E385BJ

NEW HOLLAND

E385BJ

NEW HOLLAND KOBELCO

Tier 3

Workshop
Manual

Workshop
Manual

Print No. 87731197
English

NEW HOLLAND CONSTRUCTION

NEW HOLLAND CONSTRUCTION
BUILT AROUND YOU

(6) Engine key off before touching terminals of starter and alternator.

(7) Remove battery grounding terminal before beginning work close to battery and battery relay with tools.

(8) Wash machine with care so as not to splash water on electrical equipment and connector.

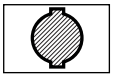
(9) When water has entered in the waterproofed connector, the removing of water is not easy. So check the removed waterproofed connector with care to protect it from entry of water. If moisture adheres on it, dry it completely before connecting.

WARNING

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

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

1.1.5 HYDRAULIC PARTS



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

(2) Flexible hose (F hose)
- Even if the connector and length of hose are the same, the parts differ according to the withstanding pressure. Use proper parts.
- Tighten it to the specified torque, and check that it is free from twist, over tension, interference, and oil leak.

1.1.6 WELD REPAIR

(1) The weld repair should be carried out by qualified personnel in the specified procedure after disconnecting the grounding cable of battery. If the grounding cable is not disconnected, the electrical equipment may be damaged.

(2) Remove parts which may cause fire due to the entry of spark beforehand.

(3) Repair attachments which are damaged, giving particular attention to the plated section of piston rod to protect it from sparks, and don't fail to cover the section with flame-proof clothes.

1.1.7 ENVIRONMENTAL ISSUES

(1) Engine should be started and operated in the place where air can be sufficiently ventilated.

(2) Waste disposal
The following parts follows the regulation.
Waste oil, waste container and battery

(3) Precautions for handling hydraulic oil
Hydraulic oil may cause inflammation of eyes.
Wear goggles to protect eyes on handling it.
- When it has got in eyes ;
  Wash eyes with water until the stimulus is gone.
- When it was swallowed ;
  Don't force him to vomit it, but immediately receive medical treatment.
- When it has adhered on skin ;
  Wash with soap and water.

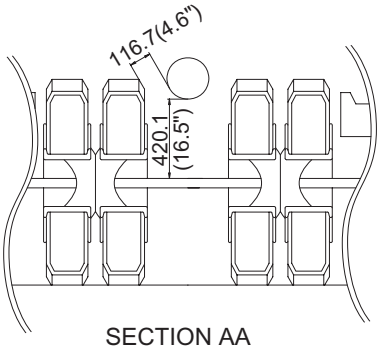
(4) Others
For spare parts, grease and oil, use KOBELCO genuine ones.

2.4 TRANSPOTATION

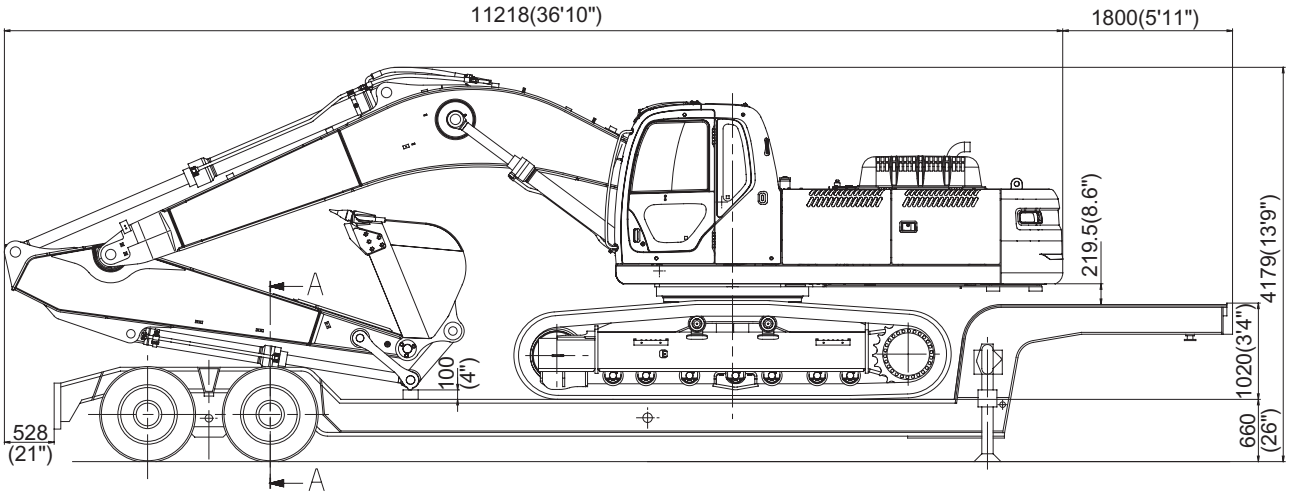
2.4.1 OVERALL DIMENSIONS OF MACHINE ON A TRAILER

(1) 6.50m (21ft-4in) Boom+3.30m (10ft-10in) Arm+1.40m³ (1.83cu•yd) Bucket

Model / Item	E385B	E385BLC
Width 600mm (23.6in) shoes	3,200 (10ft-6in)	3,200 (10ft-6in)
Weight	33,800kg (74,500 lbs)	34,200kg (75,400 lbs)



SECTION AA



3.1 BOOM

3.1.1 BOOM DIMENSIONAL DRAWING

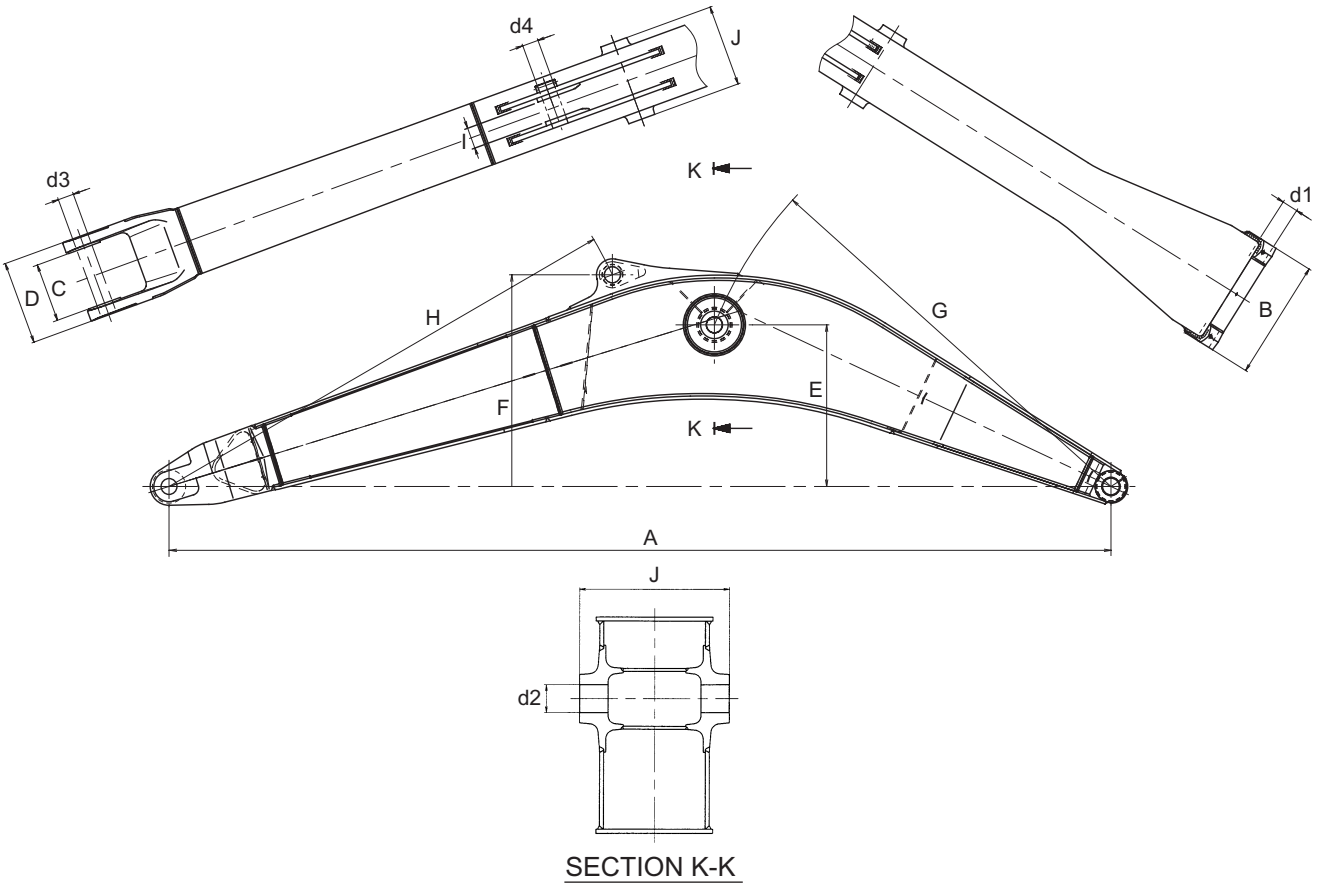


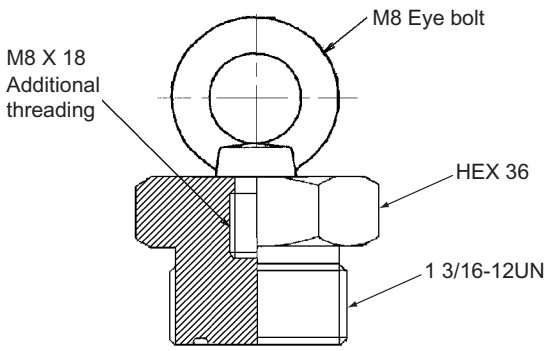
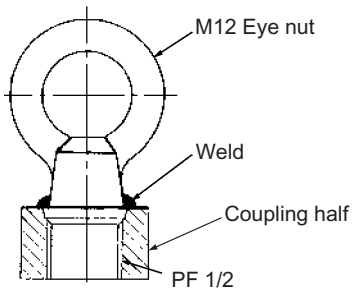
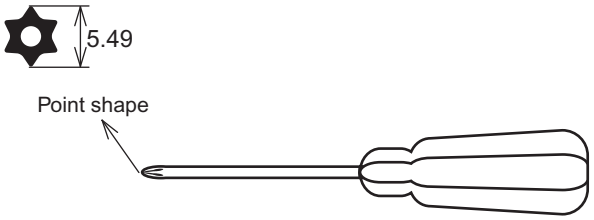
Fig. 3-1 Boom dimensional drawing

Unit : mm (ft-in)

6.50M (21ft-4in) BOOM		STD
		LC02B00164F1
No	NAME	DIMENSION
A	Boom length	6,500 (21'4")
B	Boom foot width	826 (32.5")
C	Boom end inner width	405.8 (16.0")
D	Boom end outer width	577 (22.7")
E	Height of boom cylinder rod pin	1,115 (3'8")
F	Height of arm cylinder (head side) pin	1,460.8 (4'9.5")
G	Distance between pins of boss	R2,955 (9'8")
H	Distance between pins of bracket	R3,390.5 (11'1.5")
I	Arm cylinder (head side) inner width	146 (5.75")
J	Outer width of bracket on the boom cylinder (rod side) mounting	564 (22.2")
d1	Boom foot pin dia.	ø 125 (4.92")
d2	Boom cylinder (rod side) pin dia.	ø 110 (4.33")
d3	Pin dia. of boom end.	ø 110 (4.33")
d4	Arm cylinder (head side) pin dia.	ø 110 (4.33")

Issue	Date of Issue	Applicable Machines	Remarks
First edition	August, 2007	E385B : LC10-07001~ E385BLC : YC10-03501~	S5LC1116E01 (NHK Middle East) K

Table11-4

7	Plug Nominal 1 3/16-12UN Eye bolt	YN01H01002P1 ZS91C00800		Flare hose
8	Plug PF1/2	ZE25F08000 Coupling half		For slinging the swivel joint
9	TORX driver (with tamper proof) T30 (For M6)	—		For instrument panel cover (RH)

Group		Location	Work to be done	Unit	Remarks	Unit : Hour
01	71	• Pin bushing	Replace	1 set	Include seal.	1.5
	80	Boom cylinder	O/H	2		8.0
	81	• Pin bushing	Replace	1 set	Include seal.	1.5
02 Cab & Guard	10	Cab relation			See 33.1.2	
	11	Cab ASSY	Detach/attach	1 pc.		1.4
	12	• Front lower glass, floor mat	Detach/attach	1 pc. each		0.1
	13	• Seat rear cover top, bottom	Detach/attach	4 places		0.2
	14	• Seat rear cover top, bottom	Detach/attach	1 pc. each		0.2
	15	• Right side panel (include A/C duct)	Detach/attach	3		0.3
	16	• Cable and harness (electric)	Detach/attach	6		0.2
	17	• Cab mounting bolt	Detach/attach	8 pcs.		0.2
	18	• Cab slinging	Detach/attach	3 places		0.2
	20	Guard relation			See 33.1.4	
	21	Bonnet assy (11)	Detach/attach	1 pc.		0.3
	22	Guard (7)	Detach/attach	1 pc.		0.2
	23	Guard (8)	Detach/attach	1 pc.		0.2
	24	Guard assy (5)	Detach/attach	1 pc.		0.2
	25	Stay (3)	Detach/attach	1 pc.		0.2
	26	Guard (2)	Detach/attach	1 pc.		0.2
	27	Panel assy (21)	Detach/attach	1 pc.		0.2
	28	Panel assy (23)	Detach/attach	1 pc.		0.2
	29	Panel assy (22)	Detach/attach	1 pc.		0.2
	30	Guard (15)	Detach/attach	1 pc.		0.2
	31	Guard assy (17)	Detach/attach	1 pc.		0.2
	32	Guard (16)	Detach/attach	1 pc.		0.2
	33	Beam (11)	Detach/attach	1 pc.		0.2
	34	Pillar (10)	Detach/attach	1 pc.		0.2
	35	Panel (4)	Detach/attach	1 pc.		0.2
	36	Beam (6)	Detach/attach	1 pc.		0.2
	37	Pillar (9)	Detach/attach	1 pc.		0.2
	38	Pillar (12)	Detach/attach	1 pc.		0.2
	39	Plate (49)	Detach/attach	1 pc.		0.2
	40	Guard assy (13)	Detach/attach	1 pc.		0.2
	41	Cover assy (2)	Detach/attach	1 pc.		0.2
	42	Guard assy (1)	Detach/attach	1 pc.		0.2
	43	Guard assy (4)	Detach/attach	1 pc.		0.2
	44	Guard (3)	Detach/attach	1 pc.		0.2
	45	Plate (18)	Detach/attach	1 pc.		0.2
	46	Cover assy (1)	Detach/attach	1 pc.		0.2

Note: The numbers in the parenthesis like guard (14) match the guard numbers on the upper structure.

12.2.4 MEANING OF WORDS IN USE

- Completed machine :
  When detaching, replacing and adjusting the specified parts, it means the time which is determined by addition of the preparation time, net working time and standard allowance time of the work.
- Single unit :
  When detaching, replacing and adjusting the specified parts, it means the time in which the preparation time of the work is omitted and which is determined by addition and subtraction to/from the work for "Completed machine".
- Removal and installation :
  The work to remove specified parts from machine and to attach the parts, and then to perform necessary adjustment
- Simultaneous replacement :
  The work to remove specified parts in 2 types or more from machine and to attach the spare parts, and then to perform necessary adjustment
- Adjustment :
  The work to carry out necessary adjustment with the specified parts removed or attached :
- Overhaul :
  The work to remove specified assembled parts from machine, disassemble and check them, and then to attach the spare parts to machine and to perform necessary adjustment
- Include :
  Explains the contents of work to make the specified work range clear
- Exclude :
  Shows the work which is not included in the specified primary work
- Unit :
  Time is shown by hour.

13.2 PERFORMANCE INSPECTION STANDARD TABLE

Note

The mode is already "S" mode when power is thrown.
Unless otherwise specified, measure it on "H" mode.

Table13-1

Inspection Item					Measuring Position			Standard value	Tolerance		Unit	Adjusting Point	Measuring condition
					Position	Size	Port		Hi	Lo			
Standard Measuring condition	Cleanliness of hydraulic oil				Hydraulic oil in tank			NAS 9 or less	—	—	Class	—	Sampling
	Hydraulic oil temperature				Tank surface			50 (122)	+ 5 (41)	- 5 (23)	°C (°F)	—	Atmospheric temp 50°C~-10°C (122°F~14°F)
	Water temperature				Radiator surface			75 (167)	+ 15 (59)	- 15 (5)		—	
	Engine speed	H mode Lo idle			Measure the engine speed at multi display on the gauge cluster.			1000	+ 25	- 25	min-1	Adjustment not required	LOW throttle
		H mode Hi idle						2100	+ 30	- 70			Full throttle (HI idle)
		B mode Hi idle						2100	+ 30	- 70			Perform all measurement with the air-conditioner "OFF".
		A mode Hi idle						2100	+ 30	- 70			
		Decel						1050	+ 25	- 25			
		S mode Hi idle						1900	+ 30	- 70			
Pilot primary pressure circuit					G pump	PF1/4	a4	5.0 (725)	+ 0.5 (+73)	0	MPa (psi)	PR1	HI idle
High pressure circuit	Main relief valve pressure	ATT		P1	Main pump		a1	34.3 (4970)	+ 0.7 (+100)	- 0.5 (-73)		MR1	Boom up
				P2			a2						
		Boost		P1			a1	37.8 (5480)	+ 1.0 (+145)	- 0.5 (-73)		MR1	Boom up
				P2			a2						
	Over load relief valve pressure	Boom		R			a1	37.8 (5480)	0	- 4.0 (-580)		OR4	Boom down
				H				39.7 (5760)	0	- 5.9 (-855)		OR3	Boom up
		Arm		R			a2	39.7 (5760)	0	- 5.9 (-855)		OR8	Arm out
				H				37.8 (5480)	0	- 4.0 (-580)		OR7	Arm in
		Bucket		R			a1	37.8 (5480)	0	- 4.0 (-580)		OR2	Bucket dump
				H				39.7 (5760)	0	- 5.9 (-855)		OR1	Bucket digging
		Swing		RH			a2	29.0 (4205)	+ 6.0 (+870)	0		OR6	Swing RH
				LH				29.0 (4205)	+ 6.0 (+870)	0		OR5	Swing LH
		Travel	RH	FW			a1	35.8 (5190)	0	- 2.0 (-290)		—	Simultaneous operation of travel RH and LH
				RV								—	
			LH	FW			a2	35.8 (5190)	0	- 2.0 (-290)		—	
				RV								—	

13.6 MEASURING SWING PERFORMANCES

13.6.1 SWING SPEED

(1) Purpose
Measure the swing time and confirm the performances between the hydraulic pump and the swing motor of the swing drive system.

(2) Conditions
Hydraulic oil temperature ;
45~55°C (113~131°F)
Firm, level ground
Engine revolution; Hi idle

(3) Preparation
Put the bucket empty and extend the boom, arm and bucket cylinder fully.
And the machine becomes a position of minimum reach.

(4) Measurement
Swing the machine by bringing the swing lever to its full stroke. Measure the time required to make three turns after one turn of preliminary run.

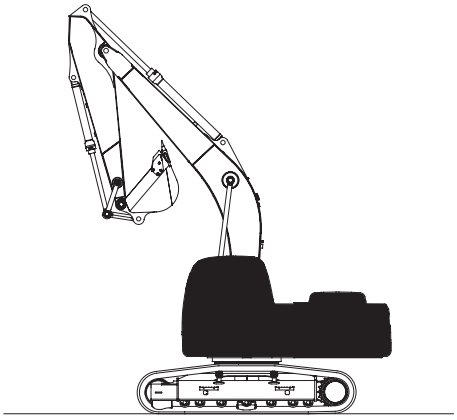


Fig. 13-20 Swing speed measuring position (at the min. reach)

13.6.2 PERFORMANCE OF SWING BRAKE

(1) Purpose
Confirm the braking torque performances by the swing relief valve.

(2) Conditions
Hydraulic oil temperature ;
45 ± 55°C (113±131°F)
Firm, level ground
Engine revolution; Hi idle

(3) Preparation

1) Put the bucket empty, retract the arm cylinder fully and extend the bucket cylinders fully. And move the boom so that the arm top pin is positioned at same height with boom foot pin.

2) Put a matching mark on the outer circumference of the swing bearing of the upper frame side and of the track frame side. Place two poles (flags) on the front and back of the extended line of the matching mark.

Swing speed — Unit : sec/3 rev

Measuring position	Standard value	Reference value for remedy	Service limit
Right	17.9~20.0	21.9~24.4	27.2~
Left	17.9~20.0	21.9~24.4	27.2~

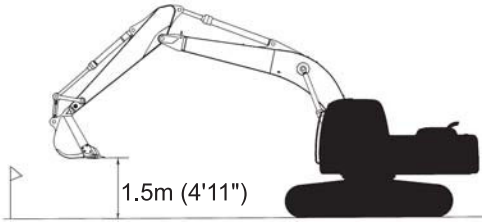
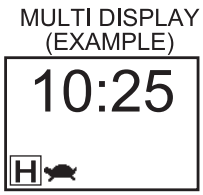


Fig. 13-21 Swing brake performance measuring position

(6) 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

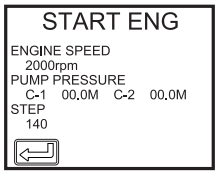
1) Turn starter switch ON keeping the work mode selector switch on the gauge cluster pressed, and hold it for 5~10 seconds, and then release it.
(If the engine is started, the following indication is not displayed. Therefore do not start the engine.)



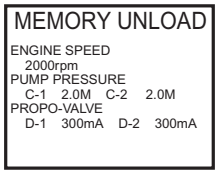
2) Keep buzzer stop switch on gauge cluster pressed for 5 seconds and release it and the screen for selection of adjustment type is displayed. And "ADJUST" is displayed.
When adjustment data is not entered in mechatro controller, "READY" is indicated. If the adjustment operation is once performed, "FIN" 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.

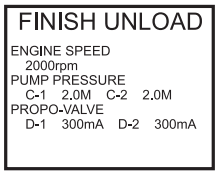


5) After starting engine, press selector switch on gauge cluster and "MEMORY UNLOAD" is indicated, the engine speed is automatically increased and the adjustment of unloading valve is performed.
"ENGINE SPEED", P1, P2 "PUMP PRESSURE" and "PROPO-VALVE" (acceleration command current) are indicated.

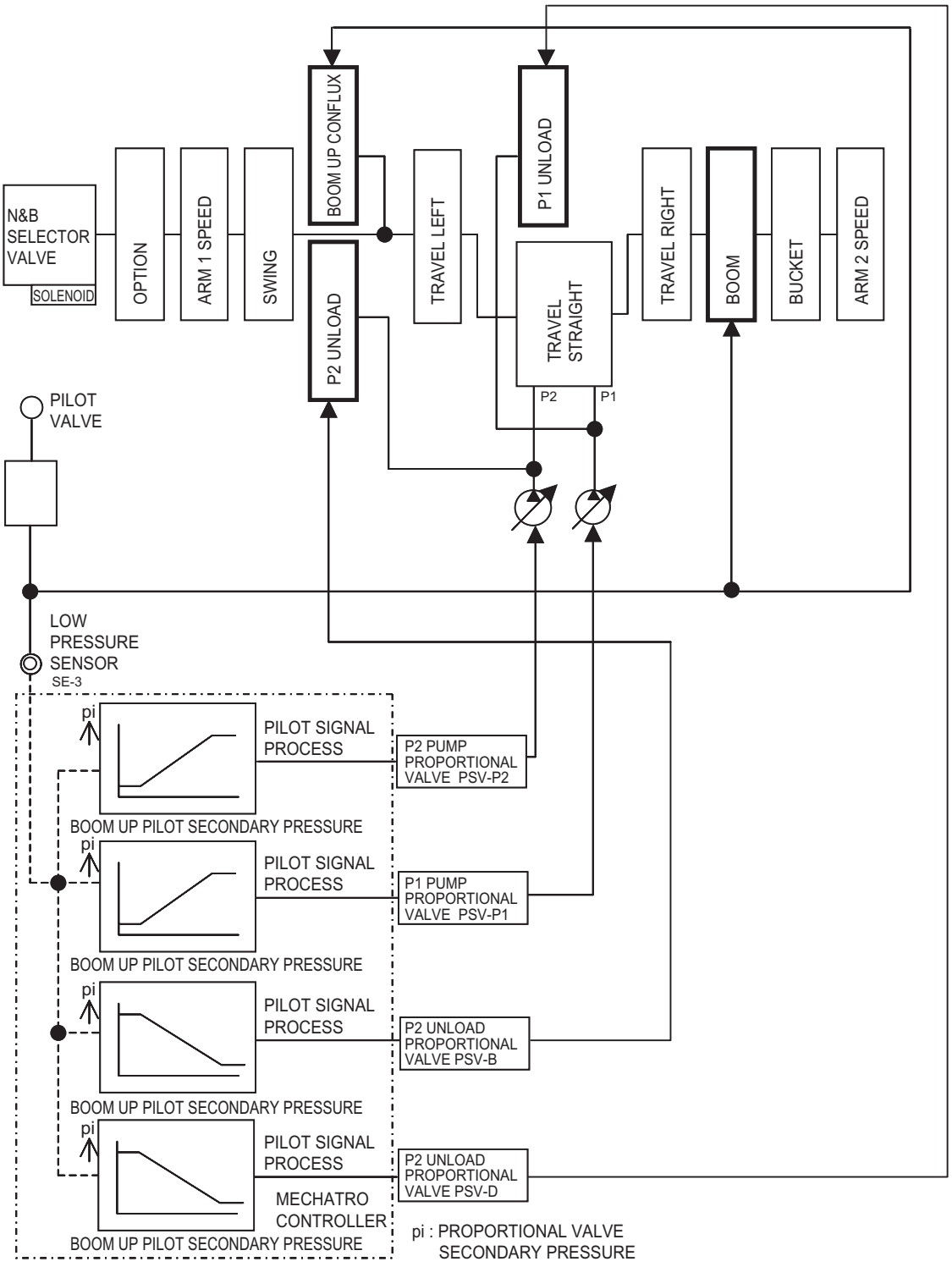


6) When the unloading proportional valve operates to the specified value, the adjustment of unloading proportional valve automatically completes. "FINISH UNLOAD" is indicated.
The speed is shifted to the speed corresponding to acceleration potentiometer.
The value of adjusting current is indicated on 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.)



21.1.4 BOOM UP CONFLUX CONTROL



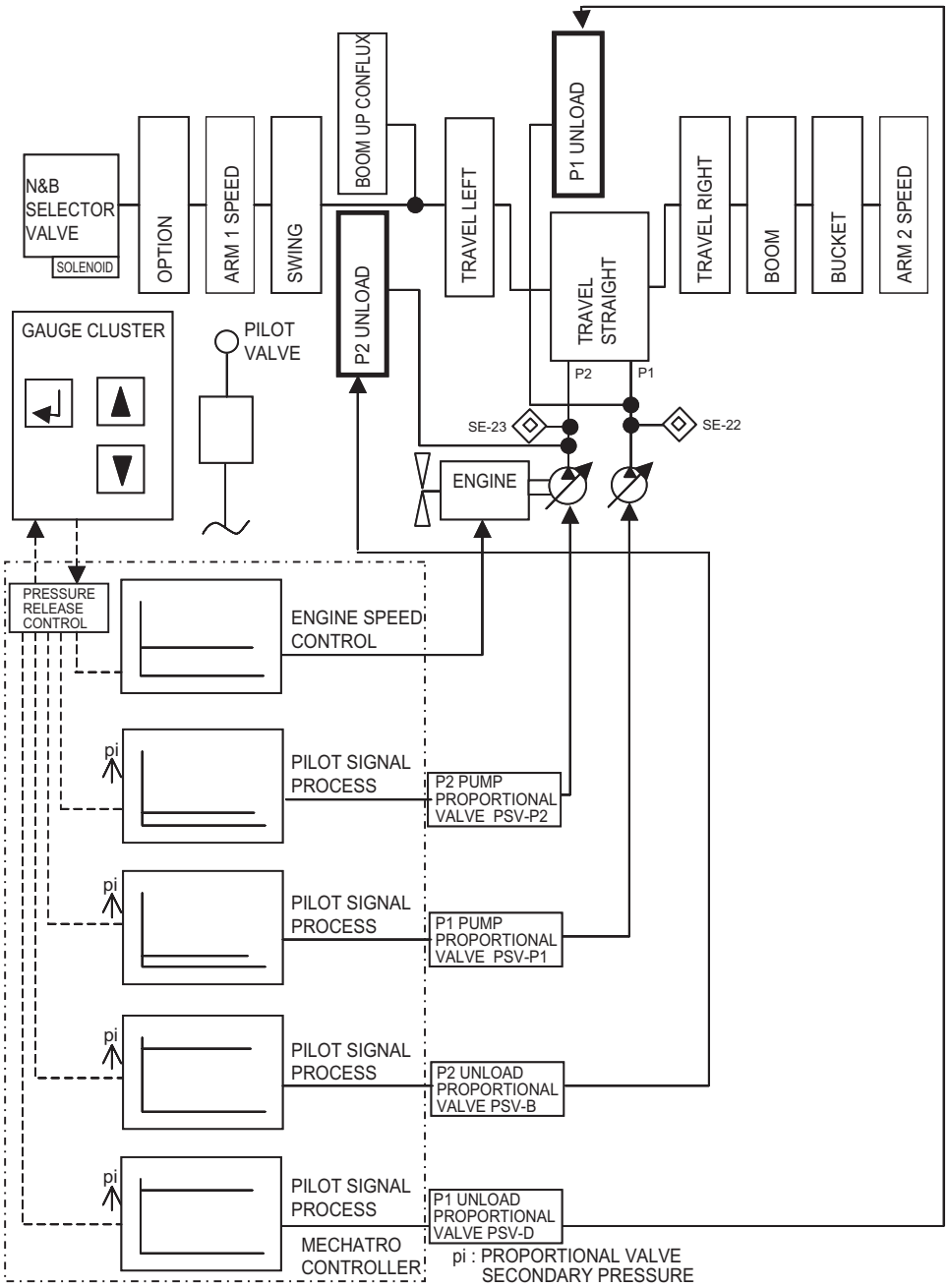
(1) On starting boom up operation, boom up operating pilot pressure switches boom spool and boom up conflux spool and is input to low pressure sensor.

(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 P1 and P2 proportional valves and P1 and P2 unload proportional valves.

(3) Each proportional valve outputs pilot proportional valve secondary pressure according to the command output by mechatro controller and changes P1 and P2 pump delivery rate and switches P1 and P2 unload pressure control valve.

(4) With original hydraulic pressure command, boom main spool and boom up conflux spool are switched, and also with the command by mechatro controller, P1 and P2 pumps and P1 and P2 unload valves are switched and consequently the delivery oil on P1 pump side confluxes delivery oil on P2 pump side during boom up operation.

21.1.12 PRESSURE RELEASE CONTROL



(1) Change mechatro controller to "PRESSURE DRAINING MODE" by operating switch on gauge cluster.
For detail of changing mode method, refer to "How to switch to "Pressure release mode"" on item 22.11.1.

(2) Once mechatro controller decides it as pressure release control, regardless of each input signal (operating pilot, accel potentiometer, etc.) the mechatro controller;

1) Outputs minimum tilt angle command to P1, P2 pump proportional valves and fixes P1, P2 pump to minimum tilt angle.

2) Outputs command of pressure release and outputs command of pressure release control to ECU and fixes engine speed to pressure release control speed.

3) Outputs maximum command to P1 and P2 unload valves and each pilot secondary pressure fixes P1 and P2 unload valves to the maximum opening.

(3) Mechatro controller senses output voltage from the main pump high pressure sensor, decides the pump pressure and displays "DRAINING HYD. PRESS" or "FAIL DRAIN HYD. PRESS" on gauge cluster.

(4) Each pump delivery oil is unloaded to tank passage enabling for the remained pressure (trapped pressure) to be released by operating each control lever and switching spool with the unload valve opened.

(2) Service diagnosis display screen (Example)

The service diagnosis display screen list is shown below. The conditions for display are H mode, engine low speed and lever to neutral position.)

1) Service diagnosis mode No.1

No.	Displays	Contents	No.	Displays	Contents
1	NO.1 MAIN CONT. P/N YN22E00001F1 PROGRAM VERSION 1-VER 11.11 2-VER 00.00 SERVICE DIAG 1	 P/No. indication Program version indication MERIT controller program version Service diagnosis mode	4	NO.4 RELAY K-1 AIS RELAY 2 OFF K-2 SAFETY RLY OFF K-3 ENG STOP OFF KEY SWITCH OFF START SWITCH OFF CHARGE LIVE K-4 LOCK LEVER OFF SWITCH OFF	 Indicated value Indicated value Indicated value Key switch Starter switch Alternator Indicated value Switch
2	NO.2 ENG G-3 SPEED SET 2205 MEAS1 2201 MEAS2 2201 G-5 ENG PRS. LIVE WATER TEMP 100 OFF MODE HM H-1 ACCEL VOLT. 4.2V POS. 100% ECU OUTPUT 0.5V	 No load setting rpm Actual rpm 1 Actual rpm 2 (Engine controller) Engine oil pressure Coolant temperaturre sensor Work mode Potentiometer voltage Voltage % indication Accel output voltage to engine controller	5	NO.5 PRESS.SENSOR B-1 BOOM RAISE 3.5V 2.6M B-2 BOOM LOWER 3.5V 2.6M B-3 ARM OUT 3.5V 2.6M B-4 ARM IN 3.5V 2.6M B-5 BUCKET DIG 3.5V 2.6M B-6 BUCKET DUMP 3.5V 2.6M	 Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value
3	NO.3 SOL.VALVE F-1 POWER BOOST COMP. OFF MEAS. OFF SWITCH OFF F-2 SWING-BRAKE COMP. OFF MEAS. OFF RELEASE SW OFF F-3 1/2-TRAVEL COMP. OFF MEAS. OFF SWITCH OFF	 Set value in computer Measured value Switch Set value in computer Measured value Switch Set value in computer Measured value Switch	6	NO.6 PRESS.SENSOR B-7 SWING 3.5V 2.6M B-9 TRAVEL(R) 3.5V 2.6M B-10 TRAVEL(L) 3.5V 2.6M B-16 P1 OPT. 3.5V 2.6M B-17 P2 OPT. 3.5V 2.6M B-18 DOZER 1 3.5V 2.6M B-19 DOZER 2 3.5V 2.6M	 Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value Sensor voltage / Pressure converted value

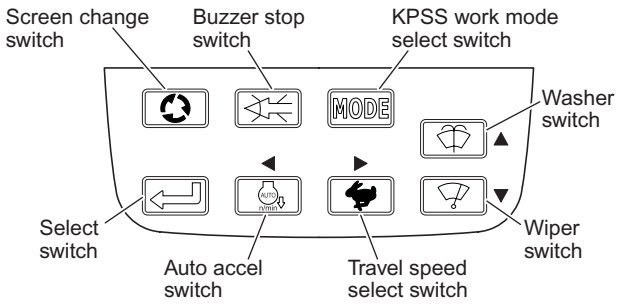
21.2.6 SET PROCEDURE OF MAINTENANCE SCHEDULE

This machine is equipped with multi-display which allows confirmation of remaining time to the coming replacement/ change time of engine oil, fuel filter, hydraulic oil filter and hydraulic oil, therefore when the remaining time reaches to Zero (0), replace or change engine oil, fuel filter, hydraulic filter, hydraulic oil, etc. and perform the initial setting by the following order.

