1. STRUCTURE

This service manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.
This service manual mainly contains the necessary technical information for operations performed in a service workshop.
For ease of understanding, the manual is divided into the following sections.

SECTION 1 GENERAL
This section explains the safety hints and gives the specification of the machine and major components.

SECTION 2 STRUCTURE AND FUNCTION
This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

SECTION 3 HYDRAULIC SYSTEM
This section explains the hydraulic circuit, single and combined operation.

SECTION 4 ELECTRICAL SYSTEM
This section explains the electrical circuit, monitoring system and each component. It serves not only to give an understanding electrical system, but also serves as reference material for trouble shooting.

SECTION 5 MECHATRONICS SYSTEM
This section explains the computer aided power optimization system and each component.

SECTION 6 TROUBLESHOOTING
This section explains the troubleshooting charts correlating **problems** to **causes**.

SECTION 7 MAINTENANCE STANDARD
This section gives the judgement standards when inspecting disassembled parts.

SECTION 8 DISASSEMBLY AND ASSEMBLY
This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your HYUNDAI distributor for the latest information.

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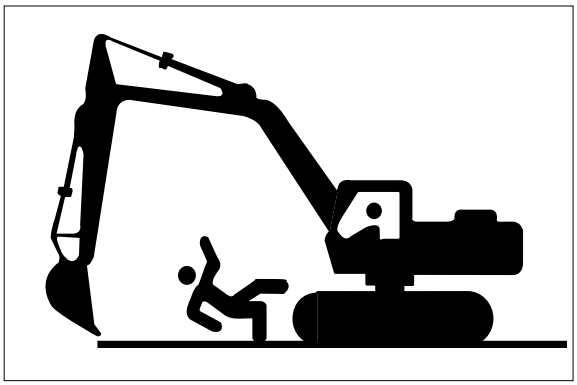
KEEP RIDERS OFF EXCAVATOR

Only allow the operator on the excavator. Keep riders off.

Riders on excavator are subject to injury such as being struck by foreign objects and being thrown off the excavator. Riders also obstruct the operator's view resulting in the excavator being operated in an unsafe manner.

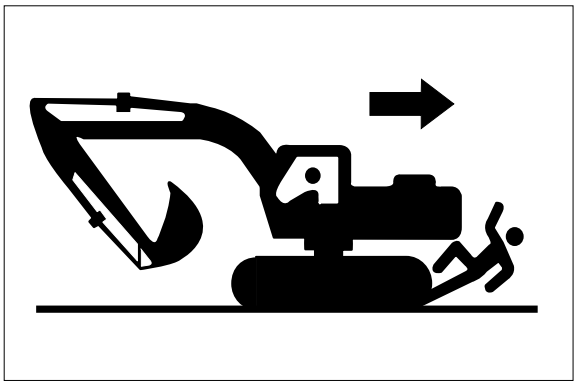


MOVE AND OPERATE MACHINE SAFELY

Bystanders can be run over. Know the location of bystanders before moving, swinging, or operating the machine.

Always keep the travel alarm in working condition. It warns people when the excavator starts to move.

Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the excavator.



OPERATE ONLY FORM OPERATOR'S SEAT

Avoid possible injury machine damage. Do not start engine by shorting across starter terminals.

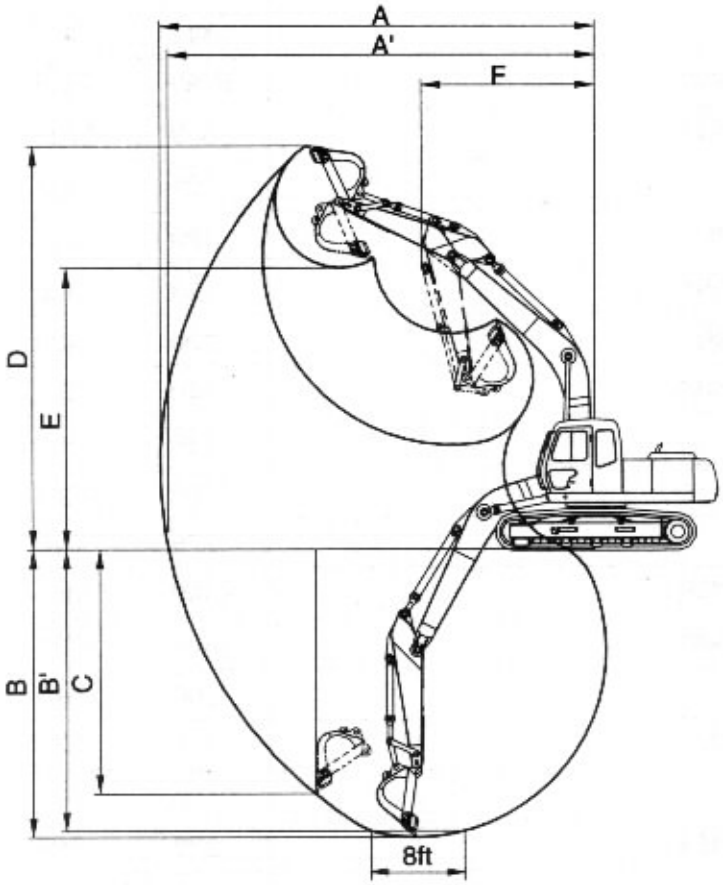
NEVER start engine while standing on ground. Start engine only from operator's seat.

PARK MACHINE SAFELY

Before working on the machine:

- Park machine on a level surface.
- Lower bucket to the ground.
- Turn auto idle switch off.
- Run engine at 1/2 speed without load for 2 minutes.
- Turn key switch to OFF to stop engine. Remove key from switch.
- Move pilot control shutoff lever to locked position.
- Allow engine to cool.

