KOBELCO

SERVICE MANUAL

HYDRAULIC EXCAVATOR

MD450BLC

Applicable: MD450BLC YS0201~

S5YS0002E-01 04/89

HYDRAULIC EXCAVATOR

SHOP MANUAL

model MD450B LC

GENERAL

SYSTEMS

COMPONENTS

PROCEDURE

MDI YUTANI

Book code No. S5YS0002E ①

SHOP MANUAL model MD450B L E

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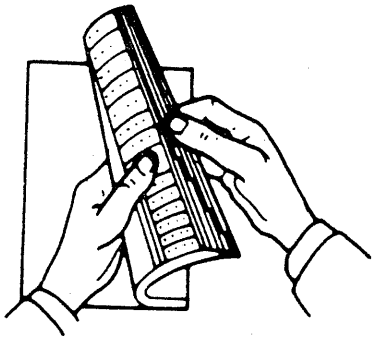


MDI YUTANI

GENERAL

1. GENERAL

1) The terms used in this Maintenance Standards shall have definitions as follows:
   Standard value:
   Standard values for adjustment or assembly of a new machine, provided the values are for standard specifications (machine with standard attachments and shoes) unless otherwise specified.
   Allowable value:
   A limit value that shall not be exceeded. If it is exceeded, remedy or replacement is required. Avoid using a machine, exceeding this value to maintain the performance or safety of the machine.
   Limit value of use:
   A value at which machine adjustment or parts replacement becomes unnecessary if it is exceeded. If the machine is still used beyond the limit value, the machine will be faced with failures leading to the out-of operation and will develop safety problems.
   Oil temperature:
   Temperature to be applied. The temperature of hydraulic oil refers to that in the hydraulic oil tank. Hydraulic oil must be circulated continuously so that the oil temperature in the circuits may be levelled off with that of the tank.

2) For items without allowable values, adjust and repair or replace them with reference to the standard values.
3) Rubber products such as hydraulic hoses, O rings and oil seals deteriorate with time. Replace them regularly or at overhaul.
4) It is advisable that important hoses for safety purpose be designated as very important parts (V.I.P.) and be replaced regularly.
5) In proceeding to maintenance, it is essential to get familiar with machine operating procedures, precautions to be observed and inspection/lubrication procedures. Read through the Operators Manual as well.

Applicable Machines

YS-0201~

Revision	Date of Issue	Remarks
First edition	April. 1989	120 K

2. PRESSURE MEASUREMENT AND ADJUSTMENT

2.1 EQUIPMENT TO BE PREPARED

Pressure gauge 50kgf/cm² (700 psi)	1 pc
100kgf/cm² (1400 psi)	2 pcs
500kgf/cm² (7000 psi)	2 pcs
Pressure measuring set	1 set
Speed meter (diesel speed meter)	1 pc
Surface thermometer (with magnet)	1 pc
Hydraulic oil analyzing apparatus	1 set

2.2 STANDARD MEASURING CONDITION

First of all, set pressures to within the tolerances in standard measuring conditions in the Performance Inspection Table (Table 1).

(1) Measuring Procedure and Method

1) Cleanliness of hydraulic oil
Sample oil from within the hydraulic oil tank and inspect it with an analyzing apparatus. If values obtained are out of tolerances, flush oil or replace filters.

2) Hydraulic oil temperature
Attach a temperature gauge to the surface of the hydraulic oil tank and measure temperature. If the temperature is low, relieve the relief valve for the bucket and others till it falls down.

3) Water temperature
Measure the temperature of the radiator surface the same way as above. If the temperature is down, wait till it goes up.

4) Engine revolution
If LO (low revolution) is not within the tolerance, adjust the length of the throttle lever and the accel cable in the operator's cab.
If HI (high revolution) does not fall within the tolerance, ask the engine manufacturer for repair. If the revolution does not fall within the tolerance when the decel is on, adjust the length of the rod located between the engine stop lever and the sloenoid.

(2) Procedure of adjusting the engine revolution

1) Adjusting the low revolution (LO) of the engine
Loosen the nut (1) fastening the control cabel and adjust the length of the cable (C). For the length (C), refer to the standard value given in the Service Standard of the Control System.

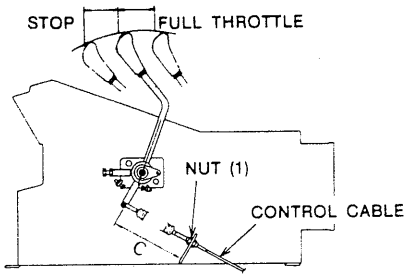


Fig. 1

2) Adjusting revolution when the decel is on
Adjusting the rod length (E) by turning the joint (2) located between the solenoid and the stop lever.

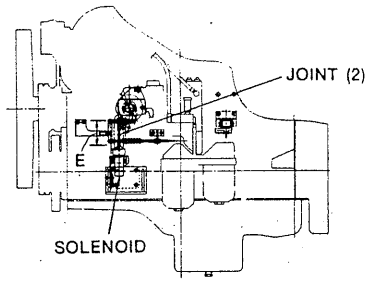
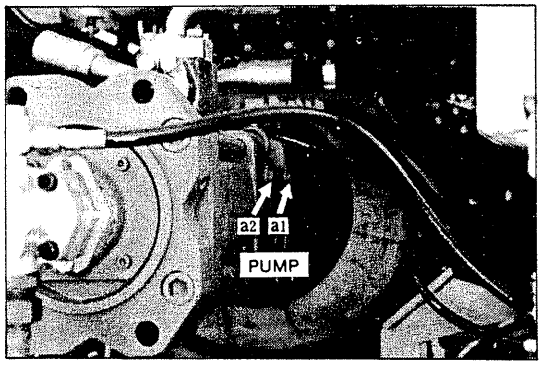


