information contained in Section - 1 under the headings "GENERAL REPAIR INSTRUCTION" and "NOTES ON THE FORMAT OF THIS MANUAL"



Cooling and Lubricating System

kg·m(lb.ft./N·m)





VALVE CLEARANCE ADJUSTMENT

1. Retighten the rocker arm shaft bracket bolts in sequence as shown in the illustration.

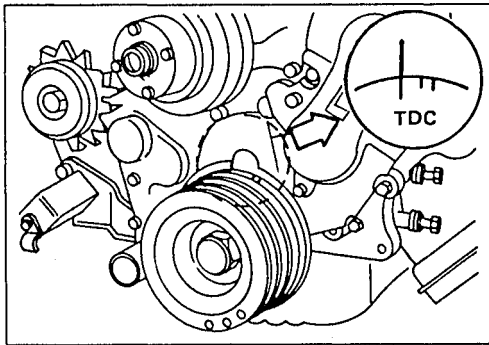


Rocker Arm Shaft Bracket Bolt

Torque

kg·m(lb.ft./N·m)

5.5 ± 0.5 ($39.8 \pm 3.6/53.9 \pm 4.9$)

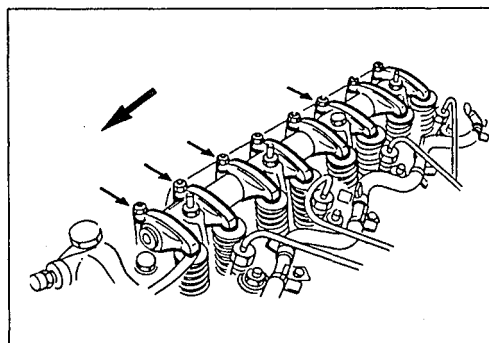


2. Bring the piston in either the No. 1 cylinder or the No. 4 cylinder to TDC on the compression stroke by turning the crankshaft until the crankshaft damper pulley TDC line is aligned with the timing pointer.

3. Check for play in the No. 1 intake and exhaust valve push rods.

If the No. 1 cylinder intake and exhaust valve push rods have play, the No. 1 piston is at TDC on the compression stroke.

If the No. 1 cylinder intake and exhaust valve push rods are depressed, the No. 4 piston is at TDC on the compression stroke.



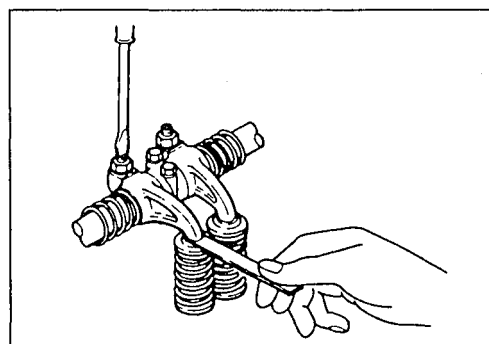
Adjust the No. 1 or the No. 4 cylinder valve clearances while their respective cylinders are at TDC on the compression stroke.

Valve Clearance

mm(in.)

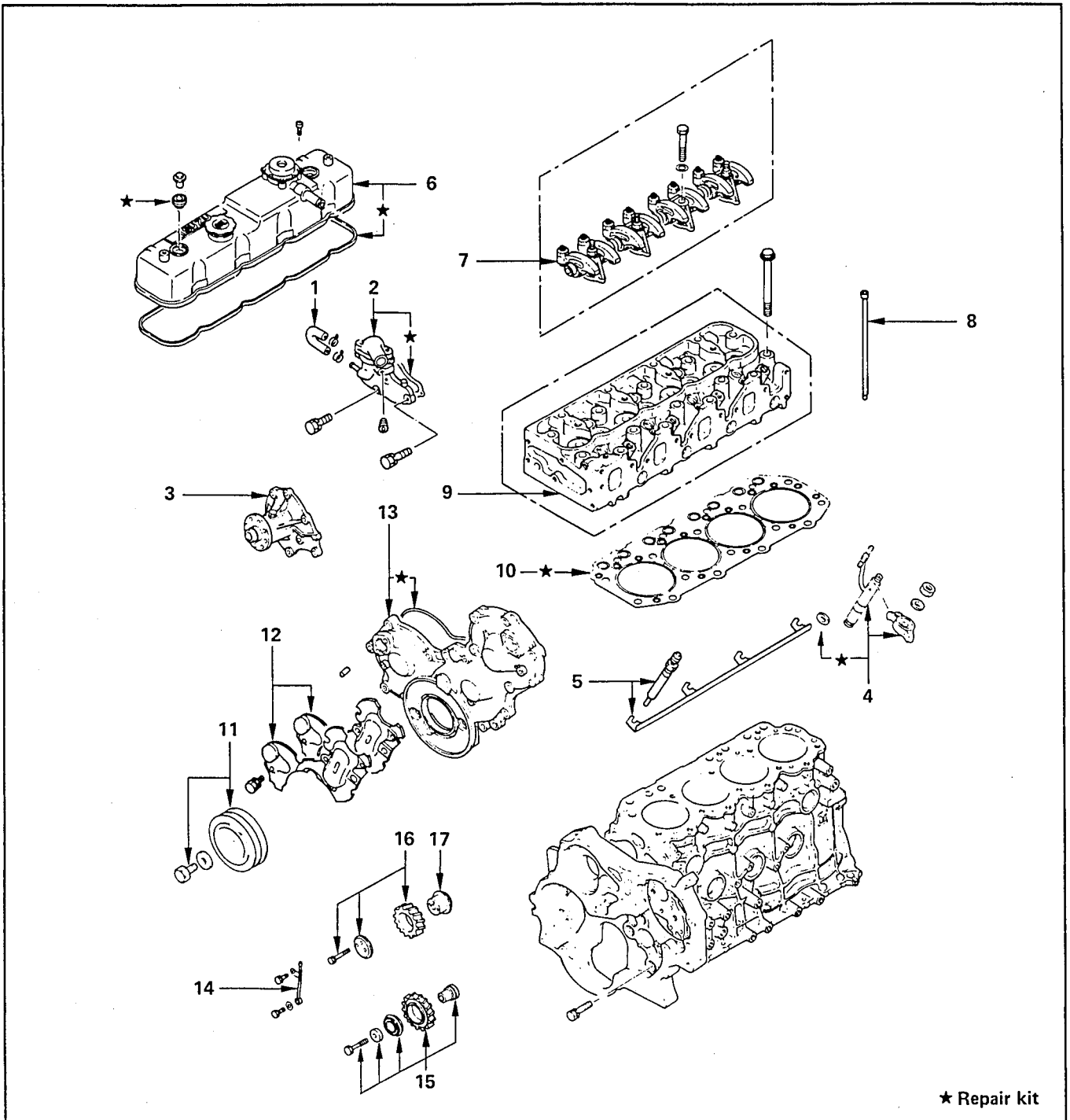
0.40 (0.016)

Loosen each valve clearance adjusting screw as shown in the illustration. (At TDC on the compression stroke of the No. 1 cylinder)



Insert a feeler gauge of the appropriate thickness between the rocker arm and the valve stem end.

4. Turn the valve clearance adjusting screw until a slight drag can be felt on the feeler gauge.
5. Tighten the lock nut securely.



