

**E265BJ**



**NEW HOLLAND**

**E265BJ**

**NEW HOLLAND KOBELCO**

Hino Engine

Workshop  
Manual

Workshop  
Manual

Print No. 87731200  
English



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- (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.



#### **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. SPECIFICATIONS

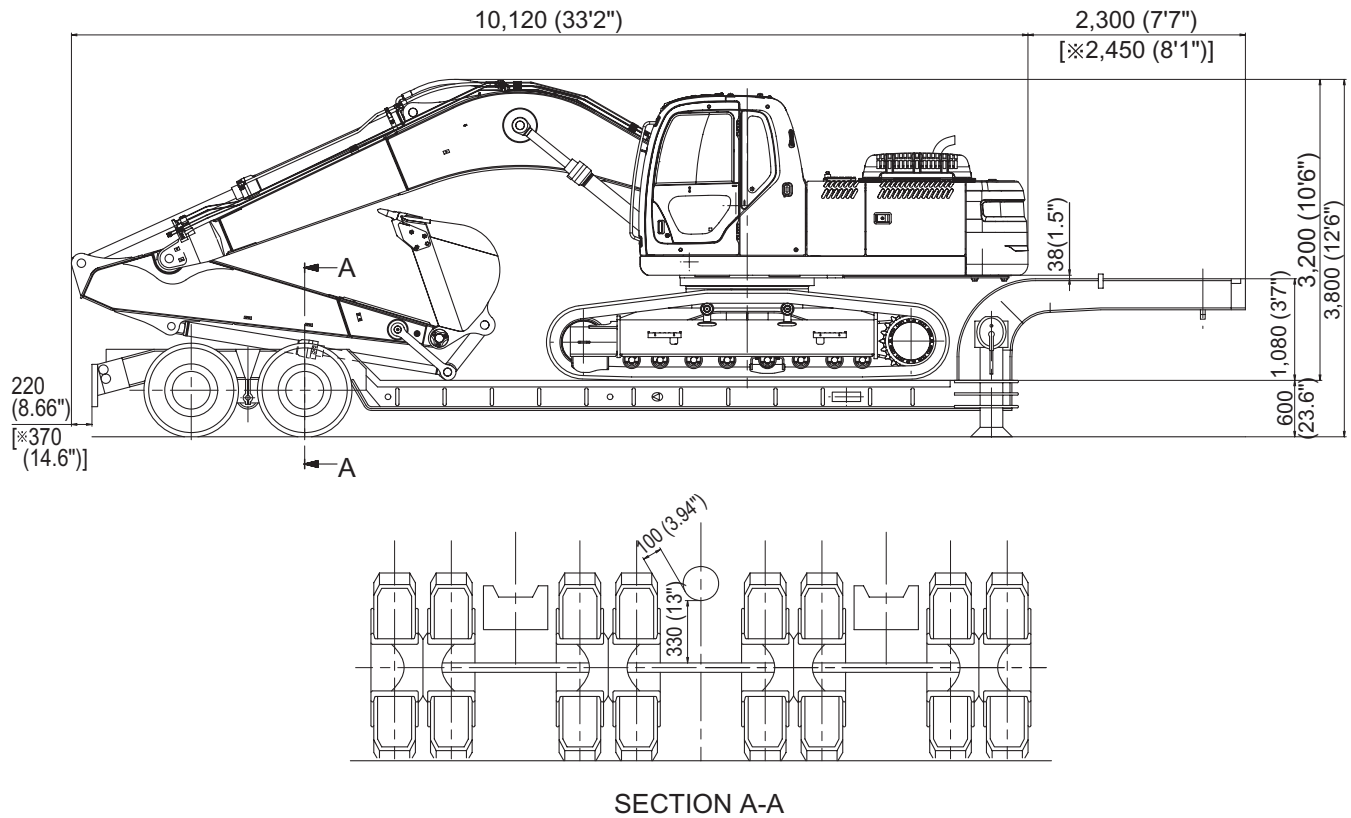
### 2.4 TRANSPORTATION

#### 2.4.1 OVERALL DIMENSIONS OF MACHINE ON A TRAILER

(1) 6.02m (19ft-9in) Boom+2.98m (9ft-9in) Arm+1.00m<sup>3</sup> (1.3cu•yd) Bucket

Item	Model	E265B	E265BLC
Width 600mm (23.6in) shoes		2,990 (9ft-10in)	3,190 (10ft-6in)
Weight		24,700kg (54,460 lbs)	25,200kg (55,570 lbs)

Unit : mm (ft-in)



#### Note

\* marks indicate LC specifications.

3.1 BOOM

3.1.1 BOOM DIMENSIONAL DRAWING

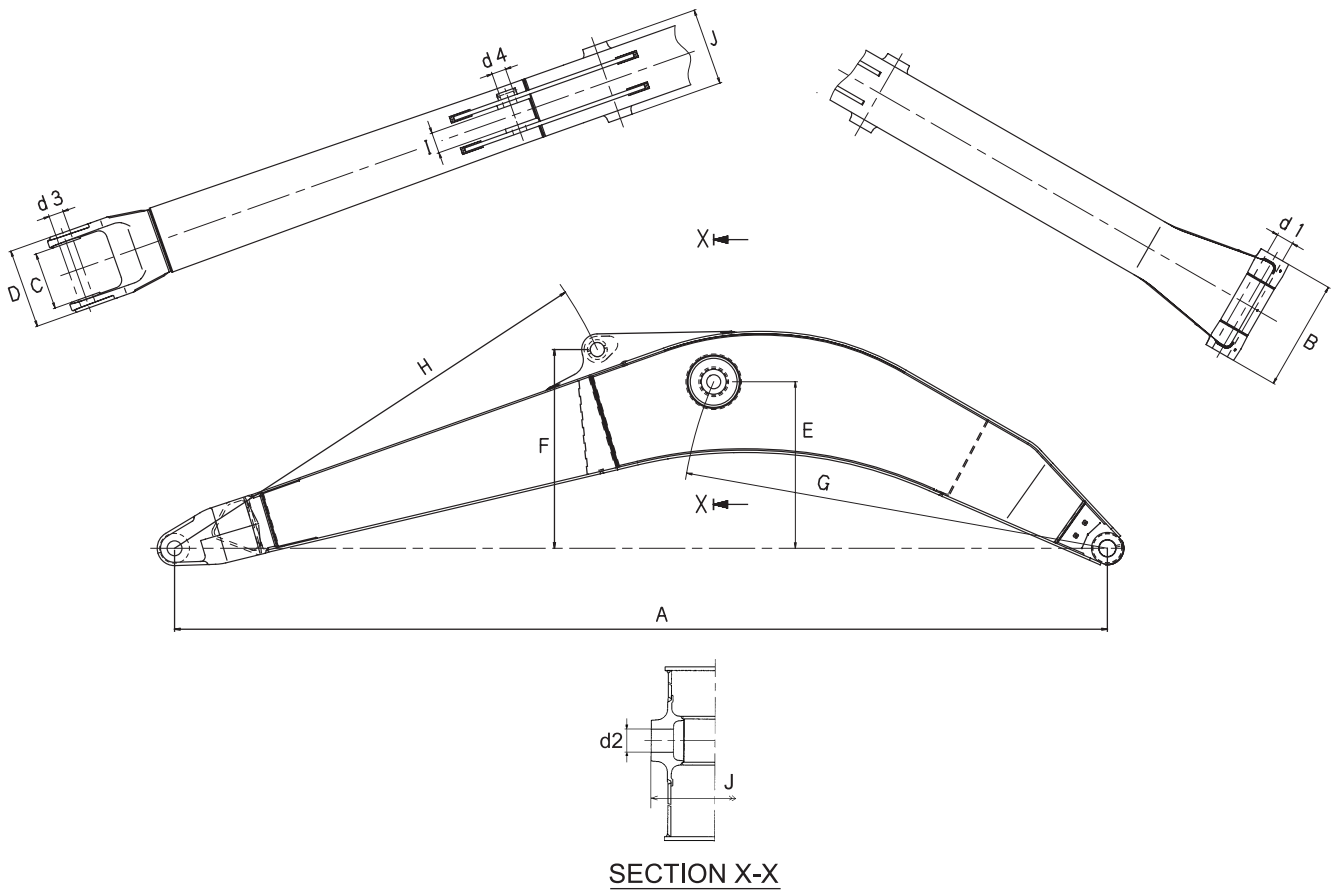


Fig. 3-1 Boom dimensional drawing

		Unit : mm (ft-in)	
6.02M (19ft-9in) BOOM		STD	—
		LQ02B00251F1	—
No	NAME	DIMENSION	
A	Boom length	6,020 (19'9")	—
B	Boom foot width	752 (29.6")	—
C	Boom end inner width	380 (15.0")	—
D	Boom end outer width	528 (20.8")	—
E	Height of boom cylinder rod pin	1,063 (3'6")	—
F	Height of arm cylinder (head side) pin	1,305 (4'3")	—
G	Distance between pins of boss	R2,437 (7'12")	—
H	Distance between pins of bracket	R3,009.5 (9'10")	—
I	Arm cylinder (head side) inner width	136 (5.35")	—
J	Outer width of bracket on the arm cylinder (rod side) mounting	522 (20.6")	—
d1	Boom foot pin dia.	ø 100 (3.94")	—
d2	Boom cylinder (rod side) pin dia.	ø 90(3.54")	—
d3	Pin dia. of boom end.	ø 90 (3.54")	—
d4	Arm cylinder (head side) pin dia.	ø 90(3.54")	—

## 11. TOOLS

Issue	Date of Issue	Applicable Machines	Remarks
First edition	October, 2006	SK250-8: LQ12-06001~ SK260LC-8 : LL12-05001~	S5LQ1114E01 (ASIA, OCE) K
↑	May, 2007	↑	↑ ASIA (HS Engine) K
↑	July, 2007	E265B : LQ12-06001~ E265BLC : LL12-05001~	↑ (NHK Russia) K
↑	↑	↑	↑ (NHK Middle East) K
↑	September, 2007	↑	↑ NHK Russia (HS Engine) K
↑	↑	↑	↑ NHK Middle East (HS Engine) K

Table11-4

<p>7</p>	<p>Plug Nominal 1-14UNS  Eye bolt</p>	<p>YN01H01001P1  ZS91C00800</p>		<p>Flare hose</p>
<p>8</p>	<p>Plug Nominal 1 3/16-12UN  Eye bolt</p>	<p>YN01H01002P1  ZS91C00800</p>		<p>Flare hose</p>
<p>9</p>	<p>Plug PF1/2</p>	<p>ZE25F08000  Coupling half</p>		<p>For slinging the swivel joint</p>
<p>10</p>	<p>TORX driver (with tamper proof) T30 (For M6)</p>	<p>—</p>		<p>For instrument panel cover (RH)</p>

## 12. STANDARD MAINTENANCE TIME TABLE

### 12.1 STANDARD WORKING TIME TABLE FOR THE MAINTENANCE OF EXCAVATOR

#### (1) Standard maintenance time table

- 1) Units of working time : 6 minutes = 0.1 hour
- 2) Calculating method of standard maintenance time :  
 Maintenance time=Working time×Number of workers  
 (Working time=Maintenance time÷Number of workers)
- 3) When more than one operation is going on :  
 Add each standard service time. A pure time (readily started) is given except covers easily removed by hand.  
 Assy works include the following works marked with black dot •.
- 4) O/H : The removing and attaching time is not included.
- 5) Abbreviations in the table.

A/C	: Air conditioner	C/V	: Control valve	O/H	: Over haul
ASSY	: Assembly	Cyl	: Cylinder	SOL	: Solenoid
ATT	: Attachment	E/G	: Engine	SW	: Switch
BRG	: Bearing	F hose	: Flexible hose	V	: Valve

#### (2) Classification of working code

No.	Group	Remarks
01	Attachment	Indicates installing, removing, replacement and overhaul.
02	Cab & Guard	
03	Swing frame	
04	Travel system	
06	Electric equipments	Indicates the installing, removing and replacement of single items.
09	E/G relation	Indicates overhaul of the single engine. (Materials prepared by manufacturer )

#### (3) Conditions for standard service time of the engine

- 1) Tools designated by E/G maker are used
  - 2) Genuine parts are changed
  - 3) Correct working procedures are observed.
- The time required for works specified in this Chapter shows the total time for maintenance.

## 12.2 ENGINE MAINTENANCE SERVICE STANDARD TIME LIST (TEMPORARY EDITION)

### Preface

This standard working time is based on the work time required for service of engine like disassembly, check, adjustment and assembly and so on under a following condition.

This standard working time is provided under the following conditions.

### 12.2.1 MEASURING METHOD

- (1) The time from the worker beginning working at the regular position of machine to the returning to the regular position after completion of the work is counted as working time.
- (2) The measuring unit is in 0.1 minute, and then round up the fractions.
- (3) The work is carried out by a couple of workmen as a general rule, and the man-hour of two workers is counted as the working time. But light work which can be carried out easily by a person and the efficient is higher is counted as a workman.

### 12.2.2 WORKING CONDITION

#### 12.2.2.1 TOOLS, INSTRUMENT

- (1) Hand tool ;  
Tools which are commercially available and each workman usually carries
- (2) Common tool ;  
Tools which are commercially available and each workman do not usually carry but the storing place is specified
- (3) Special tool ;  
Tools especially prepared by HINO Motor's Ltd. and the storing place is specified
- (4) Machine tool ;  
When measuring equipment and instrument are used, the time required to move parts to the specified place is included but the time waiting for tool is not included as a general rule

#### 12.2.2.2 WORKING PROCEDURE

The disassembly and assembly should be carried out according to working procedure prepared by HINO Motor's Ltd. Service Technical Dept. Training Group.

#### 12.2.2.3 STANDARD WORKMAN QUALIFICATION

Workmen shall basically acquire 2~3 years of maintenance experience of HINO

### 12.2.3 STANDARD TIME CONSTITUENT

#### 12.2.3.1 STANDARD WORKING TIME = NET WORKING TIME + STANDARD TIME + STANDARD ALLOWANCE TIME

- (1) Net working time  
The time workman works actually and the time required for measurement, cleaning, and so on is included, but the time required for troubleshooting is not included
- (2) Standard time  
Time required for preparation to the beginning of work, preparation of special tool, measuring equipment, parts and so on, and for the work site clean-up.
- (3) Standard allowance time  
Calculate the allowance time directly required for workmen from the following equation.  
Net standard time × HINO allowance rate  
Allowance rate varies within the range of 0.15 ~ 0.75 according to the work difficulty, contents, working position and so on.

### 13. MAINTENANCE STANDARD AND TEST PROCEDURE

Issue	Date of Issue	Applicable Machines	Remarks
First edition	October, 2006	SK250-8: LQ12-06001~ SK260LC-8 : LL12-05001~	S5LQ1314E01 (ASIA, OCE) K
↑	May, 2007	↑	↑ ASIA (HS Engine) K
↑	July, 2007	E265B : LQ12-06001~ E265BLC : LL12-05001~	↑ (NHK Russia) K
↑	↑	↑	↑ (NHK Middle East) K
↑	September, 2007	↑	↑ NHK Russia (HS Engine) K
↑	↑	↑	↑ NHK Middle East (HS Engine) K

- (3) Preparation
  - 1) Straight course more than 30m (108ft)
  - 2) Travel position in which the bottom of the bucket is lifted by about 30cm (1ft).
- (4) Measurement
  - 1) Measure the max. deviation distance of the circular arc in the 20m (66ft) length, excluding the preliminary run of 3~5m (10~16ft).
  - 2) Operate the travel lever at the same time.

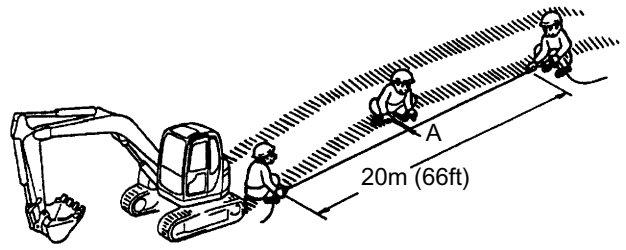


Fig. 13-15 Measuring method

Travel deviation		Unit : mm (in) / 20m (66ft)	
Measuring position	Standard value	Reference value for remedy	Service limit
A	240 (9.45) or less	480 (18.9)	720 (28.4)

**13.5.3 PERFORMANCES OF PARKING BRAKE**

- (1) Purpose
 

Confirm that the parking brake holds a stopped condition of the machine in a no-load travel position and on a 15 degree slope.
- (2) Condition
 

A slope with (Approx. 15 deg) gradient and a stopped condition in a no-load travel position
- (3) Preparation
 

Place an angle meter on the shoe plate and confirm that it makes an angle more than 15 degree. Hang a perpendicular in parallel with the guide frame rib on the track frame and put a mark (matching mark) on the shoe plate.
- (4) Measurement
 

Five minutes after the engine stops, measure the movement distance of the matching mark.

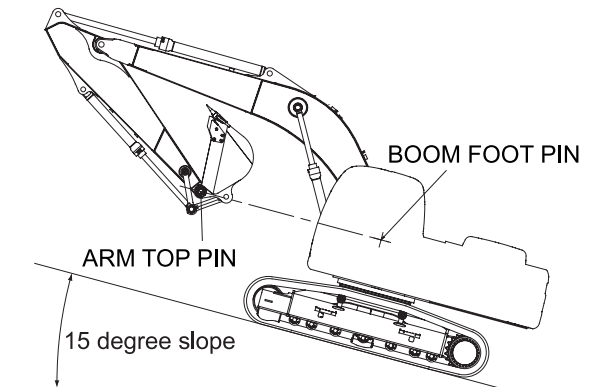


Fig. 13-16 Parking brake operating position

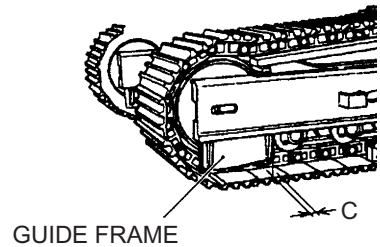


Fig. 13-17 Method of measurement

Parking brake		Unit : mm(in)/5min	
Measuring position	Standard value	Reference value for remedy	Service limit
C	0	1 (0.04)	2 (0.08)

### 13. MAINTENANCE STANDARD AND TEST PROCEDURE

#### (2) Adjustment of pump ("B" adjustment)

##### Procedure

1) The adjustment automatically shifts from engine to pump, the speed shifts from LOW idling to HIGH idling. And "MEMORY PUMP" is displayed. And the unloading proportional valve and pump proportional valve actuate, accordingly the loading of pump is increased.

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

2) After detection of the engine rated speed, the adjustment of pump is automatically completed. And "FINISH PUMP" is displayed.

(Press the buzzer stop switch on gauge cluster while this display is appeared and the adjustment is completed. The unloading adjustment required later is not performed, and default value is written.)

MEMORY PUMP		
ENGINE SPEED	2000rpm	
PUMP PRESSURE	C-1 2.0M C-2 2.0M	
PROPO-VALVE	E-1 300mA	E-2 300mA

FINISH PUMP		
ENGINE SPEED	2000rpm	
PUMP PRESSURE	C-1 35.0M	C-2 35.0M
PROPO-VALVE	E-1 300mA	E-2 300mA

#### (3) Adjustment of unloading valve ("C" adjustment)

##### Procedure

1) The adjustment shifts from pump to unloading, and the unloading valve actuates, accordingly the pump pressure is detected. And "MEMORY UNLOAD" is displayed.

The "ENGINE SPEED", P1, P2 "PUMP PRESSURE" and P1, P2 "PROPO-VALVE" voltage (command value) are indicated.

2) When the unloading valve operates to the specified value, the adjustment of unloading proportional valve is automatically terminated. And "FINISH UNLOAD" is displayed.

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

MEMORY UNLOAD		
ENGINE SPEED	2000rpm	
PUMP PRESSURE	C-1 2.0M	C-2 2.0M
PROPO-VALVE	D-1 300mA	D-2 300mA

FINISH UNLOAD		
ENGINE SPEED	2000rpm	
PUMP PRESSURE	C-1 2.0M	C-2 2.0M
PROPO-VALVE	D-1 300mA	D-2 300mA

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

#### (4) Corrective actions taken when the adjustment can not be performed;

1) In cases where the adjustment of engine can not be performed; And "ERROR ENG" is displayed.

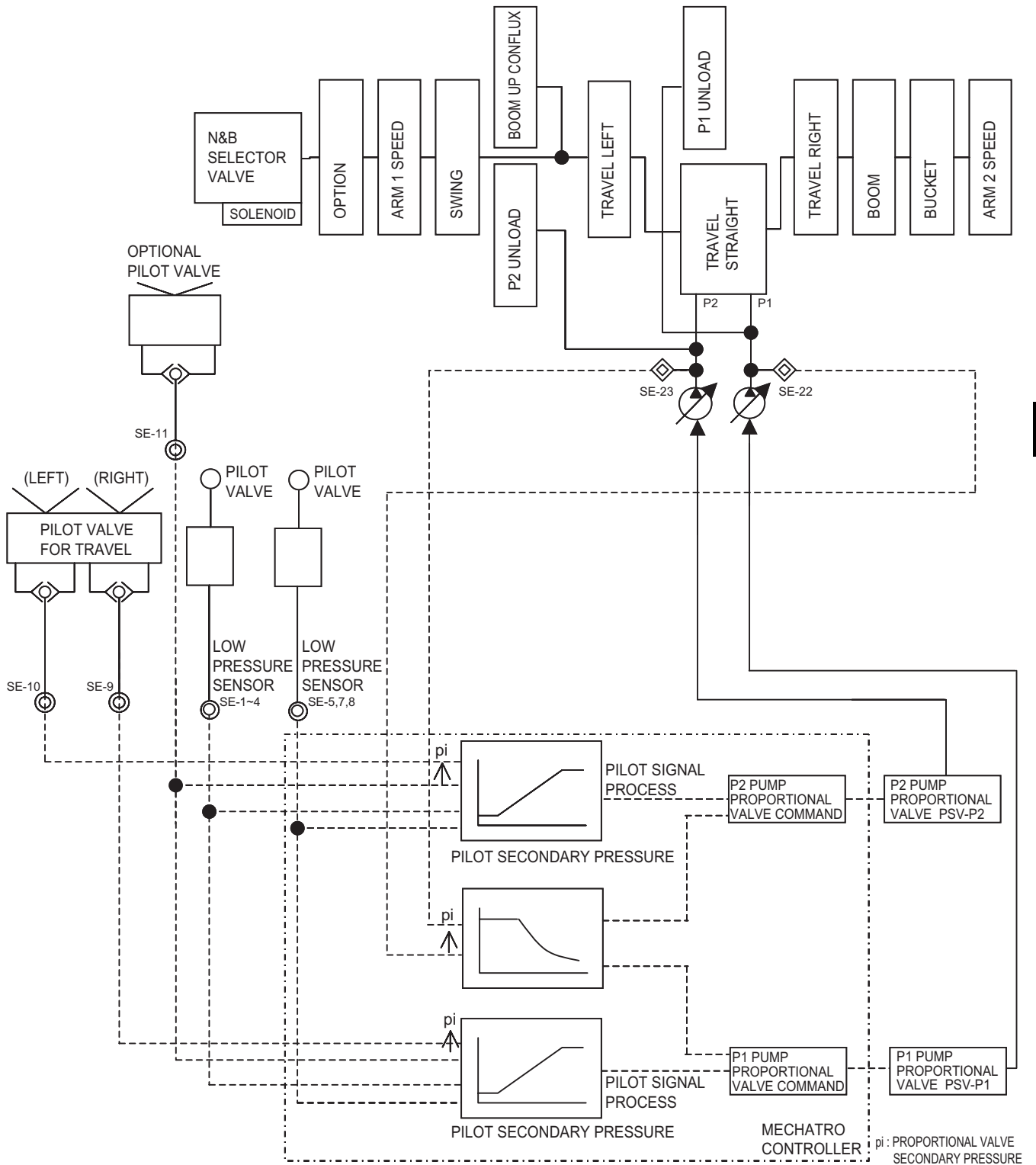
Judging condition: The read engine speed is 50rpm lower than the last value.

It is conceived that the error is caused by the speed read error, pump load applied to the engine and unusual acceleration command voltage applied to the engine controller in the course of adjustment.

- Checking speed sensor: Check that it is free from wrong reading of speed due to engine vibration.
- Checking load applied to pump: Check that it is free from abnormal increase of pump pressure during adjustment of engine through adjustment screen.
- Checking acceleration command voltage: Measure the acceleration command voltage output from mechatro controller to engine controller. Check that signal is regularly input to the engine controller by actual measurement of voltage or with failure diagnosis tool of engine controller.

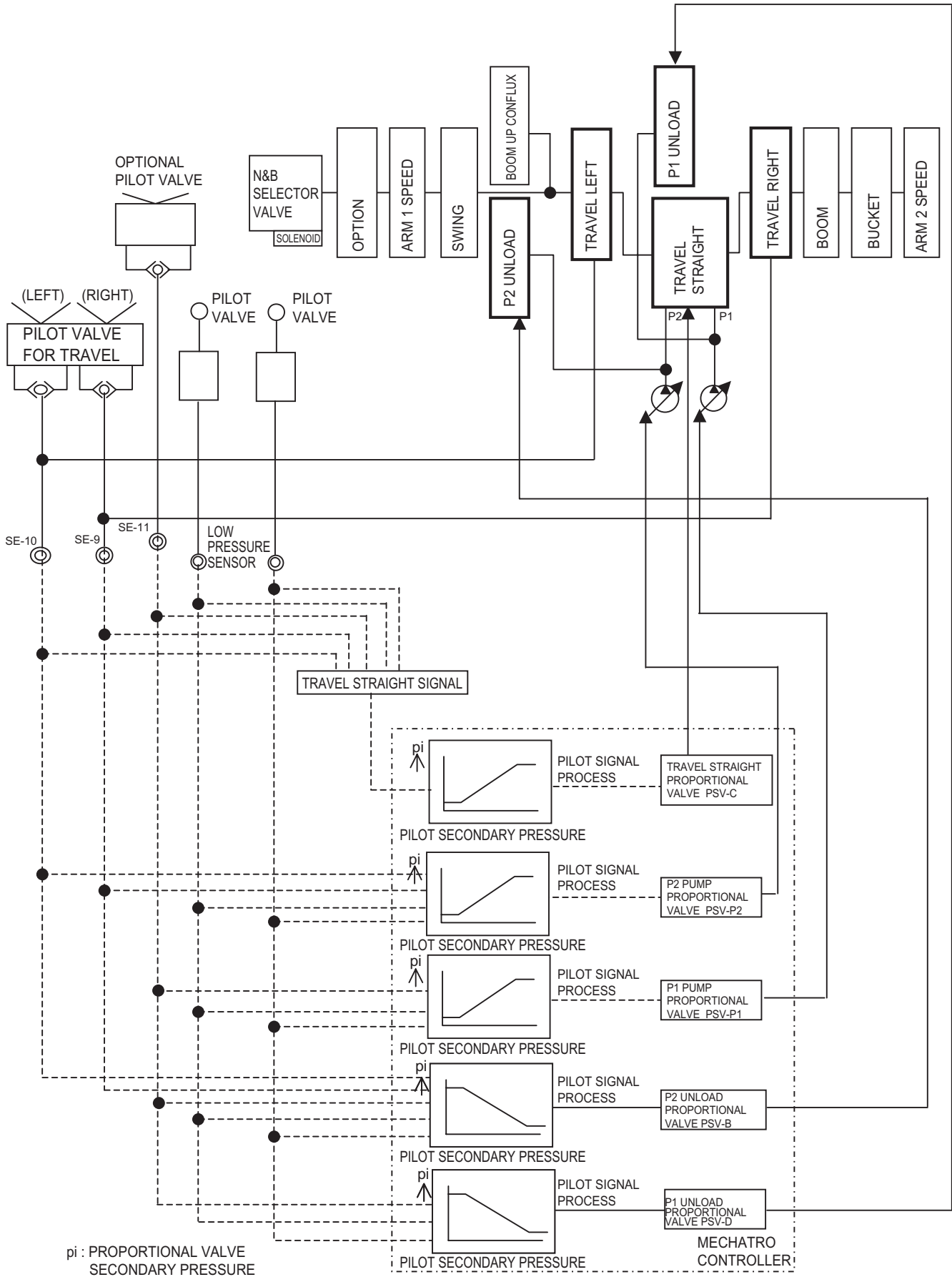
ERROR ENG.		
ENGINE SPEED	2000rpm	
PUMP PRESSURE	C-1 2.0M	C-2 2.0M
STEP	400	

21.1.3 POSITIVE CONTROL & P-Q CONTROL



# 21. MECHATRO CONTROL SYSTEM

## 21.1.11 TRAVEL STRAIGHT CONTROL



## ERROR CODE OF ENGINE

	ERROR CODE	POSSIBLE CAUSE	PROBLEM	PAGE FOR REFERENCE
SENSOR SYSTEM	P2228	Atmospheric pressure sensor malfunction (LOW)	Insufficient engine power	17-33
	P2229	Atmospheric pressure sensor malfunction (HI)	Insufficient engine power	17-33
	P0192	Common rail pressure sensor malfunction (LOW)	Insufficient engine power	17-24
	P0193	Common rail pressure sensor malfunction (HI)	Insufficient engine power	17-24
	P0191	Common rail pressure sensor malfunction	Insufficient engine power	17-23
	P0237	Boost pressure sensor malfunction (LOW)	Insufficient engine power	17-19
	P0108	Boost pressure sensor malfunction (HI)	Insufficient engine power	17-19
	P0117	Coolant temperature sensor malfunction (LOW)	Insufficient engine power	17-16
	P0118	Coolant temperature sensor malfunction (HI)	Insufficient engine power	17-16
	P0182	Fuel temperature sensor malfunction (LOW)	-	17-18
	P0183	Fuel temperature sensor malfunction (HI)	-	17-18
	P0335	Engine speed main sensor circuit malfunction	Engine does not start / Engine stopped.	17-12
	P0340	Engine speed sub sensor circuit malfunction	-	17-14
	P2120	Accelerator sensor 1 and 2 malfunction	Insufficient engine power (Low idle 800rpm fixing)	17-30
	P2122	Accelerator sensor 1 malfunction (LOW)	-	17-26
	P2123	Accelerator sensor 1 malfunction (HI)	-	17-26
	P2127	Accelerator sensor 2 malfunction (LOW)	-	17-28
	P2128	Accelerator sensor 2 malfunction (HI)	-	17-28
P1133	Emergency accelerator sensor malfunction high input	Normal operation	17-31	
SWITCH, RELAY SYSTEM	P0540	Preheat circuit malfunction (Open / GND short circuit)	Difficult to start engine.	17-50
	P0540	Preheat circuit malfunction (+B short circuit)	Difficult to start engine.	17-50
	P0617	Starter signal malfunction	-	17-53
	P0686	Main relay malfunction	-	17-53
SUPPLY PUMP SYSTEM	P0629	Supply pump SCV malfunction (Power source line short)	Engine does not start / Engine stopped.	17-43
	P0628	Supply pump SCV malfunction (Full discharge mode)	Low output	17-43
	P2635	Supply pump abnormal pressure record	-	17-45
	P2635	Supply pump SCV sticking	Low output	17-45
	P0088	Excessive common rail pressure	Low output	17-21
INJECTOR SYSTEM	P1211	Injector common 1 ground short	Low output	17-34
	P1214	Injector common 2 ground short	Low output	17-34
	P1212	Injector common 1 open circuit	Low output	17-36
	P1215	Injector common 2 open circuit	Low output	17-36
	P0201	Injector circuit malfunction-cylinder 1	Low output	17-38
	P0202	Injector circuit malfunction-cylinder 2	Low output	17-38
	P0203	Injector circuit malfunction-cylinder 3	Low output	17-38
	P0204	Injector circuit malfunction-cylinder 4	Low output	17-38
	P0263	Cylinder 1 contribution / balance fault	-	17-41
	P0266	Cylinder 2 contribution / balance fault	-	17-41
	P0269	Cylinder 3 contribution / balance fault	-	17-41
P0272	Cylinder 4 contribution / balance fault	-	17-41	
EGR SYSTEM	P0489	EGR solenoid 1 malfunction (Open circuit, ground line short)	Other problem	17-46
	P0490	EGR solenoid 1 malfunction (Power source line short)	Other problem	17-46
	P0404	EGR valve 1 stick	Other problem	17-47
	P0405	EGR lift sensor 1 circuit low input	Other problem	17-48
	P0406	EGR lift sensor 1 circuit high input	Other problem	17-48
TURBO CHARGER SYSTEM	P0234	Turbo charger over boost	Low output	17-21
ENGINE CONDITION	P0217	Engine over heat	Low output	17-17
	P0219	Engine over run	-	17-17
COMMUNICATION	U1001	Interruption of CAN communication (Machine)	-	
ECU SYSTEM	P0611	ECU charge circuit low input	Low output	17-52
	P0200	ECU charge circuit high input	Low output	17-52
	P0605	Flash ROM error	Low output	17-51
	P0606	CPU malfunction (Hard detection)	Engine does not start / Engine stopped.	17-51
	P0607	Monitoring IC malfunction in CPU	Low output	17-51
INJECTOR SYSTEM	P1601	Injector correction data conformity error	Low output	17-51
			-	
SUPPLY PUMP SYSTEM	P0088	Excessive common rail pressure, supply pump excess forced feed	Low output	17-22
SUPPLY PUMP SYSTEM	P2635	Supply pump malfunction	Low output	17-45

Note)

The numbers in the column of "page for reference" show the related page in Chapter 51 Engine.

## 21. MECHATRO CONTROL SYSTEM

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### 21.2.4 TROUBLE HISTORY DIAGNOSIS

The items of error detected by mechatro controller self diagnosis function are stored in mechatro controller as one of history. And the errors are able to be indicated on the multi display.

The warning content is record partially in "Travel history screen".

The error code for self diagnosis is stored.

#### (1) How to display

- 1) Turn starter switch on.
- 2) Press buzzer stop switch for 10 seconds continuously 5 times and the trouble history screen is displayed.