2) OPTION BOOM (5.2m, 17' 7")

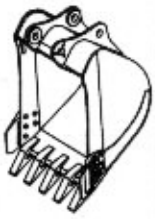
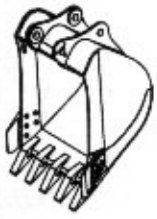
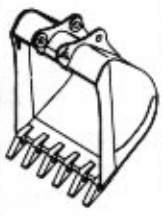


Description		2.0m(6' 7") Arm	2.40m(7' 10") Arm
Max. digging reach	A	8630mm (28' 4")	8950mm (29' 4")
Max. digging reach on ground	A'	8440mm (27' 8")	8770mm (28' 9")
Max. digging depth	B	5470mm (17' 11")	6870mm (19' 3")
Max. digging depth (8ft level)	B'	5230mm (17' 2")	5640mm (18' 6")
Max. vertical wall digging depth	C	4700mm (15' 5")	4980mm (16' 4")
Max. digging height	D	8620mm (28' 3")	8700mm (28' 7")
Max. dumping height	E	5850mm (19' 2")	5940mm (19' 6")
Max. swing radius	F	3500mm (11' 6")	3410mm (11' 2")
Bucket digging force		114.7 [125.5] KN	114.7 [125.5] KN
		11700 [12800] kgf	11700 [12800] kgf
		25790 [28220] lbf	25790 [28220] lbf
Arm digging force		128.0 [140.0] KN	114.1 [124.7] KN
		13050 [14270] kgf	11630 [12720] kgf
		28770 [31460] lbf	25640 [28040] lbf

※ [ ] : Power boost

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET

						
0.51 m³ PCSA heaped bucket	0.80 m³ PCSA heaped bucket	0.87 m³ PCSA heaped bucket	0.92 m³ PCSA heaped bucket	1.05 m³ PCSA heaped bucket	1.20 m³ PCSA heaped bucket	1.34 m³ PCSA heaped bucket

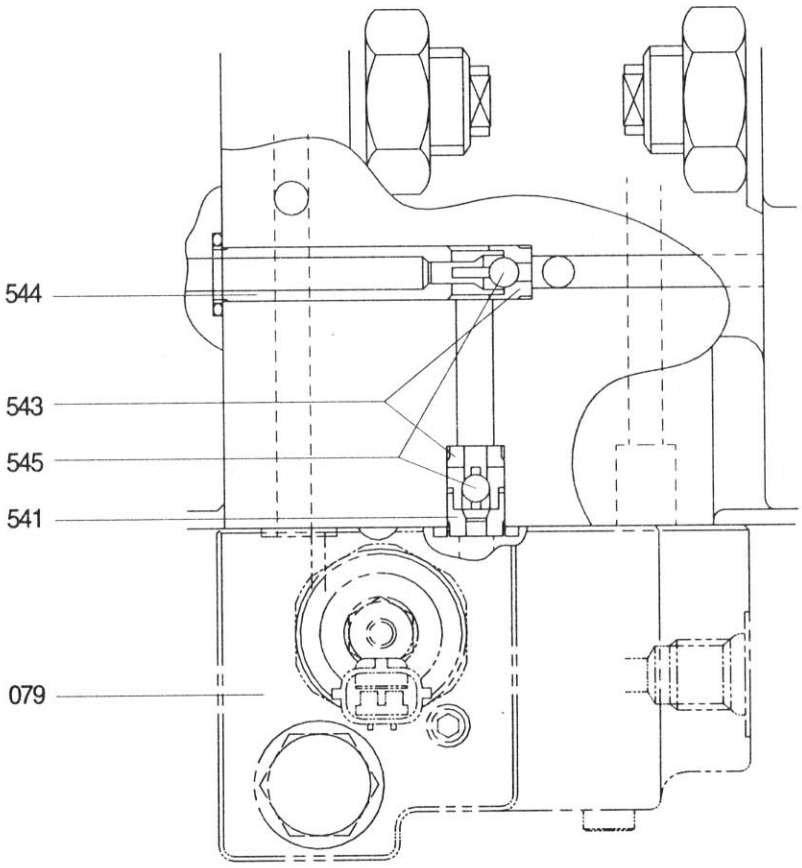
Capacity		Width		Weight	Recommendation					
					5.68m (18' 8") boom				5.2m (17' 7") boom	
PCSA heaped	CECE heaped	Without side cutter	With side cutter		2.0m arm (6' 7")	2.4m arm (7' 10")	2.92m arm (9' 7")	3.9m arm (12' 9")	2.0m arm (6' 7")	2.4m arm (7' 10")
0.51 m³ (0.67 yd³)	0.45 m³ (0.59 yd³)	700 mm (27.6")	820 mm (32.3")	580 kg (1280 lb)						
0.80 m³ (1.05 yd³)	0.70 m³ (0.92 yd³)	1000 mm (39.4")	1120 mm (44.1")	650 kg (1430 lb)						
0.87 m³ (1.14 yd³)	0.75 m³ (0.98 yd³)	1090 mm (42.9")	1210 mm (47.6")	660 kg (1460 lb)						
0.92 m³ (1.20 yd³)	0.80 m³ (1.05 yd³)	1130 mm (44.5")	1090 mm (42.9")	710 kg (1570 lb)						
1.05 m³ (1.37 yd³)	0.90 m³ (1.18 yd³)	1250 mm (49.2")	1370 mm (53.9")	740 kg (1630 lb)						
1.20 m³ (1.57 yd³)	1.00 m³ (1.31 yd³)	1400 mm (55.1")	—	770 kg (1700 lb)						
1.34 m³ (1.75 yd³)	1.15 m³ (1.50 yd³)	1550 mm (61.1")	—	800 kg (1760 lb)						