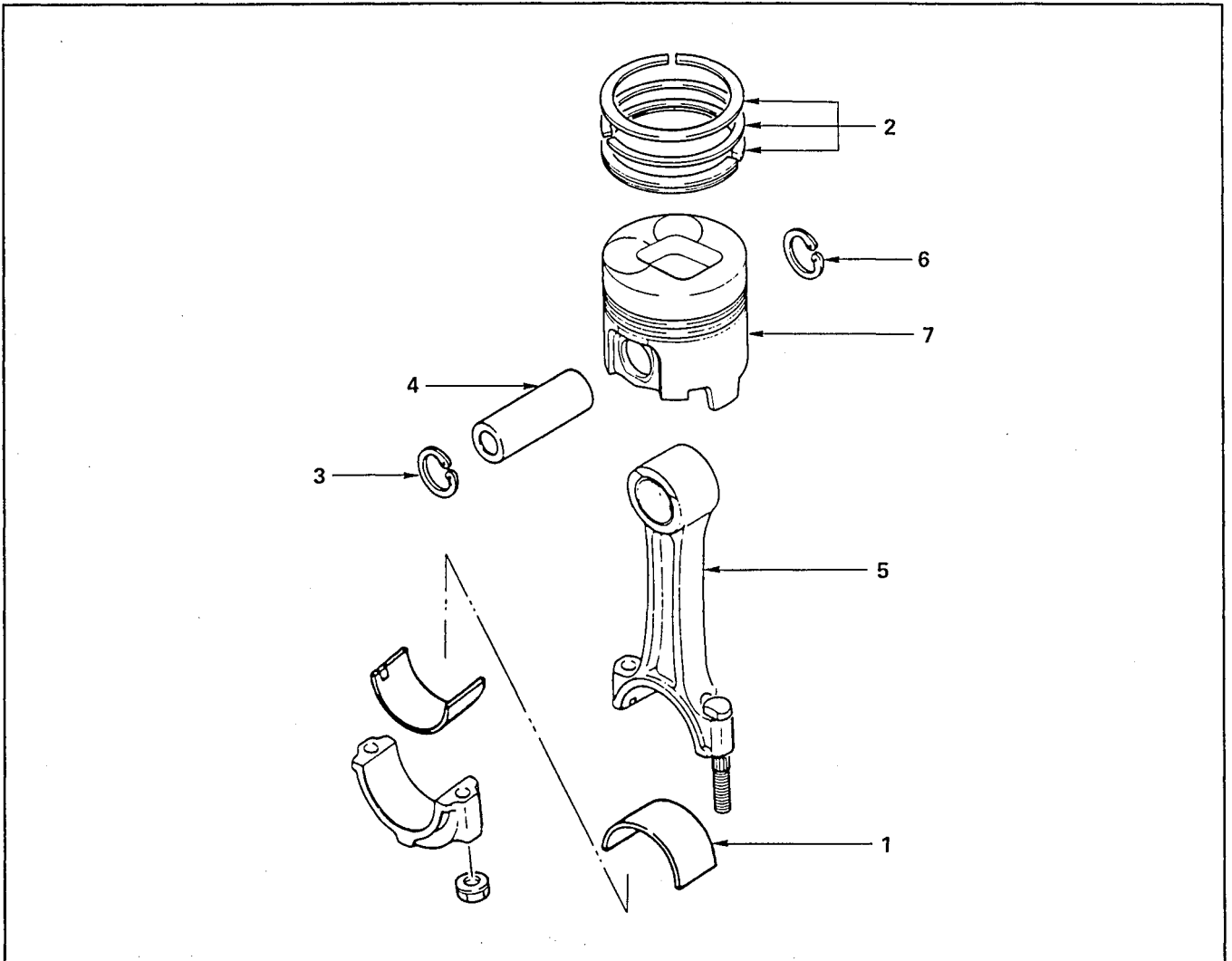
★ Repair kit

Disassembly Steps - 2

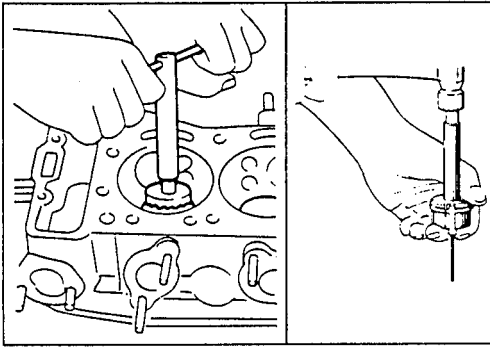
- | | |
|--------------------------------------|---|
| 1. Water by-pass hose | 10. Cylinder head gasket |
| 2. Thermostat housing | ▲ 11. Crankshaft damper pulley with dust seal |
| 3. Water pump | 12. Timing gear case cover |
| ▲ 4. Injection nozzle holder | 13. Timing gear cover |
| 5. Glow plug and glow plug connector | 14. Timing gear oil pipe |
| 6. Cylinder head cover | 15. Idler gear "B" and shaft |
| ▲ 7. Rocker arm shaft and rocker arm | ▲ 16. Idler gear "A" |
| 8. Push rod | 17. Idler gear shaft |
| ▲ 9. Cylinder head | |

Inverted Engine

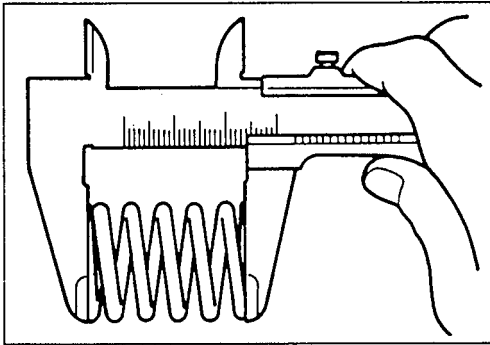
PISTON AND CONNECTING ROD

**Disassembly steps**

- ▲ 1. Connecting rod bearing
- ▲ 2. Piston ring
- ▲ 3. Piston pin snap ring
- ▲ 4. Piston pin
- ▲ 5. Connecting rod
- ▲ 6. Piston pin snap ring
- ▲ 7. Piston



3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while tapping it to fit the valve seat insert.
6. Check that the valve contact width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.



VALVE SPRING

Valve Spring Free Height

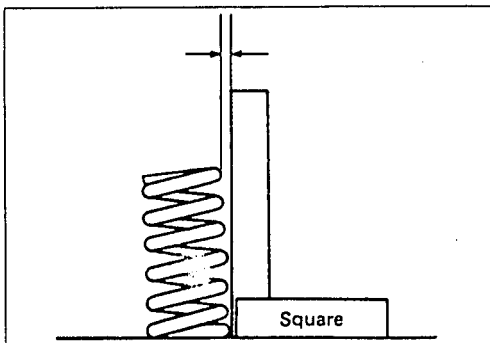


Use a vernier caliper to measure the valve spring free height.

If the measured value is less than the specified limit, the valve spring must be replaced.

Valve Spring Free Height mm(in)

Standard	Limit
49.7 (1.96)	48.2 (1.90)



Valve Spring Inclination

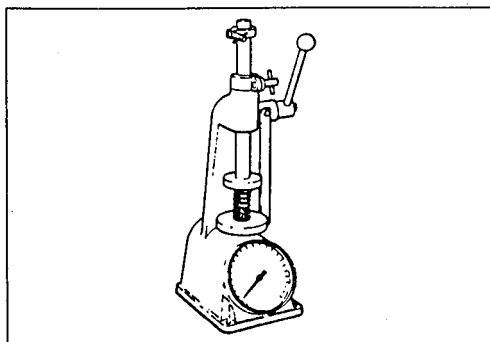


Use a surface plate and a square to measure the valve spring inclination.

If the measured value exceeds the specified limit, the valve spring must be replaced.

Valve Spring Inclination mm(in)

Standard	Limit
1.5 (0.06) or less	2.5 (0.984) or more



Valve Spring Tension

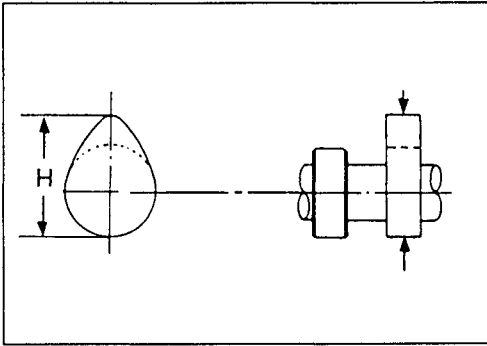


Use a spring tester to measure the valve spring tension.

If the measured value is less than the specified limit, the valve spring must be replaced.

Valve Spring Tension kg(lb)

Compressed Height	Standard	Limit
38.9 mm (1.53 in)	32.6 (71.7)	29.0 (63.8)



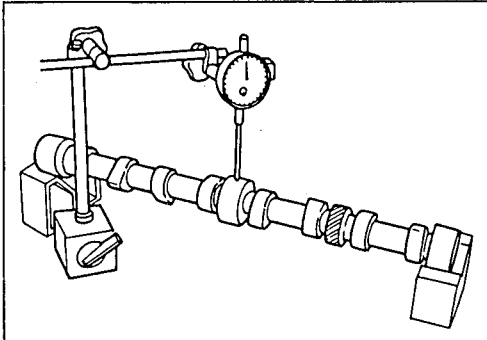
Cam Height



Measure the cam height (H) with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

Cam Height (H) mm(in)

Standard	Limit
42.08 (1.65)	41.65 (1.64)



Camshaft Run-Out

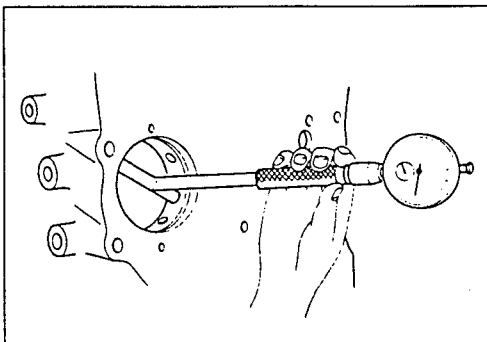


1. Mount the camshaft on V-blocks.
2. Measure the run-out with a dial indicator.

If the measured value exceeds the specified limit, the camshaft must be replaced.

Camshaft Run-Out mm(in)

Standard	Limit
0.02 (0.0008)	0.10 (0.004)



Camshaft and Camshaft Bearing Clearance



Use an inside dial indicator to measure the camshaft bearing inside diameter.

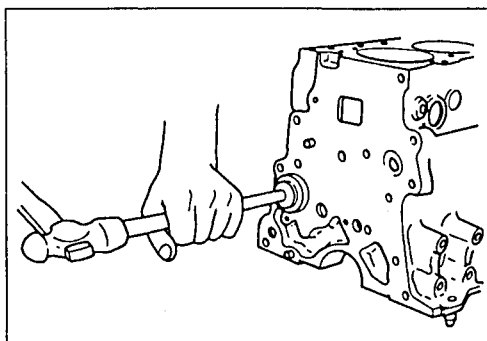
Camshaft Bearing Inside Diameter mm(in)

Standard	Limit
50.0 – 50.03 (1.9685 – 1.9696)	50.08 (1.9716)

If the clearance between the camshaft bearing inside diameter and the journal exceeds the specified limit, the camshaft bearing must be replaced.

Camshaft Bearing Clearance mm(in)

Standard	Limit
0.05 (0.002)	0.12 (0.005)



Camshaft Bearing Replacement

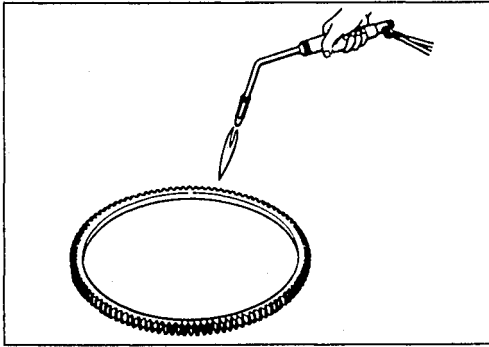


Camshaft Bearing Removal



1. Remove the cylinder body plug plate.
2. Use the camshaft bearing replacer to remove the camshaft bearing.

Bearing Replacer: 5-8840-2038-0



Ring Gear Installation

1. Heat the ring gear evenly with a gas burner to invite thermal expansion.

Do not allow the temperature of the gas burner to exceed 200°C (390°F).

2. Install the ring gear when it is sufficiently heated.

The ring gear must be installed with the chamfer facing the clutch.