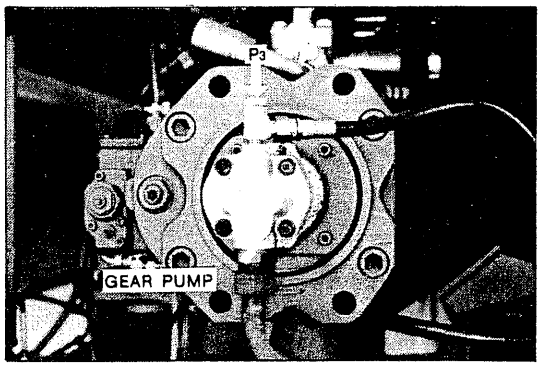
Fig. 2

2.3 PRESSURE MEASURING POSITIONS

(1) Main circuit



(2) Pilot circuit



2.4 MEASURING AND ADJUSTING THE CIRCUIT PRESSURE

(1) Measuring Procedure

1) Attaching a Pressure Gauge to the Main Circuit
Place an oil pan under the "a1" plug of the main pump (This is the pressure tapping point of the main circuit.) and remove the plug.
Then attach a pressure guage connecting joint and fit a 500kg/cm² (7000 psi) pressure gauge to it.
Remove the "a2" plug the same way and attach a pressure gauge there.

2) Attaching a Pressure Gauge to the Pilot Circuit
Place an oil pan under the gear pump plug (P_3) (which is the pressure tapping point of the pilot circuit) and remove the plug.
Then, attach a pressure gauge connecting joint and fit a 100kg/cm² (1400 psi) pressure gauge.

3) Primary Pilot Pressure Measurement
Confirm that the primary pilot pressure when all operating levers are neutral falls within the tolerance given in the Performance Inspection Standard Table (Table 1).
In case the pressure is out of an allowable value, adjust the control (RV13) of the pilot relief valve.

NOTE

If measurements fall within the tolerance in Table 1, try not to adjust it as much as possible.
Perform pressure measurement from the upstream to downstream sides.

4) Measuring the Travel Main Relief Pressure
Measure the travel main relief pressure. For measurement, do it one side by one side by locking the circular sprocket properly, as given in the Measurement Steps in the Performance Inspection Standard Table (Table 1).
In case pressue is out of a tolerance, adjust the control (RV3, RV4) according to the adjustment procedure of independent relief valve.

NOTE

Start adjustment of the 2-step relief valve from the root (high pressure).

5) (Opt.; Measuring Heavy lift pressure)
Turn on the attachment heavy lift switch and measure high pressure. Then, measure pressure by turning off the attachment heavy lift switch. For adjustment, turn on the heavy lift switch and adjust the high pressure side.)
Measuring the Main Relief Pressure. Measure the attachment pressure of the main relief valve. If measurement is out of a tolerance, adjust the pressure with the controles (RV_1, RV_2) the same way as above.

6) Preparation for Measuring the Port Relief Pressure
Before measuring the port relief pressure, tighten the travel main relief valve 180°. Then tighten up the main relief valve (the high pressure side for a 2-step type) 180°
(Opt.; Then measure pressure with the attachment heavy lift switch on) This is to keep the main relief pressure above the maximum pressure port relief pressure.

7) Measuring the Port Relief Pressure
Measure the port relief pressure (boom, arm, bucket, swing and travel motors). Measurement should be done when the port relief valve at the stroke end in Table 1 is relieving itself. If measurements are out of a tolerance, adjust the control according to the adjusting procedure of the relief valve that comes up later.

8) Disposition at the Completion of Measuring the Port Relief Pressure
(Opt.; If boost pressure is present, turn on the heavy lift switch and measure the high pressure side, which was tightened 180° up for the preparation of port relief pressure measurement.
Then, turn off the heavy lift switch and adjust the pressure to a tolerance for the low pressure. Confirm pressure by repeating steps with boost pressure and without boost pressure.)
Next, bring back the travel main relief valve 180° and adjust pressure to within the tolerance.

