HYDRAULIC EXCAVATOR

SHOP MANUAL model E265B E265BLC (HS Engine)

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NEW HOLLAND

Book Code No. **87731202**

(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.

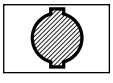
(9) When water has entered in the waterproofed connector, the removing of water is not easy. So check the removed waterproofed connector with care to protect it from entry of water. If moisture adheres on it, dry it completely before connecting.

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.

Unit ; kg (lb)

Item \ Model	E265B	E265BLC
4. Lubricant and water (Assembly of following :)	590 (1,300)	←
4.1 Hydraulic oil	160 (350)	←
4.2 Engine oil	20 (44)	←
4.3 Fuel	380 (840)	←
4.4 Water	30 (66)	←

Note

Marks * show dry weight.

3. ATTACHMENT DIMENSIONS

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3.3.3 LUG SECTION DIMENSIONAL DRAWING

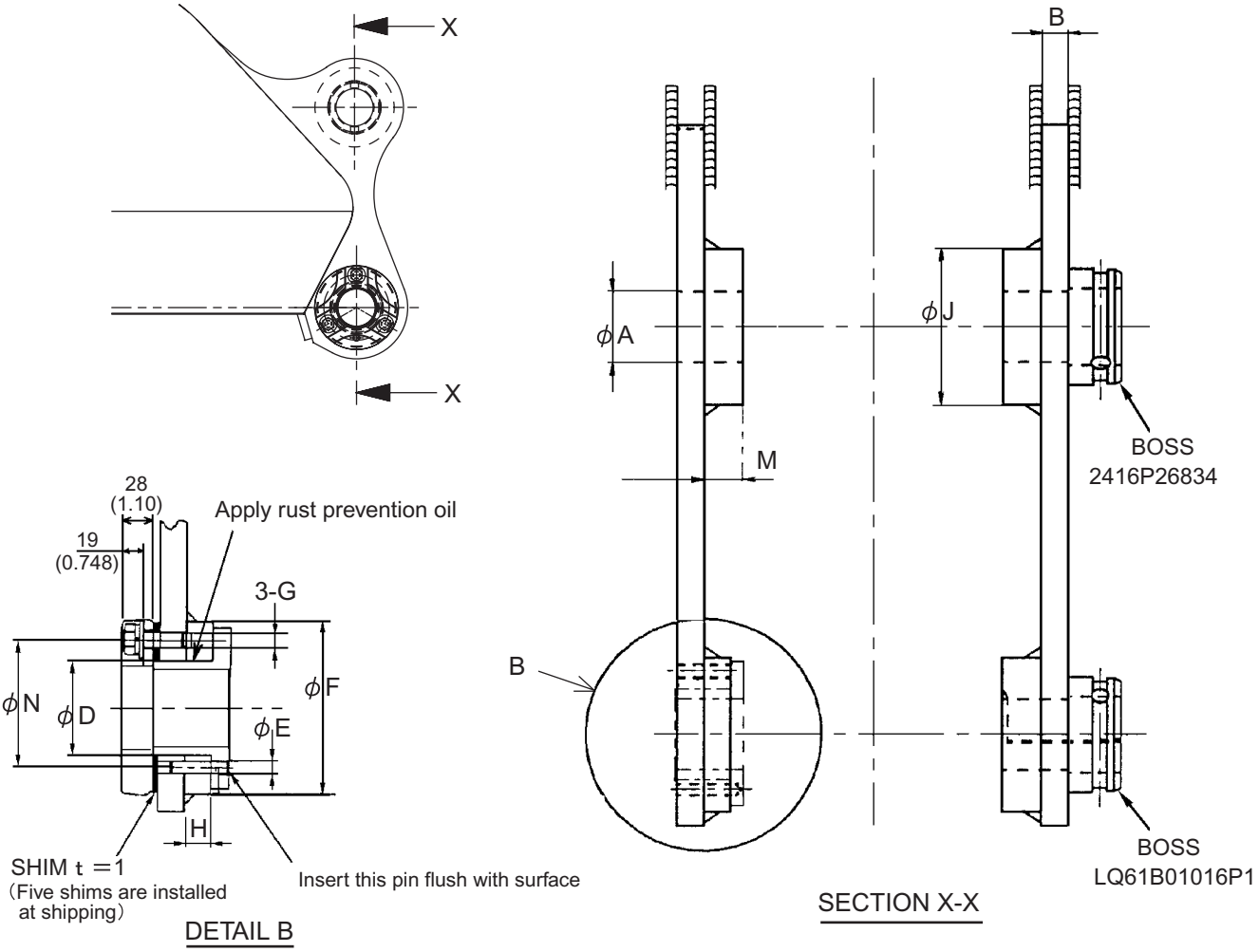


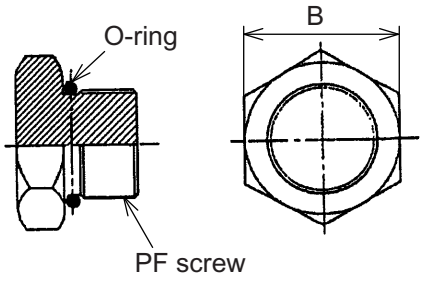
Fig. 3-8 Dimension of lug section

Unit : mm (ft-in)

Type of bucket	Capacity of bucket m^3 (cu·yd)	Part No. of bucket	Pin hole dia.	Lug plate thickness	Hole dia.	Spring pin dia.	Boss outer dia.	Screw dia.	Boss width.	Boss outer dia.	Boss width.	Screw hole P.C.D
			A	B	D	E	F	G	H	J	M	N
Hoe bucket	0.81 (1.06) [STD]	LQ61B00170F1	ϕ90 (3.45")	25 (0.984")	ϕ105 (4.13")	ϕ13 (0.512")	ϕ190 (7.48")	M16	25 (0.984")	ϕ180 (7.09")	36 (1.42")	150 (5.91")
	1.00 (1.31)	LQ61B00186F1										
	1.20 (1.57)	LQ61B00125F1										
	1.40 (1.83)	LQ61B00166F1										

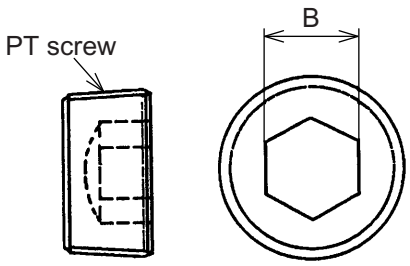
11.5.2 PLUG FOR HYDRAULIC EQUIPMENT

(1) PF screw



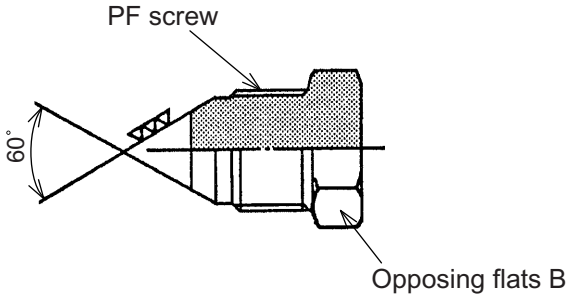
PF screw	Plug parts No.	B mm	O-ring parts No.	Nominal O-ring
PF1/4	ZE72X04000	19	ZD12P01100	1B P11
PF3/8	ZE72X06000	22	ZD12P01400	1B P14
PF1/2	ZE72X08000	27	ZD12P01800	1B P18
PF3/4	ZE72X12000	36	ZD12P02400	1B P24
PF1	ZE72X16000	41	ZD12P02900	1B P29

(2) PT screw

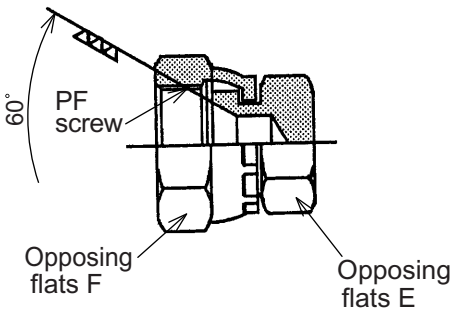


PT screw	Plug parts No.	B mm
PT1/8	ZE82T02000	5
PT1/4	ZE82T04000	6
PT3/8	ZE82T06000	8
PT1/2	ZE82T08000	10
PT3/4	ZE82T12000	14
PT1	ZE82T16000	17
PT1 1/4	ZE82T20000	22
PT1 1/2	ZE82T24000	22

(3) Plug for (F) flare hose



PF screw	Plug parts No.	B mm
PF1/4	2444Z2728D1	14
PF3/8	2444Z2728D2	17
PF1/2	2444Z2728D3	22
PF3/4	2444Z2728D4	27
PF1	2444Z2728D5	36



PF screw	Plug parts No.	E mm	F mm
PF1/4	2444Z2729D1	14	19
PF3/8	2444Z2729D2	17	22
PF1/2	2444Z2729D3	23	27
PF3/4	2444Z2729D4	27	36
PF1	2444Z2729D5	36	41
PF1 1/4	2444Z2729D6	40	50

11.13 TRACK SPRING SET JIG

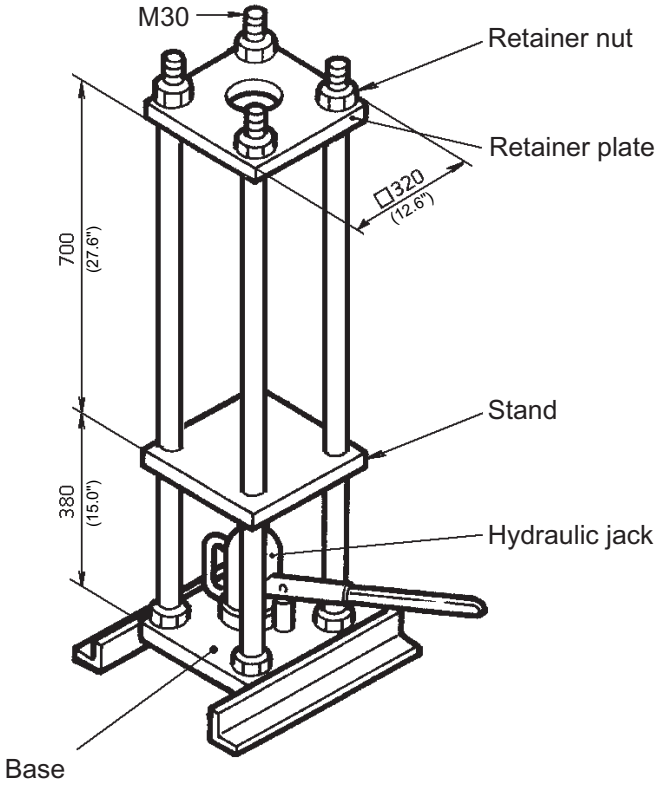


Fig. 11-6 Track spring set jig

Group		Location	Work to be done	Unit	Remarks	Unit : Hour
03 Swing frame	96	Swing motor	O/H	1 pc.		3.6
	97	Swing reduction gear	O/H	1 pc.		4.2
	100	Swivel joint relation			See 33.1.19	
	101	Swivel joint ASSY	Detach/attach	1		2.6
	102	• Piping (Top part only)	Detach/attach	1 set		0.5
	103	• Whirl stop bolt	Detach/attach	1		0.2
	104	• Cover	Detach/attach	1		0.4
	105	• Joint & elbow	Detach/attach	1 set		0.4
	106	• Mounting bolt	Detach/attach	1 set		0.4
	107	• Swivel joint slinging	Detach/attach	1		0.4
	108	• Cleaning	Cleaning	1 set		0.3
	109	Swivel joint	O/H	1 set	Removing and installing guard	3.6
		Other necessary works	Detach/attach	1 set	Lower piping	0.6
	120	Main control valve			See 33.1.15	
	121	Main control valve ASSY	Detach/attach	1 pc.		2.5
	122	• Attach tag to port name of pipe	Preparation	1 pc.		0.6
	123	• Piping	Detach/attach	1 set		1.7
	124	• Bracket mounting bolt	Detach/attach	1 pc.		0.1
	125	• Valve slinging	Detach/attach	1 pc.		0.1
	126	Main control valve ASSY	Detach/attach	1 set		6.0
		Other necessary works	Detach/attach	1 set	Guard	0.4
	130	Valve relation				
	131	Solenoid valve ASSY	Detach/attach	1		1.0
	132	• Attach tag to port name of pipe	Preparation	1		0.2
	133	• Piping	Detach/attach	1 set		0.5
	134	• Mounting bolt	Detach/attach	1		0.3
	140	Engine (E/G) mounting relation			See 33.1.13	
	141	Engine ASSY	Detach/attach	1 pc.	After removing pump & radiator	1.8
	142	• Harness connector & grounding & cable connection	Detach/attach	1 pc.		0.3
	143	• Fuel hose	Detach/attach	1 pc.		0.1
	144	• Others	Detach/attach	1 set		0.5
	145	• Mounting bolt	Detach/attach	1 pc.		0.5
	146	• Engine slinging	Detach/attach	1 set		0.2
	147	• Cleaning	Cleaning	1 pc.		0.3
	148	Engine	O/H	1 set	Reference for engine (Chapter 51)	

	Work No.	Work	Work unit	Works	SK200-8, SK250-8		SK330-8	
					Q'ty			
					1	Adding hour by 1 each	1	Adding hour by 1 each
52	00324	Overhaul of cylinder head	Completed machine	Include; Valve lapping Exclude; Replacing of valve guide, water pressure test and replacing valve seat	13.3		18.8	
53	00325	Replacing cylinder head gasket	Completed machine		8.2		10.4	
54	00326	Replacing valve	Completed machine	Include; Valve lapping	10.2		15.6	
55	00327	Replacing valve spring	Completed machine	Exclude; Removal and installing of cylinder head	4.9		8.8	
57	00328	Replacing valve stem seal	Completed machine	Exclude; Removal and installing of cylinder head	5.3		9.4	
61	00376	Removal and installing camshaft housing plug	One set		1.2	0.2	1.6	0.2
62	00377	Removal and installing camshaft (with camshaft gear)	Completed machine		2.6		3.4	
63	00352	Replacing cylinder head (one piece and one set require same hour)	Single unit	With manifold and nozzle holder Include; Valve lapping Excluding; Removal and installing of cylinder head, replacing valve guide, water pressure test and replacing valve seat	6.1		6.5	
66	00355	Replacing valve guide	Unit of 1 cylinder		1.0	0.8	1.0	0.8
72	00361	Replacing expansion plug	Single unit		0.4	0.4	0.4	0.4
73	00371	Replacing rocker arm (one piece and one set require same hour)	Unit of 1 cylinder		0.1		0.1	
74	00372	Replacing rocker arm support (one piece and one set require same hour)	Unit of 1 cylinder		0.1		0.1	
75	00373	Replacing rocker arm bushing	Unit of 1 cylinder		0.3	0.1	0.3	0.1
76	00374	Replacing valve	Unit of 1 cylinder	From cylinder head is removed condition Include; Valve lapping	0.5	0.5	0.5	0.5
77	00375	Replacing valve spring	Unit of 1 cylinder	From cylinder head is removed condition	0.2	0.2	0.2	0.2
78	00330	Replacing valve stem seal	Unit of 1 cylinder	From cylinder head is removed condition	0.3	0.3	0.3	0.3
81	00406	Removal and installing supply pump	One set	Include; Function check	2.3		2.3	
84	00411	Tightening oil pan	Single unit	From engine is removed condition	0.5		0.5	
85	00412	Removal and installing oil pan	Single unit	From engine is removed condition	0.5		0.5	
86	00413	Replacing oil pan	Single unit	From engine is removed condition	0.7		0.7	
87	00414	Replacing oil pan gasket	Single unit	From engine is removed condition	0.7		0.7	
88	00421	Replacing oil pan drain cock	Single unit	From engine is removed condition	0.5		0.5	
89	00422	Replacing oil pan drain cock gasket	Single unit	From engine is removed condition	0.5		0.5	
92	00443	Replacing breather hose	Single unit	From engine is removed condition	0.3	0.2	0.3	0.2
93	00444	Replacing oil level gauge	Single unit	From engine is removed condition	0.1		0.1	
94	00445	Replacing oil level gauge guide	Single unit	From engine is removed condition	0.2		0.2	
95	00446	Replacing oil level gauge bracket	Single unit	From engine is removed condition	0.2		0.2	
102	00512	Replacing fly wheel housing	Single unit	From engine is removed condition	3.4		3.4	
103	00541	Replacing fly wheel housing gasket	Single unit	From engine is removed condition	5.4		5.4	
104	00542	Replacing rear end plate	Single unit	From engine is removed condition	5.4		5.4	
105	00543	Replacing rear end plate gasket	Single unit	From engine is removed condition	5.4		5.4	
106	00515	Replacing crank shaft rear oil seal	Single unit	From engine is removed condition	5.4		5.4	

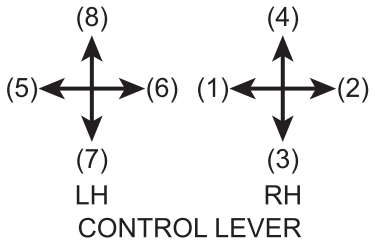
	Inspection item			Standard value	Unit	
Operating speed	Sprocket revolution (RH,LH)	1st speed		32.7 ~ 29.5	min^{-1}	
		2nd speed		52.9 ~ 47.9		
	Operating time of cylinder	Boom	Up	2.8 ~ 3.4	sec	(At no load)
			Down	2.3 ~ 2.9		
		Arm	In	3.2 ~ 3.8		
			Out	2.6 ~ 3.2		
		Bucket	Digging	2.5 ~ 3.1		
			Dumping	2.0 ~ 2.6		
	Swing speed	RH		5.0 ~ 6.2	sec / 1 rev	
		LH				
	Travel speed	1st speed	Iron shoe	19.5 ~ 21.5	sec / 20 m	
		2nd speed	Iron shoe	12.3 ~ 13.5		
Performance	Amount of travel deviation	2nd speed		0 ~ 240	mm / 20 m	
	Parking brake drift	15 degree gradient		0	mm / 5 min	
	Performance of Swing brake	Neutral position after 180° full speed swing		55 ~ 75	degree	
	Performance of Swing parking brake	15 degree gradient		0	mm	
	ATT amount of drift	Tip of the bucket tooth		95	mm / 5min	(At no load)
		Boom cylinder		7		
		Arm cylinder		6		
	Amount of horizontal play at the bucket tooth			30 ~ 50	mm	

Note

The port relief valves No.OR1~OR8 on the control section are adjusted to the following operation numbers in advance.

(1) Bucket digging, (2) Bucket dump, (3) Boom up, (4) Boom down

(5) Swing left, (6) Swing right, (7) Arm in, (8) Arm out



13.6 MEASURING SWING PERFORMANCES

13.6.1 SWING SPEED

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

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

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

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

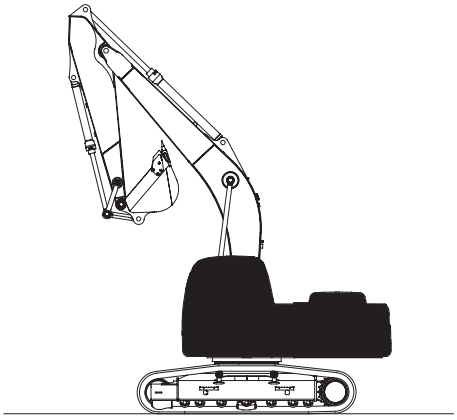


Fig. 13-20 Swing speed measuring position (at the min. reach)

13.6.2 PERFORMANCE OF SWING BRAKE

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

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

(3) Preparation

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

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

Swing speed — Unit : sec/rev

Measuring position	Standard value	Reference value for remedy	Service limit
Swing speed at min. reach	5.0~6.2	6.4~7.9	8.4~

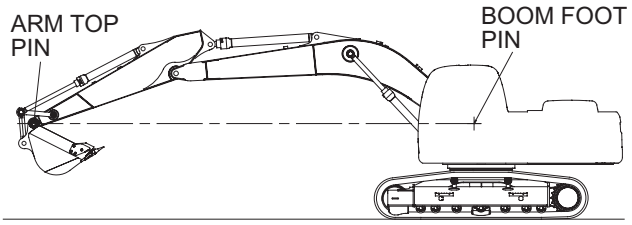
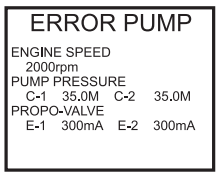


Fig. 13-21 Swing brake performance measuring position

2) In cases where the adjustment of pump can not be performed; And "ERROR PUMP" is displayed.
Judging condition 1:
P1 and P2 average pump pressure at the time when the adjustment is completed is 25MPa or less.
Judging condition 2:
The adjustment does not complete although the pump proportional valve current reaches to the specified value.

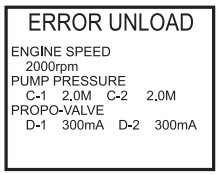


The P1 and P2 pump pressures usually increase to 33~38MPa.
When the pressure does not increase;

a. Identify the reason why the pressure does not increase,
   - Check that the relief valve operates normally.
   - Check that the hydraulic circuit is free from leak of pressure.
   - Check that the pressure sensor functions normally.
     And so on.

b. Identify the reason why the actual flow rate does not increase,
   - Check that the pump proportional valve operates normally.
   - Check that the pump regulator operates normally.
     And so on.

3) In cases where unloading valve can not be performed; And "ERROR UNLOAD" is displayed.
Judging condition 1:
The pump pressure does not increase up to the pressure in the range of the specified adjustment. Or the increased pressure is held as it is.
Judging condition 2:
Pressure sensor of either P1 pump or P2 pump is failed.



Normally the pump pressures of P1 and p2 pumps gradually increase to 10~25MPa.
(It may be affected by operating oil temperature.)

When the pump pressure does not increase;

a. Identify the reason why the pressure does not increase,
   - Check that the relief valve operates normally.
   - Check that the hydraulic circuit is free from leak of pressure.
   - Check that the pressure sensor functions normally.
     And so on.

(5) Other precautions:

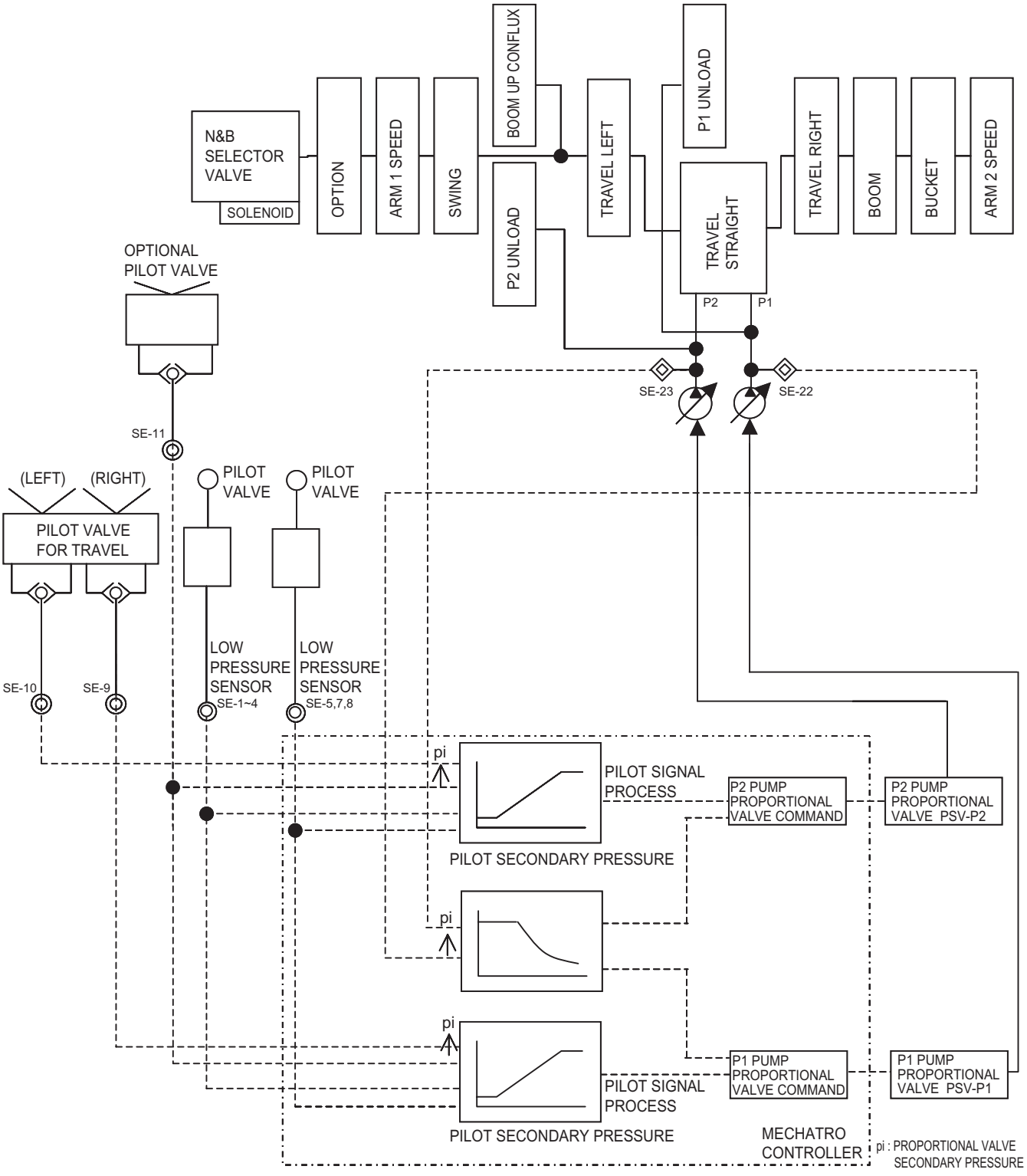
1) In the event of a failure, there is case where the adjustment may not be performed normally.
First serve the machine, and perform the adjustment work.

2) In the condition where large load is constantly applied to engine, the adjustment could not be performed normally.

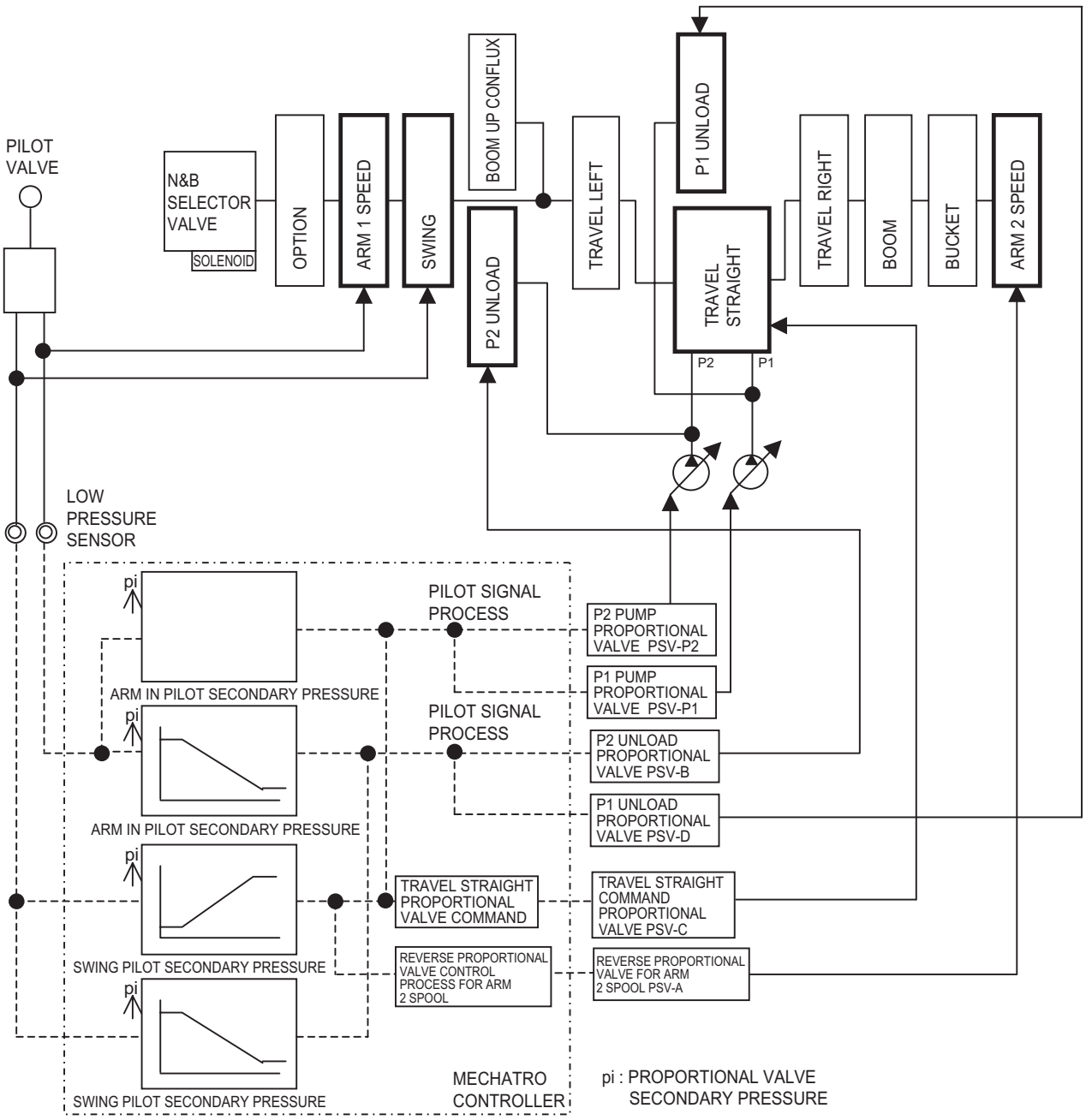
Note

For machines equipped with lifting magnet, turn the generator OFF.

21.1.3 POSITIVE CONTROL & P-Q CONTROL



21.1.10 SWING PRIORITY CONTROL



(1) During arm-in operation, arm operating pilot secondary pressure switches arm spool and is input to low pressure sensor on starting swing operation (or arm-in operation during swing operation), and swing operation pilot secondary pressure switches swing spool and is input to low pressure sensor.

(2) The output voltage of low pressure sensor is input to mechatro controller and the mechatro controller processes pilot signal and outputs command according to the input voltage to P1 and P2 proportional valves, P1 and P2 unload pressure proportional valves, travel straight valve and reverse proportional valve for arm 2 spool.

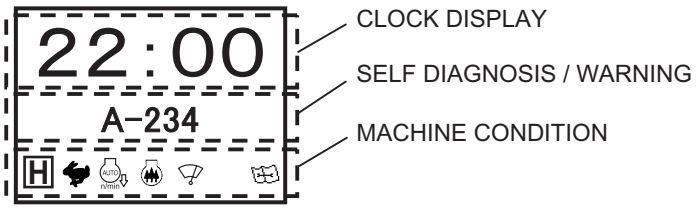
(3) Each proportional valve outputs pilot proportional valve secondary pressure according to the command output by mechatro controller and changes P1 and P2 pump delivery rate and switches P1 and P2 unload spool, travel straight spool, arm 2 spool.

(4) With original hydraulic pressure command, arm 1 spool and swing spool are switched and also with the command by mechatro controller, P1 and P2 unload spools, travel straight spool and arm 2 spool are switched enabling for two pump flow rates to be supplied to the arm cylinder head side, and consequently the return oil on arm cylinder rod side is recirculated into arm cylinder head side.

(5) Because the return oil on the arm rod side is recirculated, the working pressure is raised and pump delivery rate is used for swing operation by priority, and operated by the recirculated oil, making the operation with minimum speed drop possible.

(5) Gauge cluster display

After key is switched on and logo mark display disappears, screen for operator is displayed on multi screen. The display functions of multi display are explained below.



MULTI DISPLAY INDICATIONS

1) Display function for operator ..... Screen usually displayed during operation

1.1 Clock display function ..... Current time is displayed.

1.2 Self-diagnosis display ..... When abnormality is detected on mechatro system like sensor, proportional valve, etc., this displays error code.