Notice

Interval of replacement of parts is mentioned below.

- Engine oil : 500 Hr
- Fuel filter : 500 Hr
- Hydraulic filter : 1,000 Hr
- Hydraulic oil : 2,000 Hr (ASIA)
  5,000 Hr (OCEANIA)



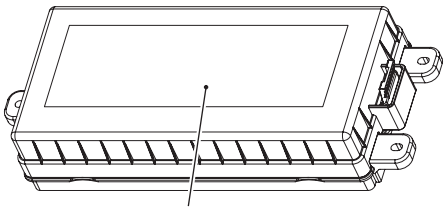
Procedure	Operating Procedure	Display on Multidisplay
1	Turn starter key switch on.	KOBELCO → After several seconds, display is changed to clock autmatically. → 10:25 H
2	Press " " switch press once display change switch on the switch panel once. And the clock display changes to the display of remaining time for coming engine oil change.	10:25 H → Press screen change switch once more. → 250 Hr ENGINE OIL H
3	Press " " switch press once select switch once and the display for the engine oil change reverses.	250 Hr ENGINE OIL H → Press select switch once more. → 250 Hr ENGINE OIL ▼▲
4	When required to adjust the interval to the coming change time by 10 hours, press " ▲" switch and the time to the coming engine oil change is added. Press " ▼" switch and the time to the coming engine oil change is reduced.	250 Hr ENGINE OIL ▼▲ → Replacing interval is changed with each pressing of switch. → 500 Hr ENGINE OIL ▼▲
5	When desired to return to the initial set time, press " " buzzer stop switch once. Press " " select switch once and the set time is stored.	500 Hr ENGINE OIL ▼▲ → To set the desired interval, press the select switch → 500 Hr ENGINE OIL H

Notice

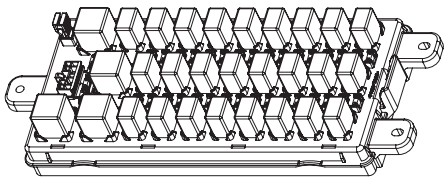
1. After displaying the display for setting by pressing the display change switch, set the respective maintenance time for fuel filter, hydraulic oil filter and hydraulic oil while repeating the procedure 2 to 5.
2. The engine oil change time is displayed on the multi-display by 500 hours as a warning, but the buzzer does not sound.

(3) Relay & fuse box (symbol E-1)

1) General view

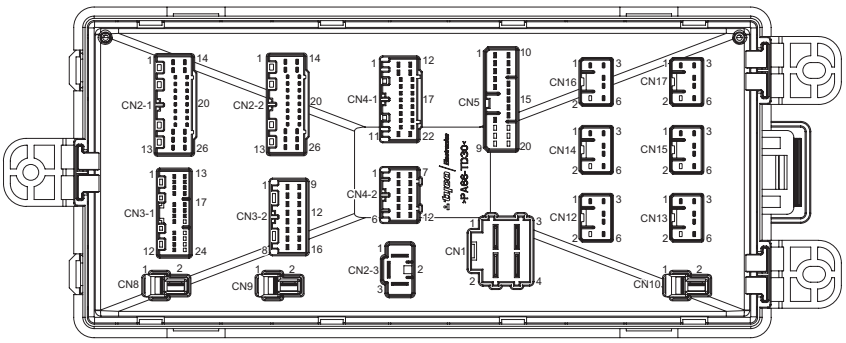


LABEL

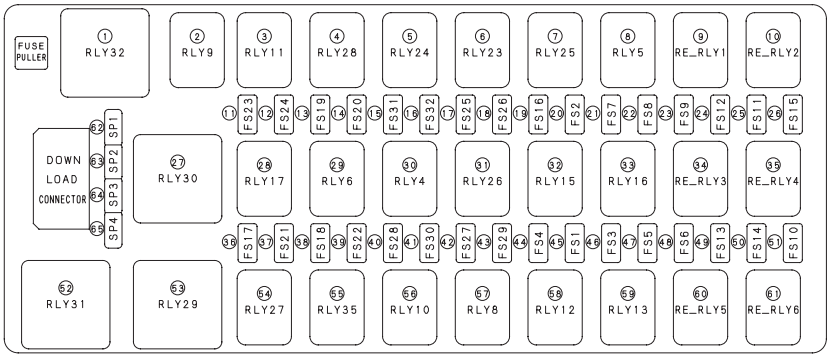


(Overhead view of box)

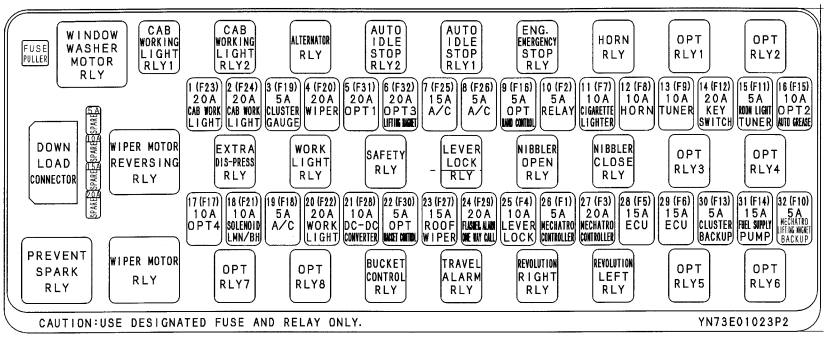
INSIDE



LOCATION OF CONNECTORS (Seen from backside)



LOCATION OF RELAY & FUSE

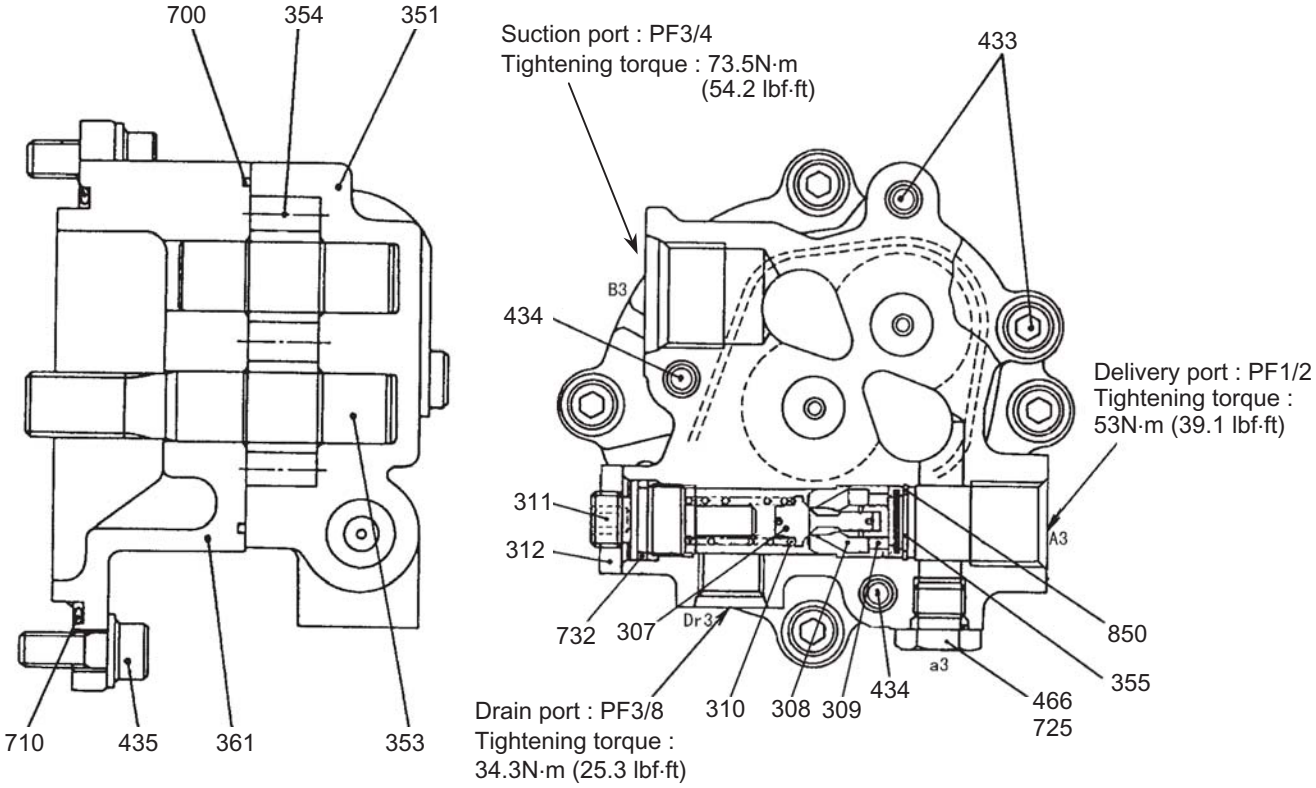


LABEL OF RELAY & FUSE BOX

Note) These circles indicate the parts which are used in standard specification

No.	CODE IN CIRCUIT	PARTS NAME	
65	SP4	MINI FUSE (20A)	○
64	SP3	MINI FUSE (15A)	○
63	SP2	MINI FUSE (10A)	○
62	SP1	MINI FUSE (5A)	○
61	RE_RLY6	MICRO RELAY (V23074A2002A403)	
60	RE_RLY5	MICRO RELAY (V23074A2002A403)	
59	RLY13	MICRO RELAY (V23074A2002A403)	
58	RLY12	MICRO RELAY (V23074A2002A403)	
57	RLY8	MICRO RELAY (V23074A2002A403)	
56	RLY10	MICRO RELAY (V23074A2002A403)	
55	RLY35	MICRO RELAY (V23074A2002A403)	
54	RLY27	MICRO RELAY (V23074A2002A403)	
53	RLY29	MINI RELAY	○
52	RLY31	MINI RELAY	○
51	FS10	MINI FUSE (5A)	○
50	FS14	MINI FUSE (15A)	○
49	FS13	MINI FUSE (5A)	○
48	FS6	MINI FUSE (15A)	○
47	FS5	MINI FUSE (15A)	○
46	FS3	MINI FUSE (20A)	○
45	FS1	MINI FUSE (5A)	○
44	FS4	MINI FUSE (10A)	○
43	FS29	MINI FUSE (20A)	○
42	FS27	MINI FUSE (15A)	○
41	FS30	MINI FUSE (5A)	○
40	FS28	MINI FUSE (10A)	○
39	FS22	MINI FUSE (20A)	○
38	FS18	MINI FUSE (5A)	○
37	FS21	MINI FUSE (10A)	○
36	FS17	MINI FUSE (10A)	○
35	RE_RLY4	MICRO RELAY (V23074A2002A403)	
34	RE_RLY3	MICRO RELAY (V23074A2002A403)	
33	RLY16	MICRO RELAY (V23074A2002A403)	
32	RLY15	MICRO RELAY (V23074A2002A403)	
31	RLY26	MICRO RELAY (V23074A2002A403)	○
30	RLY4	MICRO RELAY (V23074A2002A403)	○
29	RLY6	MICRO RELAY (V23074A2002A403)	○
28	RLY17	MICRO RELAY (V23074A2002A403)	
27	RLY30	MINI RELAY	○
26	FS15	MINI FUSE (10A)	○
25	FS11	MINI FUSE (5A)	○
24	FS12	MINI FUSE (20A)	○
23	FS9	MINI FUSE (10A)	○
22	FS8	MINI FUSE (10A)	○
21	FS7	MINI FUSE (10A)	○
20	FS2	MINI FUSE (5A)	○
19	FS16	MINI FUSE (5A)	○
18	FS26	MINI FUSE (5A)	○
17	FS25	MINI FUSE (15A)	○
16	FS32	MINI FUSE (20A)	○
15	FS31	MINI FUSE (20A)	○
14	FS20	MINI FUSE (20A)	○
13	FS19	MINI FUSE (5A)	○
12	FS24	MINI FUSE (20A)	○
11	FS23	MINI FUSE (20A)	○
10	RE_RLY2	MICRO RELAY (V23074A2002A403)	
9	RE_RLY1	MICRO RELAY (V23074A2002A403)	
8	RLY5	MICRO RELAY (V23074A2002A403)	○
7	RLY25	MICRO RELAY (V23074A2002A403)	○
6	RLY23	MICRO RELAY (V23074A2002A403)	○
5	RLY24	MICRO RELAY (V23074A2002A403)	○
4	RLY28	MICRO RELAY (V23074A2002A403)	○
3	RLY11	MICRO RELAY (V23074A2002A403)	
2	RLY9	MICRO RELAY (V23074A2002A403)	
1	RLY32	MINI RELAY (VF4-15H11)	○

(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

4) Power shift control
As shown in Fig. 24-16, the pump set power is controlled according to the movement of control by power shift pressure Pf.
As power pressure Pf rises, the compensating rod (623) moves rightward through pin (898) and compensating piston (621). Consequently like the overloading prevention operation of power control, the pump tilt angle becomes smaller and the power setting value is reduced. Conversely, if the power shift pressure Pf is reduced, the power set value is raised.
The power shift pressure Pf of this pump is ordinary set to 0MPa, but in emergency mode, the power shift pressure Pf is raised to 4.9MPa. (710 psi)

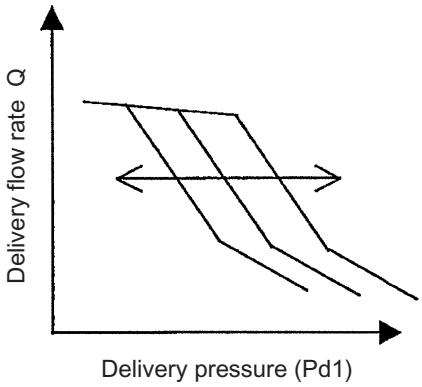


Fig. 24-16

24.1.1.3.3 ADJUSTING THE REGULATOR

The regulator may be adjusted in terms of maximum flow, minimum flow, horsepower (at emergency mode control) control characteristics, flow control characteristics using the adjust screw.

(1) Adjusting the maximum flow (See Fig. 24-3)
Adjust the maximum flow by loosening nut (808) and by tightening set screw (954) (or loosening it). Tightening set screw (954) decreases the delivery rate, as indicated in Fig. 24-17.
Only the maximum flow varies, but other control characteristics remain unchanged.

Adjust screw no.	954
No. of turns for tightening	1/4
Pilot pressure Pi (Input current I)	No change
Min. increase in delivery flow L/min (gal/min)	5.8 (1.5)

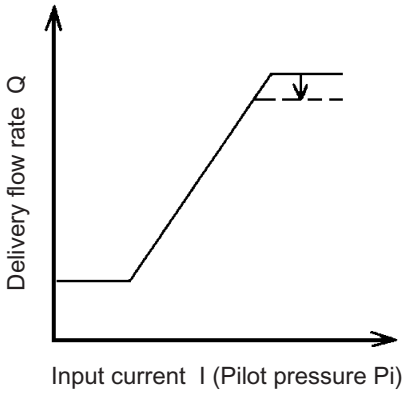


Fig. 24-17 Adjusting the max. delivery flow

(2) Adjusting the minimum flow (See Fig. 24-3)
Adjust the minimum flow by loosening nut (806) and by tightening socket screw (953) (or loosening it). Tightening socket screw increases the delivery rate, as indicated in Fig. 24-18.
Other control characteristics remain unchanged in the same way as maximum flow adjustment, care should be used of the fact that overtightening may increase a required power at the maximum delivery pressure (at relieving action).

Adjust screw no.	953
No. of turns for tightening	1/4
Pilot pressure Pi (Input current I)	No change
Min. increase in delivery flow L/min (gal/min)	4.6 (1.2)

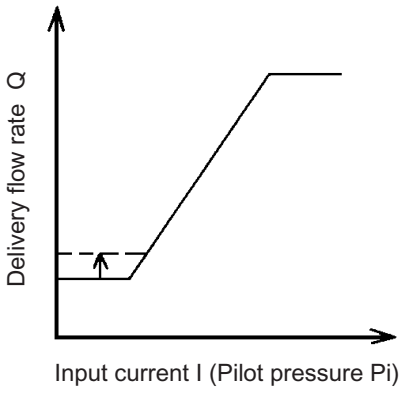
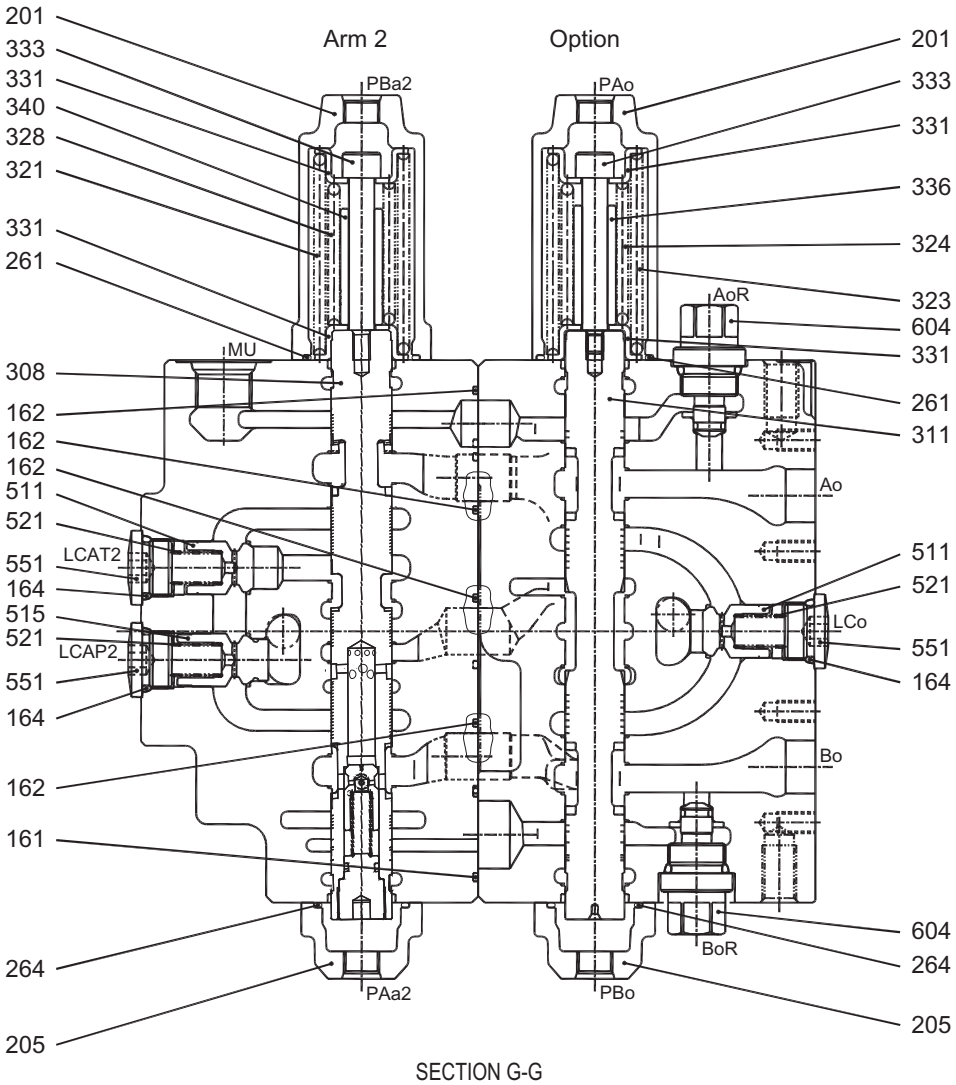
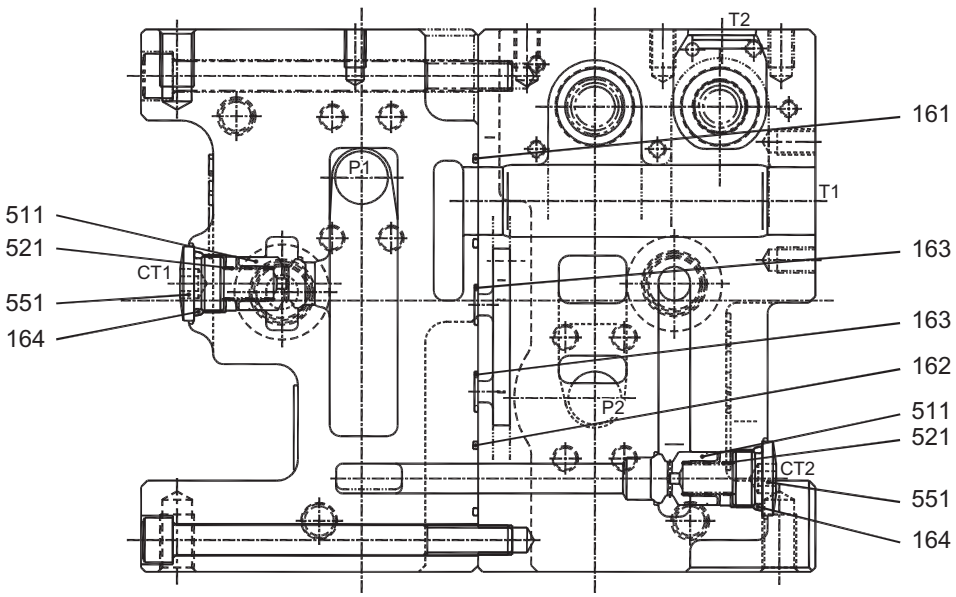


Fig. 24-18 Adjusting the min. delivery flow



SECTION G-G



SECTION H-H

Fig. 24-27 Section (5/6)

24.1.2.2.3 OPERATION

(1) In neutral position

The hydraulic oil delivered by hydraulic pump P1 enters port P1 of control valve, and passes through unloading valve P1 (309), low pressure circuit (D) and boost check valve (517), and returns to the hydraulic tank through tank port T1. And when the operation of unloading valve is impossible due to failure of electric control system, because the by-pass cut valve (606) located on the downstream of center by-pass passage (52) opens, the hydraulic oil through hydraulic pump P1 port passes through travel straight spool (306), and then flows though the center by-pass passage (52) which passes through travel right, boom, bucket and arm 2 and the by-pass cut valve (606) on P1 side, and flows into low pressure circuit (D) and boost check valve (517), and then returns to the hydraulic tank through tank port T1.

The hydraulic oil delivered by hydraulic pump P2 passes through unloading valve P2 (310), low pressure circuit (D) and boost check valve (517) and returns to the hydraulic tank through tank port T1 similarly to the hydraulic oil from hydraulic pump P1. And when the operation of unloading valve is impossible, because the by-pass cut valve (606) located on the downstream of center by-pass passage (55) opens, the hydraulic oil through hydraulic pump P2 port passes through main passage, and then flows though the center by-pass passage (55) which passes through travel left, swing, arm 1 and option and the by-pass cut valve (606) on P2 side, and flows into low pressure circuit (D) and boost check valve (517), and then returns to the hydraulic tank through tank port T1.

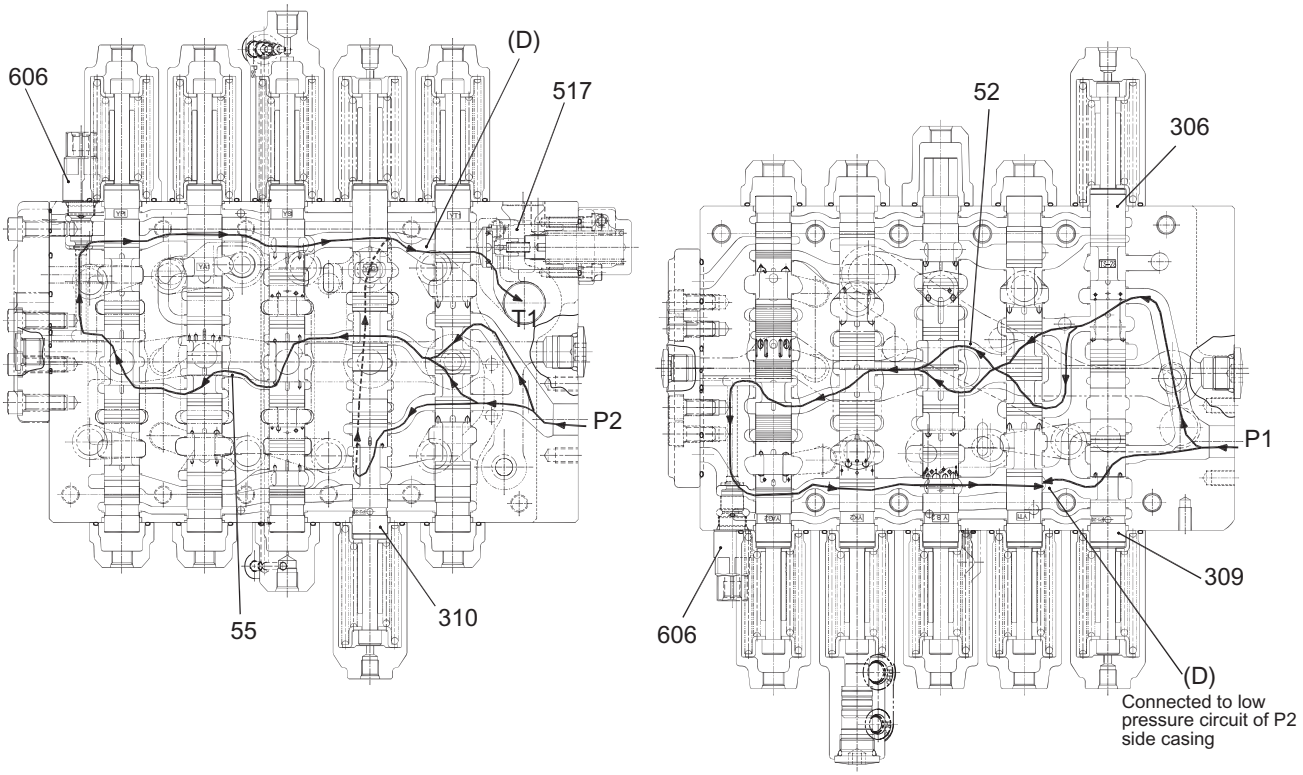


Fig. 24-39 In neutral position

(6) Swing operation

On starting swing operation, the pilot pressure enters ports PAs or PBs, and swing spool (303) moves leftward or rightward against the force of springs (321) (322), and simultaneously the secondary pressure of solenoid proportional valve [X2] acts on port PCa and switches unloading spool (310).

At the same time, in the event that the pilot pressure acts on port PAs, the pilot pressure flows through shuttle valve inside of cover (204) through the inside passage and then is led to port Pss. When the pilot pressure acts on port PBs, the pilot pressure also flows through shuttle valve inside of cover (204) and then is led to port Pss.

The hydraulic oil delivered by hydraulic pump P2 flows into parallel passage (56), pushes and opens load check valve LCs (511) and flows through between the perimeter of swing spool (303) and casing through U-shaped passage and is supplied to swing motor A side or B side through port (As) or (Bs).

In the meantime, the return oil from swing motor A side or B side passes through between the perimeter of swing spool (303) and casing through port (Bs) or (As) and flows through low pressure circuit (D) and boost check valve (517), and then returns to the hydraulic tank through tank port T1.

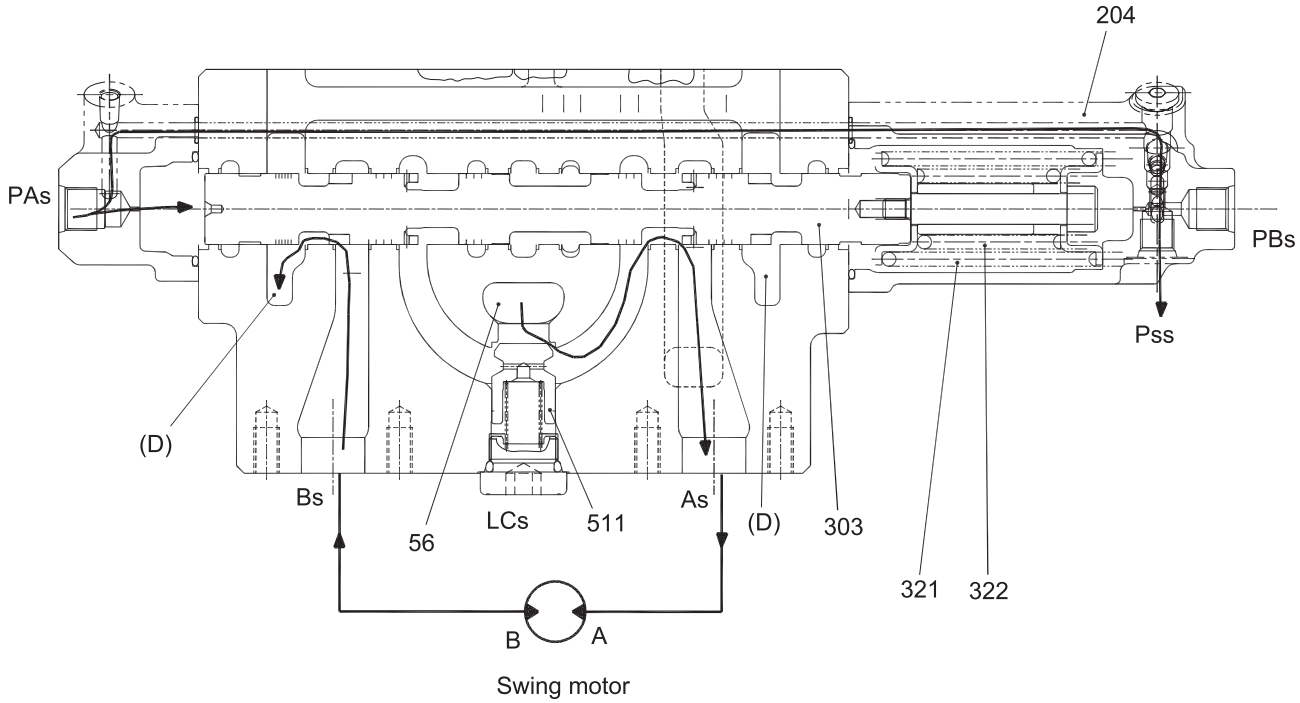


Fig. 24-50 Swing operation

24.1.3.3 OPERATION

(1) Lever in neutral (See Fig. 24-59)
The action of spring (509) (for secondary pressure setting) that determines the output pressure of the pilot valve does not act upon spool (201). Therefore, spool (201) (for return) is pushed up by spring (221) [spring seat (216)]. The output ports (2,4) connect with the T port. The result is that the output pressure is equal to the tank pressure.

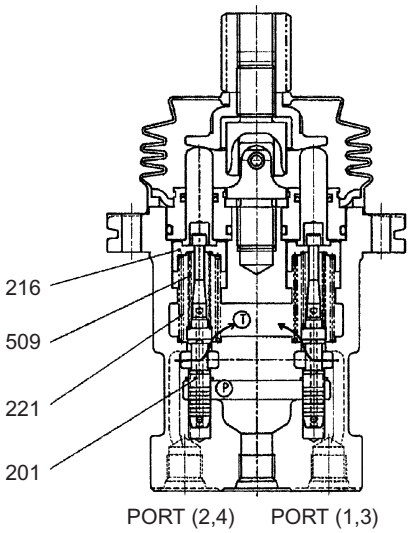


Fig. 24-59 Lever in neutral

(2) When the pilot lever is tilted (See Fig. 24-60)
When the lever is tilted and the push rod (511) strokes, the spool (201) [spring seat (216)] moves downward to make the port P to connect with the port 2, 4, with the result that the oil of the pilot pump flows to the port 2 ,4 to produce a pressure.

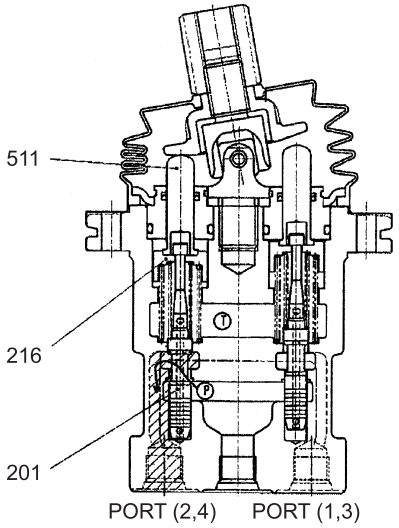


Fig. 24-60 When the lever is tilted

(3) Lever held (See Fig. 24-61)
When the pressure at ports (2,4) rises to a level equivalent to the action of spring (509) that is set by tilting the lever, the hydraulic pressure balances the spring action. When the pressure of ports (2,4) rises above a set value, ports (2,4) and the P port close while ports (2,4) and the T port open. When the pressure at ports (2,4) falls below a set value, ports (2,4) and the P port open while ports (2,4) and the T port close. Thus the secondary pressure is kept constant.

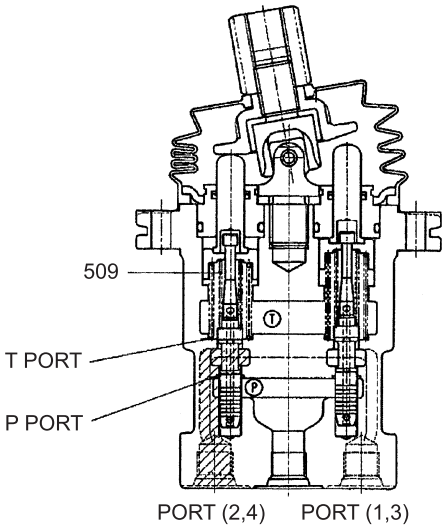


Fig. 24-61 When the lever is held

c. Condition shown in Fig. 24-67.
The machine does not travel to the left further when piston 1 (302) arrives at the end of adjust plug (401). Therefore, the relief valve keeps its normal relieving action whereby the relief pressure is held at P2.
In the processes 1 to 3 above, the relief pressure changes as shown in Fig. 24-68.

2) Function when the relief valve pressure is reduced
Let us consider the pressure of the P port is reduced.
When the pressure at port P is reduced to zero, the pressure of chamber g falls to the tank pressure level. The result is that the plunger (301) which is now open moves to the left and is seated on seat (341). At the same time, the piston 1 (302) moves to the right by the action of spring (321) and returns to the condition of Fig. 24-64.