2.5 PRESSURE ADJUSTING POINTS

(1) Pilot relief valve

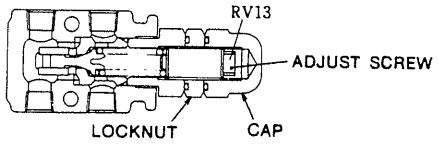


Fig. 3

(2) Swing control valve

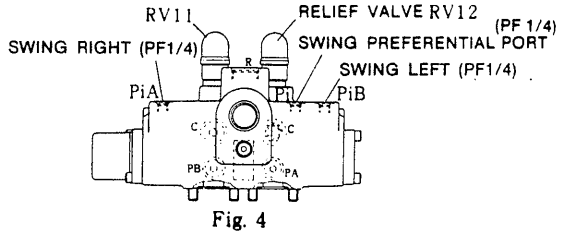
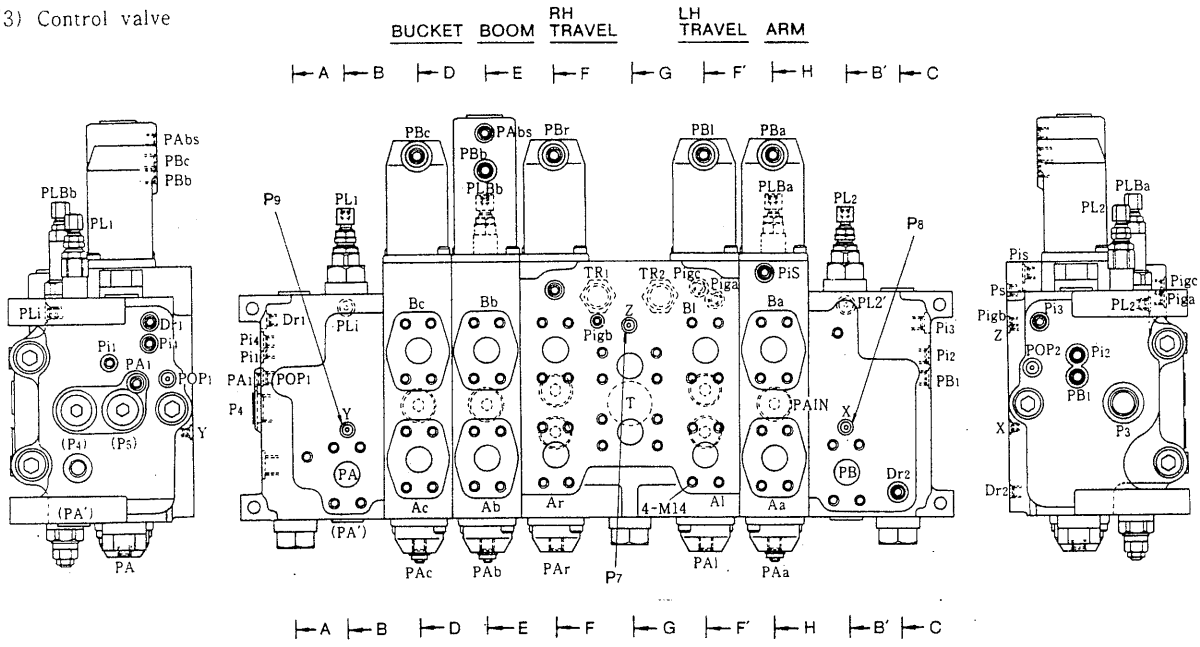
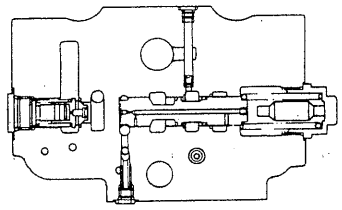


Fig. 4

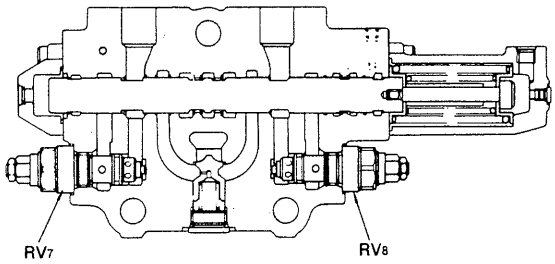
(3) Control valve





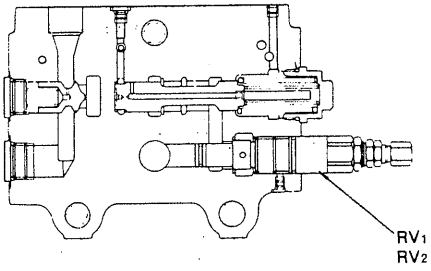
SECTION A-A, C-C

CONFLUENT FLOW CHANGEOVER VALVE



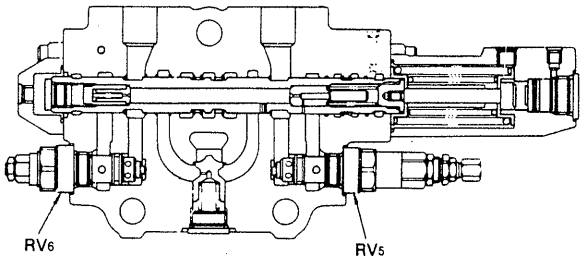
SECTION D-D

BUCKET



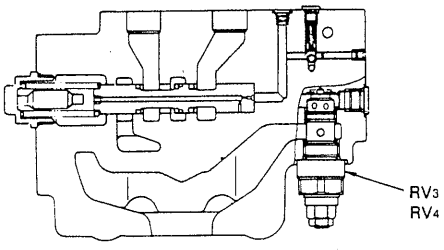
SECTION B-B, B'-B'

NEUTRAL CUT VALVE



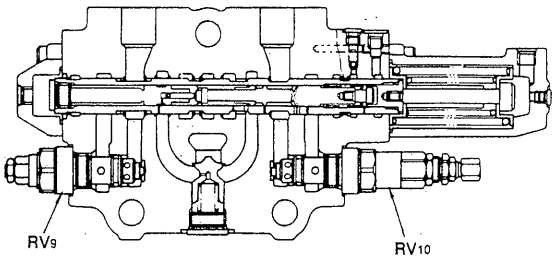
SECTION E-E

BOOM



SECTION G-G

TRAVEL PREFERENTIAL VALVE



SECTION H-H

ARM

Fig. 5

2.6 PERFORMANCE INSPECTION STANDARD

Table 1

(NOTE ; Take measurement in the S mode, unless otherwise specified.
The standard tolerance shall be an allowable range in field measurements.)