Note:

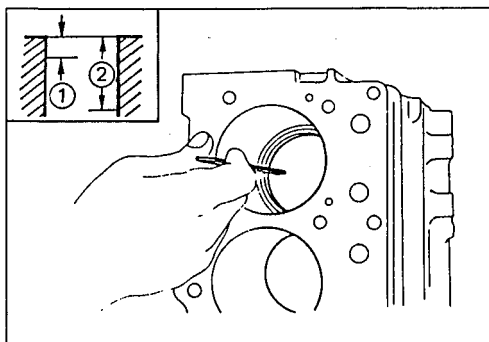
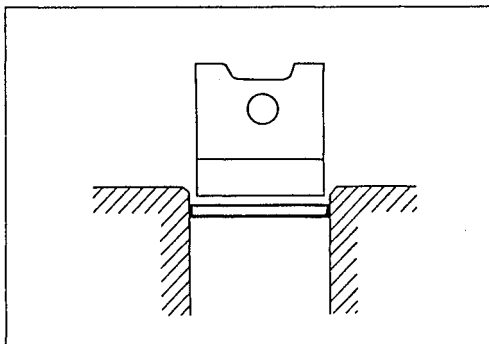
Another method of heating the ring gear to invite thermal expansion is to soak a rag in diesel fuel, wrap the diesel fuel soaked rag around the rim of the ring gear, and then light the rag.

PISTON

Piston Grade Selection and Cylinder Liner Bore Measurement



Refer to the Section "CYLINDER BODY", Item "Cylinder Liner Bore Measurement" for details on piston grade selection and cylinder or liner bore measurement.



PISTON RING

Piston Ring Gap

1. Insert the piston ring horizontally into the cylinder liner.
2. Use a piston inserted upside down to push the piston ring into the cylinder liner until it reaches either measuring point ① or measuring point ②. Cylinder liner diameter is the smallest at these two points.

Do not allow the piston ring to slant to one side or the other. It must be perfectly horizontal.

3. Use a feeler gauge to measure the piston ring gap.

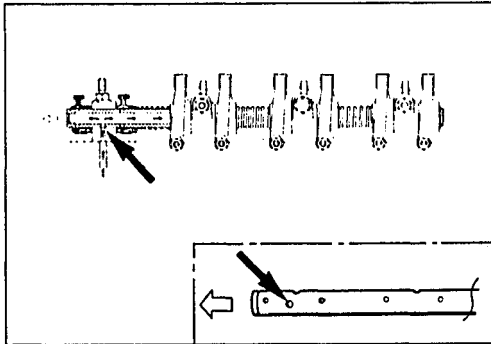
Measuring Point ①: 10 mm (0.39 in) or
Measuring Point ②: 120 mm (4.72 in)

If the piston ring gap exceeds the specified limit, the piston ring must be replaced.



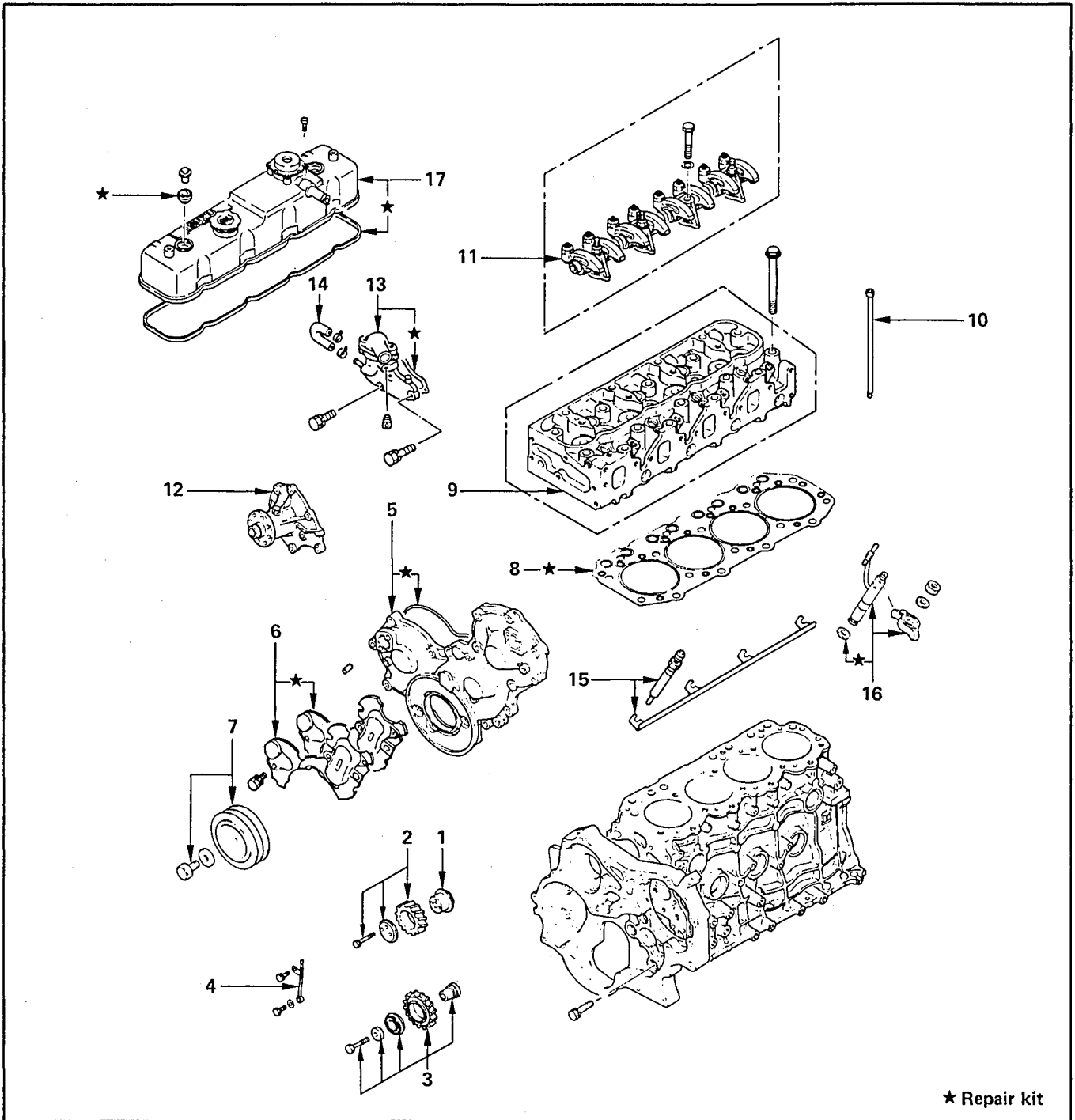


Important Operations



1. Rocker Arm Shaft

- 1) Position the rocker arm shaft with the large oil hole (4ϕ) facing the front of the engine.
- 2) Install the rocker arm shaft together with the rocker arm, the rocker arm shaft bracket, and the spring.



★ Repair kit

Reassembly Steps - 2

- ▲ 1. Idler gear shaft
- ▲ 2. Idler gear "A"
- ▲ 3. Idler gear "B"
- 4. Timing gear oil pipe
- ▲ 5. Timing case cover
- 6. Timing gear case cover
- ▲ 7. Crankshaft damper pulley with dust seal
- ▲ 8. Cylinder head gasket
- ▲ 9. Cylinder head
- 10. Push rod
- ▲ 11. Rocker arm shaft and rocker arm
- ▲ 12. Water pump
- ▲ 13. Thermostat housing
- ▲ 14. Water by-pass hose
- ▲ 15. Glow plug and glow plug connector seal
- ▲ 16. Injection nozzle holder
- 17. Cylinder head cover

15. Glow Plug and Glow Plug Connector

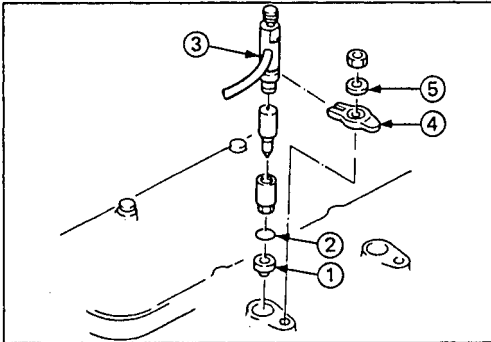


- 1) Tighten the glow plugs to the specified torque.

Glow Plug Torque kg·m(lb.ft/N·m)

2.25 ± 0.25 ($16.3 \pm 1.8/22.1 \pm 2.5$)

- 2) Install the glow plug connectors.



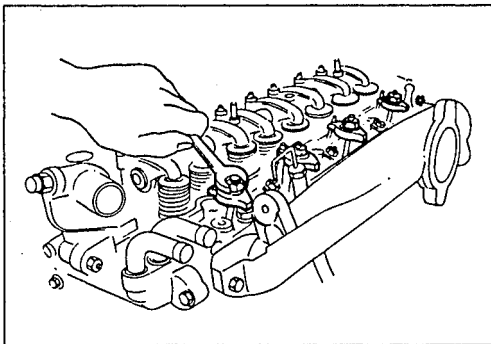
16. Injection Nozzle Holder

- 1) Install the injection nozzle gasket (1) and the O-ring (2) to the injection nozzle holder (3).
- 2) Install the nozzle holder (3) together with the nozzle holder bracket (4) to the cylinder head.
- 3) Tighten the holder nuts with washer (5) to the specified torque.