1.3 Warning display ..... When machine was thrown into dangerous state, or was failed, displays warning contents with the symbol and statement. (For warning contents, see items shown below.)

1.4 Machine condition display ..... Displays machine operating condition.

2) Display function for maintenance ..... Displays remaining time up to replacement/change of following items.
(1) Engine oil (2) Fuel filter (3) Hydraulic oil filter (4) Hydraulic oil

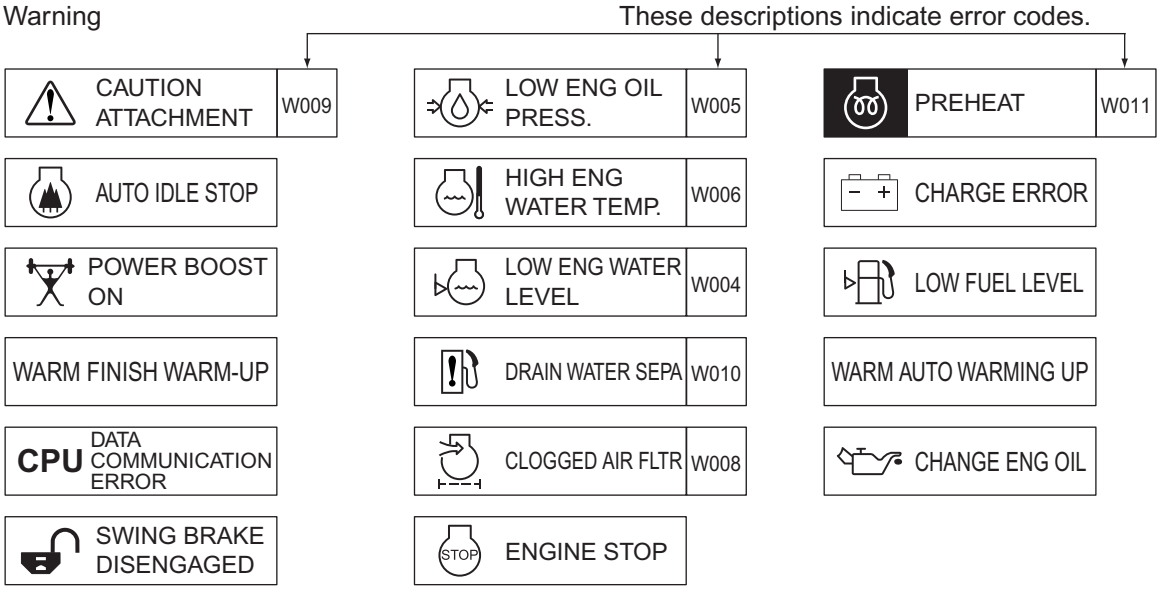
3) Failure history display function ..... Stores abnormality occurred on mechatro system in the past and displays in order of recent occurrence.

4) Mechatro adjustment display ..... Displays procedure for adjustment of mechatro system like output adjustment and unload adjustment, etc.

5) Service diagnosis display ..... Displays information like pressure sensor sensed value, proportional valve command, etc. output by mechatro controller

6) Failure diagnosis mode display function ..... Specifies failed section automatically for failures which are not detected by self diagnosis and displays the results.

· Warning



Notice

Error codes were stored as trouble history, and displayed on the monitor by the trouble history display function.

Operation No.8 :
Arm-out in full lever operation & relief
H mode Hi idle

No.32 ARM, SWING

C-1	P1-PRES	33.0~35.8 M
C-2	P2-PRES	33.0~35.8 M
E-1	P1-PSV	415~525 mA
E-2	P2-PSV	415~525 mA
D-1	P1-UL(BPC)	360 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	750 mA
B-3	ARM OUT	3.0 M
B-4	ARM IN	0.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	0.0 M
G-3	ENG SPEED	2100~2190
	POWER SHIFT	0 mA

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

Operation No.9 :
Arm-out in full lever operation & in operation
H mode Hi idle

No.32 ARM, SWING

C-1	P1-PRES	15.0~22.0 M
C-2	P2-PRES	15.0~22.0 M
E-1	P1-PSV	488~677 mA
E-2	P2-PSV	488~677 mA
D-1	P1-UL(BPC)	360 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	750 mA
B-3	ARM OUT	3.0 M
B-4	ARM IN	0.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	0.0 M
G-3	ENG SPEED	2100~2190
	POWER SHIFT	0 mA

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

Operation No.10 :
Swing in full lever operation & relief
H mode Hi idle

No.32 ARM, SWING

C-1	P1-PRES	0.5~1.8 M
C-2	P2-PRES	28.0~35.8 M
E-1	P1-PSV	350 mA
E-2	P2-PSV	557~660 mA
D-1	P1-UL(BPC)	750 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	750 mA
B-3	ARM OUT	0.0 M
B-4	ARM IN	0.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	3.0 M
G-3	ENG SPEED	2100~2190
	POWER SHIFT	0 mA

Operation No.11 :
Swing in full lever operation & in operation
H mode Hi idle

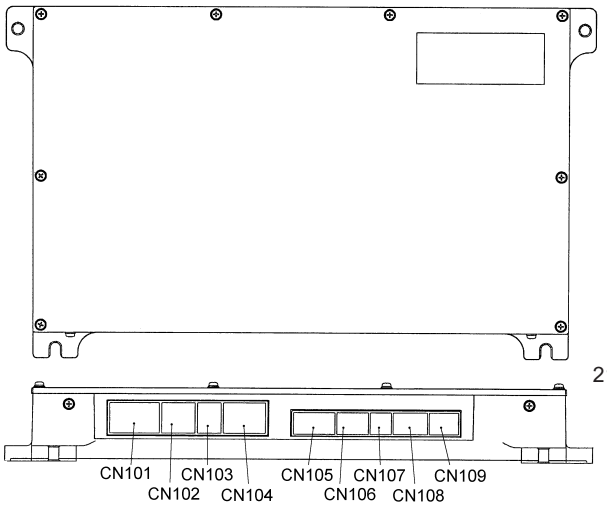
No.32 ARM, SWING

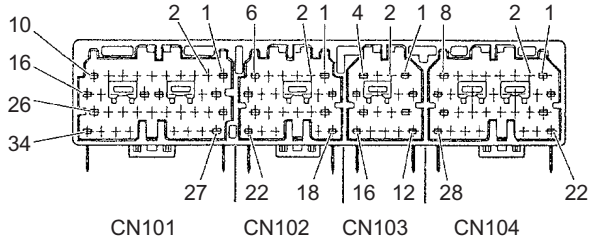
C-1	P1-PRES	0.5~1.8 M
C-2	P2-PRES	10.0~15.0 M
E-1	P1-PSV	350 mA
E-2	P2-PSV	660 mA
D-1	P1-UL(BPC)	750 mA
D-2	P2-UL(BPC)	360 mA
D-3	S-TRAVEL	350 mA
D-6	ARM-IN-2	750 mA
B-3	ARM OUT	0.0 M
B-4	ARM IN	0.0 M
B-1	BOOM RAISE	0.0 M
B-7	SWING	3.0 M
G-3	ENG SPEED	2070~2160
	POWER SHIFT	0 mA

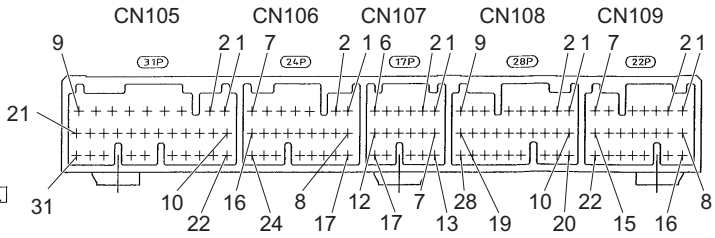
21.2.8 MECHATRO CONTROL EQUIPMENT

(1) C-1 Mechatro controller

1) Outside view



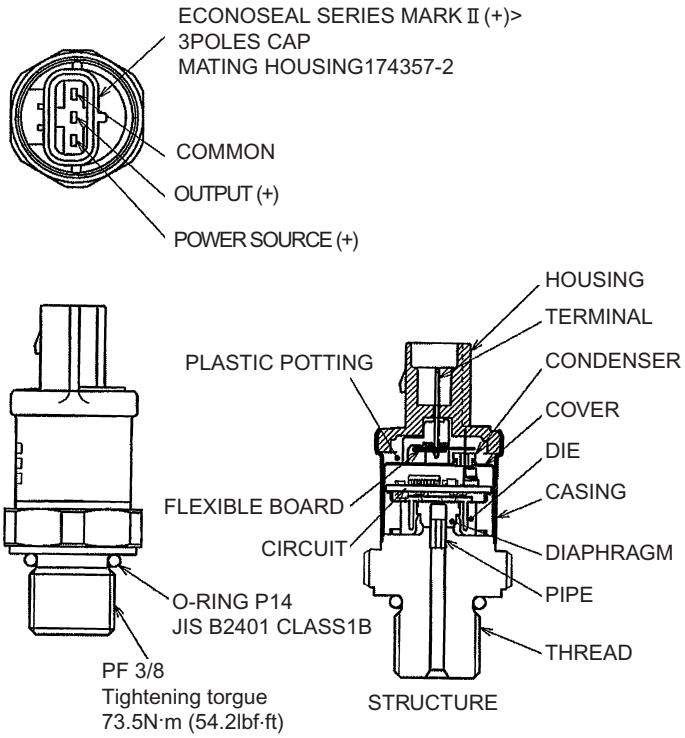




2) List of connectors

Connector No.	Pin No.	Port name	Function	Input/putput	Signal level
CN101	1	GA	Boom up	Input	0V
	2	A1			0.5~4.5V
	3	+5VA			Power output 5V
	4	+5VA	Boom down	Input	Power output 5V
	5	A2			0.5~4.5V
	6	GA			0V
	7	GA	Arm in	Input	0V
	8	A3			0.5~4.5V
	9	+5VA			Power output 5V
	10	+5VA	Arm out	Input	Power output 5V
	11	A4			0.5~4.5V
	12	GA			0V
	13	GA	Bucket digging	Input	0V
	14	A5			0.5~4.5V
	15	+5VA			Power output 5V
	16	+5VA	Bucket dump	Input	Power output 5V
	17	A6			0.5~4.5V
	18	GA			0V
	19	TXD1	Gauge cluster	Transmission	RS232C communication
	20	RXD1		Reception	RS232C communication
	21	GP			0V
	22	SHG1			Shield GND
	23	TXD3	Down load	Transmission	RS232C communication
	24	RXD3		Reception	RS232C communication
	25	DL			EARTH / OPEN(5V)
	26	GP			0V
	27	CANH1	E/G ECU		CAN communication
	28	CANL1	E/G ECU		CAN communication
	29	DO 20	Spare	Output	EARTH/OPEN
	30	DO 21	Safety relay	Output	EARTH/OPEN
	31	DO 22	Spare	Output	EARTH/OPEN
	32	DO 23	Rotary light (yellow)	Output	EARTH/OPEN
	33	DO 24	Rotary light (green)	Output	EARTH/OPEN
	34	DI 36	Heavy lift	Input	EARTH/OPEN

(4) High pressure sensor : YN52S00048P1



SPECIFICATION :

PRESSURE RANGE : 0～50 MPa

POWER SOURCE VOLTAGE : 5.0+0.5V DC

OUTPUT : 1/10Vs-9/10Vs

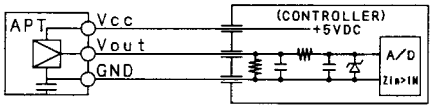
(Vs=5V DC 0.5～4.5V DC)

INSURANCE RESISTANCE : 100M ΩOR MORE

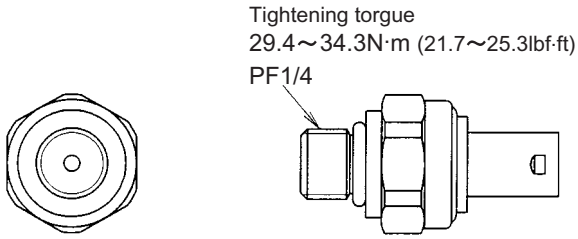
(BETWEEN CASING AND ALL IN/OUT TERMINALS AT 50V DC MEGGER)

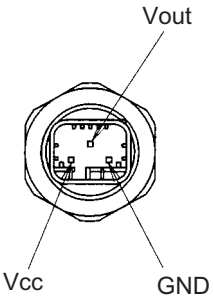
ELECTRIC CONNECTING DIAGRAM

(Ex. Construction of internal controller)



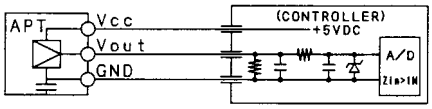
(5) Low pressure sensor : YX52S00013P1



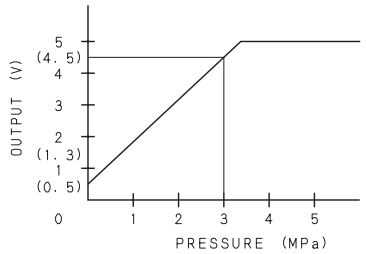


ELECTRIC CONNECTING DIAGRAM

(Ex. Construction of internal controller)



OUTPUT CHARACTERISTIC



SPECIFICATION :

PRESSURE RANGE : 0～3.0 MPa

RATED VOLTAGE : 5.0+0.5V DC

INSURANCE RESISTANCE : 50MΩ OR MORE

(BETWEEN BODY AND EACH TERMINAL AT 50V DC MEGGER)

(1) Swash plate group

The swash plate group consists of swash plate (212), shoe plate (211), swash plate support (251), tilting bushing (214), tilting pin (531), and servo piston (532). The swash plate is the cylindrical part that is formed on the opposite side of the shoe sliding surface and is supported by the swash plate support.

The hydraulic force controlled by the regulator flows into the hydraulic chamber that is provided on both sides of the servo piston. This moves the servo piston to the right and left. The result is that the swash plate swings on the swash plate support via the spherical part of the tilting pin and changes the tilting angle (a).

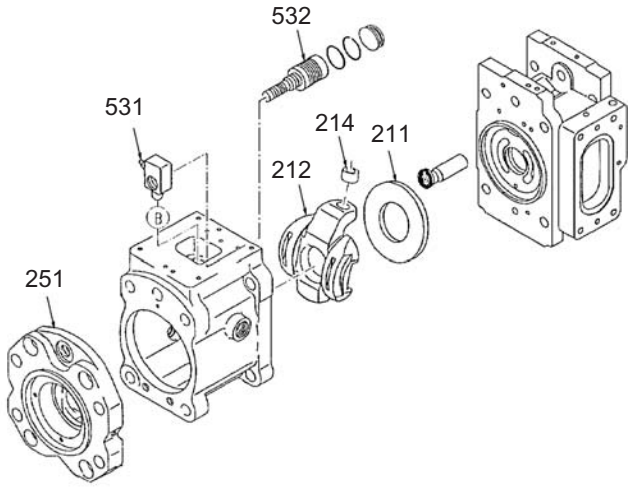


Fig. 24-6 Swash plate group

(2) Valve block group

The valve block group consists of valve block (312), valve plates (313 or 314), and valve plate pin (885). The valve plates having two crescent-shaped ports are installed to valve block (312) to feed oil and recycle it from cylinder block (141). The oil switched over by the valve plate is connected with the external pipe by way of the valve block.

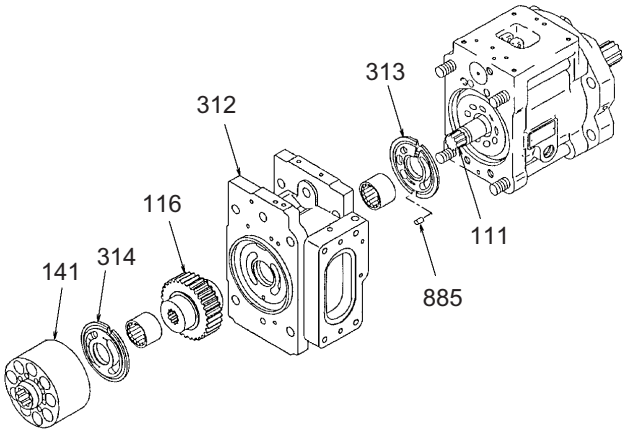


Fig. 24-7 Valve block group

(3) PTO group (OPT.)

The PTO group is composed of 1st gear (116), 2nd gear (117) and 3rd gear (118). The 2nd and the 3rd gear are supported by bearings (125) and (126) respectively and installed to the valve block.

Now, if the shaft is driven by the engine, the cylinder block rotates together by the spline linkage. If the swash plate is inclined, the pistons arranged in the cylinder block make reciprocating motion with respect to the cylinder while rotating with the cylinder block. If we keep an eye on a single piston, it makes a motion away from the valve plate (oil suction process) in the first 180° and a motion toward the valve plate (oil delivery process) in the remaining 180°. If the swash plate is not inclined (zero tilting angle), the piston does not stroke i.e. delivers no oil.

The shaft rotation is taken up by the 1st gear (116) and transmitted to the 2nd gear (117) and the 3rd gear (118), in that order, to drive the gear pump that is linked to the 3rd gear.

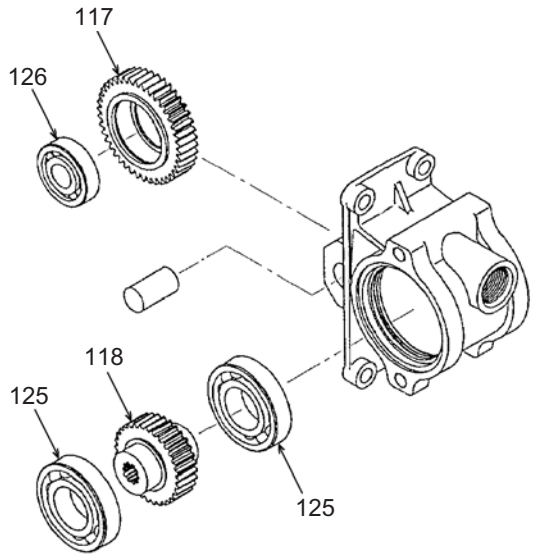


Fig. 24-8 PTO group

24.1.1.3.4 CAUSES OF FAULT RESULTING FROM REGULATOR

When trouble due to this regulator occurs, disassemble and inspect it referring to "Chapter YN33-II"

(1) When the engine is overloaded,
Load every unit of pump, and check on pumps on the right and left sides for possible damages. When pumps on both sides are failed, check on them for the following failures 1), 2). When pump on the one side is failed, start checking from para. 3).

1) Check that the power shift command current I is normal.

2) The power shift pressure is low.

- Check the dither of amp.
- Replace solenoid proportional reducing valve.

3) Stick of compensating piston (621) and compensating rod (623)

- Disassemble and clean it.

4) Stick of pin (898)

- Disassemble and clean it.

(2) The max. flow rate is not delivered.

1) Check that pilot differential pressure Pi is normal.

2) Stick of pilot piston (643)

- Disassemble and clean it.

3) Stick of spool (652)

- Disassemble and clean it.

4) Stick of pin (898)

- Disassemble and clean it.

Note : When the damage of part is severe, replace the part with new one.

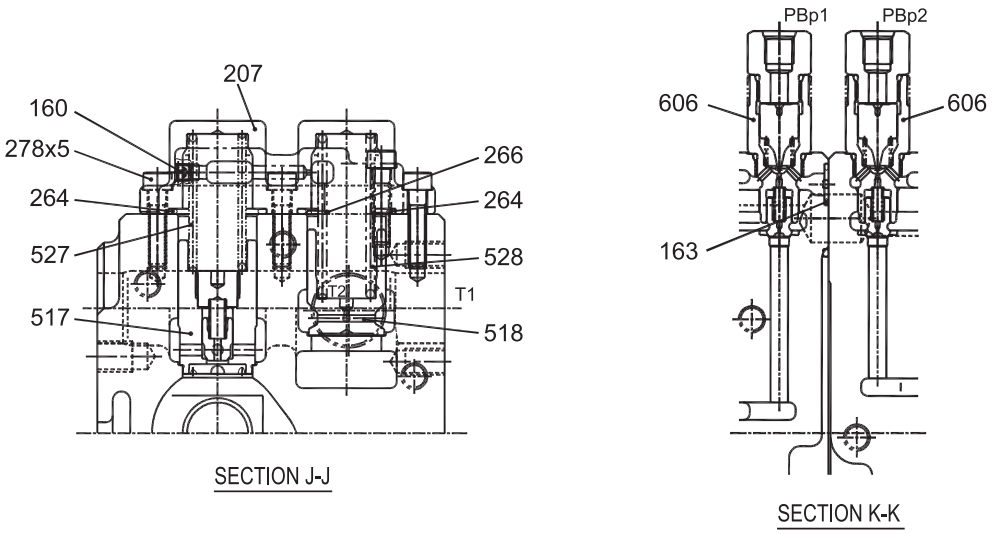


Fig. 24-28 Section (6/6)

24.1.2.2.3 OPERATION

(1) In neutral position

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

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

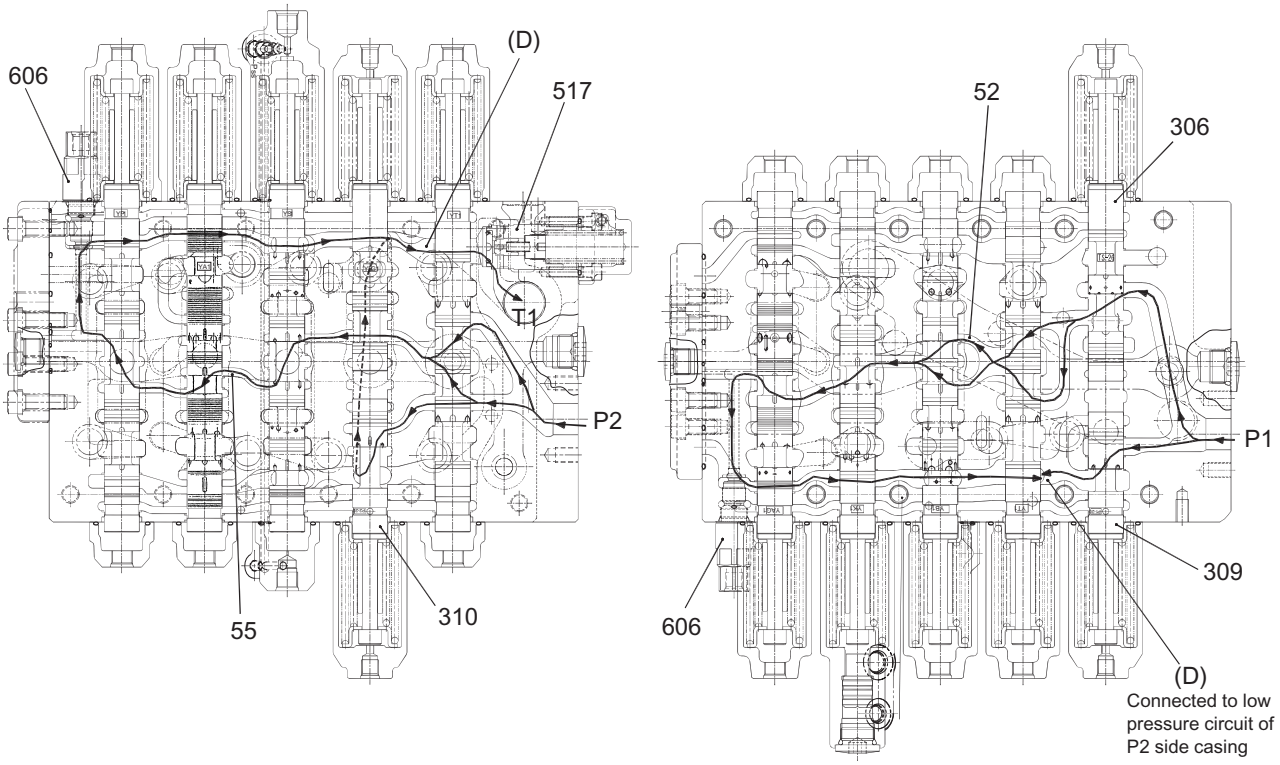


Fig. 24-38 In neutral position

3) In arm in operation (In heavy load operation)

The arm recirculation function is effective in actuating arm cylinder quickly in light load operation, but in heavy load operation (work required large power); the function causes the power loss. This control valve selects the presence of recirculation function in light and heavy load operation with solenoid proportional valve [XR]. (Variable recirculation function)

The flow path of hydraulic oil in heavy load operation, the path on the supply side to arm cylinder is the same as that in light load operation, differs from that of return oil. In heavy load operation, solenoid proportional valve [XR] actuates and arm 2 spool (308) is positioned to circuit (II). 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) is connected to low pressure passage (D) at circuit (áU), almost all the return oil passes through between the perimeter of arm 2 spool (308) and casing and flows through boost check valve (517) through low pressure (D) and returns to the hydraulic tank through tank port T1.

The return oil from AR chamber passes through between the perimeter of arm 1 spool (302) and casing and flows through casing inside passage (RH) and then is led to the inside of arm 2 spool (308) through circular notch (a) of arm 2 spool (308). In heavy load operation, since the pressure on arm cylinder head side (H) is higher than the rod side, the hydraulic oil in arm 2 spool (308) does not flow into casing inside passage (HH), but flows through check valve (319) and passes through boost check valve (517) through low pressure (D) and returns to the hydraulic tank through port T1.

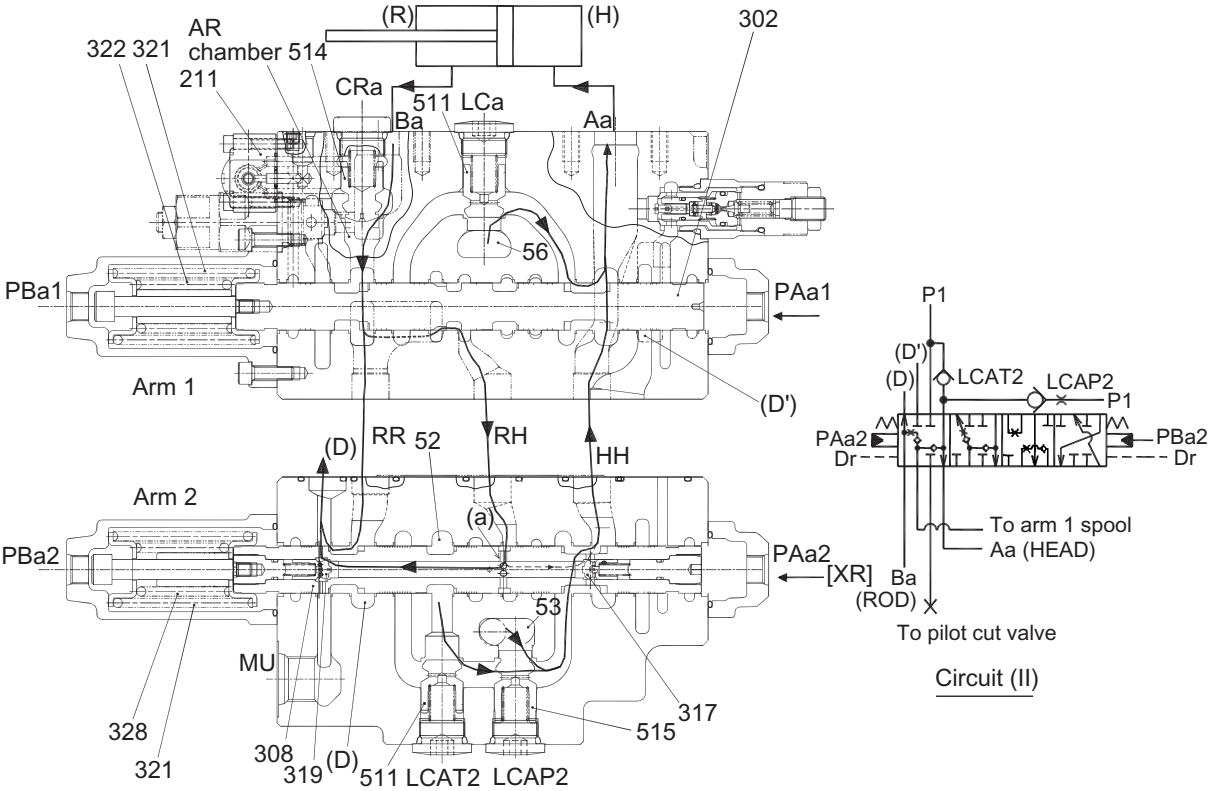
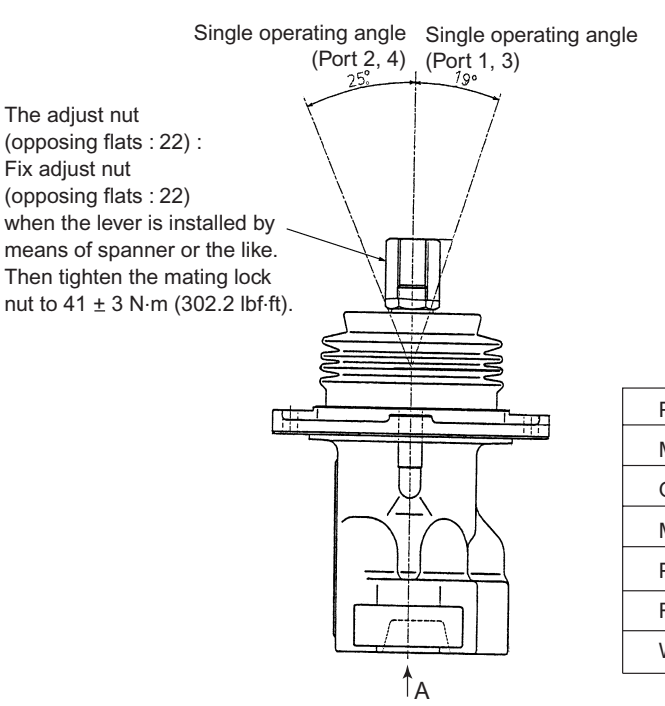


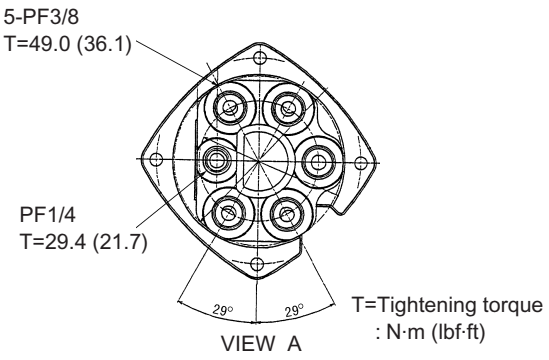
Fig. 24-48 In arm in operation (In heavy load operation)

