E215BJ

NEW HOLLAND

E215BJ

NEW HOLLAND KOBELCO

Tier 3

Workshop
Manual

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Manual

Print No. 87731205
English

NEW HOLLAND CONSTRUCTION

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BUILT AROUND YOU

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

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

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

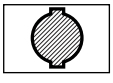
(9) When water has entered in the waterproofed connector, the removing of water is not easy. So check the removed waterproofed connector with care to protect it from entry of water. If moisture adheres on it, dry it completely before connecting.

WARNING

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

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

1.1.5 HYDRAULIC PARTS



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

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

1.1.6 WELD REPAIR

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

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

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

1.1.7 ENVIRONMENTAL ISSUES

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

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

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

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

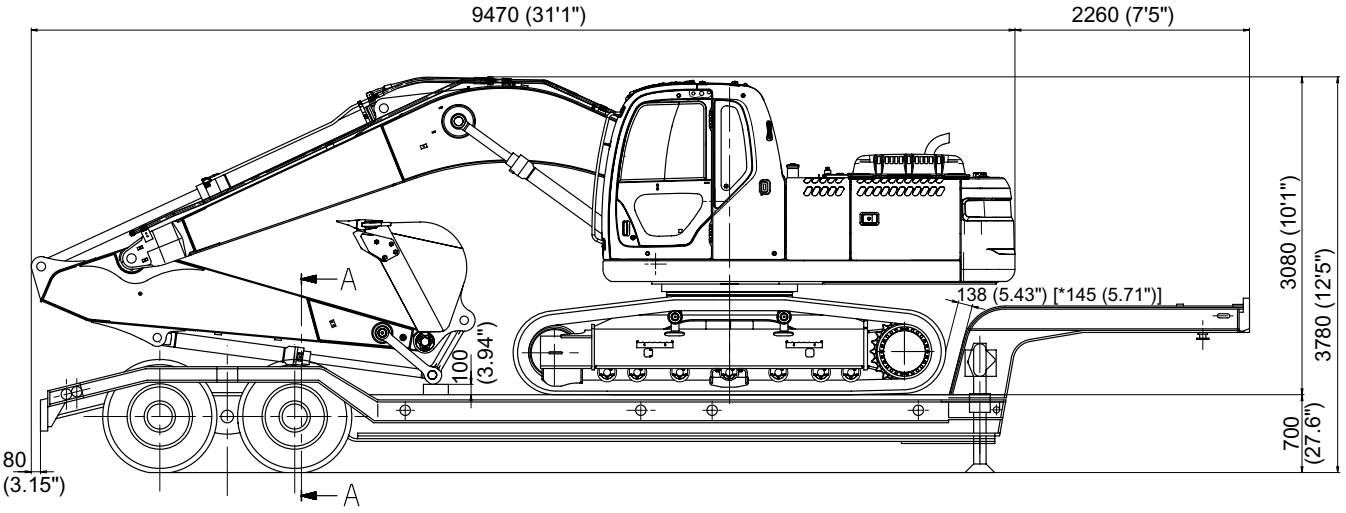
2.4 TRANSPOTATION

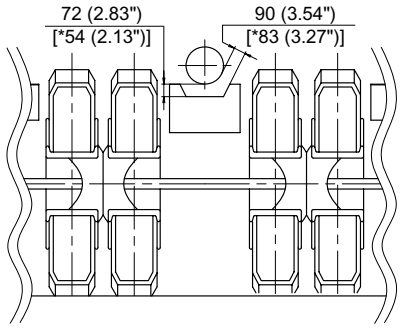
2.4.1 OVERALL DIMENSIONS OF MACHINE ON A TRAILER

(1) 5.65m (18ft-6in) Boom+2.94m (9ft-8in) Arm+0.80m³ (1.05cu•yd) Bucket

Item \ Model	E215B	E215BLC
Width 600mm (23.6in) shoes	2,800 (9ft-2in)	2,990 (9ft-10in)
Weight	20,200kg (44,500 lbs)	20,600kg (45,400 lbs)

Unit : mm (ft-in)





SECTION AA

Note

* marks indicate LC specifications.

3.1 BOOM

3.1.1 BOOM DIMENSIONAL DRAWING

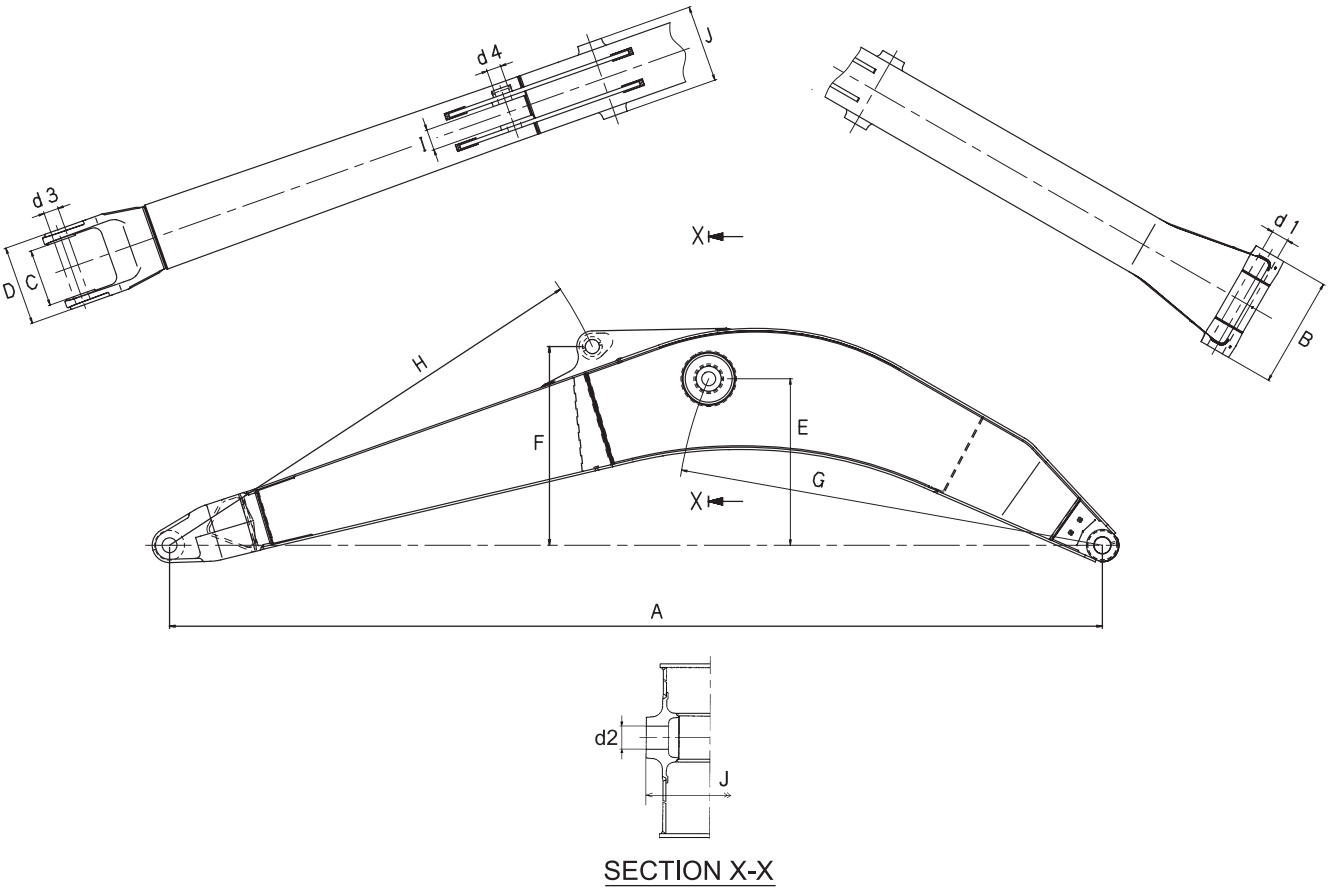


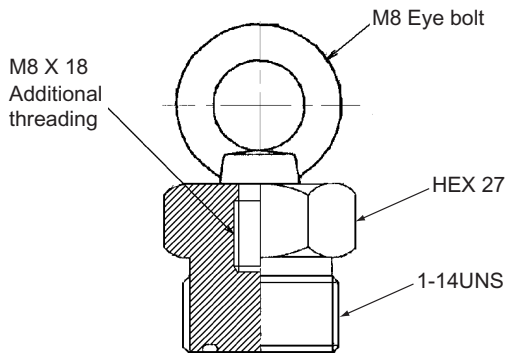
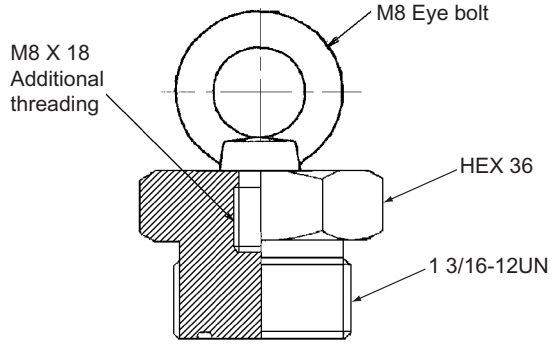
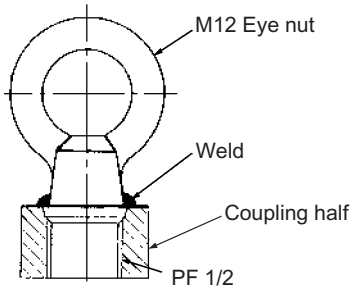
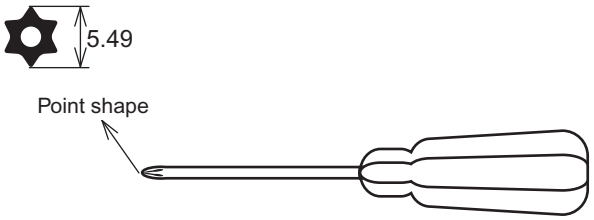
Fig. 3-1 Boom dimensional drawing

Unit : mm (ft-in)

5.65M (18ft-6in) BOOM		STD	—
		YN02B00403F1	—
No	NAME	DIMENSION	
A	Boom length	5,650 (18'6")	—
B	Boom foot width	670 (26.4")	—
C	Boom end inner width	347 (13.7")	—
D	Boom end outer width	482 (19")	—
E	Height of boom cylinder rod pin	1,008.5 (3'4")	—
F	Height of arm cylinder (head side) pin	1,203.5 (3'11")	—
G	Distance between pins of boss	R2,589 (8'6")	—
H	Distance between pins of bracket	R2,829.5 (9'3")	—
I	Arm cylinder (head side) inner width	126 (4.96")	—
J	Outer width of bracket on the arm cylinder (rod side) mounting	468 (18.4")	—
d1	Boom foot pin dia.	ø 90 (3.54")	—
d2	Boom cylinder (rod side) pin dia.	ø 85 (3.35")	—
d3	Pin dia. of boom end.	ø 90 (3.54")	—
d4	Arm cylinder (head side) pin dia.	ø 85 (3.35")	—

Issue	Date of Issue	Applicable Machines	Remarks
First edition	July, 2007	E215B : YN11-45001~ E215BLC : YQ11-06001~	S5YN1122E01 (NHK Middle East) K

Table11-4

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

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.

Issue	Date of Issue	Applicable Machines	Remarks	
First edition	August, 2006	SK200–8 : YN11-45001~ SK210LC–8 : YQ11-06001~	S5YN1318E01 (ASIA, OCE)	K
Revision	February, 2007	↑	S5YN1318E02 (ASIA, OCE)	K
↑	March, 2007	E215B : YN11-45001~ E215BLC : YQ11-06001~	↑ (NHK Russia)	K
↑	April, 2007	SK200-8 : YN11-45001~ SK210LC-8 : YQ11-06001~	↑ ASIA (HS Engine)	K
↑	July, 2007	E215B : YN11-45001~ E215BLC : YQ11-06001~	↑ (NHK Middle East)	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.

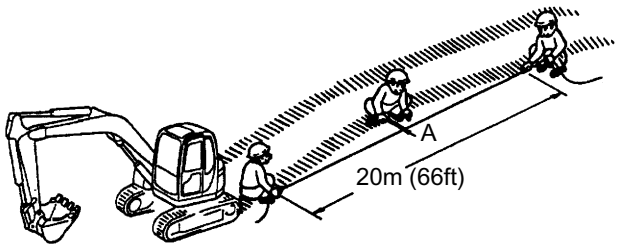


Fig. 13-15 Measuring method

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.

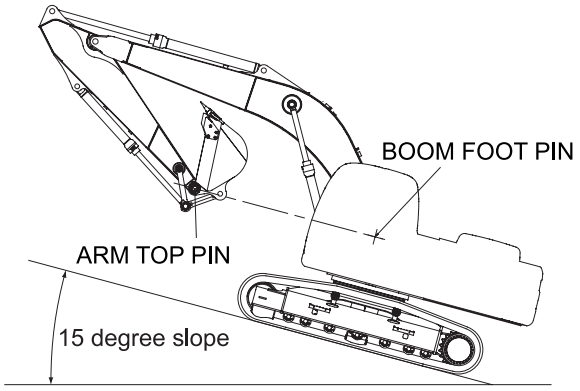


Fig. 13-16 Parking brake operating position

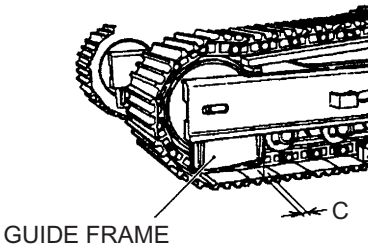


Fig. 13-17 Method of measurement

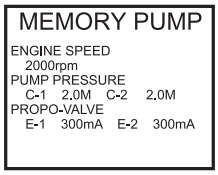
Parking brake Unit : mm(in)/5min

Measuring position	Standard value	Reference value for remedy	Service limit
C	0	1 (0.04)	2 (0.08)

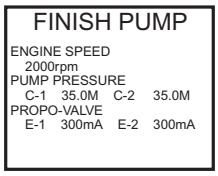
(2) Adjustment of pump ("B" adjustment)

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.



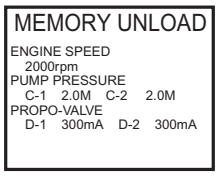
2) After detection of the engine rated speed, the adjustment of pump is automatically completed. And "FINISH PUMP" is displayed.
(Press the buzzer stop switch on gauge cluster while this display is appeared and the adjustment is completed. The unloading adjustment required later is not performed, and default value is written.)



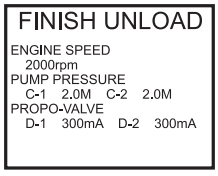
(3) Adjustment of unloading valve ("C" adjustment)

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.



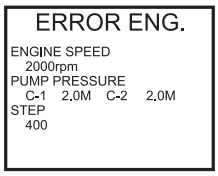
2) When the unloading valve operates to the specified value, the adjustment of unloading proportional valve is automatically terminated. And "FINISH UNLOAD" is displayed.
The speed is shifted to the speed corresponding to acceleration potentiometer. The adjusting current value is indicated on the display of current of P1, P2 unloading proportional valves. The adjusting range is usually 520~635mA.



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

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

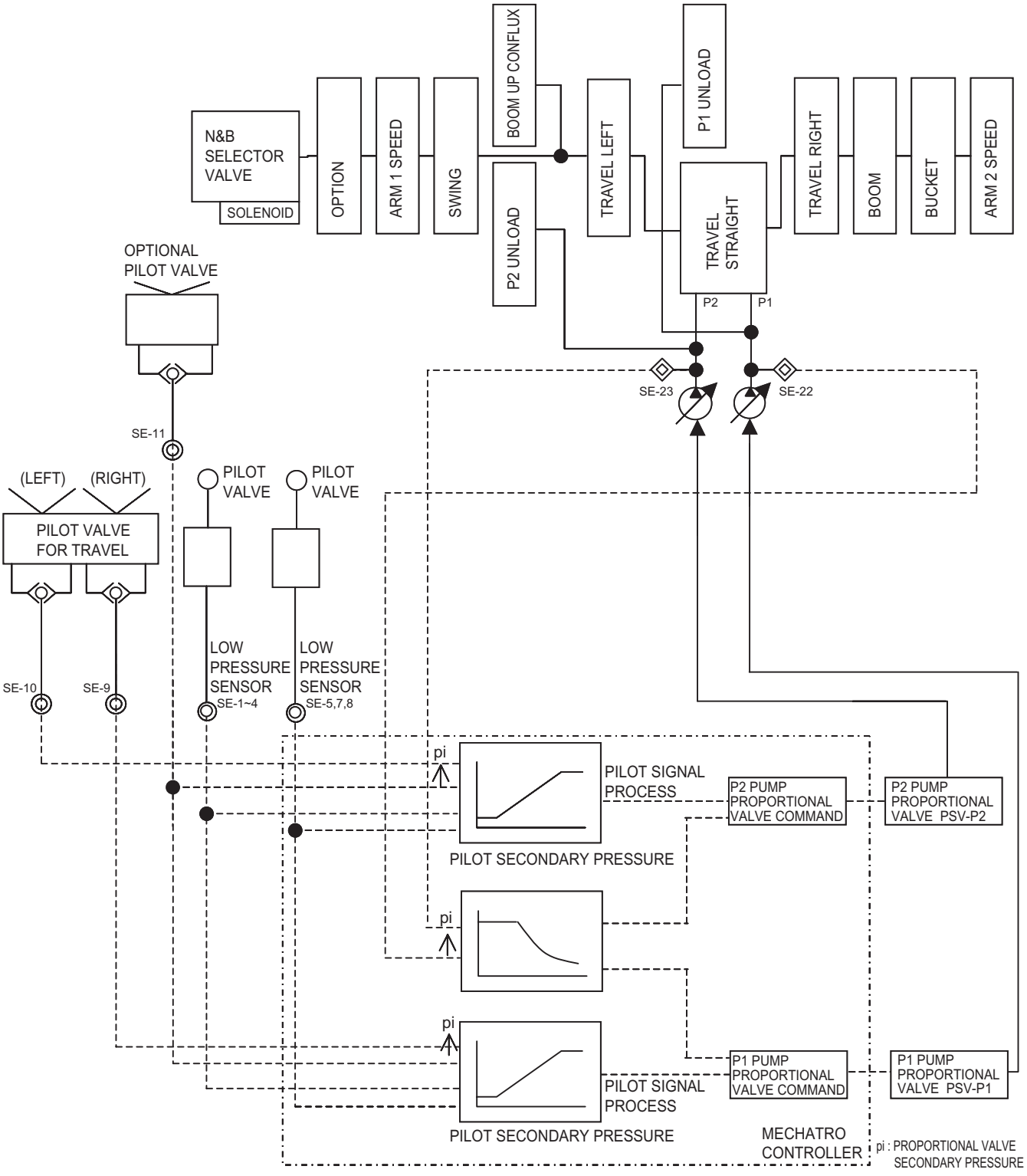
1) In cases where the adjustment of engine can not be performed; And ERROR ENG" is displayed.
Judging condition: The read engine speed is 50rpm lower than the last value.



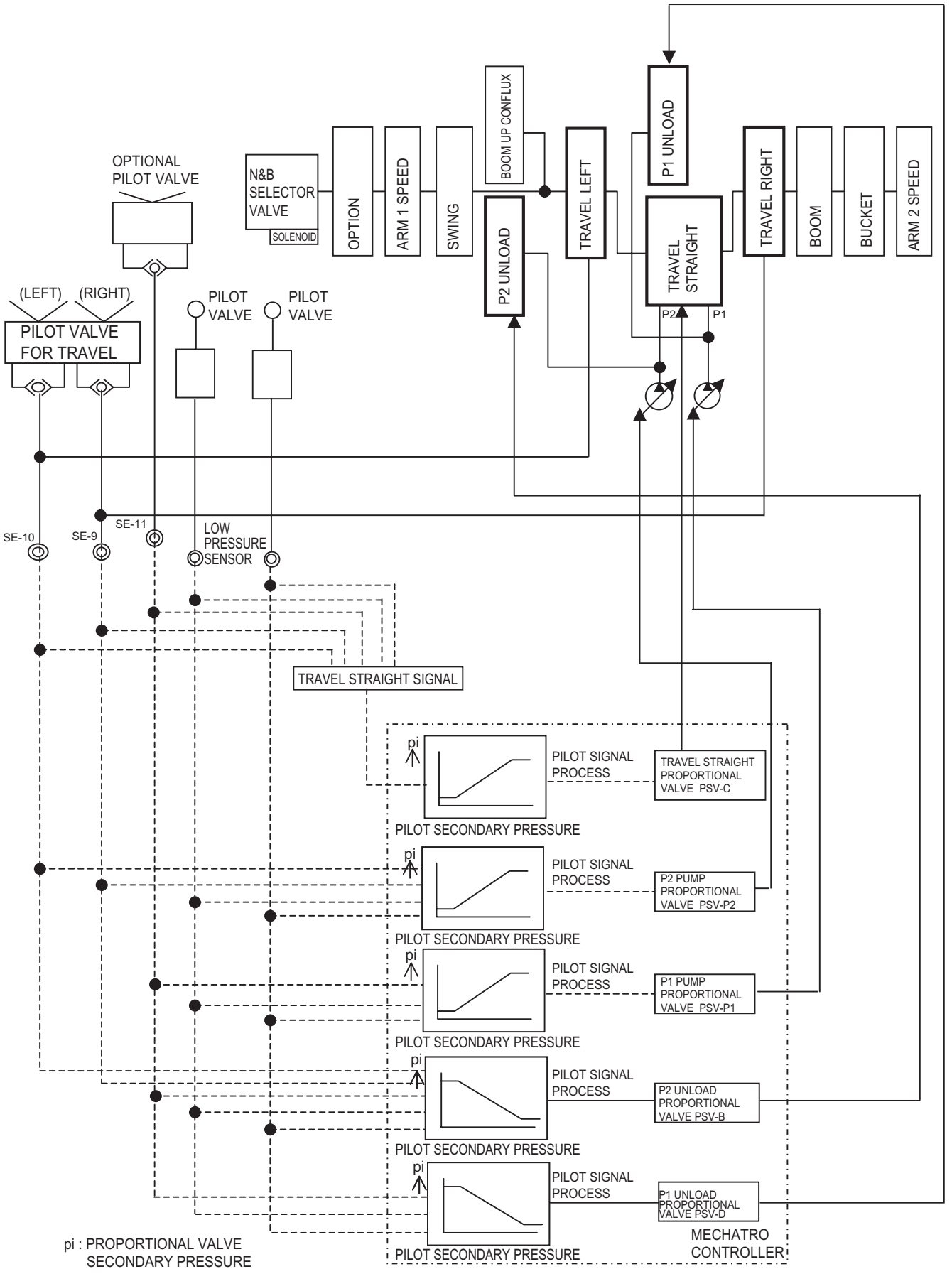
It is conceived that the error is caused by the speed read error, pump load applied to the engine and unusual acceleration command voltage applied to the engine controller in the course of adjustment.

a. Checking speed sensor: Check that it is free from wrong reading of speed due to engine vibration.
b. Checking load applied to pump: Check that it is free from abnormal increase of pump pressure during adjustment of engine through adjustment screen.
c. 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.

21.1.3 POSITIVE CONTROL & P-Q CONTROL



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.

21.2.4 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	１０５３０Ｈｒ　Ｆ０２３ ８５００Ｈｒ　Ｇ０３３ ３０００Ｈｒ　Ｐ１２１１ １５００Ｈｒ　Ｃ０１３

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.

Note

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

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		Tranmission	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

(2) Hydraulic circuit diagram

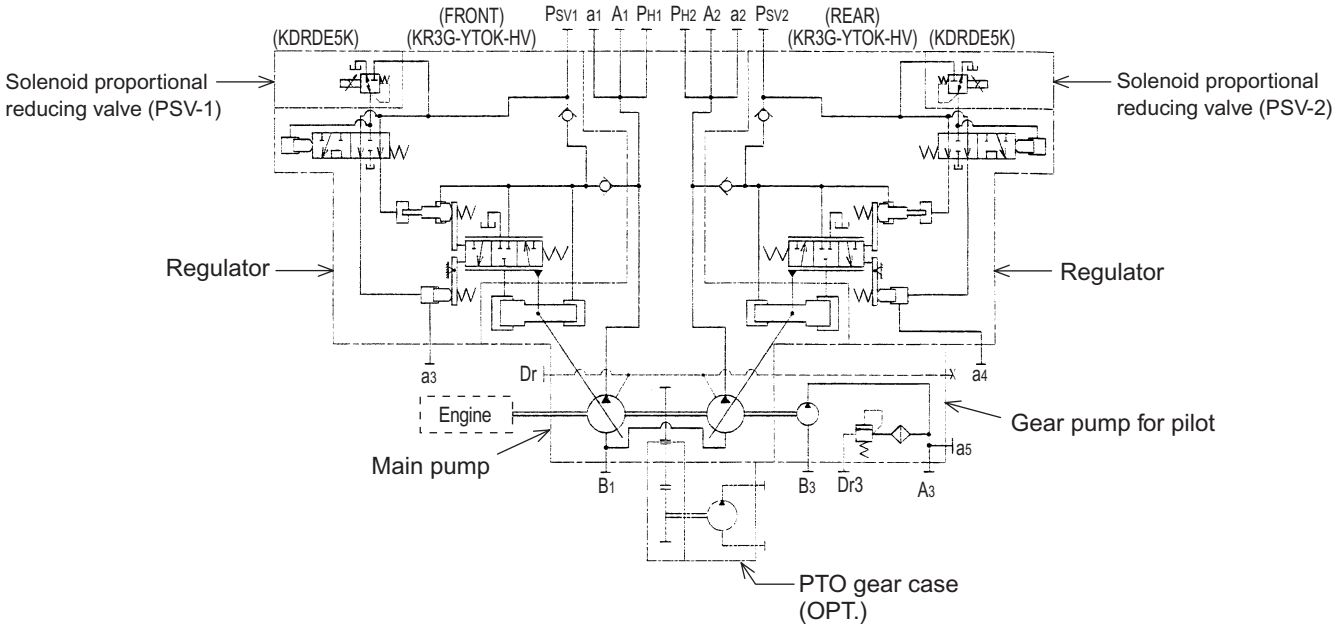


Fig. 24-2 Hydraulic circuit diagram of pump

(3) Specifications

Item			Main pump	Gear pump
Parts No.		Pump assy	YN10V00036F1	—
		Single Pump	YN10V00043F1	YN10V00014F3
Pump model			K3V112DTP1K9R-YT0K-HV	ZX10LGRZ2-07G
Max.displacement capacity		cm^3	110 X 2	10
Revolution	Rated	min-1(Clockwise seen from shaft end)	2000	←
Pressure	Rated	MPa (psi)	34.3 (4980)	5.0 (725)
	ATT boost pressure		37.8 (5480)	
Max. flow		L/min (gal/min)	220 (58) X 2 at 7.8MPa (1130 psi)	21 (5.5)
Max. input horse power		kW (PS)	114 (155)	3.4 (4.6)
Max. input torque		N·m (lbf·ft)	544 (401)	14.7 (10.8)
Regulator		Part No.	YN10V01009F1	
		Model	KR3G-YTOK-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)	

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.

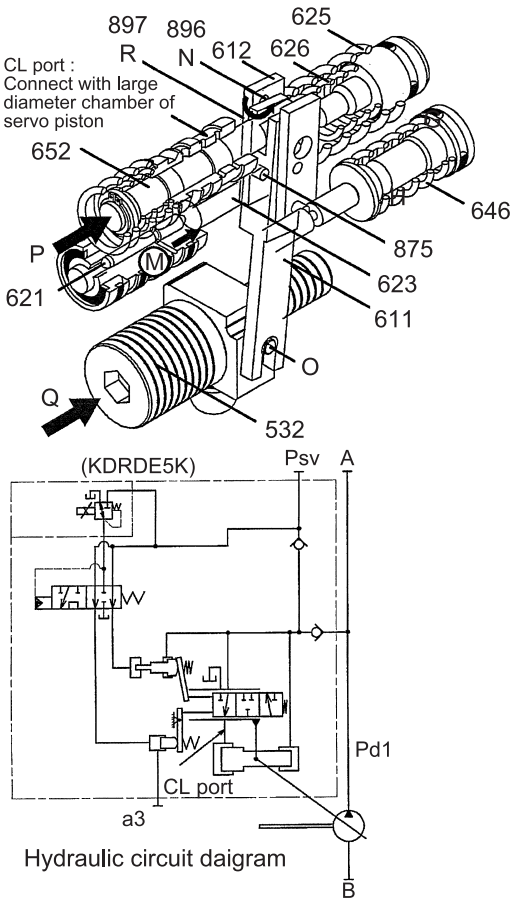


Fig. 24-14

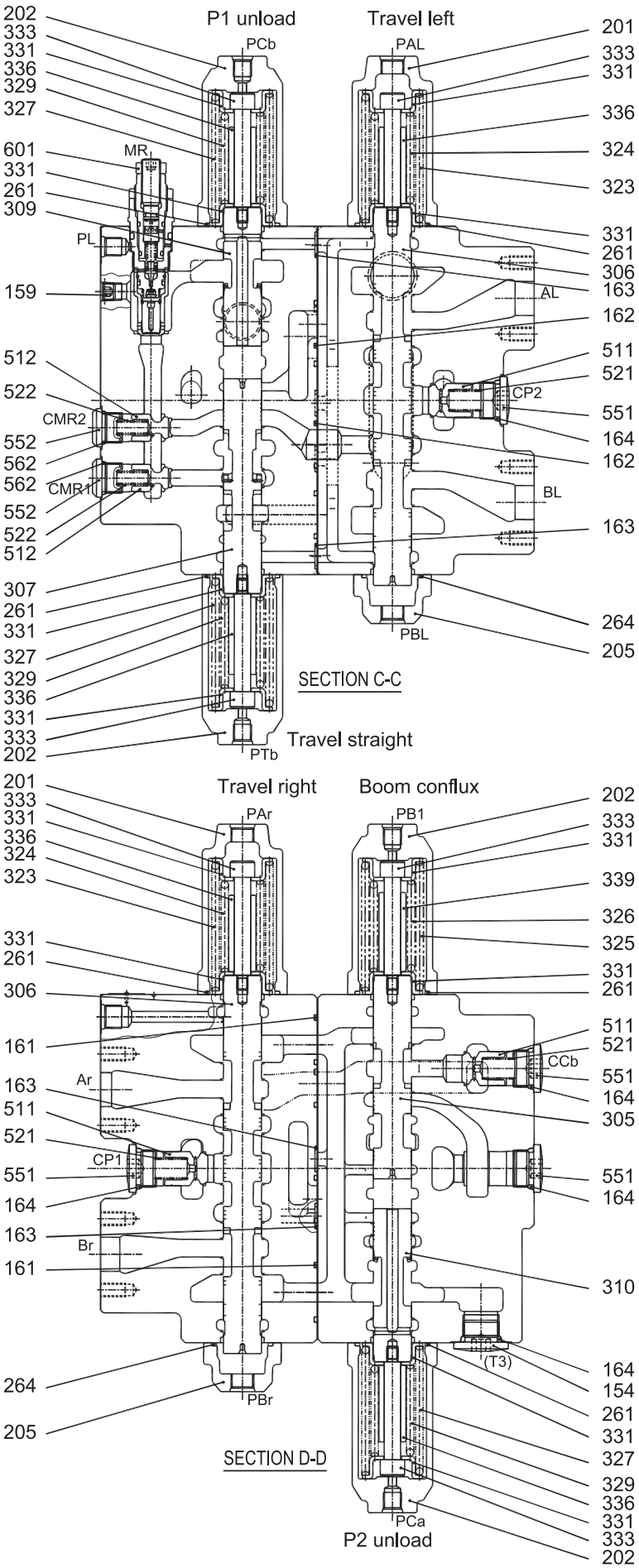


Fig. 24-25 Section (3/6)

(9) Boost check valve (517)

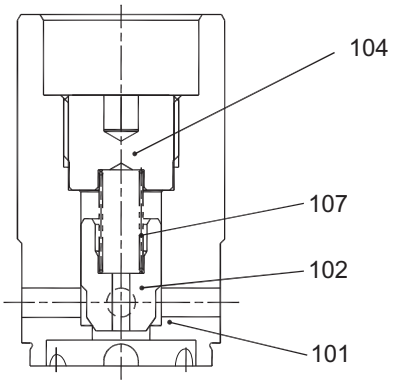


Fig. 24-36 Boost check valve

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 confluences the hydraulic oil from hydraulic pump P2 side.
The conflux 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.