Applicable for materials with density of 2000 kg/m³ (3370 lb/yd³) or less

Applicable for materials with density of 1600 kg/m³ (2700 lb/yd³) or less

Applicable for materials with density of 1100 kg/m³ (1850 lb/yd³) or less

MAIN PUMP(2/2)



VIEW A

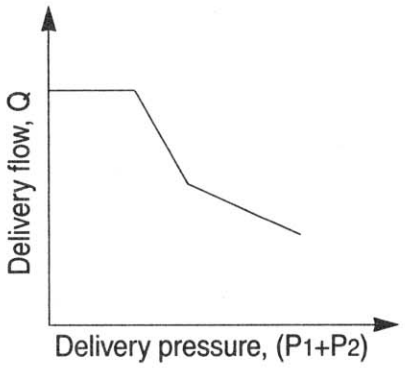
541	Seat	544	Stopper 2	079	Proportional reducing valve
543	Stopper 1	545	Steel ball		

(2) Total horsepower control

The regulator decreases the pump tilting angle(delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.
(The input horsepower is constant when the speed is constant.)
Since the regulator is of the simultaneous total horsepower type that operates by the sum of load pressures of the two pumps in the tandem double-pump system, the prime mover is automatically prevented from being overloaded, irrespective of the load condition of the two pumps, when horsepower control is under way.
Since this regulator is of the simultaneous total horsepower type, it controls the tilting angles(displacement volumes) of the two pumps to the same value as represented by the following equation :

$$Tin = P1 \times q/2\pi + P2 \times q/2\pi$$
$$= (P1+P2) \times q/2\pi$$

The horsepower control function is the same as the flow control function and is summarized in the following.(For detailed behaviors of respective parts, refer to the section of flow control).

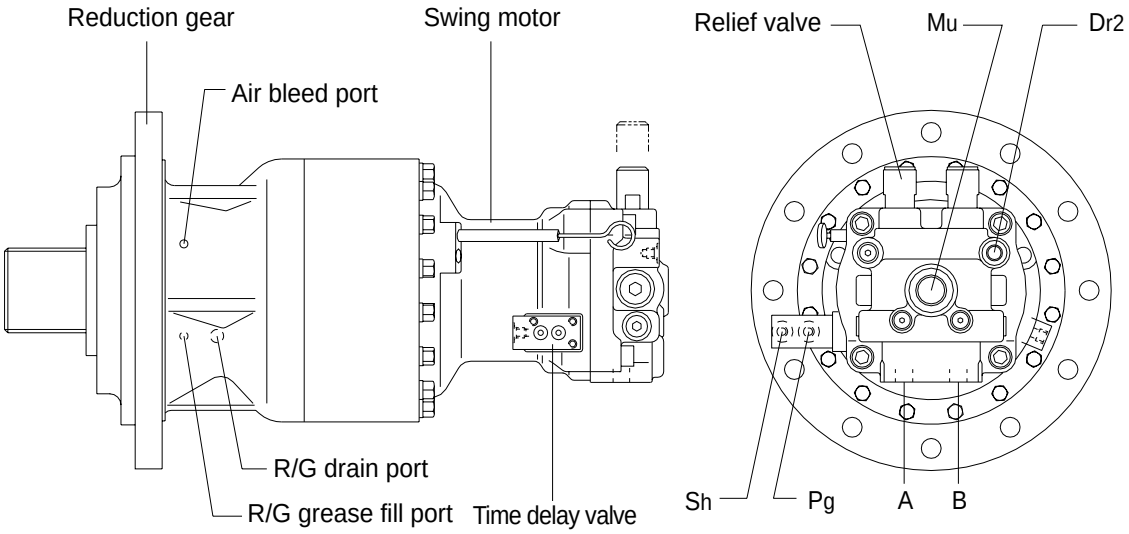


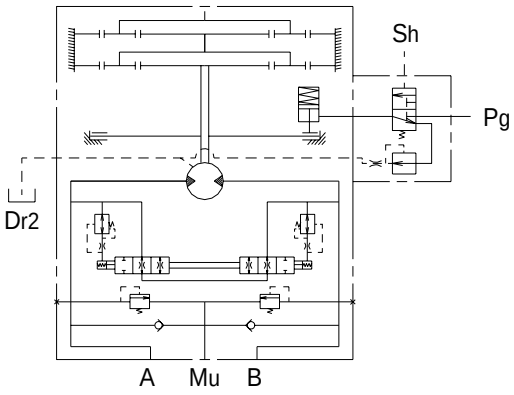
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