24.1.3 PILOT VALVE (ATT)

24.1.3.1 OUTLINE

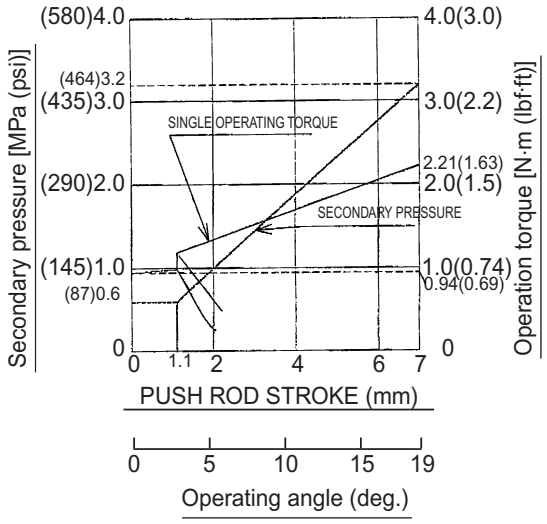
(1) Outside view



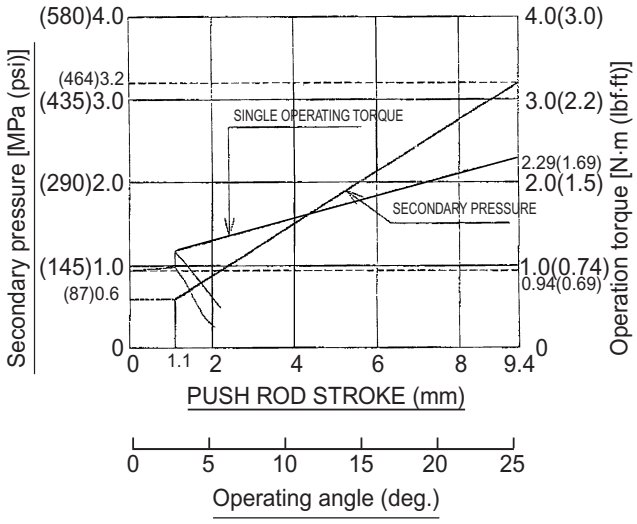


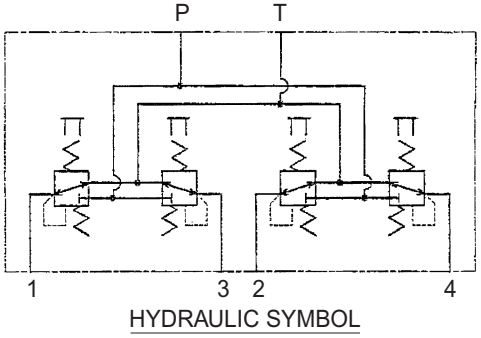
Part No.	YN30V00111F1
Model	PV48K2004
Operating torque	Refer to the curve below
Max. primary pressure	6.9 MPa (1000 psi)
Primary pressure	5.0 MPa (725 psi)
Rated flow	20 L/min (5.3gal/min)
Weight	Approx. 1.9 kg (4.2 lbs)

PORT 1, 3



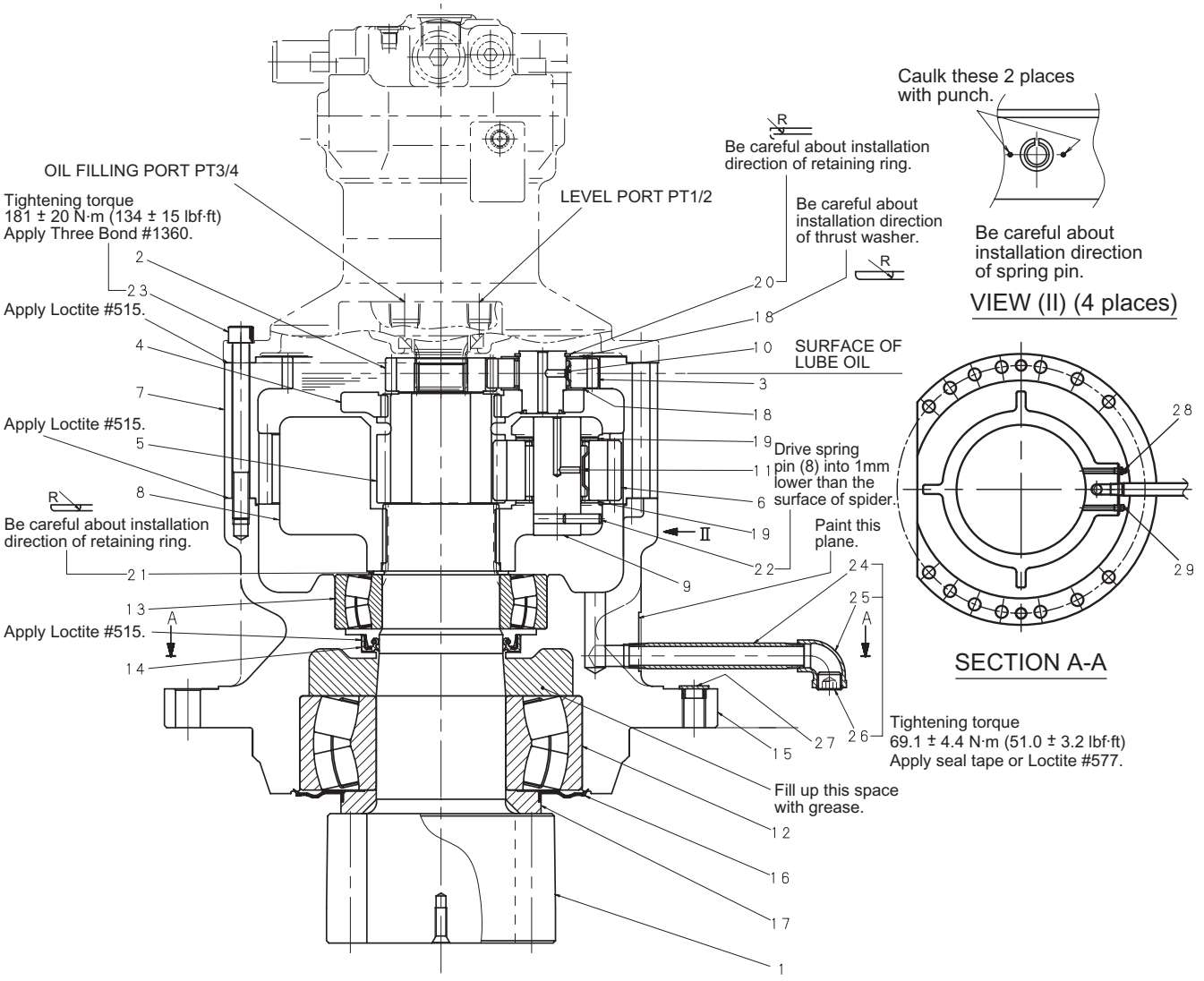
PORT 2, 4





HYDRAULIC SYMBOL

(2) Swing reduction unit



Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty	Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty
	1	PINION SHAFT	1		16	OIL SEAL	1
	2	#1 SUNGEAR	1		17	SLEEVE	1
	3	#1 PINION	4		18	THRUST WASHER	8
	4	SPIDER ASSY	1		19	THRUST WASHER	8
	5	#2 SUNGEAR	1		20	RETAINING RING	4
	6	#2 PINION	4		21	RETAINING RING	1
	7	RING GEAR	1		22	SPRING PIN	4
	8	SPIDER	1	181 (134)	23	CAPSCREW ; M14X150	16
	9	SHAFT	4		24	TUBE L=149	1
	10	NEEDLE BEARING	4		25	ELBOW	1
	11	NEEDLE BEARING	4	69.1 (51)	26	PLUG	1
	12	SPHERICAL BEARING	1		27	CAP	2
	13	SPHERICAL BEARING	1		28	GREASE NIPPLE	1
	14	OIL SEAL	1		29	RELIEF FITTING	1
	15	HOUSING	1				

24.1.6.3.3 DOUBLE COUNTERBALANCE VALVE

(1) Functions

The function of double counter balance valve is described below.

1) Overrun prevention function to control the speed of piston motor to the speed corresponding to the supply flow rate when the piston motor speed is higher than the speed decided by the supply flow rate (hereinafter called pumping action) due to the outer load.
2) Braking function to gradually stop the piston motor revolution by forming the brake circuit by the use of cross-over relief valve and giving the braking force to the piston motor revolution.
3) Shuttle valve function for high pressure selection to release the parking brake with the aid of self pressure.

(2) Operation

1) Stop condition (See Fig. 24-70)
When the control valve is at the neutral position (motor is stopped), M1 and M2 ports are locked by plunger (3) and check valve (4) (hydraulic lock) and the motor stops rotating because the pressure does not flow through P1 and P2 ports.

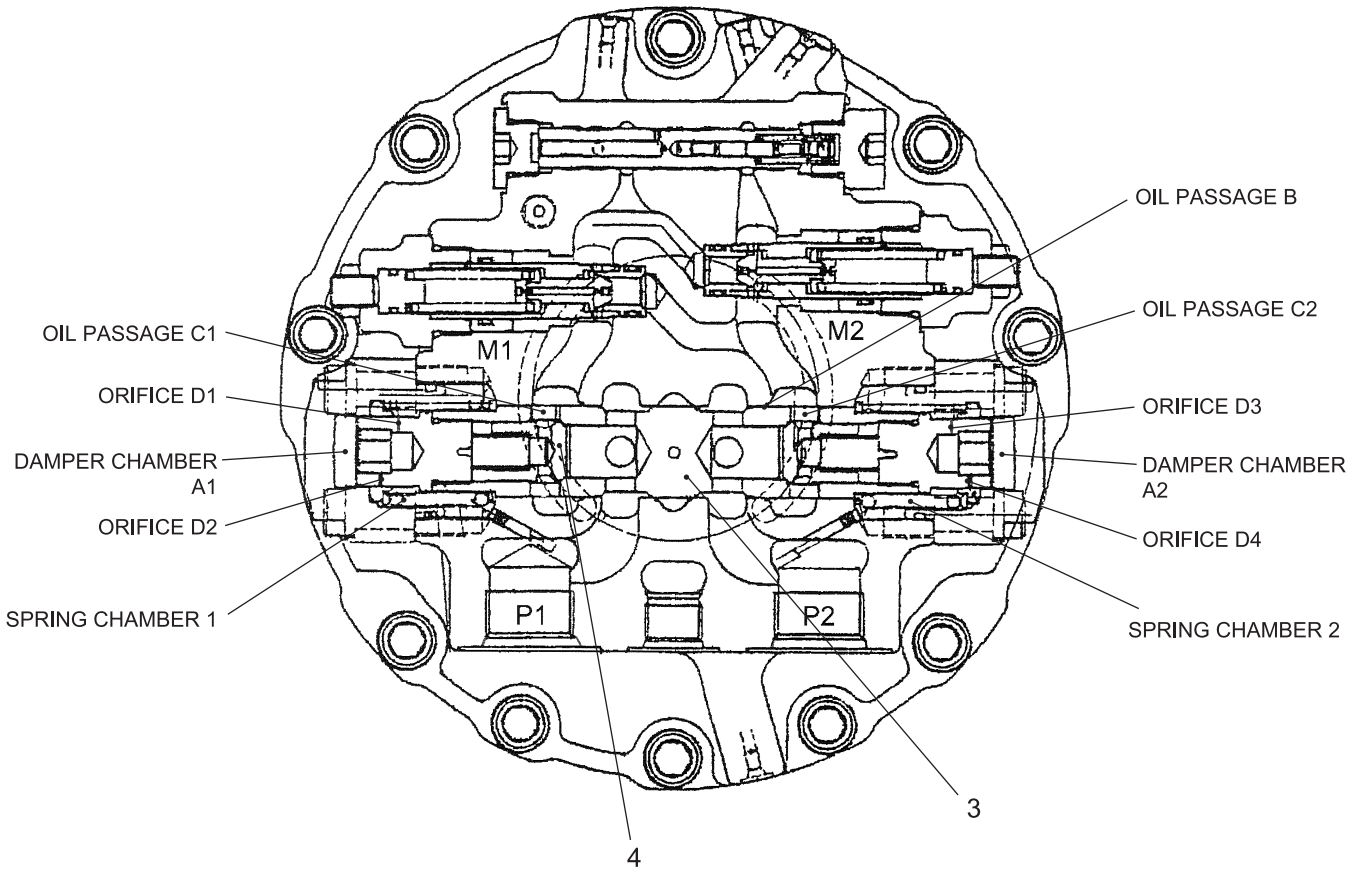


Fig. 24-70 Construction of double counter balance valve (stop condition)

24.1.6.3.7 REDUCTION UNIT

The reduction unit is constructed so that simple planetary gear reduction units which are made up of drive gear, sun gear, holder, planetary gear and ring gear (tooth is cut inside of the housing.) are combined in two stage.

When the pressure oil flows into the piston motor, the piston motor shaft rotates at high speed, and the power is input to the reduction unit section. In the reduction unit section, this high speed is reduced in two stages by the simple planetary gear reduction unit and has housing (72) with ring gear rotated, and consequently the output in low speed and high torque is obtained.

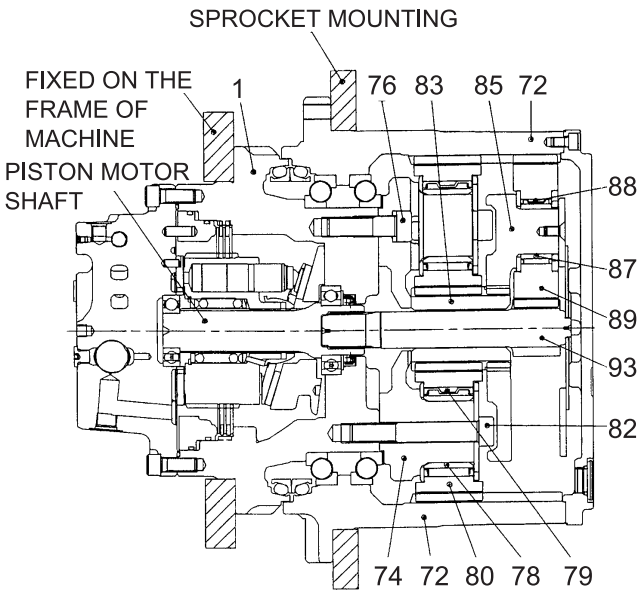


Fig. 24-83 Construction of reduction unit

(1) Operation of 1st stage reduction section

The 1st stage reduction section is made up of drive gear (93), planetary gear A (89), ring gear (72), holder (85), needle bearing (88) and inner race (87).

Planetary gear A (89) is engaged with drive gear (93). When drive gear (93) rotates clockwise, planetary gear A (89) rotates counterclockwise. On the other hand, it is also engaged with the ring gear, it kicks the tooth of the ring gear and attempts to revolve around drive gear (93).

This orbital motion in clockwise is transmitted to holder A (85) and holderA (85) starts rotating clockwise because planetary gear (89) is fixed on holder A(85) through the aid of needle bearing (88) in rotation free condition.

And holder A (85) is engaged with the 2nd stage sun gear B (83) with spline, and the rotation of this holder A (85) is transmitted to the 2nd stage sun gear B (83).

(2) Operation of 2nd stage reduction section

The 2nd stage reduction unit is made up of sun gear B (83), planetary gear B (80), ring gear (72), holder B (74), needle bearing (79) and inner race (78).

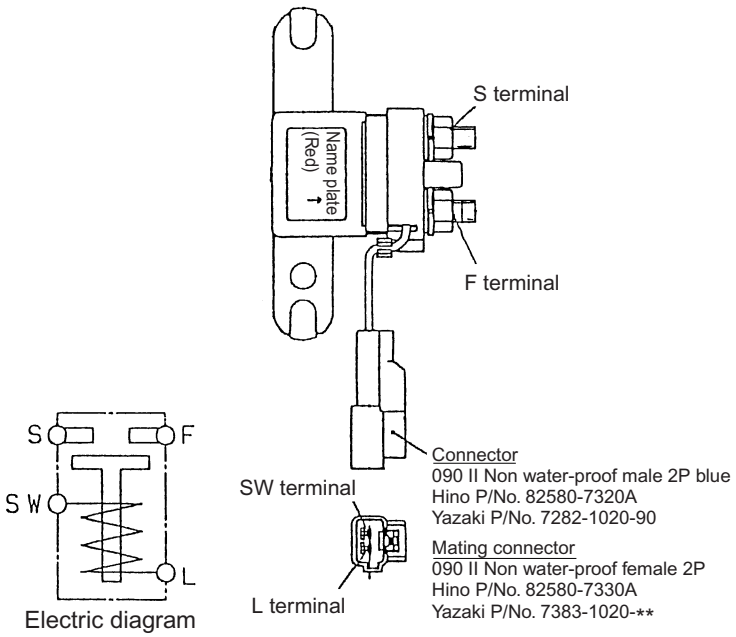
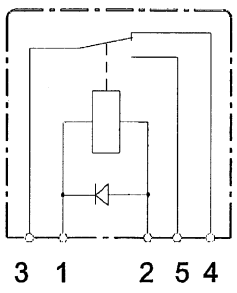
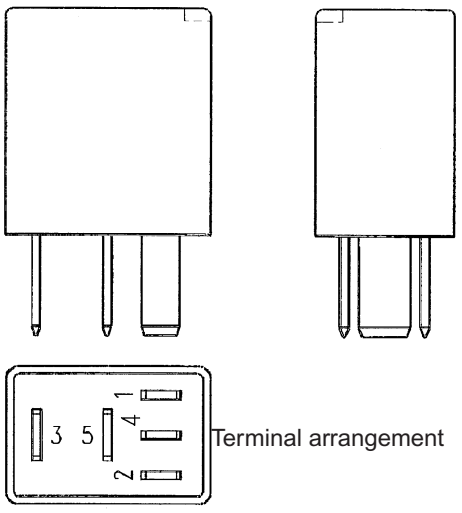
Planetary gear is engaged with sun gear B (83). When sun gear B (83) rotates clockwise, planetary gear B (80) rotates counterclockwise.

Planetary gear B (80) is fixed on holder B (74) through the aid of needle bearing (79) in rotation free condition, and holder B (74) is connected to flange (1) with bolts (76) (82) and the flange is not allowed to rotate because it is fixed on the frame of machine.

Therefore, planetary gear B (80) is not allowed to revolve differently to the 1st stage reduction section, but is allowed to rotate counterclockwise due to the installation position. And planetary gear B (80) is engaged with the ring gear and this axial motion in counterclockwise of planetary gear B (80) is transmitted to the ring gear and rotates the ring gear counterclockwise.

With the operation as described above, the housing cut on the inner bore of ring gear (72) receives the power of planetary gear A and B (89) (80) and rotates, and the power is transmitted to the driven section of the machine linked with housing (72) with ring gear.

Group	Code	Name		Parts No.
(SV) Solenoid	SV - 1	Swing parking brake SOL.	(YN35V00047F1) Solenoid valve assy	YN35V00051F1
	SV - 2	Power boost SOL		YN35V00050F1
	SV - 3	Two speed select SOL		↑
	SV - 4	Safety lock lever SOL		↑
(SW) Switch	SW - 1	Key switch		YN50S00026F1
	SW - 4	Swing parking brake release switch		YN50S00047P1
	SW - 5	Horn switch (RH)		YN50E00017P1
	SW - 7	E/G oil pressure switch		VHS835301471D
	SW - 8	Air filter clogging switch		YR11P00008S005
	SW - 10	Horn switch (LH)		YN50E00017P1
	SW - 11	Safety lock lever switch		YN50S00041F1
	SW - 13	Travel alarm switch (For Middle East)		YN50S00040DF
	SW - 15	Conflux/single select switch		YN50S00040DD
	SW - 17	Skylight wiper switch		YN50S00040D9
	SW - 19	Wiper interlock switch		YT50S00004P1
	SW - 20	Power boost switch (RH)		YN50E00017P1
	SW - 21	Power boost switch (LH)		↑
	SW - 26	Cab work light switch		YN50S00040D4
	SW - 27	Coolant level switch		VHS834601510A
	SW - 28	Water separator switch		VHS233002800A
	SW - 55	Boom work light switch		YN50S00040D1

File No. Name of part Part No. Use Applicable Machine	Specification	Description
R - 3 Relay VHS286201420A Glow relay YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	Hino P/No. S2862-01420A Rated voltage DC 24V Rated load 100A flow Min. operating voltage DC 18V or less 	
R - 4,5,6,8,9,23,24,25, 26,28 Relay YN24S00010P1 Safety relay Horn realy Work light relay Travel alarm relay Cab working light relay Auto idle stop relay 1, 2 Engine emergency stop relay Lever lock relay Alternator relay YN11 - 45001 ~ YQ11 - 06001 ~ LC10 - 07001 ~ YC10 - 03501 ~ LQ12 - 06001 ~ LL12 - 05001 ~	Maker Tyco Electronics Maker's p/No. V23074-A2002-A403 Type Micro relay A Rated voltage DC 24V Contact 1C * Accessory of relay box Pin assignment   Terminal arrangement	

25.1 BASIC SYSTEM OF AIR CONDITIONER (HVAC AIR CONDITIONER)

Air-conditioner is the unit which places evaporator and heater core parallel, and unifies a blower fan and an inside / outside air switching unit. And this unit changes hot air to cool air.

25.1.1 AIR CYCLE

- Heater
  Inside air or outside air is taken in through intake port and the air is passing through filter and heat exchange is performed with hot air (heating) at the heater core of air-con unit, and then the heated air blows off from grille through duct.

- Cooler
  Inside air or outside air is taken in through intake port and the air is passing through filter and heat exchange is performed with cold air (dehumidifying and cooling) at the evaporator of air-con unit, and then the cooled air blows off from grille through duct.

- Heater system
  The heater recycles (circulates) the cooling water in the engine, and the hot water delivered by the engine flows in the heater core of air-con unit and then heat exchange is performed.
  The intake air is heated and the heated air blows off from the grille provided on the inside of cab.
  The blow off air temperature is controlled by the temperature control switch on the control panel, and the operation is controlled by air mixing damper on the air-con unit.

(3) Characteristics of Refrigerant (Fig. 25-7)
In general, the fluid (general term of gas and liquid) has the following qualities:

1) As a gas under certain pressure is cooled down, it begins to condensate at a certain temperature to take a liquid state. The temperature at which condensation begins is unique to each substance (fluid) at a given pressure. The temperature determined by a given pressure is called saturation temperature.

2) Inversely to 1) above, the pressure at which a gas condenses for a temperature is determined. This pressure is called saturation pressure.
Fig. 25-7 illustrates the relationships between the saturation temperature and the saturation pressure in the case of refrigerant R134a used in the air-conditioner. At the temperature and the pressure on the lower righthand side of the curve in Fig. 25-7 the refrigerant take a gaseous state, while at the temperature and the pressure on the upper lefthand side of the curve, the refrigerant takes a liquid state.
Let us think of a case where an air-conditioner is operated in the midst of summer. As the refrigerant evaporates, it absorbs evaporation heat from the air of the compartment. In order to cool the inside of the compartment down to 25°C (77°F), the refrigerant must transform (evaporate) from a liquid to a gaseous state at a lower temperature. It can be seen from Fig. 25-7 that R134a under a pressure above the atmospheric pressure is capable of cooling the inside of the compartment sufficiently. (If a refrigerant that requires a pressure below the atmospheric pressure to cool it to a required temperature is used, air is mixed into the circuits, thereby deteriorating the performance of the cooling unit.) In the process in which gaseous refrigerant is brought back to a liquid state, the refrigerant is cooled and condensed by the outer air exceeding 35°C (95°F). Accordingly the refrigerant is capable of condensing at a pressure exceeding 1 MPa (145psi), as seen from Fig. 25-7.

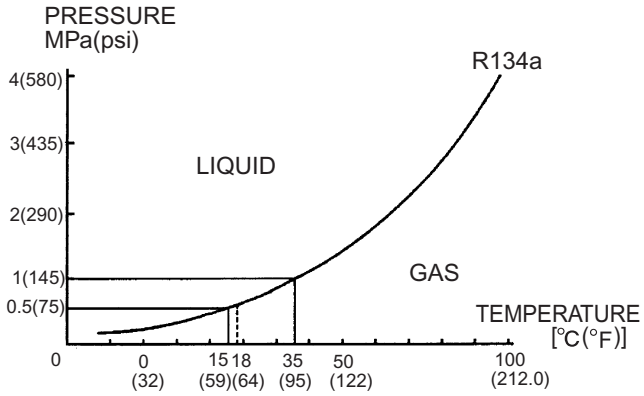


Fig. 25-7 Pressure-temperature characteristics of R134a

3) Replacing inner and outer air switching actuator
   a) Disconnect connector connected to the motor actuator.
   b) Remove intake rod from MA intake lever.
   c) Remove 3 plus screws and remove the motor actuator with MA intake lever from the unit.
   d) Remove the MA intake lever from the removed motor actuator, and install it on new motor actuator by the reverse procedure of removal.

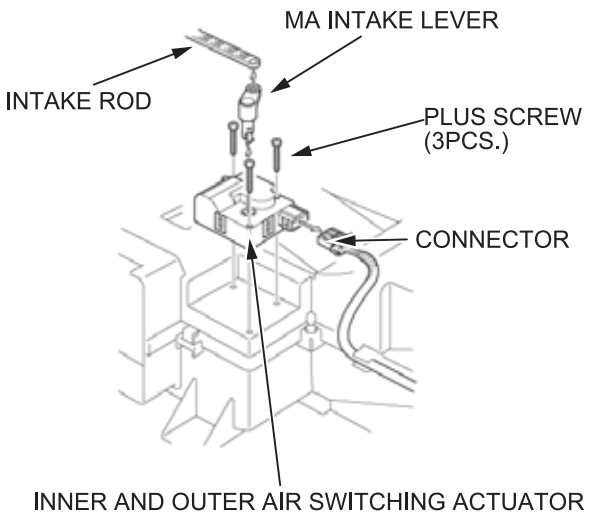


Fig. 25-24

25.7.2 STRUCTURE AND OPERATION OF EACH FUNCTIONAL PARTS AND THE INSPECTION

(1) Control panel and control unit

The control unit is integrated into control panel, and processes the signal input by each sensor, etc. and the signal input by each switch through control panel with the function of the built-in micro computer, and comprehensively controls each actuator (Inner and outer air flow select, air mix), fan motor and compressor on the output side.

And the self-diagnosis performance is provided to facilitate the trouble shooting.

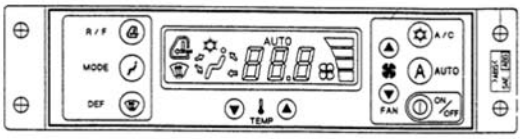


Fig. 25-34

(2) Blower controller (TKS-B215A1)

The power transistor shifts the fan motor into variable speed with base current from the control unit.

	TERMINAL NO.			CONTINUITY
	1	2	3	
TESTER	+		−	CONTINUED (4.7 kΩ ±5%)
	−	+		NOT CONTINUED
	+	−		CONTINUED(DIODE PARALLEL AND FORWARD DIRECTION FLOW)

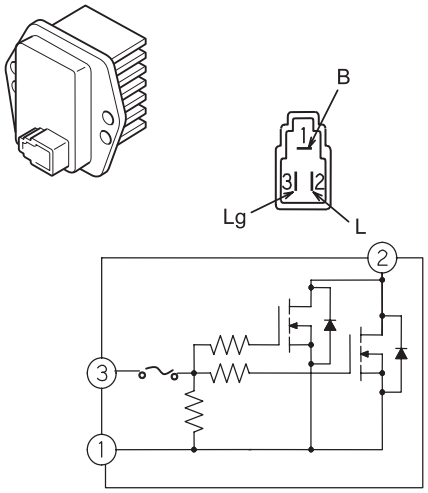


Fig. 25-35

In normal operation

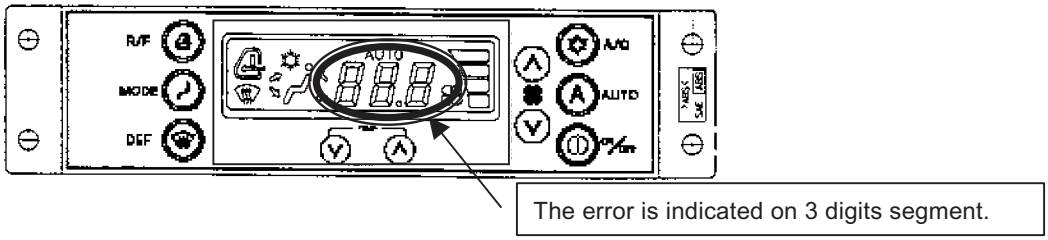
1. Disconnect the connector of blower amplifier.
2. Check continuity between terminals on the blower amplifier side.

* The installing position is provided on the left side of air-con unit.

25.9 SELF DIAGNOSIS FUNCTION ON DISPLAY OF PANEL

The failure of motor actuator and each sensor can be identified on the display of panel.

25.9.1 POSITION OF INDICATION FOR FAILURE.



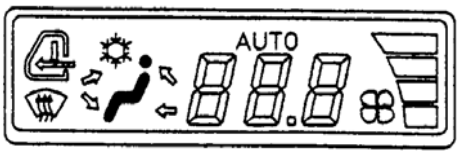
25.9.2 EXPLANATION OF INDICATION FOR FAILURE.

(1) Failure of Motor Actuator

1) HL.E is indicated on 3 digits segment.

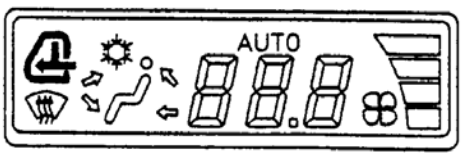
Check harness or connector to motor actuator for the air mix damper for disconnection.

2) MODE  is flickering.



Check harness or connector to motor actuator for the air outlet damper for disconnection.

3) R/F  is flickering.



Check harness or connector to motor actuator for the inner and outer air damper for disconnection.

Note) The above indication and flickering does not function if the harness and connector were disconnected under the condition the panel ON/OFF switch is ON.
After the failure was occured, if the panel ON/OFF switch is turned ON, it functions.
After correction of failure, if the main switch is not switched from OFF to ON the error indication and flickering are not released.

32. ATTACHMENT

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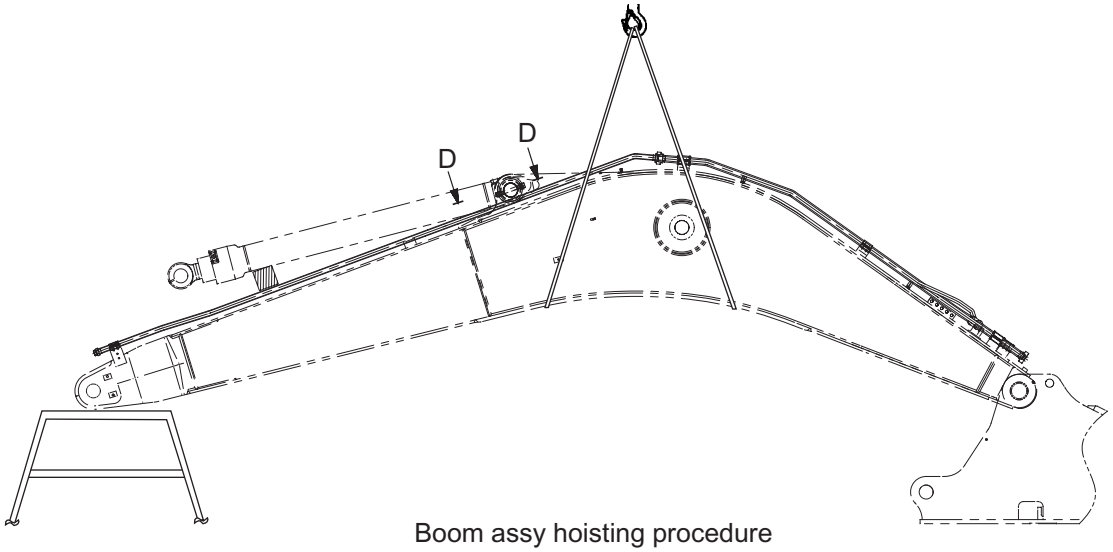
Book Code No. **S5LQ3214E01**

(8) Hoisting boom assy
Hoist and remove boom assy.

Weight of single boom : 1,980 kg (4,360 lbs)



Boom assy hoisting procedure

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

(10)Removing and installing arm cylinder

1) Lift up arm cylinder (2) with nylon sling so that the head of cylinder is not loaded.