(3) Operation of anti-reaction valve

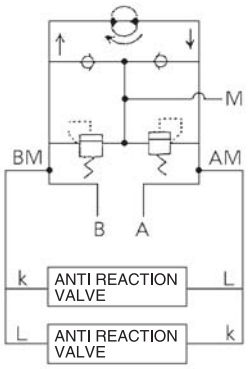


Fig. 24-69 Hydraulic circuit diagram for anti-reaction valve.

1) Neutral condition :
Fig. 24-69 illustrates the relationship between the neutral condition of the anti-reaction valve and the hydraulic circuits. Now, let us consider a braking condition in which brake pressure generates on the AM port side.

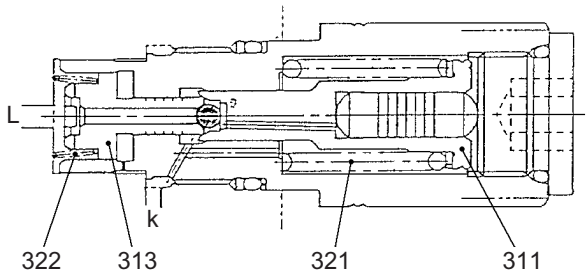


Fig. 24-70 Neutral condition

2) When brake pressure occurs :
If pressure (P) generates at the AM port, it passes through the passage L, the hole on the shaft of seat (313) and the passage m of plunger (311) and is led to the n chamber.
When the pressure P rises above a value (Ps) set by spring (321), plunger (311) compresses spring (321) and shifts it to the left.
Seat (313) compresses weak spring (322) as pushed by plunger (311) and moves to the left.

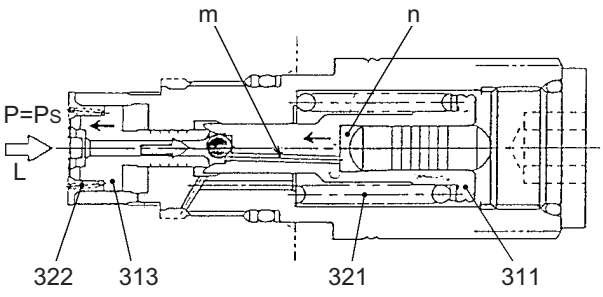


Fig. 24-71 When brake pressure occurs

(4) Function of overload relief valve

Two pieces of overload valves are located at cross-over position in the counterbalance circuit of brake valve and have the following functions:

1) When hydraulic motor starts, keep the driving pressure below predetermined value and while accelerating, bypasses surplus oil to return line.
2) When stopping the motor, keep the brake pressure, that develops on the outlet side of motor, under the predetermined value to stop the inertial force.
3) To accelerate sharply while starting, and to mitigate the braking shock while stopping. For these purposes, the developed pressure is kept comparatively low for a short period, then keep the line pressure as normal value. While the pressure is low, meshing of reduction gears, crawler and sprocket etc. can be smoothly done and the shock are absorbed.

When starting, "A" port pressure of overload valve increases, this pressure is applied to the effective diameter of valve (57-2) which seats on the valve seat (57-3) and, at the same time, is delivered, via small hole, to the connecting piston (57-4) located inside the valve (57-2) and the piston bore pressure increases up to "A" port pressure. The valve (57-2) opposes to adjusting spring (57-9) by the force of the pressure exerted on the area difference between valve seat's effective diameter and piston bore and keep the predetermined pressure. When hydraulically braking, the piston (57-7) is at the left position by the driving pressure, and when "A" port pressure increases, the pressure is applied also to the piston (57-7) through the small hole in the valve (57-2) and piston (57-7) moves rightward until it touches the cap (57-5). In this while, the valve (57-2) maintains "A" port pressure at comparatively low against the adjusting spring (57-9) force and exhaust oil to "B" port side. After the piston reached to the plug, the valve acts the same as at starting.

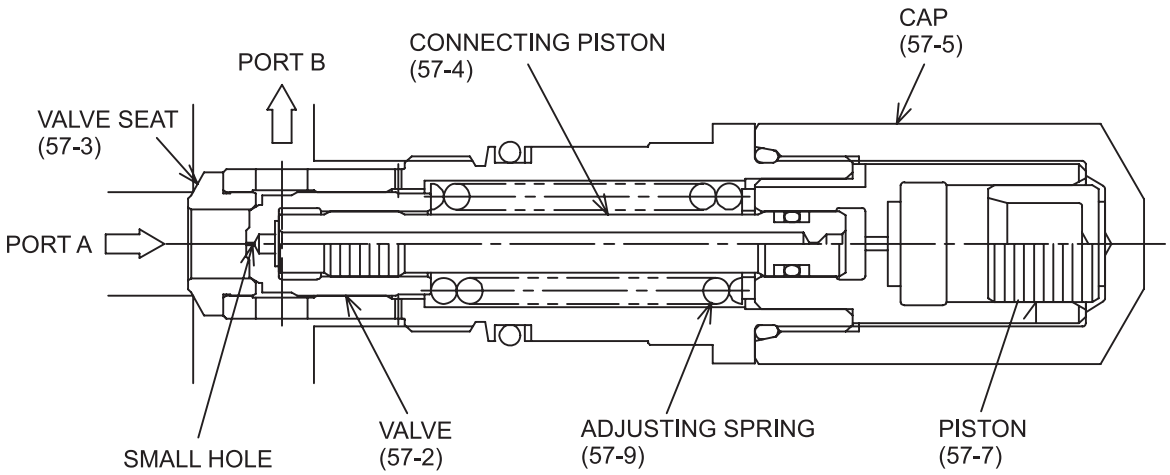


Fig. 24-85 Function of overload relief valve

(3) Bucket cylinder

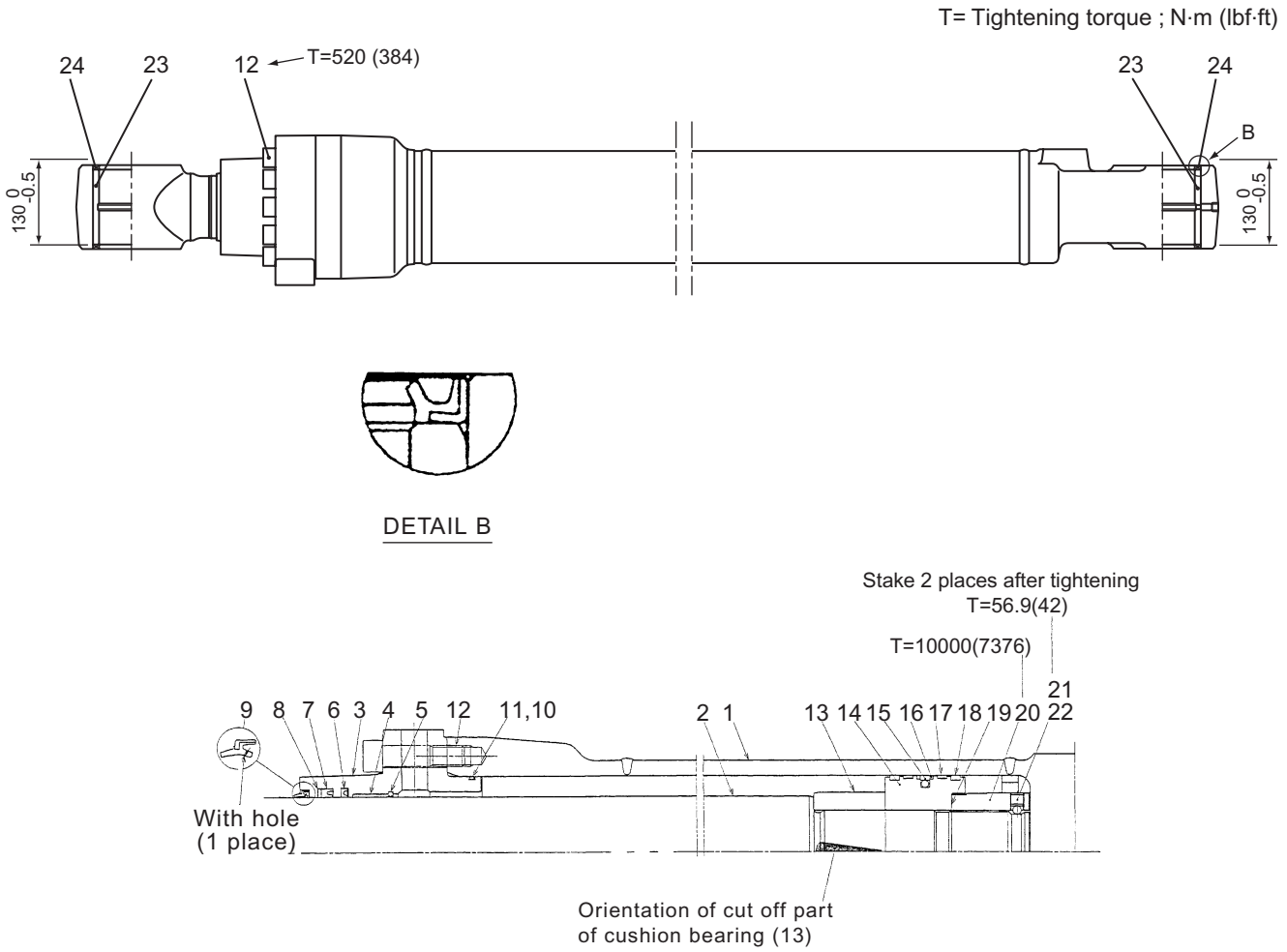
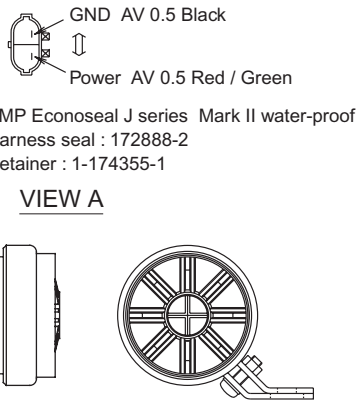
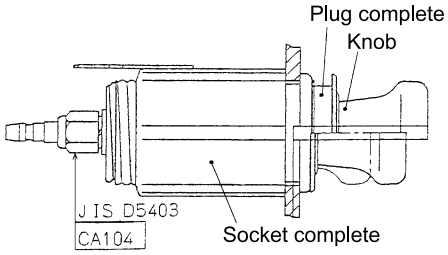
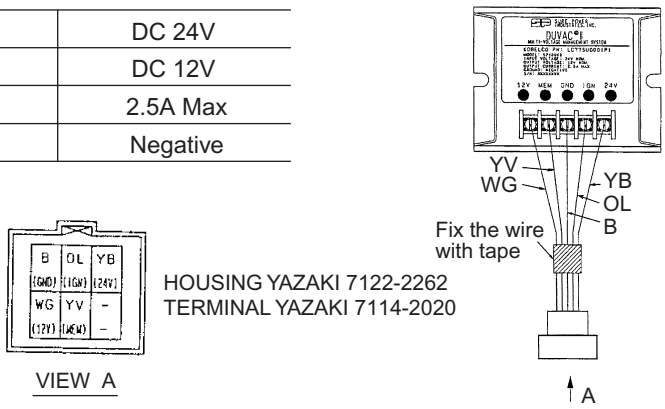
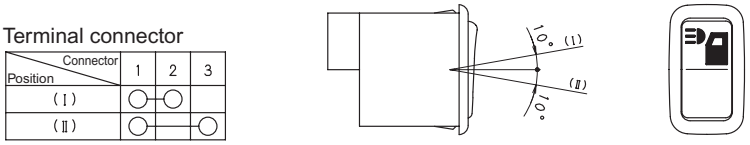
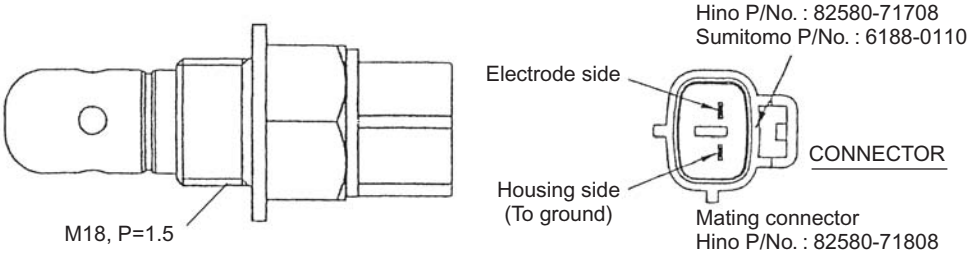
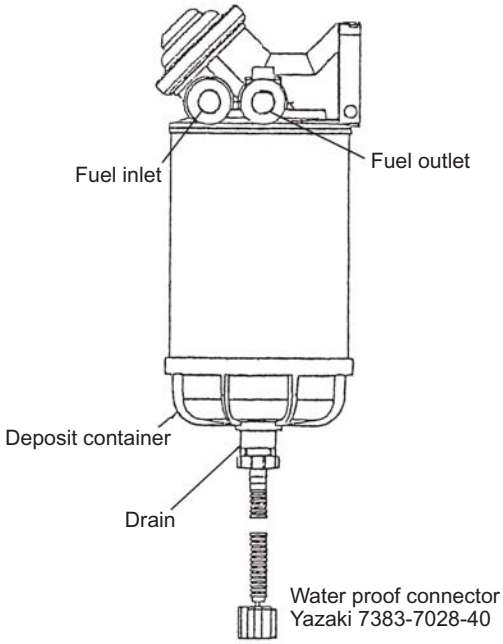


Fig. 24-97 Construction of bucket cylinder

P/No	LC01V00055F2							
No.	Parts	Q'ty	No.	Parts	Q'ty	No.	Parts	Q'ty
1	Cylinder tube	1	9	Wiper ring	1	17	Slide ring	2
2	Piston rod	1	10	O-ring	1	18	Slide ring	2
3	Rod cover	1	11	Buckup ring	1	19	Shim	1
4	Bushing	1	12	Socket bolt; M20×95	12	20	Piston nut	1
5	Snap ring	1	13	Cushion bearing	1	21	Set screw; M14×2	1
6	Buffer ring	1	14	Piston	1	22	Steel ball	1
7	U-ring	1	15	Seal ring	1	23	Pin bushing	4
8	Buckup ring	1	16	Buckup ring	2	24	Wiper ring	4

File No. Name of part Part No. Use Applicable Machine	Specification	Description
E - 13 Alarm YN53S00004F1 Travel alarm (Australia) YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Model: BA3111A Rated voltage: DC 12V~36V	
E - 14 Cigarette lighter YN81S00003P1 Cigarette lighter YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Model: 409137-0000A Rated voltage: DC 24V Max. current: 5A Recovery time: Less than 18sec Insulation resistance: More than 3MΩ /500V megger Thermal fuse: Fusing temp.180~250℃	
E - 15 Fusible link LC13E01175S002 Fuse YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Type: Slow blow fuse Allowable current: 100A	
E - 22 DC-DC converter YN77S00005F1 DC24V→DC12V YB05 - 03001 ~ LA05 - 02001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Input voltage: DC 24V Output voltage: DC 12V Output current: 2.5A Max Ground: Negative	

File No. Name of part Part No. Use Applicable Machine	Specification	Description
SW - 26 Switch YN50S00040D4 Cab work light switch YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Rated voltage: DC 24V Type: Single pole single throw (alternate) Insulation resistance: More than 1MΩ / DC500V megger 	
SW - 27 Switch VHS834601510A Coolant level switch YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Purpose: Coolant level detection Working temperature: -40℃~130℃ 	
SW - 28 Switch VHS233002800A Fuel filter YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~		

25.3 PIPING

25.3.1 AIR CONDITIONER

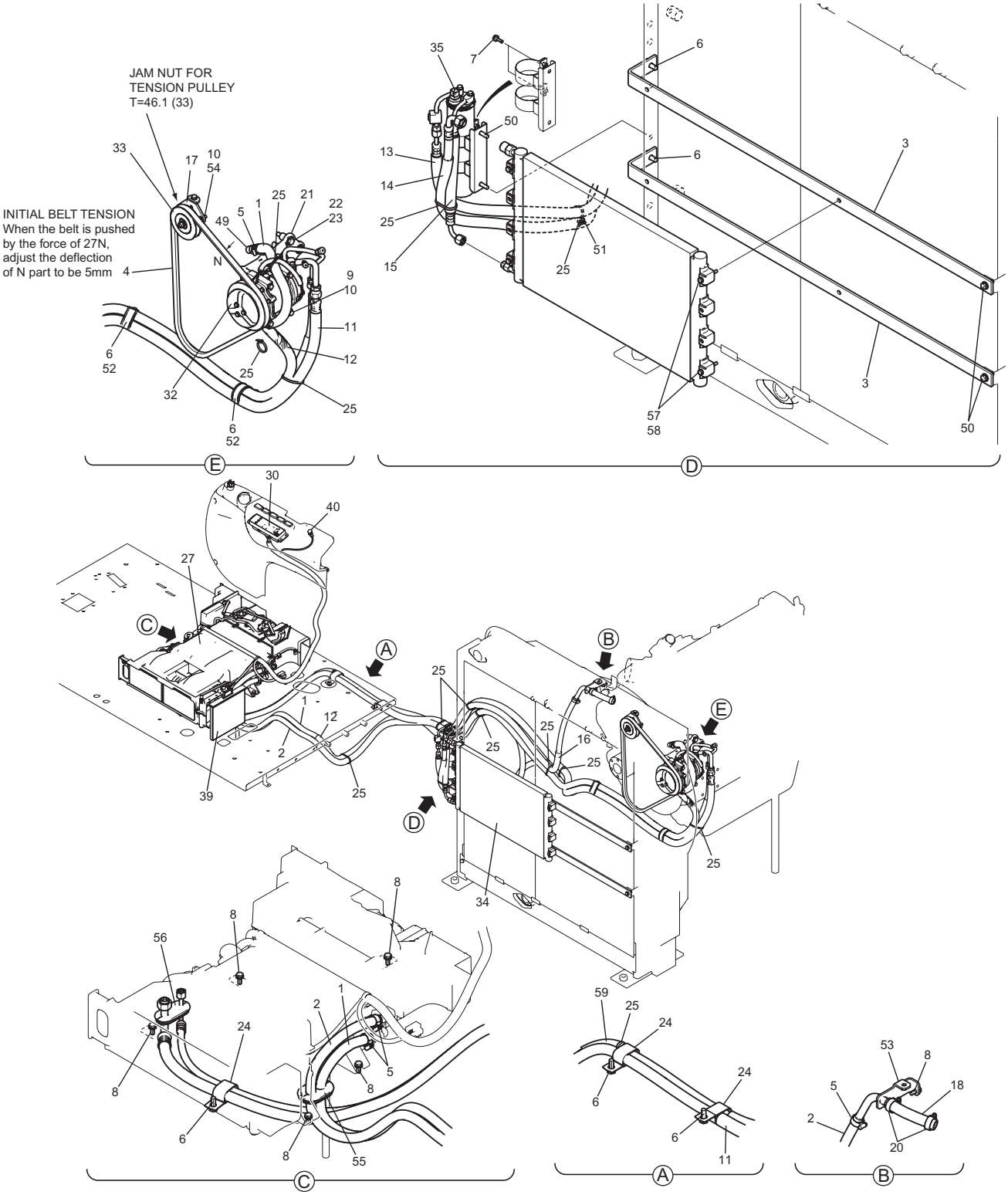


Fig. 25-5

Note

1. Apply oil for refrigerant R134a to the O-rings of all air-conditioner hose fittings.
2. Refrigerant volume : 900±50 g (2±0.1 lbs)
3. Tightening torque : T=N•m (lbf•ft)

25.5.2 DISASSEMBLY AND ASSEMBLY OF UNIT

(1) Removing inner air filter
Slide the inner air filter leftward and remove it from the unit.

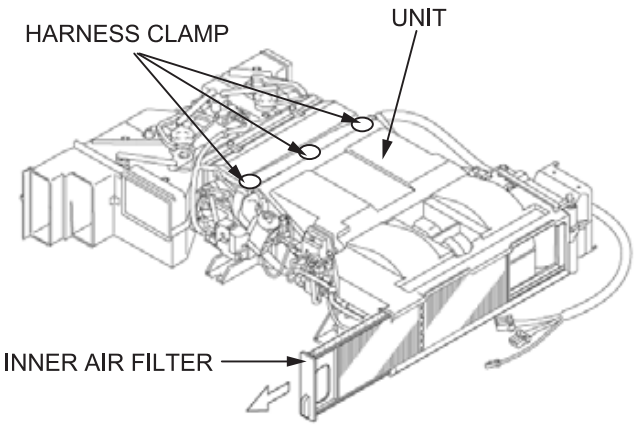


Fig. 25-15

(2) Removing selector box
Remove 6 plus screws, remove connector connected to the mode actuator on mode selector box, and separate the mode selector box from the unit.

(3) Removing main harness
Pull out 3 harness clamps from the unit, and disconnect all connected connectors and remove harness on the body from the unit.

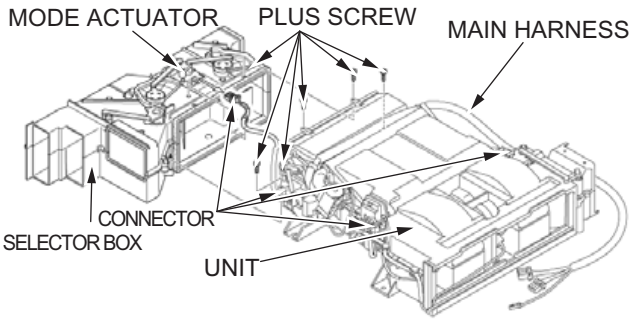


Fig. 25-16

(4) Removing upper unit case
1) Remove air MIX rod and air MIX rod sub from air MIX lever.
2) Remove 12 plus screws which are used to install the upper and lower unit casings.
Pull out the upper unit casing upward giving attention to the thermistor harness so as not to be caught by the casing.

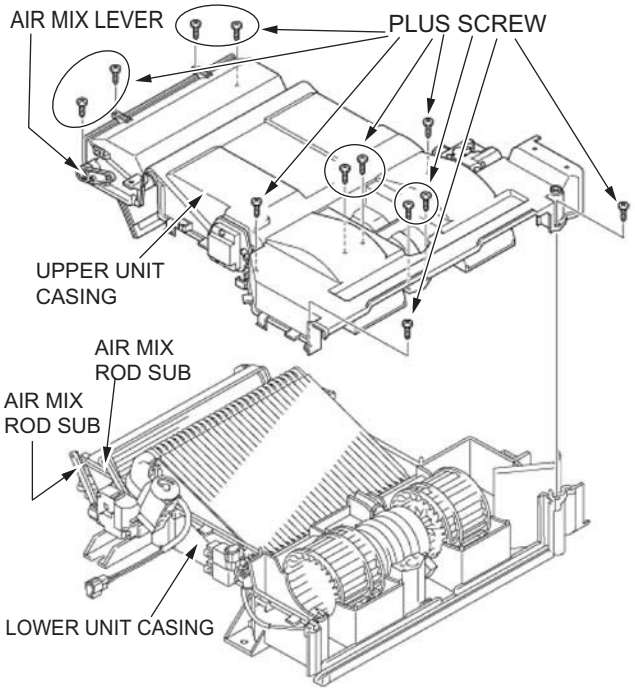
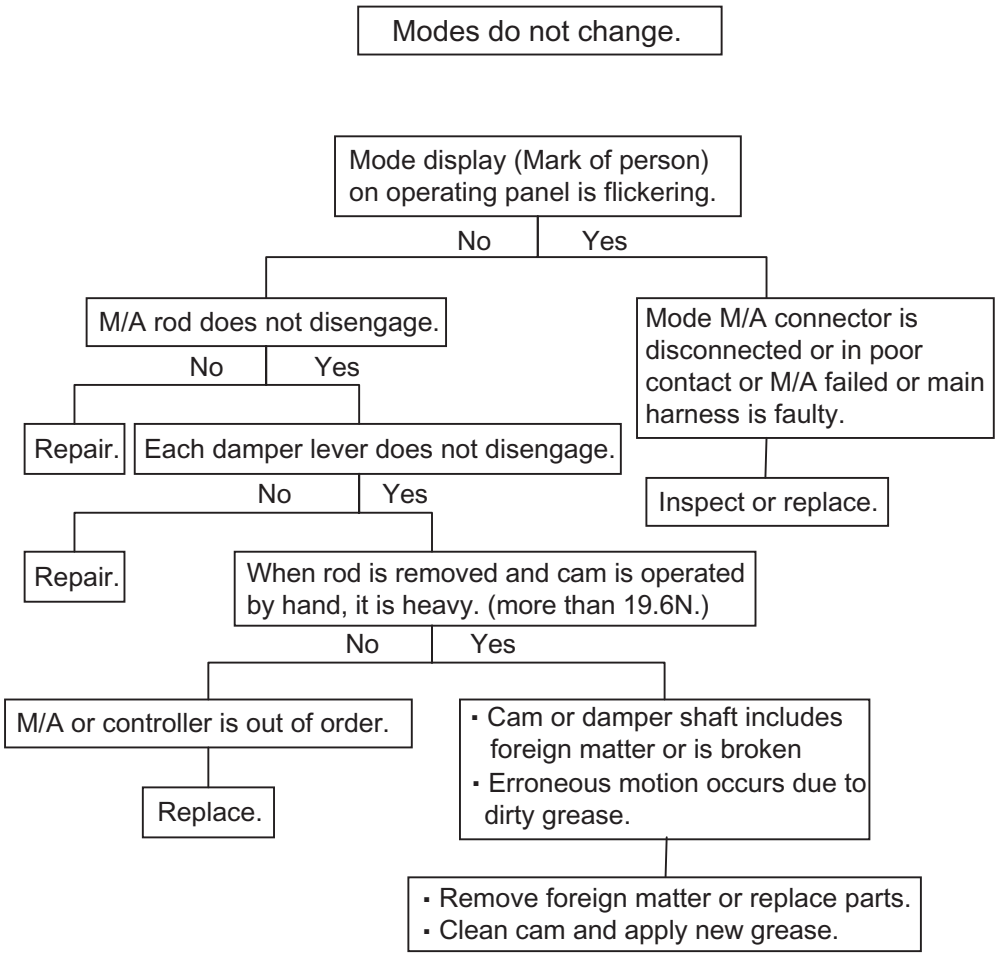


Fig. 25-17

This page is blank for editing convenience.


Modes do not change.
Mode display (Mark of person) on operating panel is flickering.
No
Yes
M/A rod does not disengage.
Mode M/A connector is disconnected or in poor contact or M/A failed or main harness is faulty.
No
Yes
Repair.
Each damper lever does not disengage.
Inspect or replace.
No
Yes
Repair.
When rod is removed and cam is operated by hand, it is heavy. (more than 19.6N.)
No
Yes
M/A or controller is out of order.
▪ Cam or damper shaft includes foreign matter or is broken
▪ Erroneous motion occurs due to dirty grease.
Replace.
▪ Remove foreign matter or replace parts.
▪ Clean cam and apply new grease.

32. ATTACHMENT

TABLE OF CONTENTS

Book Code No. **S5LC3211E01**

(9) Completion of removal of front attachments
When the removing and attaching of cylinder are not required, the work is finished.

(10)Removing and installing arm cylinder

1) Disconnect hose (F1) and (F2) at position A. After disconnection of hose, plug both ends of hose.

Note

Plug : Tools section 11.5.2-(4) Plugs for ORS fitting
Tools section 11.5.2-(5) Plugs for half clamp

:41 mm

:12 mm

2) Removing arm cylinder head pin (D)
Loosen nut (3), remove capscrew M20×180 (2) and pull out pin (D).

: 30mm

3) Removing arm cylinder
Weight of arm cylinder : 504 kg (1,110 lbs)

(11)Removing and installing boom cylinder

1) Disconnect hose (C2) at the position B and plug both end.

Note

Plug both end of disconnected pipes.

Plug : Tools section 11.5.2-(4)
Tools section 11.5.2-(5)

: 41mm

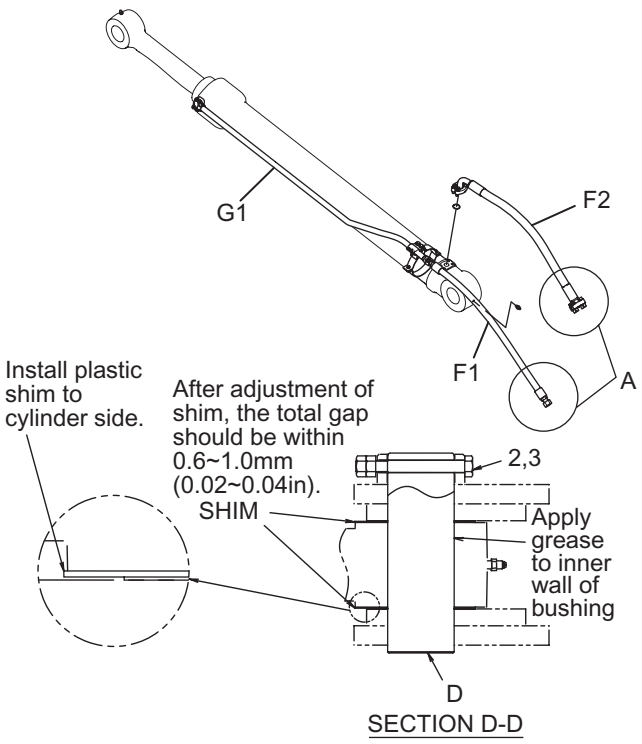


Fig. 32-21 Removing arm cylinder

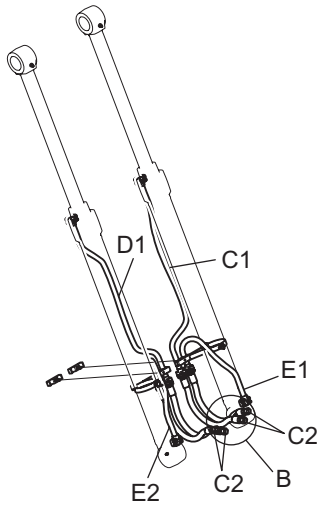


Fig. 32-22 Removing and installing boom cylinder

32.2.1.3.5 REMOVING PIN BUSHING

(1) Apply driver to wiper ring (25) of cylinder tube (1) and piston rod (2), and strike it by hammer lightly.

(2) Push out pin bushing (24) press fitted in cylinder tube (1) and piston rod (2) with press.

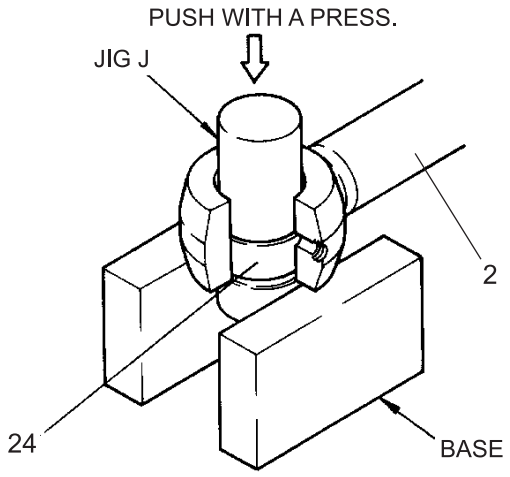


Fig. 32-44 Drawing out pin bushing (24)

32.2.1.4 CLEANING

(1) After disassembly the cylinder, wash all parts with commercial detergent.

⚠CAUTION

Never use benzene(gasoline, thinner, etc.) because it may be damage the rubber, etc.

(2) Do not use the used oil seal, O-ring, back-up ring, etc. even if they are not damaged after inspection.

(3) After cleaning, dry all parts by compressed air, and put them on the working bench taking care not to damage them.

32.2.1.5 ASSEMBLING PIN BUSHING

Start assembling the following sub assy

- Cylinder tube assy
- Piston assy
- Rod cover assy

32.2.1.5.1 ASSEMBLING PIN BUSHING

(1) Press fit pin bushing (24) in cylinder tube (1) and piston rod (2) respectively with press.

(2) Press fit wiper ring (25) in the upper and lower sides of cylinder tube (1) and piston rod (2) respectively with press.

⚠CAUTION

- Before press fitting, apply grease on wiper ring and boss hole.
- Before press fitting the pin bushing, align the position of oil hole.

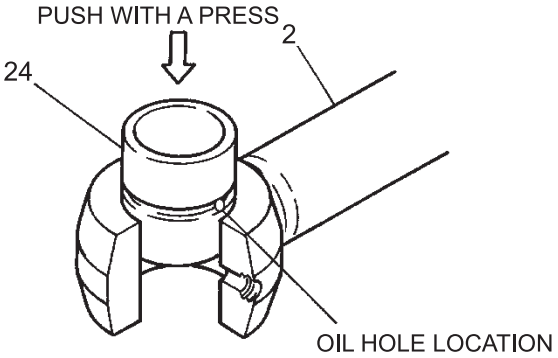
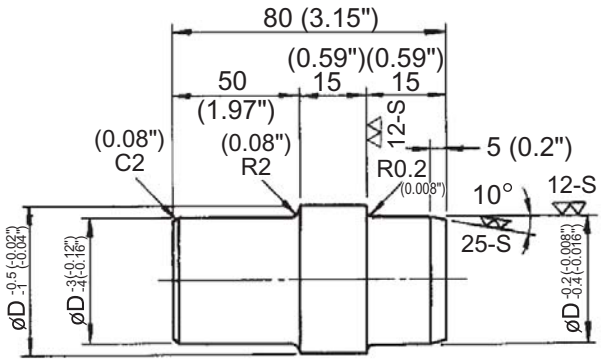


Fig. 32-45 Press fitting of pin bushing (24)

32.2.1.9.2 OTHER SPECIAL JIGS (PREPARED BY SERVICE SHOP)

(1) Bushing removing jig (Symbol J)



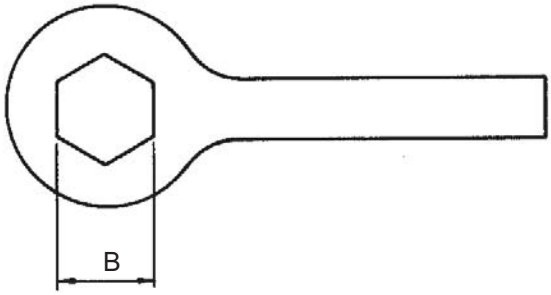
MATERIAL : Mild steel

Unit : mm (inch)

d	D	Cylinder Used
90 (3.54")	103 (4.06")	Bucket
100 (3.94")	113 (4.45")	Boom (Head Side)
110 (4.33")	123 (4.84")	Arm, Boom (Rod Side)

Fig. 32-63 Bushing removing jig

(2) Wrench for piston nut or [piston]



Unit : mm (inch)

B	Cylinder Used
115 (4.53")	Boom, Bucket
135 (5.32")	Arm

Fig. 32-64 Wrench for piston nut or [piston]

33. UPPER STRUCTURE

TABLE OF CONTENTS

Book Code No. **S5LC3316E01**

(13)Remove guard assy (1) and (2)

1) While air cleaner is removed, loosen hose clamp of engine intake and disconnect the hose.
2) Loosen 8 sems bolts (5) M12×30.
3) Remove guard assy (2),(1) in order.