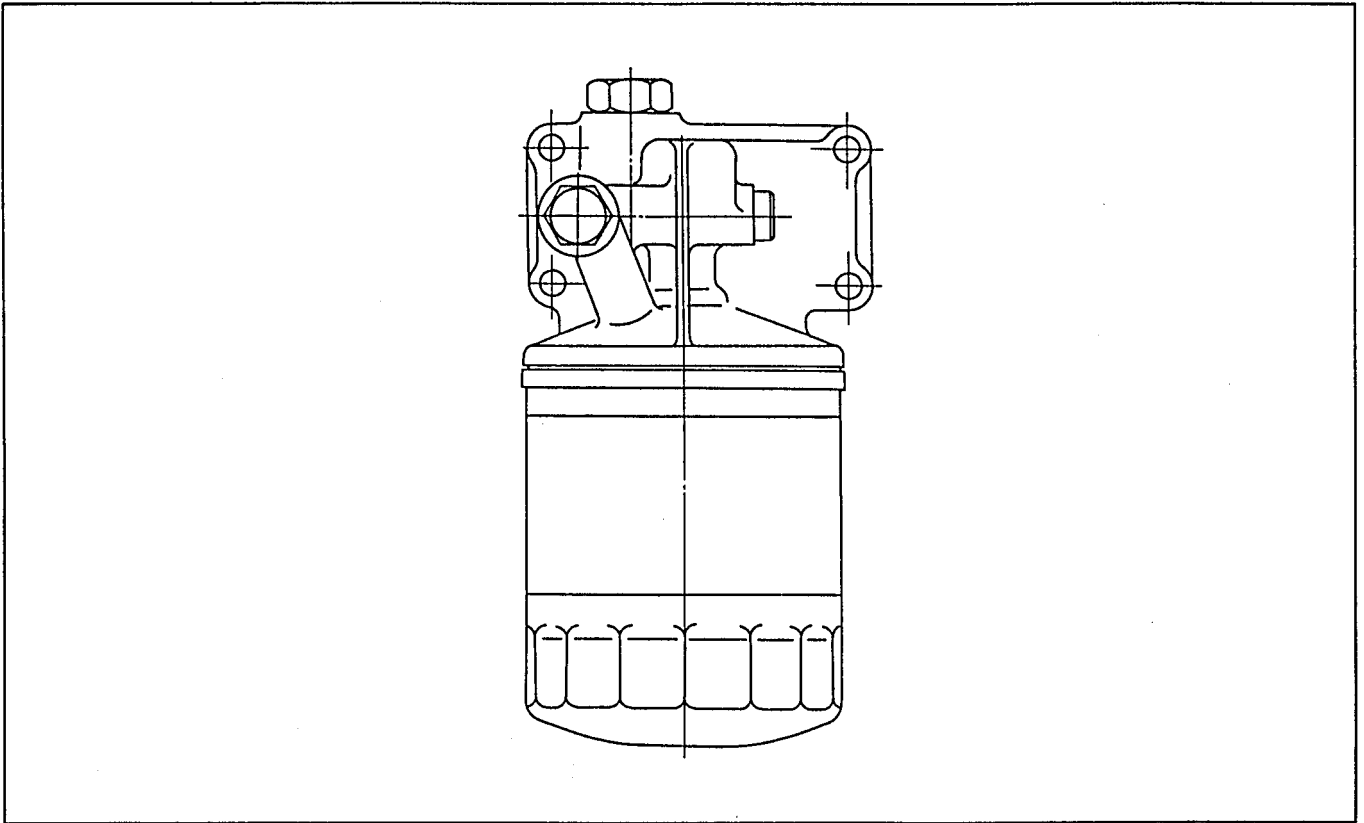


Injection Nozzle Holder Nut Torque kg·m(lb.ft/N·m)

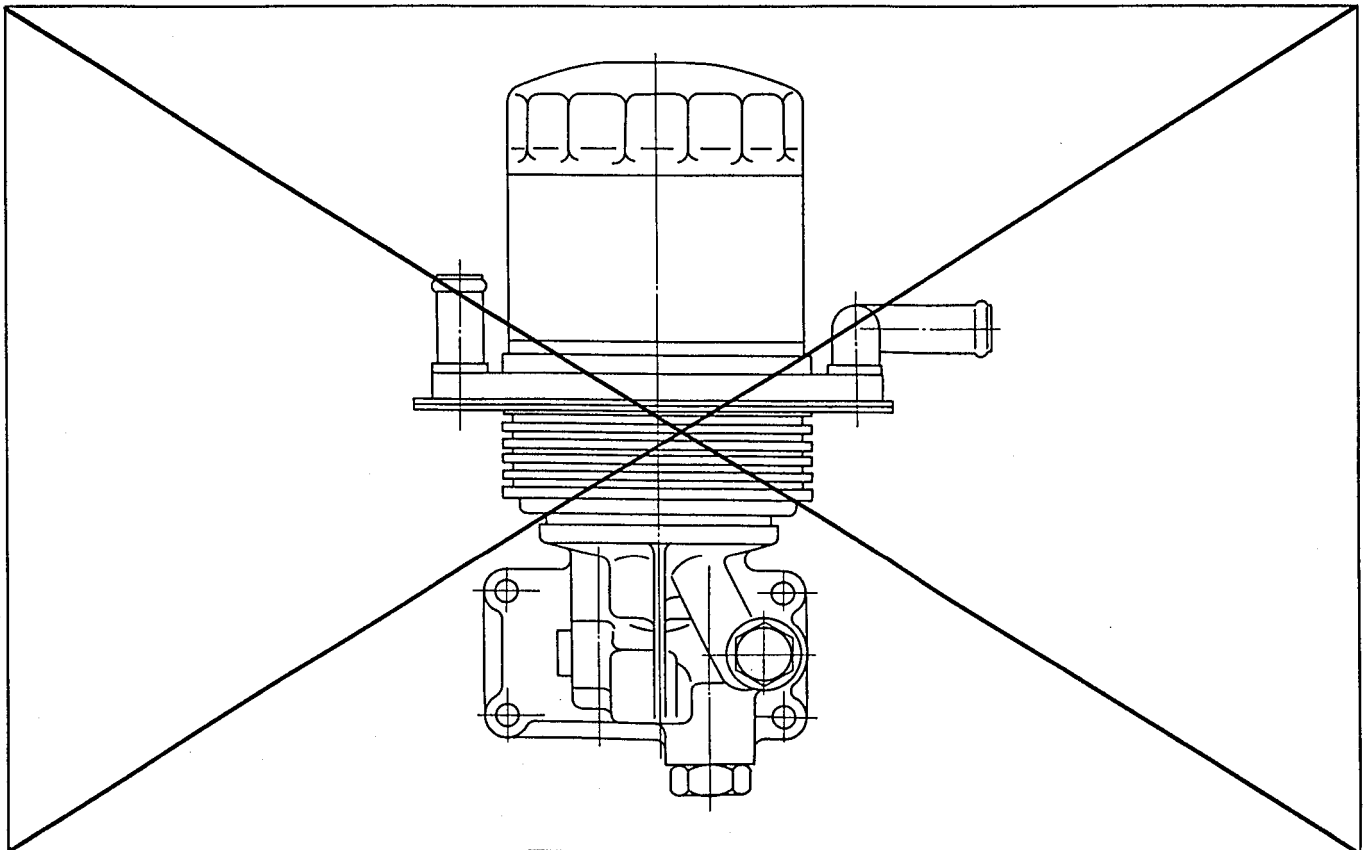
3.8 ± 0.6 ($26.0 \pm 4.3/37.2 \pm 5.9$)



MAIN OIL FILTER

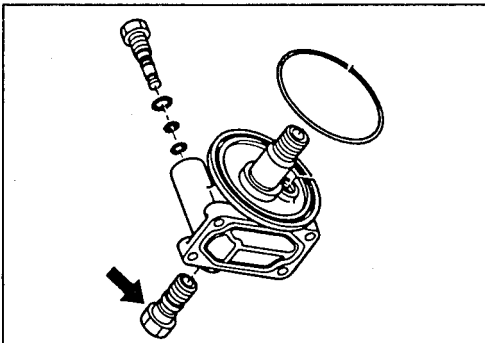


OIL FILTER WITH BUILT-IN OIL COOLER





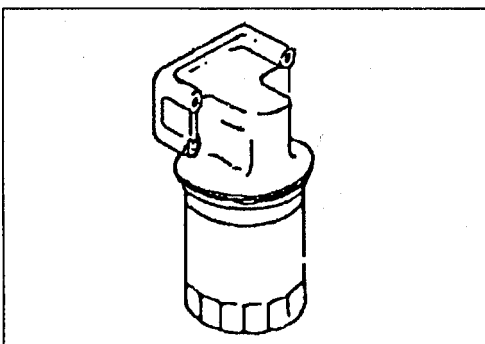
Important Operations



2. Relief Valve

Tighten the relief valve to the specified torque.

Relief Valve Torque	kg·m(lb.ft/N·m)
3.0 ± 0.5 ($21.70 \pm 3.62/29.4 \pm 4.9$)	



6. Oil Filter Cartridge

- 1) Apply engine oil to the O-ring.
- 2) Turn in the cartridge oil filter until the filter sealing face makes contact with the O-ring.
- 3) Turn in the cartridge oil filter an additional 2/3 of a turn.



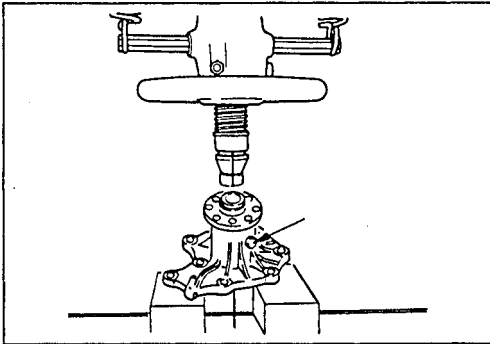
7. Drain Plug

Tighten the drain plug to the specified torque.

Drain Plug Torque	kg·m(lb.ft/N·m)
1.5 ± 0.5 ($10.85 \pm 1.45/14.7 \pm 4.9$)	



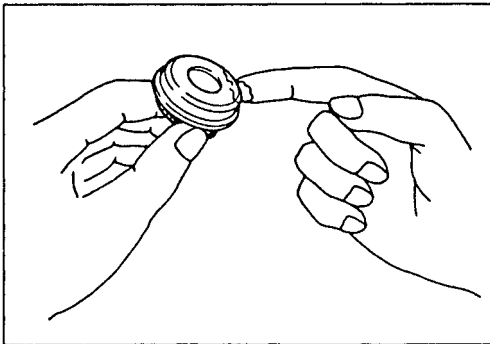
Important Operations



3. Bearing Unit

4. Set Screw

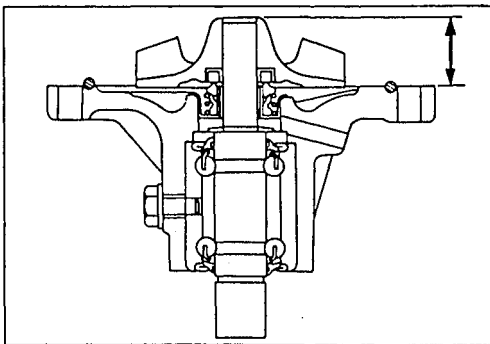
- 1) Align the bearing set screw hole with the pump body set screw hole.
- 2) Press the bearing unit into place.
- 3) Secure the bearing with the set screw.