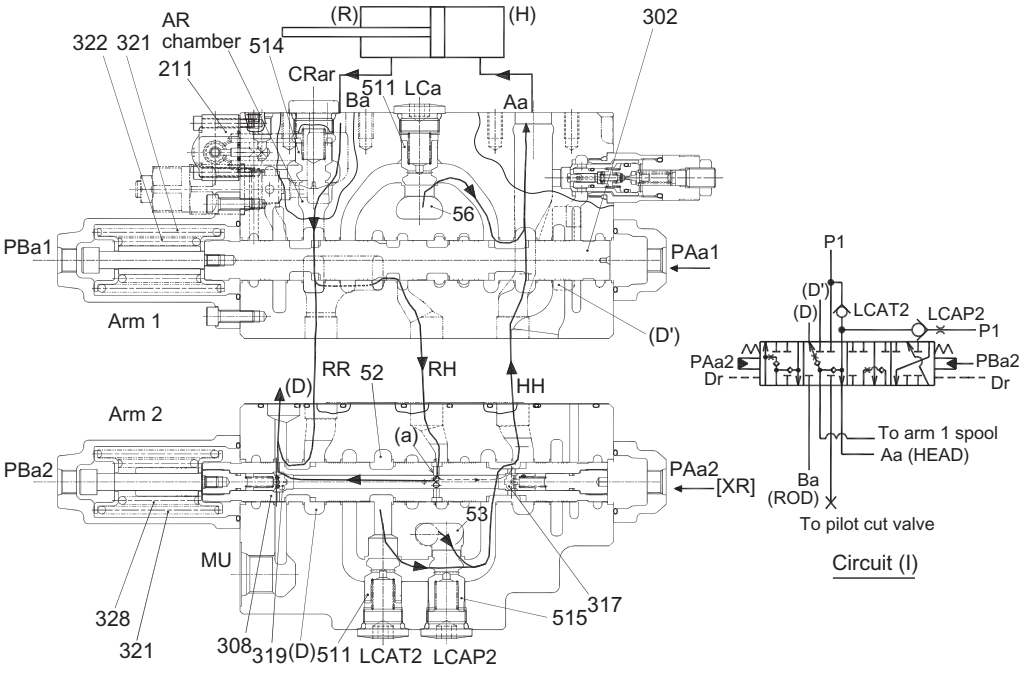
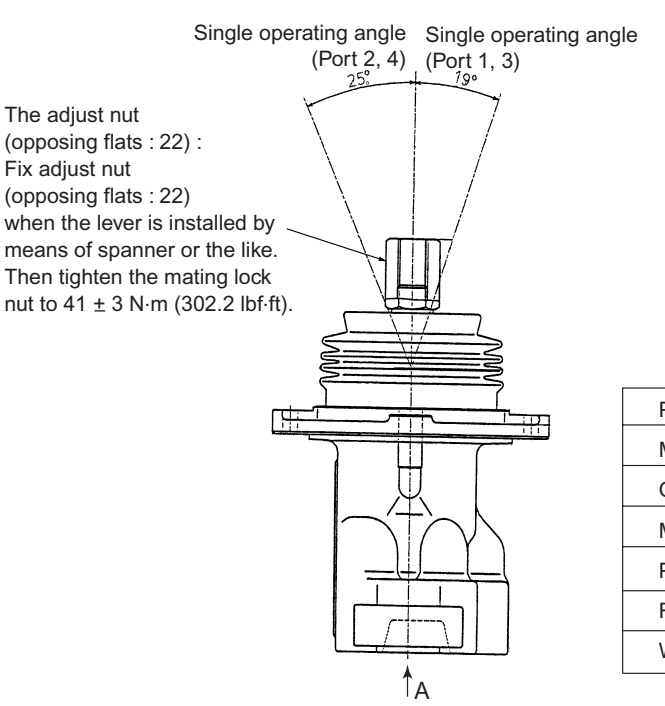


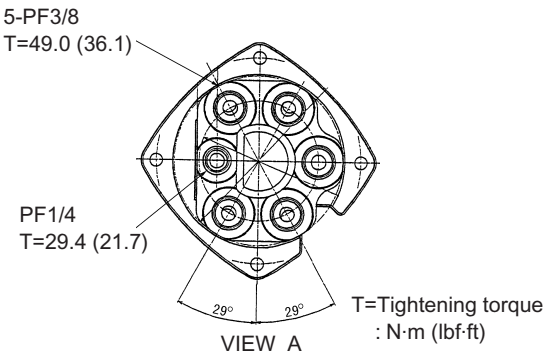
Fig. 24-47 In arm in operation (At light load: arm recirculation function)

24.1.3 PILOT VALVE (ATT)

24.1.3.1 OUTLINE

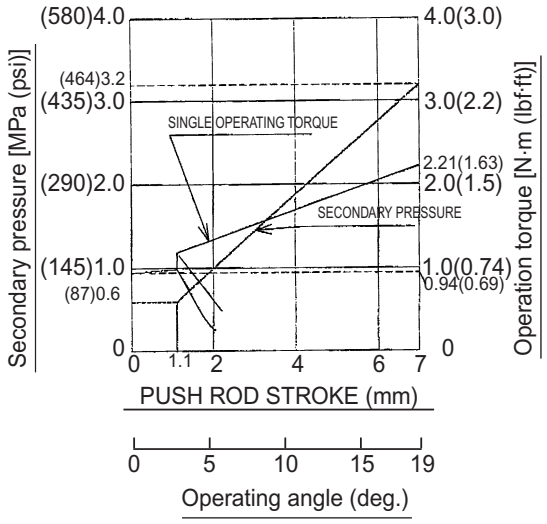
(1) Outside view



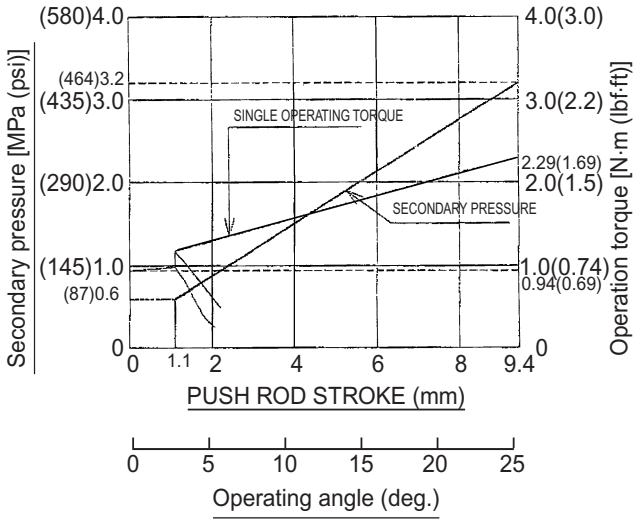


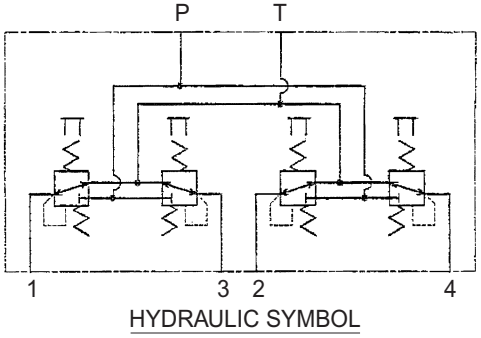
Part No.	YN30V00111F1
Model	PV48K2004
Operating torque	Refer to the curve below
Max. primary pressure	6.9 MPa (1000 psi)
Primary pressure	5.0 MPa (725 psi)
Rated flow	20 L/min (5.3gal/min)
Weight	Approx. 1.9 kg (4.2 lbs)

PORT 1, 3



PORT 2, 4





HYDRAULIC SYMBOL

24.1.5.3 OPERATION

24.1.5.3.1 OPERATION OF HYDRAULIC MOTOR

If the high pressure oil flows into the cylinder through the inlet port (a) of valve plate (131), as shown on the figure on the right, the hydraulic pressure acts upon piston (121) and creates force F in the axial direction.

The force F may be divided into force F1 vertical to shoe plate (124) via shoe (122) and force F2 at right angles with the shaft.

The force F2 is transmitted to cylinder block (111) via pistons (121) and causes drive shaft to turn so as to produce a rotating moment.

The cylinder block (111) has nine pistons equally arranged. Rotating torque is transmitted to drive shaft by turns by pistons connected to inlet port of high pressure oil.

If the oil supply and discharge directions are reversed, the drive shaft rotates in the opposite direction.

Theoretical output torque T can be given by the following equation.

$$T = \frac{P \times q}{2 \times \pi}$$

P ; Effective differential pressure MPa

q ; Displacement per revolution cc/rev

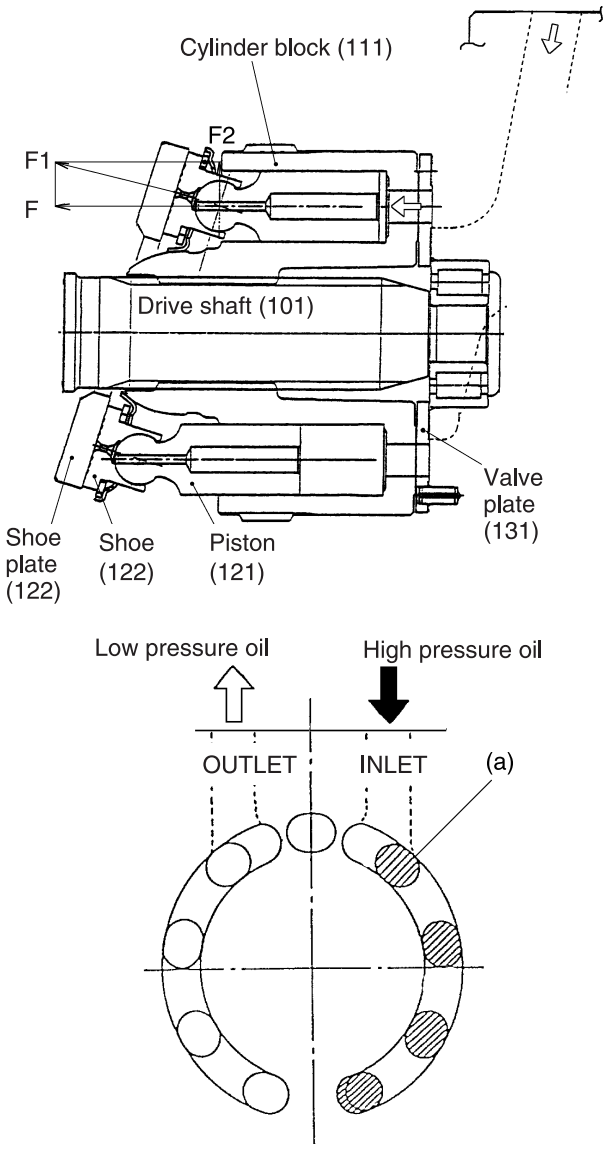


Fig. 24-61 Operation of hydraulic motor

24.1.5.3.2 VALVE CASING SECTION

(1) (1)Operation of anti-cavitation check plunger

Since the system using this type of motor is not equipped with a valve having a counterbalance function, the motor is rotated beyond the oil feed rate in some cases.

The system has check plunger(351) and sucks in deficient oil, in order to prevent cavitation from occurring due to oil deficiency.

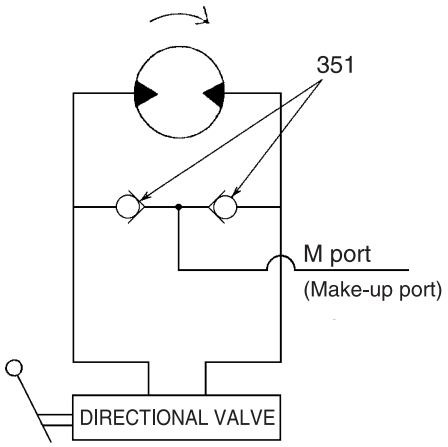


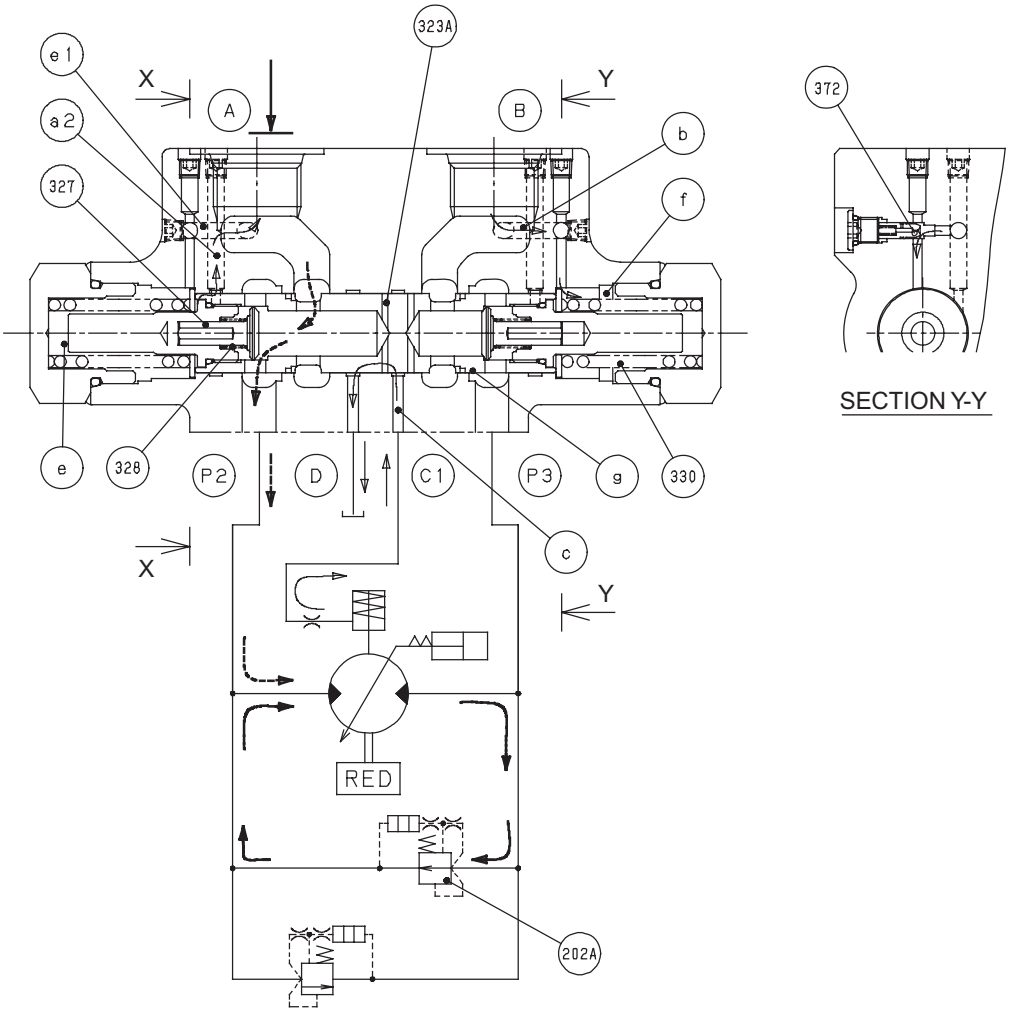
Fig. 24-62 Operation of anti-cavitation check plunger

c. When parking and stopping

When the hydraulic oil supplied from control valve to port A is cut off to stop operating, the pressure at port A and port P2 lowers. Consequently because the hydraulic pressure which has pushed spool assembly (323A) is cancelled, the spool assembly which has been shifted rightward returns to the neutral position with the force of spring (330). At this time passage g is closed and the flow rate from port P3 to port B is cut off. With this actuation, the pressure is generated on port P3 and gives the braking force to the hydraulic motor which is tried to continue rotating with the force of inertia to reduce the speed and to stop operating. Because relief valve (202A) is provided on between port P3 and port P2 and restricts the pressure generated on port P3, the hydraulic motor is protected from being broken by excess pressure and the shock caused by stopping motion is reduced.

And when the spool assembly tries to return to the neutral position, the hydraulic oil in chamber (e) is discharged into port A side through passage b2. At the same time, the hydraulic oil passes through passage b and pushes and opens throttle valve (372) located on the section Y-Y and is supplied to chamber (f) to prevent cavitation generating in chamber (f).

And when the spool assembly returns to the neutral position, port C1 and drain port D are connected with the passage provided on the spool assembly, and the hydraulic oil which is used to slide piston (112) of parking brake is discharged to drain port D through passage c. With this operation, the released parking brake actuates again and gets back the braking force.



24.1.8.2 CONSTRUCTION AND FUNCTION

24.1.8.2.1 CONSTRUCTION

(1) Boom cylinder

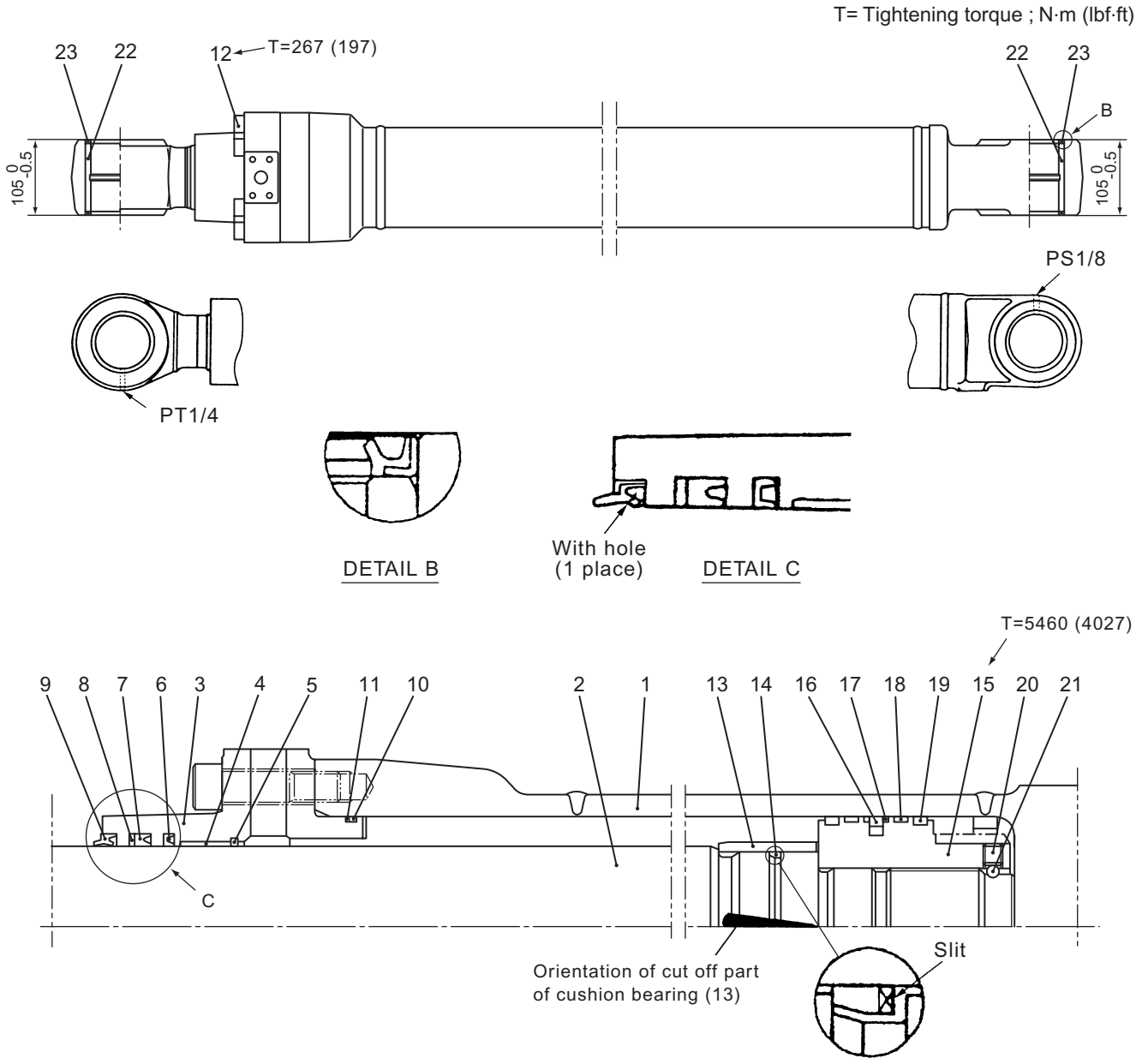
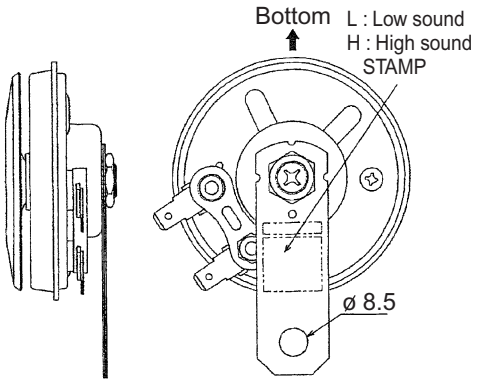
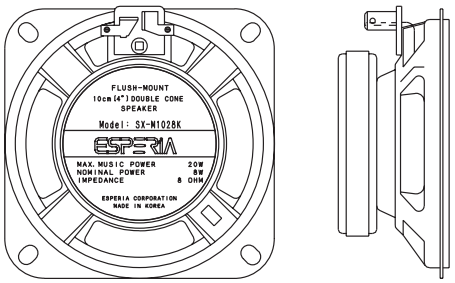
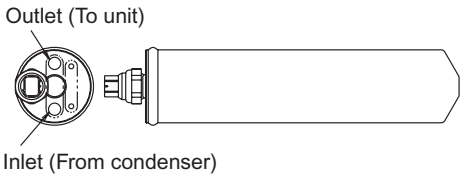
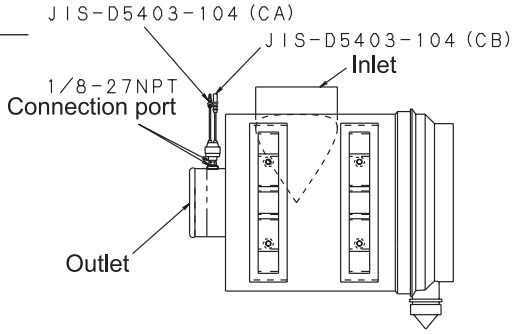
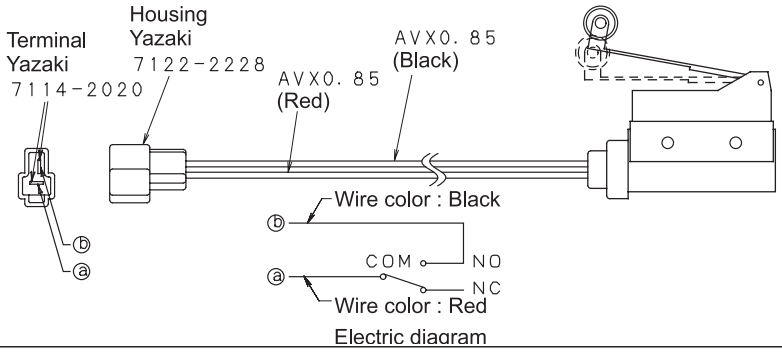
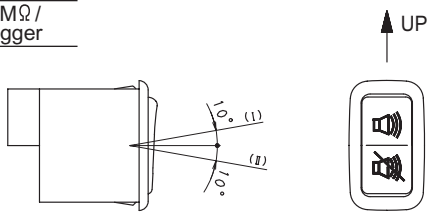
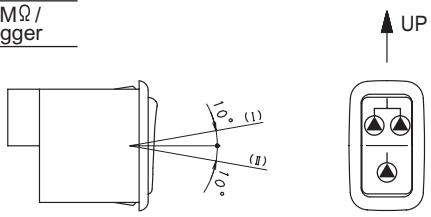


Fig. 24-79 Construction of boom cylinder

P/No	YN01V00151F1							
No.	Parts	Q'ty	No.	Parts	Q'ty	No.	Parts	Q'ty
1	Cylinder tube	1	9	Wiper ring	1	17	Buckup ring	2
2	Piston rod	1	10	O-ring	1	18	Slide ring	2
3	Rod cover	1	11	Buckup ring	1	19	Slide ring	2
4	Bushing	1	12	Socket bolt; M16×75	12	20	Set screw; M12	1
5	Snap ring	1	13	Cushion bearing	1	21	Steel ball	1
6	Buffer ring	1	14	Cushion seal	1	22	Pin bushing	2
7	U-ring	1	15	Piston	1	23	Wiper ring	4
8	Buckup ring	1	16	Seal ring	1			

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 ~	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 YT02 - 04001 ~ YT03 - 05293 ~ YT04 - 07001 ~ YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	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 ~	Maker: Sanden Corp. Airtight test pressure: 3.5MPa (508 psi) Pressure proof test pressure: 5.3MPa (769 psi) Breaking test pressure: 9.8MPa (1420 psi) Desiccant moisture adsorption capability: 17% or over than the weight of desiccant (Include initial absorption 2%) Refrigerant: HFC-134a Inner volume/Desiccant: 578cm^3/300g	

File No. Name of part Part No. Use Applicable Machine	Specification	Description
SW - 8 Switch YR11P00008S005 Air cleaner Clogging switch YT02 - 04001 ~ YT03 - 05293 ~ YT04 - 07001 ~ YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Maker's P/No. REX018171 Air cleaner LC11P00018F1	
SW - 11 Switch YN50S00041F1 Lock lever YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Model OMRON D4MC-2000	
SW - 13 Switch YN50S00040DF Travel alarm (Middle east) YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Rated voltage DC 24V Type Single pole single throw (alternate) Insulation resistance More than 1MΩ / DC500V megger Terminal connector Connector / Position: 1 2 3 (Ⅰ) ○—○ (Ⅱ) ○—○	
SW - 15 Switch YN50S00040DD Conflux / single flow switching (OPT) YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~	Rated voltage DC 24V Type Single pole single throw (alternate) Insulation resistance More than 1MΩ / DC500V megger Terminal connector Connector / Position: 1 2 3 (Ⅰ) ○—○ (Ⅱ) ○—○	

25.3 PIPING

25.3.1 AIR CONDITIONER

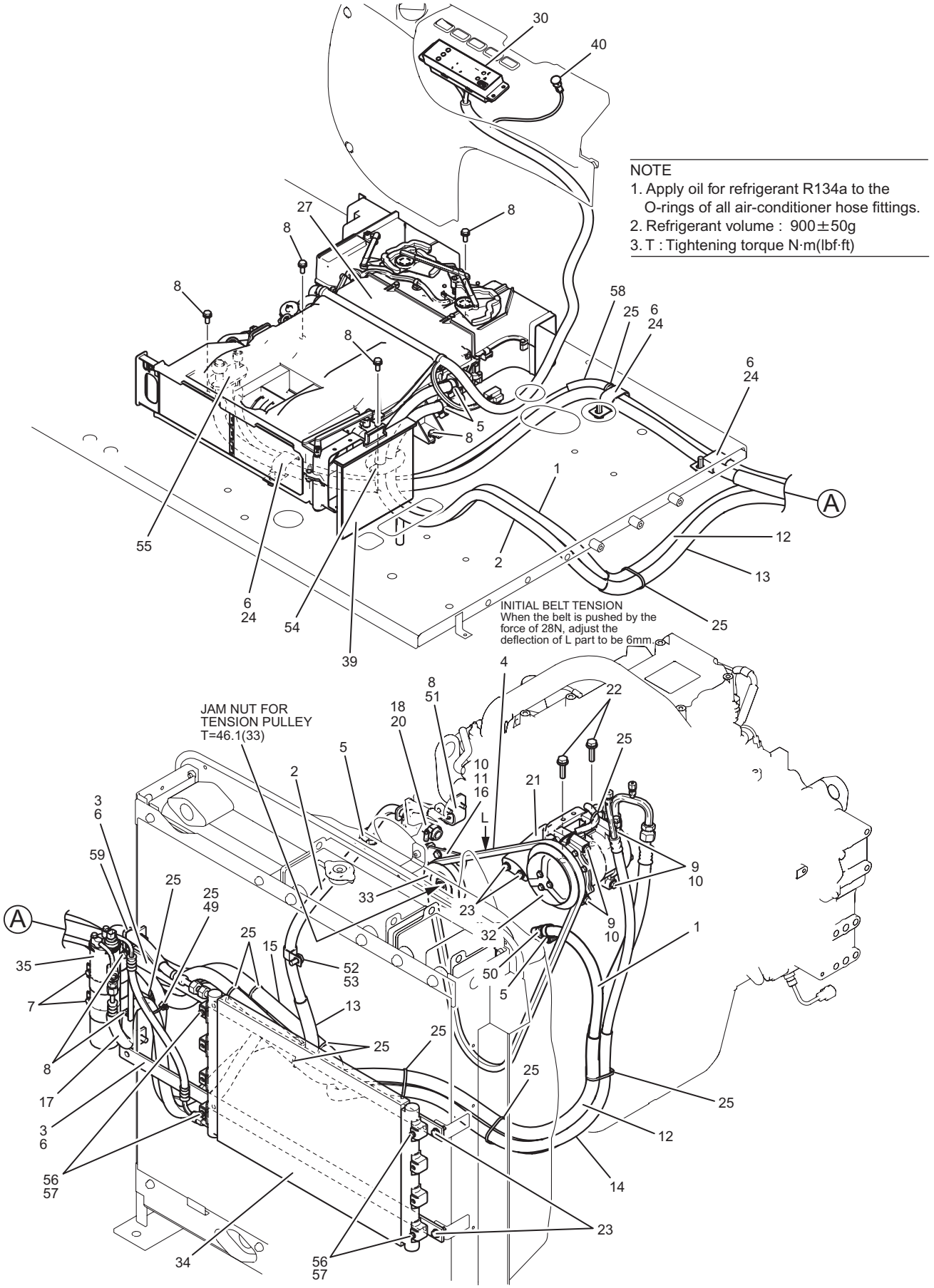


Fig. 25-5

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.