: 19 mm

Weight :

guard assy (2) : 12kg (26 lbs)

guard assy (1) : 20kg (44 lbs)

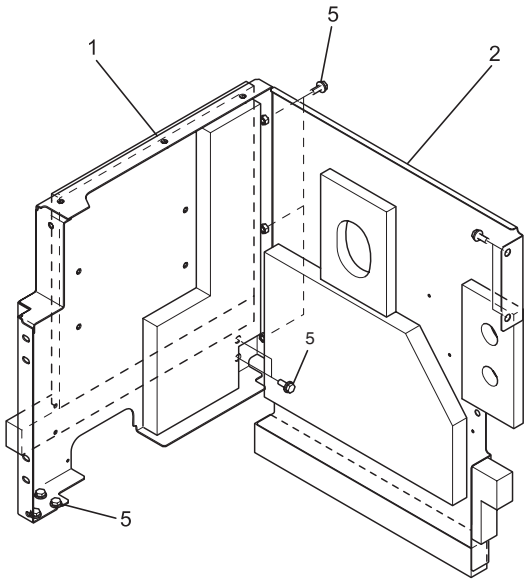


Fig. 33-24 Removing and installing of guard assy (1),(2)

(14)Remove guard assy (4), guard (3)

1) Loosen 7 sems bolts (5) M12×30.

: 19 mm

2) Remove guard assy (4), guard (3)

Weight :

guard assy (4) : 8kg (18 lbs)

guard (3) : 11kg (24 lbs)

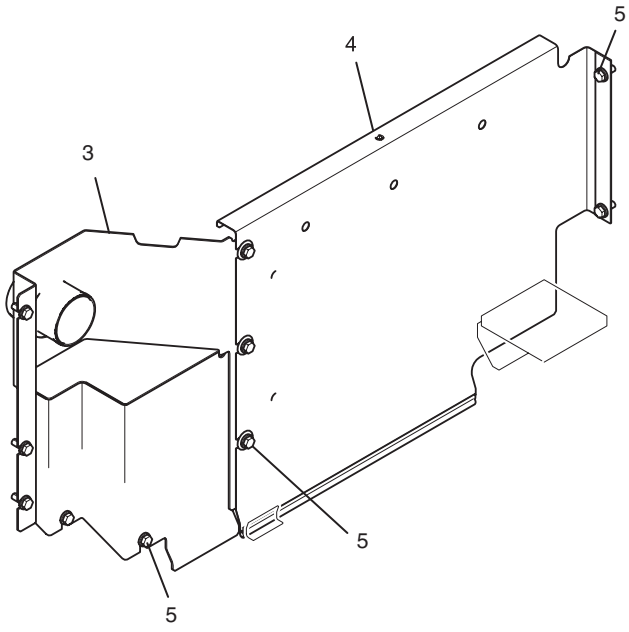


Fig. 33-25 Removing and installing of guard assy (4) and guard (3)

(15)Remove plate (18)

Loosen 3 sems bolts (39) M12×30, and remove plate (18).

: 19 mm

Weight : 2.9kg (6.4 lbs)

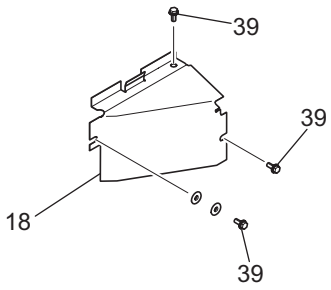


Fig. 33-26 Removing and installing of plate (18)

(5) Remove connector
Remove 4 connectors of all pressure sensors and proportional valves.

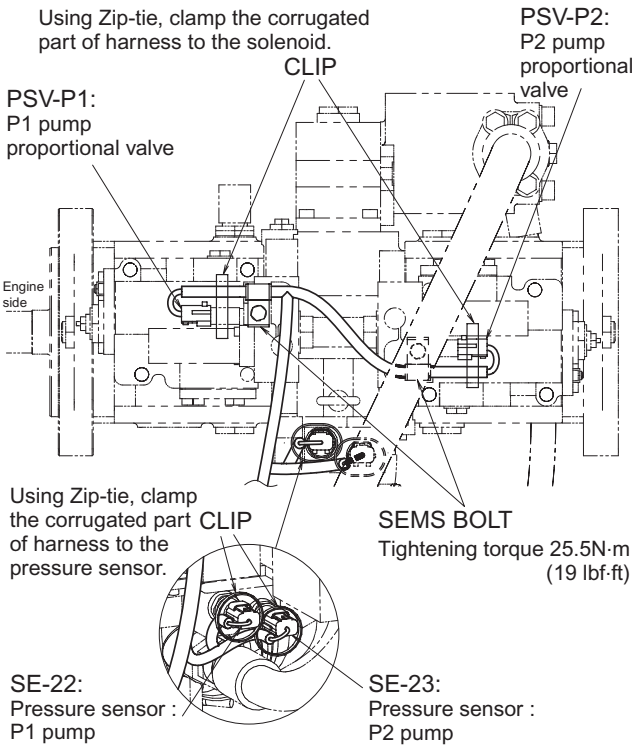


Fig. 33-45 Removing connector

(6) Remove main pump

1) Put a wire sling on the hydraulic pump and tension the wire sling a little. Loosen 8 capscrews (4) M10×35.

: 17 mm

2) Draw out the power take-off assy from the flywheel housing slowly, adjusting the tension of the wire rope.
On that occasion, the assembly is drawn out with the insert NA (2-3) remaining on the flywheel side.

3) Remove element (2-1) from the tip of the spline shaft.

4) Remove 4 capscrews (2-6) M20×50 that fasten insert R (2-4) and remove insert R (2-4).

: 17 mm

5) Remove hub (2-2)
If you loosen 2 set screws (2-7) M20×25, hub comes off from the spline shaft of the pump.

: 17 mm

6) Remove 4 capscrews (2-5) M20×60 that fasten the insert NA (2-3) with the engine side flywheel, as necessary. Then remove and spring pin (2-8) from insert NA (2-3).

: 17 mm

7) Removing bracket (1)
Loosen 4 capscrews (3) M20×55, and remove bracket (1) from pump (0).

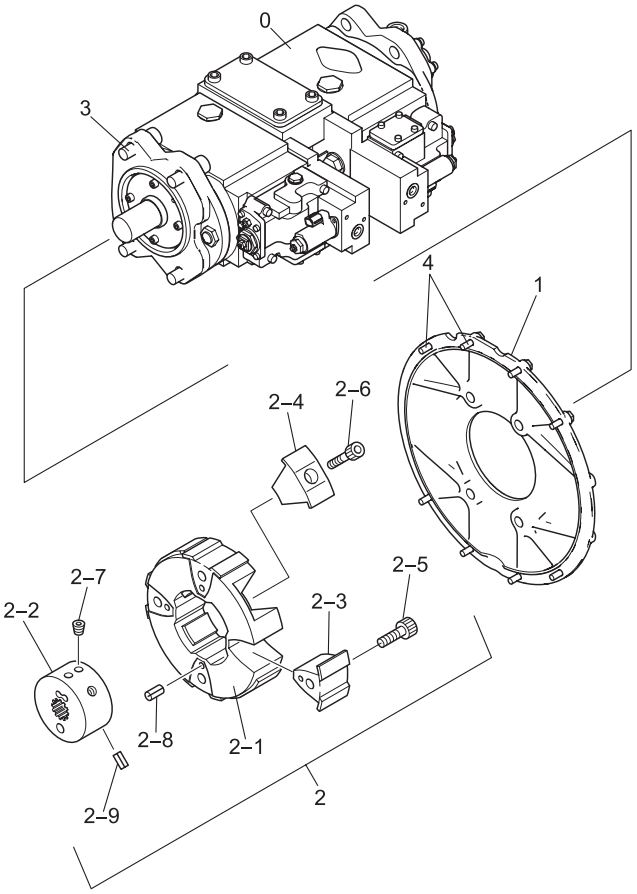


Fig. 33-46 Removing pump

33.1.12.4 PROCEDURE OF DISASSEMBLING AND ASSEMBLING THE RADIATOR/INTER COOLER CORE

(1) Preparation for disassembly and assembly

1) Remove one under cover at the bottom of the radiator.

2) Wait till the engine coolant cools down so you do not get burned. Then remove the cap of the radiator, discharge the coolant by opening the drain valve located at the back bottom and receive it in a container.
* In case of removing inter cooler only, the above mentioned work is not necessary.

(2) Disassembly

1) Loosen each 2 bolts (22) at head and bottom of shroud, remove upper plate (20) and lower plate (19).

2) Disconnect wiring connector of radiator coolant level switch.

3) Loosen 6 sems bolts (22) M10×20 attaching plate assy (21), remove plate assy (21).

4) Loosen 2 capscrews (15) M10×50 attaching radiator core.

5) After confirming that the coolant has been drained out completely, loosen and remove only the radiator side of hose bands (33) at the top and bottom of the radiator. (See Fig. 33-60)

6) Lift and remove radiator core using lifting eyes and hoist on the radiator core.
Weight : 20kg (44lbs)
Confirm the missing of rubber bushing (14) under the radiator core.

7) Loosen 2 capscrews (15) M10×50 attaching the top of the inter-cooler core.

8) Loosen and remove only the inter-cooler side of hose bands (32) at the top and bottom of the inter-cooler. (See Fig. 33-60)

9) Lift and remove inter-cooler using lifting eyes and hoist on the inter-cooler.
Confirm the missing of rubber bushing (14) under the inter-cooler.

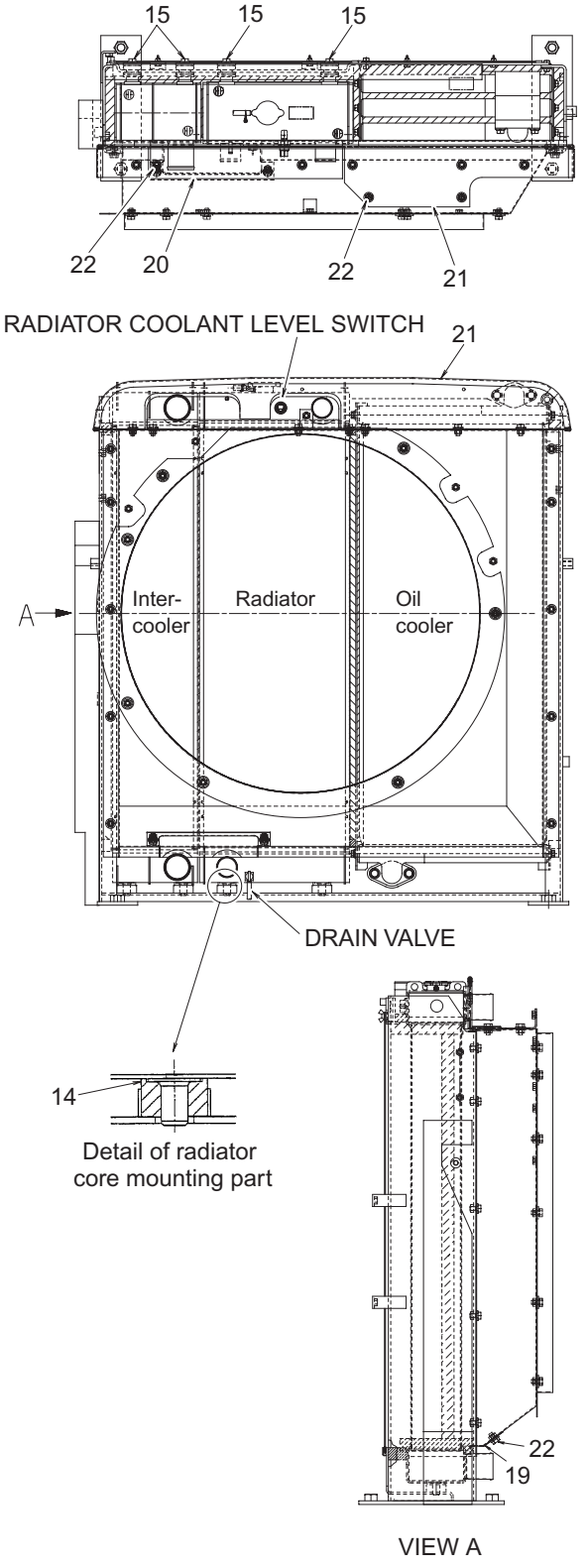


Fig. 33-64 Removing radiator and inter-cooler

33.1.17 PILOT VALVE (FOR TRAVEL)

33.1.17.1 PREPARATION FOR REMOVING

(1) Release pressure in hydraulic oil tank (See 33.1.7 HYDRAULIC TANK)

(2) Remove under cover (1) (See 33.1.5 UNDER COVER)

(3) Remove floor mat (B1).

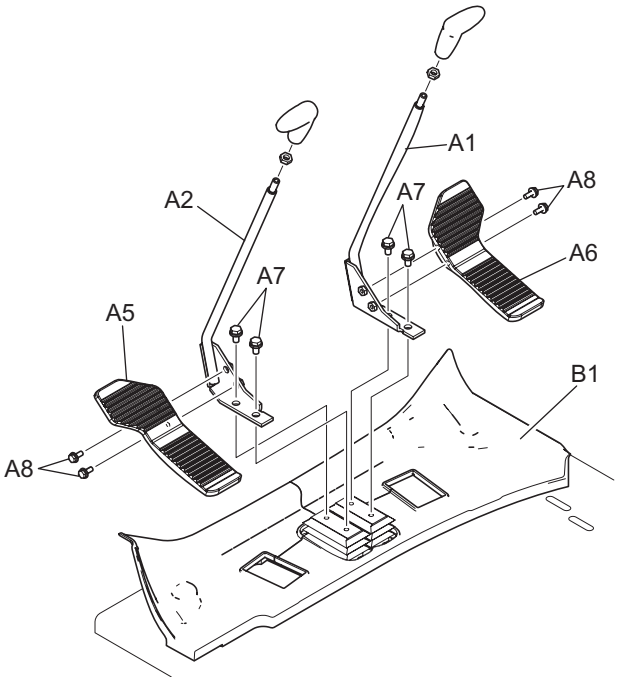


Fig. 33-76 Removing floor mat, pedal and and lever

33.1.17.2 REMOVAL

(1) Separate the two pressure sensors SE-9 (A9) and SE-10 (A9) at the connector.

: 24 mm

(2) Attach tag, and discount connectors and hoses (A2), (A3), (A4), (A5)

: 19 mm (P port)

: 22 mm (T port, 1~4 port)

(3) Plug hose ends
Plug PF1/4, PF3/8

(4) Remove 4 sems bolts (A8) M8×20, and remove right and left pedals (A5), (A6).

: 13 mm

(5) Remove 4 sems bolts (A7) M10×20 and remove right and left lever (A1), (A2).

: 17 mm

(6) Remove 4 sems bolts (A14) M10×30.

: 17 mm

(7) Remove pilot valve lifting it upward.

(8) Stop up holes with plugs PF1/4.

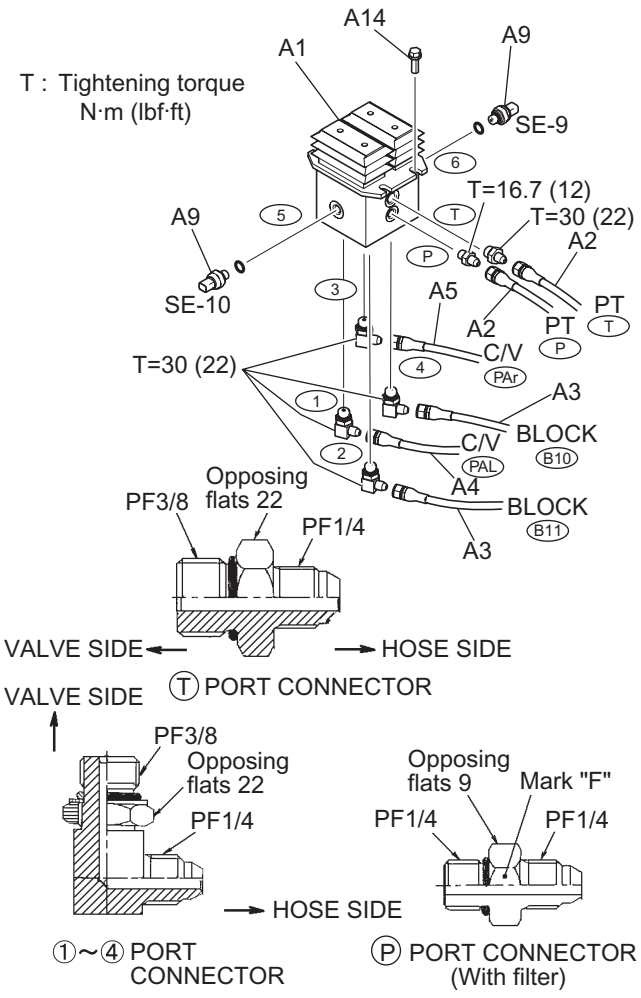


Fig. 33-77 Installing and Removing pilot valve

(2) Gear pump (For pilot)

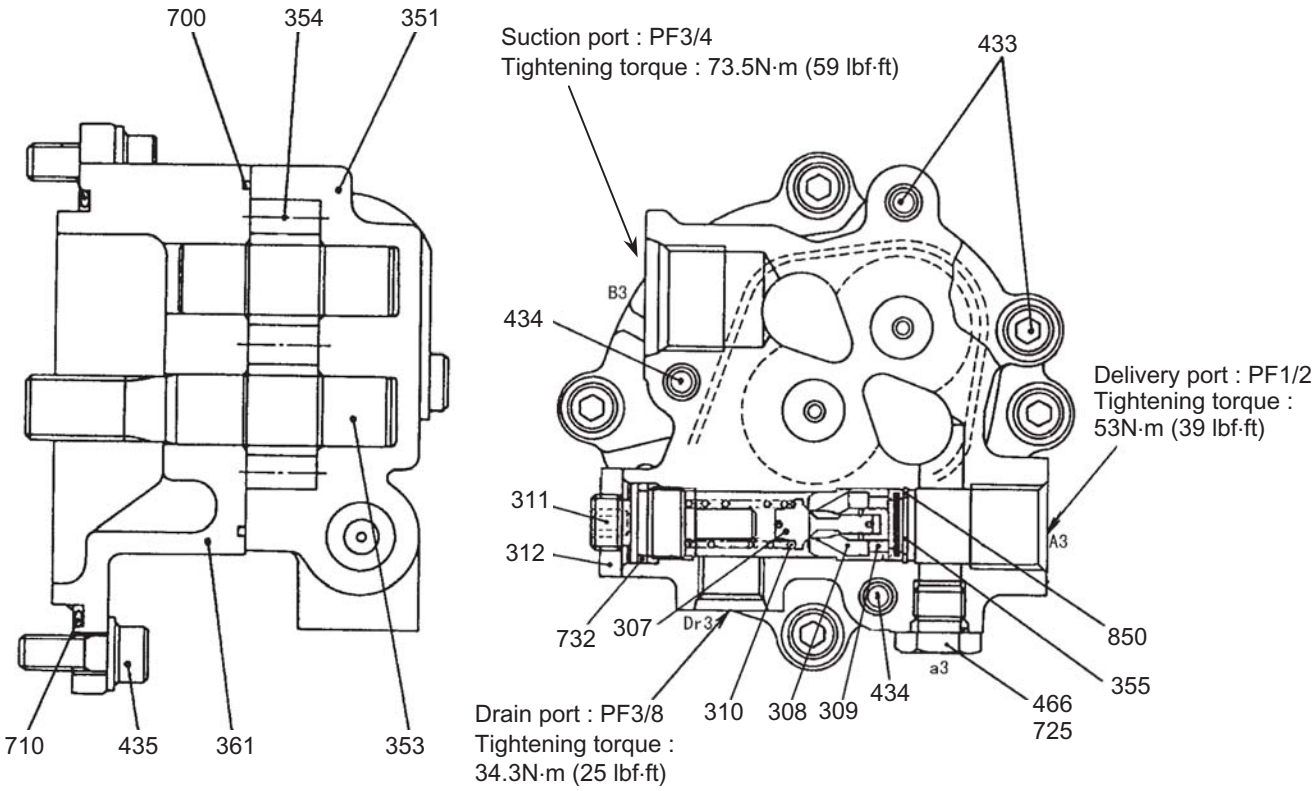


Fig. 33-92

No.	Name	Q'ty	No.	Name	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	Snap ring	1

This page is blank for editing convenience.

33.2.1.3.2 Disassembly and assembly

(1) Tools
The right list shows the tools required for remove and install.

Tool name	Dimension
Allen wrench	Opposing flats 8,10mm
Plier	For snap ring RR-20 For snap ring RR-72

(2) Disassembling procedure

1) Selecting a place for disassembly.
   - Choose a clean place.
   - Spread rubber sheet or cloth on work bench to protect parts from damaging.

2) Cleaning
Remove dust and rust, etc. on pump surface with wash oil.

3) Drain oil
Drain out the oil in the pump casing by removing drain port plug (468).

: 27 mm

   - Drain out the oil from the plugs of the front pump and the rear pump.

4) Remove cover
Remove the socket bolts (414). Then remove the cover (262).

: 8 mm

5) Remove PTO gear casing
Remove flange socket (435) and PTO gear casing.

: 8 mm

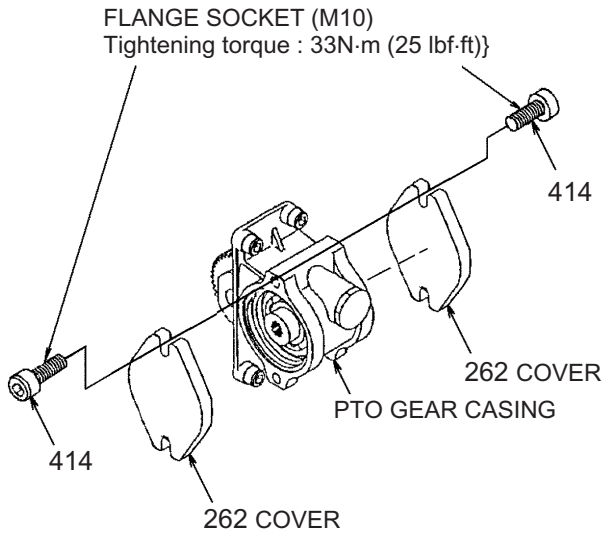


Fig. 33-134 Removing gear pump

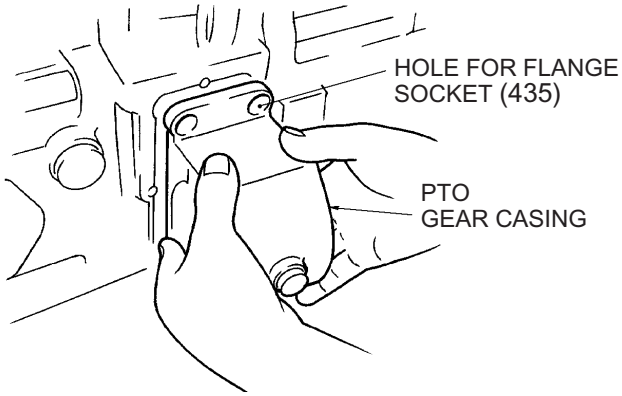


Fig. 33-135 Removing PTO gear casing

33.2.2.3.2 Disassembling the travel spool (left travel and right travel)

(1) Loosen the socket bolts (273) and remove the spring cover (201) and the O-ring (261) for travel.

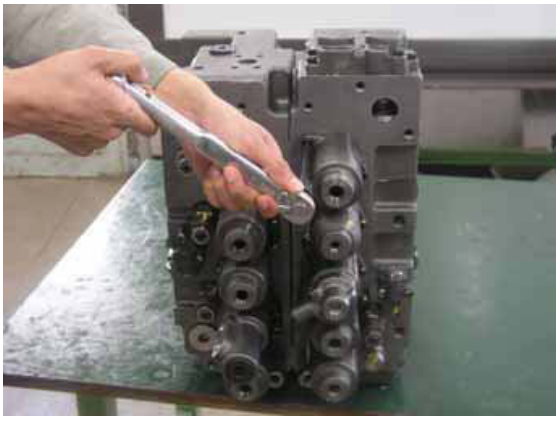


Fig. 33-148 Removing spring cover (201)

(2) Draw out the assy of travel spool (306), spring seat (331), springs (323), (324), stopper (336) and bolt (333) from casing A (101) or casing B (102).

CAUTION

When drawing out the spool assy, take care so as not to score the casing A (101) or the casing B (102).

Fig. 33-149 Drawing out travel spool (306) assy

(3) Fix the travel spool assy with vise via a protective plate (aluminum plate, etc.). Remove bolt (333) and separate spring seat (331), springs (323), (324) and stopper (336) from travel spool (306).

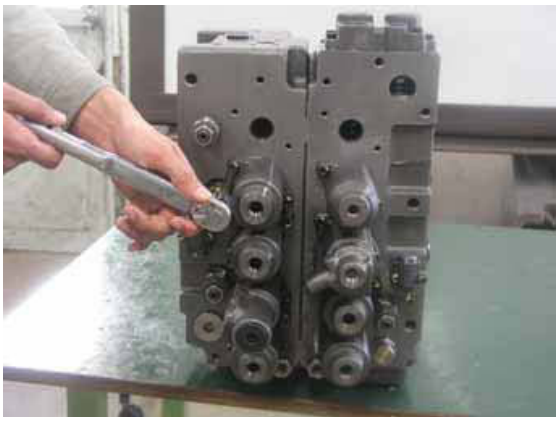


Fig. 33-150 Removing right travel spring cover (201)

Fig. 33-151 Disassembling travel spool (306) assy

33.2.2.3.20 Inspection after disassembly

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

(1) Control valve

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

⚠CAUTION

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

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

(2) Relief valve

1) Make sure that the poppet and the seat surface at the tip of the seat are without fault and that the contact surface is even all over.
2) Manually confirm that the main poppet slides smoothly onto and off the seat.
3) Confirm that the outer circumference of the main poppet and the inner circumference of its seat are free from defects such as scratches.
4) Confirm that each spring is free from breakage, deformation, and excessive wear.
5) Confirm that the orifices of the main poppet and its seat are not clogged.
6) Replace all O-rings with new ones. (Between casing and seal)

33.2.2.4 REASSEMBLY

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

(2) Figures in parentheses after part names in this instruction represent those item numbers in the structural sectional drawing. (Fig. 33-138 to Fig. 33-143)

(3) Precautions on reassembling O-ring

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

33.2.3 PILOT VALVE (ATT)

33.2.3.1 CROSS-SECTIONAL VIEW

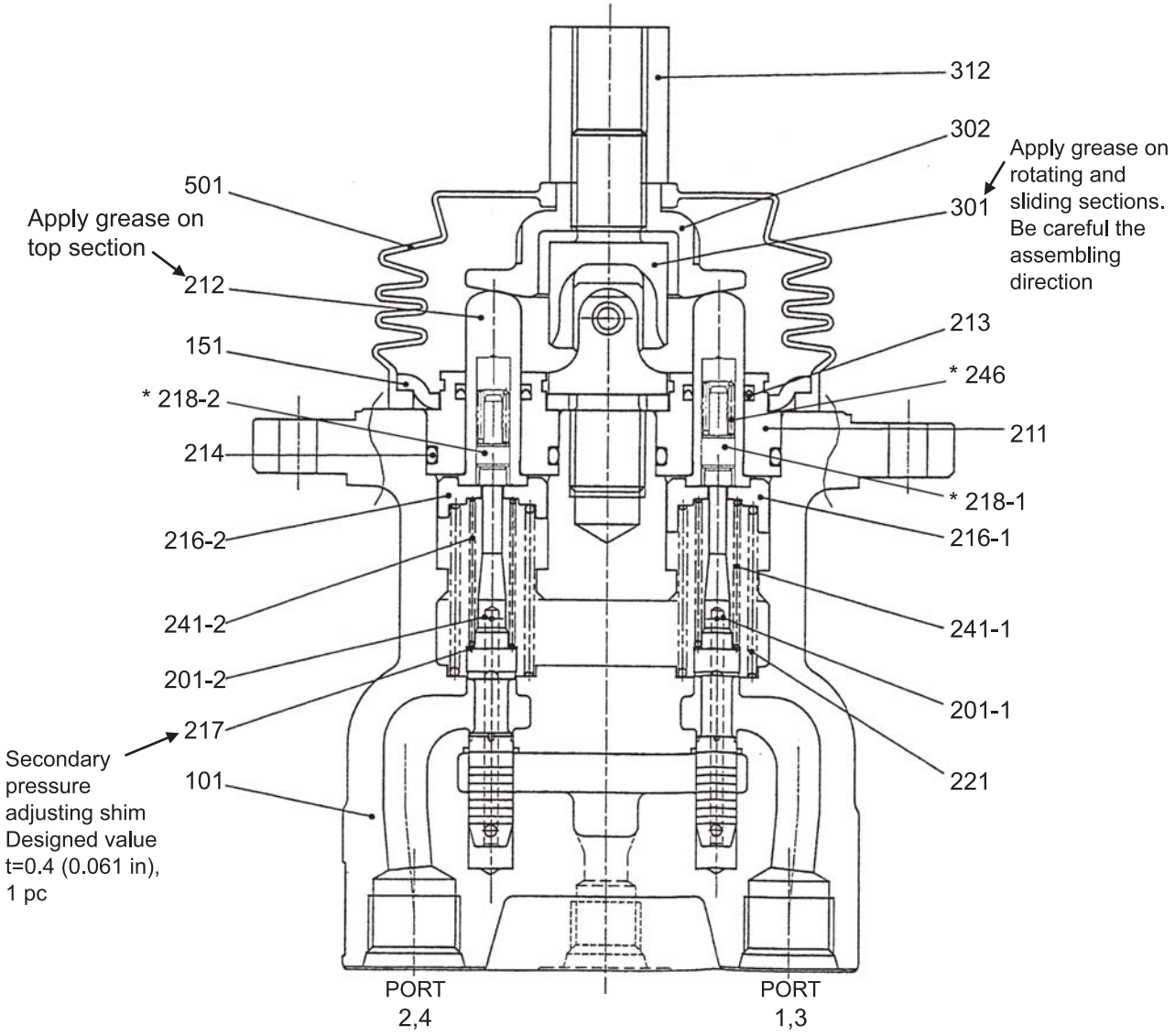


Fig. 33-181 Pilot valve (For ATT)

Apply loctite #277 to areas marked ☆

Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty		Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty
	101	Casing	1			*218-1	Seat	2
	151	Plate	1			*218-2	Seat	2
	201-1	Spool	2			221	Spring	4
	201-2	Spool	2			241-1	Spring	2
	211	Plug	4			241-2	Spring	2
	212	Push rod	4			*246	Spring	4
	213	Seal	4		47.1 (35)	301	Joint : M14	1
	214	O-ring ; 1B P20	4			302	Circular plate	1
	216-1	Spring seat	2		68.6 (51) ☆	312	Adjust nut : M14	1
	216-2	Spring seat	2			501	Boots	1
	217	Washer 2 (Shim)	4					

Note) The parts marked * might not be equipped depending on valve type.

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. 33-207

(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. 33-208 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. 33-208 No.2)

* Reassembly :

- Position the axis so that the hole is aligned with the locking screw as shown on the picture (See Fig. 33-208 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.

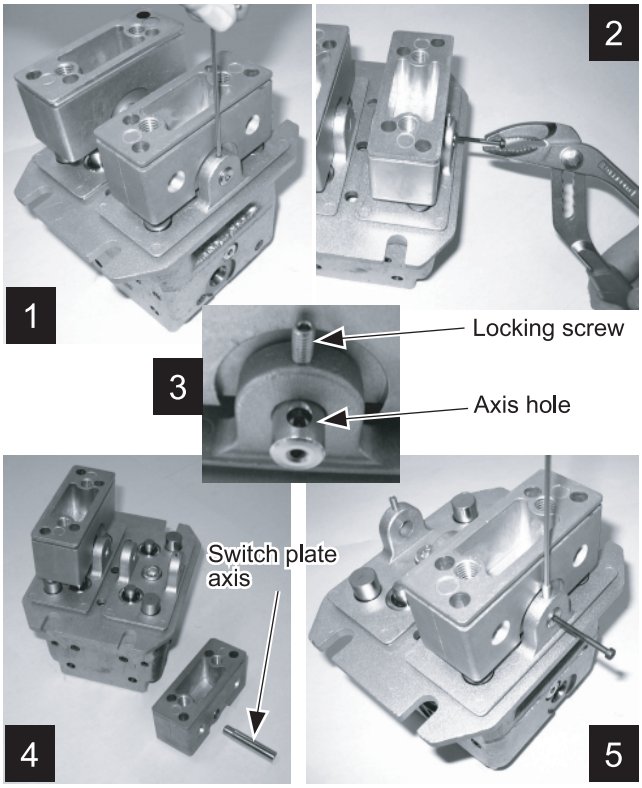
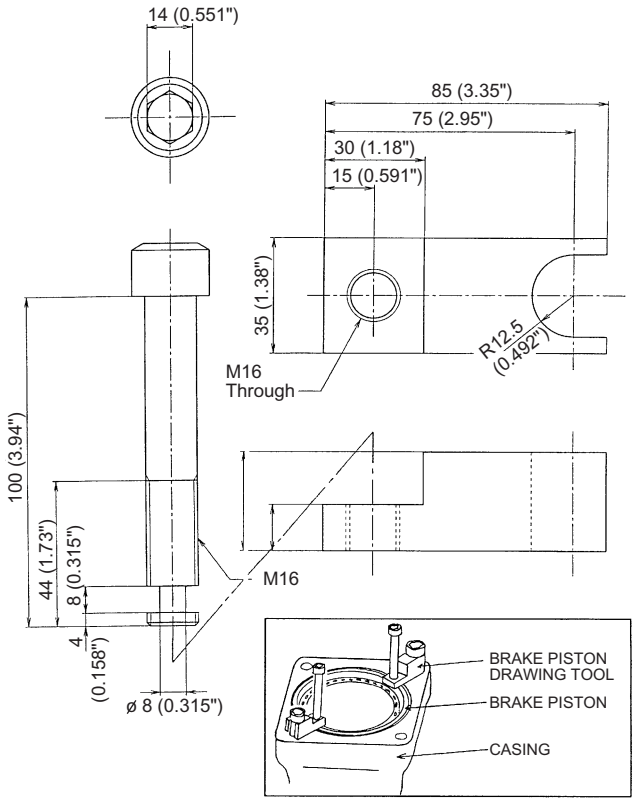


Fig. 33-208

33.2.5.2 DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

33.2.5.2.1 TOOLS

Tools			Remarks
Socket wrench	Relief valve	M33×P1.5	41mm
	Anti-reaction valvevalve	M22×P1.5	24mm
Allen wrench	M8, M20		6,10,12,17mm
	ROMH PLUG	M36×P1.5	17mm
	ROH PLUG	PF1/4, PF1/2, PF1	6mm, 8mm, 14mm
Screwdriver			Flat-bladed type, medium size 2 pcs.
Steel bar			10×8×200(0.39"×0.31"×7.87") (key material) 1 pc.
Hammer			Plastic hammer 1 pc.
Torque wrench N•m (lbf•ft)			10~45 (7.2~33) 40~180 (29~130) 120~480 (87~350)
Slide hammer bearing puller			
Brake piston drawing tool			

9) Removing spherical bearing (upper)
Set housing (15) as shown in the figure, insert jig (c) between bearing (12) and oil seal (14) and remove bearing (12) by striking from the upper side.