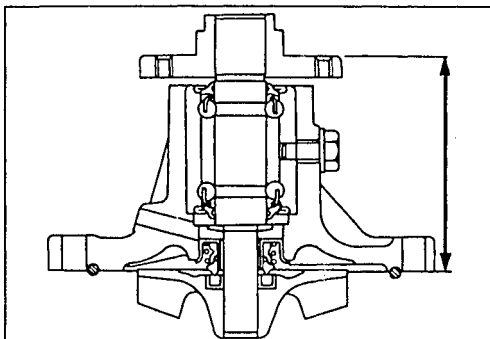
5. Impeller and Seal Unit

- 1) Apply a thin coat of liquid gasket to the seal unit outer periphery.
- 2) Install the seal unit.

- 3) Measure the impeller protection from the water pump body fitting face.



Impeller Projection	mm(in.)
25.0 (0.98)	



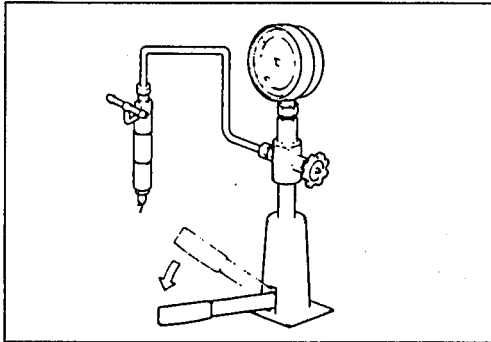
6. Cooling Fan Center

Measure the distance between the cooling fan fitting face and the water pump body fitting face.

Cooling Fan Center Distance	mm(in.)
79.2 - 79.8 (3.12 - 3.14)	



Important Operations



Performance this test before disassembling the injection nozzle.

- 1) Install the injection nozzle to the nozzle tester.
- 2) Use the nozzle tester to apply compressed fuel at 185 kg/cm^2 (2,631 psi) to the injection nozzle.
- 3) Check the area around the nozzle seat for fuel leakage.

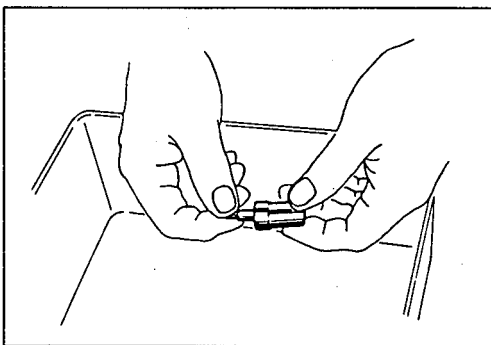
If there is fuel leakage, the injection nozzle and the injection body must be replaced as a set.

2. Injection Nozzle

- 1) Remove the injection nozzles from the nozzle holders.

The nozzle needle valve and nozzle body combinations must be interchangeable.

- 2) Immerse the injection nozzles in a tool tray filled with clean diesel fuel to protect them from dust.



2. OPERATION

When the key switch is closed, the current flows through the magnet switch terminal S to the coils P and H.

As current flows in the coils of the magnet switch, the plunger is pulled in and this causes the pinion to be pushed out into engagement with the flywheel ring gear and the magnet switch main contacts P to close.

If the pinion does not immediately engage with the ring gear, the lever springs are compressed by the lever and the plunger continues to move and make electrical contact to spin the armature.

As soon as the armature rotates and the gear teeth line up, the gears will mesh. When the key switch is opened (after engine start-up), the main contacts P opens and the starter disengages and stops.

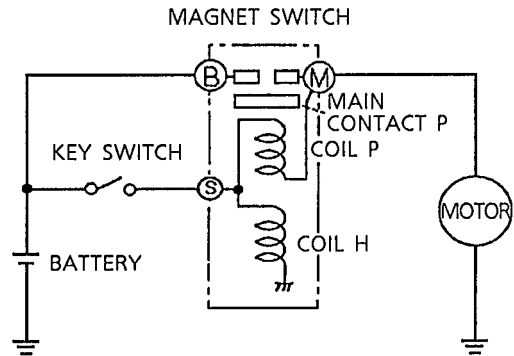


Fig. 2 Starting circuit wiring diagram

3. DISASSEMBLY

Note; Before disassembling starter, be sure to put match marks at two locations (magnet switch and yoke) so that any possible mistake can be avoided.

- (1) Remove magnet switch terminal M nut and disconnect connecting wire. Remove screws securing magnet switch, and remove magnet switch and plunger.

Note; When overrunning clutch is removed, remove pinion at first, after removing magnet switch.

- (3) If necessary to remove front bracket bearing, remove four retainer screws and press bearing out of bracket with a suitable socket.

Note; Do not remove bearing for normal service. If bearing is removed, the bearing must be replaced.

- (4) If necessary to remove rotor bearing, remove bearing with a normal bearing puller.

Note; Do not damage to plastic side of slipping with bearing puller claws since gap between bearing and slipping.

Do not remove bearing for normal service. If bearing is removed, the bearing must be replaced.

- (5) To separate stator / rectifier / regulator assembly from rear bracket.

Remove nut from terminal B bolt. Remove rectifier retaining screw and two brush holder retaining screws. Separate stator and rectifier assemblies, as a unit, from rear bracket.

- (6) Brush replacement

Unsolder one plate connecting brush and unsolder other plate. Then remove each brush with spring.

Installing new brush set. Position brush set in brush holder in proper direction as shown in figure 3 and 2.

- (7) Unsolder three stator coil leads and remove stator from rectifier.

Note; High temperature solder [Melting point of 230°C (446°F)] is used to secure stator coil leads to rectifier terminals.

Disconnect quickly, use a 180~270 Watts soldering iron no more than about 5 seconds because the diode may be damaged if it is overheated.

- (8) Unsolder two solder joints and separate brush holder and regulator assembly from rectifier.

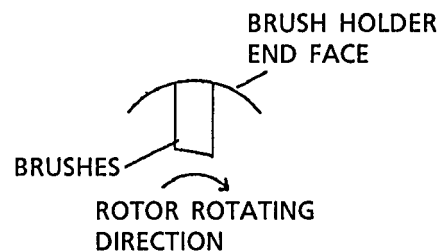
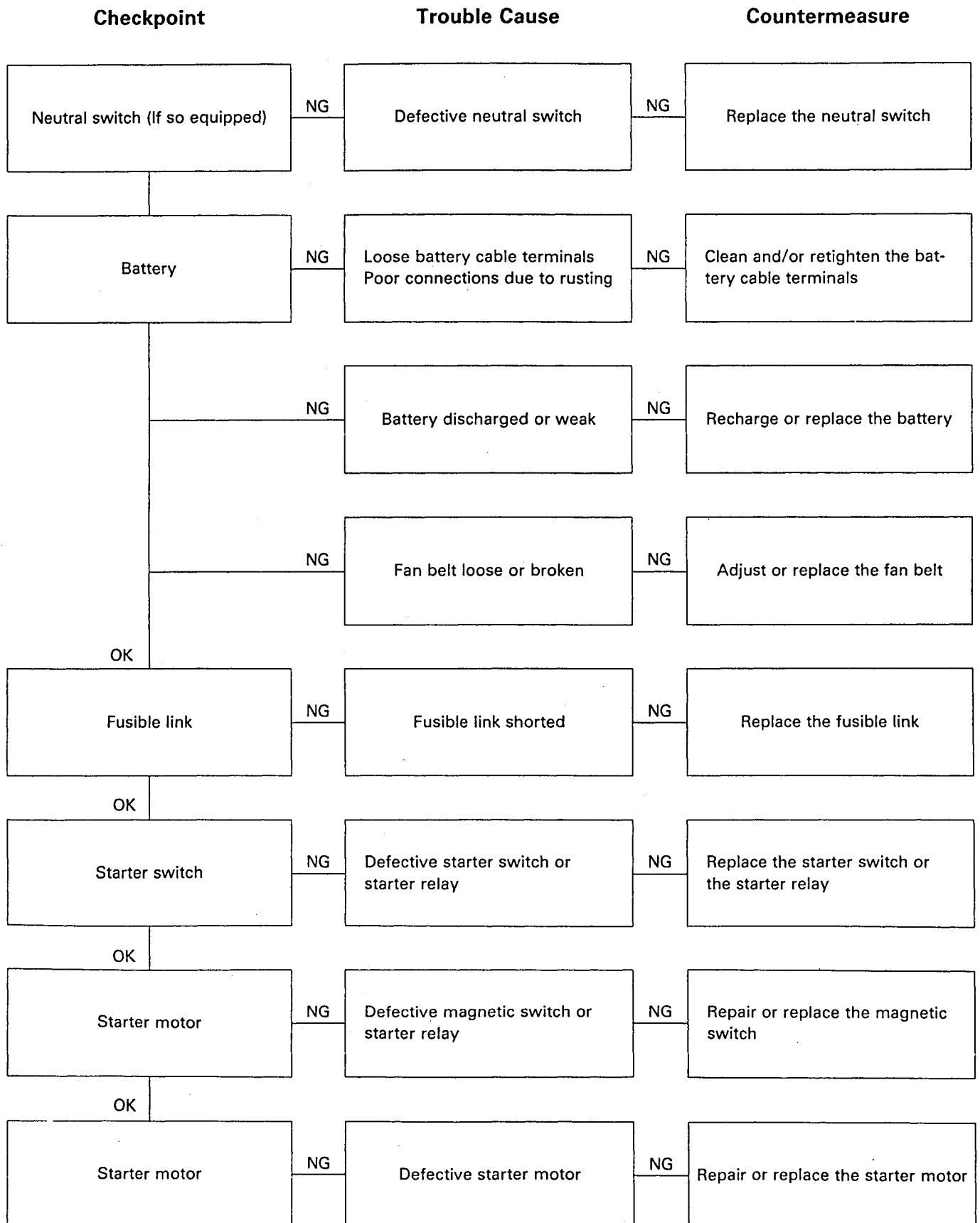