Inspection item					Pressure measurement: Position	Port	Size	Basic value	Tolerance: Upper limit	Tolerance: Lower limit	Unit	Control	Measurement: Condition, function
Standard measuring condition	Cleanliness of hydraulic oil				Hydraulic oil in tank			8	+1	-1	Class	—	Takeout of sample
	Temperature of hydraulic oil				Tank surface			50	+5	-5	℃	—	Air temperature 30°~−30℃
	Water temperature				Radiator surface			75	+15	-15		—	Air temperature 30°~−30℃
	Rated engine revolution			LO	Injection pump No.1 fuel pipe			850	+50	0	RPM	C	LO throttle
				H1				2180	+50	-20		Adjustment not neccessary	FULL throttle
		Decel		ON				1000	+50	0		E	Decel sw on
Main circuit	Main relief pressure	Attach		RH	Pump	a 1	PF1/4	280 (3980)	+5 (+70)	0	kgf/cm² (psi)	RV1	Bucket digging
				LH		a 2						RV2	Boom hoisting
			Boost pressure (OPT.)	RH		a 1		320 (4550)	+20 (+280)	0		RV1	Bucket digging
				LH		a 2						RV2	Boom hoisting
		Travel		RH		a 1		350 (4980)	+5 (+70)	0		RV3	Sprocket lock, 2-speed
				LH		a 2						RV4	
	Port relief pressure	Boom		R	Pump	a 1	PF1/4	—	—	—		RV6	Boom lowering
				H				315 (4480)	+50 (+710)	+20 (+280)		RV5	Boom hoisting
			Boost pressure (OPT.)	H				340 (4830)	+20 (+280)	0		—	Boom hoisting
				R		a 2		340 (4830)	+20 (+280)	0		—	Arm discharge
		Arm		R				315 (4480)	+50 (+710)	+20 (+280)		RV10	Arm discharge
				H								RV9	Arm digging
		Bucket		R		a 1		315 (4480)	+50 (+710)	+20 (+280)		RV8	Bucket discharge
				H								RV7	Bucket digging
		Swing		RH		a 2		255 (3630)	+5 (+70)	0		RV11	Bucket lock
				LH								RV12	
		Travel motor	RH	Front		a 1		365 (5190)	+50 (+710)	+20 (+280)		—	Insert a proper lock into the 2-speed sprocket teeth on both sides.
				Back									
			LH	Front		a 2							
				Back									
	Negative control pressure	Boom side				Pi1		32 (460)	+22 (+310)	+2 (+110)		—	Measure with all operating levers in neutral position.
		Arm side				Pi2							
Pilot circuit	Primary pressure	Discharge pressure			Pump	P 3	PF1/4	50 (710)	+3 (+40)	-3 (-40)	kgf/cm² (psi)	RV13	All operating levers neutral
	Secondary pressure	Boom			Control valve	PAb,PBb PAbS	PF3/8	50 (710)	+3 (+40)	-3 (-40)		—	At full stroke relief of circuits being measured
		Arm				PAa,PBa							
		Bucket				PAC,PBC							
		Swing				PiA,PiB							
	Secondary pressure for servo	Swing valve				P 7	PF1/8	40 (570)	+13 (+180)	0			Travel+attach
		LH/RH and neutral cut valve				P 8		40 (570)	+13 (+180)	0			Arm discharge relief
						P 9							Boom hoisting relief
	Secondary pressure for mode changeover	Mode H			Pump	a 3	PF1/4	0	+2 (+28)	0		Adjustment not necessary	Changeover to mode H
		Mode S						10.5 (213)	+2 (+28)	-2 (-28)			Changeover to mode S
		Mode F・C						10.5 (213)	+2 (+28)	-2 (-28)			Changeover to modes F and C
		Release						8.0 (114)	+5 (+71)	-1 (-14)			Change over release switch.
		ATT boost pressure (OPT.)						26.5 (377)	+3 (+43)	-3 (-43)			Heavy lift 「ON」

2.7 PROCEDURE FOR ADJUSTING THE PRESSURE OF INDEPENDENT RELIEF VALVES

1) Procedure for Adjusting the Main Relief Valve

Turning the adjust screw clockwise increases the pressure, while turning it couterclockwise decreases the pressure. References for pressure variations are as follows:

For adjusting the 2-step relief valve, loosen lock nut (1) at first, set the high pressure side by means of adjust screw (3), loosen lock nut (2) and then adjust the low pressure side by means of adjust screw (4).

Table 2

Turn of adjust screw	Pressure change kgf/cm² (lbs/in²)
½turn	about 115 (1,635)
¼ turn	about 58 (825)

2) Adjustment procedures for travel relief valve and port relief valve

Turning the adjust it counterclockwise decreases the pressure. Given below are the pressure changes for reference:

Table 3

Turn of adjust screw	Pressure change kgf/cm² (lbs/in²)
½ turn	about 115 (1,635)
¼ turn	about 58 (825)

3) Procedure for adjusting swing relief valve

Turning the adjust screw clockwise increases the pressure and turning the adjust screw counterclockwise decreases the pressure. Given below are guidelines of pressure variation.