10) Remove oil seal (14) from housing (15).

- Do not use the removed oil seal and bearing.

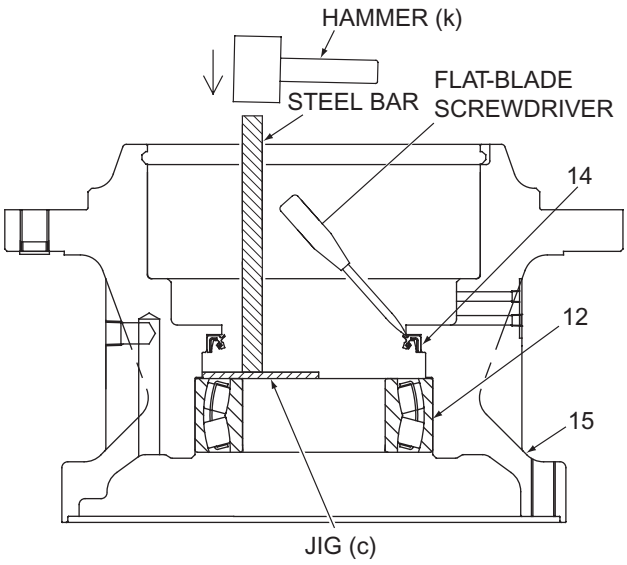


Fig. 33-252 Removing spherical bearing (upper) (12) and oil seal (14)

(4) Disassembling spider assy

1) Disassembling #1 spider assy

1. Remove retaining ring (25) with a plier (i).
2. Remove thrust washers (22), pinion (4) needle bearing (11).

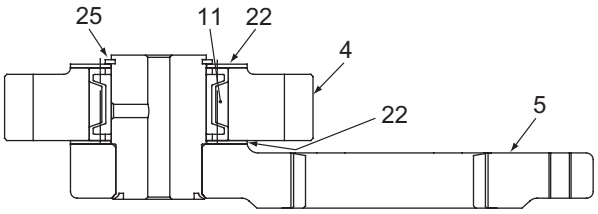


Fig. 33-253 Disassembling #1 spider assy

CAUTION

- The shaft attached to spider assy (5) is caulked. When replacing parts, replace the spider assy as a set.
- Pinions (4) can not be replaced singly. Replace them it in a set of three.

2) Disassembling #2 spider assy

1. Drive spring pin (26) into shaft (10) using steel bar 8 to 9 in diameter.
2. Draw out shaft (10) from spider (9) and remove thrust washer (23), pinion (7) and needle bearing (11).

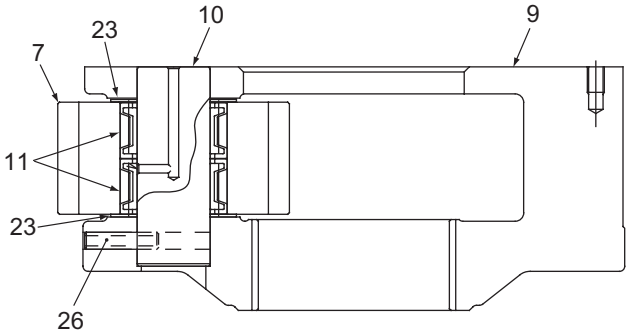


Fig. 33-254 Disassembling #2 spider assy

CAUTION

Pinions (7) can not be replaced singly. Replace them it in a set of four.

(4) Brake torque is insufficient.

Trouble	Cause	Remedy
Brake torque isinsufficient.	1. Friction plate is worn.	1. Disassemble and check. Replace if wear is beyond standard value.
	2. Brake piston is stuck.	2. Disassemble and check.
	3. Brake release pressure is not released.	3. Check and correct circuit.
	4. Break release spool is stuck.	4. Disassemble and check.
	5. Spline of friction plate is damaged.	5. Disassemble and check. Replace damaged part.

(5) The swing motor drifts much.
Check the drain rate of the hydraulic motor. If it is less than 4 L/min (1.1 gal/min), you should think that the motor is not faulty.

Trouble	Cause	Remedy
The swing motor drifts much when it is actuated by external torques. (e.g. Machine is on a slope.)	1.Relief valve malfunctions. Same as (1).	1. Replace. Same as (1).
	2. Plunger seat is faulty.	2. Replace.
	3. Seat of the anti-reaction valve is no good.	3. Replace the anti-reaction valve cartridge or block.

(6) Oil leaks

1) Oil leak from oil seal

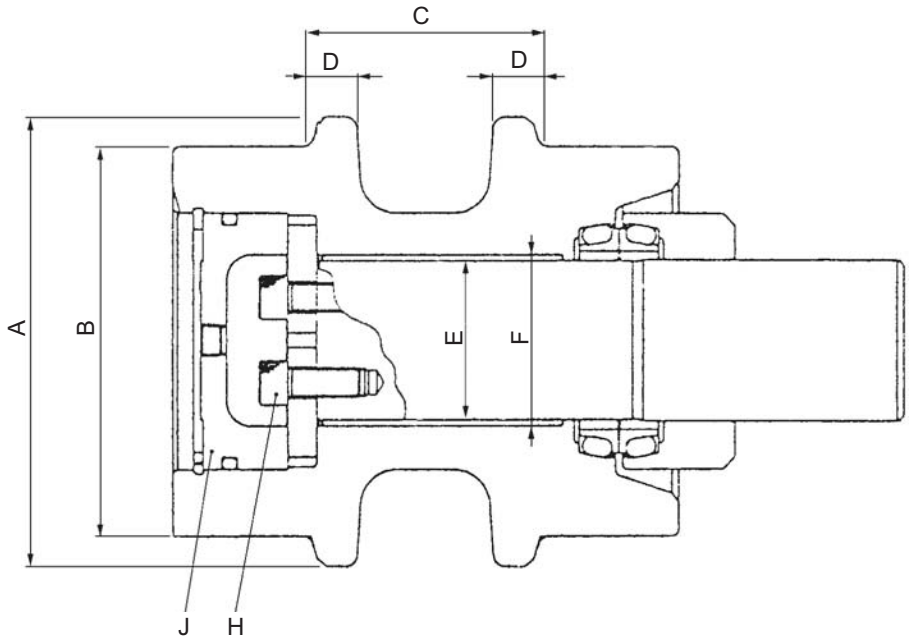
Trouble	Cause	Remedy
Oil leaks from oil seal	1. Lip of seal catches contaminant and damaged.	1. Replace oil seal.
	2. Shaft is damaged or worn.	2. Shift the lip and shaft positions or replace oil seal.
	3. Casing inner pressure has risen abnormally high, with the result that lip of oil seal is flipped.	3. Repair drain piping if clogged up.
	4. Shaft is rusted.	4. Disassemble and correct.

2) Oil leak from matching surface

Trouble	Cause	Remedy
Oil leak from matching surface	1. O-ring is missing.	1. Set O-ring correctly and assemble it.
	2. O-ring has a scratch.	2. Replace.
	3. Seal surface has a scratch.	3. Disassemble and correct.
	4. Bolt is loose or damaged.	4. Tighten to specified torque or replace.

[MEMO]

34.1.3.6 MAINTENANCE STANDARD



Unit : mm (in)

No.	Item	Standard value				Service limit	Remedy
A	Dia.	ø 185 (7.28)				ø 175 (6.89)	Reinforcement weld, repair or replace
B	Tread dia.	ø 160 (6.30)				ø 150 (5.91)	
C	Width	95 (3.74)				85 (3.35)	
D	Flange width	19 (0.748)				15 (0.591)	
E	Clearance between shaft and bushing	Basic dimension	Tolerance		Standard	Limit	Replace bushing.
		ø 65 (2.5591)	Shaft	-0.025 (-0.0010) -0.040 (-0.0016)	Clearance —	Clearance 0.8 (0.0315)	
F	Interference between roller and bushing	ø 70 (2.7559)	Hole	+ 0.030 (+0.0012) 0	Interference —	Clearance 0	
H	Tightening torque of socket bolt	114.7 N•m (85 lbf•ft)					Apply loctite #262
J	Oil	Engine oil API grade CD #30, 100cc (6.1cu•in)					Refill or replace
	Roller rotation	Roller rotates smoothly by hand.					

5) Removing bushing (4)
With idler (1) mounted on the stand, tap bushing (4) lightly by hammer, while placing the bushing drawing rod (T) against the end face of bushing (4) evenly all round, till it comes out.

6) Removing floating seals (6)
Take out floating seals (6) from idler (1), collar (2). If you intend to re-use floating seals (6), confirm that there is no scoring and rusting on the contact surface and store the floating seals in pairs by placing card board between the sealing faces.

7) Removing O-ring (7)
Separate O-ring (7) from shaft (3).

(2) Assembly

1) Pressing in bushing (4)
Align inner hole of idler (1) and bushing (4) and press fit it vertically with press so that jig (V) for bushing press-fitting is inserted into bushing (4).

2) Installing O-ring (7)
Fit O-ring (7) to O-ring groove on shaft (3).

- Apply grease to O-ring

3) Installing collar (2) (See Fig. 34-48)
Press fit the O-ring (7) installed side of shaft (3) into collar (2), and drive pin (5).

4) Installing floating seal (6)
Fit the half of floating seal (6) on each side of collar (2) and idler (1).

5) Inserting idler (1)
Insert floating seal (6) fitted side of idler (1) into shaft (3).

6) Installing floating seal (6)
Fit floating seal (6) on the other side of idler (1).

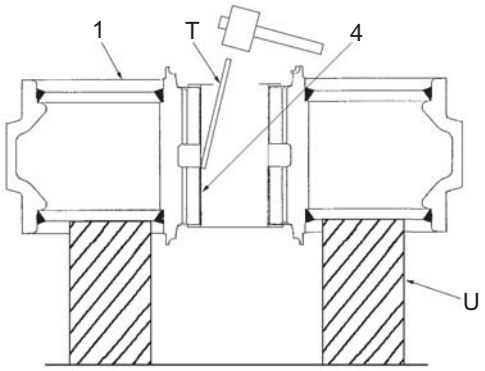


Fig. 34-46 Removing bushing (4)

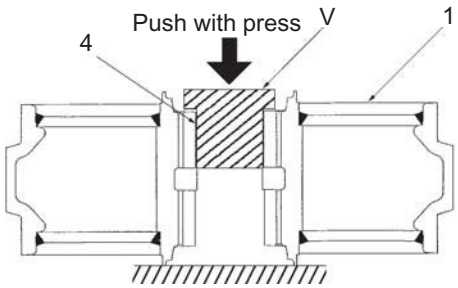


Fig. 34-47 Pressing in bushing (4)

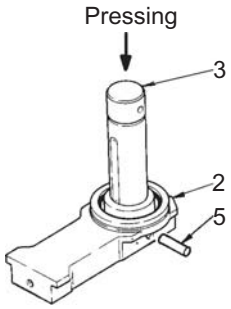


Fig. 34-48 Installing collar (2), shaft (3)

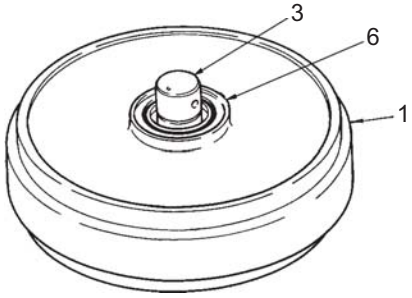


Fig. 34-49 Inserting idler (9) and installing floating seal (6)

34.1.8.3 INSTALLING

(1) Cleaning
Clean it completely so that installing surfaces of swing bearing and lower frame are free from dust and stain.

(2) Installing
Install swing bearing on lower frame meeting the matchmarks and positioning the S mark on inner race as shown in the Fig. 34-67.

(3) Temporary fastening of inner race
Coat the threads of the capscrews (2) with Loctite #262 and tighten all the capscrews (2) temporarily.

: 36 mm

(4) Regular tightening of inner race
Tighten the capscrews (2) at 180 degrees intervals alternately to a specified torque.

: 36 mm
Tightening torque : 932 N•m (690 lbf•ft)

(5) Filling grease.
Fill grease bath with 28.7kg (63 lb) of grease (NIHON GREASE CO.LTD EP-2K) or equivalent.

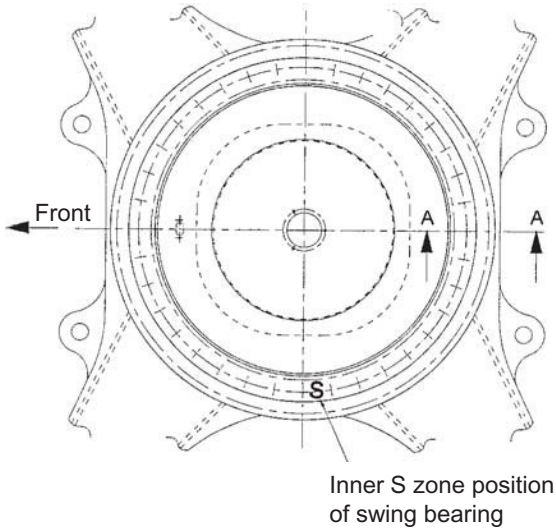


Fig. 34-67 Location of S mark on swing bearing

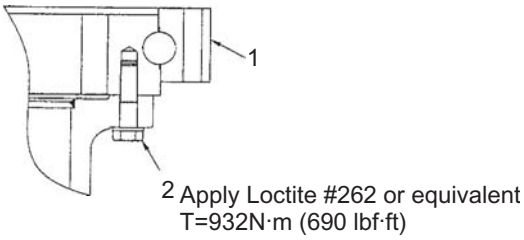


Fig. 34-68 Removing and installing capscrew (2)

34.1.8.4 CONSTRUCTION

Assy part No.			LC40F00018F1		
No.	Name	Q'ty	No.	Name	Q'ty
1	Outer race	1	6	Seal	1
2	Inner race	1	7	Taper pin	1
3	Ball	105	8	Plug	1
4	Retainer	105	9	Grease nipple (PT1/8)	1
5	Seal	1			

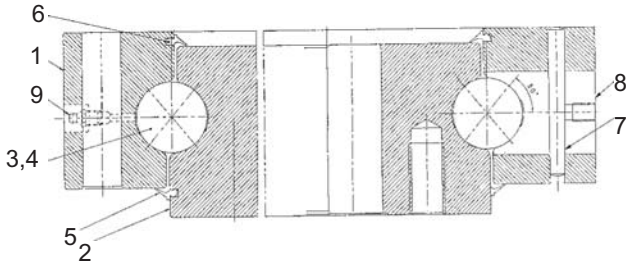


Fig. 34-69 Cross-sectional view of swing bearing

34.1.8.5 DISASSEMBLY AND ASSEMBLY

(1) Disassembly

1) Take out seal (5) fitted in the groove in the outer circumference under inner race (2) and seal (6) fitted in the groove in the inner circumference on top of outer race (1) and place them level on a square wooden block or something.

2) Draw out taper pin (7), using a hammer and an extrusion rod.

3) Draw out plug (8), utilizing an pull bolt inserted in the screwed hole (M10) in the center of the plug and using a puller.

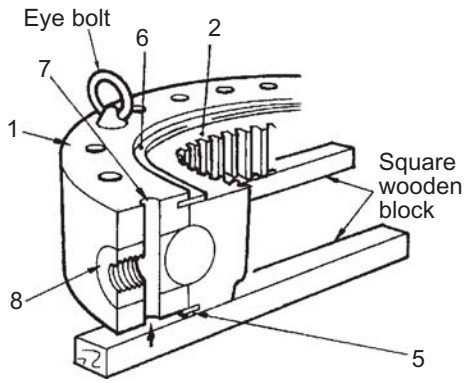


Fig. 34-70 Removing swing bearing

18) Deciding shim (52) thickness for tapered roller bearings.

CAUTION

This work should be done only when you have changed bearings (10), (51), shaft (9), casing (1) or rear cover (24).

1. Measure the assembling width "E" (See).

CAUTION

Take care not to incline shaft (9).

2. Measure the depth "F" of rear cover (24)

CAUTION

Measure them at crossed 4 places on the circuit, then calculate their mean value.

3. When thickness of shim (52) to be used is placed as "S", the clearance "Y" can be calculated as follows :
   Y=F-(E+S)

4. Select one or two shim (52) so as the clearance "Y" to come to 0-0.1 mm (0~0.004") (clearance) on this unit.

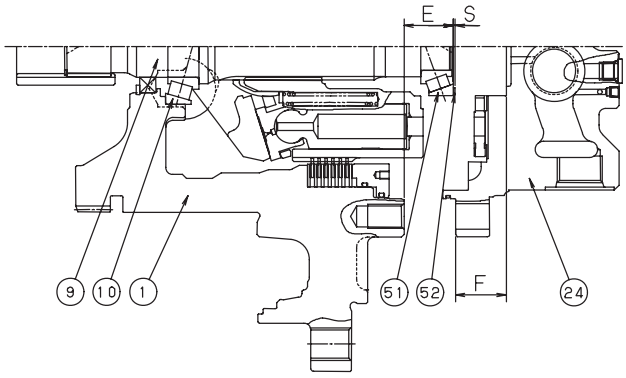


Fig. 34-83 Deciding shim thickness

(3) Disassembling overload relief valve

As a rule, overload relief valve (57) should be handled as one service part. If there are any trouble on overload relief valve (57) , replace as an assembly.

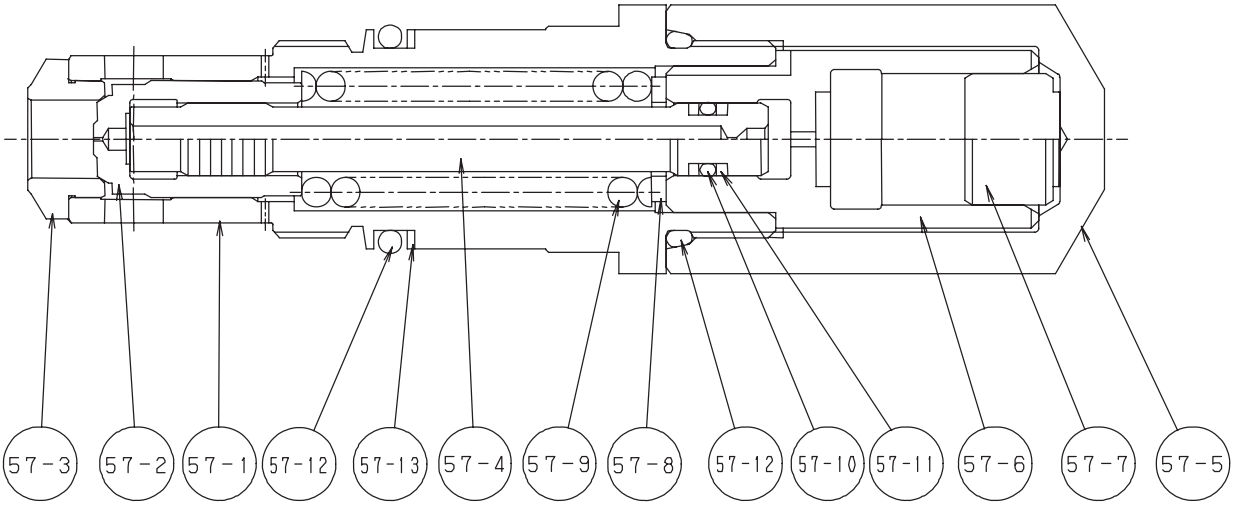


Fig. 34-84 Disassembling overload relief valve

(3) Drive shaft never rotate up to the set value

Symptom	Cause	Remedy
Rotation of drive shaft never reaches the set value	1. Shortage of oil coming in	1. Check oil flow or hydraulic circuit to motor.
	2. Large wear or flaw made on shoe, cylinder block or valve plate	2. Check, repair or replace the parts

(4) Brake refuses to work

Symptom	Cause	Remedy
Brake refuses to work	Malfunction of parking brake 1. Worn friction plate 2. Broken spring	Check, repair or replace brake piston, friction plate, spring, etc.
Brake works on counter lever operation	Malfunction of spool 1. Stick between spool and body 2. Stick of check valve or that by small particle 3. Clogging of restrictor	Repair or replace or clean up

(5) Oil leakage

Symptom	Cause	Remedy
Oil leakage	1. Loose Hex. socket head bolt or plug	1. Fasten it with given torque
	2. O-ring is torn off	2. Replace O-ring
	3. Oil leaks inside gear casing	3. Replace oil seal

(6) Would not shift from high to low

Symptom	Cause	Remedy
Would not shift from high to low	Stick of spool of pilot valve	Replace pilot valve assy.

(7) Abnormal noise

Symptom	Cause	Remedy
Abnormal noise appear together with big vibration when brake is slowly applied or oil is supplied to other circuits while motor is running	Malfunction of spool Air is caught inside brake valve	Bleed air
	Stick between spool and body	Repair or replace

(8) Hunting occurs while descending the slope

Symptom	Cause	Remedy
Severe hunting while inching	Malfunction of spool • Stick between spool and body • Restrictor is not seated completely	Repair or replace
	Interference with parking brake • Permanent set or broken spring	Repair or replace

(8) Assembling carrier 2 assy

1) Install three M10 eye bolts equally apart on carrier 2 (9).
Using the eye bolts, hang the carrier 2 assy by wire rope and place three planetary gears 2 (10) as shown on Fig. 34-117, put carrier 2 assy into ring gear (3) and mesh the splines to those of motor.

2) Insert and mesh sun gear 2 (15) on center.

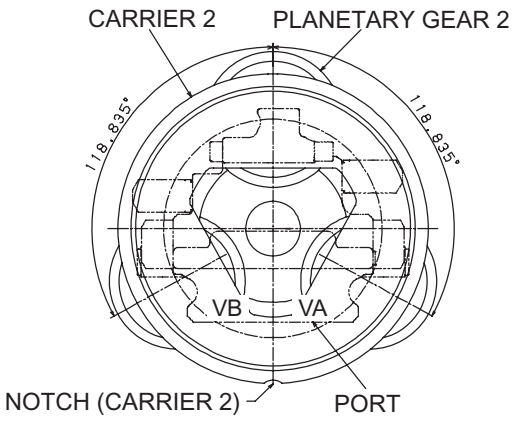


Fig. 34-117 Installing direction of carrier 2

Note

Positioning carrier 2 assy as Fig. 34-117 is important to obtain better lubrication.

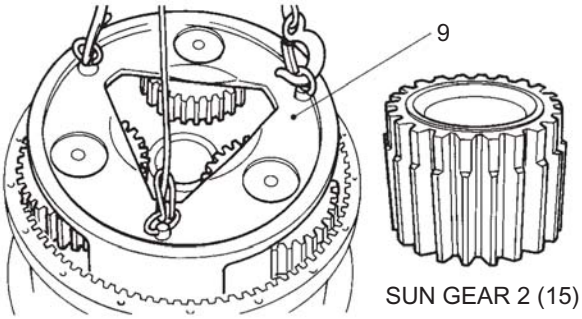


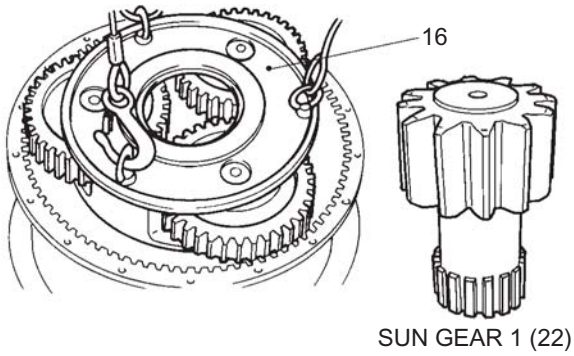
Fig. 34-118 Assembling carrier 2 assy

(9) Assembling carrier 1 assy

1) Install three M10 eye bolts equally apart on carrier 1 (16). Using the eye bolts, hang the carrier 1 assy by wire rope and place it in ring gear (3), rotate planetary gears 1 (17) by hand and adjust carrier 1 (16) to mesh with sun gear 2 (15).

2) Making sure that coupling is on the shaft end, install sun gear 1 (22) on center.

3) Place thrust plate (23) on carrier 1 (16).



Note

Face sharp edged side to cover (24). (See Fig. 34-119)

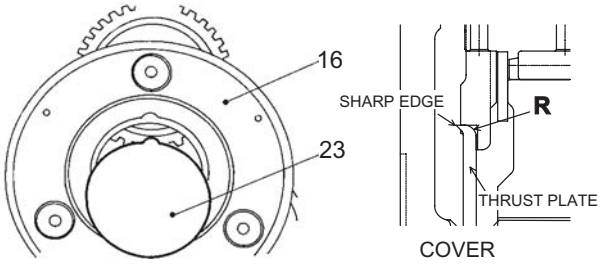


Fig. 34-119 Assembling carrier 1 assy

Table46-1

Error code	A015			
Trouble	Not yet adjusted engine or failed adjustment of engine (A adjustment)			
Judging condition	Engine adjustment is missed. Or it is impossible to set the adjusting value within the adjusting range.			
Symptom	Deviated from the reqired value, but no problem in normal operations.			
Control in the event of failure	Rotate with the default engine			
Returned in normal condition	The engine adjustment is completed normally.			
Service diagnosis checking screen	Screen No.	2	G-3 SPEED SET	
	Screen No.			
	Screen No.			
Checking object			Checking contents and remedy	
1	•Checking		Carry out engine adjustment (A adjustment). When "ERROR ENG" 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				

Table46-2

Error code	A025			
Trouble	Not yet adjusted engine or failed adjustment of pump proportional valve (B adjustment)			
Judging condition	Pump proportional valve adjustment is missed. Or it is impossible to set the adjusting value within the adjusting range.			
Symptom	Deviated from the rated output, but no problem in normal operation			
Control in the event of failure	Workable with the default proportional valve output.			
Returned in normal condition	The pump proportional valve adjustment is completed normally.			
Service diagnosis checking screen	Screen No.	9	E-1 P1 PUMP	
	Screen No.	9	E-2 P2 PUMP	
	Screen No.			
Checking object			Checking contents and remedy	
1	•Checking		Carry out pump adjustment (B 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				

Table46-23

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.

Table46-45

Error code		C013		
Trouble		P1 pump pressure sensor's wiring is disconnected.		
Judging condition		The input voltage from P1 pump pressure sensor is 0.1V or less.		
Symptom		The delicate operability of P1 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		It returns automatically in normal condition.		
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 C013 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 C013 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.

Table46-46

Error code		C014		
Trouble		P1 pump pressure sensor's power source is shortcut.		
Judging condition		The input voltage from P1 pump pressure sensor is 4.7V or more.		
Symptom		The delicate operability of P1 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		It returns automatically in normal condition.		
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 C014 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 C014 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.

Table46-67

Error code		F013		
Trouble		ATT boost solenoid valve and output transistor ON are failure, and disconnection.		
Judging condition		The feed-back signal is 24V level while exciting command is not output.		
Symptom		ATT boost is not available or is leaving available.		
Control in the event of failure		Normal control		
Returned in normal condition		The feed-back signal is grounding level while exciting command is not output.		
Service diagnosis checking screen		Screen No.	3	F-1 POWER BOOST
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• ATT boost solenoid valve SV-2			When F013 is cancelled and other error occurs by exchanging the connector for other solenoid valve. Check solenoid valve unit for possible failure. If failure found, replace it.
2	• Wiring between ATT boost solenoid valve and controller CN-117F CN-105F			When F013 is displayed after the connector is exchanged with other solenoid valve. 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.

Table46-68

Error code		F021		
Trouble		Swing parking solenoid valve and output transistor OFF are failure, and grounding is short-circuit.		
Judging condition		The feed-back signal is grounding level while exciting command is output.		
Symptom		Swing parking is not available.		
Control in the event of failure		Normal control		
Returned in normal condition		The feed-back signal is 24V level while exciting command is output.		
Service diagnosis checking screen		Screen No.	3	F-2 SWING-BRAKE
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Swing parking solenoid valve SV-1			When F021 is cancelled and other error occurs by exchanging the connector for other solenoid valve. Check solenoid valve unit for possible failure. If failure found, replace it. Check solenoid valve unit for possible failure. If failure found, replace it.
2	• Wiring between swing parking solenoid valve and controller CN-123F CN-105F			When F021 is displayed after the connector is exchanged with other solenoid valve. 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.

Table46-88

Error code		I313		
Trouble		Reception of cluster communication is abnormal. (Time-out error)		
Judging condition		Reception from gauge cluster can not receive correctly.		
Symptom		Switch operation of gauge cluster can not be done.		
Control in the event of failure		Keep the condition after immediately key-on is operated.		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.		
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Wiring between gauge cluster and controller CN-600F CN-101F			Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
2	• Mechatro controller			Check that the error is corrected after replacement of controller.

Table46-89

Error code		K014		
Trouble		Battery relay contact welded		
Judging condition		The power 24V is continuously supplied to controller for 40 seconds or more while the key switch ON signal turned OFF		
Symptom		The power on the battery relay secondary side does not turn OFF even if the key switch is turned OFF.		
Control in the event of failure		Normal control with key switch OFF		
Returned in normal condition		Turn key switch ON. Or when the power supply 24V to mechatro controller is stopped		
Service diagnosis checking screen		Screen No.	4	K-1 AIS RELAY 2
		Screen No.	4	K-3 KEY SWITCH OFF
		Screen No.		
Checking object				Checking contents and remedy
1	• Battery relay R-1 CN-256F			Turn key switch off and disconnect the connector (CN-256F) on the battery relay coil. If 24V power lives on battery relay secondary side, check on battery relay for failure and replace it if failed.
2	• Auto idle stop relay 2 R-24 • Alternator relay R-28			Turn off the key switch, and remove the connector (CN-256F) on the battery relay coil side. If power of battery relay on secondary side falls, remove either auto idling stop relay 2 or alternator relay. The failure may be occurred in case where the power falls after the relay was removed, and therefore check on the relay unit and replace it with new one if failed.
3	• Wiring between auto idle stop relay/alternator relay and controller CN-109F, CN2-1 • Fuse& relay box E-1			When K014 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 K014 is left displayed Replace fuse/relay box.
4	• Mechatro controller			Check that the error is corrected after replacement of controller.