Fig. 3 Direction of brush

1. HARD STARTING

1. STARTER MOTOR INOPERATIVE



3. INSUFFICIENT POWER

Checkpoint

Trouble Cause

Countermeasure

Continued from the previous page

OK				
Turbocharger	NG	Defective turbocharger assembly	NG	Replace the turbocharger assembly
OK				
Compression pressure	NG	Blown out cylinder head gasket Worn cylinder liner Piston ring sticking or broken Improper seating between the valve and the valve seat	NG	Replace the related parts
OK				
Valve clearance	NG	Valve clearance improperly adjusted	NG	Adjust the valve clearance
OK				
Valve spring	NG	Valve spring weak or broken	NG	Replace the valve spring
OK				
Exhaust system	NG	Exhaust pipe clogged	NG	Clean the exhaust pipe
OK				
Full load adjusting screw seal	NG	Open and improperly set adjusting screw seal	NG	Adjust and reseal the adjusting screw

10. ABNORMAL ENGINE NOISE

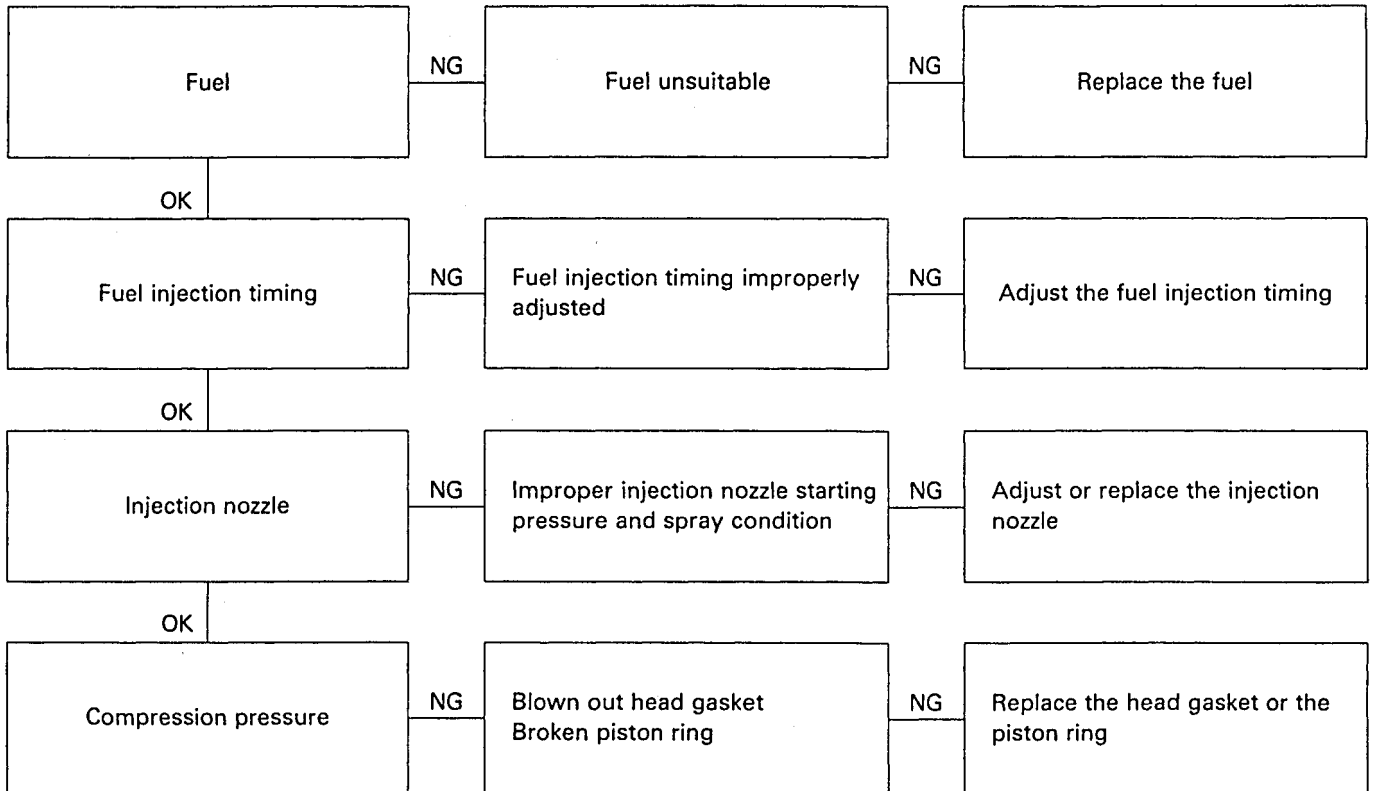
1. Engine Knocking

Checkpoint

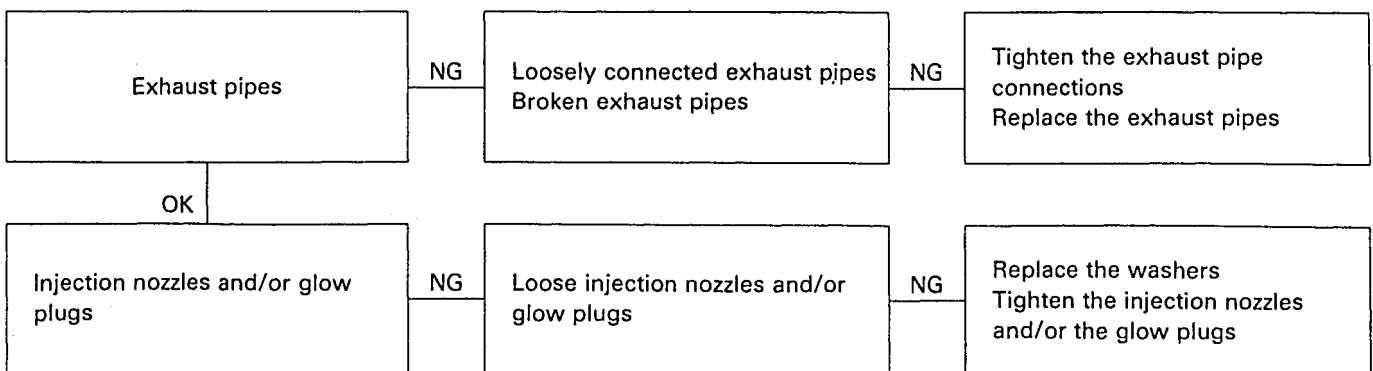
Trouble Cause

Countermeasure

Check to see that the engine has been thoroughly warmed up before beginning the troubleshooting procedure.



2. Gas Leakage Noise



Continued on the next page

List of Additional Modification Parts

How to utilize the list of additional modification parts

This manual is revised to change the standard machine to this specification on the basis of "Parts Manual" for the standard machine. This list consists of parts and disused parts.

The manual consists roughly of two sections : Breaker and Nibbler & Breaker. Each of the section is divided into four parts, 1. Upper structure, 2. Boom, 3. Standard arm, and 4. Long arm, each being assigned a kit number. The cab guard should be ordered optionally. In the case of the arm, select a connector suited for the attachment (Nibbler, Breaker) for ordering.

1. ADDITIONAL PARTS FOR THE MODIFICATION OF THE BREAKER

CAB GUARD SAME AS BREAKER, NIBBLER & BREAKER

No.	PART No.	NAME	Q'TY	REMARK	Applicable Machines
	—	Since the cab guard is an option, it is not assigned a kit number.			
	YT01C00002F1	1 GUARD ASSY			YT00101~
1	YT02C00019P1	●CAB ASSY	(1)		
1-1	YT02C01175P1	●●PLATE ASSY	2	To be performed at site.	
1-2	YT02C01395P1	●●PLATE ASSY	1		
1-3	YT02C01396P1	●●PLATE ASSY	1		
3	YT02C01372P1	●GUARD	1		
8	ZM32C12025	●SEMS BOLT	4		
	YT01C00002F2	2 GUARD ASSY			
2	YT02C00020P1	●CAB ASSY	(1)		
2-1	YT02C01175P1	●●PLATE ASSY	3	To be performed at site.	
2-2	YT02C01395P1	●●PLATE ASSY	1		
2-3	YT02C01396P1	●●PLATE ASSY	2		
3	YT02C01372P1	●GUARD	1		
4	YT02C01371P1	●GUARD	1		
5	YT02C01455P1	●PLATE ASSY	1		
6	YT02C01454P1	●PLATE ASSY	1		
7	ZS18C10030	●CAPSCREW	4		
8	ZM32C12025	●SEMS BOLT	7		
9	ZS18C12045	●CAPSCREW	1		
10	2418T10357	●WASHER	1		
11	ZW26X12000	●LOCK WASHER	1		
12	ZW26X10000	●LOCK WASHER	4		
13	ZW16H10000	●WASHER	4		

1. SUMMARY

1.1 GENERAL PRECAUTIONS

- (1) Applications of Breaker or Nibbler & Breaker
Breaker piping Applicable only when a breaker is mounted.
Nibbler & breaker piping Applicable only when a nibbler and a breaker are mounted.

- (2) Modifying a Breaker and a Nibbler & Breaker
There are specific procedures to be followed when modifying a breaker and a nibbler & breaker. Therefore, when they are to be modified at our service shop, contact the nearest breaker and nibbler manufacturer's office, and obtain instructions, so that you install the pipes and handle the machinery correctly.

- (3) Differences Between a Breaker Circuit and a Nibbler & Breaker Piping

● Breaker Piping

There is a single oil flow from pump P1 to the breaker. The oil returns to the hydraulic tank directly. The flow is single flow.



If the return oil from the breaker is fed back to the control valve, the pulsation of the breaker is transmitted to the oil cooler. This causes the machine to break down.

● Nibbler Piping

The oil flows to the nibbler is conflux flow; the oil flow is changed to the rod and the head of the nibbler cylinder.

1.2 BASIC METHOD TO BE TAKEN WHEN MOUNTING

When mounting the breaker or nibbler, always execute the following six items:

- (1) Install an option valve to the main control valve, to use the pressure oil from pump P1 for the breaker and nibbler.