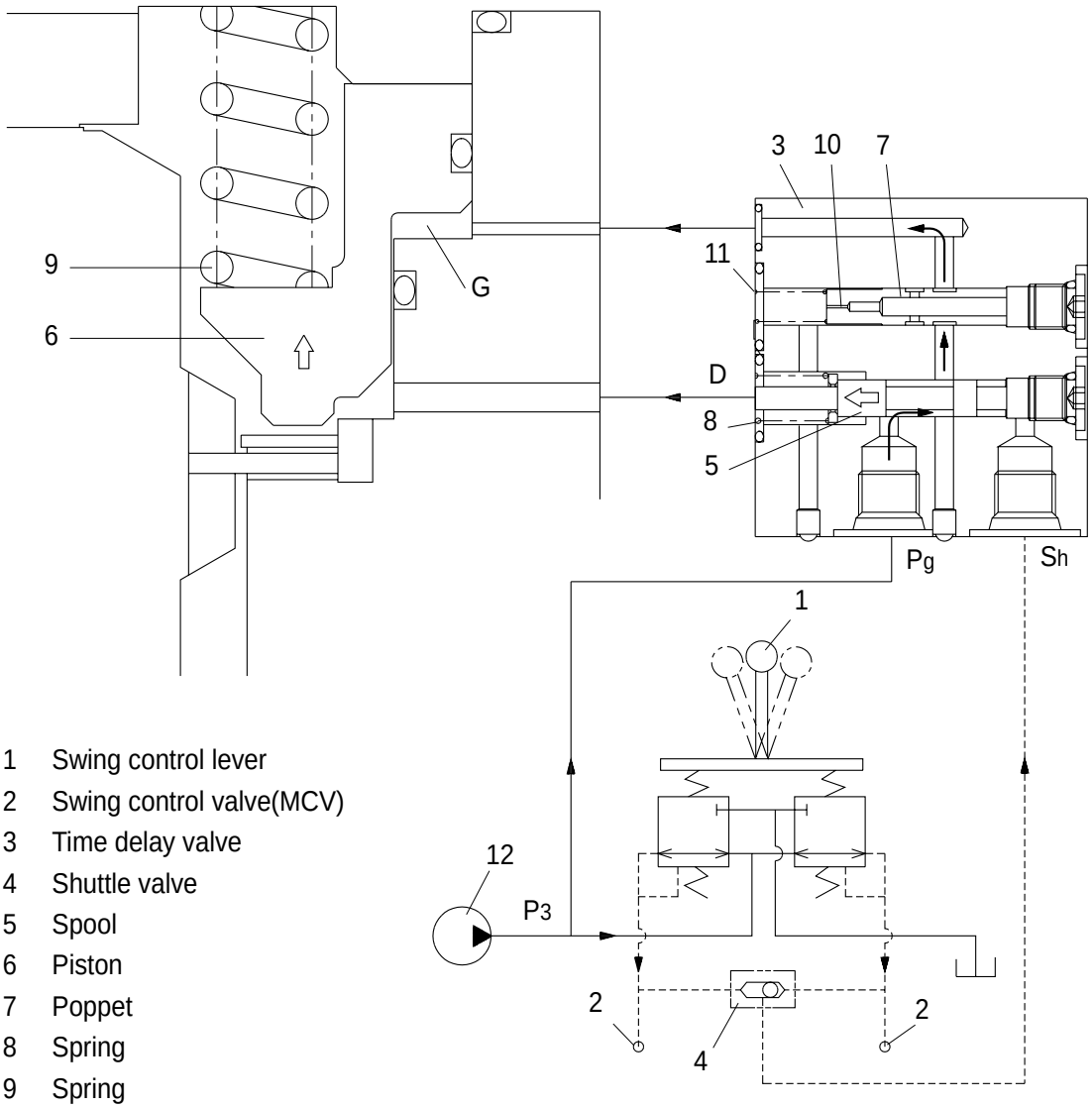
Swing motor include mechanical parking valve, relief valve, make up valve and time delay valve.





Port	Port name	Port size
A	Main port	PF 3/4
B	Main port	PF 3/4
Dr2	Drain port	PF 3/8
Mu	Make up port	PF 1
Sh	Brake release port	PF 1/4
Pg	Stand by port	PF 1/4

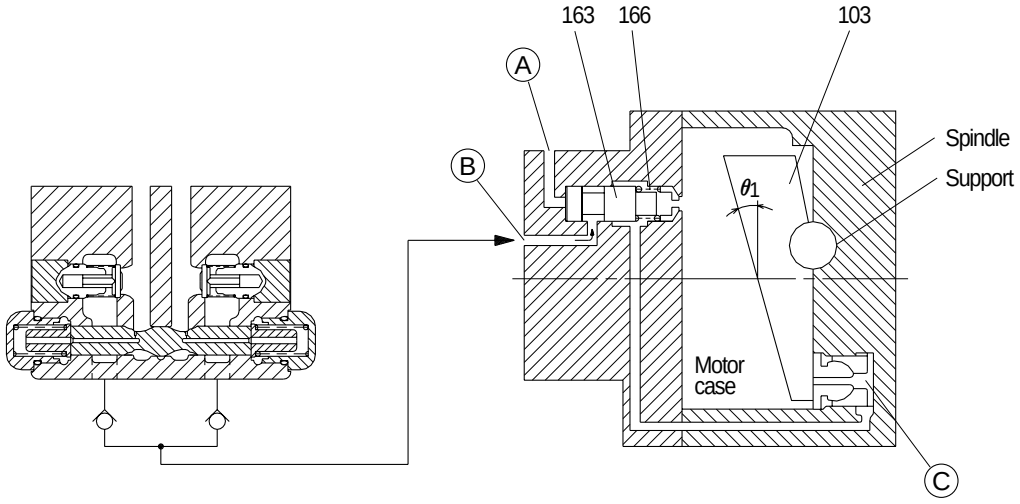
b. Meantime, the oil pressure of port D balance with the preset force of spring(11), the pressure of chamber G keeps constant pressure.



