

Service Guide

for

25J·28J·30J

SERIAL NUMBERS

25J: AH003501 and up

28J: AK004001 and up

30J: 01018501 and up

IHI



Ishikawajima Construction Machinery Co., Ltd.

PUB.No.1

HYDRAULIC MINI EXCAVATOR

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SECTION 1 SPECIFICATIONS

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GENERAL SPECIFICATIONS

■ BASE MACHINE PERFORMANCE

	Unit	25J	28J	30J
Swing speed	rpm	9.5	9.5	8.6
Travel speed	km/h	1.9	16. / 2.8	2.1 / 3.8
Gradability	% (deg.)	58 (30)	58 (30)	30

■ ENGINE

Engine model	—	ISUZU 3LB1	ISUZU 3LB1	ISUZU 3LD1
Engine type		4cycle, water cooled, swirl-chamber, overhead valve		
No. of cyl. — bore × stroke	mm	3 — 77.4 × 79.7	3 — 77.4 × 79.7	3 — 83.1 × 92
Total piston displacement	cm ³	1124	1124	1496
Rated output	ps/rpm	23 / 2400	24 / 2400	29 / 2400
Max. torque	kgf·m/rpm	7.1 / 1800	7.1 / 1800	9.7 / 1800

■ WEIGHT

		Canopy	Cab	Canopy	Cab	Canopy	Cab
Total operation weight	kg	2300	2435	2500	2635	2750	2885
Average ground bearing pressure	kgf/cm ²	0.29	0.30	0.29	0.30	0.29	0.31

■ AMOUNT OF FUEL, LUBRICATING OIL AND COOLANT

Fuel		ℓ	40	40	40
Hydraulic fluid	Oil level	ℓ	40	40	40
	Total amount in system	ℓ	62	62	62
Engine oil	Max. level	ℓ	4.5	4.5	6.3
	Min. level	ℓ	2.5	2.5	3.5
Coolant	Engine proper	ℓ	2.2	2.2	2.5
	Total amount	ℓ	5.3	5.3	5.7

BUCKET

30J

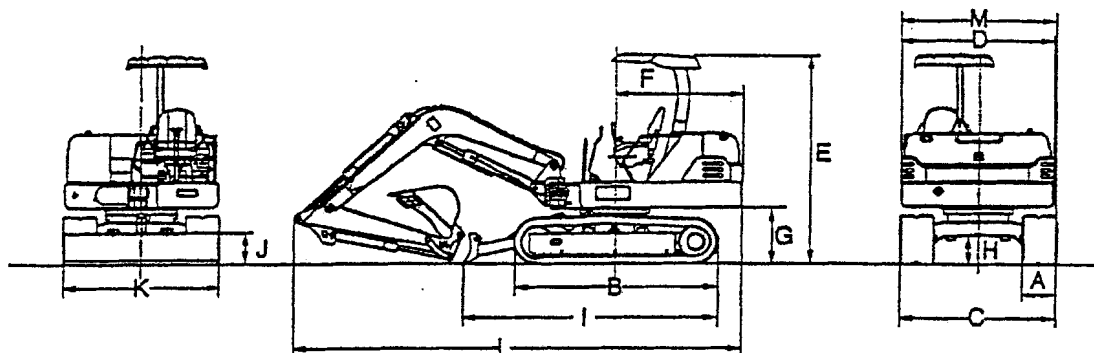
⊙ : Std. aplicable
 ○ : Applicable
 × : Not applicable

Bucket capacity		Side cutter width (mm)	Number of teeth	Weight (kg)	Combinations		Remarks	Remarks
JIS heaped (m³)	SAE heaped (m³)				Std. arm	Long arm		
0.07	0.07	485	3	69	⊙	×	Standard	General digging
0.07	0.07	485	3	81	○	×	OPT.	Reinforced
0.02	0.03	275	2	51	○	○	OPT.	Ditch digging
0.04	0.04	435	3	66	○	⊙	OPT.	Long arm Ditch digging
0.04	0.04	335	2	58	○	○	OPT.	Ditch digging
0.05	0.05	385	3	62	○	×	OPT.	Ditch digging
0.08	0.09	565	4	83	○	×	OPT.	Loading without side cutter
Slope bucket		500 × 1000		85	○	×	OPT.	Slope finishing

OVERALL DIMENSIONS AND WORKING RANGES

28J

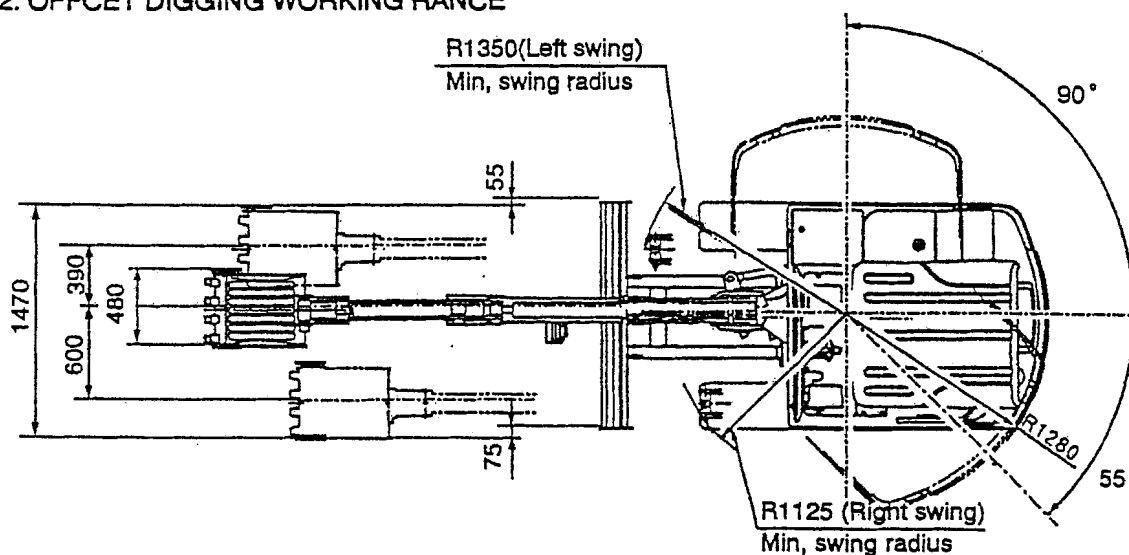
1. OVERALL DIMENSIONS



Unit : mm

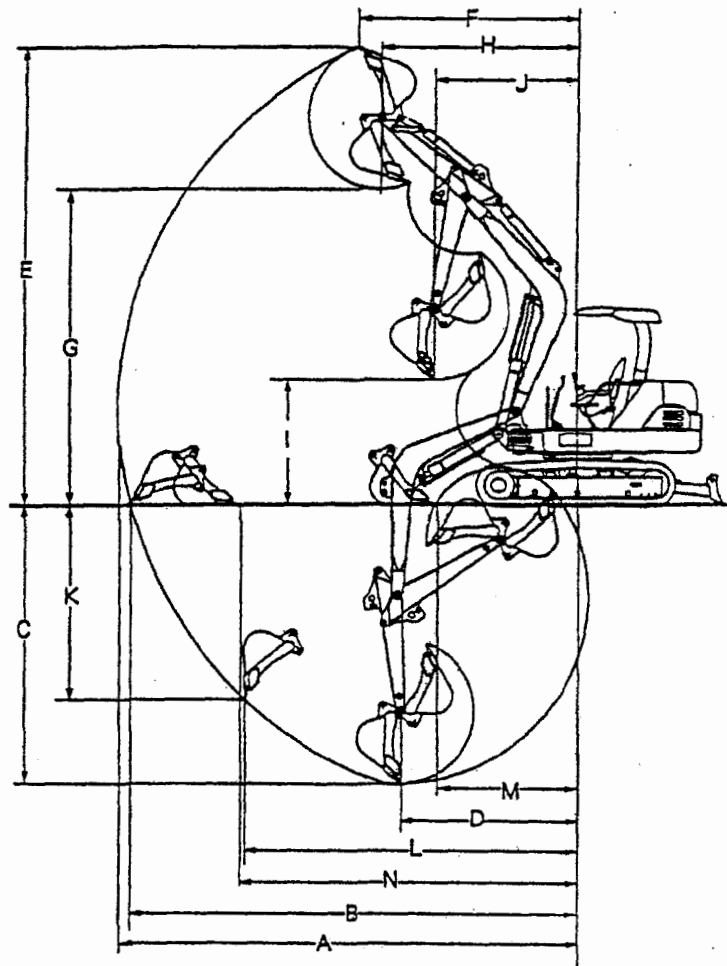
Codes	Description		Rubber shoe	Steel shoe
A	Crawler shoe width		300	300
B	Crawler length		1870	1870
C	Crawler width		1450	1450
D	Cab width	Canopy	1450	1450
		Steel cab	1450	1450
E	Cab height	Canopy	2320	2320
		Steel cab	2320	2320
F	Rear end swing radius		1280	1280
G	Rear end ground clearance		565	565
H	Mini. ground clearance		270	270
I	Overall length of undercarriage		2460	2460
J	Blade height		340	340
K	Blade width		1450	1450
L	Overall length	Blade in rear	4545	4545
		Blade in front	4295	4295
M	Overall width	Canopy	1450	1450
		Steel cab	1450	1450

2. OFFCET DIGGING WORKING RANGE



3. WORKING RANGE 25J / 28J

With Canopy

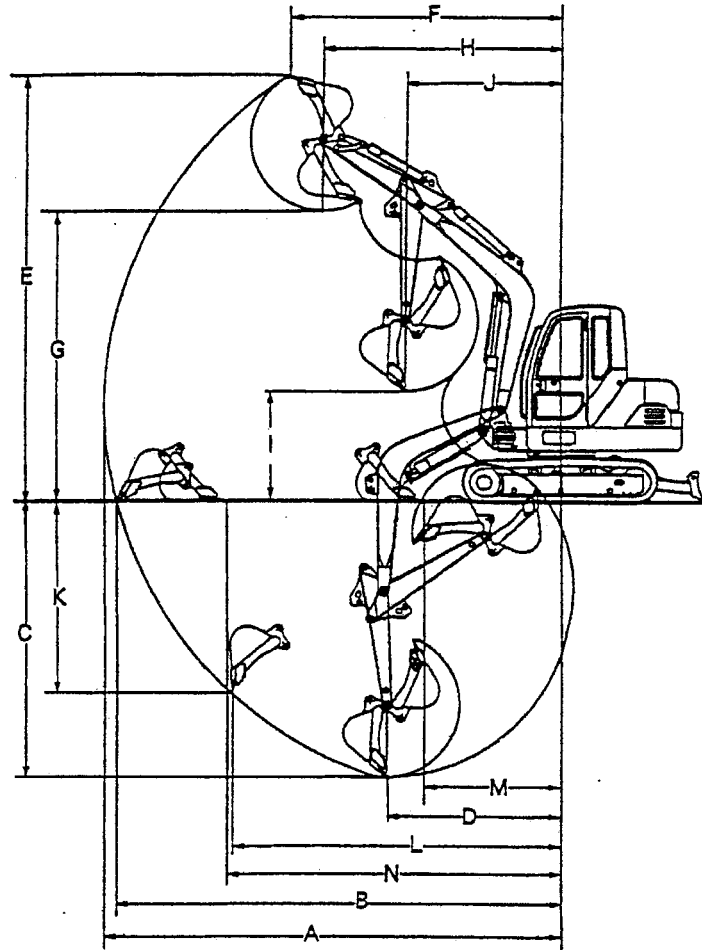


Unit : mm

Key	Description	25J		28J	
		Std. arm	Long arm	Std. arm	Long arm
	Std. of bucket capacity(m³)JIS Heaped	0.06m³	0.05m³	0.07m³	0.05m³
A	Max. digging radius	4235	4520	4325	4520
B	Max. bucket outreach at ground level	4110	4410	4205	4405
C	Max. digging depth(Not used blade)	2420	2730	2520	2730
D	Radius of max. digging depth	1815	1815	1815	1815
E	Max. digging height	4310	4535	4375	4540
F	Radius of max. digging height	1905	2120	1980	2120
G	Max. dumping height	3090	3315	3160	3310
H	Radius of max. digging height	1705	1915	1770	1915
I	Min. dumping height	1395	1095	1300	1095
J	Radius of min. dumping height	1270	1350	1295	1350
K	Max. vertical digging depth	1700	1955	1800	1975
L	Radius of max. vertical digging depth	3115	3250	3170	3250
M	Radius of min. digging ground level	1390	1185	1320	1185
N	Distance of min. digging ground fixed	3115	3450	3250	3450

4. WORKING RANGE 25J / 28J

With Cab

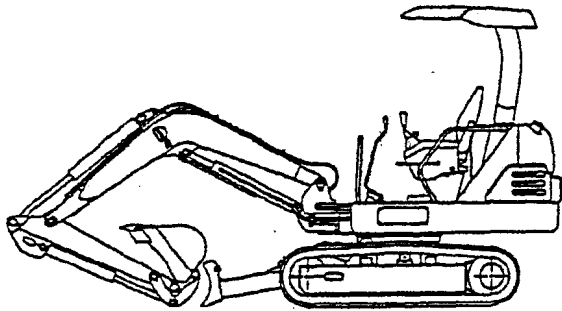


Unit : mm

Key	Description	25J		28J	
		Std. arm	Long arm	Std. arm	Long arm
	Std. of bucket capacity(m³)JIS Heaped	0.06m³	0.05m³	0.07m³	0.05m³
A	Max. digging radius	4235	4520	4325	4520
B	Max. bucket outreach at ground level	4110	4410	4205	4405
C	Max. digging depth(Not used blade)	2420	2730	2520	2730
D	Radius of max. digging depth	1815	1815	1815	1815
E	Max. digging height	3860	4020	3910	4020
F	Radius of max. digging height	2740	3010	2830	3010
G	Max. dumping height	2710	2870	2760	2870
H	Radius of max. digging height	2390	2655	2475	2655
I	Min. dumping height	1185	875	1085	875
J	Radius of min. dumping height	1535	1530	1530	1530
K	Max. vertical digging depth	1700	1955	1800	1975
L	Radius of max. vertical digging depth	3115	3250	3170	3250
M	Radius of min. digging ground level	1390	1185	1320	1185
N	Distance of min. digging ground fixed	3155	3450	2150	3450

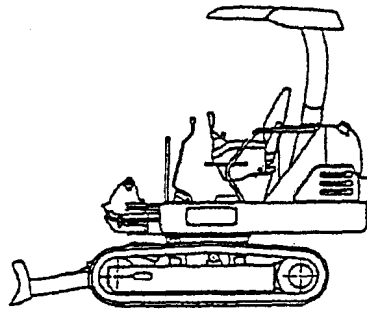
WEIGHT BREAKDOWN 28J

1. Total operating weight



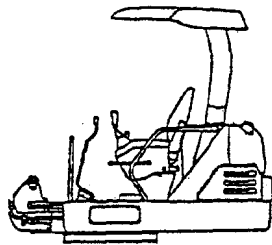
Shoe/Cabin Spec.	Weight(Kg)
Rubber/Canopy	2,500
Steel/Canopy	2,595
Rubber/Cabin	2,635
Steel/Cabin	2,730

2. Base machine



Shoe/Cabin Spec.	Weight(Kg)
Rubber/Canopy	2,165
Steel/Canopy	2,260
Rubber/Cabin	2,300
Steel/Cabin	2,395

3. Upper structure



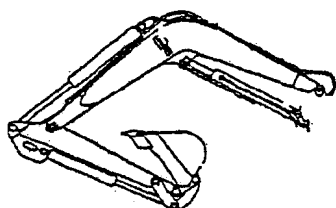
Cabin specification	Weight(Kg)
Canopy	1,245
Cabin	1,380

4. Under carriage



Specification	Weight(Kg)
Rubber shoe	920
Steel shoe	1,015

5. Hoe attachment



Specification	Weight(Kg)
Standard arm	335
Long arm	335

ENGINE MAIN DATA AND SPECIFICATIONS

Item	Data and specifications		
Machine model	25J	28J	30J
Engine model	3LB1 PA - 01		3LD1 PA - 01
Engine type	Four cycle, overhead valve, swire - combustion chamber		
No. of cylinder-bore X stroke $\phi \times \text{mm}$	3 - 77.4 X 79.7		3 - 83.1 X 92
Total piston displacement cc	1124		1496
Compression ratio	22		
Compression pressure	31 (Engine : at 250rpm)		
Fuel injection order	1 $\rightarrow$ 3 $\rightarrow$ 2		
Rated output ps/rpm	23/2400	24/2400	29/2400
Maximum torque kgf·m/rpm	7.1/1800	7.1/1800	9.7/1800
Fuel consumption g/ps·h	195		
High idling (No load) rpm	2590 ₋₅₀ ⁰		
Low idling (No Lead) rpm	1000 $\pm$ 25		
Engine weight (Dry) kg	125		146
Limit maximum incline angle deg.	30°		
Cooling fan	ϕ 360mm - suction - 7 blade		
Alternator V·A	12 V·35 A		
Starter V·A	12 V·1.0 kw		12 V·1.2 kw
Specified fuel	Diesel fuel (ASTM D975 No. 2D)		
Lubricating oil	API, CC grade or CD grade		
Lubricating oil capacity ℓ	Max. 4.5 · Min. 2.5		Max. 6.3 · Min. 3.5
Coolant capacity ℓ	2.2 (engine only)		2.5 (engine only)
Valve Clearances mm	Intake and exhaust 0.2 (at cold)		
Injection pump	Bosch, PFR - 1KX type		
Injection nozzle	Throttle type		
Covernor	Mechanical type		
Injection timing BTDC	16°		
Injection starting pressure kgf/cm ²	135		

LIFTING CAPACITIES 28J

LOAD RATING CHART (SAE METHOD)

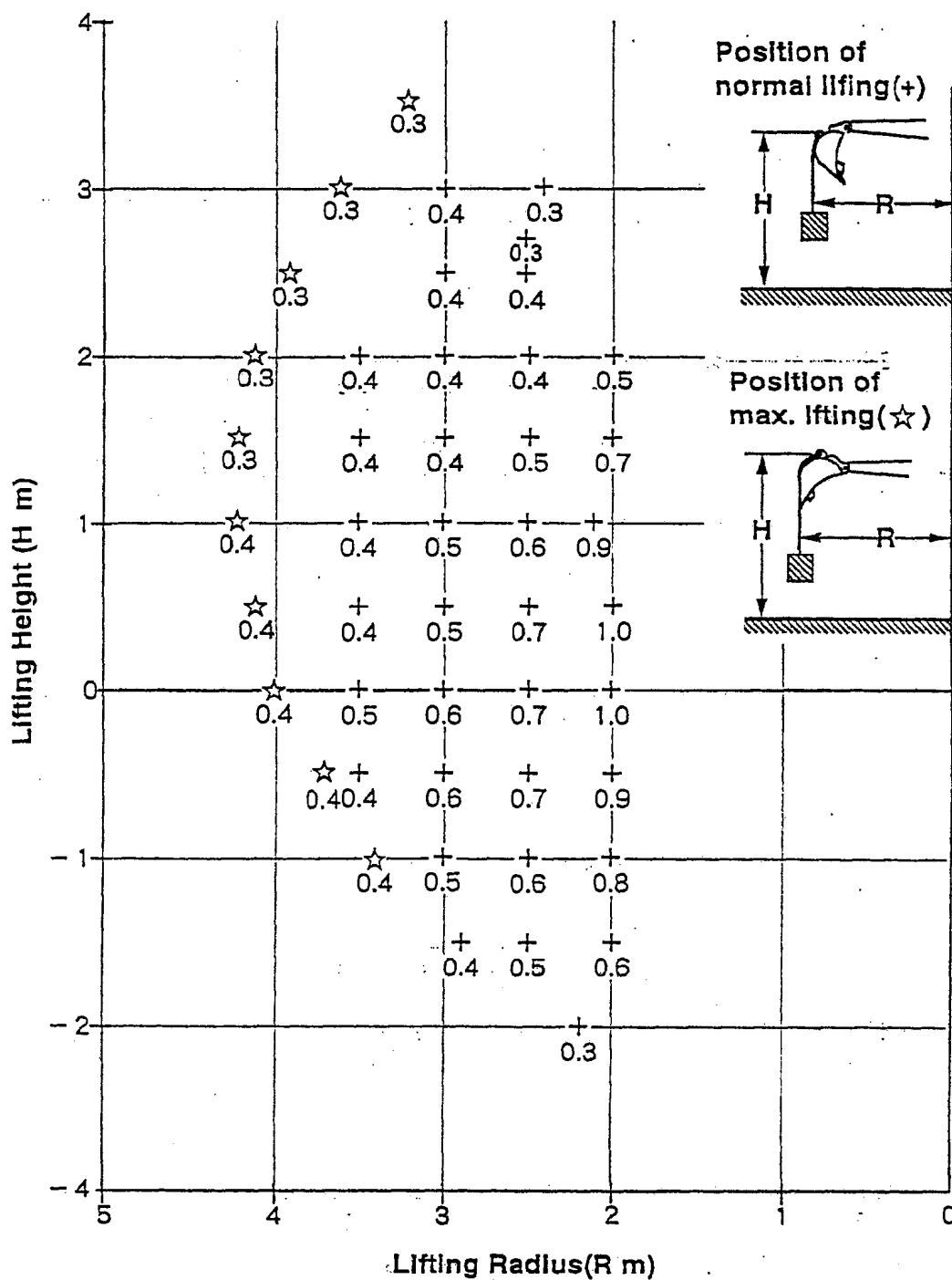
Note: At front over end and the Blade fulcrum with equipped standard arm.

Rated loads do not exceed 87% of hydraulic capacity or 75% stability.

Unit: ton

+: Lifting height

☆: Maximum lifting radius



LIFTING CAPACITIES 28J

LOAD RATING CHART (SAE METHOD)

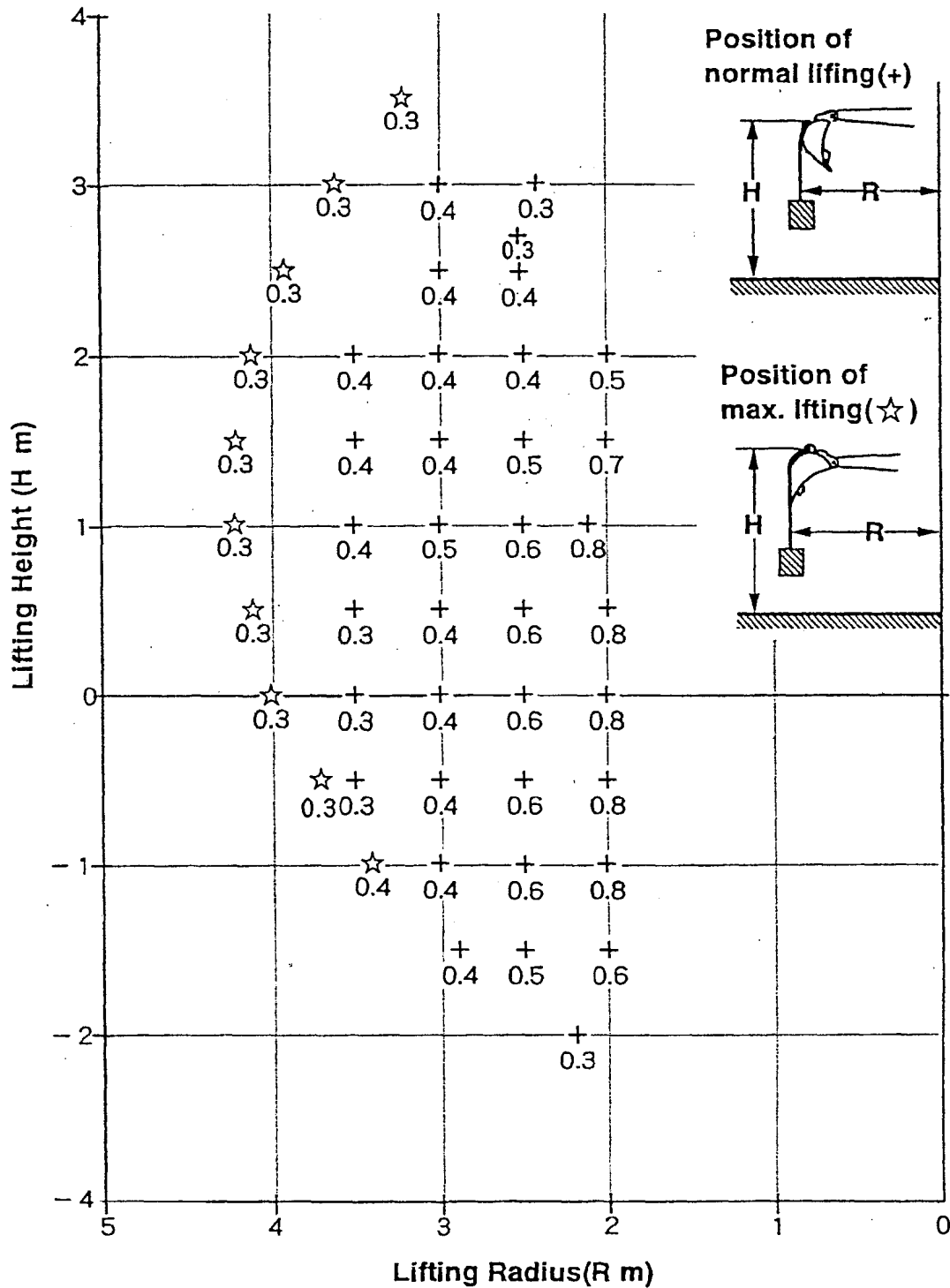
Note: At over SIDE with equipped standard arm.

Rated loads do not exceed 87% of hydraulic capacity or 75% stability.

Unit: ton

+: Lifting height

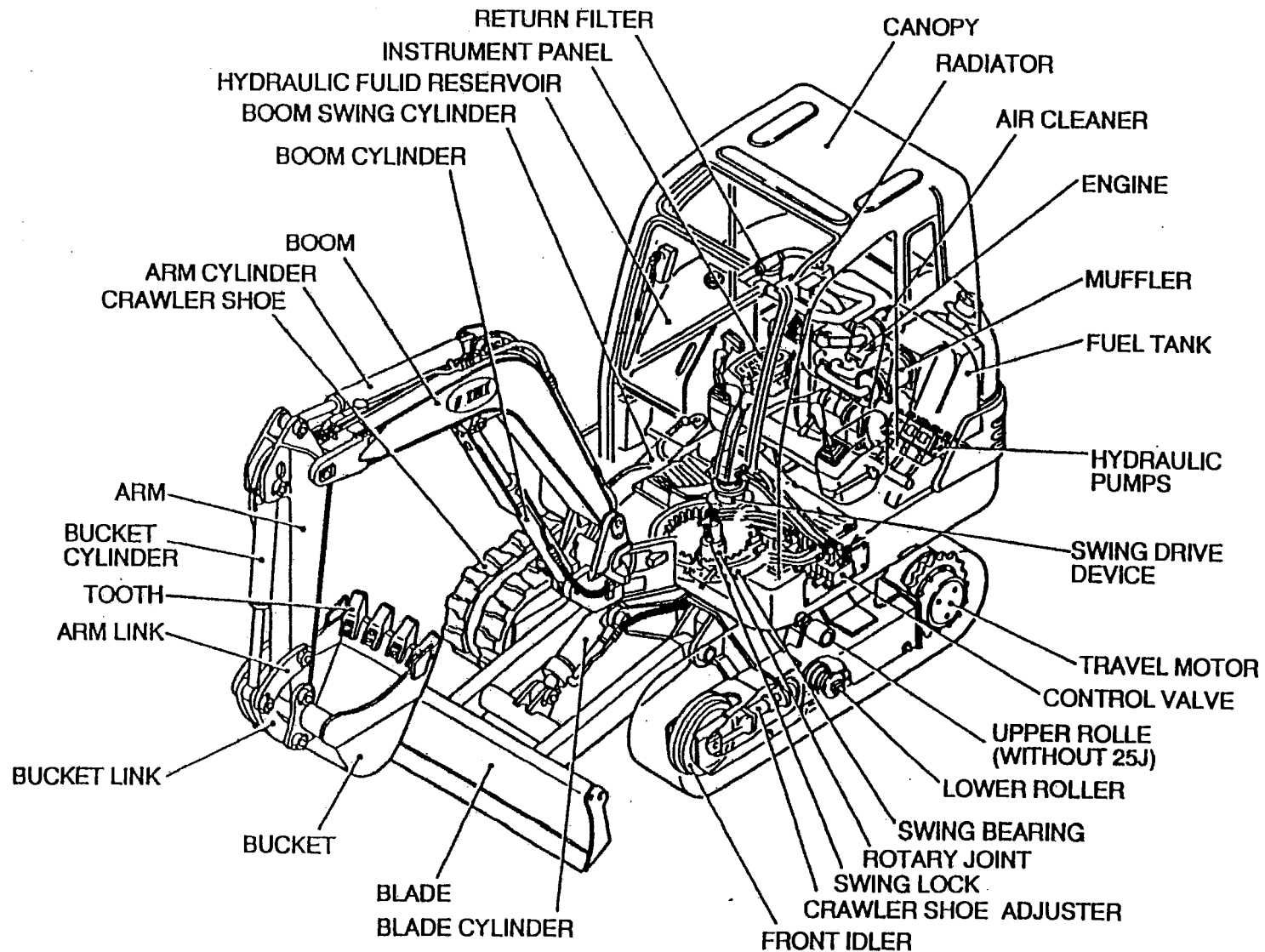
☆: Maximum lifting radius



SECTION 2 STRUCTURE & FUNCTION

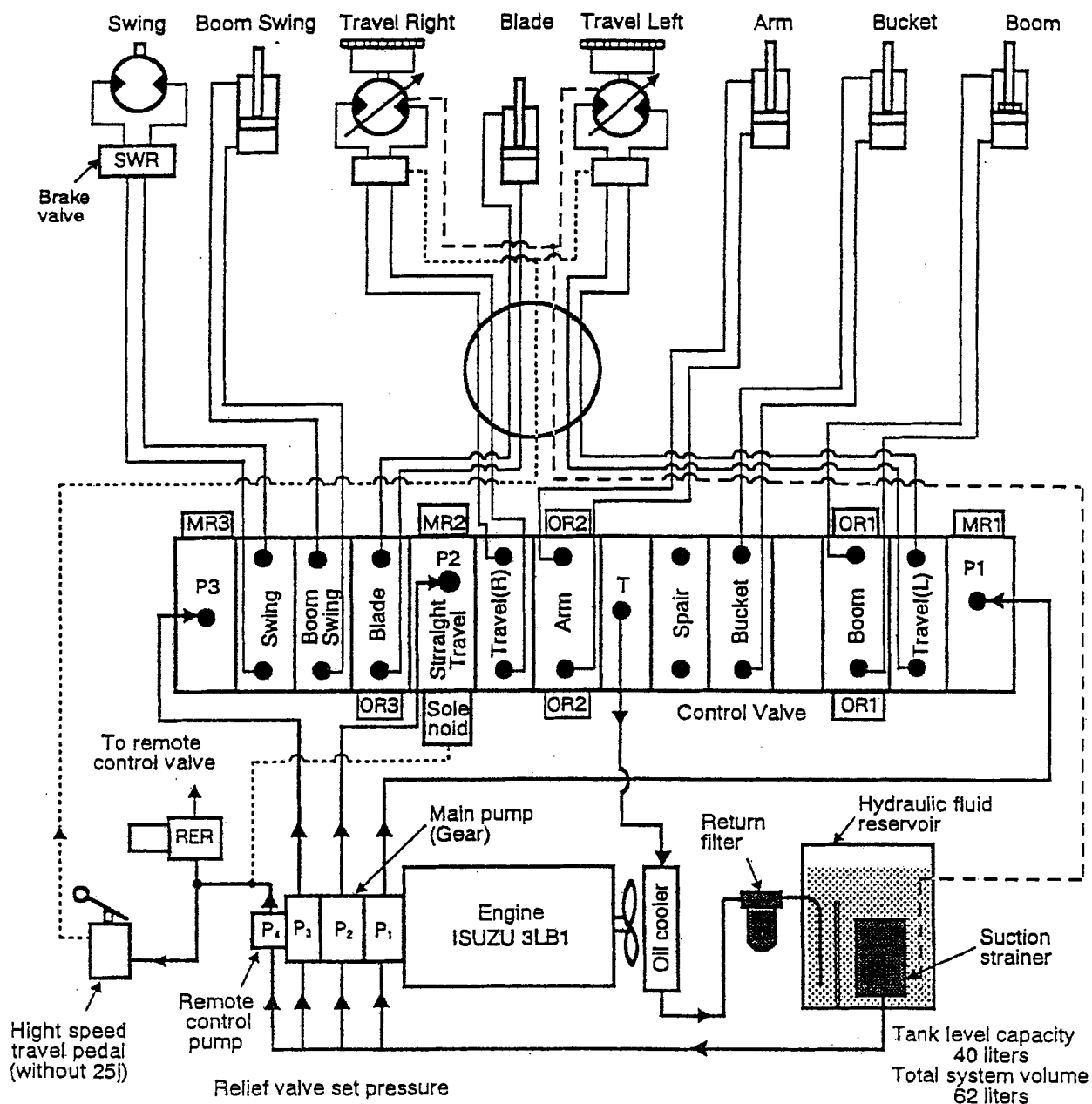
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NOMENCLATURE

HYDRAULIC SYSTEM DIAGRAM



Code	Item	Press. kgf/cm ²	
		25 J	28 J
MR1	Main relief valve P1 Pump	175	175
MR2	Main relief valve P2 Pump	175	175
MR3	Main relief valve P3 Pump	165	165
OR1	Overload relief valve (Boom)	250	250
OR2	Overload relief valve (Arm)	250	250
OR3	Overload relief valve (Blade)	250	250
SWR	Swing relief valve	115	115
RER	Remote control relief valve	35	35

Pump flow rate :

• 25J

P1; 21.6 liter/min

P2; 21.6 liter/min

P3; 19.1 liter/min

• 28J

P1; 21.6 liter/min

P2; 21.6 liter/min

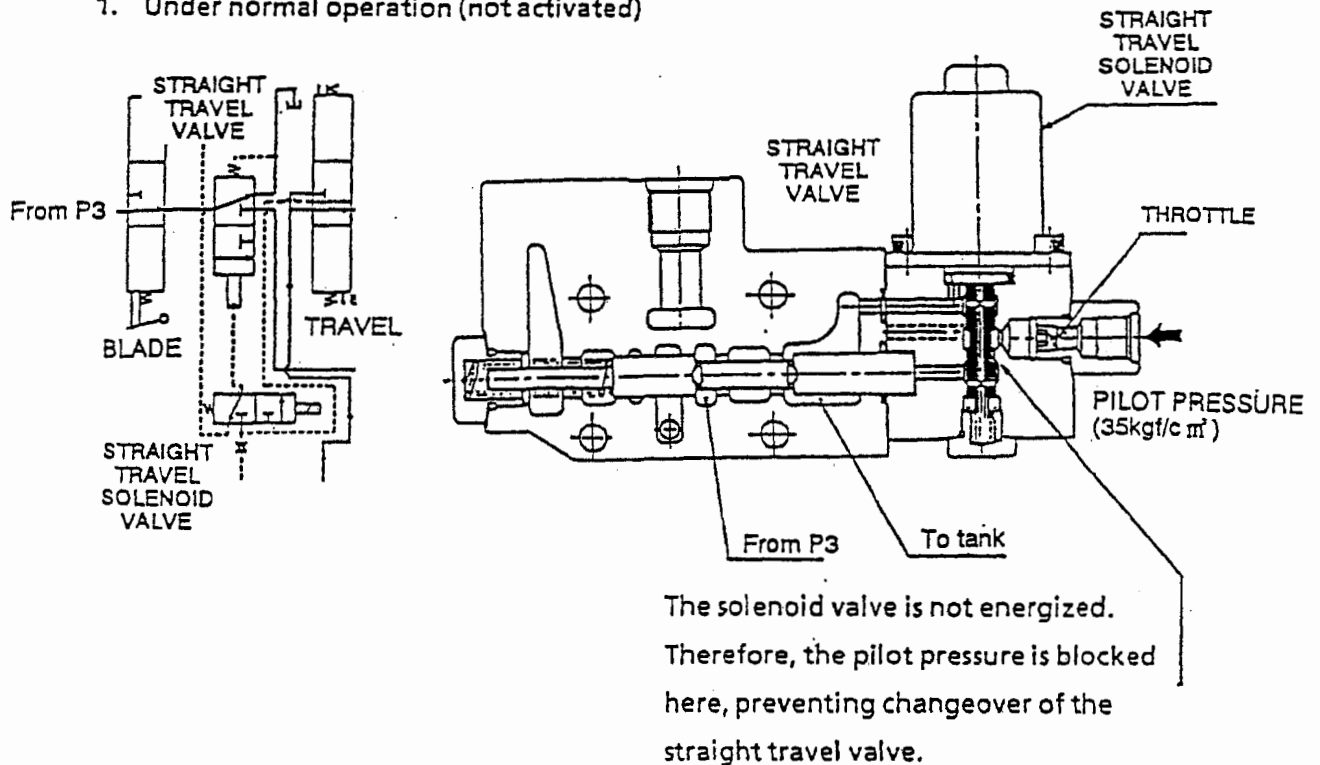
P3; 19.1 liter/min



Applicable models: 25J to 35J

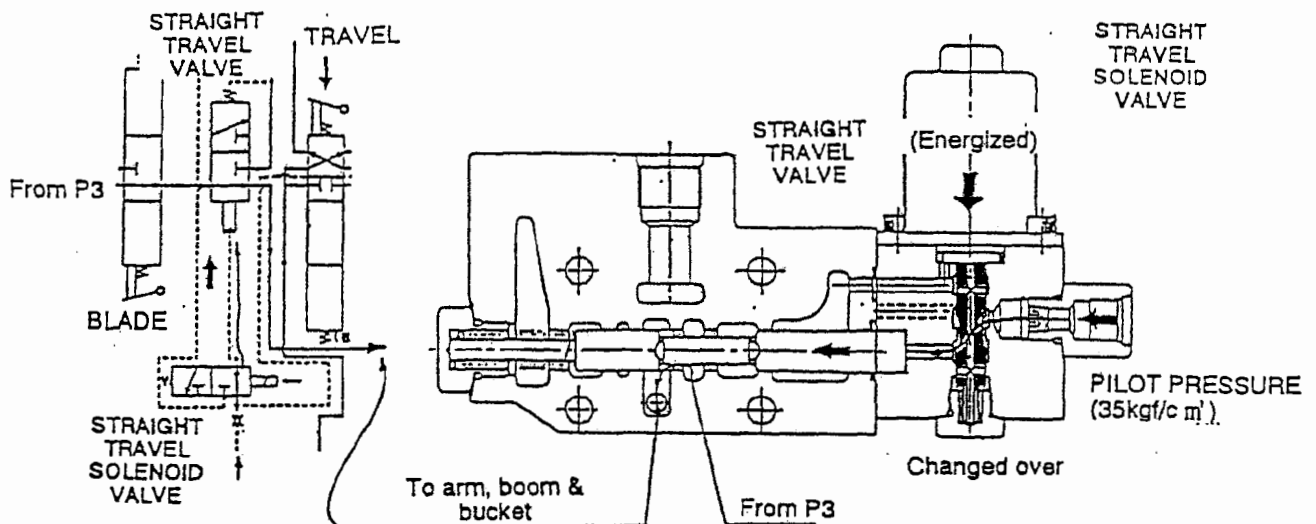
OPERATION OF THE STRAIGHT TRAVEL AND THE STRAIGHT TRAVEL SOLENOID VALVE (STRAIGHT TRAVEL – INDEPENDENT TRAVEL)