Table 4

Turn of adjust screw	Pressure change kgf/cm² (lbs/in²)
1 turn	about 100 (1,422)
¼ turn	about 25 (356)

4) Procedure for adjusting travel motor's relief valve

The travel brake valve can not be pressure adjusted from outside, as shown in the figure on the right. The pressure is adjusted with shims, and pressure variations are given below for reference:

Table 5

O.D., bore dia and thickness of shim	Pressure change kgf/cm² (lbs/in²)
ϕ17×ϕ10×1mm	about 50 (711)
ϕ17×ϕ10×0.5mm	about 25 (356)

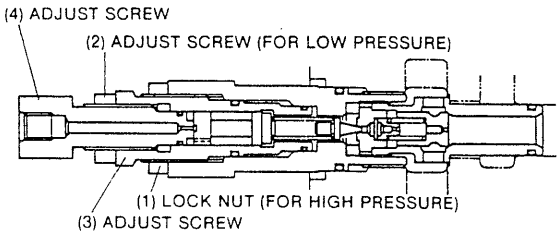
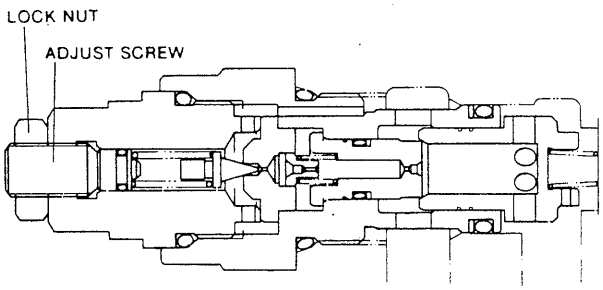


Fig. 6



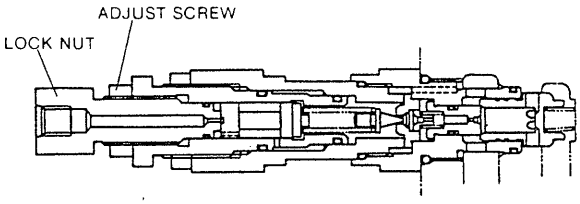


Fig. 7

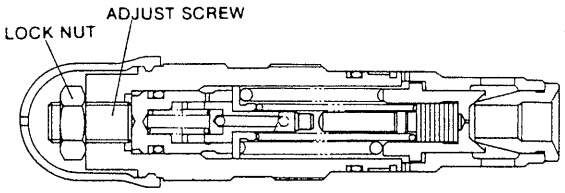


Fig. 8

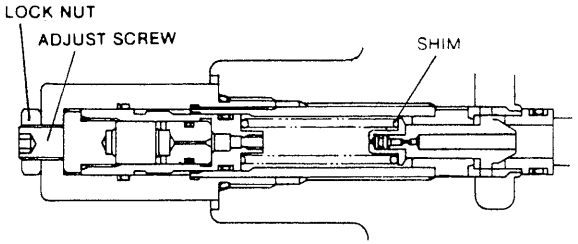


Fig. 9

5) Method of adjusting pilot relief valve

Turning the adjust screw clockwise increases the pressure and turning it counterclockwise decreases the pressure. Referential pressure changes are given below:

Table 6

Adjust screw rotation	Pressure change kgf/cm² (lbs/in²)
1 turn	about 14.4 (204.8)
¼ turn	about 3.6 (51.2)

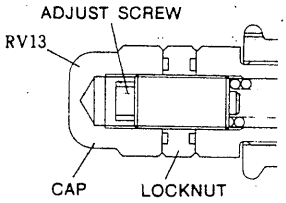


Fig. 10

6) Procedure for adjusting low pressure relief valve

The low pressure relief valve can not be pressure adjusted from outside, as shown in the figure on the under. The pressure can be adjusted with shims and pressure variations are given for reference as follws:

Table 7

O.D., bore dia and thickness of shim	Pressure change kgf/cm² (lbs/in²)
φ23×φ17.6×2mm	about 6 (85)
φ23×φ17.6×1mm	about 3 (43)

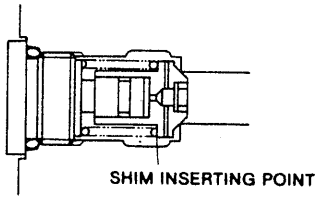


Fig. 11

2.8 PROCEDURE FOR MEASUREMENT AND ADJUSTMENT OF NEGATIVE CONTROL RELIEF PRESSURE

(1) Pressure measuring points

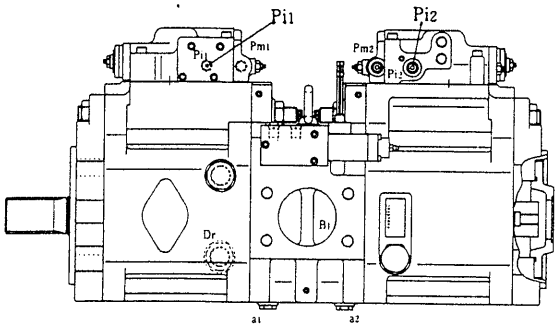


Fig. 12

(2) Measuring procedure and method

1) Connect negative control hoses A and B to Pi1 and Pi2 ports (PF1/4) on the pump side.

2) Attach a tee joint and a 100kg/cm² (1400 psi) pressure gauge to ports Pi1 and Pi2.

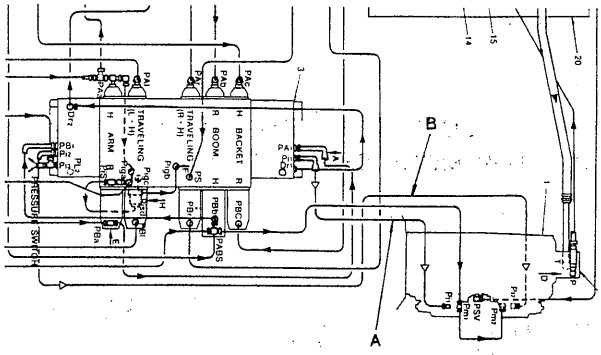


Fig. 13

3) Measure pressure with all operating levers neutral. If pressure is out of an allowable range, adjust shims according to the adjustment procedure.

2.9 PROCEDURE FOR MEASURING AND ADJUSTING THE SECONDARY PILOT PRESSURE AND SERVO PRESSURE

(1) Pressure measuring positions

All ports of the control valve (Fig. 5) and the swing control valve (Fig. 4).