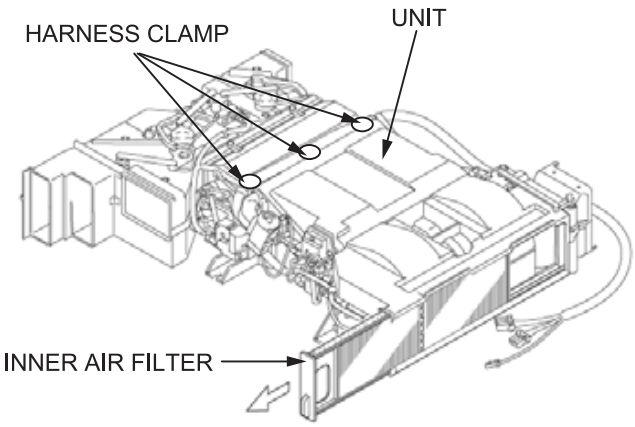


Fig. 25-15

(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.

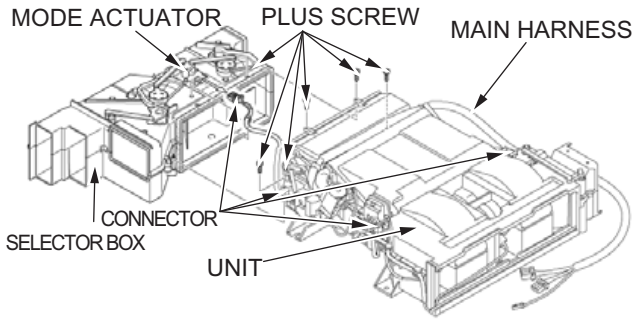


Fig. 25-16

(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.

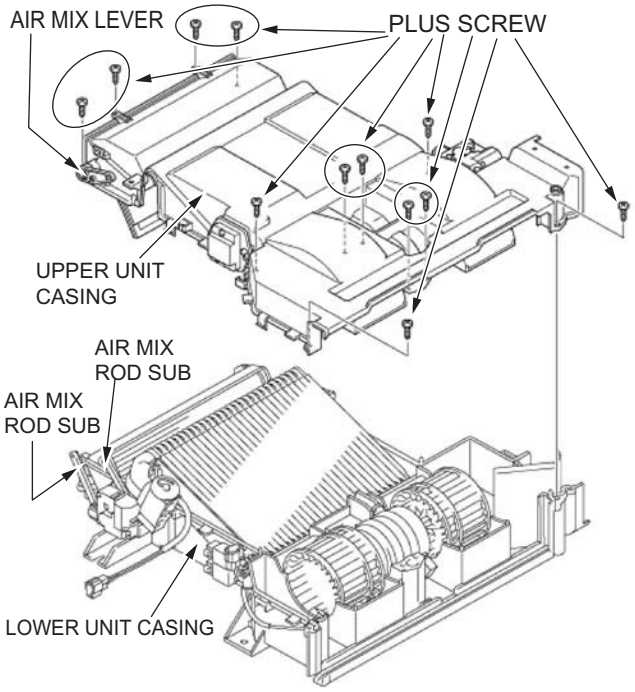


Fig. 25-17

25.7 ELECTRIC CIRCUIT

25.7.1 WIRING DIAGRAM AND CONNECTORS

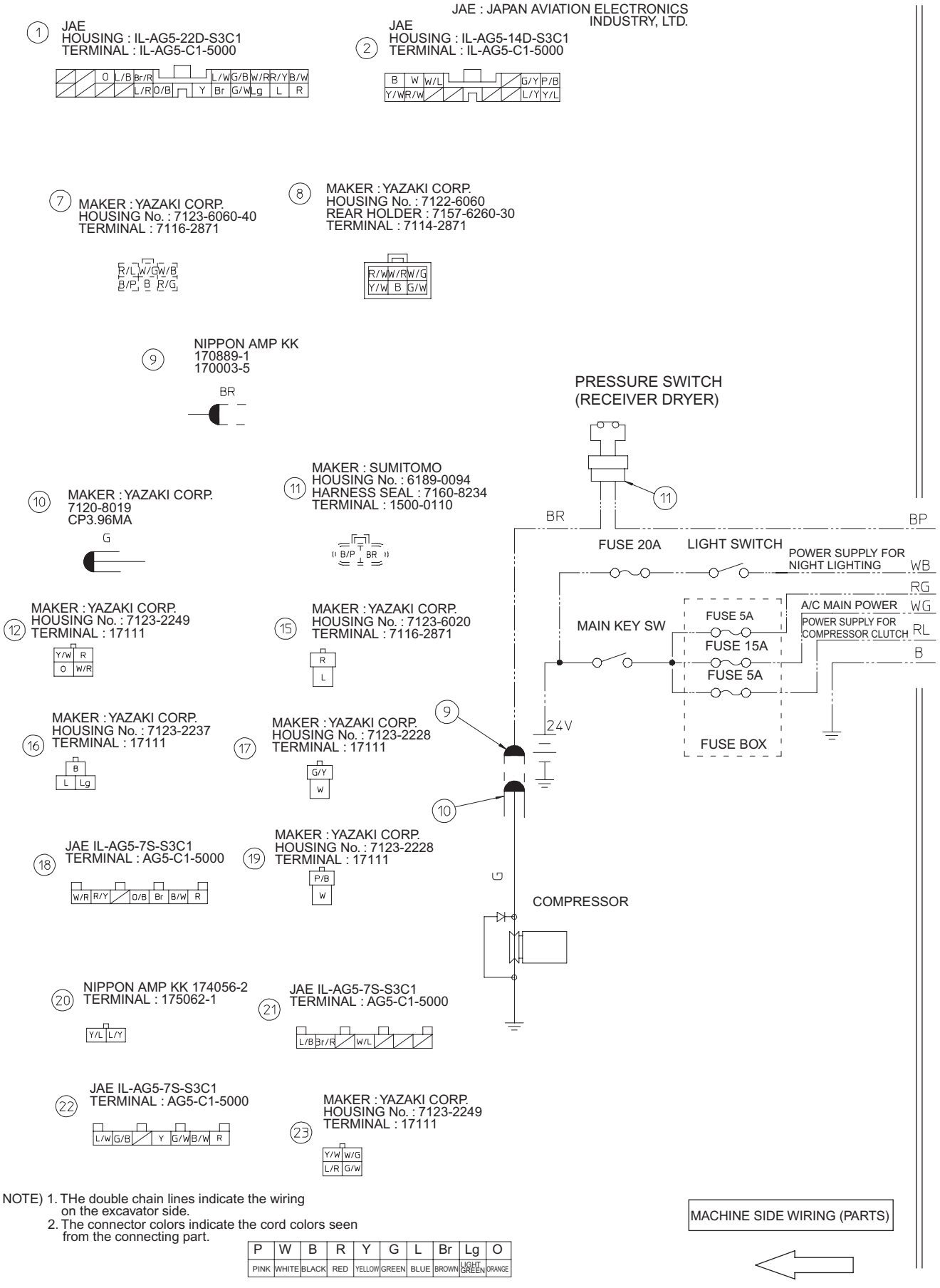
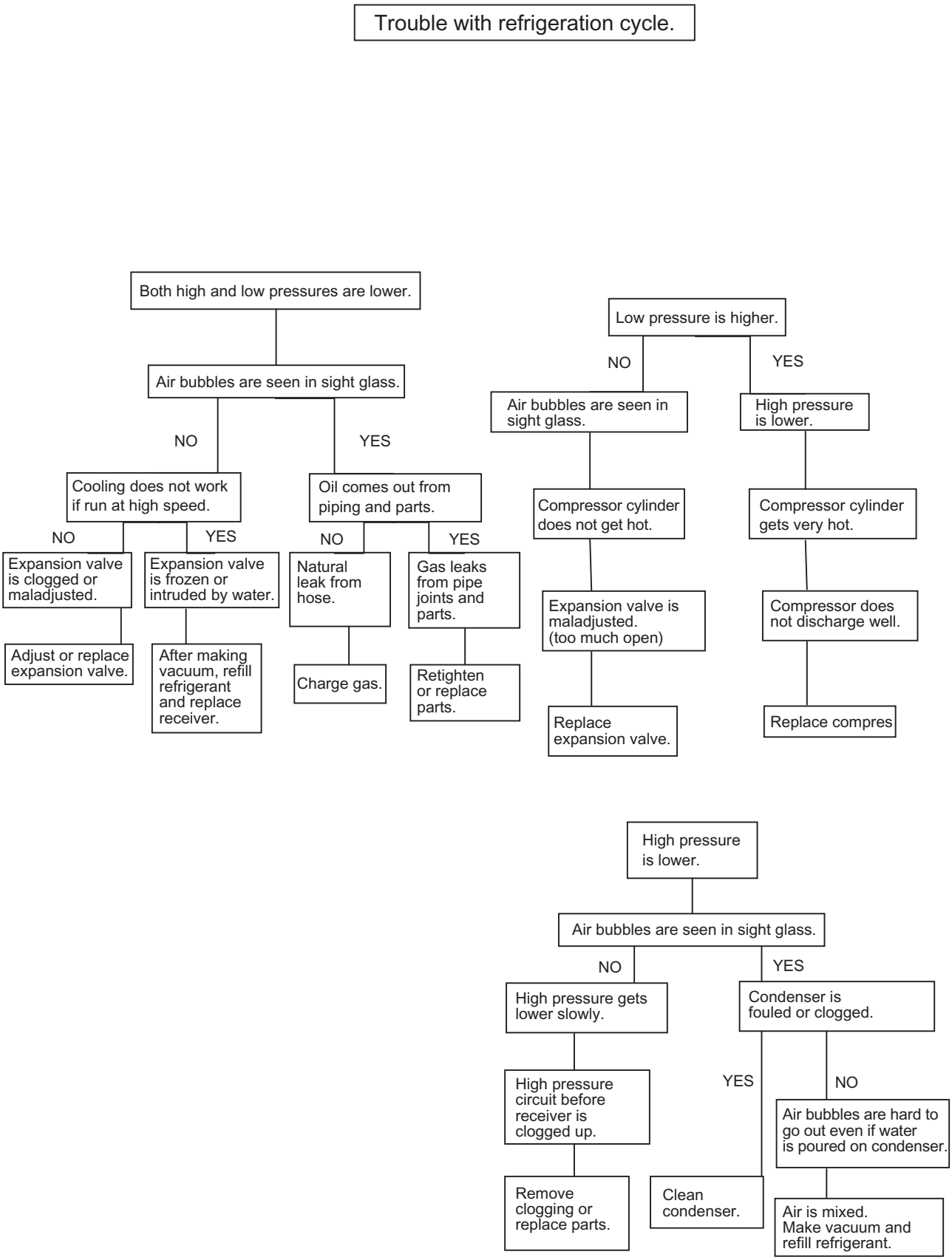


Fig. 25-32 Electric diagram (1/2)


Trouble with refrigeration cycle.
Both high and low pressures are lower.
Air bubbles are seen in sight glass.
NO
YES
Cooling does not work if run at high speed.
Oil comes out from piping and parts.
NO
YES
NO
YES
Expansion valve is clogged or maladjusted.
Expansion valve is frozen or intruded by water.
Natural leak from hose.
Gas leaks from pipe joints and parts.
Adjust or replace expansion valve.
After making vacuum, refill refrigerant and replace receiver.
Charge gas.
Retighten or replace parts.
Low pressure is higher.
NO
YES
Air bubbles are seen in sight glass.
High pressure is lower.
Compressor cylinder does not get hot.
Compressor cylinder gets very hot.
Expansion valve is maladjusted. (too much open)
Compressor does not discharge well.
Replace expansion valve.
Replace compres
High pressure is lower.
Air bubbles are seen in sight glass.
NO
YES
High pressure gets lower slowly.
Condenser is fouled or clogged.
YES
NO
High pressure circuit before receiver is clogged up.
Air bubbles are hard to go out even if water is poured on condenser.
Remove clogging or replace parts.
Clean condenser.
Air is mixed. Make vacuum and refill refrigerant.

32. ATTACHMENT

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(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 temporally 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

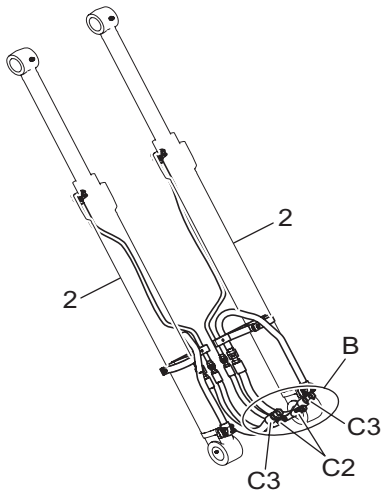


Fig. 32-22 Removing and installing boom cylinder

4) Removing boom cylinder foot pin (B)
   (See Fig. 32-23,Fig. 32-24)
   Loosen nut (5), remove capscrews M16×150 (3) and pull out pin (B).

   : 24mm

5) Remove boom cylinder (2).
   Weight of boom cylinder : 170 kg (375 lbs)
6) Remove another boom cylinder the same way.

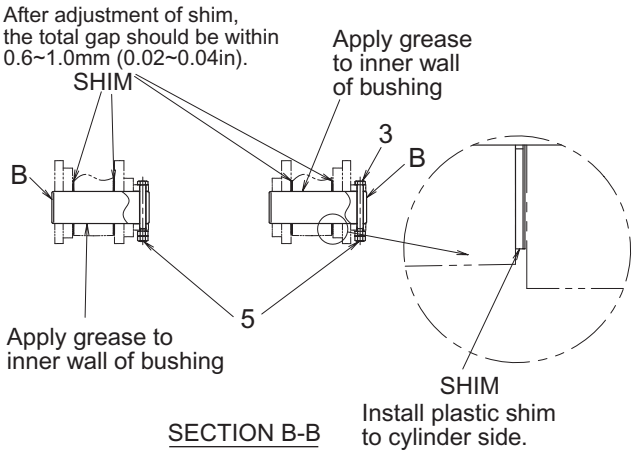


Fig. 32-23 Removing and installing boom cylinder head pin (B)

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.

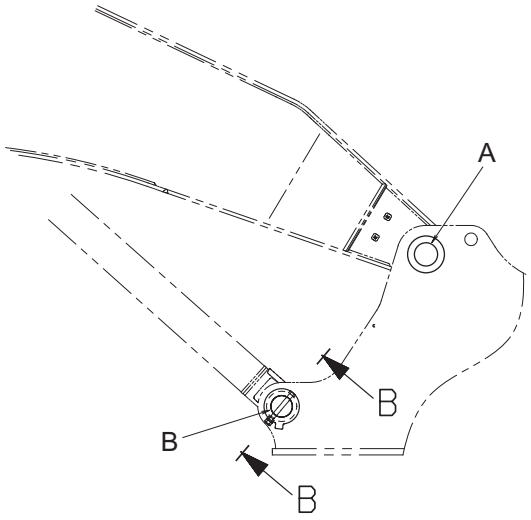


Fig. 32-24 Boom foot pin (A)

(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).

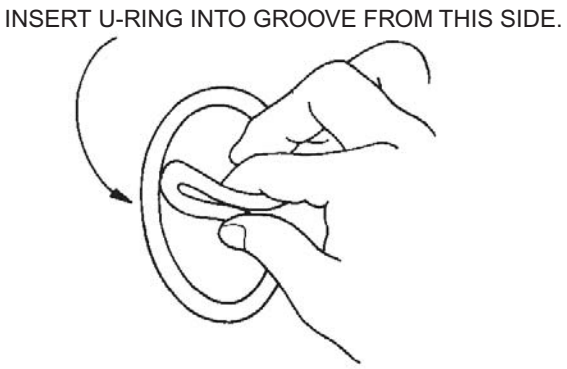


Fig. 32-49 Inserting a seal into the inner circumference of rod cover.

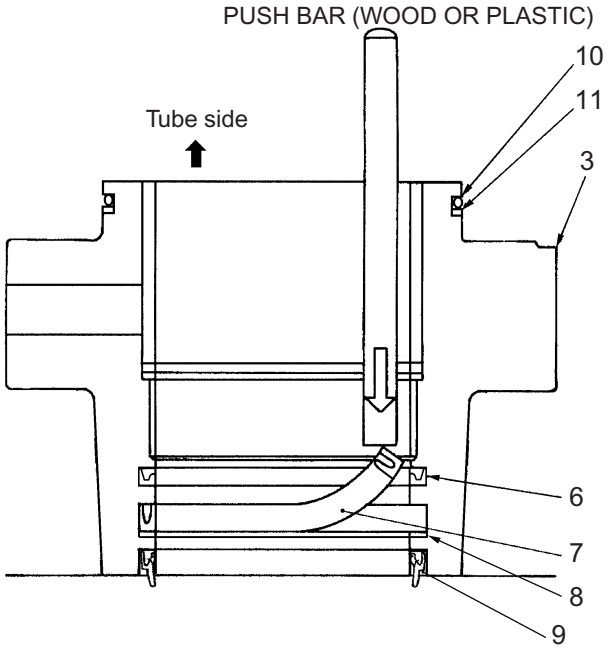


Fig. 32-50 How to fit U-ring (7)

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 (I) 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.

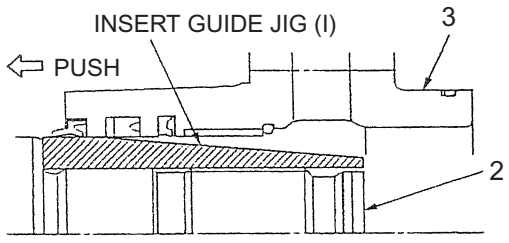
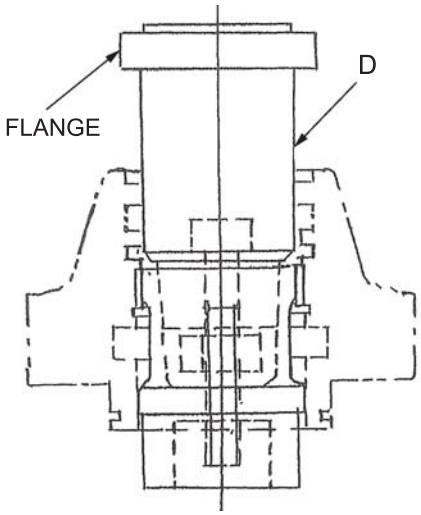


Fig. 32-51 Inserting rod cover (3)

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.

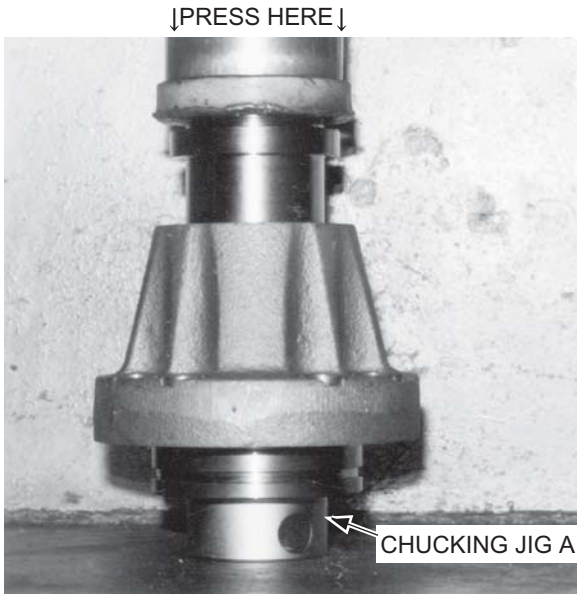
- Fit retainer tool as shown in the right figure directing large diameter section (flange section) upward.
- Clean the surface of press bench, and take care for the tool bottom face not to be damaged by foreign matter like dust, chip, etc.



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.

: 6 mm

2) Remove the operator's seat. [about 28kg (62 lbs).]
Carry out the following operations as required.

3) Remove seat belt (C1).

4) Remove armrest (A3)(A4).

5) Remove bracket assy (1), rail (7).

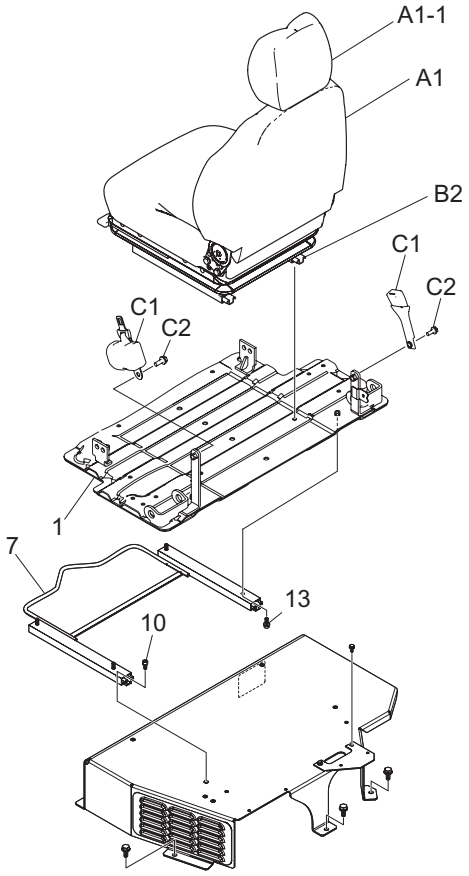


Fig. 33-1 Disassembling and Assembling seat

33.1.1.2 INSTALLATION

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

Tightening position	Allen wrench HEX (mm)	Tightening torque N·m (lbf·ft)
Capscrew (B2)	6	23.5 (17.3)
Sems bolt (C2)	17	46.1 (34)
Capscrew (A5)	13	23 (17)
Sems bolt (A6)	13	23 (17)

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)]
Suspension stroke
[Up; 37.5mm (1.48in), down; 37.5mm (1.48in)]

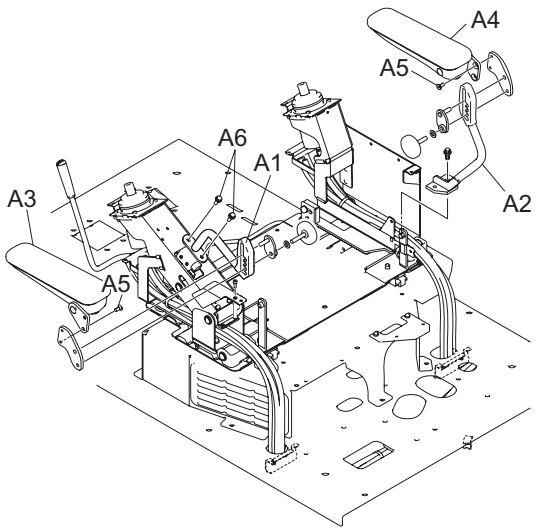


Fig. 33-2 Disassembling and Assembling armrest

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 : 367L (97gal)

(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 (16),(23) and draw out hoses (24) and (7).
   2) Put in plugs that match the hose bore.

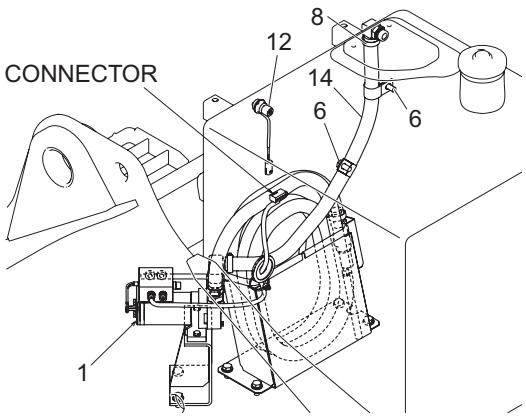


Fig. 33-28 Removing fuel feed hose (14)

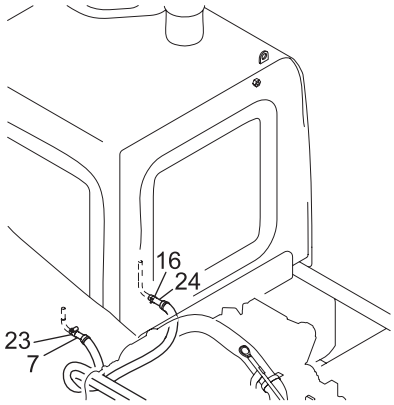


Fig. 33-29 Removing fuel hose (7), (24)

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 (11).
(See 33.1.4 GUARD)

(3) Remove Panel assy (3).
(See 33.1.4 GUARD)

(4) Unplug terminals on indicator (1-8) wiring.
(See Fig. 33-49)

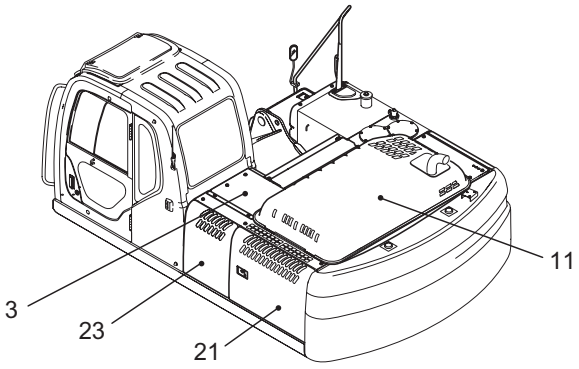


Fig. 33-48 Preparation for removal

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).

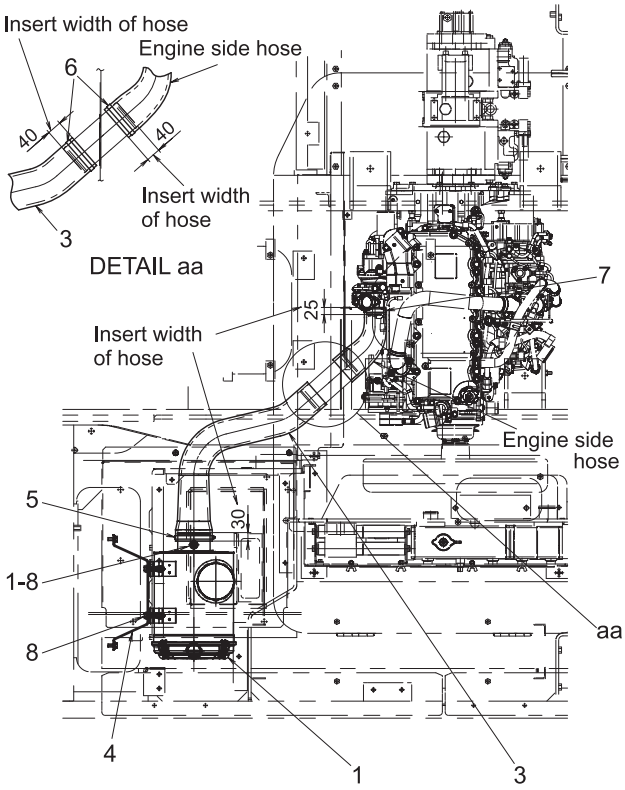


Fig. 33-49 Removing air cleaner

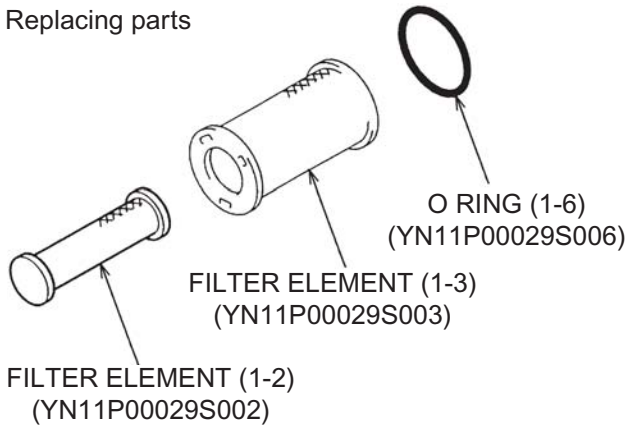
33.1.9.3 INSTALLATION

(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)



33.1.13.2 REMOVAL

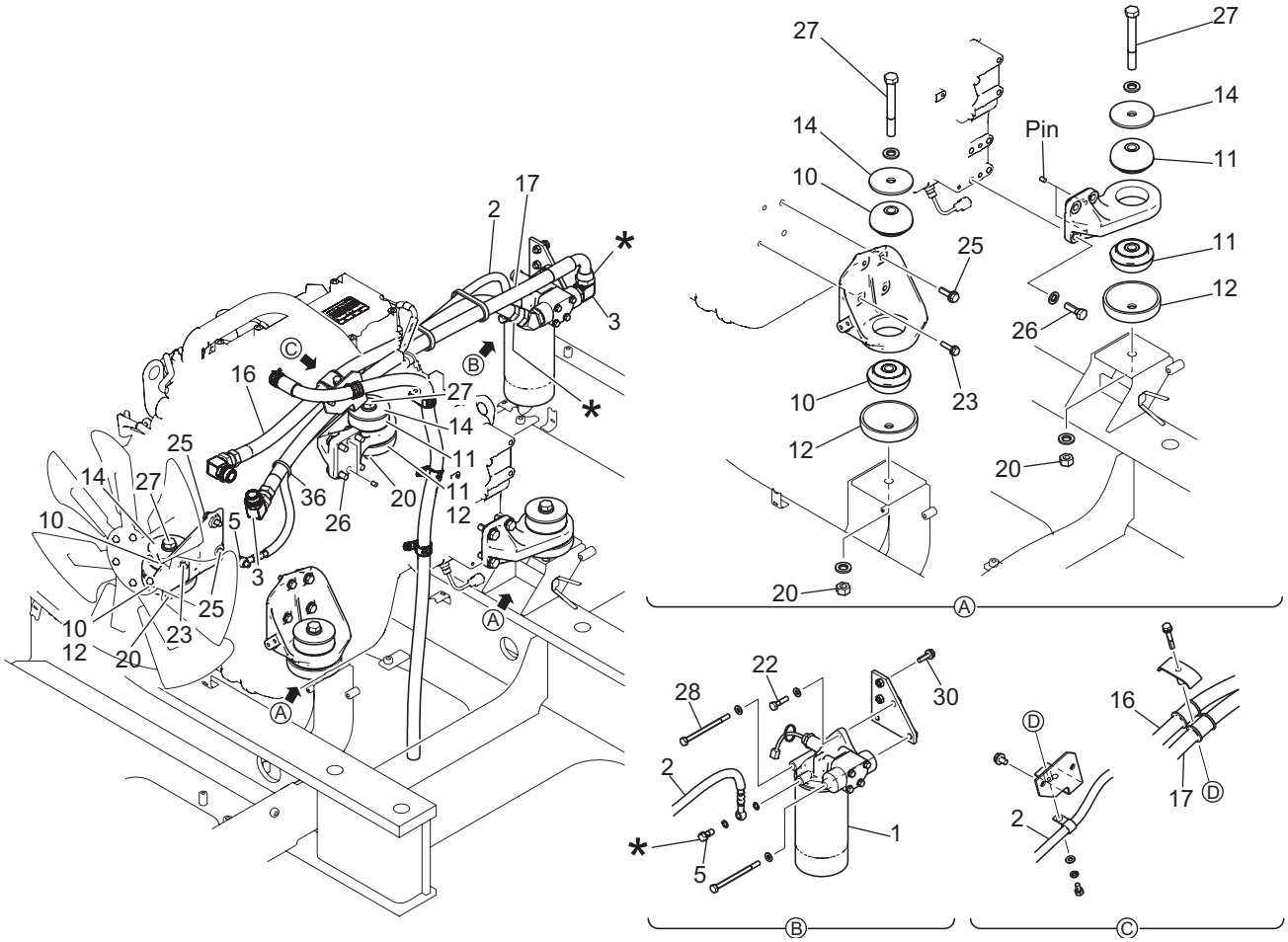


Fig. 33-65 Dismantling and mounting engine

(1) Remove hose of engine oil filter

Place oil pan under the connection of filter (1), and disconnect hoses (2), (16), (17) at * positions. (2) Plug connector of filter side and hose.