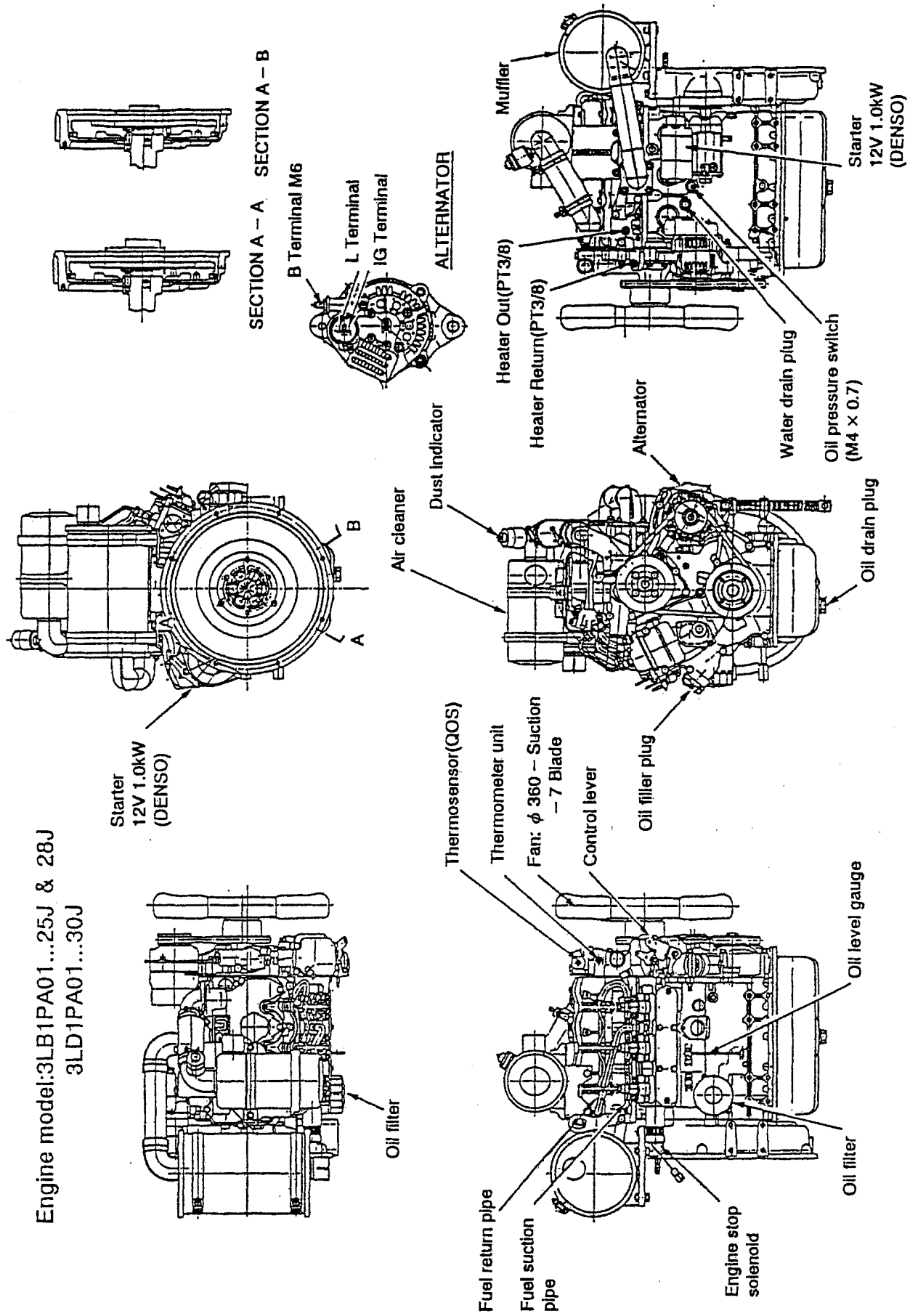
1. Under normal operation (not activated)



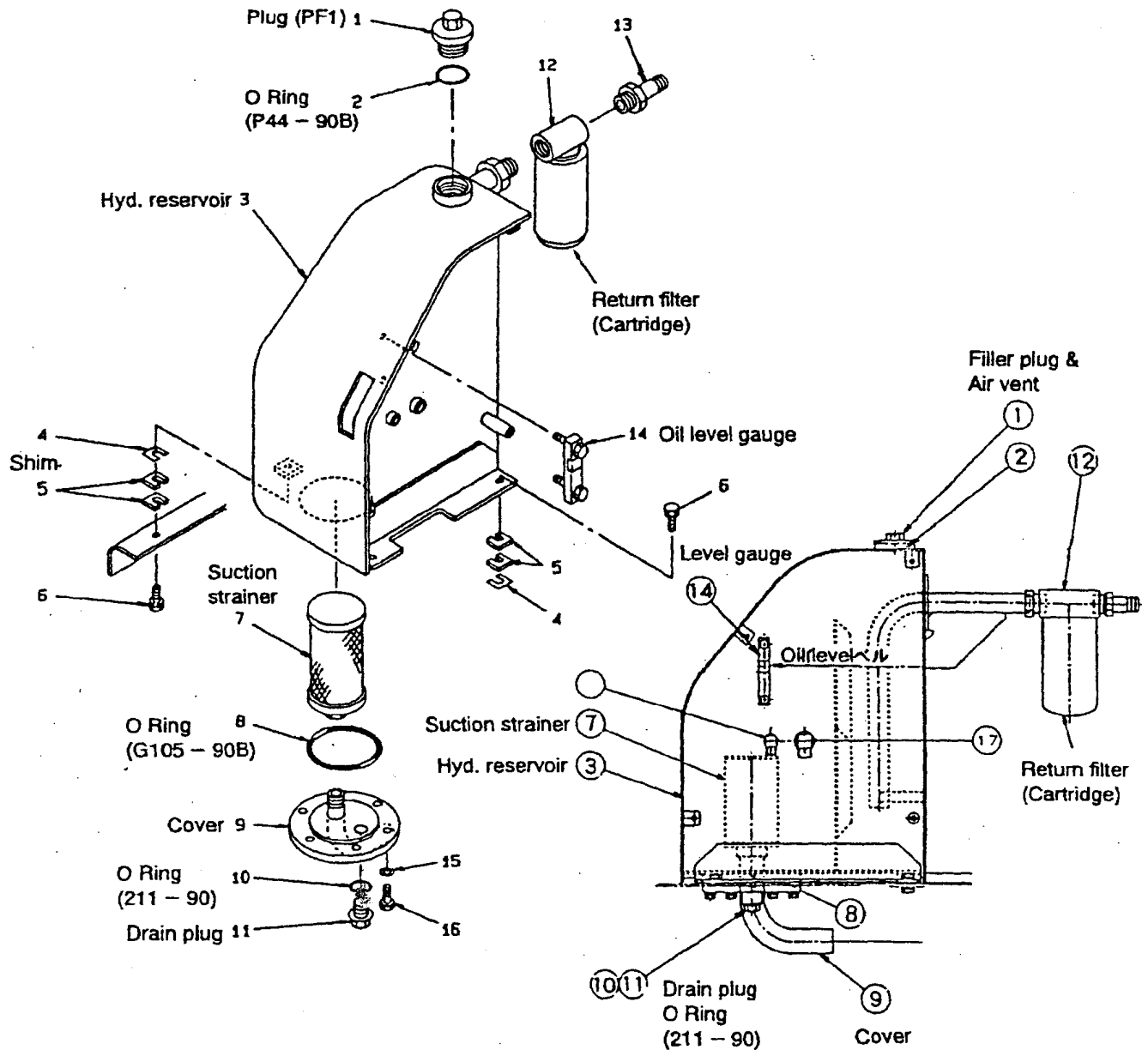
2. When traveling (Straight travel valve activated: independent travel/straight travel)

- (1) Operating the travel lever cause the spool of the control valve to activate the microswitch. The solenoid valve is then energized, and changed over.
- (2) The pilot pressure presses the spool of the straight travel valve to the left and opens the circuit.
- (3) During travel, oil will be supplied from the P₃ to the arm, boom and bucket, thus enabling straight travel.



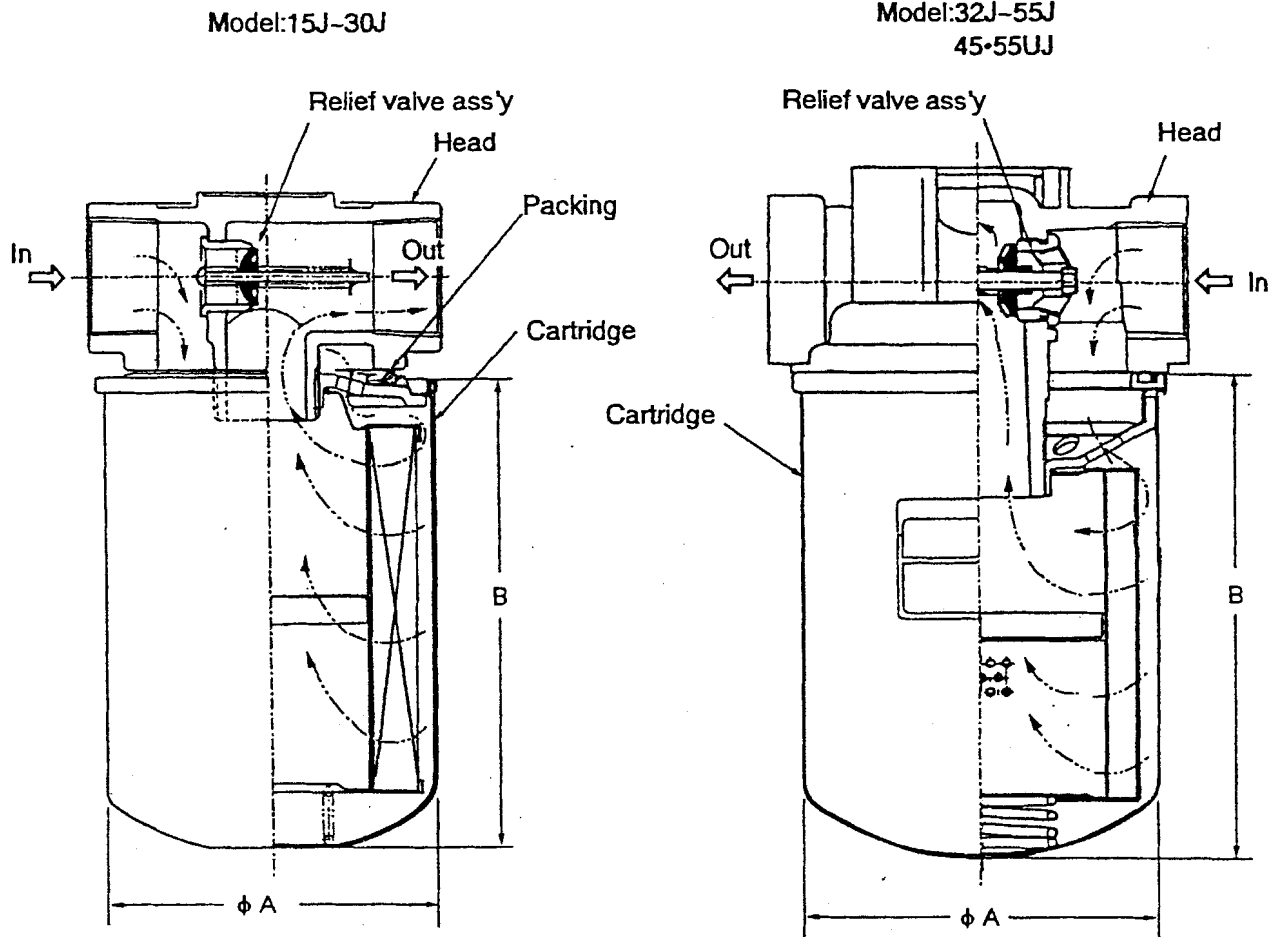
ENGINE MAJOR PARTS LOCATION

HYDRAULIC RESERVOIR ASSEMBLY



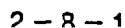
Maintenance Interval (Every Hours)				
		Initial	After	Breaker works
Suction Strainer	Cleaning	-	1000	600
Return Filter	Replace	50	500	100

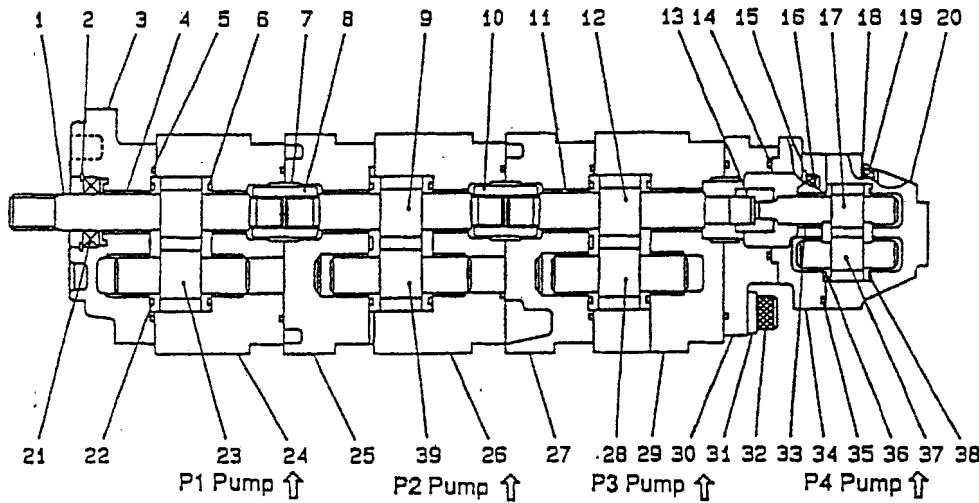
Model	Specified Fluid	Fluid Volume		Replace Interval	
		Tank level	Total system	General operation	Breaker works
25J 28J 30J	Wear proof hydraulic fluid ISO # 46	40	62	1000	600

RETURN FILTER ASSEMBLY

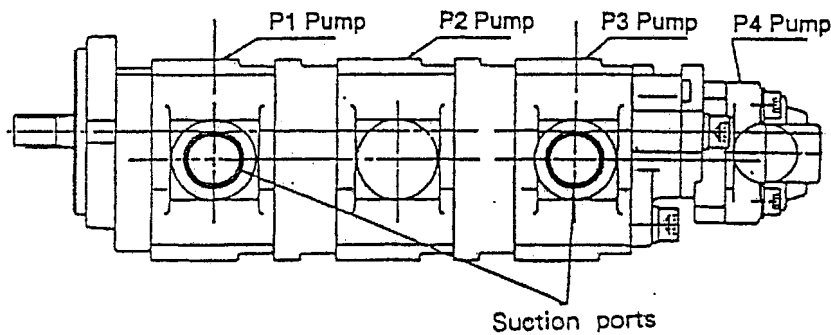
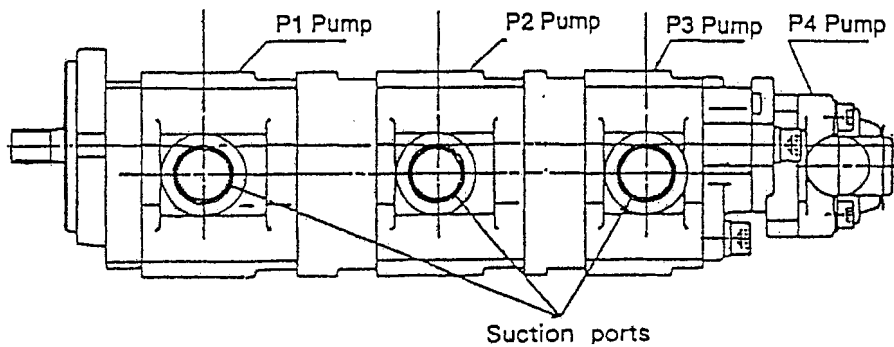
SPECIFICATIONS			
MODELS	15J~30J	32J~35J	45J~55J
Filter ass'y parts No.	075 9102 UA	075 9115 UA	075 9116 UA
Cartridge ass'y parts No.	075 9102 91	075 5142 03	075 9116 03
Dimension (mm)	φ A : 94、 B : 133	φ A : 127、 B : 172	φ A : 127、 B : 232
Flow capacity	70 ℓ /min	Max. 150 ℓ /min	Max. 200 ℓ /min
Filtration	Nominal 10 μ	Nominal 10 μ	Nominal 10 μ
Withstanding pressure	7.5 kgf/cm ²	7.0 kgf/cm ²	7.0 kgf/cm ²
Relief valve set press.	1.0 kgf/cm ²	2.5 kgf/cm ²	2.5 kgf/cm ²
Replace interval	Initial : 50 hours After : Each 500 hours Breaker works : Each 100 hours	↔	↔

Note:
Fill up the spline and the space
with "NEVER-SEIZE". \



HYDRAULIC PUMP ASSEMBLYPump for 25J, 28J & 30J ↓

No.	DISCRIPTION	QTY
1	Drive gear	1
2	Snap ring	1
3	Front cover	1
4	Bushing	8
5	Gasket	6
6	Side plate	6
7	Collar	3
8	Cupring	1
9	Drive gear	1
10	Cupring	1
11	Bushing	4
12	Drive gear	1
13	Cupring	1
14	O ring	1
15	Flat washer	2
16	Bolt	2
17	Drive gear	1
18	Flat washer	4
19	Bolt	4
20	Body	1
21	Oil seal	1
22	Gasket	6
23	Driven gear	2
24	Body	1
25	Adapter plate	1
26	Body	1
27	Adapter plate	1
28	Driven gear	1
29	Body	1
30	Adapter plate	1
31	Flat washer	4
32	Bolt	4
33	Bushing	4
34	Front cover	1
35	O ring	1
36	Side plate	2
37	Driven gear	1
38	Gasket	2
39	Driven gear	1

Pump for 25J & 28J ↓Pump for 30J ↓

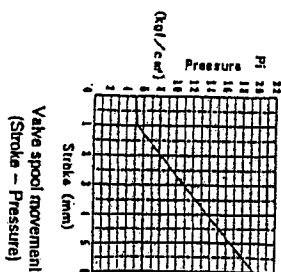
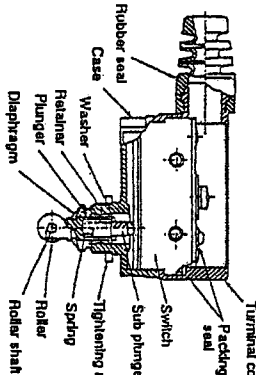
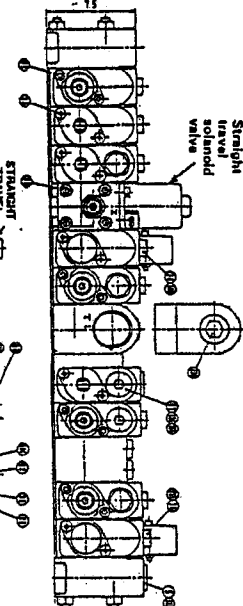
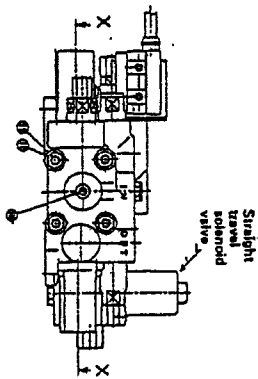
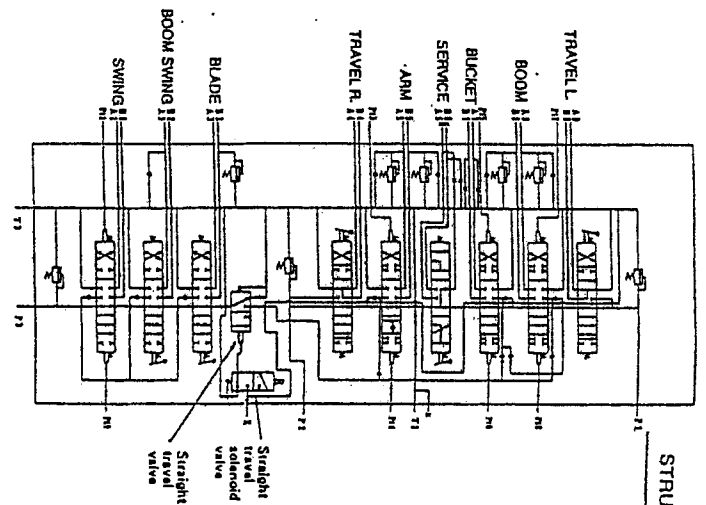
25J, 28J & 30J

RELIEF VALVE SET PRESSURE

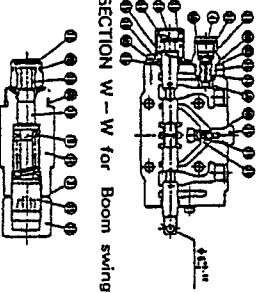
Model	Material Nominal Thermal conductivity	Main gas control	Insulation	Over board metal surface			5-year life (at set)
				Boiler	Arm	Blade	
25J	118 $\pm$ 4	Non	185 $\pm$ 3	250 $\pm$ 1 (5 / min)	250 $\pm$ 1 (5 / min)	250 $\pm$ 1 (5 / min)	115
26J	118 $\pm$ 4	Non	185 $\pm$ 3	250 $\pm$ 1 (5 / min)	250 $\pm$ 1 (5 / min)	250 $\pm$ 1 (5 / min)	115
30J	185 $\pm$ 4	Non	118 $\pm$ 3	250 $\pm$ 1 (5 / min)	250 $\pm$ 1 (5 / min)	250 $\pm$ 1 (5 / min)	105

Port size:
P1, P2, P3 - T3, A8 - B6...3/4 - 16 UNF - 28
A1,2,3,4,5,7,8,9 - B1,2,3,4,5,7,8,9...9/16 - 16 UNF - 28
P11 to P18...PF1/4
T1...PT1

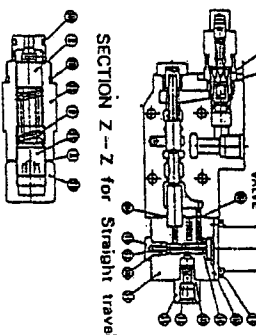
HYDRAULIC CIRCUIT



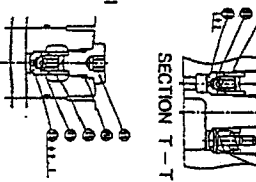
SECTION W--W for Boom swing



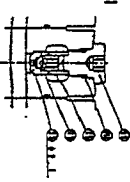
SECTION Z--Z for Straight travel



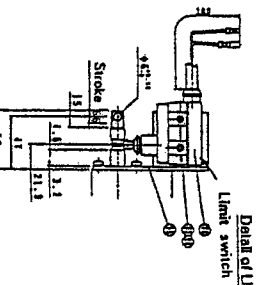
SECTION T-T



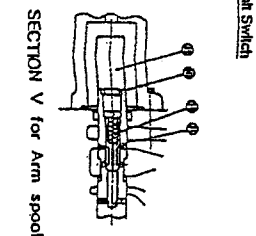
SECTION Y - Y



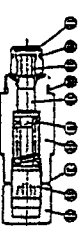
Limit switch for travel spool



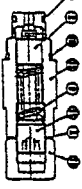
SECTION V for Arm spool



Combination valve
installed Boom A3 & B3 ports



Port relief valve
Installed Blade A3 ports



TRAVELING LIMIT SWITCH

Limit switch is provided with the traveling spool of control valve as an actuation switch for straight traveling in case of 25J to 30J, and for straight traveling and traveling pressure increase in case of 32J and 35J.

If this switch or its wiring becomes faulty, the phenomenon detailed below is caused. Depending on the phenomenon, carry out troubleshooting and take a proper measure.

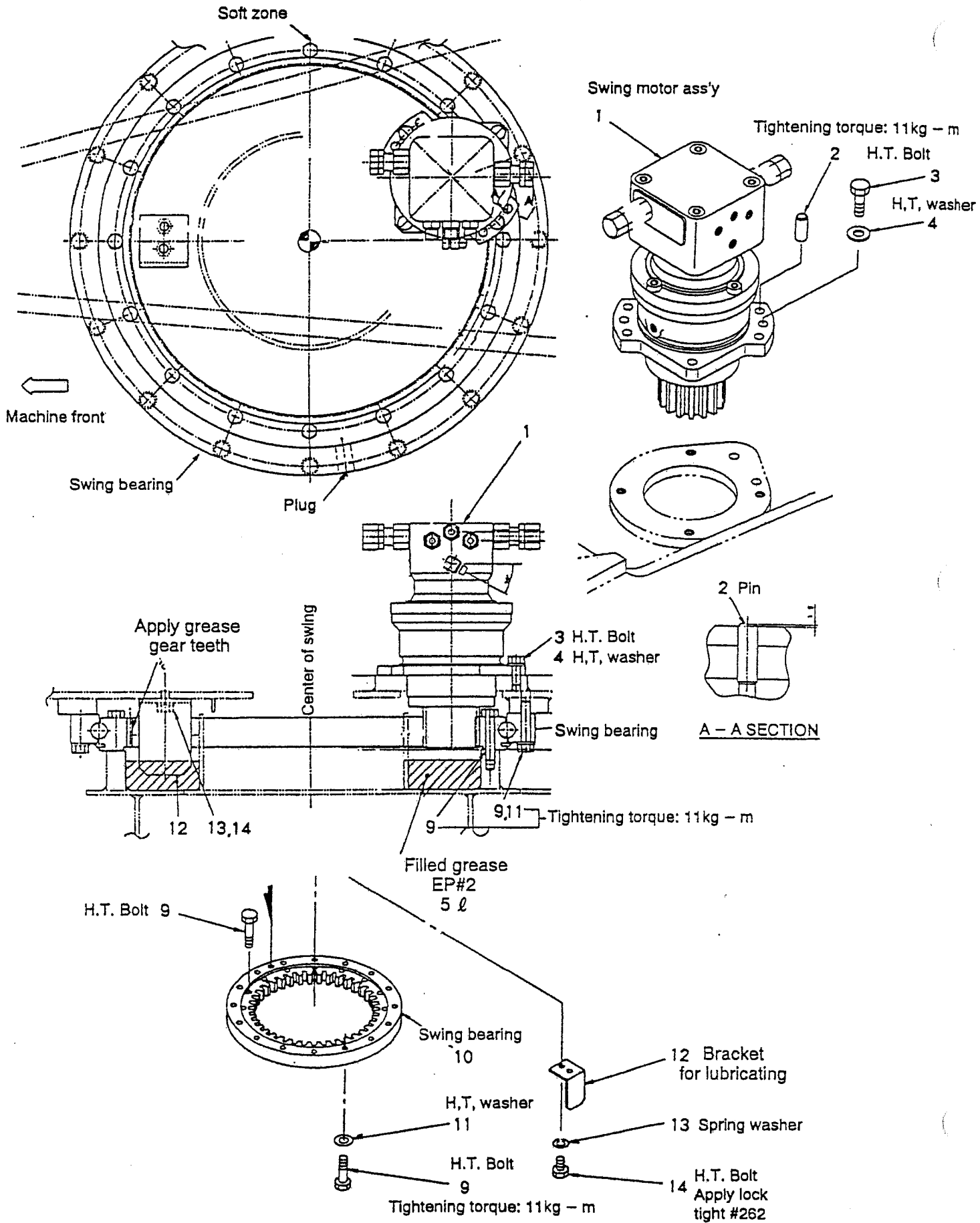
	Phenomenon		Possible cause	Measure
	25J~30J (30/35UJ)	32J・35J		
At traveling	① Straight traveling function cannot be activated. (Traveling course is curved at simultaneous operation of traveling and attachment motion.)	① Straight traveling function cannot be activated (Traveling course is curved at simultaneous operation of traveling and attachment motion.) ② Traveling force does not increase because traveling pressure does not rise.	When operating the traveling lever, the limit switch does not turn on and the solenoid is not excited, so the valve is not changed over.	Check, repair or replace the switch or its wiring.
At attachment operation	① When applying a load by using 2 pumps (P1 and P2) simultaneously, the engine stalls. ② Operating speed of attachment (boom, arm or bucket) is faster than standard time.	① The engine does not stall when using 3 pumps simultaneously. ② Operating speed of attachment (boom, arm or bucket) is faster than standard time.	Although the traveling lever has not been moved, the limit switch turns on, the solenoid is excited and the valve is changed over.	• Check and adjust the switch mounting gap. • Check switch operation. Repair or replace as required. • Check and adjust the neutral position of traveling lever.

TRAVELING LIMIT SWITCH

Limit switch is provided with the traveling spool of control valve as an actuation switch for straight traveling in case of 25J to 30J, and for straight traveling and traveling pressure increase in case of 32J and 35J.

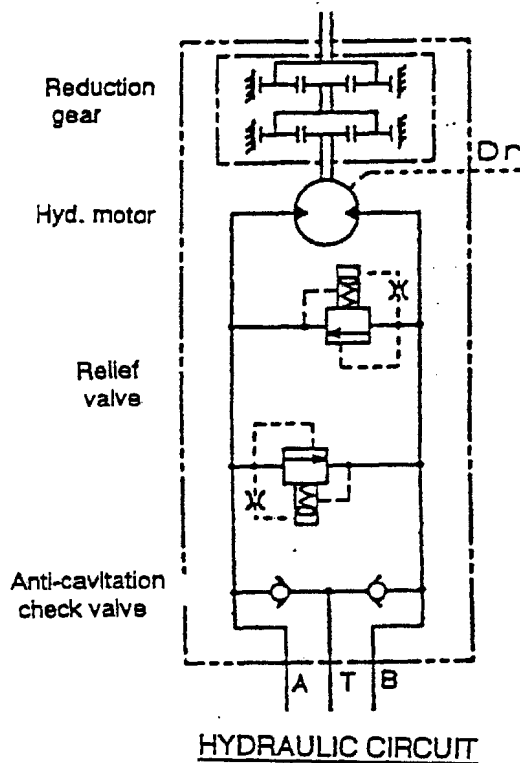
If this switch or its wiring becomes faulty, the phenomenon detailed below is caused. Depending on the phenomenon, carry out troubleshooting and take a proper measure.

	Phenomenon		Possible cause	Measure
	25J~30J (30/35UJ)	32J・35J		
At traveling	① Straight traveling function cannot be activated. (Traveling course is curved at simultaneous operation of traveling and attachment motion.)	① Straight traveling function cannot be activated (Traveling course is curved at simultaneous operation of traveling and attachment motion.) ② Traveling force does not increase because traveling pressure does not rise.	When operating the traveling lever, the limit switch does not turn on and the solenoid is not excited, so the valve is not changed over.	Check, repair or replace the switch or its wiring.
At attachment operation	① When applying a load by using 2 pumps (P1 and P2) simultaneously, the engine stalls. ② Operating speed of attachment (boom, arm or bucket) is faster than standard time.	① The engine does not stall when using 3 pumps simultaneously. ② Operating speed of attachment (boom, arm or bucket) is faster than standard time.	Although the traveling lever has not been moved, the limit switch turns on, the solenoid is excited and the valve is changed over.	• Check and adjust the switch mounting gap. • Check switch operation. Repair or replace as required. • Check and adjust the neutral position of traveling lever.

SWING DRIVE DEVICE

SWING MOTOR-REDUCTION GEAR

(Applicable model: 25J, 28J and 30J)



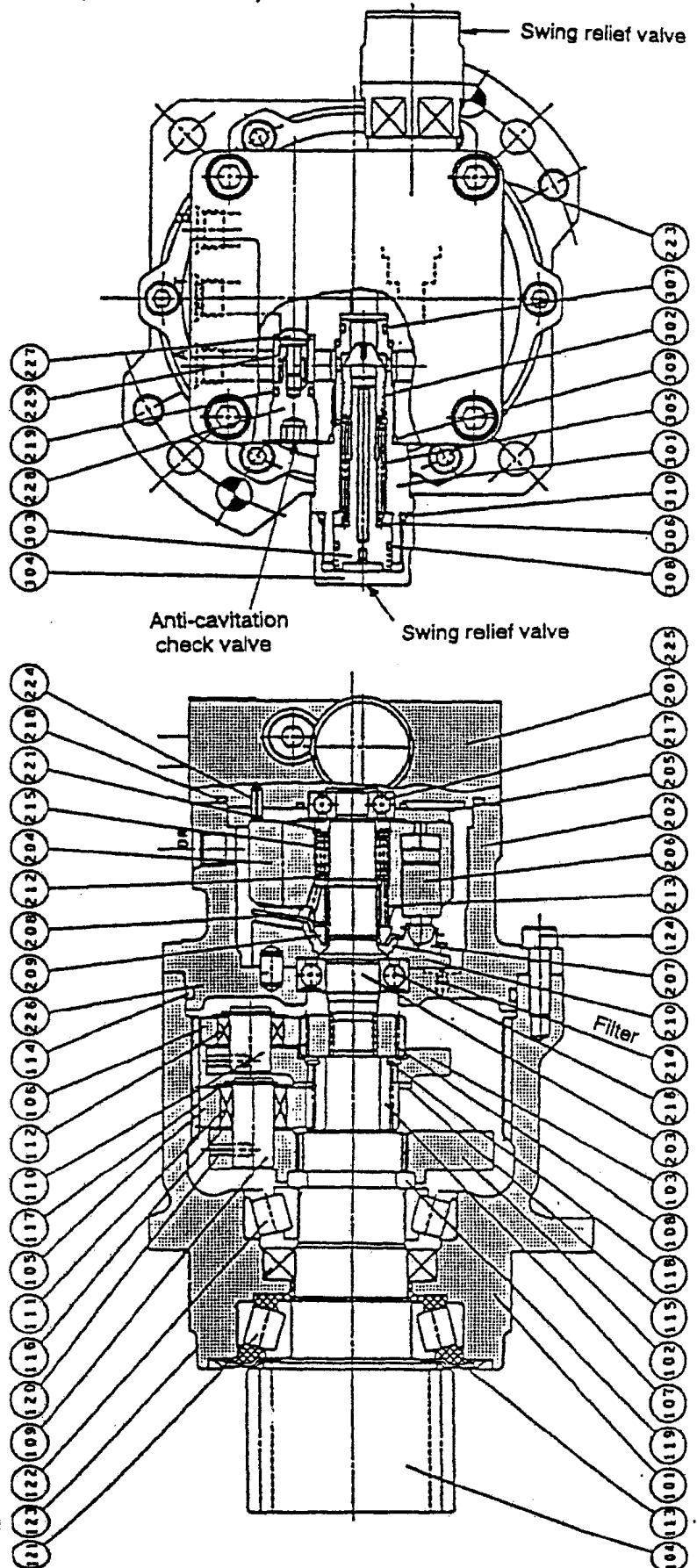
Swing set pressure and value detected at the gauge port

Models	Swing set pressure kgf/cm ²	Value detected at the P3 gauge port
25J	115	130
28J	115	130
30J	145	160

Lubricating System of Swing Reduction Gear

The motor drain circuit is connected to the inside of the reduction gear via two passages along the boundary of the motor and the reduction gear. Thus, the reduction gear is always filled with hydraulic oil.

A 10-micron filter is incorporated in the passages, to prevent worn and contaminated materials produced by the reduction gear from entering the hydraulic oil circuit.