(2) Measuring procedure and method

1) Secondary pilot pressure

Disconnect the piping on the pilot pressure receiving chamber of the control valve located in the pressure line to be measured, attach a 100kg/cm² (1400 psi) pressure gauge and measure pressure when the operating lever is brought to full stroke. Confirm that measurements are within standard range for performance inspection.

NOTE

The secondary pilot pressure may be measured but can not be adjusted. The same thing is true of the servo pressure and mode changeover.

2) Travel preferential changeover valve

Regarding the pilot pressure of the travel preferential changeover valve, measure pressure by locking the travel sprocket and by operating any attachment (boom, arm or bucket) and travel lever at the same time. (pressure built up when the travel cirtuit is relieving itself.)

3) LH/RH neutral cut valve

One neutral cut valve is located on both the lefthand and righthand sides; The pressure of one valve is measured when it is being relieved during arm discharge motion, whereas the pressure of another is measured when it is being relieved during boom hoisting motion.

2.10 MEASURING THE SECONDARY PRESSURE FOR MODE CHANGEOVER

(1) Pressure Measuring Position

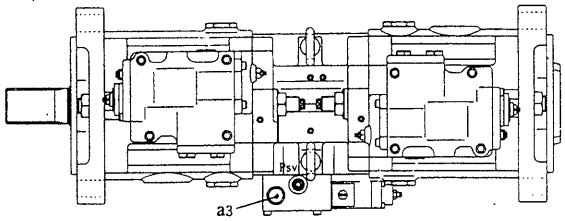


Fig. 14

(2) Measuring Procedure and Method

1) Remove the plug in port (a3) of the electromagnetic proportional pressure reducing valve attached to the pump. Then attach a pressure gauge fixing joint and then a 50kg/cm² (700 psi) pressure gauge to it.
2) Bring all operating levers to neutral position.
3) Change each switch and measure pressure.

H, S and FC modes: Measure by setting the mode changeover switch to each mode.

Release mode: Measure by bringing the mode reliease switch to RELEASE.

Attachment boost pressure: Measuer by depressing the attach boost pressure button.

2.11 PILOT VALVE'S LEVER STROKE, SECONDARY PRESSURE, LEVER STROKE AND OPERATING FORCE

PERFORMANCE CHARACTERISTICS

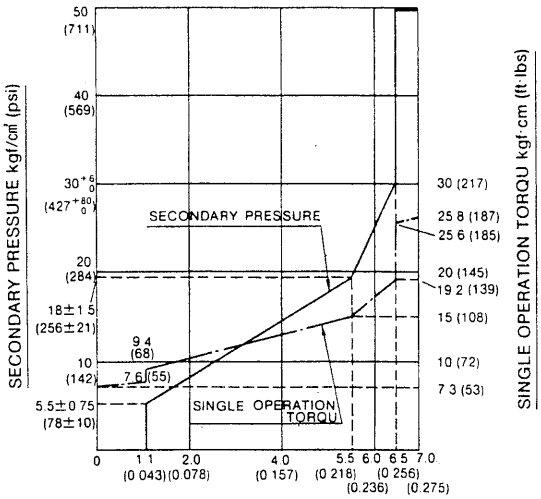


Fig. 15

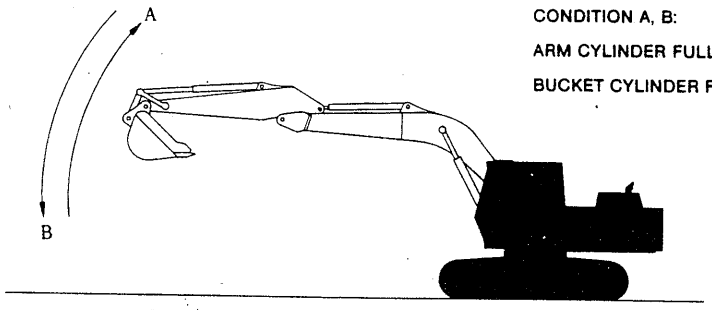
3. CYLINDER SPEED

Condition:

Engine at high idling, oil temperature of 50±5℃.

Procedure:

Measure the time from the most retracted (extended) condition to the most extended (retracted) condition of cylinders at lever full stroke with a stop watch, except that for the boom cylinder the time shall be from the ground level to the highest position. Make three mesurements and record the average value.



CONDITION A, B:
ARM CYLINDER FULLY RETRACTED.
BUCKET CYLINDER FULLY EXTENDED.

Fig. 16

CONDITION C, D: BOOM CYLINDER FULLY EXTENDED.
BUCKET CYLINDER FULLY RETRACTED.

CONDETION E, F: SET THE ARM TIP POINT TO THE BOOM FOOT HEIGHT,AND SET THE ARM ABOUT 90° TO ARM CYLINDER.

