

SERVICE MANUAL

Crawler Excavators
E265B

VERSION - C

Print No.87495895A

From S/N - N7DA26001

CONSTRUCTION

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TROUBLESHOOTING SECTION

46-TROUBLESHOOTING (BY ERROR CODES)

46.1	EVALUATION OF ACTUAL PROBLEM AT THE SITE	46-3
46.2	CLASSIFICATION OF FAILURE AND TROUBLESHOOTING.....	46-4
46.3	MECHATRO CONTROLLER BLOWN FUSE	46-4
46.4	TROUBLESHOOTING BY ERROR CODE.....	46-4

47-TROUBLESHOOTING (BY SYMPTOM)

47.1	HYDRAULIC SYSTEM.....	47-3
47.2	ELECTRIC SYSTEMS	47-27
47.2.1	WIRING CHECKING PROCEDURE.....	47-27
47.2.2	TROUBLE	47-30
47.3	ENGINE RELATED TROUBLESHOOTING.....	47-33

48-TROUBLESHOOTING (BY DIAGNOSIS MODE)

48.1	TROUBLE DIAGNOSIS MODE	48-3
------	------------------------------	------

ENGINE SECTION

51-ENGINE

CHAPTER 1 - DIAGNOSTICS	1-1
CHAPTER 2 - 6.7 L T/A ENGINE OVERHAUL.....	2-1
CHAPTER 3 - CHARGING AND START-UP	3-1

1. OUTLINE

(3) Inspecting parts

- 1) Check that the disassembled parts for damage or heavy wear.
- 2) Measure the wear of parts and clearance, and record the measured values.
- 3) If a part has damage or heavy wear, replace the part.

(4) Assembling hydraulic equipment

- 1) During the parts cleaning, ventilate the room.
- 2) Before assembly, thoroughly clean all parts.
- 3) Apply clean hydraulic oil or gear oil prior to assembly.
- 4) Replace the removed O-ring, back-up rings and oil seal with new ones, and apply grease oil on them before assembling.
- 5) Fully clean the surface on which liquid sealants are applied.
- 6) Before assembling, remove rust preventives on new parts.
- 7) Use special tools to fit bearings, bushing and oil seal.
- 8) Assemble parts using the alignment marks made during disassembly.

(5) Installing hydraulic equipment

- 1) Use the correct hydraulic oil and lubrication oil.
- 2) Air removal is required in the following cases:
 1. Change of hydraulic oil
 2. Replacement of parts on suction pipe side
 3. Removing and installing hydraulic pump
 4. Removing and installing swing motor
 5. Removing and installing travel motor
 6. Removing and installing hydraulic cylinder



If hydraulic oil and lubricating oil are not filled and also air bleed is not performed, the hydraulic equipment may be damaged.

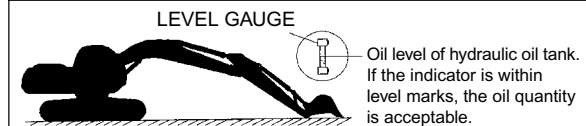
- 3) For air removal in the hydraulic pump and swing motor, loosen but do not remove the drain plug on the upper housing, start engine, and run in low idle until hydraulic fluid flows from the port. Tighten the plug securely.
- 4) For air removal from the travel motor and hydraulic cylinder, start engine and operate for 10 minutes or more at no-load and low idle.



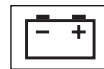
For cylinder, don't move it to the stroke end at beginning.

- 5) Air in pilot circuits can be removed by only operating digging, swing and traveling motions thoroughly.
- 6) Check hydraulic oil level.
Move attachments to hydraulic oil check position, and check hydraulic oil level of tank. Add oil if the oil level is lower than the specified level.
How to check oil level of hydraulic oil tank

Important information



1.1.4 ELECTRICAL EQUIPMENT



- (1) Handle equipment with care so as not to drop or bump it.
- (2) Connector should be removed by unlocking while holding the connector.
Never stress in tension to the caulked section by pulling wire.
- (3) Check that connector is connected and locked completely.
- (4) Turn the engine key OFF before disconnecting and connecting connectors.
- (5) Turn the engine key OFF before touching terminals of starter and alternator.
- (6) Remove battery grounding terminal before beginning work close to battery and battery relay with tools.
- (7) Wash machine with care so as not to splash water on electrical equipment and connector.
- (8) Before connecting a waterproof connector, check the connector ends for moisture. If moisture is present, dry it completely before connecting.

2. SPECIFICATIONS

Item	Unit ; kg (lb)
	E265B
4. Lubricant and water (assembly of following :)	590 (1,300)
4.1 Hydraulic oil	160 (350)
4.2 Engine oil	20 (44)
4.3 Fuel	380 (840)
4.4 Water	30 (66)

Note

* Dry weight.

3. ATTACHMENT DIMENSIONS

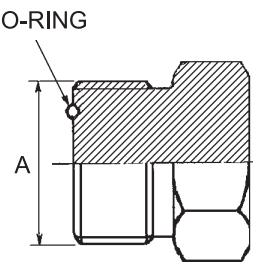
Issue	Date of Issue	Applicable Machines	Remarks
First edition	May, 2007	E265B	87495895A

NOTES

11. TOOLS

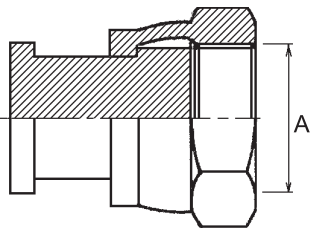
(4) Plug for ORS joints

Male



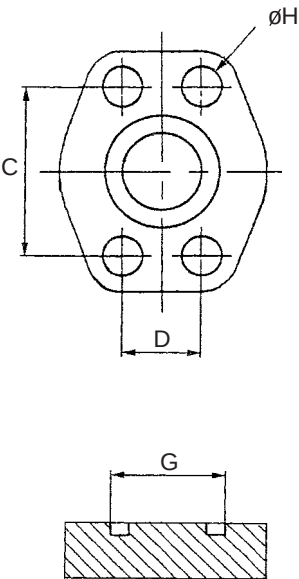
Screw size A	Applicable hose O.D	Plug parts No.	Opposing flats (HEX)	O-ring parts No.	Nominal O-ring
1-14UNS	ø21.7	YN01H01001P1	27	ZD12A01600	1B A16
1 3/16-12UN	ø27.2	YN01H01002P1	36	ZD12A01800	1B A18
1 7/16-12UN	ø34.0	YN01H01003P1	41	ZD12A02100	1B A21

Female



Screw size A	Applicable tube O.D	Plug parts No.	Opposing flats (HEX)
1-14UNS	ø21.7	YN01H01004P1	32
1 3/16-12UN	ø27.2	YN01H01005P1	36
1 7/16-12UN	ø34.0	YN01H01006P1	41

(5) Plug for half clamp



Fo t e u e MP						
S e	P u t No	C	D	G	H	O t No
	E					D
	E					D P
	E					D P
	E					D P

Fo e u e MP						
S e	P u t No	C	D	G	H	O t No
	E					D
	E					D P
	E					D P
	E					D P

[MEMO]

12. STANDARD MAINTENANCE TIME TABLE

Group	Location	Work to be done	Unit	Remarks	Unit : Hour
03 Swing frame	144 • Others	Detach/attach	1 set		0.5
	145 • Mounting bolt	Detach/attach	1 pc.		0.5
	146 • Engine slinging	Detach/attach	1 set		0.2
	147 • Cleaning	Cleaning	1 pc.		0.3
	148 Engine	O/H	1 set	Reference for engine (Chapter 51)	
	Other necessary works	Detach/attach	1 set	Removing and installing guard	0.6
		Detach/attach	1 set	Removing and installing Counterweight	0.6
		Detach/attach	1 set	Removing and installing pump	3.2
		Detach/attach	1 set	Removing and installing air cleaner	0.4
		Detach/attach	1 set	Removing and installing muffler	0.4
		Detach/attach	1 set	Removing and installing radiator	4.0
	150 Upper frame			See 33.1.21	
	151 Upper frame assembly	Detach/attach	1 pc.	After removing swivel joint	1.3
	152 • Mounting bolt	Detach/attach	1 set		0.4
	153 • Upper frame slinging	Detach/attach	1 pc.		0.4
	154 • Cleaning	Cleaning	1 pc.		0.3
	155 • Sealant	Apply	1 pc.		0.2
	Other necessary works	Detach/attach	1 set	Cab	1.4
		Detach/attach	1 set	Guard	0.4
		Detach/attach	1 set	Counterweight	0.6
		Detach/attach	1 set	Boom	1.4
04 Travel system	00 Travel relation			See 34.1.2	
	01 Track link assembly	Detach/attach	One side	Include adjustment of tension	1.5
	02 • Track link attaching and detaching position	Preparation	One side		0.1
	03 • Master pin	Detach/attach	One side		0.5
	04 • Track link extending and winding	Detach/attach	One side		0.5
	05 Shoe plate	Replace	1 pc.		0.4
	10 Upper roller relation			See 34.1.3	
	11 Upper roller assembly	Detach/attach	1	After removing track link	0.2
	12 Upper roller	O/H	1		1.0
	20 Lower roller relation			See 34.1.4	
	21 Lower roller assembly	Detach/attach	1		0.2
	22 Lower roller	O/H	1		1.5
	30 Front idler relation			See 34.1.5	
	31 Front idler assembly	Detach/attach	One side	After removing track link	0.6
	32 Front idler assembly slinging	Detach/attach	One side		0.3
	33 Front idler assembly	Detaching	One side		0.3
	34 Idler assembly	O/H	One side		1.0

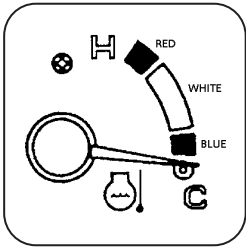
13.3 MEASUREMENT OF ENGINE SPEED

13.3.1 MEASUREMENT OF ENGINE SPEED

(1) Warming up of engine

Start engine to raise the coolant temperature of engine to 60 to 90°C (140 to 194°F) at surface of radiator upper tank.

The E/G coolant temperature gauge is used to measure. The range in white color shows the temperature of approx. 65 to 105°C (149 to 221°F), so confirm that the pointer indicates the temperature within the white range.



(2) Engine speed measured value through service diagnosis (See Fig. 13-2)

- 1) Turn "ON" the starter switch with the buzzer stop switch pressed.
- 2) A program No. and an actual engine revolution are displayed as the No.2 Item.
- 3) The screen advances -- No.2, No.3, etc. -- each time the wiper switch on the gauge cluster is pushed.
- 4) The screen returns -- No.45, No.44, etc. -- each time the "washer switch" is pushed.
- 5) The display does not disappear unless the starter switch is turned to "OFF".

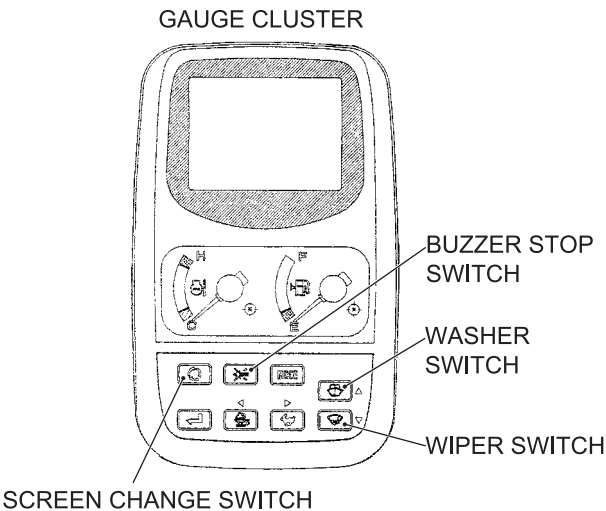


Fig. 13-1 Switch for E/G speed indication

NO	ENG	
G	SPEED SET	
	MEAS	
	MEAS	
G	ENG OIL PRS	LIVE
	WATER TEMP	°C OF
F	MODE	HM
H	ACCEL VOLT	V
	POS	
	ECU OUTPUT	V

Fig. 13-2 Service diagnosis for E/G speed measuring (Example)

13. MAINTENANCE STANDARD AND TEST PROCEDURE

(4) Measurement

- 1) When operating in regular swing speed, by shifting lever to neutral position at pole position the swing operation stops.
- 2) Calculate the swing drift angle by the following equation, after the upper swing body stops, using the amount of deflection (m) of the matching marks on the swing race and the length (m) of the circumference of the swing race :

Swing drift angle (°) = $\frac{\text{Amount of deflection of matching marks [m (ft-in)]}}{\text{Circumferential length of swing race [m (ft-in)]}} \times 360^\circ$

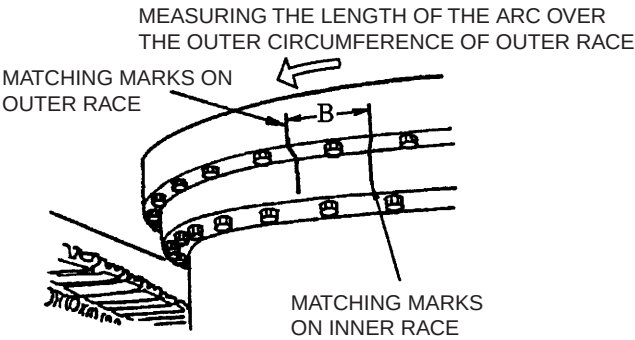


Fig. 13-22 Measuring position of swing brake performances

S	b	k	e	e	o	ce	U	t	e	ee
Me	u				St	ue	Re	e	ce	ue
o	t						o	e	e	
S		°			°			°		°

13.6.3 PERFORMANCE OF SWING PARKING BRAKE

(1) Purpose

To confirm the mechanical performances of the swing parking brake that is fitted to the inside of the swing motor.

(2) Conditions

On a slope of 15 degree incline.
Stop the machine at right angles with the slope. Put the bucket empty, retract the arm cylinder fully and extend the bucket cylinder fully. And move the boom so that the arm top pin is positioned at same height with boom foot pin.

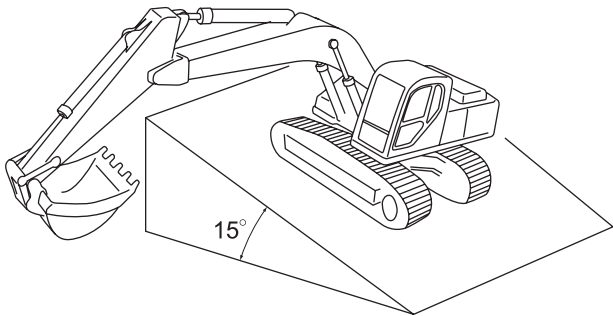


Fig. 13-23 Swing parking brake performance measuring position

(3) Preparation

Put the angle meter on the shoe plate and make sure that the angle is more than 15 degree.
Put a matching mark on the outer race side and on the inner race side.

(4) Measurement

Stop the engine and wait five minutes. Measure the length of the movement of the matching marks.

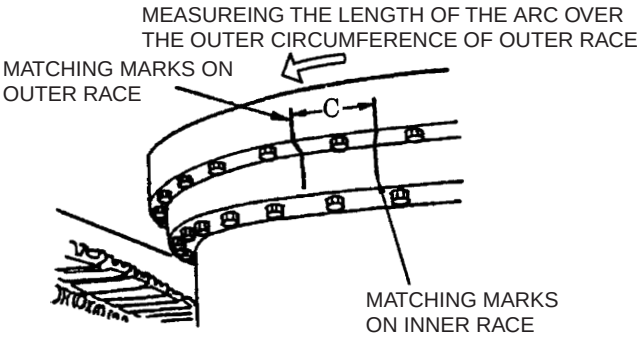


Fig. 13-24 Measuring position of swing parking brake performances

Pe	o	ce	o	k	b	k	e	U	t
Me	u			St	ue	Re	e	ce	ue
o	t					o	e	e	
C									

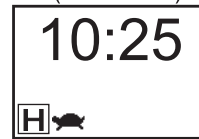
13. MAINTENANCE STANDARD AND TEST PROCEDURE

- (5) When the adjustment of unloading valve only is performed; ("C" adjustment)
In the event where only unloading valve and unloading proportional valve are replaced, perform the adjustment of unloading valve only.

Procedure

- 1) Turn starter switch ON keeping the work mode selector switch on the gauge cluster pressed, and hold it for 5~10 seconds, and then release it.
(If the engine is started, the following indication is not displayed. Therefore, do not start the engine.)

MULTI DISPLAY
(EXAMPLE)



- 2) Keep buzzer stop switch on gauge cluster pressed for 5 seconds and release it and the screen for selection of adjustment type is displayed. And "ADJUST" is displayed.

When adjustment data is not entered in mechatro controller, "READY" is indicated. If the adjustment operation is once performed, "FIN" is indicated.
And the lever lock solenoid is automatically released, disabling all operations.

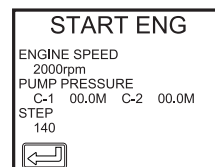


- 3) Change the adjusting items with washer switch (▲) and wiper switch (▼), and select "ADJUST UNLOAD". (See Fig. 13-35)

Like the output adjustment, when adjustment data is not entered in mechatro controller, "READY" is indicated. If the adjustment operation is once performed, "FIN" is indicated.

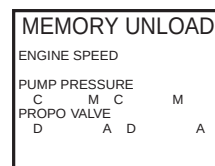


- 4) Press selector switch on gauge cluster to display "START ENG".
"ENGINE SPEED", P1, P2 "PUMP PRESSURE" and "STEP" (acceleration command voltage) are indicated.



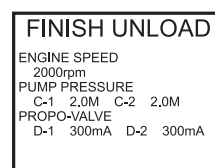
- 5) After starting engine, press selector switch on gauge cluster and "MEMORY UNLOAD" is indicated, the engine speed is automatically increased and the adjustment of unloading valve is performed.

"ENGINE SPEED", P1, P2 "PUMP PRESSURE" and "PROPO-VALVE" (acceleration command current) are indicated.



- 6) When the unloading proportional valve operates to the specified value, the adjustment of unloading proportional valve automatically completes. "FINISH UNLOAD" is indicated.

The speed is shifted to the speed corresponding to acceleration potentiometer. The value of adjusting current is indicated on the display of current of P1 and P2 unloading proportional valves. The adjusting range is usually 520~635mA.



Stop the engine. (The adjusted data is automatically stored.)

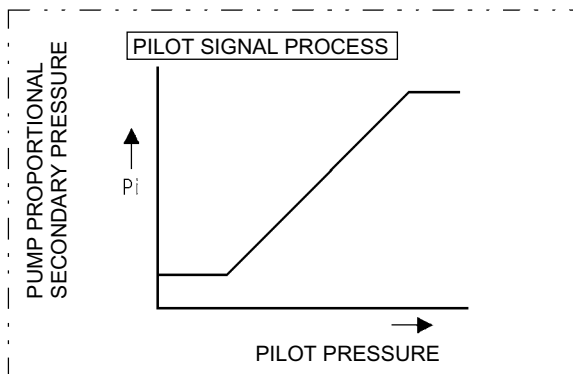
(1) Positive control

- 1) When beginning an operation, pilot secondary pressure switches each spool and enters each low pressure sensor.
- 2) The output voltage of low pressure sensor is input to mechatro controller and the mechatro controller processes pilot signal and outputs command according to the input voltage to each unload pressure proportional valve.
- 3) Each pump proportional valve outputs pilot secondary pressure according to the command output by mechatro controller and changes the swash plate angle of each pump and controls the pump output.
- 4) With this operation, the delivery rate according to lever manipulated movement is fed to the actuator, and consequently the working speed according to the lever manipulated movement will be obtained.

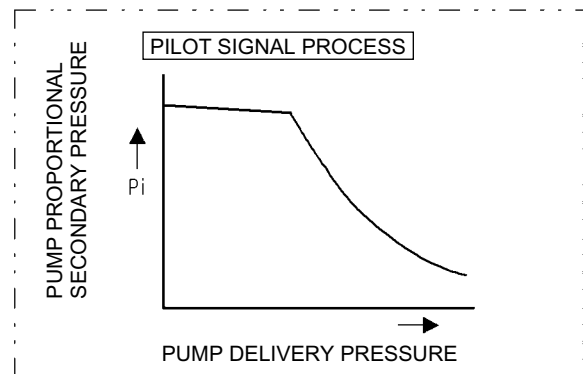
(2) P-Q control

- 1) The output voltage of high pressure sensor provided on each pump line is input to mechatro controller and the mechatro controller processes pilot signal and operates the command according to the input voltage (load pressure).
- 2) The lower value between command values calculated by positive control and operated value found by P-Q control {operated value found in item 1}) is selected and is output to each pump proportional valve as command value.
- 3) Each pump proportional valve outputs pilot secondary pressure according to the command output by mechatro controller and changes tilting angle of each pump and controls the delivery rate.
- 4) With this operation, the delivery rate according to lever manipulated movement is fed to actuator and consequently working speed will be obtained according to lever movement.

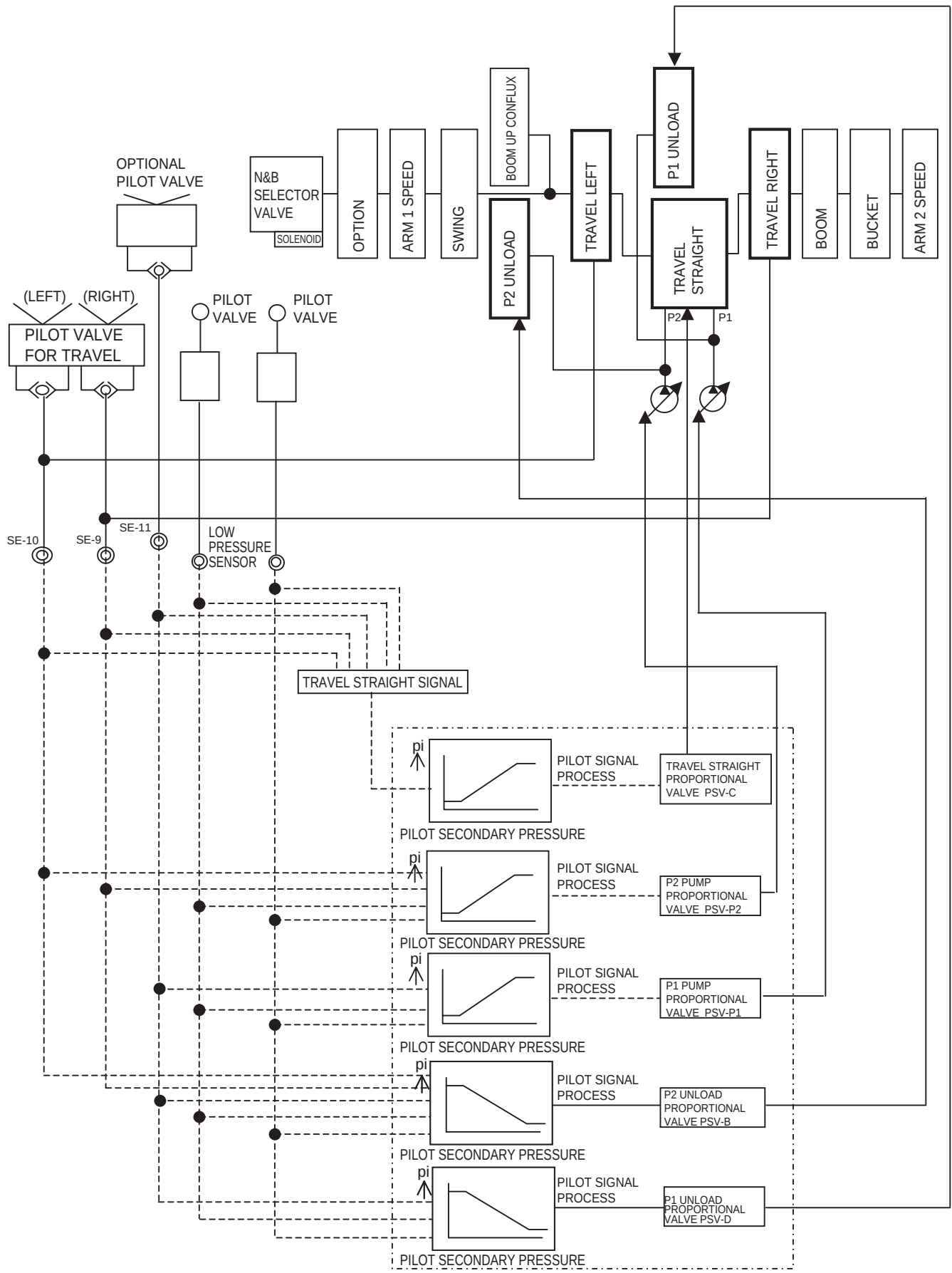
POSITIVE CONTROL



P-Q CONTROL



21.1.11 TRAVEL STRAIGHT CONTROL



(4) MAINTENANCE SCREEN DISPLAYS

This screen displays the remaining time to the end of recommended replacement/change interval specified for filter/oil.

For the initial set value of recommended replacement/change time, see the following table.

Replacement interval

Item		Default
Engine oil		500 Hr
Fuel filter		500 Hr
Hydraulic oil filter		1,000 Hr
Hydraulic oil		5,000 Hr

This menu is available for confirmation of the following items.

The maintenance screen changes each time the screen change switch is pressed.

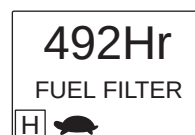
1. Remaining time display to the engine oil change

This display shows the remaining time to the coming engine oil change.



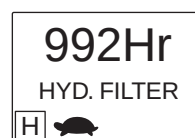
2. Remaining time display to the coming fuel filter replacement

This display shows the remaining time to the coming engine fuel filter replacement.



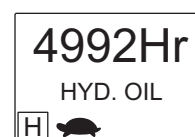
3. Remaining time display to the coming hydraulic oil filter replacement

This display shows the remaining time to the coming hydraulic oil filter replacement.



4. Remaining time display to the coming hydraulic oil change

This display shows the remaining time to the coming hydraulic oil change.



Notice

- The display automatically changes to the main screen, if switch is not operated for 30 seconds.
 - For the setting procedure of maintenance time to be performed to the coming oil change in each type and filter replacement, see the 21.2.6 SET PROCEDURE OF MAINTENANCE SCHEDULE.
-

Operation No.8 :

Arm-out in full lever operation & relief

H mode Hi idle

No.32 ARM, SWING

C-1	P1-PRES	33.0~35.8 M
C-2	P2-PRES	33.0~35.8 M
E-1	P1-PSV	415~525 mA
E-2	P2-PSV	415~525 mA
D-1	P1-UL(BPC)	360 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	750 mA
B-3	ARM OUT	3.0 M
B-4	ARM IN	0.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	0.0 M
G-3	ENG SPEED	2100~2200
	POWER SHIFT	0 mA

* Measure the values after a lapse of 5 minutes or after release of low temperature mode

Operation No.9 :

Arm-out in full lever operation & in operation

H mode Hi idle

No.32 ARM, SWING

C-1	P1-PRES	15.0~22.0 M
C-2	P2-PRES	15.0~22.0 M
E-1	P1-PSV	488~677 mA
E-2	P2-PSV	488~677 mA
D-1	P1-UL(BPC)	360 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	750 mA
B-3	ARM OUT	3.0 M
B-4	ARM IN	0.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	0.0 M
G-3	ENG SPEED	2100~2200
	POWER SHIFT	0 mA

* Measure the values after a lapse of 5 minutes or after release of low temperature mode

Operation No.10 :

Swing in full lever operation & relief

H mode Hi idle

No.32 ARM, SWING

C-1	P1-PRES	0.5~1.8 M
C-2	P2-PRES	28.0~35.8 M
E-1	P1-PSV	350 mA
E-2	P2-PSV	557~660 mA
D-1	P1-UL(BPC)	750 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	750 mA
B-3	ARM OUT	0.0 M
B-4	ARM IN	0.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	3.0 M
G-3	ENG SPEED	2100~2200
	POWER SHIFT	0 mA

Operation No.11 :

Swing in full lever operation & in operation

H mode Hi idle

No.32 ARM, SWING

C-1	P1-PRES	0.5~1.8 M
C-2	P2-PRES	10.0~15.0 M
E-1	P1-PSV	350 mA
E-2	P2-PSV	660 mA
D-1	P1-UL(BPC)	750 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	750 mA
B-3	ARM OUT	0.0 M
B-4	ARM IN	0.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	3.0 M
G-3	ENG SPEED	2100~2200
	POWER SHIFT	0 mA

21. MECHATRO CONTROL SYSTEM

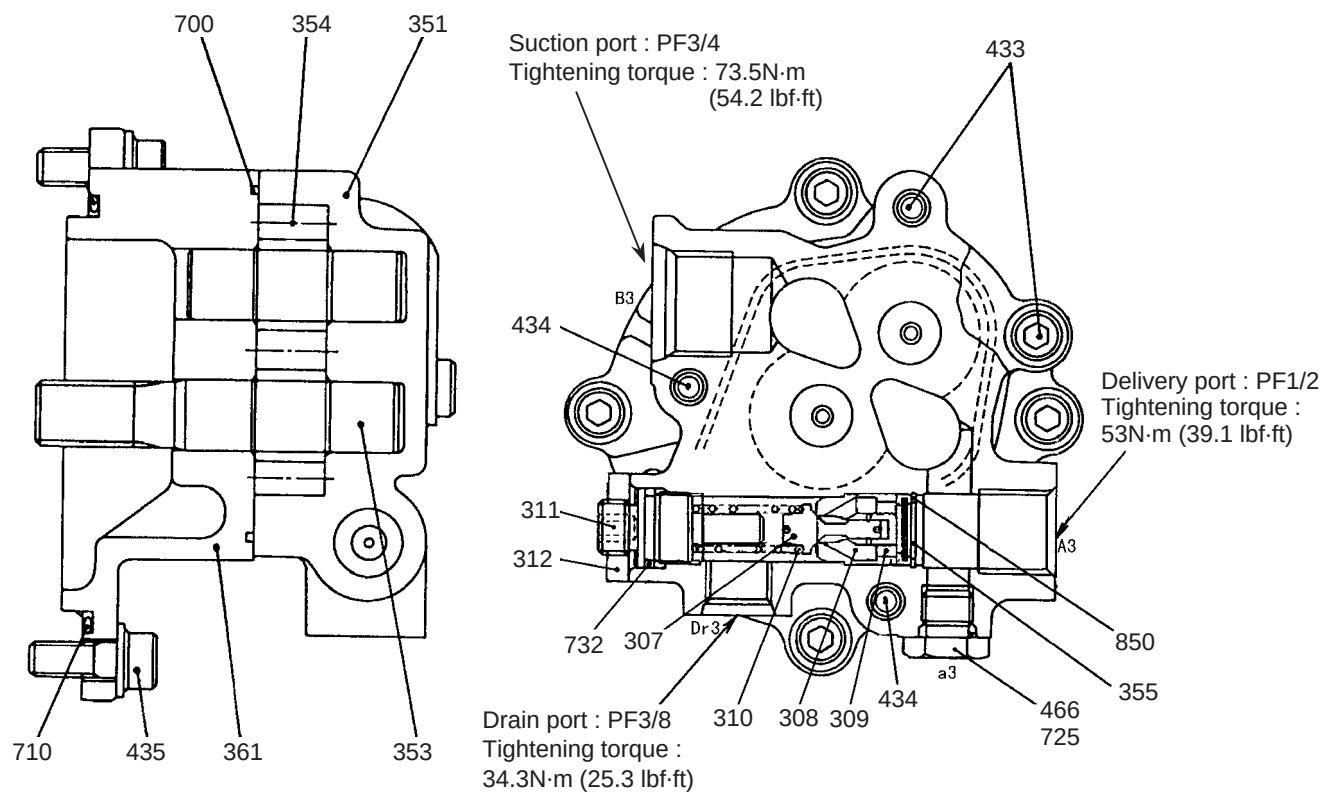
Connector No.	Pin No.	Port name	Function	Input/putput	Signal level
CN104	1	GA	Boom head (over load)	Input	0V
	2	A17			0.5~4.5V
	3	+5VA			Power output 5V
	4	+5VA	Spare	Input	Power output 5V
	5	A18			0.5~4.5V
	6	GA			0V
	7	GA	Extra pressure source	Input	0V
	8	A19			0.5~4.5V
	9	+5VA			Power output 5V
	10	+5VA	Spare	Input	Power output 5V
	11	A20			0.5~4.5V
	12	GA			0V
	13	A21	Engine coolant temperature	Input	Resistor
	14	GA	Fuel level	Input	Resistor
	15	A22			Resistor
	16	GP			Resistor
	17	A23	Selector detection	Input	0V
	18	GA			0.5~4.5V
	19	GA			Power output 5V
	20	A24	Extra pressure source	Input	Power output 5V
	21	+5VA			0.5~4.5V
	22	+5VA			0V
	23	A25		Input	0V
	24	GA			0.5~4.5V
	25	GA			Power output 5V
	26	A26	Spare	Input	GND / OPEN
	27	+5VA			
	28	DI 1			

Connector No.	Pin No.	Port name	Function	Input/putput	Signal level
CN105	1	+24V	Battery relay output side		20~32V
	2	+24V	Battery relay output side (sensor analog output)		20~32V
	3	+24V	Battery relay output side		20~32V
	4	DO 7	Travel 1,2 speed select valve	Output	24V/OPEN
	5	DO 8	Swing P/B select valve	Output	24V/OPEN
	6	DO 9	Travel 1,2 speed select valve	Output	24V/OPEN
	7	DO 11	Attachment boost select valve	Output	24V/OPEN
	8	GND	Battery (-)		0V
	9	GND	Battery (-)		0V
	10	D10+	OPT changeable relief 1	Output	+0~800mA
	11	D1+	P1 unload	Output	+0~800mA
	12	D1-			-0~800mA
	13	D2+	P2 unload	Output	+0~800mA
	14	D2-			-0~800mA
	15	D3+	Travel straight	Output	+0~800mA
	16	D3-			-0~800mA
	17	D4+	Arm in	Output	+0~800mA
	18	D4-			-0~800mA
	19	D5+	P1 pump	Output	+0~800mA
	20	D5-			-0~800mA
	21	GND	Battery (-)		0V
	22	D10-	OPT changeable relief 1	Output	-0~800mA
	23	D6+	P2 pump	Output	+0~800mA
	24	D6-			-0~800mA
	25	D7+	Spare	Output	+0~800mA
	26	D7-			-0~800mA
	27	D8+	Spare	Output	+0~800mA
	28	D8-			-0~800mA
	29	D9+	Spare	Output	+0~800mA
	30	D9-			-0~800mA
	31	+24V	Battery direct connection		20~32V

[MEMO]

24. COMPONENTS SYSTEM

(2) Gear pump (For pilot)



No.	Parts	Q'ty	No.	Parts	Q'ty
307	Poppet	1	361	Front case	1
308	Seat	1	433	Flange socket; M8×40	2
309	Ring	1	434	Flange socket; M8×55	2
310	Spring	1	435	Flange socket; M8×20	4
311	Adjust screw	1	466	VP plug ; PF1/4	1
312	Lock nut ; M14×1.5	1	700	Ring	1
351	Gear case	1	710	O-ring ; 1B G95	1
353	Drive gear	1	725	O-ring ; 1B P11	1
354	Driven gear	1	732	O-ring ; 1B P16	1
355	Filter	1	850	Locking ring	1

- b. Flow rate recovery operation (See Fig. 24-15)
Because the compensating rod (623) is pushed toward (S) with the force of outer spring (625) and inner spring (626) with reduction of self pump delivery pressure $Pd1$, and moves to the position the spring force of outer spring (625) and inner spring (626) balances the delivery pressure $Pd1$. The movement of compensating rod is transferred to lever 1 (612) through pin (875), and rotates at (T) fulcrum in arrow direction.