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

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

:36 mm

:12 mm

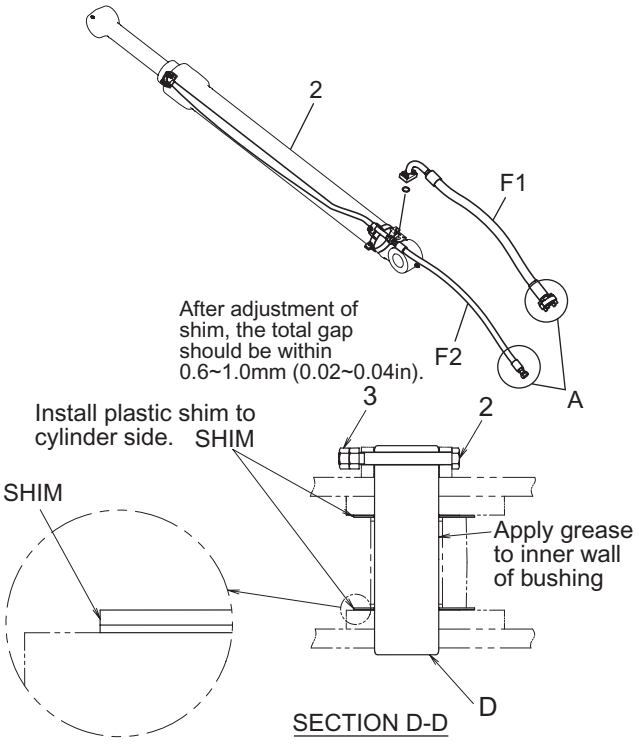


Fig. 32-21 Removing arm cylinder

3) Removing arm cylinder head pin (D)
Loosen nut (3), remove capscrew M20×165 (2) and pull out pin (D).

: 30mm

4) Removing arm cylinder (2)
Weight of arm cylinder : 331kg (730 lbs)

32.2.1.3.5 REMOVING PIN BUSHING

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

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

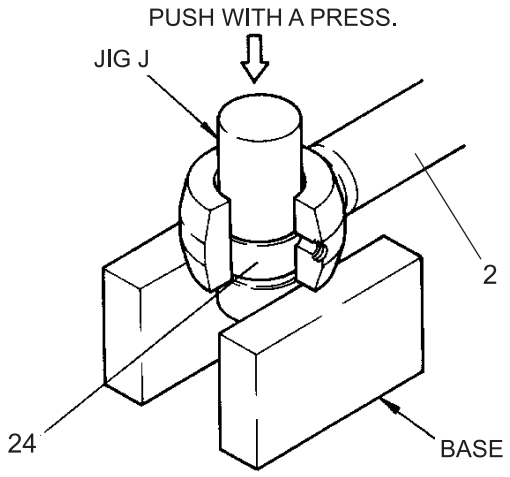


Fig. 32-44 Drawing out pin bushing (24)

32.2.1.4 CLEANING

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

⚠CAUTION

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

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

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

32.2.1.5 ASSEMBLING PIN BUSHING

Start assembling the following sub assy

- Cylinder tube assy
- Piston assy
- Rod cover assy

32.2.1.5.1 ASSEMBLING PIN BUSHING

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

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

⚠CAUTION

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

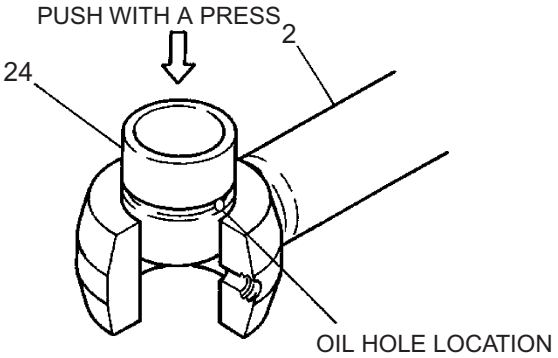


Fig. 32-45 Press fitting of pin bushing (24)

Special Jig No. List

(1) For jigs for rod cover, select jig corresponding to respective rod diameter.

(2) For jigs for piston, select jig corresponding to the cylinder bore.

Table32-6

	Application rod diameter (mm)	Kit No. of maker
Jig for rod cover removing & installing	65	3006J-56001
	70	3007J-06001
	75	3007J-56001
	80	3008J-06001
	85	3008J-56001
	90	3009J-06001
	95	3009J-56001
	100	3010J-06001
	105	3010J-56001
	110	3011J-06001
	115	3011J-56001
	120	3012J-06001
	Application cylinder bore (mm)	Kit No. of maker
Jig for seal ring inserting & correcting	95	3009J-51001
	100	3010J-01001
	105	3010J-51001
	110	3011J-01001
	115	3011J-51001
	120	3012J-01001
	125	3012J-51001
	130	3013J-01001
	135	3013J-51001
	140	3014J-01001
	145	3014J-51001
	150	3015J-01001
	160	3016J-01001
	170	3017J-01001

[MEMO]

(7) Remove panel assy (23)

1) Remove 4 nuts (4) M10.

2) Remove panel assy (23).

: 17 mm

Weight : 10kg (22 lbs)

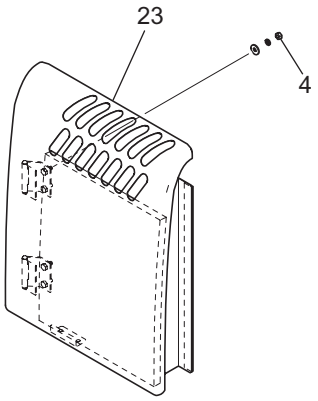


Fig. 33-17 Removing panel assy (23)

(8) Remove panel assy (22)

1) Unlock and open panel assembly (22).

2) Remove 4 nuts (4) M10.

3) Remove panel assy (22).

: 17 mm

Weight : 17kg (37 lbs)

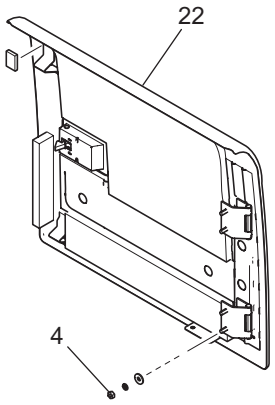


Fig. 33-18 Removing panel assy (22)

(9) Remove guard assy (16) and guard (14), (15).

1) Remove 8 sems bolts, M12×25, and guard assy (15), (16), (14) in order.

: 19 mm

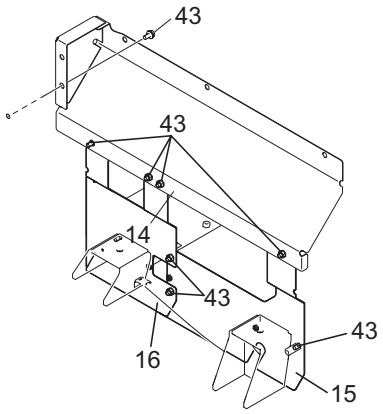


Fig. 33-19 Removing guard assy (16) and guard (14), (15).

(10)Remove pillar (11)

1) Remove 4 sems bolts (44) M12×30 and remove pillar.

: 19 mm

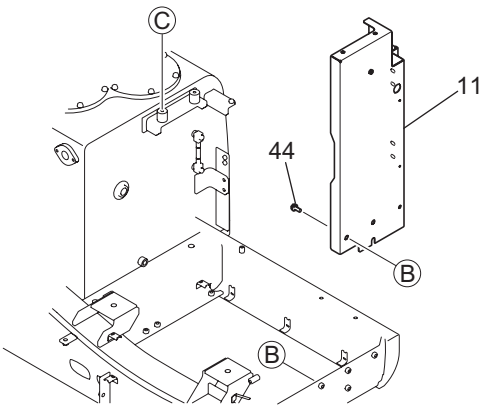


Fig. 33-20 Removing pillar (11)

(5) Connection of suction hose (A3)(See Fig. 33-34)
   1) Apply PERMATEX on pipe side of hose connection and insert it.
   2) Put the hose with clip (A13).
      Tightening torque : 5.39 N•m (4.0 lbf•ft)

(6) Assembling return element
   Assemble filter element by the use of element kit (B-100). (See Fig. 33-33,Fig. 33-39)

Note

1. Two elements (D) are used as one set.
2. Replace O-ring (C) and packing (F) with new ones respectively.

---

(7) Install return element. (See Fig. 33-33)

(8) Installing suction strainer (B2)

(9) Tighten sems bolts (C5) M10×25 that attach tank covers (C2), (C3).
   M10 Tightening torque : 46.1 N•m (34 lbf•ft)

⚠CAUTION

Replace O-ring fitted on the back side of tank cover with new one.

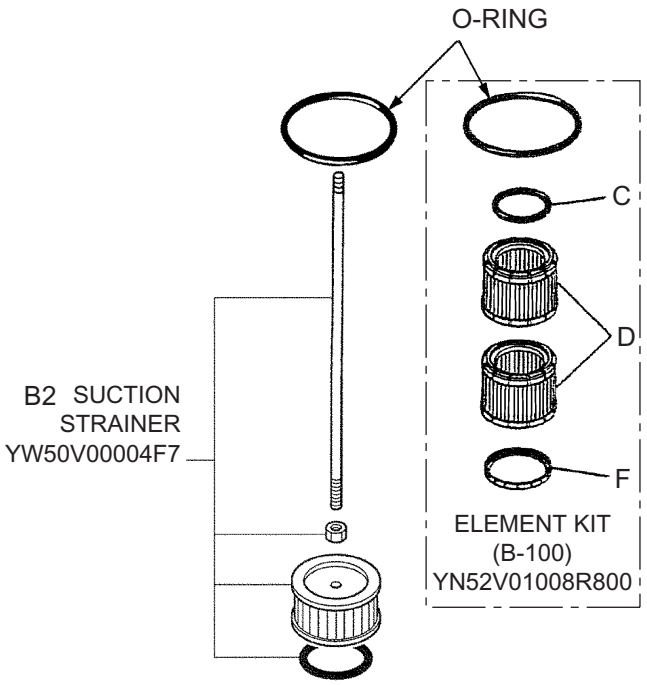


Fig. 33-39 Element & suction strainer

33.1.12 RADIATOR & OIL COOLER

33.1.12.1 PREPARATION FOR REMOVAL

(1) Bleed air from the hydraulic tank and install the suction stopper.(See 33.1.7 and 33.1.8)

(2) Remove bonnet assy (31)
(See 33.1.4 GUARD)

(3) Remove battery (See 33.1.3 BATTERY)

(4) Remove beam (4). (See 33.1.4 GUARD)

(5) Open panel assy (21). (See 33.1.4 GUARD)

(6) Removing under cover installed on lower side of radiator.

1) Remove 2 sems bolts (10) M12×30.

2) Remove cover (4).

: 19 mm

(7) Drain down of radiator
Put container 18L (4.8gal) under drain valve hose for draining water.
[Water capacity of radiator : 5.5L (1.5gal)]

(8) Remove hose from radiator sub tank (1)
Remove clip of radiator cap side and disconnect hose (8).

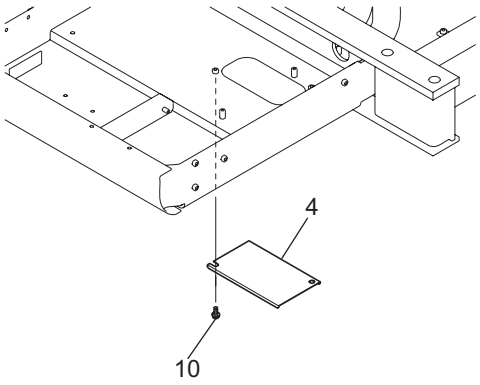


Fig. 33-55 Removing under cover (4)

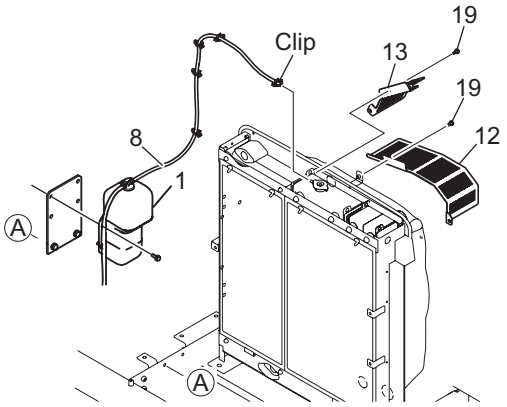


Fig. 33-56 Removing hose of sub tank (1)

CAUTION

Do not loosen the joints of the hoses related to the air-conditioner. Otherwise the refrigerant leaks.

(9) Move air-conditioner condenser and receiver tank

1) Loosen 2 sems bolts (23) M8×25 and 2 sems bolts (6) M10×25.

: 13 mm, 17 mm

2) Move a set of air-conditioner condenser and receiver tank.

(10) Disconnect connector of coolant level switch (B5). (See Fig. 33-58)

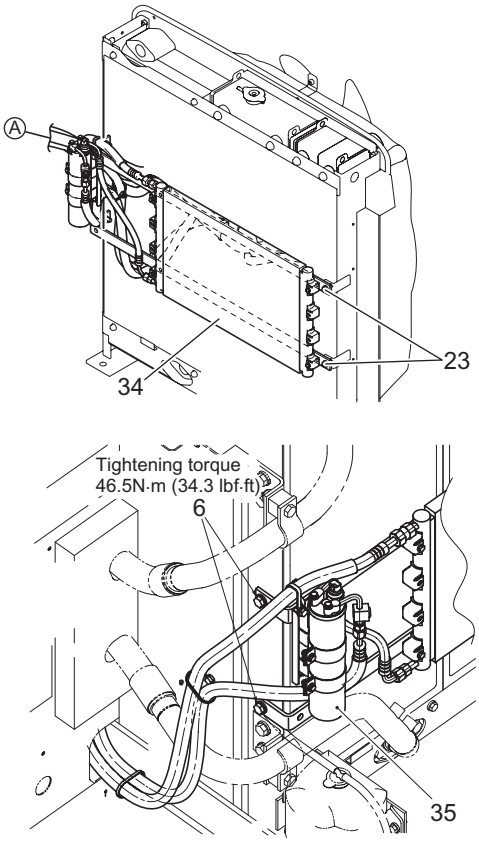


Fig. 33-57 Moving condensers and receiver tank

33.1.15 CONTROL VALVE

33.1.15.1 PREPARATION FOR REMOVING

(1) Remove guard (6)
(See 33.1.4 GUARD)

(2) Remove under cover (5).
(See 33.1.5 UNDER COVER)

(3) Install the suction stopper to the hydraulic oil tank.

(4) Remove the hoses in Fig. 33-70 and Fig. 33-71.

Note

Mark each hose with a port name before removing it.

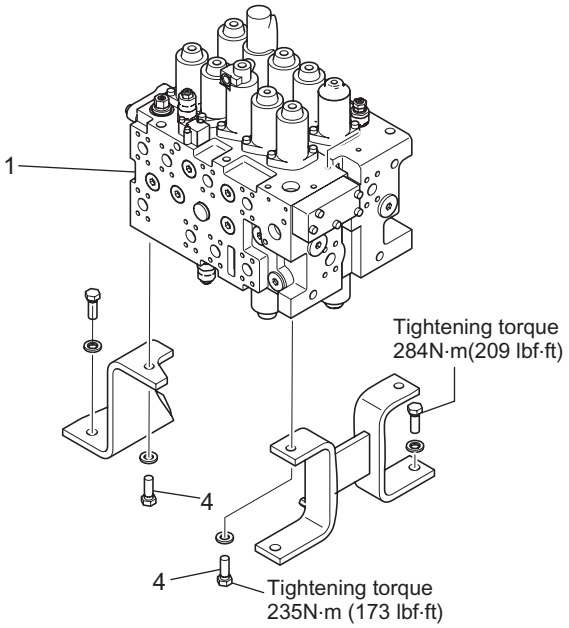


Fig. 33-69 Removing the standard main control valve

33.1.15.2 REMOVAL

(1) Remove 3 capscrews (4) M16×45, and remove control valve (1) by hoist.

: 24 mm
Weight :Approx. 235kg (518 lbs)

33.1.15.3 INSTALLATION

(1) Installing is done in the reverse order of remove.

1) Install control valve by tightening 3 capscrews (4) M16×45.

: 24 mm
Tightening torque : 235 N•m (173 lbf•ft)

2)

Tread size	Ports	Connector / Bolt			Hose nut		Remarks
		Name	Opposing flats	Tightening torque N·m (lbf·ft)	Opposing flats	Tightening torque N·m (lbf·ft)	
PF1/4	Pss,PLc2,PBp1,PBp2,PL, PB1,PTb,PCa,PCb,PCc	ORS Joint	19	36 (27)	19	29 (21)	
PF3/8	PAa1,PBa1,Pab,PBb,Pac, PBc,PAL,PBL,Par,PBr,Pas, PBs,PAa2,PBa2,Pao,Pbo,DR		22	74 (55)	22	49 (36)	
PF3/4	MU		36	162 (119)	36	118 (87)	
M10	Ar,Br,AL,BL,As,Bs,Aa,Ba,Ac,Bc	Sems bolt	14	70.6 (52.1)	—	—	
	Ab,Bb		14	57 (42)	—	—	
M12	P1,P2		17	62.2 (45)	—	—	
	T1,T2		17	96 (70)	—	—	

(2) Check for oil leak and operation.

(6) Remove capscrew for installation
Attach eye bolt, lift it up temporarily, and remove 3 capscrews (C2) M12×25.

: 19 mm
(See 11.7 SPECIAL TOOLS No.9 Plug)

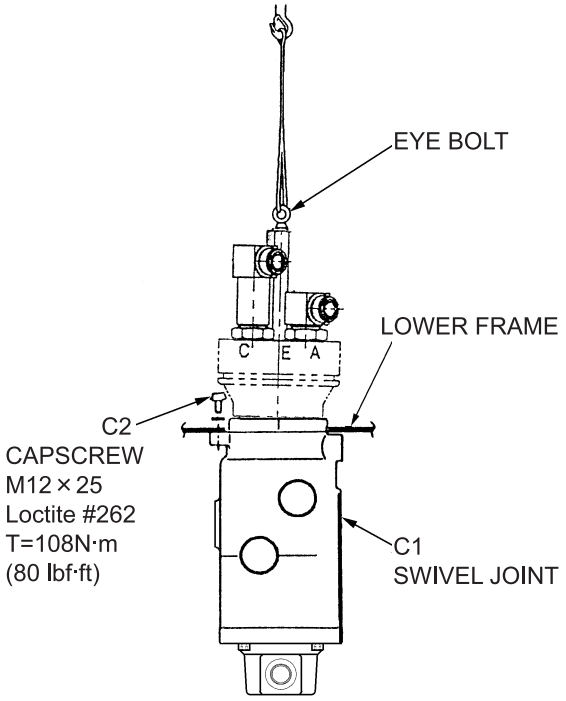


Fig. 33-84 Removing capscrew for installation

(7) Slinging the swivel joint
Weight : Approx. 24kg (53 lbs)

33.1.19.3 INSTALLATION

(1) Installing is done in the reverse order of removing.
Piping tightening torque

Size PF	Tool. HEX	Tightening torque N·m (lbf·ft)	
		O-ring type Connector	Hydraulic hose
1/4	19	36 (27)	29 (22)
3/8	22	74 (54)	49 (36)
1/2	27	108 (80)	78 (58)
3/4	36	162 (120)	118 (87)
1	41	255 (180)	137 (100)
1-3/16-12UN	36	–	177 (130)

(2) Check for oil leak and the hydraulic oil level.

(3) Check for operating.

(3) Installing procedure

1) Precautions to be exercised in installation
Assembly is a reverse order of disassembly, but notice the following.

1. Repair scored parts at disassembly. Get replacements ready beforehand.
2. Wash parts sufficiently in cleaning oil and dry them with jet air.
3. Do not forget to coat the sliding areas and bearings with clean hydraulic oil.
4. In principle, replace sealing parts such as O-rings and oil seals.
5. Tighten socket bolts and plugs to specified torques in this manual, using a torque wrench.
6. Do not mix up front pump parts with rear pump parts.

2) Installing swash plate support
Attach swash plate support (251) to pump casing (271) by tapping the swash plate support lightly with a plastic hammer.

- When the servo piston, the tilting pin, the stopper (L) and the stopper (S) have been removed, install them to the pump casing beforehand.
- When tightening servo piston and tilting pin, use a jig so as not to damage the head of the tilting pin and feedback pin.
  Coat the screwed part with Loctite #262.

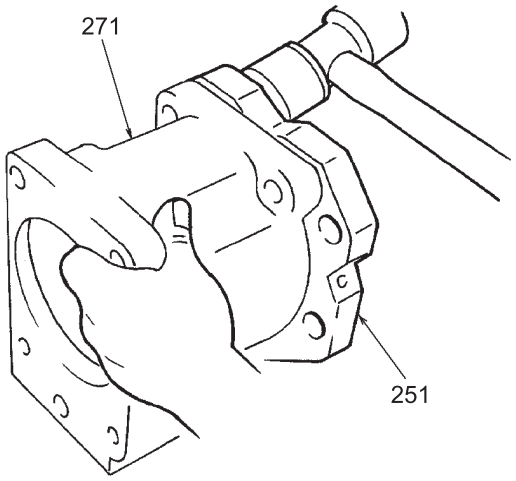


Fig. 33-101 Installing swash plate support (251)

3) Installing swash plate
Place the pump casing with its mounting surface of the regulator facing down, insert the tilting bushing of the swash plate into tilting pin (531), and fit swash plate (212) to swash plate support (251) properly.

- Confirm by the fingers of your both hands that swash plate moves smoothly.
- The shaft be installed easily if grease is applied to the sliding parts of swash plate and swash plate support.
- Do not damage the sliding surface of shoe plate.

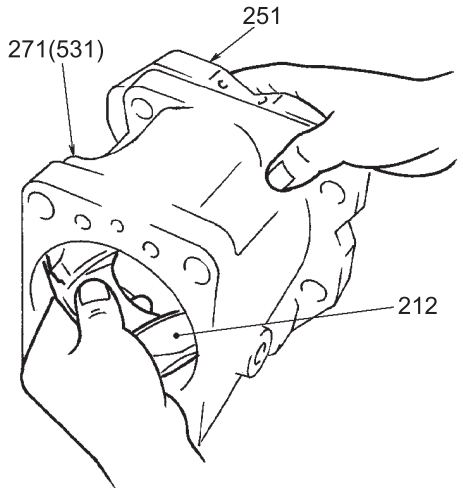


Fig. 33-102 Installing swash plate (212)

6) Remove compensating parts
(See Fig. 33-109 (D) section, See Fig. 33-111, Fig. 33-112)
After removing the cover (C) (629) sub assy, take out outer spring (625), inner spring (626) and spring seat (624) from the compensating part. Then take out adjust stem (645), pilot spring (646) and spring seat (644) from the pilot part.

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

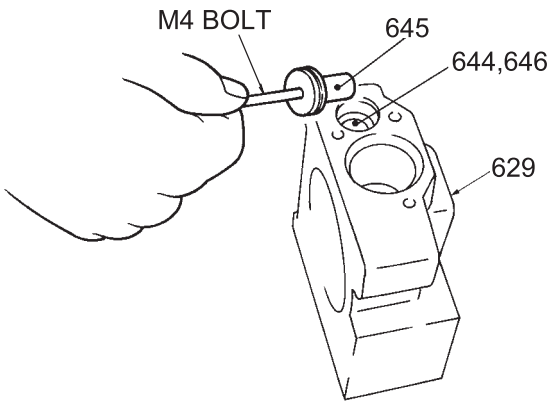


Fig. 33-112 Removing compensating parts

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

: 5 mm

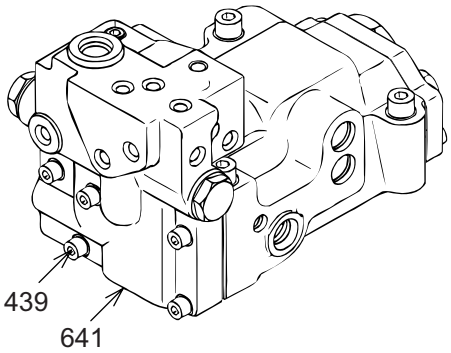


Fig. 33-113 Removing pilot cover (641) and set spring (655)

8)Remove spring seat, return spring and sleeve
(Fig. 33-109 (A) section)
Remove snap ring (814). Then remove spring seat (653), return spring (654) and sleeve (651).

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

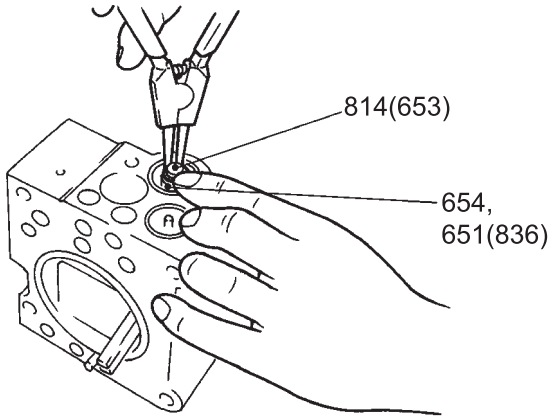


Fig. 33-114 Removing spring seat (653), return spring (654) and sleeve (651)

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

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

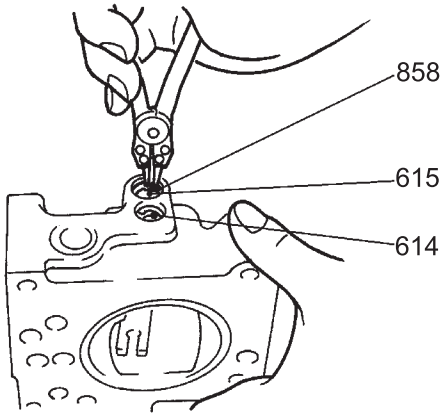


Fig. 33-115 Removing adjust plug (615)

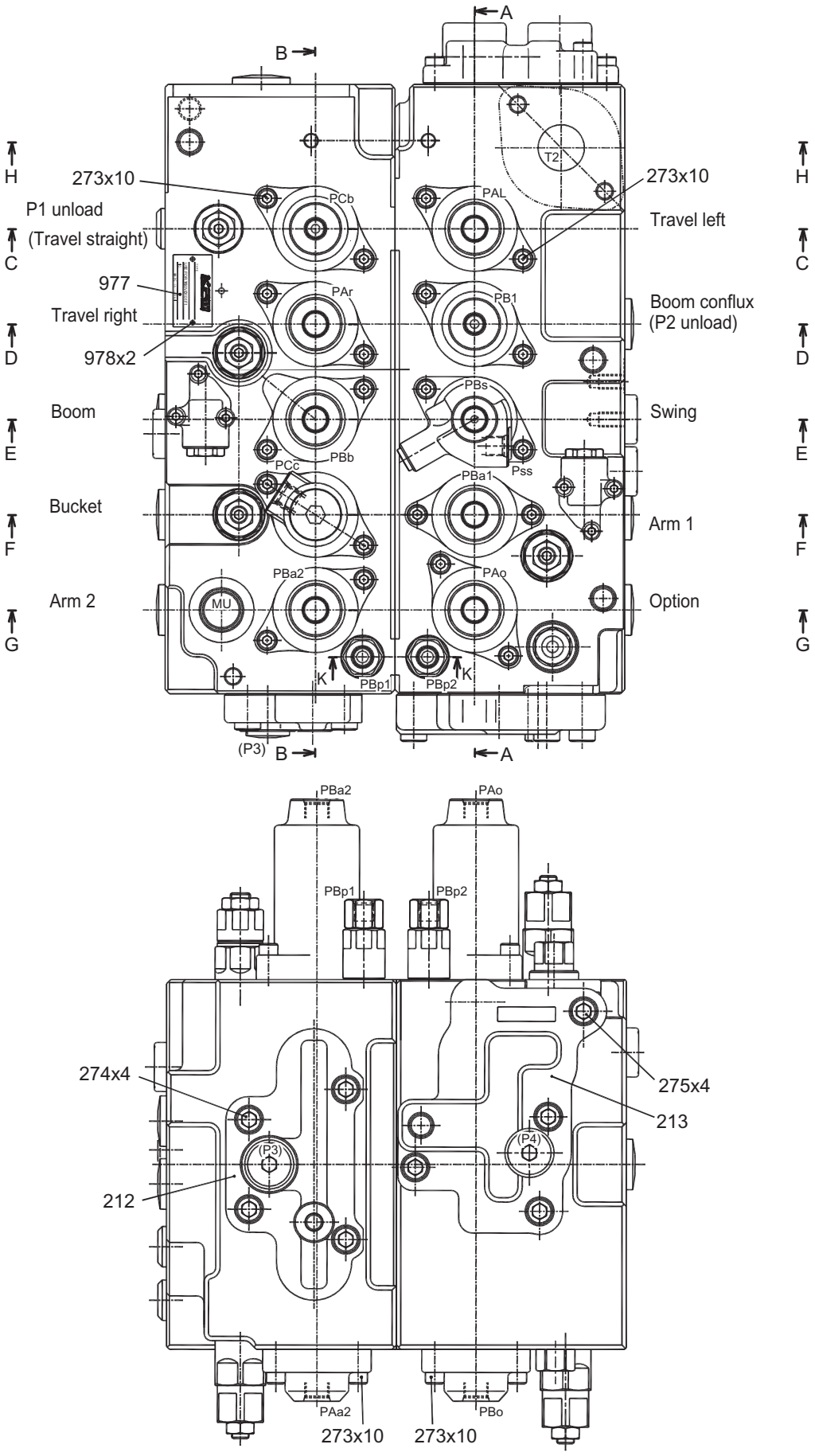


Fig. 33-138 Section (2/6)

(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.

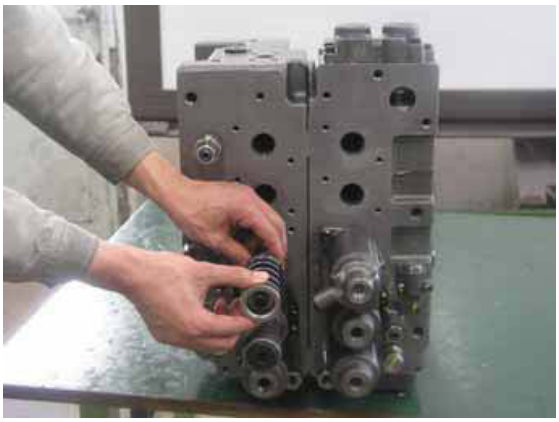


Fig. 33-154 Drawing out boom spool (301) assy

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).

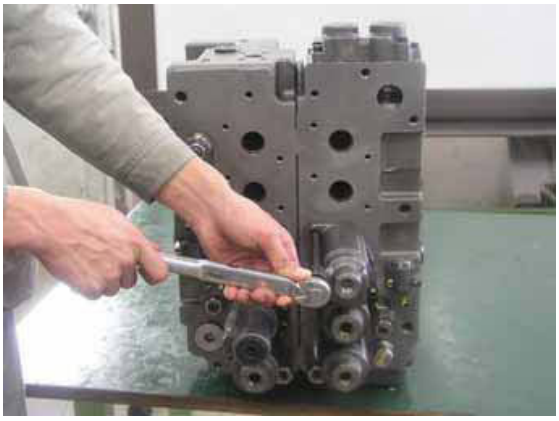


Fig. 33-155 Removing spring cover sub (204)

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

33.2.2.4.1 Installing check valve

(1) Load check valve, conflux check valve, and so on
Attach poppet (511) and spring (521) in place, place O-ring (164) in plug (551) and tighten them to the specified torque. (9 places)

(2) Load check valve of swing section
Attach poppet (511) and spring (523) in place, place O-ring (164) in plug (556) and tighten them to the specified torque. (1 place)

(3) Load check valve of arm 2 section
Attach poppet (515) and spring (521) in place, place O-ring (164) in plug (551) and tighten them to the specified torque. (1 place)

(4) Lock valve section
Attach poppet (514) and spring (524) in place, place O-ring (164) in plug (556) and tighten them to the specified torque. (2 places)

(5) Main relief valve section
Attach poppet (512) and spring (522) in place, place O-ring (562) in plug (552) and tighten them to the specified torque. (2 places)

CAUTION

Take care to prevent misassembling of parts and assembling position error because the parts in (1) to (5) are similar in shape.