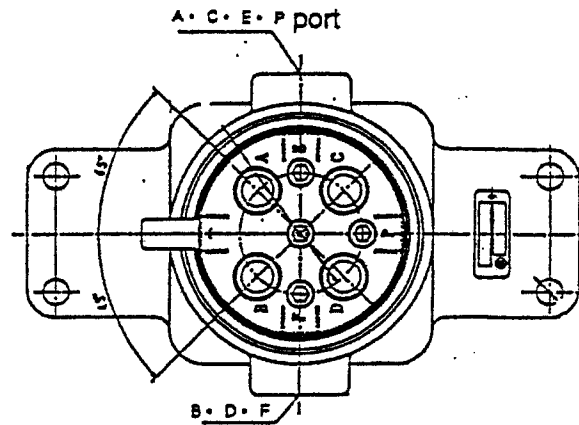
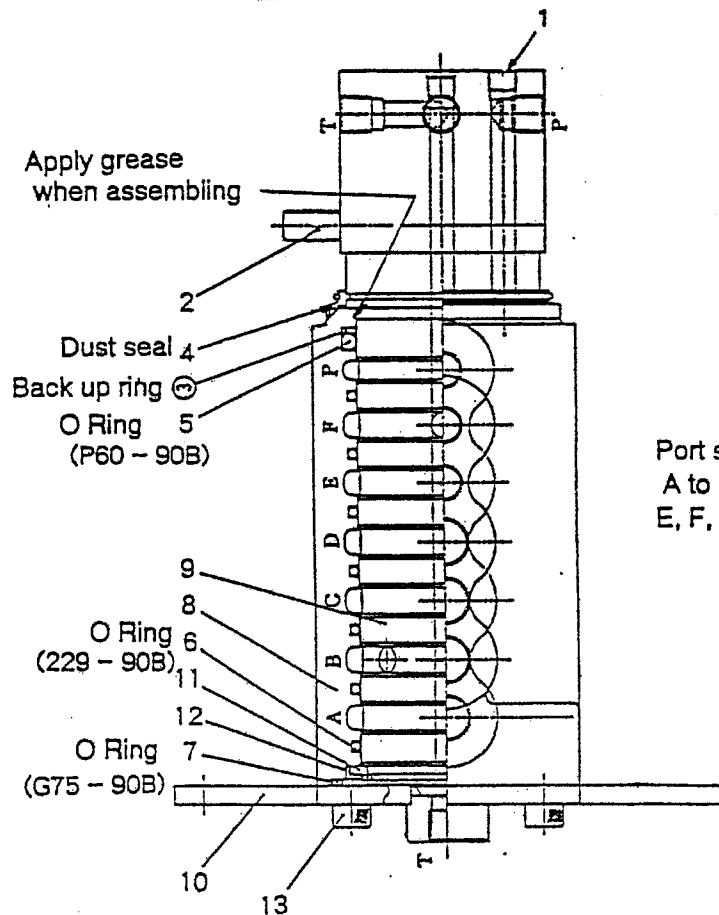


ROTARY JOINT ASS'Y

Applicable models:

25J, 28J & 30J

P/No. 075 5846UA

SECTION OF ROTARY JOINT

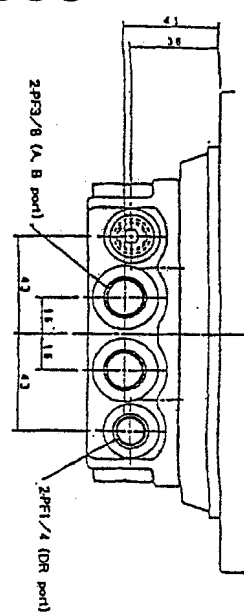
Port size:

A to D port; PT 3/8

E, F, P, T port PT 1/4

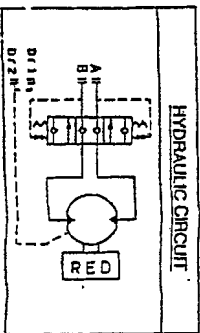
Interchangeability

Model	Part No.	Interchangeability	Part No.	Model
25J, 28J 30J	075 5846 UA	No	075 5824 UA	25G 28G
Port size	PT 3/8	↔ X ↔	PT 1/4	Port size



MOTOR SECTION

Recommended Oil Quantity of Oil Interval of Inspection Interval of Replacement	API GL-4 SAE 90 0.6 liter Every 500 hrs. Every 1000 hrs.
--	---



BRAKE VALVE SECTION

TRAVEL MOTOR • REDUCTION GEAR

No.	DESCRIPTION	QTY
101	Casing	1
102	Cover	1
103	Carrier 1	1
104	Carrier 2	1
105		
106	Gear b1	4
107	Gear b2	3
108	Gear a1	5
109	Gear a2	64
110	Pin b1	4
111	Pin b2	4
112	Roller	3
113	Seal ring	1
114	Shaft ring	1
115		
116	Thrust collar	1
117	Flashing seal	1
118	O ring	2
119	Bearing	1
120	Bearing	46
121	Bearing	54
122	Bushing	10
123	Thrust washer	10
124	Shaft ring	7
125	Seal ring	7
126	Spring pin	1
127		
128	O ring	1
129	O ring	1
130	Puff	3
131		
132		
133	(Hyd motor)	1
134		
135	Puff	1
136	O ring	1
137	Motor plate	1
138	Thrust washer	4
	Hyd motor	1
201	Body 1	1
202	Body 2	1
203	Shaft	1
204	Cylindrical	1
205	Valve plate	1
206	Piston	9
207	Shoe	9
208	Shoe holder	1
209	Barrel holder	1
210	Swash plate	1
211	Spool	1
212	Check valve	2
213	Check valve	2
214	Pin	3
215	Spring C	2
216	Spring V1	2
217	Spring V2	2
218	Puff	2
219		
220	Choke	2
221		
222	Retainer	2
223	Bearing	1
224	Bearing	1
225	O ring	1
226	O ring	2
227	O ring	2
228	Oil seal	1
229	Shaft ring	1
230	Seal ring	1
231	Bolt	6
232	Spring pin	1
233	Pin	1
234	Pin	1

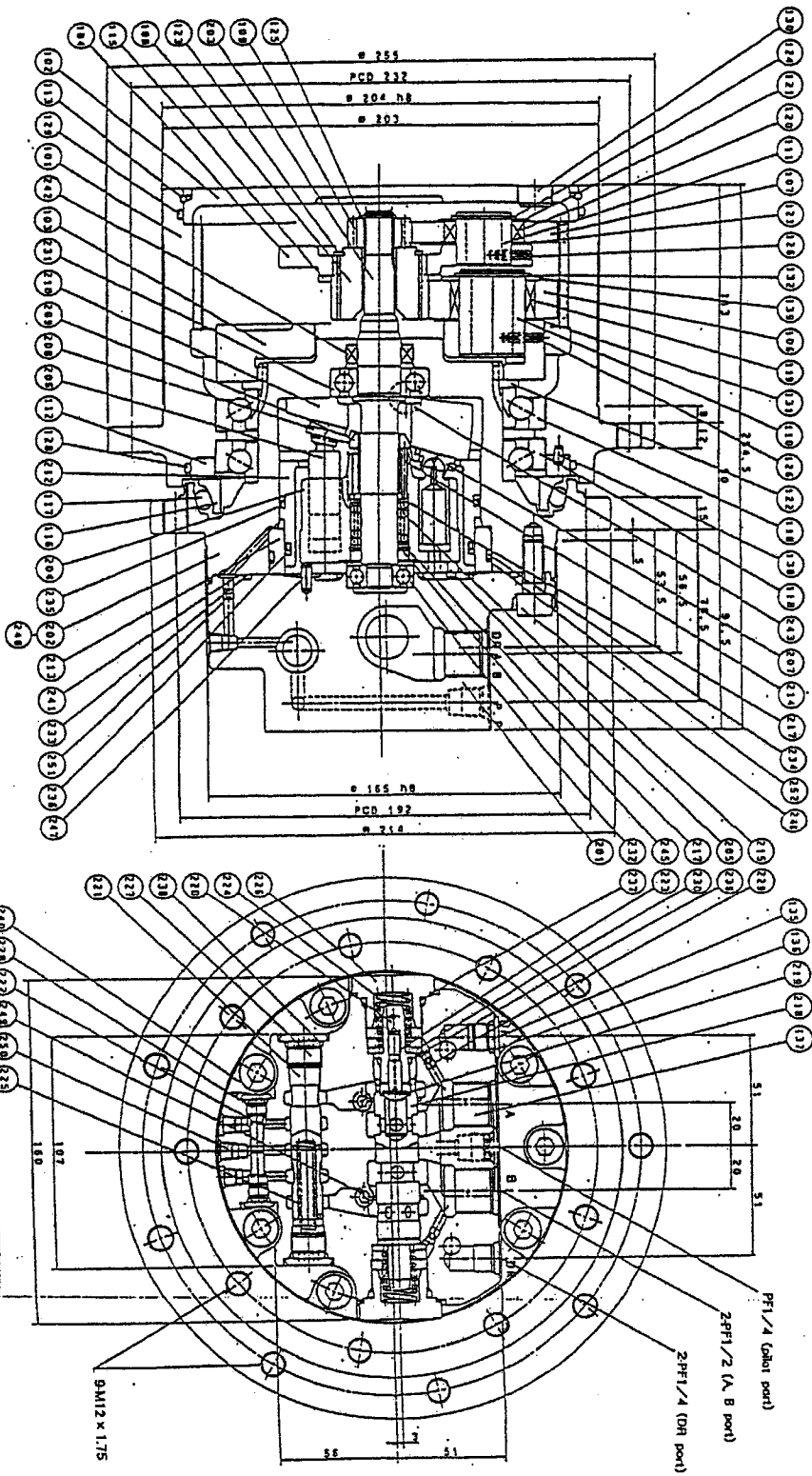
STRUCTURE & FUNCTION

28J
30J

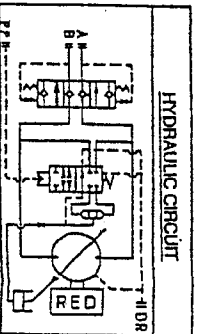
TRAVEL MOTOR • REDUCTION GEAR

28J & 30J

28J
075 7612 UA
(PHW - 250N - 41 - 16698)
30J
075 7611 UA
(PHW - 250N - 41 - 1670A)



No.	DESCRIPTION	QTY
232	Oil seal	21
243	Bolt	2
244	—	2
245	Stamp ring	1
246	Bolt	1
247	Spring pin	1
248	Pin	2
249	Pin	2
250	Pulley	2
251	Choke	6
252	Backup ring	1
231	Oil ring	1
230	Bearing	2
229	Shaft	1
228	Speed pool	2
227	Shaft	1
226	Shaft	1
225	Spring V1	1
224	Spring V2	2
223	Spring V3	2
222	Shaft	2
221	Pulley	2
220	Choke	2
219	Ring	2
218	Bearing	2

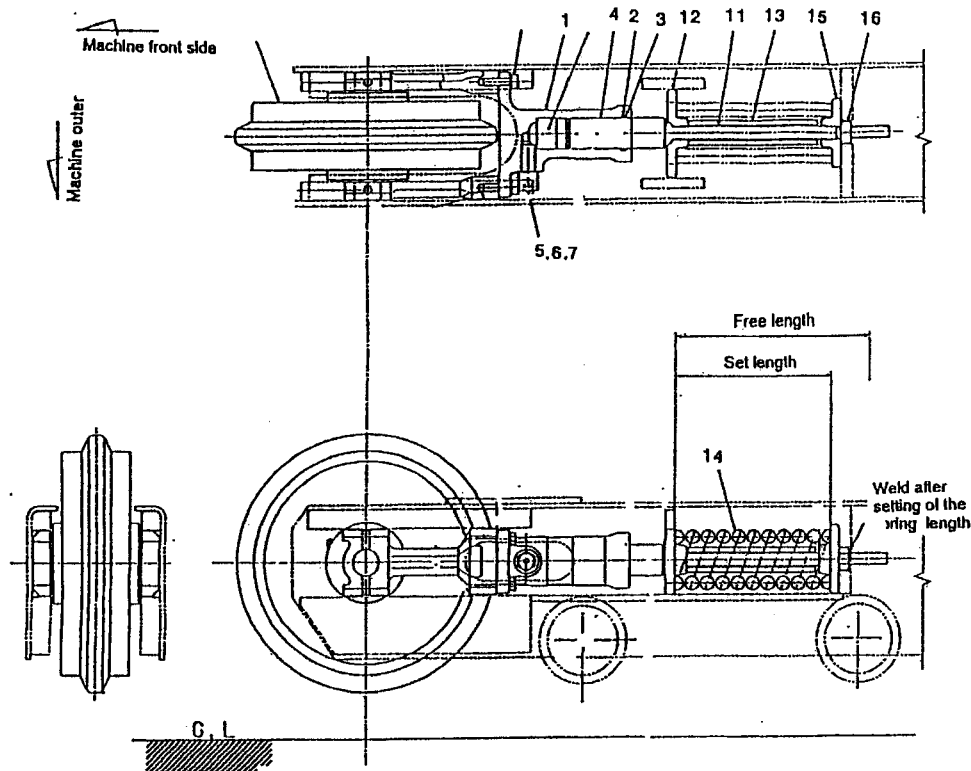


Recommended Oil Quantity of Oil Interval of inspection Interval of Replacement	API GL-4 SAE 90 0.8 liter Every 500 hrs. Every 1000 hrs.
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STRUCTURE & FUNCTION

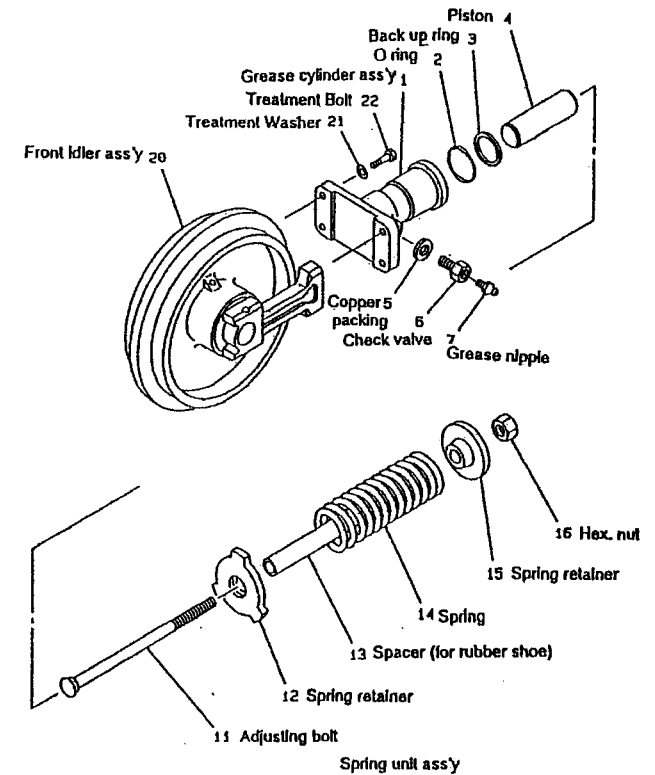
CRAWLER SHOE ADJUSTING DEVICE

All Models



SPRING LENGTH

Models	Spring length mm			Load kg	
	Steel shoe	Rubber shoe	Free length	Steel	Rubber
15J • 18J	135	135	153	800	800
25J • 28J • 30J	215	205	256	2754	3618
32J • 35J	215	205	256	2754	3618
45J • 55J	295	295	330	3600	3600
45UJ • 55UJ	295	295	330	3600	3600

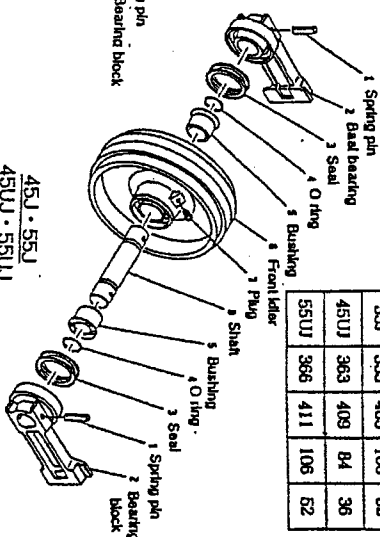
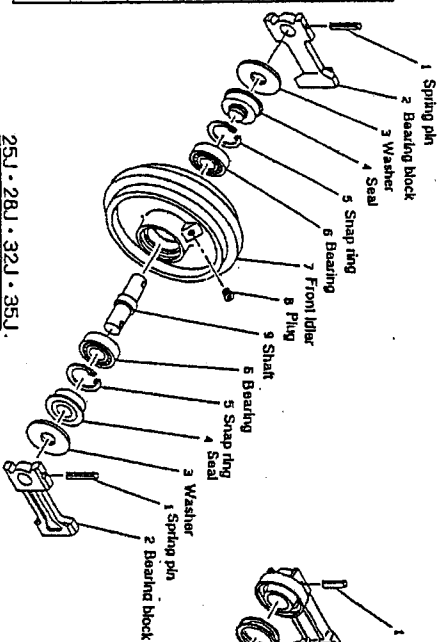
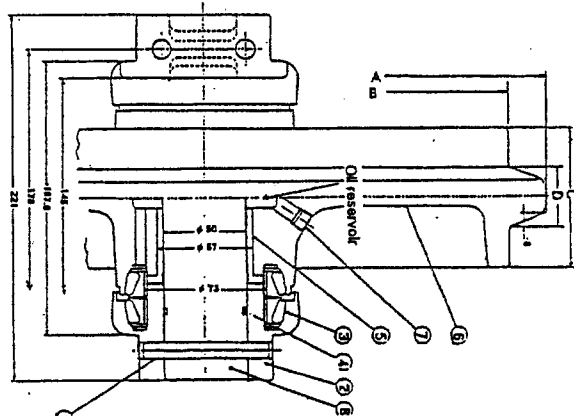
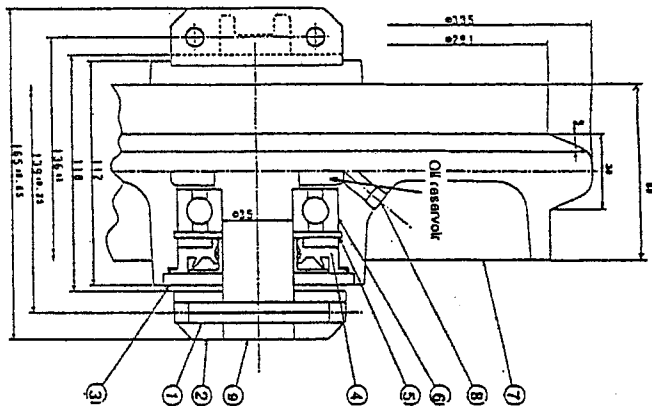


Technical drawing of a mechanical assembly, likely a pump or engine component, showing a cross-section. The drawing includes dimensions and numbered callouts (1-7) pointing to various parts. The text "Oil reservoir" is visible on the right side.

LUBRICATION

Quantity	Recommended oil	Quantity
15J • 18J	API GL-4 SAE 90	70 cc
25J~35J	API GL-4 SAE 90	80 cc
45J • 55J • UJ	API CD SAE 30	160 cc

Model	Shoe type	Part No.	Interchangeability	Part No.	Model
15J - 18J	Rubber	530 0874 00	←×→	530 0705 00	1514G3
	Steel	530 0873 00	←×→	530 0705 00	
25J~35J	Rubber	530 1003 00	←×→	530 0756 00	1525G3~35G3
	Steel	530 1004 00	←×→	530 0854 00	
45J	Rubber	530 0900 00	←○→	530 0900 00	1540G3
	Steel	530 0655 00	←○→	530 0656 00	
45UJ	Rubber	530 1022 00	←×→	530 0890 00	1540G3
	Steel	530 0656 00	←○→	530 0656 00	
55J	Rubber	530 0757 00	←○→	530 0757 00	1550G3
	Steel	530 0666 00	←○→	530 0666 00	
55UJ	Rubber	530 1023 00	←×→	530 0757 00	1550UX
	Steel	530 0666 00	←○→	530 0666 00	

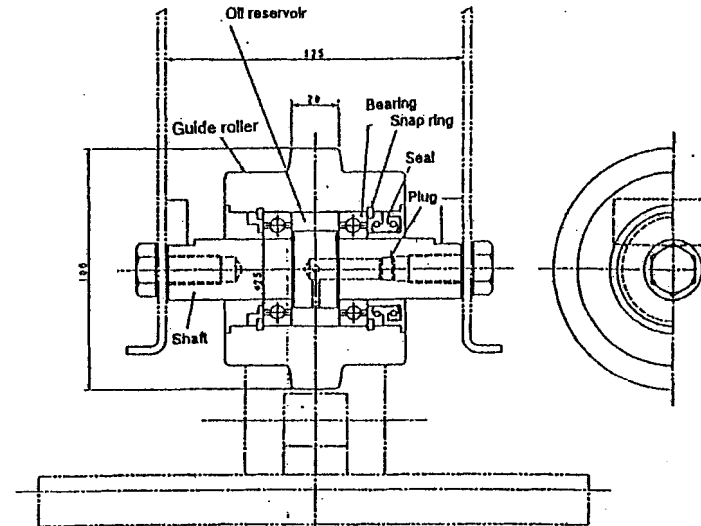


Dimension of idlers				
Model	ϕA	ϕB	C	D
45J	355	401	84	36
55J	355	403	106	52
45UJ	363	409	84	36
55UJ	366	411	106	52

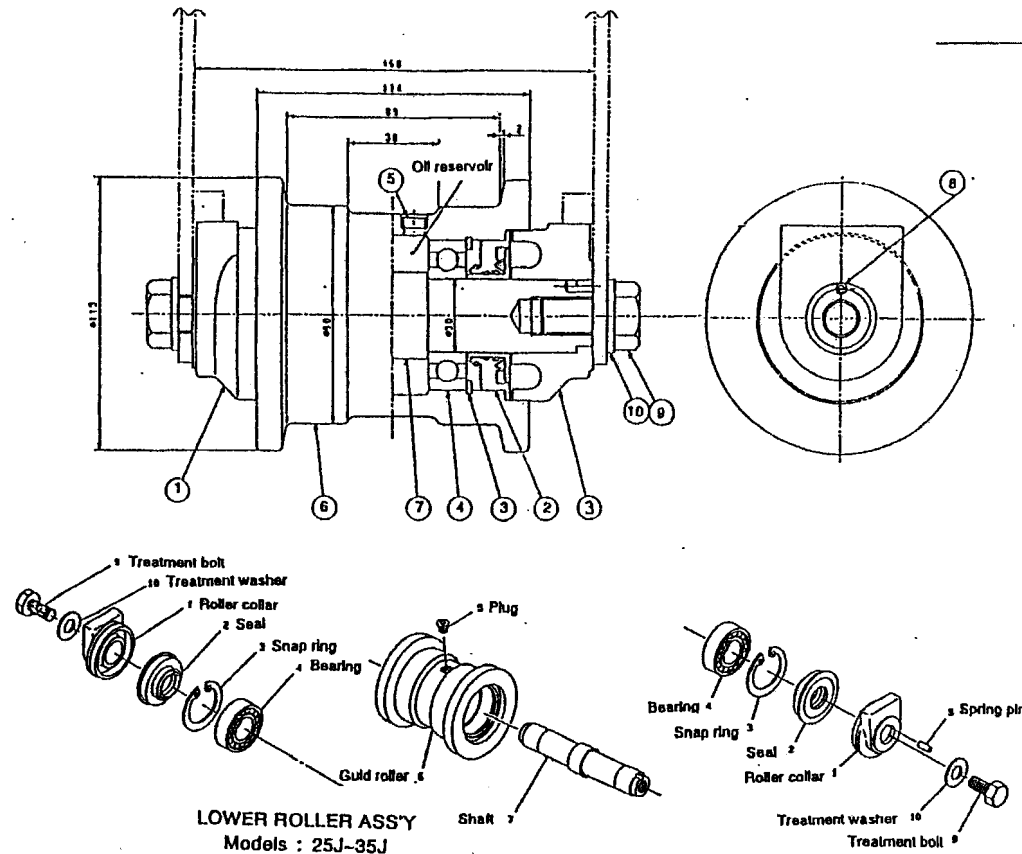
STRUCTURE & FUNCTION

LOWER ROLLER ASS'Y

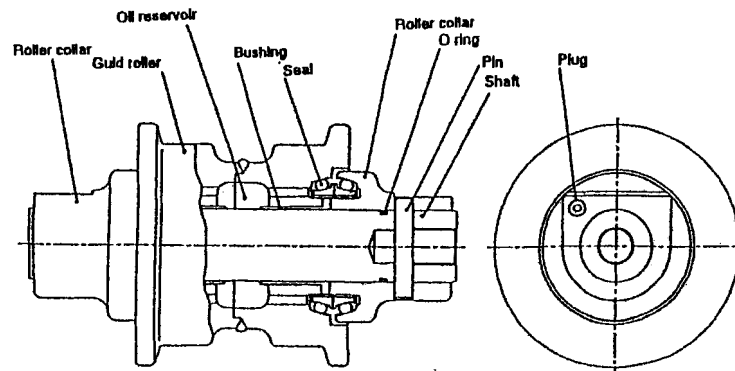
All Models



LOWER ROLLER ASS'Y
Models : 15J & 18J



LOWER ROLLER ASS'Y
Models : 25J-35J



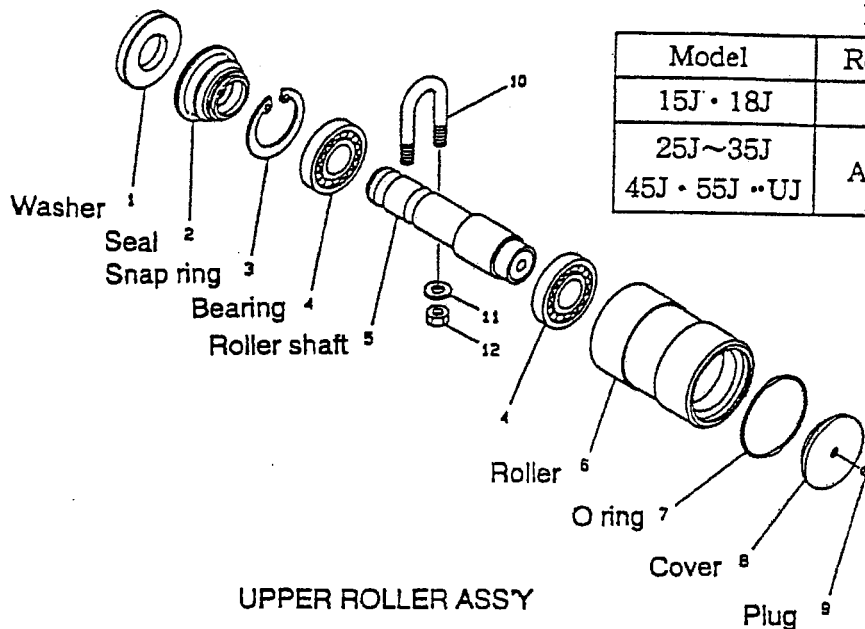
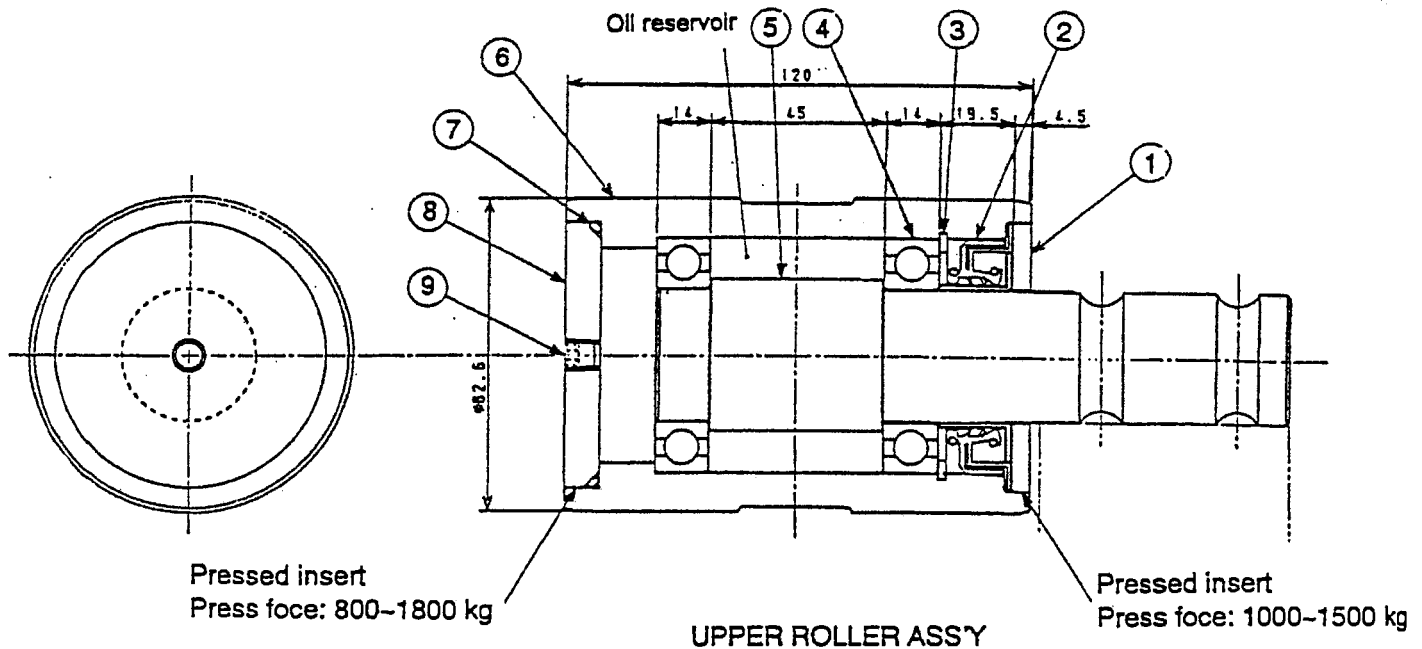
LOWER ROLLER ASS'Y
Models : 45J & 55J
: 45UJ & 55UJ

LUBRICATION

Model	Recommended oil	Quantity
15J - 18J	API GL-4 SAE 90	30 cc
25J - 35J	API GL-4 SAE 90	80 cc
45J - 55J - UJ	API CD SAE 30	100 cc

Interchangeability of Lower Rollers

Model	Shoe type	Part No.	Interchangeability	Part No.	Model
15J - 18J	Ruber	530 0853 00	←X→	530 0703 00	IS14G3
	Steel	530 0853 00	←X→	530 0703 00	
25J - 35J	Ruber	530 0903 00	←O→	530 0903 00	IS25G3~ IS35G3
	Steel	530 0903 00	←O→	530 0903 00	
45J - 45UJ	Ruber	065 3723 UA	←O→	065 3721 UA	IS40G3
	Steel	065 3723 UA	←O→	065 3721 UA	
55J - 55UJ	Ruber	065 3722 UA	←O→	065 3722 UA	IS50G3
	Steel	065 3722 UA	←O→	065 3722 UA	

UPPER ROLLER ASS'Y**LUBRICATION**

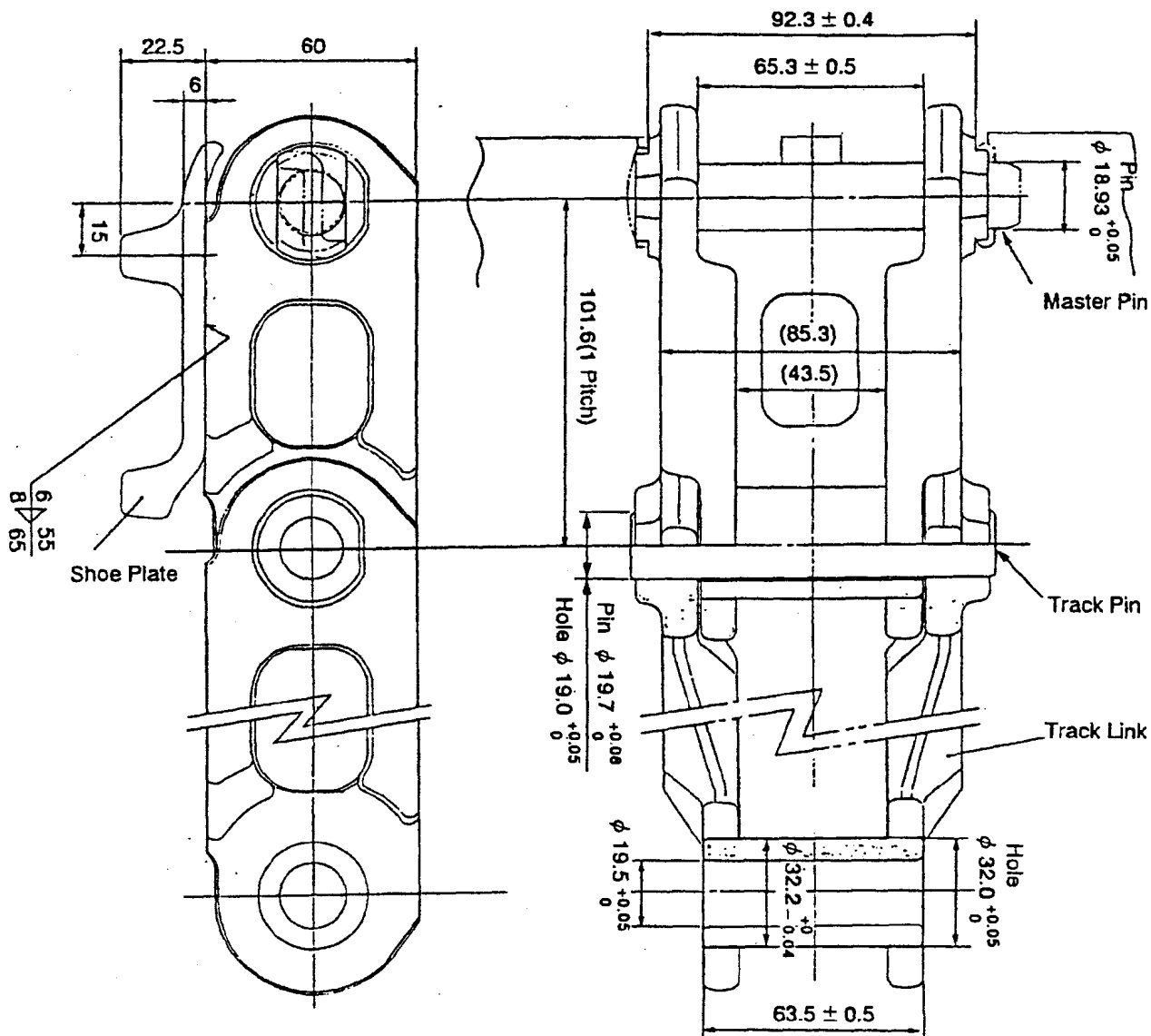
Model	Recommended oil	Quantity
15J • 18J	—	—
25J~35J 45J • 55J • UJ	API CD SAE 30	60 cc

Interchangeability of Upper Rollers

Model	Part No.	Interchangeability	Part No.	Models
15J • 18J 25J	Not installed		Not installed	IS14G3~ IS25G3
28J~55J UJ	530 0608 00	↔	530 0608 00	IS28G3~ IS50G3

CRAWLER SHOE ASSEMBLY

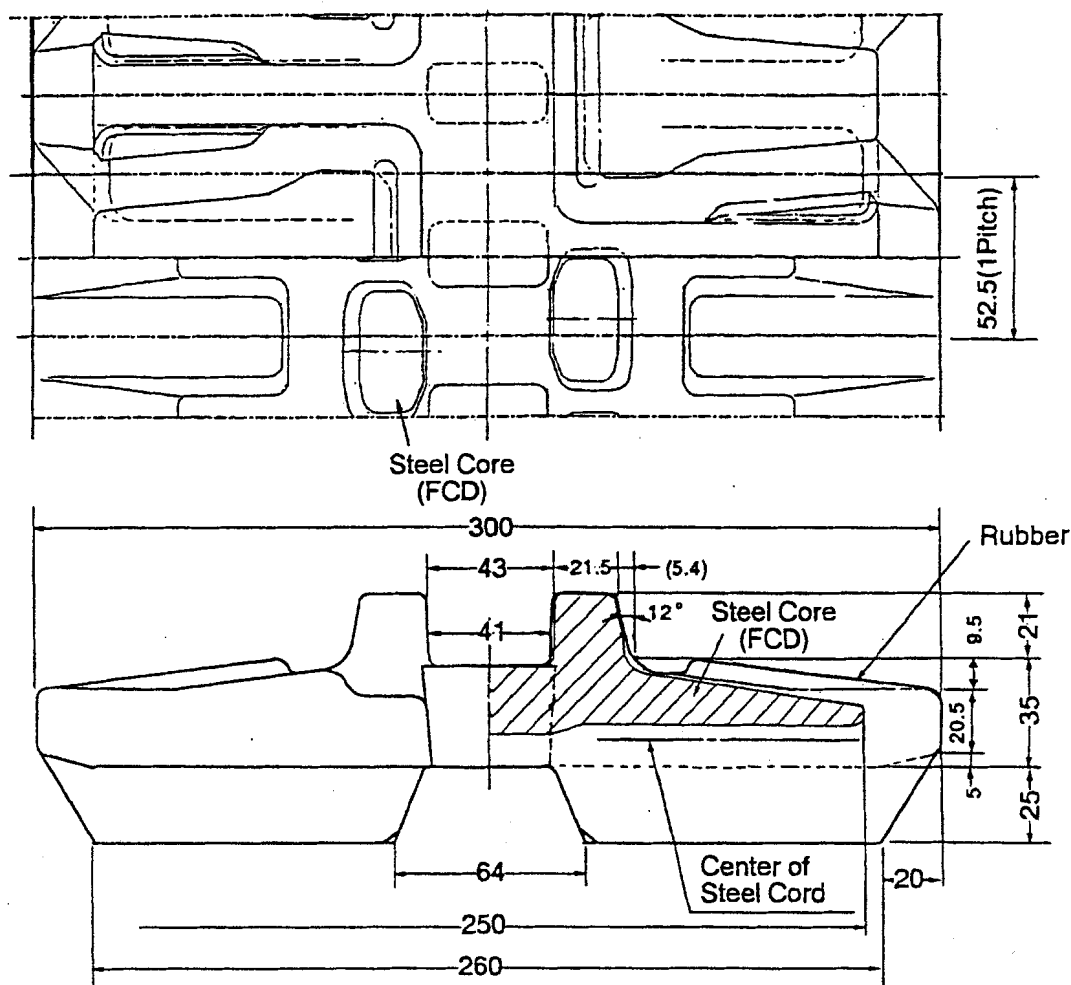
(Track Link Shoe)