(Example)

No errors	NO ERROR	
Error detected in the past	1 0 5 3 0 H r	F 0 2 3
	8 5 0 0 H r	G 0 3 3
	3 0 0 0 H r	P 1 2 1 1
	1 5 0 0 H r	C 0 1 3

- 3) Transmit trouble history data (One or many) and hour meter to gauge cluster.
  - Hour meter and 4 failure data are displayed on screen.
  - In case of more than 4 failure data, 4 data is displayed at a time for 10 seconds by turns.
- 4) Paging (Up and down)
  - Press washer switch (▲), and the item moves upward.
  - Press wiper switch (▼), and the item moves downward.
- 5) Turn starter switch off, and the display is disappeared.

#### (2) How to delete contents of trouble history

- 1) Display trouble history screen.
- 2) Press work mode change switch and buzzer stop switch simultaneously for 10 seconds or more.
- 3) When "NO ERROR" is displayed, the deletion is completed.
- 4) Turn starter switch off.

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**Note**

All the stored items are erased. It is impossible to erase data partially.

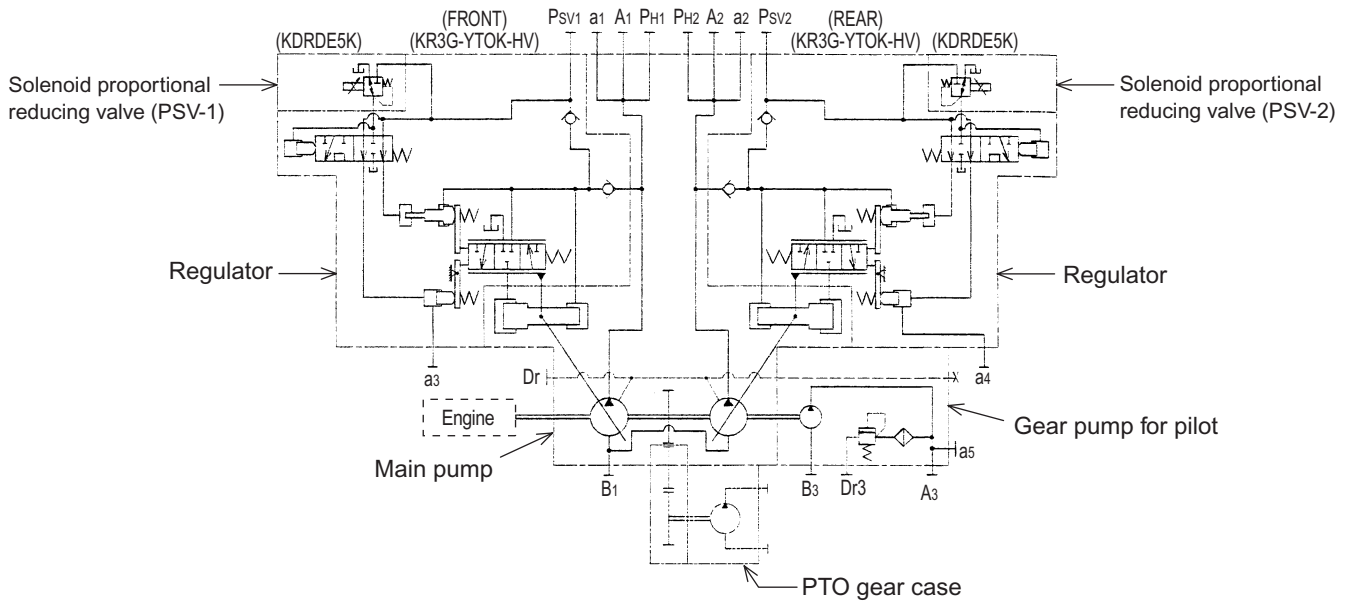
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Connector No.	Pin No.	Port name	Function	Input/putput	Signal level
CN108	1	DI 2	Key switch (ON)	Input	+24V / OPEN
	2	DI 4	Spare	Input	+24V / OPEN
	3	DI 5	Swing P/B release	Input	GND / OPEN
	4	DI 6	E/G start	Input	+24V / OPEN
	5	DI 7	High reach (hoisting at fixed position)	Input	GND / OPEN
	6	DI 16	Wiper rise up	Input	GND / OPEN
	7	DI 17	Wiper reverse	Input	GND / OPEN
	8	DI 18	ATT boost	Input	GND / OPEN
	9	DI 19	Nibbler open check SW	Input	GND / OPEN
	10	DI 21	Elevator cab up check	Input	+24V / OPEN
	11	DI 22	Spare	Input	+24V / OPEN
	12	DI 23	Lever lock	Input	+24V / OPEN
	13	DI 24	Hand control rotation / clamp open or close	Input	GND / OPEN
	14	DI 25	Front window open or close	Input	GND / OPEN
	15	DI 26	Hand control breaker	Input	GND / OPEN
	16	DI 27	Conflux/single select	Input	GND / OPEN
	17	DI 29	Overload select	Input	GND / OPEN
	18	DI 30	High reach (hoist at travel)	Input	GND / OPEN
	19		Reserved		
	20	GP			
	21	DI 33	Charge	Input	~12V / 12V~
	22	DI 34	Spare	Input	+24V / OPEN
	23	DI 35	Spare	Input	+24V / OPEN
	24		Reserved	Reserved	
	25	H1+	Accel signal 1		0~5V
	26	H2-			0V
	27	H2+	Accel signal 2		0~5V
	28	H2-			0V

Connector No.	Pin No.	Port name	Function	Input/putput	Signal level
CN109	1	DO 1	Wiper arc prevention	Output	GND / OPEN
	2	DO 2	Wiper normal moving	Output	GND / OPEN
	3	DO 3	Wiper reserve moving	Output	GND / OPEN
	4	DO 4	Washer motor	Output	GND / OPEN
	5	DO 5	Bucket move limitation	Output	GND / OPEN
	6	DO 6	Reserved	Output	GND / OPEN
	7	DO 12	Rotary light (RH)	Output	GND / OPEN
	8	DO 13	Swing flasher (RH)	Output	GND / OPEN
	9	DO 14	Swing flasher (LH)	Output	GND / OPEN
	10	DO 15	Travel alarm	Output	GND / OPEN
	11	DO 16	Auto idle stop relay	Output	GND / OPEN
	12	DO 17	Engine stop	Output	GND / OPEN
	13	DO 18	Lever lock	Output	GND / OPEN
	14	DO 19	Extra pressure release	Output	GND / OPEN
	15		Reserved		
	16	GP	IT controller		0V
	17	TXD2		Transmission	RS232C communication
	18	RXD2		Reception	RS232C communication
	19	RTS	Spare		RS232C communication
	20	CTS	Spare		RS232C communication
	21	SHG2			Shiled GND
	22	DO 10	Cab up and down switching valve	SV	24V/OPEN

## 24. COMPONENTS SYSTEM

### (2) Hydraulic circuit diagram



**Fig. 24-2 Hydraulic circuit diagram of pump**

### (3) Specifications

Item		Main pump		Gear pump
		STD	OPT.	
Parts No.	Pump assy	LQ10V00018F1	LQ10V00019F1	—
	Single Pump	LQ10V00021F1		YN10V00014F3
Pump model		K3V112DTP1L9R-YT1K-HV		ZX10LGRZ2-07G
Max. displacement capacity		cm <sup>3</sup>		10
Revolution	Rated	min-1 (Clockwise seen from shaft end)		←
Pressure	Rated	MPa (psi)		5.0 (725)
	ATT boost pressure	37.8 (5480)		
Max. flow		L/min (gal/min)		21 (5.5)
Max. input horse power		kW (PS)		3.4 (4.6)
Max. input torque		N·m (lbf·ft)		14.7 (10.8)
Regulator	Part No.	LQ10V01005F1		
	Model	KR3G-YT1K-HV		
	Control function	Electric flow control, positive flow control, total power control at emergency mode and power shift control		
	Others	With solenoid proportional reducing valve (KDRDE5K-31/30C50)		
Weight	kg (lb)	141 (310)	147 (324)	

- a. Overload prevention operation (See Fig. 24-14)  
 Because the delivery pressure Pd1 acts on the compensating rod stepped section with the rise of self pump delivery pressure Pd1 the compensating rod (623) is pushed towards (M), and moves to the position the delivery pressure Pd1 balances the spring force of outer spring (625) and inner spring (626). The movement of compensating rod is transferred to lever 1 (612) through pin (875), and rotates at (N) fulcrum in arrow direction. Furthermore the lever 1 (612) movement is transferred to feedback lever (611) through pin (897) and rotates at (O) fulcrum in the same arrow direction as (N). Consequently the spool (652) connected with feedback lever moves towards (P). When the spool moves towards (P), the delivery pressure Pd1 is led in servo piston large bore diameter chamber through spool and CL port. Since the delivery pressure Pd1 is constantly led to servo piston large bore diameter chamber, the servo piston moves towards (Q) according to the difference of area, resulting in the reduction of tilt angle, consequently the flow rate is also reduced. Since the feed back lever is connected with servo piston and spool, the feed back lever rotates at (R) fulcrum with the movement of the servo piston towards (Q), consequently the spool is returned to the original position. With this movement, the opening of spool sleeve gradually closes, and the servo piston stops at the position the opening closes completely.

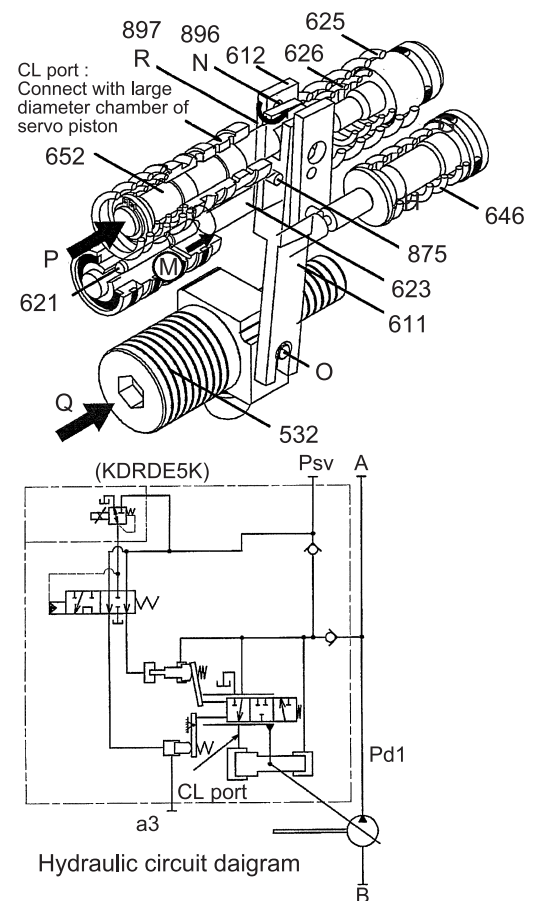


Fig. 24-14

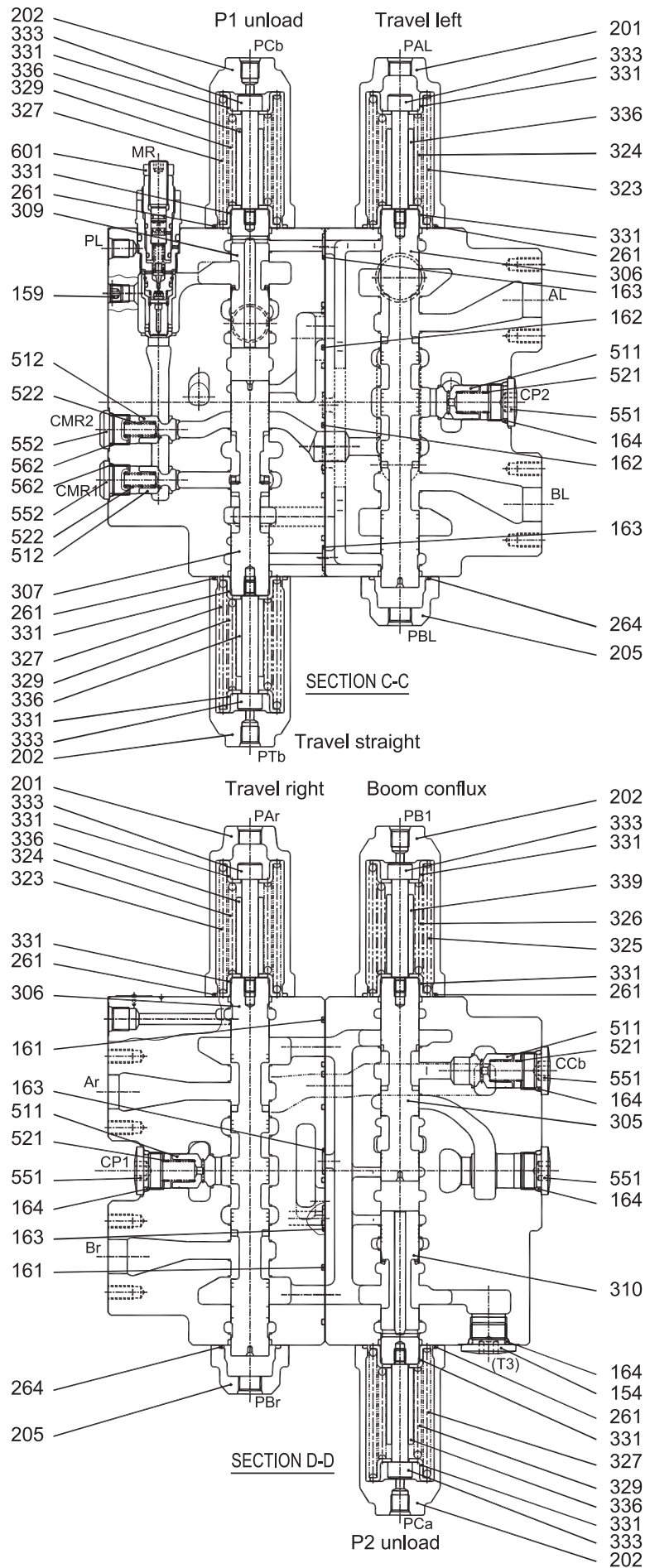


Fig. 24-25 Section (3/6)

(9) Boost check valve (517)

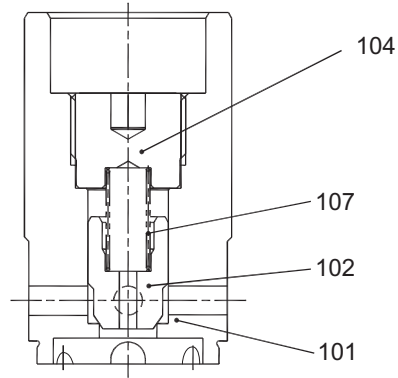


Fig. 24-36 Boost check valve

Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty	Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty
	101	Poppet	1	20~29 (15~21) Loctite #262	104	Plug	1
	102	Poppet	1		107	Spring	1

2) In arm in operation (At light load: arm recirculation function)

On starting arm in operation, the pilot pressure enters ports PAa1 and PLc2, and arm 1 spool (302) moves leftward 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, since the spool of lock valve selector (211) is switched, the spring chamber of lock valve poppet CRar (514) is connected to the drain circuit and the retention of poppet (514) is released.

And the pilot pressure enters PAa2 through solenoid proportional valve [XR], and arm2 spool (308) moves leftward against the force of springs (321) (328) and the secondary pressure of solenoid proportional valve [X1] acts on port PCb and switches unloading spools (309). But in light load operation, because the solenoid proportional valve [XR] actuates and arm 2 spool (308) stays in the position of circuit (I).

The hydraulic oil delivered by hydraulic pump P2 flows into parallel passage (56), pushes and opens load check valve LCa (511), and flows into port (Aa) through between the perimeter of arm 1 spool (302) and casing through U-shaped passage. In the meantime, the hydraulic oil delivered by hydraulic pump P1 flows through center by-pass passage (52) and pushes and opens load check valve LCAT2 (511) and enters U-shaped passage, and also the oil from parallel passage (53) pushes and opens load check valve LCAP2 (515) provided with orifice and flows into U-shaped passage. And then the hydraulic oil flows through between the perimeter of arm 2 spool (308) and casing from U-shaped passage and enters port (Aa) through casing inside passage (HH) and conflues the hydraulic oil from hydraulic pump P2 side.

The confluent hydraulic oil is supplied to arm cylinder head side (H) through port (Aa).

In the meantime, the return oil from arm cylinder rod side (R) enters the control valve through port (Ba). Because the retention of lock valve poppet CRar (514) which is located on this side of arm 1 spool (302) is released, the return oil pushes and opens lock valve poppet CRar (514) and enters AR chamber. The return oil in AR chamber is led to arm 2 spool (308) through arm 1 spool (302) and casing inside passage (RR), but because arm 2 spool (308) does not connect to low pressure passage (D) at circuit (I), the entire flow rate flows into arm 1 spool (302).

The return oil from chamber AR passes through the perimeter of arm 1 spool (302) and casing, and flows through casing inside passage (RH) and is led to the inside of arm 2 spool (308) through circular notch (a) of arm 2 spool (308). In light load operation, since the return oil contains higher pressure than that of arm cylinder head side (H) with the self weight of arm, etc. the hydraulic oil inside of arm 2 spool (308) passes through check valve (317) and flows into casing inside passage (HH) and the supplied to arm cylinder head side (H) again. (Arm recirculation function)

And a part of the return oil which was led to arm 2 spool (308) passes through check valve (319), and flows through boost check valve (517) through load pressure circuit (D) and returns to the hydraulic tank through tank port T1.

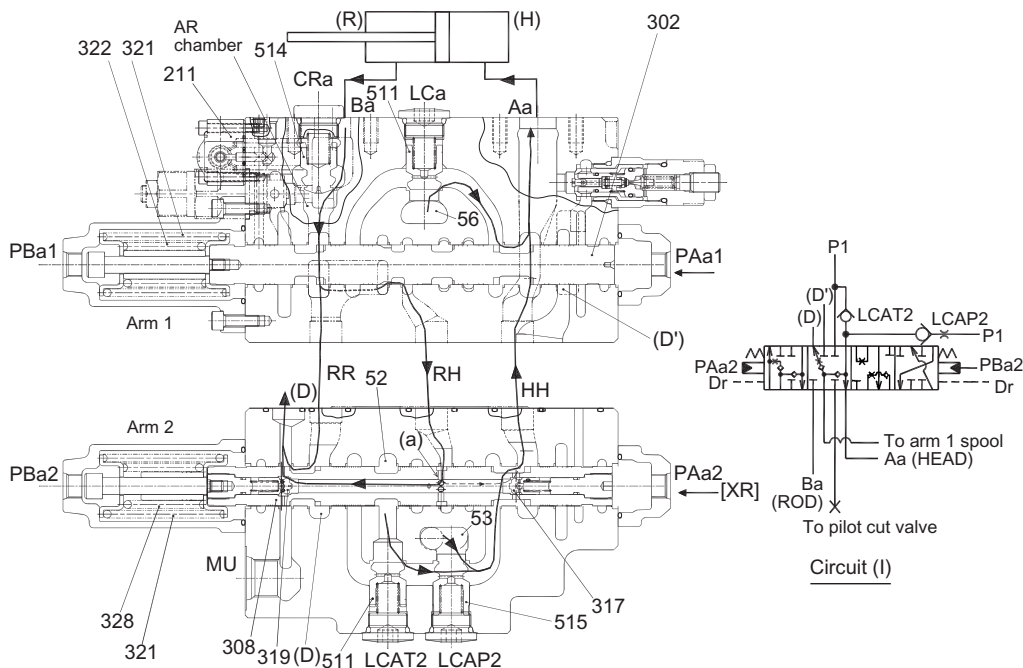
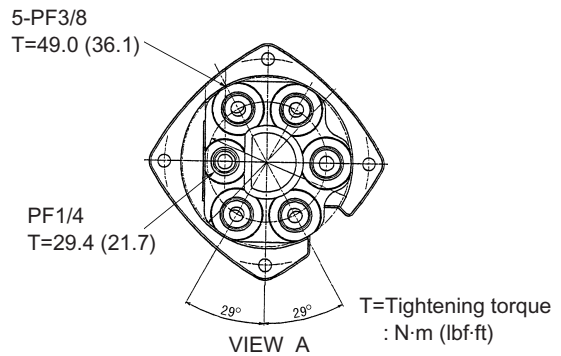
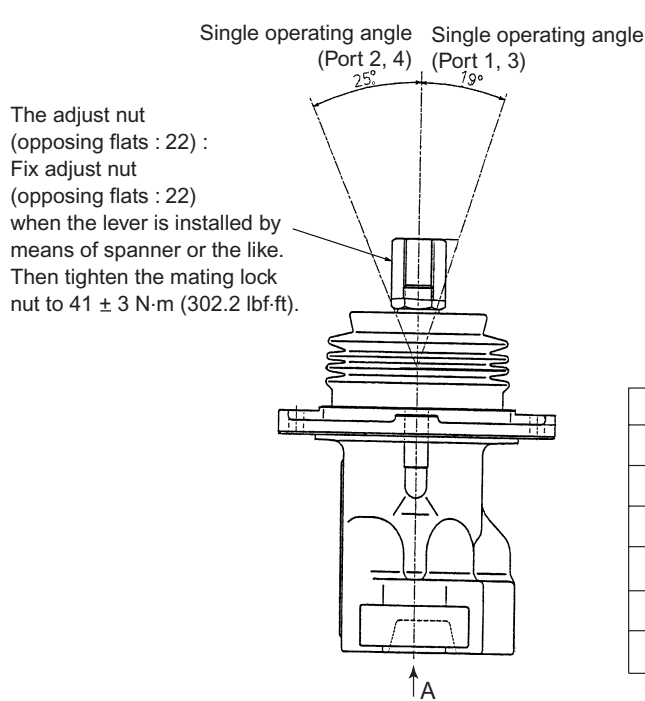


Fig. 24-47 In arm in operation (At light load: arm recirculation function)

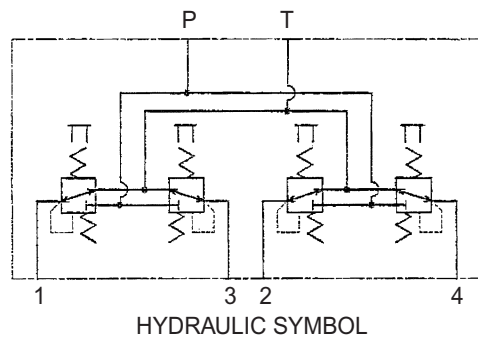
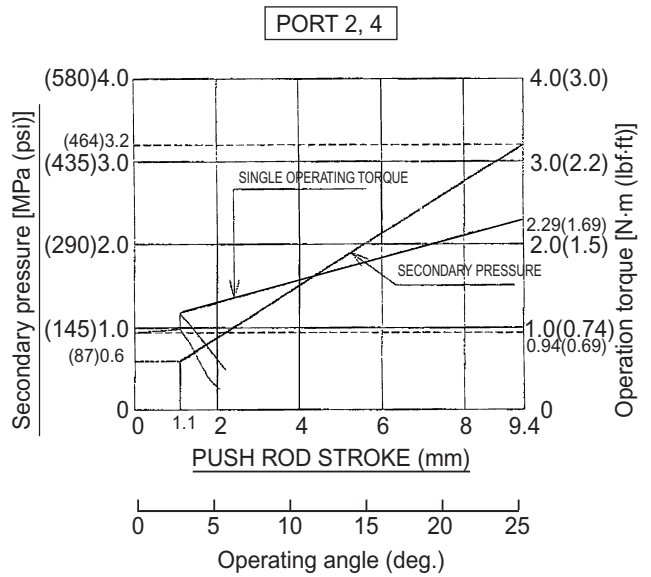
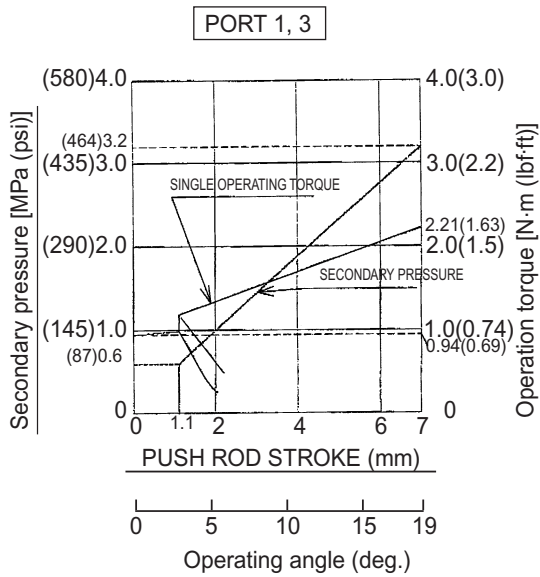
24.1.3 PILOT VALVE (ATT)

24.1.3.1 OUTLINE

(1) Outside view



Part No.	YN30V00111F1
Model	PV48K2004
Operating torque	Refer to the curve below
Max. primary pressure	6.9 MPa (1000 psi)
Primary pressure	5.0 MPa (725 psi)
Rated flow	20 L/min (5.3gal/min)
Weight	Approx. 1.9 kg (4.2 lbs)



## 24. COMPONENTS SYSTEM

### 24.1.5.3 OPERATION

#### 24.1.5.3.1 OPERATION OF HYDRAULIC MOTOR

##### (1) Swing motor

The pressure oil fed by the pump via the control valve, etc. enters the motor through port A (or port B) installed on cover (32), and is discharged from port B (or port A).

Also the oil leaking through the sliding section or clearance returns to the tank through drain port Dr installed on cover (32).

The pressure oil fed to port A goes through passage (b) inside of cover (32) and to the passage on bushing (20) section installed cover, then is fed to piston bore (f) on the cylinder through balance plate (21) passage (b) which contains crescent shaped port switching supply and discharge by 180° degree of core rotation of motor, and cylinder (24) passage (e).

The pressure oil exerts on piston assy (7), then the piston assy is pushed against cam plate (5) through a part of the shoe. Since the shoe sliding surface of cam plate (5) is inclined at a uniform angle, the pushing force of piston assy (7) on which pressure oil is exerted is converted into sliding power for the shoe on the swash plate. In addition, the shoe bulb is similarly joined to universal joint. As a result, the shoe sliding power on the swash plate is converted into rotating power through piston assy (7) and cylinder assy (24) and transmitted to the motor output shaft section.

In this way, every piston assy (7) receives the pressure oil within the stroke from top dead point to bottom dead point on a grade, the oil pressure is converted to rotating power to rotate cylinder assy (24), resulting in discharging oil in the stroke from bottom dead end and top dead point.

The discharge line function in reverse of the supply line, and the oil is discharged from port B.

As described above, the hydraulic motor is operated, and the output torque of hydraulic motor is determined by oil pressure, and speed of revolution by supply flow rate.

##### (2) Parking brake

Separator plate (8) is fitted to the external section of cylinder assy (24) with spline.

Friction plate (9) is fitted to housing (25). When the primary pilot pressure of brake release port is Zero, brake piston (11) locks the cylinder (24) (output shaft) which is rotated by the force of the spring (13) pushing separator plate and friction plate.

Conversely, when pressure of 3.2 to 4.9 MPa (464 to 710 psi) exerted on the brake relief port, brake piston power exceeds the force of spring and strokes to the contact with cover end. Then space is generated between mating parts, and the mechanical brake released.

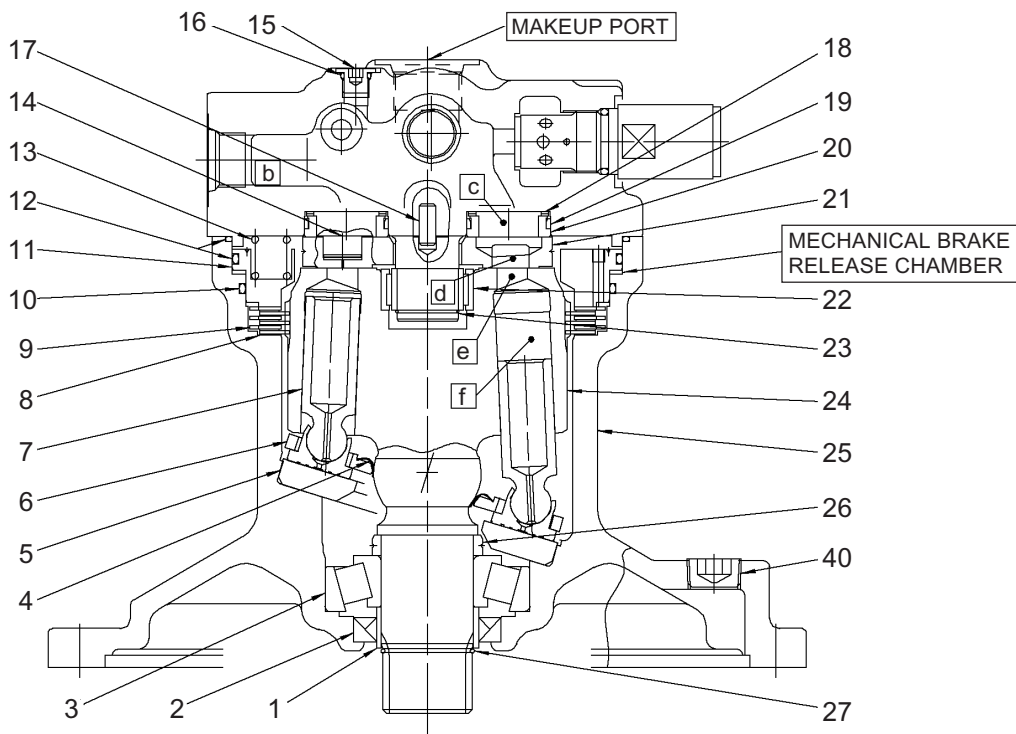


Fig. 24-61 Operation of swing motor

## 4) Braking of piston motor (See Fig. 24-72)

The double counter balance valve composes the brake circuit with the crossover relief valve.

By returning the control valve to the neutral position, the pressure oil from the hydraulic pump is cut, and the pressure of P1 and P2 becomes equal. And plunger (3) returns to the neutral position and the opening area of oil passage B becomes smaller.

On the other hand, the piston motor tries to further rotate due to the inertia energy of the outer load (pumping action of piston motor), and consequently the pressure of M2 port rises and acts on the piston motor to brake it to stop the revolution.

Then, when the pressure in M2 port side reaches to the set pressure of relief valve (17), poppet (17-2) on M1 port side moves leftward resisting the spring (17-5) to escape the pressure oil in M1 port side. Consequently, the shock pressure due to the inertia energy in M2 port side is controlled and concurrently the generation of vacuum in M1 port side is prevented.

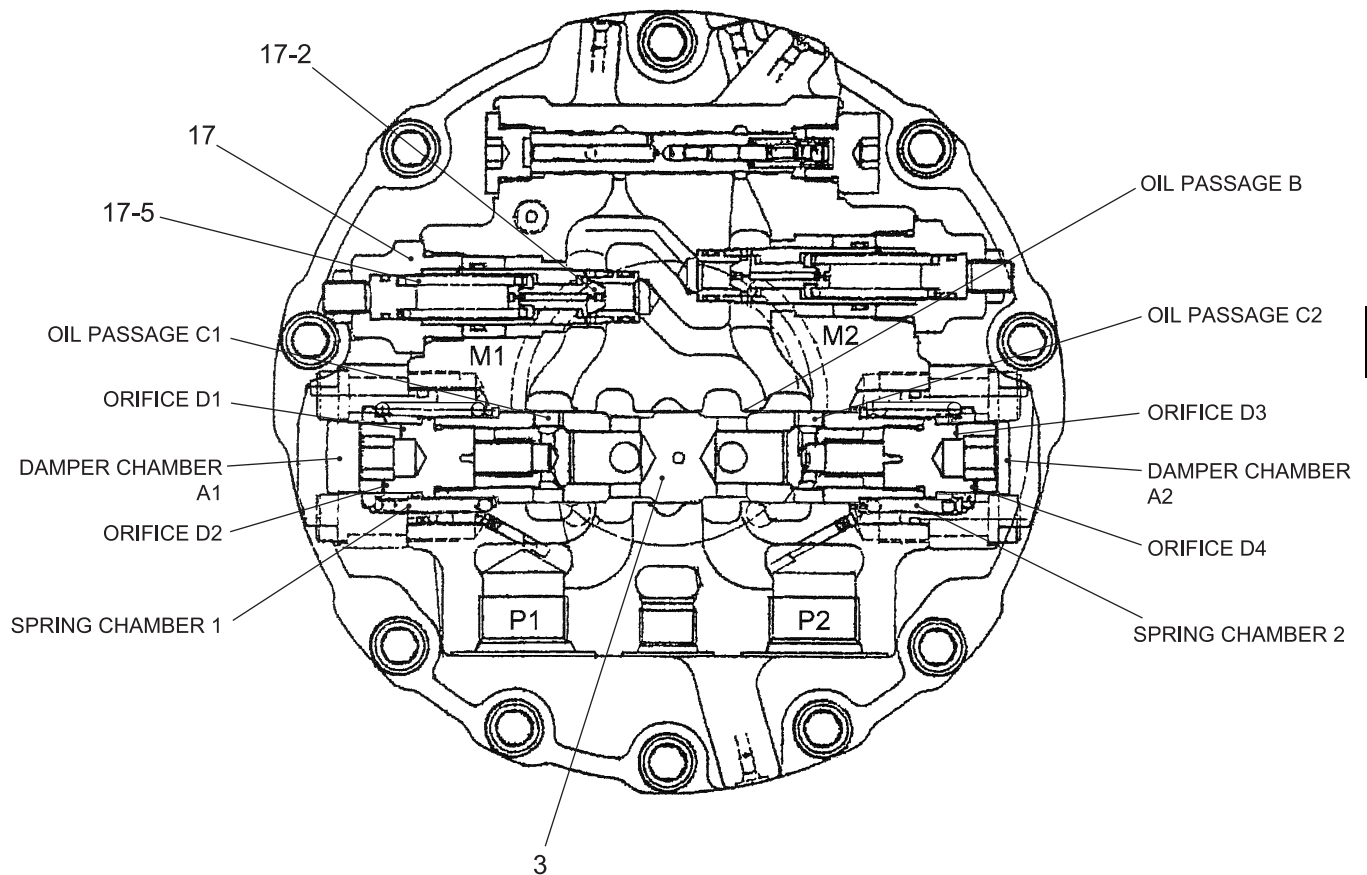


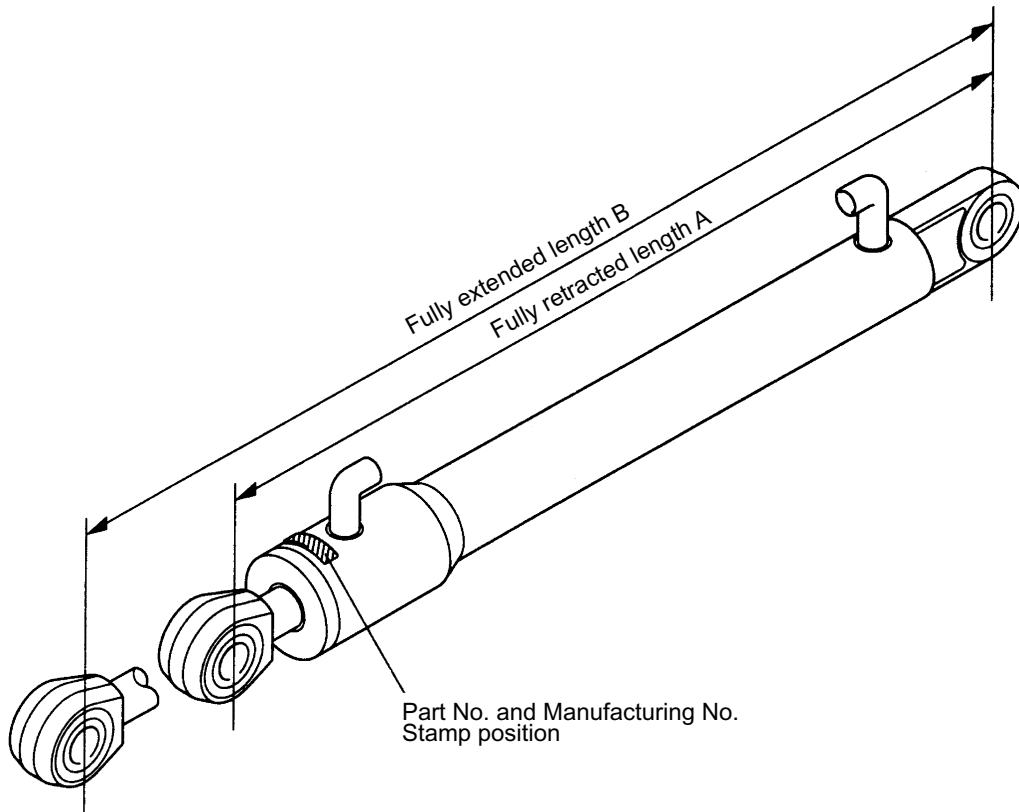
Fig. 24-72 Double counter balance valve and relief valve when piston motor is braked.