33.2.2.4.2 Assembling plate

(1) Place O-rings (162), (163) in casing.

(2) Attach plates (212), (213) and tighten socket bolts (274), (275) to the specified torque.

Replace control valve so that this plate face directs downward.

33.2.2.4.3 Assembling back pressure check valve

(1) Attach boost check valve poppet sub (517), by-pass check valve poppet (518) and springs (527), (528).

(2) Attach O-rings (264), (266) in back pressure check valve cover, attach it to casing A (101) and tighten socket bolt (278) to the specified torque.

33.2.2.4.4 Assembling lock valve selector sub

(1) Attach lock valve selector sub (211) to the casing and tighten socket bolt (211-171) to the specified torque.

33.2.2.4.5 Assembling by-pass cut valve

(1) Attach by-pass cut valve (606) to casing and tighten it to the specified torque.

CAUTION

Take care to prevent drop of poppet (606-201) and spring (606-202) when attaching by-pass cut valve.

33.2.3 PILOT VALVE (ATT)

33.2.3.1 CROSS-SECTIONAL VIEW

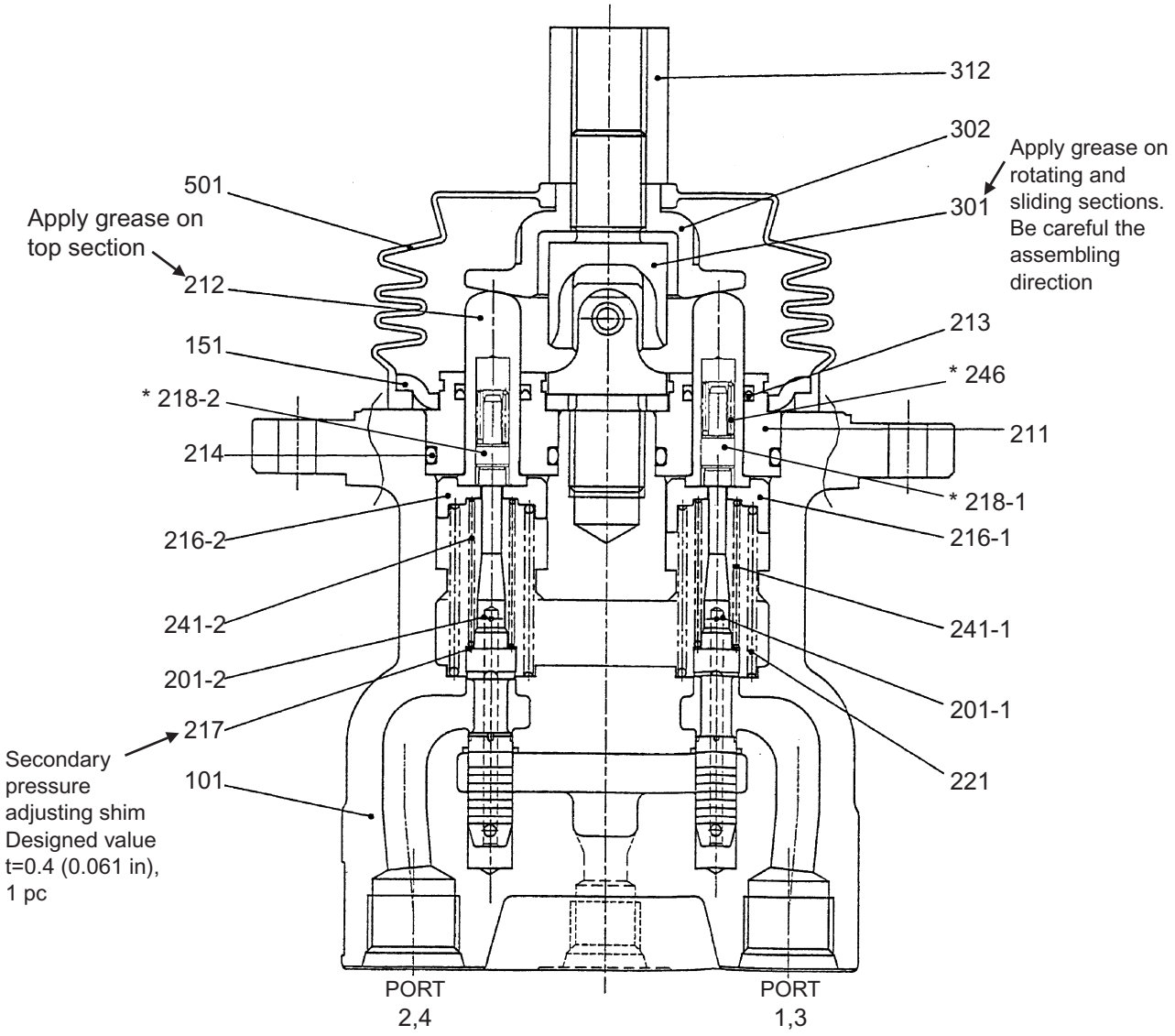


Fig. 33-180 Pilot valve (For ATT)

Apply loctite #277 to areas marked ☆

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

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

33.2.4 PILOT VALVE (FOR TRAVEL)

33.2.4.1 CONSTRUCTION

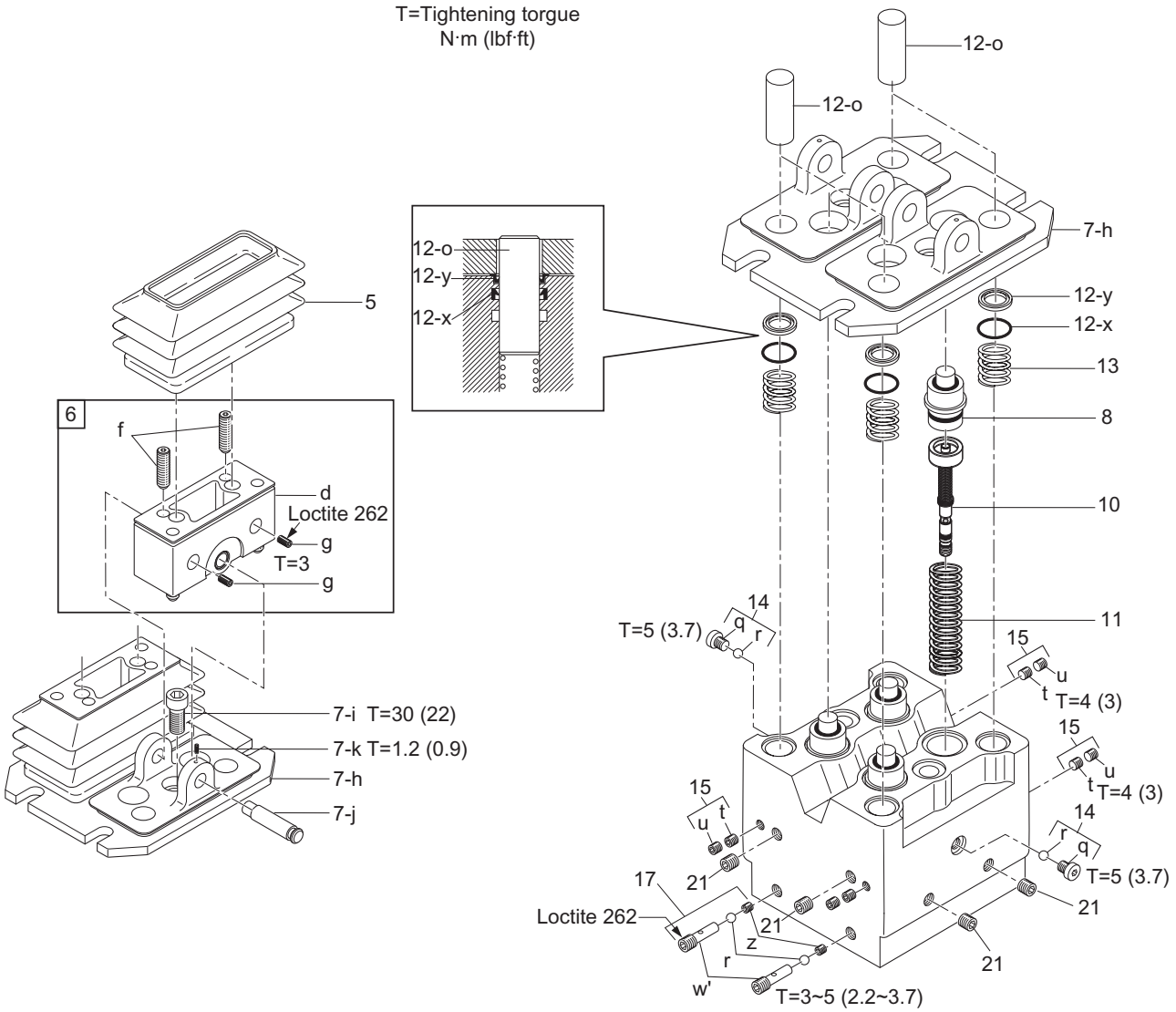


Fig. 33-205 Exploded view of pilot valve

No.	Parts	Q'ty	No.	Parts	Q'ty
5	Rubber boots	2	12-x	Seal ø14×20×3	6
6	Foot pedal (Switch plate)	(2)	12-y	Wiper ring	6
6-d	Switch plate	2	13	Damper spring	4
6-f	Regulation screw M8×28	4	14	Check valve kit	(2)
6-g	Set screw M5×8	4	14-q	Plug M8	2
7	Retaining plate kit	(1)	14-r	Ball M6, 35	2
7-h	Plate	1	15	Orifice	(4)
7-i	Capscrew M10×20	2	15-u	Plug M6	4
7-j	Shaft	2	15-t	Orifice M6, ø0.6	4
7-k	Set screw M4×10	2	17	Shuttle valve kit	(2)
8	Flange kit	4	17-w'	Shuttle valve & orifice	2
10	Control spool	4	17-r	Ball M6, 35	2
11	Return spring	4	17-z	Orifice M5, ø0.8	2
12	Damper flange kit	(4)	21	Plug	4
12-o	Damper plunger ø14	4			

Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty	Tightening torque N•m (lbf•ft)	No.	Parts	Q'ty
	1	INNER RING	1		22	NEEDLE BEARING	1
	2	OIL SEAL	1		23	SNAP RING	1
	3	TAPERED ROLLER BEARING	1		24	CYLINDER	1
	4	BACKING SPRING	1		25	HOUSING	1
	5	CAM PLATE	1		26	COLLAR	1
	6	RETURN PLATE	1		27	SNAP RING	1
	7	PISTON ASSY	9	78 (58)	28	BYPASS VALVE ASSY	2
	8	LINING PLATE	3		29	BACK-UP RING	2
	9	PLATE	3		30	O-RING ; 1B P18	2
	10	O-RING	1		31	O-RING ; 1BP12	2
	11	PISTON	1		32	COVER	1
	12	O-RING	2	78 (58)	33	RELIFE VALVE	2
	13	SPRING	19		34	O-RING ; 1B P26	4
	14	PISTON	2	284 (209)	35	SOCKET BOLT ; M16×60	4
29 (22)	15	CAP	3		36	CHECK VALVE	2
	16	O-RING ; 1B P11	3		37	SPRING	2
	17	PARALLEL PIN	2	137 (101)	38	CAP	2
	18	SCROWAVE	4		39	BACK-UP RING ; T2 P26	2
	19	TEFLON RING	4		40	PLUG	1
	20	BUSH	4		41	PISTON	2
	21	BALANCE PLATE	1		42	TEFLON RING	2

6) Assembly friction plate and lining plate
Assemble friction plate (8) and lining plate (9).

Note

Apply hydraulic oil to each side.

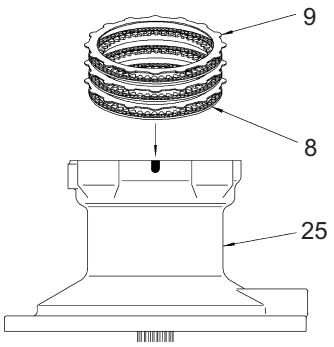


Fig. 33-253 Assembling friction plate & lining

7) Insert O-rings
Insert O-rings (10) into housing (25). Insert O-ring (12) into piston (11).

Note

Lubricate O-rings (10), (12) with grease.

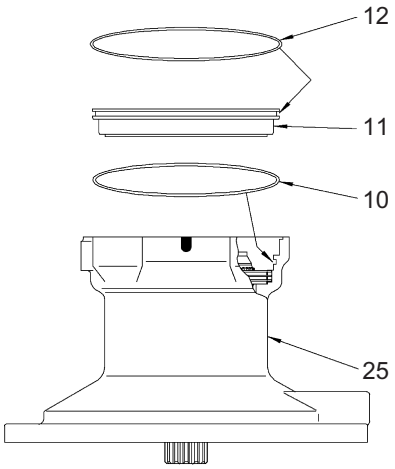


Fig. 33-254 Inserting O-rings

8) Assembly of brake piston
Lubricate specified hydraulic oil on outer sliding face of piston (11) and assemble brake piston to housing (25).

Note

It is too tight to assemble piston (11) because O-rings (10) (12) are fitted, therefore it is recommended to push piston (11) horizontally by hands at once.

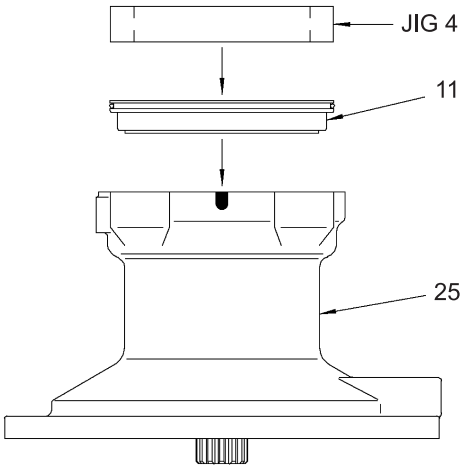


Fig. 33-255 Assembling brake piston

9) Assembly of spring ((13), brake unit)
Assemble spring (13) to piston (11) of brake unit.

Note

Insert spring (13) into original position.

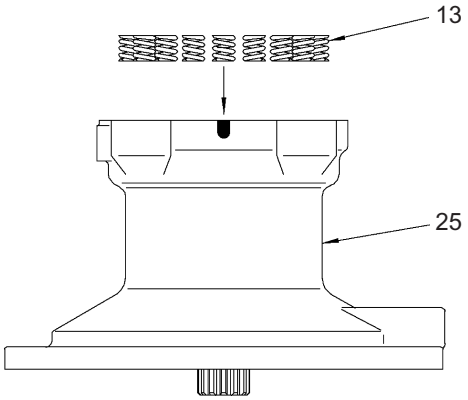


Fig. 33-256 Assembling springs

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

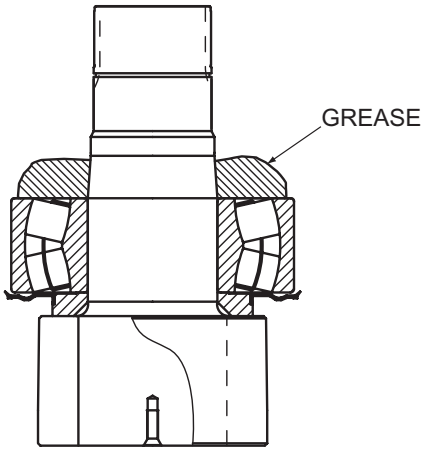


Fig. 33-277 Apply grease

(3) Placing pinion shaft assy in

1) Place housing (15) 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.

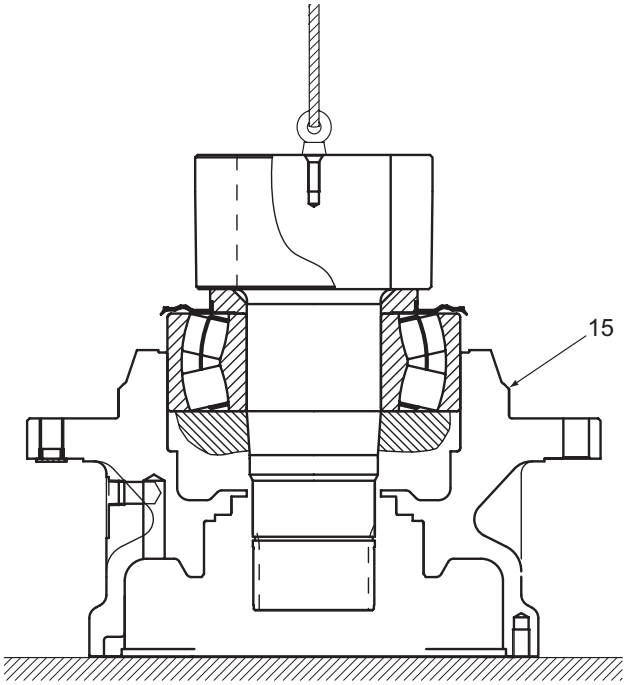


Fig. 33-278 Placing pinion shaft assy in

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

4) Fit oil seal (14) in housing (15) 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 (14) lip with grease.
- Insert it horizontally giving attention to the lip of oil seal so as not be damaged.

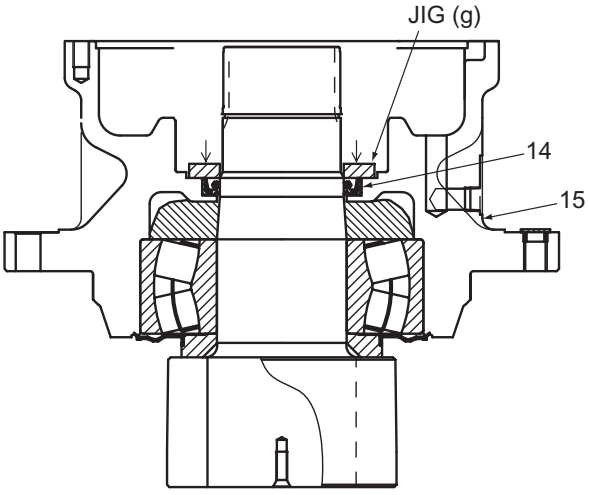


Fig. 33-279

33.2.6 SWIVEL JOINT

33.2.6.1 CONSTRUCTION VIEW

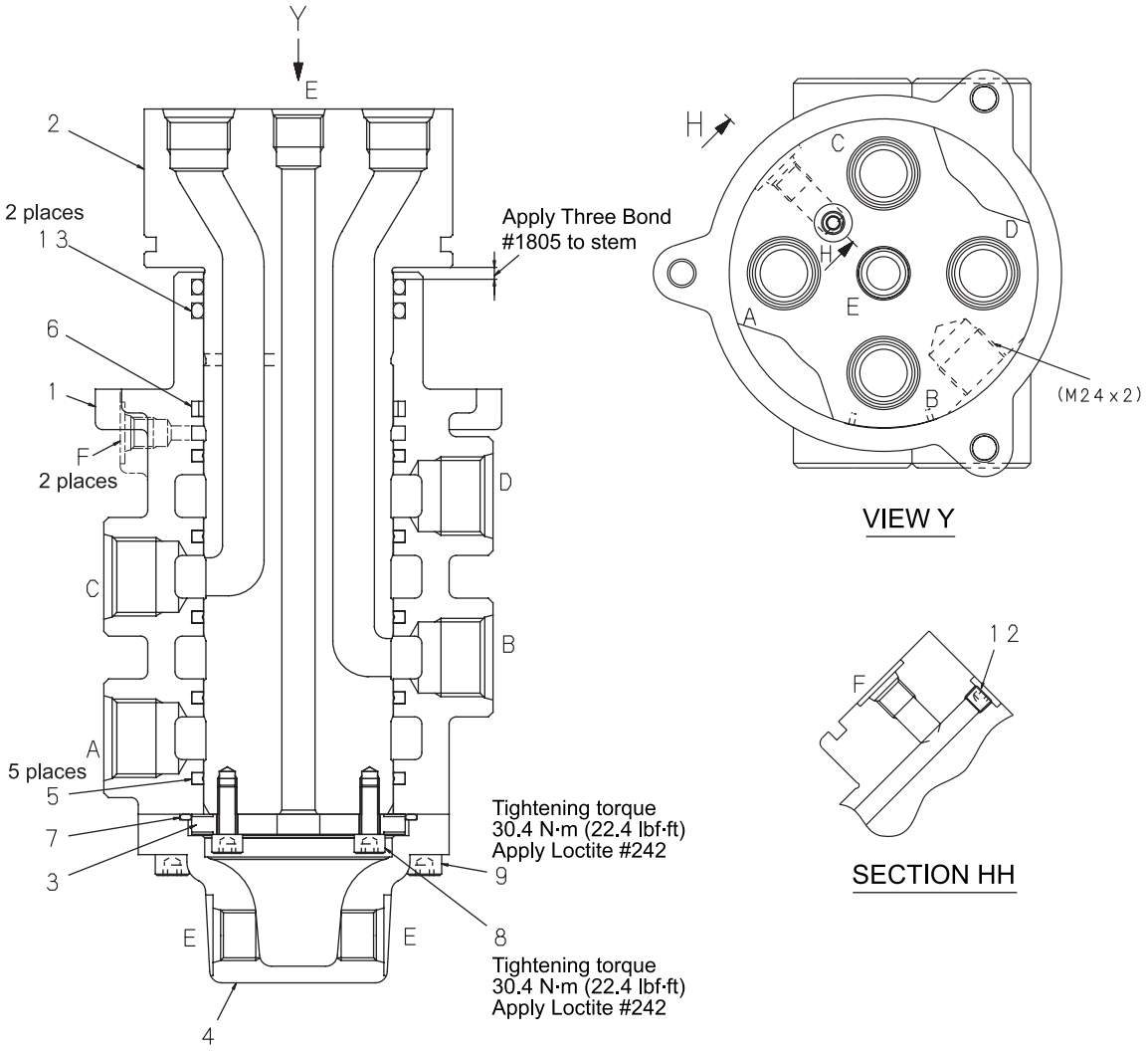


Fig. 33-290 Construction of swivel joint

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			

34. TRAVEL SYSTEM

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

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

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

6) Installing plate (4)
Mount upper roller (1) on the stand jig (f) and attach plate (4) to the end face of the shaft with bolt (9).
: 10mm,
Tightening torque : 115N•m (85 lbf•ft)

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

- Apply grease to O-ring.

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

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

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

11) Installing plug (10)
Wind seal tape around plug (10) and screw it into the plug hole of cover (4).
: 6mm,
Tightening torque : 23N•m (17 lbf•ft)

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

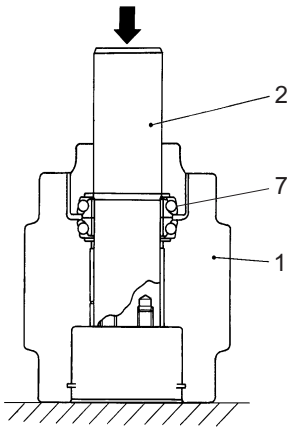


Fig. 34-20 Inserting shaft

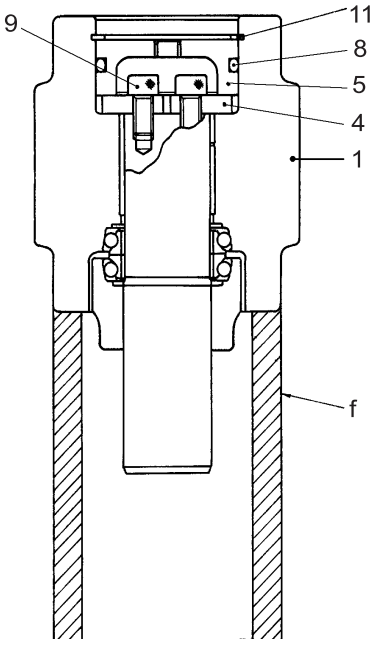


Fig. 34-21 Installing cover

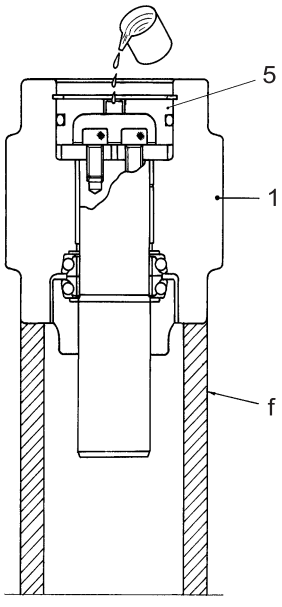


Fig. 34-22 Filling oil

34.1.4.7 TOOLS AND JIGS

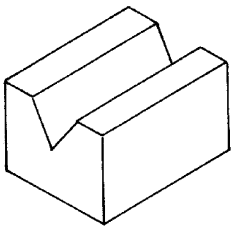
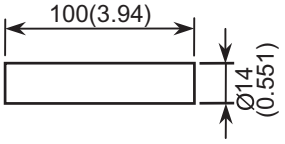
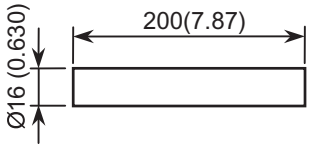
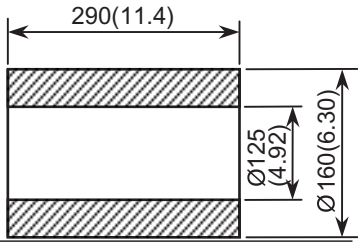
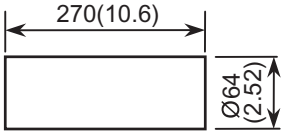
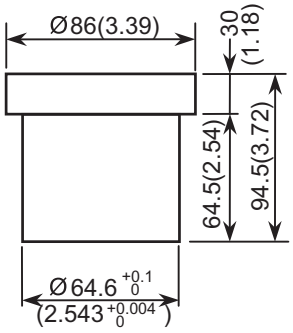
(1) Tightening tools

Unit : mm

NAME	OPPOSING FLATS
 Socket	19, 27
 Allen wrench	6

(2) Jig

Unit : mm (in)

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

34.1.6 SPROCKET

34.1.6.1 REMOVING

(1) Preparation for removal
Remove crawler referring to "34.1.2 CRAWLER", lift up crawler frame with attachment, and put it on square timbers to float and stabilize.

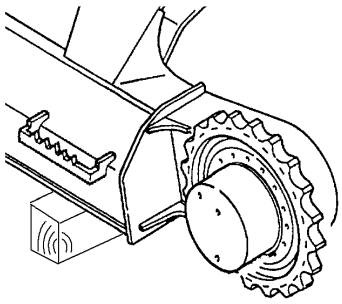


Fig. 34-66 Preparation for removal

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

Weight of sprocket : 48kg (106 lbs)

: 24 mm

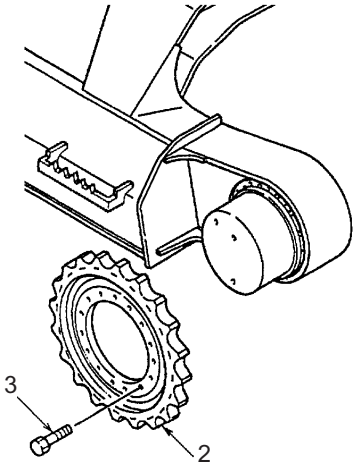


Fig. 34-67 Removing sprocket

34.1.6.2 INSTALLING

(1) Check before installing
Check the mating portion of the travel reduction unit and the sprocket, eliminate burrs and contamination thoroughly and install the sprocket.

(2) Installing sprocket temporarily
Coat the sprocket attaching capscrews with Loctite #262 and fasten the sprocket temporarily.

(3) Installing sprocket completely
Remove the wooden blocks under the truck frame, bring the machine down on the ground and tighten the sprocket.

: 24 mm

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

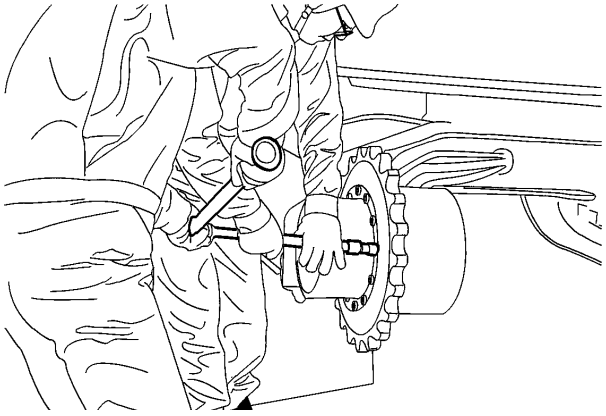


Fig. 34-68 Installing sprocket completely

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

☆ : Apply loctite

(16)Draining lube oil from the reduction gear

Next, before disassembling the reduction unit, put a screw in two tapped holes of flange (1) that are in diagonal positions and lift the reduction unit by crane. Remove two plugs (97) and drain lube oil from the reduction unit.

: 12 mm

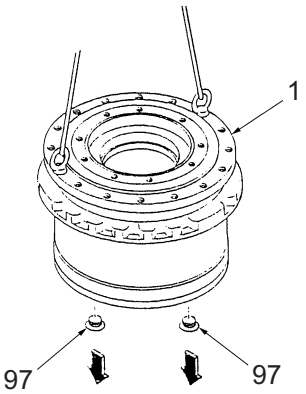


Fig. 34-109 Draining oil from reduction unit

CAUTION

Prepare an oil container before doing the work.

- Do not lift the reduction unit too high, but do the work at as low level as possible.
  (height of your knees)

(17)Removing cover (95)

Loosen bolts (96) and remove them.
Then remove cover (95).

: 8 mm

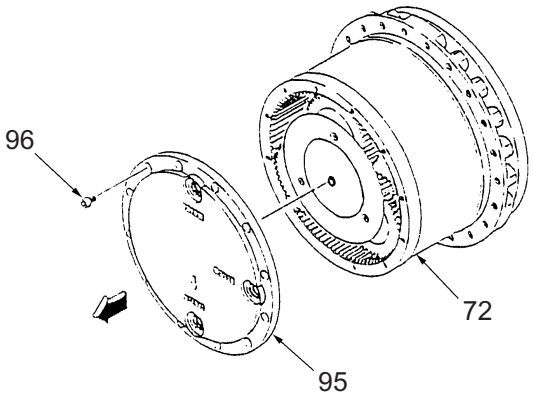


Fig. 34-110 Removing cover (95)

CAUTION

Remove the cover as below

- Liquid packing is applied between cover (95) and housing (72). For this reason, the cover is hard to come off. Loosen bolts (96) and tap the top and side faces of the removed cover (95) with a plastic mallet.
- Put a flat-blade screwdriver between cover (95) and housing (72) and take off cover (95).

(18)Removing thrust plate (94)

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

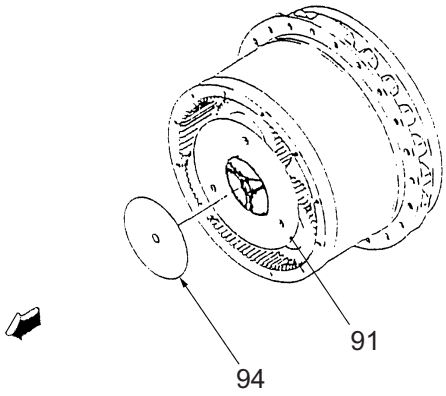


Fig. 34-111 Removing thrust plate (94)

<Motor>

(1) Fitting oil seal (53)
Make sure that flange (1) is equipped with oil seal (53). If not, press oil seal (53) into flange (1), using the oil seal fixing jig.

CAUTION

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

- Coat the lip of the bore of oil seal (53) with grease and put it in.
- Push the oil seal upright. If it is tilted, the outer diameter of oil seal (53) will be scored.
- Be careful so as not to score the lip of the bore of oil seal (53) when fixing it. If the lip is scored, oil leakage may occur and break the inside of the reduction gear while the motor is running.