1 Swing control lever
2 Swing control valve(MCV)
3 Time delay valve
4 Shuttle valve
5 Spool
6 Piston
7 Poppet
8 Spring
9 Spring
10 Orifice
11 Spring
12 Pilot pump

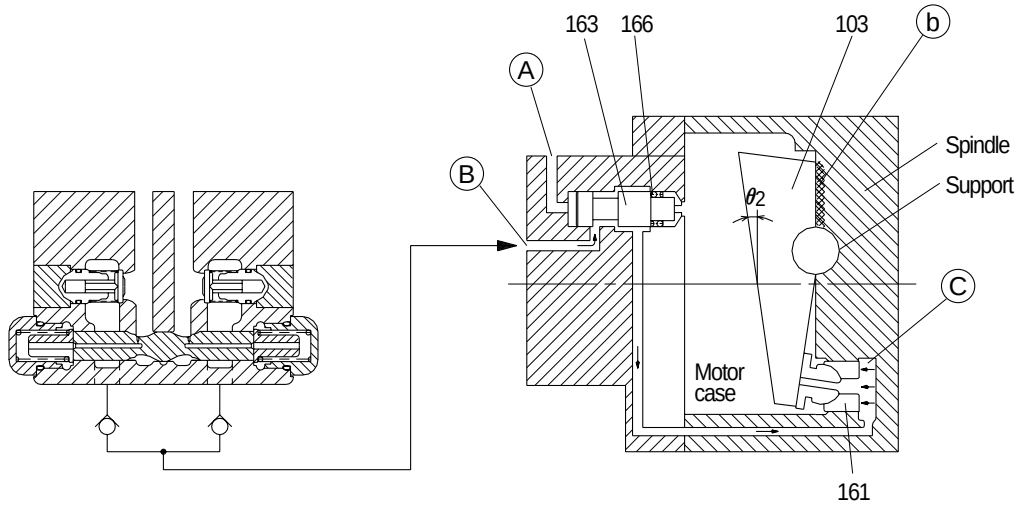
(4) High/low speed changeover mechanism

① **At low speed** - at pilot pressure of less than 20 kgf/cm² (1.96 Mpa)



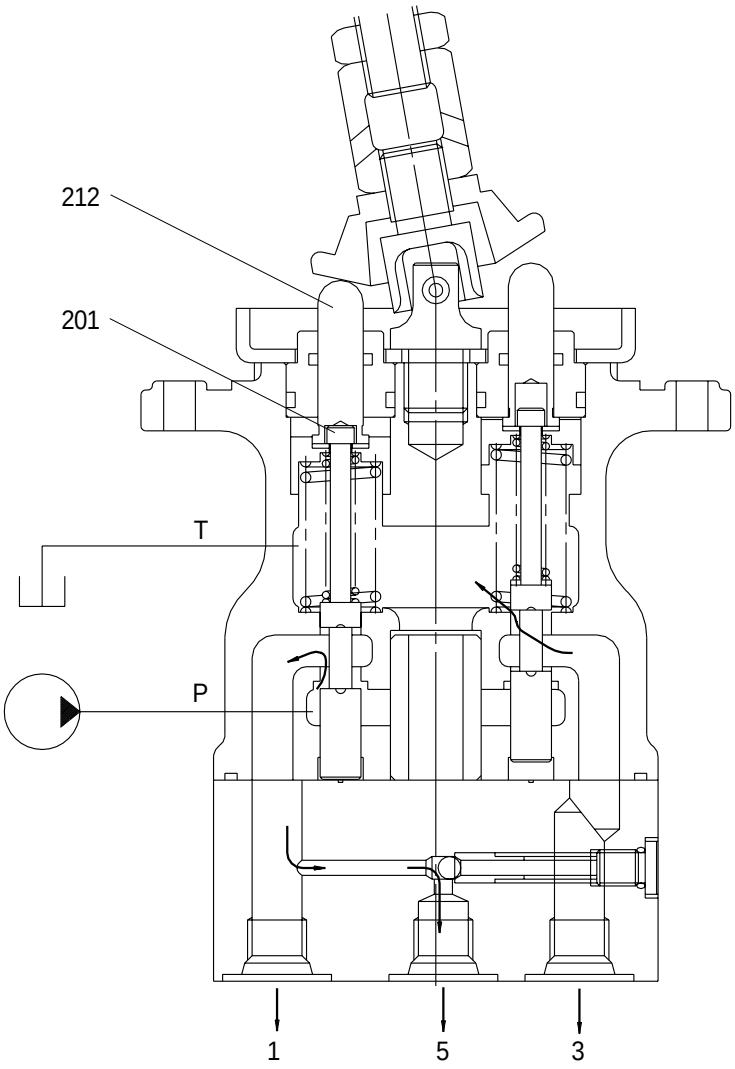
When no pilot pressure is supplied from port Ⓐ (at a pressure of 20 kgf/cm² (1.96 Mpa) or less), valve(163) is pressed toward the left by the force of spring(166), the pressurized oil supply port Ⓑ is shut off, and oil in chamber Ⓒ is released into the motor case via valve(163). Consequently, swash plate(103) is tilted at a maximum angle θ_1 and the piston displacement of hydraulic motor becomes maximum, thus leading to low-speed rotation.