Furthermore the lever 1 (612) movement is transferred to feedback lever (611) through pin (897) and rotates at (T) fulcrum in the same arrow direction as (N). Consequently the spool (652) connected to feedback lever moves toward (V).

As the spool moves toward (V), CL port is open and connected to tank port, the pressure of servo piston large bore diameter chamber is released and the servo piston (532) moves toward (W) with delivery pressure $Pd1$ in small bore diameter chamber, and consequently the flow rate is raised. Since the feed back lever is connected to servo piston and spool, the feed back lever rotates at (X) fulcrum with the movement of the servo piston toward (W), consequently the spool is returned to the original position.

With this movement, the opening of spool sleeve gradually closes, and the servo piston stops at the position the opening closes completely.

- 3) Priority mechanism of low tilt angle (low flow rate) command

As explained, the tilting commands of flow rate control and power control are transferred to feedback lever (611) and spool (652) through the large bore section of lever 1 (612) and lever 2 (613), but because the pin (dia 5) is extruded in large bore (dia 9), pin (897) on the side where making tilt angle smaller contacts with it, consequently the bore (dia 9) of lever on the side where larger tilt angle command is given is free without contact with pin (897). In this mechanical selecting manner, the command on the side of low tilt angle of the flow rate control and power control has a priority.

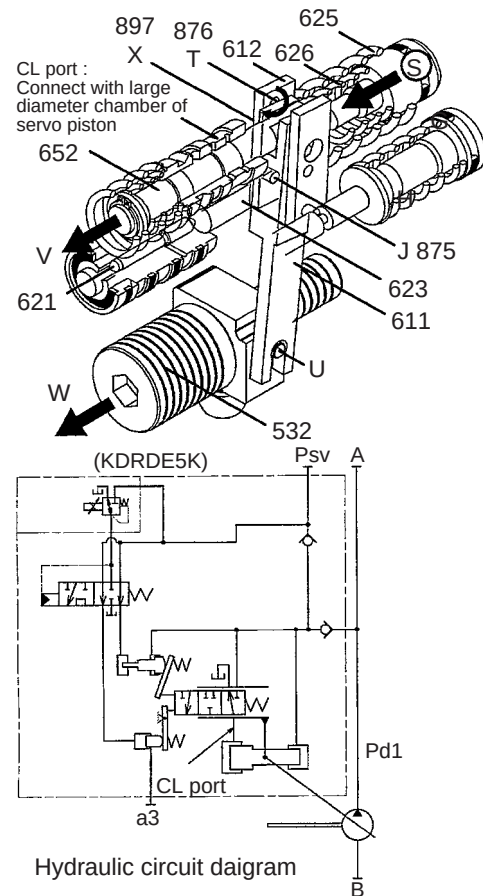
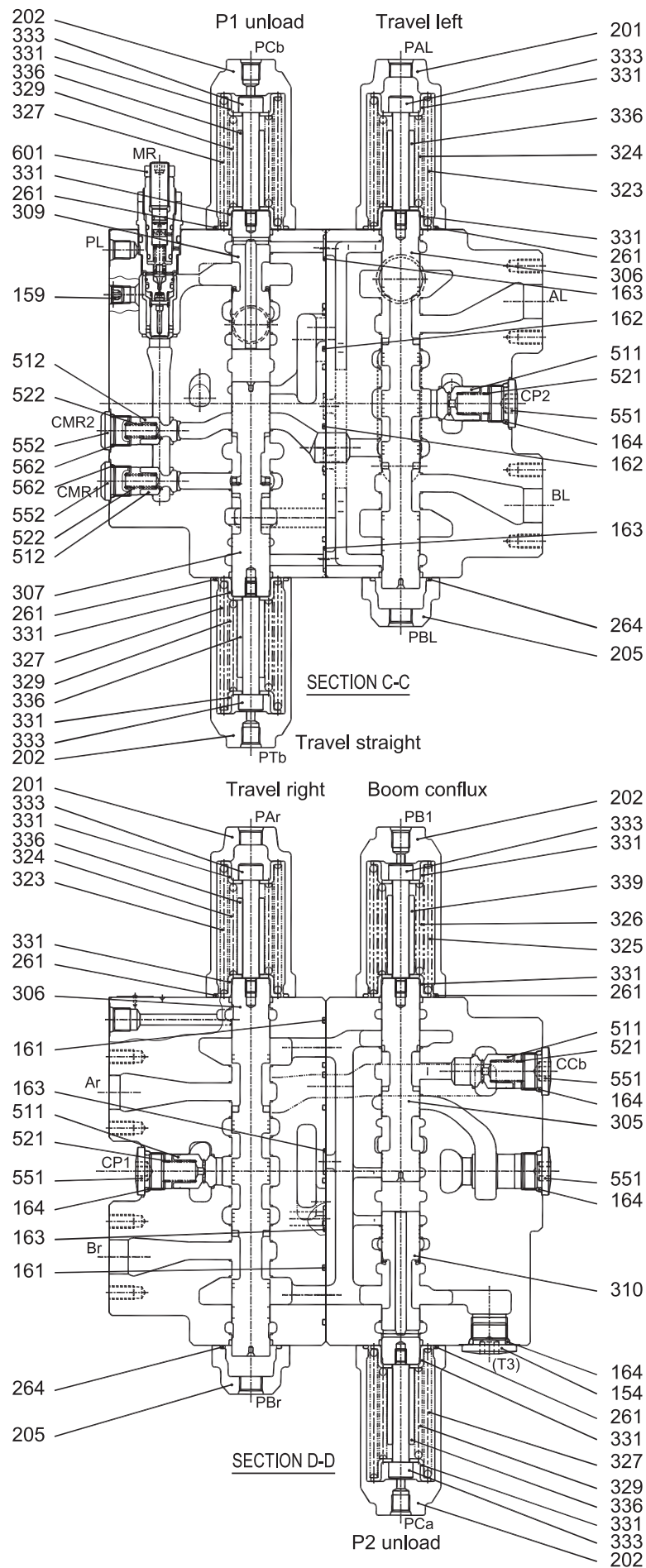


Fig. 24-15



(8) Swing shuttle valve cover (204)

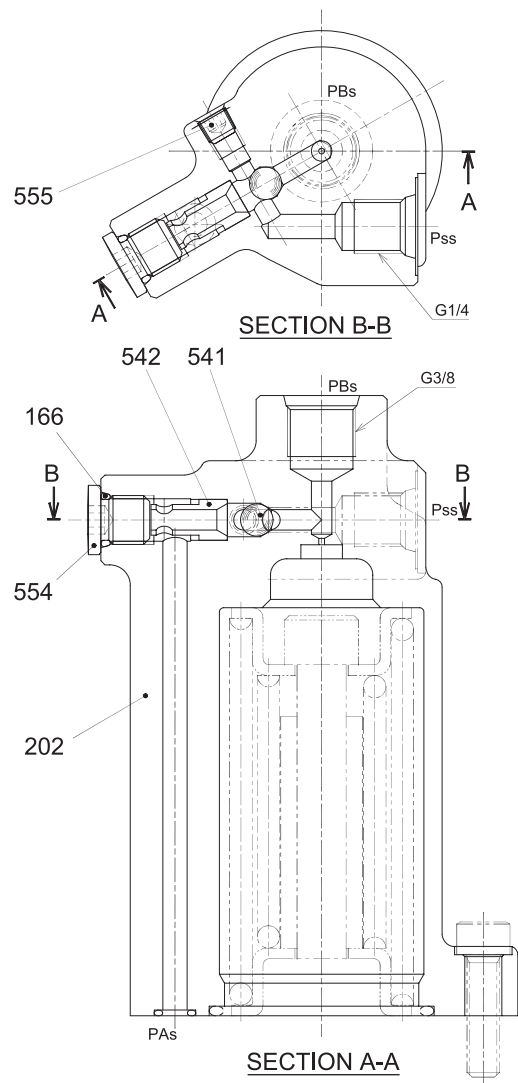


Fig. 24-35 Swing shuttle valve cover

Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty	Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty
	166	O-ring	1		542	Seat	1
	202	Cover	1	25~29 (18~21)	554	Plug	1
	541	Steel ball	1	7.9~9.8 (5.9~7.2)	555	Plug	1

3) In boom down operation

On starting boom down operation, the pilot pressure enters port PBb and boom spool (301) moves leftward against the force of springs (321) (322) and the secondary pressure of solenoid proportional valve [X1] acts on PCb and switches unloading spool (309). And simultaneously the spool of lock valve selector (211) is switched, and the poppet (514) is released because the spring chamber of lock valve poppet CRb (514) is connected to the drain circuit.

The hydraulic oil delivered by hydraulic pump P1 flows into parallel passage (53), and pushes and opens load check valve LCb (511), and flows through between the perimeter of boom spool (301) and casing through U-shaped passage, and is supplied to boom cylinder rod side (R) through port (Bb).

In the meantime, the return oil from boom cylinder head side (H) enters the control valve through port (Ab). Because the retention of lock valve poppet CRb (514) which is located on this side of boom spool (301) is released, the lock valve poppet (514) pushes and opens. And then the return oil enters BH chamber and passes through between the perimeter of boom spool (301) and casing, and flows through low pressure circuit (D) and boost check valve (517), and the returns to the hydraulic tank through tank port T1. And a part of the return oil flows into the inside of boom spool (301) through circular notch of boom spool (301). Since the return oil contains sufficient pressure with the self weight of boom, arm, etc. the return oil passes through inside passage of boom spool (301) and pushes and opens poppet (317) leftward as shown in the figure and flows through the circular notch, and then supplied to boom cylinder rod (R) side again through port Bb.

(Boom recirculation function)

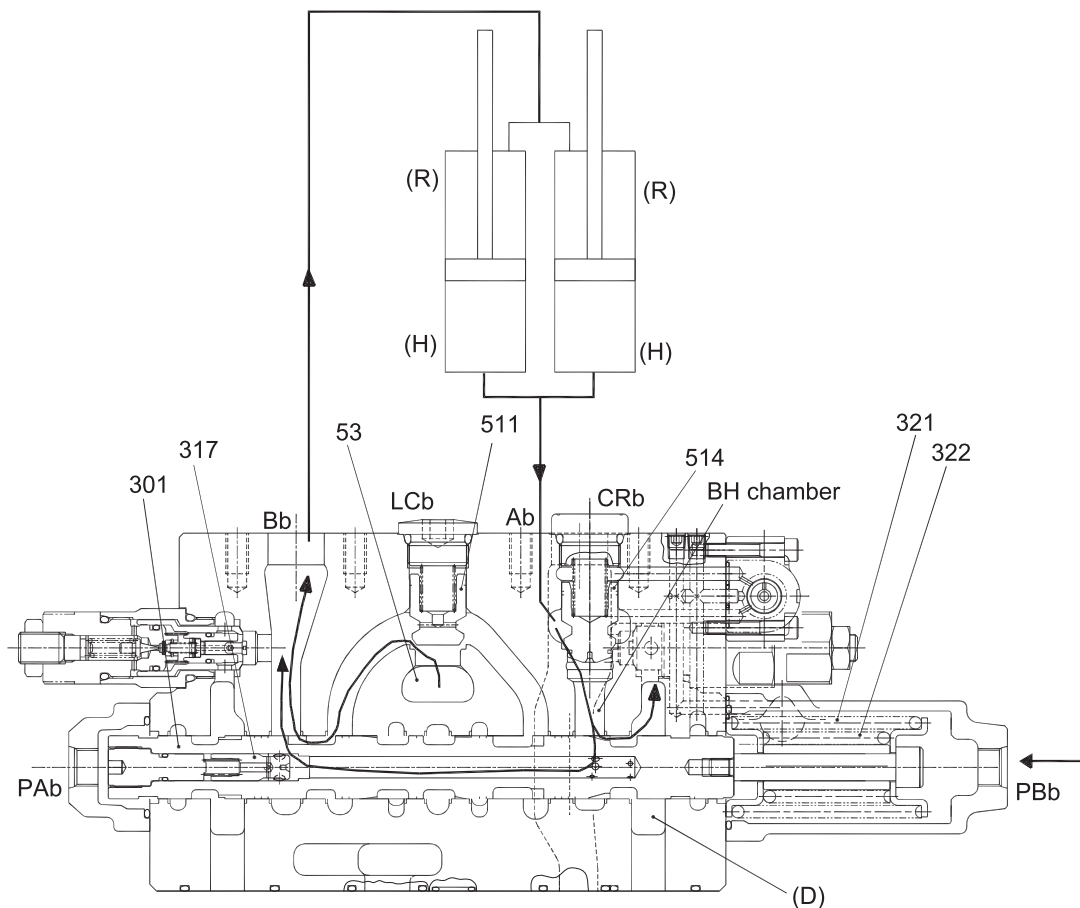


Fig. 24-45 In boom down operation

(10) Boost check valve, By-pass check valve

1) Boost check valve

The boost check valve is located between low pressure passage (D) and tank port T1 and generates boost pressure necessary for the low pressure passage.

a. In normal operation

The hydraulic oil from low pressure passage (D) moves the boost check valve (517) upward against the force of spring (527), and returns to the hydraulic tank through tank port T1. At this time, the pressure generated by spring (527) is used as the boost pressure for the low pressure passage.

But the return oil used for the arm out and bucket dumping operation does not pass through boost check valve (517), but returns from low pressure passage (D') to hydraulic tank through tank port T1.

b. In make up operation

When supplying to make up the flow rate through low pressure passage (D) after the swing operation is suspended, if the hydraulic oil quantity in low pressure passage (D) is not enough, the deficient hydraulic oil is made up from hydraulic tank into low pressure passage (D).

When the deficient hydraulic oil in low pressure passage (D) is not sufficient, the pressure of low pressure passage (D) is lowered. If the pressure of low pressure passage (D) is lowered to the pressure at tank port T1, poppet (102) housed in boost check valve (517) receives the pressure at tank port T1 on the receiving section in ring type which is made up of guide diameter and seat diameter of poppet (102), and is pushed upward and opens, and the hydraulic oil flows from the hydraulic tank to low pressure passage (D) to make up the deficient flow rate.

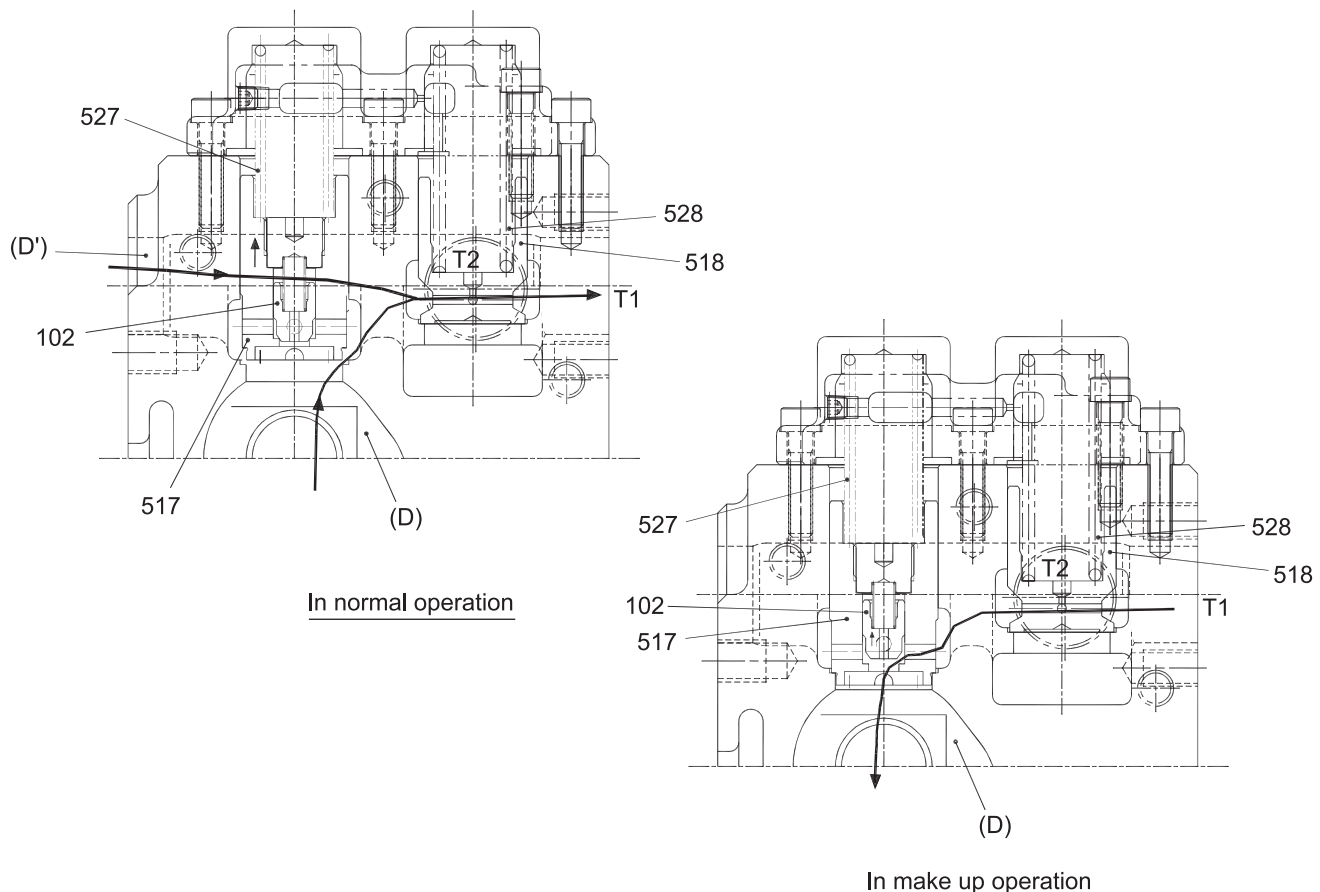


Fig. 24-55 Boost check valve operation

24. COMPONENTS SYSTEM

(2) Specifications

Swing motor unit part No.		LQ15V00021F1
Hydraulic motor	Type	MFC160-065
	Part No.	LQ15V00015F2
	Displacement	cm ³ (in ³)
	Working pressure	MPa (psi)
	Max. flow	L/min (gal/min)
	Braking torque	N•m (lbf•ft)
	Release pressure	MPa (psi)
	Relief set pressure	MPa (psi)
	Weight	kg (lbs)

(3) Explanation of construction

- 1) The rotary group of the swing motor consists of a cylinder (24) which is integral with the drive shaft and nine piston assy (7) arranged in the cylinder bores. The cylinder (24) is supported by bearings (3) (22) on both ends.

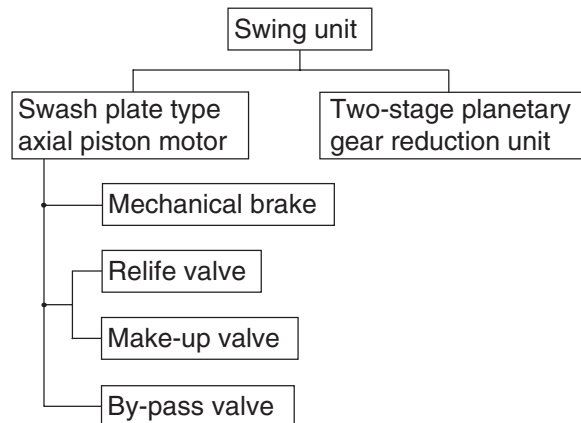
Each piston assy (7) is guided by a return plate (6) and retaining spring (4) so as to slide smoothly on the cam plate (5).

The balance plate (21) is forced against the end of the cylinder by the force of the disc spring (18) and the hydraulic force acting on the bushing (20).

A mechanical brake is installed between the cylinder exterior and the housing (25).

A relief valve to cushion hydraulic shock and a backup valve to prevent cavitation are built in to the cover (33).

- 2) The reduction gear system consists of two stage planetary gears. The system decelerates high-speed rotary motion of the swing motor and converts it to low-speed large-torque motion in order to rotate the pinion shaft.

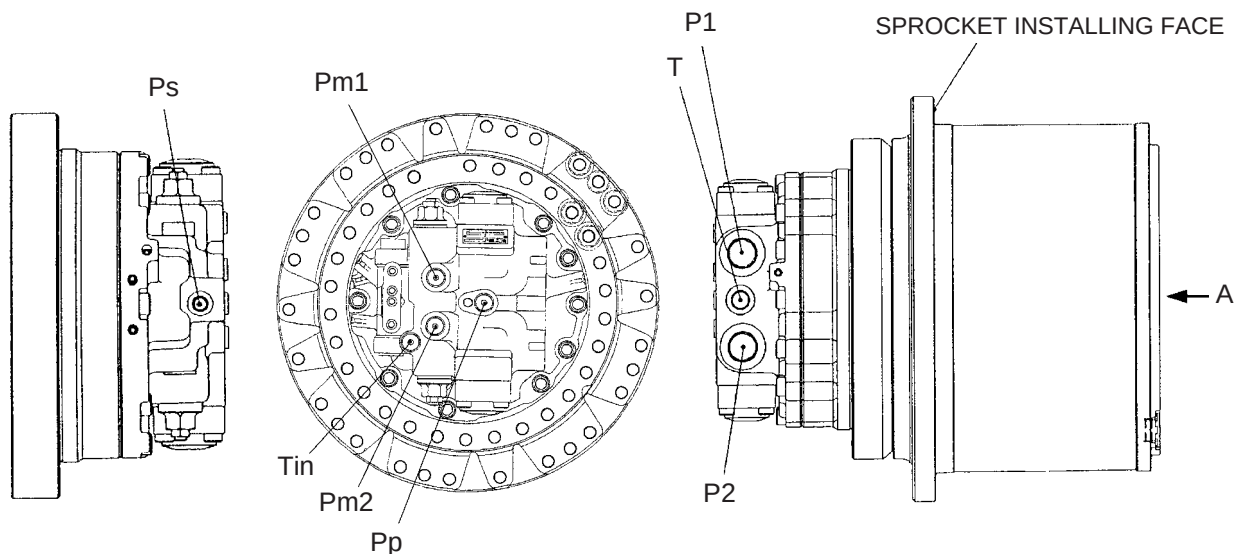


24. COMPONENTS SYSTEM

24.1.6 TRAVEL MOTOR

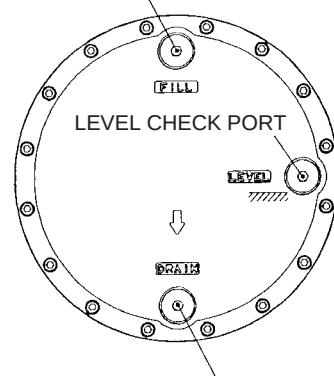
24.1.6.1 SPECIFICATIONS

24.1.6.1.1 General view



PORT SIZE	Tightening torque N·m (lbf·ft)	PORT SYMBOL	PORT NAME
PF1	255 (188)	P1 P2	Motor drive port Motor drive port
PF1/2	108 (79.7)	T	Drain port
PF1/4	36.3 (26.7)	Ps	1st,2nd speed change over pilot port
		Pm1	P1 side pressure detecting port
		Pm2	P2 side pressure detecting port
		Pp	Parking brake release port
		Tin	Lubrication port in the inside of motor case

LUBRICATION PORT



DRAIN PORT

VIEW A

24.1.6.1.2 SPECIFICATIONS

ITEM	PARTS NO.		LQ15V00020F1
	TYPE		MAG-170VP-3800G-K1
Reduction unit	Reduction rate	rpm	1/43.246
	Lube oil		Gear oil SAE #90 GL4
	Oil level	L (gal)	5.0 (1.3)
Hydraulic motor	Max. displacement	cc/rev (cu-in/rev)	181.3/112.6 (11.06/6.87)
	System. pressure	MPa (psi)	34.3 (4,980)
	2-speed changeover pressure	MPa (psi)	4.9 (710)
	Auto 1st-speed return pressure	MPa (psi)	27.3 (3,980)
Parking brake	Braking torque	N·m (lbf·ft)	25.1 (18,520)
	Release pressure	MPa (psi)	1.1 (160)
Total weight		kg (lbs)	262 (577)

24.1.6.3.4 CROSSOVER RELIEF VALVE

The construction of relief valve is shown in Fig. 24-74. This relief valve is the differential area direct driven type.

(1) Operation and function of relief valve

After starting the control valve, and if the piston motor is started or braked, the pressure on the front side of poppet (17-2) rises to the set pressure or higher and resists against spring (17-5) force, and poppet (17-2) moves rightward and is separated from poppet seat (17-3). And the high pressure oil in the front side of poppet (17-2) is bypassed into the oil passage on the low pressure side. This way, by bypassing the high pressure oil into the low pressure side, the shock pressure due to the inertia energy in the oil passage on the high pressure side is controlled and concurrently the generation of vacuum in the low pressure oil passage is prevented.

(2) Shockless function (See Fig. 24-76)

When the relief valve starts operating, shockless piston (17-9) moves leftward. And the inside of spring chamber D is held at the low pressure. Consequently the pressure receiving area of poppet (17-2) becomes S1, and the receiving area is only S1 to the Receiving area S1-S2 when the relief valve is set to the regular position.

Therefore, the relief valve operating pressure is kept in approx. 1/3 of the regular set pressure until the movement of shockless piston (17-9) is completed, and the shock pressure due to the inertia energy in the oil passage on the high pressure side is absorbed.

After completion of the movement of shockless piston, the pressure in the spring chamber D rises and the pressure on the front and after sides of poppet (17-2) becomes equal, and the relief valve operates at the regular set pressure.

As described above, the relief valve operates in two stages to reduce the shock generated when starting or braking the piston motor, and provides a fine operability. And the difference of pressure wave form between the conventional type and shockless type is shown in Fig. 24-76.