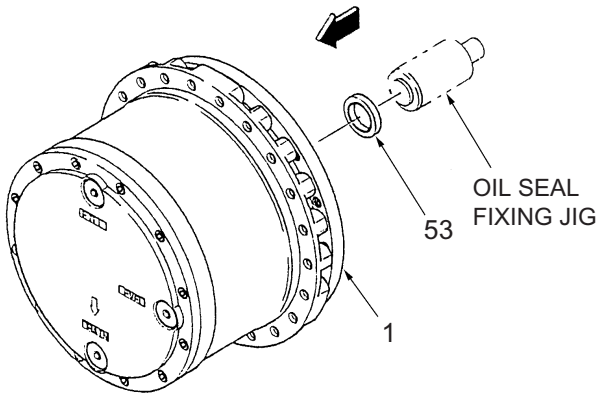


Fig. 34-135 Fixing oil seal (53)

(2) Assembling piston assy (48)
Place spring (61) in the hole where piston assy (48) of flange (1) is located.
Then, mount piston assy (48) to flange (1).

CAUTION

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

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

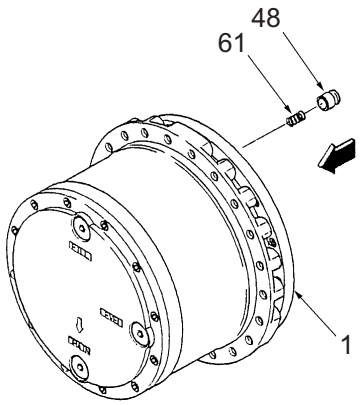


Fig. 34-136 Assembling piston assy (48)

(3) Fitting steel balls (47)
Fit steel balls (47) in the holes in the spherical surface of flange (1).

CAUTION

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

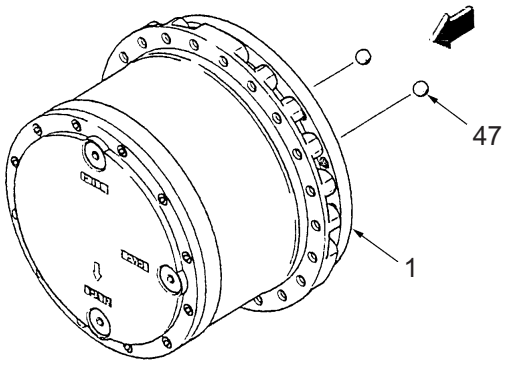


Fig. 34-137 Fixing steel balls (47)

Parts	Check point	Tolerance	Remedy
Swash plate (46)	3. Spherical hole in which a steel ball is placed	Ball depth : 14.5mm (0.571in)	Replace swash plate.
Shaft (36)	1. O.D. of oil seal sliding surface	The sliding surface shows a scratch deeper than 0.02mm (0.0008in) or is roughened, except the oil seal lip moving marks on the 1.6a roughness.	Replace shaft.
	2. Spline at the joint of cylinder block (43)	The pin that measures the over-pin dia. 47.380mm (1.86535in) measures ø3.00mm (0.11811in) or is broken.	
	3. Spline at the joint of drive gear	The pin that measures the between dia. 30.498mm (1.20071in) measures ø3.33mm (0.13122in) or is broken.	
Brake piston (56)	1. Appearance and dimension	Height : 38.2mm (1.504in)	Replace brake piston.
	2. Sliding surface	Roughness: 2.5a	
	3. Appearance	The surface shows a scratch deeper than 0.02mm (0.0008in) or is roughened.	
Disk plate (54)	1. Appearance and dimension	Thickness : 3.2mm (0.126in)	Replace disk plate.
	2. Appearance	The moving surface has a deep scratch or the abrasive material is peeled off.	
Ball bearing (49) Ball bearing (50)	1. Rolling surface	Flaking or impressed marks are seen.	Replace ball bearing.
	2. Function	Rotation is abnormal. (abnormal sound and uneven rotation)	
Piston assy (48)	1. Sliding surface of shoe	The roughness is 1.6a or the surface is roughened or the scratch is deeper than 0.02mm (0.0008in).	Lap the sliding surface of shoe. (#1000) In case the scratch does not disappear, replace the flange holder kit.
	2. O.D. of piston	The roughness is 1.2a or the surface is roughened or the scratch is deeper than 0.02mm (0.0008in).	Replace flange holder kit.
	3. O.D. of piston and bore diameter of flange holder (1)	Clearance: 0.040mm (0.00157in)	
	4. Gap on shoe ball	Gap : 1.0mm (0.039in)	
Plunger (3)	1. O.D. of plunger	The roughness is 0.8a or the surface shows a scratch deeper than 0.02mm (0.0008in) or is roughened.	Replace base plate kit.

(5) Auto 2-speed select function

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

Table46-1

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

Table46-2

Error code		A025		
Trouble		Not yet adjusted engine or failed adjustment of pump proportional valve (B adjustment)		
Judging condition		Pump proportional valve adjustment is missed. Or it is impossible to set the adjusting value within the adjusting range.		
Symptom		Deviated from the rated output, but no problem in normal operation		
Control in the event of failure		Workable with the default proportional valve output.		
Returned in normal condition		The pump proportional valve adjustment is completed normally.		
Service diagnosis checking screen		Screen No.	9	E-1 P1 PUMP
		Screen No.	9	E-2 P2 PUMP
		Screen No.		
Checking object				Checking contents and remedy
1	•Checking			Carry out pump adjustment (B adjustment). When"ERROR PUMP" was displayed during adjustment, refer to the section "Adjustment procedure - Measures to be taken with the adjustment failed"
2	• Mechatro controller			Check that the error is corrected after replacement of controller.
3				

Table46-21

Error code		B052		
Trouble		Bucket digging pressure sensor outputs error		
Judging condition		After starter switch ON and engine does not start yet. And the input voltage from the bucket digging pressure sensor after starter switch ON is in the range of 1.4V or more to less than 4.7V.		
Symptom		The bucket digging operability becomes poor.		
Control in the event of failure		Normal control		
Returned in normal condition		Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen		Screen No.	5	B-5 BUCKET DIG
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Bucket digging pressure sensor SE-1			When B052 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between bucket digging pressure sensor and controller CN-124F CN-101F			When B052 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.

Table46-22

Error code		B053		
Trouble		Bucket digging pressure sensor's wiring is disconnected.		
Judging condition		The input voltage from bucket digging pressure sensor is 0.1V or less.		
Symptom		The bucket digging speed slows down a little.		
Control in the event of failure		Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) Set output of P1 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	5	B-5 BUCKET DIG
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Bucket digging pressure sensor SE-1			When B053 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between bucket digging pressure sensor and controller CN-124F CN-101F			When B053 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.

Table46-41

Error code		B172		
Trouble		P2 side option pressure sensor outputs error		
Judging condition		After starter switch ON and engine does not start yet. And the input voltage from the P2 side option pressure sensor after starter switch ON is in the range of 1.4V or more to less than 4.7V.		
Symptom		The P2 side option operability becomes poor.		
Control in the event of failure		Normal control		
Returned in normal condition		Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen		Screen No.	6	B-17 P2 OPT.
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• P2 side option pressure sensor SE-11			When B172 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between P2 side option pressure sensor and controller CN-303F CN-102F			When B172 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. 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.

Table46-42

Error code		B173		
Trouble		P2 side option pressure sensor's wiring is disconnected.		
Judging condition		The input voltage from P2 side option pressure sensor is 0.1V or less.		
Symptom		The selection of conflux does not work.		
Control in the event of failure		Set proportional valve output rate of P1 and P2 pumps to 0mA. (Hydraulic pump emergency mode) Set output of P2 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	6	B-17 P2 OPT.
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• P2 side option pressure sensor SE-11			When B173 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between P2 side option pressure sensor and controller CN-303F CN-102F			When B173 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller			Check that the error is corrected after replacement of controller.

Table46-61

Error code		D063		
Trouble		Arm-in spool 2 proportional valve's wiring is disconnected.		
Judging condition		The feed-back value from proportional valve is 100mA or less. (If output is 100mA or less, judging is not done.)		
Symptom		Operability of combined operation with arm-in becomes poor.		
Control in the event of failure		Set Arm-in spool 2 proportional valve output to 0mA.		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	8	D-4 ARM IN-2-SPEED
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Arm-in spool 2 proportional valve PSV-A			When D063 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	• Wiring between Arm-in spool 2 proportional valve and controller CN-121F CN-105F			When D063 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller			Check that the error is corrected after replacement of controller.

Table46-62

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

Table46-80

Error code		H023		
Trouble		Boom angle potentiometer's wiring is disconnected.		
Judging condition		The input voltage from boom angle potentiometer is 0.1V or less.		
Symptom		Indications of rating load and working radius of High-reach crane become abnormal.		
Control in the event of failure		Normal control		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	12	H-2 BOOM
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Boom angle potentiometer SE-17			Measure the resistance between terminals of boom angle potentiometer. 4.0~6.0k Ω Turn the potentiometer and measure resistance between signal and GND. Normal value: 0 to all resistance (4.0~6.0)k Ω
2	• Wiring between boom angle potentiometer and controller CN-702F CN-103F			Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller			Check that the error is corrected after replacement of controller.

Table46-81

Error code		H024		
Trouble		Boom angle potentiometer's power source is shortcut.		
Judging condition		The input voltage from boom angle potentiometer is 0.1V or less.		
Symptom		Indications of rating load and working radius of High-reach crane become abnormal.		
Control in the event of failure		Normal control		
Returned in normal condition		It returns automatically in normal condition.		
Service diagnosis checking screen		Screen No.	12	H-2 BOOM
		Screen No.		
		Screen No.		
Checking object				Checking contents and remedy
1	• Boom angle potentiometer SE-17			Measure the resistance between terminals of boom angle potentiometer. 4.0~6.0k Ω Turn the potentiometer and measure resistance between signal and GND. Normal value: 0 to all resistance (4.0~6.0)k Ω
2	• Wiring between boom angle potentiometer and controller CN-702F CN-103F			Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	• Mechatro controller			Check that the error is corrected after replacement of controller.

Table46-97

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.

(5) Slow boom up, insufficient power

No.	Sections	Contents/normal value		Corrective action, others
1	Boom up pressure sensor	Carry out service diagnosis	•See Service Diagnosis Data List Operation No.3 boom up full lever and relief	Check and replace pressure sensor Check remote control valve
2	Remote control valve	Measure directly remote control pressure of boom up	Check that pressure is 3.0MPa or more in boom up full lever and high idling operation	Check remote control valve When equipped with multi control valve, check it while changing lever pattern
3	Pump pressure sensor	Carry out service diagnosis for P1, P2 pump pressures in operation.	•See Service Diagnosis Data List Operation No.4 boom up full lever and in operation	When there is difference between P1 and P2 pump pressures, check high pressure sensor.
4	Actual measuring current value of P1/P2 unload proportional valve	Carry out service diagnosis	•No.8 D-1 P1 unload valve (cut valve) D-1 P2 unload valve (cut valve) •See Service Diagnosis Data List Operation No.3 Boom up full lever & relief	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
5	Secondary pressure of P1, P2 unload proportional valve	Measure the proportional valve secondary pressure directly at the ports A7 and A5 of 8 sections solenoid block	Check that P1/P2 unload secondary pressures are within the range of 0.5~1.2MPa in boom up full lever and high idling operation	Replace proportional valve
6	Actual measuring current value of P1/P2 pump proportional valve	Carry out service diagnosis	•No.9 E-1 P1 pump E-2 P2 pump •See Service Diagnosis Data List Operation No.4 boom up full lever & in operation	In case where the reading is largely differed from the actually measured value, check proportional valve and controller for possible failure.
7	Secondary pressure of P1, P2 pump proportional valve	Measure the pump proportional valve secondary pressure directly (Ports a3, a4)	Check that P1/P2 pump proportional valve pressures are within the range of 1.8 to 3.0MPa in boom up full lever and high idling operation	Replace proportional valve
8	P2 by-pass cut valve <Trouble> Only P2 pressure is low.	Visual check	No problem for sliding ability of main poppet and no contamination on orifice No problem for sliding ability of internal piston (Check it through PBp2 port.)	Clean and replace
9	Remote control valve	Check targeted remote control valve	Check that spool is free from abnormal damage and spring is free from breakage	Replace
10	Lock valve poppet <Trouble> Both P1 and P2 pressures are low.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface	Replace (Check on the casing side for damage)
11	Conflux check valve <Trouble> Only P2 pressure is high.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface	Replace (Check on the casing side for damage)
12	Holding valve for boom (poppet) <Trouble> Both P1 and P2 pressures are high.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface	Replace (Check on the casing side for damage)

No.	Sections	Contents/normal value		Corrective action, others
13	Remote control valve	Check targeted remote control valve	Check that spool is free from abnormal damage and spring is free from breakage	Replace
14	Travel straight spool <Trouble> P2 pressure is low.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage.	Replace (Check on the casing side for damage)
15	Swing spool <Trouble> P2 pressure is high.	Visual check	When removing, free from abnormal resistance against sliding Free from abnormal damage, etc on outside surface Spring is free from breakage.	Replace (Check on the casing side for damage)
16	Swing relief valve <Trouble> Relief pressure is low.	Check set pressure	•See Service Diagnosis Data List Operation No.10 Swing full lever and relief	Reset or replace
17	Swing motor	Visual check	Inner parts (cylinder block, piston, valve brake etc) are to be free from abnormal resistance against sliding. Free from abnormal damage, etc on outside surface (brake plate etc)	Replace
18	Swing reduction gear oil	Take sample oil from swing reduction gear drain	Sampling oil does not include a lot of metal powder.	Disassemble and inspect reduction gear
19	Swing reduction	Visual check	Tooth surface is not worn abnormally and is not chipped.	Replace

(12)Noise occurred at swing operation

No.	Sections	Contents/normal value		Corrective action, others
1	Swing parking brake solenoid	Carry out service diagnosis	No.3 F-2 SWING-BRAKE Lever neutral: COMP ON, MEAS ON Swing: COMP OFF, MEAS OFF	Check swing pressure sensor Check harness
2		Measurement of solenoid valve A2 port	Lever neutral: 0MPa In operation: 4MPa or more	Replace solenoid valve
3	Boost check valve (Sound of cavitation at stopping)	Visual check	When removing, free from abnormal resistance against sliding Spring is free from breakage.	Replace
4	By-pass check valve (Sound of cavitation at stopping)	Visual check	When removing, free from abnormal resistance against sliding Spring is free from breakage.	Replace
5	Swing motor (Brake valve/friction plate)	Visual check	Disassemble and inspect abnormal wear and scuffing	Replace
6	Swing motor piston	Visual check	When removing, free from abnormal resistance against sliding Spring is free from breakage.	Replace
7	Swing reduction gear oil	Take sample oil from swing reduction gear drain.	Sampling oil does not include a lot of metal powder.	Disassemble and inspect reduction gear
8	Swing reduction	Visual check	Tooth surface has no abnormally worn and chipped.	Replace

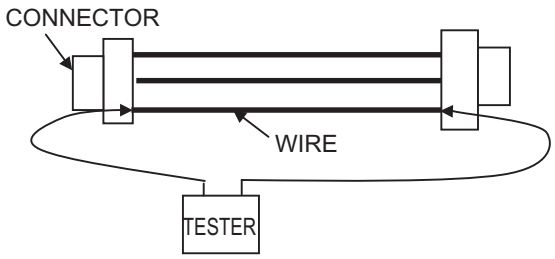
(13)Swing drifts on a slope while swing control lever is in neutral position

47.2 ELECTRIC SYSTEMS

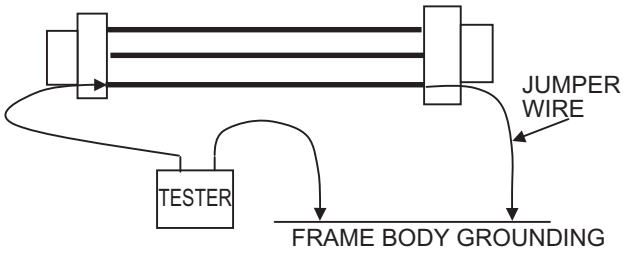
47.2.1 WIRING CHECKING PROCEDURE

Check for continuity between connector terminals, presence or absences of short-circuit with other wires, and presence or absences of short-circuit with machine body grounding.

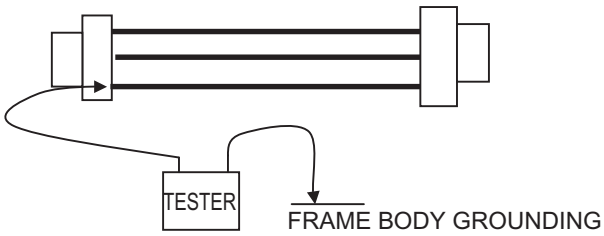
(1) Checking for disconnection between connectors.
(When both ends measurement is easy because of short distance between connectors,)
Measure the resistance using tester.
Pull out opposite connector first.
When the resistance is zero (0), it is in normal condition.



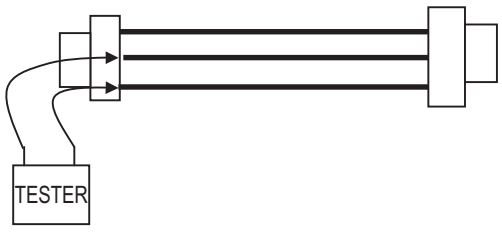
(When both ends measurement is difficult because of long distance between connectors,)
Measure the resistance using tester.
Pull out opposite connector first.
Where the resistance is zero (0), if the terminal on one side is connected to frame body grounding with jumper wire, it is in normal condition.
The resistance is 1M Ω or more when the terminal on one side is not connected to frame body grounding with jumper wire, it is in normal condition.



(2) Checking for presence or absence of short-circuit with machine body
Measure the resistance using tester.
Pull out opposite connector first.
When the resistance is 1M Ω or more, it is in normal condition.



(3) Checking for presence or absence of short-circuit between wirings.
Measure the resistance using tester.
Pull out opposite connector first.
When the resistance is 1M Ω or more, it is in normal condition.



48. TROUBLESHOOTING (TROUBLE DIAGNOSIS MODE)

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48.1 TROUBLE DIAGNOSIS MODE 48-3

48

Book Code No. **S5YN4818E01**

GENERAL	1
STANDARD VALUE	2
PARTS TO BE PREPARED	3
ENGINE ASSEMBLY/DISASSEMBLY	4
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COOLING	11
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STARTING AND CHARGING	13
TURBOCHARGER	14
AIR COMPRESSOR	15
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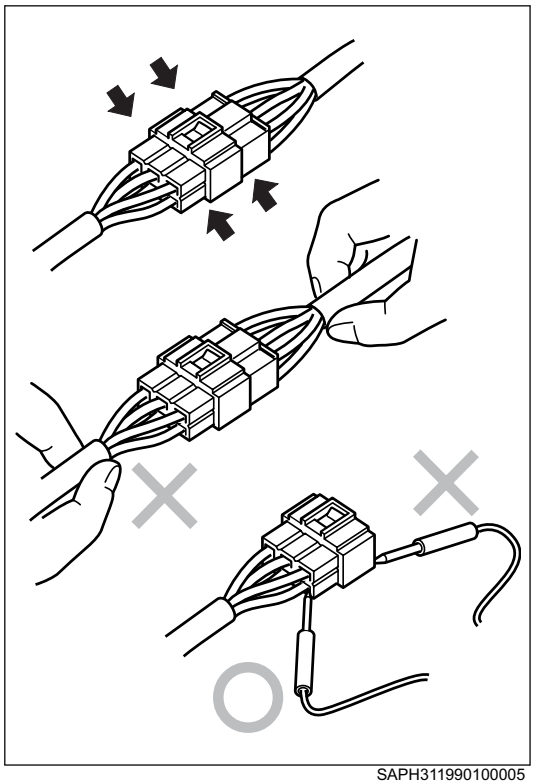
For your information:

This documentation does not contain any descriptions in regard to the hatched part

"6. Emission Control".
"15. Air Compressors".


SAPH311990100005

(4) Handling of connector

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

4. Precautions for electric welding

Inadvertent electric welding on a cab or chassis may cause reverse welding current from the grounding circuit, resulting in damage to electric and electronic parts. Observe the following items for electric welding.

(1) Turn "OFF" the starter switch.
(2) Make sure that switches are "OFF".
(3) Disconnect the minus (-) terminal of the battery according to the removal procedure of the battery cable.
(4) Disconnect connectors of each computer.
(5) Remove all fuses. (For locations of fuses, refer to "Electrical System Chapter".)
(6) Be sure to connect grounding of the electric welding machine near the welding area.
Connect grounding from a bolt (plated bolt) or a frame near the welding area.
Remove paint of the frame for connection of grounding from the frame.
(7) Other precautions
a. Put a cover on rubber hoses, wire harnesses, pipes, tires, etc. around the welding area so that they may not be exposed to spatter.
b. Perform welding under appropriate conditions and minimize heat effect in the peripheral area. Also maintain welding quality.
(8) After welding, connect and assemble in the order of the fuse and the minus terminal of the battery disassembled. When paint is removed from a frame or cab, apply rust preventive coating with the same color.
(9) After reassembly, check the function if it operates correctly.

Failure diagnosis table for each problem

JP31199010301001

Engine mechanical

Causes and actions are described for each item.

JP03Z01020601001

Status	Cause	Action
Engine overheat (coolant)	Insufficient coolant	Replenish coolant
	Faulty thermostat	Replace thermostat
	Water leak from cooling system	Correction
	Faulty coolant pump	Repair or replace
	Faulty head gasket	Replace head gasket
Engine overheat (radiator)	Clogging of radiator	Cleaning of radiator
	Corrosion of cooling system	Clean and repair cooling system
	Clogging of radiator core front part	Clean radiator
	Faulty radiator cap	Replace radiator cap
Engine overheat (compression pressure)	Non-synchronous injection timing	Adjust injection timing.
	Faulty fuel injection pressure	Adjust injection pressure
	Faulty fuel	Replace with correct fuel
	Faulty injector	Replace injector
Engine overheat (lubrication unit)	Deterioration of engine oil	Replace engine oil
	Faulty oil pump	Replace oil pump
	Insufficient engine oil	Replenish engine oil
Large engine oil consumption (piston, cylinder liner and piston ring)	Wear of piston ring and cylinder liner	Replace piston ring and cylinder liner
	Damage to piston ring	Replace piston ring and cylinder liner
	Faulty fixing of piston ring	Replace piston ring and cylinder liner
	Faulty assembly of piston ring	Replace piston ring and cylinder liner
	Faulty engine oil	Replace engine oil
	Faulty piston ring joint	Reassemble piston ring
Large engine oil consumption (valve and valve guide)	Wear of valve stem	Replace valve and valve guide
	Wear of valve guide	Replace valve guide
	Faulty assembly of valve stem seal	Replace stem seal
	Excessive oil lubrication to rocker arm	Inspection of clearance between rocker arm and rocker arm shaft
Large engine oil consumption (others)	Faulty oil level gauge	Replace with correct level gauge
	Excessive filling of engine oil	Fill with appropriate amount of oil.
	Leak of engine oil	Repair or replace the part of oil leak.
Piston seizure (in operation)	Sudden stop of engine	Perform warm-up before stop of engine
Piston seizure (lubrication unit)	Insufficient engine oil	Replenish engine oil
	Deterioration of engine oil	Replace engine oil
	Incorrect engine oil	Replace with correct engine oil.
	Low oil pressure	Inspection of lubrication unit
	Faulty oil pump	Replace oil pump
Piston seizure	Abnormal combustion	Refer to overheat section.
Piston seizure	Cooling unit	Refer to overheat section.

SAPH311990100031

Inspection item			Standard value	Repair limit	Service limit	Action
Piston ring	Free joint clearance	Top	Approx. 11.5 {0.4527}	—	—	
		Second	Approx. 14 {0.5512}	—	—	
	Gap between ends of piston ring	Top	0.3 - 0.40 {0.0118 - 0.0157}	—	1.5 {0.0591}	Replace piston ring
		Second	0.75 - 0.9 {0.0295 - 0.0354}	—	1.2 {0.0472}	
		Oil	0.15 - 0.3 {0.0059 - 0.0118}	—	1.2 {0.0472}	
	Ring width B dimension	Top	2.5 {0.0984}	—	–0.1 {–0.0039}	Replace piston ring
		Second	2 {0.0787}	—	–0.1 {–0.0039}	
		Oil	4 {0.1574}	—	–0.1 {–0.0039}	
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 - 0.025L {0.0000 - 0.0010} (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

Tightening torque (Alternator 50A)

JP31199020205013

Unit : N·m{kgf·cm, lbf·ft}

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

Standard value (starter)

JP31199020205014

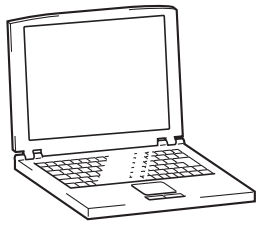
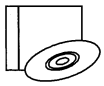
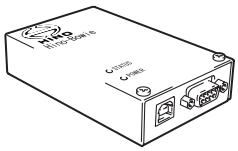
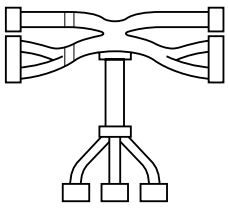
Unit : mm {in.}

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

Engine Failure Diagnosis

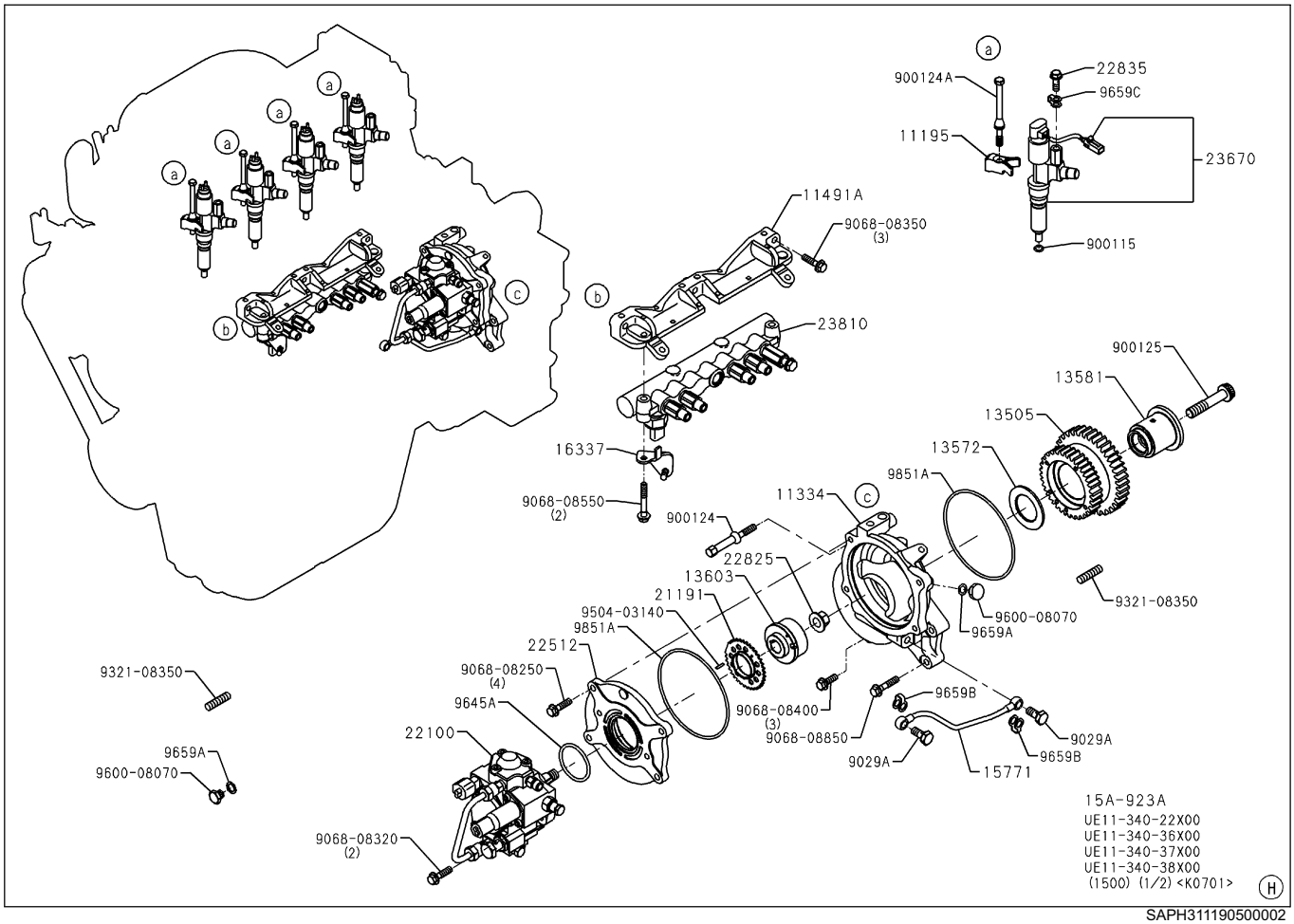
Special tool

JP31199030901016

Shape	Part No.	Name	Remark
	–	Personal computer (DOS-V)	• Operating system(OS):Windows95, Windows98(IE5.0 or later), Windows2000(SP3, IE5.0 or later), WindowsXP(SP1a, IE6.0 or later) • CPU and memory: Conditions that assure operation of the above operating system • Display: 800 x 600, 256 colors or more
		HinoDX	Failure diagnosis software (CD-ROM)
	09121–1040	Hino-Bowie (Interface box)	Used together with the cable between the vehicle and Hino-Bowie (09042-1220)
	09049–1080	Signal check harness	This is installed as interruption between vehicle harness and the ECU. Tester inspection is allowed in energized status.

Part layout

JP311990504020003



SAPH311190500002

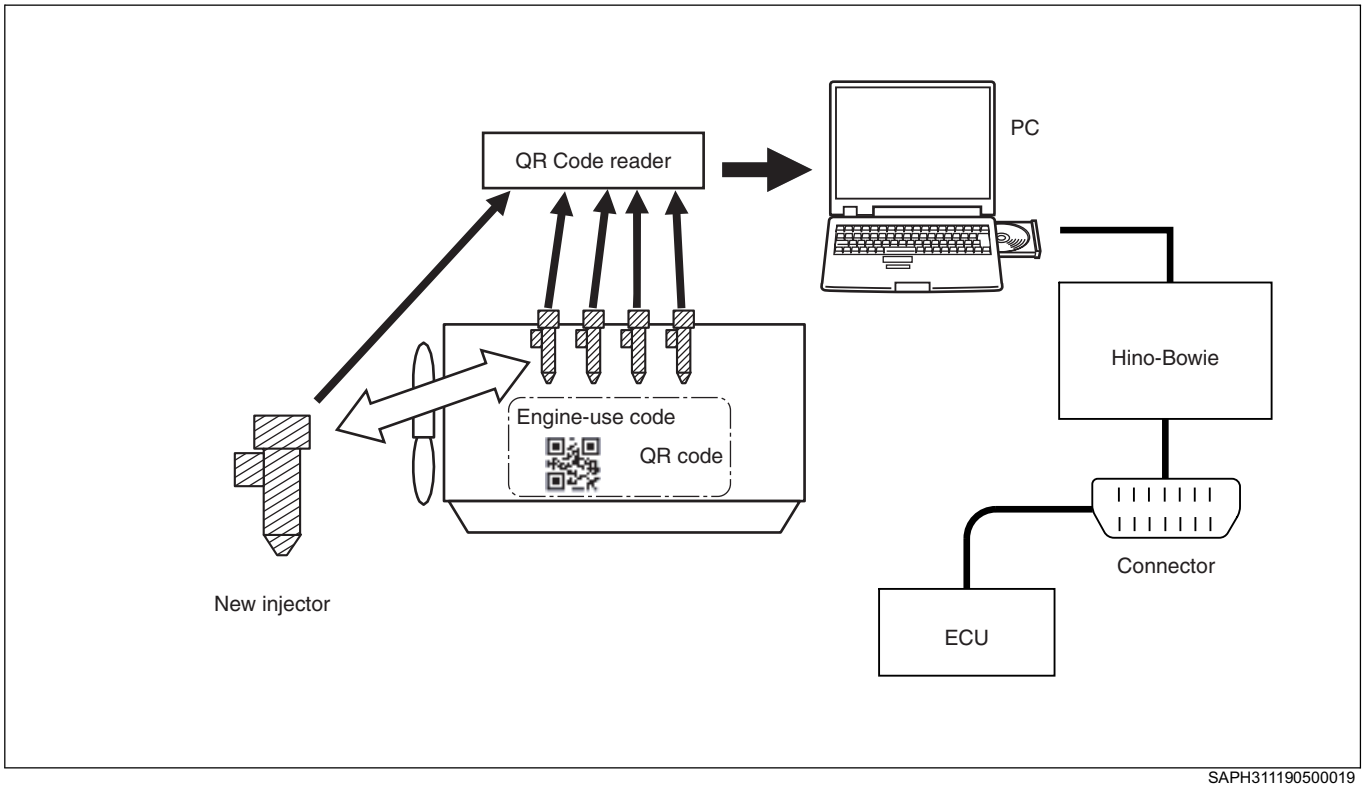
11195	Nozzle clamp holder	23670	Injector
11334	Bearing holder case	23810	Common rail assembly
11491A	Common rail bracket	9645A	O–ring*
22100	Supply pump	9851A	O–ring*

*Parts not to be reused.