: 17 mm, 41 mm

(2) Plug connector of filter side and hose.

(3) Loosen engine mounting bolt of frame

1) Loosen 4 nuts (20) M18.

: 27 mm

2) Loosen 4 capscrews (27) M18×150.

3) Remove 4 plates (14).

4) Remove upper rubber mounts (10) and (11) 2 each.

(4) Slinging 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: ø6 (0.236")×1m (3ft 3in) - 2pcs.

(5) Position engine on the stand stably.

(2) Removing the swing unit
Remove 13 capscrews (1) M20×55.

: 30 mm

1) Remove two plastic caps (2) M12 at the top of the swing motor and install eye bolts.

: Flat-blade screwdriver

2) Put a wire sling in the eye bolts and remove the swing motor unit.
Weight of swing motor unit ;
Approx. 192kg (423 lbs) (Include reduction assy)

33.1.18.3 PREPARATION FOR INSTALL

(1) Clean mating surfaces of swing motor unit and upper frame.
Tools : spatula, wash oil

(2) Apply Loctite #515 on entire mounting surface of swing motor unit.

33.1.18.4 INSTALLATION

Install the swing motor unit in the reverse order of disassembly, confirming the orientation of the swing motor unit.

(1) Tighten 13 capscrews (1) M20×55.

: 30 mm
Tightening torque : 539N•m (400 lbf•ft) Apply Loctite #262

(2) Fill inside from motor drain port to casing with hydraulic oil before piping for drain

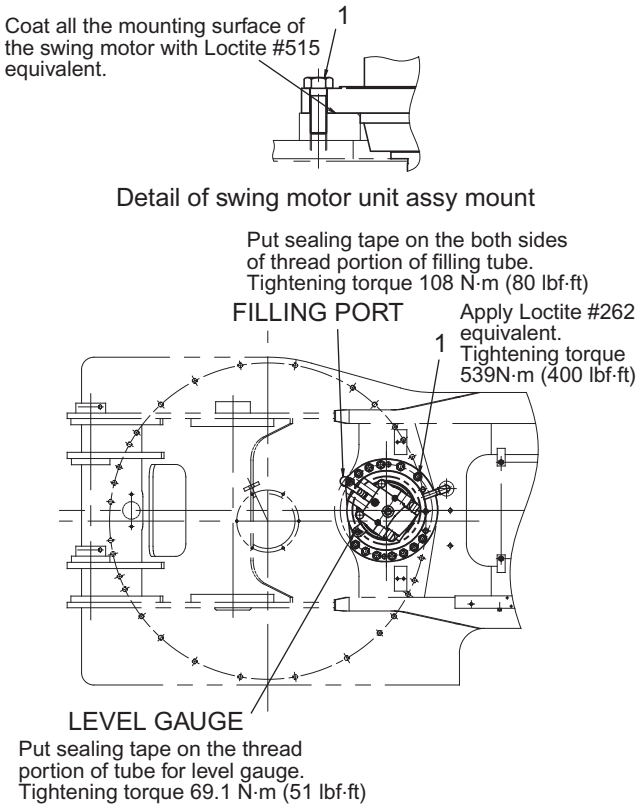


Fig. 33-79 Installing swing motor unit

33.1.18.5 PREPARATION FOR DRIVE

(1) Before starting operation, check that gear oil #90 (API grade GL-4) level of swing reduction is sufficient.
Amount of oil : 3L (0.8gal)

(2) When starting operation, operate motor in low idling and at low speed for several minutes, and check it for possible oil leak and noise.

6) Disassembling the pump casing and the valve block
Place the pump level on a work bench with its mounting surface of the regulator facing down. Then separate pump casing (271) and valve block (312).

- When facing the mounting surface of the regulator down, place a rubber sheet on a work bench so as not to score the mounting surface.
- When the pump casing has been separated from the valve block, draw out the 1st gear (116) at the same time.

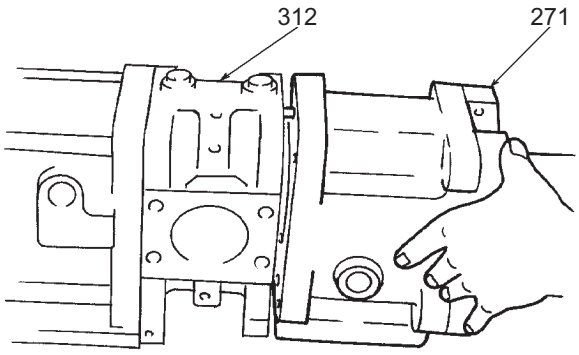


Fig. 33-93 Disassembling the pump casing (271) and the valve block (312)

7) Drawing out the cylinder assy
Draw out cylinder (141) out of pump casing (271) in parallel to shaft (111). At the same time draw out piston (151), plate (153), spherical bushing (156) and cylinder spring (157).

- Use care so as not to score the sliding surface of the cylinder, spherical bushing, shoe and the swash plate.

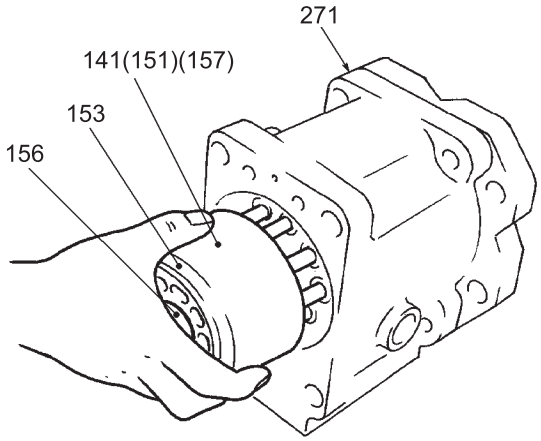


Fig. 33-94 Drawing out the cylinder assy

8) Remove seal cover (F)
Remove socket bolt (406) M8 and seal cover F (261).

: 6 mm

- The seal cover (F) may be drawn out with ease if it is taken out by tightening bolts in the tapped holes (M6 tap) of the seal cover (F).
- An oil seal is fitted to seal cover (F). Therefore, use care so as not to score the oil seal.

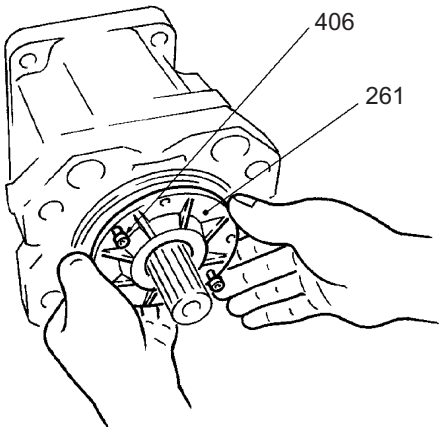


Fig. 33-95 Removing seal cover F (261)

Note

Marks ⓌⓍⓎⓏ in Fig. 33-90 show the position where regulator is installed.

No.	Name	Q'ty	No.	Name	Q'ty	No.	Name	No.
412	Socket bolt ; M8X50	2	628	Adjust screw (C)	1	732	O-ring ; 1B P16	1
413	Socket bolt ; M8X70	2	629	Cover (C)	1	733	O-ring	1
418	Socket bolt ; M5X12	2	630	Lock nut ; M30X1.5	1	734	O-ring ; 1B G25	1
438	Socket bolt ; M6X20	8	631	Sleeve (For PF)	1	753	O-ring ; 1B P9	1
439	Socket bolt ; M6X25	5	641	Pilot cover	1	755	O-ring ; 1B P11	7
466	VP plug ; PF1/4	3	642	Spool	1	756	O-ring ; 1B P26	1
496	Plug ; NPTF1/16	17	643	Pilot piston	1	757	O-ring ; 1B P12.5	1
541	Seat	2	644	Spring seat (Q)	1	763	O-ring ; 1B G35	1
543	Stopper 1	2	645	Adjust stem (Q)	1	801	Nut ; M8	1
545	Ball	2	646	Pilot spring	1	802	Nut ; M10	1
601	Casing	1	651	Sleeve	1	814	Snap ring	1
611	Feed back lever	1	652	Spool	1	836	Snap ring	1
612	Lever (1)	1	653	Spring seat	1	858	Snap ring	2
613	Lever (2)	1	654	Return spring	1	874	Pin ; ϕ4X11.7L	1
614	Fulcrum plug	1	655	Set spring	1	875	Pin ; ϕ4X8L	2
615	Adjust plug	1	656	Block cover	1	876	Pin ; ϕ5X8L	2
621	Compensating rod	1	662	Spring	1	887	Pin	1
622	Piston case	1	708	O-ring ; 1B G75	1	897	Pin ; ϕ4X19L	1
623	Compensating rod	1	722	O-ring ; 1B P6	3	898	Pin ; ϕ7.5X11L	1
624	Spring seat (C)	1	724	O-ring ; 1B P8	8	924	Socket screw ; M8X20	1
625	Outer spring	1	725	O-ring ; 1B P10	1	041	Check valve sub	2
626	Inner spring	1	728	O-ring ; 1B P18	1	079	Solenoid proportional reducing valve	1
627	Adjusting stem (C)	1	730	O-ring ; 1B P22	1			

The numbers in a rectangle represent adjust screws. Do not tamper with the adjust screws as much as possible.

Tightening torque of bolt, plug and nut

No.	Thread size	Tightening torque N·m (lbf·ft)
412,413	M8	29 (21)
438,439	M6	12 (8.9)
418	M5	6.9 (5)
466	PF 1/4	36 (26)
496	NPTF1/16	8.8 (6.5)
630	M30X1.5	160 (118)
801	M8	16 (12)
802	M10	19 (14)

33.2.2 CONTROL VALVE

33.2.2.1 SECTIONAL VIEW

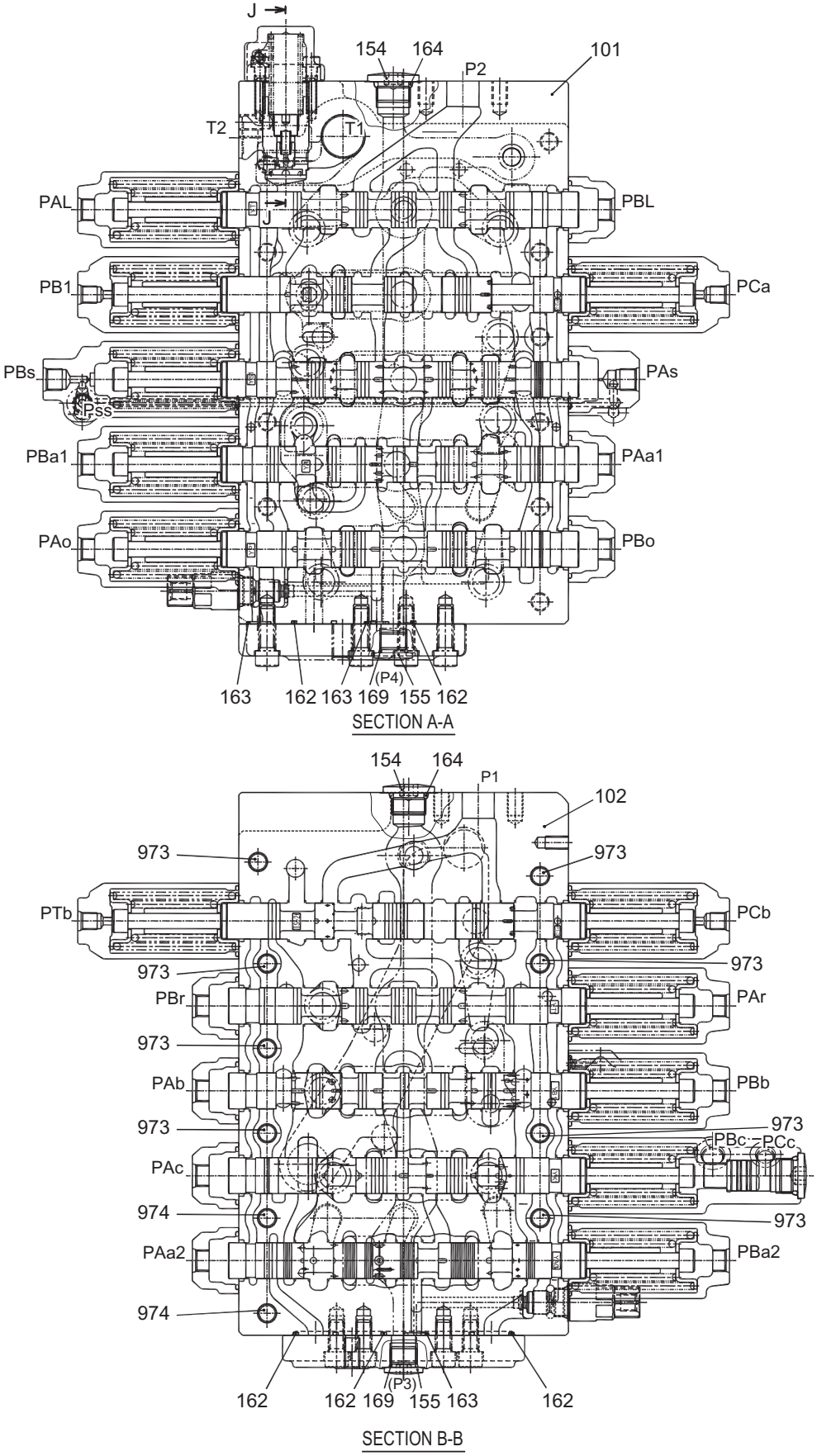


Fig. 33-137 Section (1/6)

(3) Fix the boom spool assy with vise via a protective plate (aluminum plate, etc.) and remove bolt (333). Then separate spring seat (331), springs (321), (322) and stopper (336) from boom spool (301). Do not disassemble boom spool (301) further unless there is special reason.

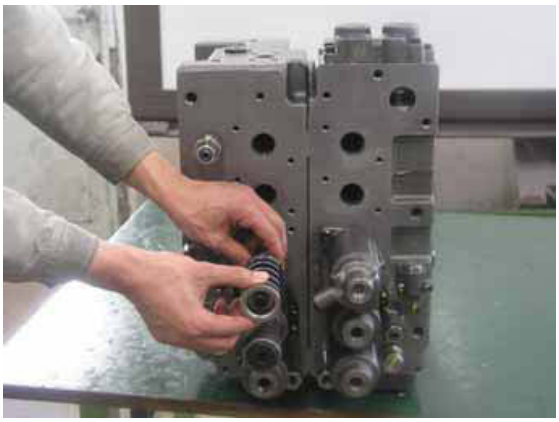


Fig. 33-154 Drawing out boom spool (301) assy

33.2.2.3.5 Disassembling the swing spool

(1) Loosen the socket bolts (273) and remove the spring cover sub (204) and the O-ring (261), (266) for swing. Do not disassemble spring cover sub (204) further unless there is special reason.

(2) Draw out the assy of swing spool (303), spring seat (331), springs (321), (322), stopper (336) and bolt (333) from casing A (101).

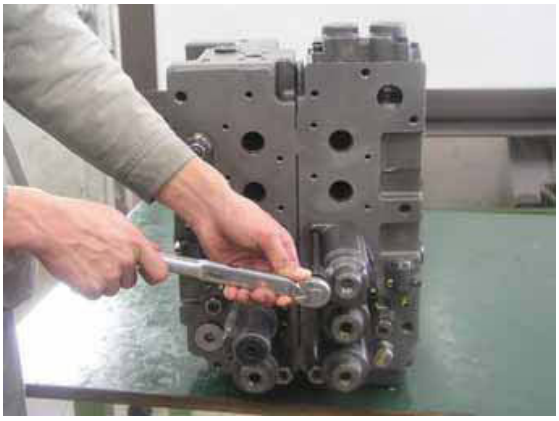


Fig. 33-155 Removing spring cover sub (204)

CAUTION

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

(3) Fix the swing spool assy with vise via a protective plate (aluminum plate, etc.) and remove bolt (333). Then separate spring seat (331), springs (321), (322) and stopper (336) from swing spool (303).

Fig. 33-156 Drawing out swing spool (303) assy

33.2.2.4.6 Assembling relief valve and relief valve hole plug assembly

(1) Tighten main relief valve (601), port relief valves (602), (603), (605) and relief valve hole plug assembly (604) in respective place to the specified torque.

CAUTION

Assemble it giving attention to the label attached when disassembling to prevent mistake because the port relief valves (602), (603), (605) are similar in shape.

33.2.2.4.7 Assembling p2 unload spool

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

CAUTION

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

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

CAUTION

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

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

33.2.2.4.8 Assembling travel straight spool

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

CAUTION

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

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

CAUTION

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

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

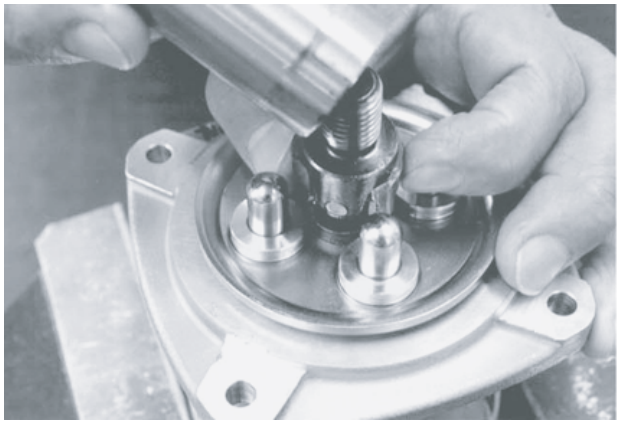


Fig. 33-185 Installing Jig A

(5) Turn joint (301) in counterclockwise with Jig A to remove.
Jig A : See page 33-120.
: 24mm

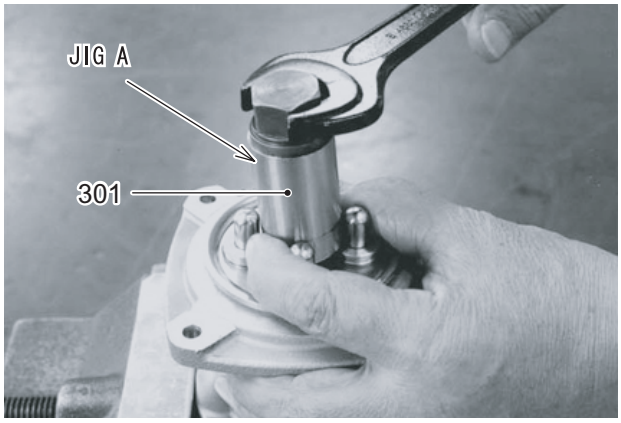


Fig. 33-186 Removing joint (301)

CAUTION

When the force of return springs (221) is strong, never loosen joint (301). If loosened, it might result in jumping out of plate (151), plug (211) and push rod (212). Remove joint (301) pressing plate (151) downward with two fingers.

(6) Remove plate (151)

- When the force of return springs (221) are strong, press plate to let it come up slowly.

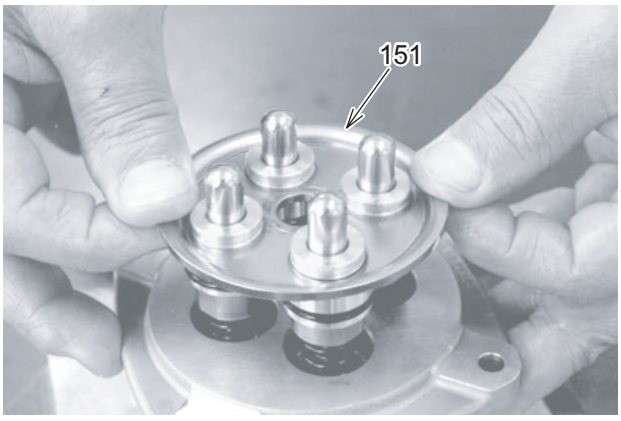


Fig. 33-187 Removing plate (151)

- When the force of return springs (221) are weak, plug is left in casing (101) due to sliding resistance of O-ring (214).

Pull plug (211) out with a driver.

CAUTION

To prevent personal injury, plug (211) must be removed slowly and evenly until the return spring (221) force is completely released.

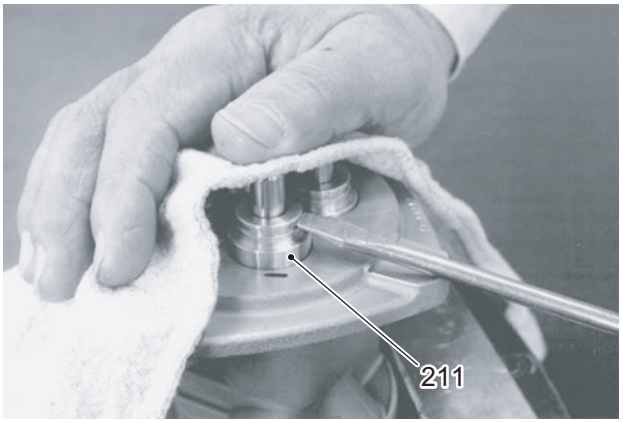


Fig. 33-188 Removing plug (211)

3) Lift the retaining plate to remove it.
(See Fig. 33-211)

* Reassembly :

- Use the retaining plate to insert the 4 guides into the body simultaneously and perpendicularly.
(See Fig. 33-211 left side)

4) Reassemble parts in reverse order.

5) Drain the pilot control unit (See 33.2.4.3).

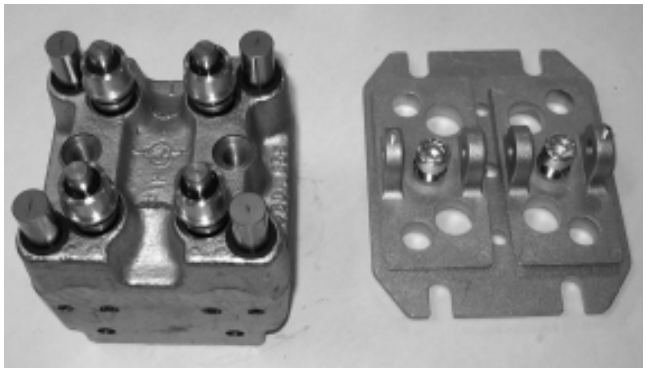


Fig. 33-211

(5) Damping plunger seals 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))

2) Remove the wiper ring of the damping plunger (1).
(See Fig. 33-212 No.1)

* Reassembly :

- Replace with a new wiper ring.

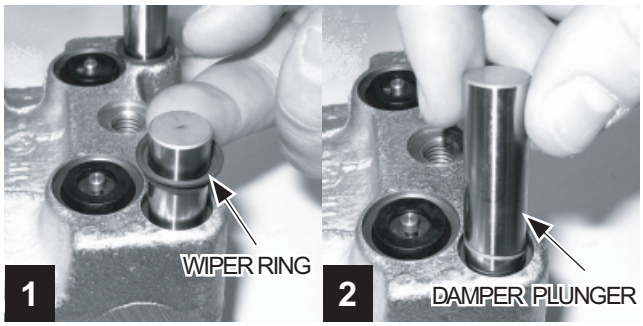


Fig. 33-212

CAUTION

Always place the damping plunger prior to the wiper ring, and make sure the wiper ring is correctly positionned.

3) Remove the damping plunger (2).
(Fig. 33-212 No.2)

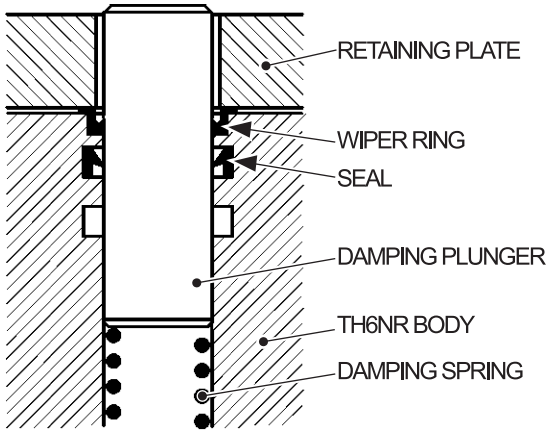


Fig. 33-213

4) Using a needle, remove the seal placed inside the body (See Fig. 33-214 No.3, 4)

* Reassembly :

- Replace with a new seal and grease it.

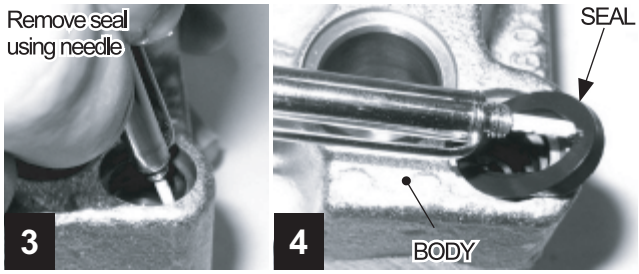


Fig. 33-214

3) Loosen relief valve (051) and separate it from valve casing (303).

: 41 mm

4) Loosen anti-reaction valve sub assy (052) and remove from valve casing (303). (See Fig. 33-230)

: 6 mm

5) Separate ROMH plug (469) from valve casing (303) and draw out spring (355) and plunger (351).

: 14 mm

6) Loosen socket bolt (401) and separate valve casing (303) from casing (301). If the socket bolt (401) are loosened, the valve casing floats off casing (301) by the force of brake spring (712). Then separate valve plate (131) from valve casing (303).

: 17 mm

7) Draw out brake spring (712) from brake piston (702).

8) Put the claw of the brake piston removing jig in the concaved part of brake piston (702). Tighten 2 bolts of jig simultaneously, and draw out the brake piston (702) with the jig, from the casing.

9) Lay the motor on its side again and draw out cylinder block (111) from drive shaft (101). Then draw out piston (121), set plate (123), spring (114) and shoe plate (124).

CAUTION

Handle the parts with care so as not to score the sliding surfaces of cylinder block (111) and shoe (122).

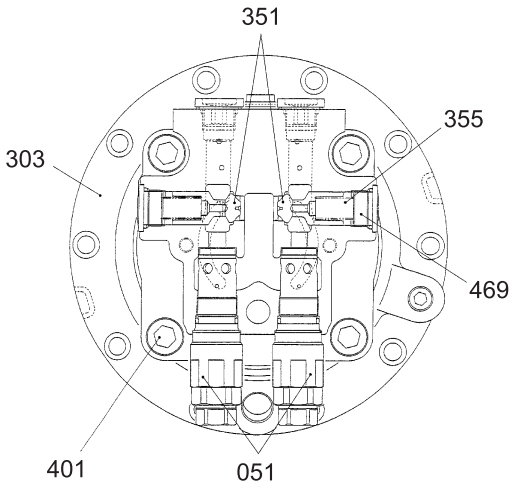


Fig. 33-231 Removing relief valve (651), anti-reactionvalve (052), anti-cavitation plunger (351) and valve casing (303)

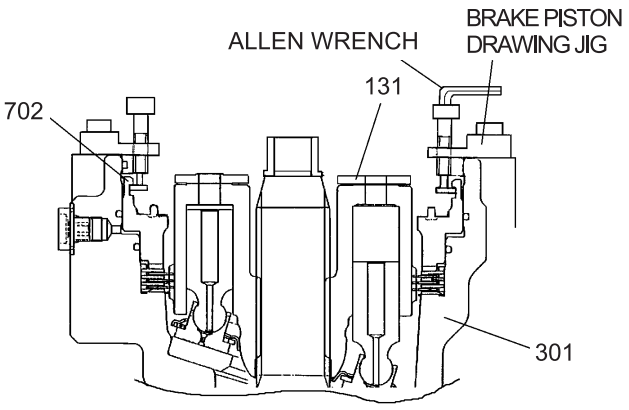


Fig. 33-232 Removing brake piston (702)

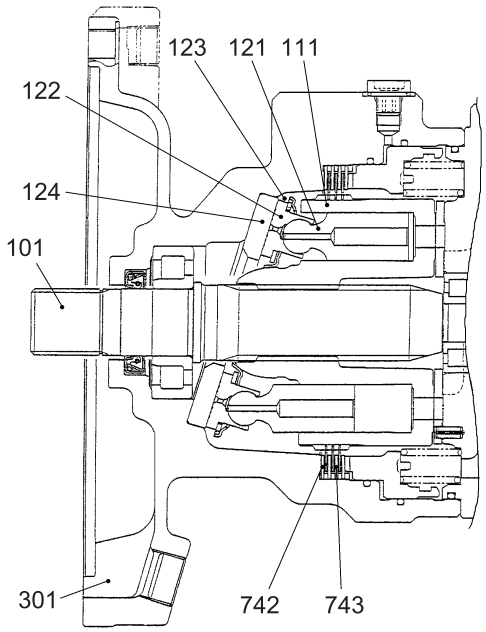


Fig. 33-233 Drawing cylider block (111), piston sub assy, friction plate (742) and separator plate

5) Apply sufficient grease to the pinion shaft assy.
Grease : Lithium extreme-pressure grease
(SHELL Albania EP2 or equivalent)

(3) Placing pinion shaft assy in

1) Place housing (13) on level bench.

2) Attach eye bolt to screw (M10) at the axis end of pinion shaft assy, and perpendicularly hang up pinion shaft assy and place it in the housing.

- Horizontally orient the outer race of spherical bearing and insert it in by striking lightly.
  If the outer race is tilted, it is hard to insert even if striking. Then do not force to insert it in, but take it away once and horizontally orient the outer race twice and insert it in again.

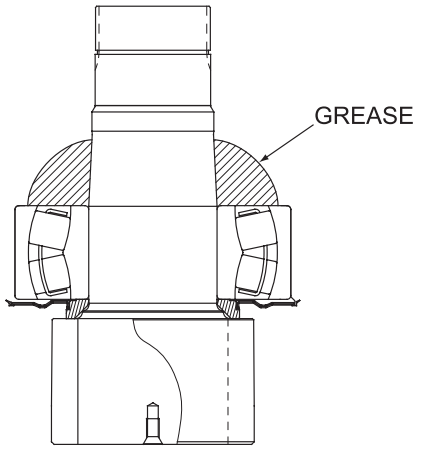


Fig. 33-255 Apply grease

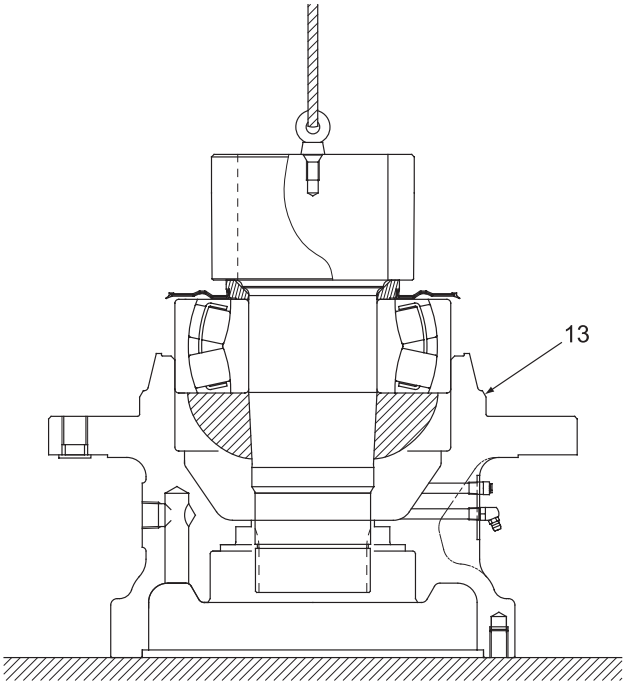


Fig. 33-256 Placing pinion shaft assy in

3) Set housing assy so that the pinion directs downward.