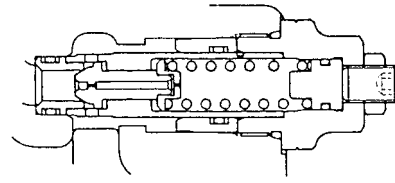


Fig. 24-74 Construction of relief valve

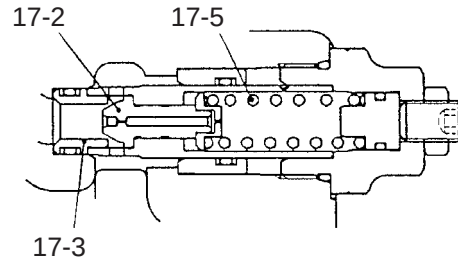


Fig. 24-75 Operation of relief valve

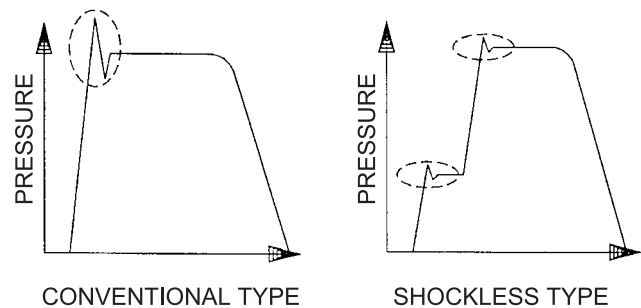
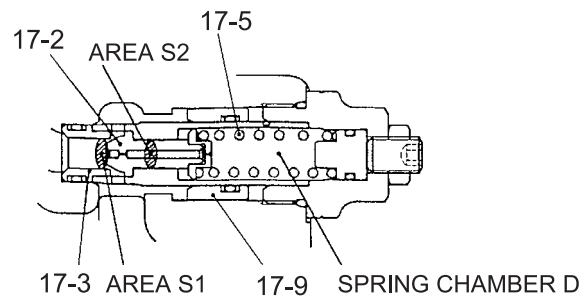


Fig. 24-76 Shockless function and comparison of pressure waves

24. COMPONENTS SYSTEM

24.1.8.2 CONSTRUCTION AND FUNCTION

24.1.8.2.1 CONSTRUCTION

(1) Boom cylinder

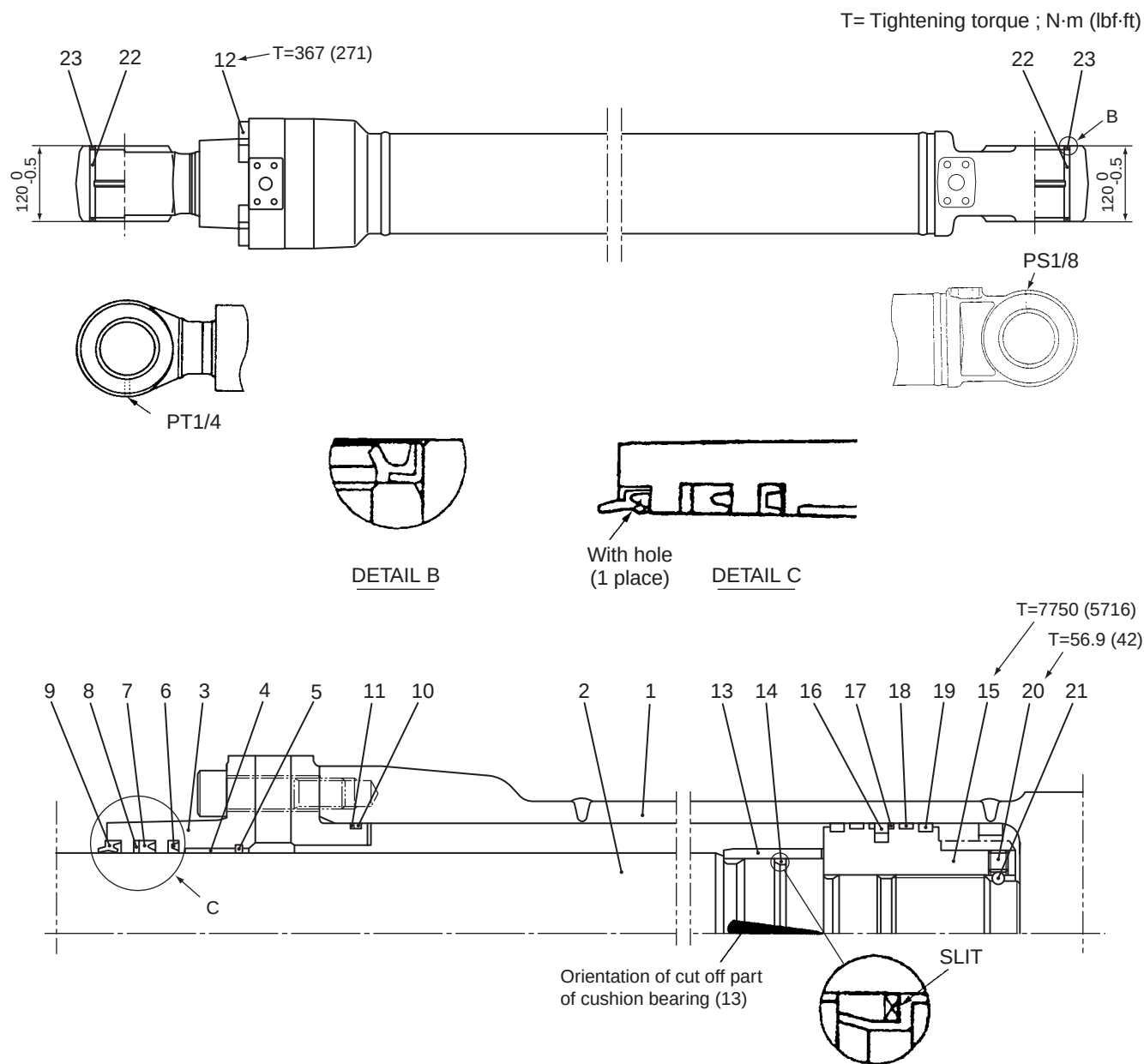
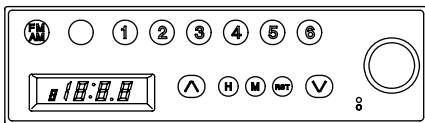
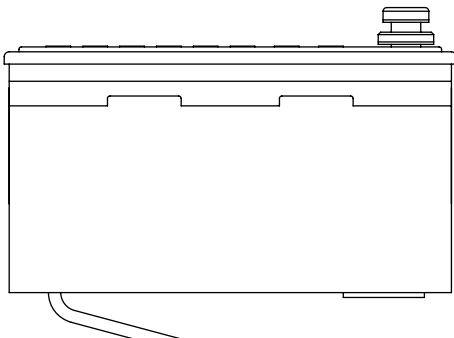
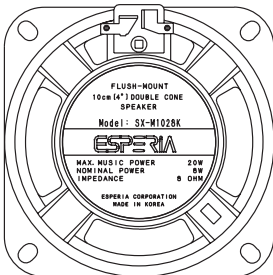
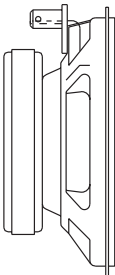
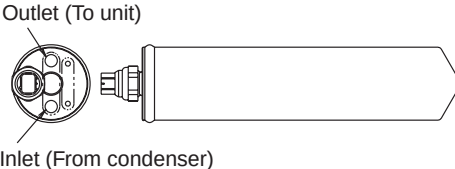


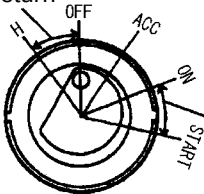
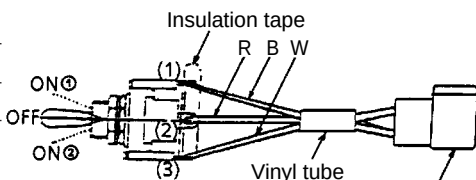
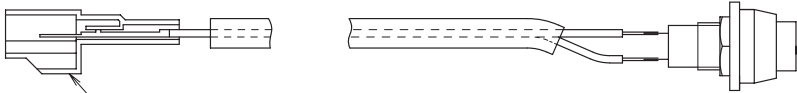
Fig. 24-87 Construction of boom cylinder

P/No LQ01V00028F1								
No.	Parts	Q'ty	No.	Parts	Q'ty	No.	Parts	Q'ty
1	Cylinder tube	1	9	Wiper ring	1	17	Buckup ring	2
2	Piston rod	1	10	O-ring	1	18	Slide ring	2
3	Rod cover	1	11	Buckup ring	1	19	Slide ring	2
4	Bushing	1	12	Socket bolt; M18×80	12	20	Set screw; M14	1
5	Snap ring	1	13	Cushion bearing	1	21	Steel ball	1
6	Buffer ring	1	14	Cushion seal	1	22	Pin bushing	4
7	U-ring	1	15	Piston	1	23	Wiper ring	4
8	Buckup ring	1	16	Seal ring	1			

24. COMPONENTS SYSTEM

File No. Name of Part Part No. Use Applicable Machine	Specification	Description														
E - 7 Tuner YN54S00045P1 Radio (AM & FM)																
E - 8, 9 Speaker, LH & RH YN54S00006P1 Radio	<table><tr><td>Model</td><td>SX-M1028K</td></tr><tr><td>Rated input</td><td>8W</td></tr><tr><td>Impedance</td><td>8 Ω</td></tr><tr><td>Frequency</td><td>33.3Hz</td></tr></table>	Model	SX-M1028K	Rated input	8W	Impedance	8 Ω	Frequency	33.3Hz	 						
Model	SX-M1028K															
Rated input	8W															
Impedance	8 Ω															
Frequency	33.3Hz															
E - 10 Receiver dryer YN54S00041P1 Air-con	<table><tr><td>Maker</td><td>Sanden Corp.</td></tr><tr><td>Airtight test pressure</td><td>3.5MPa (508 psi)</td></tr><tr><td>Pressure proof test pressure</td><td>5.3MPa (769 psi)</td></tr><tr><td>Breaking test pressure</td><td>9.8MPa (1420 psi)</td></tr><tr><td>Desiccant moisture adsorption capability</td><td>17% or over than the weight of desiccant (Include initial absorption 2%)</td></tr><tr><td>Refrigerant</td><td>HFC-134a</td></tr><tr><td>Inner volume/Desiccant</td><td>578cm³/300g</td></tr></table>	Maker	Sanden Corp.	Airtight test pressure	3.5MPa (508 psi)	Pressure proof test pressure	5.3MPa (769 psi)	Breaking test pressure	9.8MPa (1420 psi)	Desiccant moisture adsorption capability	17% or over than the weight of desiccant (Include initial absorption 2%)	Refrigerant	HFC-134a	Inner volume/Desiccant	578cm ³ /300g	
Maker	Sanden Corp.															
Airtight test pressure	3.5MPa (508 psi)															
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Breaking test pressure	9.8MPa (1420 psi)															
Desiccant moisture adsorption capability	17% or over than the weight of desiccant (Include initial absorption 2%)															
Refrigerant	HFC-134a															
Inner volume/Desiccant	578cm ³ /300g															

24. COMPONENTS SYSTEM

File No. Name of Part Part No. Use Applicable Machine	Specification	Description																																										
SV - 1, 2, 3, 4 Solenoid directional valve (8 spool) assy Hydraulic symbol A1 to A4 (YN35V00047F1) YN35V00050F1 YN35V00051F1	<table><tr><td>Rated pressure</td><td>5.0 MPa (725 psi)</td></tr><tr><td>Solenoid directional pressure</td><td>Rated voltage DC 24V</td></tr><tr><td>Solenoid proportional valve</td><td>Dither current 100Hz,200mA P-P Coil resistance 17.5Ω (at 20C)</td></tr><tr><td>Connector specification</td><td>AMP MARK II HOUSING 174354-2 TERMINAL 173706-1</td></tr></table>	Rated pressure	5.0 MPa (725 psi)	Solenoid directional pressure	Rated voltage DC 24V	Solenoid proportional valve	Dither current 100Hz,200mA P-P Coil resistance 17.5Ω (at 20C)	Connector specification	AMP MARK II HOUSING 174354-2 TERMINAL 173706-1	P1, P2, T, A1, A8 port PF3/8 A2~A7 port PF1/4 AMP MARK II																																		
Rated pressure	5.0 MPa (725 psi)																																											
Solenoid directional pressure	Rated voltage DC 24V																																											
Solenoid proportional valve	Dither current 100Hz,200mA P-P Coil resistance 17.5Ω (at 20C)																																											
Connector specification	AMP MARK II HOUSING 174354-2 TERMINAL 173706-1																																											
SW - 1 Switch YN50S00029F1 Key switch	Connection <table><tr><th>Terminal Position</th><th>B</th><th>G1</th><th>G2</th><th>ACC</th><th>M</th><th>ST</th></tr><tr><td>H</td><td>○</td><td>○</td><td></td><td></td><td></td><td></td></tr><tr><td>OFF</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>ACC</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td></tr><tr><td>ON</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr><tr><td>START</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr></table>	Terminal Position	B	G1	G2	ACC	M	ST	H	○	○					OFF							ACC	○	○	○	○			ON	○	○	○	○	○		START	○	○	○	○	○	○	Auto return  VIEW A Terminal arrangement 
Terminal Position	B	G1	G2	ACC	M	ST																																						
H	○	○																																										
OFF																																												
ACC	○	○	○	○																																								
ON	○	○	○	○	○																																							
START	○	○	○	○	○	○																																						
SW - 4 Switch YT50E00001F1 Swing parking brake release	<table><tr><td>Type</td><td>Single-pole double-throw (alternate)</td></tr><tr><td>Rated</td><td>DC30V, 10A</td></tr><tr><td>Insulation resistance</td><td></td></tr></table> <table><tr><td rowspan="2">Contact construction :</td><td>T No.</td><td>1</td><td>2</td><td>3</td></tr><tr><td>Position</td><td></td><td></td><td></td></tr><tr><td>Swing parking release</td><td>ON①</td><td></td><td>○</td><td>○</td></tr><tr><td>Normal</td><td>ON②</td><td>○</td><td>○</td><td></td></tr></table>	Type	Single-pole double-throw (alternate)	Rated	DC30V, 10A	Insulation resistance		Contact construction :	T No.	1	2	3	Position				Swing parking release	ON①		○	○	Normal	ON②	○	○		 YAZAKI 7122-2237 7114-2020 Red (2) White (3) Blue (1)																	
Type	Single-pole double-throw (alternate)																																											
Rated	DC30V, 10A																																											
Insulation resistance																																												
Contact construction :	T No.	1	2	3																																								
	Position																																											
Swing parking release	ON①		○	○																																								
Normal	ON②	○	○																																									
SW - 5, 10 Switch YN50E00017P1 Horn - LH & RH	<table><tr><td>Type</td><td>Buried in left grip</td></tr><tr><td>Switch assy</td><td>YN50E00017P1</td></tr><tr><td>Rating</td><td>125V 3A AC</td></tr><tr><td>Insuration resistance</td><td>More than 100MΩ / DC500V megger</td></tr></table>	Type	Buried in left grip	Switch assy	YN50E00017P1	Rating	125V 3A AC	Insuration resistance	More than 100MΩ / DC500V megger	SW-10 : Buried in left grip Right and left switches are same.  Sumitomo wiring systems HOUSING : 6090-1031 (2P male) Sumitomo wiring systems TERMINAL : 8230-4282 Lead wire (Sumitomo wiring systems Robo top DP3)																																		
Type	Buried in left grip																																											
Switch assy	YN50E00017P1																																											
Rating	125V 3A AC																																											
Insuration resistance	More than 100MΩ / DC500V megger																																											

25. AIR-CONDITIONER SYSTEM

25.2.2 CONSTRUCTION

(1) Air conditioner unit

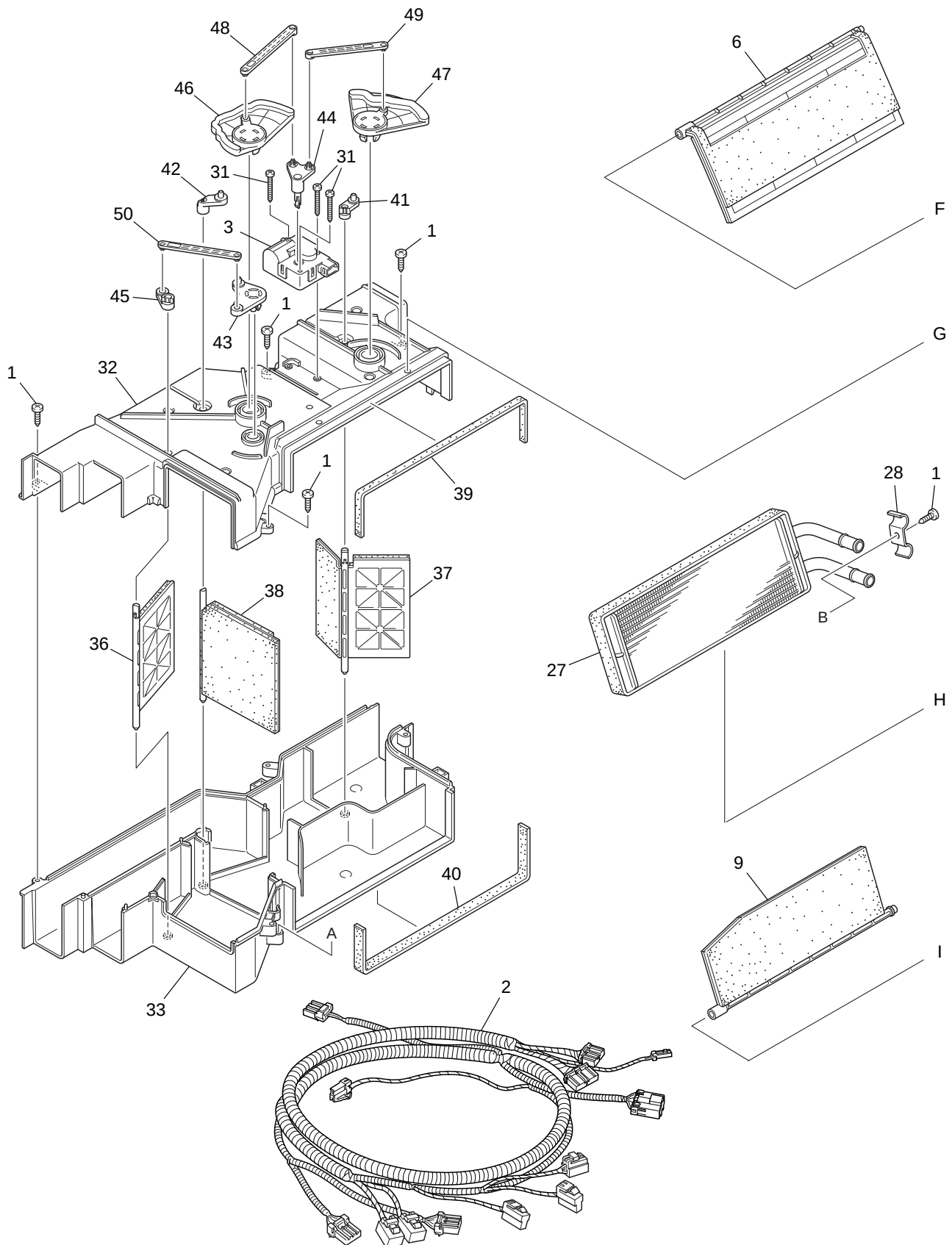


Fig. 25-2 Air conditioner unit (1/2)

Fig. 25-10 shows how the block type expansion valve is constructed. The temperature sensing part is provided in the shaft of the expansion valve to directly detect the refrigerant temperature at the outlet of the evaporator.

The diaphragm contains R134a in saturated state. The pressure in the diaphragm changes according to the temperature detected by the sensor. The change in the pressure causes the force acting upon the diaphragm to vary accordingly.

The high-pressure high-temperature liquid refrigerant that is fed from the receiver side reduces the pressure abruptly as it passes through the valve (throttling action). On that occasion, part of the refrigerant evaporates by the very heat of the refrigerant and cooled off. The result is that low-pressure low-temperature damp refrigerant vapor is fed to the evaporator.

The opening of the valve is determined by the equilibrium between the pressure (low) of the evaporator side, the action of the adjust spring and the pressing force of the diaphragm (the temperature of the refrigerant at the outlet of the evaporator to be sensed by the thermowell). The feed rate is controlled automatically so that under the pressure in the evaporator, the refrigerant is properly overheated ($3\sim 8^{\circ}\text{C}$) and goes out of the evaporator. This action is carried out by sensing the refrigerant temperature at the outlet of the evaporator as against the inlet pressure of the evaporator and consequently controlling the feed rate of the refrigerant.

This means that if the refrigerant pressure drop in the evaporator is excessive, it is difficult to control the overheating or the feed rate of the refrigerant. For this reason, the smaller the pressure drop of the evaporator, the better.

The expansion valve senses the pressure and the temperature at the outlet of the evaporator and controls the overheating of the refrigerant and the refrigerant supply to the evaporator more securely. The air-conditioner of this machine adopts a block type expansion valve.

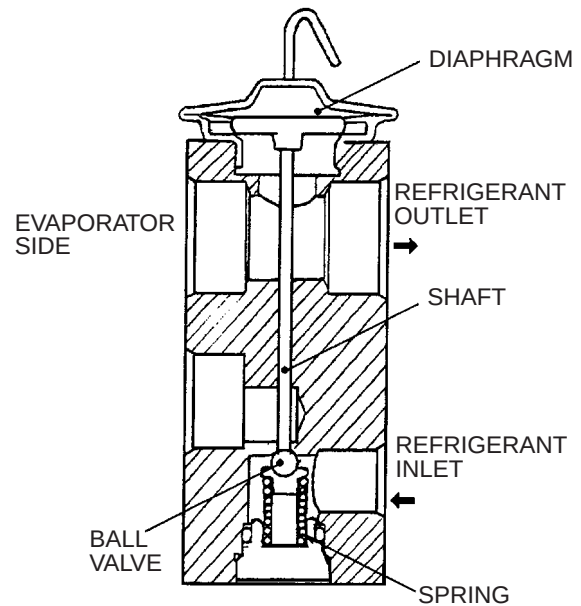


Fig. 25-10 Block type expansion valve

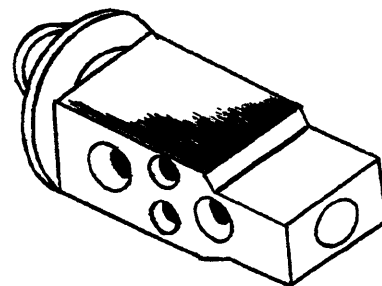


Fig. 25-11 Expansion valve outside view

25. AIR-CONDITIONER SYSTEM

25.6.3 CHARGING PROCEDURE

25.6.3.1 VACUUM MAKING OPERATION

(1) Connecting gauge manifold (See Fig. 25-25)

- 1) Close the high pressure valve (HI) and the low pressure valve (LO) of the gauge manifold.
- 2) Connect the charging hoses (red and blue) with the service valves of the compressor.

Red hose :

High pressure side (HI) of the gauge manifold→high pressure side (DIS) of compressor

Blue hose :

Low pressure side (LO) of gauge manifold→low pressure side (SUC) of compressor

CAUTION

- Do not mistake the high pressure hose for the low pressure hose in any circumstances when connecting them. Put the hose in firmly till a clicking sound is heard.

- 3) Connect the center valve of the gauge manifold with the charging hose of the vacuum pump.

CAUTION

Some kinds of gauge manifolds are not equipped with an open/close valve in the center.

(2) Starting Vacuum (See Fig. 25-27)

- 1) Open the high pressure valve (HI) and the low pressure valve (LO) on the gauge manifold.
- 2) Turn on the vacuum pump and create a vacuum for 30 minutes or longer.
- 3) When the vacuum time is over (degree of vacuum : less than - 750 mmHg), close the high pressure valve and the low pressure valve on the gauge manifold.
- 4) Then turn off the vacuum pump.

(3) Air Leak Check

Close the high pressure valve and the low pressure valve on the gauge manifold, let the system set for five minutes or more. Check to make sure that the gauge reading does not return toward 0.

CAUTION

If the gauge indication swings toward 0, there is somewhere that is leaking. Retighten pipe joints, make vacuum again and make sure of no leakage.

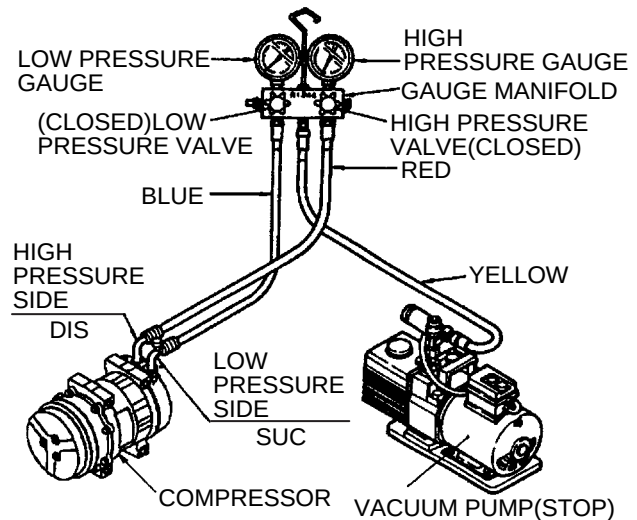


Fig. 25-25

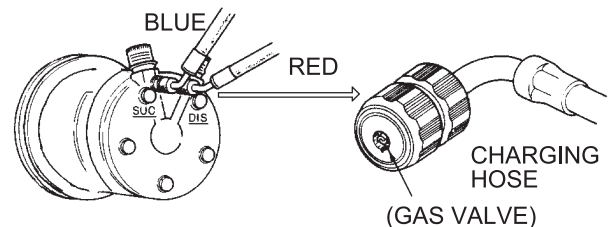


Fig. 25-26 Connecting gauge manifold

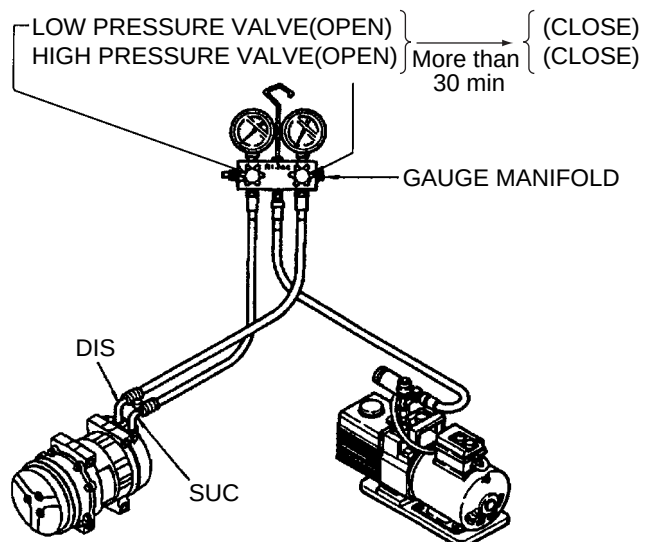
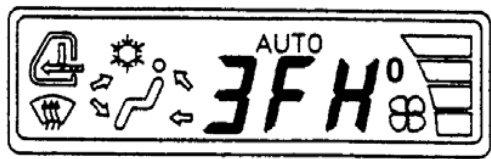


Fig. 25-27 Vacuum making operation



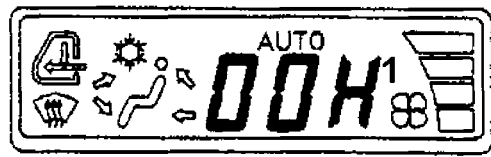
25. AIR-CONDITIONER SYSTEM

- (3) Contents of monitor mode display
Refer to the list of segment display exclusively used for monitor and the list of segments in three digits.
- 1) Example 1



When the segment exclusively used for monitor indicates 0 (displays the inner air sensor condition), since the segment indicates 3F, the sensor is in normal operating condition according to the list of 3 segments.
--> The inner air sensor is in normal operating condition.

- 2) Example 2



When the segment exclusively used for monitor indicates 1 (displays the evaporator sensor condition), since the segment indicates 00, the sensor is in disconnection condition according to the list of 3 segments
--> The evaporator sensor is in disconnection condition.

- 3) Example 3



When the segment exclusively used for monitor indicates 2 (displays the solar radiation sensor condition), since the segment indicates FF, the sensor is in short-circuiting condition according to the list of 3 segments.
-->The solar radiation sensor is in short-circuiting condition.

- 4) List of 3 segments

		SECOND SEGMENT															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
THIRD SEGMENT	0	INNER AIR SENSOR DISCONNECTION															
		EVAPORATOR SENSOR DISCONNECTION															
		SOLAR RADIATION SHORT-CIRCUITING															
	1																
	2																
	3																
	4																
	5	EACH SENSOR IS NORMAL															
	6																
	7																
	8																
	9																
	A																
	B																
	C																
	D																
E	SOLAR SENSOR 5V SIDE SHORT-CIRCUITING																
																	
F								INNER AIR SENSOR SHORT-CIRCUITING									
								EVAPORATOR SENSOR SHORT-CIRCUITING									

32. ATTACHMENT

(3) Removing bucket attaching pin (K)

Lift up bucket, position it so that bucket attaching pin (K) is not loaded, adjust bucket link, and pull out bucket attaching pin (K).

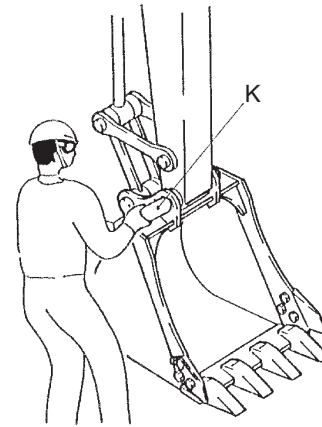


Fig. 32-4 Removing bucket attaching pin

(4) Removing bucket drive pin (J)

Put bucket on the ground, position it so that the bucket drive pin (J) is not loaded, adjust bucket link, and pull out pin (J).
Store the removed pin (J) in original position again.

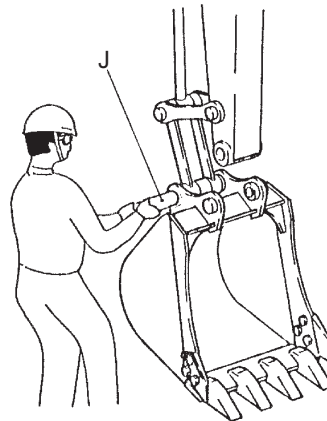


Fig. 32-5 Removing bucket drive pin

32.1.2.2 ATTACHING BUCKET

(1) Attaching bucket drive pin (J)

Attach bucket drive pin (J) first, then continue in the reverse procedure of removing.



- **When aligning the pin holes, do not put your finger in the pin holes, but align them visually.**
- **Check the seals for damaged and replace as necessary.**
- **When inserting the pin, coat the shaft with grease.**

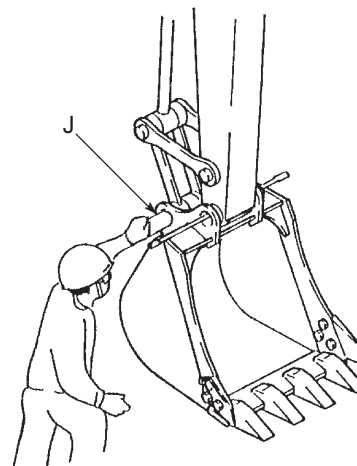


Fig. 32-6 Attaching bucket

32. ATTACHMENT

32.2.1.1.3 NECESSARY TOOLS

Tools and jigs vary with types of cylinder, but it is necessary to prepare the tools in Table32-1 as a guideline.

Table32-1 List of Tools and Jigs

Tool / Jig	Remarks	Tool / Jig	Remarks
Hammer	1. Steel hammer 2. Wooden or plastic mallet	Spatula	Metallic one with smooth corners.
Screwdriver	A few types of large and small sizes	Gimlet	A sharp-point tool may be used in place of a gimlet.
Chisel	Flat chisel	Special jig	1. For removing and press-fitting bushing. (A), (D), (C) 2. For press-fitting wiper ring. (D) 3. For inserting and reforming seal ring. (E),(F),(G),(H) See para 32.2.1.9 for detail)
Vise	One having an operation wide enough to hold cylinder head O.D. and tube mounting pins (clevis)	Rust remover	
Wrench	1. Eye wrench 2. Allen wrench 3. Extension pipe for wrenches	Measuring instruments	1. Slide caliper 2. Micrometer 3. Cylinder gauge (Fig. 32-25) 4. V-block

- For the details of special tools and jigs, refer to the back pages of this manual.

32.2.1.1.4 EXTERNAL CLEANING

The cylinder taken off the excavator has dust and foreign matter, and grease is usually adhered to the clevis part. For this reason, remove external soil and contamination from the cylinder with water and steam before bringing it into the workshop.

- The following describes the construction of boom cylinder. When disassembling and servicing the cylinder, confirm the construction of cylinder referring to Parts Manual.