Tightening torque

22825	63.7N·m {650 kgf·cm, 47lbf·ft}	9068-08320	28.5N·m {290kgf·cm, 21lbf·ft}
900124	108N·m {1,100 kgf·cm, 80lbf·ft}	9068-08400	28.5N·m {290kgf·cm, 21lbf·ft}
900124A	25N·m {250 kgf·cm, 18lbf·ft}	9068-08850	28.5N·m {290kgf·cm, 21lbf·ft}
9068-08250	28.5N·m {290kgf·cm, 21lbf·ft}		

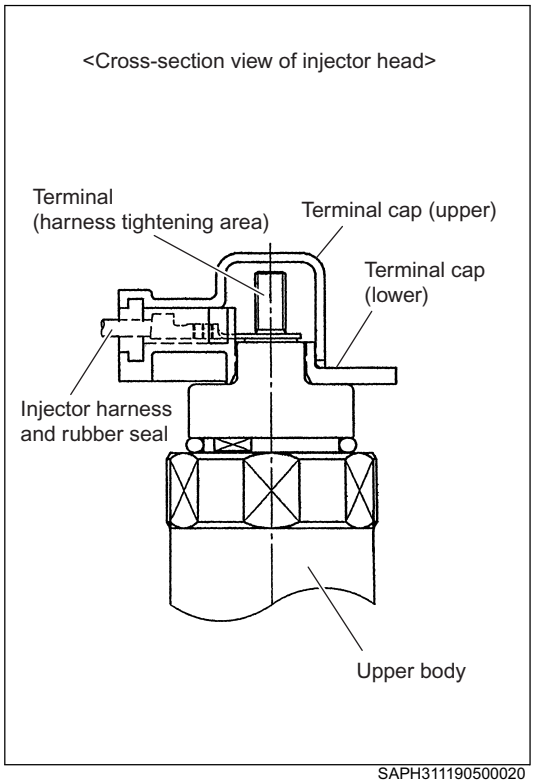
(1) Read the injector QR code with the scanner of the QR code reader and prepare the correction data file.
(2) Enter the injector correction value directly from the PC tools to the engine ECU.



SAPH311190500019

Inspection of injector

JP31199050704006



SAPH311190500020

1. Inspection of injector insulation

(1) Remove the injector plastic terminal cap (upper).
(2) Measure the insulation resistance between the injector upper body and one terminal (no polarity) of two terminals for the injector harness.

Standard value (normal temperature)	**1000MΩor more**

(3) Measure the resistance value between two terminals above.

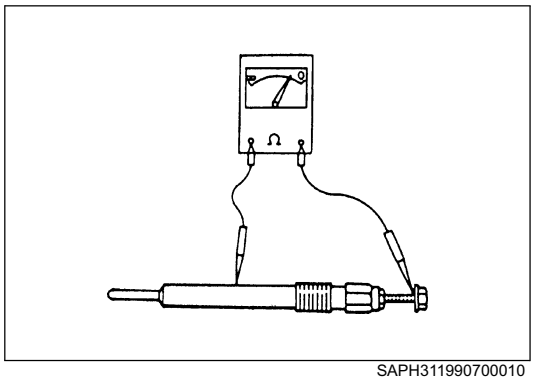
Standard value (at 20°C)	**0.45Ω±0.1**

(4) If the resistance value in (2) and (3) exceeds the standard value, replace the injector assembly.

2. Cleaning of injector

(1) Remove sludge at or around the terminal, if any.

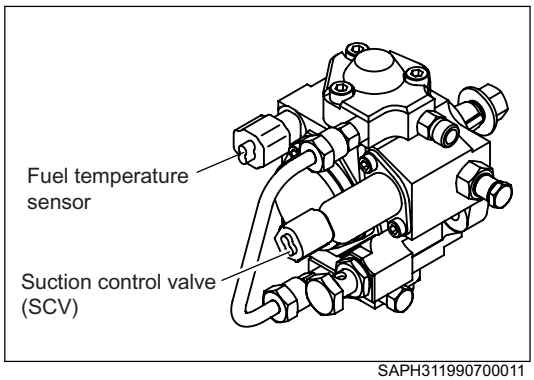
⚠ **CAUTION** • **In removing sludge, do not use a cleaning agent. Wipe it off with a rag. Use of a cleaning agent may result in electric failure due to penetration of the agent.**


SAPH311990700010

3. Inspection of glow plug

(1) Measure continuity between the body and the terminal using a circuit tester. If it is faulty, replace the glow plug.

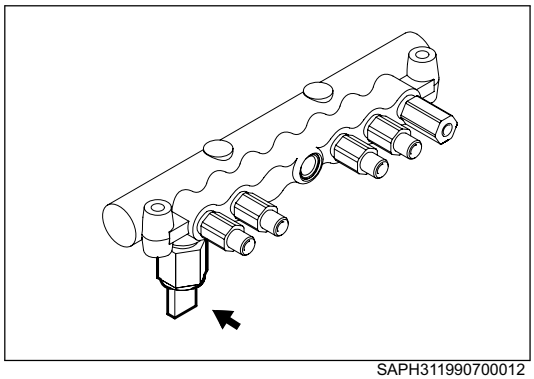
Standard value	
Resistance value : Ω(Normal temperature 20°C{68°F})	**2.59 - 3.29**



SAPH311990700011

4. Inspection of suction control valve SCV and fuel temperature sensor

(1) For inspection and replacement of the suction control valve (SCV) and the fuel temperature sensor, refer to the chapter of "J05E FUEL SYSTEM ".

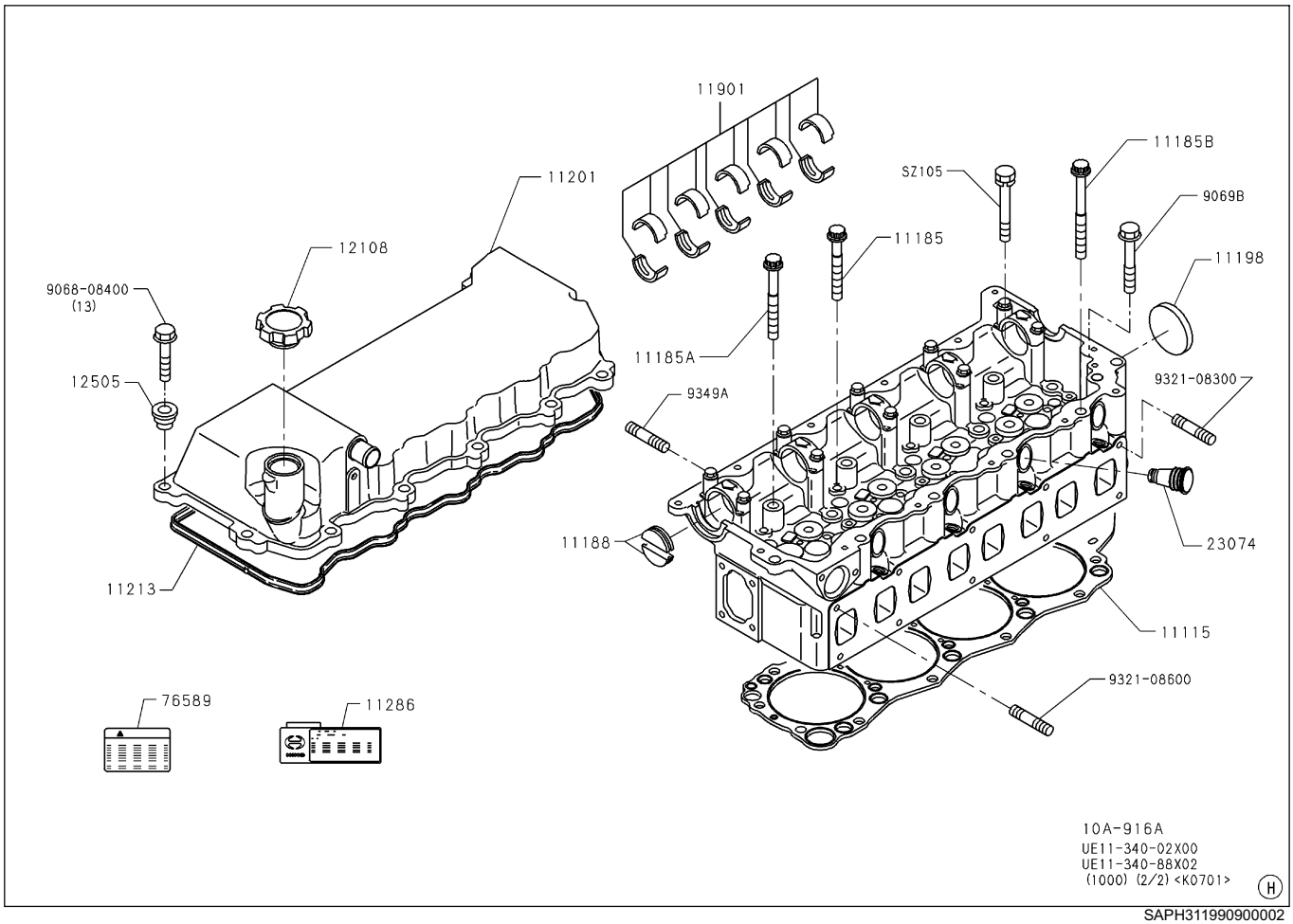

SAPH311990700012

5. Inspection of common rail pressure sensor

(1) For inspection and replacement of the common rail pressure sensor, refer to the chapter of "J05E FUEL SYSTEM".

6. Inspection of injector

(1) For inspection and replacement of the injector, refer to the chapter of "J05E FUEL SYSTEM".



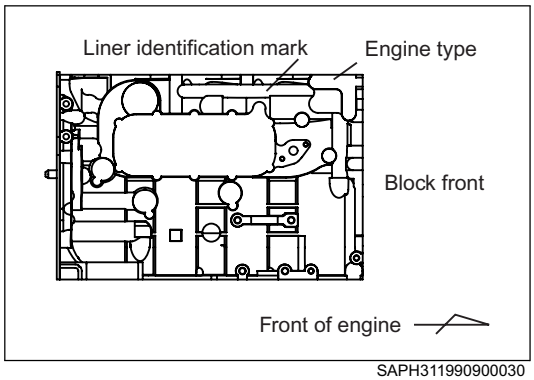
SAPH311990900002

11115	Cylinder head gasket	12108	Oil filler cap
11188	Semicircular plug	12505	Silent block
11201	Cylinder head cover	23074	Injection pipe oil seal*
11213	Head cover gasket		

*Parts not to be reused.

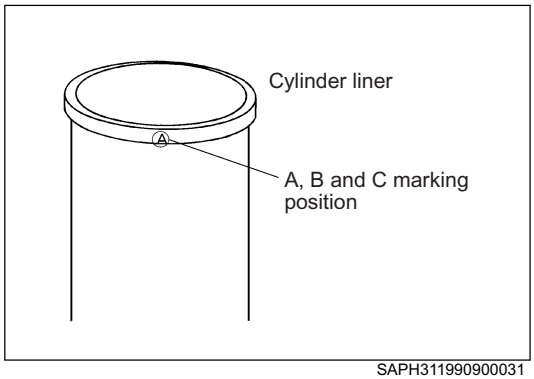
Tightening torque

11185	59N·m{600kgf·cm, 44lbf·ft}+90°+90°	9069B	59N·m{600kgf·cm, 44lbf·ft}
11185A	59N·m{600kgf·cm, 44lbf·ft}+90°+135°	9349A	30N·m{300kgf·cm, 22lbf·ft}
11185B	59N·m{600kgf·cm, 44lbf·ft}+90°+180°	SZ105	59N·m{600kgf·cm, 44lbf·ft}
9068-08400	28.5N·m{290kgf·cm, 21lbf·ft}		

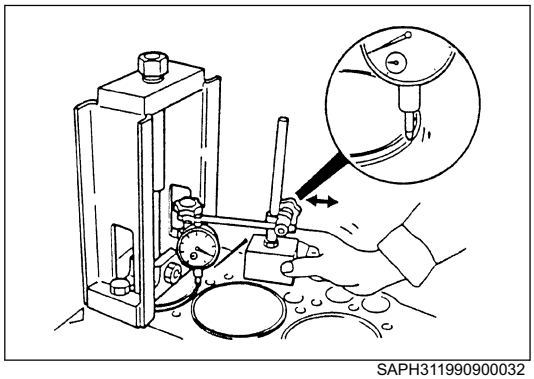


SAPH311990900030

⚠ **CAUTION** • **When a new cylinder liner is installed, install the cylinder liner with the same identification mark (A, B, C) stamped on the cylinder block.**



SAPH311990900031

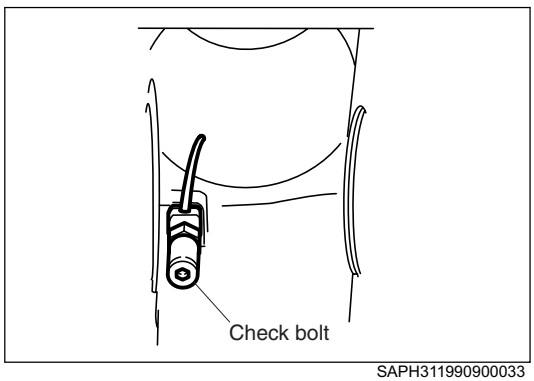

SAPH311990900032

2. Inspection of protrusion at cylinder liner flange

(1) Fix the cylinder liner using a special tool.
Tightening torque : 9.8 N·m {100 kgf·cm, 7 lbf·ft}
Special tool : 09420–2100 Cylinder liner puller

(2) Measure protrusion of the flange using a dial gauge.

Standard value (mm{in.})	**0.01 - 0.08 {0.0004 - 0.0031}**



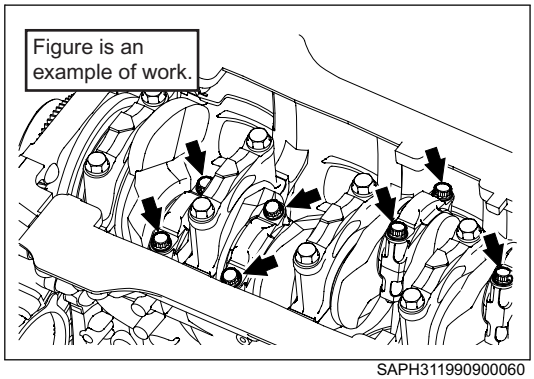
SAPH311990900033

3. Inspection and adjustment of cooling jet

(1) Remove the standard oil check valve and install the cooling jet on the cylinder block using a special tool.
Special tool : 9001–24262 Check bolt

Replacement of piston and connecting rod

JP31199090702005

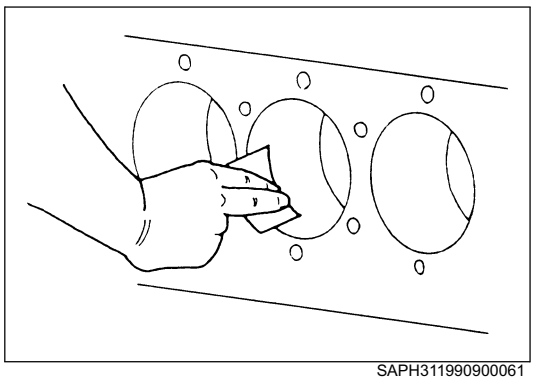


SAPH311990900060

1. Removal of piston

(1) Remove bolts and remove the connecting rod cap.

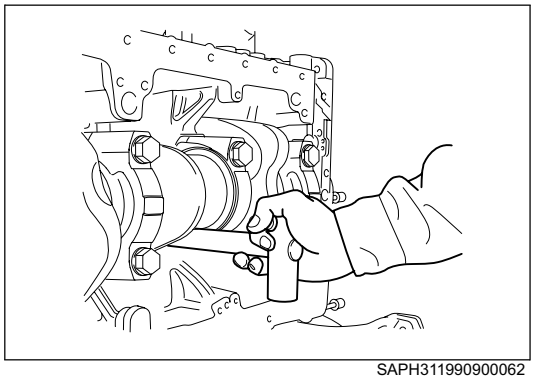
⚠ **CAUTION**
- **Insert a large flat tip screwdriver into the flywheel gear from the flywheel housing inspection hole to prevent turning of the crankshaft.**
- **Store removed connecting rod cap for each cylinder number so that combinations of the connecting rod and the connecting rod cap may not be changed.**


SAPH311990900061

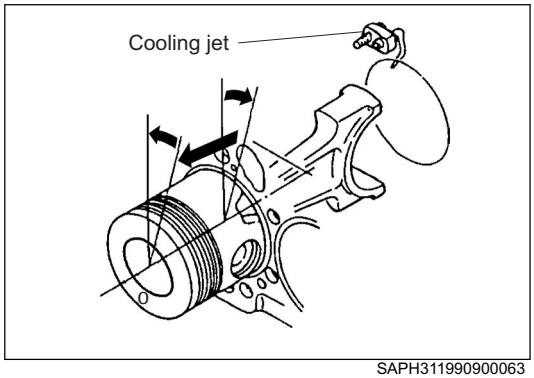
(2) Remove carbon on the cylinder liner inner surface with a scraper or a sand paper (No. 150 or so) in the circumferential direction.

⚠ **CAUTION**
- **Do not damage parts lower than the carbon deposit area.**

(3) Fix the cylinder liner with bolts and a plate.


SAPH311990900062

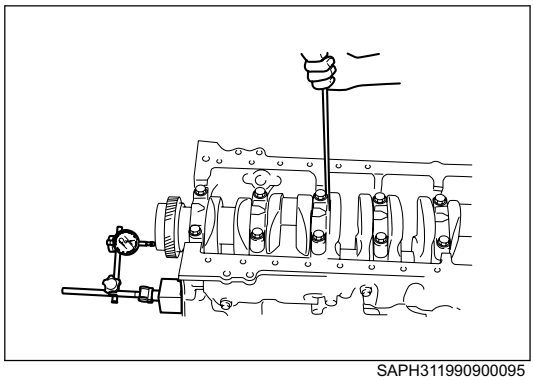
(4) Hit the connecting rod from underneath the engine using a handle of a hammer. Remove the piston together with the connecting rod.



SAPH311990900063

NOTICE
- **In removing the piston, rotate the connecting rod as shown in the figure. Do not bend the cooling jet.**

⚠ **CAUTION**
- **Store removed pistons and connecting rods for each cylinder number.**
- **Be careful not to touch the cooling jet.**



SAPH311990900095

Inspection of crankshaft

JP311990907030002

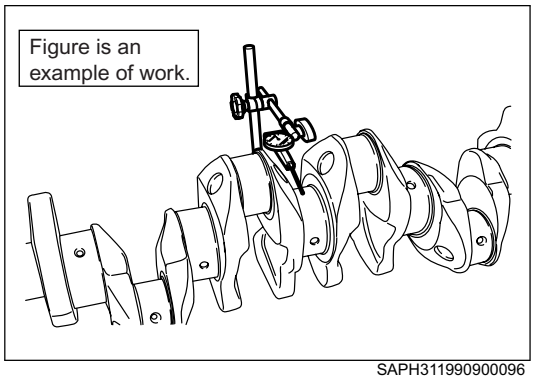
1. Inspection of end play

(1) Measure the end play of the crankshaft using a dial gauge. If it is beyond the repair limit, replace the thrust bearing. If it is beyond the service limit, replace the crankshaft.

Standard value (mm{in.})	Repair limit (mm{in.})	Service limit (mm{in.})
0.050 - 0.219 {0.020 - 0.0086}	0.50{0.0197}	1.219{0.0480}

NOTICE

- **Standard width of thrust bearing2.5mm{0.0984in.}**

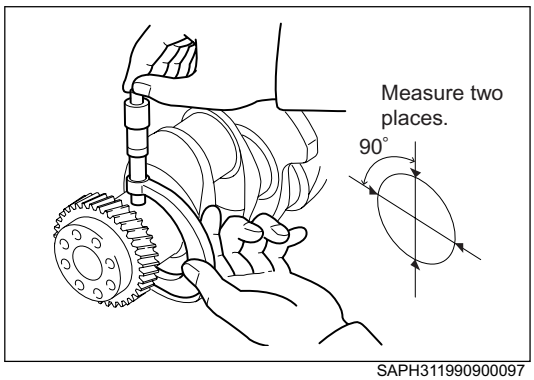


SAPH311990900096

2. Inspection of rotation runout

(1) Measure the crankshaft rotation runout using a dial gauge. If it is beyond the repair limit, grind the crankshaft and use the undersize bearing.

Repair limit (mm{in.})	0.15{0.0060}



SAPH311990900097

3. Inspection of journal wear

(1) Measure the outer diameter of the crankshaft journal using a micrometer. If it is faulty, grind or replace the crankshaft. When the crankshaft is ground, use the undersize bearing.

Journal standard value (mm{in.})	80{3.1496}

Wear value (mm{in.})	Action
Eccentric wear 0.10{0.0039}	Regrind for correction.
Wear of 0.20{0.0079} or more	Regrind
Wear of 1.20{0.0472}	Replace the crankshaft.

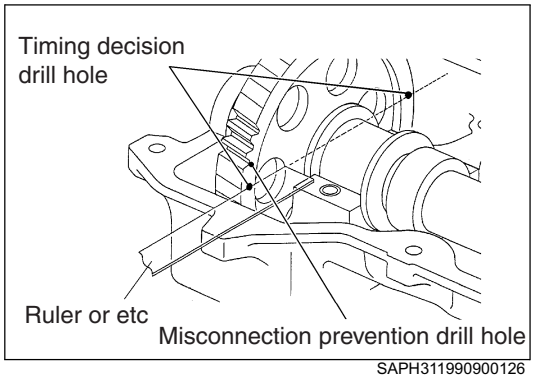
Installation of camshaft

JP31199090702010

1. Align the No. 1 cylinder to the compression top dead center.

2. Installation of camshaft and rocker arm.

(1) Place the camshaft so that two holes at 180 degrees from the three drilled holes of the camshaft gear may be horizontal to the upper surface of the camshaft housing.

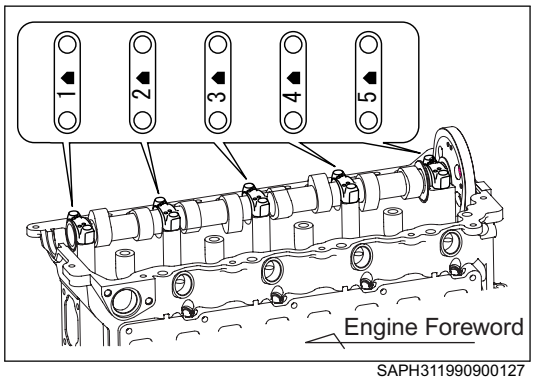


SAPH311990900126

⚠ CAUTION

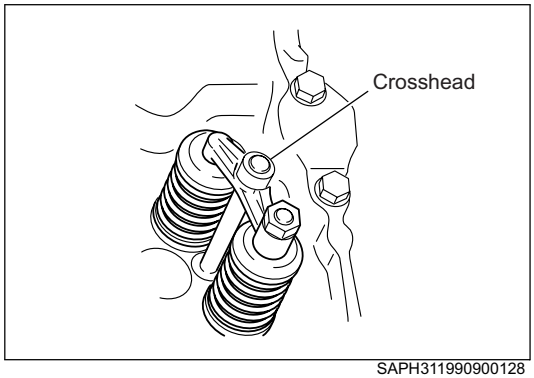
- **Place a transparent plastic ruler or an edged ruler on the upper surface of the camshaft housing and the side of the camshaft gear. Make sure that the position of the foolproof drilled hole is above the ruler.**

(2) Coat the bearing parts with engine oil and then install the camshaft bearing caps in numerical order 1-2-3-4-5 from the front of the engine, making sure the five-sided mark on the cap points forward.



SAPH311990900127

(3) Make sure the crosshead is correctly laid across each valve.



SAPH311990900128

⚠ CAUTION

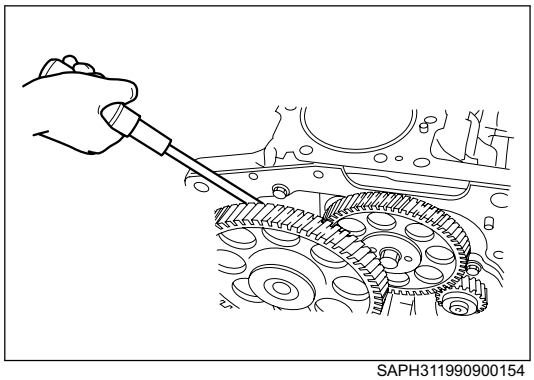
- **To make sure the crosshead is correctly in place, move it to the left and right by hand and make sure it clicks against the valves.**
- **If the crosshead is not sitting properly on the valves, it will push the upper seat and cause the valve to drop out.**

(4) Make sure the rocker arm is correctly assembled on the rocker arm shaft.

(5) Fully unscrew the adjust screw on the end of the rocker arm.

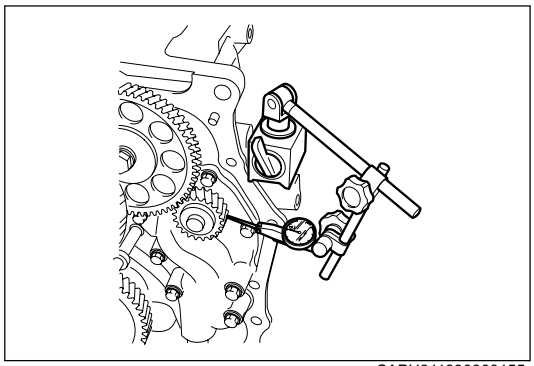
NOTICE

- **Securing the rocker arm and nozzle clamp together with a string will facilitate installation work.**


SAPH311990900154

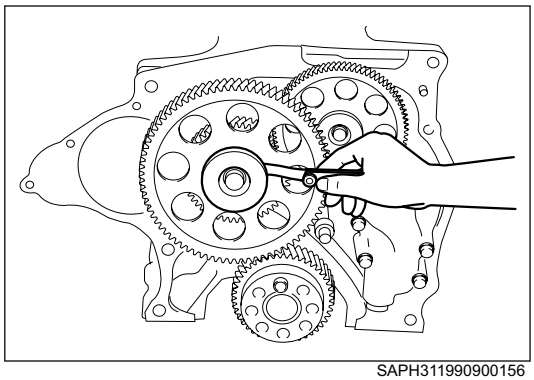
6. Inspection of backlash between sub-idle gear at cam idle gear and oil pump gear

(1) Insert a large flat tip screwdriver into the sub-idle gear to prevent turning of the sub-idle gear.


SAPH311990900155

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

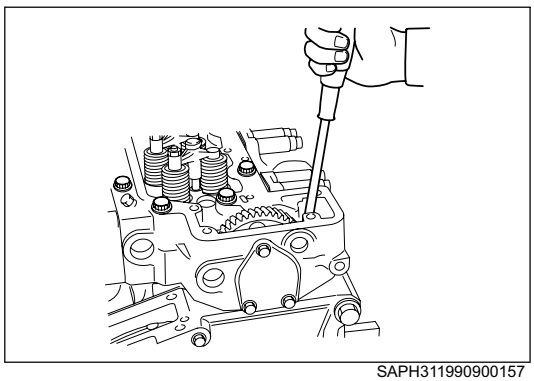
Standard value (mm{in.})	Service limit (mm{in.})
0.030 - 0.131 {0.0012 - 0.0005}	0.30{0.0118}


SAPH311990900156

7. Inspection of idle gear end play

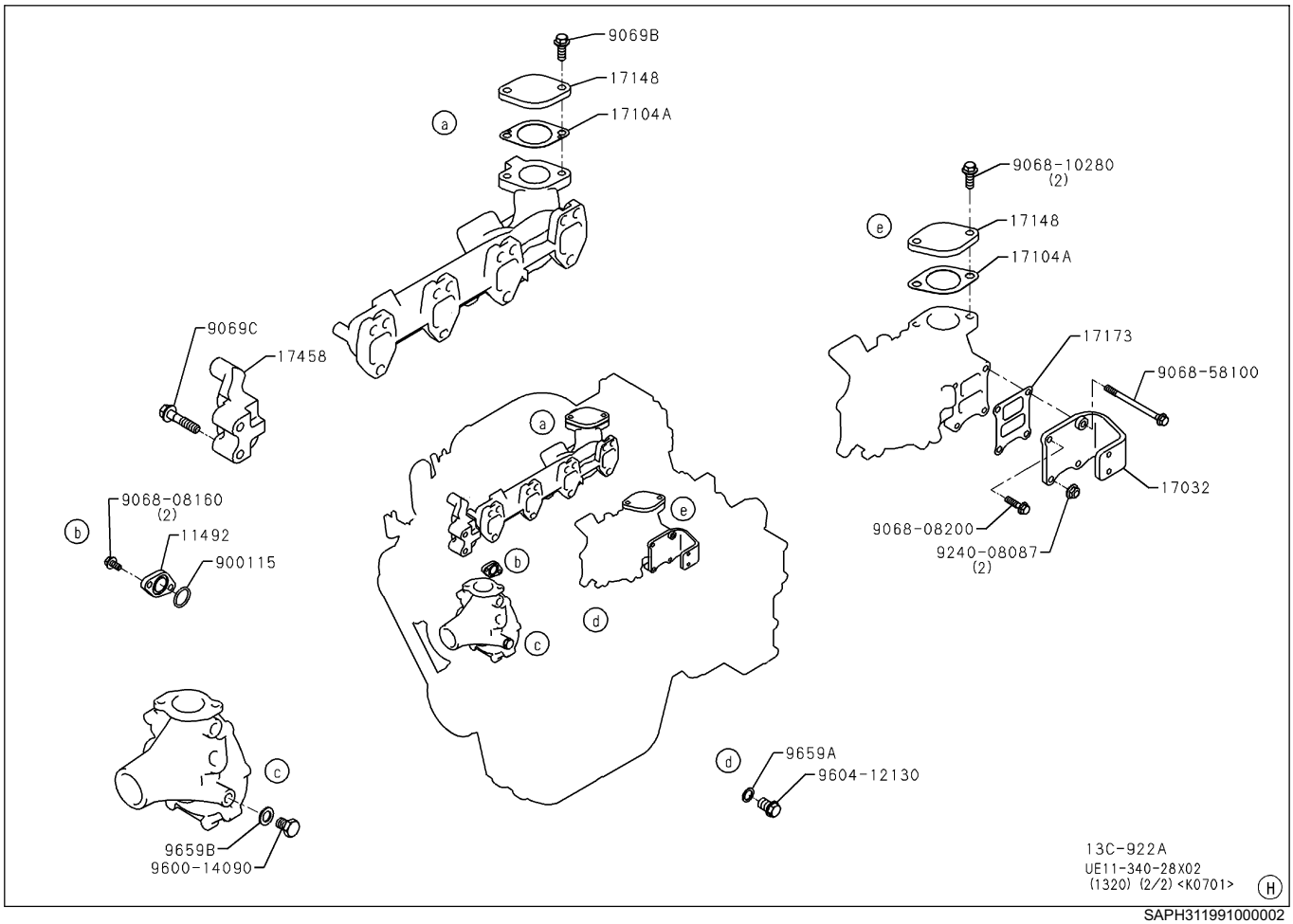
(1) Measure the end play of each gear using a thickness gauge. If it is beyond the service limit, replace each gear or shaft.