## 24. COMPONENTS SYSTEM

### 24.1.8 CYLINDER

#### 24.1.8.1 SPECIFICATIONS

(1) General view

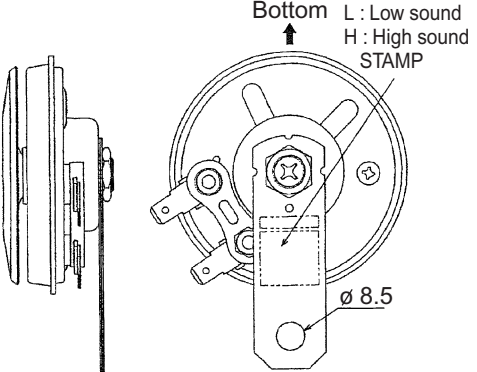
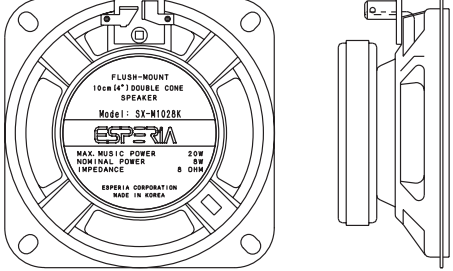
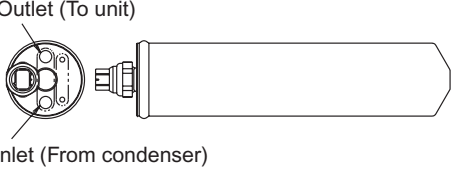


**Fig. 24-86 General view of cylinder**

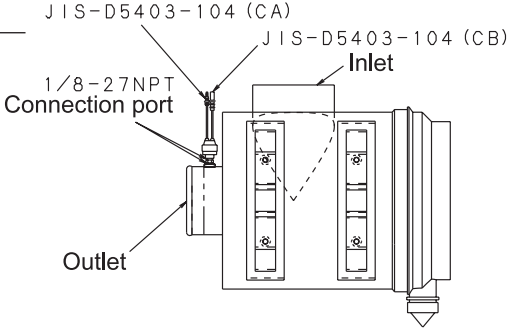
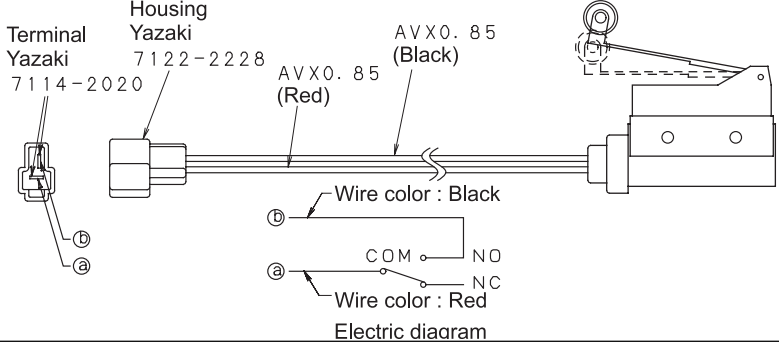
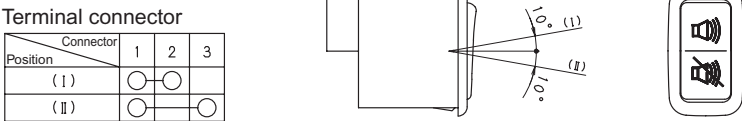
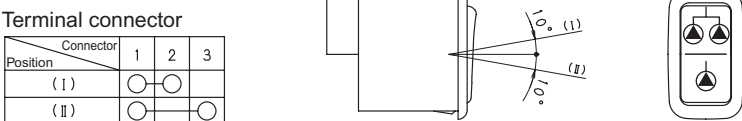
(2) Specifications

Unit : mm (ft-in)

Use	Part No. of cylinder assy	Cylinder bore / Rod Dia.	Stroke	Center distance of pins Full extend B / Full retract A	Cushion	Dry weight kg (lbs)
Boom	LQ01V00028F1	ø135 / ø95 (5.31" / 3.74")	1,235 (4-1)	3,045 / 1,810 (19-12 / 5-11)	With cushion on rod side R-50	223 (492)
Arm	LQ01V00038F2	ø145 / ø105 (5.71" / 4.13")	1,635 (5-4)	3,856 / 2,221 (12-8 / 7-3)	With cushion on both sides H-40,R-60	331 (730)
Bucket	LQ01V00030F2	ø125 / ø85 (4.92" / 3.35")	1,200 (3-11)	2,962 / 1,762 (9-9 / 5-9)	With cushion on rod side R-50	192 (423)

File No. Name of part Part No. Use Applicable Machine	Specification	Description														
E - 5, 6 Horn LC53S0001D1 (High) LC53S0001D2 (Low) Warning sound YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	<table border="1"> <tr><td>Type</td><td></td></tr> <tr><td>Rated voltage</td><td>DC24V</td></tr> <tr><td>Operating voltage range</td><td>DC20~30V</td></tr> <tr><td>Sound level</td><td>113±5dB(A)/2m</td></tr> <tr><td>Basic frequency</td><td>420±20Hz high sound 350±20Hz low sound</td></tr> <tr><td>Insulation resistance</td><td>More than 3MΩ /DC500V</td></tr> </table>	Type		Rated voltage	DC24V	Operating voltage range	DC20~30V	Sound level	113±5dB(A)/2m	Basic frequency	420±20Hz high sound 350±20Hz low sound	Insulation resistance	More than 3MΩ /DC500V			
Type																
Rated voltage	DC24V															
Operating voltage range	DC20~30V															
Sound level	113±5dB(A)/2m															
Basic frequency	420±20Hz high sound 350±20Hz low sound															
Insulation resistance	More than 3MΩ /DC500V															
E - 8, 9 Speaker YN54S00006P1 Radio YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	<table border="1"> <tr><td>Model</td><td>SX-M1028K</td></tr> <tr><td>Rated input</td><td>8W</td></tr> <tr><td>Impedance</td><td>8Ω</td></tr> <tr><td>Frequency</td><td>33.3Hz</td></tr> </table>	Model	SX-M1028K	Rated input	8W	Impedance	8Ω	Frequency	33.3Hz							
Model	SX-M1028K															
Rated input	8W															
Impedance	8Ω															
Frequency	33.3Hz															
E - 10 Receiver dryer YN54S00041P1 Air-con YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	<table border="1"> <tr><td>Maker</td><td>Sanden Corp.</td></tr> <tr><td>Airtight test pressure</td><td>3.5MPa (508 psi)</td></tr> <tr><td>Pressure proof test pressure</td><td>5.3MPa (769 psi)</td></tr> <tr><td>Breaking test pressure</td><td>9.8MPa (1420 psi)</td></tr> <tr><td>Desiccant moisture adsorption capability</td><td>17% or over than the weight of desiccant (Include initial absorption 2%)</td></tr> <tr><td>Refrigerant</td><td>HFC-134a</td></tr> <tr><td>Inner volume/Desiccant</td><td>578cm<sup>3</sup>/300g</td></tr> </table>	Maker	Sanden Corp.	Airtight test pressure	3.5MPa (508 psi)	Pressure proof test pressure	5.3MPa (769 psi)	Breaking test pressure	9.8MPa (1420 psi)	Desiccant moisture adsorption capability	17% or over than the weight of desiccant (Include initial absorption 2%)	Refrigerant	HFC-134a	Inner volume/Desiccant	578cm <sup>3</sup> /300g	
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Refrigerant	HFC-134a															
Inner volume/Desiccant	578cm <sup>3</sup> /300g															

## 24. COMPONENTS SYSTEM

File No. Name of part Part No. Use Applicable Machine	Specification	Description						
SW - 8 Switch YR11P0008S005 Air cleaner Clogging switch YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	<table border="1" data-bbox="438 365 906 439"> <tr> <td>Maker's P/No.</td> <td>REX018171</td> </tr> <tr> <td>Air cleaner</td> <td>LC11P00018F1</td> </tr> </table>	Maker's P/No.	REX018171	Air cleaner	LC11P00018F1			
Maker's P/No.	REX018171							
Air cleaner	LC11P00018F1							
SW - 11 Switch YN50S00041F1 Lock lever YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	<table border="1" data-bbox="438 790 906 831"> <tr> <td>Model</td> <td>OMRON D4MC-2000</td> </tr> </table>  <p>Electric diagram</p>	Model	OMRON D4MC-2000					
Model	OMRON D4MC-2000							
SW - 13 Switch YN50S00040DF Travel alarm (Middle East) YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	<table border="1" data-bbox="438 1220 906 1361"> <tr> <td>Rated voltage</td> <td>DC 24V</td> </tr> <tr> <td>Type</td> <td>Single pole single throw (alternate)</td> </tr> <tr> <td>Insulation resistance</td> <td>More than 1MΩ / DC500V megger</td> </tr> </table>	Rated voltage	DC 24V	Type	Single pole single throw (alternate)	Insulation resistance	More than 1MΩ / DC500V megger	
Rated voltage	DC 24V							
Type	Single pole single throw (alternate)							
Insulation resistance	More than 1MΩ / DC500V megger							
SW - 15 Switch YN50S00040DD Conflux / single flow switching (OPT) YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	<table border="1" data-bbox="438 1650 906 1792"> <tr> <td>Rated voltage</td> <td>DC 24V</td> </tr> <tr> <td>Type</td> <td>Single pole single throw (alternate)</td> </tr> <tr> <td>Insulation resistance</td> <td>More than 1MΩ / DC500V megger</td> </tr> </table>	Rated voltage	DC 24V	Type	Single pole single throw (alternate)	Insulation resistance	More than 1MΩ / DC500V megger	
Rated voltage	DC 24V							
Type	Single pole single throw (alternate)							
Insulation resistance	More than 1MΩ / DC500V megger							

25.3 PIPING

25.3.1 AIR CONDITIONER

NOTE

1. Apply oil for refrigerant R134a to the O-rings of all air-conditioner hose fittings.
2. Refrigerant volume :  $900 \pm 50\text{g}$
3. T : Tightening torque N·m(lbf·ft)

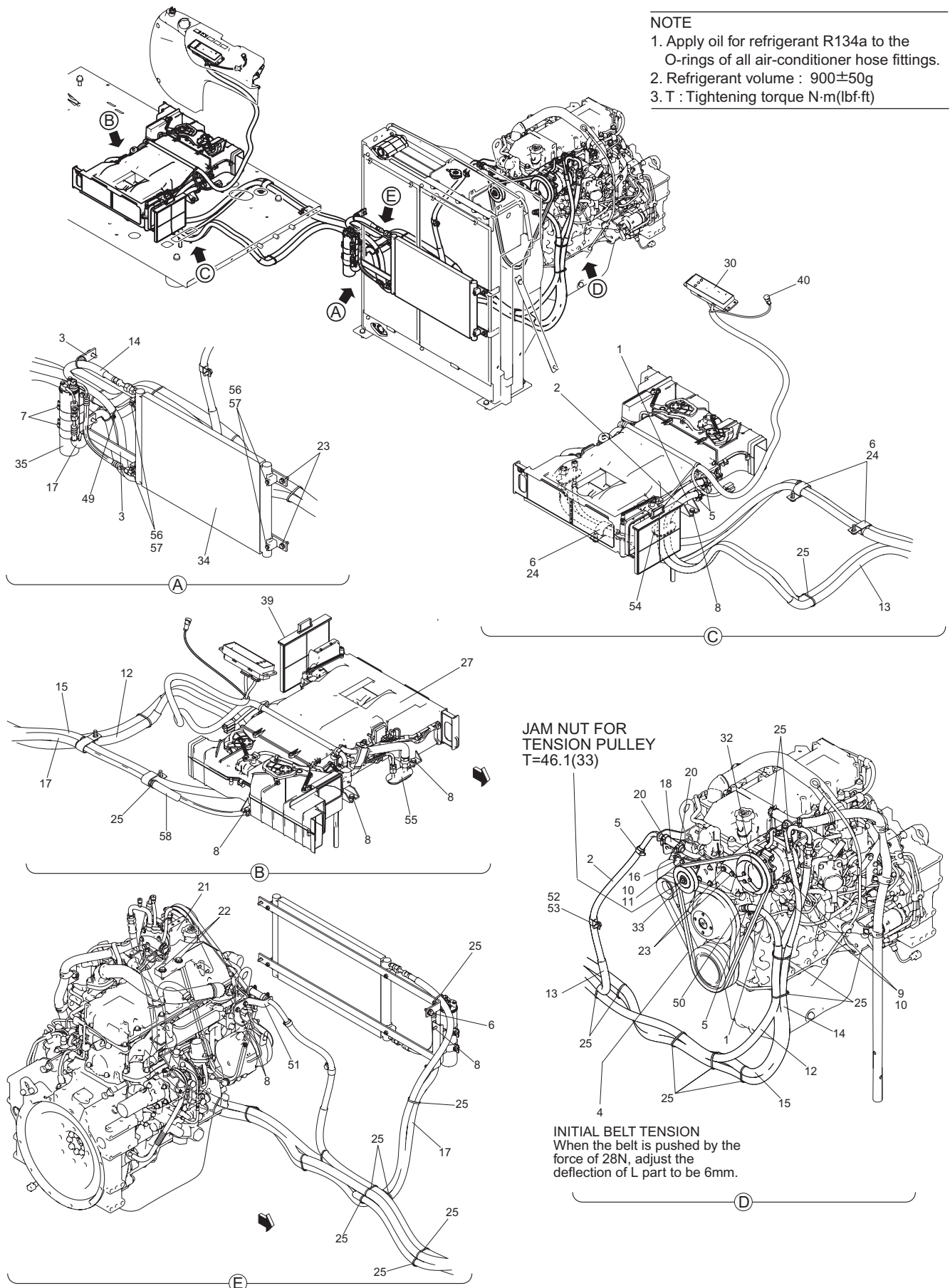


Fig. 25-5

## 25. AIR-CONDITIONER SYSTEM

### 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.

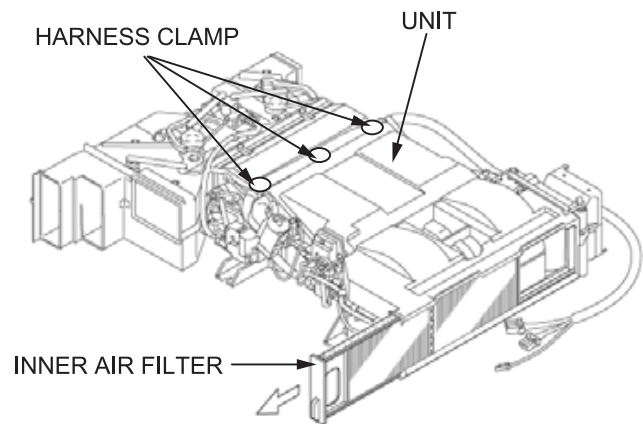


Fig. 25-15

#### (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.

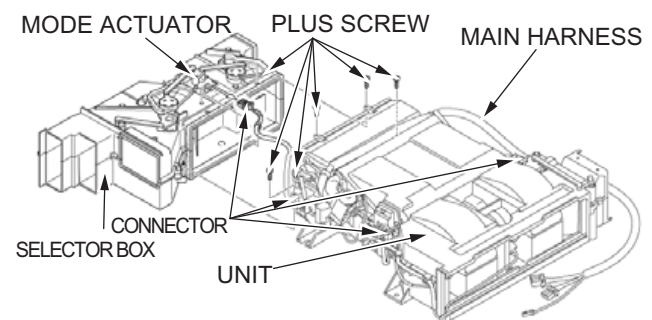


Fig. 25-16

#### (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.

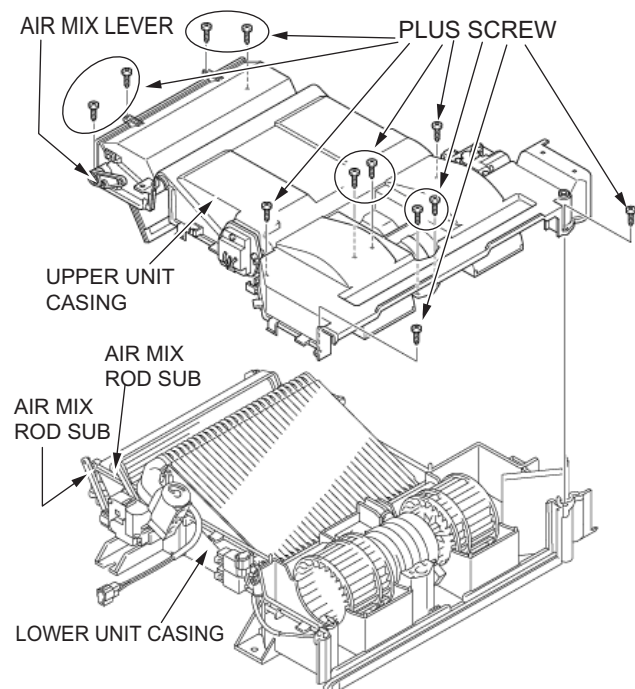
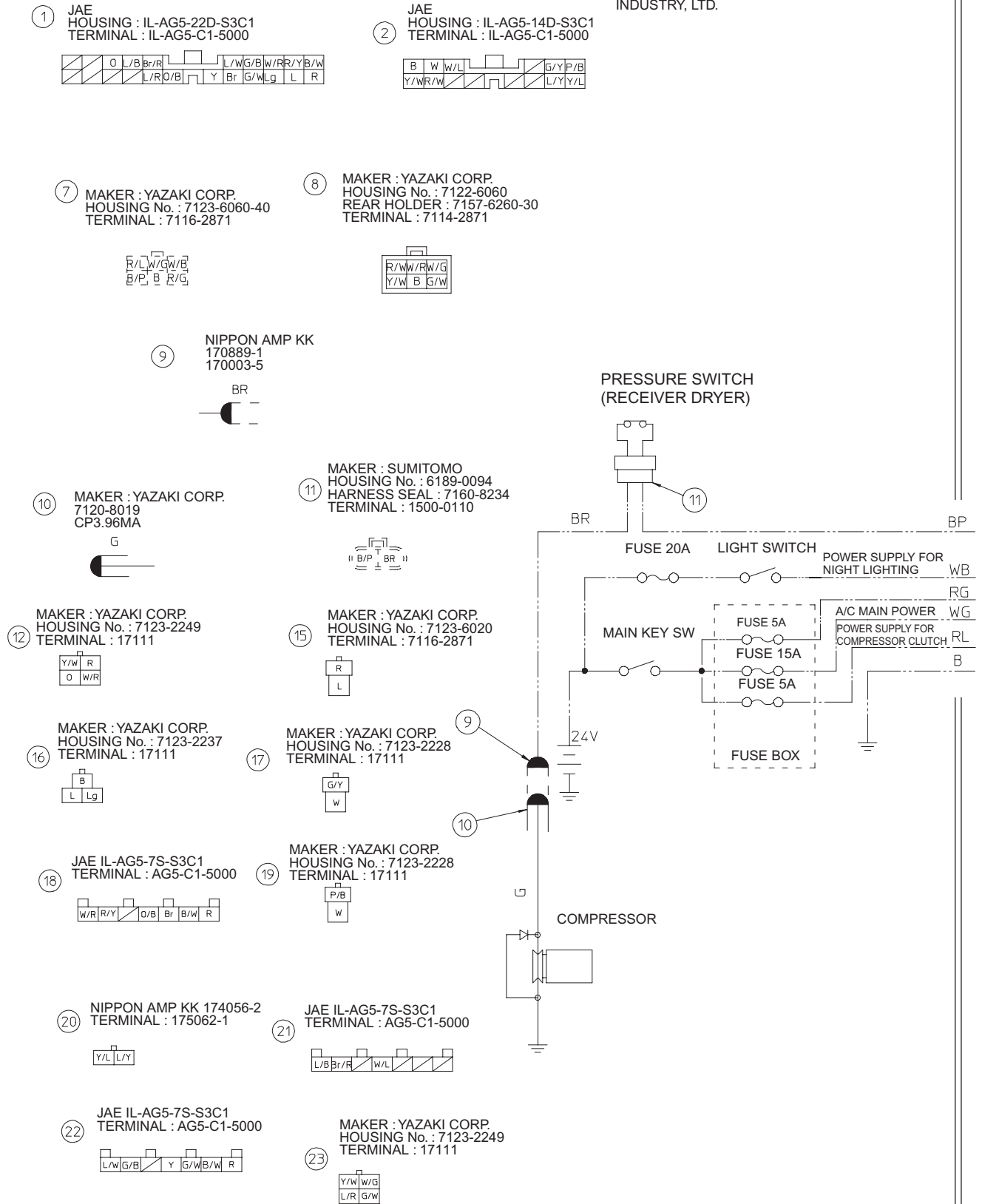


Fig. 25-17

25.7 ELECTRIC CIRCUIT

25.7.1 WIRING DIAGRAM AND CONNECTORS

JAE : JAPAN AVIATION ELECTRONICS  
INDUSTRY, LTD.



NOTE) 1. The double chain lines indicate the wiring on the excavator side.  
2. The connector colors indicate the cord colors seen from the connecting part.

P	W	B	R	Y	G	L	Br	Lg	O
PINK	WHITE	BLACK	RED	YELLOW	GREEN	BLUE	BROWN	LIGHT GREEN	ORANGE

MACHINE SIDE WIRING (PARTS)

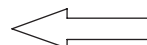
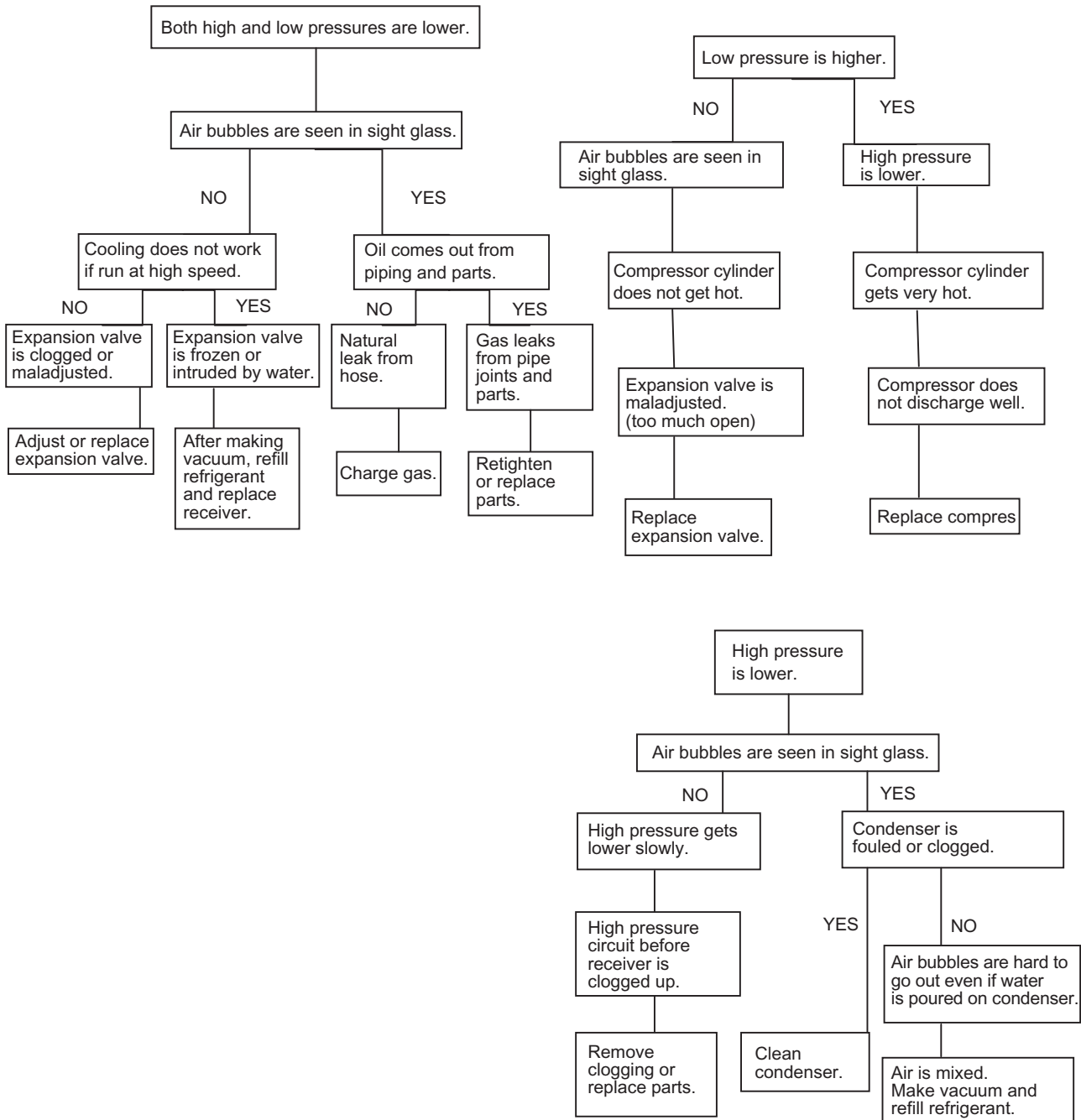


Fig. 25-32 Electric diagram (1/2)

Trouble with refrigeration cycle.



# 32. ATTACHMENT

## TABLE OF CONTENTS


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32.1.4	BOOM .....	32-9
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32.2.1	CYLINDER .....	32-13

## 32. ATTACHMENT


### (11) Removing and installing boom cylinder

- 1) Release pressure from boom circuit and bleed air in hydraulic tank.
- 2) Sling boom cylinder (2) using nylon sling temporarily not to act the weight of cylinder upon the cylinder head.
- 3) Disconnect each two hoses (C2) and (C3). And plug their both ends.

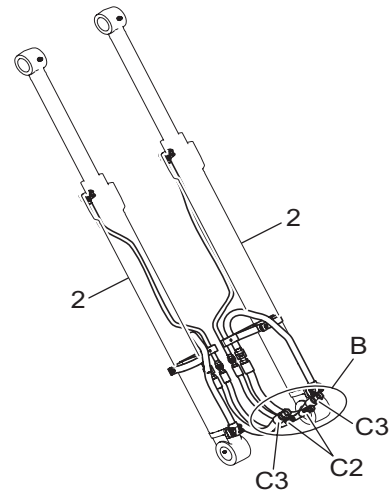
Plug : TOOLS 11.5.2-(4) Plugs for ORS fitting

 : 27,32,36,41mm

- 4) Removing boom cylinder foot pin (B)  
(See Fig. 32-23, Fig. 32-24)  
Loosen nut (5), remove capscrews M16×150 (4) and pull out pin (B).

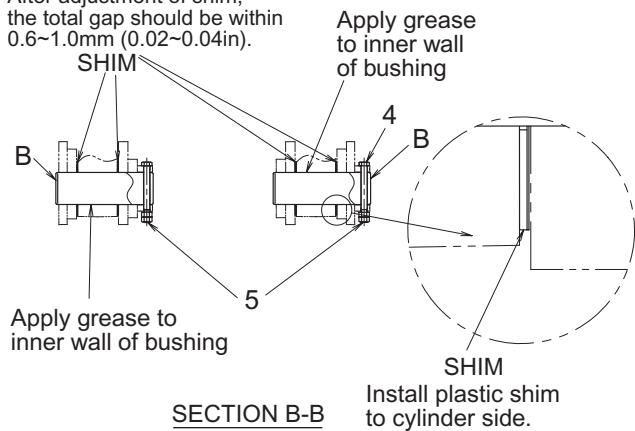
 : 24mm

- 5) Remove boom cylinder (2).  
Weight of boom cylinder : 223 kg (492 lbs)
- 6) Remove another boom cylinder the same way.



**Fig. 32-22 Removing and installing boom cylinder**

After adjustment of shim, the total gap should be within 0.6~1.0mm (0.02~0.04in).



**Fig. 32-23 Removing and installing boom cylinder head pin (B)**

### 32.1.4.3 ATTACHING BOOM

#### (1) Attaching boom foot pin (A)

First of all, insert boom foot pin (A) and install the boom assy.

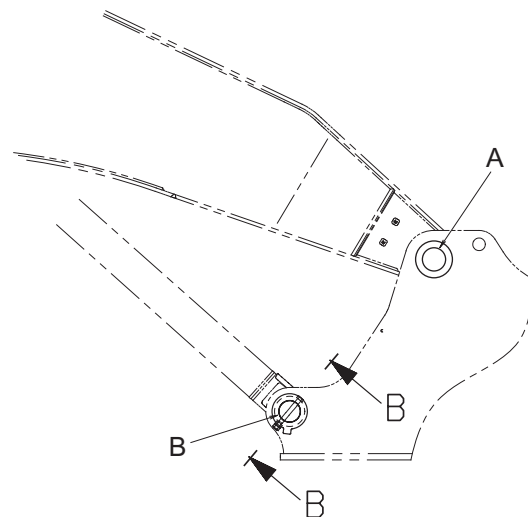
Attach it in the reverse procedure of removing, paying attention to the following points.

- 1) When aligning the pin holes, do not put your finger in the pin holes, but align them visually.
- 2) Check that the dust seals is not damaged and replace as necessary.
- 3) When inserting the pin, coat the shaft with grease.
- 4) Refer to paragraph 32.1.3.2 (page 32-8) about installing of jam nut.

- 5) When installing boom and cylinder, check the clearance of mounting section in thrust direction, and decide the thickness of shim according to the maintenance standard.

Install plastic shim first, and insert iron shim into remaining gap.

Regarding the position of shim, refer to Fig. 32-20.



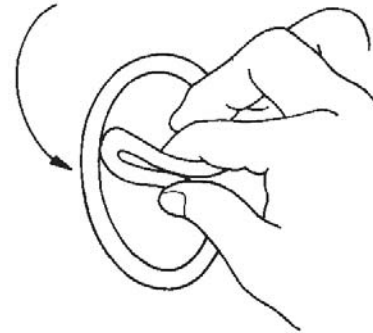
**Fig. 32-24 Boom foot pin (A)**

- (3) Fit buffer ring (6), back-up ring (8) and U-ring (7) in their grooves in that order. Before setting packings, coat them with hydraulic oil (or vaseline if not available). If you forget the coating, the packings may be scored. When attaching seals, deform them in a heart shape as illustrated.

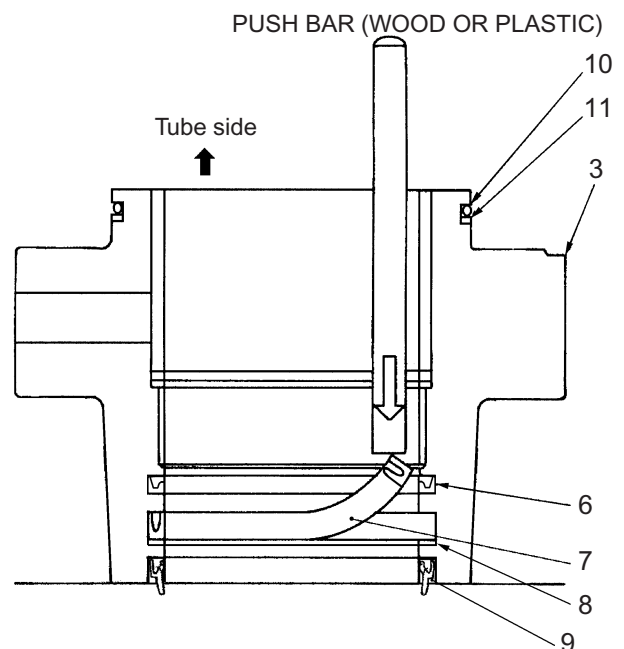
**CAUTION**

- U-ring (7) is harder than other packing and it would be difficult to deform them in a heart shape. In such a case, put a U-ring in the groove obliquely by hand as deep as possible and push in the last part with a push bar till it is set with a click.
- Buffer ring (6) should be fitted taking care of the fitting direction. The reverse fitting may cause deformation, damage, etc. of the piston due to high pressure generated between the buffer ring and U-ring.
- If U-ring (7) is set upside down, the lip may be damaged. Check that it is positioned correctly.
- Attach back-up ring (11) on the open air side of O-ring (10). (See Fig. 32-50).