INTERCHANGEABILITY

G Series	Parts No.	Interchangeability	J Series	Parts No.
IS - 25GX3	065 3086 UA 250W × 101.6P × 36L	↔	25J	065 33086 UA 250W × 101.6P × 36L
IS - 28GX3	065 3586 UA 300W × 101.6P × 38L	↔	28J	065 3586 UA 300W × 101.6P × 38L
IS - 30GX3	065 3082 UA 300W × 101.6P × 41L	↔	30J	065 3082 UA 300W × 101.6P × 41L

RUBBER CRAWLER SHOE ASSEMBLY

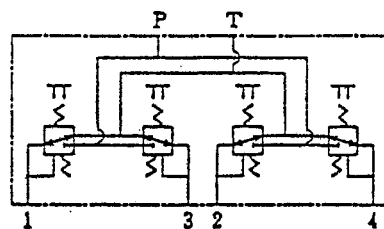
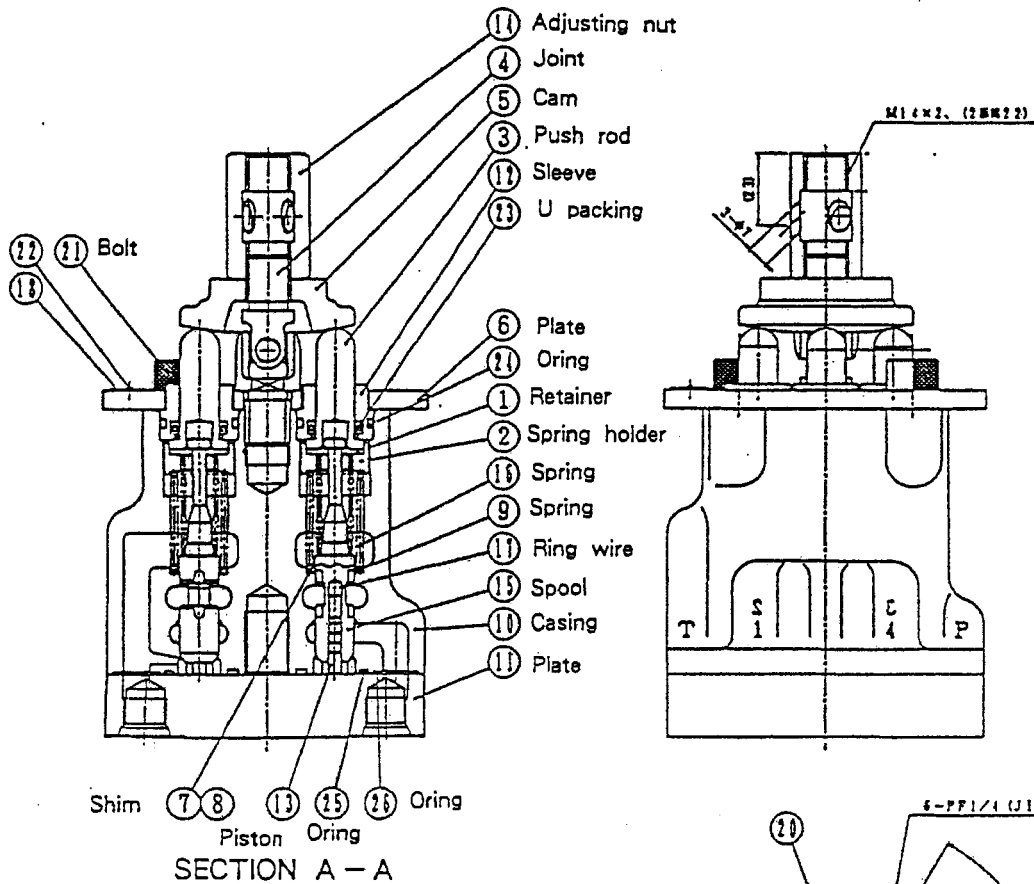
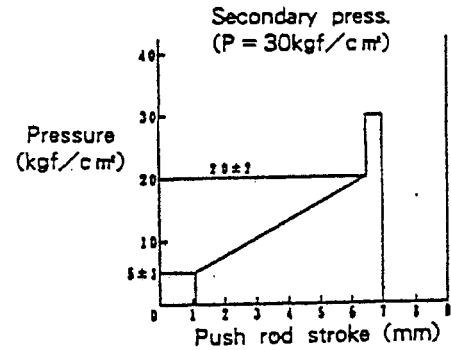
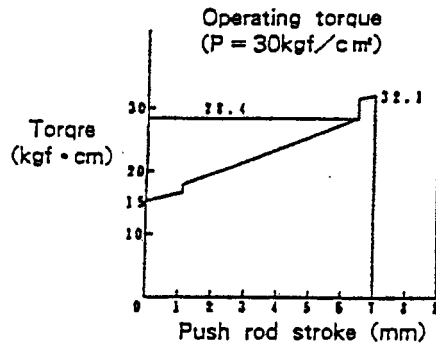


SECTION OF RUBBER SHOE

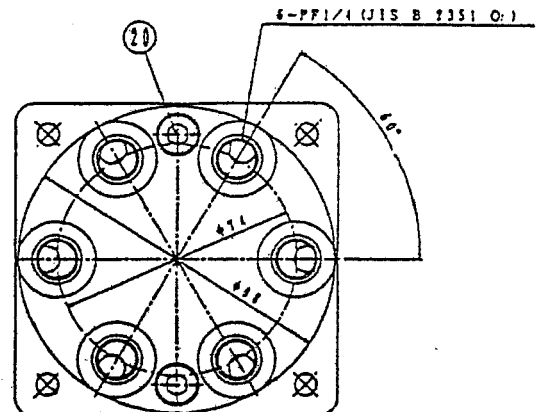
INTERCHANGEABILITY

G Series	Parts No.	Interchangeability	J Series	Parts No.
IS - 25GX3 ~ # 3468	065 3579 UA 300W × 52.5P × 72L	× → ← ○	25J	065 3707 UA 300W × 52.5P × 72L Short Pitch, Reinforced
	065 3707 UA 300W × 52.5P × 72L Short Pitch, Reinforced	← ○ →		
IS - 28GX3	065 3580 UA 300W × 52.5P × 76L	× → ← ○	28J	065 3708UA 300W × 52.5P × 76L Short Pitch, Reinforced
	065 3708 UA 300W × 52.5P × 76L Short Pitch, Reinforced	← ○ →		
IS - 30GX3 ~ # 8141	065 3581 UA 300W × 52.5P × 80L	× → ← ○	30J	065 3709 UA 300W × 52.5P × 80L Short Pitch, Reinforced
	065 3709 UA 300W × 52.5P × 80L Short Pitch, Reinforced	← ○ →		

REMOTE CONTROL VALVE ASSEMBLY

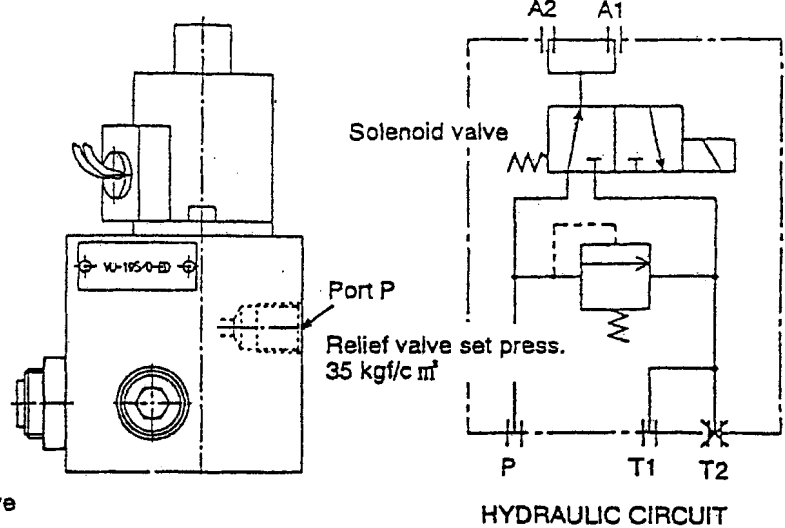
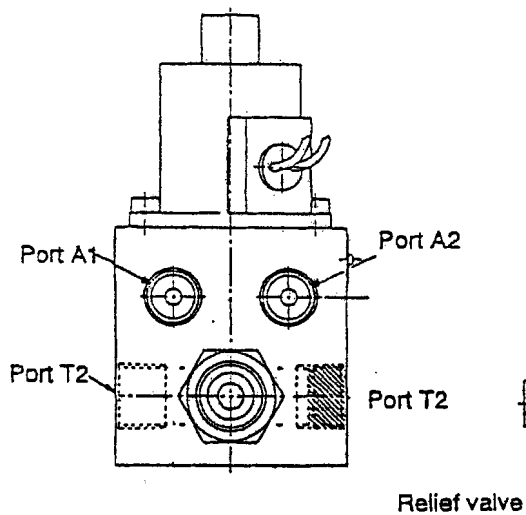
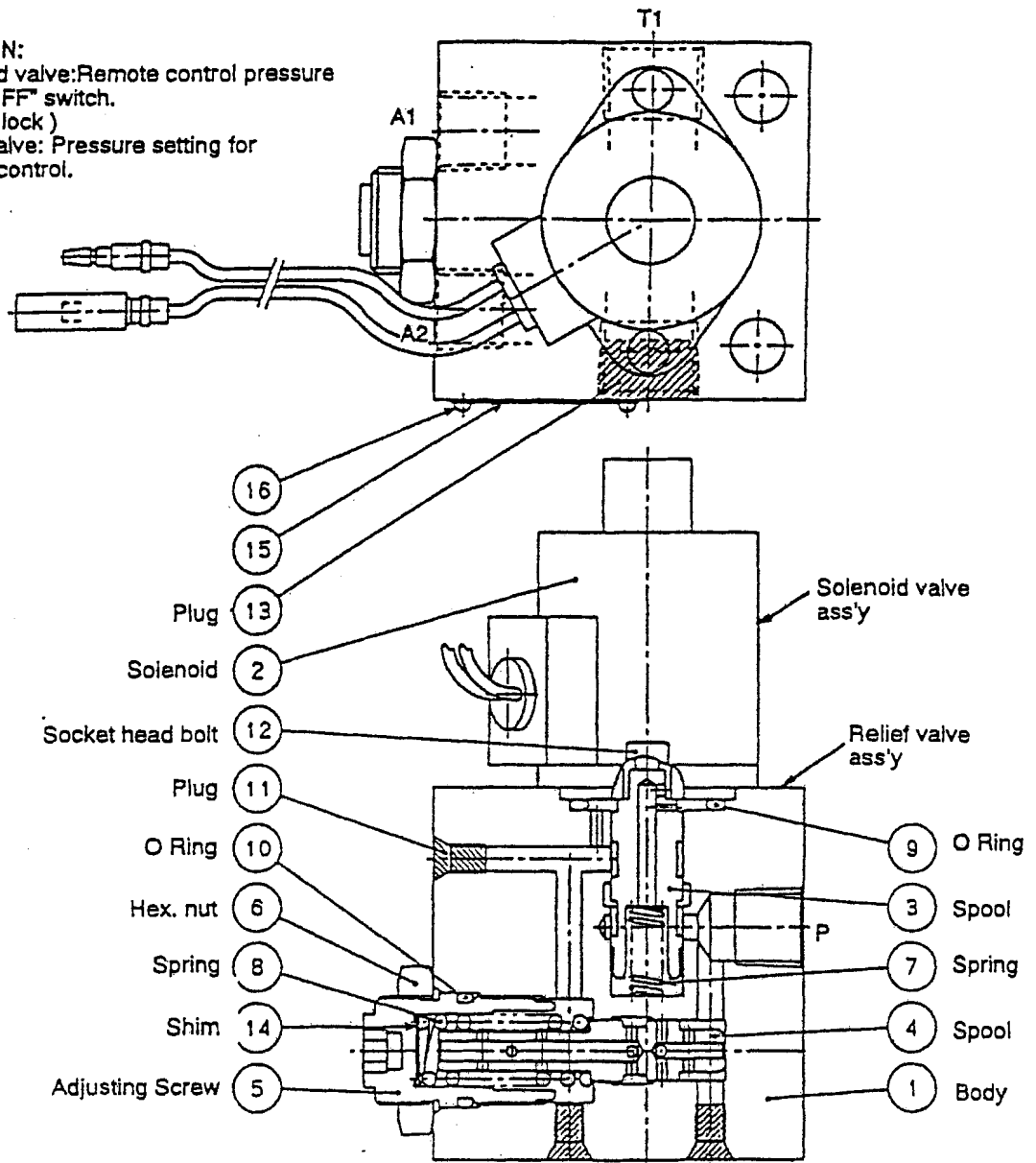


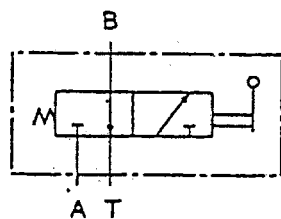
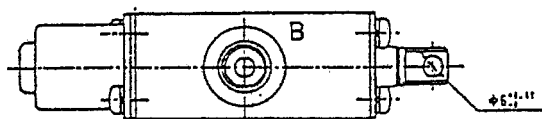
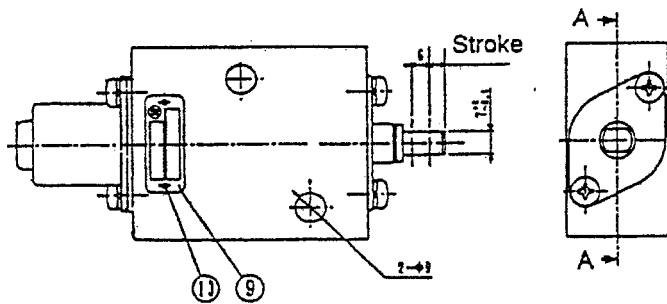
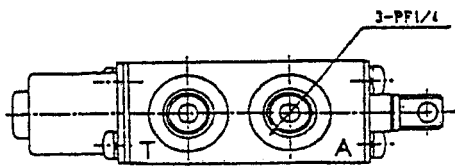
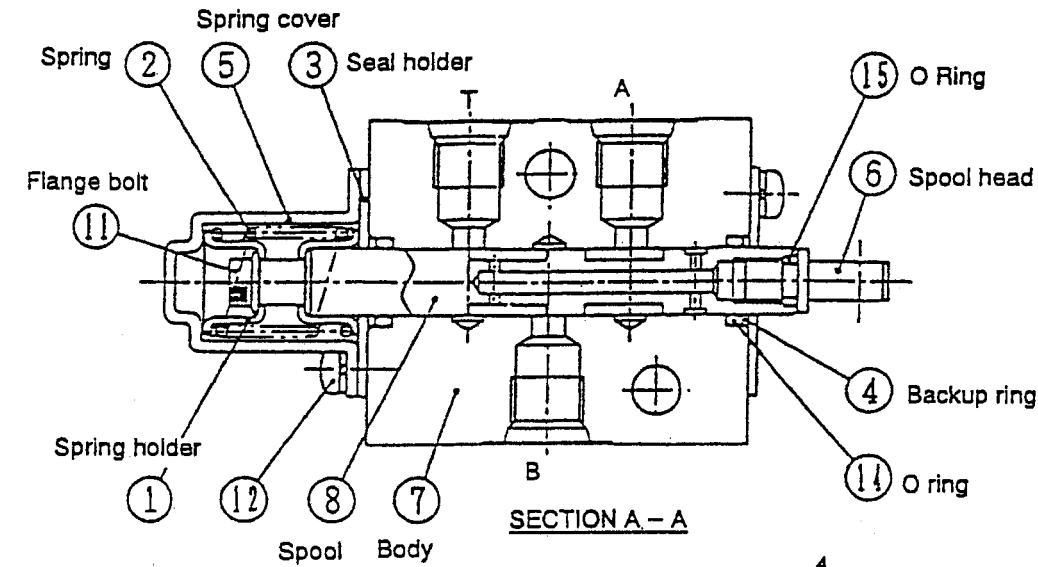
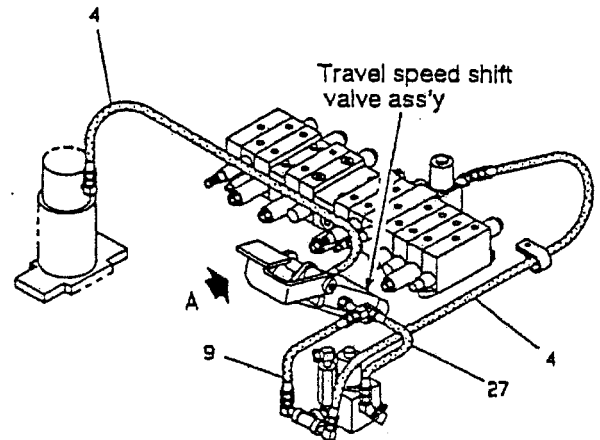
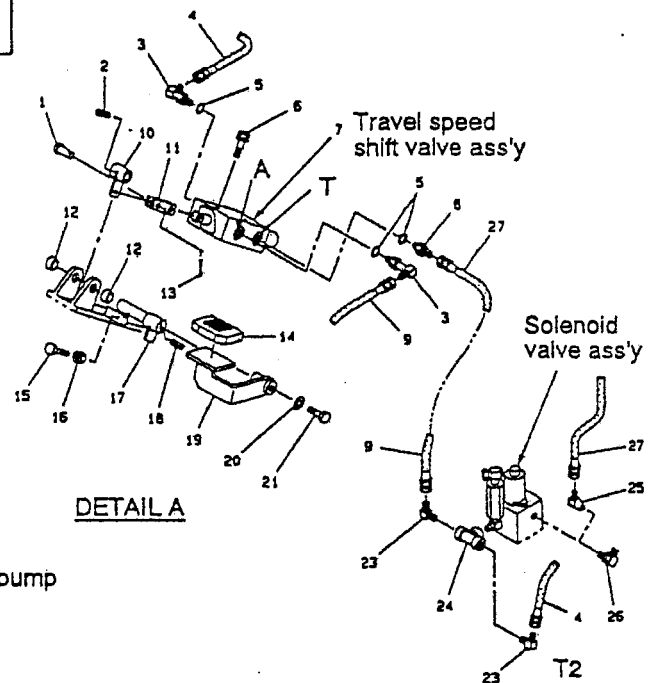
HYDRAULIC CIRCUIT



SOLENOID VALVE ASSEMBLY**FUNCTION:**

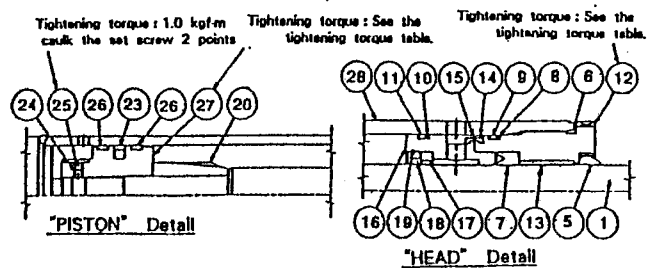
- Solenoid valve: Remote control pressure "ON" "OFF" switch. (Control lock)
- Relief valve: Pressure setting for remote control.



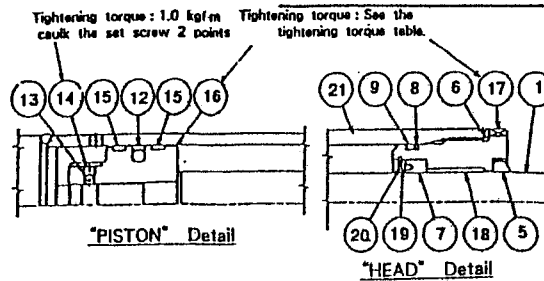
TRAVEL SPEED SHIFT VALVE ASSEMBLYHYDRAULIC CIRCUITINSTALLED VALVE & PIPINGDETAIL A

B port: To travel motor
 T port: To hyd. tank
 A port: From remo-con. pump
 (35 kgf/cm²)

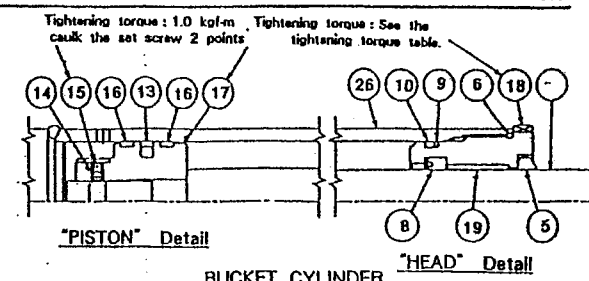
STRUCTURE & FUNCTION



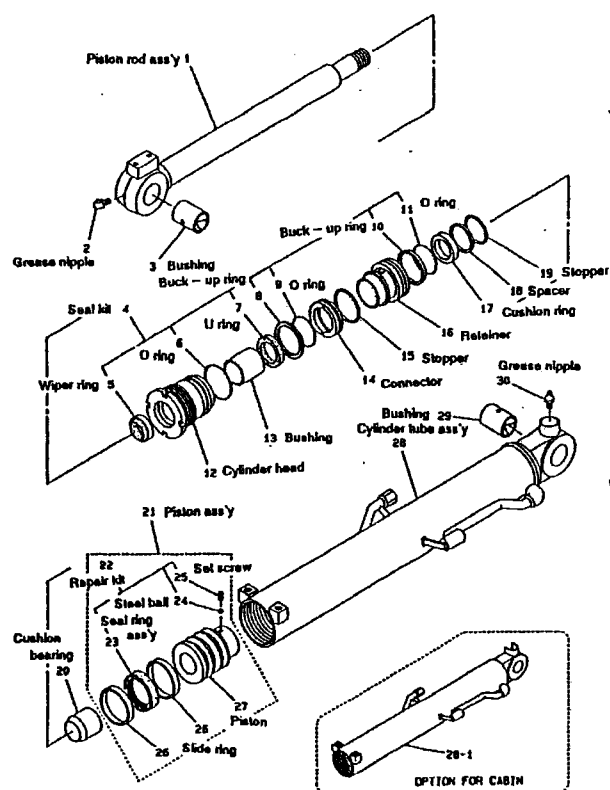
BOOM CYLINDER



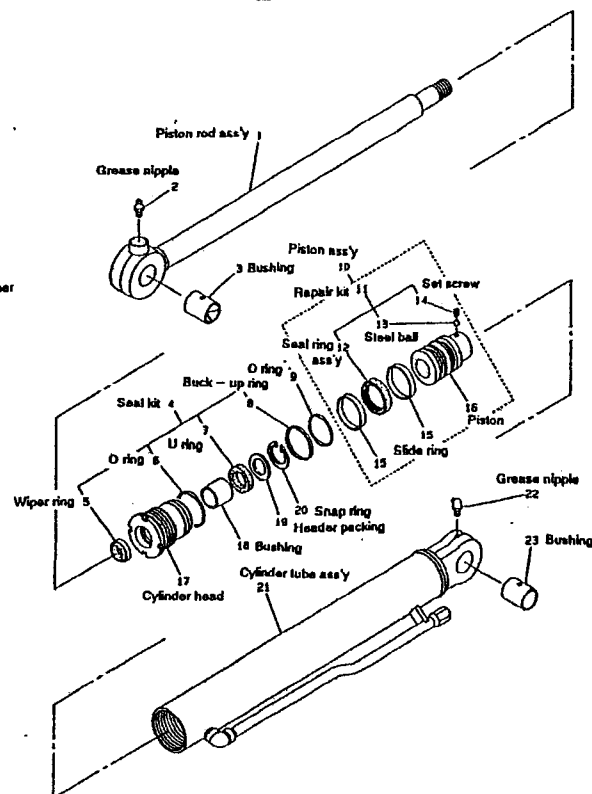
ARM CYLINDER



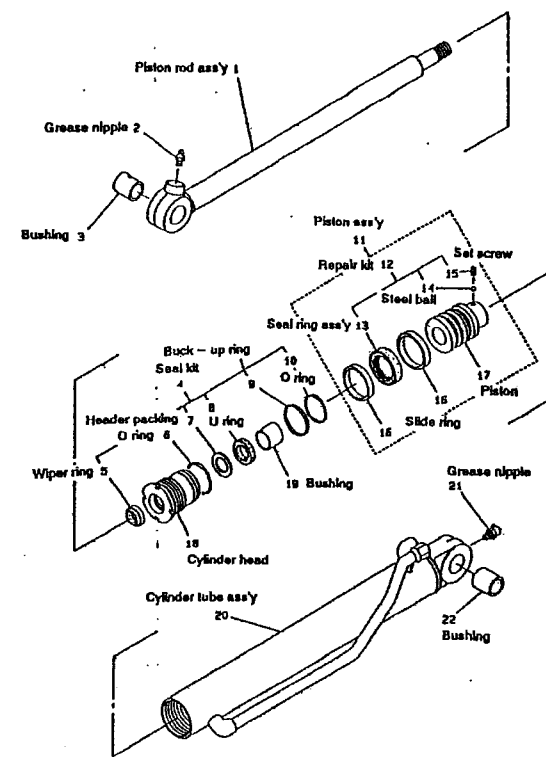
BUCKET CYLINDER



BOOM CYLINDER



ARM CYLINDER



BUCKET CYLINDER

HYDRAULIC CYLINDERS
25J • 28J & 30J

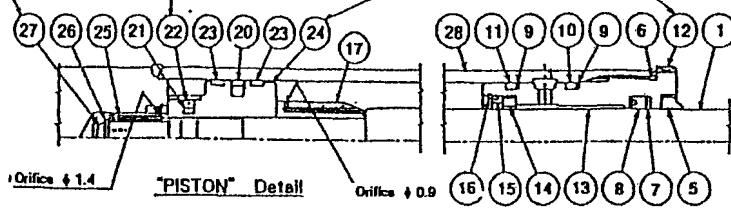
STRUCTURE & FUNCTION

25J
28J
30J

Tightening torque: 32 kgf-m
(M10 x 1.5)

Tightening torque: 1.0 kgf-m
caulk the set screw 2 points.

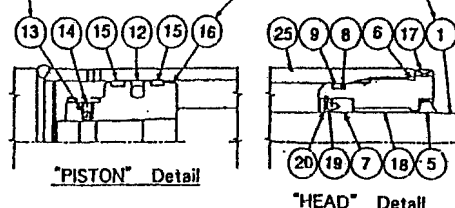
Tightening torque: See the
tightening torque table.



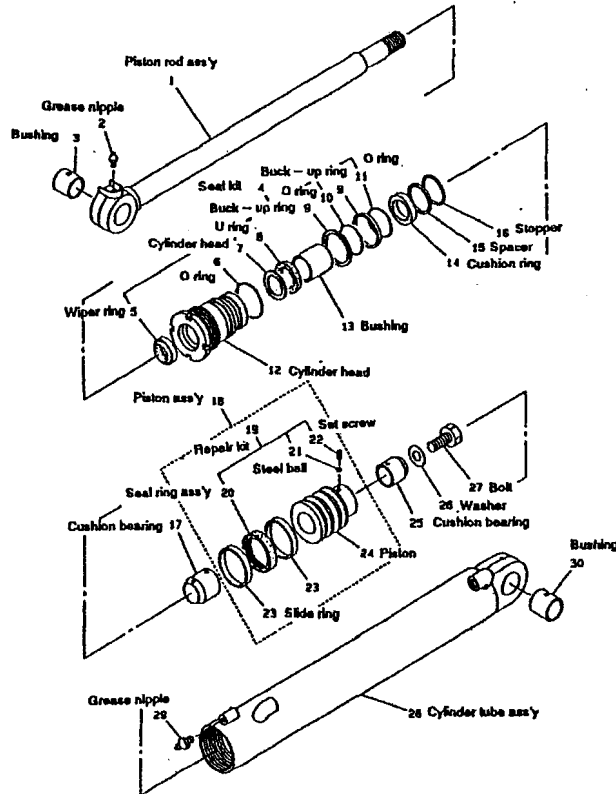
BOOM SWING CYLINDER

Tightening torque: 1.0 kgf-m
caulk the set screw 2 points.

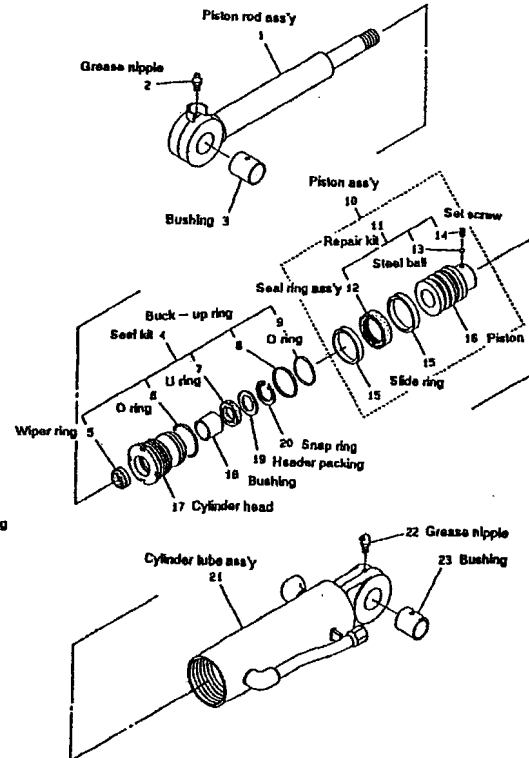
Tightening torque: See the
tightening torque table.



BLADE CYLINDER



BOOM SWING CYLINDER



BLADE CYLINDER

HYDRAULIC CYLINDERS

25J · 28J & 30J

INTERCHANGEABILITY

O : Yes
X : No

	25J	Interchange-ability	IS-25G3
Boom w/canopy	075 8624 UA φ 40 × φ 75 × 490	→X→ ←X←	075 2919 UA φ 45 × φ 75 × 485
Boom (w/cab)	075 8623 UA φ 40 × φ 75 × 455	→X→ ←X←	075 2911 UA φ 45 × φ 75 × 435
Arm	075 2878 UA φ 40 × φ 70 × 500	→X→ ←X←	075 2928 UA φ 40 × φ 70 × 500
Bucket	075 2878 UA φ 40 × φ 63 × 450	→X→ ←X←	075 2938 UA φ 40 × φ 63 × 410
Boom swing	075 2970 UA φ 40 × φ 70 × 475	→X→ ←X←	075 2648 UA φ 40 × φ 70 × 475
Blade	075 2950 UA φ 45 × φ 85 × 140	→O→ ←O←	075 2950 UA φ 45 × φ 85 × 140

φ Rod D × φ Bore × Stroke (mm)

INTERCHANGEABILITY

O : Yes
X : No

	28J	Interchange-ability	IS-28G3
Boom w/canopy	075 8624 UA φ 40 × φ 75 × 490	→X→ ←X←	075 2919 UA φ 45 × φ 75 × 485
Boom (w/cab)	075 8623 UA φ 40 × φ 75 × 455	→X→ ←X←	075 2911 UA φ 45 × φ 75 × 435
Arm	075 2929 UA φ 45 × φ 75 × 500	→O→ ←O←	075 2929 UA φ 45 × φ 75 × 500
Bucket	075 2878 UA φ 40 × φ 63 × 450	→X→ ←X←	075 2938 UA φ 40 × φ 63 × 410
Boom swing	075 2970 UA φ 40 × φ 70 × 475	→X→ ←X←	075 2648 UA φ 40 × φ 70 × 475
Blade	075 2889 UA φ 45 × φ 85 × 140	→X→ ←X←	075 2950 UA φ 45 × φ 85 × 140

φ Rod D × φ Bore × Stroke (mm)

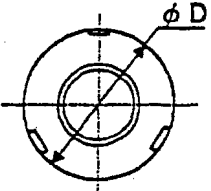
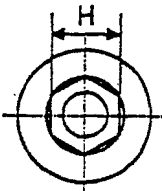
INTERCHANGEABILITY

O : Yes
X : No

	30J	Interchange-ability	IS-30G3
Boom w/canopy	075 8626 UA φ 45 × φ 80 × 490	→X→ ←X←	075 2920 UA φ 45 × φ 85 × 570
Boom (w/cab)	075 8625 UA φ 45 × φ 80 × 455	→X→ ←X←	075 2913 UA φ 45 × φ 80 × 625
Arm	075 8627 UA φ 45 × φ 75 × 530	→X→ ←X←	075 2930 UA φ 40 × φ 75 × 650
Bucket	075 2898 UA φ 40 × φ 65 × 490	→X→ ←X←	075 2940 UA φ 40 × φ 70 × 470
Boom swing	075 2970 UA φ 40 × φ 70 × 475	→X→ ←X←	075 2947 UA φ 50 × φ 85 × 601
Blade	075 2889 UA φ 45 × φ 85 × 140	→X→ ←X←	075 2951 UA φ 50 × φ 100 × 135

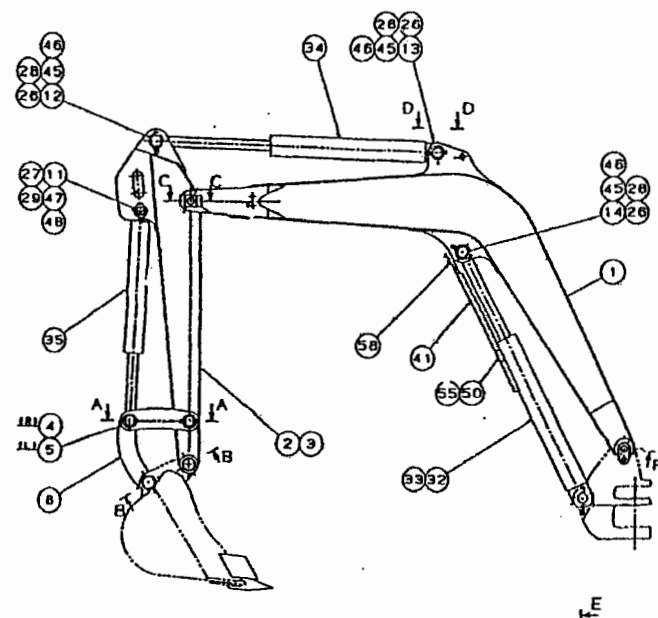
φ Rod D × φ Bore × Stroke (mm)

TIGHTENING TORQUE TABLE
for Hydraulic Cylinders
25J•28J & 30J

		Cylinder head		Piston	
					
Model	Dimension Torque	Tightening torque kgf · m	Diameter ϕ D	Tightening torque kgf · m	Wide "H"
25J	Boom	32	90	45	50
	Arm	32	85	80	46
	Bucket	29	76	70	46
	Swing	31	85	70	46
	Blade	35	100	52	50
28J	Boom	32	90	80	50
	Arm	32	90	60	50
	Bucket	29	76	70	46
	Swing	31	85	52	46
	Blade	35	100	100	50
30J	Boom	34	95	80	50
	Arm	32	90	80	46
	Bucket	29	78	70	46
	Swing	31	85	52	46
	Blade	38	100	100	50

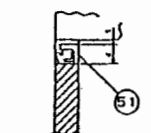
ATTACHMENT ASSEMBLY

Models: 25J & 28J



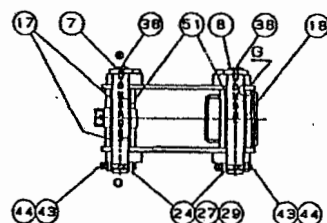
Note:

- 1) Double-nut tightened clearance should be 0.5 to 1 mm.
- 2) Apply molybdeum disulfide grease at three place, the boom foot, boom point and arm point.
EP 2 grease can be applied at other places.
- 3) Install the dust seal No.51 and 52 with the lip facing outward.
- 4) Adjust the installed clearance at the pin connection using 21 to 31 washers as necessary so that it is 0.8 mm or less.
The number of washers shown is for reference only.

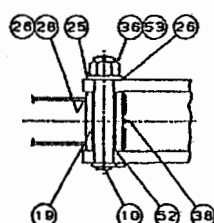


Install the dust seal with the lip facing outward.