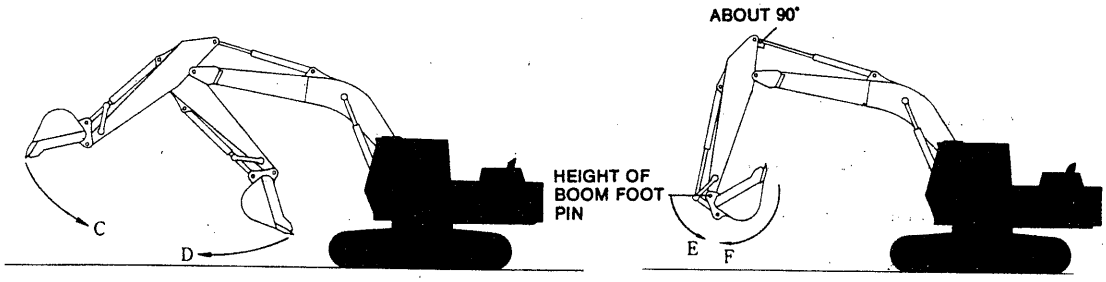


Fig. 17

Table 8 Unit: sec

Symbol	Item	Standard value(3.4m(11'2")arm)	Remarks
A	Boom cylinder extension	3.1~3.7	H Mode
B	Boom cylinder retraction	3.1~3.7	H Mode
C	Arm cylinder extension	4.8~5.4	H Mode
D	Arm cylinder retraction	3.6~4.2	H Mode
E	Bucket cylinder extension	5.0~5.6	H Mode
F	Bucket cylinder retraction	2.9~3.5	H Mode

NOTE

The operating time does not include the cushion stroke times.

4. CYLINDER OIL-TIGHTNESS

Condition:

Engine stopped, oil temperature of 50±5℃, fully retract the arm cylinder and hold the bucket (empty) at 1.5m (4ft-11in) above ground.

Procedure:

After keeping the machine for three minutes under the above condition, measure the movement of the cylinders and the fall of the bucket top end in ten minutes.

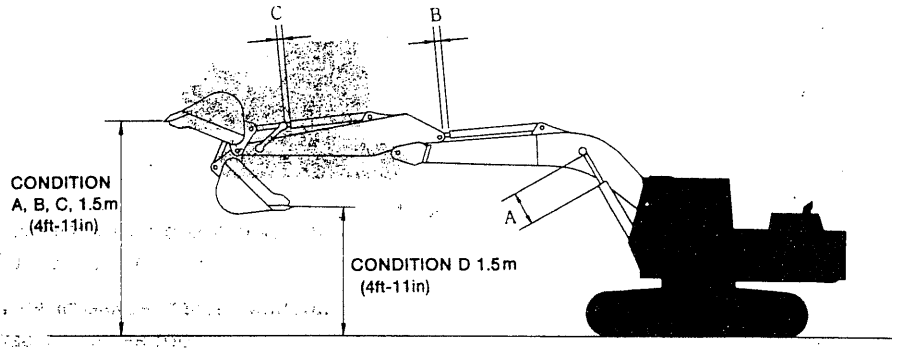


Fig. 18

Table 9

Symbol	Item	Standard value	Remarks
A	Boom cylinder (Retraction of rod)	35	
B	Arm cylinder (Extension of rod)	—	
C	Bucket cylinder (Extension of rod)	—	
D	Fall of bucket top end	550 mm / 10 min (22 in / 10 min)	

5. SWING PERFORMANCE

A. Swing performance

Condition:

Engine at high idling, oil temperature of 50 ± 5℃, fully retract the bucket cylinder and arm cylinder, and hold the bucket (empty) at 1.5 m (4 ft-11 in) above ground.

Procedure:

Measure the time required to make two turns after one turn of start-up with a stop watch and give the time required to make one turn. Repeat it three times and give an average value.

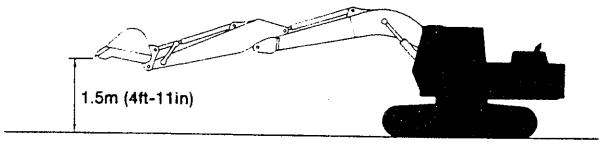


Fig. 19

B. Swing brake

condition:

Engine at high idling, oil temperature of 50 ± 5℃, fully extend the bucket cylinder and fully retract the arm cylinder, and hold the bucket (empty) at 1.5m (4ft-11 in) above ground.

Procedure:

Measure the braking distance at the top end of the bucket, actuating swing relief valve after one turn of start-up. Repeat it three times on clockwise and counterclockwise direction respectively and give an average value for each direction.

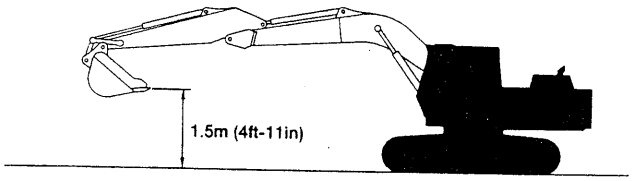


Fig. 20

C. Swing maintain performance

Condition:

Engine stopped, oil temperature of 50 ± 5℃, fully retract the bucket cylinder and the arm cylinder, and set the machine on a 10 deg. slope, holding the bucket at 1.5m (4ft-11 in) above ground.

Direct the attachment perpendicular to the slope and measure the swing (overrun) at the bucket top end for 20 seconds. Measure it in both the clockwise and counterclockwise directions.

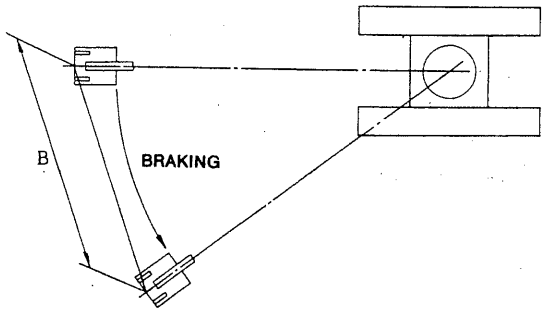


Fig. 21

Table 10

Symbol	Item	Standard value	Remarks
A	Swing speed	6.6~7.2	
B	Swing brake performance	11.3~16.7m (37'~55')	(65°~105°)
C	Swing maintain performance	0 mm/20 sec (0 in/20 sec)	

NOTE

Measure the swing drift value in "C" 10 seconds after the engine stops.