4) Fit oil seal (12) in housing (13) by means of jig (g).

- Apply Loctite #515 to the perimeter of oil seal.
- Fill one third (1/3) of the space of the groove-shaped section provided on the oil seal (12) lip with grease.
- Insert it horizontally giving attention to the lip of oil seal so as not be damaged.

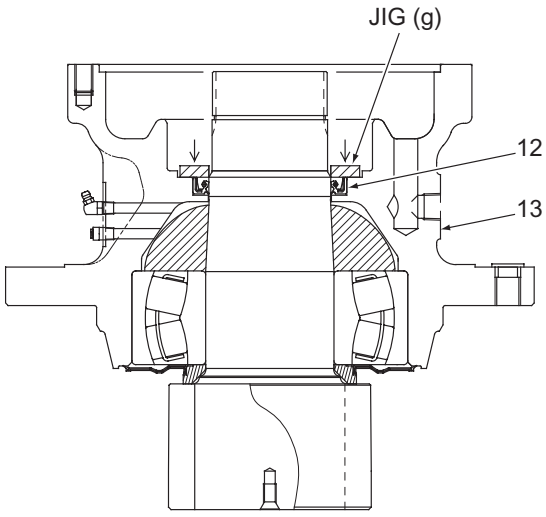


Fig. 33-257

33.2.6 SWIVEL JOINT

33.2.6.1 CONSTRUCTION VIEW

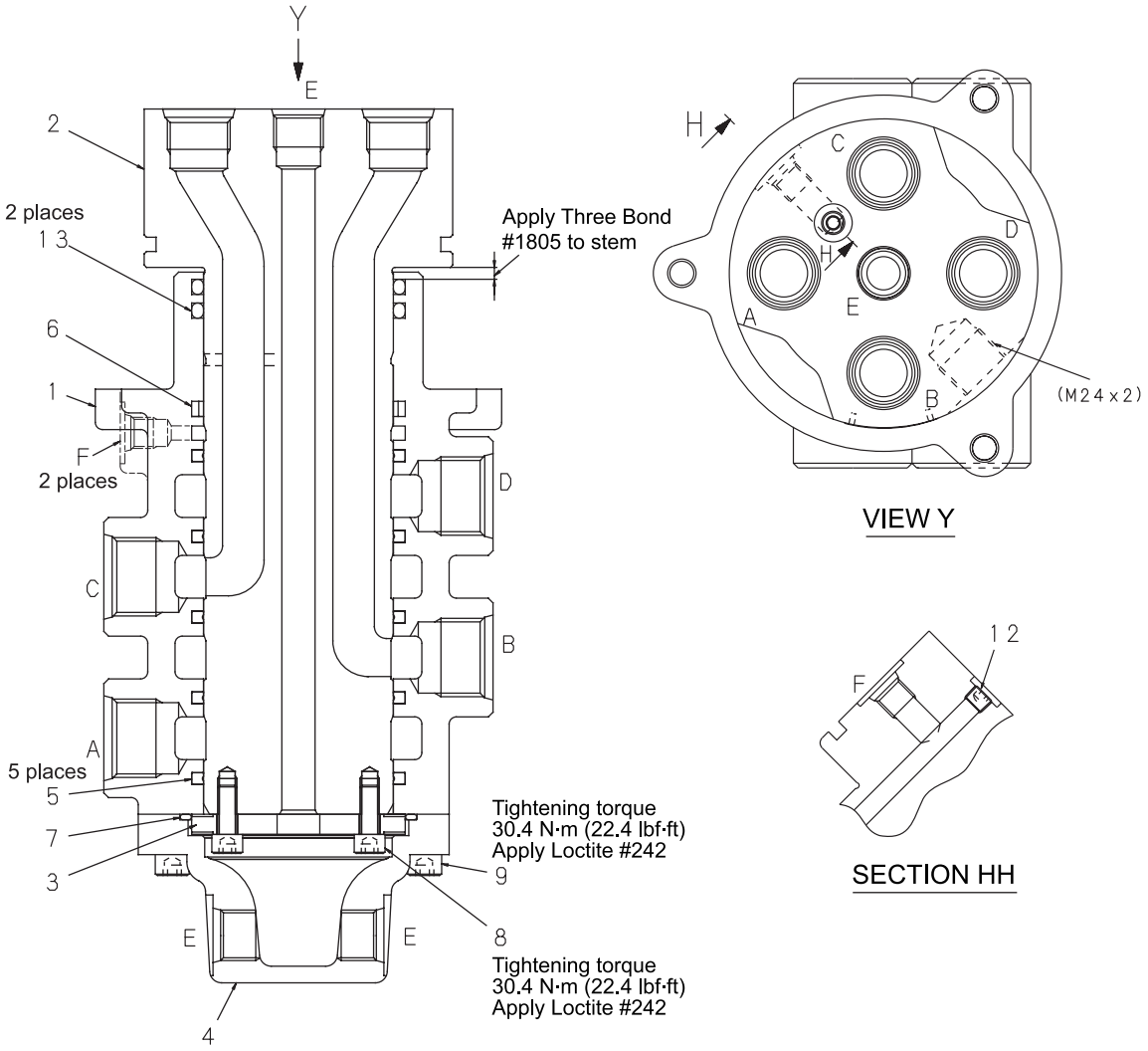


Fig. 33-268 Construction of swivel joint

No.	Part name	Q'ty	No.	Part name	Q'ty
1	Body	1	7	O-ring (G95 1A)	1
2	Stem	1	8	Socket bolt (M8×20)	2
3	Thrust plate	1	9	Socket bolt (M8×30)	3
4	Cover	1	12	Plug	1
5	Seal	5	13	O-ring (P80)	2
6	Seal assy	1			

Issue	Date of Issue	Applicable Machines	Remarks	
First edition	March, 2007	E215B : YN11-45001~ E215BLC : YQ11-06001~	S5YN3421E01 (NHK Russia)	K
↑	July, 2007	↑	↑ (NHK Middle East)	K

PREFACE

(1) This Manual describes all the procedures from removing to attaching, arranging them by item.

(2) This Manual consists of first part. Removing and attaching, and sequel. Disassembling and assembling.

(3) The removing and attaching can be performed in the procedure specified in Table of Contents, but in view of actual repairing or time saving some process can be omitted.

(4) The removing and attaching procedure does not completely cover all possible situations because of differences of field condition and defective section.

(5) Please be aware that the procedure to be followed must be determined according to the above conditions. When disassembly and assembly are required, select the necessary section, itemize the work contents with good understanding, then starts working.

34.1.3.7 TOOLS AND JIGS

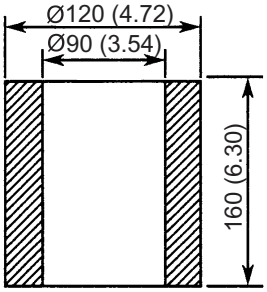
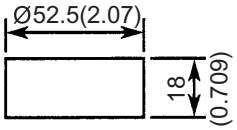
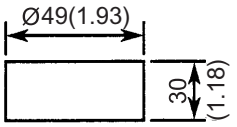
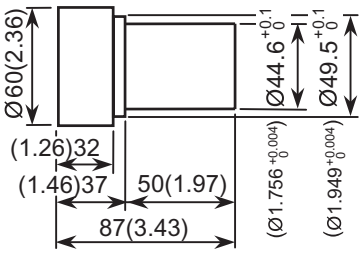
(1) Tightening tools

Unit : mm

NAME	OPPOSING FLATS
 Socket	30
 Allen wrench	6,8

(2) Jigs

Unit : mm (in)

No.	NAME	SHAPE
f	Stand jig	
g	For extruding bushing	
h	For extruding shaft	
i	Bushing fixing jig	

5) Removing bushing (2)
With idler (1) mounted on the stand, tap bushing (2) lightly by hammer, while placing the bushing drawing rod (T) against the end face of bushing (2) evenly all round, till it comes out.

6) Removing floating seals (4)
Take out floating seals (4) from idler (1), collar (3). If you intend to re-use floating seals (4), confirm that there is no scoring and rusting on the contact surface and store the floating seals in pairs by placing card board between the sealing faces.

7) Removing O-ring (7)
Separate O-ring (7) from shaft (6).

(2) Assembly

1) Pressing in bushing (2)
Align inner hole of idler (1) and bushing (2) and press fit it vertically with press so that jig (V) for bushing press-fitting is inserted into bushing (2).

2) Installing O-ring (7)
Fit O-ring (7) to O-ring groove on shaft (6).

- Apply grease to O-ring

3) Installing collar (3) (See Fig. 34-50)
Press fit the O-ring (7) installed side of shaft (6) into collar (3), and drive pin (5).

4) Installing floating seal (4)
Fit the half of floating seal (4) on each side of collar (3) and idler (1).

5) Inserting idler (1)
Insert floating seal (4) fitted side of idler (1) into shaft (6).

6) Installing floating seal (4)
Fit floating seal (4) on the other side of idler (1).

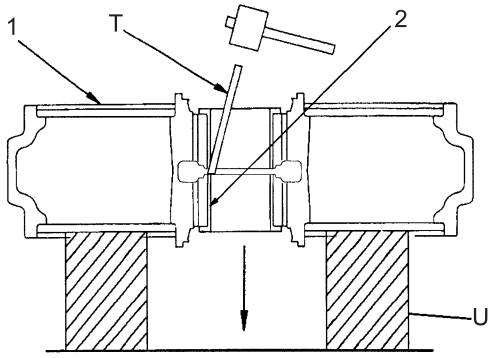


Fig. 34-48 Removing bushing (2)

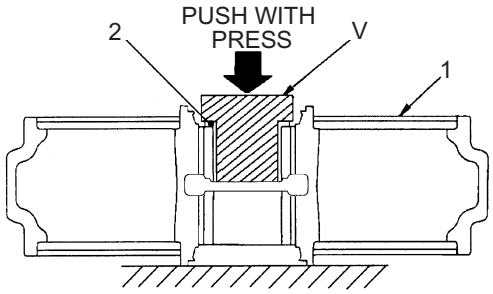


Fig. 34-49 Pressing in bushing (2)

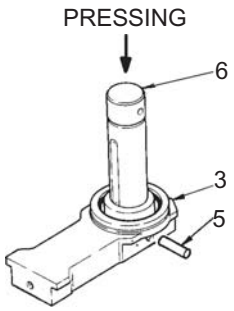


Fig. 34-50 Installing collar (3), shaft (6)

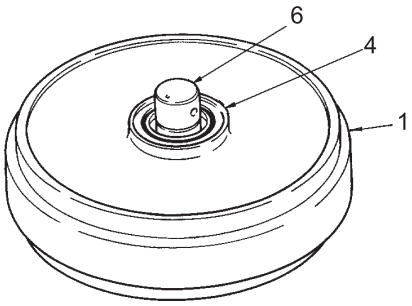


Fig. 34-51 Inserting idler (1) and installing floating seal (4)

(5) Removing sprocket
Removing twenty two (one side) capscrews (2) M18×55.

: 24 mm

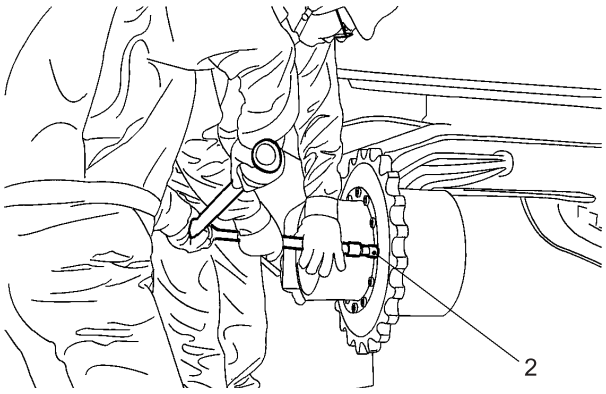


Fig. 34-74 Removing and installing sprocket

(6) Loosening travel motor attaching bolts (3)
Apply match marks on travel motor and crawler frame, and remove seventeen (one side) capscrews (3) M20×60.

: 24 mm

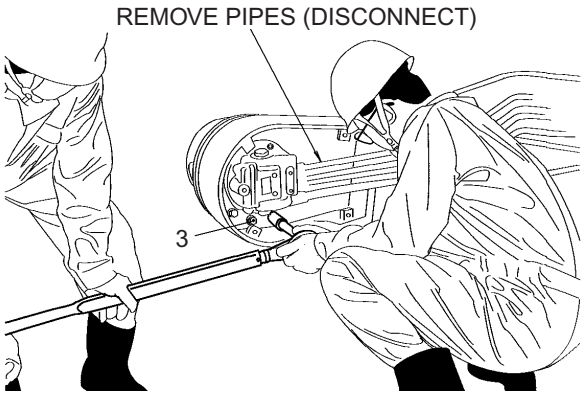


Fig. 34-75 Removing and installing travel motor attaching bolts

(7) Slinging travel motor assy
Sling travel motor with nylon sling applied on the side close to sprocket installing section and remove the motor.

Weight of motor : About. 260kg (573 lbs)

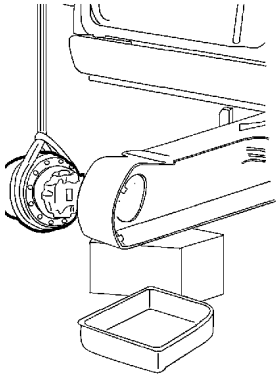


Fig. 34-76 Slinging travel motor

34.1.7.3 INSTALLING

Installing of the travel motor piping is performed in the reverse order of removal.

1) Cleaning
Check that contact surface of travel motor and crawler frame is free from burr and stain.

2) Tightening torque
Tighten capscrew and hydraulic pipes to the torque specified in "Tightening Torque".

3) Fill inside from motor drain port to casing with hydraulic oil before piping for drain. When starting operation, operate motor in low idling and at low speed for several minutes, and check it for possible oil leakage and noise.

NAME	SIZE	TOOLS HEX	NO.	TIGHTEING TORQUE N·m(lbf·ft)	REMARKS
SEMS BOLT	M12	19	6	83.4 (61)	APPLY LOCTITE #262
CAPSCREW	M16	24	3	279 (206)	
FLARELESS NUT FOR PIPES, SLEEVE	ϕ10X1.5	19	—	49(36)	
	ϕ18X2.5	32	—	147(110)	
	ϕ28	41	—	275(200)	
HOSE CAP	PF1/4	19	—	29.4(21.7)	
	PF1/2	27	—	78.5(57.9)	
CONNECTOR	PF1/4	19	—	36.3(27)	
	PF1/2	27	—	108(80)	
	PF1	41	—	255(190)	

34.2.1.3.3 Disassembling procedure

(1) Cleaning travel motor

1) Tighten eye bolt to the tapped hole for spindle (2), hang up the travel motor with hoist and carry it to washing bath.

Note

Tighten two eye bolts to the tapped holes for spindle in such locations that they are symmetrical each other.

2) Clean each section of travel motor with car washing brush.

Note

Carefully clean the space between hub (1) and spindle (101) (floating seal fitting section) because earth and sand might be entered.

(2) Installing travel motor

1) Put travel motor on work bench.

Note

Align the thread hole of hub (1) to the threaded hole of work bench and softly insert the travel motor in attaching hole of work bench.

2) Attach the travel motor on the work bench in such locations that two socket bolts are symmetrical each other.

CAUTION

Securely tighten the socket bolt. If not, there is a possibility of injury due to the drop of travel motor when it has been turned over.

(3) Draining lube oil.

1) Lay the travel motor horizontally. (Direct the drain port downward.)
2) Loosen oil filler plug (30) and release the pressure in the reduction unit, and then lightly tighten the plug again.

Note

If the pressure is applied to the inside of reduction unit, lubricating oil may be gushed out when loosening the plug of drain port.

3) Put the oil pan under the top end of drain port and slowly loosen the plug of drain port and then drain lubricating oil.

Note

Prepare the oil pan of which the capacity is sufficient for the lubricating oil quantity specified to the reduction unit, 5.3L.

(3) Assembling parking brake

1) Direct rear flange attaching face of piston upward while turning the work bench.

2) Install separator plate (116), friction plate and separator plate in that order.

3) Apply soft metal bar to piston (112) and insert it in spindle (101) while striking the bar with a hammer.

Note

Strike 3 or 4 points divided into equal divisions on the circumference of piston in order and assemble it in the condition where the piston is held in level because the sliding surface might be damaged if the piston is largely tilted.

(4) Assembling taper roller bearing

1) Push taper roller bearing (150) on which the outer ring has been removed against shaft (102), and then apply metal bar to the inner race and insert it while striking the bar with a hammer.

Issue	Date of Issue	Applicable Machines	Remarks	
First edition	July, 2006	SK330-8 : LC10-07001~ SK350LC-8 : YC10-03501~	S5YN4618E01 (ASIA, OCE)	K
↑	August, 2006	SK200-8 : YN11-45001~ SK210LC-8 : YQ11-06001~	↑	K
↑	October, 2006	SK250-8 : LQ12-06001~ SK260LC-8 : LL12-05001~	↑	K
Revision	February, 2007	↑	S5YN4618E02 (ASIA, OCE)	K
↑	March, 2007	E215B : YN11-45001~ E215BLC : YQ11-06001~	↑ (NHK Russia)	K
↑	April, 2007	SK200-8 : YN11-45001~ SK210LC-8 : YQ11-06001~	↑ ASIA (HS Engine)	K
↑	July, 2007	E215B : YN11-45001~ E215BLC : YQ11-06001~	↑ (NHK Middle East)	K

Table46-13

Error code		B023		
Trouble		Boom down pressure sensor's wiring is disconnecting.		
Judging condition		The input voltage from boom down pressure sensor is 0.1V or less.		
Symptom		The boom down operability becomes poor.		
Control in the event of failure		Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) Set output of P1 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	5	B-2 BOOM LOWER
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Boom down pressure sensor SE-4			When B023 is cancelled and other error occurs after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between boom down pressure sensor and controller CN-127F CN-101F			When B023 is displayed 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.

Table46-14

Error code		B024		
Trouble		Boom down pressure sensor's power source is shortcut.		
Judging condition		The input voltage from boom down pressure sensor is 4.7V or more.		
Symptom		The boom down operability becomes poor.		
Control in the event of failure		Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) Set output of P1 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	5	B-2 BOOM LOWER
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Boom down pressure sensor SE-4			When B024 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 boom down pressure sensor and controller CN-127F CN-101F			When B024 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.

Table46-35

Error code	B104		
Trouble	Travel left pressure sensor's power source is shortcut.		
Judging condition	The input voltage from Travel left pressure sensor is 4.7V or more.		
Symptom	The Travel left operability becomes poor.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) P1, Set output of P2 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	B-10 TRAVEL (L)
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Travel left pressure sensor SE-10	When B104 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 travel left pressure sensor and controller CN-302F CN-102F	When B104 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.

Table46-36

Error code	B113		
Trouble	Option selector position detect pressure sensor's wiring is disconnected.		
Judging condition	The input voltage from option selector position detect pressure sensor is 0.1V or less.		
Symptom	When B mode is selected, option selector valve error is indicated.		
Control in the event of failure	Normal control		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	16	B-11
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Option selector position detect pressure sensor SE-29	When B113 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 option selector position detect pressure sensor and controller CN-162F CN-104F	When B113 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.

Table46-57

Error code		D023		
Trouble		P2 unload 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		Independent operations of boom up and of bucket digging/dump become slow.		
Control in the event of failure		Set output of P2 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	8	D-2 P2 UN-LOAD (BP-CUT)
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• P2 unload proportional valve PSV-B			When D023 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between P2 unload proportional valve and controller CN-118F CN-105F			When D023 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.

Table46-58

Error code		D032		
Trouble		Travel straight proportional valve and output transistor ON are failure.		
Judging condition		The feed-back value from proportional valve is 1000mA or more.		
Symptom		Travel deviation occurs by combined operation of travel and attachment.		
Control in the event of failure		Set Travel straight proportional valve output to 0mA.		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	8	D-3 S-TRAVEL
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Travel straight proportional valve PSV-C			When D032 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 Travel straight proportional valve and controller CN-119F CN-105F			When D032 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.

Table46-78

Error code	H013			
Trouble	Accel potentiometer is disconnected.			
Judging condition	The input voltage from accel potentiometer is 0.1V or less.			
Symptom	LOW idling is fixed.			
Control in the event of failure	LOW idling is fixed.			
Returned in normal condition	It returns automatically in normal condition.			
Service diagnosis checking screen	Screen No.	2	H-1 ACCEL VOLT.	
	Screen No.			
	Screen No.			
Checking object			Checking contents and remedy	
1	• Accel potentiometer SE-16		Measure the resistance between terminals of speed sensor. 1.6~2.4k Ω Turn the potentiometer and measure resistance between signal and GND.	
2	• Wiring between accel potentiometer and controller CN-402F CN-102F		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.	

Table46-79

Error code	H014			
Trouble	Accel potentiometer's power source is shortcut.			
Judging condition	The input voltage from accel potentiometer is 4.7V or more.			
Symptom	LOW idling is fixed.			
Control in the event of failure	LOW idling is fixed.			
Returned in normal condition	It returns automatically in normal condition.			
Service diagnosis checking screen	Screen No.	2	H-1 ACCEL VOLT.	
	Screen No.			
	Screen No.			
Checking object			Checking contents and remedy	
1	• Accel potentiometer SE-16		Measure the resistance between terminals of accel potentiometer. 1.6~2.4k Ω Turn the potentiometer and measure resistance between signal and GND.	
2	• Wiring between accel potentiometer and controller CN-402F CN-102F		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.	

Table46-97

Error code	R164		
Trouble	Auto idle stop relay 2 relay error		
Judging condition	The mechatro controller output line to auto idle stop relay 2 is short-circuited with the power source.		
Symptom	Power source for mechatro controller often turns off. Auto idle stop relay 2 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-1 AIS RELAY 2
	Screen No.		
	Screen No.		

	Checking object	Checking contents and remedy
1	• Auto idle stop relay 2 relay R-24	When error is cancelled after removing of auto idle stop relay 2, check relay unit for failure, replace it with new one if failed. When resistance between relays (1) and (2) is 0 Ω, it is in abnormal condition. 
2	• Wiring between auto idle stop relay 2 and controller CN-109F, CN2-2 •Fuse & relay box E-1	When R164 is left displayed with the relay removed Check that no power 24V is produced on relay (-) line according to the wiring checking procedure and replace it if necessary. When no failure found after checking on wiring and R164 is left displayed. Replace fuse/relay box.
3	• Mechatro controller	Check that the error is corrected after replacement of controller.

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

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

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

(15)Travel speed is slow/poor

No.	Sections	Contents/normal value		Corrective action, others
1	Travel right and left pressure sensor	Carry out service diagnosis	•See Service Diagnosis Data List Operation No.18 Travel right full lever and idling Operation No.19 Travel left full lever and idling	Check and replace pressure sensor Check remote control valve
2	Remote control valve	Measure directly remote control pressure of travel right and left	Check that pressure is 2.1MPa or more in travel right (left), forward (reverse) full lever and high idling operation	Check remote control valve
3	Actual measuring current value of P1/P2 unload proportional valve	Carry out service diagnosis	•No.9 D-1 P1 unload valve (cut valve) D-1 P2 unload valve (cut valve) •See Service Diagnosis Data List Operation No.18 Travel right full lever & idling Operation No.19 Travel left full lever & idling	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
4	Secondary pressure of P1, 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
5	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.18 Travel right full lever & idling Operation No.19 Travel left full lever & idling	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 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
7	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 voltage of low pressure sensor other than sensor for travel •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 travel straight proportional valve	Measure directly the proportional valve secondary pressure	0.8MPa or less in high idling operation regardless of neutral/operation	Replace proportional valve
9	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

47.2.2 TROUBLE

(1) Engine does not stop.

(2) "CPU DATA COMMUNICATION ERROR" is displayed on multi display.

(3) Auto accel does not actuate. (The engine speed does not automatically slow down.)

(4) Auto accel does not actuate. (The engine speed does not automatically speed up.)

(5) Wiper does not function.

Table48-1 Failure diagnosis Mode-1/Diagnosis item

No.	Display	Contents of diagnosis
13	1 TRAVEL-S	Is normal pressure generated in the condition that P1 side flow rate is minimum, unload valve is emergency position and travel straight is stroked fully?
14	2 TRAVEL-S	Is normal pressure generated in the condition that P2 side flow rate is minimum, unload valve is emergency position and travel straight is stroked fully?
15	1 P1 ENGINE	Is rated engine speed obtained in the condition that P1 side flow rate increases little by little when P1 side flow rate is relieved?
16	2 P2 ENGINE	Is rated engine speed obtained in the condition that P2 side flow rate increases little by little when P2 side flow rate is relieved?

Note

When pump regulator does not have "Total power control of Emergency mode", "1 P1 PUMP" of No.7 and "1 P2 PUMP" of No.10 are not given a diagnosis.

Table48-2 Failure diagnosis Mode-1/Diagnosis and Remedy

Diagnosis (Display)	Possible cause	Remedy
SENSOR CHECK NG	Disconnection of pressure sensor, Short circuit, Abnormal output	Check each pressure sensor by service diagnosis and replace it if necessary
P1 UN-LOAD PSV NG	Secondary pressure is excessive high against the command	Check P1 unload proportional valve and replace it if necessary
	Secondary pressure is excessive low against the command	
P1 UN-LOAD SPOOL NG	Stuck at full-stroke side	Check P1 unload spool and replace it if necessary
	Stuck at neutral side	
P2 UN-LOAD PSV NG	Secondary pressure is excessive high against the command	Check P2 unload proportional valve and replace it if necessary
	Secondary pressure is excessive low against the command	
P2 UN-LOAD SPOOL NG	Stuck at full-stroke side	Check P2 unload spool and replace it if necessary
	Stuck at neutral side	
P1 B-P CUT NG	Stuck at closing side	Check P1 by-pass cut valve and replace it if necessary
	Stuck at neutral side	
P2 B-P CUT NG	Stuck at closing side	Check P2 by-pass cut valve and replace it if necessary
	Stuck at neutral side	
P1 PUMP PSV NG	Secondary pressure is excessive high against the command	Check P1 pump proportional valve and replace it if necessary
	Secondary pressure is excessive low against the command	
P1 PUMP NG	Delivery rate is excessive large against the command	Check P1 pump regulator and replace it if necessary. Check P1 pump and replace it if necessary.
	Delivery rate is excessive small against the command	
P2 PUMP PSV NG	Secondary pressure is excessive high against the command	Check P2 pump proportional valve and replace it if necessary
	Secondary pressure is excessive low against the command	

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.

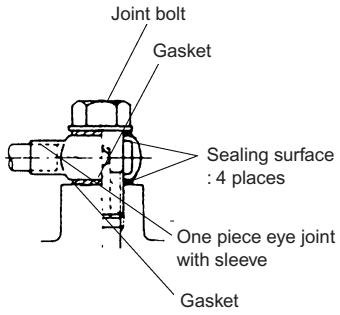
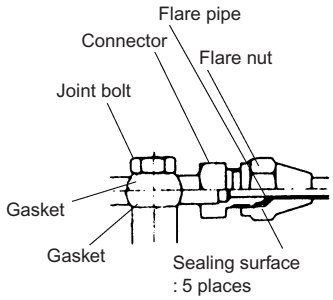
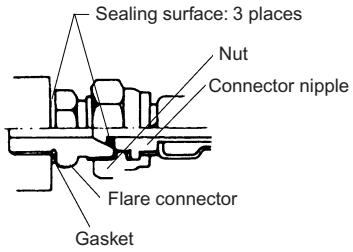
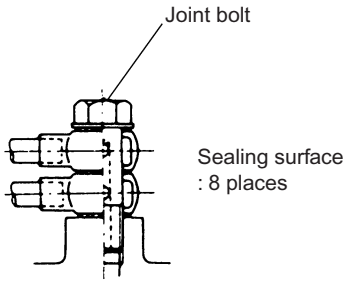
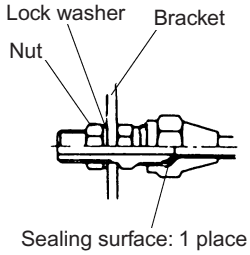
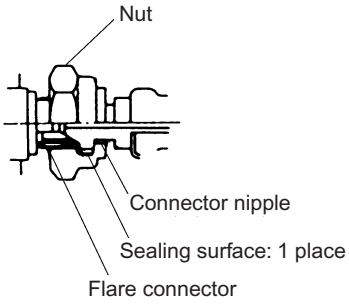
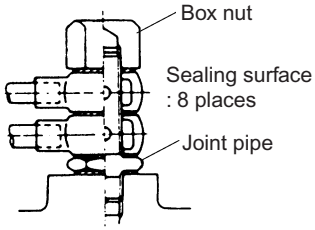
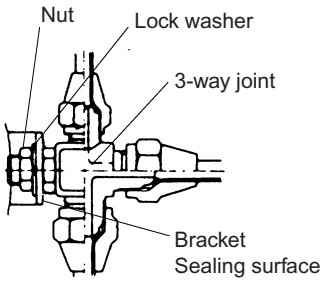
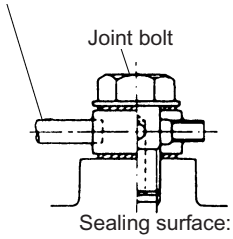
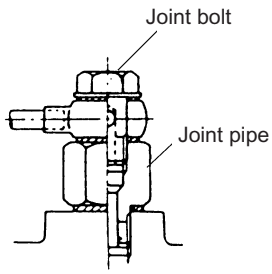
(2) This manual shows both the SI unit and conventional units. The conventional units are shown in { }.