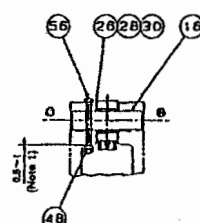
Detail G



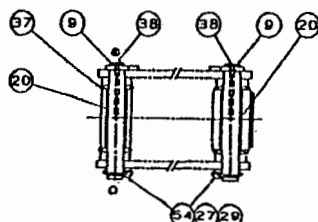
Section A - A



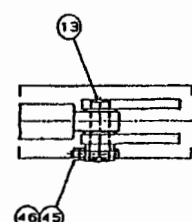
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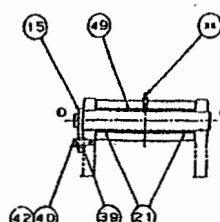
Section E



Section B - B



View D - D



Section F

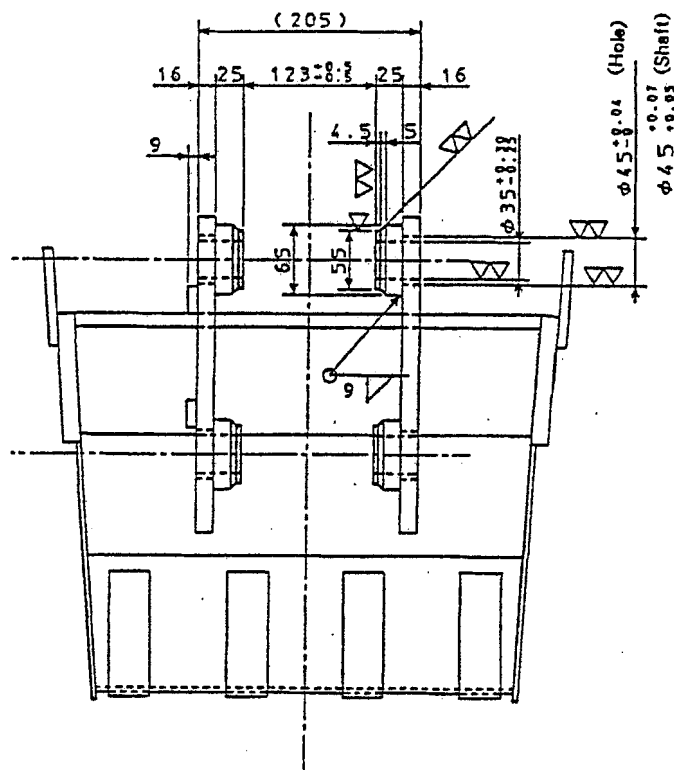
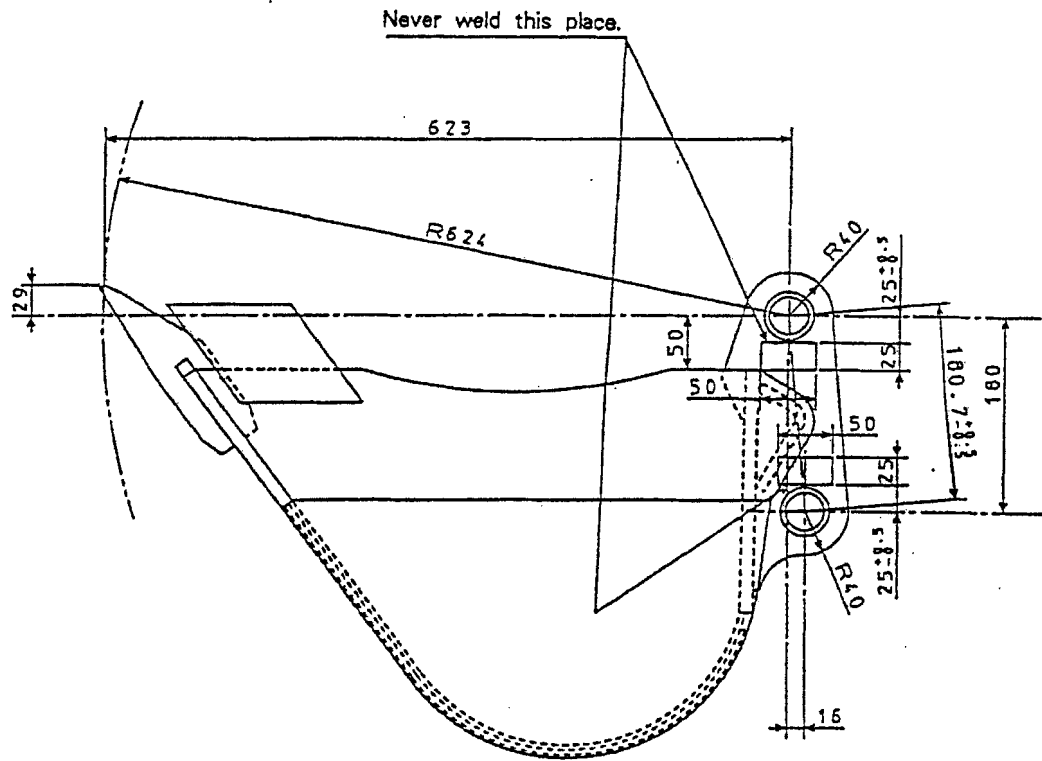
Key	Descriptions	Q'ty	Remarks
1	Boom	1	
2	Arm	1	Std.
3	Arm	1	Long
4	Arm Link R.	1	
5	Arm Link L.	1	
6	Bucket Link	1	
7	Pin	1	φ 35 × 207
8	Pin	1	φ 35 × 207
9	Pin	1	φ 35 × 228
10	Head Pin	2	φ 40 × 225
11	1 Hole Pin	1	φ 35 × 133
12	1 Hole Pin	1	φ 40 × 153
13	1 Hole Pin	1	φ 40 × 127
14	1 Hole Pin	1	φ 40 × 160
15	Wing Pin	1	φ 40 × 295
16	1 Hole Pin	1	φ 40 × 158
17	Steel Bushing	2	45 × 5 × 30
18	Steel Bushing	1	45 × 5 × 112
19	Steel Bushing	1	60 × 5 × 116
20	Steel Bushing	2	45 × 5 × 122
21	Steel Bushing	2	50 × 5 × 40
22	—	—	—
23	—	—	—
24	Collar	2	65 × 19
25	Washer	1	8 × 80D
26	Washer	(6)	0.8 × 75 × 40D
27	Washer	(2)	0.8 × 60 × 35D
28	Washer	(3)	1.6 × 75 × 40D
29	Washer	(2)	1.6 × 60 × 35D
30	Washer	(2)	2.3 × 75 × 40D
31	Washer	(2)	2.3 × 60 × 35D
32	Boom Cylinder	1	
33	Boom Cylinder	(1)	
34	Arm Cylinder	1	
35	Bucket Cylinder	1	
36	Castle Nut	1	M36
37	O ring	1	87 × 52 × 7.5
38	Grease Nipple	6	PT1/8
39	Boss	1	
40	Treatment Bolt	1	M10 × 40
41	Cover	1	
42	Flat Washer	1	10
43	Treatment Bolt	2	M8 × 70
44	Treatment Nut	4	M8
45	Treatment Bolt	3	M12 × 80
46	Treatment Nut	6	M12
47	Treatment Bolt	1	M10 × 80
48	Treatment Nut	4	M10
49	Spacer	1	50 × 4.5 × 133.5
50	Stay	1	
51	Dust Seal	6	φ 35
52	Dust Seal	2	φ 40
53	Cotter Pin	1	6 × 70
54	Ring Pin	2	
55	Treatment Bolt	2	M10 × 16
56	Treatment Bolt	1	M10 × 110
57	—	—	—
58	Bolt	2	M10 × 20

BUCKET DATA

Applicable models :

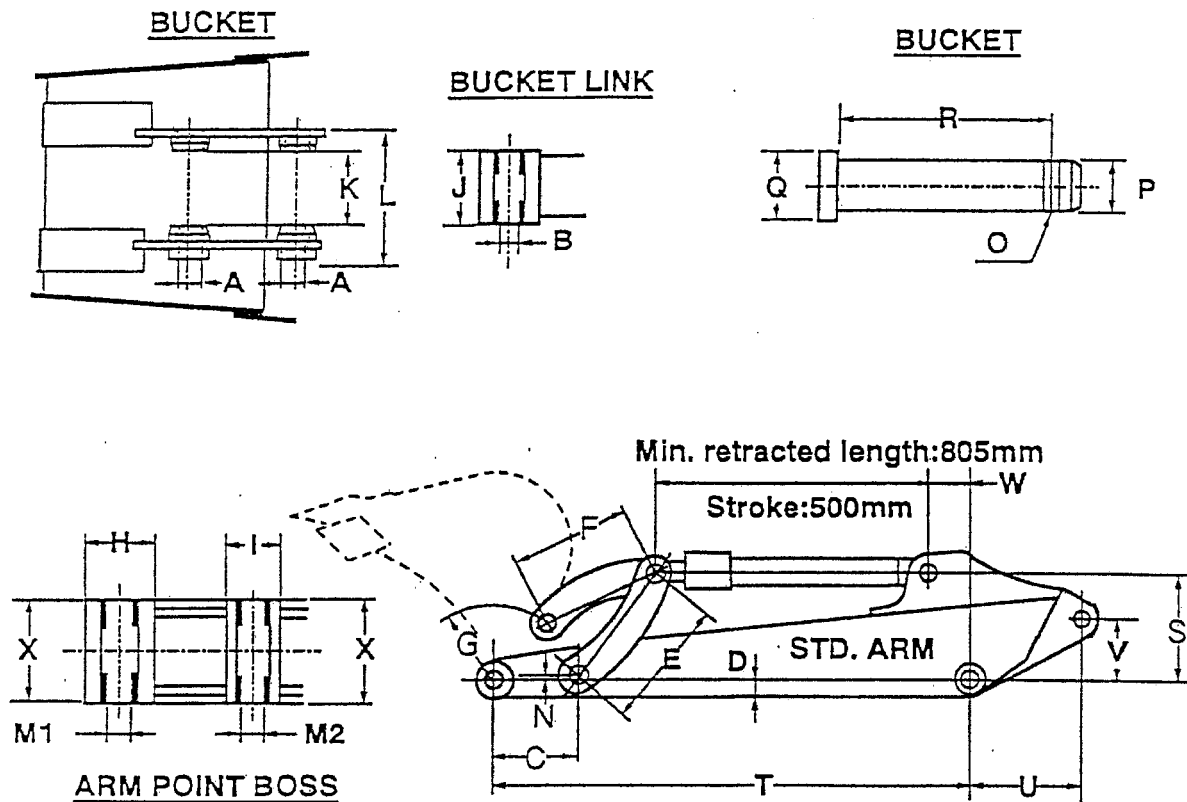
25J • 28J

25G • 27G • 28G

(Dimension of the ear plate)

HYDRAILIC BREAKER INSTALLATION DATA

28J



Key	A	B	C	D	E	F	G	H	I	J	K	L
Dimensions(mm)	φ 35	φ 35	179.5	44	245	270	187	φ 76.3	φ 65	122	123	205

Key	M1	M2	N	O	P	Q	R	S	T	U	V	W	X
Dimensions(mm)	φ 35	φ 35	0	14	φ 35	40 × 50	214	205	1100	248	143.1	45	122

Figure of B•M1•M2 shows that measurement of bushing inner diameter.

HYDRAULIC SYSTEM (When details are request, see for SERVICE GUIDE)

1	Type of pump		gear	4	Type of hyd. tank	Pressurized totally enclosed type
2	Max. displacement	ℓ /Min	21.6 × 2	5	Oil cooler	Std. equipped
3	Relief set pressure	kgf/cm ²	175	6	Service ports	Std. equipped

STRUCTURE & FUNCTION

25J
28J
30J

MONITOR PANEL ASS'Y

Applicated all models

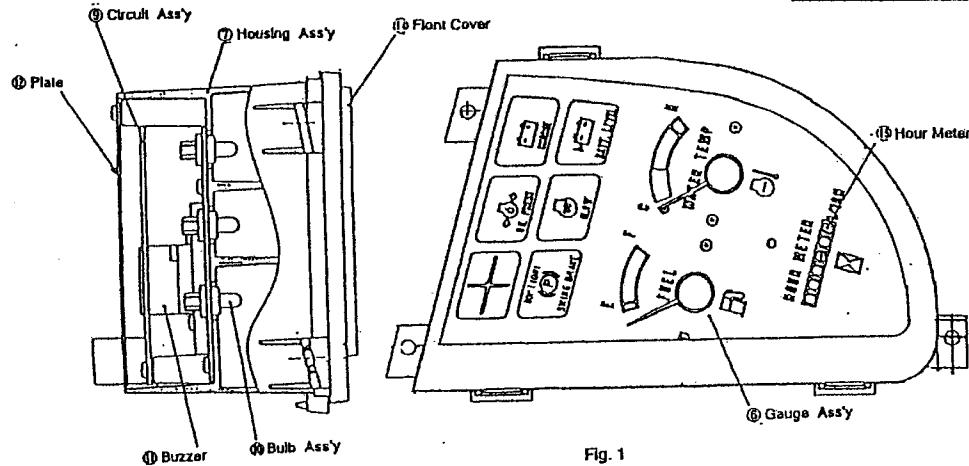
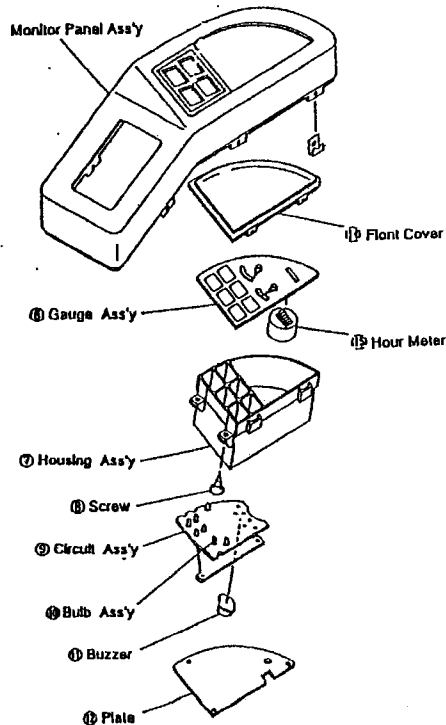


Fig. 1

METER	WATER TEMP.	FUEL	HOUR
Dial Scale	105°C Green 67°C White Red	F Green E Red	
Measurement point	67°C / 105°C	E / F	
Std. Resistance Value	49.8 Ω	15.5 Ω	80 Ω
Allowance	Initial ± 5° After endurance ± 7°	0 - 5° + 10° + 1° ± 7°	± 1 min/day ± 3 min/day

Table - 1 Indicator Standards



Lamp and buzzer check functions

As shown in Fig. 2, the buzzer driving signal is output when powered.
Check time is determined according to Table 3.

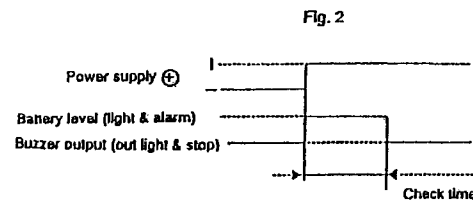


Fig. 2

Alarm function

Depending on the Input signals listed in Table 4, a corresponding alarm display signal output.
In some cases, a buzzer alarm signal is simultaneously output.

Table - 4

Indication	Input signal condition		Buzzer alarm
	Normal	Abnormal	
Charge	+ 10V more than	+ 3V below	Yes *
Engine oil press.	-	0 V	Yes *
Battery level	+ 3V	0 V	Yes
Glow	-	I	Yes

Charge and engine oil pressure alarms are activated during engine operation only.

Table - 2 Connection of connector

No.	To connect	No.	To connect
1	+ 12V	6	Oil pressure
2	Light	7	Opt.
3	Charge	8	Water temp sensor
4	Glow	9	Fuel sensor
5	Battery level	10	Earth

5	4	3	2	1
10	9	8	7	6

Meter side connector

Table - 3 Check time

Check time	Atmospheric temperature
2 +0 -0.5 sec	Room temp.

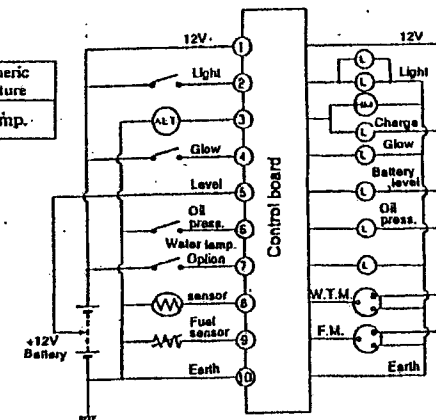
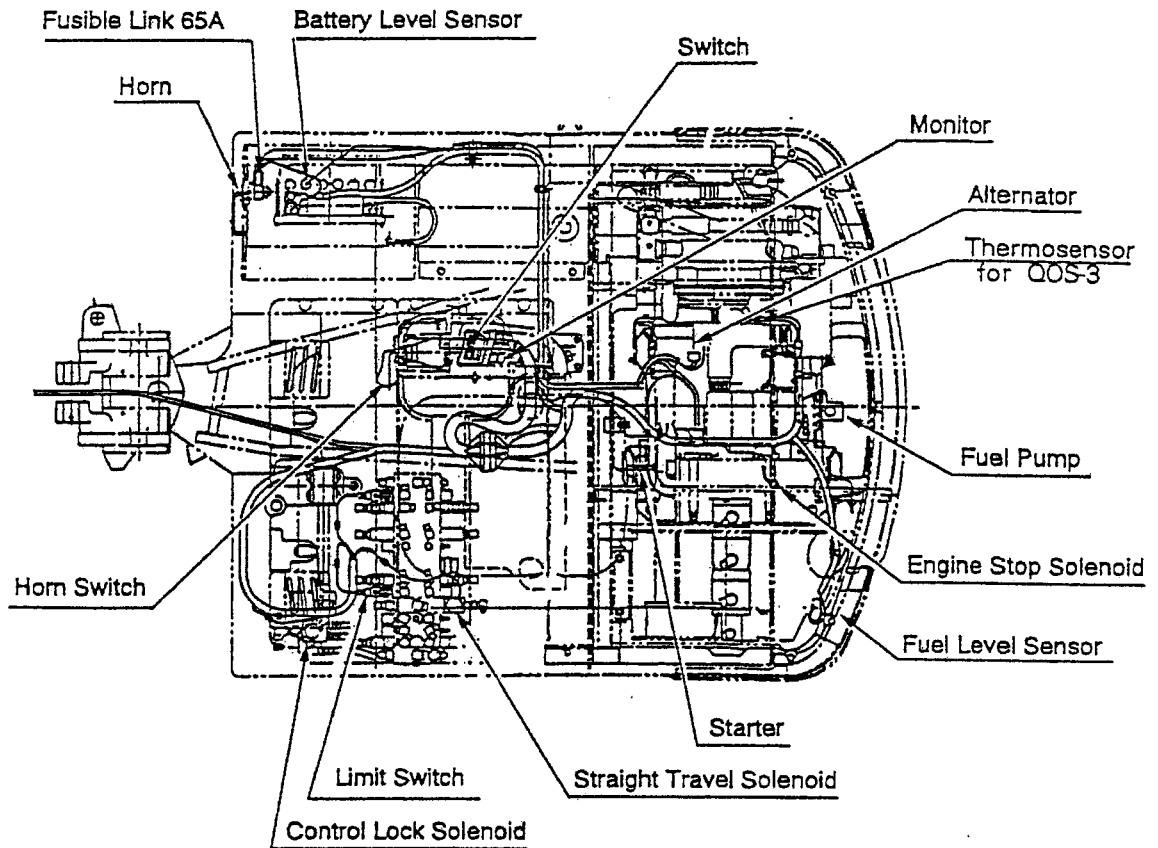
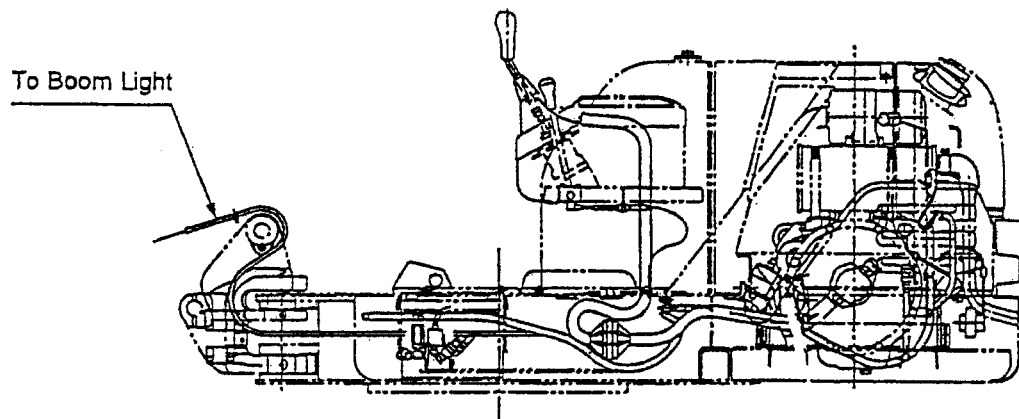


Fig. 3 ELECTRICAL CIRCUIT IN METER

ELECTRICAL WIRING & LOCATIONS

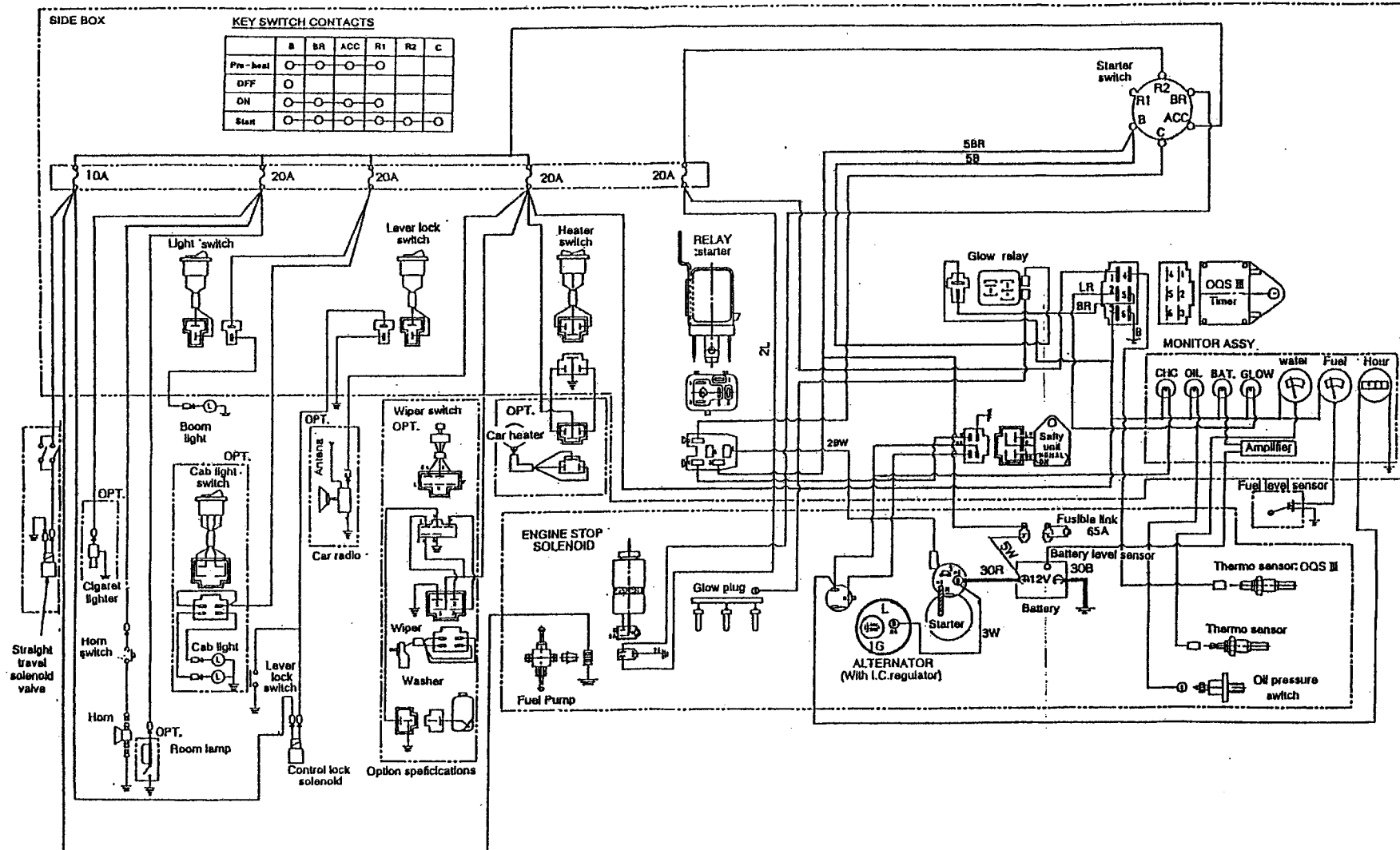


View from Machine Upper Side



View from Machine Left Side

ELECTRICAL WIRING SYSTEM DIAGRAM



OPERATING TYPES

The attachment operating mode by means of 2 levers has 6 types(A – G) as illustrated below, and we make A type as our standard.

By a demand for customer, we shall be able to change from the standard type to one type of (B – G).

When making the type change, perform the working operation safely according to that lever type.

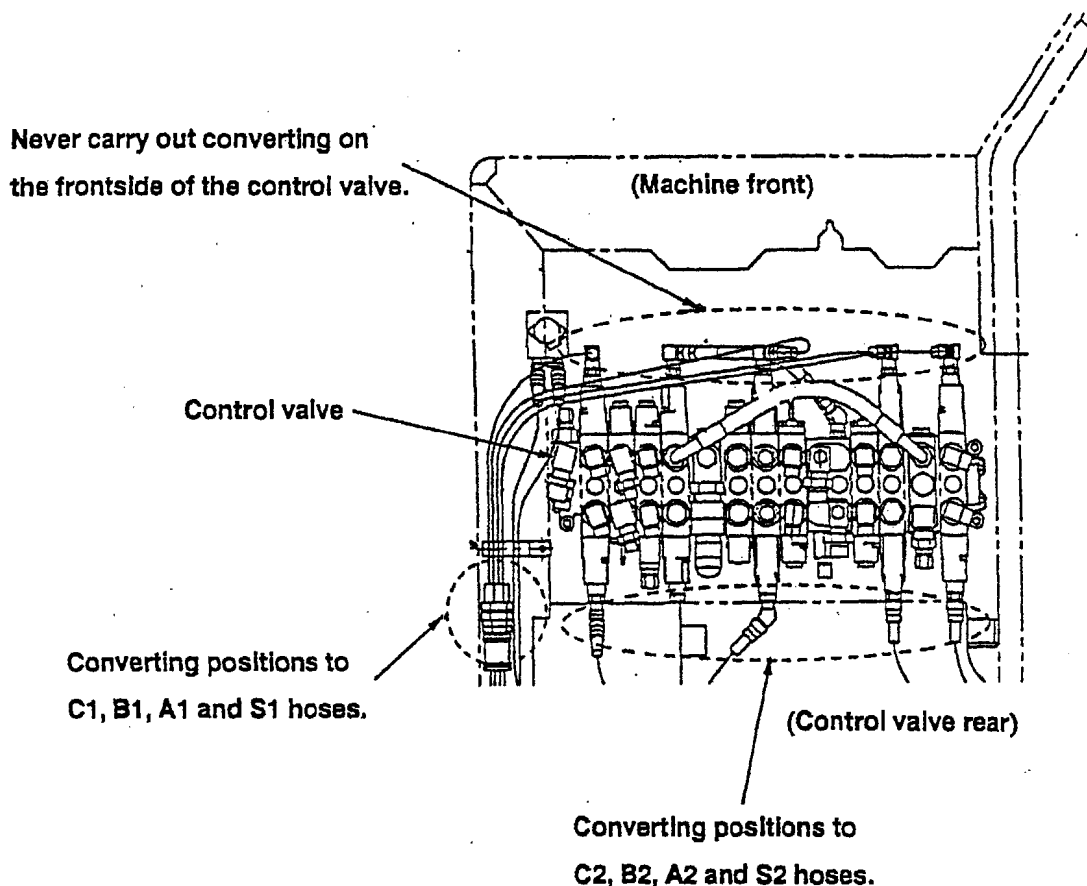
TYPE	HOW TO OPERATE	REMARK
A		STANDARD (ISO pattern)
B		OPTION
C		
D		
F		
G		

CONVERTING OF LEVER PATTERN

Precaution on converting of the operating lever pattern.

Converting of the operating lever of Model 25J to 55J should be carried out on the rear and lateral sides of the control valve.

The front and remote control valve sides shall never be used for this work.



Converting of the operating lever pattern of each model shall be carried out by changing hose connections in conformance with the Table of Lever Pattern Hose Connection.

On each hose, a nameplate with a mark is given.

OPERATION

CONVERTING OF LEVER PATTERN

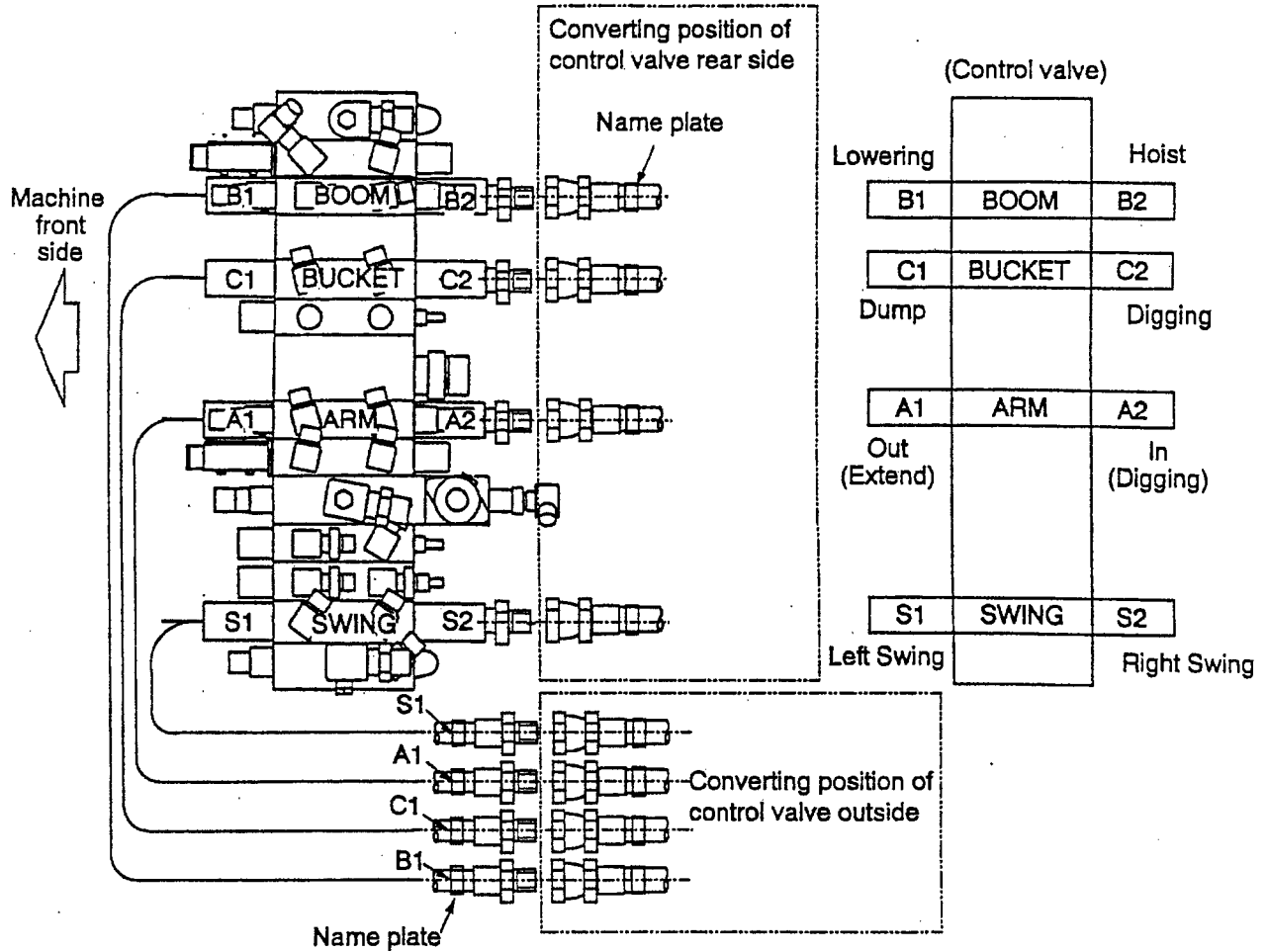


Table of Lever Pattern Hose Connection

ACTION		Type "A"	Type "B"	Type "C"	Type "D"	Type "F"	Type "G"
BOOM	Lowering	B1 - R4	B1 - R4	B1 - L4	B1 - L4	B1 - L4	B1 - R4
	Hoist	B2 - R2	B2 - R2	B2 - L2	B2 - L2	B2 - L2	B2 - R2
BUCKET	Digging	C1 - R3	C1 - R3	C1 - L1	C1 - L1	C1 - R3	C1 - L1
	Dump	C2 - R1	C2 - R1	C2 - L3	C2 - L3	C2 - R1	C2 - L3
ARM	Out	A1 - L4	A1 - L3	A1 - R4	A1 - R2	A1 - R4	A1 - L4
	In	A2 - L2	A2 - L1	A2 - R2	A2 - R4	A2 - R2	A2 - L2
SWING	Right	S2 - L1	S2 - L4	S2 - R1	S2 - R1	S2 - L1	S2 - R1
	Left	S1 - L3	S1 - L2	S1 - R3	S1 - R3	S1 - L3	S1 - R3

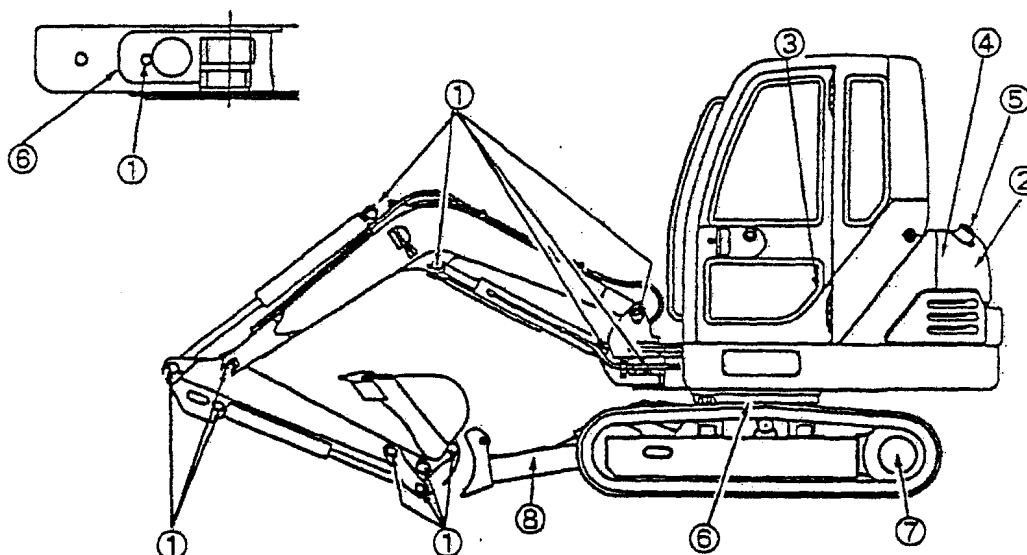
SECTION 4 MAINTENANCE

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LUBRICATION CHART MAINTENANCE AND CHECKS

The interval of lubrication, maintenance and check is the maximum interval indicated by the hour meter. Of course it should be shortened in service operating conditions.



Check points	Check Items	Check intervals					
		Initial period of use After 50 hours	Daily	Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours
① Attachment pins	Pin grease "G"			○			
② Fuel tank	Drain water trapped in fuel tank			○			
③ Hydraulic fluid reservoir	Hydraulic fluid "H"		○				●
	Drain moisture from the hydraulic fluid reservoir			○			
	Clean hydraulic suction strainer						○
④ Return filter	Replace cartridge	●				●	
⑤ Engine	Replace Engine oil "E"	●	○		●		
	Replace Fuel filter element			○ Drain		●	
	Replace Oil filter element	●			●		
	Replace Air cleaner element				○	●	
	Check Coolant "W"		○				
⑥ Swing bearing	Bearing lubrication grease			○			
	Ring gear grease (grease bath)					○	
⑦ Travel reduction gear	Lubricant "L"	○				○	●
⑧ Blade	Pin lubrication grease			○			

Symbol	G	L	H	E	W	○	●
	Grease	Gear oil	Hydraulic fluid	Engin oil			
Remarks	EP - 2 Lithium grease	API-GL - 4, GL - 5 SAE90	Wear - proof hydraulic fluid (VG - 45)	API-CC or CD SAE 10W30	Coolant	Inspection/ Maintenance /Supply	Replacement

RECOMMENDED LUBRICATION TABLE 25J • 28J

LOCATION	REQUIRED AMOUNT	REPLACING INTERVAL	USE	SPECIFICATION	SHELL OIL	ESSO STANDARD	MOBIL OIL
Diesel Engine (ISUZU 3LB1)	Max. 4.5 liter Min. 2.5 liter	250 Hrs. Initial period of use after 50 hours	Cold Regions	API, Class CD SAE20	Rimula Oil 20/20W	Esso Lube HDX20	Mobil Delbac 1320
			General	API, Class CD SAE30	Rimula Oil 30	Esso Lube HDX30	Mobil Delbac 1330
			Tropical Regions	API, Class CD SAE40	Rimula Oil 40	Esso Lube HDX40	Mobil Delbac 1340
Hydraulic Fluid	Total Amount 62 liter Tank Capacity 40 liter	1000 Hrs. (600 Hrs. with breaker used)	Ambient Temp. Above -5°C	Wear Proof Hydraulic Fluid ISO No.46	Tellus Oil No. 46 *No. 68	Nuto H46 *H68	Mobil Oil DTE25 *DTE26
			Ambient Temp. Below -5°C	Wear Proof Hydraulic Fluid ISO No.32	Tellus Oil 32	Nuto H-32(-12°C) H-22(-36°C)	DTE24 (-22°C)
Lower Rollers	80cc/per	1000Hrs.	—	API, GL-4 or GL-5, SAE90 Gear Oil	Spirax EP90	Esso Gear Oil GP90	Mobil Lube HD90
Front Idlers	80cc/per	1000Hrs.	—				
Travel Reduction Gears	25J : 0.6 liter 28J : 0.8 liter	1000Hrs.	—	API, Class CD SAE30 Engine Oil	Rimula Oil 30	Esso Lube HDX 30	Mobil Delbac 1330
Upper Rollers "28J"	60cc/per	1000Hrs.	—				
Grease in Swing Gear	7.2 liter	1000Hrs.	—	EP2 Lithium Grease	Shell Albania EP2 Lithium Grease	Lithtan EP2	Mobil Prex 47
General Greasing Points	Swing Bearing, Attachments, etc.		—				

Note:

1. Oils in the hydraulic fluid columns marked with *should be use above 0°C.
2. If the oil becomes dirty or deterioration of the oil's properties are excessive, replace more frequently than described above.
3. Disassemble the track roller and upper roller when replacing the oil in them.