	Standard value (mm{in.})	Service limit (mm{in.})
Main idle gear	0.114 - 0.160 {0.0045 - 0.0063}	0.30{0.0118}
Sub-idle gear	0.040 - 0.095 {0.0016 - 0.0037}	0.30{0.0118}


SAPH311990900157

8. Inspection of backlash between cam idle gear and sub-idle gear

(1) Insert a large flat tip screwdriver into the sub-idle gear from the side of the cam idle gear of the cylinder head to prevent turning of the sub-idle gear.



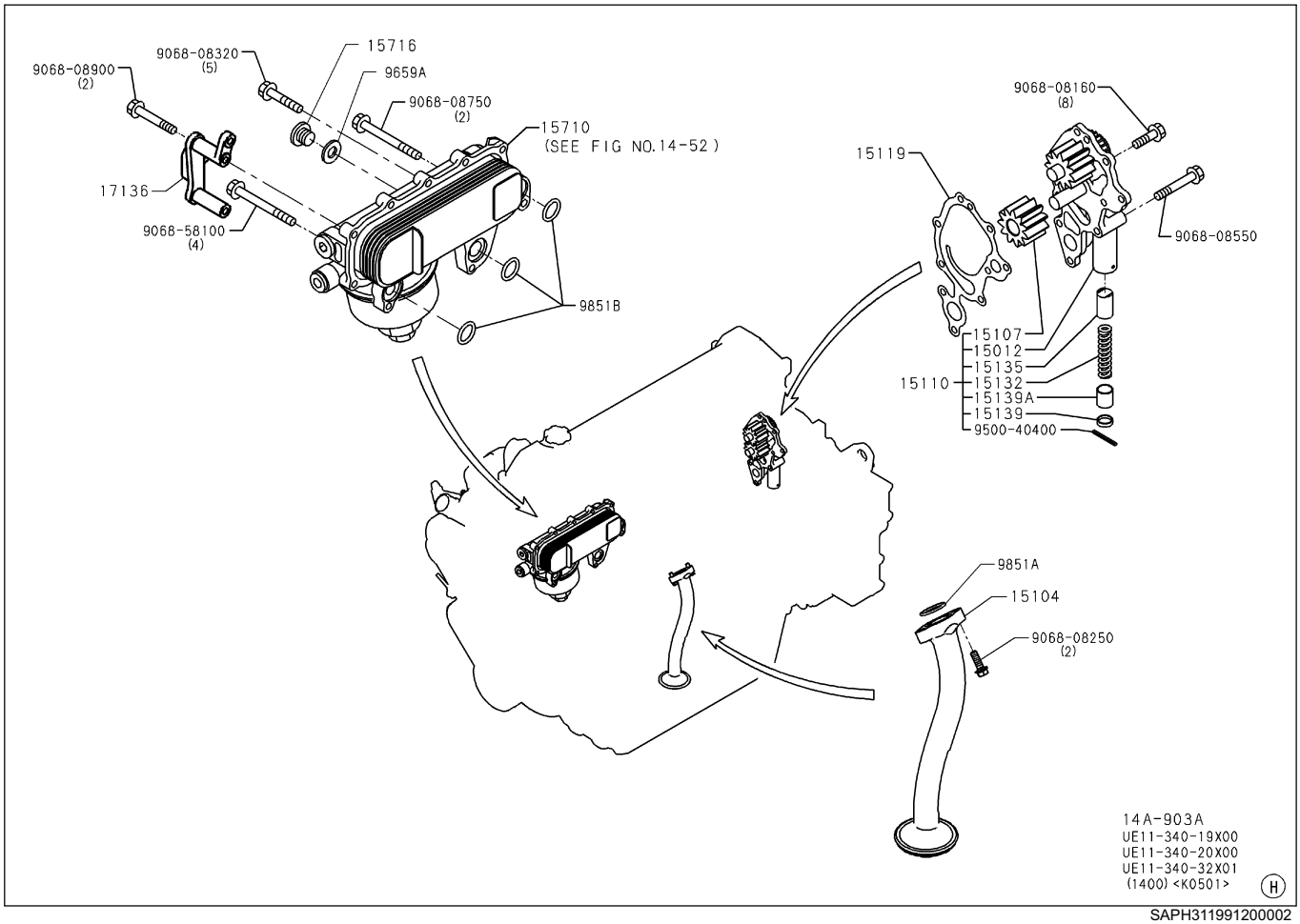
SAPH311991000002

17104A	Gasket*	17148	Plate

*Parts not to be reused.

Part layout

JP311991204020001



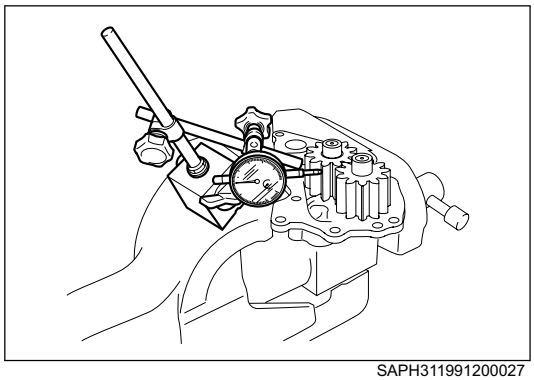
SAPH311991200002

15012	Oil pump cover assembly	15710	Oil cooler
15104	Oil strainer	9500-40400	Cotter pin*
15107	Driven gear	9851A	O–ring*
15110	Oil pump assembly	9851B	D–ring*
15119	Gasket*	15139	Seat2
15132	Relief valve spring	15139A	Seat1
15135	Safety valve		

*Parts not to be reused.

Tightening torque

9068-08160	28.5N·m {290kgf·cm, 21lbf·ft}	9068-08750	24.5±4.9N·m {250±50kgf·cm, 18±4llbf·ft}
9068-08250	31N·m {320kgf·cm, 23lbf·ft}	9068-08900	24.5±4.9N·m {250±50kgf·cm, 18±4lbf·ft}
9068-08320	24.5±4.9N·m {250±50kgf·cm, 18±4lbf·ft}	9068-58100	24.5±4.9N·m {250±50kgf·cm, 18±4llbf·ft}
9068-08550	28.5N·m {290kgf·cm, 21lbf·ft}		

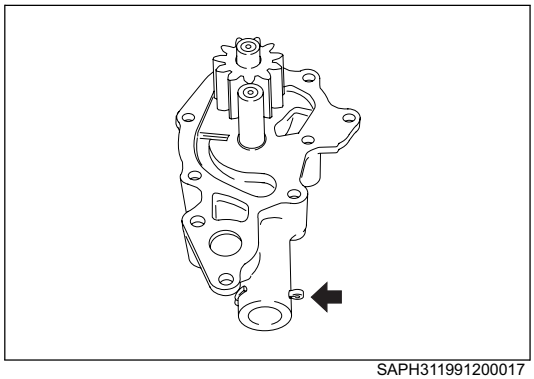

SAPH311991200027

8. Inspection of drive gear backlash

(1) Fix the oil pump assembly with a vice.

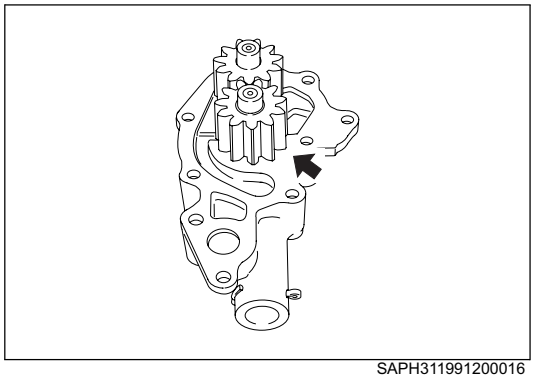
(2) Measure backlash between the drive gear and the driven gear using a dial gauge. If it is beyond the service limit, replace the oil pump assembly.

Standard value (mm{in.})	Service limit (mm{in.})
0.072 - 0.277 {0.0028 - 0.0109}	0.30{0.0118}


SAPH311991200017

9. Assembly of oil pump

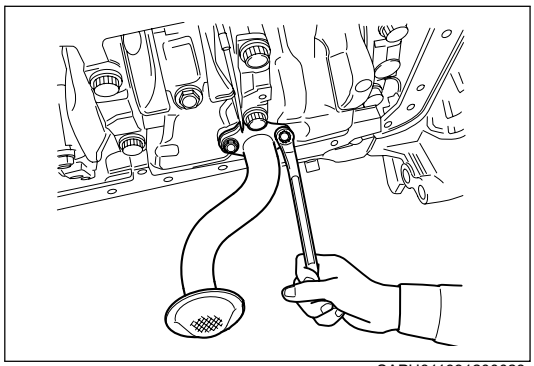
(1) Install the safety valve, relief valve, seat 1 and seat 2 on the oil pump cover assembly with new cotter pins.


SAPH311991200016

(2) Install the driven gear.

Replacement of oil strainer

JP31199120704003


SAPH311991200028

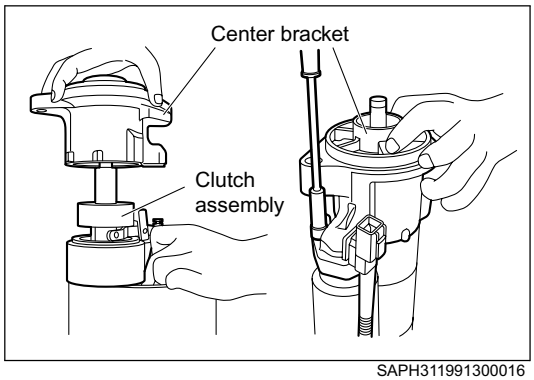
1. Removal of oil strainer

(1) Remove bolts and remove the oil strainer.

2. Installation of oil strainer

(1) Replace the O-ring with new ones and install the oil strainer.

Tightening torque : 31 N·m {320 kgf·cm, 23 lbf·ft}

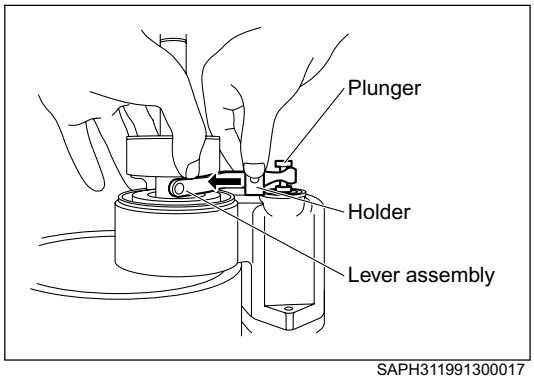


SAPH311991300016

13. Removal of center bracket

(1) Remove two set bolts at the switch using a box screwdriver or offset wrench.

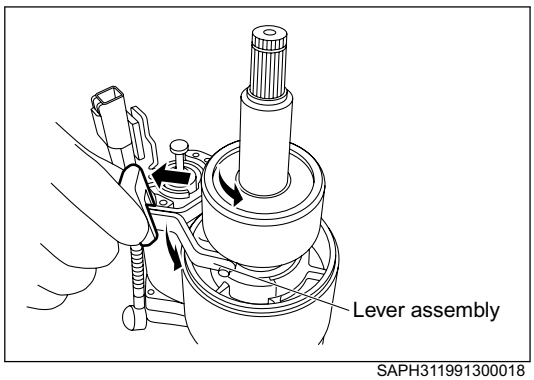
(2) Lift and remove the center bracket.



SAPH311991300017

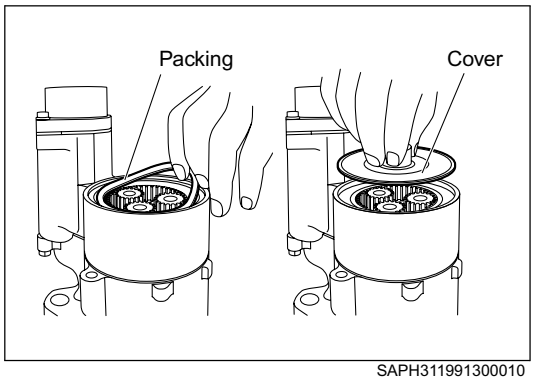
14. Removal of lever

(1) Hold the lever holder and press the entire lever to the clutch. Remove the link with the plunger.



SAPH311991300018

(2) Turn and pull out the lever assembly using the clutch as the axis.



SAPH311991300010

11. Installation of cover

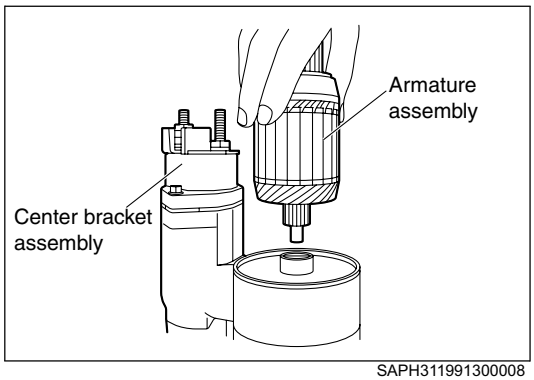
(1) Install a new packing.

(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.**

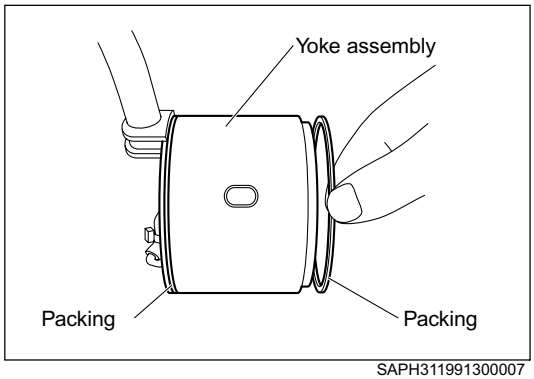


SAPH311991300008

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.**

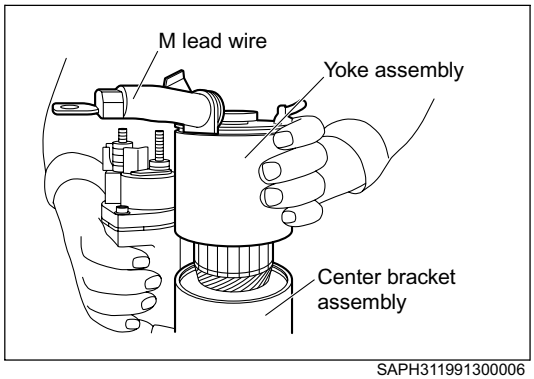


SAPH311991300007

14. Installation of packing

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

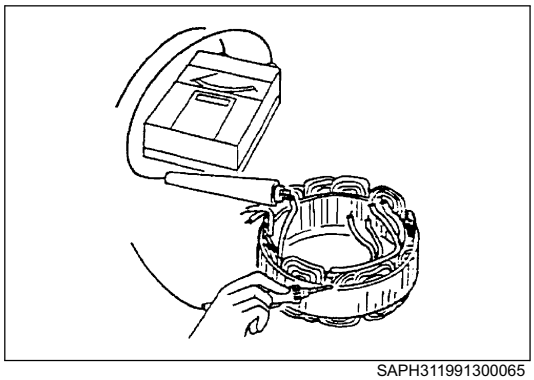
⚠ **CAUTION** • **Damaged packing must not be resued. Replace it with a new part.**



SAPH311991300006

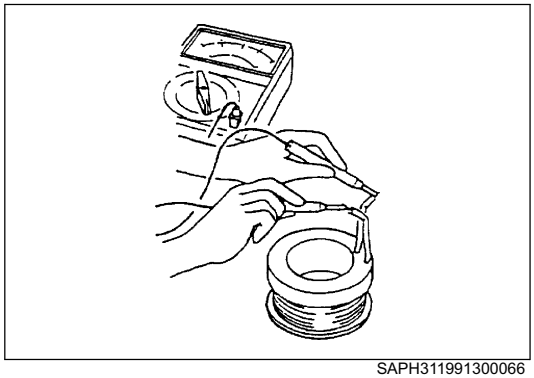
15. Installation of yoke assembly

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


SAPH311991300065

(2) Measure the resistance between the stator coil core and each terminal using a megger tester.

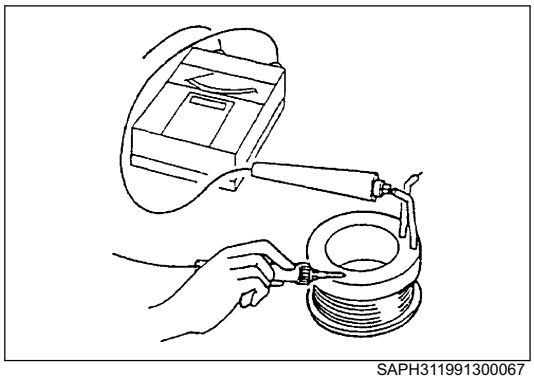
Standard value (MΩ)	1 or more


SAPH311991300066

(3) Measure the resistance of the field coil using a circuit tester.

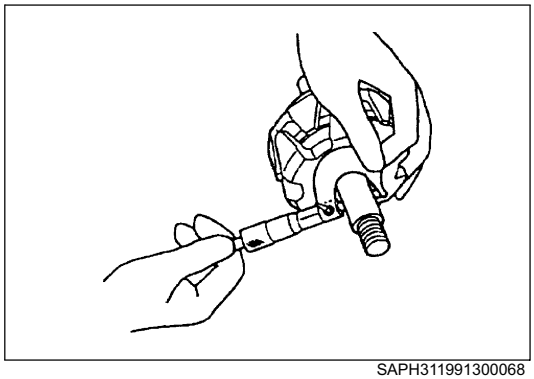
Standard value (Ω)	6.4 - 7.0

⚠ **CAUTION**
- **Do not damage the circumferential surface of the coil.**
- **Damaged coil circumference must not be reused.**


SAPH311991300067

(4) Measure the resistance between the core and the coil using a megger tester.

Standard value (MΩ)	1 or more


SAPH311991300068

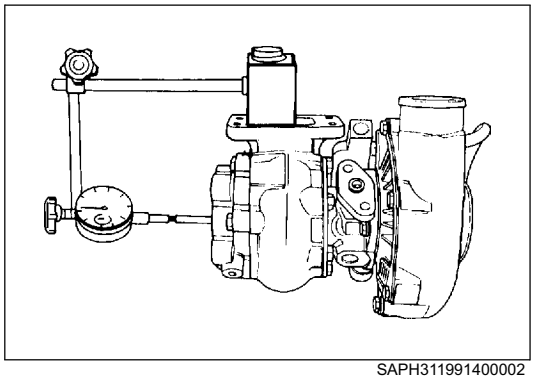
2. Inspection of rotor assembly

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

Standard value (mm{in.})	25{0.9843}
Service limit (mm{in.})	24.98{0.9835}

Inspection

JP31199140501001



SAPH311991400002

1. Inspection of turbine shaft axial play

(1) Inspect play of the turbine shaft at the exhaust side using a special tool.

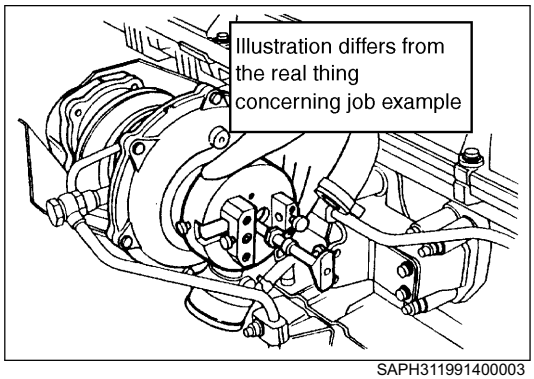
Special tool : 09444-1800 Tool assembly

(2) If the measurement value is beyond the standard value, ask the manufacturer to overhaul the unit.

Standard value (mm{in.})	**Axial direction**	**0.1 {0.0039}**
	Radial direction	**1.0 {0.0393}**

NOTICE

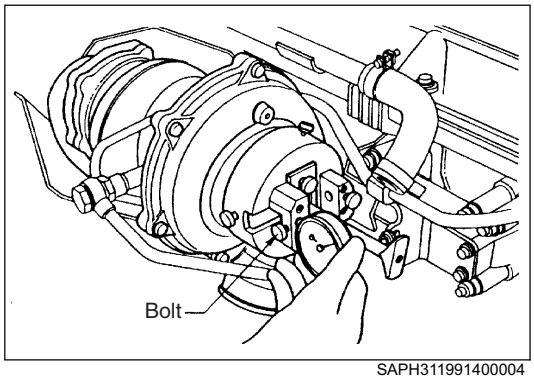
- **Since the assembly is replaced, disassembly and inspection are not allowed.**



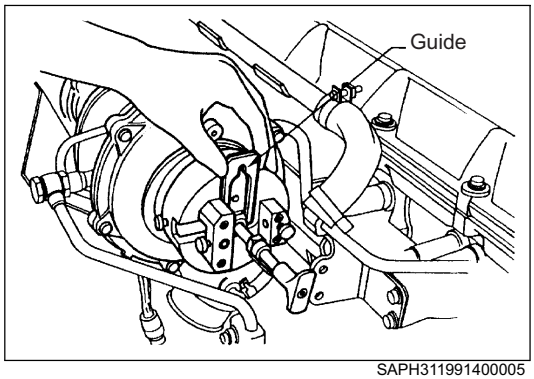
SAPH311991400003

2. Inspection procedure with special tool

(1) Remove dial gauge (key No. 1), loosen the bolt (key No. 13) of the guide (key No. 13) and turn the guide (key No. 2) 90°. Put the dial gauge into the plate (key No. 8) which is inspected for axial play, and tighten the bolt (key No. 19) for fixing.



SAPH311991400004



SAPH311991400005

(2) Insert the guide (key No. 9) to preventment horizontal movement of the measuring instrument.

Alternator

JP311991606010002

Status	Cause	Action
Lamp is ON.→Charge current does not run (alternator).	Faulty regulator (open PTr)	Replace regulator.
	Faulty stator coil (disconnection, rare shorting)	Replace stator coil.
	Fault feed coil (disconnection, rare shorting)	Replace feed coil.
	Faulty diode (open, shorting)	Replace rectifier.
	Disconnection or poor contact of lead wire (plate, support, etc.)	Repair or replace lead wire.
Lamp is ON.→Charge current does not run (wiring).	Disconnection of wire (fuse)	Replace wire (fuse).
Lamp is ON.→Voltmeter indicates 29V or more (alternator).	Faulty regulator (shorting of PTr)	Replace regulator.
	Faulty tightening of voltage detection circuit (e.g. support)	Repair, replace voltage detection circuit or replace regulator.
Lamp is ON.→Charge current is correctly running (alternator).	Faulty regulator (open Tr)	Replace regulator.
Lamp is OFF.→Charge current is always limited.→Battery goes flat (alternator).	Faulty stator coil (disconnection of 1 phase, rare shorting)	Replace stator coil.
	Faulty diode (open, shorting)	Replace rectifier.
	Disconnection or poor contact of lead wire (plate, support, etc.)	Repair or replace lead wire.
Lamp is OFF.→Charge current is always limited.→Battery goes flat (operation load).	Operation load is large (Load balance is poor).	Reduce load
Lamp is OFF.→Charge current is always large.→Battery fluid runs short in a short period of time (alternator).	Faulty regulator (shorting of PTr)	Replace regulator.
	Faulty tightening of voltage detection circuit (e.g. support)	Repair or replace voltage detection circuit.
Lamp is OFF.→Charge current is always large.→Battery fluid runs short in a short period of time (battery).	Battery is close to the service life.	Replace battery.
Others→Abnormal noise (alternator)	Faulty stator coil (rare shorting, grounding)	Replace stator coil.
	Contact of inner surface (faulty bearing, wear of bracket)	Repair or replace bearing.
Others→Abnormal noise (V belt)	Faulty tension of V belt (belt slip)	Correction

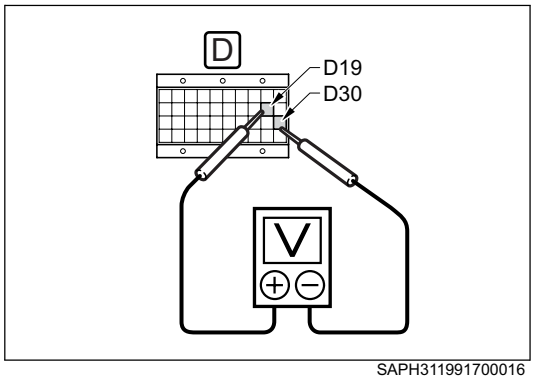
Table of failure code

JP311991706010O1

NOTICE • **For the system status by indication of DTC code in the table, refer to "1. Pre-inspection, Inspection, Engine ECU".**
"Reference : Inspection, Engine ECU, Engine diagnosis code"

[a] Failure diagnosis and [b] Alarm display (alarm status)	DTC code	Estimated failure cause	Page
a. Engine does not start Engine stopped. b. DTC code indication.	P0335	Engine speed main sensor circuit malfunction	17-12
	P0606	CPU malfunction (Hard detection)	17-47
	P0629	Supply pump SCV malfunction (Power source line short)	17-43
a. Low output b. DTC code indication.	P0200	ECU charge circuit high input	17-48
	P0611	ECU charge circuit low input	17-48
a. Low output (LOW idle 800rpm fixing) b. DTC code indication.	P2120	Accelerator sensor 1 and 2 malfunction	17-30
a. Low output b. DTC code indication.	P0217	Engine overheat	17-17
a. Difficult to start engine. b. DTC code indication.	P0540	Preheat circuit malfunction	17-46
a. Low output b. DTC code indication.	P0234	Turbocharger over boost	17-21
	P0088	Excessive common rail pressure	17-21
	P0088	Excessive common rail pressure, supply pump excess forced feed	17-22
	P0108	Boost pressure sensor circuit high input	17-19
	P0117	Coolant temperature sensor circuit low input	17-16
	P0118	Coolant temperature sensor circuit high input	17-16
	P0191	Common rail pressure sensor malfunction	17-23
	P0192	Common rail pressure sensor circuit low input	17-24
	P0193	Common rail pressure sensor circuit high input	17-24
	P0201	Injector circuit malfunction -cylinder 1	17-38
	P0202	Injector circuit malfunction -cylinder 2	17-38

3	Measurement of voltage between terminals



SAPH311991700016

1. Set the starter key to "OFF" and connect the connector of the sub-speed sensor.
2. Start the engine and keep idling status.
3. Measure voltage between terminal D19 and terminal D30 of the signal check harness.
4. After measurement, stop the engine.

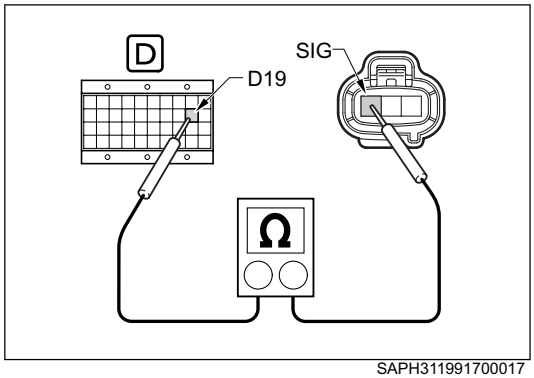
Standard : Pulse waveform of 0 ↔ 5 V

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

OK

Engine ECU failure, ECU connector failure

4	Measurement of resistance between terminals



SAPH311991700017

1. Leave the connector of the sub-speed sensor connected.
2. Measure resistance between the No. 1 terminal at the unit harness of the sub-speed sensor connector and terminal D19 of the signal check harness.

⚠ **CAUTION** • **The connector of the sub-speed sensor in the figure is viewed from the fitting surface.**

Standard value : 2 Ω or less

NG → Harness failure

OK

Failure of sub-speed sensor

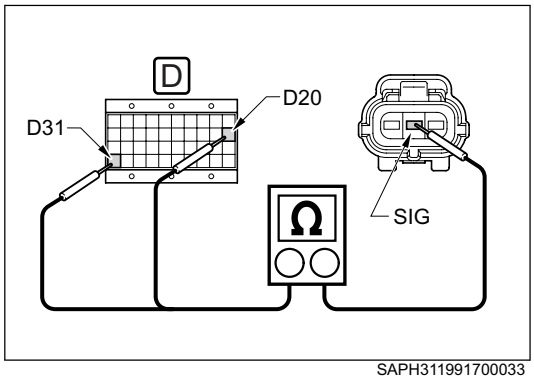
Engine speed main and sub sensor circuit malfunction (DTC code P0335)

JP31199170601006

1. Inspection item

(1) Take actions of (DTC code P0335) and (DTC code P0340).
"Reference : Engine speed main sensor circuit malfunction (DTC code P0335), Engine ECU, Engine diagnosis code"
"Reference : Engine speed sub sensor circuit malfunction (DTC code P0340), Engine ECU, Engine diagnosis code"

3	Measurement of resistance between terminals



SAPH311991700033

1. Set the starter key to "OFF" and disconnect the ECU side connector of the signal check harness.
2. Measure the resistance between terminals D20/D31 of the signal check harness and the SIG terminal of the common rail pressure sensor connector (at unit harness side).

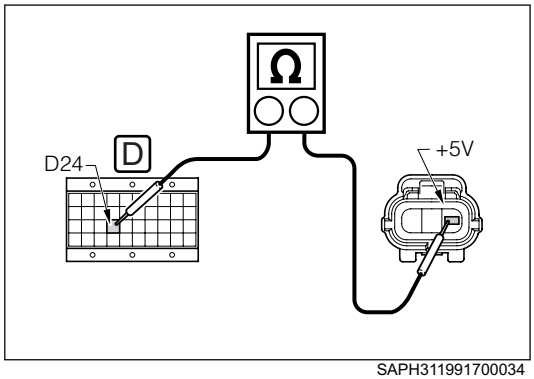
Standard value : 2 Ω or less

NG → Harness failure

OK

Connector contact failure

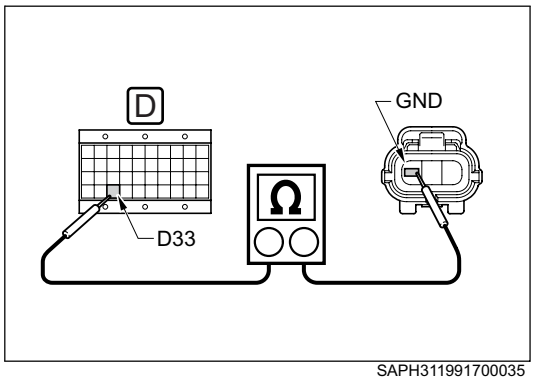
4	Measurement of resistance between terminals



SAPH311991700034

1. Set the starter key to "OFF" and disconnect the ECU side connector of the signal check harness.
2. Measure the resistance between terminals D24 of the signal check harness and the +5 V terminal of the common rail pressure sensor connector (at unit harness side).

Standard value : 2 Ω or less



SAPH311991700035

3. Measure the resistance between terminal D33 of the signal check harness and the GND terminal of the common rail pressure sensor connector (at unit harness side).

Standard value : 2 Ω or less

NG → Harness failure

OK

Engine ECU failure, ECU connector failure