INSERT U-RING INTO GROOVE FROM THIS SIDE.



**Fig. 32-49 Inserting a seal into the inner circumference of rod cover.**



**Fig. 32-50 How to fit U-ring (7)**

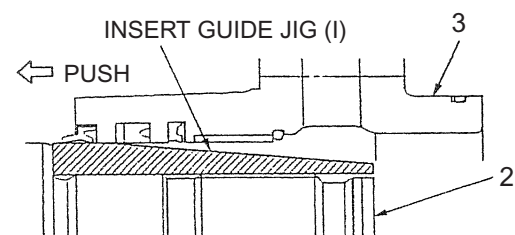
#### 32.2.1.5.4 INSERTING ROD COVER ASSY TO PISTON ROD

Inserting rod cover (3) to piston rod assy by the following procedure.

- (1) Fix piston rod assy on working bench.
- (2) Install rod cover (3) on piston rod (2) with inserting guide jig (1) as shown in Fig. 32-51 paying attention for the lip section of U-ring not to be caught on the stepped section.

**CAUTION**

- For the rod the outer diameter of piston installing section is small, insert spacer on the faucet section of rod first, and attach inserting guide jig.
- Apply hydraulic oil on the inserting guide jig and outer surface of piston rod lightly to make the insertion smooth.



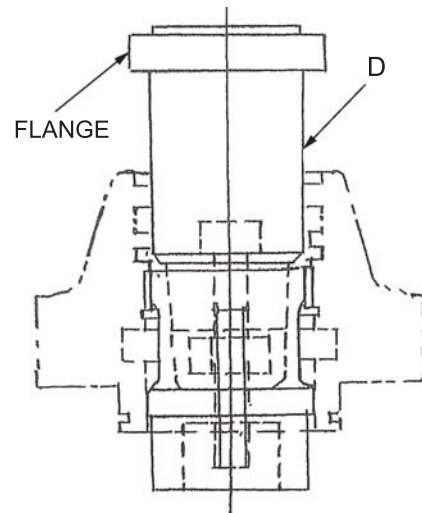
**Fig. 32-51 Inserting rod cover (3)**

## 32. ATTACHMENT

### 3) Attaching tools for retainer

Put retainer on the press bench directing the wiper ring fitting section of rod cover upward, then put retainer tool (D) on the rod cover.

- Fit retainer tool as shown in the right figure directing large diameter section (flange section) upward.
- Clean the surface of press bench, and take care for the tool bottom face not to be damaged by foreign matter like dust, chip, etc.



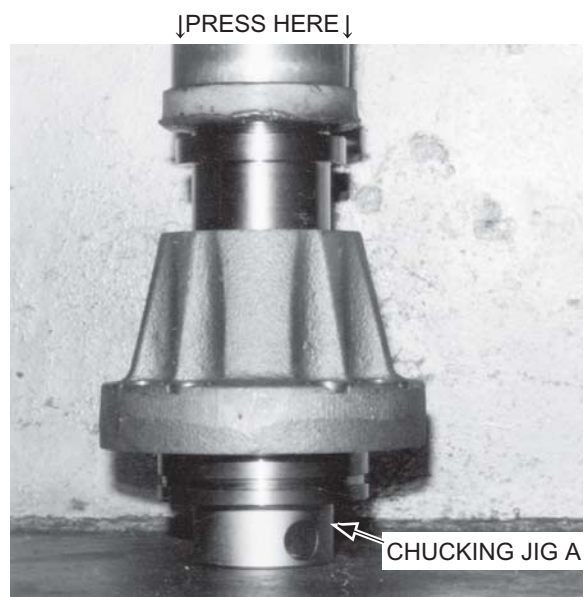
### 4) Cutting into of the edge of chuck

Press the upper section of retainer tool gradually so that the edge of chuck tool (A) cuts into the bushing surface.

Set the pressing force to 2~3 tons (4410~6615 lbs).

After completion of pressing, tighten adjuster bolt again by hand.

- Press it with retainer tool (D).



### 33.1 REMOVING AND INSTALLING

#### 33.1.1 OPERATOR SEAT

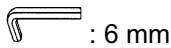
##### 33.1.1.1 REMOVAL

(1) Preparation for removal

- 1) Remove the head rest (A1-1) of the operator's seat (A1) to ease handling.
- 2) Move the whole control stand to its foremost position.
- 3) Move the operator's seat to its forward end.
- 4) Incline the reclining seat as forward as possible.

(2) Remove operator's seat. (Include upper rail.)

- 1) With the above-mentioned condition, remove two cap screws (B2) M8×20 from the upper rail. Then move the control stand to its rearmost end and remove two capscrews (B2) M8×20.



- 2) Remove the operator's seat. [about 20kg (44 lbs).]  
Carry out the following operations as required.
- 3) Remove seat belt (C1).
- 4) Remove armrest (A3)(A4).
- 5) Remove bracket assy (1), rail (8).

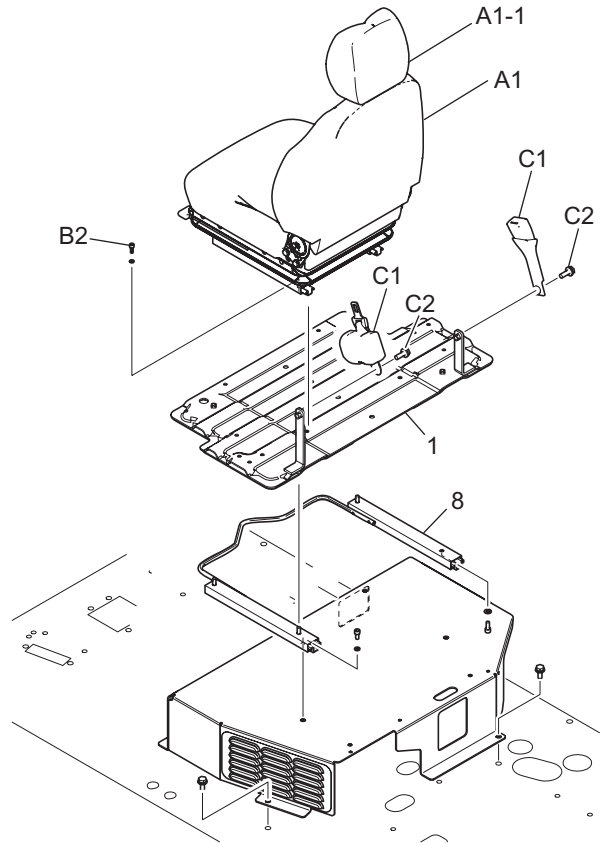


Fig. 33-1 Disassembling and Assembling seat

##### 33.1.1.2 INSTALLATION

Install it in reverse procedure of removing according to the tightening torque table.

Tightening position	Allen wrench HEX	Tightening torque N·m (lbf·ft)
Capscrew (B2)	6	23.5 (17.3)
Sems bolt (C2)	17	46.1 (34)
Sems bolt (A5,A6)	13	23.5 (17.3)

**Reference : Movement on rail**

- Upper rail ..... Fixed on lower surface of seat**  
[Forward 80mm (0.26in), backward 80mm (0.26in)]
- Lower rail ..... Fixed on seat stand.**  
[Forward 60mm (0.19in), backward 60mm (0.19in)]
- Amount of adjustment of seat height**  
[Up; 23mm (0.07in), down; 37mm (0.16in)]

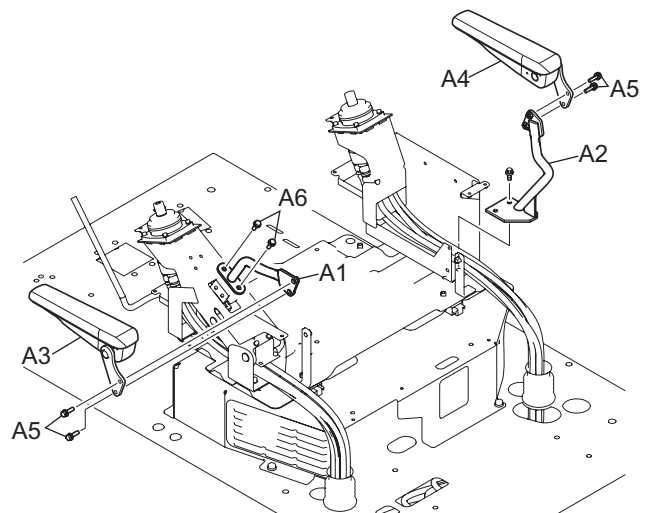



Fig. 33-2 Disassembling and Assembling armrest

## 33. UPPER STRUCTURE

### 33.1.6 FUEL TANK

#### 33.1.6.1 PREPARATION FOR REMOVAL

- (1) Draining fuel. (See Fig. 33-30)
  - 1) Unlock cap (B2) with a starter key and open it.
  - 2) Loosen valve (A8) under the tank.
  - 3) Draining fuel  
Capacity of tank : 460L (122gal)
- (2) Remove stay (7) and guard (2).  
(See 33.1.4 GUARD)
- (3) Remove the connector for level sensor (A4).  
(See Fig. 33-30)
- (4) Disconnect the connector of automatic fuel stop switch (12).
- (5) Removal of fuel feed hose
  - 1) Loosen 2 sems bolts (6) M12×25.  
 : 19 mm
  - 2) Loosen clip (8) and disconnect hose (14).
  - 3) Install the plug which fits to hose bore.
- (6) Remove the connector of fuel feed pump (1) from the tank.
- (7) Remove fuel hose
  - 1) Loosen clip (14),(27) and draw out hoses (21) and (7).
  - 2) Put in plugs that match the hose bore.

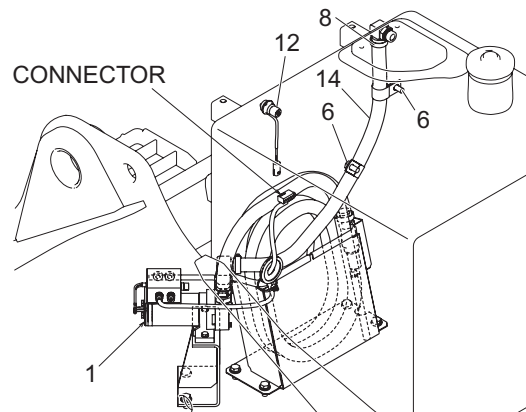


Fig. 33-28 Removing fuel feed hose (14)

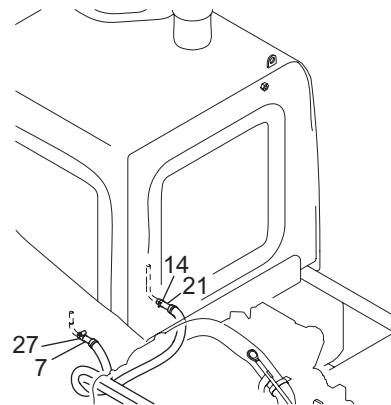


Fig. 33-29 Removing fuel hose (7), (21)

33.1.9 AIR CLEANER

33.1.9.1 PREPARATION FOR REMOVAL

- (1) Opening bonnet assy (21) and (23).  
(See 33.1.4 GUARD)
- (2) Open bonnet assy (31).
- (3) Remove Panel assy (3).
- (4) Unplug terminals on indicator (1-8) wiring.  
(See Fig. 33-49)

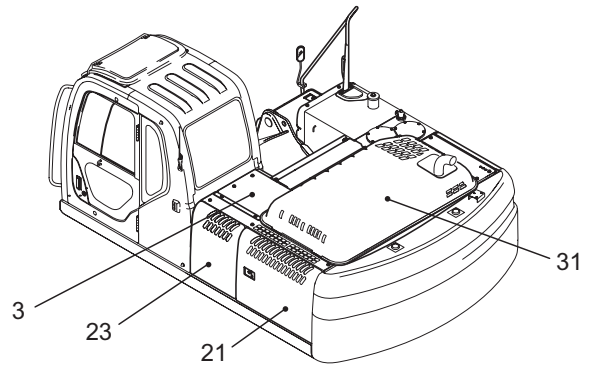
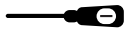


Fig. 33-48 Preparation for removal

33.1.9.2 REMOVAL

- (1) Pulling out hose (3).
  - 1) Loosen clips (5), (6) on both sides of hose (3).
  - 2) Pulling out hose (3)

 : Flat-blade screw driver

- (2) Remove air cleaner assy (1)

- 1) Remove 4 sems bolts (8) M10×25

 : 17 mm

- 2) Remove air cleaner assy (1) from plate (4).

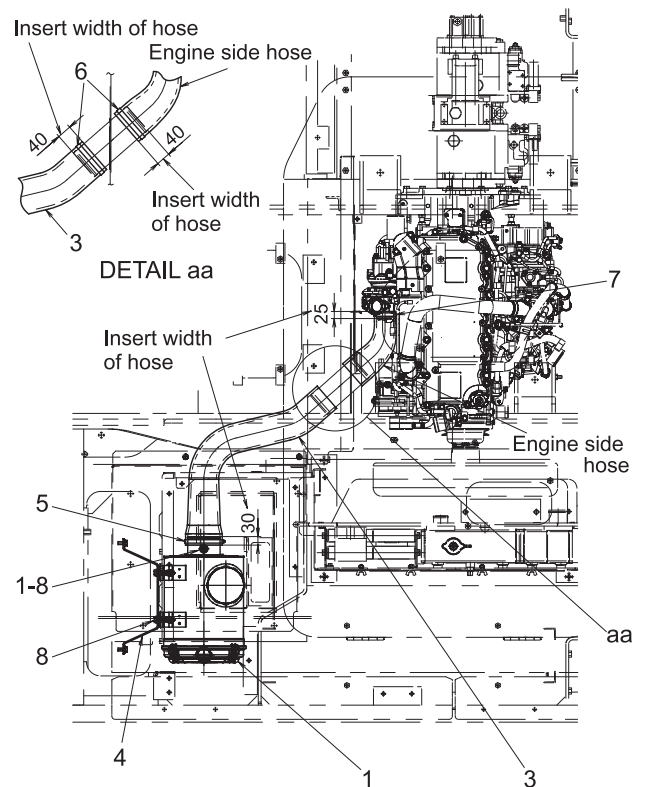


Fig. 33-49 Removing air cleaner

33.1.9.3 INSTALLATION

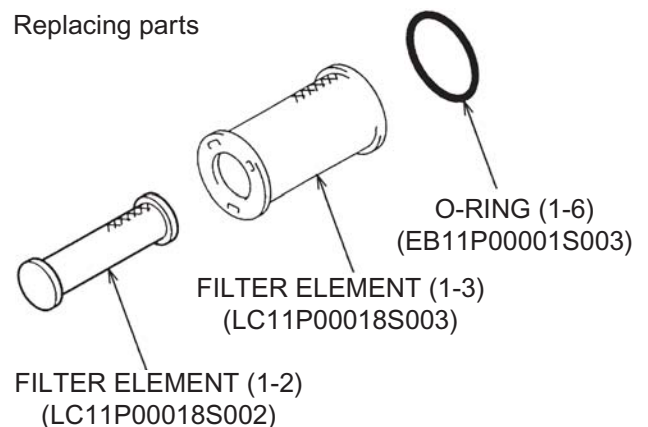
- (1) Installing is the reverse order of removing with attention paid to the following items:

- 1) Put in air hoses (2), (3) to the end as shown in Fig. 33-49.

- 2) Tightening torque :

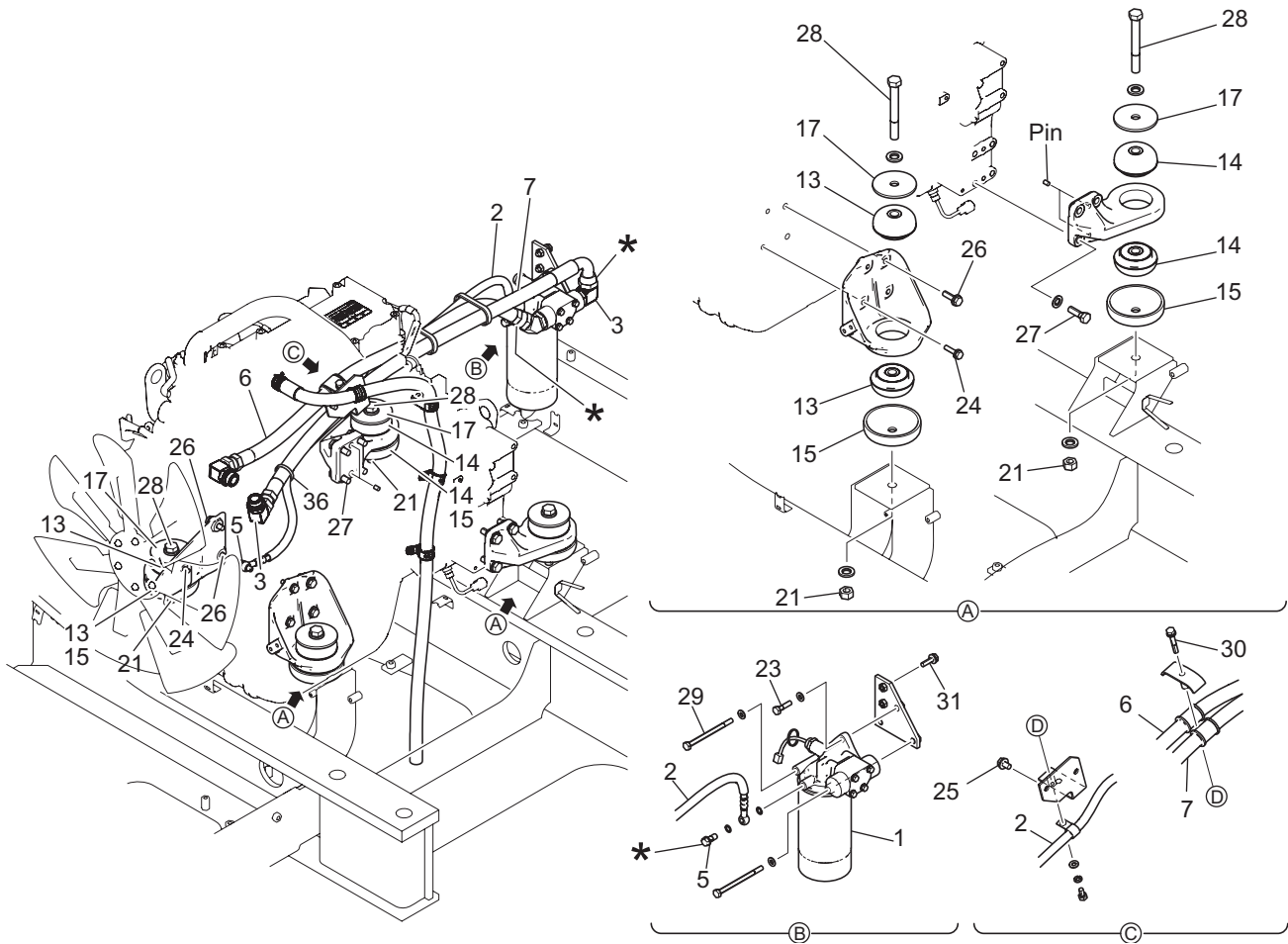
No.	Name	Tightening torque N·m (lbf·ft)
1-8	Indicator	3.9 (2.9)
8	Sems bolt	39.2 (29) (Apply Loctite #262)
5,6,7	Clip	5.9 (4.4)

Replacing parts



## 33. UPPER STRUCTURE


### 33.1.13.2 REMOVAL



**Fig. 33-65 Dismantling and mounting engine**

- (1) Remove hose of engine oil filter

Place oil pan under the connection of filter (1), and disconnect hoses (2), (6), (7) at \* positions.

 : 17 mm, 41 mm

- (2) Plug connector of filter side and hose.  
 (3) Loosen engine mounting bolt of frame

- 1) Loosen 4 nuts (21) M18.

 : 27 mm

- 2) Loosen 4 cap screws (28) M18×150.  
 3) Remove 4 plates (17).  
 4) Remove upper rubber mounts (13) and (14) 2 each.

- (4) Slings engine body

#### Note

Prepare a stand, which withstands the weight of the engine assy and can place the removed engine firmly. (Refer to "Tool".)

- 1) Sling engine hooking wire to lifting lugs on the front and rear sides.

Weight: Approx. 580 kg (1,280 lbs)

Wire:  $\phi 6$  (0.236")×1m (3ft 3in) - 2pcs.

- (5) Position engine on the stand stably.

33.1.19 SWIVEL JOINT


33.1.19.1 PREPARATION FOR REMOVING

Remove boom piping hose


33.1.19.2 REMOVAL

(1) Remove travel motor hose and tube


- 1) Remove 2 hoses (A16). (E port : PF1/2)

 : 27 mm, Tightening torque : 78.5 N•m (58 lbf•ft)


- 2) Remove tubes (A1), (A2). (C, D port : PF1)

 : 41 mm, Tightening torque : 275 N•m (203 lbf•ft)

- 3) Remove tubes (A3), (A4). (A, B port : PF1)

 : 41 mm, Tightening torque : 275 N•m (203 lbf•ft)

- 4) Remove 2 hoses (A7). (F port : PF1/4)

 : 19 mm, Tightening torque : 29.4 N•m (22 lbf•ft)

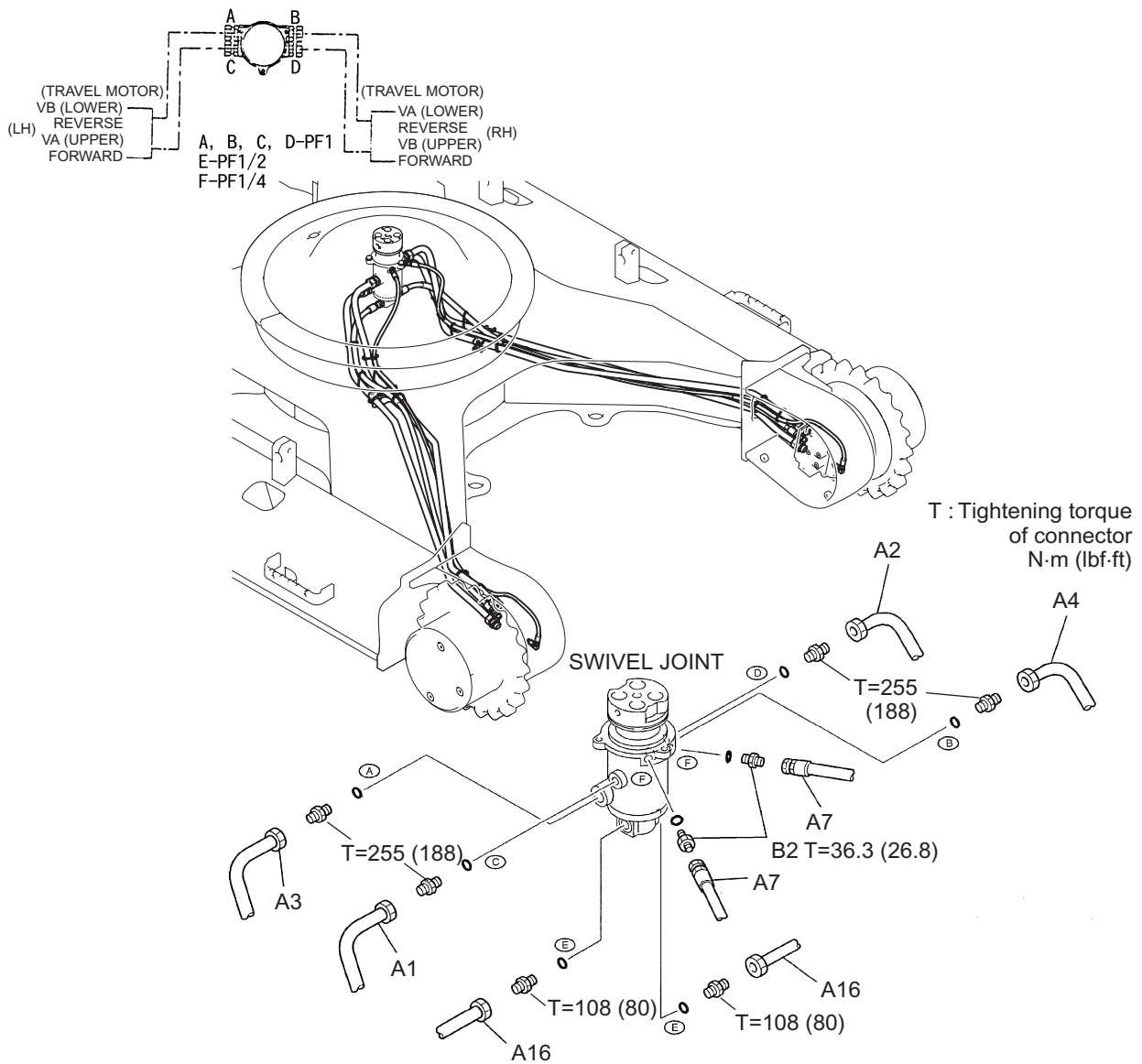


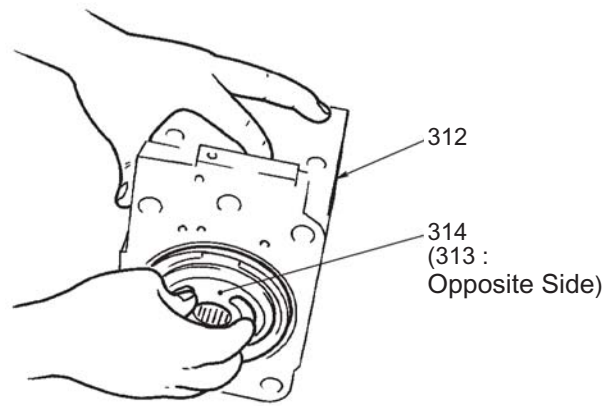
Fig. 33-80 Removing piping (lower side)

### 33. UPPER STRUCTURE

#### 12) Remove valve plate

Remove valve plate (313, 314) from valve block (312).

- The valve plate may come off during the operation under 6).

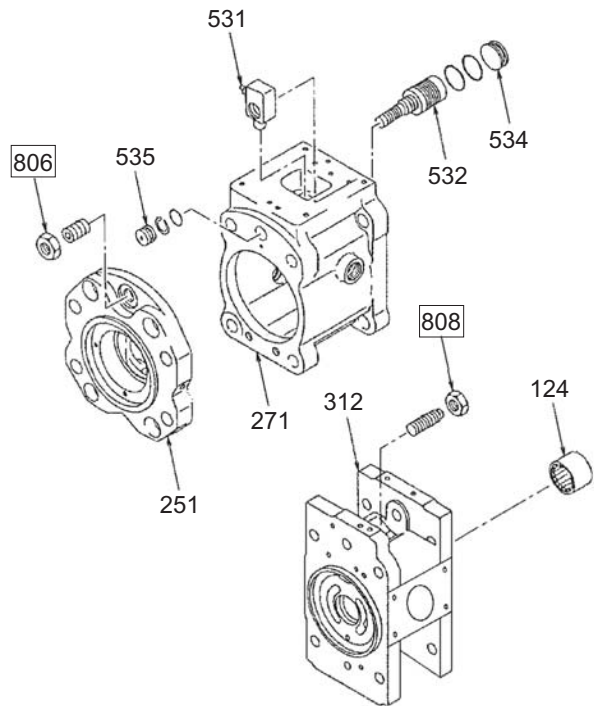


**Fig. 33-99 Removing valve plates (313), (314)**

#### 13) Remove other parts

If necessary, remove stopper (L) (534), stopper (S) (535), servo piston (532) and tilting pin (531) from pump casing (271), and remove needle bearing (124) from valve block (312).

- When removing the tilting pin, use care so as not to score the head of the tilting pin, using a jig.
- It is hard to separate the tilting pin from the servo piston in some cases as Loctite is coated on the mating part between them. Use care so as not to score the servo piston by applying undue force.
- Do not draw out needle bearings except when their service life has ended.
- Do not loosen hex nuts (806),(808) of valve block (312) and swash plate support (251). A set flow rate changes.



**Fig. 33-100 Removing other parts**

6) Remove compensating parts

(See Fig. 33-109 (D) section, See Fig. 33-111, Fig. 33-112)

After removing the cover (C) (629) sub assy, take out outer spring (625), inner spring (626) and spring seat (624) from the compensating part. Then take out adjust stem (645), pilot spring (646) and spring seat (644) from the pilot part.

- Adjust stem (645) comes out easily if an M4 bolt is used.

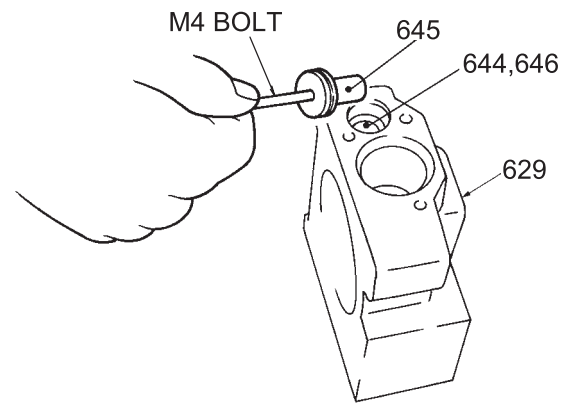


Fig. 33-112 Removing compensating parts

7) Remove pilot cover and the set spring

Remove socket bolt (439) and pilot cover (641). Once the pilot cover comes off, separate set spring (655) from the pilot section. (Fig. 33-109 (A) and (B) section)

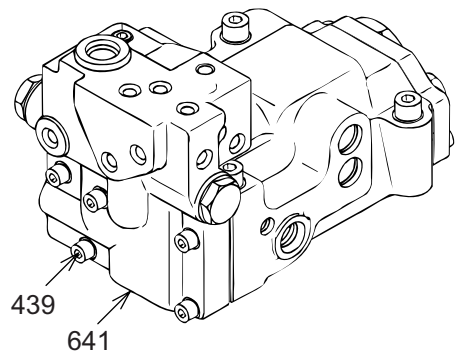
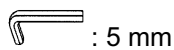


Fig. 33-113 Removing pilot cover (641) and set spring (655)

8) Remove spring seat, return spring and sleeve (Fig. 33-109 (A) section)

Remove snap ring (814). Then remove spring seat (653), return spring (654) and sleeve (651).

- Sleeve (651) is equipped with snap ring (836).
- When removing snap ring (814), return spring (654) comes out : Use care so as not to lose it.

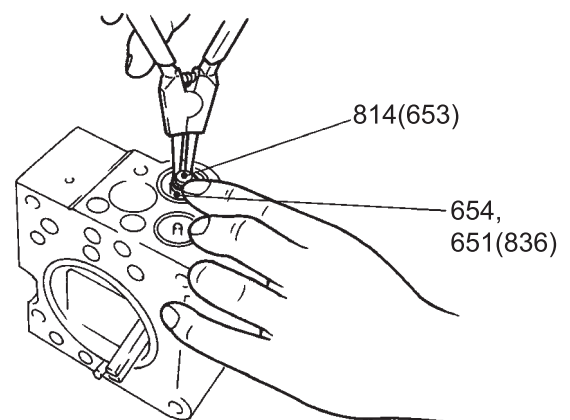


Fig. 33-114 Removing spring seat (653), return spring (654) and sleeve (651)

9) Remove adjust plug (Fig. 33-109 (F),(G) section) remove snap ring (858) and take out fulcrum plug (614) and adjust plug (615).

- Fulcrum plug (614) and adjust plug (615) come off easily if a M6 bolt is used.

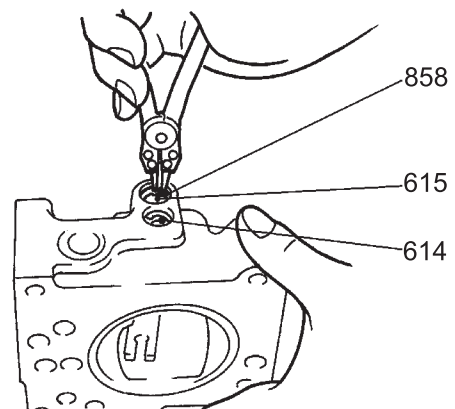


Fig. 33-115 Removing adjust plug (615)

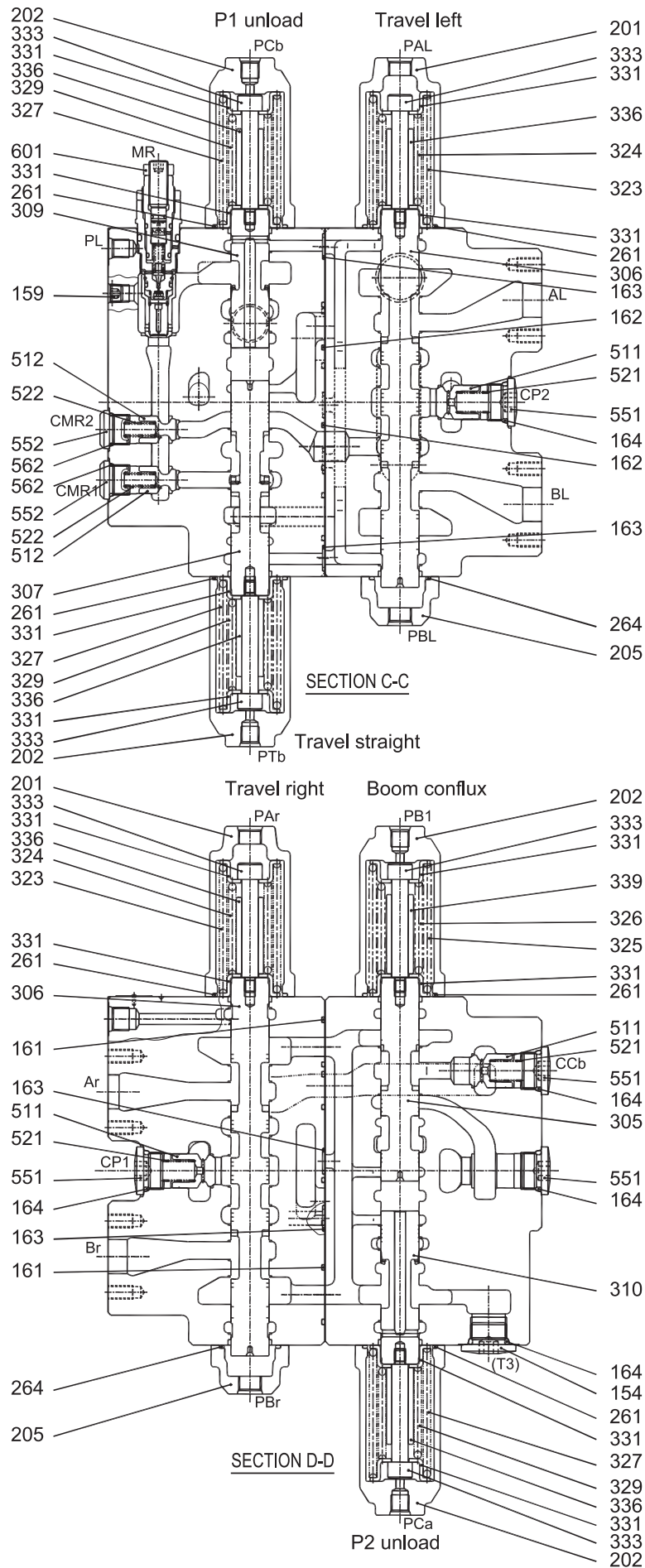


Fig. 33-139 Section (3/6)

**33.2.2.3.7 Disassembling arm 1 spool**

- (1) Loosen socket bolts (273), and remove spring cover (201) and O-ring (261) of arm 1 spool.
- (2) Draw out the assembly which is consist of arm 1 spool (302), spring seat (331), spring (321, 322), stopper (336) and bolt (333) from casing A (101).