② **At high speed** - at pilot pressure of 20 kgf/cm² (1.96 Mpa) or more



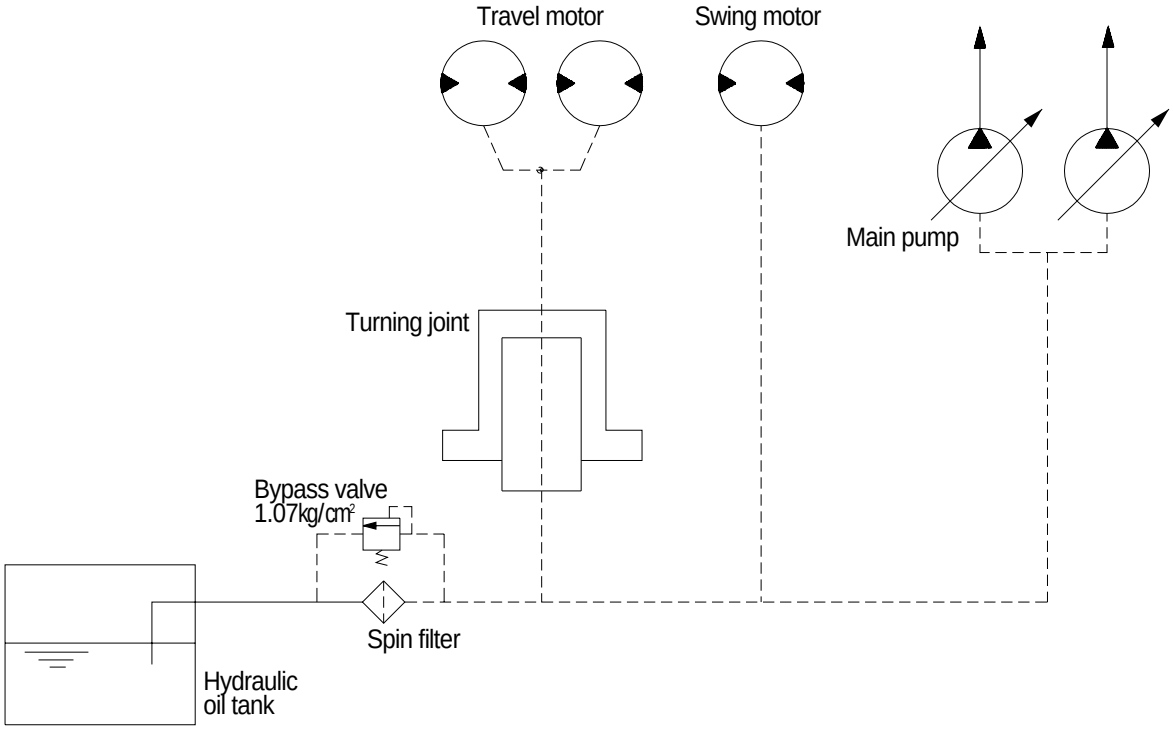
When a pilot pressure is supplied from port Ⓐ (at a pressure of 20 kgf/cm² (1.96 Mpa) or more), the pressure overcomes the force of spring(166) and valve(163) is pressed toward the right. The pressurized oil at supply port Ⓑ is then introduced into chamber Ⓒ via valve(163). Piston(161) pushes up swash plate(103) until it touches side ⓑ of the spindle. At this time, swash plate(103) is tilted at a minimum angle θ_2 and the piston displacement of hydraulic motor becomes minimum, thus leading to high-speed rotation.

(3) Swing shuttle function(LH only)



When the push rod(212) is stroked, the spool(201) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
At the same time, the pressure of port P1 applied shuttle valve, the ball moves to the right, and port P1 is connected with port P5.
In this manner, oil flow swing motor, than swing motor, than swing brake valve is released.

3. DRAIN CIRCUIT



Besides internal leaks from the motors and main pump, the oil for lubrication circulates. These oil have to be fed to the hydraulic tank passing through spin filter.
When the drain oil pressure exceed 1.07kg/㎠ (15psi), the oil returns to the hydraulic tank directly.

1) TRAVEL MOTOR DRAIN CIRCUIT

Oil leaked from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and return to the hydraulic tank after being filtered by spin filter.