	SI unit	Conventional unit	Conversion value*1 (1[Conventional unit] = X [SI unit])		SI unit	Conventional unit	Conversion value*1 (1[Conventional unit] = X [SI unit])
Force	N	kgf	1kgf=9.80665N	Spring constant	N/mm	kgf/mm	1kgf/mm=980665N/mm
Torque*2	N· m	kgf· cm	1kgf· cm=0.0980665 N· m	Volume	L	cc	1cc=1mL
Pressure	Pa	kgf/cm^2	1kgf/ cm^2=98.0665kPa =0.0980665MPa	Efficiency	W	PS	1PS=0.735499kW
		mmHg	1mmHg=0.133322k Pa	Calorific value	W· H	cal	1kcal=1.13279W· h
Rotational speed	r/min	rpm	1rpm=1r/min	Fuel consumption rate	g/W· h	g/PS· h	1g/PS· h=1.3596g/ kW· h
	min^{-1}		1rpm=1min^{-1}				

***1 : 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.

***2 : The conversion value of the torque may vary depending on the 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)
		 Sealing surface: 5 places
	 Sealing surface: 1 place	
		
One piece eye joint without sleeve  Sealing surface: 4 places		
 Sealing surface: 6 places		

Inspection item			Standard value	Repair limit	Service limit	Action
Piston	Piston ring groove	Top	2.5 {0.0984}	—	+0.2 {+0.0079}	Replace piston
		Second	2 {0.0787}	—	+0.2 {+0.0079}	
		Oil	4 {0.1574}	—	+0.1 {+0.0039}	
	Clearance between piston ring and piston ring groove	Top	0.09 - 0.13 {0.0035 - 0.0051}	—	—	Replace piston ring or piston.
		Second	0.04 - 0.08 {0.00016 - 0.0031}	—	—	
		Oil	0.02 - 0.06 {0.0008 - 0.0024}	—	—	
	Piston pin outer diameter		37 {1.4567}	—	–0.04 {–0.0015}	Replace piston pin
	Piston boss inner diameter		37 {1.4567}	—	+0.05 {+0.0020}	Replace piston
	Clearance between piston pin and piston boss		–0.002T - 0.025 {0.0000 - 0.0010} L (T : Tightening allowance, L : Clearance)	—	0.05 {0.0020}	Replace piston pin or piston
Connecting rod bushing inner diameter			37 {1.4567}	—	+0.1 {0.0039}	Replace connecting rod bushing
Connecting rod bushing oil clearance			0.015 - 0.036 {0.0006 - 0.0014}	—	0.08 {0.0031}	Replace piston pin or connecting rod bushing

Inspection item		Standard value	Service limit	Action
Metal bushing inner diameter of shaft assembly		9 {0.3543}	9.2 {0.3622}	Replace shaft assembly
Bearing housing inner diameter of rear bracket		28 {1.1024}	28.1 {1.1063} or more	Replace commutator end frame
Start magnet switch assembly	Between C terminal and M terminal (P coil)	0.12 - 0.15Ω	—	Replace start magnet switch assembly
	Between C terminal and body (H coil)	1.13 - 1.25Ω	—	

Tightening torque (starter)

JP31199020205015

Unit : N· m{kgf· cm, lbf· tt}

Tightening area	Tightening torque	Remark
C lead wire mounting bolt	2 - 3 {19 - 25, 1 - 2}	
M lead wire mounting nut	12.3 - 15.2 {126 - 154, 9 - 11}	
Commutator end frame mounting through bolt	15.7 - 17.6 {160 - 179, 12 - 13}	
Brush holder set bolts of commutator end frame	3.6 - 4.9 {37 - 49, 3 - 4}	
Start magnet switch assembly mounting bolt at pinion case	3.6 - 4.9 {37 - 49, 3 - 4}	
Pinion case switch set bolts	14 - 16 {140 - 160, 10 - 12}	

Turbocharger

Standard value

JP31199020205016

Unit : mm {in.}

Inspection item		Standard value	Repair limit	Service limit	Action
Turbine shaft play	Axial direction	0.1 {0.0039}	—	—	
	Diameter direction	1.0 {0.0397}	—	—	

Tightening torque

JP31199020205017

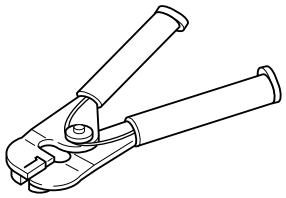
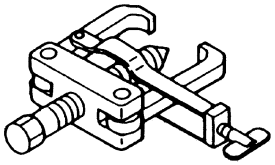
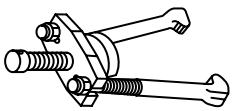
Unit : N· m{kgf· cm, lbf· tt}

Tightening area	Tightening torque	Remark
Turbocharger mounting nut	56 {570, 41}	

Air compressor

Special tool

JP31199030901013

Shape	Part No.	Name	Remark
	09440-1060	Piston ring expander	Remove the piston ring
	09650-1101	Bearing puller	Supply pump side For bearing and drain of drive gear
	09650-1310	Puller assembly	Drive gear side For drain of bearing

Instruments

JP31199030901014

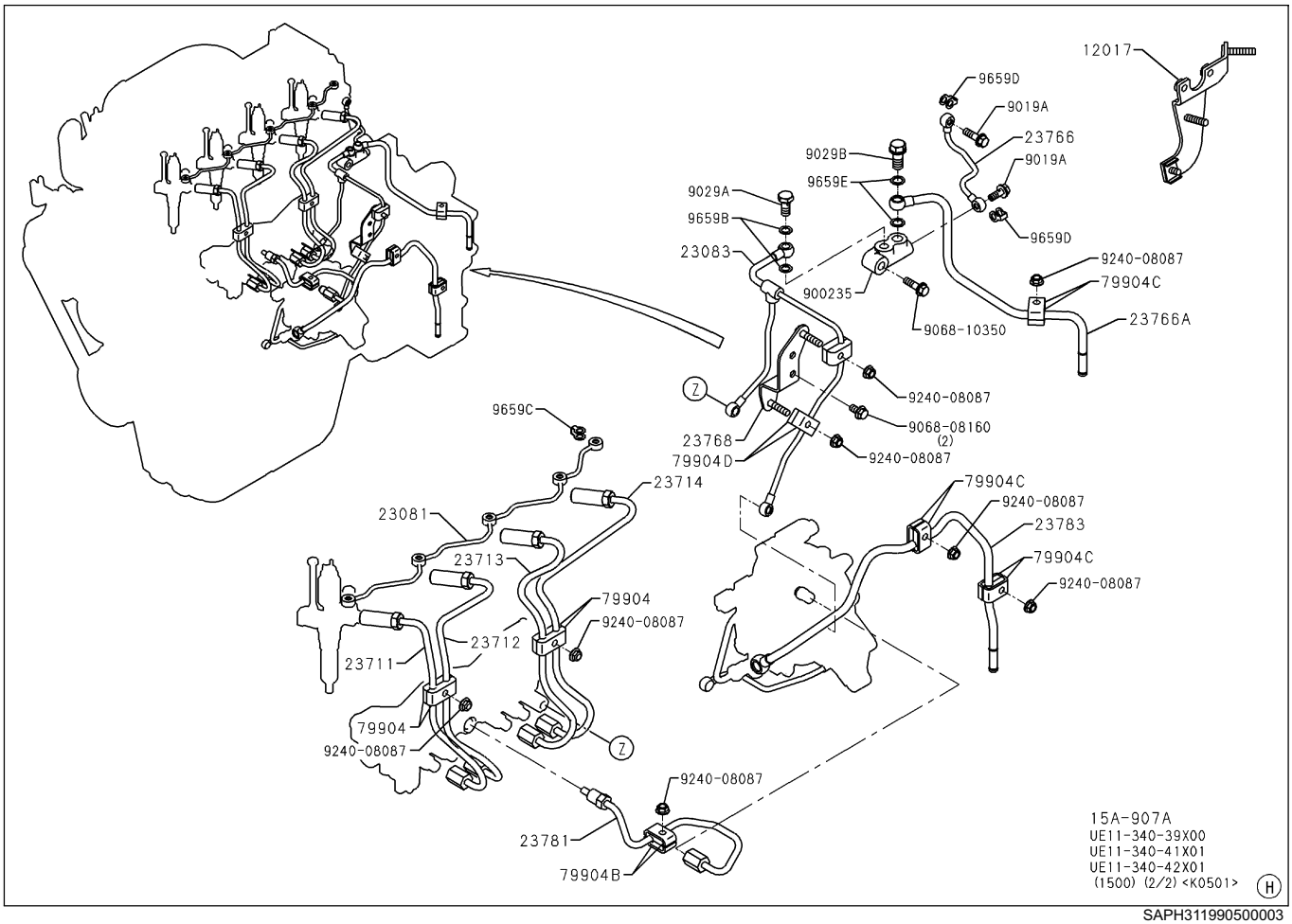
Name	Remark
Micrometer	For measurement of part outer diameter
Cylinder gauge	For measurement of part inner diameter
Thickness gauge	For measurement of parts
Dial gauge	For measurement of parts

Lubricant, etc.

JP31199030901015

Name	Remark
Dye penetrant	For inspection of crack

NOTICE • **The wheel shovel has with the air compressor.**



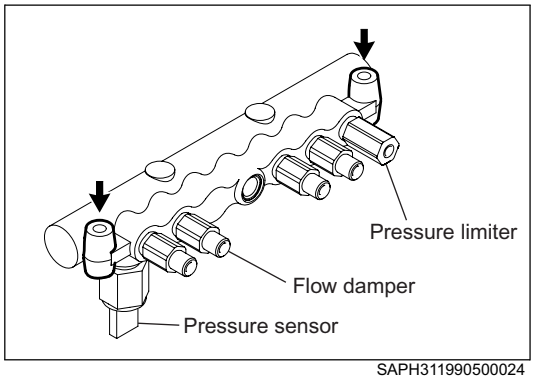
SAPH311990500003

23081	Leakage pipe	23766A	Through feed pipe
23083	Through feed pipe	23781	Fuel pipe
23711	Injection pipe	23783	Fuel pipe
23712	Injection pipe	9659B	Gasket*
23713	Injection pipe	9659C	Gasket*
23714	Injection pipe	9659D	Gasket*
23766	Through feed pipe	9659E	Gasket*

*Parts not to be reused.

Replacement of common rail

JP31199050704007

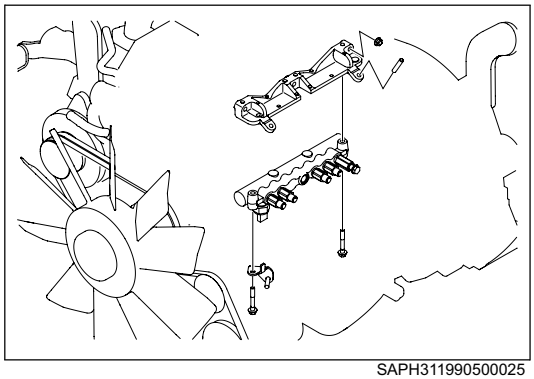


SAPH311990500024

1. Removal of common rail

(1) Remove the common rail together with the flow damper, pressure sensor and pressure limiter from the intake manifold.

⚠ **CAUTION** • **Remove dirt around parts before removing the common rail**



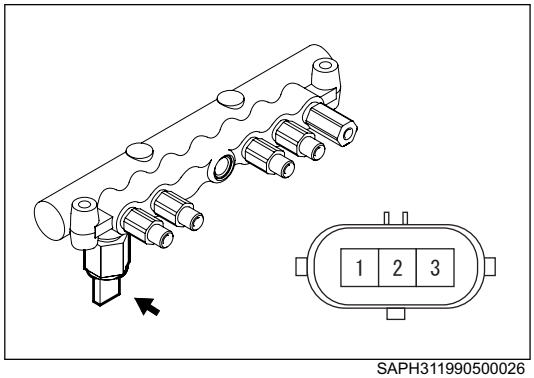
SAPH311990500025

2. Installation of common rail

(1) Install the common rail on the intake manifold.

Inspection of common rail

JP31199050704008

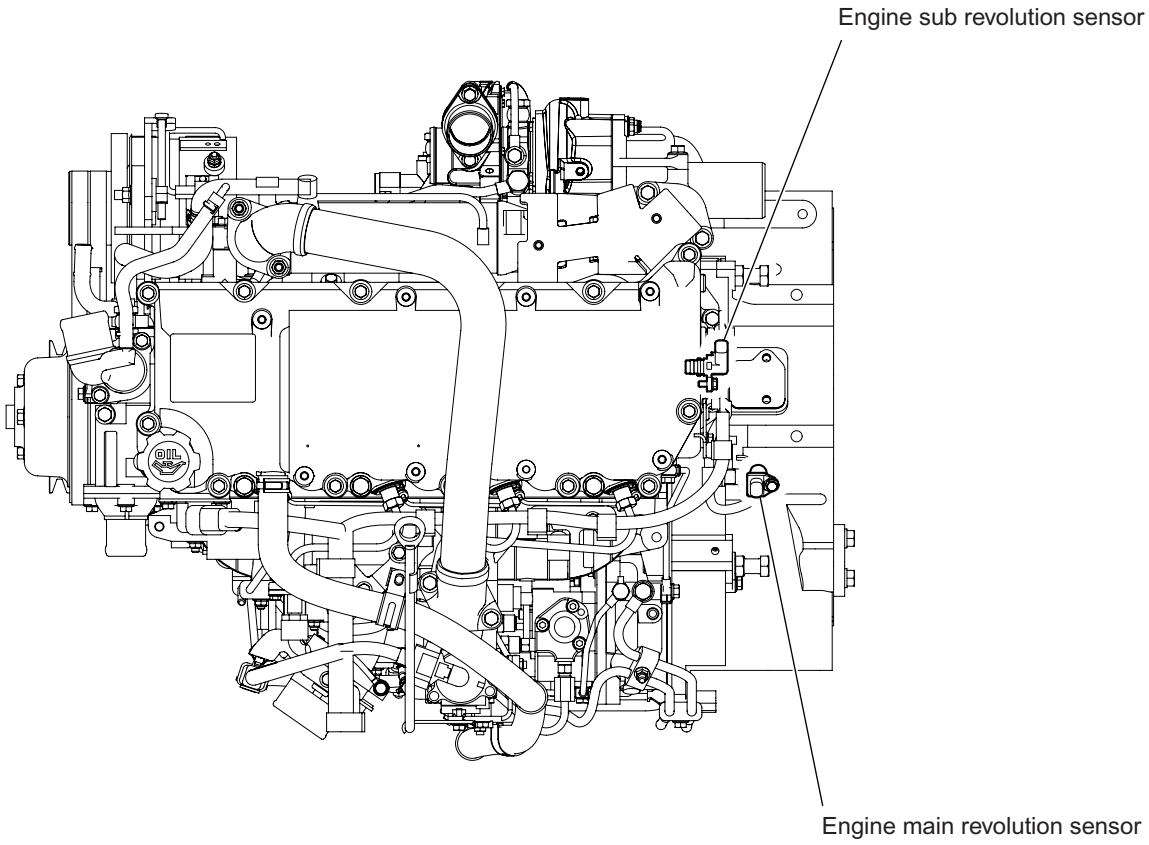


SAPH311990500026

1. Inspection of common rail pressure sensor

(1) Measure the resistance value between terminals using a circuit tester. If it exceeds the standard value, replace the common rail assembly

	Between 1 and 2	Between 2 and 3
Standard value (kΩ) At stop of engine	0.5 - 3.0	6.5 - 18.5

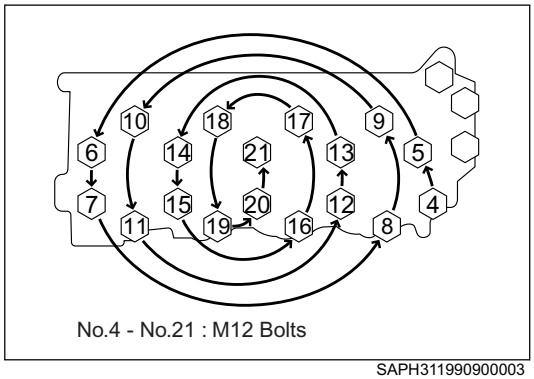


Upper view

SAPH311990700006

Replacement of cylinder head

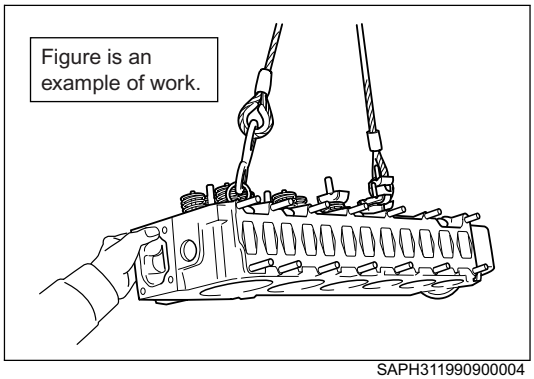
JP31199090704001



SAPH311990900003

1. Removal of cylinder head and head gasket

(1) Loosen the head bolts from outside to inside gradually (1/4 turn for each) as shown in the order of the figure and remove them.



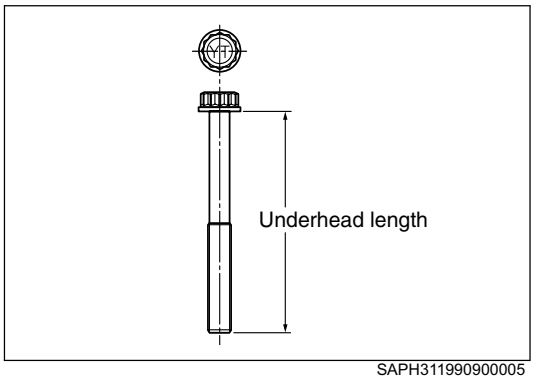
SAPH311990900004

(2) Remove the cylinder head using a special tool and hoist.

Special tool : 09433–1070 Eye bolt

NOTICE

- **If it is difficult to remove the cylinder head, insert a chisel between the cylinder head and the cylinder block, and move the chisel vertically so that the contact surface may not be damaged. Then, separate the cylinder head.**

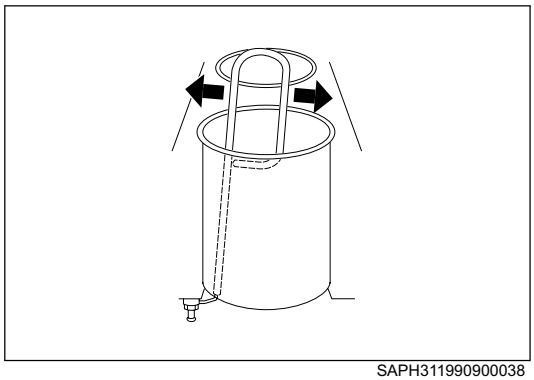


SAPH311990900005

2. Inspection of head bolt length

(1) Measure the underhead length of the head bolt (M12 only) using vernier calipers. If it is beyond the service limit, replace it with a new one.

Service limit (mm{in.})	**126.5{4.9803 in.}**



SAPH311990900038

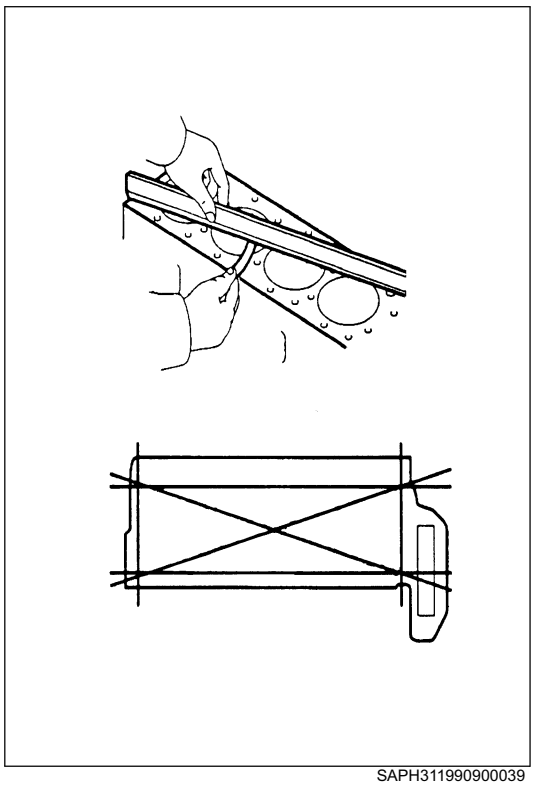
(7) If injection does not hit the target circle, correct it with a special tool.

Special tool : 09472–1620 Tool

(8) If it cannot be corrected, install a new cooling jet for reinspection.

(9) Remove the check bolt and install the cooling jet on the cylinder block using the genuine oil check valve.
Tightening torque : 22 N· m {220 kgf· cm, 16 lbf· ft}

(10) After assembly of the piston, make sure that the cooling jet does not interfere with the piston at the piston bottom dead center.



SAPH311990900039

4. Inspection of cylinder block

(1) Inspection of cylinder block distortion

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

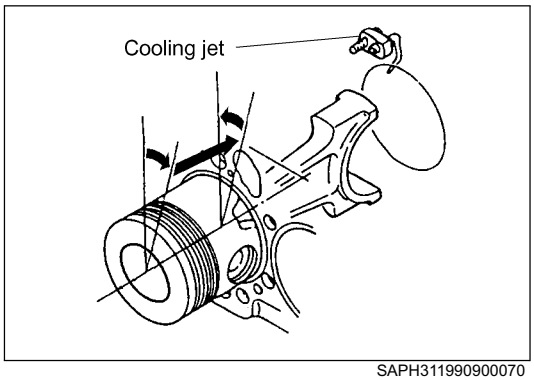
Standard value (mm{in.})	Service limit (mm{in.})
Longitudinal direction 0.06{0.0024} Square direction 0.03{0.0012}	**0.2{0.0079}**

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

⚠ **CAUTION** • **Repair of the upper surface by grinding can change backlash of the timing gear. Do not grind it.**

(2) Inspection of cylinder block crack

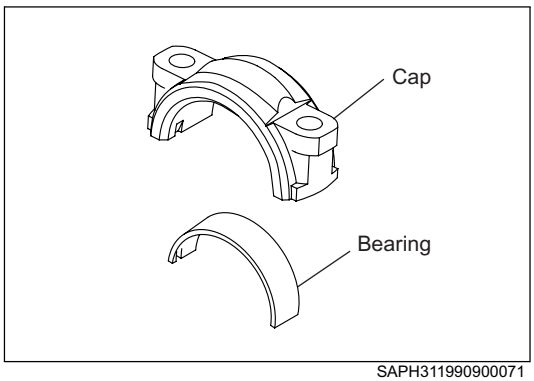
a. With dye penetrant test method (red check), make sure that there is no crack or damage in the cylinder block.



SAPH311990900070

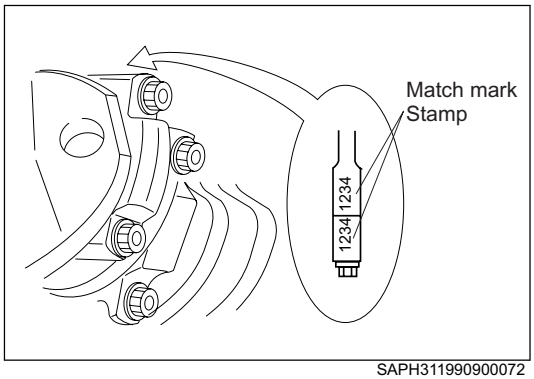
(4) Insert the piston carefully so that the connecting rod may not come in contact with the cooling jet.

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



SAPH311990900071

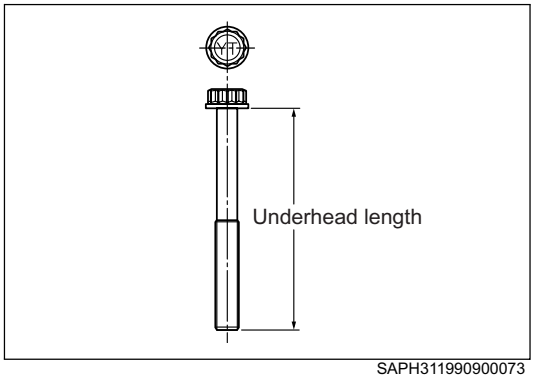
(5) Install the connecting rod bearing to suit concave shape of the connecting rod cap.



SAPH311990900072

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

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

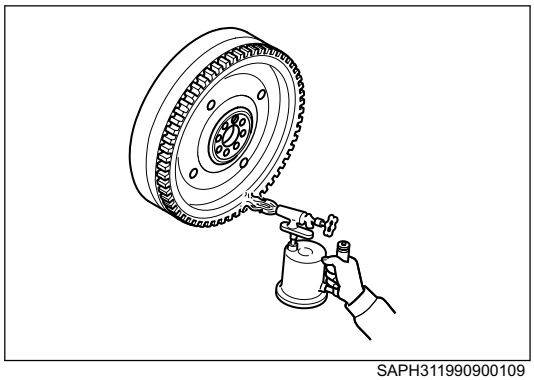


SAPH311990900073

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

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

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

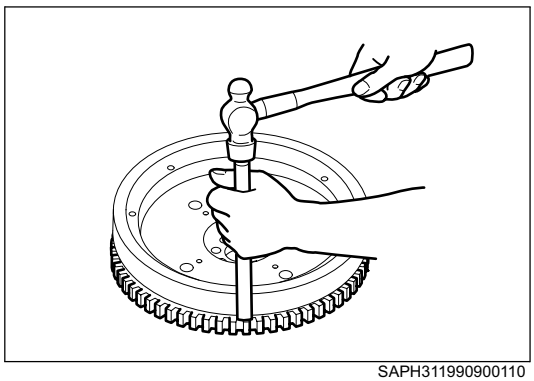


SAPH311990900109

2. Removal of ring gear

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

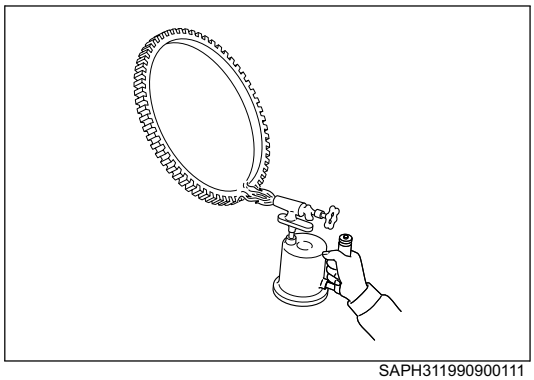
⚠ **CAUTION** • **Do not touch the ring gear and the flywheel with bare hand while they are hot.**



SAPH311990900110

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

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

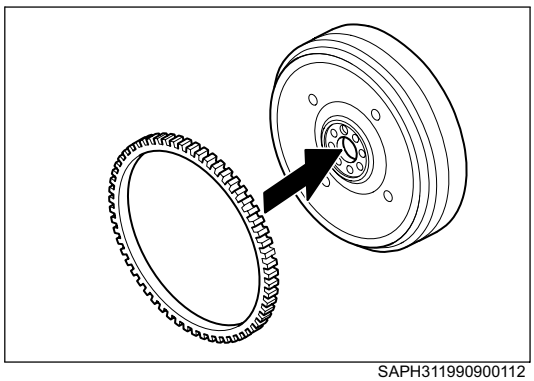


SAPH311990900111

3. Installation of ring gear

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

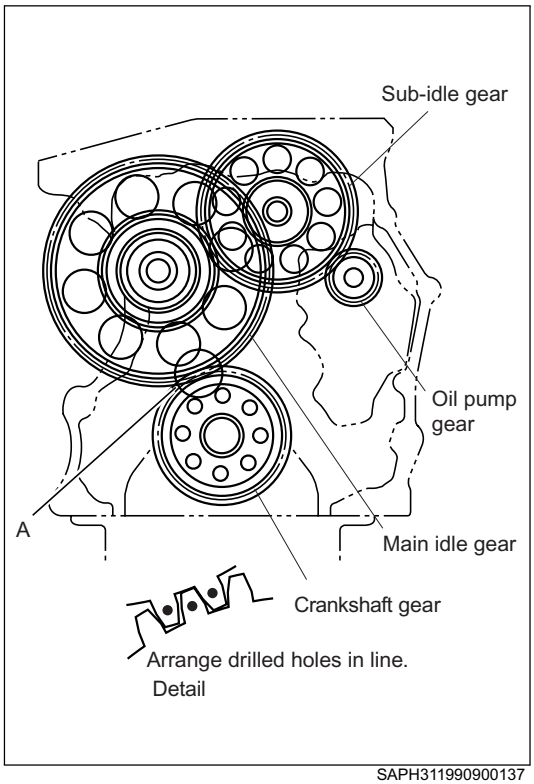
⚠ **CAUTION** • **Do not touch the ring gear and the flywheel with bare hand while they are hot.**



SAPH311990900112

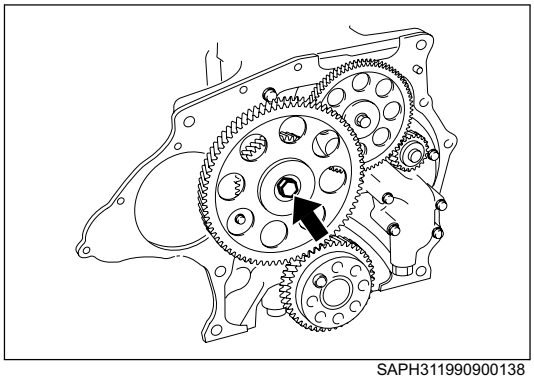
(2) Face the chamfered side toward the flywheel and install it on the flywheel quickly.

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



SAPH311990900137

(3) Face the lubricating hole of the idle gear shaft toward the oil pan (downward). Install A in the figure by adjusting the timing of the crankshaft gear and the main idle gear as in the detailed drawing.



SAPH311990900138

(4) Apply engine oil to the bolt seat and the bolt thread of the idle gear shaft mounting bolt.

(5) Install the idle gear shaft mounting bolt.
Tightening torque : 172 N· m {1,750 kgf· cm, 127 lbf· ft}

(6) Measure backlash and end play of each idle gear. Make sure that it is within the standard value.

Adjustment of valve clearance

JP31199090706001

1. Precautions before adjustment

⚠ **CAUTION** • **Before adjustment, make sure that bolts of the cylinder head, rocker arm support, nozzle clamp, camshaft housing and camshaft bearing cap are tightened to the specified torque.**

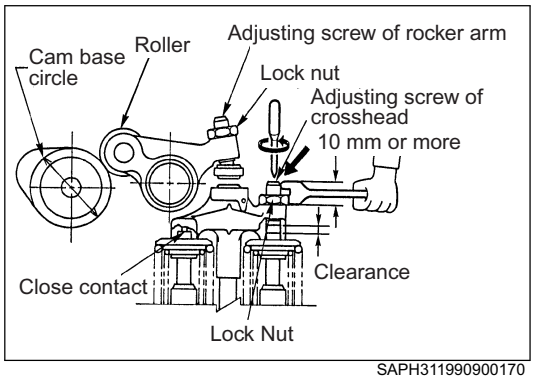
2. Adjustment of valve clearance

(1) Make sure that there is no dirt between the crosshead and the valve stem

(2) Turn the crankshaft in the forward direction and adjust the cylinder to the compression top dead center.

⚠ **CAUTION** • **Make sure that there is a roller on the cam base circle.**

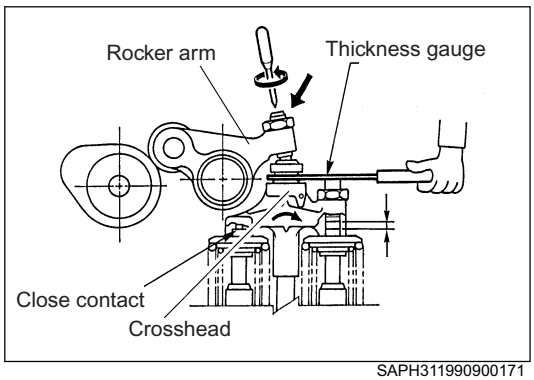
(3) Loosen the adjusting screw and the lock nut of the crosshead completely.



SAPH311990900170

⚠ **CAUTION** • **Provide the adjusting screw protrusion of 10 mm or more from the top surface of the crosshead. If the adjusting screw is not completely separated from the valve stem, correct adjustment is not allowed.**

(4) Insert a thickness gauge between the rocker arm and the crosshead and adjust the clearance with the adjusting screw of the rocker arm. Tighten the lock nut.



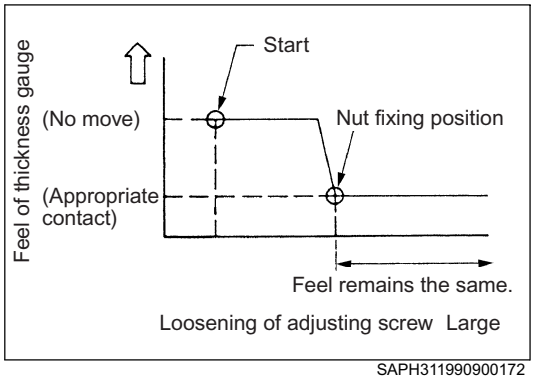
SAPH311990900171

Standard value (cold engine)	**IN**	**0.30mm{0.0118 in.}**
	EX	**0.45mm{0.0177 in.}**

Tightening torque : 25 N· m {250 kgf· cm, 18 lbf· ft}

(5) Loosen the adjusting screw of the crosshead with the thickness gauge inserted. Make sure that feel on the thickness gauge is not lighter.