Issue	Date of Issue	Applicable Machines	Remarks	
First edition	July, 2006	SK330–8 : LC10-07001~ SK350LC–8 : YC10-03501~	S5LC4711E01 (ASIA, OCE)	K
Revision	February, 2007	↑	S5LC4711E02 (ASIA, OCE)	K
↑	August, 2007	E385B : LC10-07001~ E385BLC : YC10-03501~	↑ (NHK Middle East)	K

No.	Sections	Contents/normal value		Corrective action, others
15	Check arm 2 spool and recirculation <Trouble> Both P1, P2 pressures are low.	Disassembly and investigation (spring side)	Free from abnormal resistance against sliding Spring is free from breakage.	Replace spool assembly
16	Check lock valve poppet <Trouble> Both P1, P2 pressures are high.	Visual check	Free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface	Replace (Check on the casing side for damage)

(9) Bucket digging is slow

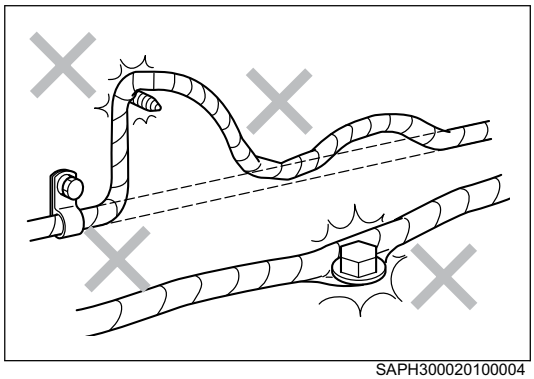
No.	Sections	Contents/normal value		Corrective action, others
1	Bucket digging pressure sensor	Carry out service diagnosis	•See Service Diagnosis Data List Operation No.12 bucket digging full lever and relief	Check and replace pressure sensor Check remote control valve
2	Remote control valve	Measure directly remote control pressure of bucket digging	Check that pressure is 3.0MPa or more in bucket digging full lever and high idling operation	Check remote control valve When equipped with multi control valve, check it while changing lever pattern
3	Pump pressure sensor	Carry out service diagnosis for P1, P2 pump pressures in operation.	•See Service Diagnosis Data List Operation No.13 Bucket digging full lever and in operation	When there is difference between P1 and P2 pump pressures, check high pressure sensor
4	Actual measuring current value of P1/P2 unload proportional valve	Carry out service diagnosis	•No.8 D-1 P1 unload valve (cut valve) D-1 P2 unload valve (cut valve) •See Service Diagnosis Data List Operation No.12 Bucket digging full lever & relief	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
5	Secondary pressure of P1, P2 unload proportional valve	Measure the proportional valve secondary pressure directly at the ports A7 and A5 of 8 sections solenoid block	Check that P1/P2 unload secondary pressures are within the range of 0.5~1.2MPa in bucket digging full lever and high idling operation	Replace proportional valve
6	Actual measuring current value of P1/P2 pump proportional valve	Carry out service diagnosis	•No.9 E-1 P1 pump E-2 P2 pump •See Service Diagnosis Data List Operation No.13 Bucket digging 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.
7	Secondary pressure of P1, P2 pump proportional valve	Measure the pump proportional valve secondary pressure directly (Ports a3, a4)	Check that P1 pump proportional valve pressures is 2.3MPa or more and P2 pump proportional valve pressure is 1.9 to 2.5MPa in bucket digging full lever and high idling operation.	Replace proportional valve
8	Attachment boost solenoid command	Carry out service diagnosis	No.3 POWER BOOST Bucket digging COMP OFF MEAS OFF	Check harness Replace solenoid valve
9	Attachment boost solenoid secondary pressure	Measure switching valve secondary pressure	Check that pressure is 0MPa in bucket digging full lever and high idling operation	Replace solenoid valve

No.	Sections	Contents/normal value		Corrective action, others
6	Secondary pressure of travel straight proportional valve	Measure directly the proportional valve secondary pressure at the ports A6 (travel straight) of 8 sections solenoid block	Check that travel straight secondary pressure is 2.7MPa or more in optional attachment full lever and high idling operation	Replace proportional valve
7	P1 by-pass cut valve <Trouble> Only P1 pressure is low.	Visual check	No problem for sliding ability of main poppet and no contamination on orifice No problem for sliding ability of internal piston (Check it through PBp2 port.)	Clean or replace
8	Relief pressure	Check set pressure	•See Service Diagnosis Data List Operation No.16 P2 side OPT full lever and relief (Set value of factory shipment is 24.5MPa.)	Reset or replace
9	Remote control valve	Check targeted remote control valve	Check sealing ability of shuttle valve and entry of dust in orifice.	Replace
10	Travel straight spool <Trouble> P1 pressure is high.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage.	Replace (Check on the casing side for damage)
11	Spool for optional attachment <Trouble> P1, P2 pressures are high.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage.	Replace (Check on the casing side for damage)
12	Over load relief valve	Check targeted spool visually	Free from dust entered in over load relief valve Seat is free from abnormality.	Replace

(21)Selector valve for option malfunctions: Breaker circuit is not obtained.
(Indication of failure is displayed. For reference, see "Table47-1 Action of optional selector solenoid valve")

No.	Sections	Contents/normal value		Corrective action, others
1	N&B selector spool	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage	Replace (Check on the casing side for damage)
2	N&B selector solenoid	Screw for emergency	Check that the error indication is disappeared by turning emergency screw	Replace solenoid valve
3	N&B selector solenoid	Carry out service diagnosis	•No.11 F-4 Option selector is B mode COMP ON, MEAS ON Spool position BRK Selector switch BRK	Check solenoid valve Check harness
4	N&B selector pressure sensor	Carry out service diagnosis	•No.16 B-11 Data List 3.0MPa at B mode and 0.0MPa at A mode	Check pressure sensor Check harness

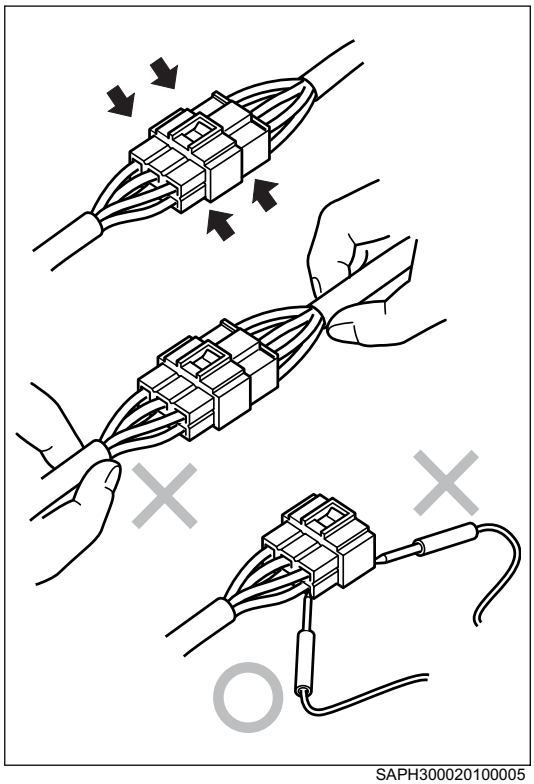
Trouble \ Factors		Fuel system				Intake and exhaust system				Lubrication system				Cooling system	
		Failure of injector	Failure of supply pump	Improper fuel injection time	Fuel leak into the head cover	Turbocharger oil drain tube clogged	Seal of turbocharger worn, damaged	Seizing and interference of turbocharger	Damage of EGR cooler	Failure of oil pump	Failure of relief valve	Failure of regulator valve	Leak and crush of hydraulic piping	Damage of water pump	Failure of thermostat (Not open)
Faulty starting	Poor start ability (Take a long time)	○	○												
	Faulty engine starting/engine does not rotate.														
	Faulty engine starting/engine rotates but no exhaust gas (No fuel injection)														
	Faulty engine starting/exhaust gas is emitted but engine does not start (With fuel injection)	○	○												
Insufficient rotation	Engine poor run-up (Low follow-up ability)	○	○					○							
	Rotation in bad condition (hunting)														
Poor output	Engine stalled during operation.		○												
	Output is lowered.	○	○	○				○							
	Overheating			○										○	○
Other failures	Exhaust smoke is black	○	○					○							
	Exhaust smoke is white	○		○		○	○		○						
	Larger oil consumption (or blue exhaust gas)					○	○						○		
	Early contamination of oil				○	○	○				○				
	Larger fuel consumption	○		○	○										
	Intruding of oil in coolant, back flow, reduction of coolant quantity						○		○						
	Hydraulic pressure down (Monitor lights up)									○	○	○	○		
	Oil quantity increased. (Intruding of water and fuel)	○	○		○										
	Vibration	○													



SAPH300020100004

(3) Handling of wire harness

a. Mark clamps and clips to prevent interference of a wire harness with body edge, sharp edge and bolts. Be sure to reassemble it to the original position.
b. When parts are assembled, be careful not to pinch a wire harness.



SAPH300020100005

(4) Handling of connector

a. When a connector is removed, hold the connector (as shown by the arrow in the left) and pull it out. Do not pull the wire harness.
b. Unlock the locking connector before pulling.
c. Insert the locking connector completely until it clicks.
d. To insert a test lead into the connector, insert it from the back of the connector.
e. If it is difficult to insert a test lead from the back of the connector, prepare a harness for inspection.

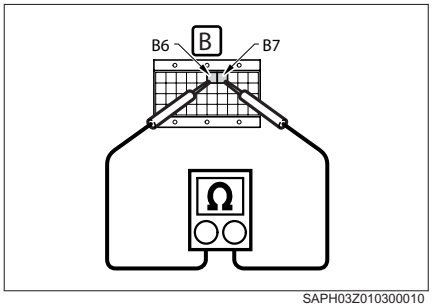
4. How to read troubleshooting for each diagnosis monitor code

(1) "Diagnosis code table" and "Troubleshooting for each code" are described for each system that gives output of the diagnosis monitor code. When the diagnosis monitor code is known, troubleshooting can be started from the code list.

Failure of main speed sensor (DTC code P0335/diagnosis monitor code 13)

JP03Z01030601004

1	Measurement of resistance between terminals



SAPH03Z010300010

1. Set the starter key to "LOCK" and connect the signal check harness.
2. Remove the ECU side connector of the signal check harness and meausre the resistance between terminal B6 and terminal B7.

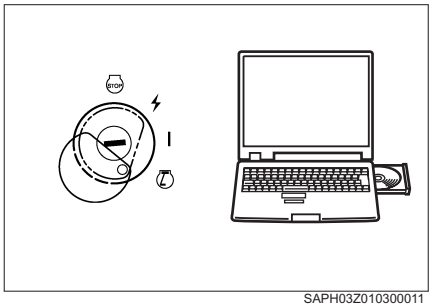
Details of work

Standard value : Approx. 125.5 17 (20 dC)

NG → [3] Go to measurement of resistance between sensor terminals.

OK

2	Check of diagnosis code



SAPH03Z010300011

1. Connect the ECU side connector of the signal check harness. After deleting the past failure, output the diagnosis code again.

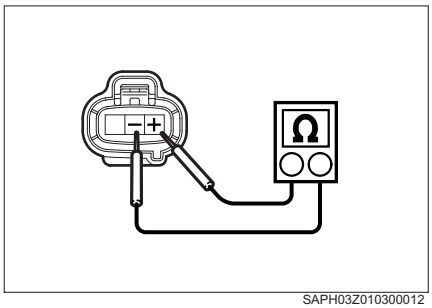
Standard : Normal

NG → Contact failure of ECU connector, ECU failure, short-circuit of harness

OK

Normal

3	Measurement of resistance between terminals



SAPH03Z010300012

1. Remove the connector of the main engine speed sensor and measure the resistance between No. 1 and No. 2 terminals at the sensor.

Standard value : Approx. 125.5 17 (20 dC)

NG → Failure of main engine speed sensor

Indicates replacement of the main engine revolution sensor.

OK

Check the harness of the relevant circuit and repair the faulty area.

Harness disconnection or connector failure

SAPH300020100030

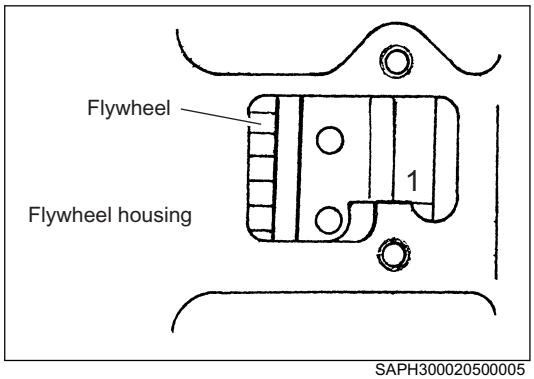
Inspection item			Standard value	Repair limit	Service limit	Action
Connecting rod end play			0.20 - 0.52 {0.0079 - 0.0205}	—	1.0 {0.0394}	Replace connecting rod or crankshaft
Camshaft	Camshaft journal outer diameter		40 {1.5748}	—	–0.15 {–0.0059}	Replace camshaft
	Camshaft bearing inner diameter		40 {1.5748}	—	+0.15 {+0.059}	Bearing Replacement
	Camshaft bearing oil Clearance		0.020 - 0.063 {0.0008 - 0.0025}	—	—	Replace camshaft or bearing
	Cam height	IN	50.067 {1.9711}	—	–0.08 {–0.0031}	Replace camshaft
		EX	52.104 {2.0513}	—		
	Cam lift	IN	8.067 {0.3176}	—	–0.08 {–0.0031}	Replace camshaft
		EX	10.104 {0.3978}	—		
Camshaft	Camshaft journal width (Rear journal)		33 {1.2992}	—	—	
	Camshaft end play		0.100 - 0.178 {0.0039 - 0.0070}	—	—	Replace camshaft
	Camshaft runout		0.04 {0.0016}	—	0.1 {0.039}	Replace camshaft
Rocker shaft outer diameter			22 {0.8661}	—	–0.08 {–0.0031}	Replace rocker shaft
Rocker arm bushing inner diameter			22 {0.8661}	—	+0.08 {+0.0031}	Replace rocker arm bushing
Rocker arm oil clearance			0.030 - 0.101 {0.00012 - 0.0040}	—	0.15 {0.0059}	
Valve stem outer diameter		IN	7 {0.2756}	—	—	Replace valve
		EX	7 {0.2756}	—	—	
Valve guide inner diameter		IN	7 {0.2756}	—	—	Replace valve guide
		EX	7 {0.2756}	—	—	
Oil clearance between valve guide and valve stem		IN	0.023 - 0.058 {0.0009 - 0.0020}	—	—	Replace valve or valve guide
		EX	0.050 - 0.083 {0.0020 - 0.0033}	—	—	
Valve sink		IN	0.55 - 0.85 {0.0217 - 0.0335}	—	1.1 {0.0433}	Replace valve and valve seat
		EX	1.15 - 1.45 {0.0453 - 0.0571}	—	1.7 {0.0669}	

4 ENGINE ASSEMBLY/DISASSEMBLY

Replacement of supply pump

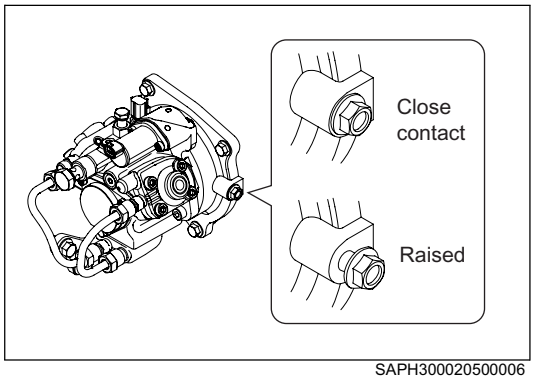
JP30002050704003

1. Compression upper dead center setting of No.1 cylinder



SAPH300020500005

(1) Turn the crankshaft counterclockwise when viewed from the flywheel. Set the timing mark in the flywheel housing inspection window to "1".

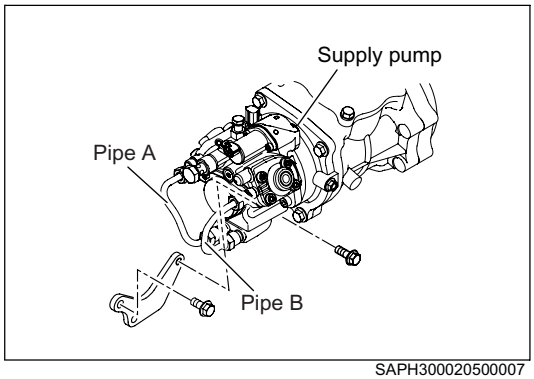


SAPH300020500006

(2) Remove the inspection window plug in the bearing holder case of the supply pump. Tighten the guide bolt (9069-08180) very gently and make sure that the bolt seating comes in close contact with the bearing holder.

⚠ **CAUTION** • **If it is raised, there must be contact other than the stopper key for the coupling flange. Do not tighten hard.**

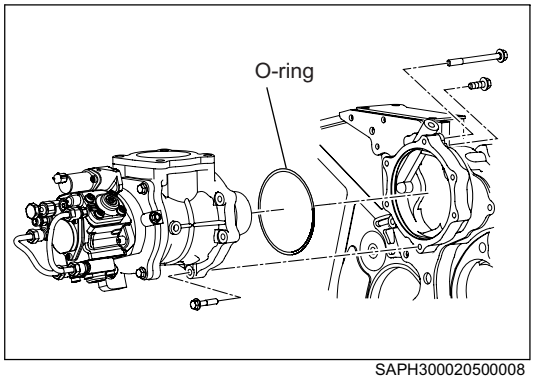
2. Removal of supply pump



SAPH300020500007

(1) Remove the fuel pipe connected to the supply pump.

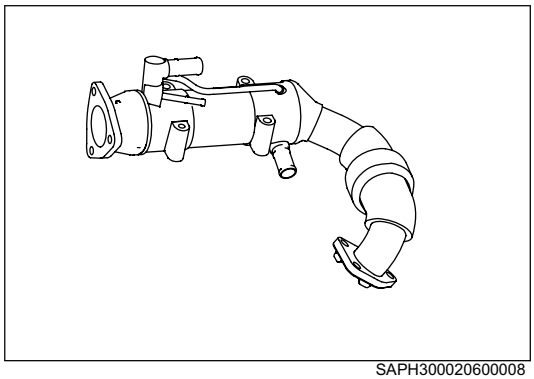
⚠ **CAUTION** • **Do not remove pipes A and B.**



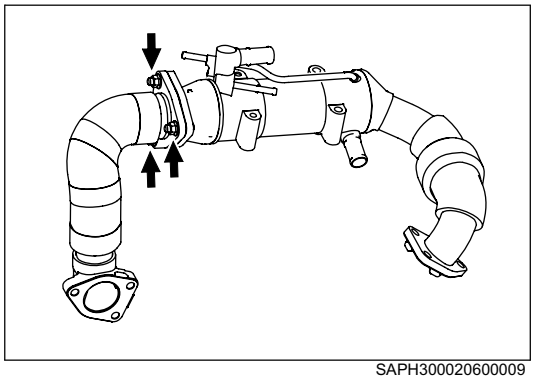
SAPH300020500008

(2) Remove the supply pump together with the supply pump drive.

(3) Remove the supply pump at the bearing holder case from the supply pump drive.

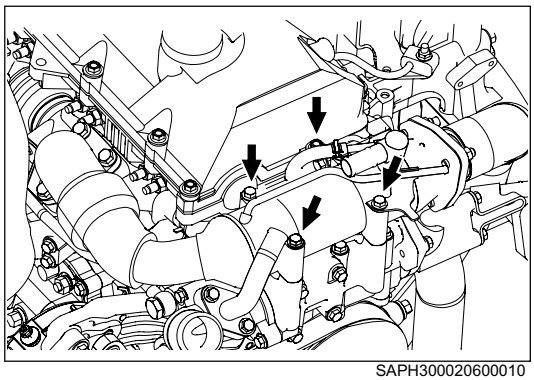

SAPH300020600008

(4) Remove the EGR cooler.

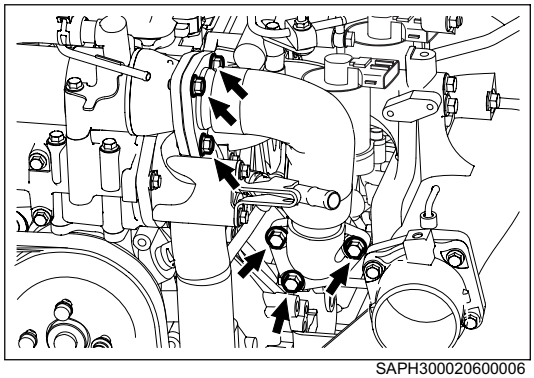

SAPH300020600009

4. Installation of EGR cooler

(1) Replace the gasket with a new one and tighten the EGR pipe and the EGR cooler temporarily.


SAPH300020600010

(2) Install the EGR cooler.
Tightening torque : 37 N·m {377 kgf·cm, 27 lbf·ft}

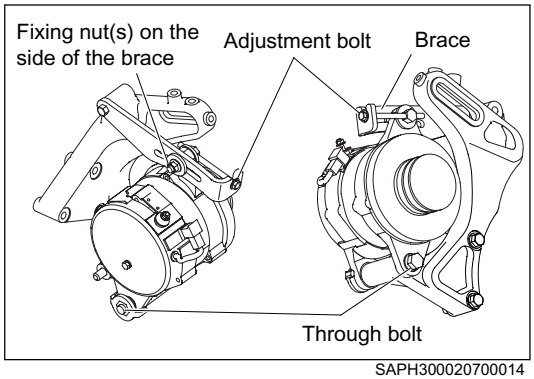

SAPH300020600006

(3) Tighten the EGR pipe and the EGR cooler with bolts.

Tightening torque :
57±11 N·m {582±116 kgf·cm, 42±8 lbf·ft}

Removal and installation of the alternator

JP30002070702004



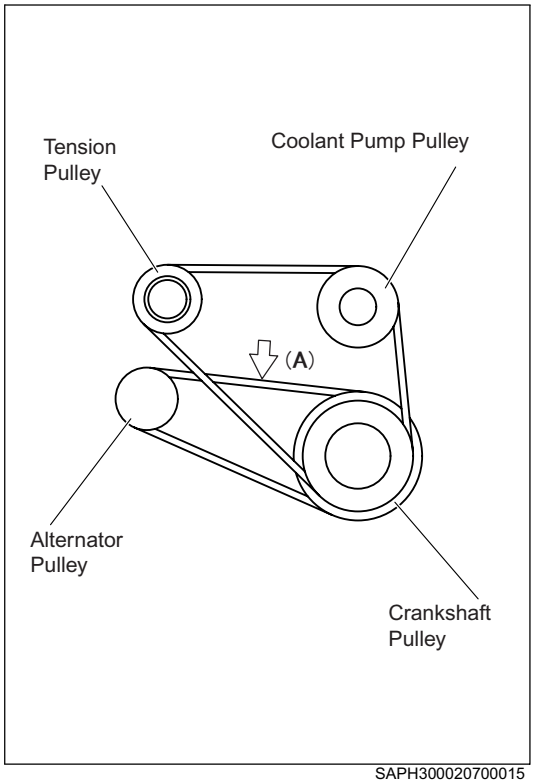
SAPH300020700014

1. Removal of alternator.

(1) Remove the adjustment bolt.
(2) Remove the fixing nut(s) on the side of the brace.
(3) Remove the through bolt while supporting the alternator, and remove the alternator.

⚠ CAUTION

- **When the through bolt is removed, the alternator falls. The alternator must be firmly supported during the through bolt removal.**



SAPH300020700015

2. Installation of alternator.

(1) Fasten the alternator provisionally with the through bolt and the fixing nut on the side of the brace.
(2) Use the special tool and adjust the adjustment bolt so that the V-belt is within the reference value at the measuring position (A).

Item	When installing a new belt	At the time of inspection
Deflection	22 - 23mm {0.8661 - 0.9055in.}	24 - 25mm {0.9449 - 0.9843in.}
Tension	100 - 120 N {10 - 12 kgf, 22 - 27 lbf}	70 - 80 N {7 - 8 kgf, 16 - 18 lbf}

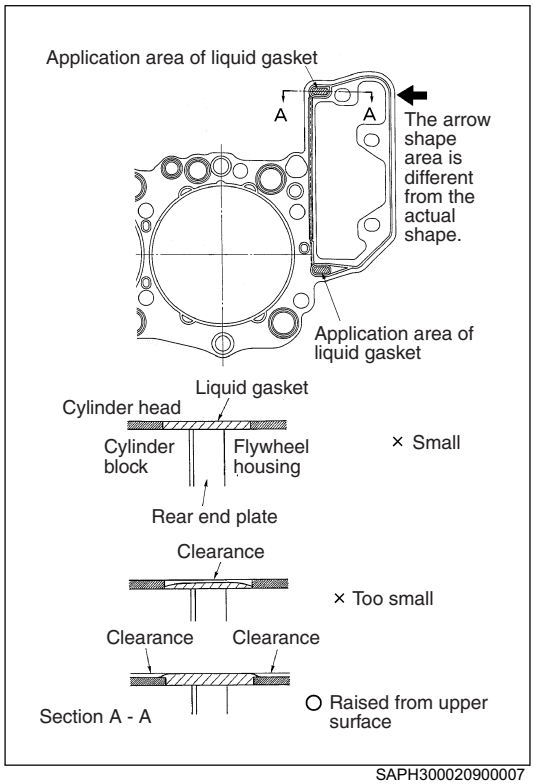
Special tool : 09444-1210 Compression gauge (used at the time of measuring the deflection amount) [Reference push force 98N {10kgf, 22lbf}]
95506-00090 (Denso part No.) Belt tension gauge (used at the time of measuring the tension force)

⚠ CAUTION

- **When the V-belt has been replaced by a new one, the V-belt will become loose because of initial run-in, so that the V-belt tension should be adjusted again after running the engine for 3 to 5 minutes.**

NOTICE

- **At the time of inspection, the new V-belt has reached the value after complete initial stretching. A new V-belt completes initial stretching after running the engine for approximately two hours.**

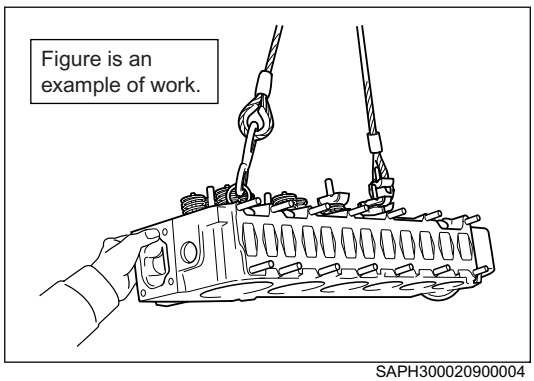


SAPH300020900007

(3) Apply appropriate amount of liquid gasket [Threebond TB1211 (white) or equivalent] to the head gasket hole at the joint surface between the cylinder block and the flywheel housing.

⚠ **CAUTION**

- **Apply the liquid gasket so that the surface of the liquid gasket may be raised on the head gasket.**
- **Install the oil cooler within 20 minutes after application of the liquid gasket.**



SAPH300020900004

4. Installation of cylinder head

(1) Clean the head bolt seat at the cylinder head upper surface and the cylinder head lower surface.

(2) Apply engine oil to the head bolt seat and the bolt thread.

(3) Align the dowel pins of the cylinder block using a special tool and hoist and mount the cylinder head.

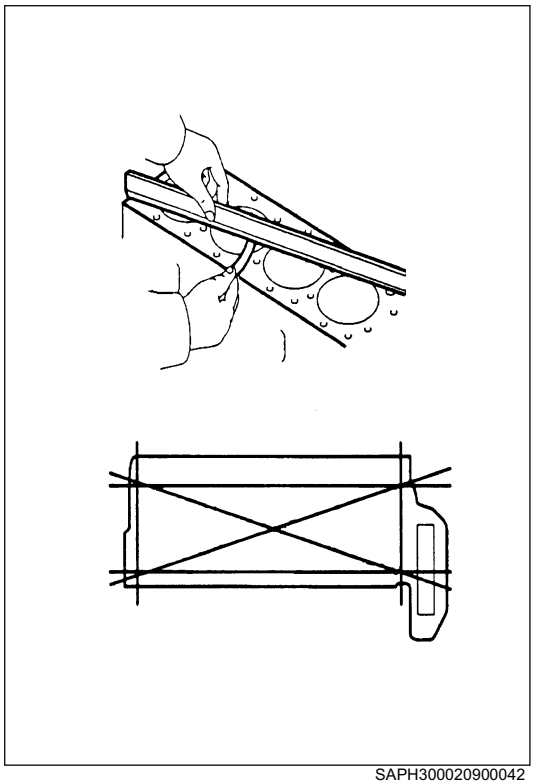
⚠ **CAUTION**

- **Before mounting the cylinder head, make sure that there is no foreign matter in the cylinder.**
- **When the cylinder head is mounted, be careful for engagement between the cam idle gear and the sub-idle gear. (Contact of gear teeth with undue force may cause impact mark or chipping, resulting in abnormal noise or missing tooth.)**

NOTICE

- **Mounting of the cylinder head with guide bolt can prevent displacement of the liquid gasket.**

Special tool : 09433–1070 Eye bolt



SAPH300020900042

4. Inspection of cylinder block

(1) Inspection of cylinder block distortion

a. Measure distortion on the cylinder block using a ruler.

Standard value (mm{in.})	Service limit (mm{in.})
Longitudinal direction 0.06{0.0024} Square direction 0.03{0.0012}	**0.2{0.0079}**

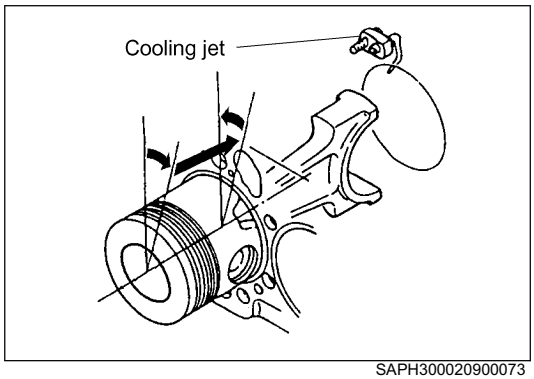
b. If the measurement value is beyond the service limit, replace it.

⚠ **CAUTION**

- **Repair of the upper surace by grinding can change backlash of the timing gear. Do not grind it.**

(2) Inspection of cylinder block crack

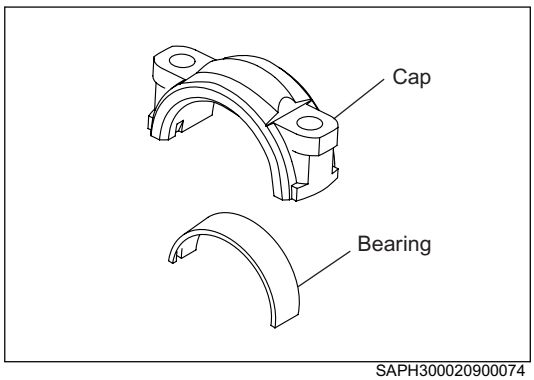
a. With dye penetrant test method (red check), make sure that there is no crack or damage in the cylinder block.



SAPH300020900073

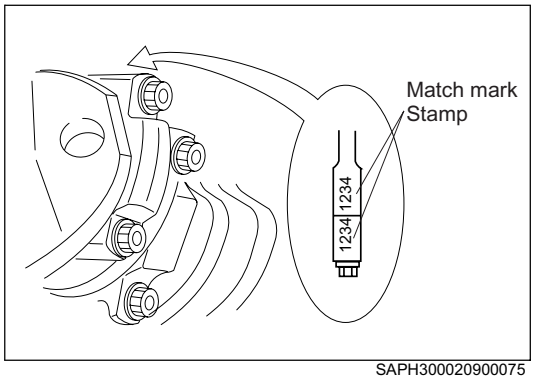
(4) Insert the piston carefully so that the connecting rod may not come in contact with the cooling jet.

⚠ **CAUTION**
- **Face the "0" mark on the piston toward the exhaust side for insertion.**
- **Set the crankshaft of the cylinder as the top dead center for assembly.**
- **Do not damage the cylinder liner, crankshaft and cooling jet during work.**



SAPH300020900074

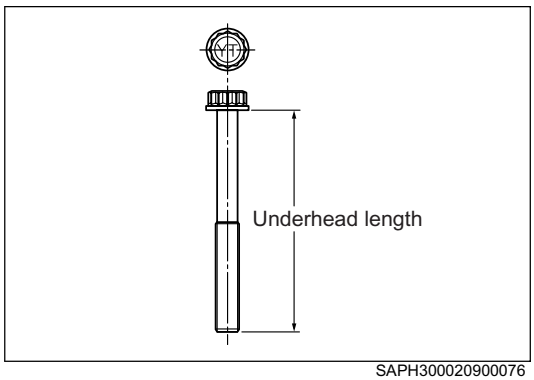
(5) Install the connecting rod bearing to suit concave shape of the connecting rod cap.



SAPH300020900075

(6) Align the match mark of the connecting rod cap with that of the connecting rod and fix it with a dowel pin.

⚠ **CAUTION**
- **Do not change the combination between the connecting rod and the connecting rod cap.**

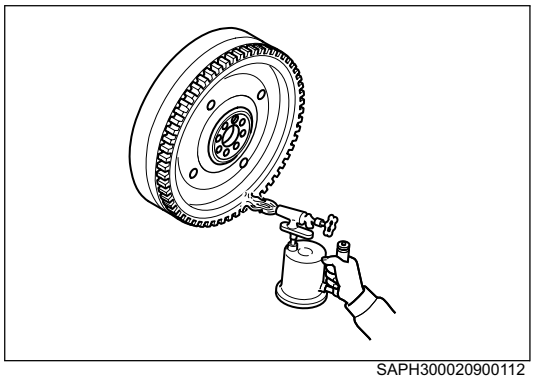


SAPH300020900076

(7) Measure the underhead length of the connecting rod bolt using a vernier calipers. If it is out of the service limit, replace it with a new one.

Service limit (mm{in.})	**68.0{2.6772} or less**

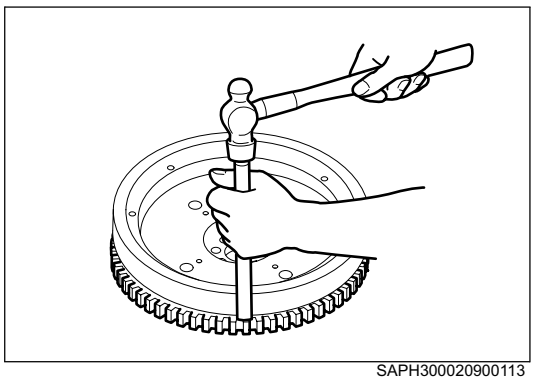
(8) Apply engine oil to the connecting rod bolt thread and the seat and install it on the connecting rod.


SAPH300020900112

2. Removal of ring gear

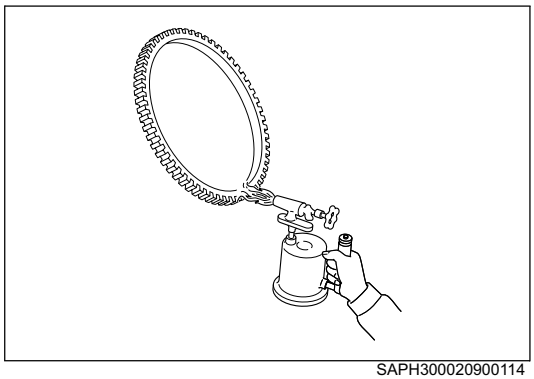
(1) Heat the entire ring gear circumference with a burner until it is about 200 °C(392°F).

⚠ **CAUTION** • **Do not touch the ring gear and the flywheel with bare hand while they are hot.**


SAPH300020900113

(2) Hit the circumference of the ring gear gently using a backing rod to remove the ring gear from the flywheel.

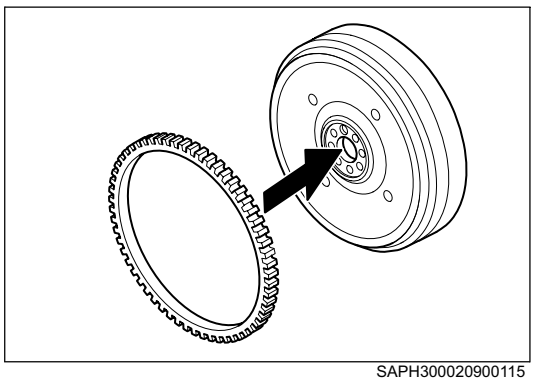
⚠ **CAUTION** • **Do not touch the ring gear and the flywheel with bare hand while they are hot.**


SAPH300020900114

3. Installation of ring gear

(1) Heat the entire ring gear circumference with a burner until it is about 200 °C(392°F).

⚠ **CAUTION** • **Do not touch the ring gear and the flywheel with bare hand while they are hot.**


SAPH300020900115

(2) Face the chamfered side toward the flywheel and install it on the flywheel quickly.

⚠ **CAUTION** • **Do not touch the ring gear and the flywheel with bare hand while they are hot.**

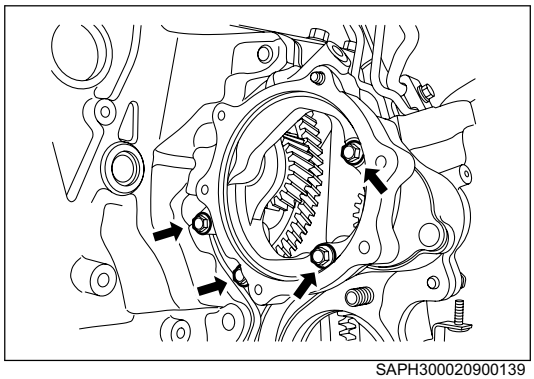
Overhaul of sub-idle gear (bearing case side)

JP30002090702014

1. Removal of bearing case assembly

(1) Remove the supply pump drive.
"Reference : Replacement, Supply pump".

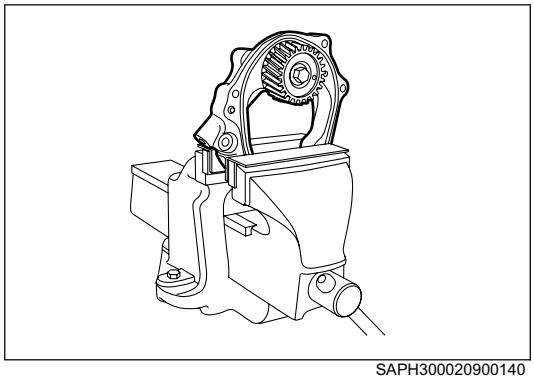
(2) Remove 5 bolts and remove the bearing case assembly.