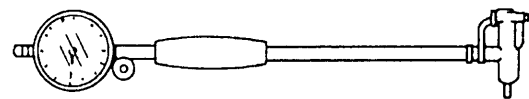


Fig. 32-25 Cylinder gauge

32.2.1.1.5 DISCHARGING OIL

Place a wooden-block on the work bench and place the cylinder on it to prevent it from rotating. Charge air into ports A and B alternately to actuate the piston rod till the hydraulic oil in the cylinder is drained out. At this time, connect a suitable hose to each port so that the hydraulic oil may not gush out.

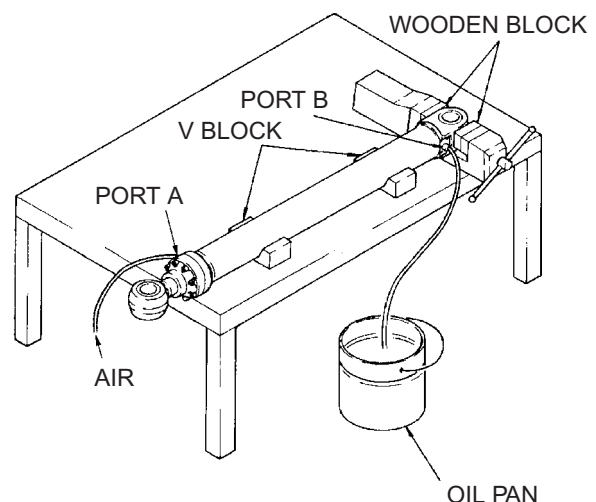


Fig. 32-26 Preparation

32.2.1.5.5 ASSEMBLING PISTON ASSEMBLY ONTO PISTON ROD

(1) Install cushion on the extraction side, cushion bearing (13) and cushion seal (14) by using the following procedure.

- 1) Install cushion seal (14) with the slit machined side toward the piston side.
- 2) Install the cushion bearing (13) with the flattened side as shown in Fig. 32-52.

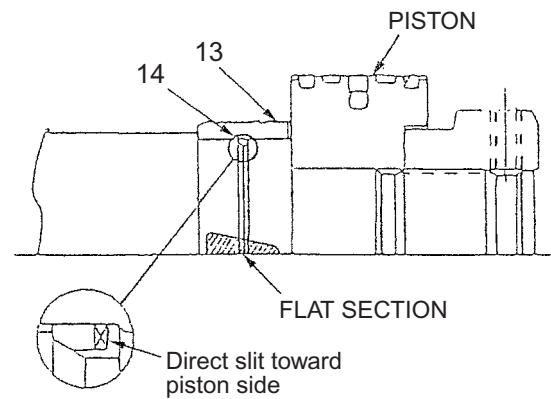


Fig. 32-52 Cushion mechanism on extension side

(2) When cushion is installed on the retraction side, fit cushion bearing (13) and cushion seal (14) by using the following procedure.

- 1) Install cushion bearing before installing piston nut. The nut installed will obstruct the installation of the cushion bearing.
- 2) Install the cushion seal with the slit side toward the piston.
- 3) Install the cushion bearing with the flattening side as shown in Fig. 32-53.
- 4) Put the stopper in the groove. Push the cushion bearing fully into the stopper, and install the snap ring. Use a plastic mallet in order not to damage the rod, cushion bearing.

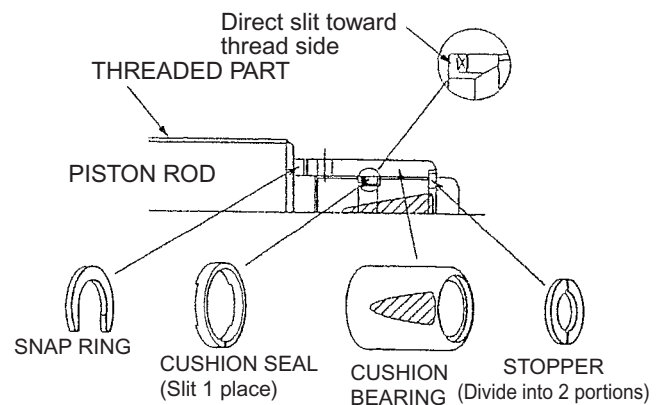


Fig. 32-53 Cushion mechanism on retraction side

CAUTION

Cushion seal and cushion bearing should be installed noting the direction. If they are installed in reverse directions, the cushion will not be effective. After installing cushion, be sure that the cushion bearing moves up and down, and right and left.

32. ATTACHMENT

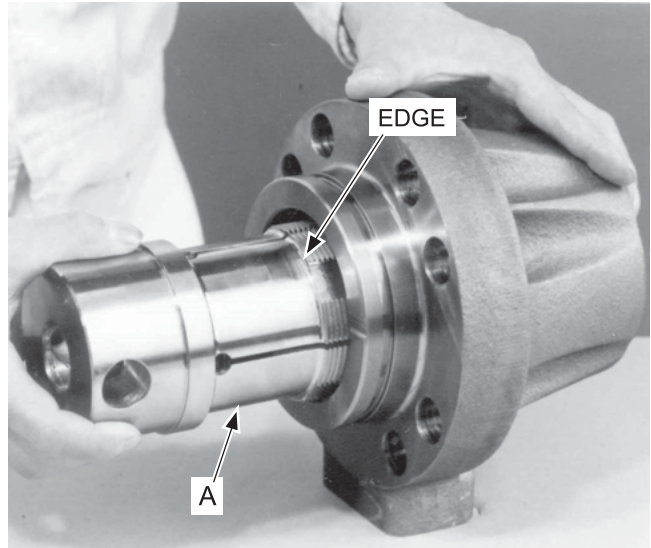
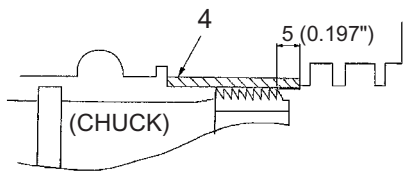
32.2.1.9.3 SPECIAL JIG HANDLING PROCEDURE

(1) How to remove bushing from rod cover.

1) Attaching chuck assembly tool.

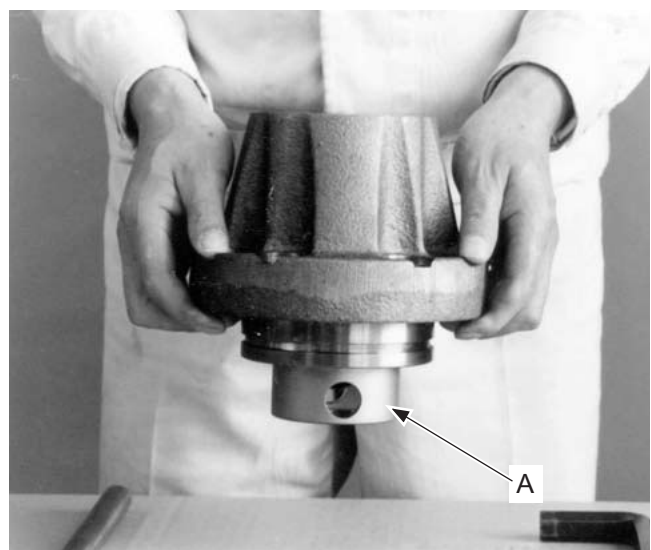
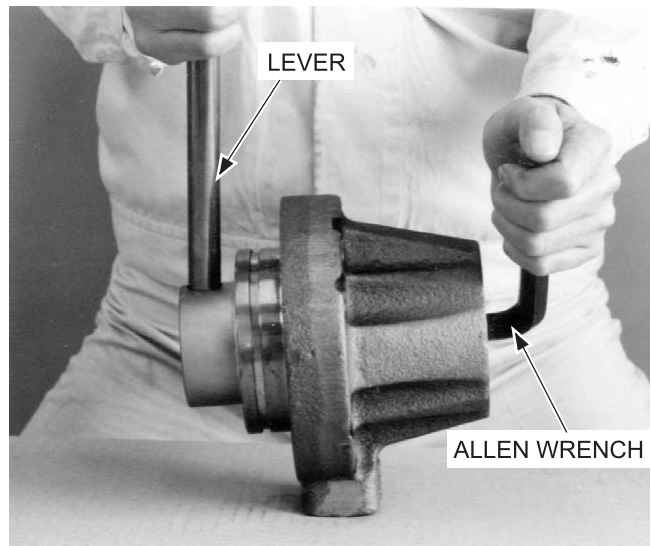
Insert the tool into the rod cover slowly until the top edge end of chuck assembly reaches to the end of bushing (4).

- Special attention must be paid so that the inner surface of rod cover is not damaged by the edge of tool.
- Attach top on the position 5mm (0.2 in) from the bushing end face so that the edge does not protrude from the end face.



2) Tightening chuck assembly tool temporarily

- a. Fit Allen wrench to the head of adjuster bolt on the top end of tool, and insert lever in the round hole on the rear end of tool.
 - b. Secure with Allen wrench and lever to the position where the tool does not drop even if the rod cover is raised, inclining it forward and rearward.
- Move rod cover onto the work bench holding tool attached.



33. UPPER STRUCTURE

Issue	Date of Issue	Applicable Machines	Remarks
First edition	May, 2007	E265B	87495895A

PREFACE

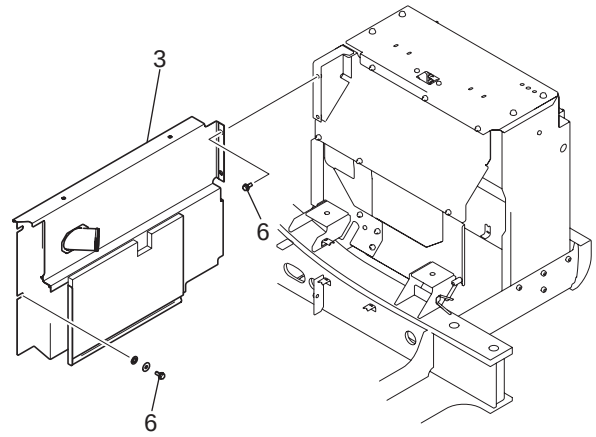
- (1) This Manual describes all the removal and installation procedures.
- (2) This Manual consists [Removing and installing], and [Disassembling and assembling].
- (3) The removal and installation can be performed in the procedure specified in Table of Contents, but in view of actual repairing or time saving, some processes can be omitted.
- (4) The removal and installation procedure does not completely cover all possible situations because of differences in field conditions.
- (5) Recognize well that the service person must decide upon a work procedure before proceeding to repair. When deciding the work procedure, choose an item that is needed, familiarize yourself with the contents of the work and itemize the work procedure, before starting work.
- (6) Disconnect the negative terminal of battery first, when the removing and the installing of the electric component and wiring are performed.
- (7) The explanatory note and figure of this manual may differ from the actual machine by the difference in specification.

33. UPPER STRUCTURE

(15) Remove cover assembly (1)

- 1) While air cleaner is removed, loosen hose clamp of engine intake and disconnect the hose.
- 2) Loosen 5 semi bolts (6) M12×30, and remove cover assembly (1).

 : 19 mm

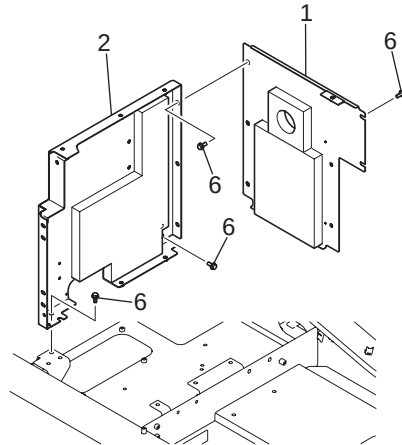


(16) Remove guard assembly (2)

- Loosen 4 semi bolts (6) M12×30, and remove guard assembly (2).

 : 19 mm

Weight : 20kg (44 lbs)



(17) Remove guard assembly (3)

- Loosen 2 semi bolts (6) M12×30, and remove guard assembly (3).

 : 19 mm

Weight : 16kg (35 lbs)

Fig. 33-24 Removing and installing of cover and guard assembly

(18) Remove plate (19)

- Loosen 3 semi bolts (43) M12×25, and remove plate (19).

 : 19 mm

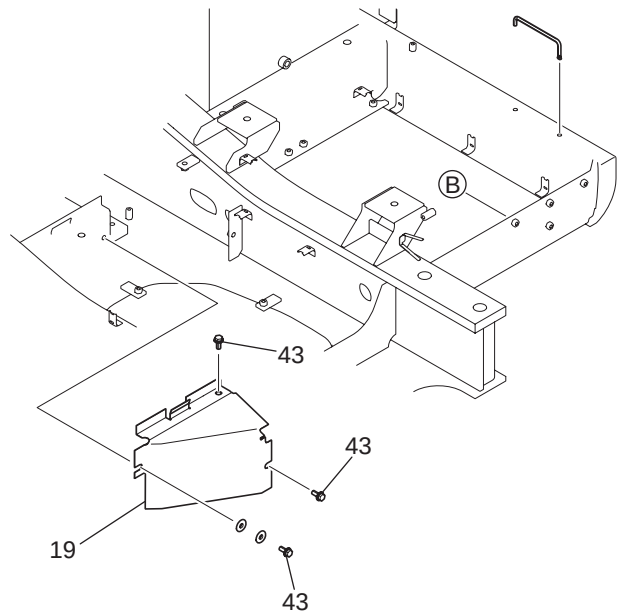


Fig. 33-25 Removing and installing of plate (19)

33. UPPER STRUCTURE

33.1.8.2 REMOVAL

(1) Loosen sems bolts (A15) M12×40 and remove half clamp (A4). And disconnect 2 hoses (A1), (A2) from the delivery side.

 : 19 mm

(2) Remove pilot pump suction hose (1)
(See Fig. 33-42)

 : 36 mm

(3) Remove suction hose (A3) and drain hose (6)

1) Remove 4 capscrews (B2) M12×30.

 : 10 mm

2) Remove elbow (B1) of suction hose (A3) from pump.

3) Remove drain hose (6) (Dr).

 : 36 mm

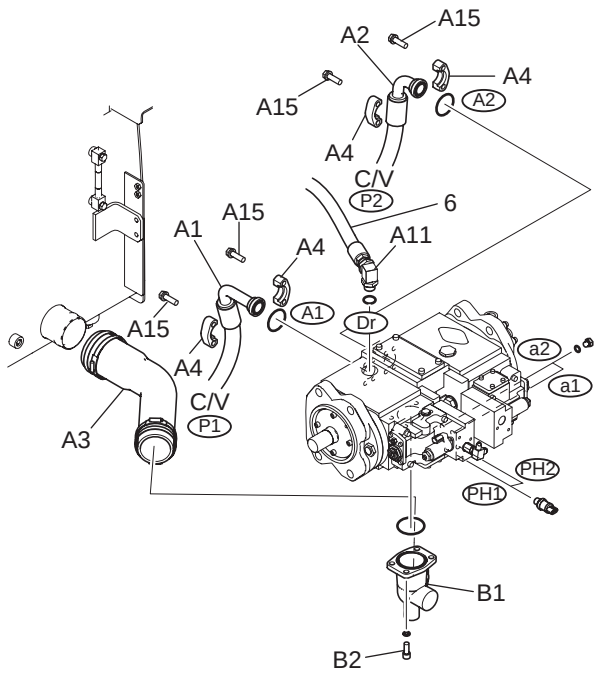


Fig. 33-41 Removing hoses

(4) Removing other hoses

1) Disconnect hoses of the following ports.

Port	Hose No.	 Tool	Remarks
Dr3	3	22	Drain
*Psv1	4	19	Pilot primary pressure P1 side
*Psv2	2	19	Pilot primary pressure P2 side
Psv1	A11	22	Pilot pump delivery

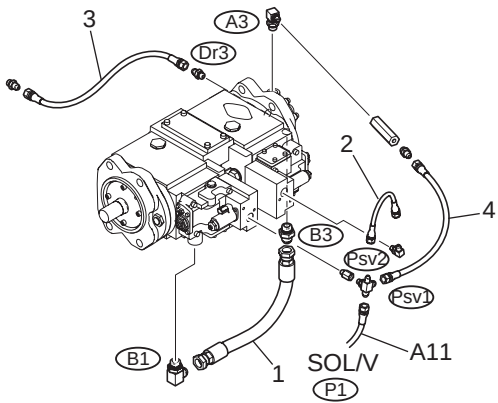


Fig. 33-42 Removing other hoses

Note

Remove the parts marked * only if necessary.

2) Attach tags to hoses to identify.

3) Put a plug in the hoses and the pump.

33. UPPER STRUCTURE

(5) Disconnecting hydraulic oil hose (1), (2)

- 1) Loosen 2 capscrews (20) M12×55 for attaching clamp (15).
- 2) Place an oil pan under the hose joint. Loosen 4 sems bolts (18) M12×35, and remove hoses (1) and (2).

(6) Remove radiator assembly.

- 1) Remove 4 capscrews M20×45 and washers.

 : 30 mm

 : 30 mm

- 2) When lifting, shift the radiator so it does not interfere with the engine fan.
- 3) Plug up pipe ends with clean cloth, etc.
- 4) Removing radiator
Place a wire sling in the lifting eyes of the radiator assy and remove the assembly by crane.
Weight : 145kg (320 lbs)

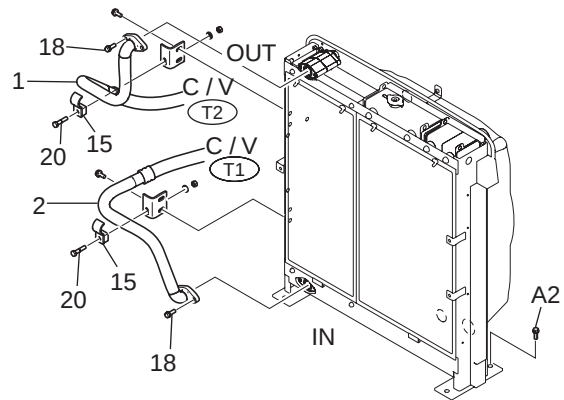


Fig. 33-59 Removing hydraulic oil hose (1), (2)

33. UPPER STRUCTURE

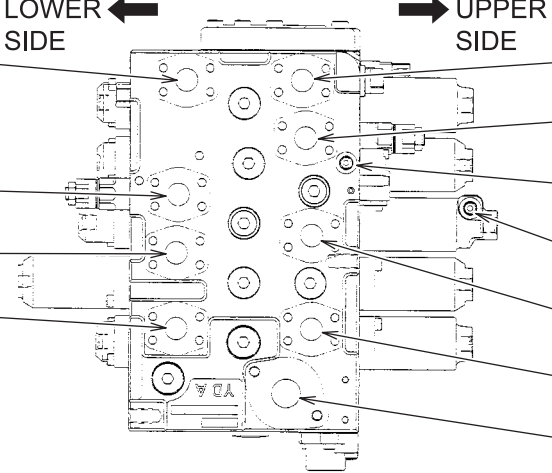
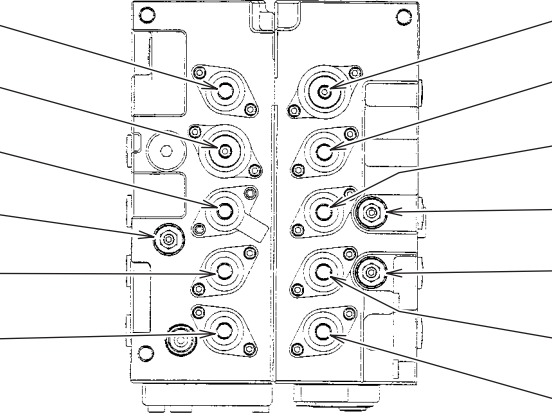
Function	Ports	Ports on left side (on machine)	Ports	Function
Option	Bo		Ao	Option
Arm 1 in	Aa		Ba	Arm 1 out
Swing left	Bs		PLc2	Arm in lock release
Travel left reverse	BL		Pss	Swing low pressure sensor
			As	Swing right
			AL	Travel left forward
			T1	Tank return
Travel left reverse	PBL		PTb	Travel straight
P2 unload	PCa		PBr	Travel right reverse
Swing right	PAs		PAb	Boom up
Arm (H) relief valve	-		-	Boom (R) relief valve
Arm in	PAa1		-	Bucket (H) relief valve
Option	PBo		PAc	Bucket digging
			PAa2	Arm 2 in

Fig. 33-73 Control valve ports (2/2)

33. UPPER STRUCTURE

33.1.20.3 INSTALLATION

- (1) Installing is done in the reverse order of removing.
- (2) Cleaning mating surfaces of upper frame and swing bearing.
- (3) Apply Loctite #515 to the inside of the capscrews on the contact surface.
- (4) Sliding upper frame
Match marks and install it with a reamer bolt (10) and a washer (11) temporarily.

CAUTION

Confirm the reamer bolt positions referring to Fig. 33-91.



: 30 mm Apply Loctite #262
Tightening torque : 490 N•m (360 lbf•ft)
Apply Loctite #262

- (5) Install swing bearing
Install 32 capscrews (9) M20×115.

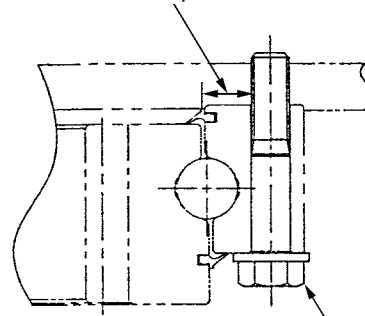


: 30 mm Apply Loctite #262
Tightening torque : 490 N•m (360lbf•ft)
Install a reamer bolt (10).



: 30 mm
Tightening torque : 490 N•m (360lbf•ft)

Apply Loctite #515 to the race surface over the whole circumference (shaded area) on the inside of capscrew.



Apply Loctite #262 equivalent.
T=490N•m (360 lbf•ft)

10,11

Fig. 33-90 Bearing mount

OUTER (S) ZONE POSITION

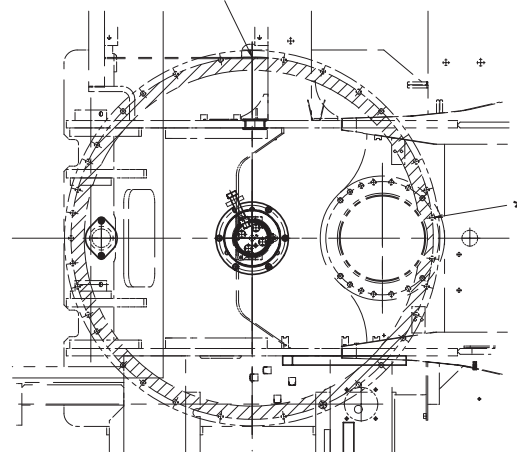


Fig. 33-91 Reamer bolt position (*) Apply Loctite to shaded area

33. UPPER STRUCTURE

4) Installing shaft

Install shaft (111) fitted with bearing (123), bearing spacer (127) and snap ring (824), to swash plate support (251).

- Do not knock on the shaft with a hammer or something.
- Fix the bearing by lightly tapping the outer race of it by means of a plastic hammer and set it exactly to the end by using a steel rod and others.

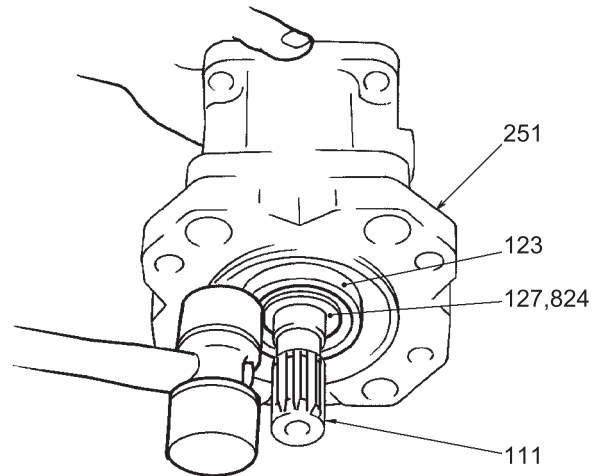
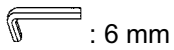


Fig. 33-105 Installing shaft (111)

5) Installing seal cover

Assemble seal cover (F) (261) to pump casing (271) and fix it with socket bolts (406).



Tightening torque : 29 N•m (22 lbf•ft)

- Coat the oil seal in seal cover (F) with a thin film of grease.
- Handle the oil seal with sufficient care so it is not scored.

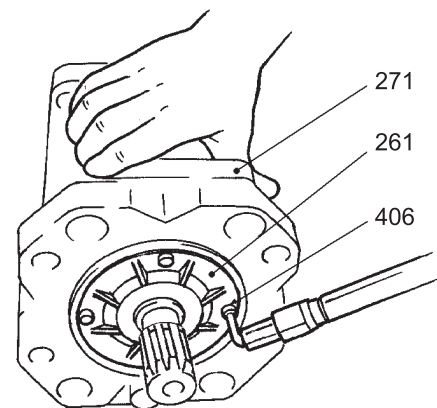


Fig. 33-106 Installing seal cover F (261)

6) Inserting piston cylinder sub

Assemble the piston cylinder sub [cylinder block (141), piston (151), shoe (152), plate (153), spherical bushing (156) and cylinder spring (157)].

Align the spherical bushing with the cylinder spline and insert them into the pump casing.

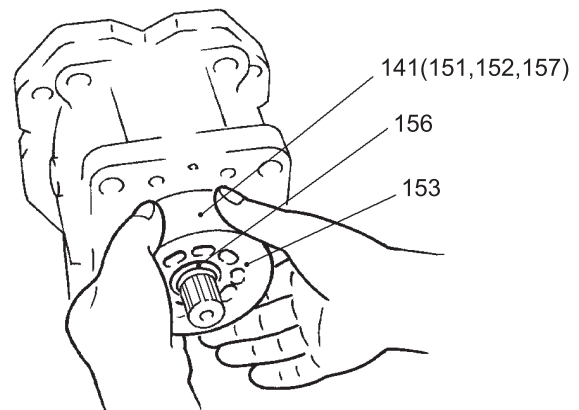


Fig. 33-107 Inserting piston cylinder sub

7) Installing valve plate

Install valve plate (313), (314) to valve block (312) by aligning pin.

- Do not mistake the suction and delivery sides of the valve plate.

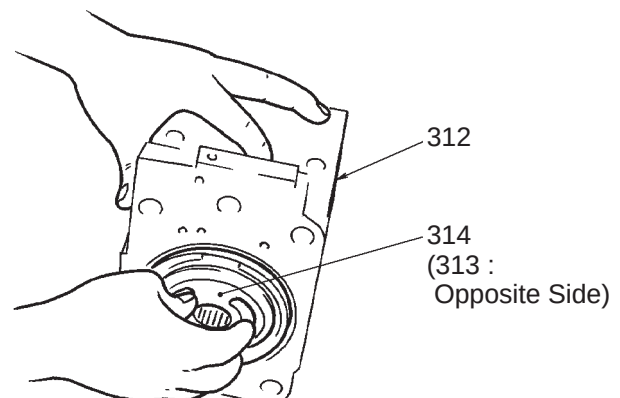


Fig. 33-108 Installing valve plates (313), (314)

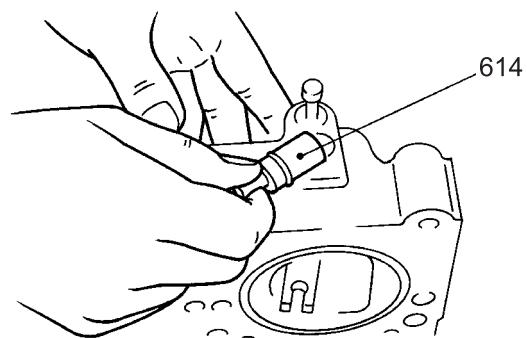


Fig. 33-118 Removing fulcrum plug (614)

10) Remove lever (Fig. 33-111 (G) section)

Remove lever 2 (613).

Do not draw out pin (875).

- The work is eased if tweezers are used.

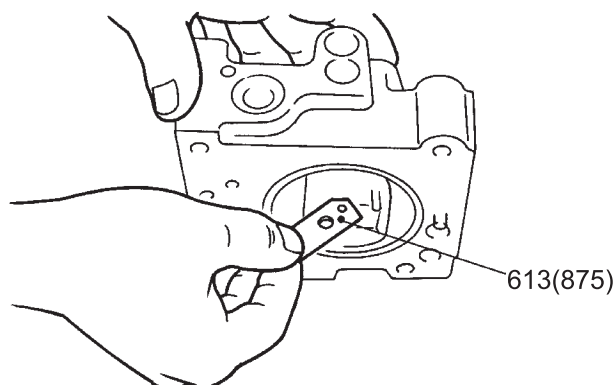


Fig. 33-119 Removing lever 2 (613)

11) Remove feedback lever

Draw out pin (874) and remove feedback lever (611).

- Push out pin (874) [pin dia : $\varnothing 4\text{mm}$ (0.157in)] from above with a slender steel rod so as not to interfere with lever 1 (612).

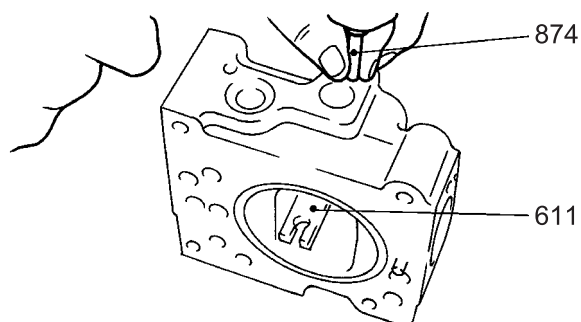


Fig. 33-120 Removing feedback lever (611) [1]

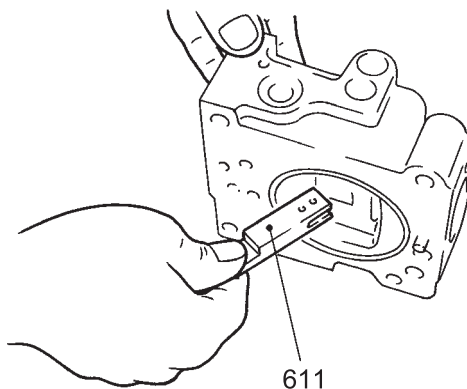


Fig. 33-121 Removing feedback lever (611) [2]

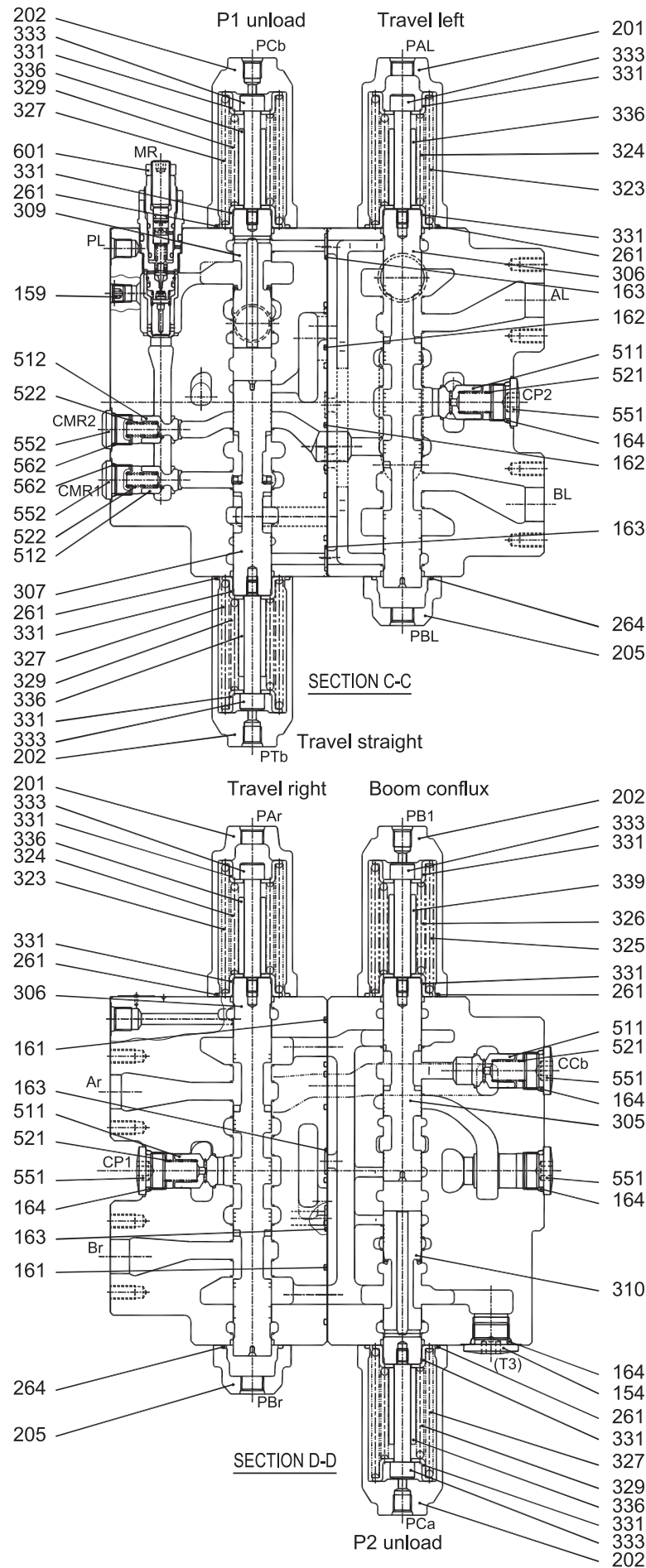


Fig. 33-141 Section (3/6)

33. UPPER STRUCTURE

33.2.2.3.6 Disassembling bucket spool

- (1) Loosen socket bolts (273) and remove bucket spring cover (209) and O-ring (261).