**CAUTION**

When drawing out the spool assy, use care so as not to score casing A (101).

- (3) Fix the arm 1 spool assy with vise via a protective plate (aluminum plate etc.) and remove bolt (333). Then remove spring seat (331), spring (321, 322) and stopper (336) from arm 1 spool (302).



Fig. 33-160 Removing arm 1 spring cover (201)



Fig. 33-161 Disassembling arm 1 spool (302) assy

**33.2.2.3.8 Disassembling arm 2 spool**

- (1) Loosen socket bolts (273), and remove spring cover (201) and O-ring (261) of arm 2 spool.
- (2) Draw out the assembly which is consist of arm 2 spool (308), spring seat (331), spring (321, 328), stopper (340) and bolt (333) from casing B (102).

**CAUTION**

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

- (3) Fix the arm 2 spool assy with vise via a protective plate (aluminum plate etc.) and remove bolt (333). Then remove spring seat (331), spring (321, 328) and stopper (340) from arm 2 spool (308). Do not disassemble arm 2 spool (308) further unless there is special reason.



Fig. 33-162 Removing arm 2 spring cover (201)



Fig. 33-163 Disassembling arm 2 spool (308) assy

## 33. UPPER STRUCTURE

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### 33.2.2.4.12 Assembling bucket spool

(1) Hold the mid section of bucket spool (304) with vise provided with protection plate (aluminum plate, etc.), fit spring seat (331), springs (321), (322) and stopper (336) and tighten bolt (333) to the specified torque.

---

#### CAUTION

- Apply Loctite #262 when tightening bolt (333).
  - Take care not to deform bucket spool (304) because of careless over clamping.
- 

(2) Place bucket spool assembly in item (1) in casing B (102).

---

#### CAUTION

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

---

(3) Attach spring cover (209) with O-ring (261) attached to the spring side of bucket spool assembly and tighten socket bolt (273) to the specified torque.

(4) Attach piston (216) to spring cover (209), place O-ring (164) in plug (551) and tighten to the specified torque.

---

### 33.2.2.4.13 Assembling swing spool

(1) Hold the mid section of swing spool (303) with vise provided with protection plate (aluminum plate, etc.), fit spring seat (331), springs (321), (322) and stopper (336) and tighten bolt (333) to the specified torque.

---

#### CAUTION

- Apply Loctite #262 when tightening bolt (333).
  - Take care not to deform swing spool (303) because of careless over clamping.
- 

(2) Place swing spool assembly in item (1) in casing A (101).

---

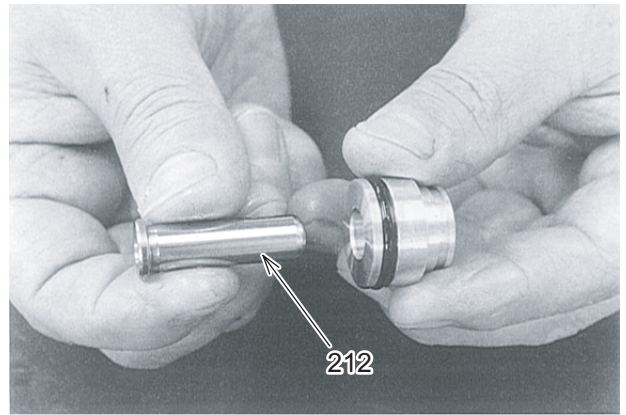
#### CAUTION

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

---

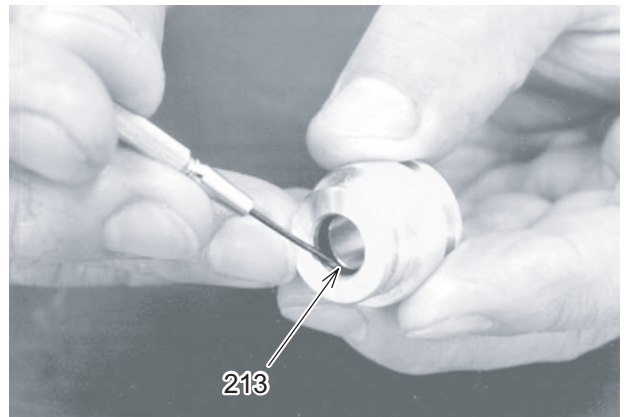
(3) Attach spring cover sub (204) with O-rings (261), (266) attached to the spring side of swing spool assembly and tighten socket bolt (273) to the specified torque.

- (11) Pull out push rod (212) from plug (211).  
 (12) Remove O-ring (214) from plug (211).



**Fig. 33-193 Removing push rod (212)**

- (13) Remove inside seal (213) from plug (211) with small driver.



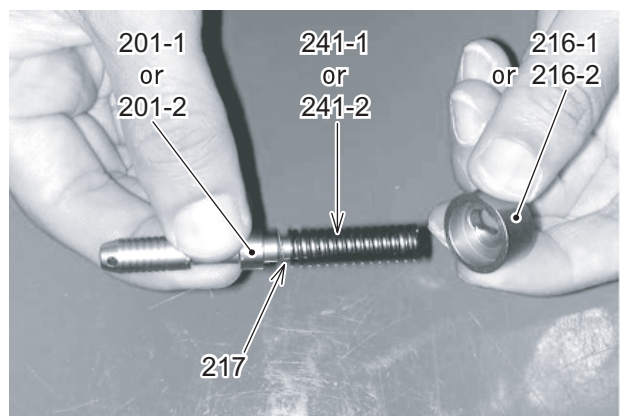
**Fig. 33-194 Removing seal (213)**

### 33.2.3.3 CLEANING PARTS

- (1) Clean parts with wash oil roughly.
- (2) Clean parts with wash oil completely.
- (3) Dry parts by swabbing clean rag.
- (4) Apply rust preventives on parts.

### 33.2.3.4 ASSEMBLING

- (1) Fit washer 2 (217), springs (241-1), (241-2), spring seats (216-1), (216-2) to spool (201-1), (201-2).



**Fig. 33-195 Assembling pressure reducing valve**

### 33. UPPER STRUCTURE

#### 6) Guide/plunger and regulation unit replacement

- Extract the regulation units from the body (using flat nose pliers).
- Inspect the regulation units. If defects are detected on the parts, replace the 4 units.

#### 7) Return spring replacement :

- Extract the return springs from the body (using flat nose pliers).

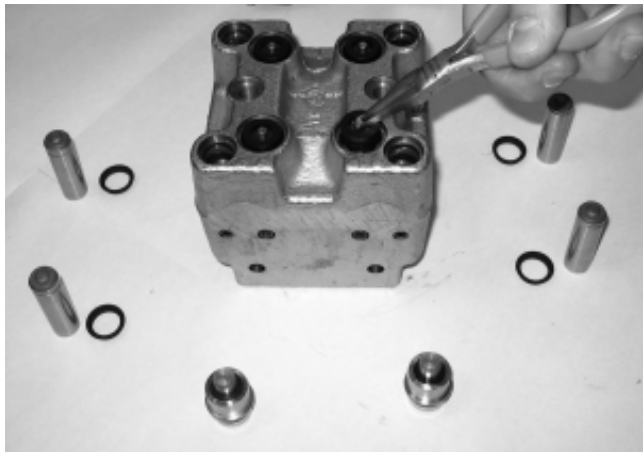


Fig. 33-217

- Inspect the return springs. If defects are detected, replace the 4 springs.

#### 8) Reassemble parts in reverse order.

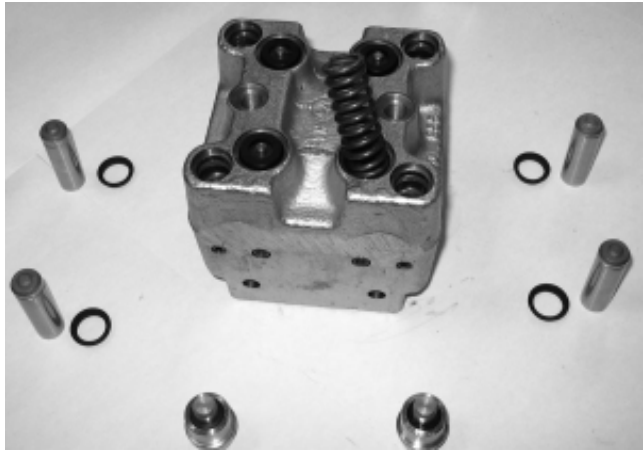


Fig. 33-218

#### (7) Throttle kit replacement

##### 1) Remove

- The pilot control unit from the machine
- Both rubber boots (See 33.2.4.2 (1))
- Both switch plates (See 33.2.4.2 (2))
- The retaining plate (See 33.2.4.2 (4))
- The damping plungers and springs (See 33.2.4.2 (5))

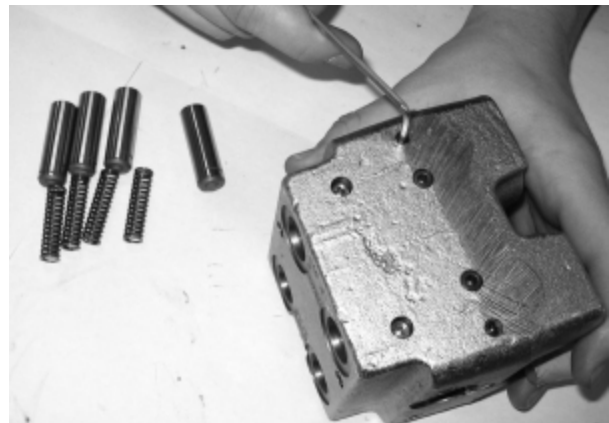


Fig. 33-219

4. Remove backing spring (4) from cylinder (24).

This completes disassembly.

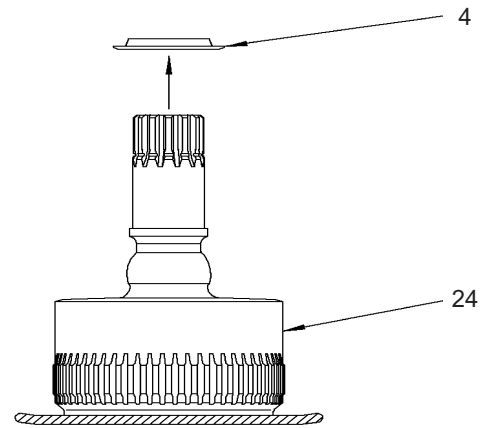


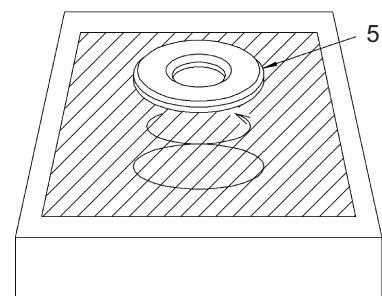
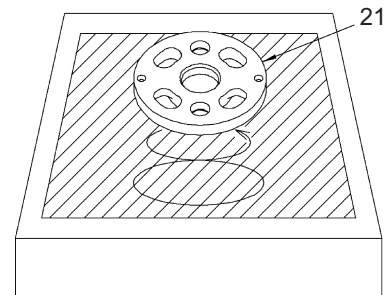
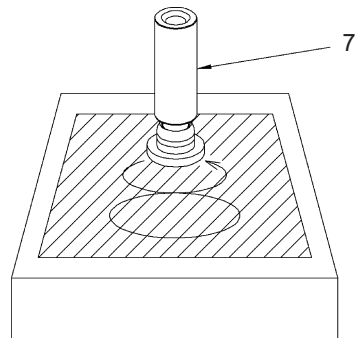
Fig. 33-242 Removing backing springs

(2) Assembly

1) Preparation

Before reassembling, perform below procedure.

1. Check each part for damage caused by using or disassembling. If damaged, remove scratches by rubbing with "wet and dry" sandpaper of appropriate coarseness. Clean each part with clean washing oil and dry with an air jet.
2. Replace all seals.
3. Paper lap the sliding face of piston assembly (7), balance plate (21), and cam plate (5) with sandpaper #2000 on a true flat surface.



4. When assembling, lubricate the sliding parts with specified clean hydraulic oil.

Fig. 33-243 Lapping the piston assy etc.

### 33. UPPER STRUCTURE

#### 6) Pulling out pinion shaft

Pull pinion shaft (1), sleeve (17), oil seal (16) and spherical bearing (lower) (12) out by means of press while supporting housing (15) as shown in the figure.

- Spherical bearing (upper) (13) and oil seal (14) are left in the housing.

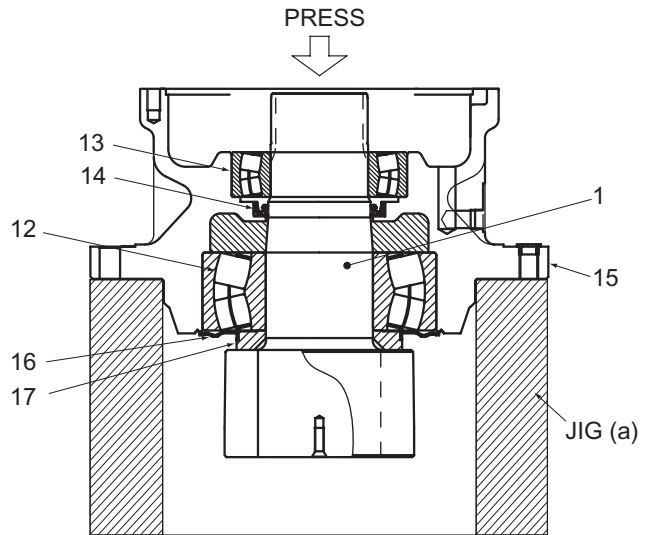


Fig. 33-269 Pulling out pinion shaft (1)

#### 7) Removing spherical bearing (lower) (12)

Pull oil seal (16), sleeve (17) and spherical bearing (lower) (12) out by means of jigs (b) (c) while supporting pinion shaft assy as shown in the figure.

Press force : 30t (66,150 lb)

- Do not use the removed oil seal and bearing.

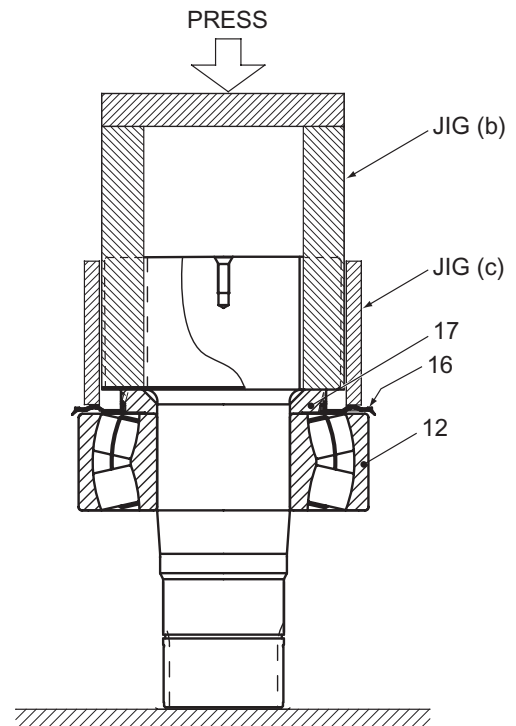


Fig. 33-270 Removing spherical bearing (lower) (12)

Symp-tom	Cause	External Inspection	Action	Repair
Abnormal temperature rise	Seizure of the motor sliding surfaces in the circuit	Look for metallic foreign bodies in the motor drain oil or trapped in the drain filter. Open the motor inlet and outlet ports and apply a pilot pressure of 3.2~4.9 MPa (464~711 psi) to the brake release port then check that the output shaft can be turned through at by a torque of approximately 30~40 N•m (22~30 lbf•ft).	If you find a metallic foreign bodies, or if the output shaft does not turn smoothly at a torque of 30~40N•m (22~30 lbf•ft), it is highly likely that an internal part is broken so disassemble the motor to investigate.	Repair or replace damaged parts. Replace the motor assembly.
Oil leakage from joints	Damaged O-ring			Replace O-ring (s).
	Damage to seal surfaces			Repair the seal faces or replace.
	Loose bolts	Inspect for loose bolts.	Tighten to the correct torque.	
Oil leakage from oil seals	Damage or wear to the lip parts of oil seal			Replace the oil seals.
	Damage or wear to seal surfaces			Repair, or replace the motor assembly.
	Abnormal pressure inside the case	Investigate the pressure in the case and the drain volume.	Reduce pressure within the case to 0.3 MPa (44 psi) or less. If the drain volume is excessive, disassembly and investigation is required.	Replace the oil seal. Repair or replace damaged parts. Replace the motor assembly.

Table B

No.	Inspection Point	Repair
A	Wear to the sliding surface of balance plate (21).	Repair or replace the part concerned.
B	Damage to the sliding surface of cam plate (5).	Repair the part concerned or replace the motor.
C	Damage to the sliding surface of piston assembly (7).	Repair the part concerned or replace the motor.
D	Wear to the exterior of pistons assembly (7).	Repair the part concerned or replace the motor.
E	Wear to the piston holes in cylinder assembly (24).	Replace the motor.
F	Damage to the teflon rings (19).	Replace the teflon rings.

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[MEMO]

## 4) Installing floating seals (7)

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

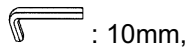
- Prior to placing floating seal (7) in, apply engine oil lightly to seal surface.

## 5) Inserting shaft (2)

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

## 6) Installing plate (4)

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



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

## 7) Installing O-ring (8)

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

- Apply grease to O-ring.

## 8) Installing cover (5)

Attach cover (5) to upper roller (1). Use a press in this operation as a press fit is used.

## 9) Installing snap ring (11)

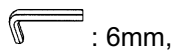
Fix snap ring (11) into upper roller (1), using snap ring pliers.

## 10) Filling oil

Fill in 30cc (1.83cu•in) of engine oil API grade CD #30 through the plug hole in cover (4).

## 11) Installing plug (10)

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



Tightening torque : 23N•m (17 lbf•ft)

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

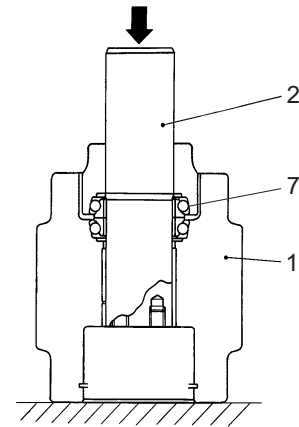


Fig. 34-20 Inserting shaft

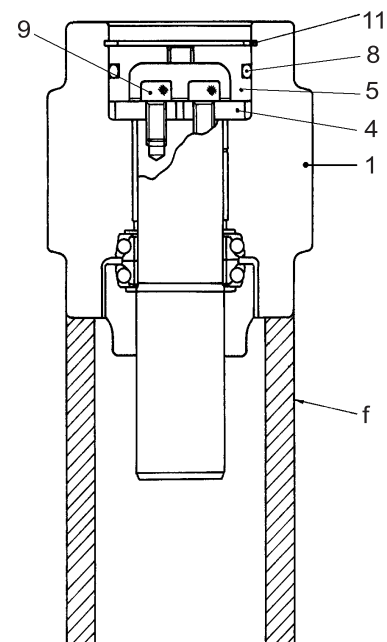


Fig. 34-21 Installing cover

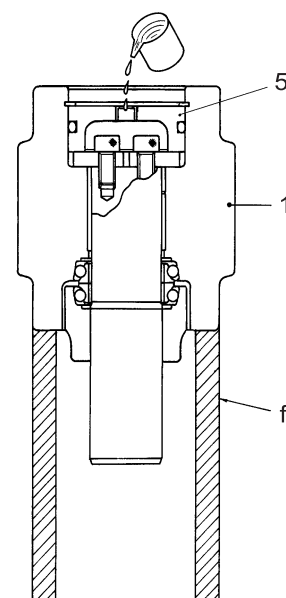


Fig. 34-22 Filling oil

## 34. TRAVEL SYSTEM

### 34.1.5 FRONT IDLER (IDLER ADJUSTER ASSY)

#### 34.1.5.1 FRONT IDLER ASSY

FRONT IDLER ASSY			LQ52D00025F1
No.	NAME	Q'TY	REMARKS
1	IDLER ASSY	2	YN52D00009F1
2	IDLER ADJUSTER ASSY	2	LQ54D00010F1
3	CAPSCREW	4	M16X45
4	GREASE NIPPLE	2	

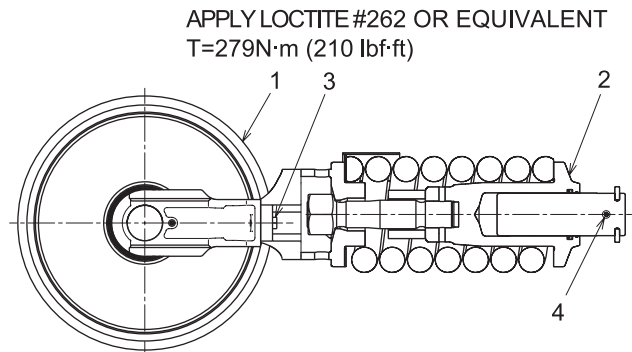


Fig. 34-41 Front idler assy

#### 34.1.5.2 REMOVING

- (1) Preparation for removal  
Remove crawler. (Above mentioned)
- (2) Removing idler assy  
Sling idler assy, and push it forward with bar.  
Weight of crawler Æ idler assy : 255kg (562 lbs)



Keep away from the front side of front idler.

- (3) Installing  
Installing is done in the reverse order of removing.
- (4) Where idling assy (1) has to be separated  
Loosen cap screw (3), and separate idler assy (1) from idler adjuster assy (2).



Weight of idler assy : 107kg (236 lbs)  
Weight of idler adjuster assy : 147kg (324 lbs)

- The separated idler assy (1) should be placed on square timbers.

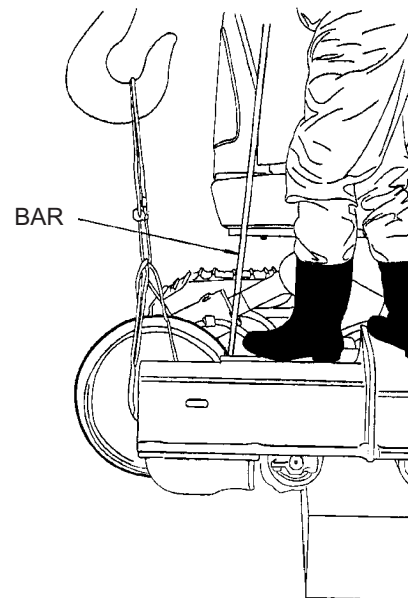


Fig. 34-42 Removing and installation the front idler

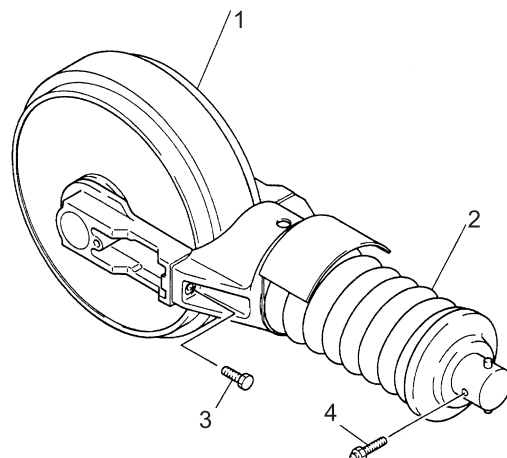


Fig. 34-43 Separating idler assy (1) from idler adjuster

(2) Sprocket tooth profile gauge : W

Unit : mm (in)

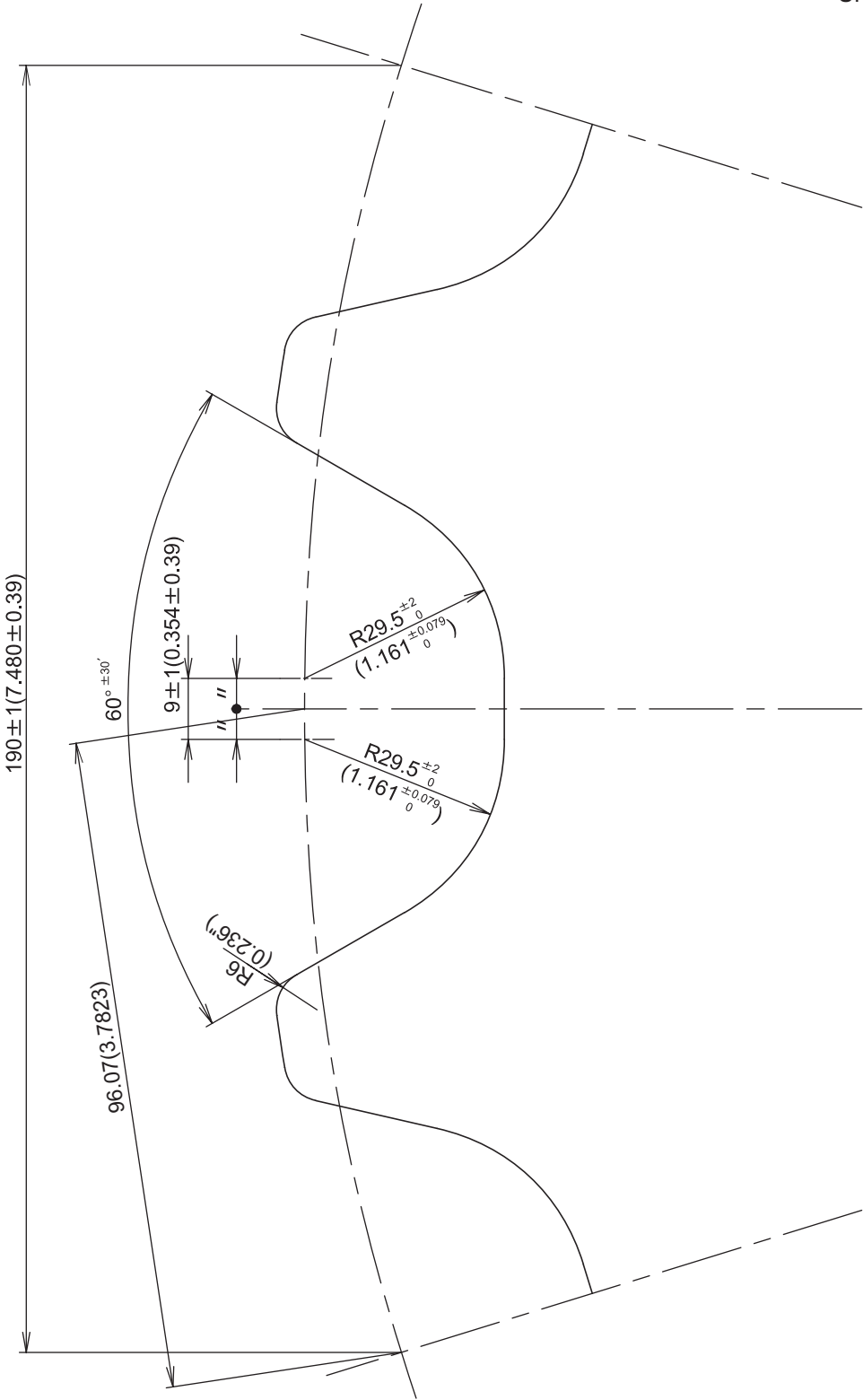


Fig. 34-70 Tooth profile gauge (Full scale)

## 34. TRAVEL SYSTEM

### 34.2.1.3 DISASSEMBLY AND ASSEMBLY


#### 34.2.1.3.1 DISASSEMBLY PROCEDURE


##### (1) Removing cap (11)

Fix the motor on a stable work bench, loosen eight socket bolts (13) and remove cap (11) with O-ring (12).

Next, remove spring seat (10), spring (9) and spring seat (8).

Then separate plug (15), O-ring (14), spring (34) and ball (33).

 : 10 mm

 : 14 mm

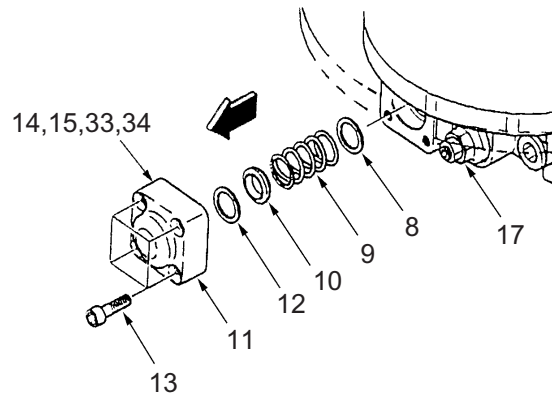


Fig. 34-89 Removing the cap assy

#### **CAUTION**

Cap (11) is pressed out by spring (9).

Therefore, do the work, taking care of the following.

- Loosen socket bolts (13) evenly all round.
- Loosen socket bolts (13), holding down cap (11).

##### (2) Removing double counterbalance plunger (3)

Push the end of plunger (3) lightly so part of plunger (3) comes out of base plate (2). Then, hold the end of plunger (3) by hand and draw out plunger (3) from base plate (2), while turning it by hand.

#### **CAUTION**

Plunger (3) and base plate (2) have a very tight fit.

Therefore, do the work, paying attention to the following.

- In case plunger (3) gets stuck halfway and does not come out, do not try to force it out. If it is pulled out by force, the bore surface of base plate (2) and the outer surface of plunger (3) are scored.

In case the plunger gets stuck halfway, do as follows:

Put plunger (3) back into base plate (2) by lightly tapping the end face of it with a plastic mallet. Then make sure that the plunger (3) moves smoothly and draw out the plunger (3) once again, turning it by hand.

- Do not disassemble plunger (3) unless it is necessary; the outer surface of it may be scored at disassembly.

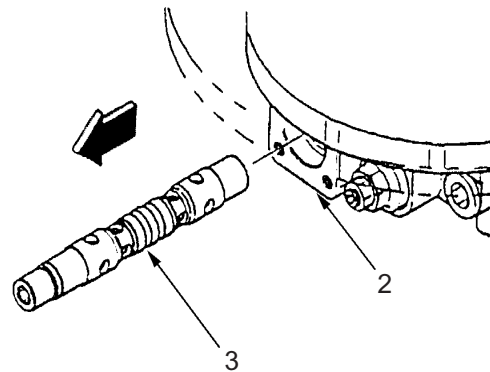


Fig. 34-90 Removing double counterbalance valve spool (3)

### 34.2.1.3.2 ASSEMBLING PROCEDURE

<Reduction unit>

- (1) Assembling floating seal (70) into flange (1)  
 Confirm the below items concerning floating seal (70). Then assemble floating seal (70) to flange (1), using the floating seal fixing jig.

#### **CAUTION**

Make certain that there is no dust on the surface of flange (1) in contact with floating seal (70).

- Thoroughly degrease the surface where floating seal (70) of flange (1) is located.
- Make sure that no dust is there on the O-ring of floating seal (70).
- Thoroughly degrease the surface of the O-ring in floating seal (70).

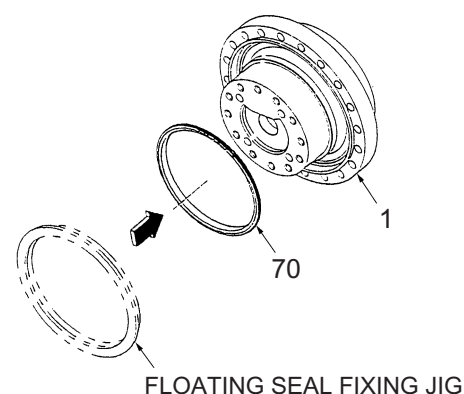
- (2) Assembling angular bearing (71) to housing (72)  
 Press angular bearing (71) into housing (72), using a pressing jig and a press.

- (3) Assembling floating seal (70) into housing (72)  
 Make sure of the following as to floating seal (70).  
 Then assemble floating seal (70) into housing (72), using the floating seal fixing jig.

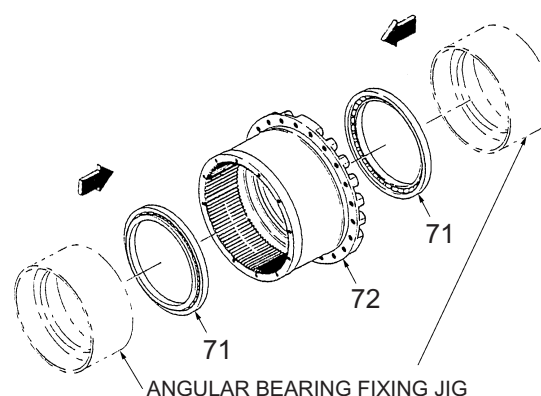
#### **CAUTION**

Make certain that there is no dust and foreign matter on the surface on which floating seal (70) in housing (72) is located.