- (2) Functions of the option valve :

The option valve transmits oil pressure to the nibbler or the breaker. It contains a spool that changes the flow of the oil to the rod and the head of the nibbler cylinder. It also contains a single / conflux flow spool that selects a single flow from the A1 port of the main pump or conflux flow of the A1 and A2 ports of the main pump.

- (3) Action of the single / conflux flow spool :

A solenoid valve is provided under the floor plate and the single / conflux select switch in the instrument panel, in order to operate the single / conflux change spool.

- (4) Installing the operation panel :

A pedal and a pilot valve are mounted to the floor plate and a remote control piping is placed between the option valves and pedal, in order to operate the breaker or the nibbler.

- (5) Installing the selector valve :

On the nibbler & breaker attached machine, a selector valve is mounted to the boom in order to change the oil flow for the breaker and for the nibbler.

- (6) Reinforcement of the attachment :

Reinforcement plates are welded to the standard arm (civil engineering services : for general use) and to the idler links of the nibbler & breaker attached machine.

3.5 CONTROL PIPING (BREAKER)

3.5.1 MAIN CONTROL PIPING (OPTION VALVE)

(1) Modification Procedure

Install the additional parts listed in Table 6 to the main control piping of the standard machine, as shown in Fig. 17.

NOTE :

- Before starting the modification work, check parts according to the Additional Parts List.
- When disconnecting and reconnecting pipes, take care, so as not to allow dirt and foreign matter to enter.

TIGHTENING TORQUE

Installing parts on the control valve side

Thread size (PF)	Spanner (mm)	O ring type coupling	
		Tightening torque kgf·m (ft·lbs)	Hydraulic hose Tightening torque Kgf·m (ft·lbs)
1/4	19	3.0±0.3 (22±2.2)	3.0±0.5 (22±3.6)
3/8	22	5.0±0.5 (36±3.6)	

Installing parts on the hydraulic tank side

Thread size (PF)	Spanner (mm)	O ring type coupling	
		Tightening torque Kgf·m (ft·lbs)	Hydraulic hose Tightening torque Kgf·m (ft·lbs)
1/4	19	3.7±0.2 (27±1.4)	3.0±0.5 (33±3.6)
3/8	22	7.5±0.5 (54±3.6)	

Table 6

MAIN CONTROL PIPING		YT06H00006F4		
No.	PART No.	NAME	Q'TY	REMARK
1	ZH32X04000	ELBOW	2	PF1/4
2	HH55Q04004G1	TEE	1	PF1/4
3	ZH22X04000	CONNECTOR	3	PF1/4
21	ZH32X04006	ELBOW	1	PF1/4+ PF3/8
31	2444R1120D045	HOSE	1	PF1/4 L=450
32	2444R1120D150	HOSE	1	PF1/4 L=1500

(2) Connector mounting direction

As seen from the top of the control valve of the machine.

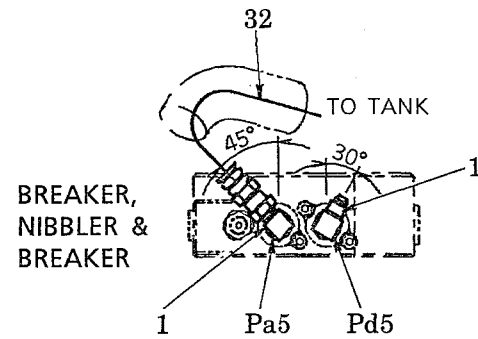


Fig. 16 Control valve piping

As seen from the bottom of the control valve of the machine.

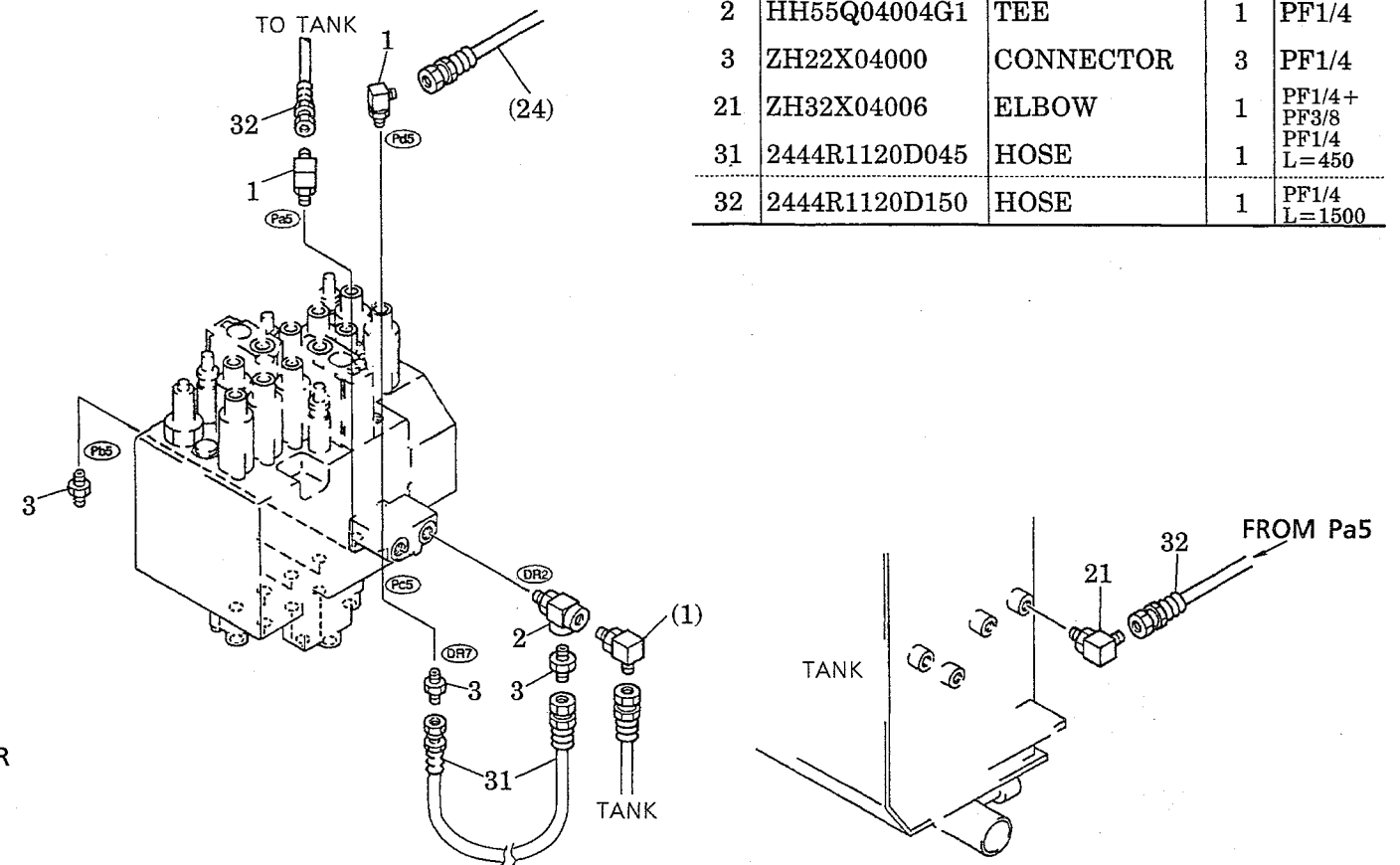
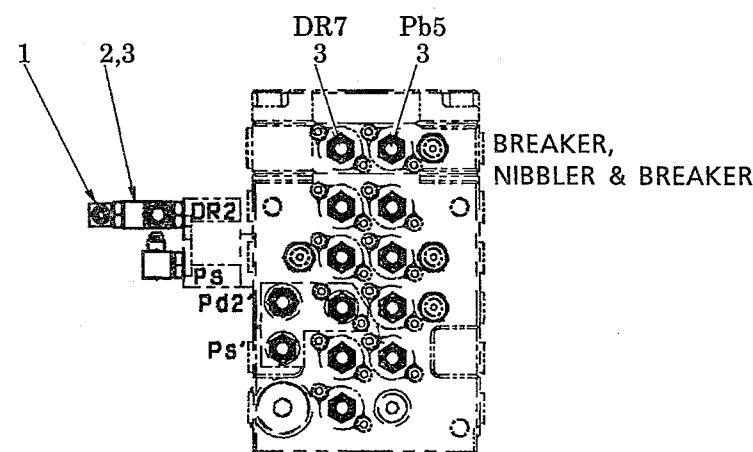


Fig. 17 Main control piping (Breaker)

(3) Parts to be disused

When the main control piping, the parts shown in Table 7 and Fig. 18 are disused from the standard machine.

Table 7

No.	PART No.	NAME	Q'TY	REMARK
23	ZE72X06000	PLUG	1	PF3/8

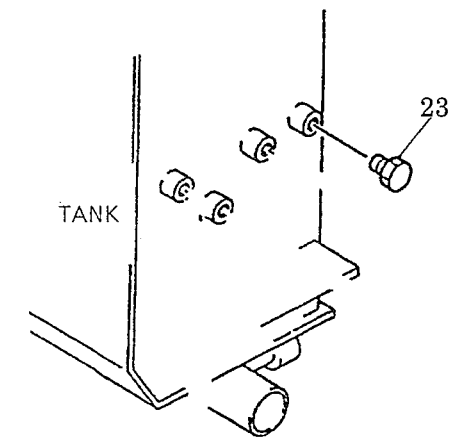


Fig. 18 Parts to be disused

4.4 UPPER HYDRAULIC PIPING
(NIBBLER & BREAKER)

Assemble the additional parts listed in Table 27 to the upper hydraulic piping of the standard machine, as shown in Fig. 38.