Fig. 33-159 Removing spring cover (209)

- (2) Draw out the assembly of bucket spool (304), spring seat (331), springs (321), (322), stopper (336) and bolt (333) from casing B (102).



Fig. 33-160 Drawing out bucket spool (304) assy

- (3) Fix the bucket spool assembly with vise via a protective plate (aluminum plate, etc.) and remove bolt (333). Then separate spring seat (331), springs (321), (322) and stopper (336) from bucket spool (304).
- (4) When needed to disassemble the spring cover of bucket spool, loosen plug (551) with casing B (102) installed. After removing cover (209) from casing B (102), remove plug (551) and then take out piston (216).



Fig. 33-161 Disassembling bucket spring cover (209)

CAUTION

When drawing out the spool assembly, use care so as not to score casing B (102).

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33. UPPER STRUCTURE

33.2.2.4.6 Assembling relief valve and relief valve hole plug assembly

- (1) Tighten main relief valve (601), port relief valves (602), (603) and relief valve hole plug assembly (604) in respective place to the specified torque.



Assemble it giving attention to the label attached when disassembling to prevent mistake because the port relief valves (602), (603) are similar in shape.

33.2.2.4.7 Assembling p2 unload spool

- (1) Hold the mid section of P2 unload spool (310) with vise provided with protection plate (aluminum plate, etc.), fit spring seat (331), springs (327), (329) and stopper (336) and tighten bolt (333) to the specified torque.



- Apply Loctite #262 when tightening bolt (333).
 - Take care not to deform P2 unload spool (310) because of careless over clamping.
-

- (2) Place P2 unload spool assembly in item (1) in casing A (101).
-



Place P2 unload spool assembly in casing A (101) carefully. Do not squeeze it into place.

- (3) Attach spring cover (202) with O-ring (261) attached to the spring side of P2 unload spool assembly and tighten socket bolt (273) to the specified torque.

33.2.2.4.8 Assembling travel straight spool

- (1) Hold the mid section of travel straight spool (307) with vise provided with protection plate (aluminum plate, etc.), fit spring seat (331), springs (327), (329) and stopper (336) and tighten bolt (333) to the specified torque.



- Apply Loctite #262 when tightening bolt (333).
 - Take care not to deform travel straight spool (307) because of careless over clamping.
-

- (2) Place travel straight spool assembly in item (1) in casing B (102).
-



Place travel straight spool assembly in casing B (102) carefully. Do not squeeze it into place.

- (3) Attach spring cover (202) with O-ring (261) attached to the spring side of travel straight spool assembly, and tighten socket bolt (273) to the specified torque.

33. UPPER STRUCTURE

33.2.3.2 DISASSEMBLY

- (1) Plug each port of pilot valve, and clean it with kerosine.
P port : PF1/4
1~4 and T port : PF3/8
- (2) Fix pilot valve with vise via a protective plate (Aluminum plate etc.), and remove boots (501).

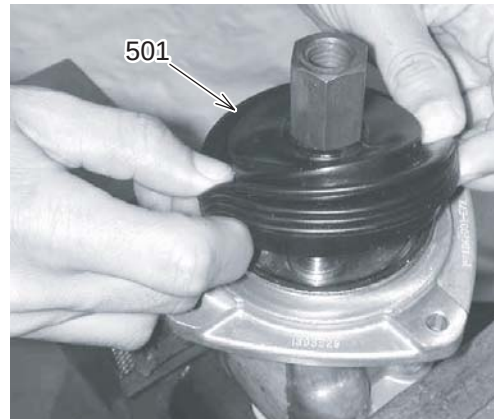


Fig. 33-183 Removing boot (501)

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

 : 22mm, 32mm

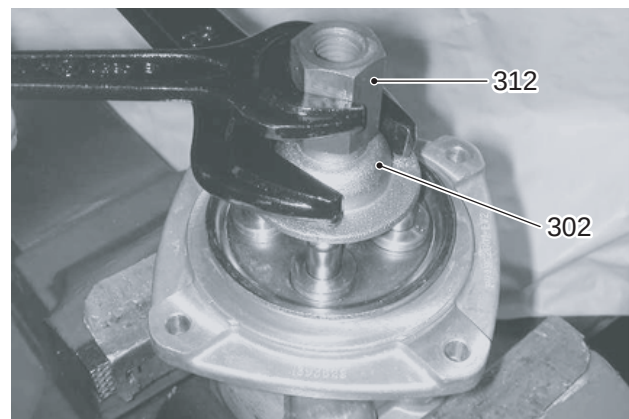


Fig. 33-184 Removing adjusting nut (312)

- (4) Remove circular plate (302)

 : 32mm

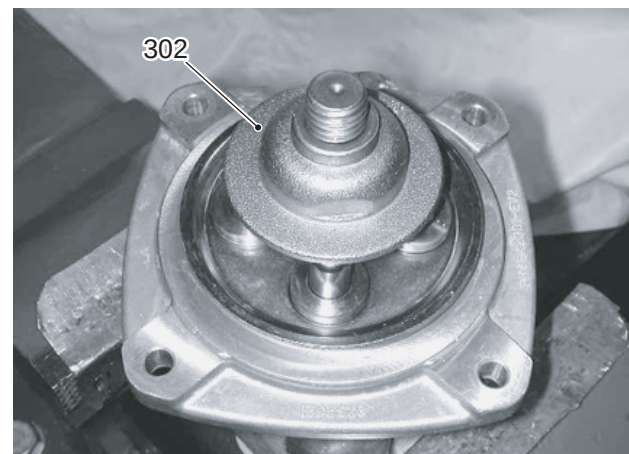


Fig. 33-185 Removing circular plate (302)

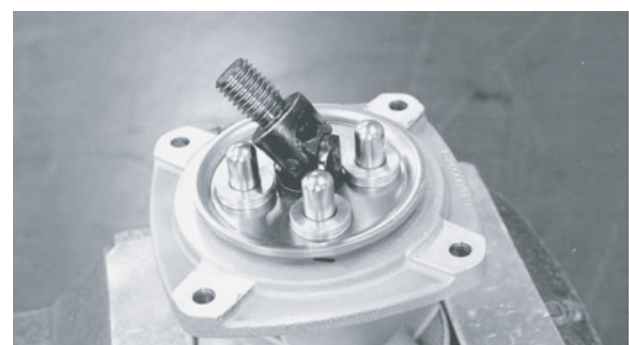


Fig. 33-186 Circular plate is removed

33. UPPER STRUCTURE

33.2.4.2 DISASSEMBLY AND ASSEMBLY

(1) Boot replacement

Note

The pilot control unit does not need to be removed from the machine to perform this operation.

- 1) Remove both faulty boots.
(using a flat screw driver if necessary)
- 2) Replace both boots with a new one.
 - * Reassembly :
 - First fit the lower part of the rubber boot on the retaining plate between the 2 switch plates
 - Then put the lower part in the external groove of the retaining plate
 - Finish by fitting the upper part of the rubber boot on the switch plate.

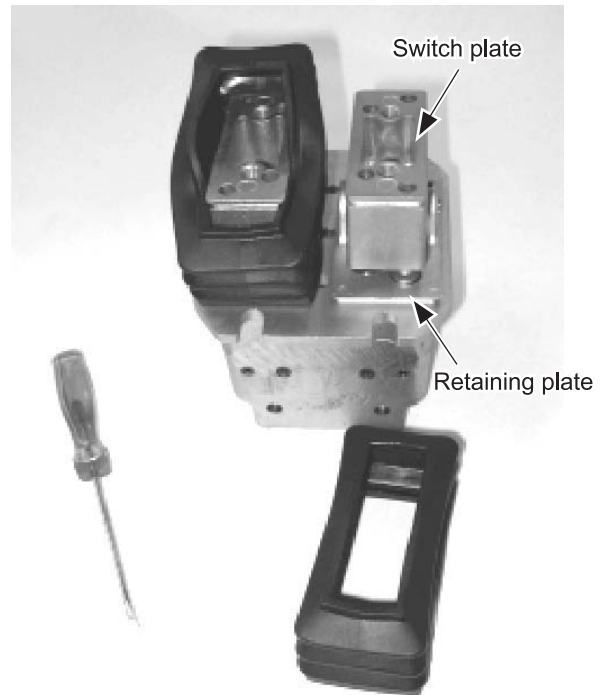


Fig. 33-208

(2) Switch plate removal

- 1) Remove :
 - The pilot control unit from the machine.
 - Both rubber boots (See 33.2.4.2 (1))
- 2) Remove the screw locking the axis using a 2mm socket wrench. (See Fig. 33-209 No.1)
 - * Reassembly :
 - Apply a droplet of Loctite #262 on the locking screw thread.
 - Torque :1.2 N•m (0.89 lbf•ft)
- 3) Fit a M3 screw on the switch plate axis in order to remove it
(Using pliers if necessary). (See Fig. 33-209 No.2)
- * Reassembly :
 - Position the axis so that the hole is aligned with the locking screw as shown on the picture (See Fig. 33-209 No.3)
- 4) Mark out the position of the switch plate before removing it.
- 5) Repeat the operation for the second switch plate.
- 6) Reassemble parts in reverse order.

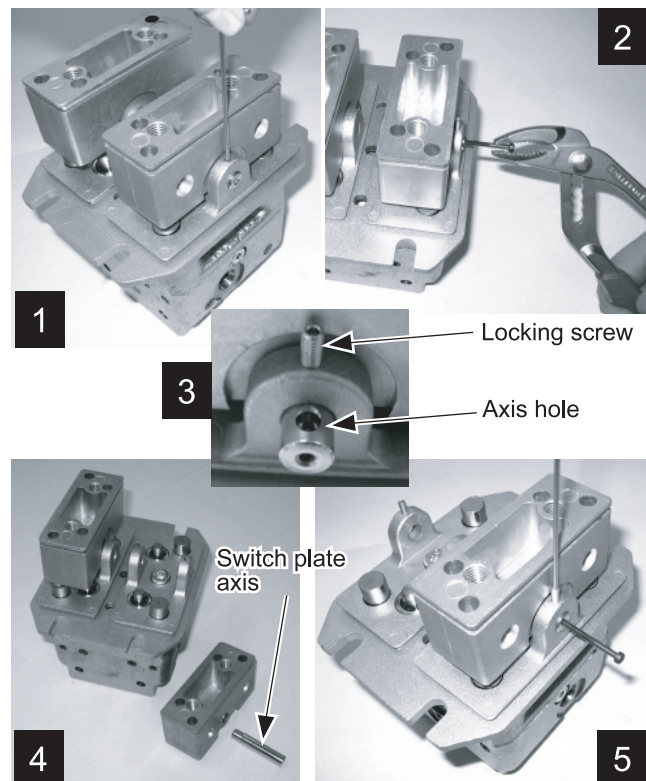


Fig. 33-209

33. UPPER STRUCTURE

33.2.5.2 DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

(1) Disassembly

- 1) Removal of relief valve assembly etc.
Remove relief valve assembly (33), cap (38), spring (37) and check (36) from cover (32).

 : 14 mm, 10 mm

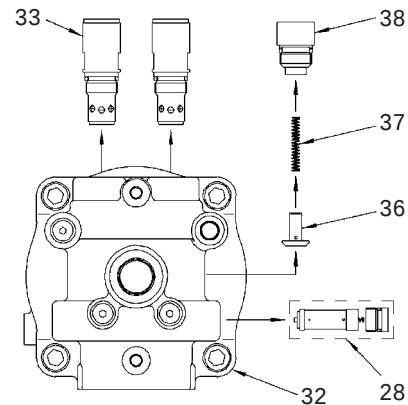


Fig. 33-230 Removing relief valve, bypass valve

2) Marking at swing motor

Before disassembling motor, make a matching mark between cover (32) and housing (25). This precaution will assist in reassembly.

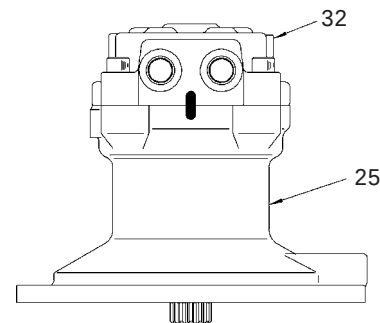


Fig. 33-231 Making a matching mark

3) Removal of cover assembly

Loosen hexagon socket bolt (35) and place shaft of motor assembly to downward and take cover (32) out.

 : 14 mm

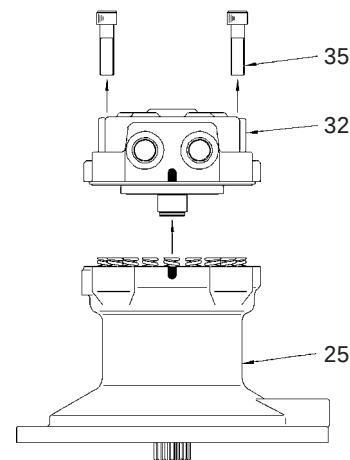


Fig. 33-232 Removing cover

4) Remove balance plate

Remove snap ring (23) with steel pointer and remove inner race of needle-bearing (22) and balance plate (21) by bearing puller.

In this time, remove balance plate (21) with attaching gear puller to crescent shaped hole of balance plate (21) and shaft of cover (32), because inner race of needle bearing (22) is press fitted into the shaft.

Remove piston (14) and piston (41) and teflon ring (42) from balance plate (21).

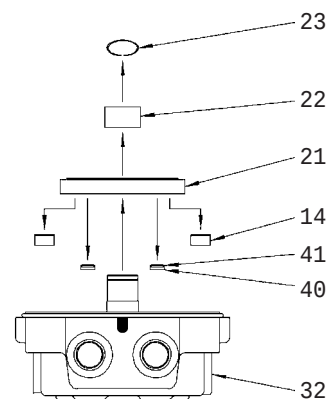


Fig. 33-233 Removing balance plate

33. UPPER STRUCTURE

13) Assembly of cover

After cleaning the matching surface between cover (32) and housing (25) and degreasing it, assemble cover (32) to housing (25) lightly, holding them up with hands.

Note

Fit matching marks on housing (25) and cover (32) made before disassembling.

Note

At this stage, there is 4.5mm (0.18in) distance between the housing (25) and the cover (32).

14) Tighten cover (32) and housing (25) with hexagonal socket bolt (35).



: 14 mm

Tightening torque ; 284 N•m {209 kgf•m}

Note

The 4 bolts (35) should be tightened equally, straight and slowly.

15) Assembly of valve assembly, check bypass valve assembly, and time delay valve

- Assemble relief valve assembly (33) to cover (32).



: 14 mm

Tightening torque ; 78 N•m {(58 lbf•ft)}

- Assemble check (36), spring (37) and cap (38) to cover (32).



: 14 mm

Tightening torque ; 137 N•m {101 lbf•ft}

- Assemble bypass valve assembly (28) to cover (32).



: 10 mm

Tightening torque ; 78 N•m {58 lbf•ft}

Note

Assemble removed parts to original state when reassembling.

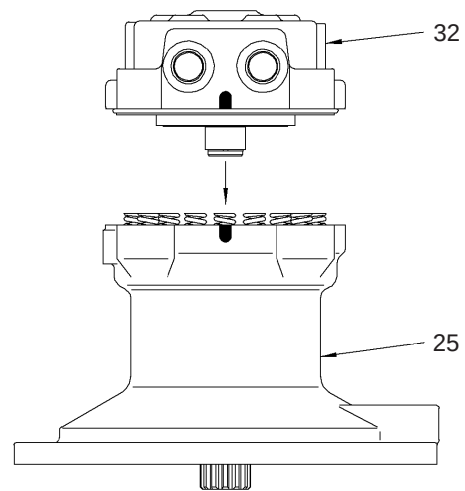


Fig. 33-262 Assembling cover

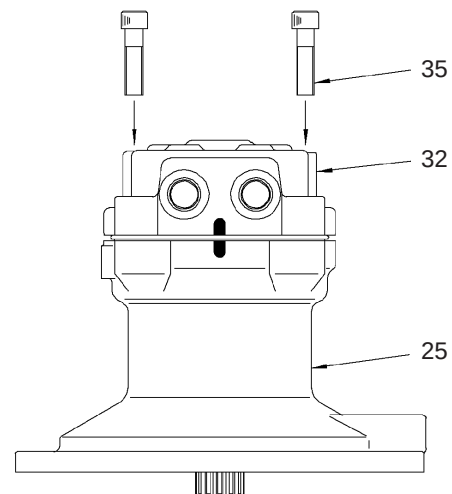


Fig. 33-263 Tightening socket bolt

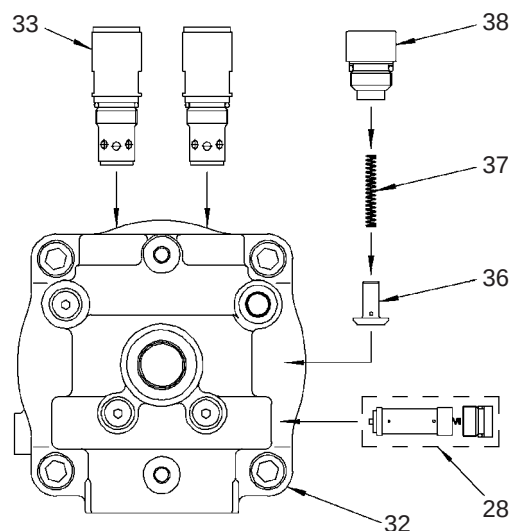
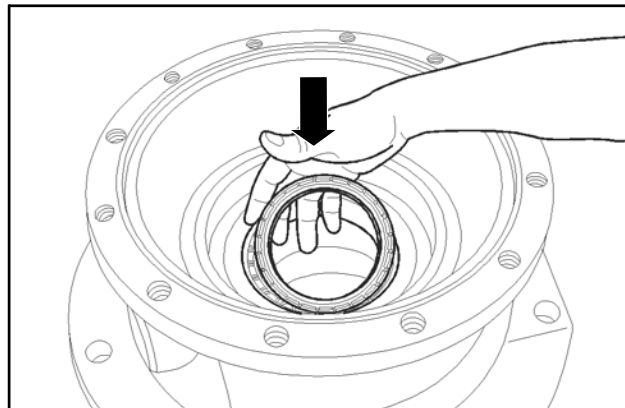


Fig. 33-264 Assembling valve assy

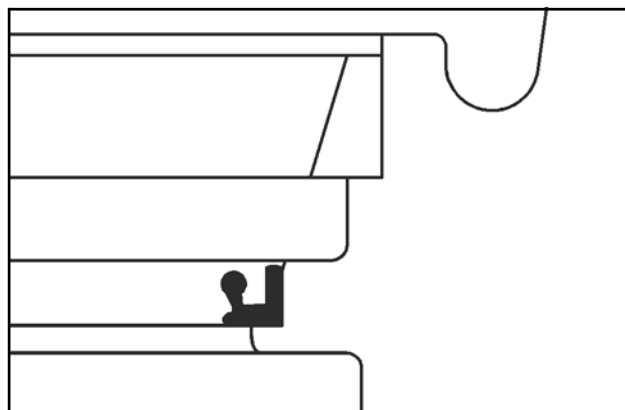
33. UPPER STRUCTURE

33.2.5.3.3 ASSEMBLY

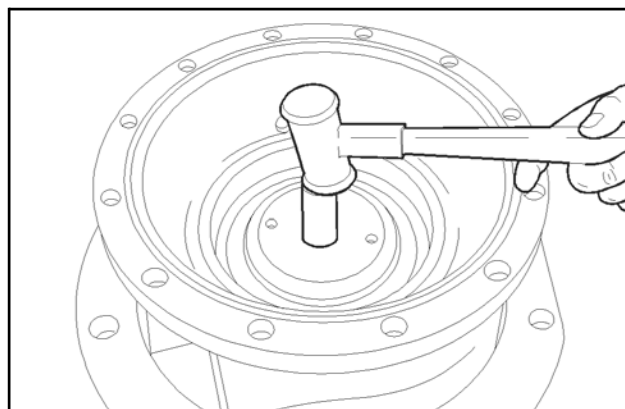
1. Place the seal ring (6) into its seat in the gearbox housing (5).



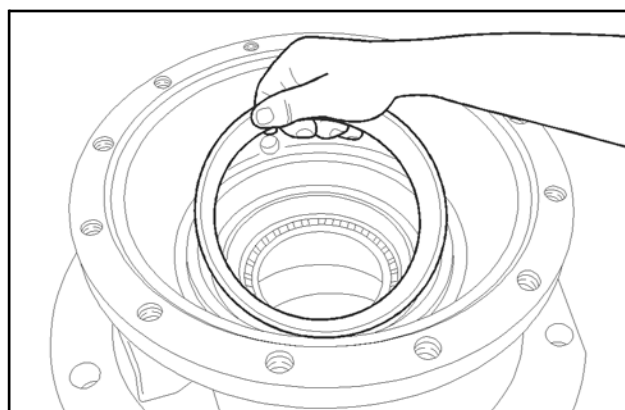
Use as reference for previous step.



2. By using the stopper (6689960930) and a rubber hammer, push the seal ring (6) against the seat shoulder.

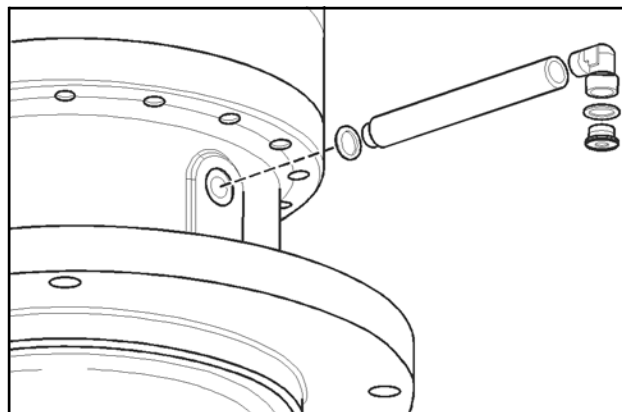


3. Place the bearing outer ring (7) inside the gearbox housing (5).



33. UPPER STRUCTURE

32. Assembling the angle (13) and the extension (14) on the gearbox housing (5). Insert the washer (12) and the 3/8 in. plug (11) into the angle (13). Tighten the plug (11) using a torque wrench to $25 \pm 5 \text{ N}\cdot\text{m}$ ($18.4 \pm 3.7 \text{ lbf}\cdot\text{ft}$) torque.



Fill the gearbox with lubricant oil as per specifications.

NOTES

4) Installing floating seals (7)

Two floating seals (7) make a pair. Install one floating seal to retainer installed in the shaft (2), and another to the inside of upper roller (1).

- Prior to installing the floating seal (7), apply engine oil lightly to seal surface.

5) Inserting shaft (2)

Coat shaft (2) with a thin film of oil and insert it into upper roller (1).

6) Installing plate (4)

Mount upper roller (1) on the stand jig (f) and attach plate (4) to the end face of the shaft with bolt (9).



: 10mm,

Tightening torque : 115N•m (85 lbf•ft)

7) Installing O-ring (8)

Fit O-ring (8) to the groove of cover (5).

- Apply grease to O-ring.

8) Installing cover (5)

Install the cover (5) to upper roller (1). Use a press in this operation as a press fit is necessary.

9) Installing snap ring (11)

Install the snap ring (11) into upper roller (1) using a snap ring pliers.

10) Adding oil

Pour 30cc (1.0 oz) of engine oil API grade CD #30 through the plug hole in cover (4).

11) Installing plug (10)

Wind seal tape around plug (10) and screw it into the plug hole of cover (4).



: 6mm,

Tightening torque : 23N•m (17 lbf•ft)

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

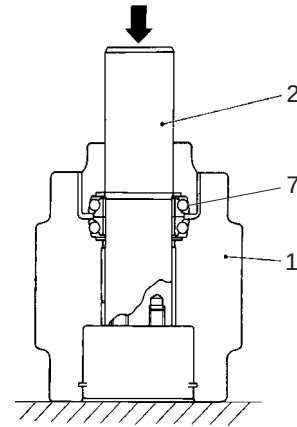


Fig. 34-20 Inserting shaft

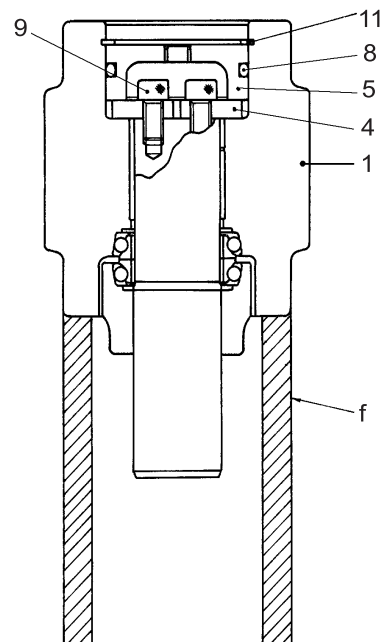


Fig. 34-21 Installing cover

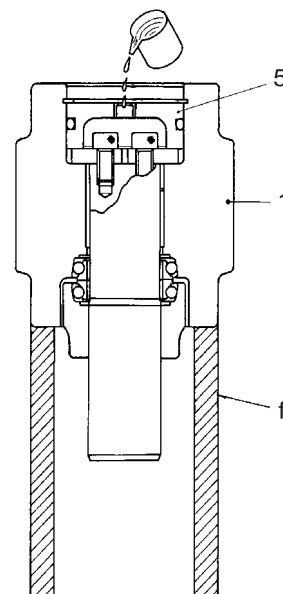


Fig. 34-22 Filling oil

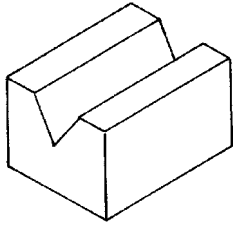
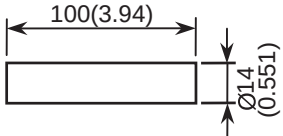
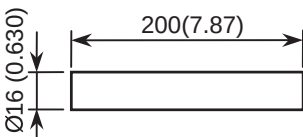
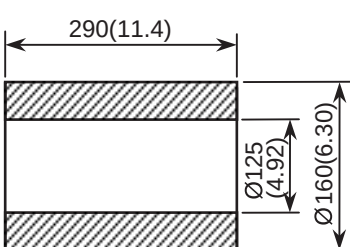
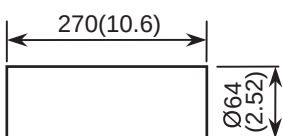
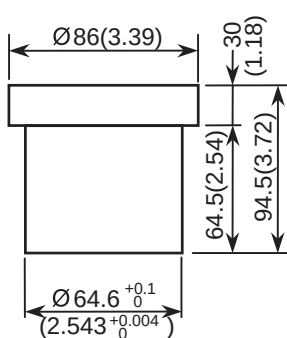
34. TRAVEL SYSTEM

34.1.4.7 TOOLS AND JIGS

(1) Tightening tools

Unit : mm	
NAME	OPPOSING FLATS
 Socket	19, 27
 Allen wrench	6

(2) Jig

Unit : mm (in)		
No.	NAME	SHAPE
K	V-block	
L	Pin (5) extrusion rod	
N	Bushing extrusion rod	
M	Stand jig	
P	Shaft extrusion jig	
Q	Bushing fixing jig	

34. TRAVEL SYSTEM

34.1.6 SPROCKET

34.1.6.1 REMOVING

(1) Preparation for removal

Remove crawler referring to "34.1.2 CRAWLER", lift up crawler frame with attachment, and put it on square timbers to float and stabilize.

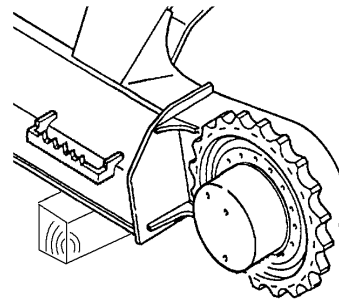


Fig. 34-66 Preparation for removal

(2) Removing sprocket

Loosen 30 capscrews (2) M16×50, for the attaching of the sprocket by means of a socket and remove the sprocket (1).

Weight of sprocket : 48kg (106 lbs)

 : 24 mm

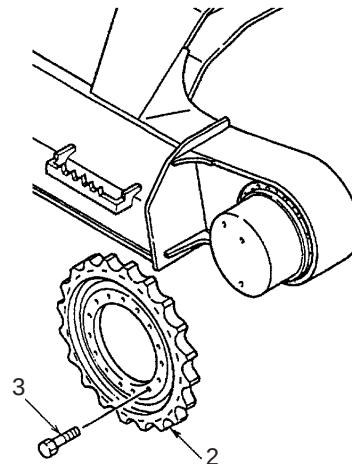


Fig. 34-67 Removing sprocket

34.1.6.2 INSTALLING

(1) Check before installing

Check the mating portion of the travel reduction unit and the sprocket, eliminate burrs and contamination thoroughly and install the sprocket.

(2) Installing the sprocket

Apply Loctite #262 to the sprocket attaching capscrews (3) and fasten the sprocket to the travel reduction unit.

(3) Installing sprocket completely

Remove the wooden blocks under the truck frame, bring the machine down on the ground and tighten the sprocket.