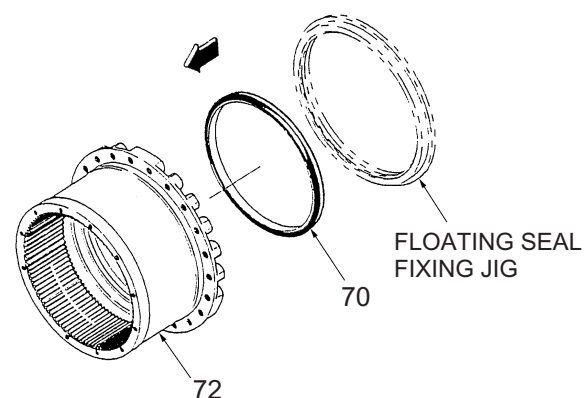
- Thoroughly degrease the surface where floating seal (70) in housing (72) is located.
- Make sure that there is no dust and foreign matter on the O-ring of floating seal (70).
- Thoroughly degrease the surface of the O-ring in floating seal (70).



**Fig. 34-120 Assembling floating seal (70)**



**Fig. 34-121 Pressing in angular bearing (71)**



**Fig. 34-122 Fixing floating seal (70)**

## 34. TRAVEL SYSTEM

### (9) Installing brake piston (56)

Attach O-rings (57), (58) to brake piston (56).

Next, mount brake piston (56) to flange (1) so the larger diameter side of the brake piston faces upward.

### **CAUTION**

Coat O-rings (57), (58) with sufficient grease, before fixing them.

- Align the knock pin hole in flange (1) in contact with base plate (2) with the knock pin hole in brake piston (56), using the positioning jig. Then install brake piston (56).
- Before fitting brake piston (56), coat the outer surface of the brake piston and the bore of flange (1) with grease.
- Assemble brake piston (56) by pressing it so it does not tilt. If the brake piston is assembled inclined, it develops trouble and tears off O-rings in some cases.

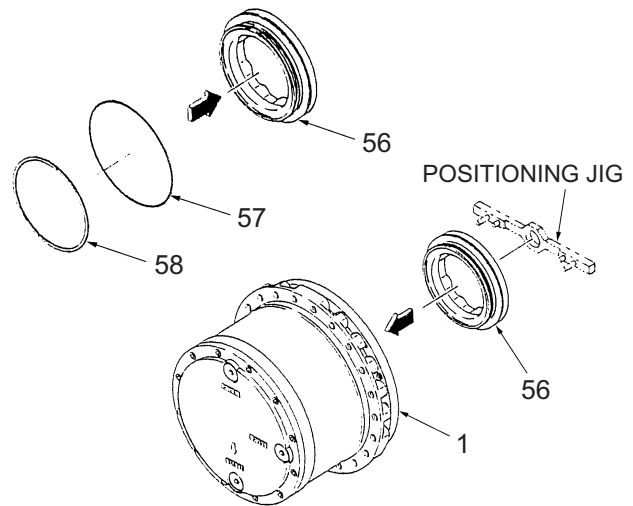


Fig. 34-148 Installing brake piston (56)

### (10) Fitting springs (59)

Fit springs (59) into eight holes in brake piston (56).

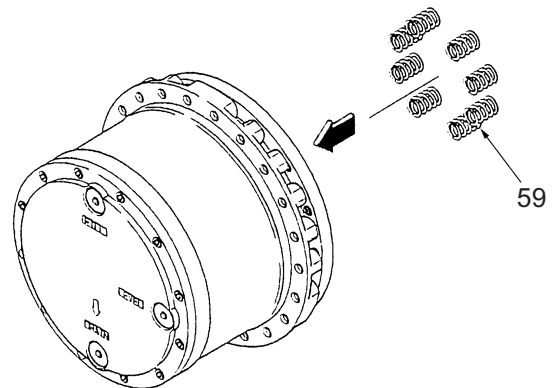


Fig. 34-149 Fixing spring (59)

### (11) Attaching valve plate (62)

Place base plate (2) on a work bench and press bearing (50) in the center of base plate (2), using the bearing fixing jig.

Confirm that knock pin (60) is fixed in base plate (2) and attach valve plate (62) to base plate (2).

### **CAUTION**

Place valve plate (62) with the copper alloy side facing upward.

- Coat the matching face between base plate (2) and valve plate (62) with grease to prevent the valve plate from falling off.
- Use care so as not to score the copper alloy surface of valve plate (62).

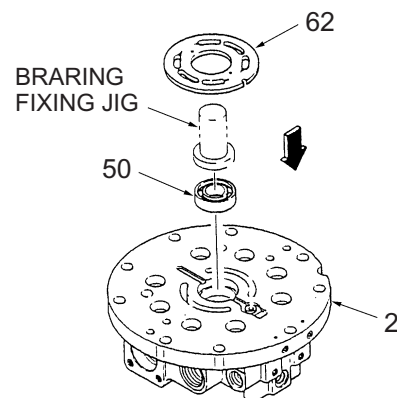


Fig. 34-150 Attaching valve plate (62)

Trouble	Probable cause	Remedy
Abnormal sound and revolution and pressure fluctuations occur due to cavitation.	<p>Motor is installed improperly or the location of hydraulic oil tank is improper.</p> <p>Therefore, hydraulic oil is discharged from motor piping and motor circuits while the hydraulic device is not running.</p> <p>The motor developed aeration immediately after motor was driven.</p>	<p>Confirm the motor orientation and if it is wrong, correct it to the correct orientation.</p> <p>Check that the oil level in the hydraulic oil tank is above the motor level and if not, change it higher than the motor level. Before running, place a self supply circuit so hydraulic oil is filled up in motor circuit and piping.</p>
	<p>When motor makes pumping action, motor inlet pressure becomes negative due to malfunctioning double counterbalance valve.</p> <p>This causes the motor to develop cavitation.</p>	<p>Disassemble and repair or replace double counterbalance valve according to the shop manual.</p>
Motor stopped while running	<p>Engine stalled because of too much load.</p>	<p>Review load condition and change it to a suitable level.</p>
	<p>Motor stalled as the sliding surface of piston motor was seized.</p>	<p>Check the spec (flow and motor revolution in particular). if the motor revolution exceeds a limit value, decrease the flow.</p> <p>Replace motor as insides of motor are broken beyond reuse.</p>

## 46. TROUBLE SHOOTING (BY ERROR CODES)

### 46.2 CLASSIFICATION OF FAILURE AND TROUBLESHOOTING

Classify failures into the following 3 types and carry out the troubleshooting.

No.	Classes of failure	Troubleshooting
A	When error code after self-diagnosis is displayed on gauge cluster	Carry out troubleshooting according to the error code.
B	When no failure is detected currently but error code after self diagnosis is remained in trouble history	When it is hard to recreate the failure situation, cancel the data in the history and reproduce the failed situation or suppose the cause according to the troubleshooting by error code, and then repair it.
C	When error code after self diagnosis is not displayed or is not remained in the history	<ul style="list-style-type: none"><li>• Carry out troubleshooting according to instructions in Chapter 47 "TROUBLESHOOTING BY TROUBLE".</li><li>• Carry out troubleshooting according to instructions in Chapter 48 "TROUBLE DIAGNOSIS MODE".</li></ul>

### 46.3 THE BLOWN FUSE OF MECHATRO CONTROLLER

If the fuse of mechatro controller has blown, the following display appears on the gauge cluster.

(1) The blown fuse of mechatro controller

a. Blown fuse 5A of mechatro controller :

"DATA COMMUNICATION ERROR" is displayed on the gauge cluster in the condition where the controller program is not executed.

b. Blown fuse 20A of mechatro controller

The controller functions normally but the power supply applied when the controller drives the solenoid, etc. stops.

Many error codes are displayed on the gauge cluster.

D013, D023, D033, D063,

E013, E023, F021

### 46.4 TROUBLESHOOTING BY ERROR CODE

When error code was displayed on the gauge cluster with the aid of self-diagnosis display function, carry out the troubleshooting referring to applicable page in the contents of error codes.

Error Code	Trouble	Described page
A015	Engine adjustment (A adjustment) is not adjusted yet or is failed.	46-7
A025	Pump propo. valve adjustment (B adjustment) is not adjusted yet or is failed.	46-7
A035	Unload valve adjustment (C adjustment) is not adjusted yet or is failed.	46-8
A215	Written data of ROM adjustment data is incorrect.	46-8
A225	Writing of ROM adjustment data is incorrect.	46-9
A235	Written data of ROM hour meter data is incorrect.	46-9
A245	Writing of ROM hour meter data is incorrect.	46-10
A255	Writing of proportional valve adjustment data is incorrect.	46-10
B012	Incorrect output of boom up pressure sensor	46-11
B013	Disconnection of boom up pressure sensor	46-11
B014	Short-circuit of boom up pressure sensor	46-12
B022	Incorrect output of boom down pressure sensor	46-12
B023	Disconnection of boom down pressure sensor	46-13
B024	Short-circuit of boom down pressure sensor	46-13

Table46-17

Error code	B034		
Trouble	Arm-out pressure sensor's power source is shortcut.		
Judging condition	The input voltage from arm-out pressure sensor is 4.7V or more.		
Symptom	Shock at stopping of arm-out is great.		
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, P2 unload proportional valves to 0mA. (Valve emergency mode)		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	5	B-3 ARM OUT
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Arm-out pressure sensor SE-8	When B034 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 arm-out pressure sensor and controller CN-131F CN-101F	When B034 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.	

Table46-18

Error code	B042		
Trouble	Arm-in pressure sensor outputs error		
Judging condition	After starter switch ON and engine does not start yet. And the input voltage from the arm-in pressure sensor after starter switch ON is in the range of 1.4V or more to less than 4.7V.		
Symptom	The arm-in 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-4 ARM IN
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Arm-in pressure sensor SE-7	When B042 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 arm-in pressure sensor and controller CN-130F CN-101F	When B042 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

## 46. TROUBLE SHOOTING (BY ERROR CODES)

**Table46-39**

Error code	B163		
Trouble	P1 side option pressure sensor's wiring is disconnected.		
Judging condition	The input voltage from P1 side option pressure sensor is 0.1V or less.		
Symptom	The P1 side option does not work.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) Set output of P1 unload proportional valve to 0mA. (Valve emergency mode) But normal control is done when the left control pedal selection is ON.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	B-16 P1 OPT.
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• P1 side option pressure sensor SE-20	When B163 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 side option pressure sensor and controller CN-304F CN-102F	When B163 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.	

**Table46-40**

Error code	B164		
Trouble	P1 side option pressure sensor's wiring is disconnected.		
Judging condition	The input voltage from P1 side option pressure sensor is 4.7V or more.		
Symptom	The P1 side option does not work.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) Set output of P1 unload proportional valve to 0mA. (Valve emergency mode) But normal control is done when the left control pedal selection is ON.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	B-16 P1 OPT.
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• P1 side option pressure sensor SE-20	When B164 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 side option pressure sensor and controller CN-304F CN-102F	When B164 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.	

Table46-61

Error code	D063		
Trouble	Arm-in spool 2 proportional valve's wiring is disconnected.		
Judging condition	The feed-back value from proportional valve is 100mA or less. (If output is 100mA or less, judging is not done.)		
Symptom	Operability of combined operation with arm-in becomes poor.		
Control in the event of failure	Set Arm-in spool 2 proportional valve output to 0mA.		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	8	D-4 ARM IN-2-SPEED
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Arm-in spool 2 proportional valve PSV-A	When D063 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 Arm-in spool 2 proportional valve and controller CN-121F CN-105F	When D063 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.	

Table46-62

Error code	E012		
Trouble	P1 pump proportional valve and output transistor ON are failure.		
Judging condition	The feed-back value from proportional valve is 1000mA or more.		
Symptom	The delicate operability of P2 pump related attachment becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode)		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	9	E-1 PUMP P1
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• P1 pump proportional valve PSV-P1	When E012 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it. When replacing of connector is executed, turn off power source once.	
2	• Wiring between P1 pump proportional valve and controller CN-141F CN-105F	When E012 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary. When replacing of connector is executed, turn off power source once.	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

## 46. TROUBLE SHOOTING (BY ERROR CODES)

**Table46-82**

Error code	H033		
Trouble	Arm angle potentiometer's wiring is disconnected.		
Judging condition	The input voltage from arm angle potentiometer is 0.1V or less.		
Symptom	Indications of rating load and working radius of High-reach crane become abnormal.		
Control in the event of failure	Normal control		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	12	H-3 ARM
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Arm angle potentiometer SE-19	Measure the resistance between terminals of arm angle potentiometer. 4.0~6.0k Ω Turn the potentiometer and measure resistance between signal and GND. Normal value: 0 to all resistance (4.0~6.0)k Ω	
2	• Wiring between arm angle potentiometer and controller CN-703F CN-103F	Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

**Table46-83**

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

Table46-99



Error code	R184		
Trouble	Safety lock lever relay error		
Judging condition	The mechatro controller output line to safety lock lever relay is short-circuited with the power source.		
Symptom	Safety lock lever timer does not actuate.		
Control in the event of failure	Relay output is stopped.		
Returned in normal condition	When the power is OFF		
Service diagnosis checking screen	Screen No.	4	K-4 LOCK LEVER
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	<ul style="list-style-type: none"> <li>Safety lock lever relay R-26</li> </ul>	<p>When error R184 is cancelled after removing of safety lock lever relay, check relay unit for failure, replace it with new one if failed.</p> <p>When resistance between relays (1) and (2) is 0 Ω, it is in abnormal condition.</p> 	
2	<ul style="list-style-type: none"> <li>Wiring between safety lock lever relay and controller CN-109F, CN2-2</li> <li>Fuse &amp; relay box E-1</li> </ul>	<p>When R184 is left displayed with the relay removed</p> <p>Check that no power 24V is produced on relay (-) line according to the wiring checking procedure and replace it if necessary.</p> <p>When no failure found after checking on wiring and R184 is left displayed.</p> <p>Replace fuse/relay box.</p>	
3	<ul style="list-style-type: none"> <li>Mechatro controller</li> </ul>	Check that the error is corrected after replacement of controller.	

Table46-100

Error code	R214		
Trouble	Safety relay error		
Judging condition	The mechatro controller output line to safety relay is short-circuited with the power source.		
Symptom	Safety relay does not actuate.		
Control in the event of failure	Relay output is stopped.		
Returned in normal condition	When the power is OFF		
Service diagnosis checking screen	Screen No.	4	K-2 SAFETY RLY
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	<ul style="list-style-type: none"> <li>Safety lock lever relay R-26</li> </ul>	<p>When error R214 is cancelled after removing of safety relay, check relay unit for failure, replace it with new one if failed.</p> <p>When resistance between relays (1) and (2) is 0 Ω, it is in abnormal condition.</p> 	
2	<ul style="list-style-type: none"> <li>Wiring between safety lock lever relay and controller CN-109F, CN2-2</li> <li>Fuse &amp; relay box E-1</li> </ul>	<p>When R214 is left displayed with the relay removed</p> <p>Check that no power 24V is produced on relay (-) line according to the wiring checking procedure and replace it if necessary.</p> <p>When no failure found after checking on wiring and R214 is left displayed.</p> <p>Replace fuse/relay box.</p>	
3	<ul style="list-style-type: none"> <li>Mechatro controller</li> </ul>	Check that the error is corrected after replacement of controller.	

## 47. TROUBLESHOOTING (BY TROUBLE)

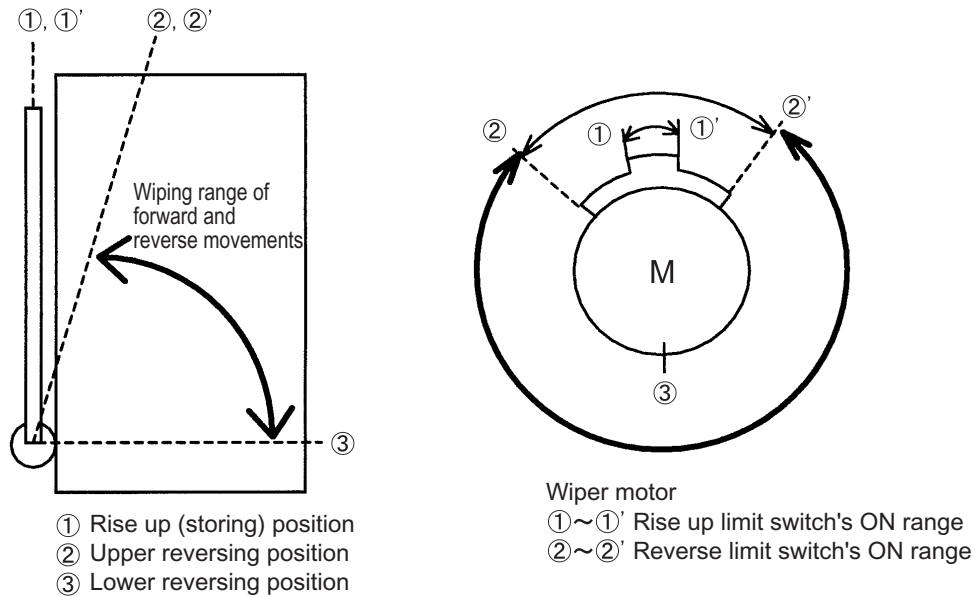
No.	Sections	Contents/normal value		Corrective action, others
3	Pump pressure sensor	Carry out service diagnosis for P1, P2 pump pressures in operation.	•See Service Diagnosis Data List Operation No.7 arm in full lever and in operation	When there is difference between P1 and P2 pump pressures, check 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.6 Arm in 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 to 1.2MPa in arm in 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.7 Arm in 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/P2 pump proportional valve pressures are 2.0MPa or more in arm in full lever and high idling operation. (Secondary pressure is affected by oil temperature and attachment weight)	Replace proportional valve
8	Actual measuring current value of arm in spool 2 proportional valve	Carry out service diagnosis	•See Service Diagnosis Data List Operation No. 1 Operation is nil Operation No.6 Arm in full lever & relief Operation No.7 Arm in 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.
9	Secondary pressure of arm in spool 2 proportional valve	Measure directly the proportional valve secondary pressure at the ports A8 (arm 2 spool) of 8 sections solenoid block.	Check that secondary pressure of proportional valve secondary pressures are within the range of following Lever neutral: 0MPa Motion in the air: 1.7 to 2.2MPa Arm in relief: 2.5MPa or more	Replace proportional valve
10	Actual measuring current value of travel straight proportional valve	Carry out service diagnosis	Check that the value is not change regardless of operation •See Service Diagnosis Data List Operation No. 1 Operation is nil Operation No.18 Travel right full lever & idling Operation No.19 Travel left full lever & idling	•Check pressure sensor of travel •In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
11	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	0.8MPa or less in high idling operation regardless of neutral/operation	Replace proportional valve
12	Remote control valve	Check targeted remote control valve	Check that spool is free from abnormal damage and spring is free from breakage	Replace

## 47. TROUBLESHOOTING (BY TROUBLE)

No.	Sections	Contents/normal value		Corrective action, others
5	Actual measuring current value of P1/P2 unload proportional valve	Carry out service diagnosis	<ul style="list-style-type: none"> <li>•No.8 D-1 P1 unload valve (cut valve) D-1 P2 unload valve (cut valve)</li> <li>•See Service Diagnosis Data List Operation No.18 Travel right full lever &amp; idling Operation No.19 Travel left full lever &amp; idling</li> </ul>	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
6	Secondary pressure of P1, 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 followings in travel right (left), forward (reverse) full lever and high idling operation Travel right (P1 unload): 0.5 to 1.0MPa Travel left (P2 unload): 0.5 to 1.0MPa	Replace proportional valve
7	Actual measuring current value of P1/P2 pump proportional valve	Carry out service diagnosis	<ul style="list-style-type: none"> <li>•No.9 E-1 P1 pump E-2 P2 pump</li> <li>•See Service Diagnosis Data List Operation No.18 Travel right full lever &amp; idling Operation No.19 Travel left full lever &amp; idling</li> </ul>	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
8	Secondary pressure of P1, P2 pump proportional valve	Measure the pump proportional valve secondary pressure directly (Ports a3, a4)	Check that P1/P2 unload secondary pressures are within the range of followings in travel right (left), forward (reverse) full lever and high idling operation Travel right (P1 pump): 2.7MPa or more Travel left (P2 pump): 2.7MPa or more	Replace proportional valve
9	Exchange P1 for P2	Exchange delivery pipe of P1 for P2	Check the direction of deviation	If the direction is changed, inspect a pump. If the direction is not changed, inspect a valve and travel unit.
10	Remote control valve	Check targeted remote control valve	Check that spool is free from abnormal damage and spring is free from breakage Check sealing ability of shuttle valve and entry of dust in orifice	Replace
11	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)
12	Travel spool <Trouble> Pump pressure is high.	Visual check of targeted spool	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)
13	Travel motor relief valve	Check set pressure	Check P1 and P2 pump pressures are 32MPa or more in right and left travel levers full lever (relief operation at locked crawler belt) and high idling	If P1 is low, right travel motor's relief valve is failed. If P2 is low, left travel motor's relief valve is failed. Replace as necessary

## 47. TROUBLESHOOTING (BY TROUBLE)

### (5) Wiper does not function



No.	Sections	Contents/normal value	Corrective action, others																																																
1	Fuse	Check fuse No.20	Replace fuse																																																
2	SW-19: Wiper interlock switch	Service diagnosis No.19 D125 Wiper switch display (D125) is OFF with front window closed.	Check wiper interlock switch and repair it if necessary Check according to "WIRING CHECKING PROCEDURE" and repair it if necessary																																																
3	Rise up limit switch built-in wiper motor Reverse limit switch	Service diagnosis No.25 Wiper system  Switch action in operation <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Normal condition</th> <th>①~①'</th> <th>①~②,①'~②'</th> <th>②~③~②'</th> </tr> </thead> <tbody> <tr> <td>Rise up limit switch</td> <td>ON</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>Reverse limit switch</td> <td>ON</td> <td>ON</td> <td>OFF</td> </tr> </tbody> </table>	Normal condition	①~①'	①~②,①'~②'	②~③~②'	Rise up limit switch	ON	OFF	OFF	Reverse limit switch	ON	ON	OFF	Check according to "WIRING CHECKING PROCEDURE"																																				
Normal condition	①~①'	①~②,①'~②'	②~③~②'																																																
Rise up limit switch	ON	OFF	OFF																																																
Reverse limit switch	ON	ON	OFF																																																
4	R-31: Arc prevention relay R-29: Forward rotation relay R-30: Reverse rotation relay	Service diagnosis No.25 Wiper system  <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>When started by forward rotation:</th> <th>STOP</th> <th>START①</th> <th>①~②</th> <th>②~③</th> <th>③~②'</th> <th>②' (STOP)</th> <th>②' (REVERSE)</th> <th>②'~③</th> <th>③~②</th> <th>② (STOP)</th> <th>② (FORWARD)</th> </tr> </thead> <tbody> <tr> <td>Arc prevention relay</td> <td>OFF</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>OFF</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>Forward rotation relay</td> <td>OFF</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>Reverse rotation relay</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>OFF</td> <td>ON</td> <td>ON</td> <td>ON</td> <td>OFF</td> <td>OFF</td> </tr> </tbody> </table> <p>Check that the relay is worked as shown in the table. * When the limit switch does not change in OFF after 4 seconds from the wiper startup, turn OFF all relay's outputs.</p> <p>Check that the relay is excited. Check relay &amp; fuse box and replace it if necessary.</p>	When started by forward rotation:	STOP	START①	①~②	②~③	③~②'	②' (STOP)	②' (REVERSE)	②'~③	③~②	② (STOP)	② (FORWARD)	Arc prevention relay	OFF	ON	ON	ON	ON	OFF	ON	ON	ON	OFF	ON	Forward rotation relay	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	Reverse rotation relay	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	
When started by forward rotation:	STOP	START①	①~②	②~③	③~②'	②' (STOP)	②' (REVERSE)	②'~③	③~②	② (STOP)	② (FORWARD)																																								
Arc prevention relay	OFF	ON	ON	ON	ON	OFF	ON	ON	ON	OFF	ON																																								
Forward rotation relay	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	ON																																								
Reverse rotation relay	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF																																								

# 51. ENGINE

## PREFACE

This service manual explains the single engine. Note that this manual is edited without modification by based on the service manual of HINO MOTOR.

## 7. Definition of terms

Terms in this manual are defined as follows :

- (1) Direction
  - a. Individual unit
    - Front/back direction  
The power input side is front and the output side is back.
    - Rotating direction  
When viewed from the rear, the clockwise direction is right rotation and the counterclockwise direction is left rotation.
    - Vertical direction  
With a unit mounted on the vehicle (chassis), the upward direction is upper and the downward direction is lower.
    - Left/right direction  
When viewed from the rear, the left direction is left and the right direction is right.
- (2) Standard value .....Basic dimension excluding tolerance and clearance generated by tolerances when two parts are joined
- (3) Repair limit...It is the value requiring repair. Symbol of + or - with the value means increase or decrease to the standard value.
- (4) Service limit...It is the value requiring replacement. Symbol of + or - with the value means increase or decrease to the standard value.
- (5) Warning.....It is an item that may result in risk of human life or serious injury by incorrect handling.
- (6) Caution.....It is an item that should not be performed including inhibited work or an item that require attention in working procedures.
- (7) Reference.....It is supplementary explanation in work.

## 8. Unit

- (1) SI unit is used in this manual. SI unit is the international unit to unify the conventional different international units into one unit per quantity and to promote smooth technical communications.
- (2) This manual shows both the SI unit and conventional units. The conventional units are shown in { }.

	SI unit	Convent ional unit	Conversion value* <sup>1</sup> (1[Conventional unit] = X [SI unit])		SI unit	Convent ional unit	Conversion value* <sup>1</sup> (1[Conventional unit] = X [SI unit])
Force	N	kgf	1kgf=9.80665N	Spring constant	N/mm	kgf/mm	1kgf/mm=980665N/ mm
Torque* <sup>2</sup>	N·m	kgf·cm	1kgf·cm=0.0980665 N·m	Volume	L	cc	1cc=1mL
Pressure	Pa	kgf/cm <sup>2</sup>	1kgf/ cm <sup>2</sup> =98.0665kPa =0.0980665MPa	Efficiency	W	PS	1PS=0.735499kW
		mmHg	1mmHg=0.133322k Pa	Calorific value	W·h	cal	1kcal=1.163W·h
Rotational speed	r/min	rpm	1rpm=1r/min	Fuel consumpt ion rate	g/W·h	g/PS·h	1g/PS·h=1.3596g/ kW·h
	min <sup>-1</sup>		1rpm=1min <sup>-1</sup>				

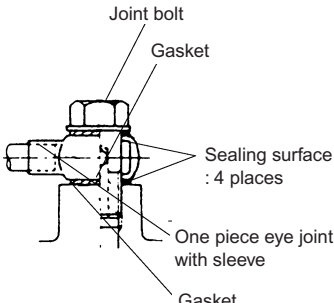
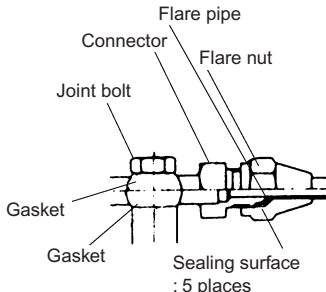
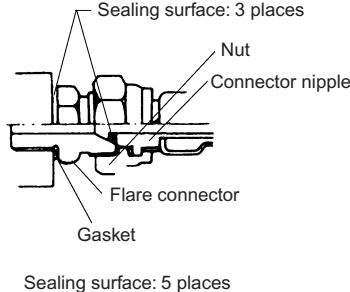
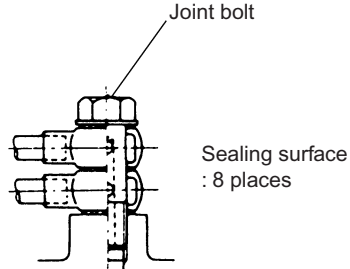
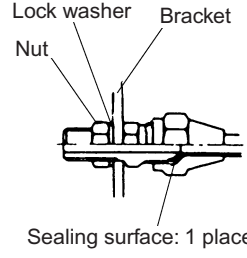
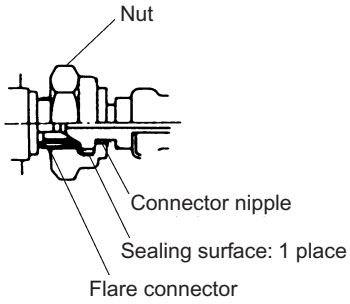
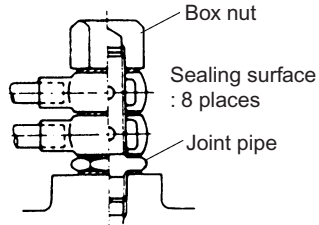
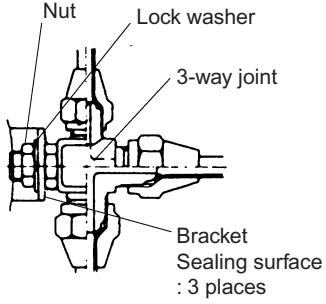
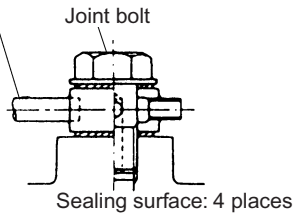
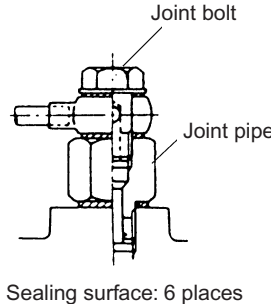
\*<sup>1</sup> : X means the value when 1 [Conventional unit] is converted to the SI unit.

It is used as the conversion factor from the conventional unit to the SI unit.

\*<sup>2</sup> : The conversion value of the torque may vary depending on the unit.

Observe the standard values described for each unit.

3. Examples of joint methods in various pipes

Gasket sealing method	Metal sealing method	
	Type A (Flare pipe type)	Type B (Nipple connector type)
		
		
		
<p>One piece eye joint without sleeve</p> 		
		

## Engine Mechanical

### Standard value

JP31199020205006

Unit : mm {in.}

Inspection item		Standard value	Repair limit	Service limit	Action
Valve clearance (cold)	IN	0.30 {0.0118}	—	—	
	EX	0.45 {0.0177}	—	—	
Cylinder liner protrusion		0.01 - 0.08 {0.003 - 0.003}	—	—	
Cylinder liner flange width		8 {0.314}	—	—	
Cylinder block flange width		8 {0.314}	—	—	
Cylinder block inner diameter	A	117 - 117.008 {4.6063 - 4.6066}	—	—	
	B	117.008 - 117.014 {4.6066 - 4.6068}	—	—	
	C	117.014 - 117.022 {4.6068 - 4.6072}	—	—	
Cylinder liner outer diameter	A	116.982 - 116.99 {4.6056 - 4.6059}	—	—	
	B	116.99 - 116.996 {4.6059 - 4.6061}	—	—	
	C	116.996 - 117.004 {4.6061 - 4.6064}	—	—	
Clearance between cylinder liner and cylinder block		0.01 - 0.026 {0.0003 - 0.0010}	—	—	
Cylinder liner inner diameter		112 {4.4094}	—	112.15 {4.4154}	Cylinder Replace liner
Piston outer diameter (Pin hole 23mm{0.9 in.} above the lower end of the skirt Square direction)		111.9±0.006 {4.4089±0.0002}	—	—	
Piston clearance		0.088 - 0.112 {0.0034 - 0.0044}	—	—	Cylinder Liner Replace piston

## Tightening torque (Alternator 50A)

JP31199020205013

Unit : N·m{kgf·cm, lbf·ft}

Tightening area	Tightening torque	Remark
Bearing cover mounting bolt	1.9 - 2.5 {20 - 25, 1 - 2}	
Pulley mounting nut	127 - 157 {1, 300 - 1, 600, 94 - 116}	
Feed coil - Rear bracket	2.9 - 3.9 {30 - 39, 2 - 3}	
Heat sink mounting bolt	1.9 - 2.5 {20 - 25, 1 - 2}	Screw lock is used
Regulator mounting bolt	1.9 - 2.5 {20 - 25, 1 - 2}	
Inside B terminal mounting nut	4.9 - 5.9 {50 - 60, 4 - 4}	
Front side - Rear side mounting bolt	7.8 - 9.8 {80 - 99, 6 - 7}	
Coupler holder mounting bolt	1.9 - 2.5 {20 - 25, 1 - 2}	
Cover mounting bolt	3.3 - 4.4 {34 - 44, 2 - 3}	

## Standard value (starter)

JP31199020205014

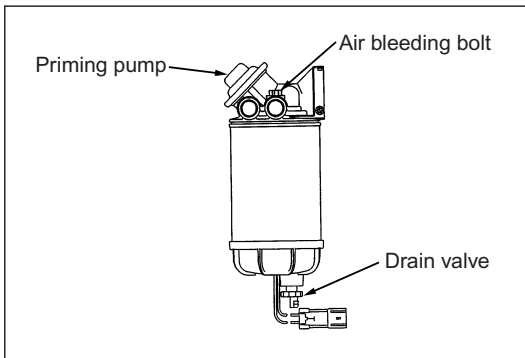
Unit : mm {in.}

Inspection item		Standard value	Service limit	Action
Yoke assembly	Resistance between coil lead wire and yoke	—	1k $\Omega$ or less	Replace yoke assembly
	Brush length	18 {0.7087}	13 {0.5118} or less	Replace brush
Armature assembly	Resistance between commutator and core	1M $\Omega$ or more	1k $\Omega$ or less	Replace armature assembly
	Commutator outer diameter	36 {1.4173}	34 {1.1458} or less	
	Shaft outer diameter A	12 {0.4724}	11.98 {0.4717} or less	
	Shaft outer diameter B	9 {0.3643}	8.98 {0.3535} or less	
	Undercut depth	0.5 - 0.8 {0.0197}	0.2 {0.0079} or less	Correction
Holder assembly	Resistance between holder and plate	—	1k $\Omega$ or less	Replace holder assembly
	Brush length	18 {0.7087}	13 {0.5118} or less	Replace brush
Shaft assembly outer diameter	A	26 {1.0236}	25.90 {1.0197} or less	Replace shaft assembly
	B	12.1 {0.4764}	12.04 {4.7401} or less	
Clutch assembly inner sleeve outer diameter		25 {0.9843}	24.90 {0.9803} or more	Replacement
Metal bushing inner diameter of pinion case		25 {0.9843}	25.2 {0.9921} or more	Replace brush
Metal bushing inner diameter of center bracket		26 {1.02362}	26.2 {1.0315}	Replace center bracket



## Fuel filter drain (on machine main unit)

JP31199050704001



1. Prepare a water container under the drain pipe.
2. Loosen the fuel filter air bleeding bolt and the drain valve. Discharge water at the bottom of the fuel filter case.