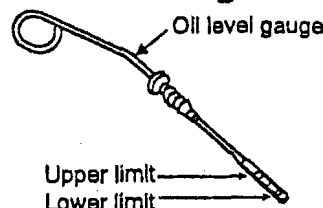
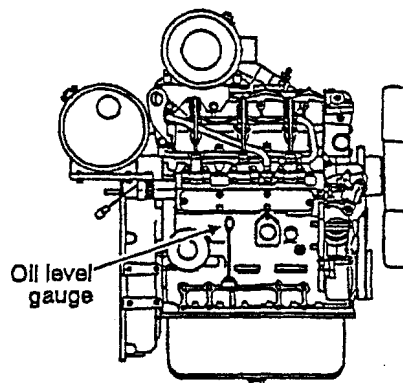
DAILY MAINTENANCE AND CHECKS

ENGINE OIL LEVEL

- ① Place the machine on a leveled ground.
- ② Check the oil level in the crankcase with the dipstick on the side of the engine. Remove the dipstick, wipe the lower end with a clean cloth, insert and remove it again to check the oil level. Keep the oil at the proper level.
- ③ Fill the engine crankcase to the proper level with the heavy duty lubricating oil specified under Lubricating Oil Specifications.

CAUTION

The oil level check must be made ten or twenty minutes later after the engine has been stopped.

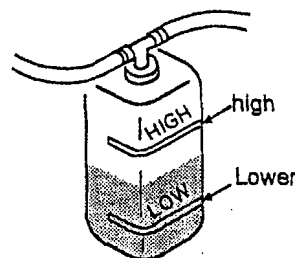


COOLANT LEVEL

- ① Check the coolant level in the reserve tank. The coolant level should be between the high and lower limit lines.
- ② If necessary, add clean soft water mixed long-Life-Coolant.

CAUTION

Do not open the radiator cap during ordinary maintenance work. Never open it when the engine temperature is high, since boiling water jets out and it is very hazardous.



Reserve tank level

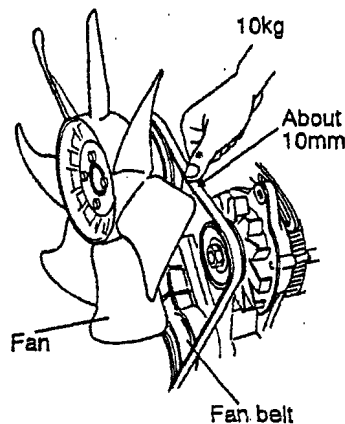
FAN BELT

Check the fan belt for tension and any abnormalities.

- ① When belt is depressed 10mm with the thumb (about 10kg pressure) at midway between the fan pulley and generator pulley, the belt tension is correct. When the belt tension is too tight, it will result an generator failure. Contrary, loosely tensioned belt will cause a belt slippage leading belt damage also lead to make noise.
- ② Check the belt condition. Replace them if any damage is discovered.

CAUTION

When the fan belt is tension too tight, excess load is applied to the bearing causing possible troubles.

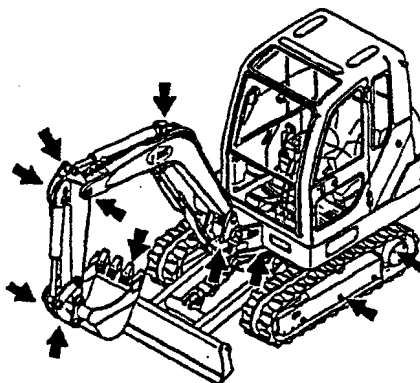


DAILY MAINTENANCE AND CHECKS

■ BOLTS, NUTS AND PINS CHECK

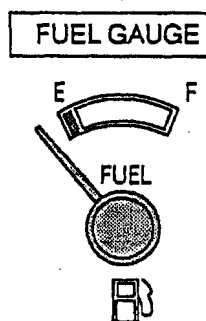
Check the following sections more frequently.

- Bolts and nuts used along the arm and the bucket structure.
- Tooth fixed bolts.
- Swing bearing fixed bolts.
- Travel reduction gear fixed bolts.
- Fixed bolts of the upper and lower rollers.



■ FUEL TANK FLUID LEVEL

Check the amount of the fuel by the fuel gauge after setting the starter switch in the ON position.



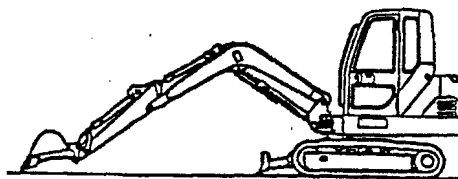
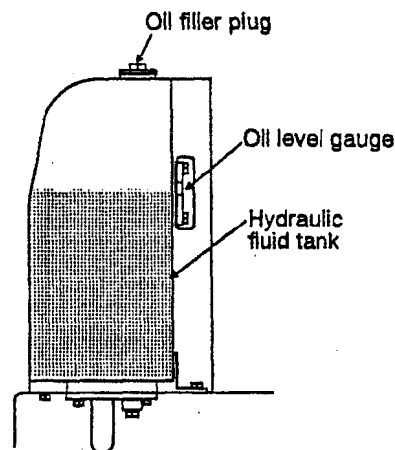
■ HYDRAULIC RESEVOIRE FLUID LEVEL

Check the hydraulic fluid level by means of the following procedure.

- ① Position the machine in a flat area with the dig and bucket cylinders completely retracted and the boom lowered so that the bucket rests on the ground.
- ② If the hydraulic fluid level is midway between the upper and lower limits of the oil gauge, the quantity of oil is considered to be sufficient.

When the oil level is insufficient for working operations, add hydraulic fluid by means of the following procedure.

- ① Position bucket as specified for checking hydraulic fluid level (Dig and bucket cylinders retracted with the bucket resting on ground.)
- ② Loosen the oil filler plug to purge air in fluid reservoir.
- ③ Remove the oil filler plug and add hydraulic fluid.
- ④ Position hoist, dig and bucket cylinders in fully extended position. To seal off the fluid reservoir, close oil filler port and pressurize reservoir.



Bucket position at time of checking hydraulic fluid level.

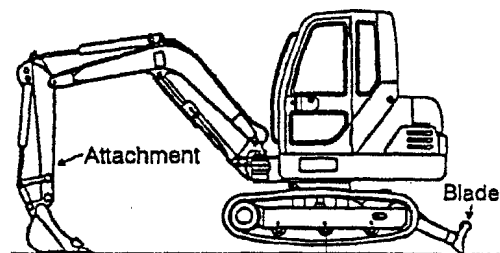
50 HOURS MAINTENANCE AND CHECKS

■ CHECK TRACK SHOE TENSION

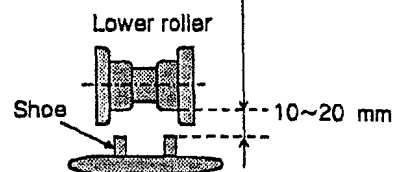
Lift the machine by using the hoe attachment and the blade, and check the amount of sag between the lower roller and shoe.

The standard amount of sag is (10 to 20) mm near the center. (In case rubber shoe.)

In case of steel shoe, 30 to 50 mm.



Inspection of condition under tension of shoes belt



■ SHOE ADJUSTMENT

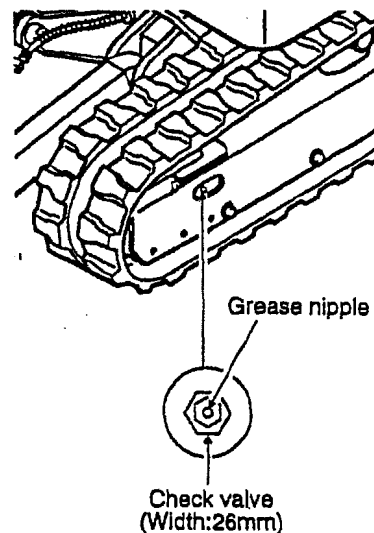
- ① Using a grease gun, supply grease to the shoe tension adjusting cylinder until shoe tension reaches the specified range.
- ② To obtain uniform tension on both sides of shoes, move the machine forward and backward.
- ③ Then recheck the shoes on both left and right crawler frames for correct tension adjustment.

■ RELIEVING TRACK SHOE TENSION

If the track shoes are found to have excessive tension, loosen them by means of the following procedure;

Remove soil deposited on front idler bearing. Lift up the crawler frame, and loosen the valve seat about 10 mm. As the grease discharges, the track shoes will be loosened (use a 26 mm socket wrench).

When track shoe tension is adjusted, retighten valve seat.



⚠ CAUTION

To discharge grease, always loosen the valve seat, never the grease fitting.

Always exercise caution when loosening the valve seat. Never expose your face to, or stand in front of, seat when loosening.

Be sure the tension adjustments of left and right shoe belts are equal. If not, the machine may meander when traveling.

MAINTENANCE

50 HOURS MAINTENANCE AND CHECKS

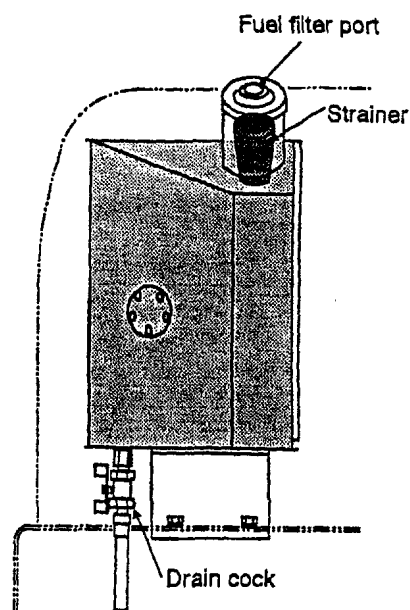
■ DRAIN MOISTURE FROM FUEL TANK

Prior to starting work, draining must be done by means of the drain cock on the bottom of the tank.

If the air temperature is expected to be lower than 0°C, the draining must be done at the end of work.

☆ The following maintenance and checks should be made in 50 hours for the first time only.

- Return filter replacement.
- Engine oil replacement.
- Engine oil filter replacement.



250 HOURS MAINTENANCE AND CHECKS

■ THE ENGINE OIL AND THE OIL FILTER ELEMENT CHANGE

The engine oil change and the oil filter element change must be made simultaneously according to the following change schedule. In the engine operation, when the oil filter warning lamp light on, the filter element is clogging. In such a case change the filter element regardless the specified change schedule.

- ① Change interval
 - a. Engine oil :
Every 250 operation hours (50 Hours initially)
 - b. Oil filter element :
Every 250 operation hours (50 hours initially)
- ② Engine oil draining
 - a. Wipe clean around the oil filter cap taking care so that no foreign particles entry. Remove the filter cap.
 - b. Drain plug at the oil pan to drain the engine oil.
To shorten the oil draining time required, it is recommendable to do this procedures while the engine is warm.
- ③ Oil filter element removal
Use a filter wrench to remove the cartridge type oil filter.

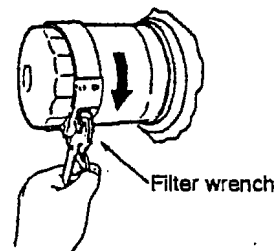
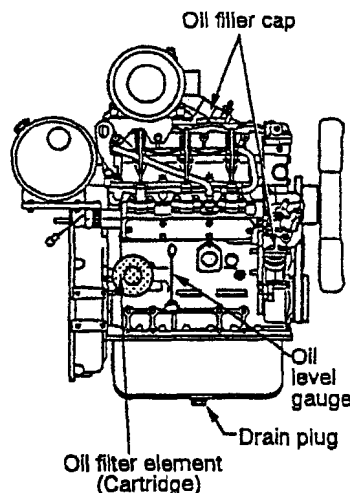
⚠ CAUTION

Use a container to catch the drained oil so that the engine and the machine does not be fouled by the drained oil.

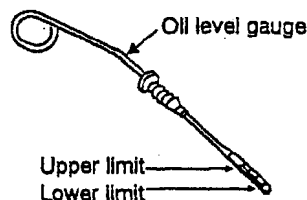
- ④ Oil filter element installation
Apply a coat of engine oil to the o-ring. Turn in the new cartridge until the sealing face is fitted against the o-ring. Use the filter wrench to turn in the cartridge an additional $\frac{3}{4}$ turn.
- ⑤ Engine oil refilling
 - a. Reinstall the drain plugs.
 - b. Fill the new engine oil from the oil filler port. Check the oil level with the dipstick after the oil has been gone down completely. (about 15 minutes)
- ⑥ Check after the oil change
Operate the engine with the low idle speed and allow the engine oil to be circulated in the lubricating system.
 - a. Oil leak check
After the oil pressure gauge begins to register the oil pressure normally, check the lubricating system for oil leak, and make sure that no oil leak is observed at all.
 - b. Oil level check
Stop the engine and keep it stationary ten to twenty minutes. Use the dipstick to recheck the oil level. Replenish with the engine if necessary until the specified oil level.

⚠ CAUTION

When the engine started after the oil has been changed, the oil level will be slightly lowered than the initial level due to the oil is fully filled up into the entire oil circuits.



Install the cartridge

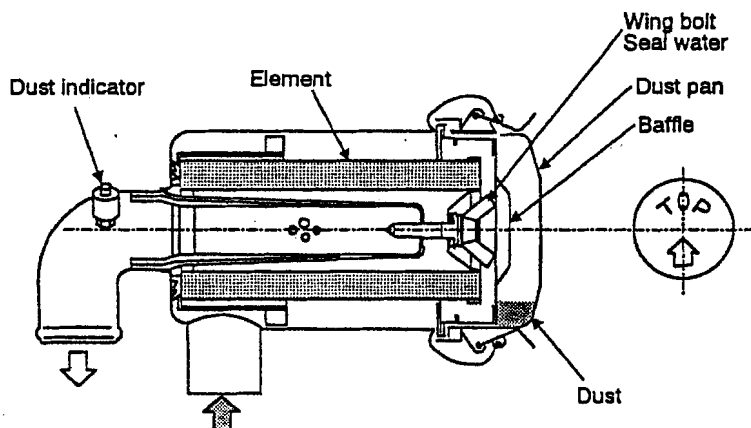


250 HOURS MAINTENANCE AND CHECKS

■ CLEAN THE AIR FILTER ELEMENT

Clean the air filter element after every 250 hours of operation.

The air cleaner is equipped with a "Servi-signal" indicator located on the outlet side of the air cleaner. With the engine running, check indicator each day. If red signal is in the service level, clean filter element or replace if necessary. Inspect filter gaskets for damage and replace if necessary.



- ① Stop the engine.
- ② Remove the dust pan and clean the dust pan.
- ③ Remove the wing bolt and take out the element.
- ④ Cleaning the filter paper element

Dry compressed air must be blown directly along the pleats of the filter paper element in an up/down direction from the circle of the element. Care must be taken that the air pressure at the nozzle does not exceed 7 kg/cm² and adequate distance should be maintained between the nozzle and the element. When the cleaning is over, place an electric light bulb inside the element and check the element for damage by observing it from the outside. The element must be replaced with a new one if any small holes or thin areas are found in the filter paper. Also, if any damage or deformation is discovered in the element packing during reassembly, the element must be replaced.

- ⑤ Install the element and tighten the wing bolt securely.
- ⑥ Install the dust pan with arrow point upward.

⚠ CAUTION

Be sure to stop the engine when cleaning the air filter element.

- Resetting the dust indicator
After cleaning by element, the dust indicator must be reset. The signal return to yellow when the button is pressed.

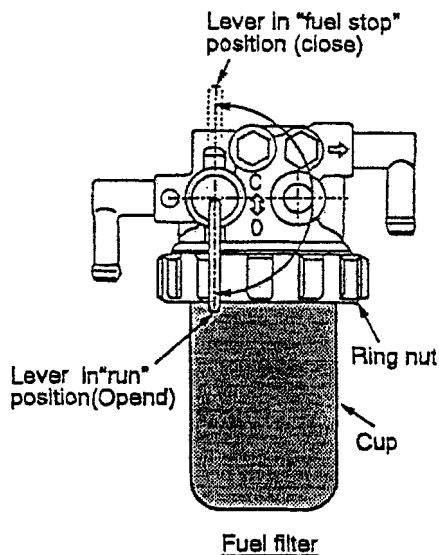
250 HOURS MAINTENANCE AND CHECKS

■ DRAIN WATER TRAPPED IN THE FUEL FILTER

- ① Put down the bucket on the ground and stop the engine.
- ② Shift the fuel stop lever in the "fuel stop" position.
- ③ Loosen the ring nut and remove the cup and the element.
- ④ Drain water trapped in the cup, clean the cup and the element.
- ⑤ Install the element and cup to the body with tighting the ring nut.

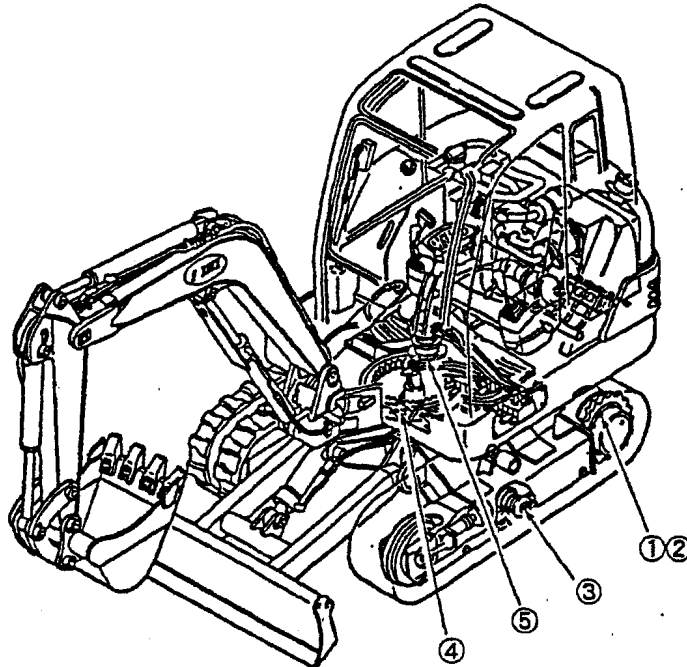
■ PURGING AIR OF FUEL SYSTEM

Purge air when cleaning/replacing the fuel filter, and emptying the fuel tank. Purging air is automatically done, when the starter switch is set to ON position for 20 seconds. Start the engine after purging air completely.



500 HOURS MAINTENANCE AND CHECKS

■ PERFORM MAIN BOLTS TORQUE CHECK



25J / 28J

Items	Tightening point		Wrench size (mm)	Bolt size	No. of bolts	Torque (kg-m)
①	Travel reduction gears fixed bolt		19	M12 P=1.75	12 / Piece	11.0
②	Sprocket fixed bolt		19	M12 P=1.75	12 / Piece	11.0
③	Lower roller fixed bolt		24	M16 P=2.0	2 / Piece	25.0
④	Swing bearing fixed	Inner race	19	M12 P=1.75	20	11.0
		Outer race	19	M12 P=1.75	24	11.0
⑤	Swing motor fixed bolt		19	M12 P=1.75	6	11.0

30J

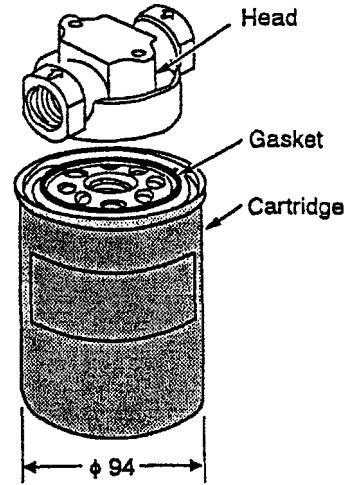
Items	Tightening point		Wrench size (mm)	Bolt size	No. of bolts	Torque (kg-m)
①	Travel reduction gears fixed bolt		19	M12 P=1.75	9/Piece	11.0
②	Sprocket fixed bolt		19	M12 P=1.75	9/Piece	11.0
③	Lower roller fixed bolt		24	M16 P=2.0	2/Piece	25.0
④	Swing bearing fixed	Inner race	19	M12 P=1.75	16	11.0
		Outer race	19	M12 P=1.75	16	11.0
⑤	Swing motor fixed bolt		19	M12 P=1.75	4	11.0

The threads and seating faces of the bolts and nuts should be coated with molybdenum disulfide grease before they are tightened.

500 HOURS MAINTENANCE AND CHECKS

■ REPLACEMENT THE RETURN FILTER

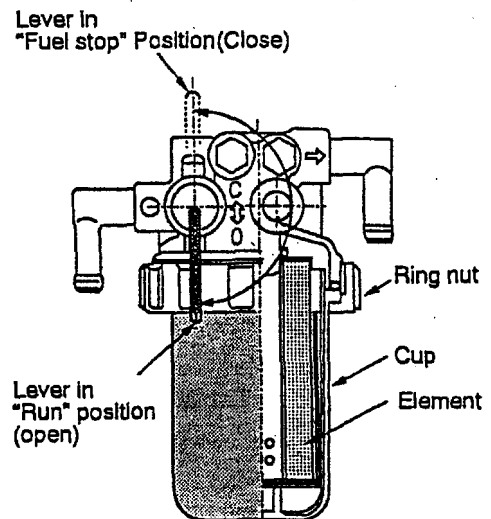
- ① Put down the bucket on the ground and stop the engine.
 - ② Loosen hydraulic fluid reservoir oil filler plug to relieve air pressure within reservoir.
 - ③ Using filter wrench, remove the filter cartridge turning counter clockwise.
 - ④ Install a new cartridge by tightening the gasket is pressed down of a turn by filter wrench after packing is contact with sealing face.
 - ⑤ Start the engine and check the hydraulic fluid level.
 - ⑥ Pressurize the hydraulic fluid reservoir. After fully extending all the cylinders and removing oil filler plug, install the plugs again.
 - ⑦ Check for leaks on the oil filter.
- ☆ When operation breaker operations, replace the return filter each in 100 hours operation.
- ☆ Replace this filter in 50 hours for the first time only.



Return filter

■ REPLACEMENT THE FUEL FILTER

- ① Put down the bucket on the ground and stop the engine.
- ② Shift the fuel stop lever in the "fuel stop" position.
- ③ Loosen the ring nut to remove the cup and the element.
- ④ Clean the inside of the cup and install a new element.
- ⑤ Install the element and the cup to the body with tighten the ring nut.

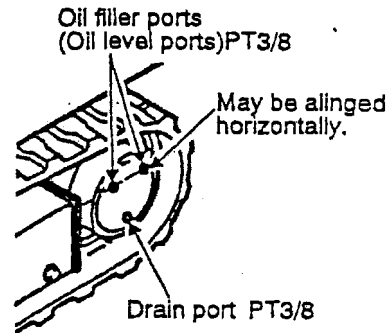


500 HOURS MAINTENANCE AND CHECKS

TRAVEL REDUCTION GREAS OIL LEVEL CHECK

Use the following procedure to check the gear oil in the travel reduction case.

- ① Place the machine on level ground so that the oil filler port (oil level port) and drain port may be aligned as shown in the figure with one another.
- ② Remove the oil level check plug.
If the quantity of oil is insufficient, replenish as required.



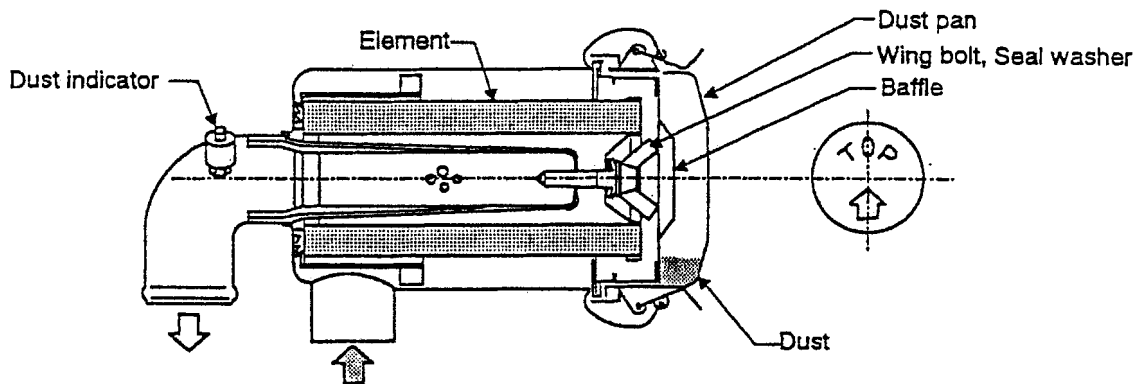
Plugs position for oil level check

CAUTION

When the quantity of oil is found to have increased abnormally, it is necessary to check the oil seal of the traver motor.
If the seal is leaking, contact a service representative.

REPLACEMENT THE AIR FILTER ELEMT

The air cleaner is equipped with a "Servi-Signal" indicator located on the outlet side of the air cleaner. With the engine running, check indicator each day. If red signal is in the service level, clean filter element or replace if necessary. Inspect filter gaskets for damage and replace if necessary.



- ① Stop the engine.
- ② Remove the dust pan and clean the dust pan.
- ③ Remove the wing bolt to take out the element.
- ④ Install a new element and tightening the wing bolt.
- ⑤ Install the dust pan with arrow point upward.

After replacement the element, the dust indicator must be reset. Press the button of the dust indicator to release off the red signal.

CAUTION

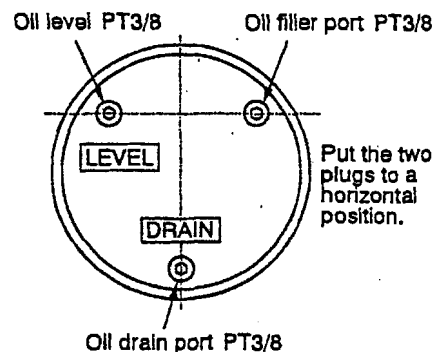
Be sure to stop the engine.

1000 HOURS MAINTENANCE AND CHECKS

■ REPLACEMENT THE TRAVEL REDUCTION GEARS OIL

Use the following procedure to replace the gear oil in the travel reduction case.

- ① Place the machine on level ground so that the oil filler port (oil level port) and drain port may be aligned as shown in the figure.
- ② Remove the drain and filler plugs and drain the oil.
- ③ When the oil is thoroughly drained, wind sealing tape around the drain plug before fitting the plug into the drain port.
- ④ Supply new oil through the oil filler port. When the new oil overflows from the oil level port, install the plug.



Positions of plugs when oil level check

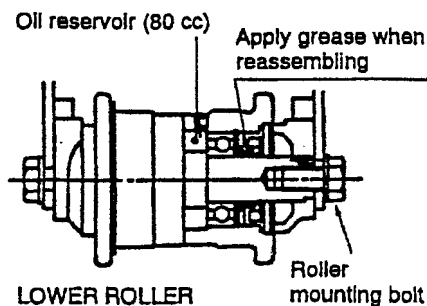
Recomende oil	Quantity oil		
	25J	28J	30J
Engine oil API CD SAE 30	0.6 ℓ	0.8 ℓ	0.8 ℓ

1000 HOURS MAINTENANCE AND CHECKS

■ CHANGE LOWER ROLLER OIL

Disassemble the lower roller to replace oil.

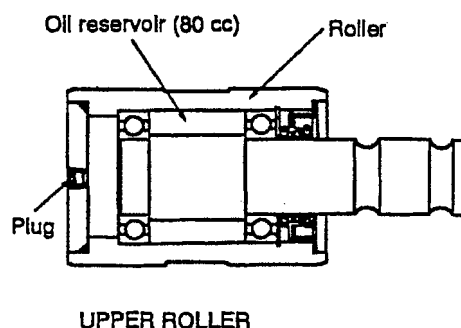
Recommended Oil:	API GL-4 SAE90
Quantity of Oil:	80 cc/unit



■ CHANGE UPPER ROLLER OIL(WITHOUT 25J)

Detach the roller from the frame and replace the oil after remove the plug out of it.

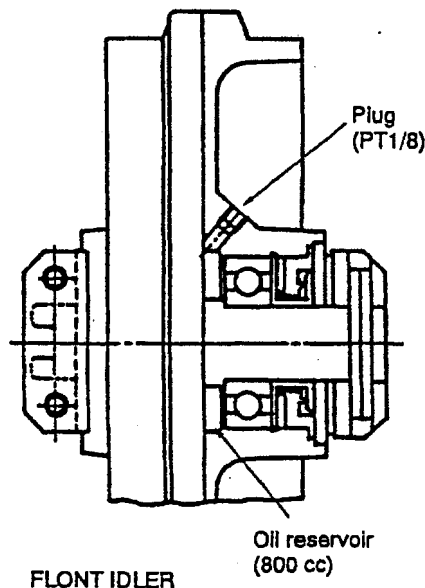
Recommended Oil:	API CD SAE30
Quantity of Oil:	60 cc/unit



■ CHANGE FRONT IDLER OIL

Disassemble the front idler to change oil.

Recommended Oil:	API GL-4 SAE90
Quantity of Oil:	80 cc/unit

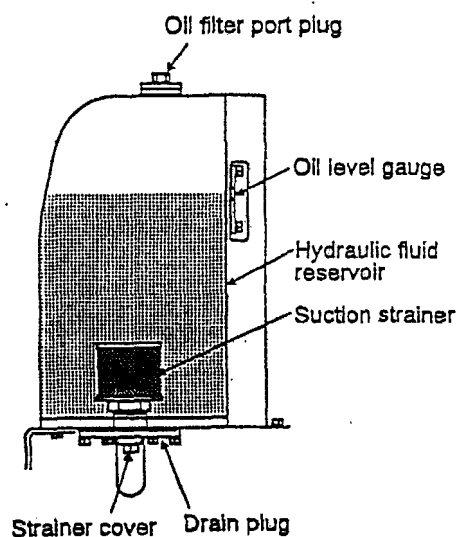


1000 HOURS MAINTENANCE AND CHECKS

REPLACEMENT THE HYDRAULIC FLUID

- ① Bring the bucket down to the ground and stop the engine.
- ② Loosen hydraulic fluid reservoir oil filter plug to relieve air pressure within reservoir, and then remove drain plug to let out the fluid. Drain the fluid in all parts of the hydraulic system thereafter.
- ③ Remove the strainer cover from the hydraulic fluid reservoir and flush the inside of the reservoir with the clean flushing oil.
- ④ Supply the hydraulic fluid after install the strainer cover and drain plug.
- ⑤ Pressurize the hydraulic fluid reservoir.
- ⑥ Start the engine at low speed, check the level of the hydraulic fluid after performing all types of movements. Then supply the fluid to the limit.

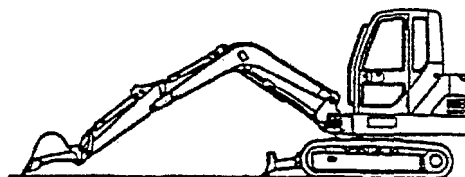
Recomonded oil	Quantity of oil
Wear proof Hydraulic Fluid ISO No. 32 or No. 46	Total amount :62 ℓ Lever amount :40 ℓ



CLEAN THE SUCTION STRAINER

The suction strainer shall be cleaned whenever the hydraulic fluid is replaced.

- ① Remove the pipe joint and strainer cover, wash the strainer with light oil, and then install it into the reservoir.
- ② Pressurize the hydraulic fluid reservoir.

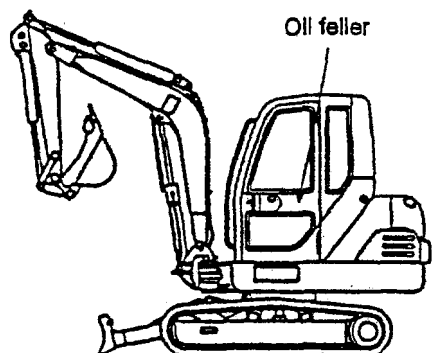


Bucket position at the time of checking the hydraulic fluid level.

CAUTION

Breaker operations are severer in the working conditions than with ordinary excavation work and they make hydraulic fluid deteriorated earlier.

If the machine is kept used with deteriorated hydraulic fluid, failures may occur in the hydraulic systems or in the whole circuits and, therefore, in such cases, it is suggested that hydraulic fluid and strainer should be replaced in 600 hours.



Bucket position at the time of sealing off fluid reservoir

UNUSUAL OPERATING CONDITIONS

5. Special attention must be given to the hydraulic fluid during very cold weather.

CAUTION

BEFORE attempting any working operations, warm up the hydraulic fluid as described in "Pre-Operation Warm-Up on page 48".

6. At the end of the work period, or whenever the machine is to be left idle for extended periods, prevent it from being frozen to the ground by parking it on wood, concrete, asphalt or mat surface.

EXTREME HEAT

Like extreme cold, extreme heat requires that precautions be taken with respect to the cooling system, the battery and lubrication. Protect the machine by performing the following recommended procedures:

1. High temperatures necessitate the use of lubricants which are both more viscous and which resist deterioration at higher operating temperatures. Refer to the Lubrication Section and lubricate the machine using the lubricants recommended for the expected temperatures.

Crankcase oil is particularly important because it helps dissipate heat. Check the oil level frequently and add oil as required to maintain required level. Too little oil will hinder heat dissipation.

2. To ensure proper coolant circulation, drain and flush the cooling system, clean any foreign matter from the radiator cooling fins and through-core air passages, replace defective hoses, tighten hose clamps, tension the water pump drive belt properly, eliminate any leaks detected and fill the system with a 50% solution of ethylene glycol.

A corrosion inhibitor is recommended.

Engine overheating due to loss of coolant will most often be corrected by SLOWLY adding coolant while the engine is running at FAST IDLE. Should this fail to

correct the problem, drain and flush the system and refill with fresh coolant (50% solution of ethylene glycol) and a corrosion inhibitor.

Allow the engine to cool before draining and flushing the cooling system.

Water containing more than small concentrations of salt or minerals should not be used in the cooling system. Salt facilitates corrosion and minerals deposit on the coolant passage walls.

Both processes inhibit proper cooling.

3. Increased evaporation rates will cause the battery electrolyte level to fall more rapidly during very hot weather. Check the level frequently and add distilled water as required to maintain the proper level.

4. Air circulation around the engine and battery must not be restricted. Keep air intake and exhaust openings clear of leaves, paper or other foreign matter which may restrict air flow.

5. Keep the engine clean of dirt, grease and other substances which inhibit heat dissipation.

6. Operate engine at full throttle when digging or tracking machine. Run the engine only when engaged in work operations or when traveling the machine. Avoid prolonged periods at idle and shut the engine down if operations are interrupted.

SANDY OR DUSTY WORK SITES

The presence of large amounts of sand or dust at the work site can contribute to accelerated component wear. Either substance will act as an abrasive when deposited on moving parts of the machine.

This problem can be alleviated by increasing the schedule of lubrication and by servicing breathers and filters at more frequent intervals. Follow the recommendations below when operating in sand or dust on a regular basis.

UNUSUAL OPERATING CONDITIONS

Special problems in maintenance and operation are caused by unusual conditions such as extremes in heat, cold and humidity, high altitude, salt water, and dusty or sandy work sites. When operating under such conditions, special precautions must be taken to prevent machine damage, minimize wear, and avoid component deterioration.

EXTREME COLD

In periods of extreme cold, the problems of freeze damage, inadequate lubrication and battery failure may become particularly troublesome. With the onset of very cold weather, it is advisable to "winterize" the machine by servicing the cooling system and switching to the lubricants recommended for cold weather usage. Follow the recommendations below when the machine must be operated in very cold conditions.

1. To prevent freeze damage to the cooling system and cracking of the engine block or head, drain and flush the cooling system. Clean the radiator exterior, making certain the air passages through the core and the cooling fins are free of foreign matter.

Refill the cooling system, adding an antifreeze solution recommended by the engine manufacturer in an amount and strength appropriate to the anticipated temperatures. A corrosion inhibitor is recommended.

Never use a chromate base corrosion inhibitor when the coolant contains ethylene glycol. Use only non-chromate base inhibitors.

Inspect the thermostat, clamps, radiator hoses and radiator core for proper condition. Replace or repair any cooling system component found to be defective.

2. Condensation in the fuel tank contaminates the fuel supply with water, which can

freeze in the fuel lines and block the fuel flow to the engine. To minimize this possibility, keep the tank as full as is practical during cold weather.

This may entail refilling the tank more frequently than usual, but the inconvenience is small compared to clearing a blocked fuel line.

If water should be noticed in the fuel supply, drain the tank and refill it with uncontaminated fuel.

3. Lubricate the machine with the lubricants recommended for cold weather operation in the Lubrication Section. If necessary, change the engine oil and other lubricants in order to conform to the recommendations.
4. The battery is more likely to sustain freeze damage if not kept fully charged because its electrolyte will freeze at a higher temperature than that in a fully charged battery. Be certain the battery is charging when the engine is running and use an external charger to restore full charge when the machine is not being operated. The battery can discharge if snow or ice short circuits the terminals. Keep the battery posts and cable connectors clean and dry. Remove any corrosion with a solution of soda and water. During extremely cold weather, it is advisable to remove and store the battery in a heated area when the machine is to remain idle overnight or for any extended period.

CAUTION

Water added to the battery can freeze before it mixes with the electrolyte. During very cold weather, add water to the battery just prior to, or during operation of the machine. If the machine is not to be run, water may be added if an external charger is connected to the battery.