 : 24 mm

Tightening torque : 279 N•m (206 lbf•ft)

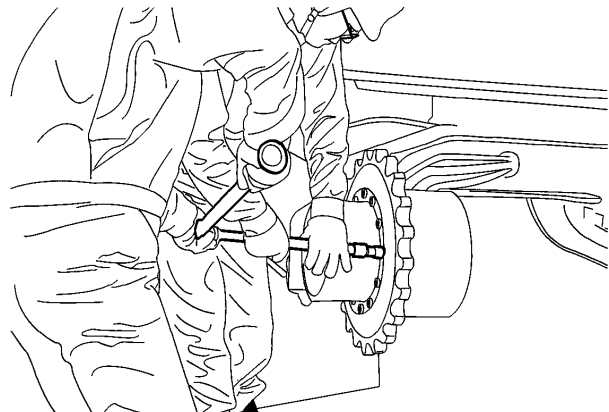


Fig. 34-68 Installing sprocket completely

34. TRAVEL SYSTEM

Tightening torque N•m (lbf•ft)	Width across flats mm	No.	NAME	Q'TY	Tightening torque N•m (lbf•ft)	Width across flats mm	No.	NAME	Q'TY
		1	FLANGE	1			44	COLLAR	1
		2	BASE PLATE	1			45	PIN	3
		3	PLUNGER ; FOR BRAKE VALVE	1			46	PLATE (SWASH PLATE)	1
		4	CHECK VALVE	2			47	BALL	2
		5	SPRING	2			48	PISTON ASSY	2
137 (100) ☆	14	6	PLUG ; M24, P=1.5	2			49	BALL BEARING	1
		7	O-RING 1B P21	2			50	BALL BEARING	1
		8	SPRING SEAT	2			51	PIN	1
		9	SPRING	2	205 (150)	12	52	CAPSCREW ; M14×35	10
		10	SPRING SEAT	2			53	OIL SEAL ; TCZ50×72×9	1
		11	CAP	2			54	DISK PLATE	3
108 (80)	10	12	O-RING 1B G45	2			55	FRICTION PLATE	2
		13	CAPSCREW ; M12×40	8			56	BRAKE PISTON	1
		14	O-RING 1B P8	2			57	O-RING	1
20.6 (15)	14	15	PLUG ; PF1/8	2			58	O-RING	1
373 (270)	27	17	RELIEF VALVE ASSY ; PF1-5/16	2			59	SPRING	6
9.8 (7.2)	2.5	18	PLUG ; METAL PLUG M5	8			60	PIN	4
		19	SPOOL A ; 2-SPEED SELECT	1			61	SPRING	2
		20	SPOOL C	1			62	VALVE PLATE	1
		21	SPRING	1			63	O-RING 1B P10	4
118 (87)	10	22	PLUG ; PF1/2	1			64	O-RING	1
		23	O-RING 1B P18	2			65	NAME PLATE	1
		24	SPRING GUIDE	1			66	RIVET	2
118 (87)	10	25	PLUG ; PF1/2	1			67	PLUG ; PT1	2
		26	WASHER	1			68	PLUG ; PT1/2	1
2.45 (1.8)	2.5	28	ORIFICE ; M5×5	1			69	PLUG ; PT1/4	1
2.45 (1.8)	2.5	29	ORIFICE ; M5×5	3			70	FLOATING SEAL	2
2.45 (1.8)	2.5	30	ORIFICE ; M5×5	2			71	ANGULAR BEARING	2
36.8 (27)	6	31	PLUG ; PF1/4	4			72	HOUSING (RING GEAR)	1
		32	O-RING 1B P11	4			73	SHIM	1
		33	BALL	2			74	HOLDER C	1
		34	SPRING	2			75	WASHER	8
		36	SHAFT	1	539 (400) ☆	T90	76	BOLT ; M20×70	8
		37	CYLINDER BLOCK	1			77	THRUST PLATE	4
		38	PISTON ASSY	9			78	INNER RACE	4
		39	RETAINER PLATE	1			79	NEEDLE BEARING	4
		40	RETAINER HOLDER	1			80	PLANETARY GEAR C	4
		41	SNAP RING	1			81	THRUST PLATE	4
		42	SPRING SEAT	1	539 (400) ☆	T90	82	BOLT ; M20×130	4
		43	SPRING	1			83	SUNGEAR C	1

☆ : Apply loctite

34. TRAVEL SYSTEM

(16) Draining lube oil from the reduction gear

Before disassembling the reduction unit, install eye bolts in two tapped holes of flange (1). Use a hoist to lift the reduction unit. Remove two plugs (97) and drain lube oil from the reduction unit.

 : 12 mm

CAUTION

Prepare an oil container before lifting.

- Do not lift the reduction unit above knee level.

(17) Removing cover (95)

Loosen and remove bolts (96).

Remove the cover (95).

 : 8 mm

CAUTION

Take note of the following:

- Liquid sealant is applied between cover (95) and housing (72). The cover will be hard to remove. Loosen bolts (96) and tap the top and sides of the cover (95) with a plastic mallet.
- Use a flat-blade screwdriver between cover (95) and housing (72) to pry the cover off.

(18) Removing thrust plate (94)

Remove the thrust plate (94) from the top face of thrust plate (91)

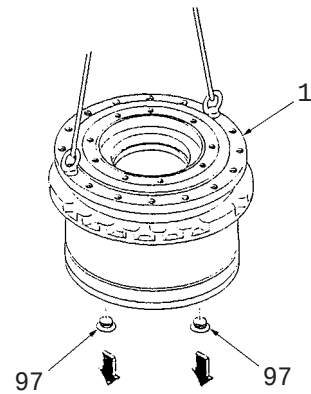


Fig. 34-109 Draining oil from reduction unit

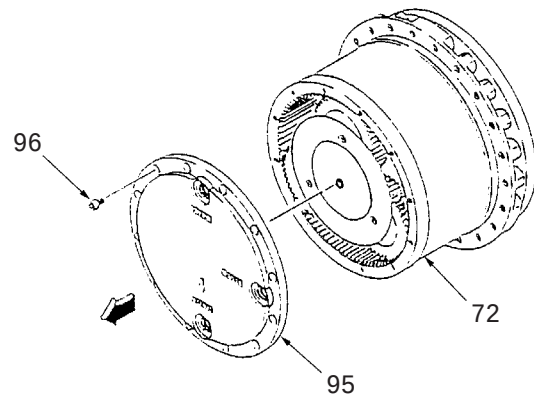


Fig. 34-110 Removing cover (95)

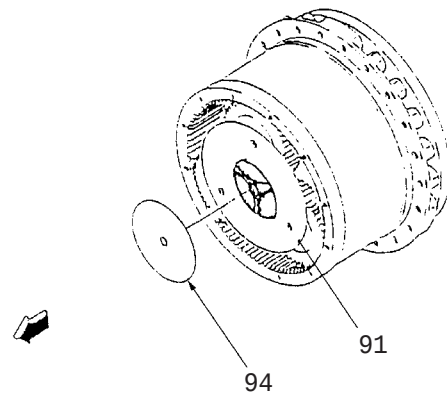


Fig. 34-111 Removing thrust plate (94)

<Motor>

(1) Installing oil seal (53)

Make sure that flange (1) is equipped with oil seal (53). If not, press oil seal (53) into flange (1), using the oil seal installation jig and following the below information.

CAUTION

Before installing oil seal (53), apply grease to the oil seal bore surface of flange (1) and outer diameter surface of oil seal (53).

- Apply grease to the lip of oil seal with grease and position the oil seal in the bore.
- Press the oil seal until fully seated. Be sure the seal is straight.
- Be careful not to damage the lip oil seal when installing. If the lip is damaged, oil leakage may occur and reduction gear failure will result.

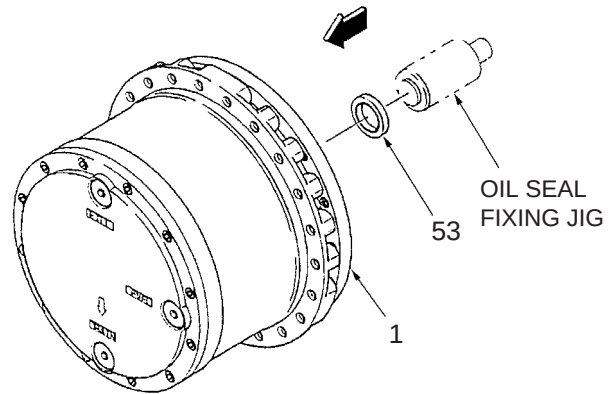


Fig. 34-135 Installing oil seal (53)

(2) Installing piston assembly (48)

Position spring (61) in the piston assembly (48) bore in flange (1).

Install piston assembly (48) in flange (1) following the Cautions below.

CAUTION

Place spring (61) in the center of the bore.

- Install piston assembly (48) with its cylindrical part facing downward.
- Before installing piston assy (48), apply hydraulic oil to the bore of flange (1) and the outer surface of the cylindrical part of piston assy (48).
- After installing piston assembly, make sure it moves smoothly.

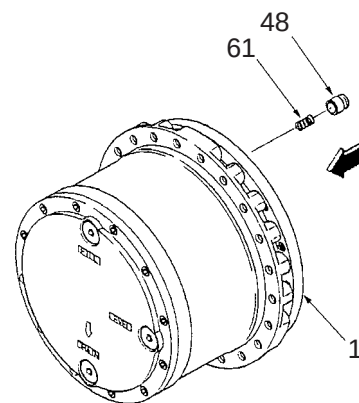


Fig. 34-136 Installing piston assy (48)

(3) Installing steel balls (47)

Install steel balls (47) in the bores in the spherical surface of flange (1).

CAUTION

Before installing steel balls (47), apply hydraulic oil to the bore surface in the spherical surface in flange (1) and the steel balls.

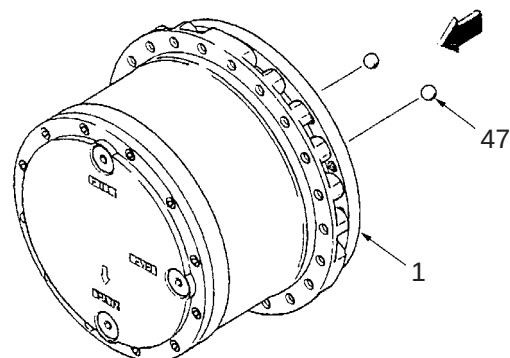


Fig. 34-137 Fixing steel balls (47)

34. TRAVEL SYSTEM

Parts	Check point	Tolerance	Remedy
Swash plate (46)	3. Spherical hole in which a steel ball is placed	Ball depth : 14.5mm (0.571in)	Replace swash plate.
Shaft (36)	1. O.D. of oil seal sliding surface	The sliding surface shows a scratch deeper than 0.02mm (0.0008in) or is roughened, except the oil seal lip moving marks on the 1.6a roughness.	Replace shaft.
	2. Spline at the joint of cylinder block (43)	The pin that measures the over-pin dia. 47.380mm (1.86535in) measures $\varnothing 3.00\text{mm}$ (0.11811in) or is broken.	
	3. Spline at the joint of drive gear	The pin that measures the between dia. 30.498mm (1.20071in) measures $\varnothing 3.33\text{mm}$ (0.13122in) or is broken.	
Brake piston (56)	1. Appearance and dimension	Height : 38.2mm (1.504in)	Replace brake piston.
	2. Sliding surface	Roughness: 2.5a	
	3. Appearance	The surface shows a scratch deeper than 0.02mm (0.0008in) or is roughened.	
Disk plate (54)	1. Appearance and dimension	Thickness : 3.2mm (0.126in)	Replace disk plate.
	2. Appearance	The moving surface has a deep scratch or the abrasive material is peeled off.	
Ball bearing (49) Ball bearing (50)	1. Rolling surface	Flaking or impressed marks are seen.	Replace ball bearing.
	2. Function	Rotation is abnormal. (abnormal sound and uneven rotation)	
Piston assy (48)	1. Sliding surface of shoe	The roughness is 1.6a or the surface is roughened or the scratch is deeper than 0.02mm (0.0008in).	Lap the sliding surface of shoe. (#1000) In case the scratch does not disappear, replace the flange holder kit.
	2. O.D. of piston	The roughness is 1.2a or the surface is roughened or the scratch is deeper than 0.02mm (0.0008in).	
	3. O.D. of piston and bore diameter of flange holder (1)	Clearance: 0.040mm (0.00157in)	Replace flange holder kit.
	4. Gap on shoe ball	Gap : 1.0mm (0.039in)	

34. TRAVEL SYSTEM

(5) Auto 2-speed select function

Trouble	Probable cause	Remedy
High-speed rotation can not be selected	Pilot pressure is not at Ps port.	Check that pilot pressure is at Ps port, check for the cause, inspect and repair.
	Foreign matter is included between spool and base plate, and spool does not change over.	Disassemble, remove foreign matter, and check the extent of scratch according to the maintenance manual. If spool is reusable, reassemble. If it can not be reused, replace base plate kit.
	2-speed control piston develops abnormal wear and pressure is leaking into casing.	Disassemble and replace flange holder kit.
	2-speed control piston is not fixed.	Assemble 2-speed piston in a regular position.
	Orifice in 2-speed oil passage is clogged with foreign matter. Therefore, pressure does not reach 2-speed control piston.	Disassemble, eliminate foreign matter and reassemble.
Motor changes over to high speed, but changes to low speed as the temperature of hydraulic oil rises.	2-speed control piston is worn abnormally, and pressure is leaking into casing.	Disassemble and replace flange holder kit.
Motor does not select low speed.	Pressure at Ps port does not go down even if speed control switch is set at low speed.	Check that pressure at Ps port is below 0.5MPa (71psi) and review piping system.
	Spring in 2-speed control valve is broken.	Disassemble, remove foreign matter and replace spring.
	Spring is not placed in 2-speed control valve.	Assemble spring in a correct position.
	Since foreign matter is included between spool and base plate, spool does not come back.	Disassemble, clean foreign matter, and check the extent of scratch according to the maintenance manual. If spool is reusable, reassemble. If not, replace base plate kit.
Motor does not change over to low speed.	Orifice in 2-speed passage is clogged with foreign matter, and pressure does not go out of 2-speed control piston chamber.	Disassemble, remove foreign matter and reassemble.
	Spring in 2-speed control valve is fatigued. As the result, change pressure is low.	Disassemble and replace spring.
Motor changes to low speed, but changes to high speed while running.	Pilot piping is clogged with foreign matter and oil leaks from 2-speed control valve. As the result, pilot pressure rises to a changeover level.	Clean the inside of piping and remove foreign matter. Also review the piping system.

46. TROUBLE SHOOTING (BY ERROR CODES)

Table46-3

Error code	A035		
Trouble	Not yet adjusted unload valve or failed adjustment of unload valve (C adjustment)		
Judging condition	The adjustment of unload valve is missed. Or the adjusting value can not be set in the adjusting range.		
Symptom	It is not normal output, but no problem in normal operation		
Control in the event of failure	Work with the aid of output by default proportional valve.		
Returned in normal condition	The adjustment of unload valve is completed normally.		
Service diagnosis checking screen	Screen No.	8	D-1 P1 UN-LOAD (BP-CUT)
	Screen No.	8	D-2 P2 UN-LOAD (BP-CUT)
	Screen No.		
Checking object		Checking contents and remedy	
1	•Checking		Carry out adjustment of unload valve (C adjustment). When"ERROR PUMP" was displayed during adjustment, refer to the section "Adjustment procedure - Measures to be taken with the adjustment failed"
2	• Mechatro controller		Check that the error is corrected after replacement of controller.
3			

Table46-4

Error code	A215		
Trouble	The data of ROM adjustment is written incorrectly.		
Judging condition	Check adjustment data, and judge the content of memory is correct or not. (Trouble history only)		
Symptom	No affect.		
Control in the event of failure	Control at side of correct memory data.		
Returned in normal condition	It does not regain. Replace controller.		
Service diagnosis checking screen	Screen No.		
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	Mechatro controller		Check that the error is corrected after replacement of controller.
2			
3			

46. TROUBLE SHOOTING (BY ERROR CODES)

Table46-23

Error code	B054		
Trouble	Bucket digging pressure sensor's power source is shortcut.		
Judging condition	The input voltage from bucket digging pressure sensor is 4.7V or more.		
Symptom	The bucket digging speed slows down a little.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) Set output of P1 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	5	B-5 BUCKET DIG
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Bucket digging pressure sensor SE-1		When B054 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between bucket digging pressure sensor and controller CN-124F CN-101F		When B054 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

Table46-24

Error code	B062		
Trouble	Bucket dump pressure sensor outputs error		
Judging condition	After starter switch ON and engine does not start yet. And the input voltage from the bucket dump pressure sensor after starter switch ON is in the range of 1.4V or more to less than 4.7V.		
Symptom	The bucket dump operability becomes poor.		
Control in the event of failure	Normal control		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	5	B-6 BUCKET DUMP
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Bucket digging pressure sensor SE-2		When B062 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between bucket digging pressure sensor and controller CN-125F CN-101F		When B062 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

46. TROUBLE SHOOTING (BY ERROR CODES)

Table46-43

Error code	B174		
Trouble	P2 side option pressure sensor's wiring is disconnected.		
Judging condition	The input voltage from P2 side option pressure sensor is 4.7V or more.		
Symptom	The selection of conflux does not work.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) Set output of P2 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	B-17 P2 OPT.
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• P2 side option pressure sensor SE-11		When B174 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between P2 side option pressure sensor and controller CN-303F CN-102F		When B174 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

Table46-44

Error code	C012		
Trouble	P1 pump pressure sensor outputs error		
Judging condition	After starter switch ON and engine does not start yet. And the input voltage from the P1 pump pressure sensor after starter switch ON is in the range of 1.4V or more to less than 4.7V.		
Symptom	The P1 pump operability becomes poor.		
Control in the event of failure	Normal control		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	7	C-1 PUMP P1
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• P1 pump pressure sensor SE-22		When C012 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between P1 pump pressure sensor and controller CN-139F CN-103F		When C012 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller		Check that the error is corrected after replacement of controller.

46. TROUBLE SHOOTING (BY ERROR CODES)

Table46-63

Error code	E013		
Trouble	P1 pump proportional valve's wiring is disconnected.		
Judging condition	The feed-back value from proportional valve is 100mA or less. (If output is 100mA or less, judging is not done.)		
Symptom	The delicate operability of P2 pump related attachment becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode)		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	9	E-1 PUMP P1
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• P1 pump proportional valve PSV-P1	When E013 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it. When replacing of connector is executed, turn off power source once.	
2	• Wiring between P1 pump proportional valve and controller CN-141F CN-105F	When E013 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary. When replacing of connector is executed, turn off power source once.	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

Table46-64

Error code	E022		
Trouble	P2 pump proportional valve and output transistor ON are failure.		
Judging condition	The feed-back value from proportional valve is 1000mA or more.		
Symptom	The delicate operability of P2 pump related attachment becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode)		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	9	E-2 PUMP P2
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• P2 pump proportional valve PSV-P2	When E022 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it. When replacing of connector is executed, turn off power source once.	
2	• Wiring between P2 pump proportional valve and controller CN-142F CN-105F	When E022 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary. When replacing of connector is executed, turn off power source once.	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

46. TROUBLE SHOOTING (BY ERROR CODES)

Table 46-83

Error code	H034		
Trouble	Arm angle potentiometer's power source is shortcut.		
Judging condition	The input voltage from arm angle potentiometer is 0.1V or less.		
Symptom	Indications of rating load and working radius of High-reach crane become abnormal.		
Control in the event of failure	Normal control		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	12	H-3 ARM
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Arm angle potentiometer SE-19	Measure the resistance between terminals of arm angle potentiometer. 4.0~6.0k Ω Turn the potentiometer and measure resistance between signal and GND. Normal value: 0 to all resistance (4.0~6.0)k Ω	
2	• Wiring between arm angle potentiometer and controller CN-703F CN-103F	Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

Table 46-84

Error code	H091		
Trouble	Fuel sensor grounding is short-circuited.		
Judging condition	The input voltage from fuel sensor is 0.1V or less.		
Symptom	Warning for low fuel level is indicated.		
Control in the event of failure	Fuel level becomes 0%.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	10	H-9 FUEL LEVEL
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Fuel sensor potentiometer SE-15	Move fuel sensor and measure the resistance between terminals of fuel sensor. EMPTY 95 Ω ~ FULL 5 Ω	
2	• Wiring between fuel sensor and controller CN-152F CN-104F	Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

46. TROUBLE SHOOTING (BY ERROR CODES)

Table 46-98

Error code	R174		
Trouble	Engine forcibly stop relay error		
Judging condition	The mechatro controller output line to engine forcibly stop is short-circuited with the power source.		
Symptom	When key switch is turned off but engine does not stop. Engine auto idle stop function does not actuate.		
Control in the event of failure	Relay output is stopped.		
Returned in normal condition	When the power is OFF		
Service diagnosis checking screen	Screen No.	4	K-3 ENG STOP
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Engine forcibly stop relay R-25	When error is cancelled after removing of engine forcibly stop relay, check relay unit for failure, replace it with new one if failed. When resistance between relays (1) and (2) is $0\ \Omega$, it is in abnormal condition. 	
2	• Wiring between engine forcibly stop relay and controller CN-109F, CN2-2 • Fuse & relay box E-1	When R174 is left displayed with the relay removed Check that no power 24V is produced on relay (-) line according to the wiring checking procedure and replace it if necessary. When no failure found after checking on wiring and R174 is left displayed. Replace fuse/relay box.	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

47. TROUBLESHOOTING (BY TROUBLE)

No.	Sections	Contents/normal value		Corrective action, others
13	Boom spool <Trouble> Only P1 pressure is high.	Visual check.	When removing, free from abnormal resistance against sliding. Spring is free from breakage.	Replace. (Check on the casing side for damage).
14	Check boom spool and recirculation <Trouble> Only P1 pressure is low.	Disassembly and investigation.	Free from abnormal resistance against sliding. Spring is free from breakage.	Replace spool assembly.
15	Conflux spool <Trouble> Only P2 pressure is high.	Visual check.	When removing, free from abnormal resistance against sliding. Spring is free from breakage. Free from abnormal damage, etc on outside surface.	Replace. (Check on the casing side for damage).
16	Main relief valve <Trouble> Relief pressure is low.	Check set pressure.	•See Service Diagnosis Data List Operation No.3 boom up full lever and relief.	Reset or replace.
17	Over load relief valve <Trouble> Relief pressure is low.	Visual check (Head side).	Pressure is 32MPa or more in boom up full lever and high idling. Free from dust entered in over load relief valve. Seat is free from abnormality.	When only relief pressure of boom up is low, replace valve.

(6) Slow boom down/insufficient power for lifting up body

No.	Sections	Contents/normal value		Corrective action, others
1	Boom down pressure sensor.	Carry out service diagnosis.	•See Service Diagnosis Data List Operation No.5 boom down full lever & in operation.	Check and replace pressure sensor. Check remote control valve.
2	Remote control valve.	Measure remote control pressure of boom down directly.	Check that pressure is 3.0MPa or more in boom down full lever and high idling operation.	Check remote control valve When equipped with multi control valve, check it while changing lever pattern.
3	Actual measuring current value of P1 unload proportional valve.	Carry out service diagnosis.	P1 unload valve (cut valve). •See Service Diagnosis Data List Operation No.5 boom down full lever & in operation.	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
4	Secondary pressure of P1 unload proportional valve.	Measure the proportional valve secondary pressure directly at the ports A7 of 8 sections solenoid block.	Check that P1 unload secondary pressures are within the range of 0.8 to 1.2MPa in boom down full lever and high idling operation.	Replace proportional valve.
5	Actual measuring current value of P1 pump proportional valve	Carry out service diagnosis	•No.9 E-1 P1 pump. •See Service Diagnosis Data List Operation No.5 boom down full lever & in operation.	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
6	Secondary pressure of P1 pump proportional valve.	Measure the pump proportional valve secondary pressure directly (Ports a3, a4)	Check that P1 pump proportional valve pressures are within the range of 2.0 to 2.5MPa in boom down full lever and high idling operation.	Replace proportional valve.

47. TROUBLESHOOTING (BY TROUBLE)

No.	Sections	Contents/normal value		Corrective action, others
7	Swing reduction gear oil	Take sample oil from swing reduction gear drain.	Sampling oil does not include a lot of metal powder.	Disassemble and inspect reduction gear.
8	Swing reduction	Visual check	Tooth surface has no abnormally worn and chipped.	Replace.

(13) Swing drifts on a slope while swing control lever is in neutral position

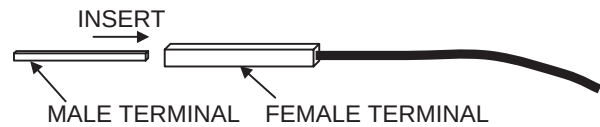
No.	Sections	Contents/normal value		Corrective action, others
1	Swing pressure sensor	Carry out service diagnosis.	•Engine stop & starter key ON. All pilot low pressure sensors are within range of 0 to 0.1MPa.	Check and replace pressure sensor.
2	Remote control valve	Check targeted remote control valve.	Check that spool is free from abnormal damage and spring is free from breakage.	Replace.
3	Swing parking brake solenoid	Carry out service diagnosis.	No.3 F-2 SWING-BRAKE Lever neutral: COMP ON, MEAS ON Swing: COMP OFF, MEAS OFF	Check swing pressure sensor Check harness. Check parking brake release switch.
4		Measurement of solenoid valve A2 port	Lever neutral: 0MPa In operation: 4MPa or more	Replace solenoid valve.
5	Swing motor (Brake valve/friction plate)	Visual check	Disassemble and inspect abnormal wear and scuffing.	Replace.
6	Parking brake	Visual check	Piston and friction plate do not have abnormal resistance against sliding Free from spring damage.	Replace.

(14) Swing drifts at stopping

No.	Sections	Contents/normal value		Corrective action, others
1	Shuttle valve <Trouble> Pilot pressure is low	Visual check	No contamination on spool cover (short side) and orifice. No damage on spool cover (long side) and shuttle.	Clean or replace.
2	Swing pressure sensor	Carry out service diagnosis	•Engine stop & starter key ON All pilot low pressure sensors are within range of 0 to 0.1MPa.	Replace pressure sensor.
3	Swing relief valve <Trouble> Relief pressure is low.	Check set pressure	•See Service Diagnosis Data List Operation No.10 Swing full lever and relief.	Reset or replace.
4	Anti-reaction valve	Visual check	Free from dirt entering Sliding part should be free from foreign matter entering, abnormal damage and wear.	Clean or replace
5	Remote control valve	Check targeted remote control valve	Check that spool is free from abnormal damage and spring is free from breakage.	Replace
6	Swing motor	Visual check	Inner parts (cylinder block, piston, valve brake etc) are to be free from abnormal resistance against sliding. Free from abnormal damage, etc on outside surface (brake plate etc).	Replace.

47. TROUBLESHOOTING (BY TROUBLE)

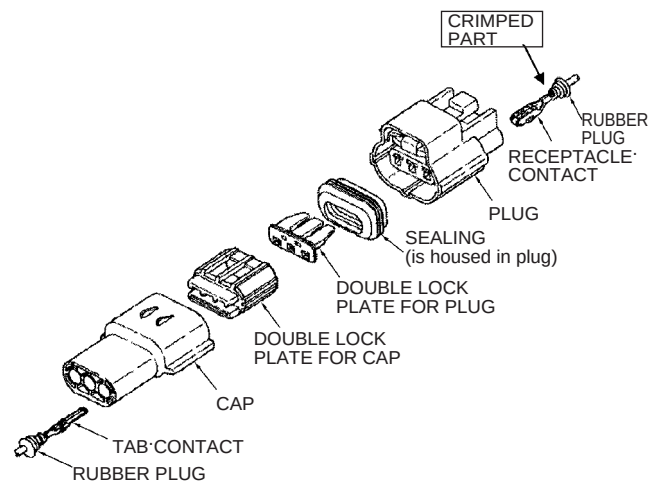
- (4) Checking connector terminal for contact
Insert male terminal into female terminal unit, and then check that the inserting force is equivalent to other female terminals.
If there is looseness, replace the female terminal with new one.
Clean the terminal.



CAUTION

Do not insert the male terminal -- the thickness differs.
It may cause loose connection.

- (5) Caution which should be paid in measuring voltage
When measuring the power supply to electric equipment at connector position with the grounding terminal contained inside of connector, measure the voltage between grounding inside of connector and power terminal.
When measuring the voltage between frame body grounding and power source, the disconnection of wiring to grounding inside of connector cannot be identified.
Since the voltage may vary between with connector connected and with connector not connected.
Measure the voltage with each connector connected whenever possible.
- (6) Checking the general view of connector
- Check the terminal crimped condition.
Pull one electric cable with the about 3kg force, and make sure that the cable does not come out of the terminal.
When came out, replace the terminal and crimp it again.
 - Check connector for imperfect insertion
Check that all top ends form a line on the same position as seen from the connector engaged side.
When moved along, push it in further through wire inserting hole.
 - Check connector for intruding of water.
Pull out the connector and check that the inside is free from intruding of water.
When water intruding is found, check rubber plug for damage and also that the sealing is fitted properly.