**CAUTION** • Since discharged water contains fuel, observe the local disposal procedure for disposal.

3. Close the drain valve.

4. Start the priming pump and bleed air from the system.

**CAUTION** • Make sure that the fuel filter air bleeding bolt is loose.

5. Tighten the fuel filter air bleeding bolt.

Tightening torque :

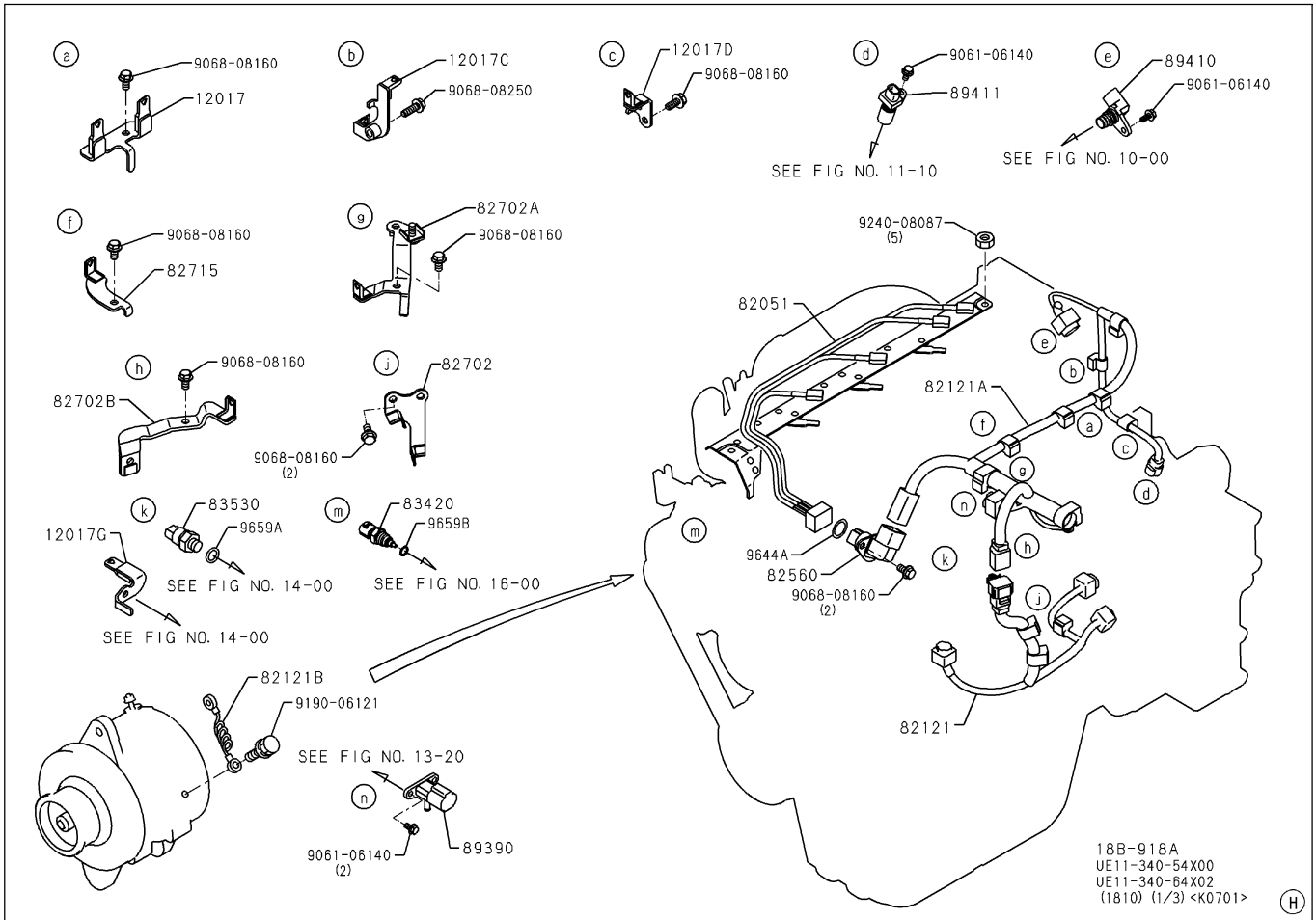
1.7 - 2.6 N·m {17.3 - 23 kgf·cm, 1.2 - 1.9 lbf·ft}

**CAUTION** • After work, wipe off spilled water or fuel. After start of the engine, make sure that there is no fuel leak.

# Electrical System

## Part layout

JP31199070402001



SAPH311990700001

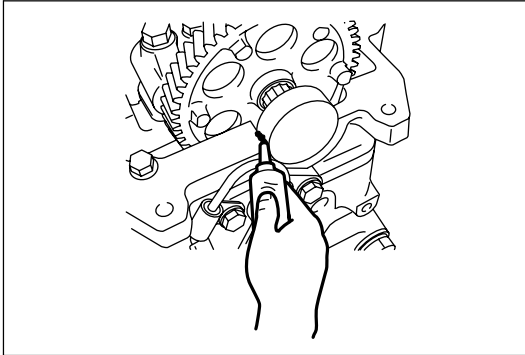
82051	Injector harness	89390	Boost pressure sensor
83420	Water temperature sender gauge	89410	Engine sub revolution sensor
83530	Oil pressure warning switch	89411	Engine main revolution sensor

### Tightening torque

9190-06121	4N·m{40kgf·cm, 3lb·ft}		
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## 8 INTAKE

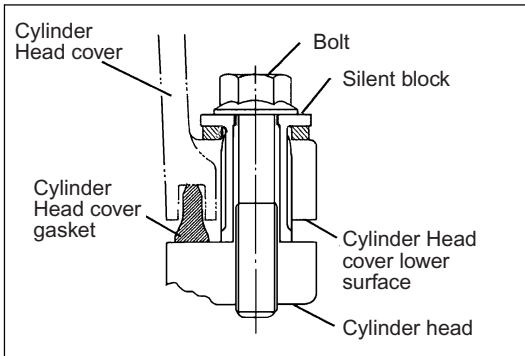
<b>Intake Manifold .....</b>	<b>8-2</b>
Part layout.....	8-2
Replacement.....	8-4



SAPH311990900015

- (3) Coat the semicircular plugs with liquid gasket (Three Bond TB 1207B-Black or equivalent) just before you install the cylinder head cover.

**CAUTION** • Install the oil cooler within 20 minutes after application of the liquid gasket.



SAPH311990900016

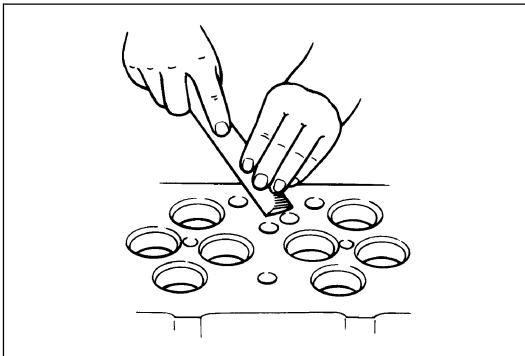
- (4) Put the cylinder head cover on the cylinder head and tighten bolts.

**Tightening torque : 28.5 N·m {290 kgf·cm, 21 lbf·ft}**

**NOTICE** • Silent block the rubber is attached to the spacer

## Overhaul of cylinder head

JP31199090702001

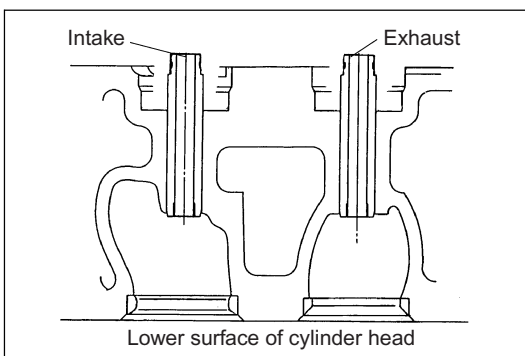


SAPH311990900017

### 1. Cleaning of cylinder head

- (1) Remove carbon or other deposit using a scraper.
- (2) Clean the cylinder head.

**CAUTION** • To remove carbon or other deposit, do not damage the lower surface of the cylinder head.



SAPH311990900018

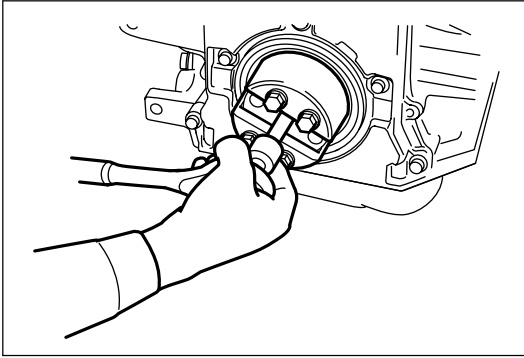
### 2. Replacement of valve guide

- (1) Remove the valve stem seal.
- (2) Remove the valve guide using a brass bar or press.
- (3) When a new valve guide is assembled, do not pry the end in assembly and press fit using a special tool.

**Special tool : 09471-1520 Guide**

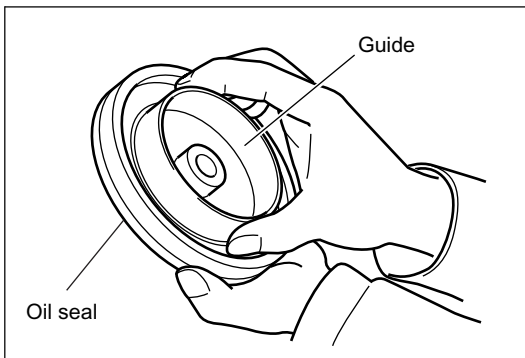
**CAUTION** • In press fit, be careful not to damage the valve stem at the upper/lower ends of the guide.

• In press fit, be sure to apply engine oil to the circumference of the valve guide.



SAPH311990900048

- (3) Remove two bolts which installed the plate of the special tool oil seal puller on the crankshaft.
- (4) Attach the accompanying center bolt to the special tool oil seal puller and tighten it. Pull out the front oil seal.

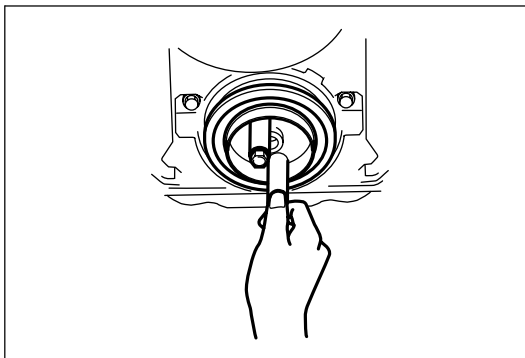


SAPH311990900049

## 2. Installation of front oil seal

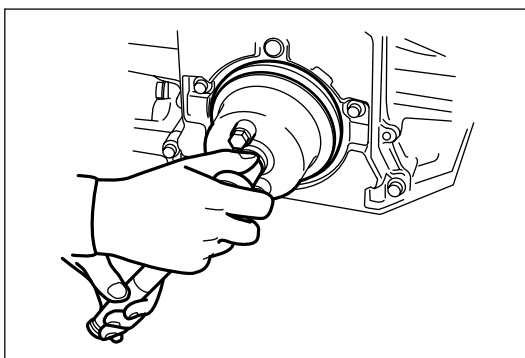
- (1) Insert a new oil seal into the guide of the oil seal press.  
**Special tool : 09407-1030 Oil seal press**

**⚠ CAUTION** • Be careful for front/rear directions of the front oil seal. (The felt surface is at the crankshaft damper side.)



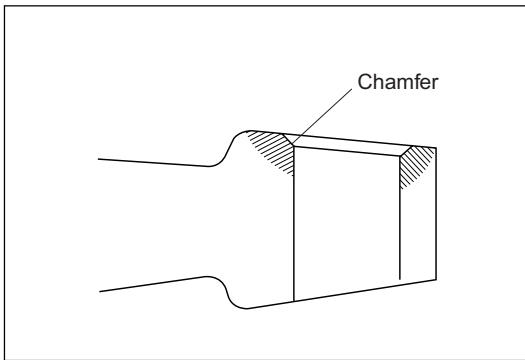
SAPH311990900050

- (2) Remove contamination from the joint surface of the front oil seal and the cylinder block.
- (3) Apply small amount of engine oil to the seal area of the front oil seal.
- (4) Install the oil seal press guide inserting a new front oil seal with accompanying guide bolts on the crankshaft.



SAPH311990900051

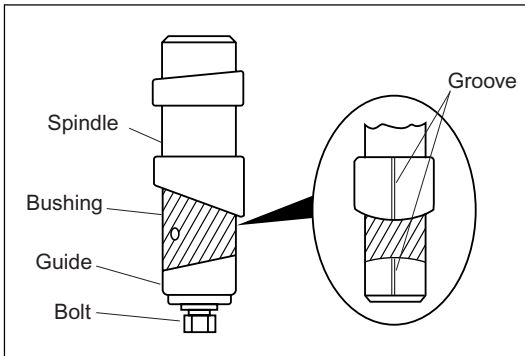
- (5) Align the oil seal press hole to the guide bolt and insert the oil seal press.
- (6) Attach the accompanying center bolt to the oil seal press and tighten it until stop. Press fit the front oil seal.



SAPH311990900086

- (5) Chamfer one side of the connecting rod small end uniformly according to the figure.

- CAUTION**
- Remove burr completely.
  - After chamfering, remove dirt from the inner surface at the small end and from the oil hole.



SAPH311990900087

## 2. Installation of connecting rod bushing

- (1) Install a new bushing on the special tool spindle and install the special tool guide and the special tool bolt.

**Special tool : 09402-1540 Spindle**

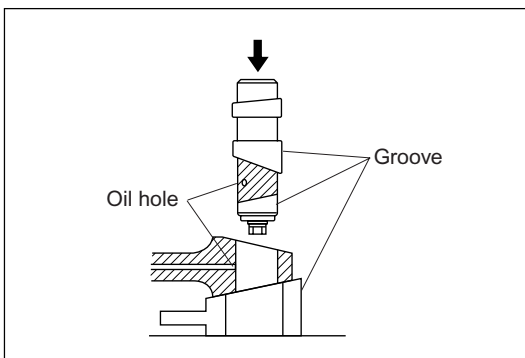
**09481-1540 Guide**

**9191-08252 Bolt**

**Tightening torque :**

**5 - 6 N·m {50 - 70 kgf·cm, 3.5 - 4 lbf·ft}**

- CAUTION**
- Align grooves of the special tool guide and the special tool spindle for installation.
  - Make sure that the edge of the special tool spindle and the special tool guide is in close contact.



SAPH311990900088

- (2) Align the connecting rod oil hole with the bushing oil hole assembled on the special tool. Make sure that the groove of the special tool spindle is in alignment with the groove of the special tool press sub-assembly.

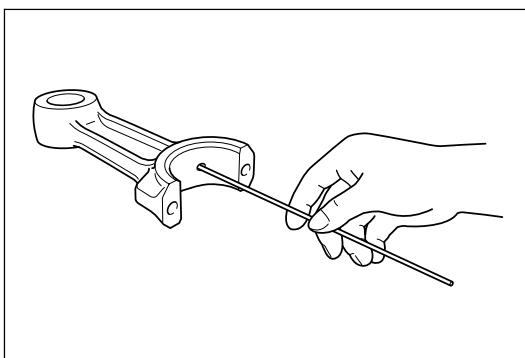
- CAUTION**
- Place the connecting rod so that the chamfer side of the connecting rod small end inner diameter may be the bushing side
  - Apply engine oil to the inner diameter surface of the connecting rod.

- (3) Install the bushing on the connecting rod using a press.  
 (4) Insert a rod with the diameter of 6 mm from the oil hole at the connecting rod large end and make sure that it goes through the oil hole at the small end.

**NOTICE**

- Displacement of oil holes may cause insufficient lubrication, resulting in seizure.

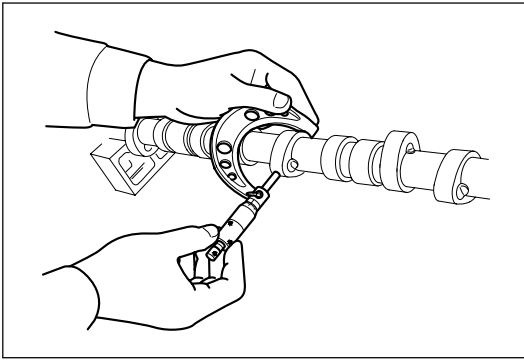
- (5) Insert a new piston pin and check if there is no drag or backlash.



SAPH311990900089

## Inspection of camshaft and camshaft bearing

JP31199090702008

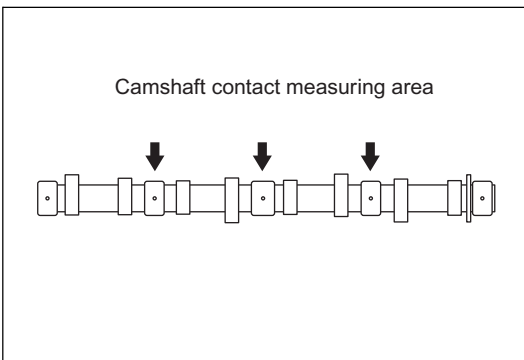


SAPH311990900121

### 1. Inspection of cam height on camshaft

- (1) Measure the cam height using a micrometer. If it is beyond the service limit, replace the camshaft.

		Standard value (mm{in.})	Service limit (mm{in.})
Cam height	IN	50.067{1.9711}	49.987{1.9680}
	EX	52.104{2.0513}	52.024{2.0482}
Cam lift	IN	8.067{0.3176}	(7.987{0.3144})
	EX	10.104{0.3978}	(10.024{0.3946})

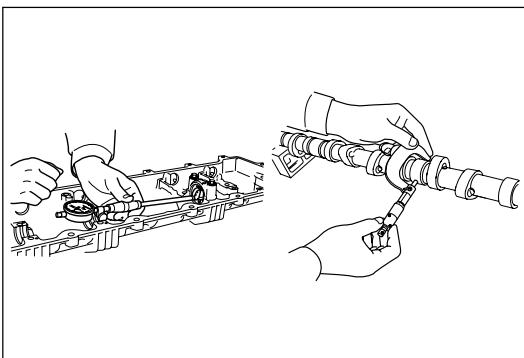


SAPH311990900122

### 2. Inspection of camshaft runout

- (1) Put the journal at both ends of the camshaft on the V block.
- (2) Put a dial gauge to each journal of the camshaft and measure runout of the camshaft. If it is beyond the service limit, replace the camshaft.

Standard value (mm{in.})	Service limit (mm{in.})
0.04{0.0016}	0.1{0.0039}



SAPH311990900123

### 3. Inspection of camshaft bearing oil clearance

- (1) Measure the outer diameter of the camshaft journal using a micrometer.

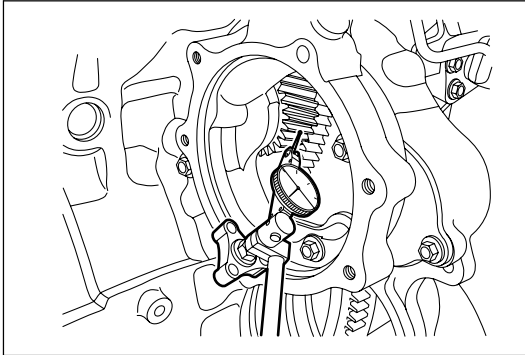
Standard value (mm{in.})	Service limit (mm{in.})
40{1.5748}	39.85{1.5689}

- (2) Measure the camshaft bearing inner diameter using a cylinder gauge.

Standard value (mm{in.})	Service limit (mm{in.})
40{1.5748}	40.15{1.5807}

- (3) Calculate the difference of the camshaft journal bearing inner diameter. If it is beyond the standard value, replace the camshaft or the camshaft bearing.

Standard value (mm{in.})	0.020 - 0.063 {0.0008 - 0.0025}
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SAPH311990900150

- (3) Measure backlash between the main idle gear and the air compressor idle gear using a dial gauge and a magnet stand. If it is beyond the service limit, replace each gear.

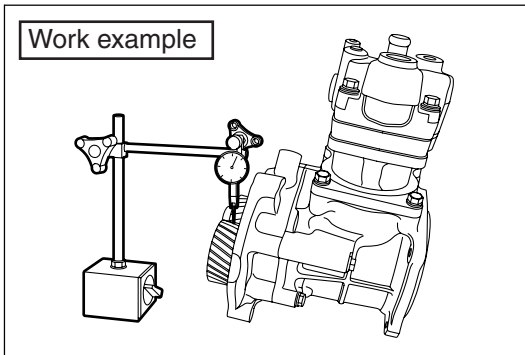
**NOTICE**

- If the magnet stand is not stable, provide a steel plate for measurement using bolt holes of the cylinder block.

Standard value (mm{in.})	Service limit (mm{in.})
0.032 - 0.096 {0.0013 - 0.0038}	0.10{0.0039}

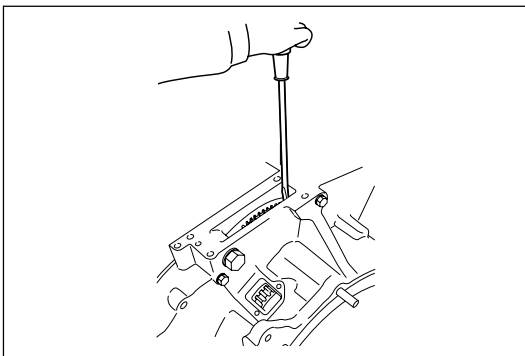
#### 4. Inspection of backlash between idle gear at bearing case and supply pump drive gear

- (1) Remove the supply pump drive.  
"Reference : Replacement, Supply pump"
- (2) Remove the bearing case assembly.
- (3) Fix the supply pump drive with a vice and install the bearing case assembly.
- (4) Measure backlash between the idle gear and the supply pump drive gear using a dial gauge and a magnet stand. If it is beyond the service limit, replace each gear.



SAPH311990900151

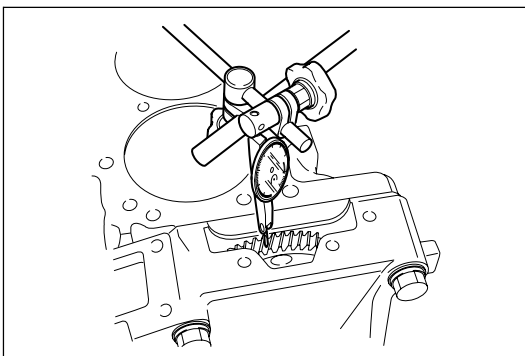
Standard value (mm{in.})	Service limit (mm{in.})
0.020 - 0.083 {0.0008 - 0.0033}	0.10{0.0039}



SAPH311990900152

#### 5. Inspection of backlash between main idle gear and sub-idle gear

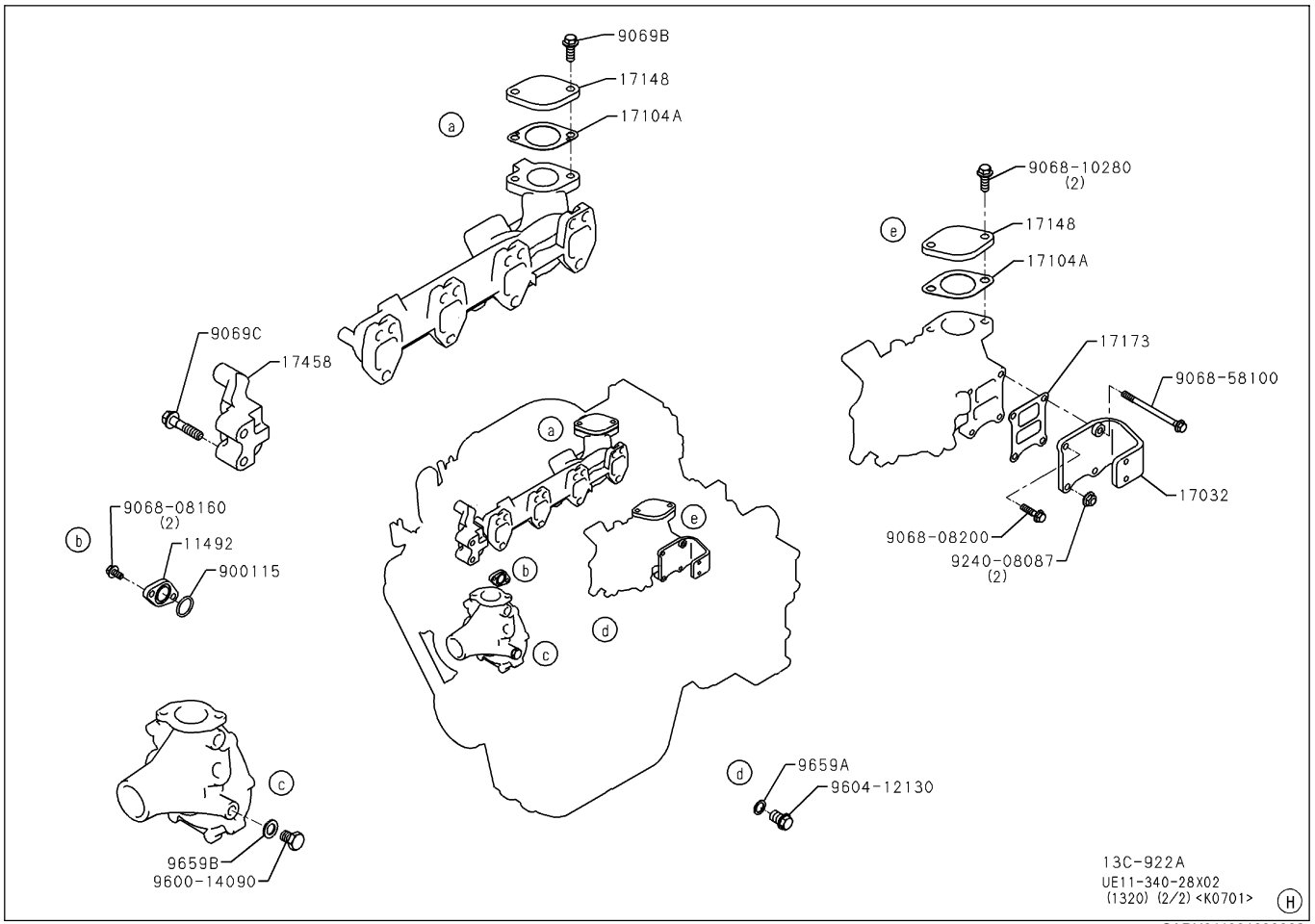
- (1) Insert a large flat tip screwdriver into the main idle gear from the timing gear dust cover of the flywheel housing to prevent turning of the main idle gear.



SAPH311990900153

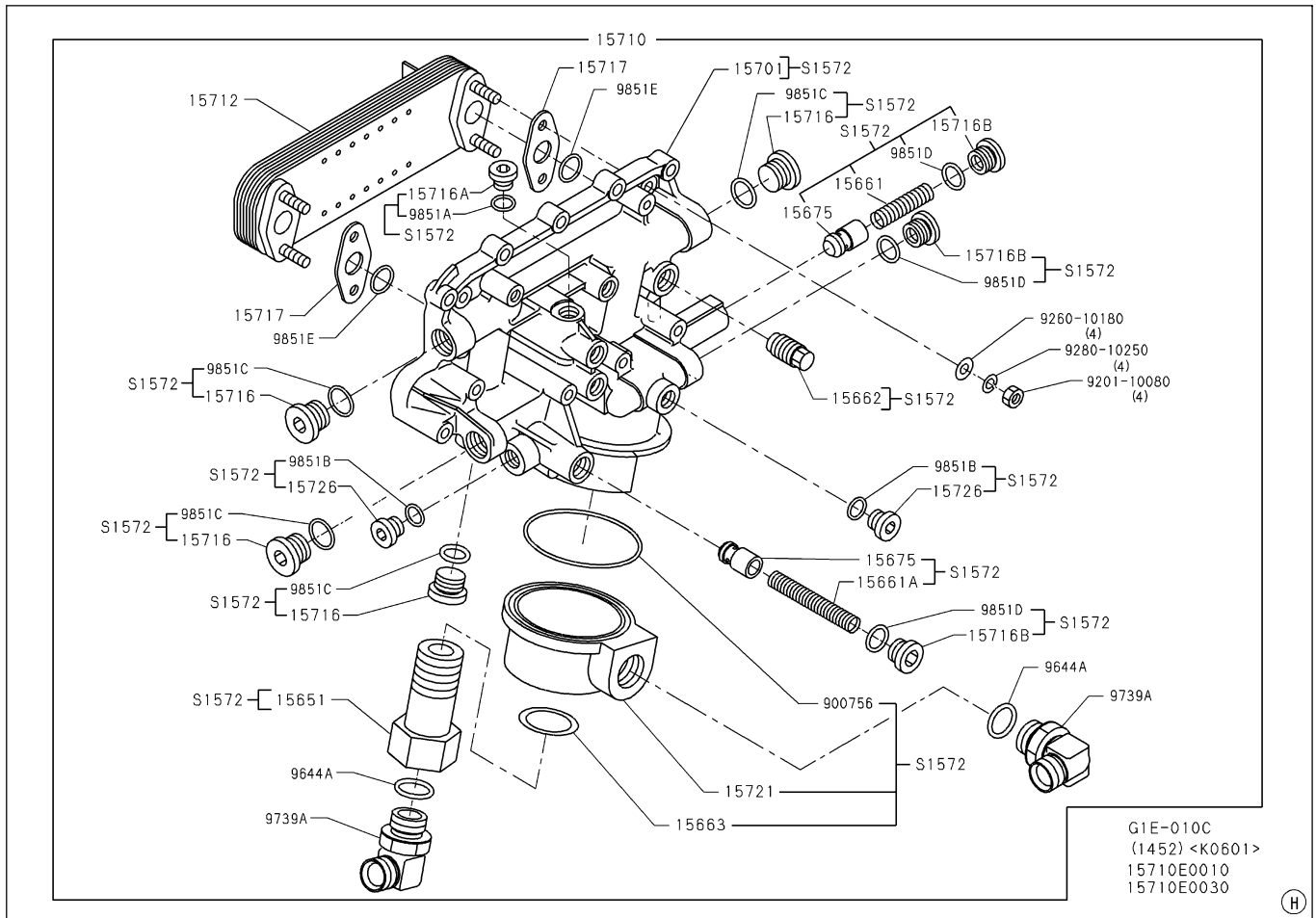
- (2) Measure backlash between the main idle gear and the sub-idle gear using a dial gauge and a magnet stand. If it is beyond the service limit, replace each gear.

Standard value (mm{in.})	Service limit (mm{in.})
0.030 - 0.113 {0.0012 - 0.0044}	0.30{0.0118}



17104A	Gasket*	17148	Plate
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\*Parts not to be reused.



SAPH311991200003

15662	Drain plug	9644A	O-ring*
15675	Safety valve	9739A	Elbow
15701	Oil cooler case	9851A	O-ring*
15710	Oil cooler assembly	9851B	O-ring*
15712	Oil cooler element	9851C	O-ring*
15717	Gasket*	9851D	O-ring*
15720	Oil cooler case assembly	9851E	O-ring*

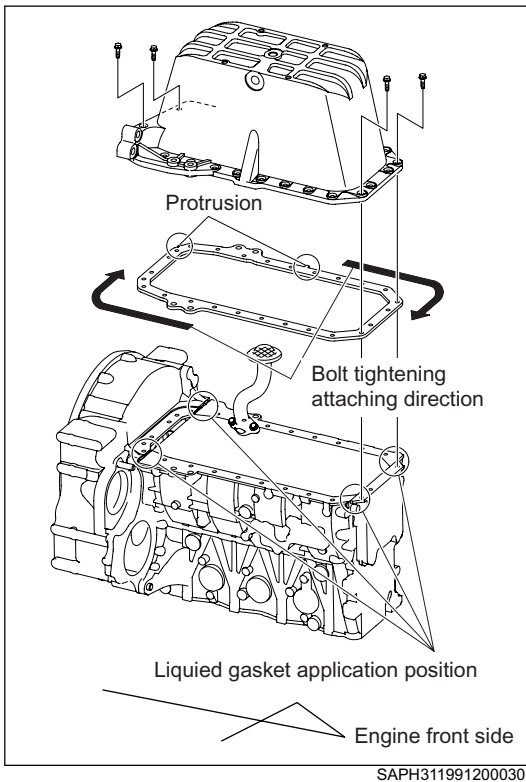
\*Parts not to be reused.

**Tightening torque**

15662	44.1±4.9 N·m {450±50 kgf·cm, 33±4lbf·ft}	9201-10080	24.5±4.9 N·m {250±50 kgf·cm, 18±4lbf·ft}
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## Replacement

JP31199120704004



### 1. Installation of oil pan

- (1) Cut the gasket of the rear end plate to be flush to the cylinder block lower surface using a scraper.
- (2) Make sure that there is no deformation, dirt or oil on the joint surface between the cylinder block and the oil pan. Apply liquid gasket [Threebond TB1207D (silver) or equivalent] to the front rear end of the cylinder block lower surface.
- (3) Insert several stud bolts (70 mm{2.7559 in.} or larger) for positioning into the cylinder block screw hole.
- (4) Position the oil pan gasket protrusion at the intake side and the flywheel housing (printed seal surface at cylinder block). Align the new oil pan gasket and oil pan to the cylinder block lower surface and tighten bolts in the arrow order of the figure.