SAPH300020900139

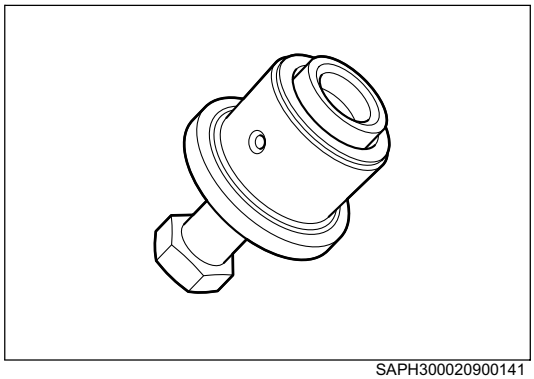
⚠ CAUTION • **One bolt is tightened from the timing gear case.**

(3) Fix the bearing case with a vice.



SAPH300020900140

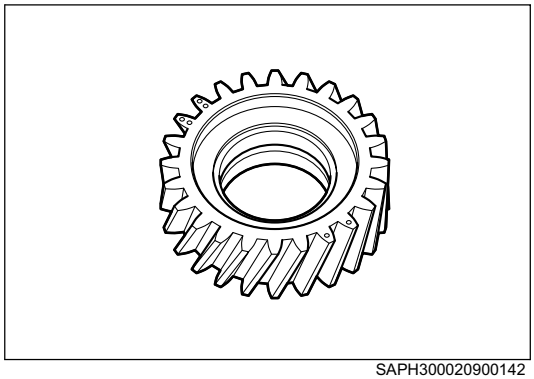
(4) Remove the sub-idle gear shaft mounting bolt and pull out the idle gear shaft using a sliding hammer.



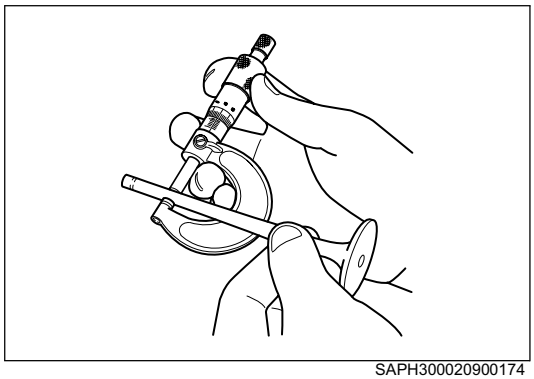
SAPH300020900141

(5) Remove the sub-idle gear.

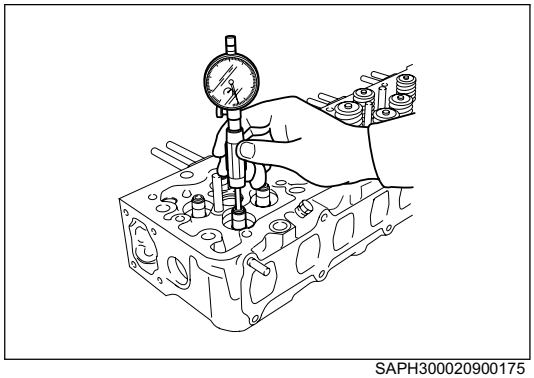
(6) Remove the idle gear thrust plate.



SAPH300020900142



SAPH300020900174



SAPH300020900175

8. Inspection of oil clearance between valve guide and valve stem

(1) Measure the outer diameter of the valve stem using a micrometer.

	Standard value (mm{in.})
Intake valve stem	**7{0.2756}**
Exhaust valve stem	**7{0.2756}**

(2) Measure the valve guide inner diameter using a cylinder gauge.

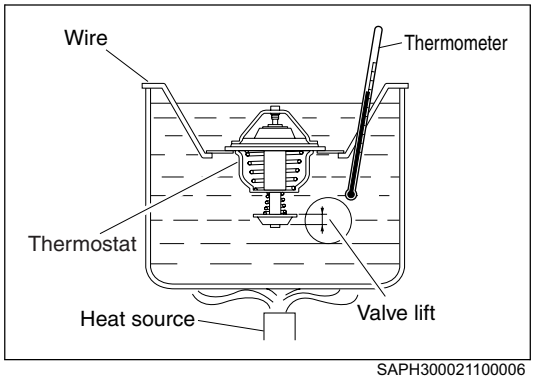
	Standard value (mm{in.})
Intake valve guide	**7{0.2756}**
Exhaust valve guide	**7{0.2756}**

(3) Calculate the difference between the valve system outer diameter and the valve system inner diameter. If it is beyond the standard value, replace the valve or the valve guide.

	Standard value (mm{in.})
Intake valve oil clearance	**0.023 - 0.058 {0.0009 - 0.0023}**
Exhaust valve oil clearance	**0.050 - 0.083 {0.0020 - 0.0033}**

Inspection of thermostat

JP30002110703001



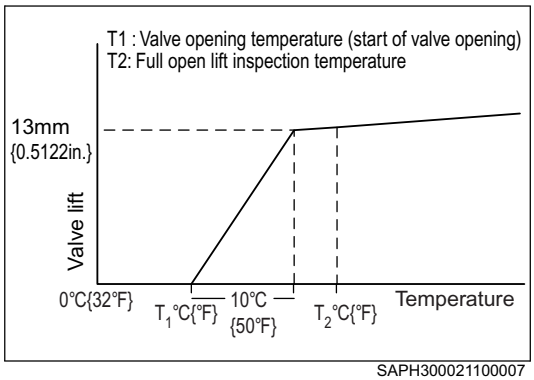
SAPH300021100006

1. Individual inspection of thermostat

(1) Put the thermostat in water as shown in the figure and heat it.

⚠ CAUTION

- **Support the thermostat in the center to prevent approach to the heat source.**
- **Stir the water well so that water temperature in the container may be uniform.**



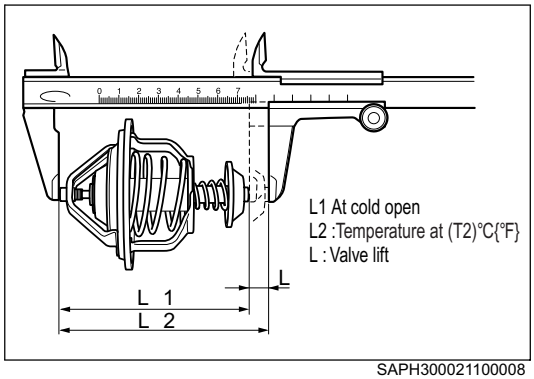
SAPH300021100007

(2) Measure the temperature (valve opening temperature) that opens the thermostat valve.

Thermostat valve opening temperature standard value : T1(°C{°F})	**74.5 - 76.5 {166.1 - 173.3}**

NOTICE

- **The thermostat valve opening temperature (T1) is stamped on the thermostat seat.**



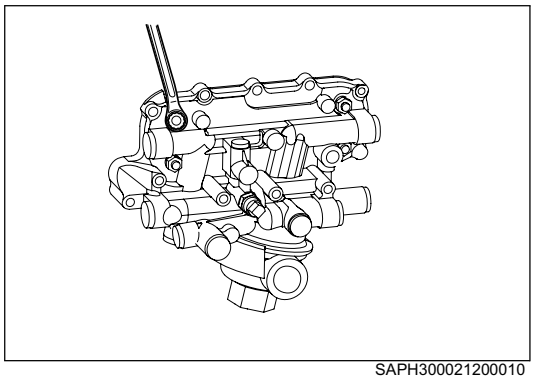
SAPH300021100008

(3) Increase the water temperature to 95 °C{203°F} and measure the lift of the thermostat valve.

Thermostat valve full open lift inspection temperature : T2 (°C{°F})	Valve lift : L (mm{in.})
95{203}	**10{0.3937} or more**

(4) Put the full open thermostat valve in water at normal temperature. Make sure that the thermostat valve closes completely within 5 minutes.

(5) If faulty item is found with the inspection above, replace the thermostat.



SAPH300021200010

7. Installation of oil cooler element

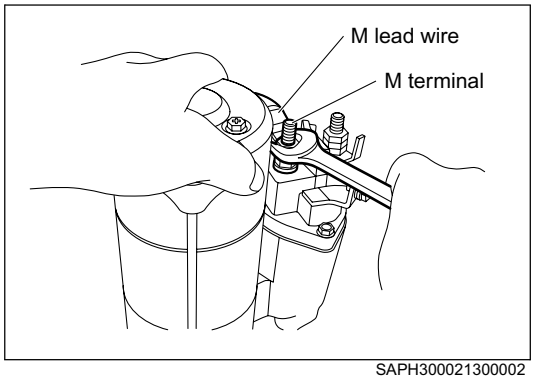
(1) Assemble new gasket and new O-ring and assemble the oil cooler element with nuts.

Tightening torque :
24.5±4.9 N·m {250±50 kgf·cm, 18±4 lbf·ft}

⚠ **CAUTION** • **In handling the oil cooler element, be careful not to give damage to it.**

Disassembly

JP30002130702001



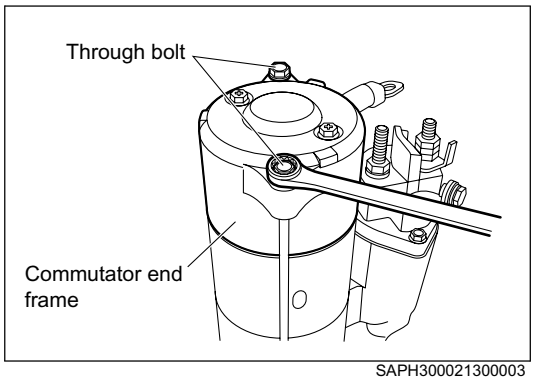
SAPH300021300002

NOTICE • **Fix the starter on the working table to ease accessibility.**

1. MRemoval of lead wire

(1) Remove the cap of the M terminal.

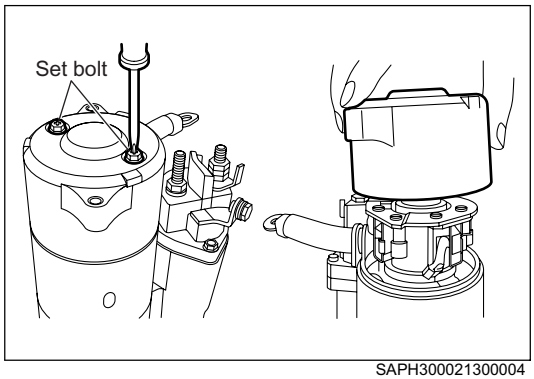
(2) Remove nuts and remove the M lead wire.



SAPH300021300003

2. Removal of commutator end frame

(1) Loosen and remove two through bolts.



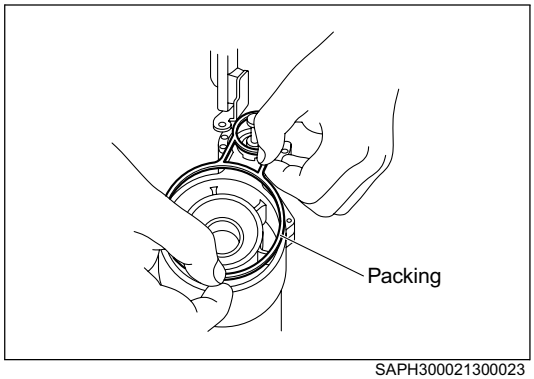
SAPH300021300004

(2) Remove two set bolts and remove the commutator end frame.

⚠ **CAUTION** • **Hold the M lead wire and remove the commutator end frame by lifting.**

Assembly

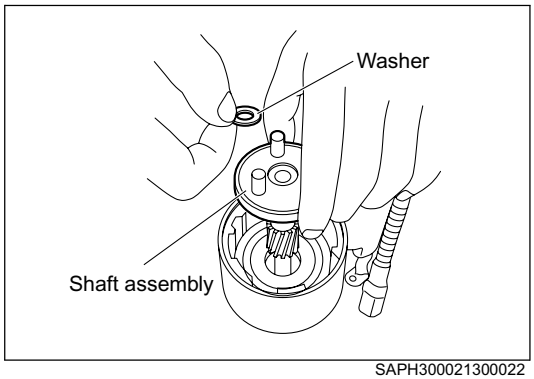
JP30002130702002



SAPH300021300023

1. Installation of packing

(1) Install a new packing on the center bracket assembly.



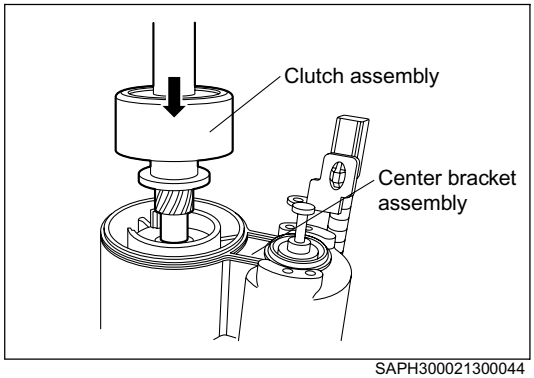
SAPH300021300022

2. Installation of shaft assembly

(1) Turn the center bracket assembly upside down and hold the carrier plate. Lubricate parts (refer to the lubrication point drawing and the lubrication list) and install the shaft assembly.

⚠ **CAUTION**

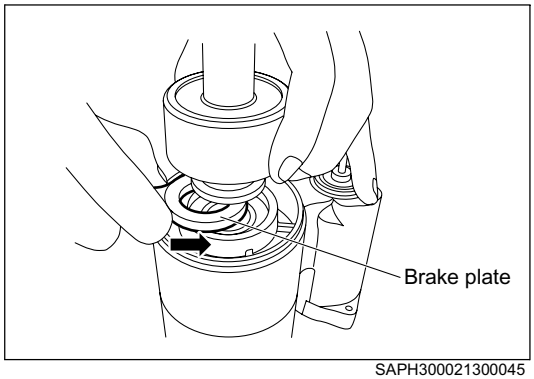
- **Washers are available at the upper and lower parts of the carrier plate. Be careful for loss of the washers.**



SAPH300021300044

3. Installation of clutch assembly

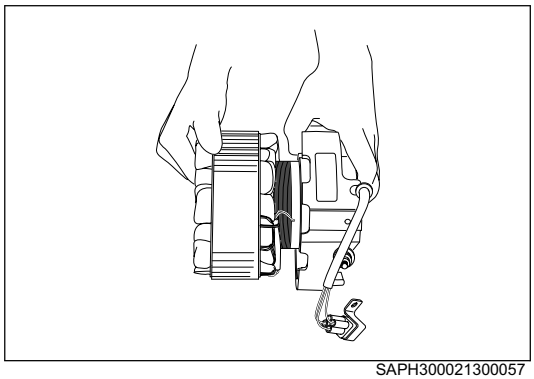
(1) Lubricate parts (refer to the lubrication point drawing and the lubrication list) and insert the clutch assembly into the center bracket assembly.



SAPH300021300045

4. Installation of brake plate

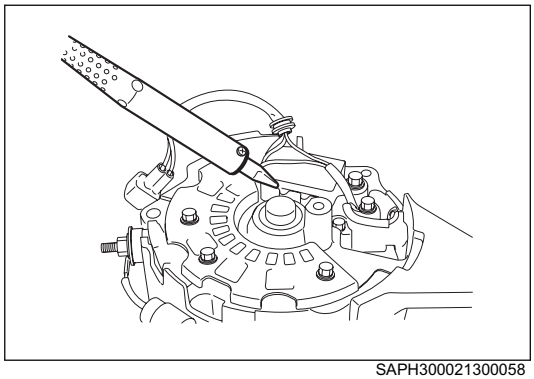
(1) Lubricate parts (refer to the lubrication point drawing and the lubrication list) and install the brake plate.



SAPH300021300057

(2) Remove the stator coil from the rear bracket.

⚠ **CAUTION** • **Do not damage the stator coil.**

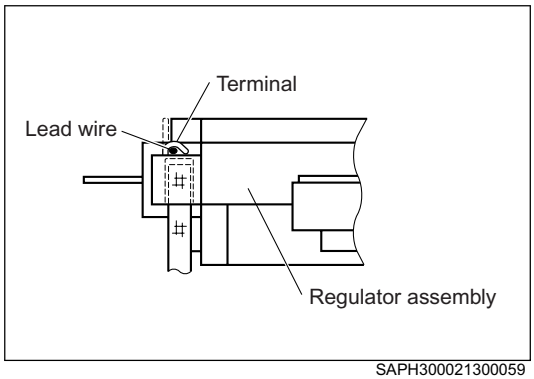


SAPH300021300058

(3) Remove solder of the lead wire connecting the regulator and the field coil using a soldering bit.

⚠ **CAUTION** • **Remove the lead wire of the field coil by raising the terminal of the regulator.**

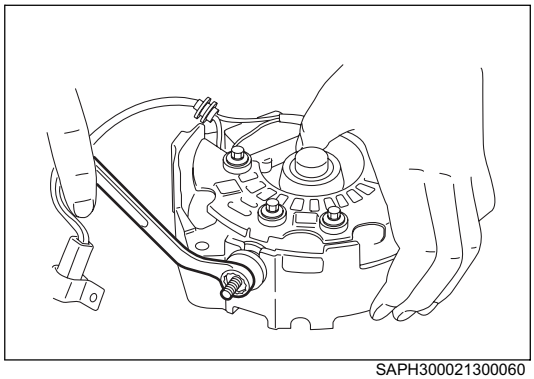
• **Perform soldering in a short time (within 5 seconds).**



SAPH300021300059

(4) Loosen the nut at the B terminal.

⚠ **CAUTION** • **Loosen the nut to some extent and do not remove it from the B terminal.**

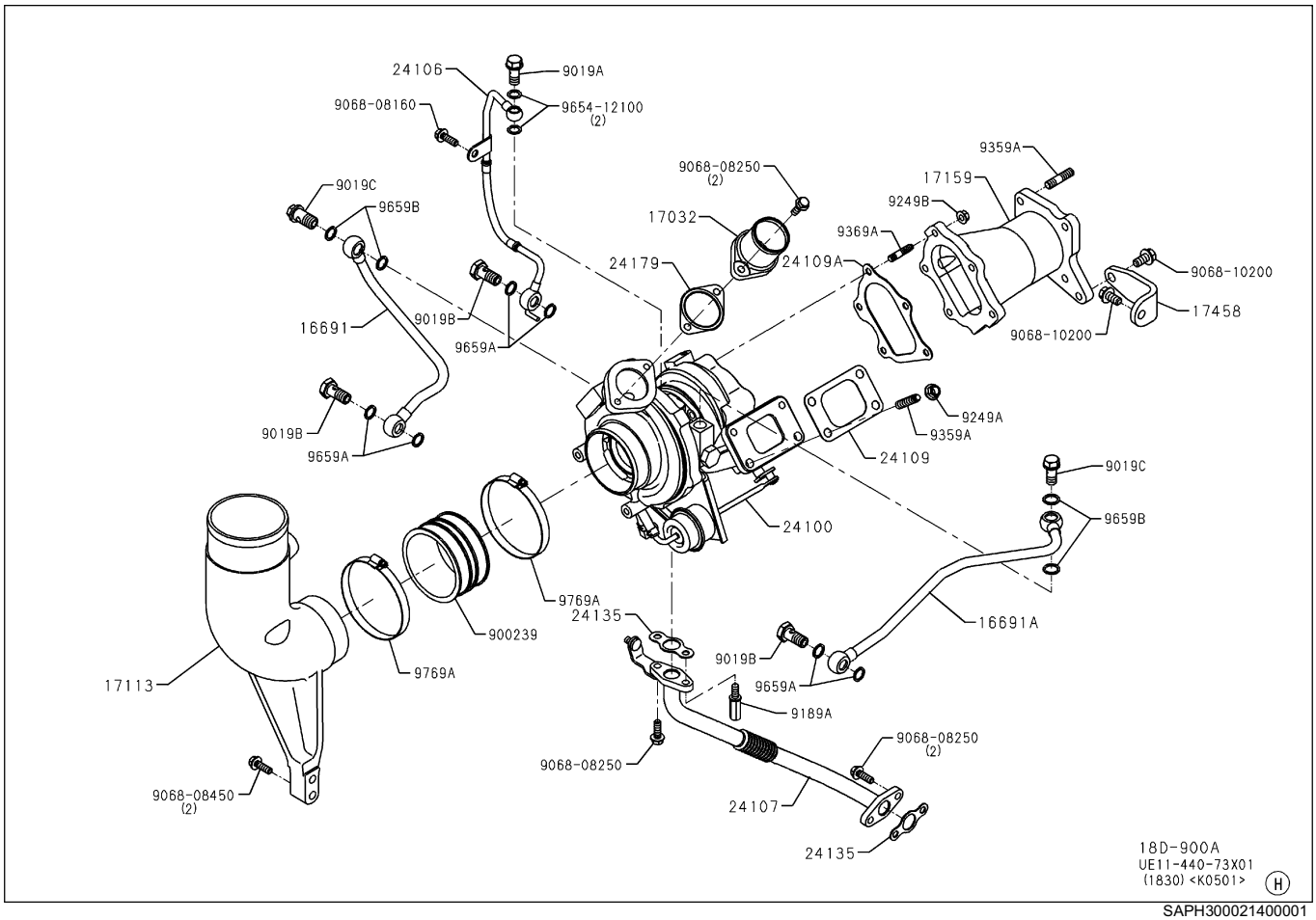


SAPH300021300060

Turbocharger Assembly

Part layout

JP30002140402001



SAPH300021400001

16691	Coolant pipe	24109	Gasket*
16691A	Coolant pipe	24109A	Gasket*
17113	Intake pipe	24135	Gasket*
17159	Exhaust manifold connector	24107	Oil outlet pipe
17458	Exhaust pipe bracket	9654-12100	Gasket*
24100	Turbocharger assembly	9659A	Gasket*
24106	Oil inlet pipe	9659B	Gasket*

*Parts not to be reused.

Tightening torque

9249A	56 N·m {570 kgf·cm, 41lbf·ft}	

Status	Cause	Action
Lamp is ON. → Charge current is correctly running (alternator).	Faulty regulator (open Tr)	Replace regulator.
Lamp is OFF. → Charge current is always limited. → Battery goes flat (alternator).	Faulty stator coil (disconnection of 1 phase, rare shorting)	Replace stator coil.
	Faulty diode (open, shorting)	Replace rectifier.
	Disconnection or poor contact of lead wire (plate, support, etc.)	Repair or replace lead wire.
Lamp is OFF. → Charge current is always limited. → Battery goes flat (operation load).	Operation load is large (Load balance is poor).	Reduce load
Lamp is OFF. → Charge current is always large. → Battery fluid runs short in a short period of time (alternator).	Faulty regulator (shorting of PTr)	Replace regulator.
	Faulty tightening of voltage detection circuit (e.g. support)	Repair or replace voltage detection circuit.
Lamp is OFF. → Charge current is always large. → Battery fluid runs short in a short period of time (battery).	Battery is close to the service life.	Replace battery.
Others → Abnormal noise (alternator)	Faulty stator coil (rare shorting, grounding)	Replace stator coil.
	Contact of inner surface (faulty bearing, wear of bracket)	Repair or replace bearing.
Others → Abnormal noise (V belt)	Faulty tension of V belt (belt slip)	Correction

Starter

JP30002150601003

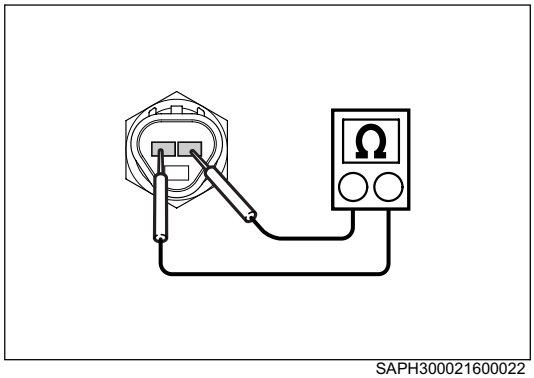
Status	Cause	Action
Starter does not turn. Turning is low.	Faulty connection of starter key	Repair connecting area.
	Flat battery	Charge or replace.
	Disconnection, loosening or corrosion of battery terminal	After cleaning, tighten.
	Grounding wire is disconnected.	Be sure to connect it.
	Use of incorrect engine oil	Replace with correct oil.
	Faulty contact of start magnet switch assembly.	Replace start magnet switch assembly
	Faulty contact or failure of starter relay	Replace starter relay.
	Wear of starter brush	Replace brush
	Seizure of commutator	Repair commutator.
	Wear of commutator	Undercut
	Shorting of armature	Replace armature assembly
	Insufficient tension of brush spring	Replace brush spring.
	Faulty operation of clutch	Clean or replace.

[a] Failure diagnosis and [b] Alarm display (alarm status)	DTC code	Diagnosis monitor code	Estimated failure cause
a. Low output b. Failure code(DTC code) indication.	P0088	68	Excessive common rail pressure (1st step)
	P0088	69	Excessive common rail pressure (2nd step)
	P0088	76	Excessive common rail pressure, supply pump excess forced feed
	P0108	37	Boost pressure sensor circuit high input
	P0117	11	Coolant temperature sensor circuit low input
	P0118	11	Coolant temperature sensor circuit high input
	P0191	67	Common rail pressure sensor malfunction
	P0192	67	Common rail pressure sensor circuit low input
	P0193	67	Common rail pressure sensor circuit high input
	P0201	51	Injector circuit malfunction -cylinder 1
	P0202	52	Injector circuit malfunction -cylinder 2
	P0203	53	Injector circuit malfunction -cylinder 3
	P0204	54	Injector circuit malfunction -cylinder 4
	P0205	55	Injector circuit malfunction -cylinder 5
	P0206	56	Injector circuit malfunction -cylinder 6
	P0237	37	Boost pressure sensor circuit low input
	P0404	88	EGR valve 1 stick
	P0405	86	EGR lift sensor 1 circuit low input
	P0406	86	EGR lift sensor 1 circuit high input
	P0407	87	EGR lift sensor 2 circuit low input
	P0408	87	EGR lift sensor 2 circuit high input
	P0489	81	EGR solenoid 1 malfunction (Open/ground short-circuit)

Engine overheat (DTC code P0217/diagnosis monitor code 6)

JP30002160601008

1	Measurement of resistance between terminals



SAPH300021600022

1. Set the starter key to "OFF", disconnect the connector of the coolant temperature sensor and measure the resistance between No. 1 and No. 2 terminals at the sensor.

   Standard value (Measure either one point of the following.)
   : 2.45kΩ (Coolant temperature at 20 °C{68 °F})
   : 1.15kΩ (Coolant temperature at 40 °C{104 °F})
   : 584Ω (Coolant temperature at 60 °C{140 °F})
   : 318Ω (Coolant temperature at 80 °C{176 °F})

NOTICE

- **This code is displayed when the coolant temperature sensor is normal and the coolant temperature is 115 °C{221 °F} or more.**
- **While this failure code is detected, the maximum injection volume is restricted. When the coolant temperature is 80 °C{176°F} or less, normal control is resumed.**

NG → Failure of coolant temperature sensor
Take actions of (DTC code P0117,P0118/diagnosis monitor code 11)

OK

Failure of engine cooling system

Engine overrun (DTC code P0219/diagnosis monitor code 7)

JP30002160601009

1. This failure code is displayed when the engine speed of 2,700 r/min or more is detected. While this failure code is detected, fuel injection is stopped. When the engine speed is lower than 2,600 r/min., fuel injection is resumed.

NOTICE

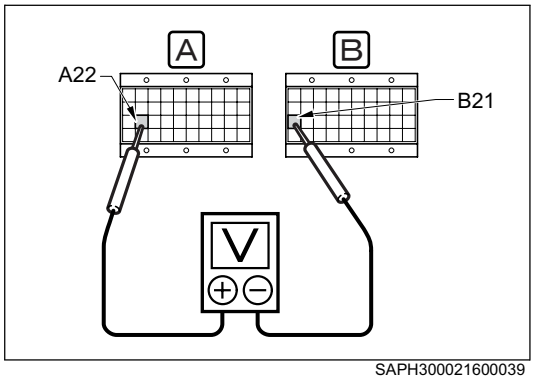
- **The objective of this failure code is not to detect overrun due to failure of this system, but to memorize high revolution of the engine.**
- **Engine speed may be incorrectly recognized with noise on the speed sensor signal due to harness failure or modification, resulting in detection of overrun.**

Accelerator sensor 1 malfunction (DTC code P2127, P2128/diagnosis monitor code 22)

JP30002160601018

DTC	P2127	Accelerator sensor circuit 2 low voltage
DTC	P2128	Accelerator sensor circuit 2 high voltage

1	Measurement of voltage between terminals



SAPH300021600039

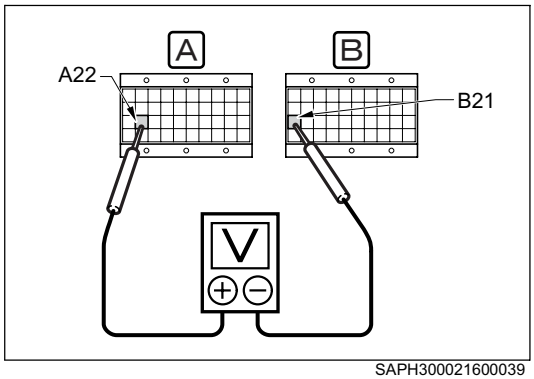
1. Set the starter key to "OFF" and connect the signal check harness.
2. Set the starter key to "ON" and measure the voltage between terminal A22 and terminal B21 of the signal check harness.

Standard value : 0.7 - 1.5V (idle status)

NG → [3] Voltage measuring at the output port of the mechatronic controller

OK

2	Measurement of voltage between terminals



SAPH300021600039

1. While increasing the throttle, measure the voltage between terminal A22 and terminal B21 of the signal check harness.

Standard value

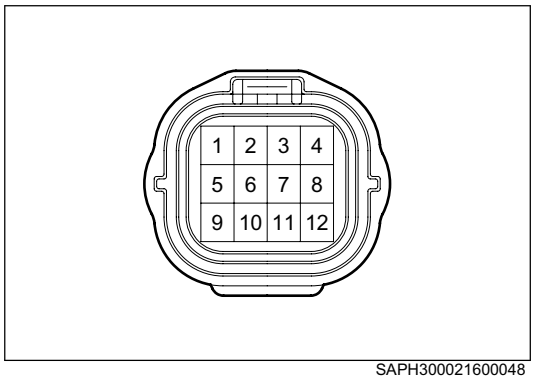
Measuring item	Engine revolution(r/min)	Voltage(V)
Low idle	**1,000**	**Approx. 1.4**
High idle	**2,100**	**Approx. 3.5**

NG → Defective mechatronic controller

OK

Harness failure

3	Measurement of resistance between injector terminals



SAPH300021600048

1. Disconnect the injector clustered connector at the front of the cam housing.
2. Measure the resistance between terminals of the injector clustered connector (male) at the cam housing.

Failure code		Terminal to measure resistance
DTC code	Diagnosis monitor code	
P0201	**51**	**9 ↔ 10**
P0202	**52**	**1 ↔ 2**
P0203	**53**	**7 ↔ 8**
P0204	**54**	**5 ↔ 6**
P0205	**55**	**3 ↔ 4**
P0206	**56**	**11 ↔ 12**

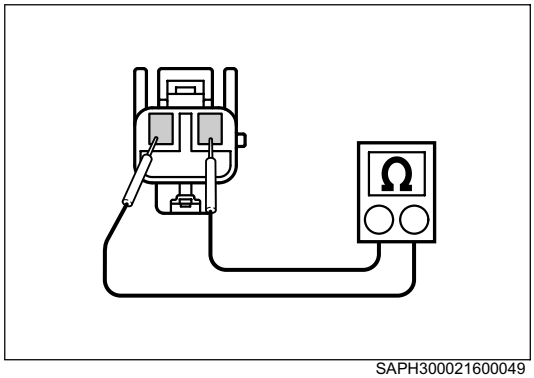
Standard value : 2 Ω or less

NG → [4] Go to measurement of resistance between injector terminals.

OK

machine harness disconnection (Check the harness between the ECU and the injector clustered connector.)

4	Measurement of resistance between injector terminals



SAPH300021600049

1. Remove the head cover and disconnect the injector connector (injector side) of the cylinder indicated by the failure code. Measure the resistance between the No. 1 terminal and the No. 2 terminal.

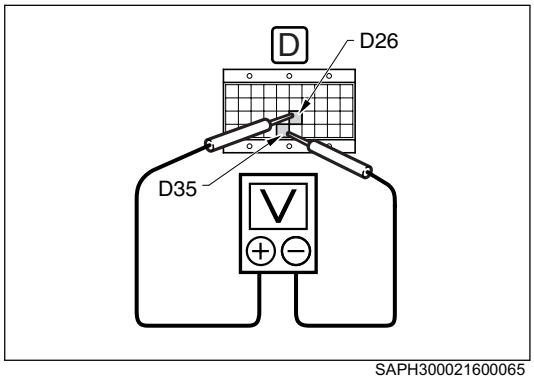
Standard value : 0.45 ± 0.05 Ω

NG → [5] Go to measurement of resistance between injector terminals.

OK

Contact failure of harness or connector inside the head cover

3	Measurement of voltage between terminals



SAPH300021600065

1. Set the starter key to "OFF" and connect the connector of EGR solenoid valve 1.
2. Set the starter key to "ON" and measure the voltage between terminal D26 and terminal D35 of the signal check harness.

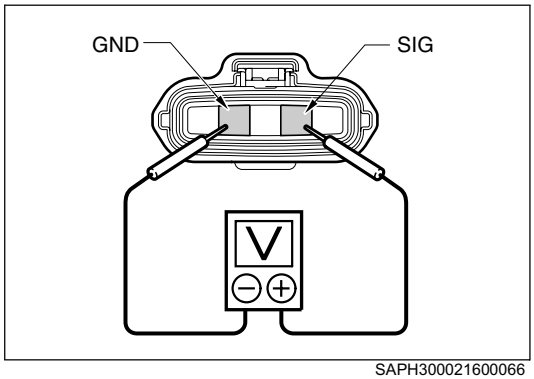
Standard value : 1.3 to 4.0 V

NG → [4] Go to measurement of voltage between terminals.

OK

Engine ECU failure, ECU connector failure

4	Measurement of voltage between sensor terminals



SAPH300021600066

1. Leave the connector of the EGR lift sensor connected.
2. Measure the voltage between the SIG terminal and the GND terminal of the EGR lift sensor connector (at machine harness side).