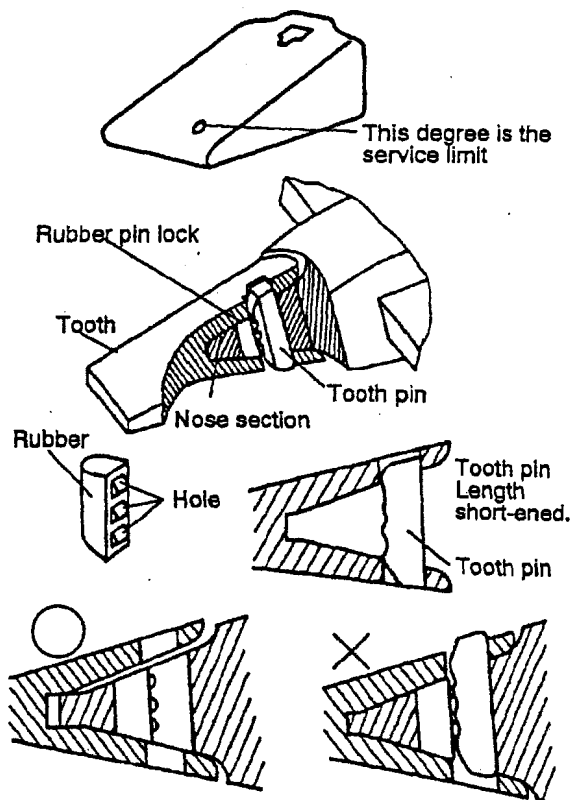
IRREGULAR INTERVALS MAINTENANCE AND CHECKS

REPLACEMENT PERIOD OF TOOTH

The replacement period varies with the work conditions, so the service limit is illustrated below.

REPLACEMENT OF TOOTH

- (1) Remove the tooth pin from the worn tooth.
- (2) Remove adhered or hardened soil from the nose section.
- (3) Clean the interior of the new tooth and mount it to the nose section.
- (4) Drive the tooth pin in until the pin is flush with the tooth surface.



BE CAREFUL OF THE FOLLOWING REPLACING THE SUIT

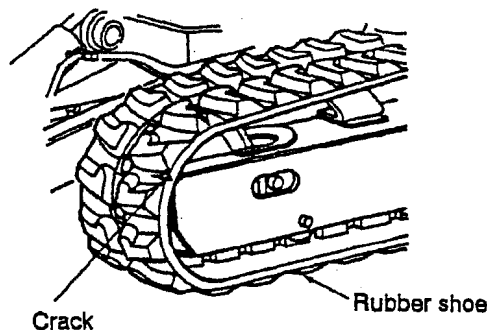
- (1) Check that the rubber pin lock and tooth pin are not defective.
- (2) Check the inside of the tooth.
- (3) Check the fit of tooth pin.

CHECK OF RUBBER CRAWLER SHOE

If the crawler shoe is cracked and water enters through the crack, the steel cord inside corrodes and separates.

As the condition gets worse, the crawler belt may become disconnected.

Therefore, if cracks are found, contact the nearest service representative for repair.



ADJUSTMENT OF BUCKET FIXED CLEARANCE

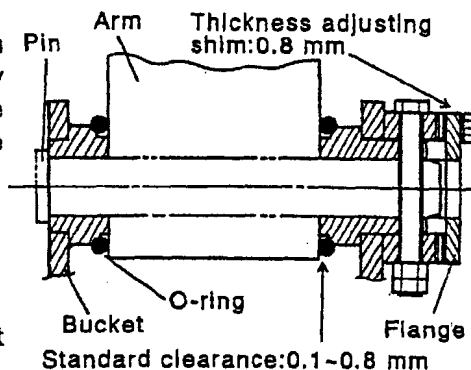
When the bucket fixed clearance becomes 1mm or over, adjust the clearance to 0.1~0.8mm by taking out necessary number of sheets of the clearance adjusting shims and fix the flange again by fixing bolts.

Bolts : M10 × 30 (4 units)

Spanner : 17mm

CAUTION

Be sure to maintain the clearance as above, but do not fill it up.



IRREGULAR INTERVALS MAINTENANCE AND CHECKS

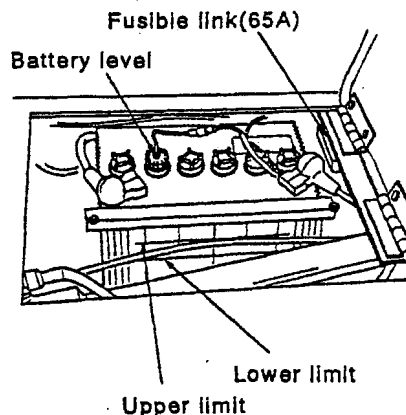
■ BATTERY MAINTENANCE

1. CLEANLINESS

Any acid that may have been spilled should be mopped and battery then cleaned with a rag and water and allowed to dry. Terminals must not be allowed to corrode; this can be prevented by keeping them coated with a good quality grease.

2. BATTERY RECHARGE

Battery should not be allowed to stand in a fully discharged condition, but should be recharged as soon as possible. If battery is out of use for a long time, it must not be allowed to run down completely. The battery should be given a small recharge, sufficient to bring it back to fully charged state about every one or two months. Trickle charging is not recommended and during charging as before, care must be taken that temperature of electrolyte does not rise above 40 °C for temperate climates and 52 °C for battery using lower gravity acids specified for tropical use.



3. INSPECTION

For close inspection of cells, use a flashlight and not a naked light as gases evolved from a battery may, in certain circumstances, be highly explosive. To avoid risk of sparks giving rise to explosion, do not rest flashlight or other metal object on top of battery.

4. TOPPING UP

Maintain level of electrolyte in cells at correct height by adding distilled water when required. If any electrolyte is spilled, replace it with fresh sulphuric acid of same specific gravity as that remaining in cell. Level of electrolyte must never fall below tops of plates.

⚠ CAUTION

NEVER reverse terminals when using jumper cables to start engine. This might effect polarity of alternator.

■ FUSIBLE LINK

A fusible link is provided between the positive terminal of the battery and the starter switch in order to protect wiring from burning in case of occurrence of short-circuiting in electrical wiring. If power supply is interrupted by short-circuiting of wiring, check the fusible link after repairing the wiring and when it is found, replace the fusible link.

2 YEARS MAINTENANCE AND CHECKS

■ SELECTION OF COOLANT

Long-Life-Coolant (LLC) is supplied to this machine before shipment.

This is a coolant provided with properties of antifreezing, corrosion-proof and fouling-proof.

Its long lasting effects will maintain the machine free from coolant exchange for 2 years through summer and winter seasons.

The Long-Life-Coolant is therefore recommended for use with this machine when exchanging its coolant.

■ MIXING RATIO OF LONG-LIFE-COOLANT

The mixing ratio of Long-Life-Coolant with water determines the freezing point.

Select the mixing ratio for a freezing point lower by 5° than the expected lowest atmospheric temperature.

Normally, the Long-Life-Coolant is used under a mixing ratio of 30 to 50%.

If the mixing ratio is less than 30%, occurrence of rust is feared and when it is over 50%, overheating is feared and sealing components may be deteriorated quicker than usual.

Meanwhile, use city water to mix with Long-Life-Coolant

Freezing point (°C)	- 15	- 25	- 35
Mixing ration (%)	30	40	50
Quantity of LLC (ℓ)	1.7	2.3	2.85
Quantity of water (ℓ)	4.0	3.4	2.85
Coolant Total amount: 5.7 ℓ	Engine proper : Radiator and other proper : Tank :		2.5 ℓ 2.7 ℓ 0.5 ℓ

UNUSUAL OPERATING CONDITIONS

1. Keep sand and dust out of the hydraulic system by keeping the reservoir filler cap tight and servicing the hydraulic system filters frequently.
2. The fuel system should be kept free of sand and dust by keeping the tank filler cap tight and servicing the fuel filters frequently.
3. The engine breathers and air cleaner should also be serviced frequently to prevent sand and dust from entering the engine. The engine oil and oil filter should be changed at shorter than normal intervals to ensure a clean oil supply to the engine's moving parts.
4. When lubricating the machine, thoroughly clean each grease fitting before attaching the grease gun. Pump generous amounts of grease into all lubrication points, using the fresh grease to pump out old.
5. Adequate ground bearing support may be required for the tracks when operating in soft sand. Be alert for signs of track digging into sand during operations. It may be necessary to back off and fill in area where tracks dig in.
The increased frequency of lubrication and service discussed above should be determined by observations made at the work site. Inspection will determine how long it takes for lubricants, breathers and filters to accumulate unacceptable amounts of sand or dust. The frequency of lubrication and service should be adjusted accordingly.
1. Make frequent inspections for rust and corrosions and remove them as soon as they are detected. Dry and paint exposed surfaces after rust and corrosion have been removed.
2. Where paint may not be applied, such as on polished or machined surfaces, coat the area with grease or lubricant to repel water.
3. Keep bearings and their surrounding surfaces well lubricated to prevent the entry of water.
4. Never use saltwater in the cooling system. Internal corrosion will occur and all parts will have to be replaced.
5. Hose down the machine periodically when working in saltwater. If necessary, use an oil soaked cloth to clean moving parts.
6. If the machine is submerged, be sure it is never submerged in water deeper than upper crawler belt.
If the machine exceeds this limit, disassemble, clean and lubricate the lower.

HIGH ALTITUDES

Variations in altitude alter the fuel-air mixture burned in the engine and affect the engine's performance. At high altitudes, atmospheric pressures are lower and less oxygen is available for combustion of the fuel. Above 1500 meter, the engine fuel setting may have to be changed to ensure proper performance.

Consult engine manufacturer should this problem arise.

Keeping the air cleaner clean and free of obstructions will help alleviate high altitude problems.

At high altitudes, closely monitor the engine temperature for overheating.

HIGH HUMIDITY OR SALTWATER

In some locations, such as coastal areas, the machine may be exposed to the deteriorating effects of salt, moisture, or both. To protect exposed metallic surfaces, wiring, paint and other items, keep them dry and well lubricated where salt or high humidity are encountered. Follow the recommendations below when operating in these conditions.

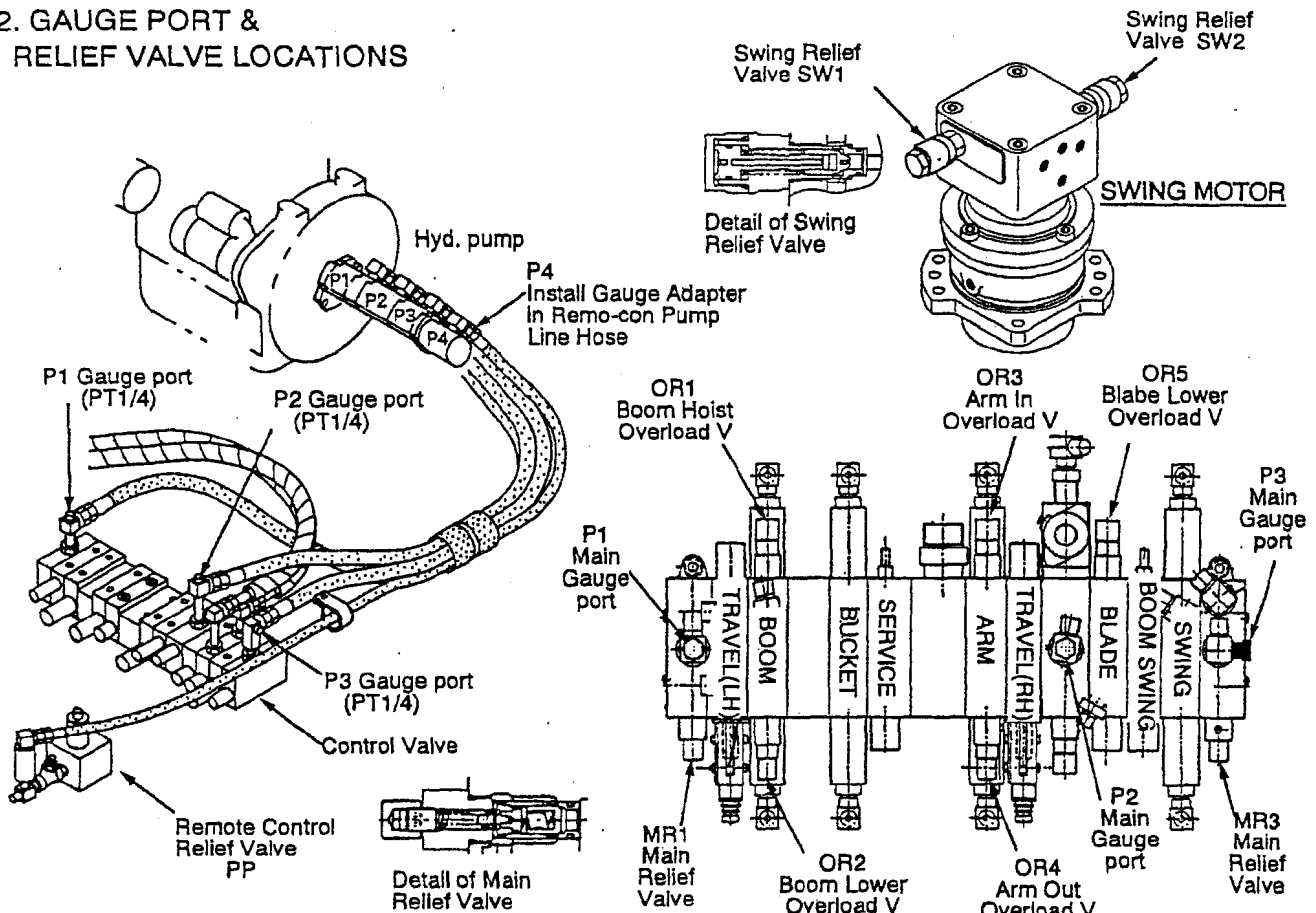
HYDRAULIC SYSTEM PRESSURE SETTINGS

1. SET PRESSURE

Hyd. Temp. : 50~60 °C

	Relief Valve	Gauge Port	Valve Location	Maintenance Std. kgf/cm ²		備考
				Standard	Allowable	
Main	Travel (LH), Boom, Bucket, Service	P1	MR1	175 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	165~180	Rated Engine RPM
	Travel (RH), Arm, Service	P2	MR2	175 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	165~180	Rated Engine RPM
	Swing, Blade Boom Swing	P3	MR3	165 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	155~170	Rated Engine RPM
Overload	Boom (Hoist)	Install Gauge Adapter in Att. Line Hose	OR1	250 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$ at 5 ℓ /min	240~255 at 5 ℓ /min	
	Boom (Lower)		OR2			
	Arm (In)		OR3			
	Arm (Out)		OR4			
	Blade (Lower)		OR5			
Brake	Swing	P3	SW1, SW2	115 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	105~130	Rated Engine RPM
	Travel	P1(LH) P2(RH)	—	Not Equipped		Relieved Travel Boosting Valve
Remote Control		P4	PP	35 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	30~40	Rated Engine RPM

2. GAUGE PORT & RELIEF VALVE LOCATIONS



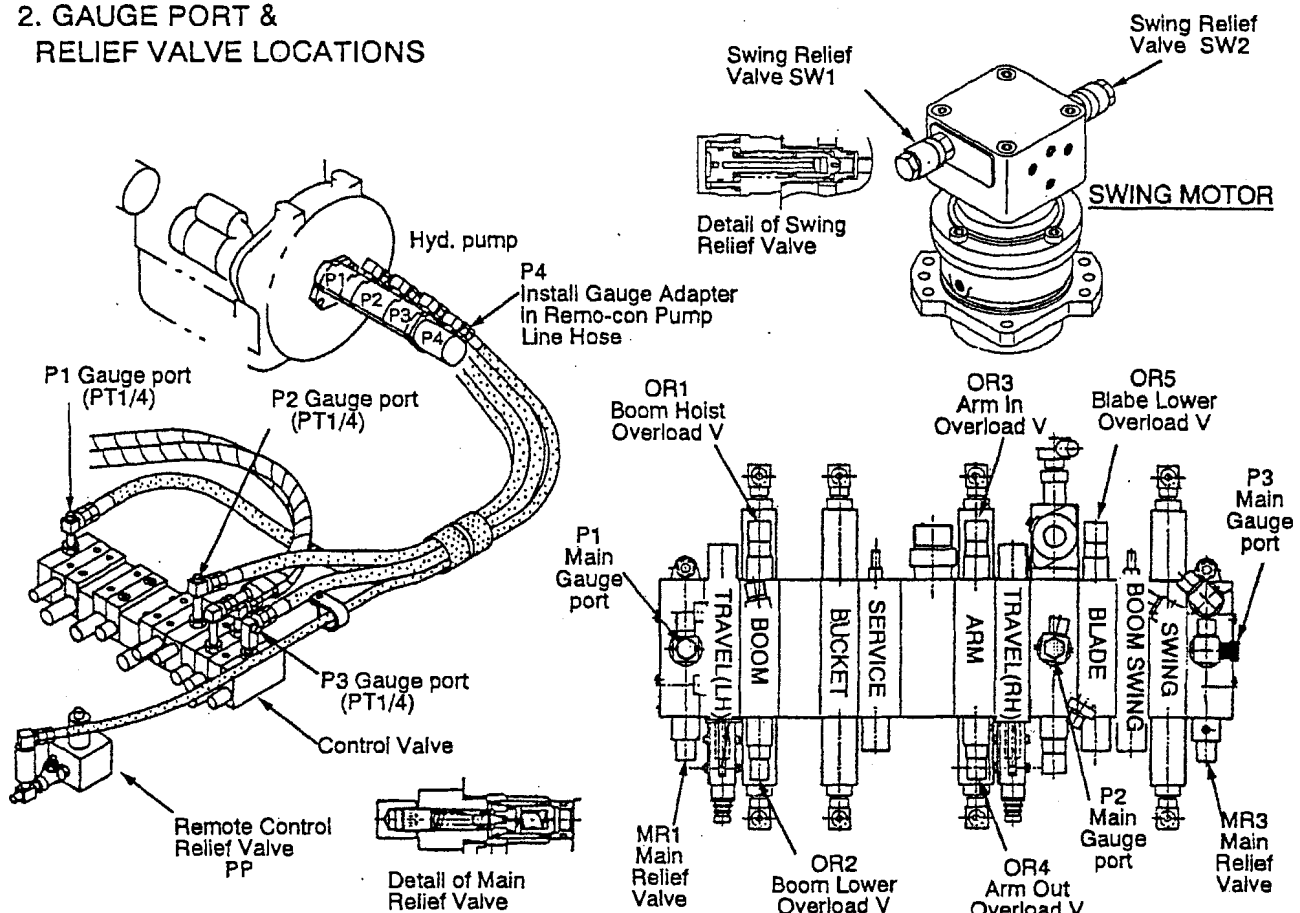
HYDRAULIC SYSTEM PRESSURE SETTINGS

1. SET PRESSURE

Hyd. Temp. : 50~60°C

	Relief Valve	Gauge Port	Valve Location	Maintenance Std. kgf/cm ²		備考
				Standard	Allowable	
Main	Travel (LH), Boom, Bucket, Service	P1	MR1	185 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	175~190	Rated Engine RPM
	Travel (RH), Arm, Service	P2	MR2	185 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	175~190	Rated Engine RPM
	Swing, Blade Boom Swing	P3	MR3	175 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	165~180	Rated Engine RPM
Overload	Boom (Hoist)	Install Gauge Adapter in Att. Line Hose	OR1	250 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$ at 5 ℓ /min	240~255 at 5 ℓ /min	
	Boom (Lower)		OR2			
	Arm (In)		OR3			
	Arm (Out)		OR4			
	Blade (Lower)		OR5			
Brake	Swing	P3	SW1, SW2	145 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	135~160	Rated Engine RPM
	Travel	P1 (LH) P2 (RH)	—	Not Equipped		Relieved Travel Boosting Valve
Remote Control		P4	PP	35 $\begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$	30~40	Rated Engine RPM

2. GAUGE PORT & RELIEF VALVE LOCATIONS



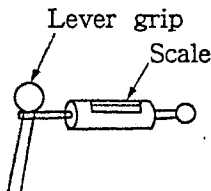
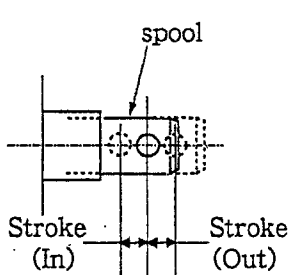
SECTION 6 PERFORMANCE STANDARDS

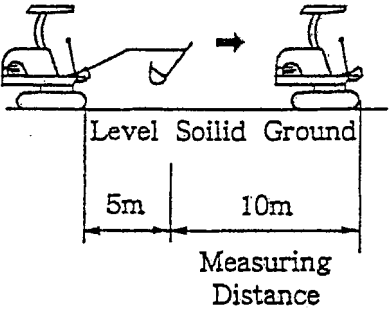
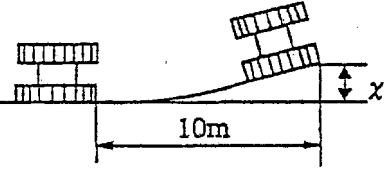
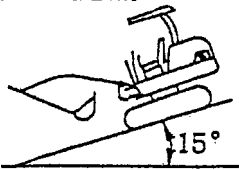
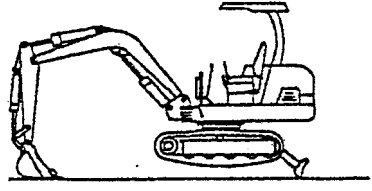
25J • 28J

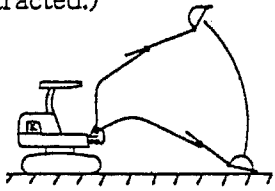
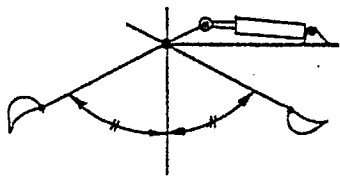
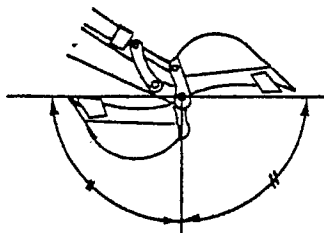
Hydraulic Pressure	6-1-1
Lever Operating Force	6-1-1
Spool Stroke	6-1-1
Swing (Operating Speed, Natural Drift)	6-1-2
Travel (Travel Speed, Travel alignment, Drift)	6-1-3
Boom Cylinder Speed	6-1-4
Arm Cylinder Speed	6-1-4
Bucket Cylinder Speed	6-1-4
Blade Cylinder Speed	6-1-5
Boom Swing Cylinder Speed	6-1-5
Cylinder Drift	6-1-5

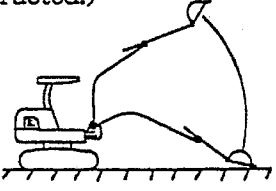
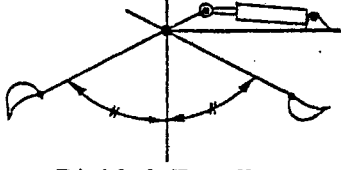
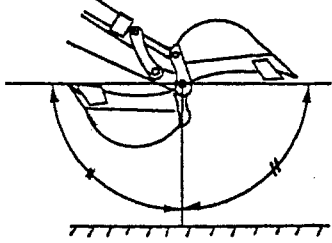
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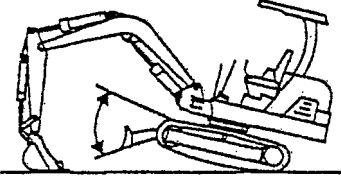
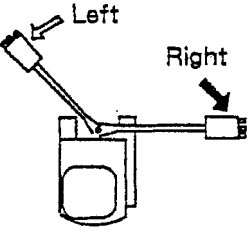
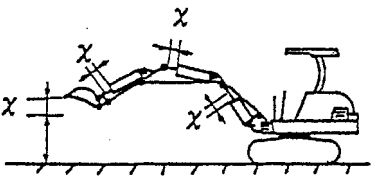
Hydraulic Pressure	6-2-1
Lever Operating Force	6-2-1
Spool Stroke	6-2-1
Swing (Operating Speed, Natural Drift)	6-2-2
Travel (Travel Speed, Travel alignment, Drift)	6-2-3
Boom Cylinder Speed	6-2-4
Arm Cylinder Speed	6-2-4
Bucket Cylinder Speed	6-2-4
Blade Cylinder Speed	6-2-5
Boom Swing Cylinder Speed	6-2-5
Cylinder Drift	6-2-5

ITEM	CONDITION	25J		28J	
		STANDARD	ALLOW.	STANDARD	ALLOW.
HYDRAULIC PRESSURE	Engine : Rated r.p.m. Oil temp : 50° - 60°C	kgf/cm ²	kgf/cm ²	kgf/cm ²	kgf/cm ²
Boom		175 ± 5	Max.180 Min.165	175 ± 5	Max.180 Min.165
Arm		175 ± 5	Max.180 Min.165	175 ± 5	Max.180 Min.165
Bucket		175 ± 5	Max.180 Min.165	175 ± 5	Max.180 Min.165
Swing		115 ± 5	Max.120 Min.105	115 ± 5	Max.120 Min.105
Travel		175 ± 5	Max.180 Min.165	175 ± 5	Max.180 Min.165
Boom Swing		165 ± 5	Max.170 Min.155	165 ± 5	Max.170 Min.155
Blade		165 ± 5	Max.170 Min.155	165 ± 5	Max.170 Min.155
LEVER OPERATING FORCE	Engine : Low speed Oil temp : 50° - 60°C Measuring Position : Use spring balance scale and hook under grip. 				
Boom					
Arm					
Bucket					
Swing					
Travel					
Boom Swing					
Blade					
Throttle					
SPOOL STROKE (CONTROL VALVE)		6.0 mm	←	6.0 mm	←
Boom Arm Bucket Swing					
Travel Boom Swing Blade		6.0 mm	←	6.0 mm	←

ITEM	CONDITION	25J		28J	
		STANDARD	ALLOW.	STANDARD	ALLOW.
TRAVEL Travel Speed	Engine : Rated r.p.m. Oil temp : 50° - 60°C Time required for 10m travel after 5m take off. 	19.6 sec ± 0.5 sec	Below 23.1 sec	High Speed 13.6 sec ± 0.5 sec Low Speed 22.1 sec ± 0.5 sec	High Speed below 16.0 sec Low Speed below 26.1 sec
Travel Alignment	Engine : Rated r.p.m. Oil temp : 50° - 60°C Measure turning distance during 10m travel. 	Below 500 mm	Below 700 mm	Below 500 mm	Below 700 mm
Natural Drift 	Engine : Idling Oil temp : 50° - 60°C Measure drift gravity in 5 minutes.	100 mm /5 min	500 mm /5 min	100 mm /5 min	500 mm /5 min
Time for Crawler belt	Engine : Rated r.p.m. Oil temp : 50° - 60°C Measure time required for five turns after one turn. 	36.3 sec ± 1.0 sec	Below 42.8 sec	High Speed 27.3 sec ± 1.0 sec Low Speed 44.1 sec ± 1.0 sec	High Speed below 32.2 sec Low Speed below 52.0 sec

ITEM	CONDITION	25J		28J	
		STANDARD	ALLOW.	STANDARD	ALLOW.
BOOM CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° - 60°C Measure time to raise boom from ground level to maximum height (with arm and bucket cylinder fully retracted.) 	Hoist 3.9 sec ± 0.3 sec Lower 3.6 sec ± 0.3 sec	Below 5.1 sec Below 4.7 sec	Hoist 3.9 sec ± 0.3 sec Lower 3.6 sec ± 0.3 sec	Below 5.1 sec Below 4.7 sec
ARM CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° - 60°C  Divided Equally Measure time for full extension or retraction of cylinder.	Arm In 3.1 sec ± 0.3 sec Arm Out 3.6 sec ± 0.3 sec	Below 4.1 sec Below 4.7 sec	Arm In 3.5 sec ± 0.3 sec Arm Out 3.9 sec ± 0.3 sec	Below 4.6 sec Below 5.1 sec
BUCKET CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° - 60°C  Divided Equally Measure time for full extension or retraction of cylinder.	Dig 3.6 sec ± 0.3sec Dump 2.2 sec ± 0.3 sec	Below 4.7 sec Below 2.9 sec	Dig 3.5 sec ± 0.3 sec Dump 2.2 sec ± 0.3 sec	Below 4.6 sec Below 2.9 sec

ITEM	CONDITION	25J		28J	
		STANDARD	ALLOW.	STANDARD	ALLOW.
BOOM CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° - 60°C Measure time to raise boom from ground level to maximum height (with arm and bucket cylinder fully retracted.) 	Hoist 3.9 sec ± 0.3 sec Lower 3.6 sec ± 0.3 sec	Below 5.1 sec Below 4.7 sec	Hoist 3.9 sec ± 0.3 sec Lower 3.6 sec ± 0.3 sec	Below 5.1 sec Below 4.7 sec
ARM CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° - 60°C  Divided Equally Measure time for full extension or retraction of cylinder.	Arm In 3.1 sec ± 0.3 sec Arm Out 3.6 sec ± 0.3 sec	Below 4.1 sec Below 4.7 sec	Arm In 3.5 sec ± 0.3 sec Arm Out 3.9 sec ± 0.3 sec	Below 4.6 sec Below 5.1 sec
BUCKET CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° - 60°C  Divided Equally Measure time for full extension or retraction of cylinder.	Dig 3.6 sec ± 0.3sec Dump 2.2 sec ± 0.3 sec	Below 4.7 sec Below 2.9 sec	Dig 3.5 sec ± 0.3 sec Dump 2.2 sec ± 0.3 sec	Below 4.6 sec Below 2.9 sec

ITEM	CONDITION	28J		25J	
		STANDARD	ALLOW.	STANDARD	ALLOW.
BLADE CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° - 60°C  Measure time for full extension or retraction of cylinder.	Hoist 2.5 sec ± 0.3 sec Lower 2.4 sec ± 0.3 sec	Below 3.3 sec Below 3.2 sec	Hoist 2.6 sec ± 0.3 sec Lower 2.4 sec ± 0.3 sec	Below 3.4 sec Below 3.2 sec
BOOM SWING CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° - 60°C  Measure time for full extension or retraction of cylinder.	Left 5.6 sec ± 0.3 sec Right 5.9 sec ± 0.3 sec	Below 7.4 sec Below 7.8 sec	Left 5.6 sec ± 0.3 sec Right 5.8 sec ± 0.3 sec	Below 7.4 sec Below 7.6 sec
CYLINDER DRIFT	Engine : Stopped Oil temp : 50° - 60°C Load : Non load Boom top section to be parallel with ground level Measure the variation of rod length in 10 minutes. 	Boom Cylinder : below 15 mm Arm Cylinder : below 15 mm Bucket Cylinder : below 5 mm Bucket Tooth Point : below	Below 30 mm Below 30 mm Below 10 mm Below 400 mm	Boom Cylinder : below 15 mm Arm Cylinder : below 15 mm Bucket Cylinder : below 5 mm Bucket Tooth Point : below	Below 30 mm Below 30 mm Below 10 mm Below 400 mm

SECTION 8 TROUBLE SHOOTING

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As the operator, it is your responsibility to detect any unusual sounds, odors or other signs of abnormal performance that could indicate trouble ahead.

By detecting any failures in their early stages, you can save yourself unnecessary downtime and your employer a lot of money! Therefore, it is also your responsibility to use good judgment in detecting failures in the bud and repairing them quickly. If you don't, one failure may lead to another.

Before attempting a repair yourself, ask yourself IF you have the **RIGHT TOOLS**, IF you have the **PROPER TEST EQUIPMENT** and IF you can accurately **DIAGNOSE** the cause of the failure.

If you can't answer **YES** to all three questions, rely on your Distributor Serviceman. He has the tools, testing equipment and service knowledge to pinpoint the problem in minutes instead of the hours consumed in hit — or — miss methods. **TIME IS MONEY!** He will save it for you.

If you decide to attempt a repair yourself, follow a logical **TROUBLESHOOTING PROCEDURE**. Don't simply replace parts until the trouble is found.

GENERAL PROCEDURE

I — KNOW THE SYSTEM Study this manual and learn what makes the machine "tick", how it should behave, sound and smell.

II — OPERATE THE MACHINE Test operate all machine functions. Note all abnormal sounds, odors and movements.

III — INSPECT THE MACHINE Look for leaks, listen for the source of abnormal sounds, detect the origin of unusual odors. Check the condition of the oil and filters.

IV — LIST THE POSSIBLE CAUSES Use your best judgment in listing all possible causes of the failure.

V — REACH A CONCLUSION Review your list of possible causes and decide which are the most likely to cause the failure. Consider the most obvious first.

VI — TEST YOUR CONCLUSION Test your conclusions, in order of obviousness, until the source of the failure is found. The machine can then be repaired at minimal cost and downtime.

VII — REVIEW MAINTENANCE PROCEDURES Prevent recurrences of all premature failures by regularly checking the filters, temperature, adjustments and lubrication. Make daily inspections.

HYDRAULIC SYSTEM

GENERAL Before attempting any hydraulic troubleshooting, become fully acquainted with the following two basic facts governing a hydraulic system:

1 – VOLUME Volume determines the speed of an operation. A hydraulic pump displaces a given amount of oil for every revolution of the pump. This volume is expressed in terms of liters per minute (ℓ /min). The greater the engine speed, the greater the pump speed. As a result, the speed of the hydraulic function operating is directly related to the speed of the engine. A reduction in the speed of a cylinder or motor is caused by a smaller quantity of oil being delivered to the components by the pump.

exerted by the hydraulic oil on those parts of a hydraulic system which are open to the pump. Pressure is automatic and the result of resistance in the sense that; when there is no resistance in the system, there is no pressure. When we operate a hydraulic cylinder or motor to accomplish a task, the amount of resistance required to overcome the task results in pressure being sensed by the hydraulic pump. This pressure is expressed in terms of kilogram per centimeter (kg/cm^2).

Once a basic understanding of the differences between volume and pressure has been obtained, accurate troubleshooting of any hydraulic system can be accomplished.

RELIEF VALVES Relief valves are installed in the hydraulic system to protect system components. Whenever pressure rises to the relief setting, the effected relief valve opens allowing excess oil to return to the reservoir through an outlet passage in the valve.

When checking pressures and adjusting relief valves, be sure hydraulic oil is at operating temperature $110^{\circ} - 135^{\circ} \text{ F}$ ($44^{\circ} - 55^{\circ} \text{ C}$). Note: Relief pressures will exceed set levels when the hydraulic system is checked with cold oil.

When adjusting pressures, **BE SURE TO USE** a high quality calibrated hydraulic pressure gauge.



NEVER resort to increasing relief valve pressure settings in an attempt to cure the ills of any hydraulic system. Fully diagnose the problem and maintain the proper pressure settings of all relief valves.

DIRT – YOUR CONSTANT ENEMY

The majority of hydraulic problems in any hydraulic system can be traced directly to dirt or contamination in the system. Do not neglect your hydraulic system. **KEEP IT CLEAN!**

Change the oil and oil filters at established intervals.

If, in spite of these precautions, improper operation does occur, the cause can generally be traced to one of the following:

1. Use of the wrong viscosity or type of oil.
2. Insufficient fluid in the system.
3. Presence of air in the system.
4. Internal leakage.
5. Improper adjustments.

HYDRAULIC SYSTEM GENERAL PROCEDURES

Base all hydraulic system troubleshooting on a firm foundation of good common sense and logical procedure. Don't overlook the obvious; check it first. Never pursue a course of simply replacing parts until the problem is solved.

Points to remember when troubleshooting hydraulics:

1. Did the problem occur **suddenly**..... or has the condition **gradually** gotten worse? A sudden malfunction will generally indicate a break. A gradually worsening situation indicates a wear condition.
2. Is the engine speed up to specifications? A slow engine will definitely affect the speed of all operations. Always remember — Volume determines speed and vice versa.

3. **ALWAYS** set hydraulic relief valves to **FACTORY SETTINGS!**

4. Whenever **ANY PART** of the hydraulic system is to be opened, **ALWAYS REMEMBER — CLEANLINESS!** Clean the entire surrounding area **BEFORE** the work is to be performed. **NEVER** set any hydraulic components, seals, rings, etc. in a contaminated area.

The intent of the following hydraulic system troubleshooting guide is to help in isolating problems experienced with the machine. Most problems can be solved by knowing where and what to look for. This guide provides a method of identifying and isolating these problems through a logical sequence, rather than one of replacing parts at random. This guide does not provide any repair procedures.