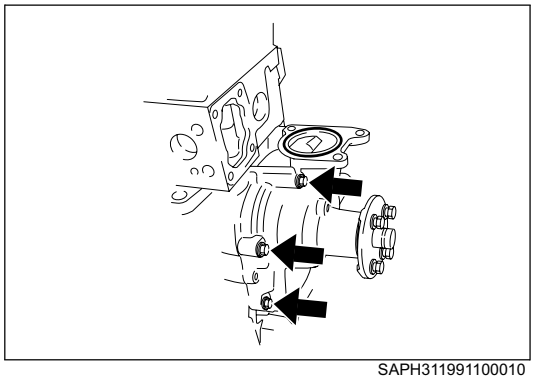
⚠ **CAUTION** • **If it becomes lighter, make adjustments again from the beginning.**



SAPH311990900172

Replacement of coolant pump

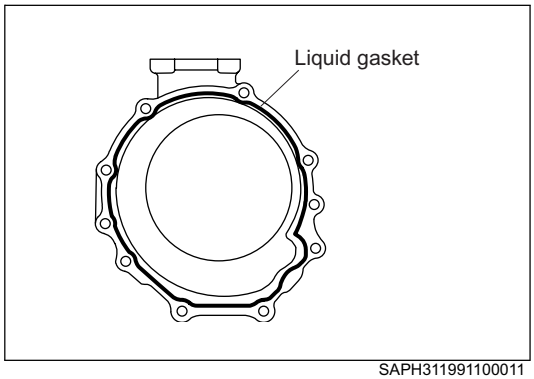
JP31199110704002



SAPH311991100010

1. Removal of coolant pump

(1) Remove bolts and remove the coolant pump.



SAPH311991100011

2. Installation of coolant pump

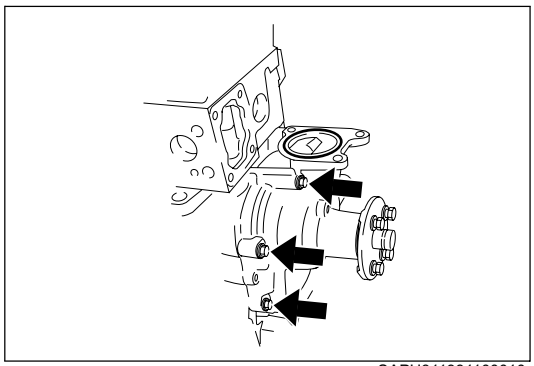
(1) Remove contamination on the joint surface between the coolant pump and the cylinder block using a scraper and degrease the surface.

(2) Apply the liquid gasket [Threebond TB1207B (black) or equivalent] to the coolant pump as shown in the figure.

⚠ CAUTION

- **Apply it continuously.**
- **Apply the liquid gasket at the width of 2 to 3mm{0.0787 to 0.1181in.}.**
- **Install the oil cooler within 20 minutes after application of the liquid gasket.**
- **Fill the groove on the water pump flange with the liquid gasket.**

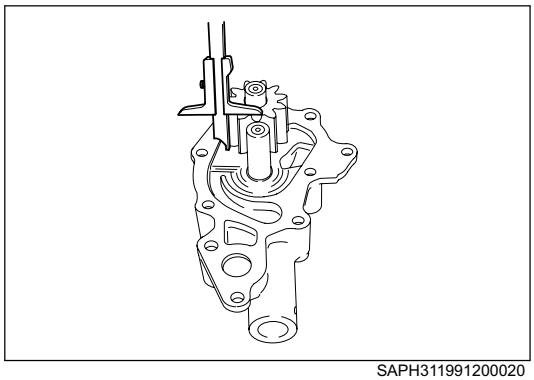
(3) Install the coolant pump to the dowel pin of the cylinder block.



SAPH311991100010

NOTICE

- **When the coolant pump is installed using a guide bolt, displacement of the liquid gasket does not occur.**

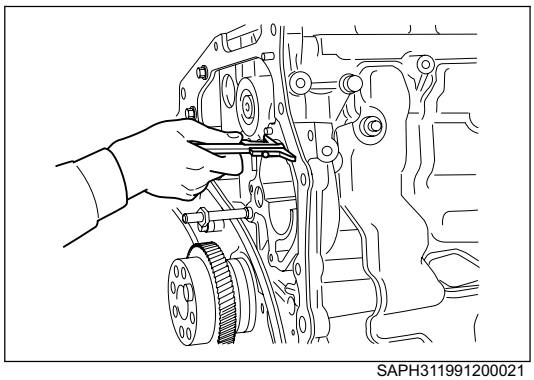


SAPH311991200020

4. End play inspection between drive gear and cylinder block

(1) Measure the drive gear width and the pump chamber depth at the cylinder block using a depth gauge.

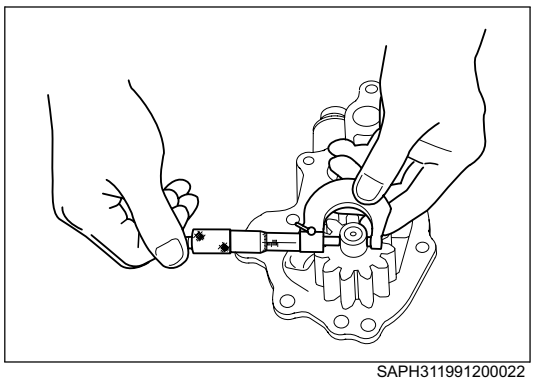
Measuring area	Standard value (mm{in.})
Width of drive gear	28.5{1.1220}
Depth of pump chamber at cylinder block	28.5{1.1220}



SAPH311991200021

(2) Calculate the difference between the depth of the drive gear and the pump chamber depth at the cylinder block. If it is beyond the service limit, replace the oil pump assembly.

Standard value (mm{in.})	Service limit (mm{in.})
0.049 - 0.113{0.0020 - 0.0044} (reference)	0.15{0.0060}

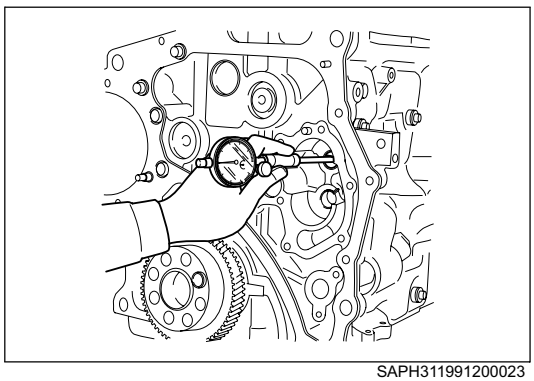


SAPH311991200022

5. Inspection of clearance between outer diameter of driven gear shaft and cylinder block hole diameter

(1) Measure the outer diameter of the driven gear shaft using a micrometer and measure the cylinder block hole diameter using a cylinder gauge.

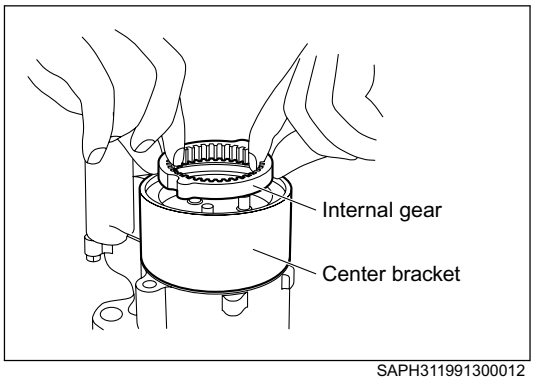
Measuring area	Standard value (mm{in.})
Outer diameter of driven gear shaft	18{0.7087}
Cylinder block hole diameter	18{0.7087}



SAPH311991200023

(2) Calculate the difference between the outer diameter of the driven gear and the cylinder block hole diameter. If it is beyond the service limit, replace the oil pump assembly.

Standard value (mm{in.})	0.040 - 0.099 {0.0016 - 0.0039}

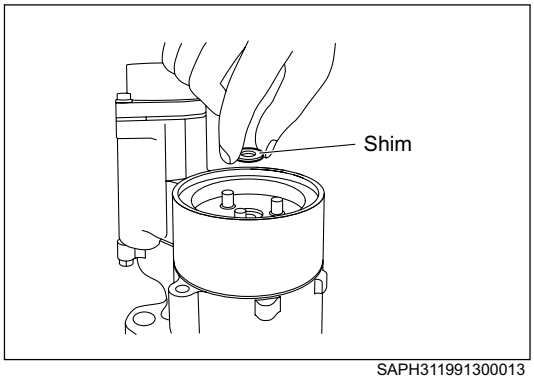


SAPH311991300012

10. Removal of internal gear

(1) Remove the internal gear from the center bracket.

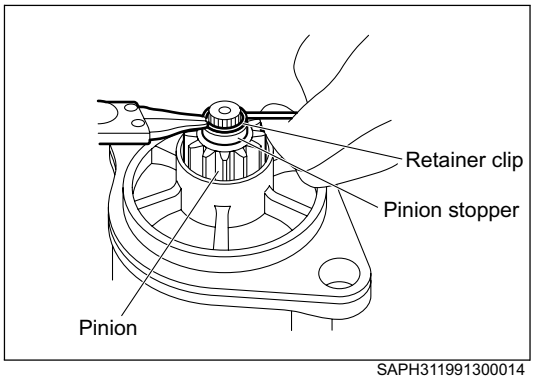
⚠ **CAUTION** • **Make sure that the gear is not damaged or chipped.**



SAPH311991300013

11. Removal of shim washer

(1) Remove the shim washer from the center bracket.



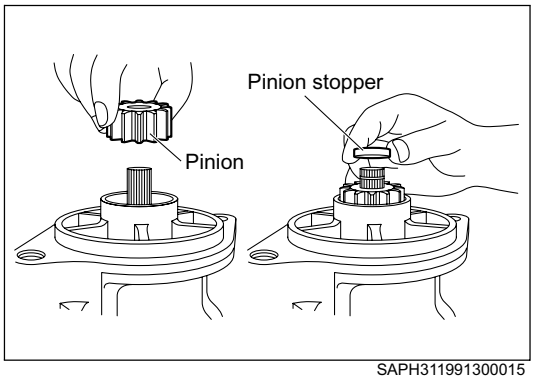
SAPH311991300014

12. Removal of pinion

(1) Remove the retainer clip using a tool such as snap ring pliers.

⚠ **CAUTION** • **Retainer clip must not be reused. Replace it with a new one.**

NOTICE • **Push upward or pull out the chipped part of the clip mouth.**

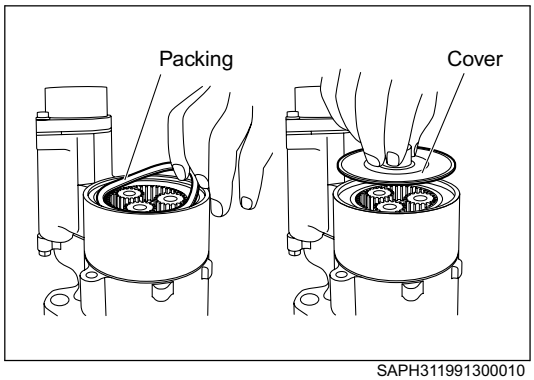


SAPH311991300015

(2) Remove the pinion stopper.

(3) Remove the pinion.

⚠ **CAUTION** • **Make sure that the gear is not damaged or chipped.**



SAPH311991300010

11. Installation of cover

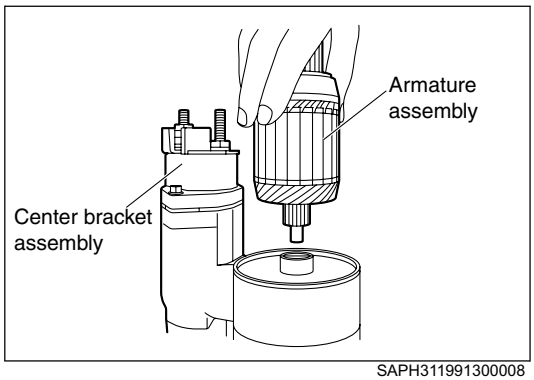
(1) Install a new packing.

(2) Install the cover on the center bracket assembly.

12. Installation of rear bearing

(1) Install the bearing on the armature assembly using a press.

⚠ **CAUTION** • **When the bearing is removed, replace it with a new one.**

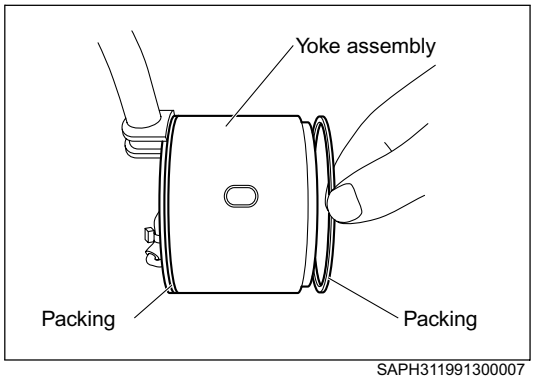


SAPH311991300008

13. Installation of armature assembly

(1) Install the armature assembly.

⚠ **CAUTION** • **When the armature assembly is installed, the washer at the end of the gear may be dropped and lost. Be careful for handling.**

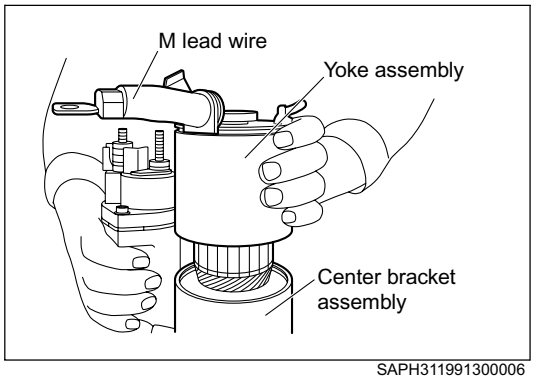


SAPH311991300007

14. Installation of packing

(1) Install a new packing on the centering location at both ends of the yoke assembly.

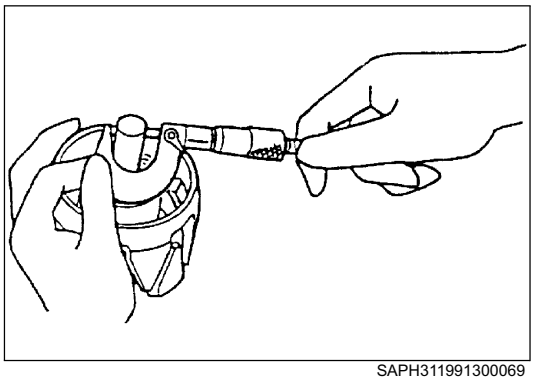
⚠ **CAUTION** • **Damaged packing must not be resued. Replace it with a new part.**



SAPH311991300006

15. Installation of yoke assembly

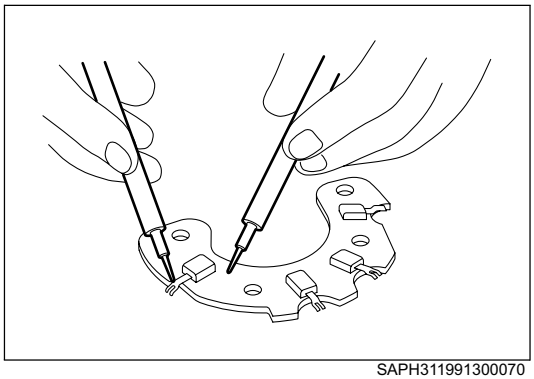
(1) Install the yoke assembly on the center bracket assembly.



SAPH311991300069

(2) Measure the outer diameter of the shaft at the roller bearing insertion area of the rotor assembly using a micrometer.

Standard value (mm{in.})	17{0.6693}
Service limit (mm{in.})	16.98{0.6685}

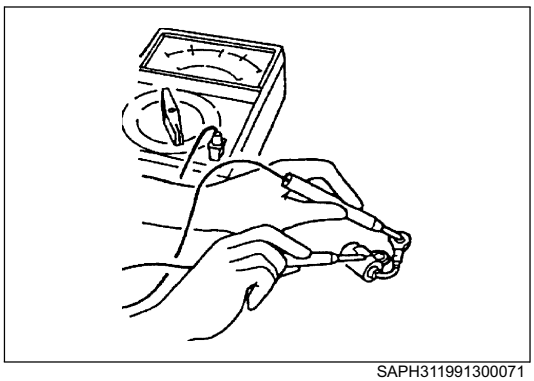


SAPH311991300070

3. Inspection of diode, capacitor and regulator

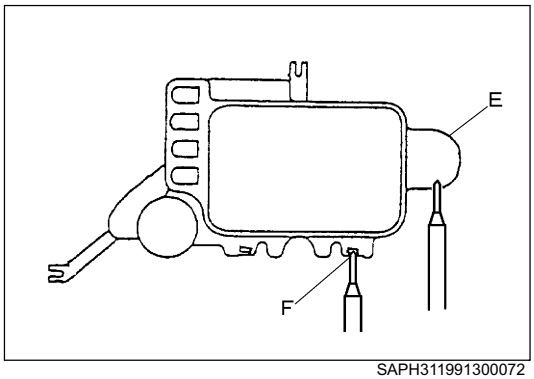
(1) Measure the resistance of the holder between the minus diode and the heat sink holder using a circuit tester.

	Standard value
Forward resistance value	Approx. 10 Ω
Reverse resistance value	Infinite



SAPH311991300071

(2) Measure the resistance between the capacitor terminal and the body using a circuit tester. Make sure that it indicates 800 kΩ and then immediately indicates infinite value.



SAPH311991300072

(3) Inspection of regulator
Measure the resistance between regulator terminals F and E using a circuit tester.

	Standard value
Forward resistance value	Approx. 10 Ω
Reverse resistance value	Infinite

Replacement

JP31199140704001

1. Removal

(1) Remove the boost pipe and U-turn pipe.

(2) Disconnect all pipes connected to the turbocharger.

⚠ **CAUTION**
- **Loosen union bolt of the coolant pipe, drain coolant and remove the pipe. Disconnect the lower pipe similarly and remove the oil pipe.**
- **After removing pipes, be sure to seal oil holes, water holes and cylinder block holes to prevent entry of dirt.**

(3) Remove the bolts fixing the exhaust pipe and the turbocharger and remove the turbocharger.

⚠ **CAUTION**
- **After removal, seal holes both at the exhaust manifold and the exhaust pipe to prevent entry of foreign matter.**
- **If a stud bolt is sticking, remove and replace the stud bolt using a commercially available stud remover.**

2. Installation

(1) Install the turbocharger in the reverse order of disassembly. When the turbocharger is installed on the engine or after installation, observe the following precautions for work. Pay special attention to entry of foreign matter inside the turbocharger.
Tightening torque :
56 N· m {570 kgf· cm, 41 lbf· ft}
(Turbocharger to exhaust manifold)

(2) Lubrication and cooling system

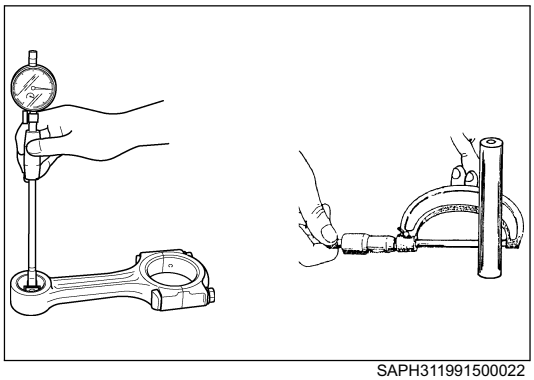
a. Before installation on the engine, pour new engine oil from the oil inlet and turn the turbocharger with hand to lubricate the journal bearing and the thrust bearing.

b. Clean the oil pipe, oil hose, coolant pipe and hose. Check for pipe deformation, hose crack or dirt or foreign matter in the pipe or hose.

c. Do not use sealant at the installation surface of the oil pipe and the coolant pipe or joint between the coolant hose and the coolant pipe to prevent failures such as damage due to clogging or loosening of tightened areas.

d. Be sure to use new soft washers, O-rings and gaskets.

e. Be sure to install the oil pipe, oil hose, coolant pipe and coolant hose correctly to prevent leak of oil or water from connections.

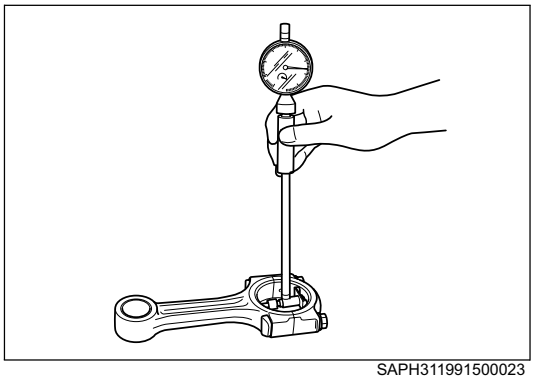


SAPH311991500022

2. Piston pin oil clearance

(1) Using a cylinder gauge and micrometer, measure the inner diameter of the connecting rod small end and the outer diameter of the piston pin. Replace the piston pin or the connecting rod if the clearance between the piston pin and connecting rod small end is beyond its service limit.

Measuring area	Standard value (mm)	Operation limit (mm)
Piston pin outer diameter	**14**	—
Clearance between piston pin and connecting rod small end	**0.016-0.044**	**0.07**

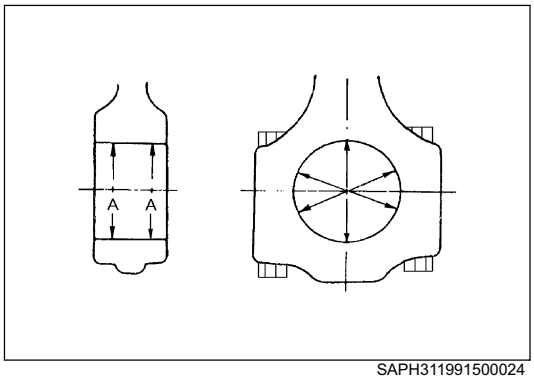


SAPH311991500023

3. Crankshaft oil clearance

(1) Assemble the connecting rod with the connecting rod bearing attached to it.

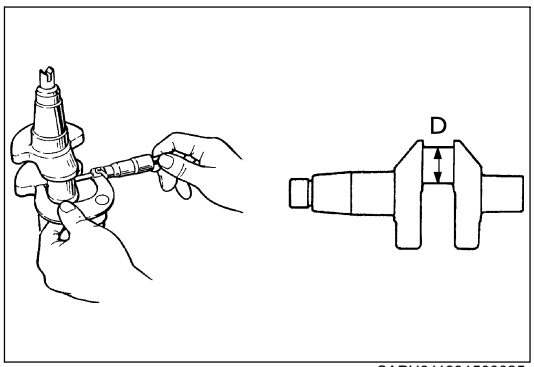
Tightening torque :
23 - 26 N· m {230 - 260 kgf· cm, 17 - 19 lbf· ft}



SAPH311991500024

(2) With the conditions described in step (1), measure the inner diameter of the connecting rod large end (part A in the figure at left) using a cylinder gauge.

Standard value (mm)	34



SAPH311991500025

(3) Measure the outer diameter of the crank pin (part D in the figure at left) using a micrometer.

Standard value (mm)	34

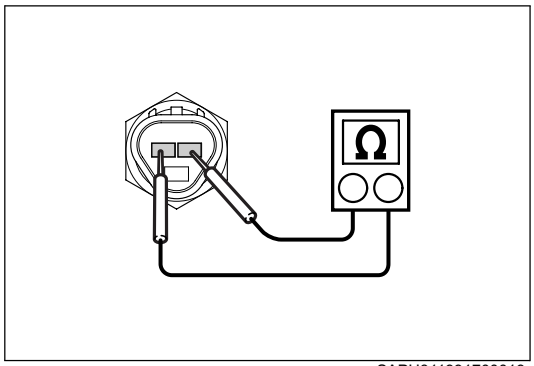
Status	Cause	Action
Faulty idling (nozzle)	Faulty injection pressure	Adjust injection pressure.
	Faulty spray status	Adjust or replace nozzle
	Carbon deposit at nozzle end	Remove carbon
	Seizure of needle valve	Replace nozzle
Faulty idling (engine)	Faulty valve clearance	Adjustment of valve clearance
	Faulty contact of valve seat	Adjust or replace valve and valve seat.
	Low coolant temperature	Perform warm-up.
	Large variation of compression pressure between cylinders	Overhaul engine Training of engine difference not performed after exchange of the engine ECU
	Training of engine difference not performed after exchange of the engine ECU	Perform training of engine difference after exchange of the engine ECU
Gas leak (head gasket)	Reuse	Replace gasket.
	Damage	Replace gasket.
	Replace gasket.	Replace gasket.
Gas leak (head bolt)	Loose head bolt	Tighten bolt.
	Incorrect tightening sequence or incorrect tightening torque	Tighten bolt to correct torque according to the correct tightening sequence.
	Extension of head bolt	Replace bolt.
Gas leak (cylinder block)	Crack	Replace cylinder block.
	Distortion of cylinder block upper surface	Repair or replace cylinder block.
	Depression of cylinder liner insertion (insufficient protrusion of cylinder liner)	Replace cylinder liner or block.
Gas leak (cylinder head)	Crack of cylinder head	Replace cylinder head.
	Distortion of cylinder head lower surface	Repair or replace cylinder head.
Gas leak (cylinder liner)	Crack of cylinder liner	Replace cylinder liner.
	Corrosion of cylinder liner	Replace cylinder liner.
	Insufficient protrusion of cylinder liner	Replace cylinder liner or block.
Gas leak (others)	Incorrect injection timing	Adjust injection timing.

[a] Failure diagnosis and [b] Alarm display (alarm status)	DTC code	Estimated failure cause
a. Low output b. DTC code indication.	P0203	Injector circuit malfunction -cylinder 3
	P0204	Injector circuit malfunction -cylinder 4
	P0237	Boost pressure sensor circuit low input
	P0404	EGR valve 1 stick
	P0405	EGR lift sensor 1 circuit low input
	P0406	EGR lift sensor 1 circuit high input
	P0489	EGR solenoid 1 malfunction (Open circuit, ground line short)
	P0490	EGR solenoid 1 malfunction (Power source line short)
	P0605	Flash ROM error
	P0607	Monitoring IC malfunction in CPU
	P0628	Supply pump SCV malfunction (Full discharge mode)
	P1211	Injector common 1 ground short
	P1212	Injector common 1 power source line short
	P1212	Injector common 1 open circuit
	P1214	Injector common 2 ground short
	P1215	Injector common 2 power source line short
	P1215	Injector common 2 open circuit
	P1601	Injector correction data conformity error
	P2228	Atmospheric pressure sensor circuit low input
	P2229	Atmospheric pressure sensor circuit high input
	P2635	Supply pump SCV sticking
	P2635	Supply pump malfunction
a. Other problems b. DTC code indication.	P0182	Fuel temperature sensor circuit low input
	P0183	Fuel temperature sensor circuit high input
	P0340	Engine speed sub sensor circuit malfunction
	P0686	Main relay malfunction
	P2122	Accelerator sensor circuit 1 low voltage
	P2123	Accelerator sensor circuit 1 high voltage
	P2127	Accelerator sensor circuit 2 low voltage
	P2128	Accelerator sensor circuit 2 high voltage

Engine overheat (DTC code P0217)

JP31199170601008

1	Measurement of resistance between terminals



SAPH311991700019

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

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

NOTICE

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

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

OK

Failure of engine cooling system

Engine overrun (DTC code P0219)

JP31199170601009

1. This failure code is displayed when the engine speed of 2,600 r/min or more is detected. While this failure code is detected, fuel injection is stopped. When the engine speed is lower than 2,500 r/min., fuel injection is resumed.

NOTICE

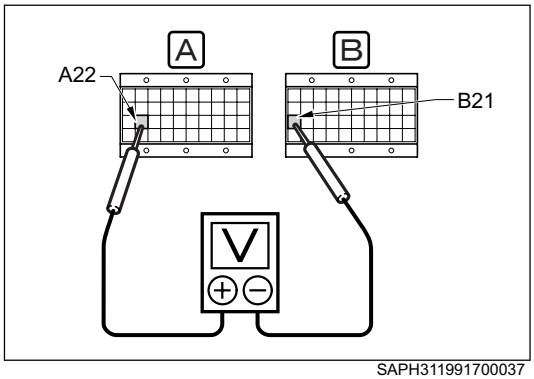
- **The objective of this failure code is not to detect overrun due to failure of this system, but to memorize high revolution of the engine.**
- **Engine speed may be incorrectly recognized with noise on the speed sensor signal due to harness failure or modification, resulting in detection of overrun.**

Accelerator sensor 1 malfunction (DTC code P2127, P2128)

JP31199170601018

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

1	Measurement of voltage between terminals



SAPH311991700037

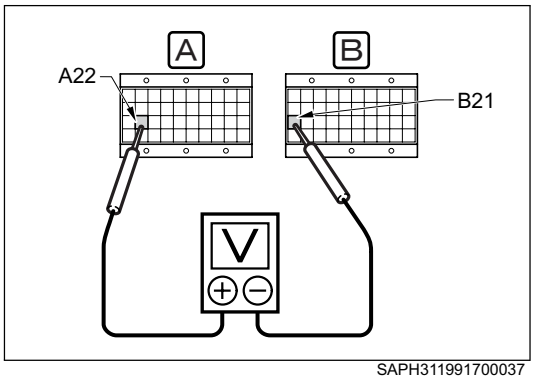
1. Set the starter key to "OFF" and connect the signal check harness.
2. Set the starter key to "ON" and measure the voltage between terminal A22 and terminal B21 of the signal check harness.

Standard value : 0.7 - 1.5V (idle status)

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

OK

2	Measurement of voltage between terminals



SAPH311991700037

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

Standard value

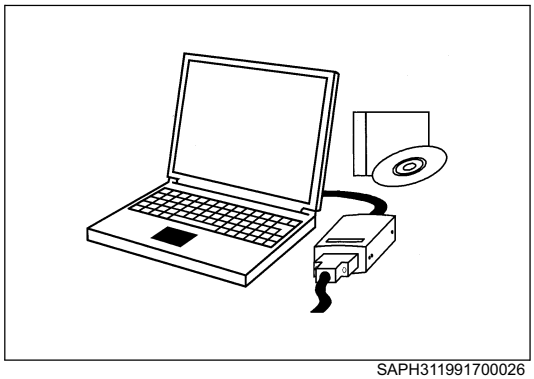
Measuring item	Engine revolution (r/min)	Voltage(V)
Low idle	**1,000**	**Approx.1.4**
High idle	**2,000**	**Approx.3.3**

NG → Defective mechatronic controller

OK

Harness failure

3	Check of failure code



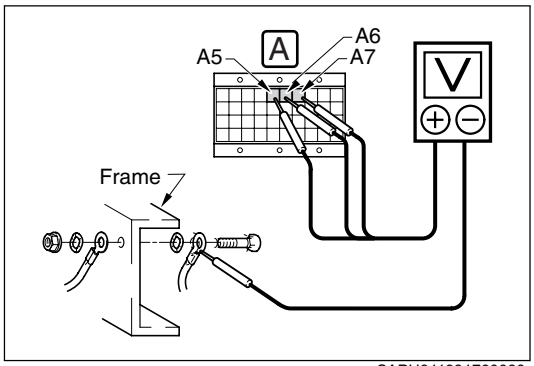
SAPH311991700026

1. Make sure that other failure code is not output.
   If other failure code is output, repair the failure first and delete the past failure with the failure diagnosis tool (HINO field support system) using PC.
   Then, if this failure code is output again, the following failures may be estimated.
   - Excessive fuel flow due to leak from broken pipe, crack in pipe or pipe connection between the flow damper and the injector pipe
     →Check for leak
   - Too large or too small fuel flow due to increase of leak inside inside the injector
     →Check for leak on the individual injector with a nozzle tester
   - Excessive fuel flow due to failure of injection nozzle and seat
     →Check for seat failure on the individual injector with a nozzle tester
   - Too large or too small fuel flow due to malfunction of the injector
     →Check with replacement of injector
   - Too small fuel flow due to clogging in the fuel supply system
     →Inspection of fuel filter
2. To specify a failure location above, check the compensation between cylinders with the failure diagnosis tool (HINO field support system) using PC and stop an injector. Then, perform diagnosis while viewing the engine data.