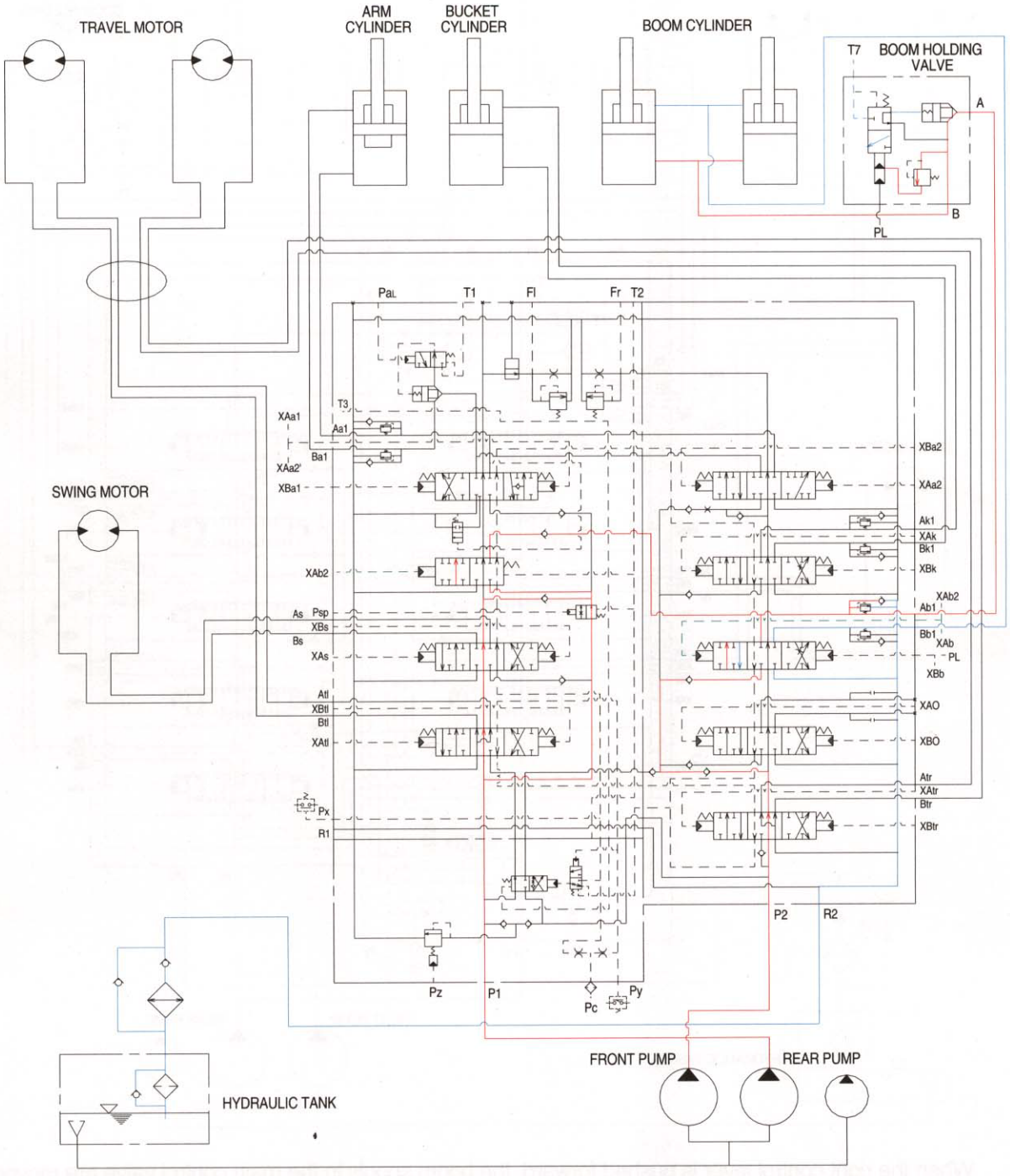
2) SWING MOTOR DRAIN CIRCUIT

Oil leaked from the swing motor returns to the hydraulic tank passing through a spin filter with oil drained from the travel circuit .

3) MAIN PUMP DRAIN CIRCUIT

Oil leaked from main pump returns to the hydraulic tank passing through spin filter.

1. BOOM RAISE OPERATION



When the right control lever is pulled back, the boom spools in the main control valve are moved to the raise position by the pilot oil pressure from the remote control valve.

The oil from the front and rear pump flows into the main control valve and then goes to the large chamber of boom cylinders.

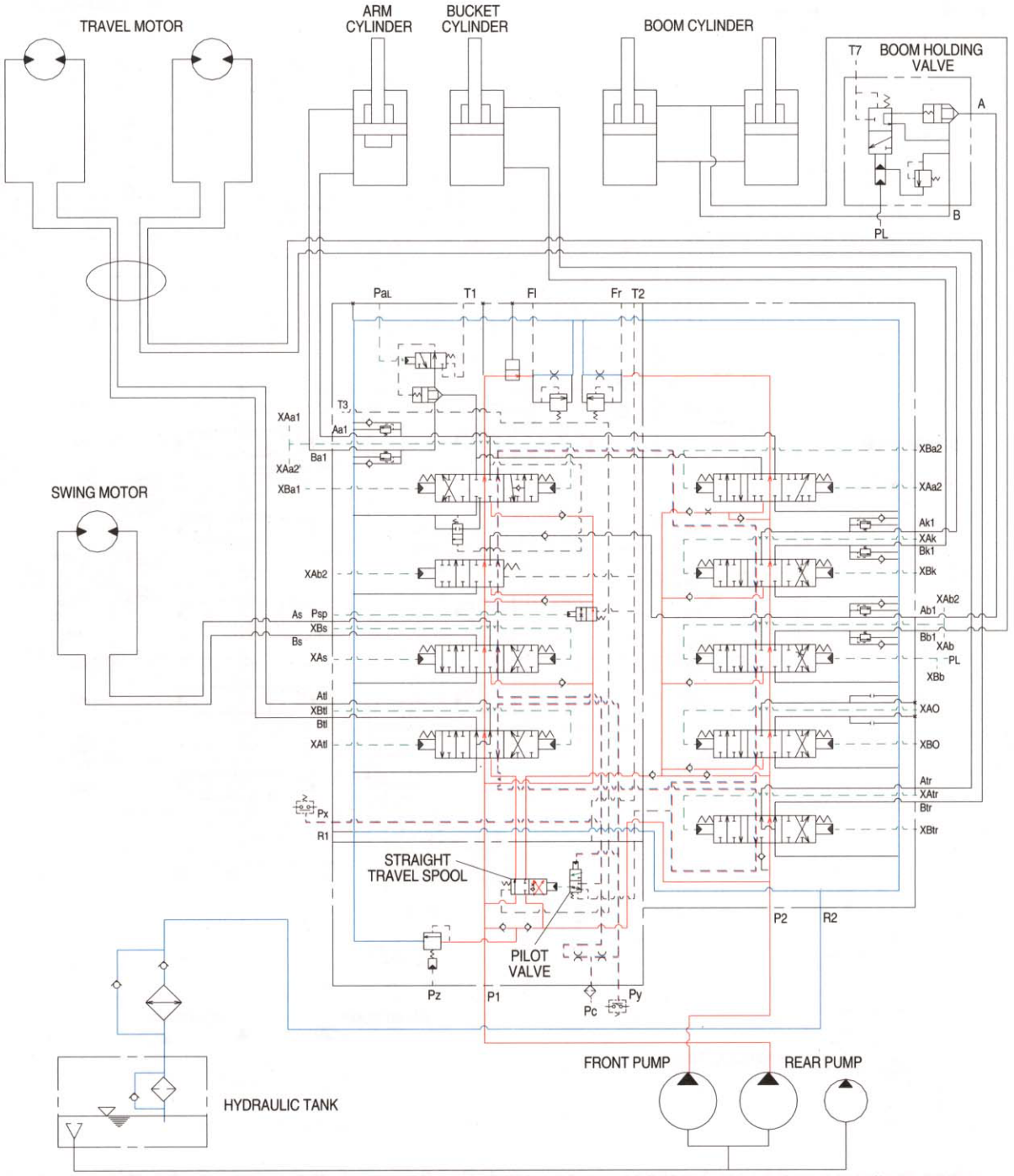
At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the boom goes up.