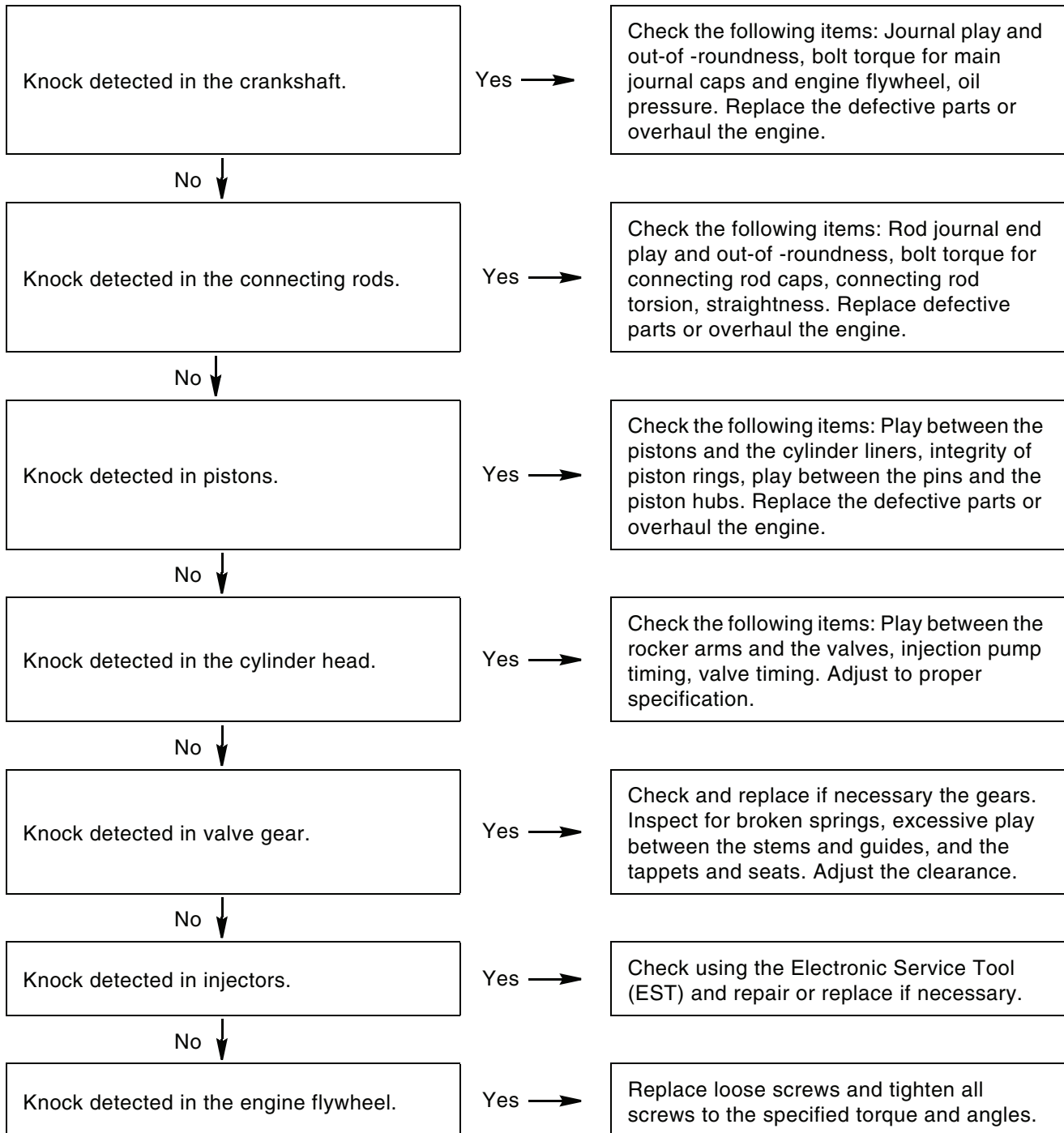


48. TROUBLESHOOTING (TROUBLE DIAGNOSIS MODE)

Issue	Date of Issue	Applicable Machines	Remarks
First edition	May, 2007	E265B	87495895A

NOTES

ENGINE KNOCKS IRREGULARLY



CODING OF SOURCE ENGINES

ENGINE MODEL BREAKDOWN DISCRIPTION

6	6	7	T	A	E	D	J
							Engine Calibration (Power) (D) J= 97 kW (130 H.P.) (E) G= 137 kW (183.7 H.P.) (E) D= 145 kW (194.4 H.P.) (E) C= 148 kW (198.5 H.P.) (B) F= 157 kW (210.5 H.P.) (B) D= 169kW (226.6 H.P.)
							Compression Ratio B = 16.5:1 > 130 kW (174 H.P.) D = 17.5:1 < 130 kW (174 H.P.) E = 17.5:1 > 130kW (174 H.P.)
							E = Electronic Injection (Common Rail)
							A = Intercooled
							T = Turbocharged
							67 = Total Displacement in Liters/ Cubic Inches- 6.7 Liters (409 Cubic Inches)
							6 = Number of Cylinders

ENGINE PROPERTIES

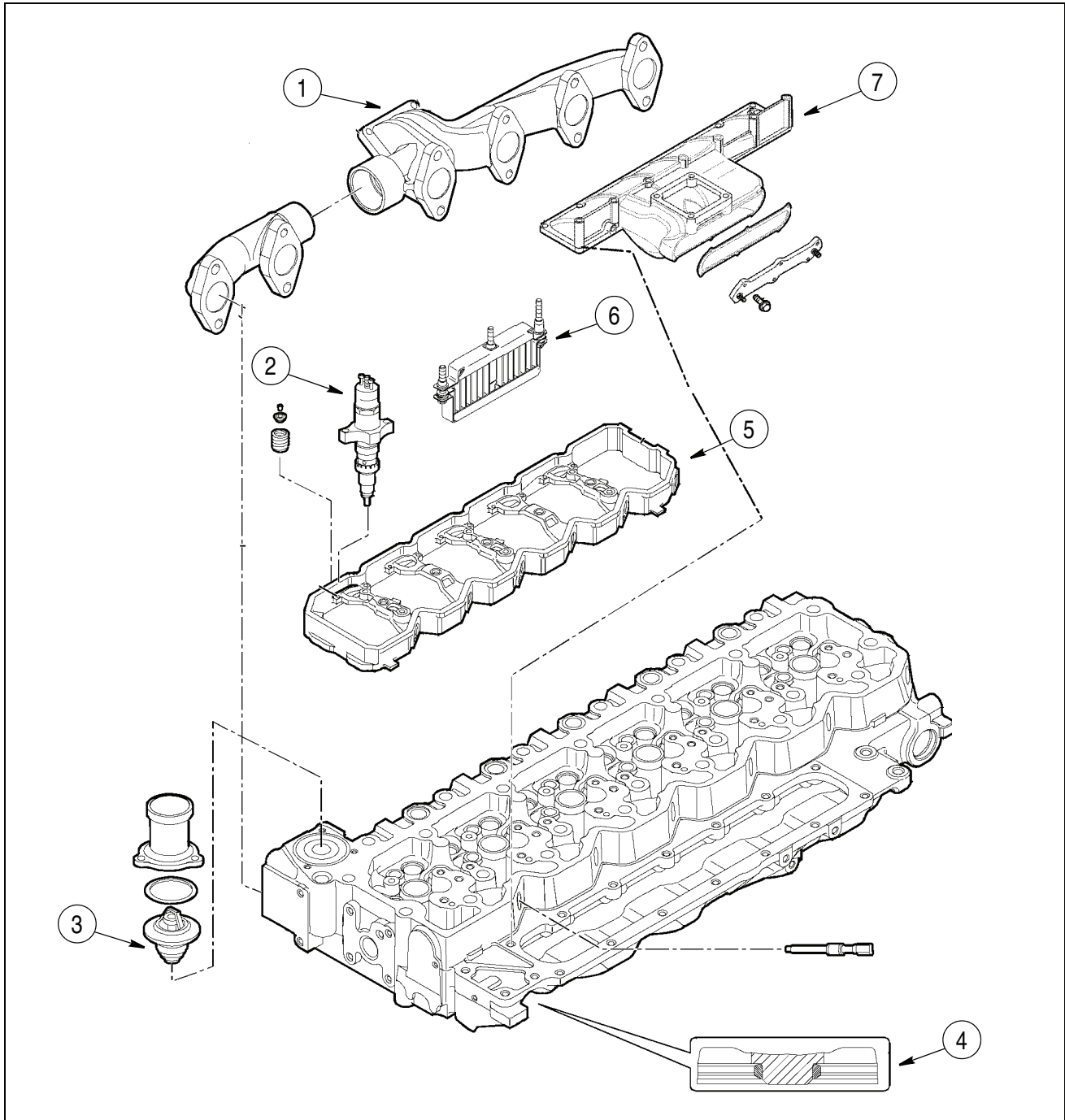
A	667TA	667TA	667TA	667TA	667TA	667TA
B	EEG	EEC	EBF	EED	EBD	EDJ
C	6 CYLINDERS					
D	6728 cm ³ (410.6 c.i.)					
E	137 kW (183.7 h.p.) 2100 rpm	148 kW (198.5 h.p.) 2100 rpm	157kW (210.5 h.p.) 2000 rpm	145kW (194.4 h.p.) 2000 rpm	169 kW (226.6 h.p.) 2000 rpm	97 kW (130.1 h.p.) 2200 rpm
F	Electronic Direct Injection					
G	Common Rail					
H	T.A.A. (Turbo Charged, Air to Air Cooling)					

- A. Type of engine
- B. Engine model
- C. Number of cylinders
- D. Total displacement
- E. Maximum power currently available
- F. Type of Injection
- G. Injection system
- H. Air supply system

SPECIAL TOOLS

380000158.....	1-6 Nm dyanametric (torque) screw driver for calibrating injector solenoid valve connector check nut (Common Rail).
380000665.....	Tool for removing the crankshaft front seal.
380000663.....	Tool for removing the crankshaft rear seal.
380000671.....	Injector extracting tool.
380000666.....	Coupler for installing the crankshaft front seal.
380000664.....	Coupler for installing the crankshaft rear seal. (except engines: 667TA/EBF - 667TA/EED).
380000988.....	Tool for rotating the engine flywheel (except engines 667TA/EBF - 667TA/EED).
380001099.....	Tool for removing injectors

CYLINDER HEAD ENGINE: 667TA/EDJ



BS06K136

Figure 2-23

- | | | | |
|---------------------|---------------|--------------------------------|--------------------|
| 1. EXHAUST MANIFOLD | 3. THERMOSTAT | 5. SUPPORT WITH WIRING HARNESS | 7. INTAKE MANIFOLD |
| 2. INJECTOR | 4. VALVE SEAT | 6. GRID HEATER | |

The cast iron cylinder head is machined to accommodate the following parts:

- valve seats (4).
- injectors (2).
- thermostat (3).

The cylinder head is also fitted for the following components to be inserted on to the head.

- exhaust manifold (1).
- intake manifold (7) with seat for grid heater (6).

WATER PUMP

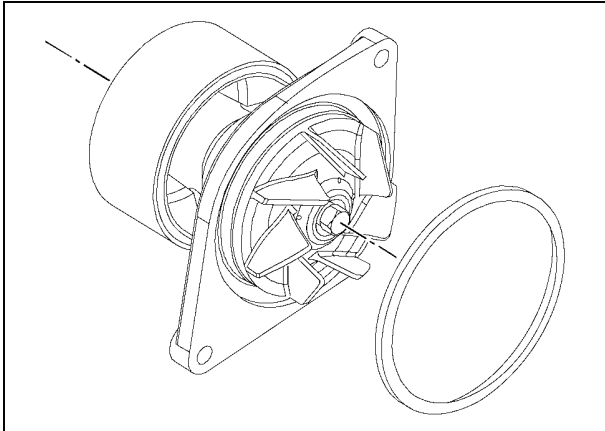


Figure 2-45

WATER PUMP

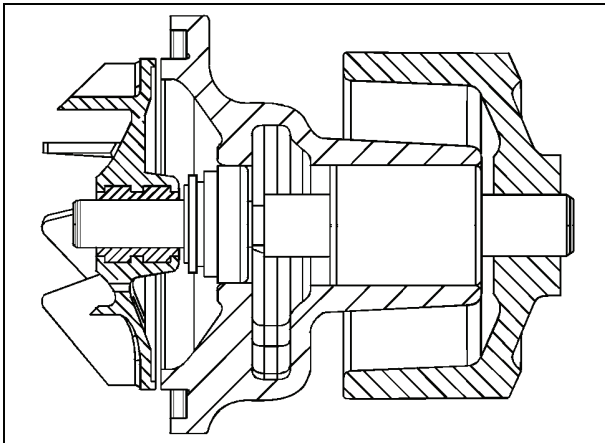


Figure 2-46

WATER PUMP CROSS SECTION

The water pump is housed in a cavity in the front of the engine block, and is driven by a Poly-V belt. The water pump is sealed to the block by a rubber ring.

The engine temperature is controlled by a thermostat.

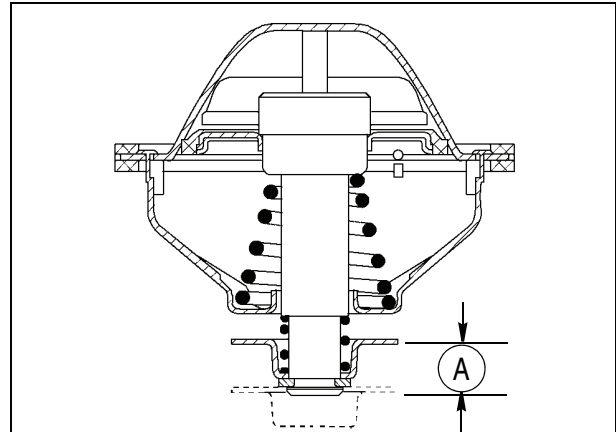


Figure 2-47

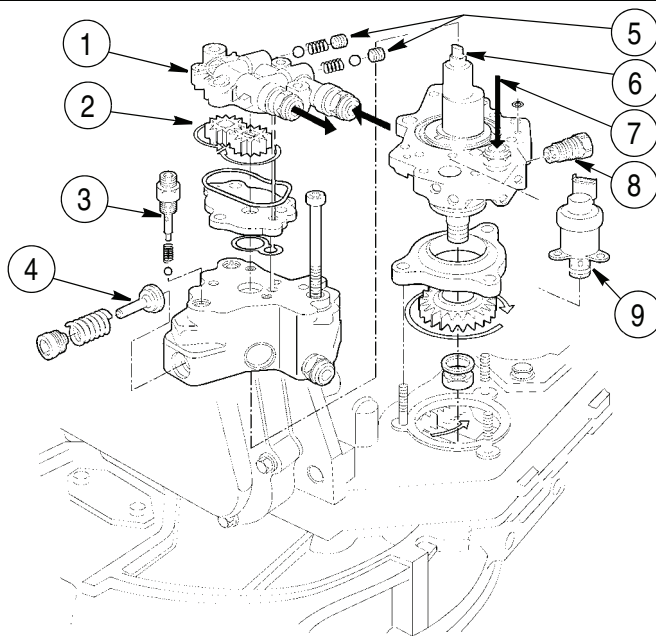
THERMOSTAT

A. STROKE STARTS AT 96° C (204° F) $\geq$ 7.5MM (.30 IN).

Thermostat opening for engines:

667TA/EEG, EEC, EBF, EED, EBD= 79 to 83° C (174 to 181° F).

667TA/EDJ= 83 to 98° C (181 to 208° F).



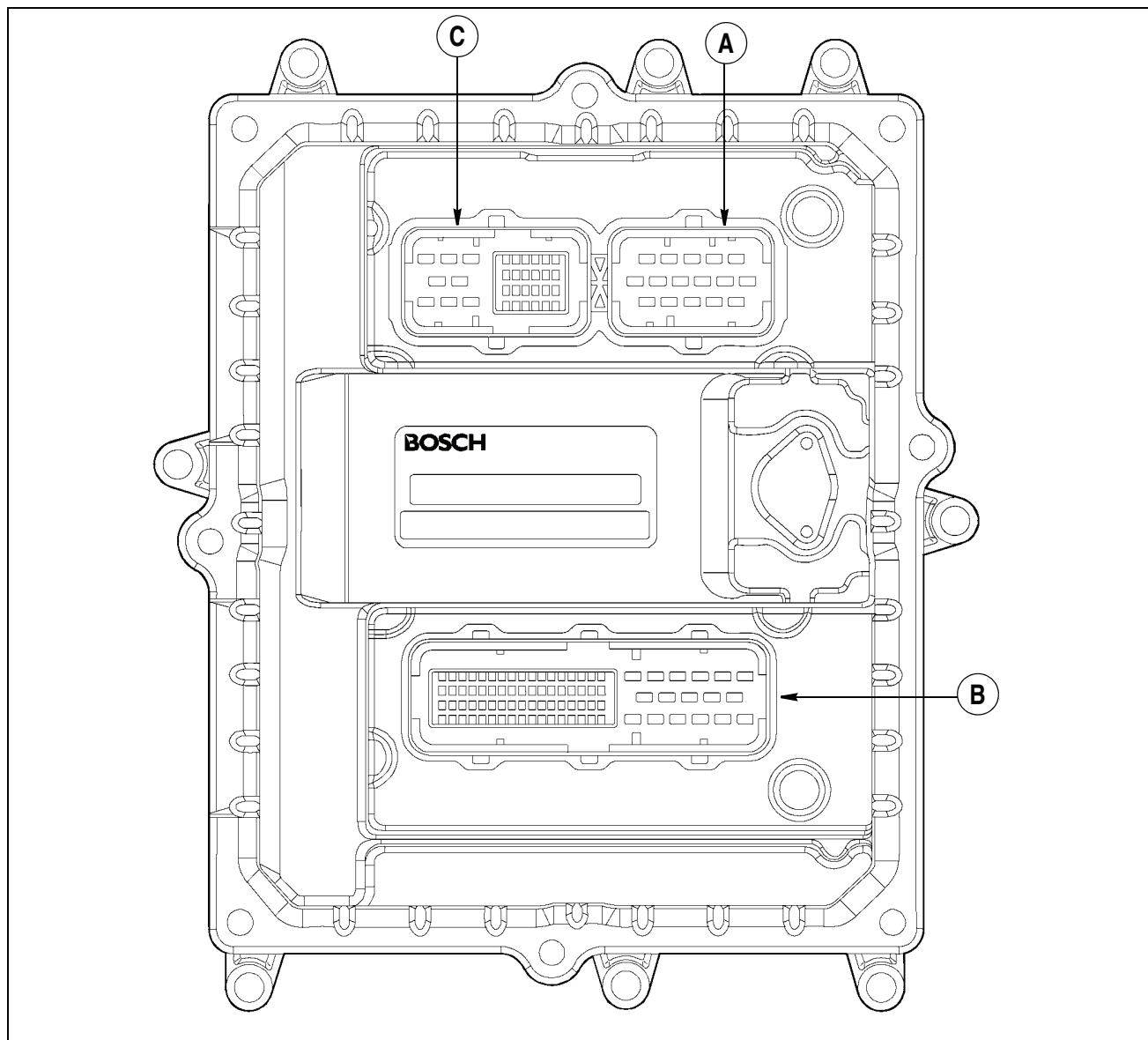
BS06K061

Figure 2-56

EXPLODED VIEW OF HIGH PRESSURE PUMP

- | | | |
|--|--|--|
| 1. MECHANICAL GEAR CHARGE FEED PUMP | 4. INDIVIDUAL HIGH PRESSURE PUMP
PLUNGER (1 OF 3) | 7. HIGH PRESSURE PUMP FUEL
INLET FROM FILTER |
| 2. GEAR SET | 5. BY-PASS VALVES ON FEED PUMP | 8. 5 BAR (72 PSI) LOW PRESSURE
FUEL REGULATOR VALVE |
| 3. HIGH PRESSURE FUEL DELIVERY VALVE TO
COMMON RAIL | 6. PUMP SHAFT | 9. HIGH PRESSURE REGULATOR
SOLENOID VALVE |

EDC7UC31 ELECTRONIC CONTROL UNIT



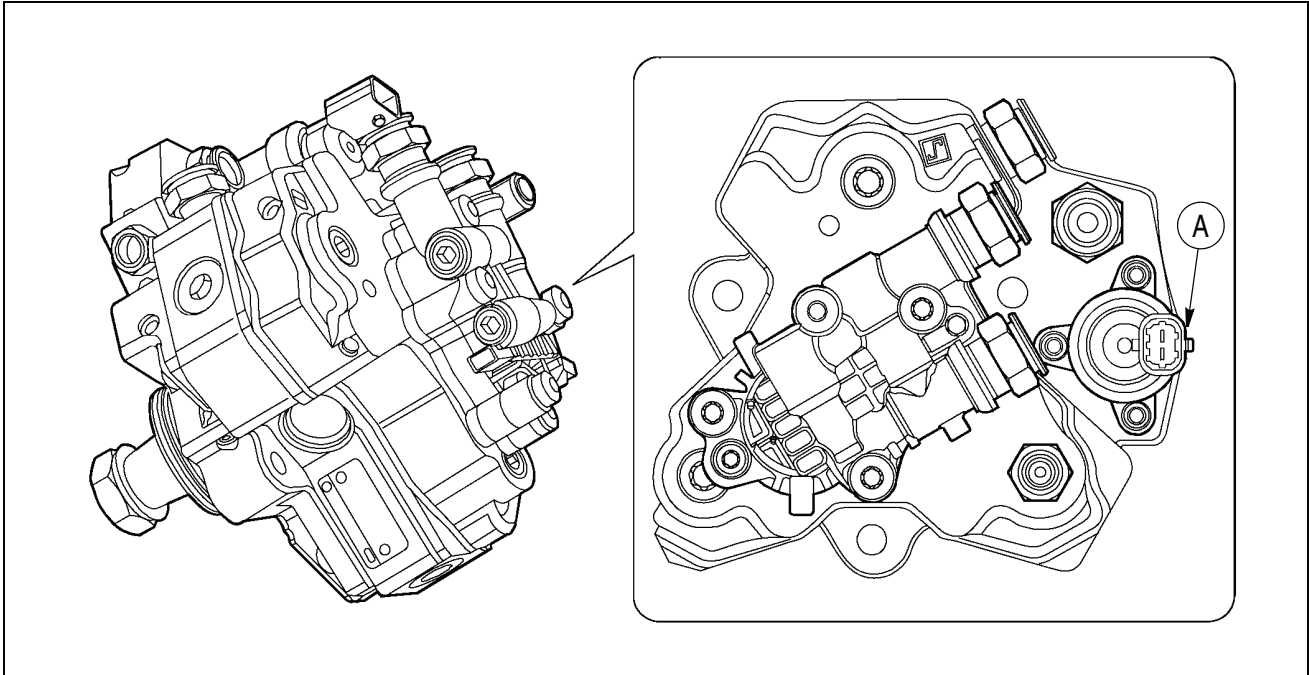
BS06K073

Figure 2-72

EDC7UC31 ELECTRONIC CONTROL UNIT

- A. CONNECTOR TO INJECTORS
- B. CONNECTOR FOR POWER INPUT AND FUNCTIONS PROVIDED FOR IN THE APPLICATION
- C. CONNECTOR TO SENSORS

HIGH PRESSURE PUMP - PRESSURE REGULATOR



BS06K212

Figure 2-86

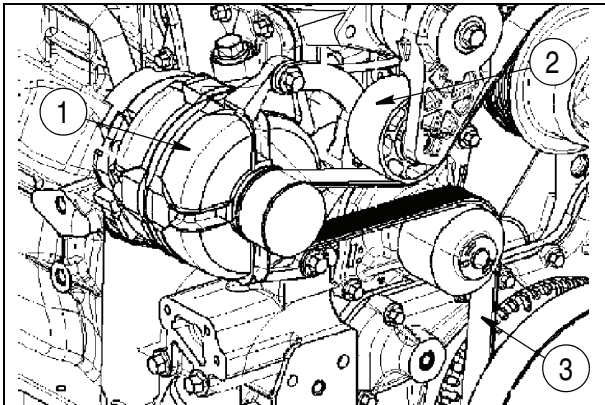
A. PRESSURE REGULATOR

The quantity of fuel supplied to the high pressure pump is controlled by the supply pressure regulator solenoid valve. The high pressure regulator is controlled by the EDC7UC31 control unit.

Delivery pressure to the common rail is modulated between 250 and 1600 bar (3626 and 23206 psi) by the EDC7UC31 control unit by controlling the high pressure regulator solenoid valve.

- This component is a Normally Open solenoid valve.
- The solenoid is connected to the EDC7UC31 control unit on pins 9A - 10A.
- The solenoid valve impedance is approximately 3.2 ohms.

STEP 17



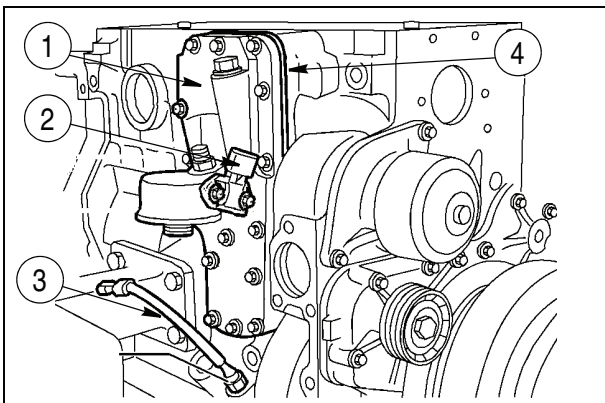
BS06K236

Figure 2-109

Release the drive belt tensioner (2) and remove the belt (3) from the pulleys. Then remove the belt tensioner (2).

Loosen bolts holding the alternator to bracket and remove the alternator (1).

STEP 18



BS06K237

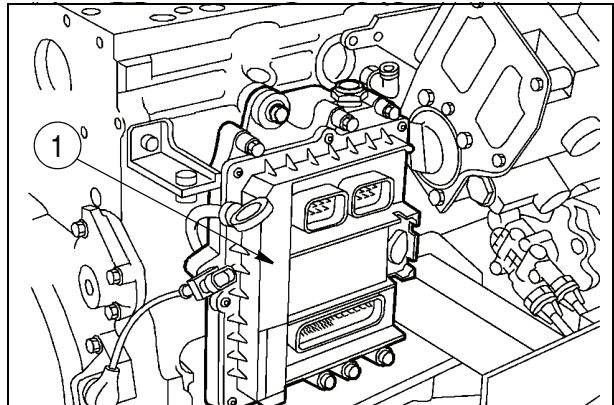
Figure 2-110

Take out bolts and remove the oil temperature-pressure sensor (2).

Take out bolts and then remove heat exchanger/ oil filter bracket (1) and intermediate plate (4) and relevant gaskets.

Remove the oil level sensor (3).

STEP 19

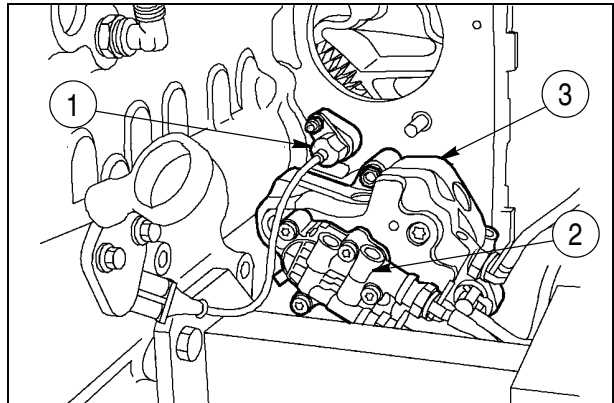


BS06K238

Figure 2-111

Remove the bolts and disconnect the EDC7UC31 control unit (1), including the heat exchanger.

STEP 20

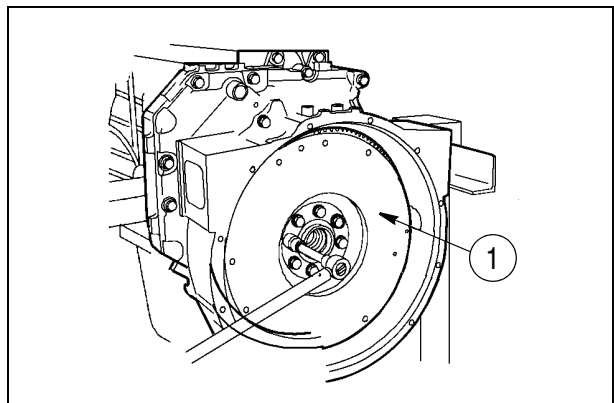


BS06K239

Figure 2-112

Remove the nut and disconnect the timing sensor (1). Remove the nuts and disconnect the high pressure pump (3) including the feed pump (2).

STEP 21



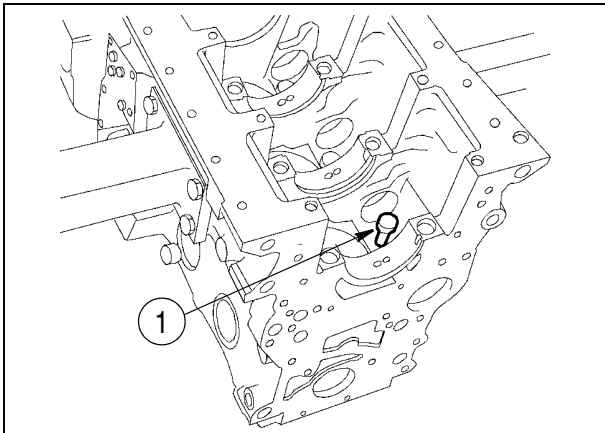
BS06K240

Figure 2-113

Loosen bolts on flywheel (1) but do not remove the flywheel.

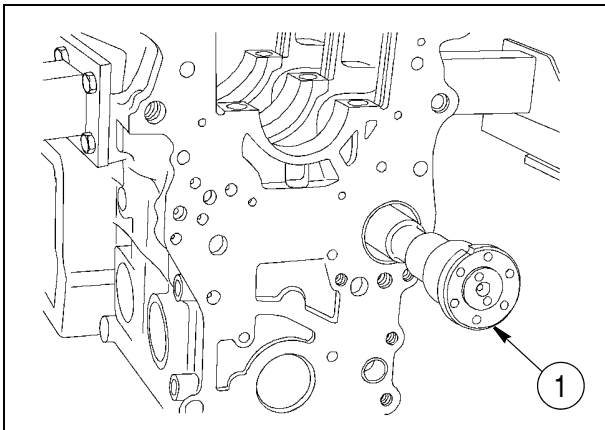
INSTALLING THE TAPPETS AND CAMSHAFT

STEP 53



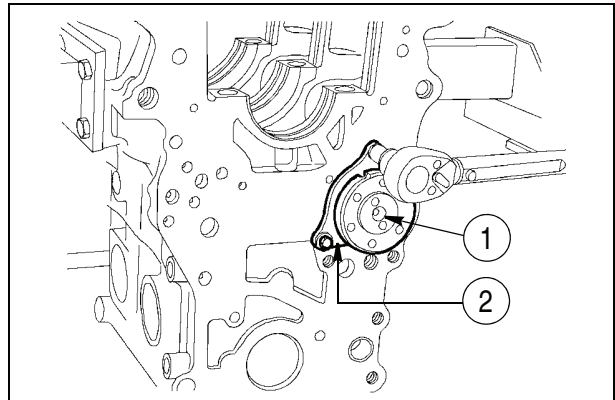
BS06K274 Figure 2-147
Lubricate tappets (1) and install them into their respective seats of the engine block.

STEP 54



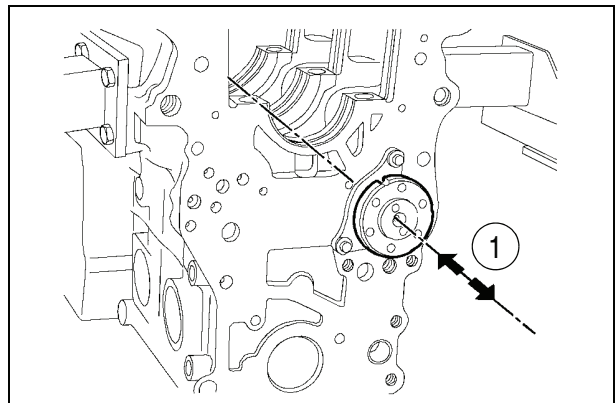
BS06K275 Figure 2-148
lubricate the camshaft support bearings and install camshaft (1) taking care not to damage the bearings or support seats.

STEP 55



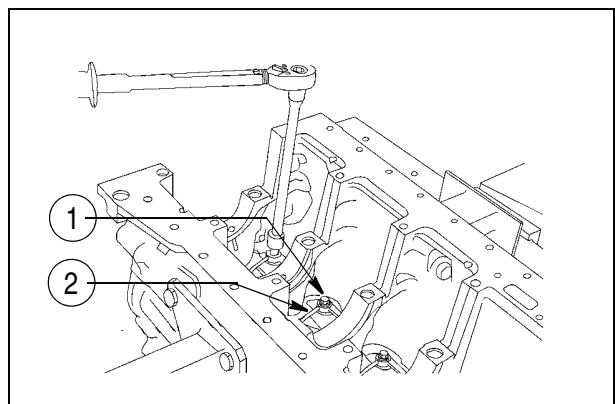
BS06K276 Figure 2-149
Place camshaft (1), retaining plate (2) with the slotted hole facing the engine block upper side and the stamping facing the operator, then tighten bolts to the specified torque 20 to 30 Nm (14.8 to 22.1 lb.-ft.).

STEP 56



BS06K277 Figure 2-150
Check the camshaft end play (1). It must be between 0.13 - 0.23 mm (0.005 - 0.009 in.).

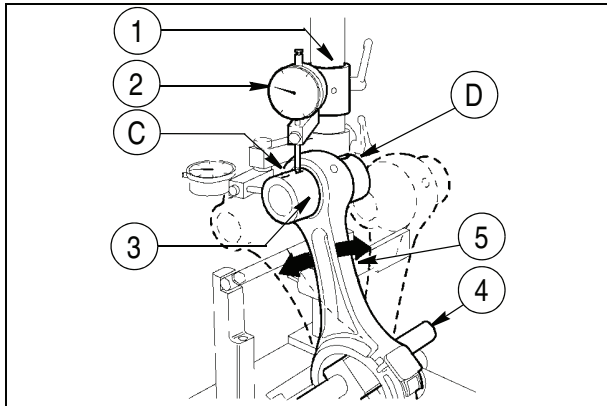
STEP 57



BS06K278 Figure 2-151
Install nozzles (2) and tighten fastening bolts (1) using general bolt torque specifications.