6. TRAVEL PERFORMANCE

A. Travel deflection

Condition:

Engine at high idling, oil temperature of 50 ± 5 ℃, on level solid soil, approach run more than 2 m. (6 ft-7 in)

Procedure:

Draw a target line parallel to the crawler and measure deflection in 20 m (65 ft-7 in) of running. Repeat it three times and give an average value.

B. Travel speed

Condition:

Engine at high idling, oil temperature of 50 ± 5℃, on level solid soil, with approach run more than 2 m. (6 ft-7 in)

Procedure:

Measure the time to run 20 m (65 ft-7 in), using a stop watch. Repeat it three times and give an average value.

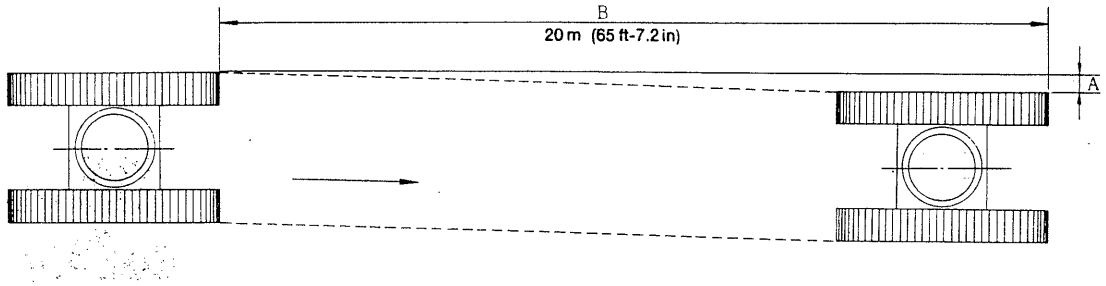


Fig. 22

C. Parking brake

Condition:

Engine stopped, oil temperature of 50 ± 5℃, a slope of 17 degrees.

Procedure:

Leave the machine for one minute with its bucket and arm cylinders fully retracted and with its bucket held at 2 m (6 ft-7 in) above ground, and measure the distance in which the machine moves back in ten minutes.

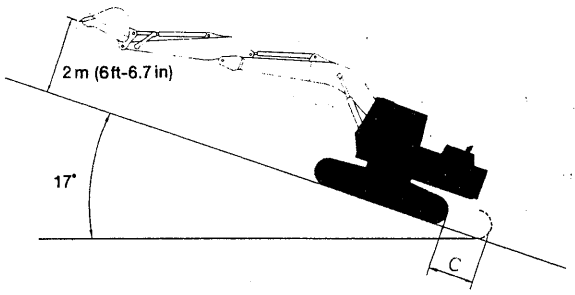


Fig. 23

Table 11

Symbol	Item	Standard value	Remarks
A	Travel deflection	0~1200 mm (3ft-11 in)	
B	Travel speed	1 st 19.8~22.8 sec/20 m 2 nd 11.6~14.6 sec/20 m	H Mode
C	Parking brake	0mm	

7. OIL DRAIN FROM MOTORS

A. Swing motor

Condition:

Engine at high idling, oil temperature of 50±5℃.

Procedure:

With the swing locked, measure the drain for one minute, with the hydraulic system in relief state.

B. Travel Motor

Condition:

Engine at high idling, oil temperature of 50±5℃.

Procedure:

With the travel motor locked, measure the drain for one minute, with the hydraulic system in relief state.

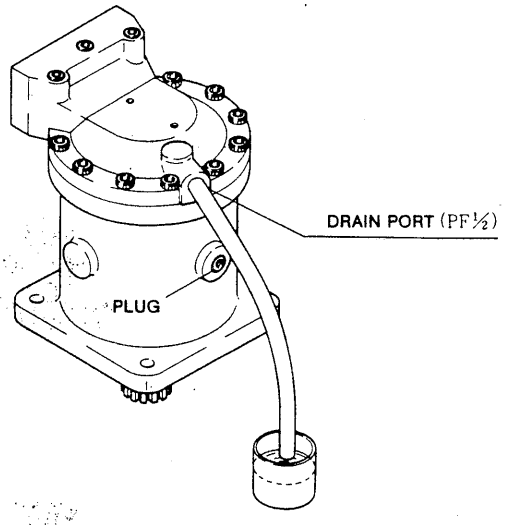


Fig. 24

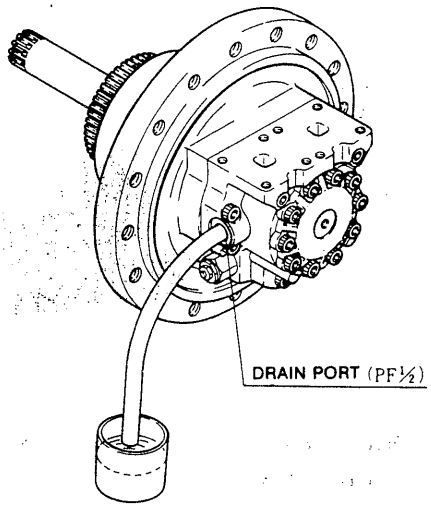


Fig. 25

Table 12

Unit: ℓ/min (gal/min)

Symbol	Item	Standard value	Allowable value	Remedy
A	Drain of swing motor	14 (3.7)	28 (7.4)	Overhaul
B	Drain of travel motor	15 (4.0)	30 (7.9)	Overhaul