Main relay malfunction (DTC code P0686)

JP31199170601034

1	Measurement of voltage between terminals



SAPH311991700060

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 set the starter key to "ON". Measure the voltage between terminals A5, A6, A7 and the chassis GND.

Standard value : 0 V

NG → Defective harness

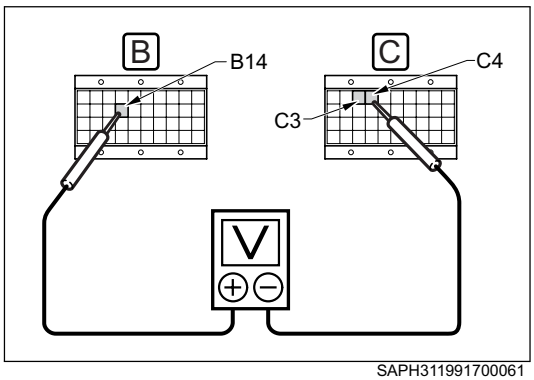
OK

Engine ECU failure, engine ECU connector failure

Starter signal malfunction (DTC code P0617)

JP31199170601035

1	Measurement of voltage between terminals



SAPH311991700061

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 set the starter key to "ON".
3. Measure voltage between terminal B14 and terminals C3/C4.

⚠ **CAUTION** • **Measuring shall be done in an environment where the engine may be started.**

Standard value
: 0 V (when starter key is at "OFF")
: 24 V (when starter key is at "START")

NG → Harness failure

OK

Engine ECU failure, ECU connector failure

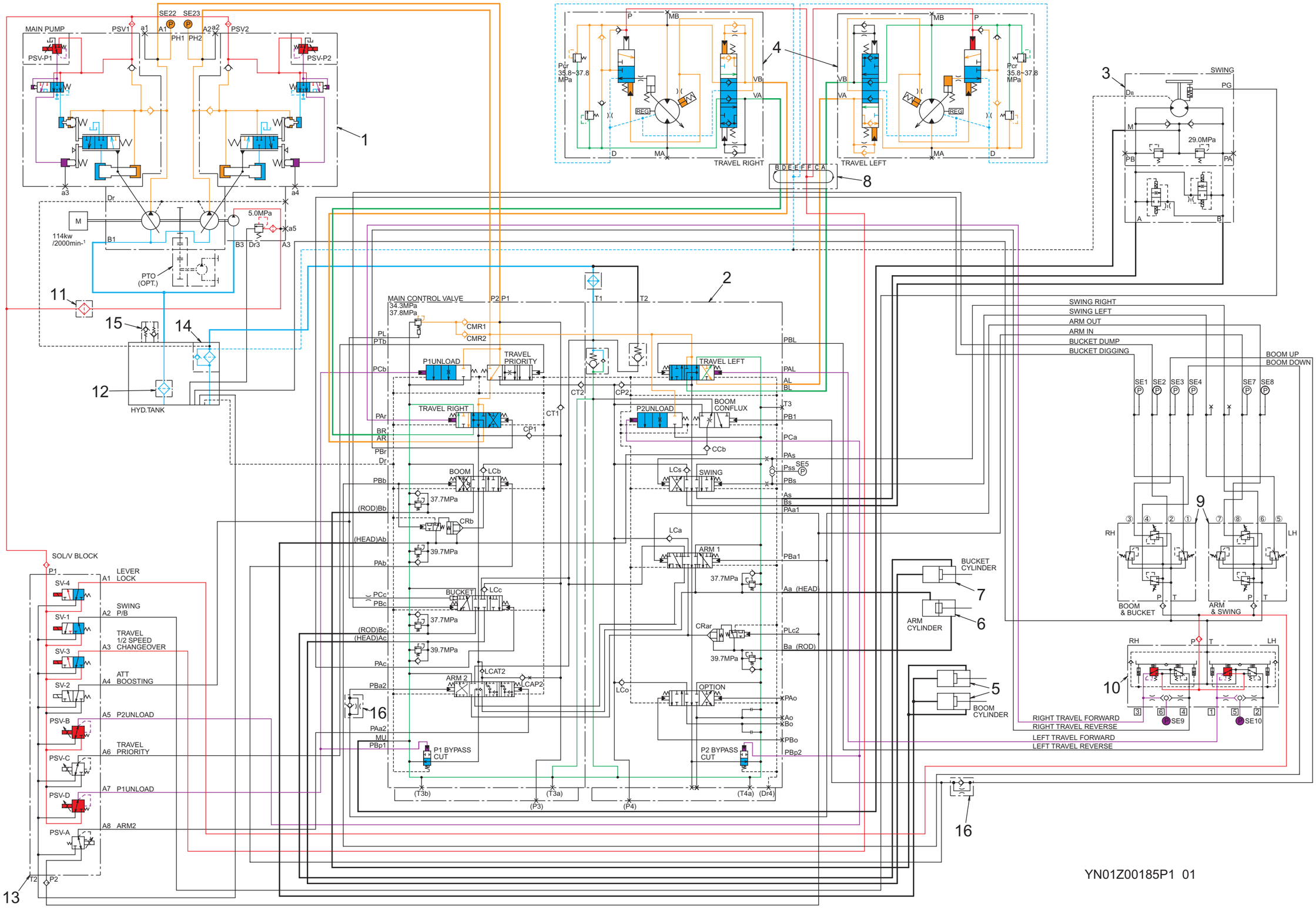


Fig. 22-2 TRAVEL CIRCUIT : Travel 2nd speed, RH & LH simultaneous operation.

This section describes the following operations.

(3) Arm in, heavy load operating pilot circuit (recirculation cut)

(4) Arm in, heavy load operating sequence confluxed main circuit

22.9.3 ARM IN, HEAVY LOAD OPERATING PILOT CIRCUIT

(1) Operation :

1) In arm-in operation, when the heavy loading is applied to arm and the P2 pump pressure increases to the set pressure, the voltage output by P2 pump pressure sensor (SE-23) is converted to signal (signal processing) by mechatro controller, consequently the current of arm 2 solenoid proportional valve is controlled according to the load pressure and the arm variable recirculation is cut.
When the recirculation is cut, internal confluence is held similarly to that in light load operation.

2) Left pilot valve actuation due to arm-in operation is equivalent to that at light load operation.

22.9.4 ARM IN, HEAVY LOAD OPERATING RECIRCULATION CUT MAIN CIRCUIT

(1) Purpose :
Speed up for arm in operation

(2) Principle :
Cut the recirculation and reduce rod pressure.

(3) Operation :

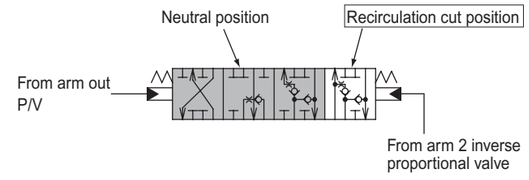
1) P2 pump delivery oil flows in the travel left section through P2 port of C/V (2) and branched off in by-pass circuit and parallel circuit. Consequently the arm spool is switched and pushes and opens load check valve LCa through parallel circuit, and flows in the arm spool.

2) On the other hand, P1 pump delivery oil flows in P1 port of C/V (2), and flow in travel right tandem passage through travel straight section. Then because arm 2 spool was switched, the delivery oil opens load check valve LCAT2, and confluences with P2 pump delivery oil in the valve section, and is flowed into arm cylinder head (H) side through Aa port of C/V(2).

3) The return oil from arm cylinder (R) side flows in Ba port of C/V(2) and is flowed to arm lock valve CRar, but because the arm lock valve CRar is open, the return oil goes through arm lock valve CRar and flows in arm 2 spool.

4) The return oil returns directly into tank circuit because arm 2 spool is switched to recirculation cut position.

Position of arm 2 spool



23. ELECTRIC SYSTEM

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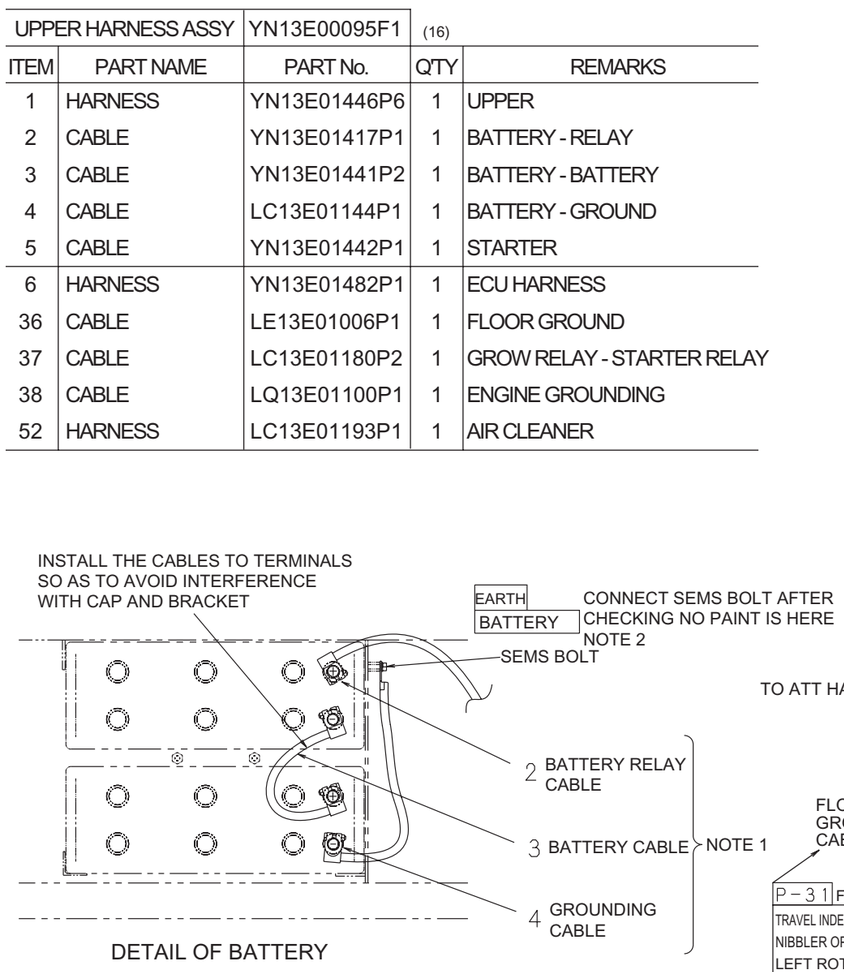
Book Code No. S5YN2322E01

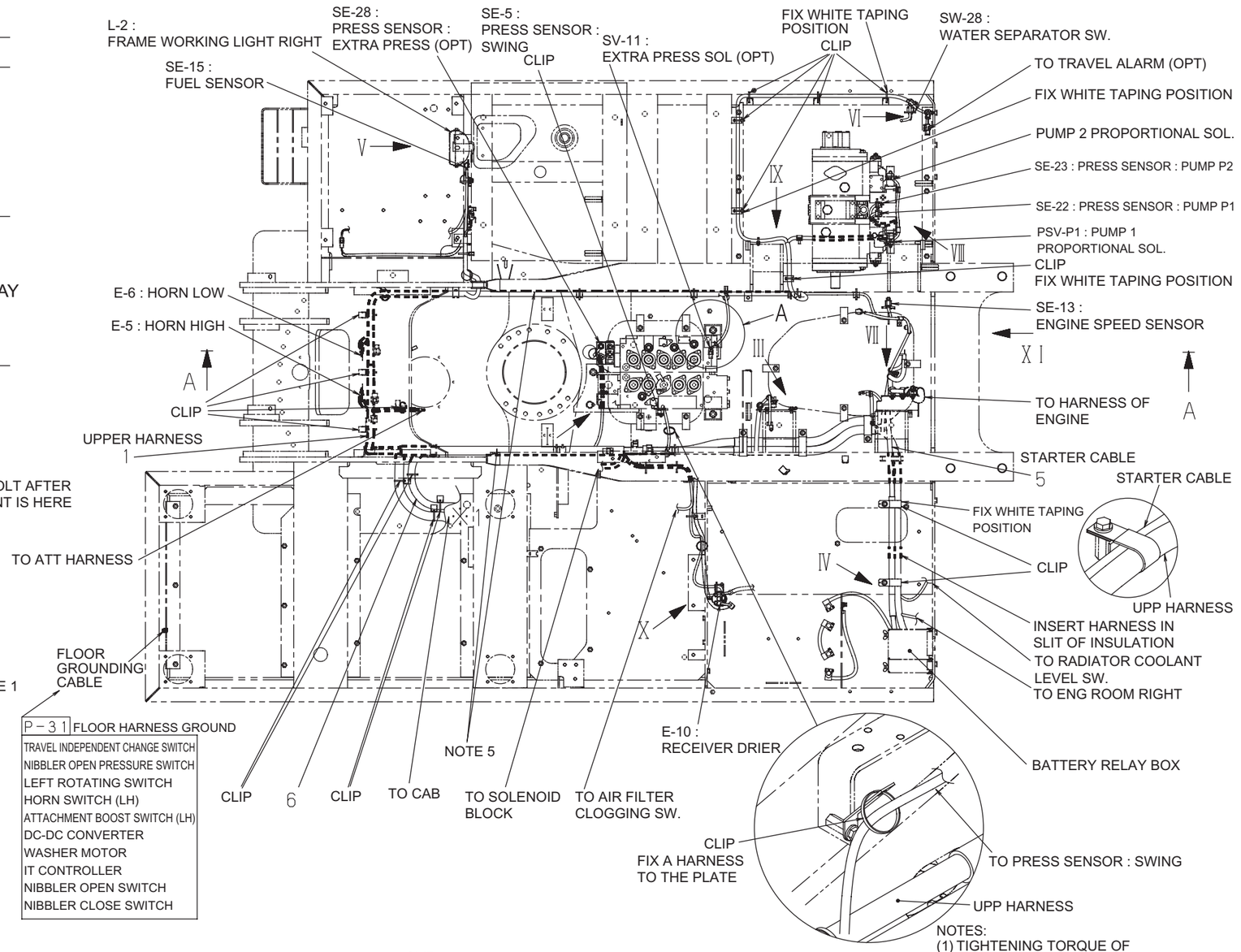
23

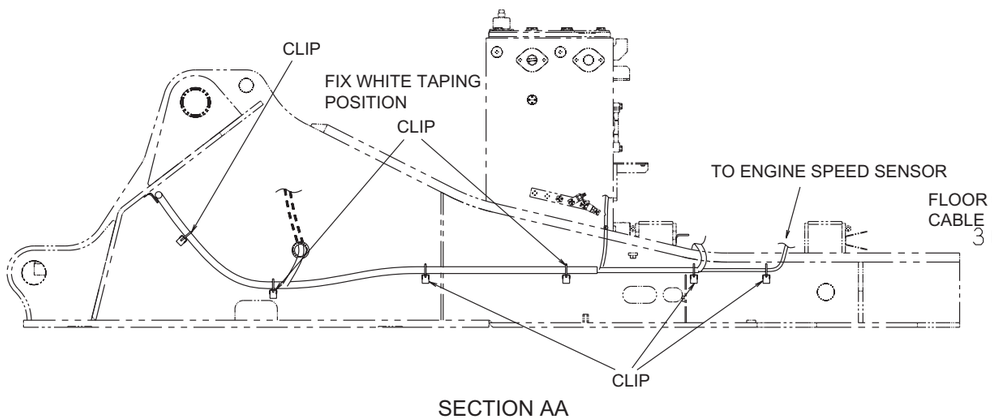
23.3.5 UPPER HARNESS ASSY (1/6)

UPPER HARNESS ASSY		YN13E00095F1	(16)	
ITEM	PART NAME	PART No.	QTY	REMARKS
1	HARNESS	YN13E01446P6	1	UPPER
2	CABLE	YN13E01417P1	1	BATTERY - RELAY
3	CABLE	YN13E01441P2	1	BATTERY - BATTERY
4	CABLE	LC13E01144P1	1	BATTERY - GROUND
5	CABLE	YN13E01442P1	1	STARTER
6	HARNESS	YN13E01482P1	1	ECU HARNESS
36	CABLE	LE13E01006P1	1	FLOOR GROUND
37	CABLE	LC13E01180P2	1	GROW RELAY - STARTER RELAY
38	CABLE	LQ13E01100P1	1	ENGINE GROUNDING
52	HARNESS	LC13E01193P1	1	AIR CLEANER

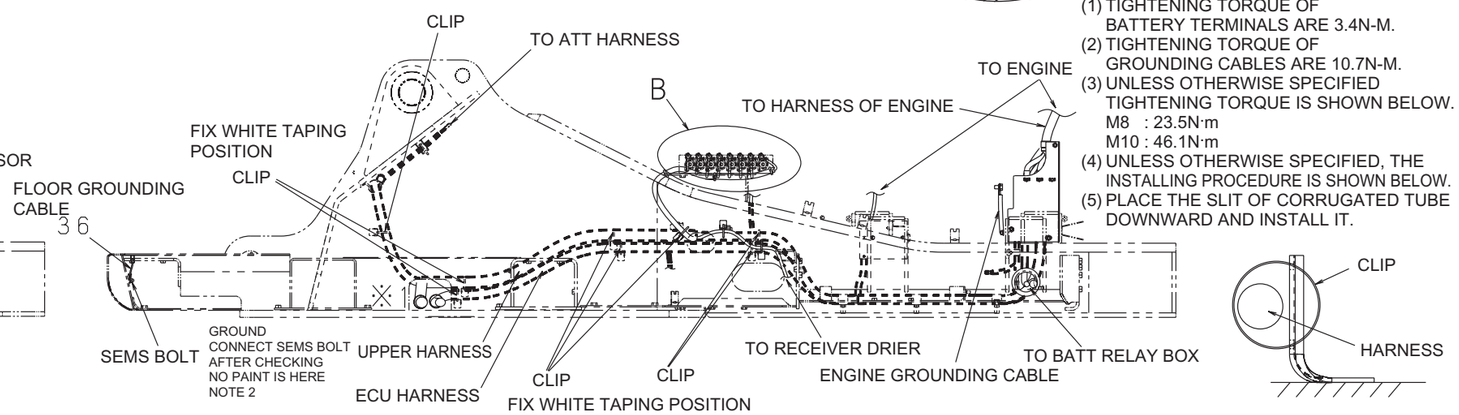


DETAIL OF BATTERY



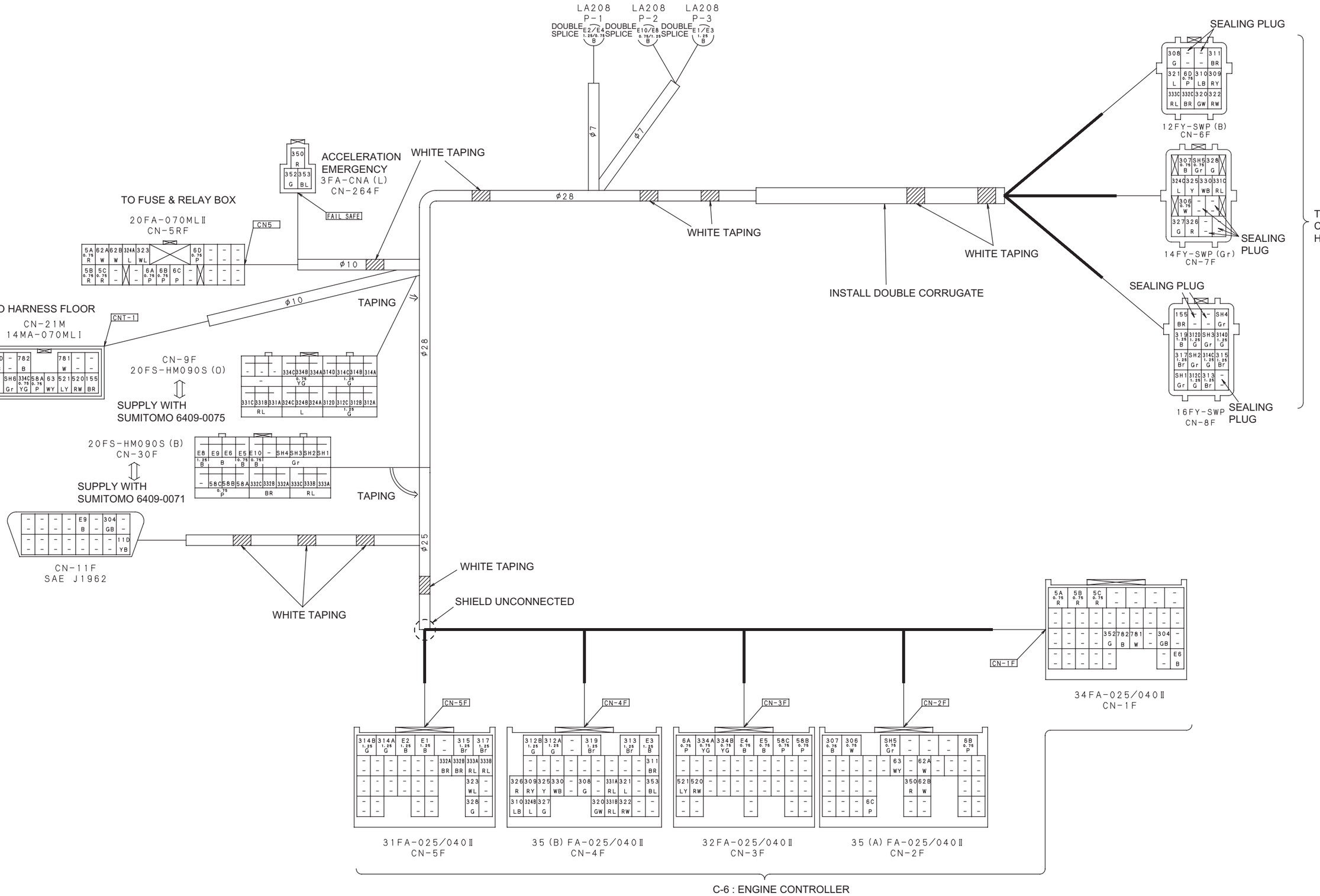


SECTION AA

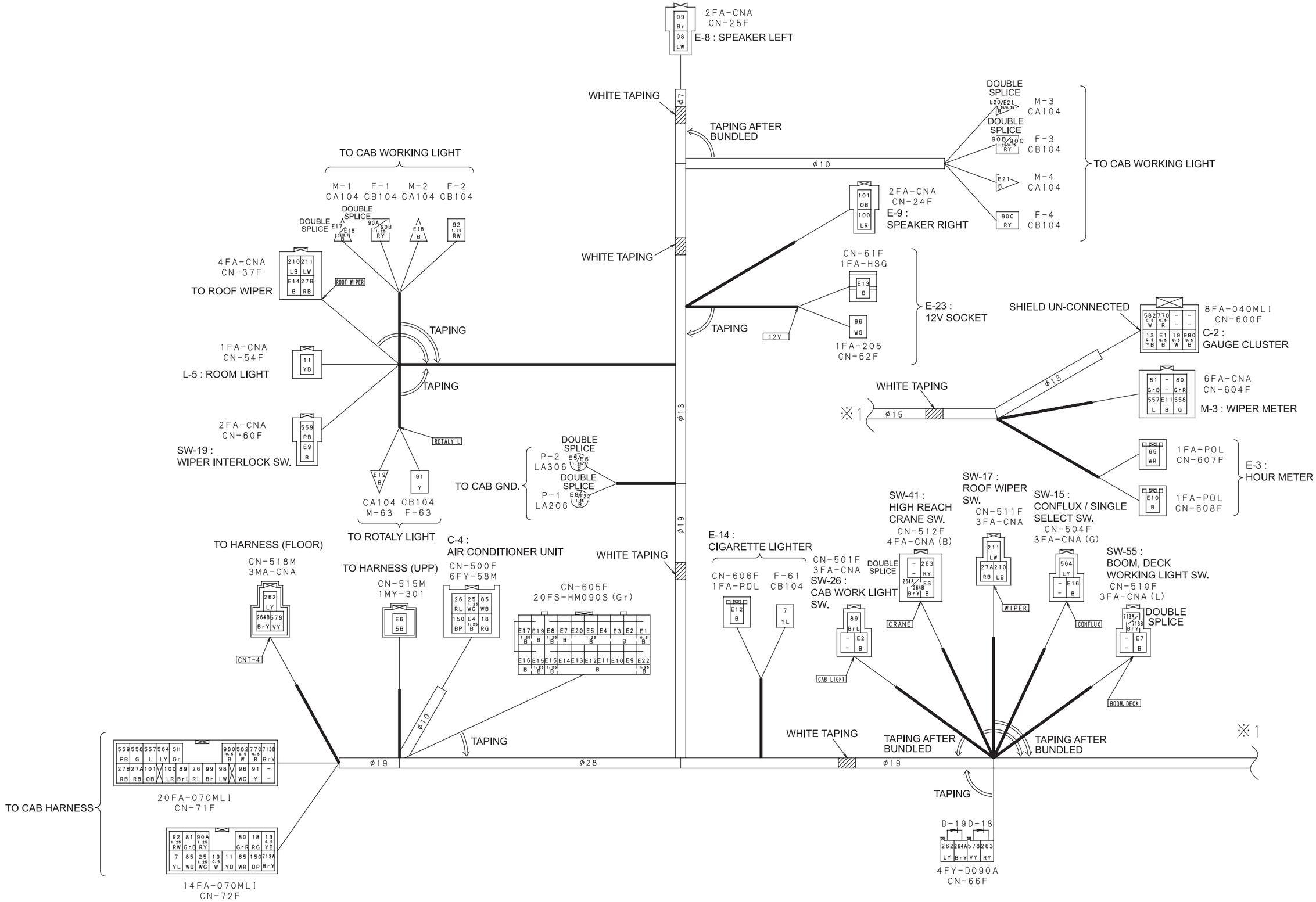


NOTES:
(1) TIGHTENING TORQUE OF BATTERY TERMINALS ARE 3.4N-M.
(2) TIGHTENING TORQUE OF GROUNDING CABLES ARE 10.7N-M.
(3) UNLESS OTHERWISE SPECIFIED TIGHTENING TORQUE IS SHOWN BELOW.
M8 : 23.5N·m
M10 : 46.1N·m
(4) UNLESS OTHERWISE SPECIFIED, THE INSTALLING PROCEDURE IS SHOWN BELOW.
(5) PLACE THE SLIT OF CORRUGATED TUBE DOWNWARD AND INSTALL IT.

23.3.5-6 ECU HARNESS (1/2) : YN13E01482P1



23.3.8.1 CAB HARNESS (1/2) : YN14E01102P3



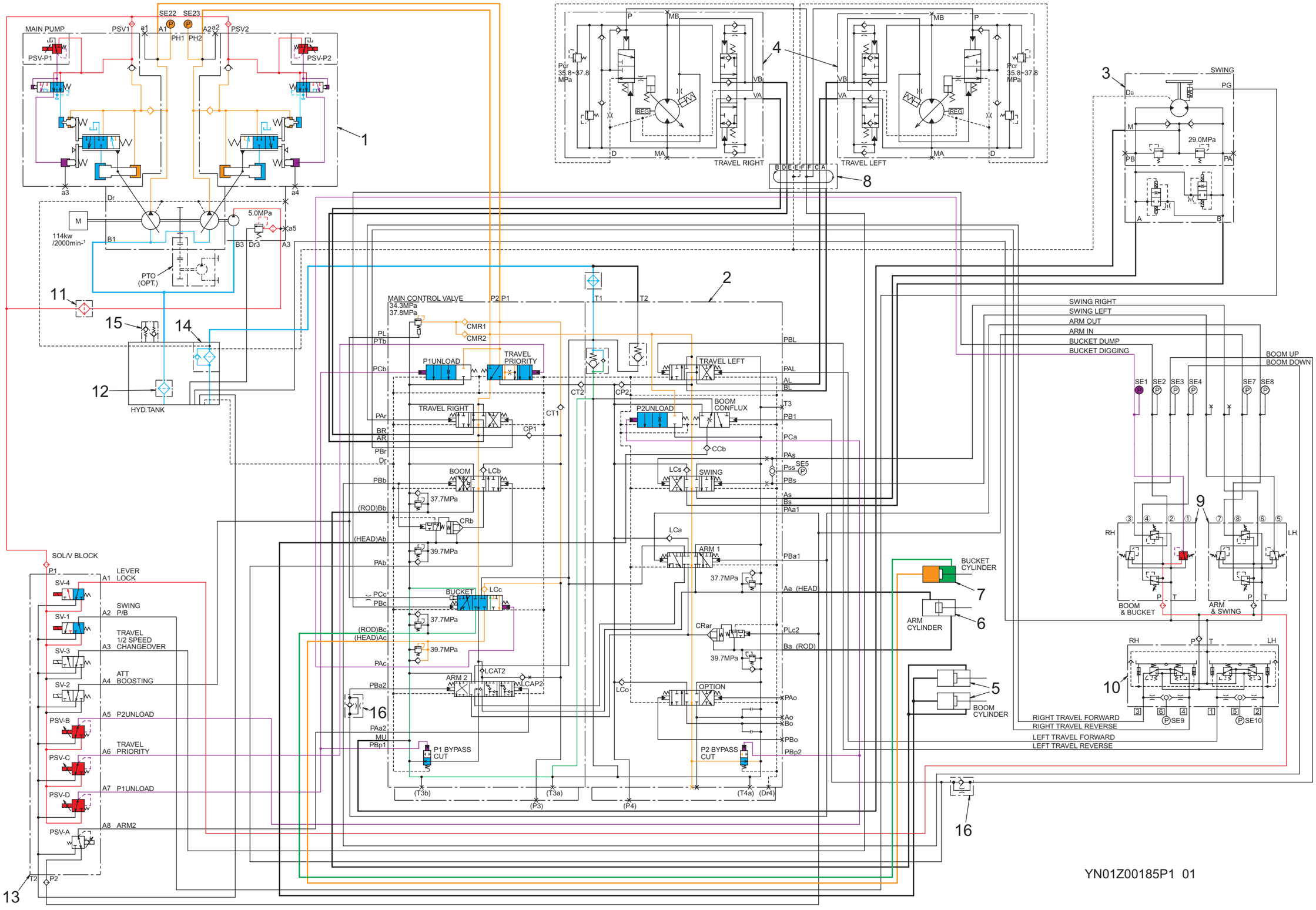


Fig. 22-3 BUCKET CIRCUIT : Bucket digging (Travel straight conflux), Auto-accelation and Standby flow rate constant control