CHECKING THE FLEXING

STEP 80



BS06K307

Figure 2-180

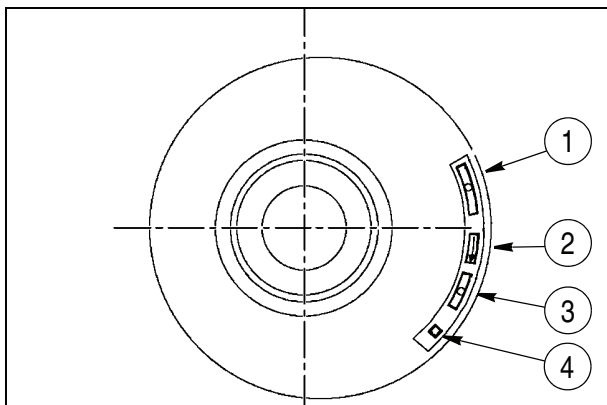
Check connecting rod flexing (5) by comparing two points (C) and (D) of pin (3) on the vertical plane of the connecting rod axis.

Place comparator (2) vertical support (1) so that the comparator rests on pin (3) at point (C).

Swing the connecting rod back and forth, looking for the highest position of the pin. Under such condition, set comparator (2) to zero.

Move the spindle with connecting rod (5) and repeat the highest point check on opposite side (D) of pin (3). The difference between points (C) and (D) must not be greater than 0.08 mm (0.003 in.).

INSTALLING CONNECTING ROD-PISTON ASSEMBLY CONNECTING ROD-PISTON COUPLING



BS06K308

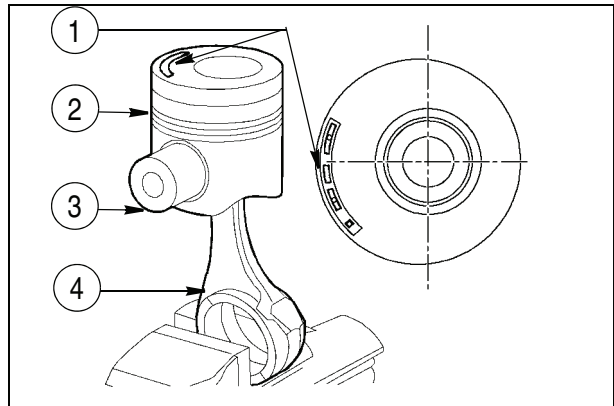
Figure 2-181

The following reference data is engraved on the piston crown.

1. Part number and design modification number
2. Arrow showing piston assembly direction into cylinder bore, this arrow shall face the front key of the engine block.
3. Manufacture date

4. Marking showing 1st slot insert testing.

STEP 81

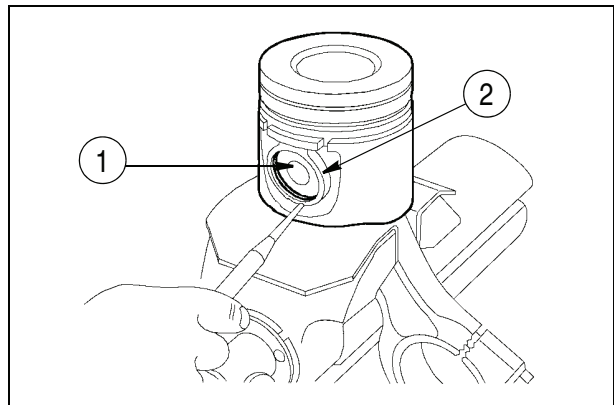


BS06K309

Figure 2-182

Connect piston (2) to connecting rod (4) by means of pin (3) so reference inscription (1) for installing piston (2) in the cylinder bore and the numbers stamped on connecting rod (4) can be seen as shown in the figure.

STEP 82

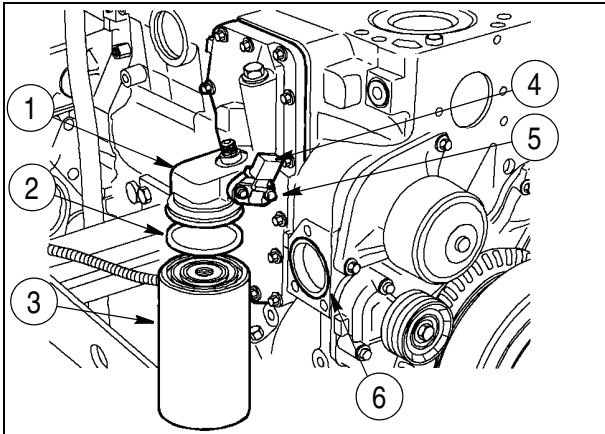


BS06K310

Figure 2-183

insert pin (1) fastening split rings (2)

STEP 119



BS06K347

Figure 2-220

Lubricate the sealing ring (2) with engine oil and set it on the oil filter (3).

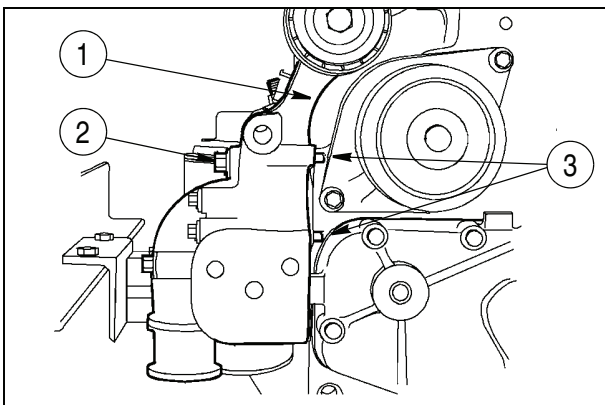
Screw oil filter (3) on the oil filter bracket (1) till gasket makes contact with bracket and then tighten an additional 3/4 turn (except for 667TA/EEG and 667TAEEC engines)

Apply a new sealing ring on the oil temperature/pressure sensor (4) and install it on oil filter bracket (1).

Tighten bolts (5) to 20 Nm (14.8 lb.-ft.) max the specified torque.

Install a new sealing ring (6) in the engine block seat.

STEP 120



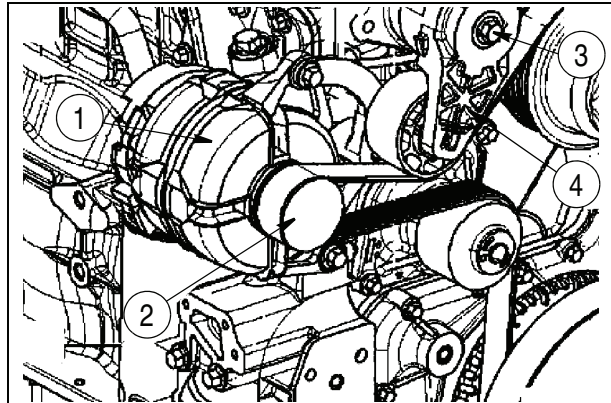
BS06K348

Figure 2-221

Position the alternator support (1) so that pins (3) are set against the engine block.

Tighten the bolts (2) to 40 to 50 Nm (29.5 to 36.9 lb.-ft.) the specified torque.

STEP 121



BS06K349

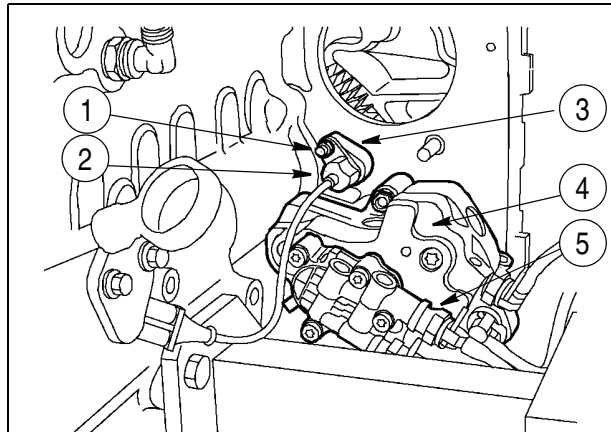
Figure 2-222

Reconnect alternator (1) and tighten the bolts to 40 to 50 Nm (29.5 to 36.9 lb.-ft.) the specified torque.

Reconnect automatic tensioner (4) and tighten bolt (3) to 40 to 50 Nm (29.5 to 36.9lb.-ft.)specified torque.

Turn the automatic belt tensioner (4) to install the belt (2) on pulleys and guide rollers.

STEP 122

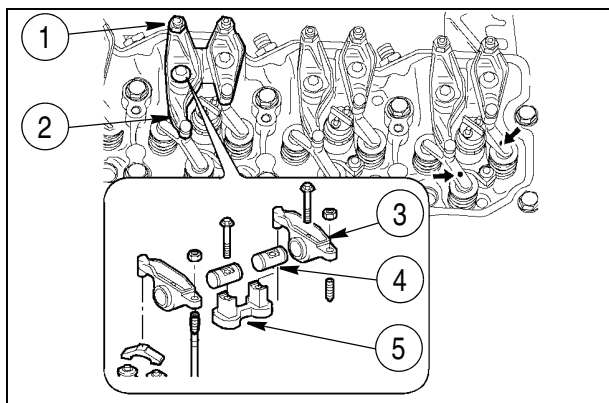


BS06K350

Figure 2-223

Install the high pressure pump (4) including the feed pump (5) and tighten the nuts to the specified torque. Install the support (3) with a new sealing ring, the timing sensor (2) with a new sealing ring and tighten the fastening nut (1), to the general bolt torque specifications in the repair manual.

STEP 151



BS06K382

Figure 2-255

Check tappet adjusters (1) that they are loose to prevent their balking on the rods (2, figure 2-254) when installing the rocker assembly.

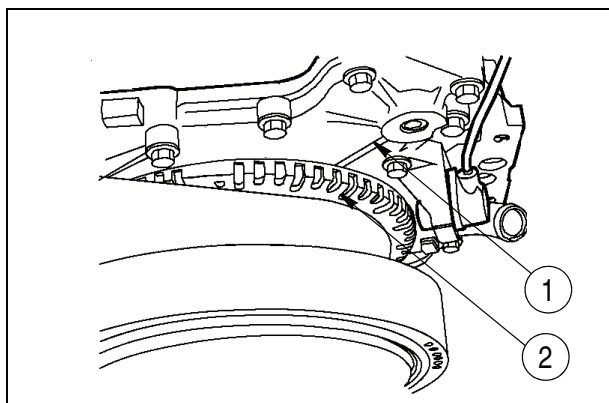
Then install the rocker assembly consisting of:

bracket (5), rockers (3), shafts (4), and secure them to the cylinder head by tightening the fastening bolts (2) to 36 Nm (26.5 lbf ft.) of specified torque.

LOCATING TOP DEAD CENTER (TDC)

IMPORTANT: Due to the additional lobe for the Internal EGR, each cylinder must be adjusted by taking it to the T.D.C. (top dead center) and adjusting the clearance of both valves on every cylinder.

STEP 152



BS06K345

Figure 2-256

1. ENGINE BLOCK 2. TONE WHEEL

- Remove the injector from the number one cylinder.
- Rotate engine over using Special Tool 380000988 to bring the number one cylinder to the highest point using a dial indicator. Check to see if push rods are loose, if they are not rotate the engine 360° now they should be loose.

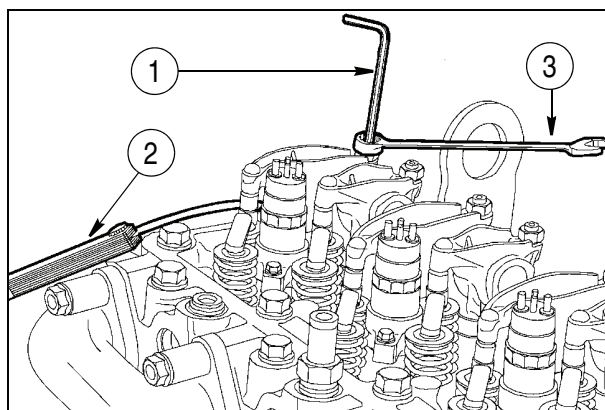
- Put a reference mark on tone wheel (1) and the engine block (2).

STEP 153

Measure the circumference of the tone wheel and divide by 3. Starting from the reference mark on tone wheel put on in step 152. Put the other two marks of the calculated length on the tone wheel.

VALVE CLEARANCE ADJUSTMENT

STEP 154



BS06K383

Figure 2-257

Adjust clearance between rockers and valves using set screw wrench (1), box wrench (3) and feeler gauge (2).

Working clearance shall be as follows:

- Intake valves: 0.20 - 0.30 mm (0.008 - 0.012 in.)
- Exhaust valves: 0.46 - 0.56 mm (0.18 - 0.022 in.)

NOTE: Firing Order (1- 5- 3- 6- 2- 4)

- Adjust the valves for cylinder number 1.
- Rotate to the next reference mark and adjust valve clearance for cylinder number 5.
- Rotate to the next reference mark and adjust valve clearance for cylinder number 3. This should be one complete revolution of the tone wheel.
- Rotate to the next reference mark and adjust valve clearance for cylinder number 6.
- Rotate to the next reference mark and adjust valve clearance for cylinder number 2.
- Rotate to the next reference mark and adjust valve clearance for cylinder number 4. There should have been two complete revolutions of the tone wheel and all of the valves should be set.
- Reinstall the number one injector.

NOTES

22.2 HYDRAULIC CIRCUITS AND
 COMPONENTS

STD. SCHEMATIC HYD. LINES		LQ01Z000051P1	
Item	Component name	Part No.	Model No.
1	Hyd. pump assy	LQ10V00018F1	K3V112DTP
2	Control valve (main)	LQ30V00026F1	KMX15YD
3	Swing motor unit	LQ15V00025F1	MFC160
4	Travel motor unit	LQ15V00020F1	MAG-170VP
5	Boom cylinder (RH & LH)	LQ01V00028F1	ø95×ø135×1235
6	Arm cylinder	LQ01V00038F1	ø105×ø145×1635
7	Bucket cylinder	LQ01V00030F1	ø85×ø125×1200
8	Swivel joint	YN55V00053F1	
9	Pilot valve (ATT)	YN30V00111F1	PV48K2
10	Pilot valve (travel)	YN30V00105F1	6TH6 NRZ
11	Inline filter	YN50V00020F1	Y-457400
12	Suction strainer	YW50V00004F7	Y-501400
13	Solenoid valve assy	YN35V00047F1	8KWE5A-30
14	Return filter	YN52V01008F3	FZ1F183A012A
15	Air breather	YN57V00004F1	AB0210GA008A
16	Restrictor	YN21V00005F1	07381-00000

Note

The part numbers may be changed due to modification,
so use only the numbers for references.

22.7 BOOM CIRCUIT

This section describes the boom raise confluent operation.

- (1) Boom up pilot circuit
- (2) Boom up 2 pumps confluent main circuit in C/V

22.7.1 BOOM RAISE PILOT CIRCUIT

- (1) Operation :
 - 1) If boom up operation is performed, the secondary pilot proportional pressure from the right pilot valve (10) gets out of port 3 and acts upon the low pressure sensor (SE3). At the same time, the pressure acts upon the PAb and PB1 ports.
 - 2) The secondary pressure which enters the PAb port of C/V (2) shifts the boom spool. The secondary pressure which enters the PB1 port shifts the boom confluent spool.

22.7.2 BOOM UP 2 PUMPS CONFLUENT MAIN CIRCUIT IN C/V

- (1) Purpose :
Boom up speed up
- (2) Principle :
Confluenting oil from 2 pumps
- (3) Operation :
 - 1) The oil delivered through A1 port of P1 pump flows into C/V (2) P1 port, and branches into bypass circuit and parallel circuit. Since P1 unloading valve is closed, the boom spool is moved and bypass circuit is closed, the oil opens load check valve LCb through parallel circuit and flows into boom spool.
 - 2) Then the oil passes through boom spool, opens lock valve of boom lock valve CRb, and is led into H side of boom cylinder through C/V (2) Ab port.
 - 3) Meanwhile, the oil delivered from the A2 port of the P2 pump enters the P2 port of C/V (2) and due to shut off the P2 unloading valve, the oil then passes through the parallel circuit and via the restrictor on the circumference of the boom confluent spool, pushes the load check valve CCb open from the boom confluent circuit, and combines the oil delivered by the P1 pump internally.
 - 4) The return oil from boom cylinder R side flows into tank circuit through boom spool from C/V (2) Bb port.

This section describes the following operations.

- (5) Arm out pilot circuit
- (6) Arm out 2 pumps conflux main circuit
- (7) Natural fall protection with arm lock valve

22.9.5 ARM OUT PILOT CIRCUIT

- (1) Operation :
 - 1) When the arm out operation is performed, the secondary pilot proportional pressure gets out of port 8 of the left pilot valve (9), and acts upon the low pressure sensor (SE-8). At the same time, the oil is branched off in two flows and act upon the PBa1 and Pba2 ports of C/V (2).
 - 2) The operating proportional secondary pressure flowed in Pba1 port of C/V (2) switches the arm 1 spool.
 - 3) Then, the operating secondary pressure flowed in PBa2 port of C/V (2) switches the arm 2 spool valve.

22.9.6 ARM OUT 2 PUMPS CONFLUX MAIN CIRCUIT

- (1) Purpose :
Arm out operation speed up.
- (2) Principle :
The oil delivered by the P1 pump is conflused with that delivered by the P2 pump in C/V (2).
- (3) Operation :
 - 1) P1 pump delivery oil opens load check valve (LCAT2) by switching arm 2 spool and confluses with P2 pump delivery oil just short of the arm lock valve.
 - 2) And, P2 pump delivery oil flows through arm 1 spool and confluences with P1 delivery oil, opens lock valve of arm lock valve CRar with free flow and is flowed into arm cylinder rod (R) side through Ba port of C/V(2).
 - 3) On the other hand, the return oil from arm cylinder (H) side flows in Aa port, and returns into tank circuit through arm 1 spool and arm 2 spool.
The return line which does not pass through boost check valve is used for this return circuit to reduce the pressure loss.

22.9.7 NATURAL FALL PROTECTION WITH ARM LOCK VALVE

- (1) Purpose :
To prevent the arm from falling naturally by the weight of the arm and bucket.
- (2) Principle :
Complete seat of the return circuit against the arm spool of the arm cylinder (R) side circuit.
- (3) Operation :
 - 1) When the secondary pressure for arm operation disappears and the arm cylinder stops, the pressure on the rod (R) side passes through the selector of the lock valve from the Ba port of C/V, acts the back pressure on the lock valve CRar and seats the lock valve.
 - 2) Since the oil flow into the arm spool from the lock valve is shut off completely, natural fall of the arm due to oil leaks through the arm spool is prevented.

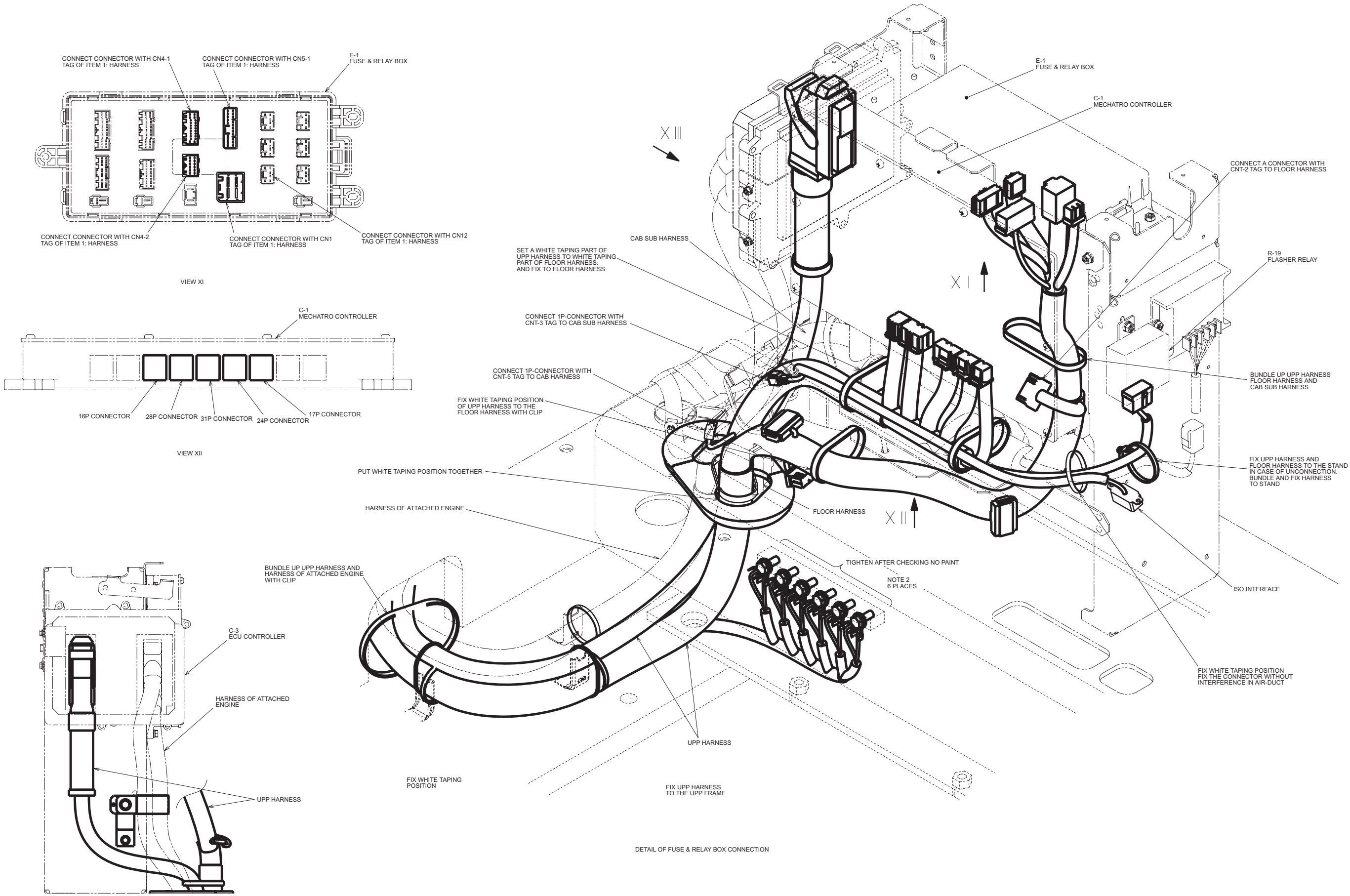
[MEMO]

23.2 ELECTRICAL EQUIPMENT LIST

[illegible]

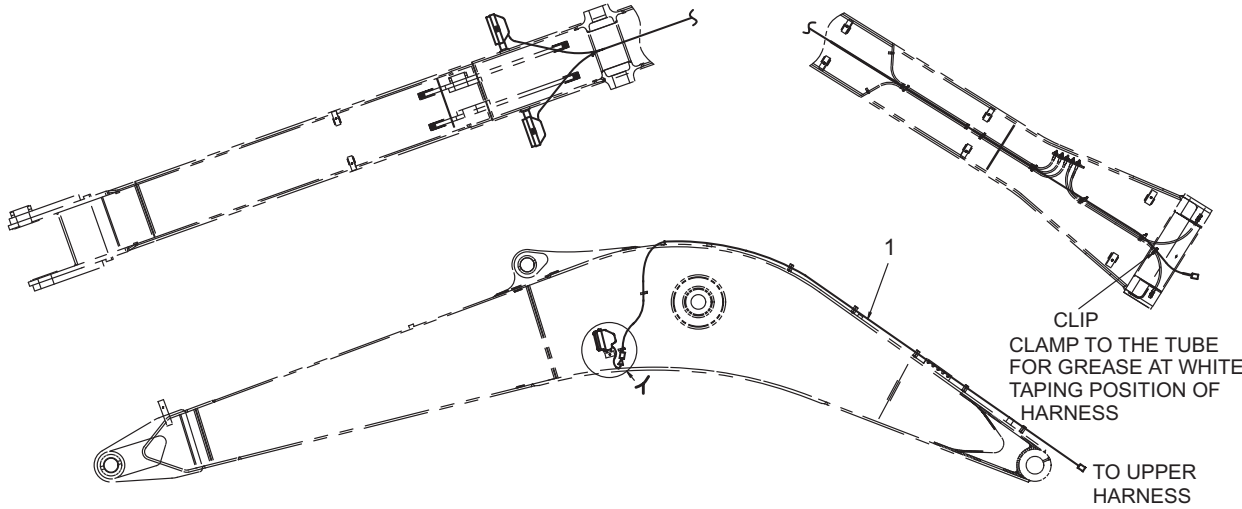
NOTE : The parts number may be changed due to the improvement of machine, so use the number for reference only.

23.3.5 UPPER FRAME HARNESS ASSY (5/6)



23.3.8 BOOM CYL. LIGHT HARNESS ASSY

BOOM HARNESS ASSY		LQ15E00015F0	(01)		
ITEM	PART NAME	PART No.	Q'TY	REMARKS	
1	HARNESS	LQ15E01004P1	1	BOOM LIGHT	



23.3.8-1 BOOM CYL LIGHT HARNESS : LQ15E01009P1

BOOM WORKING LIGHT RIGHT

CB104

85A
WB

30

1100

1100

30

85B
WB

CB104

BOOM WORKING LIGHT LEFT

2550

850

WHITE TAPING

30



DOUBLE
SPLICE

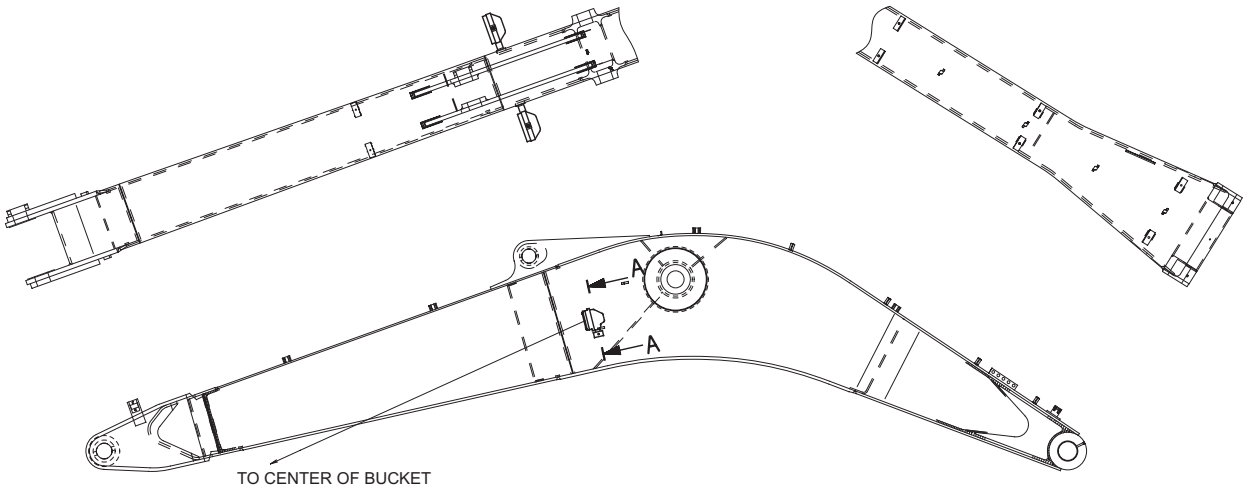
1MA-CNA
CN-110M
TO UPP HARNESS

CONNECTORS SELECTION TABLE

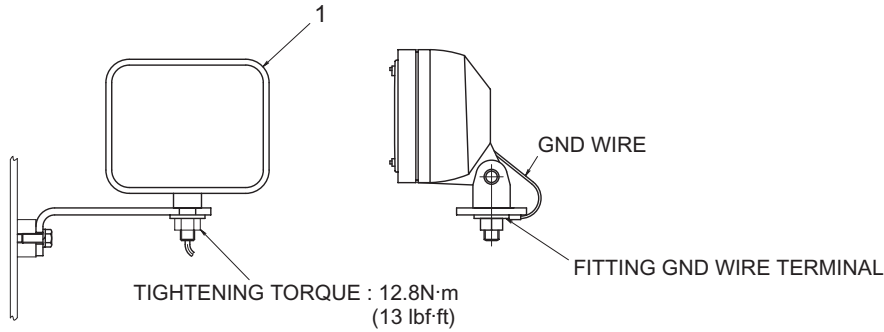
CONNECTOR NAME (PIN NUM.)	MANUFUC.	HOUSING	TERMINAL
1MA-CNA	AMP	172127-1	170340-1
CB104	AMP	170889-1	170003-5

23.3.9 INSTALLING BOOM LIGHT

INSTALLING BOOM LIGHT		YN80E00026F1	(04)		
ITEM	NAME	PARTS No.	Q'TY	REMARKS	
1	LIGHT	2456R442F1	2		



INSTALL WORKING LIGHT TO FACE THE CENTER OF BUCKET
WHEN ARM IS COMPLETELY STROKED AT THE END OF PUSHING SIDE
AND BUCKET IS STROKED AT 90° TO ARM



SECTION AA

This section describes boom lower operation.

- (1) Boom down pilot circuit
- (2) Prevention of natural fall by lock valve and actuation at lowering
- (3) Constant recirculation function of boom down main circuit

22.7.3 BOOM DOWN PILOT CIRCUIT

- (1) Operation :
 - 1) If the boom down operation is performed, the secondary pilot proportional pressure comes out of port C of the right pilot valve (9) and acts upon the low pressure sensor (SE-4).
At the same time, the pressure acts upon the PBb port of C/V (2).
 - 2) The voltage output of the low pressure sensor (SE-4) enters the mechatro controller and processed in it.
 - 3) Then, the proportionl secondary pressure fed into C/V (2) PBb port and branches off in two lines and switches boom spool and releases boom lock valve.

22.7.4 PREVENTION OF NATURAL FALL BY LOCK VALVE AND ACTUATION AT LOWERING

- (1) Purpose :
Prevention of natural fall when the lever is neutral
- (2) Principle :
The oil is prevented from returning to the boom spool by the poppet seat of the boom lock valve.
- (3) Operation :
In the boom down action, the selector valve is changed over by the secondary proportional pressure of PBb port. Then the poppet spring chamber of the lock valve CRb gets through the drain line (Dr) and makes the lock valve poppet open.
When the boom lever is at neutral, the drain line on the lock valve CRb poppet spring chamber is closed which causes the poppet closed.
The result is that the oil returning from the boom cylinder head (H) to the boom spool is held and makes the leak from the boom spool zero.
Thus the boom cylinder is prevented from making a natural fall.

22.7.5 CONSTANT RECIRCULATION FUNCTION OF BOOM DOWN MAIN CIRCUIT

- (1) Purpose :
Prevention of cavitation during boom lowering motion.
- (2) Principle :
The oil returning from the boom cylinder head (H) is recirculated to the rod (R).
- (3) Operation :
When the oil is supplied to the boom cylinder rod (R) side during boom down operation, the boom moves faster than it should do in some cases by the self weight of the attachment.
On that occasion, the circuit pressure on the rod (R) side is on the negative side.
The oil supplied to the boom cylinder rod (R) flows into the A1 port of the P1 pump and the P1 port of C/V. The oil then passes through the boom spool and goes out of the Bb port.
On that occasion, the oil returning from the head (H) goes through the recirculation path in the boom spool, pushes the check valve in the spool open, is recirculated to the Bb port and is supplied to the rod (R). When the (R) pressure is larger than the head (H) pressure, the check valve in spool closes.
Thereupon, the recirculation is stopped.

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