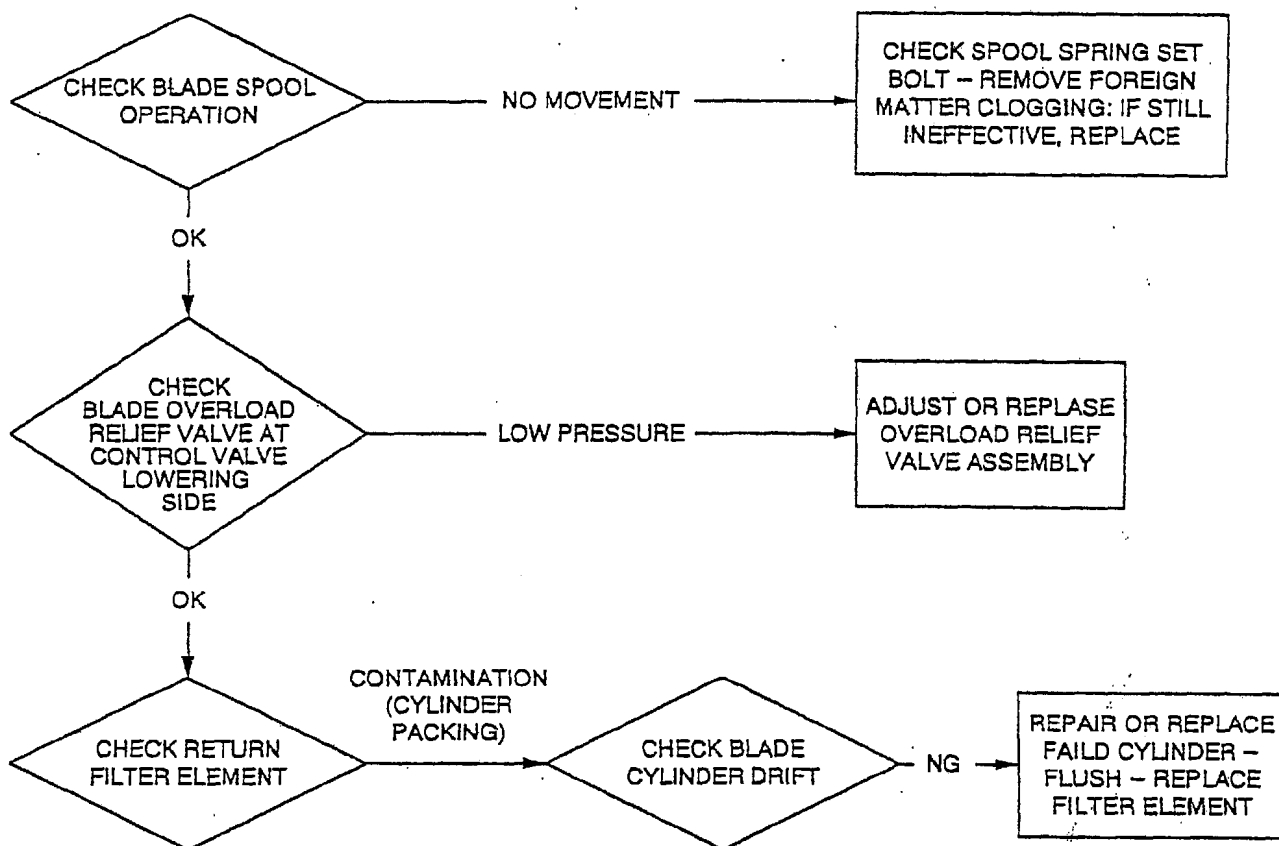
BLADE

No Movement Of Blade Cylinder(All Ather Operations Nomal)

Weak Blade Lowering Power(All Ather Operations Nomal Blade)

Slow Movement Blade

Too Much Drift Blade Cylinder



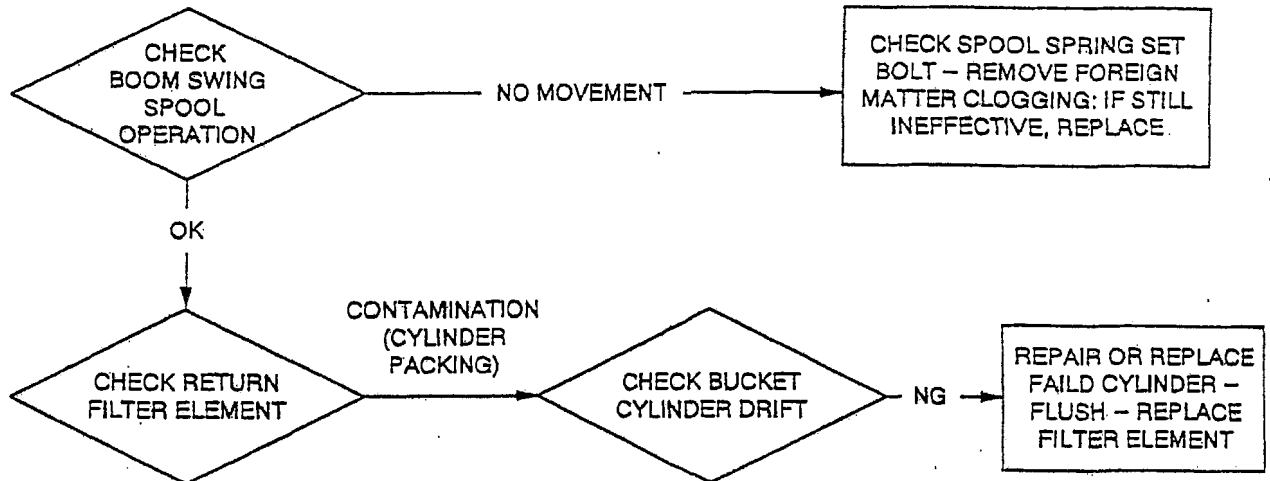
BOOM SWING

No Movement Of Boom Swing Cylinder(All Ather Operations Nomal)

Weak Boom Swing Power(All Ather Operations Nomal)

Slow Boom Swing Movement

Too much Drift Boom Swing Cylinder



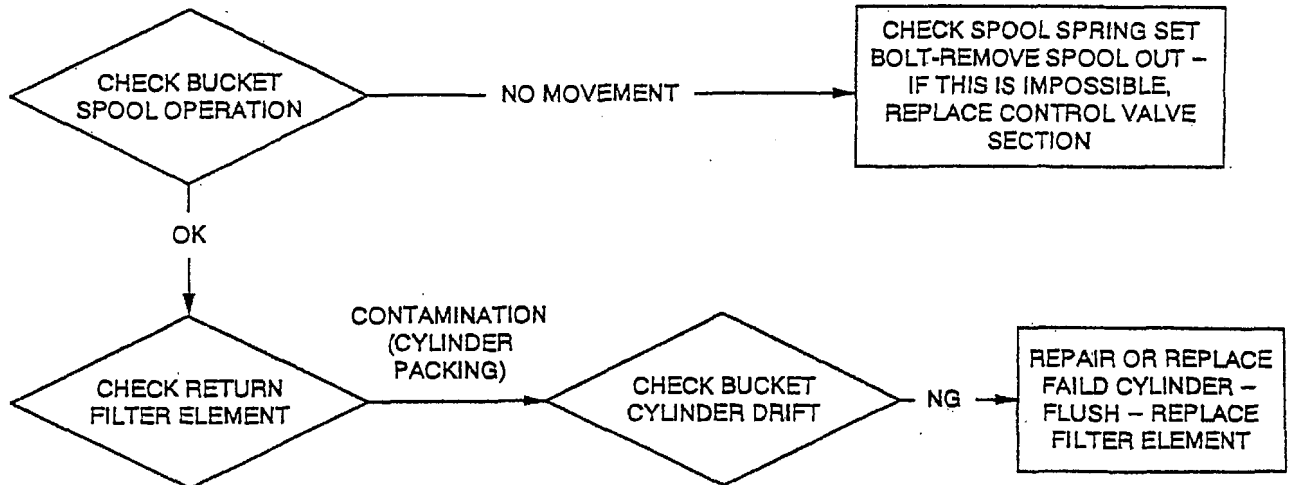
BUCKET

No Movement Of Bucket Cylinder(All Ather Operations omal)

Weak Bucket Digging Power(All Ather Operations Nomal)

Slow bucket Movement

Too much Drift Bucket Cylinder

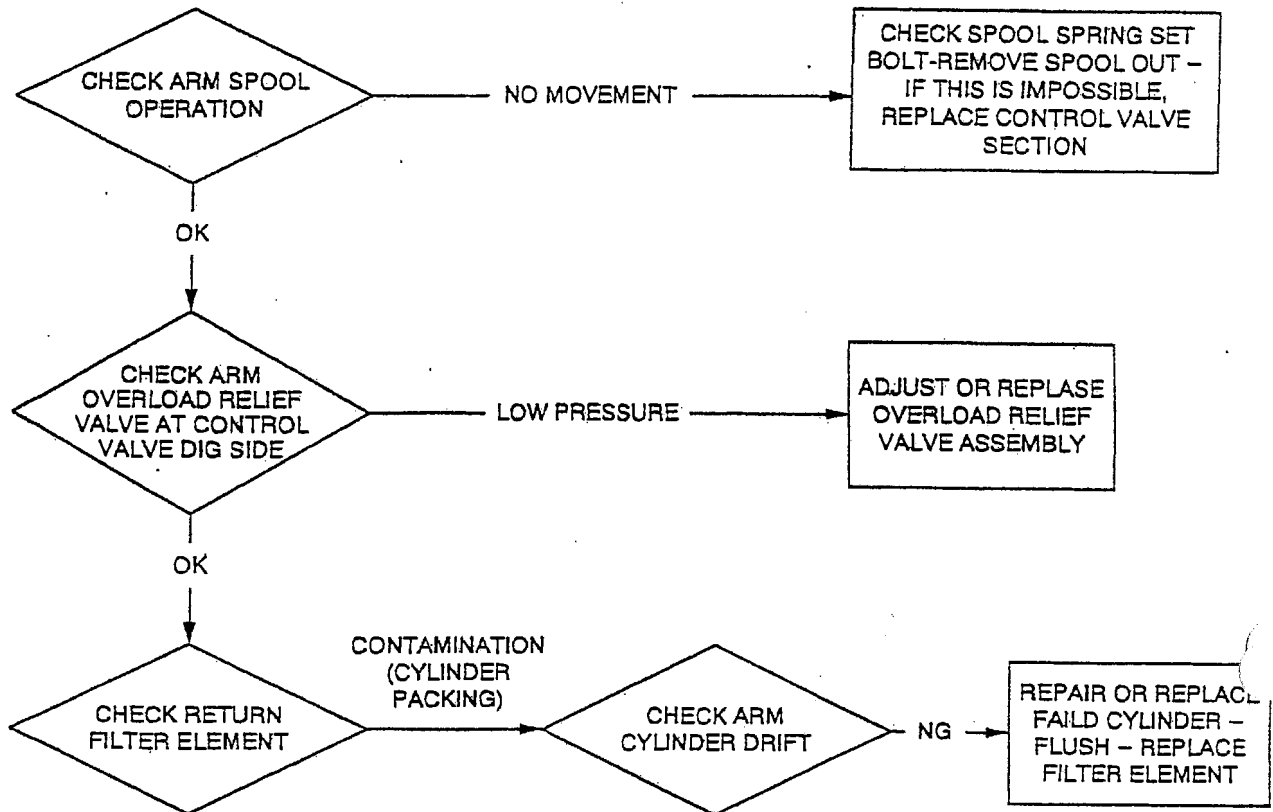


ARM

No Movement Of Arm Cylinder(All Other Operations Normal)

Weak Arm Digging Power(All Other Operations Normal)

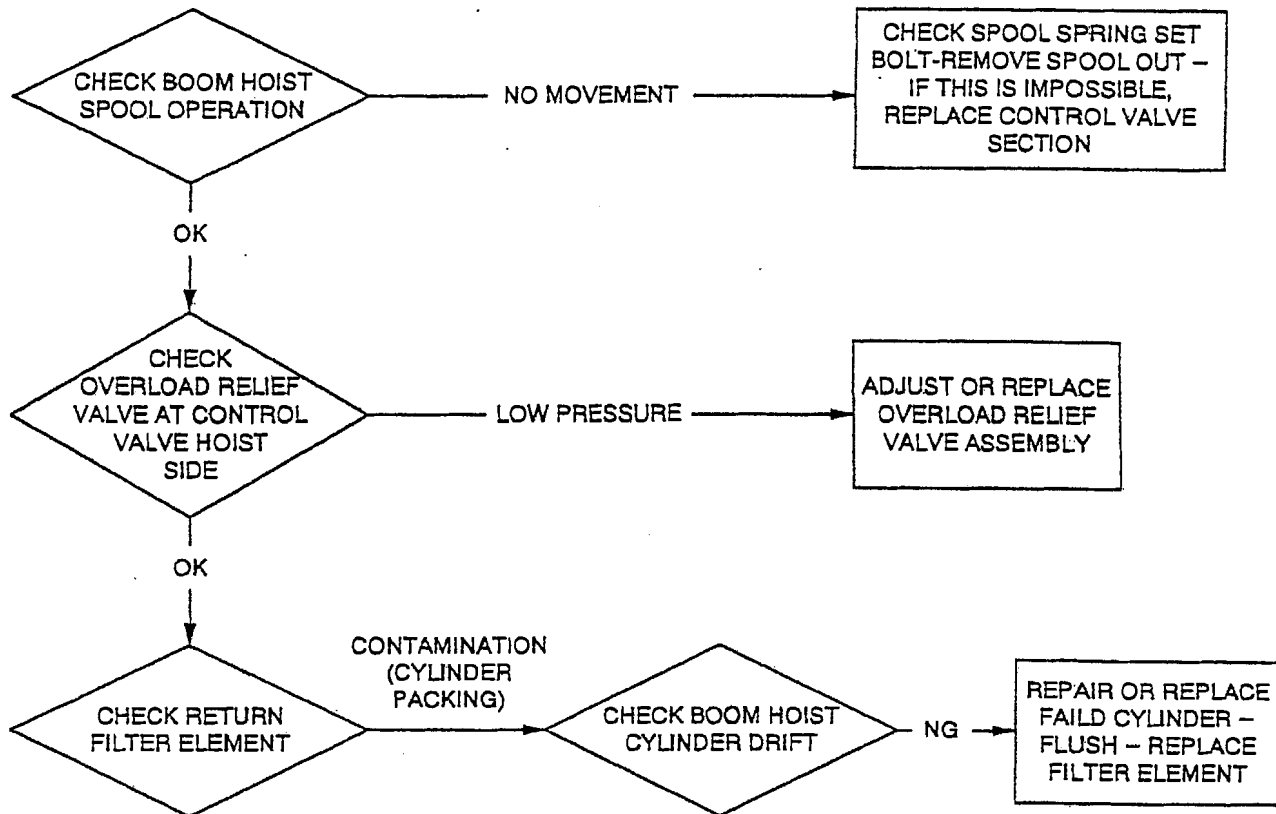
Slow Arm Movement Too Much Drift Arm Cylinder



BOOM

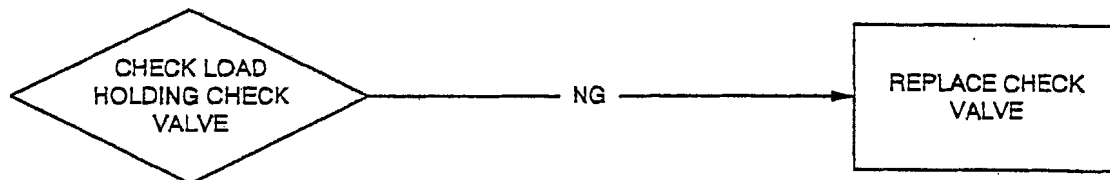
No Boom Hoist Or Boom Hoist Slow(All Ather Operations Nomal)

Too Much Drift Boom Cylinder

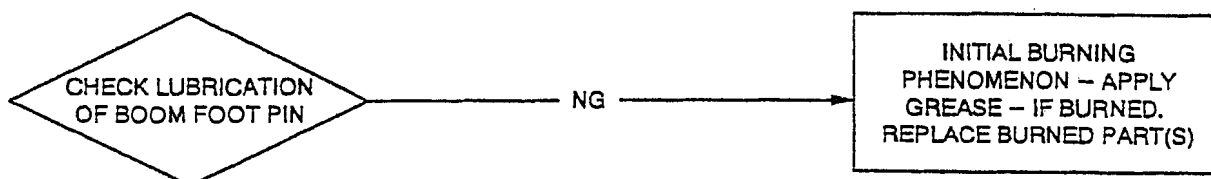


Boom Drops When Hoist Lever Pulled Back Slowly

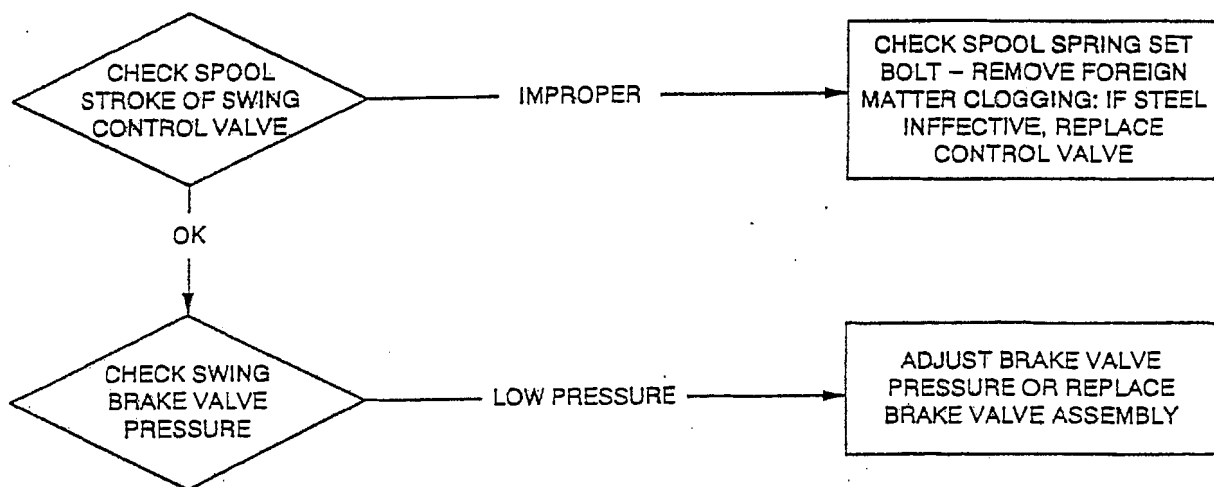
(Only Half Lever Operation)



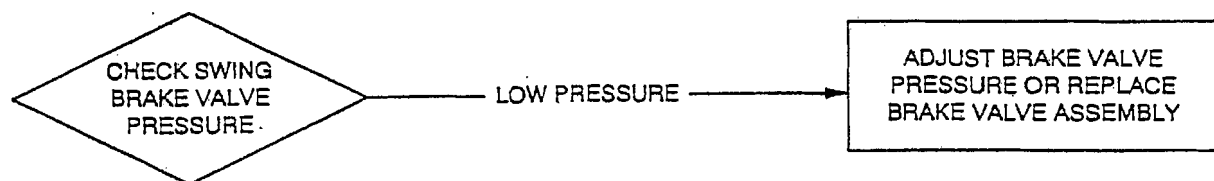
Noise Generation When Moving Up And Down



Slow Swing(Other Operating Normal)

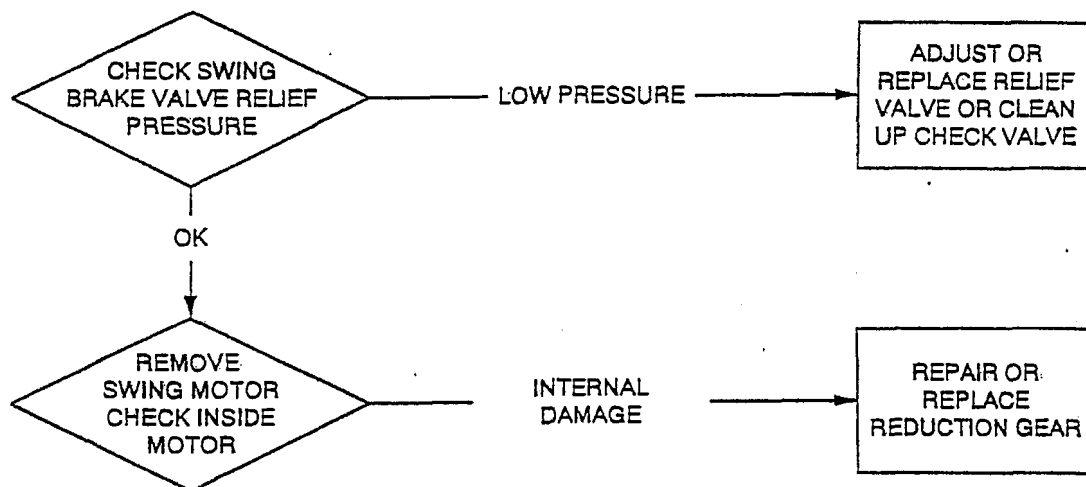


Swing Runout At Stop On Slope

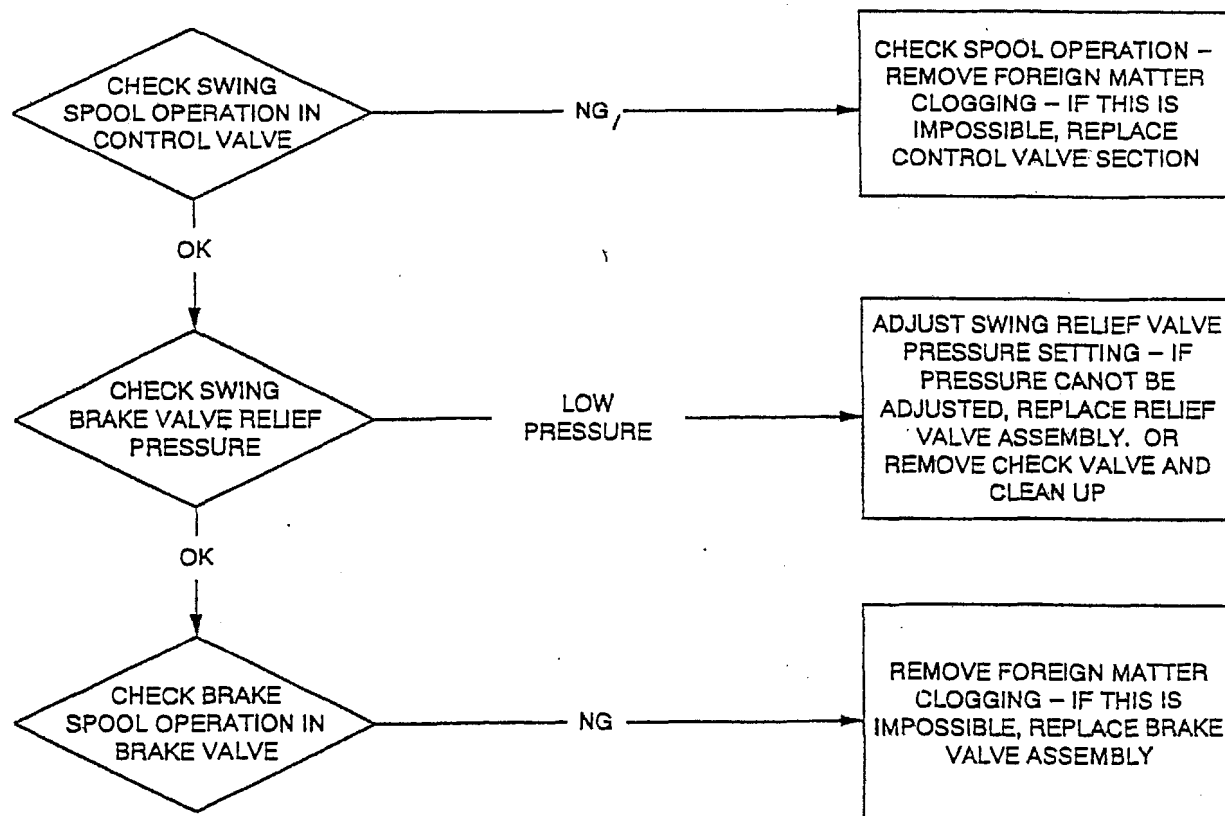


SWING

No Swing(Other Operatings Normal)
(Nelther Right Nor Left Swing)

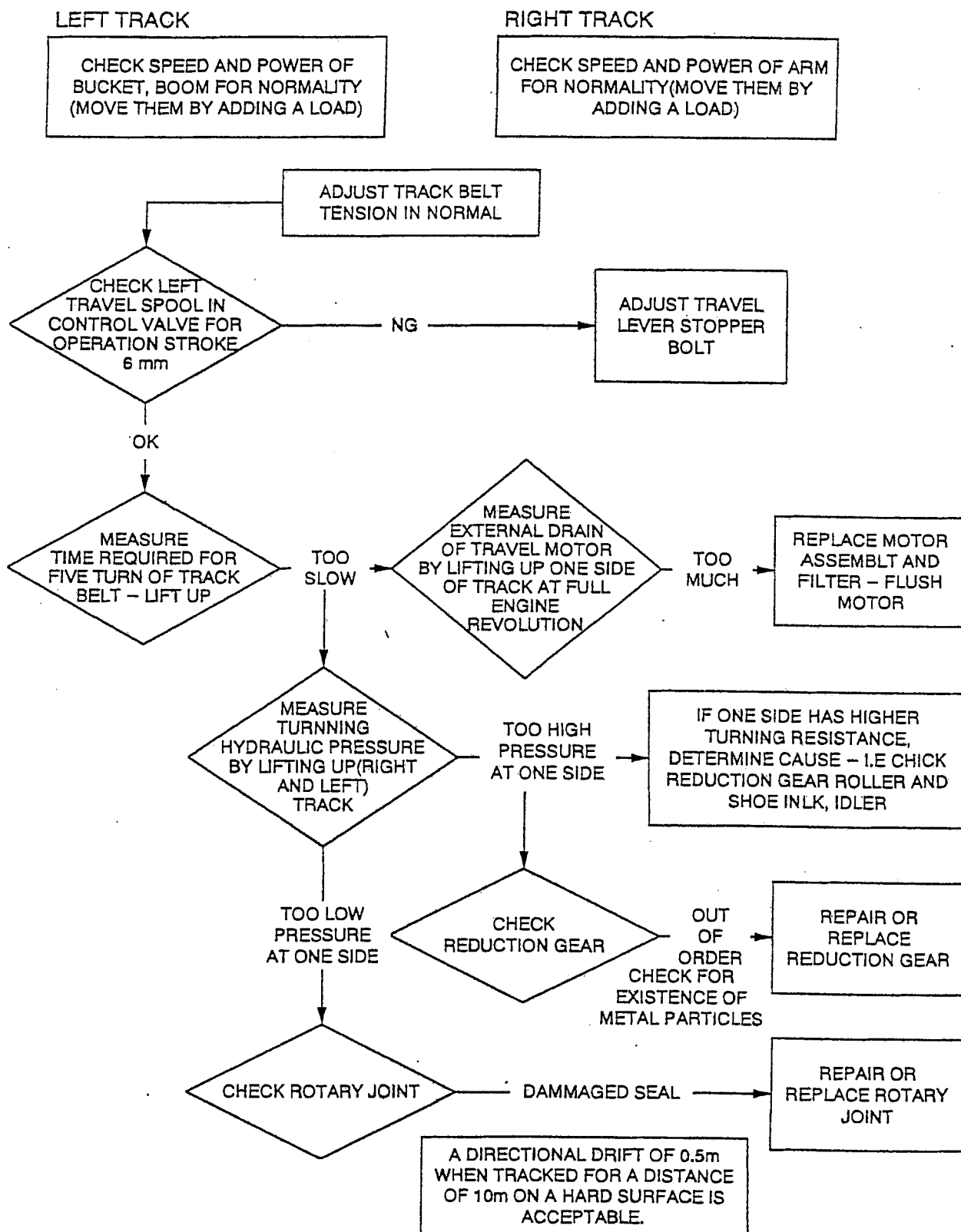


Swing - Cannot Stop

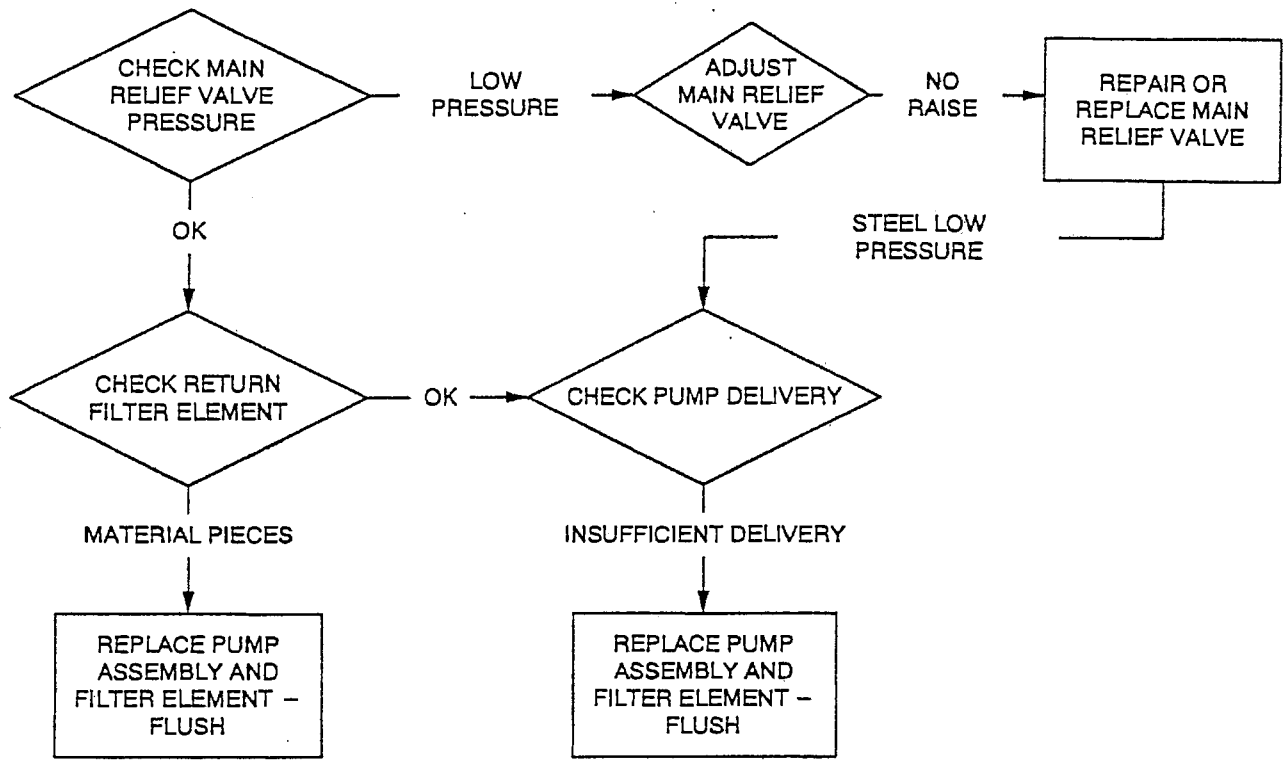


TRAVEL

Travel Speed Drops On One Side(Directional Drift) (All Other Operations Normal)

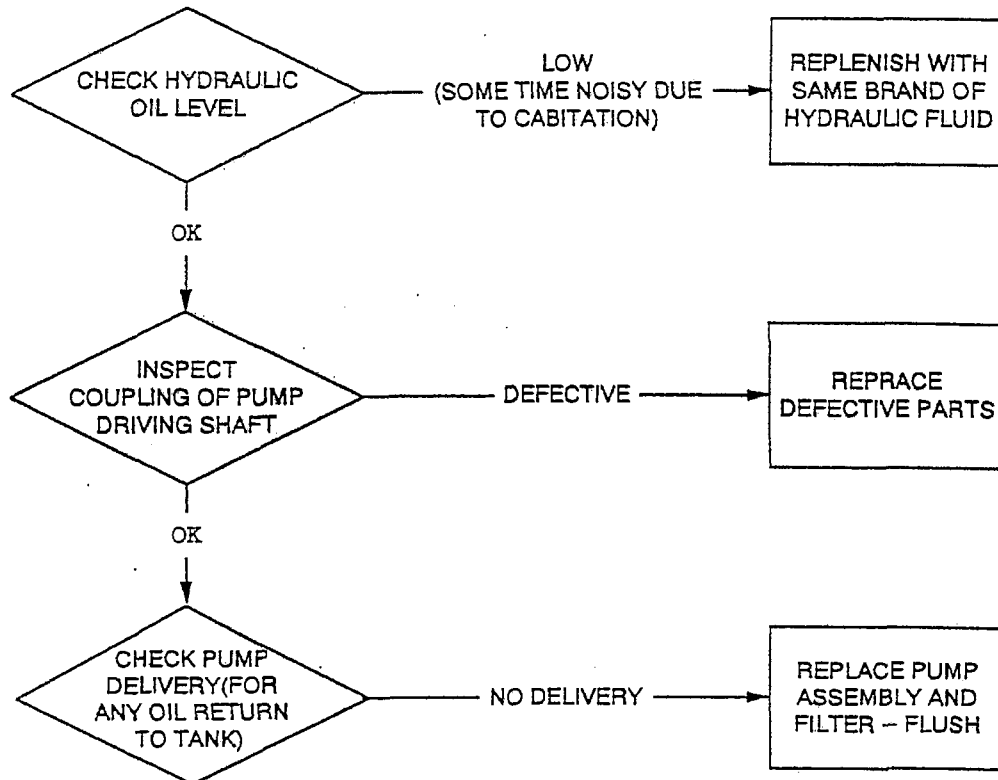


ALL Operations Fall On One Side Of Control Valve
Operations Slow On One Side Control Valve



STEP - BY - STEP
ELIMINATION METHOD

All Operation Fail



CHECKING METHOD OF PUMP DELIVERY :

1. GRASP THE DELIVERY HOUSE. (SENSE OF TOUCH)
2. OPEN OIL FILLING PORT OF HYDRAULIC OIL TANK AND OBSERVE THE FLOW OF RETERN OIL.
3. MEASURE BY FLOW MATER.

TRAVELING LIMIT SWITCH

Limit switch is provided with the traveling spool of control valve as an actuation switch for straight traveling in case of 25J to 30J, and for straight traveling and traveling pressure increase in case of 32J and 35J.

If this switch or its wiring becomes faulty, the phenomenon detailed below is caused. Depending on the phenomenon, carry out troubleshooting and take a proper measure.

	Phenomenon		Possible cause	Measure
	25J~30J (30/35UJ)	32J・35J		
At traveling	① Straight traveling function cannot be activated. (Traveling course is curved at simultaneous operation of traveling and attachment motion.)	① Straight traveling function cannot be activated (Traveling course is curved at simultaneous operation of traveling and attachment motion.) ② Traveling force does not increase because traveling pressure does not rise.	When operating the traveling lever, the limit switch does not turn on and the solenoid is not excited, so the valve is not changed over.	Check, repair or replace the switch or its wiring.
At attachment operation	① When applying a load by using 2 pumps (P1 and P2) simultaneously, the engine stalls. ② Operating speed of attachment (boom, arm or bucket) is faster than standard time.	① The engine does not stall when using 3 pumps simultaneously. ② Operating speed of attachment (boom, arm or bucket) is faster than standard time.	Although the traveling lever has not been moved, the limit switch turns on, the solenoid is excited and the valve is changed over.	• Check and adjust the switch mounting gap. • Check switch operation. Repair or replace as required. • Check and adjust the neutral position of traveling lever.

OVERHEATING AND NOISY HYDRAULIC PUMP

EQUIPMENT	PROBABLE CAUSE	REMEDY
Hydraulic pump	1.Low hydraulic oil	Replenish hydraulic oil
	2.Air in suction line.	Replace packing or tighten lock bolts.
	3.Water mixed in hydraulic system.	Replace hydraulic oil
	4.Relief valve pressure defective or valve itself defective.	Adjust pressure to specified or raplace valve.
	5.Suction strainer clogged.	Clean filter element.
	6.Clogged oil cooler.	Clean.

DEFECTIVE TRAVEL

EQUIPMENT	PROBABLE CAUSE	REMEDY
Travel motor	1. Machine moves when it is parked on a slope. 2. Machine moves during digging operation. 3. The machine is unable to travel straight.	Internal leakage in travel motor.
Rotary joint	O-Ring worn or damaged, causing internal leakage.	Repair or replace rotary joint.
Travel reduction gear	Bearings, shafts and gears damaged.	Replace.

FAULTY SWING

EQUIPMENT	PROBABLE CAUSE	REMEDY
Swing motor	Internal leakage inside swing motor, causing drop in swing speed. (Drift of machine when machine stops swinging)	Repair or replace.
Brake Valve	1. Drift of machine is excessive when machine is stopped. (Brake valve is defective or pressure has dropped) 2. Machine stops abruptly when swing is stopped. (Relief pressure higher than normal).	Replace valve or adjust pressure. Adjust relief pressure.
Reduction gear	Bearings, shafts and gears are damaged.	Replace.

TROUBLESHOOTING DIGGING FORCE AND SPEED DECREASE

EQUIPMENT	PROBABLE CAUSE	REMEDY
Engine	Engine output drop (engine speed fluctuaics) 1. Fuel pump. 2. Fuel injection timing faster than normal (Engine knocks). 3. Injection timing later than normal (Thick exhaust smoke is emitted from engine). 4. Injection pump. 5. Fuel filter clogged. (Check filter screen inside tank) 6. Air in injection pump. 7. a. Fuel valve wet with fuel. b. Valve gap insufficient. c. Piston ring seized. d. Piston ring damaged. e. Defective cooling. f. Defective lubrication.	Repair or replace. Delay timing. Advance timing. Repair or replace. Clean or replace. Purge air. Reseat valve. Adjust valve gap. Replace. Replace. Check fan belt, etc. Check engine oil.
Hydraulic oil	Low hydraulic oil. Improper viscosity	Replenish hydraulic oil. Replace hydraulic oil with recommended viscosity.
Hydraulic pump	Number 1 pump a. Travel motor (right) output and travel speed drops b. Arm cylinder piston force and speed drops Number 2 pump a. Boom cylinder piston force and speed drops b. Travel motor (left) output and travel speed drops c. Bucket cylinder piston force and speed drops Number 3 pump a. Blade cylinder piston force and speed drops b. Boom swing cylinder piston force and speed drops c. Swing force and swing speed drops	Repair or replace. Repair or replace. Repair or replace.
Load holding check valve	1. Dust deposited on valve seat. 2. Valve seat and spring defective.	Overhaul and clean. Replace valve.

EQUIPMENT	PROBABLE CAUSE	REMEDY
Main relief valve	1. Relief valve damaged. 2. Relief valve clogged with dust or other foreign substances. 3. Relief valve pressure too low.	Replace. Overhaul and clean. Check and adjust pressure.
Overload relief valve	Boom, arm or blade erratic. (Cause same as case of main relief valve above.)	Same as above.
Hydraulic cylinders	If pumps and valves are OK, piston packing may be worn or damaged, thus causing internal leakage.	Repair or replace.
Make-up valve	Boom swing erratic. Valve seat damaged or scored. Contamination on valve seat.	Clean or replace valve.

EXCESSIVE CYLINDER DRIFT

EQUIPMENT	PROBABLE CAUSE	REMEDY
Overload relief valve.	1. Valve seat worn or damaged. 2. Valve O-Ring damaged. 3. Dust or other foreign substances inside valve. 4. Valve spring fatigued, causing pressure reduction	Replace relief valve.
Hydraulic cylinders	Internal leakage due to wear or damage of piston ring or packing.	Repair or replace piston ring or packing.
Spool	Leakage.	Replace control valve.