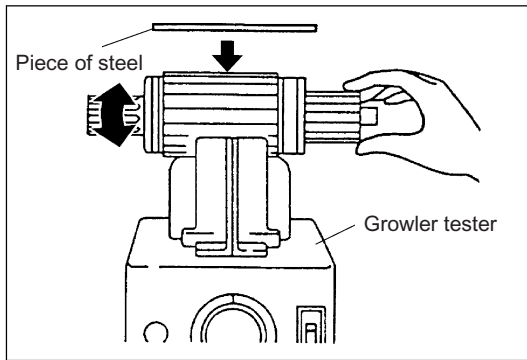
#### **Tightening torque :**

**19.6 - 24.5 N·m {200 - 250 kgf·cm, 14 - 18 lbf·ft}**

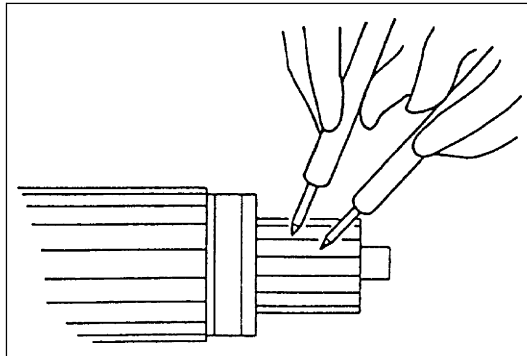
- (5) Remove positioning stud bolts and install the correct bolts.
- (6) Tighten bolts in the arrow order of the figure.

**Tightening torque : 30 N·m {300 kgf·cm, 22 lbf·ft}**

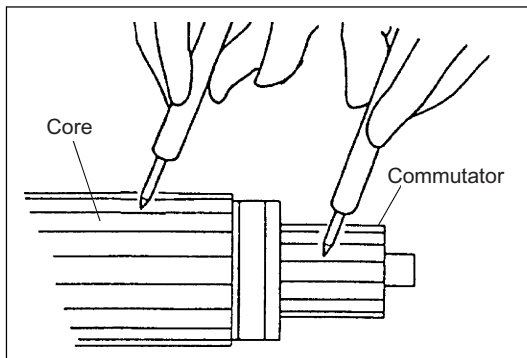
- ⚠ CAUTION**
- Check if the washer is not riding on the flange.
  - Make sure that the printed seal is not peeled or damaged before installation of the oil pan gasket.



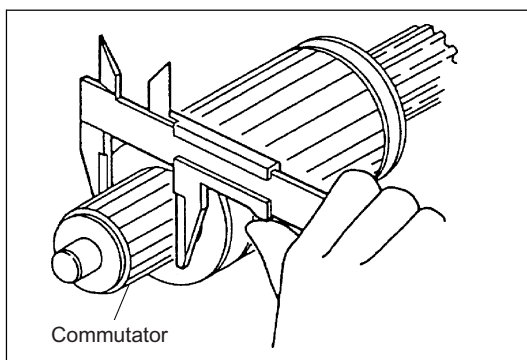
SAPH311991300027



SAPH311991300028



SAPH311991300029



SAPH311991300030

## 2. Inspection of armature assembly

- (1) Turn the armature assembly using a commercially available growler tester and put a piece of steel on the armature assembly. Make sure that the steel piece is not vibrating on the core circumference.

- (2) Make sure that adjacent segments of the commutator have electric continuity using a circuit tester.

- (3) Make sure that there is no discoloration at the coil.

- (4) Measure the resistance between the commutator and the core using a circuit tester and check insulation. When the value is below the service limit, replace it.

Standard value	Service limit
1MΩ or more	1kΩ or less

**CAUTION** • After cleaning and drying, take measurements.

- (5) Measure the commutator outer diameter using vernier calipers. When the value is below the service limit, replace it.

**CAUTION** • After removing roughness on the surface (after polishing), take measurements.

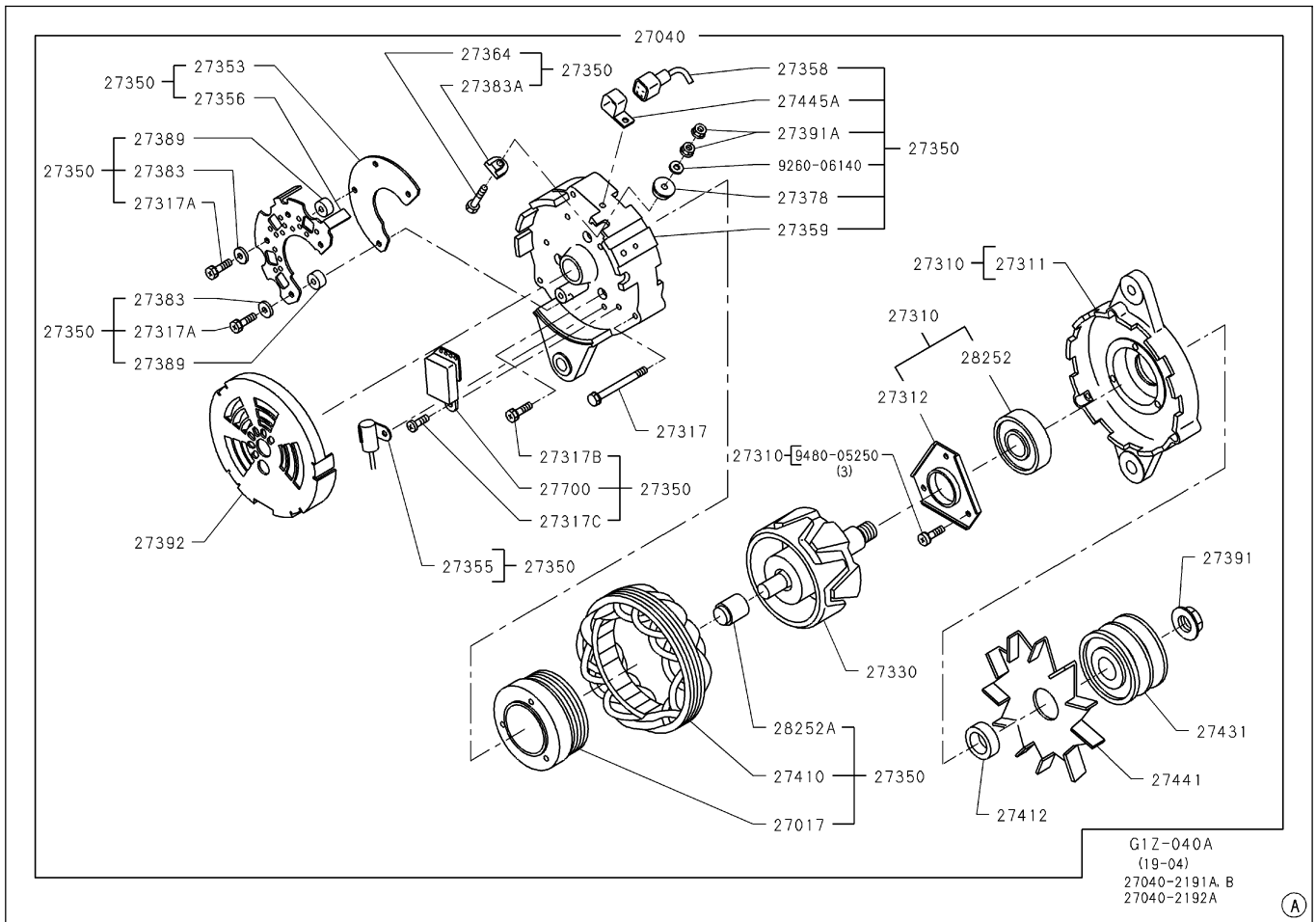
### Commutator outer diameter

Standard value (mm{in.})	Service limit (mm{in.})
36{1.4173}	34{1.3386} or less

## Alternator (50A)

### Part layout (typical example of 50A)

JP31199130402002

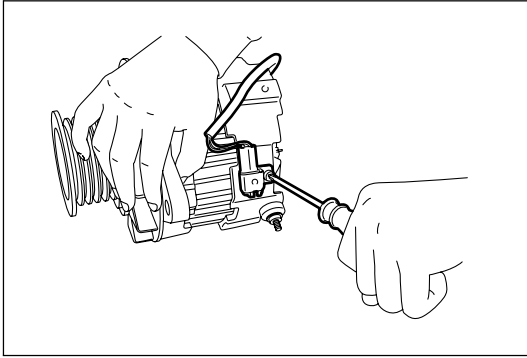


SAPH311991300047

27017	Feed coil	27383A	Insulator
27040	Alternator	27389	Insulator
27310	Drive end frame assembly	27392	Cover
27311	Drive end frame	27410	Stator coil
27312	Bearing cover	27412	Collar
27330	Rotor assembly	27431	Pulley
27350	End frame assembly	27441	Fan
27353	Rectifier minus	27445A	Coupler holder
27356	Rectifier plus	27700	Regulator
27359	End frame	28252	Front bearing
27383	Insulator	28252A	Rear bearing

### Tightening torque

27317	7.8-9.8 N·m{80-99 kgf·cm, 6-7lbf·ft}	27317C	1.9-2.5 N·m{20-25 kgf·cm, 1-2lbf·ft}
27317A	1.9-2.5 N·m{20-25 kgf·cm, 1-2lbf·ft}	27391	127 - 157 N·m{1, 300 - 1, 600 kgf·cm, 94-116lbf·ft}
27317B	2.9 - 3.9 N·m{30 - 39 kgf·cm, 2-3lbf·ft}	27391A	Internal nut : 4.9-5.9 N·m{50-60 kgf·cm, 3.6-4.3lbf·ft}

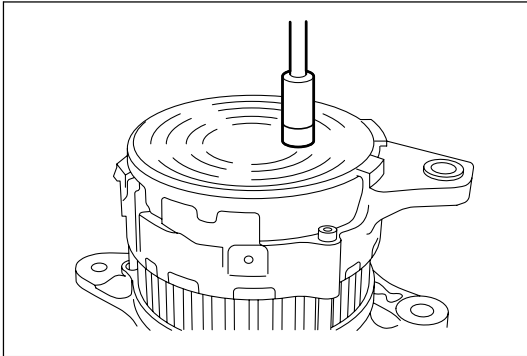


SAPH311991300085

- (2) Install the coupler holder and tighten bolts.

**Tightening torque :**

**1.9 - 2.5 N·m {20 - 25 kgf·cm, 1 - 2 lbf·ft}**



SAPH311991300086

- (3) Align the tab and install the cover. Fix it with bolts.

**Tightening torque :**

**3.3 - 4.4 N·m {34 - 44 kgf·cm, 2 - 3 lbf·ft}**

- ⚠ CAUTION** • Do not hit the cover because the tab may be broken.

# 16 FAILURE DIAGNOSIS FOR EACH ENGINE STATUS


## FAILURE DIAGNOSIS FOR EACH ENGINE STATUS

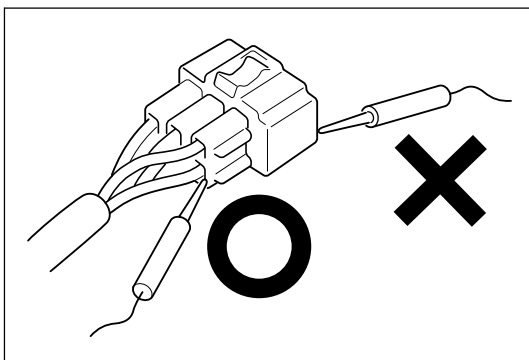
.....	16-2
Engine mechanical .....	16-2
Alternator .....	16-5
Starter .....	16-6
Turbocharger .....	16-7

## Engine ECU

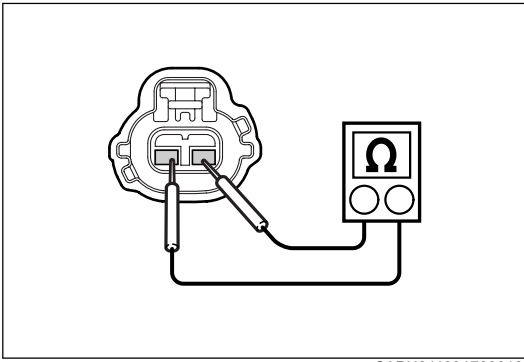
### Precautions

JP31199170102001

-  **CAUTION**
- **Make sure that each connector is connected before inspection.**
  - **Do not place a tester rod on the connecting surface of the connector. Otherwise, terminals are damaged or short-circuited.**
  - **Delete the past failure memory after recording. Perform failure diagnosis again to check current failure.**
  - **After failure analysis, delete the past failure memory. If the past failure memory is not deleted, the failure indicator lamp remains ON.**
  - **All connector drawings are viewed from the connecting surface. Place the tester rod from the back.**



SAPH311991700001

**3** Measurement of resistance between terminals

SAPH311991700013

1. Disconnect 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.  $125.5 \pm 17 \Omega$  (20 °C{68 °F})**

NG

Failure of main engine speed sensor

OK

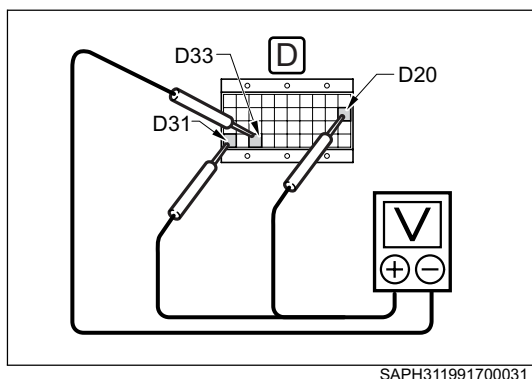
Harness disconnection or connector failure

## Common rail pressure sensor malfunction (DTC code P0192, P0193)

JP31199170601016

DTC	P0192	Common rail pressure sensor circuit low input
DTC	P0193	Common rail pressure sensor circuit high input

### 1 Measurement of voltage between terminals



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 terminals D20/D31 and terminal D33 of the signal check harness.

**Standard value : 0.7 to 4.7 V**

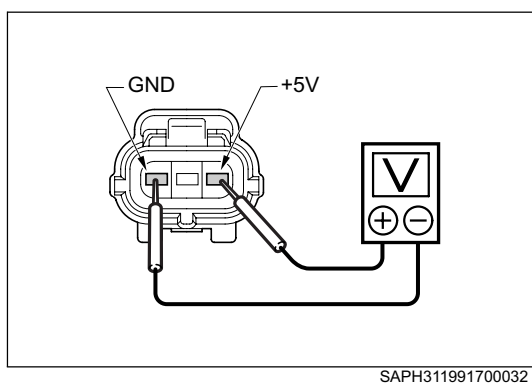
NG

[2] Go to measurement of voltage between terminals.

OK

Engine ECU failure, ECU connector failure

### 2 Measurement of voltage between sensor terminals



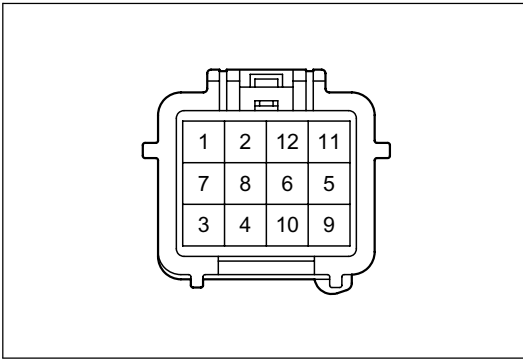
1. Set the starter key to "OFF" and disconnect the connector of the common rail pressure sensor.
2. Set the starter key to "ON" and measure voltage between the +5V terminal and the GND terminal of the common rail pressure sensor connector (at unit harness side).

**Standard value : 5 ± 0.5 V**

NG

[4] Go to measurement of resistance between terminals.

OK

**3 Measurement of resistance between injector terminals**


SAPH311991700043

1. Set the starter key to "OFF".
2. The injector clustered connector at the front side of the engine shall be disconnected.
3. Measure the resistance between terminals of the injector clustered connector (at unit harness side).

DTC code	Terminal to measure resistance	
	+ side	- side
P1211	5, 6, 10, 12	ECU case ground
P1214	2, 4, 7, 8	ECU case ground

**Standard value :**  $\infty \Omega$

NG

Harness failure (failure including pinching of harness which has not satisfied the standard value)

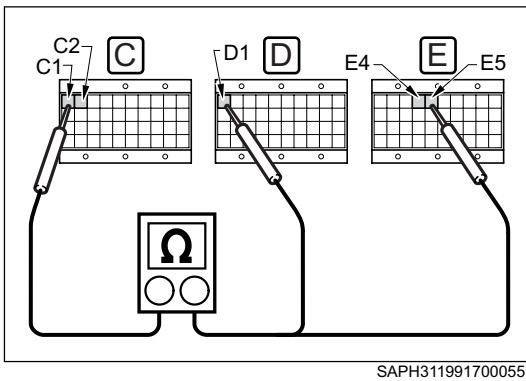
OK

Inspection of harness inside head cover (Short-circuit of the harness inside the head cover to the ground line may have occurred.)

## Preheat circuit malfunction (DTC code P0540)

JP31199170601030

### 1 Measurement of resistance between terminals



1. Set the starter key to "OFF" and connect the signal check harness.
2. Disconnect the ECU side connector of the signal check harness and measure the resistance between terminals C1, C2 and terminals D1, E4, E5.

**Standard value :  $25 \pm 2.5 \Omega$**

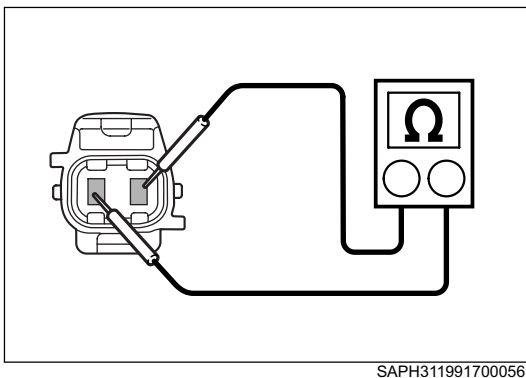
NG

[2] Go to measurement of resistance between terminals.

OK

Engine ECU failure, ECU connector failure

### 2 Measurement of relay resistance



1. Remove the heater relay and measure the resistance between terminals.

**Standard value :  $24.8 \pm 0.5 \Omega$**

NG

Heater relay failure

OK

Harness failure, connector failure

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## 22.8 SWING CIRCUIT

This section describes the following operations.

- (1) Swing left pilot circuit
- (2) Swing auto parking brake
- (3) Swing main circuit
- (4) Swing motor circuit

### 22.8.1 PILOT CIRCUIT FOR LEFT SWING

(1) Operation :

- 1) When the left swing operation is performed, the pilot proportional secondary pressure is delivered through port (5) of left pilot V (9), and the secondary pressure acts on PBs port of C/V (2), and simultaneously flows out from Pss port of C/V and acts on low pressure sensor (SE-5).
- 2) The voltage output by the low pressure sensor is input in the mechatro controller, and is signal-processed.
- 3) Then, the secondary pressure led into PBs port of C/V (2) switches the swing spool.

### 22.8.2 SWING AUTO PARKING BRAKE

(1) Purpose :

Swing lock in neutral position and parking

(2) Principle :

Release mechanical brake only when required to operate swing and arm in.

(3) Operation :

- 1) The swing parking system excites the swing parking SOL (SV-1) usually if the key switch is turned on and works by the action of the mechanical brake.
- 2) The mechanical brake is released if the swing parking solenoid is de-excited only when the secondary operating pressure in the swing and arm in actions acts upon any of the low pressure sensors (SE-5, 7).
- 3) The swing parking solenoid (SV-1) is excited five seconds after the pressure of the swing low pressure sensors (SE-5) is reduced to zero. In the case of arm in operation, the swing parking solenoid (SV-1) is excited the moment the pressure of the arm in low pressure sensor (SE-7) is reduced to zero. This causes the mechanical brake to operate.

### 22.8.3 SWING MAIN CIRCUIT

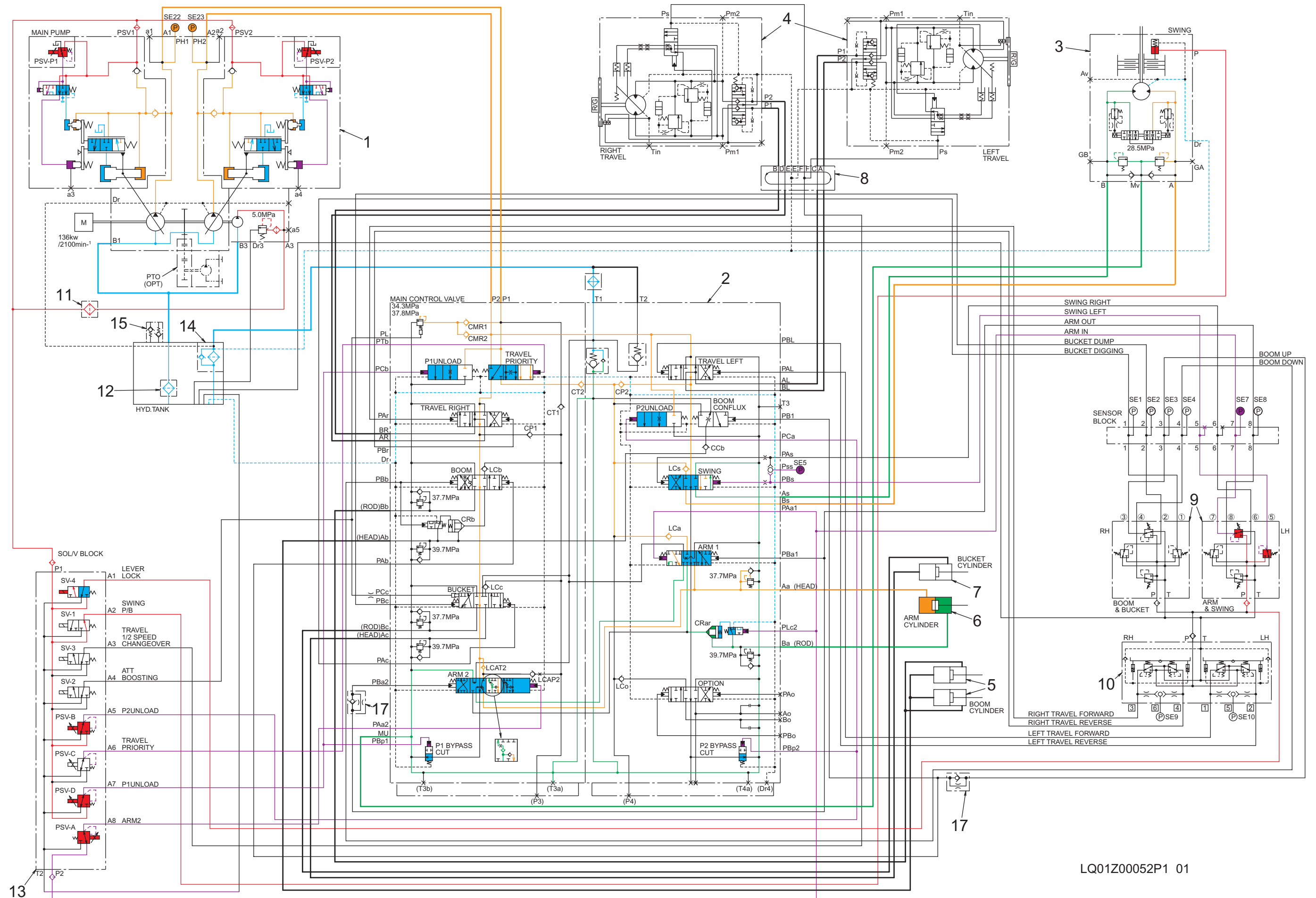
(1) Operation :

The oil delivered from the A2 port of the P2 pump enters the P2 port of C/V (2) and is branched off into the bypass line and the parallel circuit. However, since the bypass line is closed as the swing spool is shifted, the oil pushes the load check valve LCs open through the parallel circuit, enters the A port of the swing motor via the Bs port of C/V (2), and rotates the swing motor counterclockwise.

### 22.8.4 SWING MOTOR CIRCUIT

(1) Anti cavitation circuit at swing deceleration

(2) Shockless relief valve that prevents the swing motor from being reversed.



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Fig. 22-11 COMBINED CIRCUIT : Swing / Arm in operation, swing priority function

23. ELECTRIC SYSTEM

23.3 HARNESS

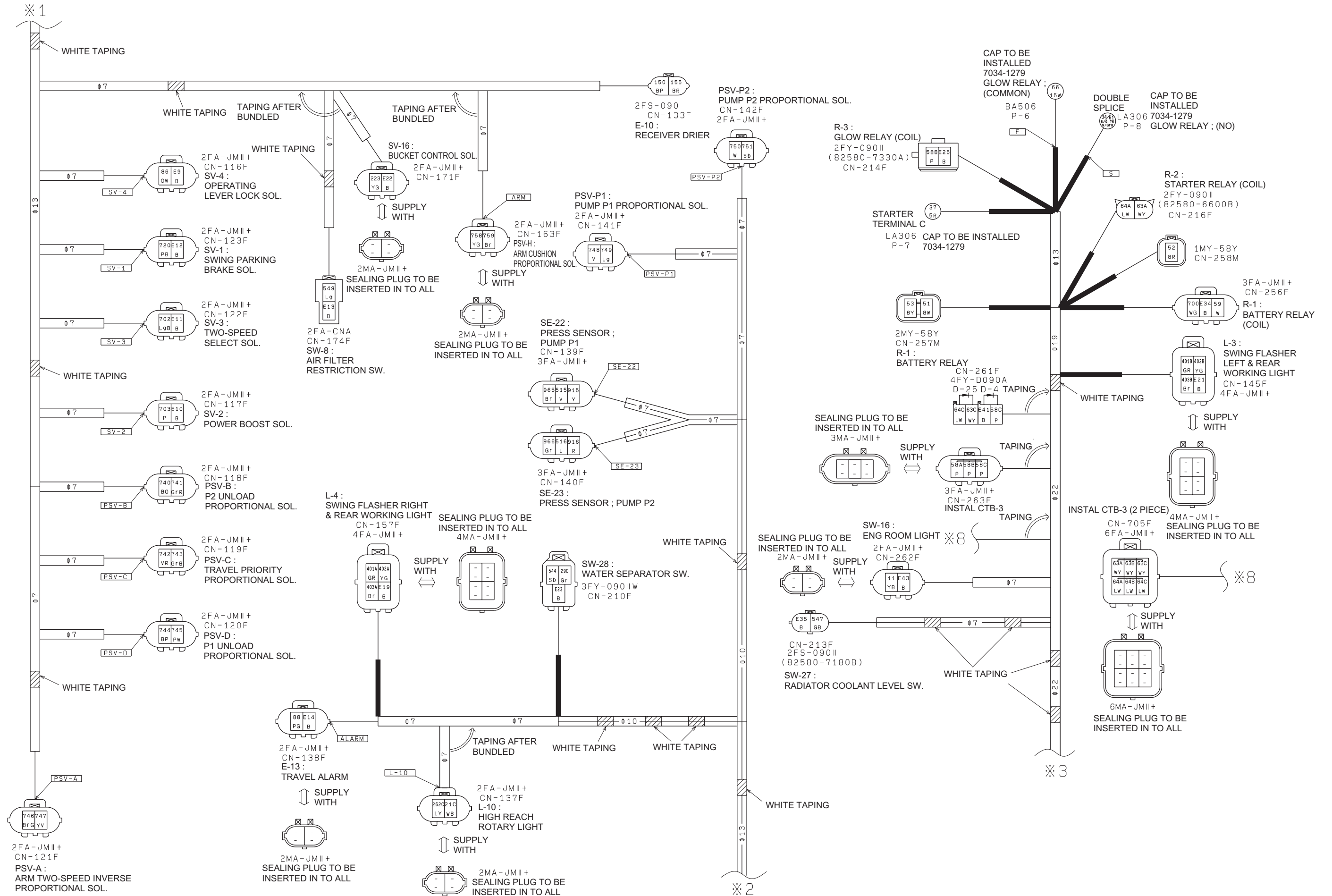
23.3.1 HARNESS LIST

DIVISION		DRAWING No.		HARNESS			REMARKS
POSITION	ITEM	NAME	ASSEMBLY No.	CODE No.	NAME	DRAWING No.	
UPPER FRAME	3.2	INSTRUMENT PANEL ASSY	YN17M00069F1				
	3.3	CONTROLLER INSTALL (ENGINE)	YN22E00220F1				
		CONTROLLER INSTALL	YN22E00219F1				
	3.4	UPPER ELEC ASSY	LC03E00008F1				
	3.5	UPPER HARNESS ASSY	LQ13E00042F1	1	HARNESS	LQ13E01144P5	UPPER
				2	HARNESS	LQ13E01137P1	ECU HARNESS
				3	CABLE	LC13E01144P1	BATTERY TO GROUND
				4	CABLE	LQ13E01100P1	ENGINE GROUND
				5	CABLE	YN13E01441P2	BATTERY TO BATTERY
				6	CABLE	LQ13E01145P1	STARTER
				7	CABLE	LQ13E01094P1	BATTERY TO RELAY
				8	HARNESS	LC13E01193P1	AIR CLEANER
				9	CABLE	LC13E01180P2	GLOW RELAY TO STARTER RELAY
				10	CABLE	LE13E01006P1	FLOOR TO UPPER FRAME GROUND
3.6	ENGINE HARNESS ASSY	LQ16E00010F1	1	HARNESS	LQ16E01015P1	ENGINE SUB	
3.7	UPPER HARNESS ASSY (FLOOR PLATE)	LC13E00032F1	1	HARNESS	YN13E01449P3	FLOOR	
			4	HARNESS	LC13E01186P1	CAB SUB	
			9	CABLE	LE13E01005P1	FLOOR GROUND	
CAB	3.8	CAB HARNESS	LC14E00023F1	1	HARNESS	YN14E01102P3	CAB
BOOM	3.9	BOOM HARNESS ASSY	LQ15E00026F1	1	HARNESS	LQ15E01018P1	BOOM LIGHT
LIGHT	3.10	BOOM LIGHT INSTALL	YN80E00011F1				BOOM LIGHT
	3.11	DECK LIGHT INSTALL	YN80E00049F1				DECK LIGHT
	3.12	CAB LIGHT INSTALL	YN80E00058F1	6	HARNESS	YN02C01760P1	CAB LIGHT (OPT)
ALARM	3.13	TRAVEL ALARM ASSY	YN53E00015F1				
FUEL PUMP	3.14	FUEL PUMP ASSY	YN22P00024F1				

Note

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

23.3.5-1 UPPER HARNESS (2/4) : LQ13E01144P5





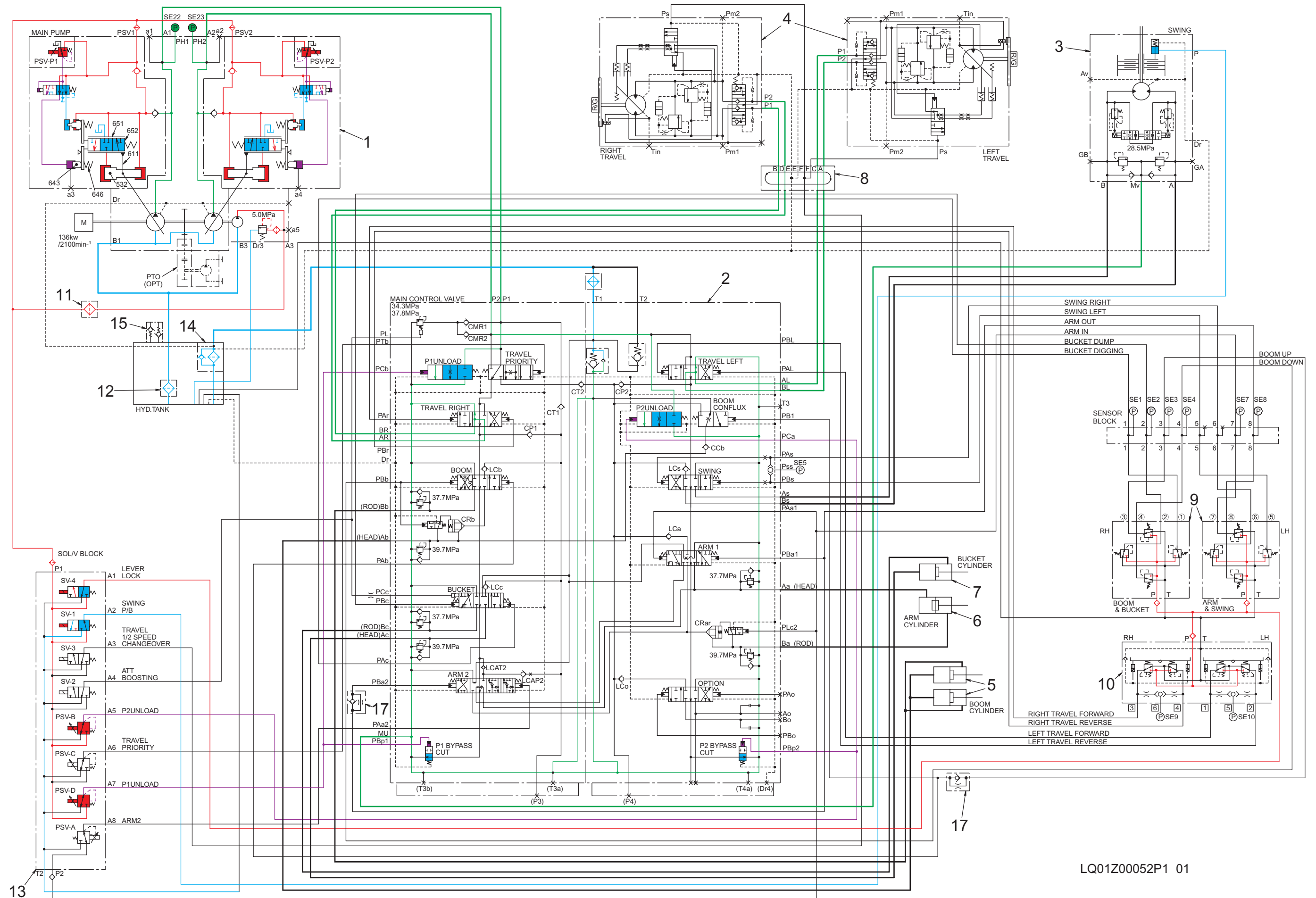


Fig. 22-1 NEUTRAL CIRCUIT : Positive control function at safety lock lever down (unlocked position)

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