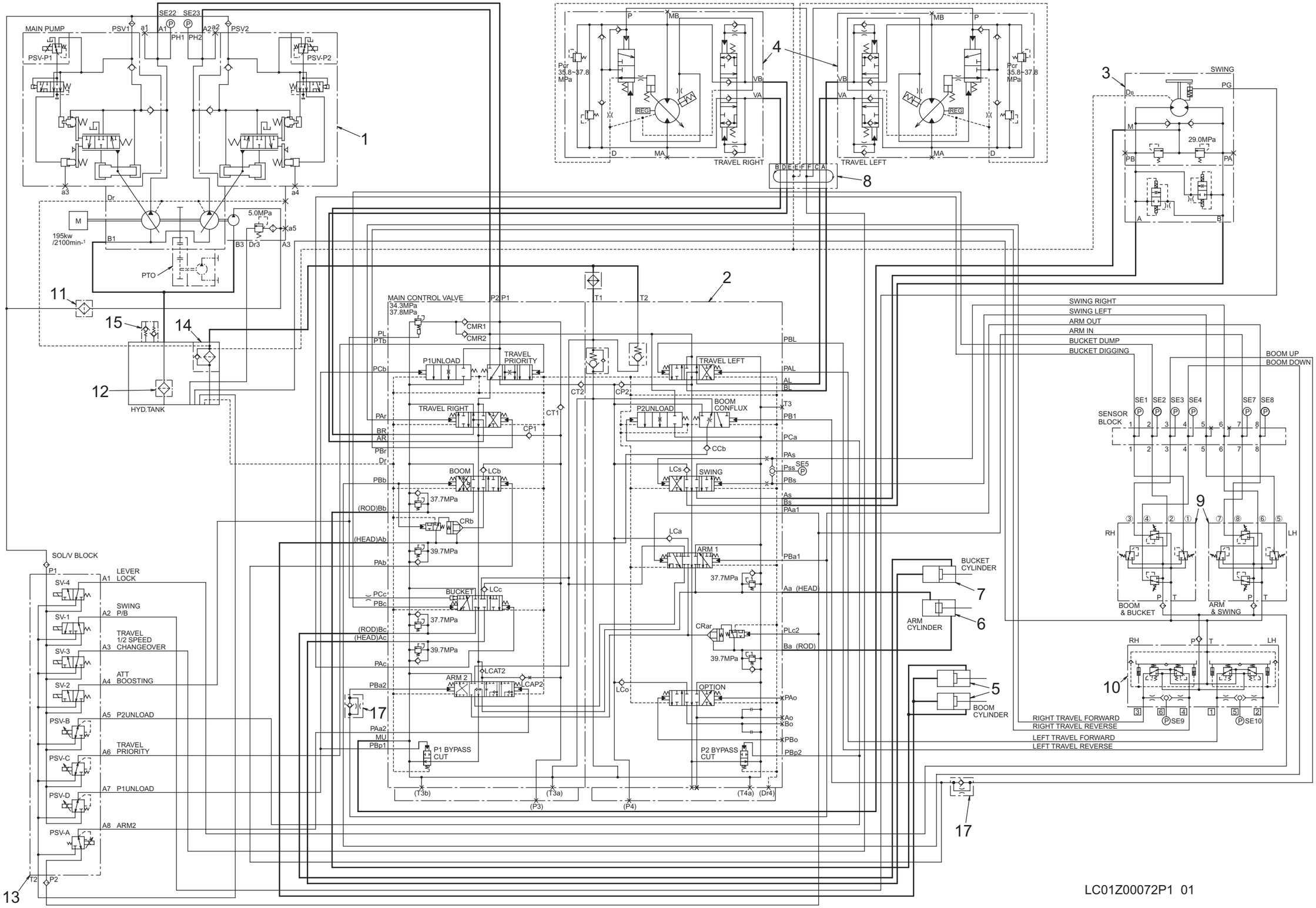
Standard value : 1.3 to 4.0 V

NG → Failure of EGR lift sensor

OK

Harness failure

22.2.1 STANDARD



LC01Z00072P1 01

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 portáC 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.

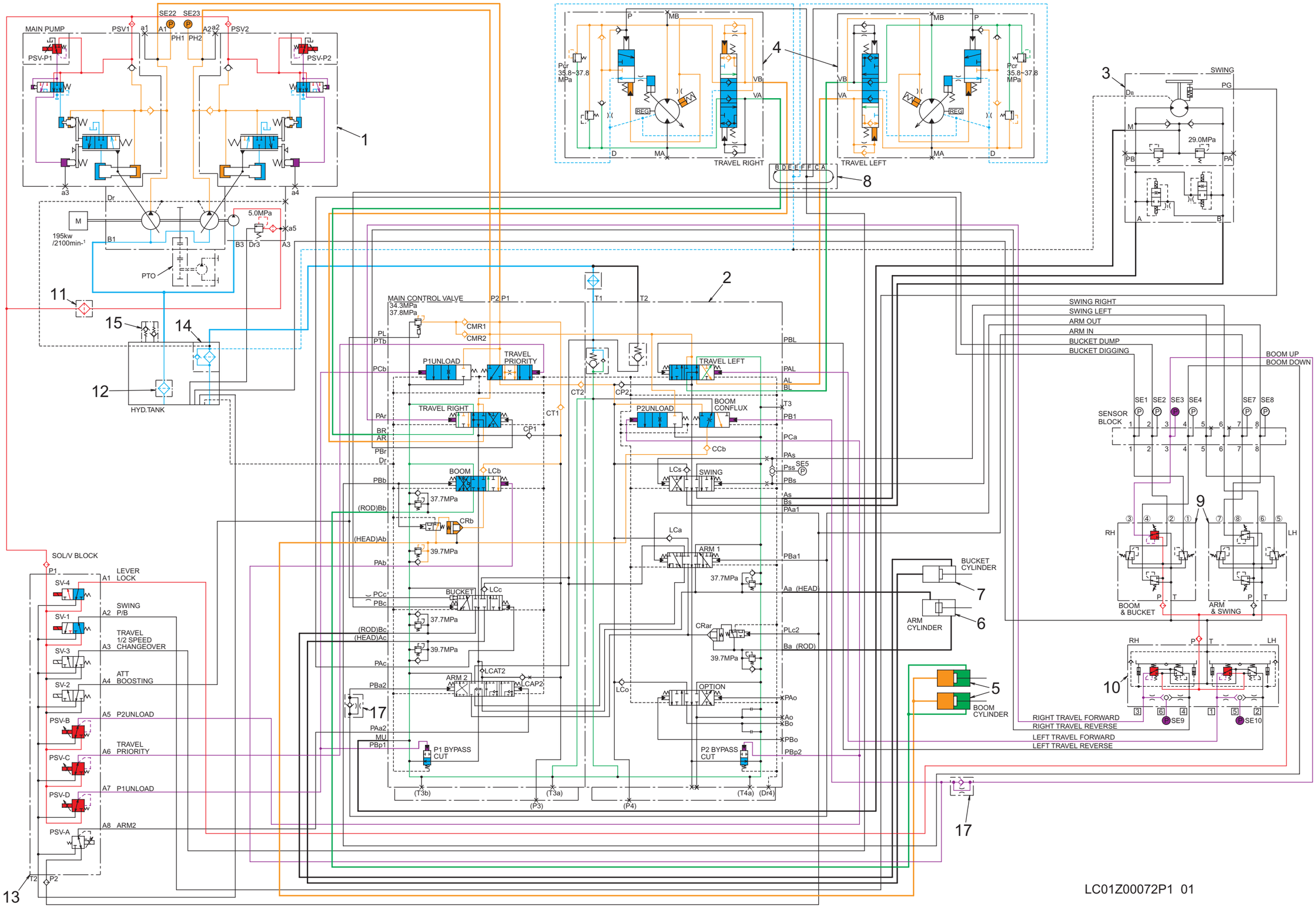
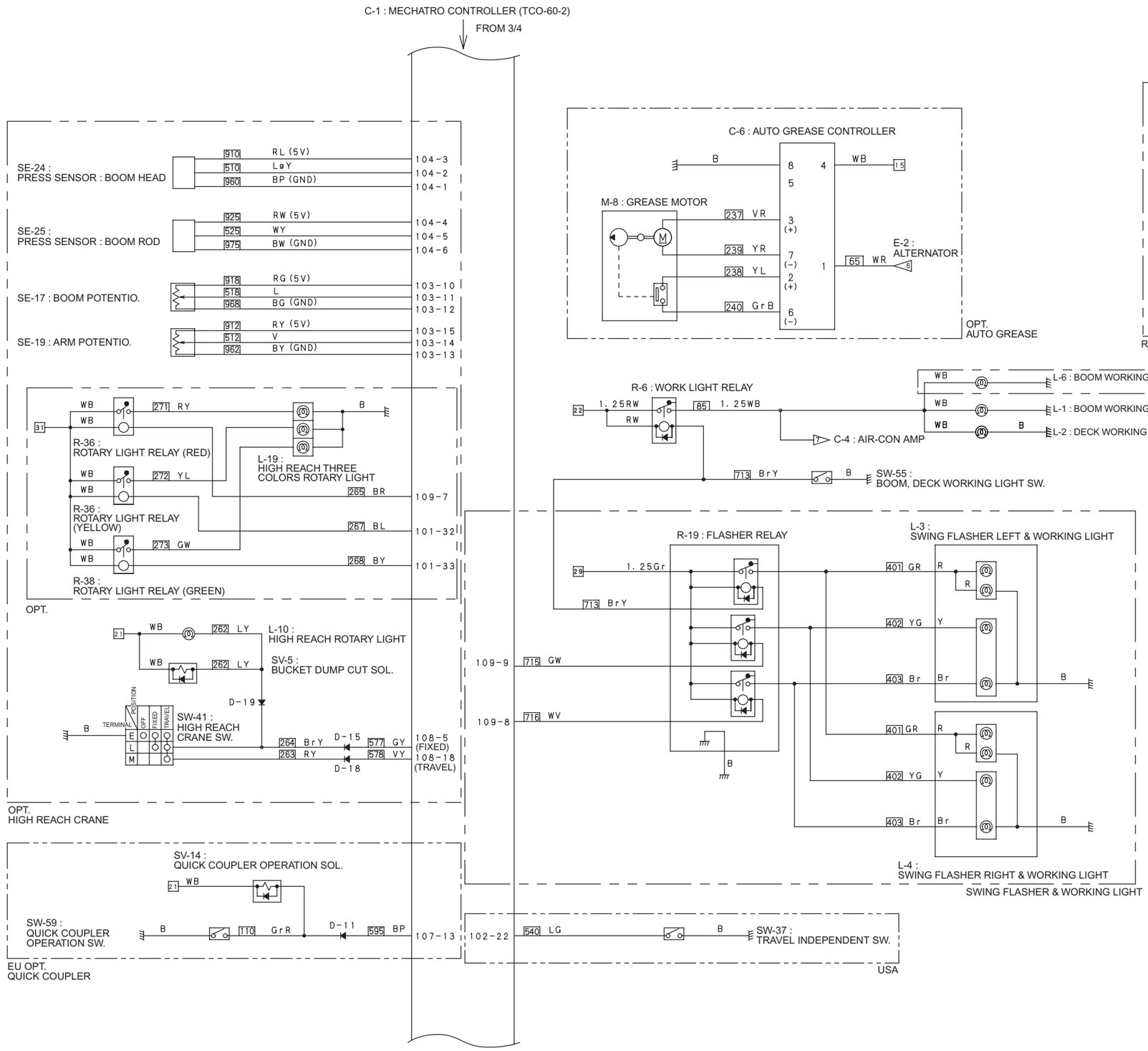
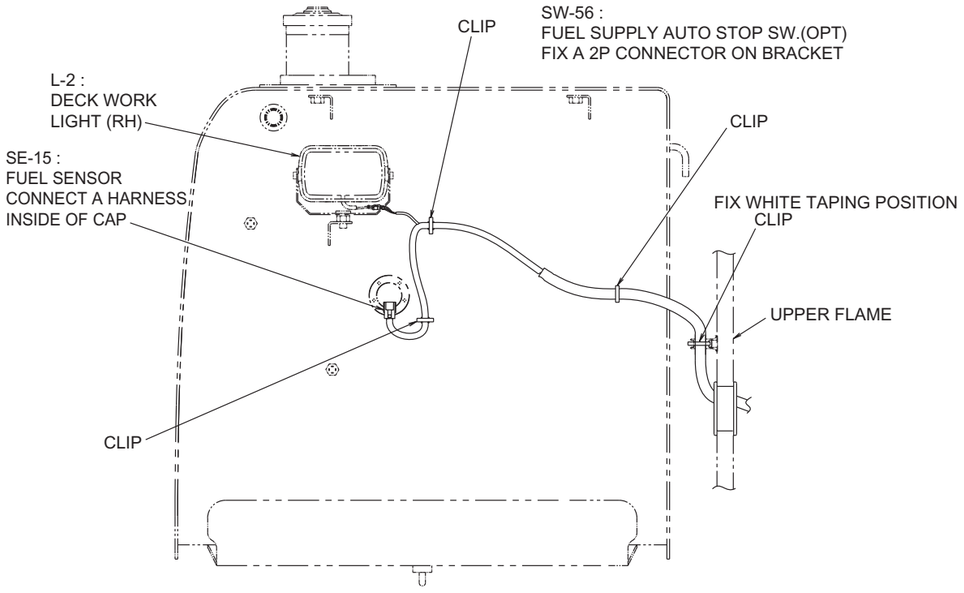


Fig. 22-10 COMBINED CIRCUIT : Boom up & Travel forward 1st speed operation, Travel straight function.

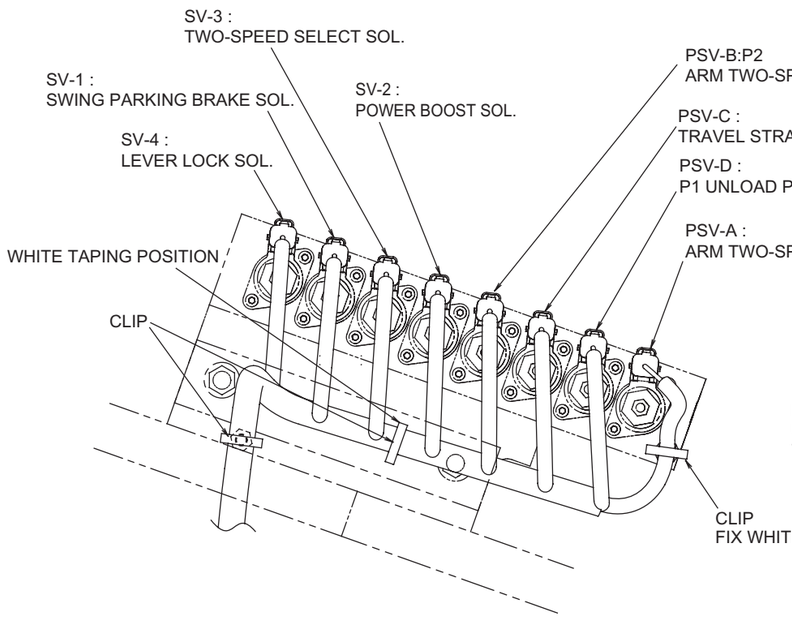


(4/4)
LC03Z00036P1 03

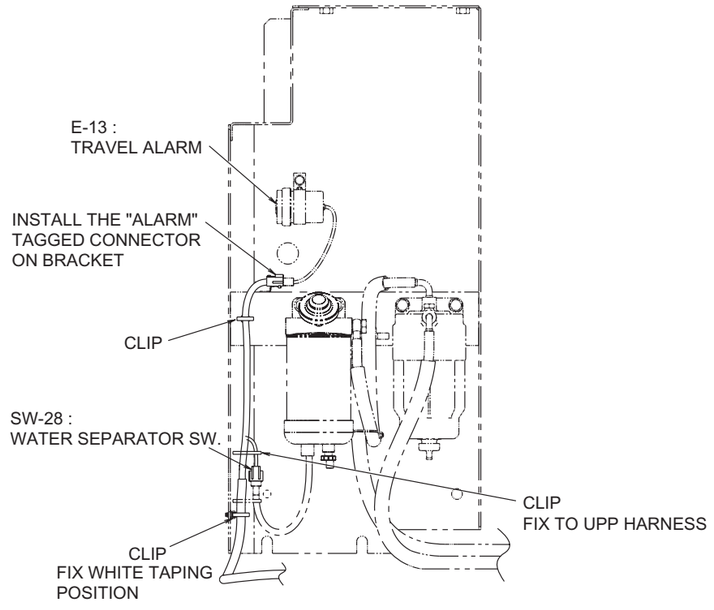
23.3.5 UPPER HARNESS ASSY (6/6)



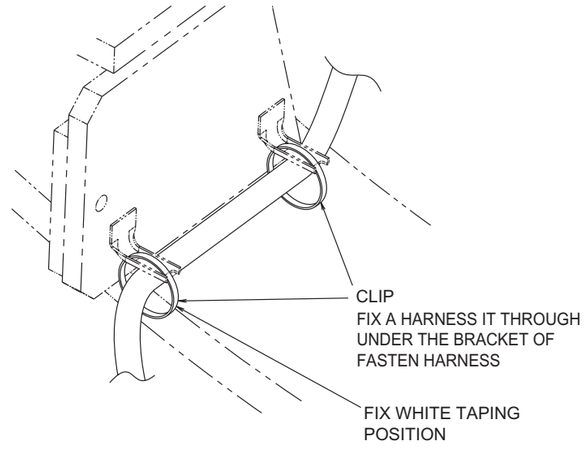
VIEW Ⅴ



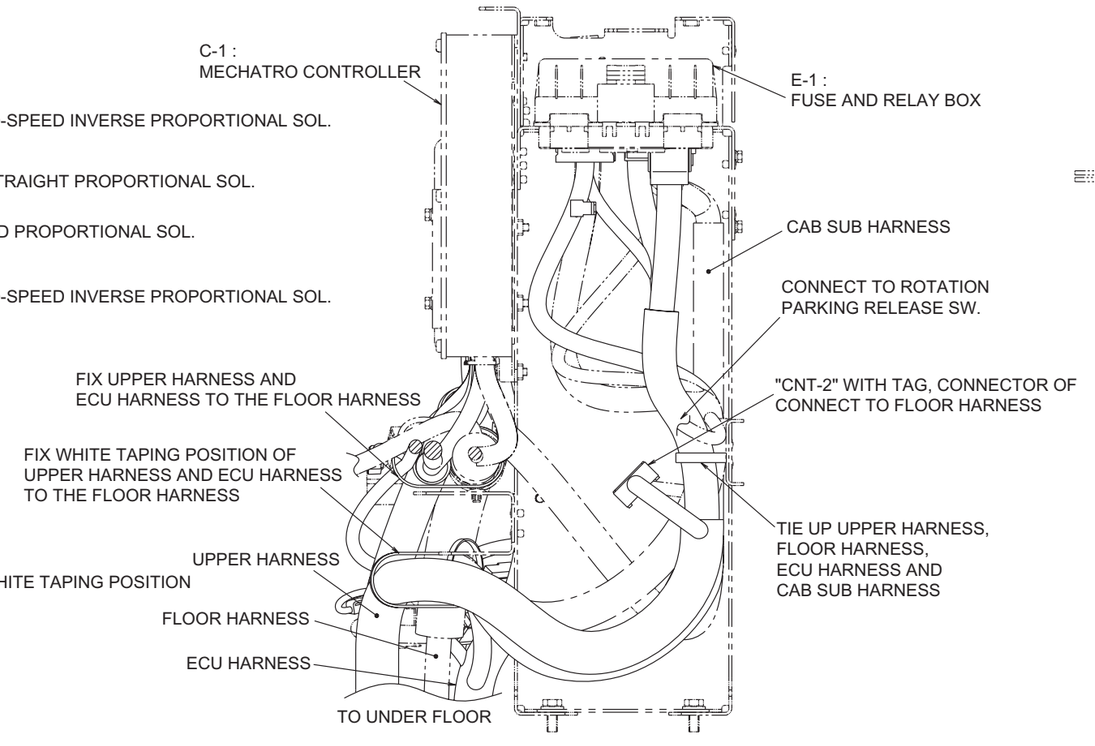
DETAIL B (DETAIL OF PSV BLOCK)

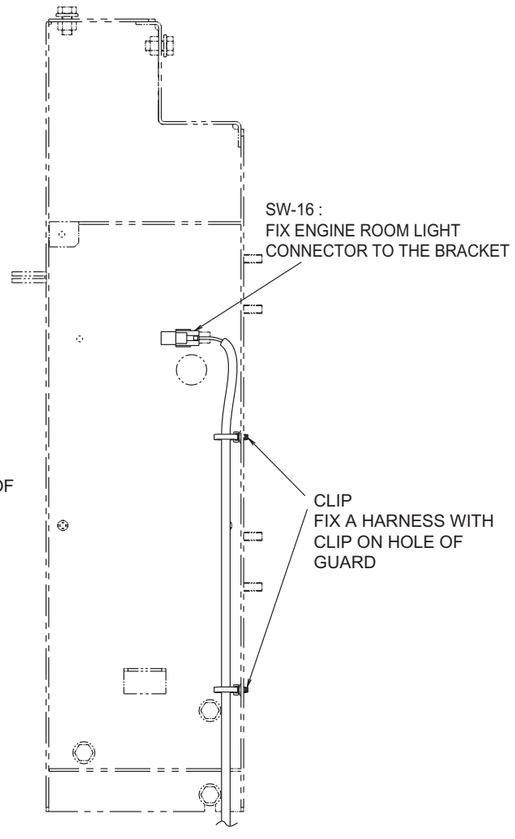


VIEW Ⅵ (DETAIL OF TRAVEL ALARM INSTALL)



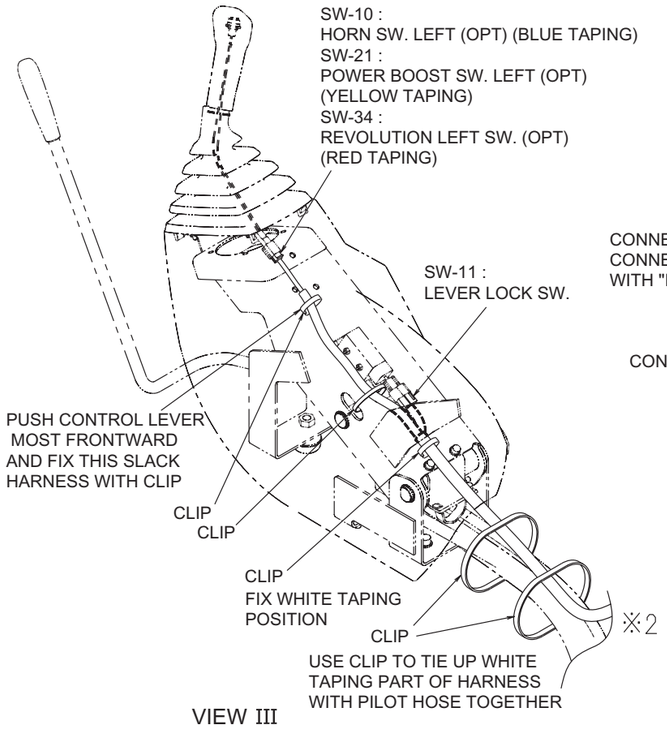
DETAIL A



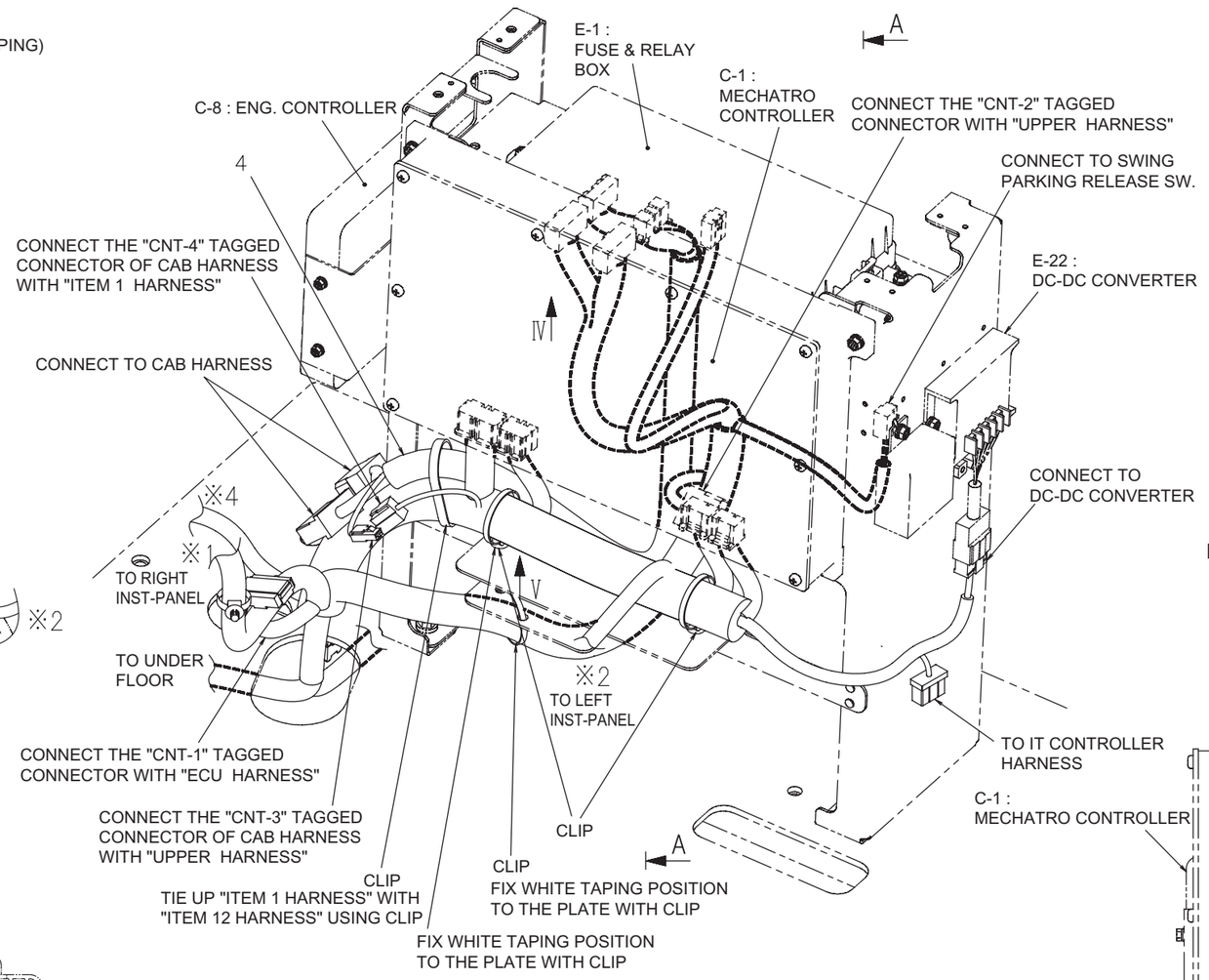


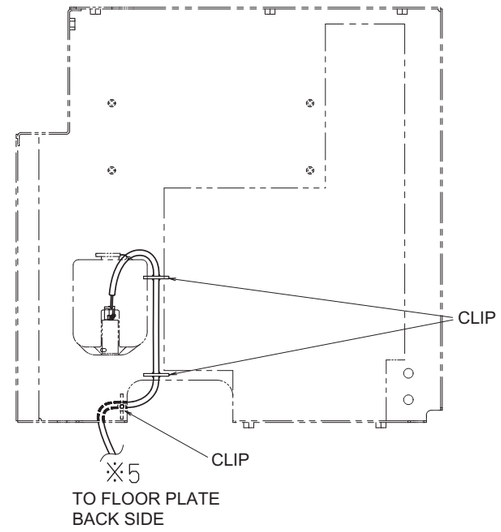
VIEW Ⅹ Ⅹ

23.3.7 UPPER HARNESS ASSY (FLOOR PLATE) (2/2)



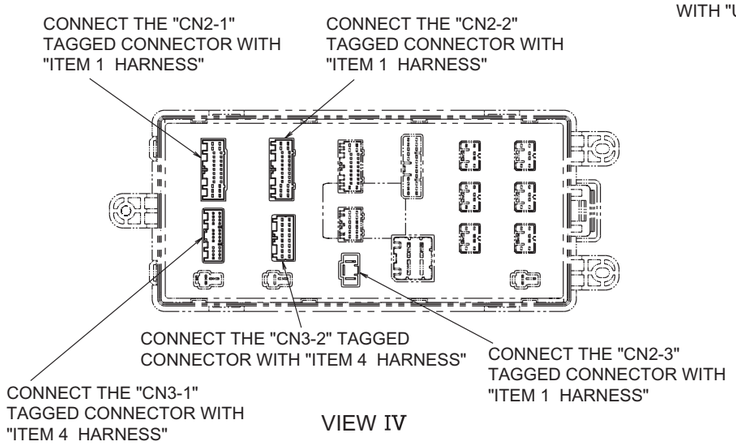
VIEW III





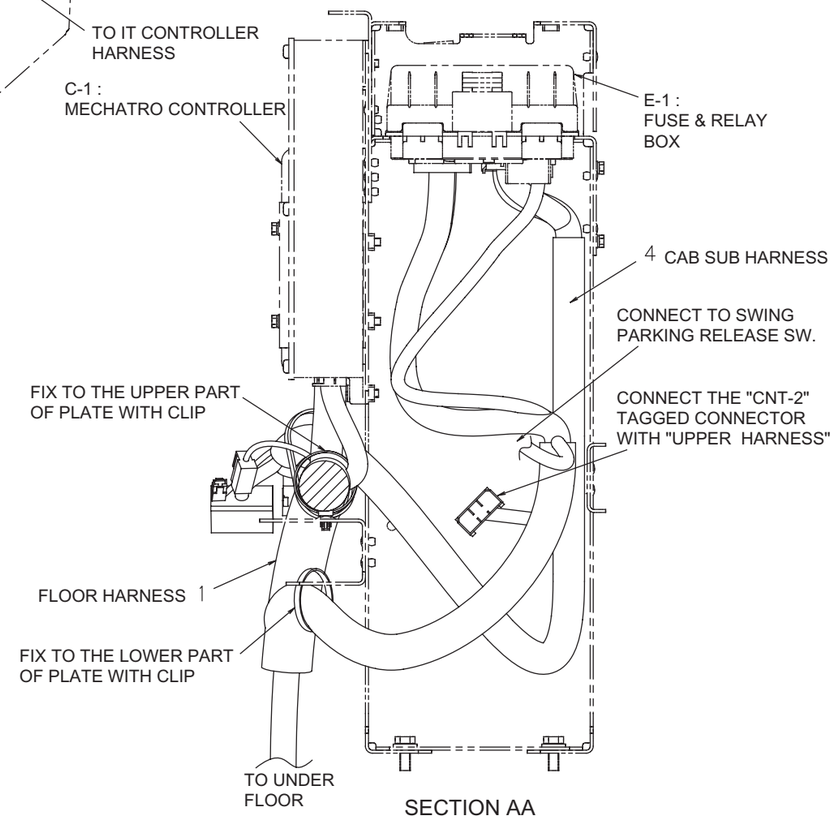
DETAIL OF WASHER MOTOR CONNECTION

DETAIL OF FUSE & RELAY BOX CONNECTION



VIEW IV

VIEW Ⅴ



SECTION AA

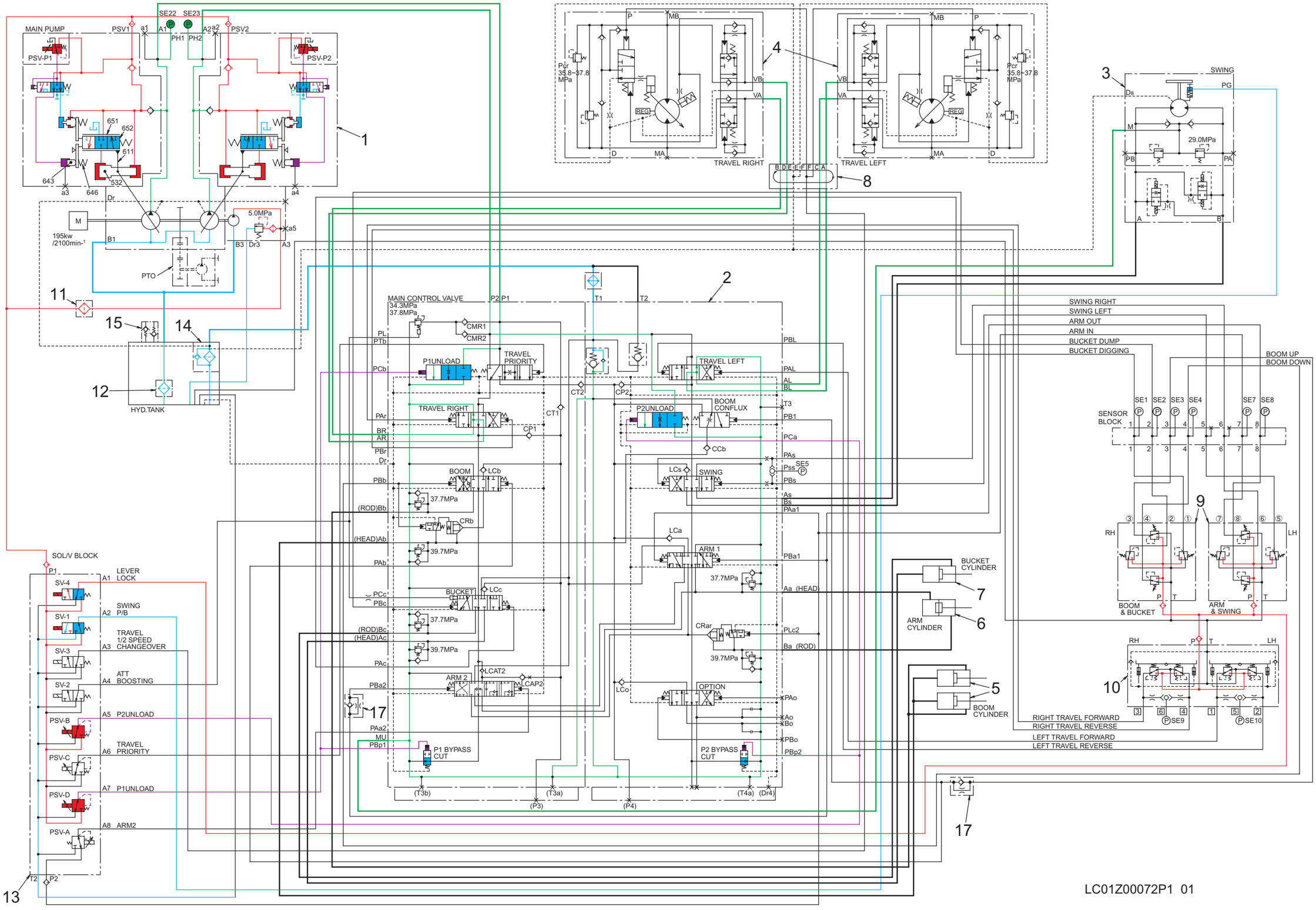


Fig. 22-1 NEUTRAL CIRCUIT : Positive control function at safety lock lever down (unlocked position)