TIGHTENING TORQUE

		O ring type coupling
Thread size (PF)	Spanner (mm)	Tightening torque kgf·m (ft·lbs)
1/2	27.32	11 ± 1 (80 ± 7.2)

		Flareless joint
Tube size	Spanner (mm)	Tightening torque kgf·m (ft·lbs)
∅18×t2.5	32	15 ± 1.6 (108 ± 12)

Thread size	Spanner (mm)	Tightening torque kgf·m (ft·lbs)
M12	19	12.3 ± 1.2 (89 ± 8.7)

Table 27

UPPER HYDRAULIC PIPING		YT03H00005F1		
No.	PART No.	NAME	Q'TY	REMARK
1	ZA23F18008	CONNECTOR	1	∅18-PF1/2
2	YT03H01029P1	CONNECTOR	1	∅18-PF1/2
3	ZD12P01800	O RING; 1B P18	1	
4	YT32H01030P1	BUSHING	2	
5	YT03H01018P1	ROD BOLT	1	M12×240
6	ZW16H12000	WASHER	1	
7	ZN18C12010	NUT	6	
9	YT03H01022P1	CLAMP	2	
10	YT03H01039D3	HOSE	1	∅18 L=2600
11	YT03H01039D6	HOSE	1	∅18 L=2750

NOTE :

- Before starting the modification work, check parts according to the Additional Parts List.
- When disconnecting and reconnecting pipes, take care, so as not to allow dirt and foreign matter to enter.
- At assembly, use care of O rings do not come off.
- Regarding the tightening torque of O ring type joints, hydraulic hoses and flareless joints, refer to the Remark of Table 27 and the Tightening Torque Table.

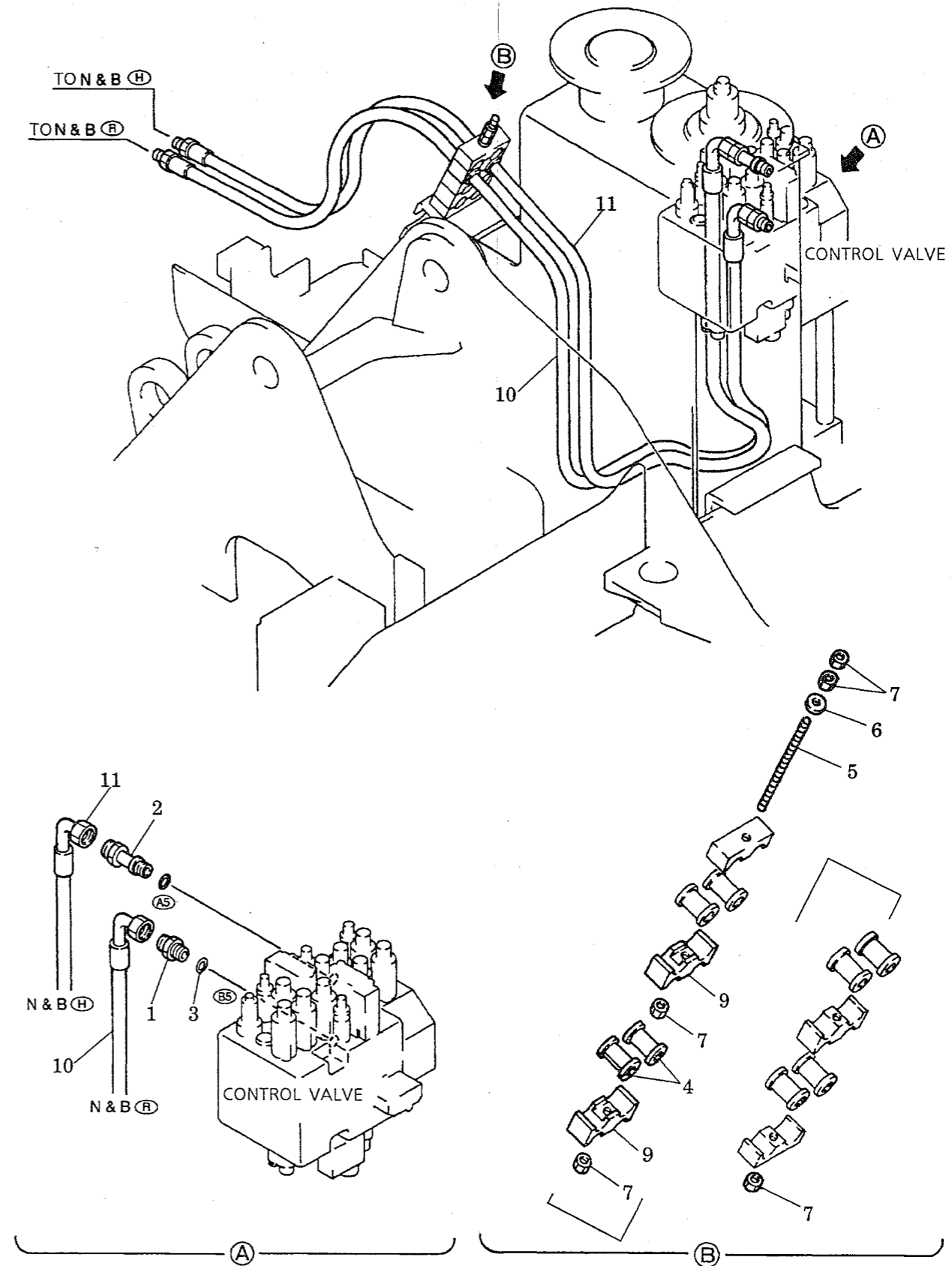


Fig. 38 Upper hydraulic piping (Nibbler & Breaker)

5.4 MODIFICATION OF THE 2.07M (6ft-9in)

LONG ARM (BREAKER, NIBBLER & BREAKER)

5.4.1 MODIFICATION OF THE 2.07M (6ft-9in) ARM
Install the additional parts listed in Table 41 to the long arm of the standard machine, as shown in Fig. 52.

NOTE :

- Use weld symbol B welding rods (mild steel 50kg grade).
- Seal the unwelded areas of the tapped block.

Table 41

2.07M (6ft-9in) LONG ARM ASSY (Breaker, N&B)		YT12B00013F7		
No.	PART No.	PART NAME	Q'TY	REMARK
1	•YT12B00013F4 (•YT12B00029P1)	•LONG ARM ASSY •LONG ARM	(1)	With bushing KAI, EU STD
2	•YT12B01057P1	•PLATE	(1)	KAI, EU STD
3	•YT12B01052P1	•PLATE	1	
4	•YT12B01053P1	•PLATE	1	
5	•2416T24666	•BRACKET	2	
6	•LE12B01024P1	•BRACKET	2	

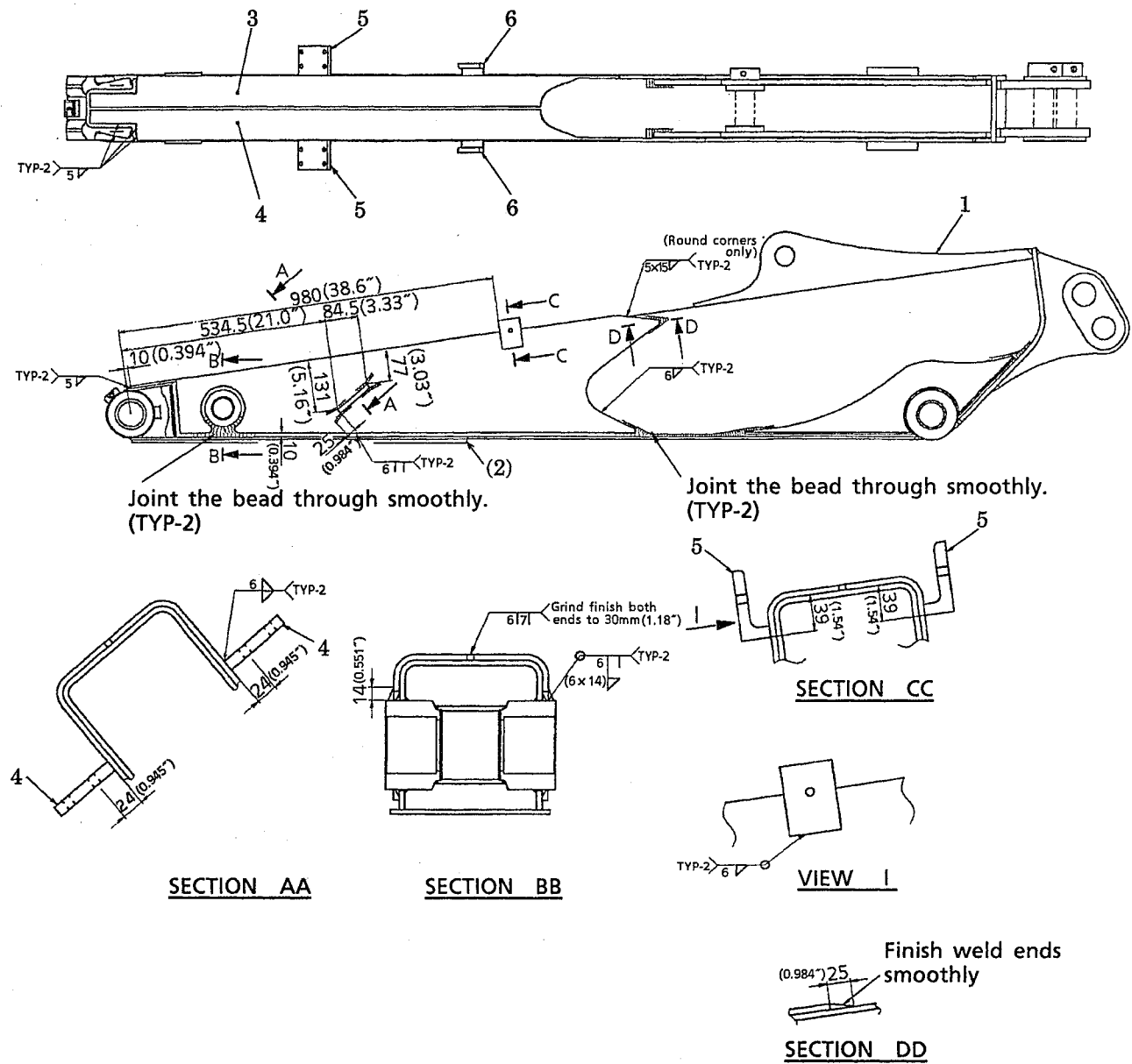


Fig. 52 Modification of the 2.07m (6ft-9in) long arm (Nibbler & Breaker)

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