The excessive pressure in the boom cylinder bottom end circuit is prevented by relief valve.

When the boom is raised and the control lever is returned to neutral position, the circuit for the holding pressure at the bottom end of the boom cylinder is closed by the boom holding valve.

GROUP 5 COMBINED OPERATION

1. OUTLINE



The oil from the front and rear pump flows through the neutral oil passage, bypass oil passage and confluence oil passage in the main control valve. Then the oil goes to each actuator and operates them. Check valves and orifices are located on these oil passage in the main control valve. These control the oil from the main pumps so as to correspond to the operation of each actuator and smooth the combined operation.

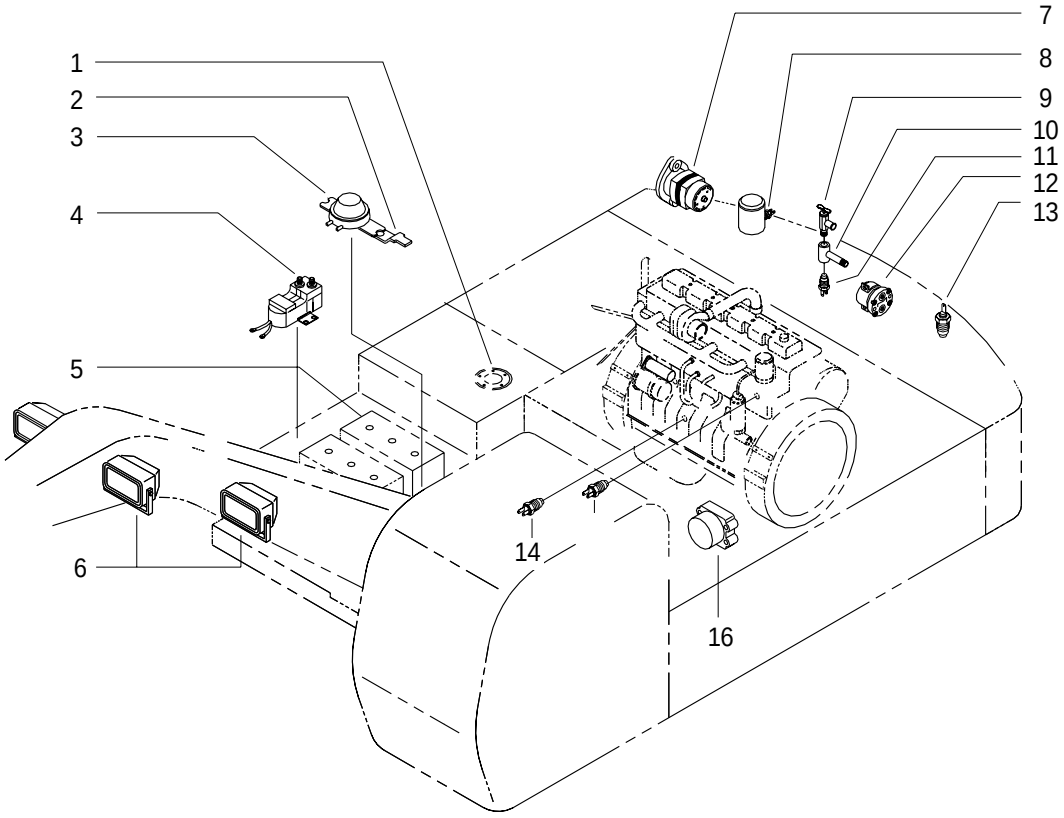
PILOT VALVE FOR STRAIGHT TRAVEL

This pilot valve for straight travel is provided in the main control valve.

If any actuator is operated when traveling, the spool of pilot valve is pushed to the downward by the pilot oil pressure from the pilot pump. At the same time, the straight travel spool is pushed to the left by the oil through the pilot valve for straight travel.

Consequently, the left and right travel oil supply passage are connected, and equivalent amount of oil flows into the left and right travel motors. This keeps the straight travel.

2. LOCATION 2



1	Fuel sender	7	Alternator	12	Start relay
2	Connector plate	8	Water temp sender	13	Air cleaner switch
3	Battery relay	9	Heater valve	14	Engine oil pressure switch
4	Fuel filler pump	10	Heater adapter	15	Overheat switch
5	Battery	11	Hyd temp sender	16	Governor motor
6	Lamp				

4. HEAD LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.8) → I/conn 〔CN-37(1)〕 → Head lamp switch 〔CS-39(6)〕
Head lamp relay 〔CR-13(4)〕

※ When lamp switch ON

Head lamp switch ON 〔CS-39(2)〕 → Head lamp relay 〔CR-13(3) → (1)〕 → Ground
〔CR-13(4) → (2)〕 →

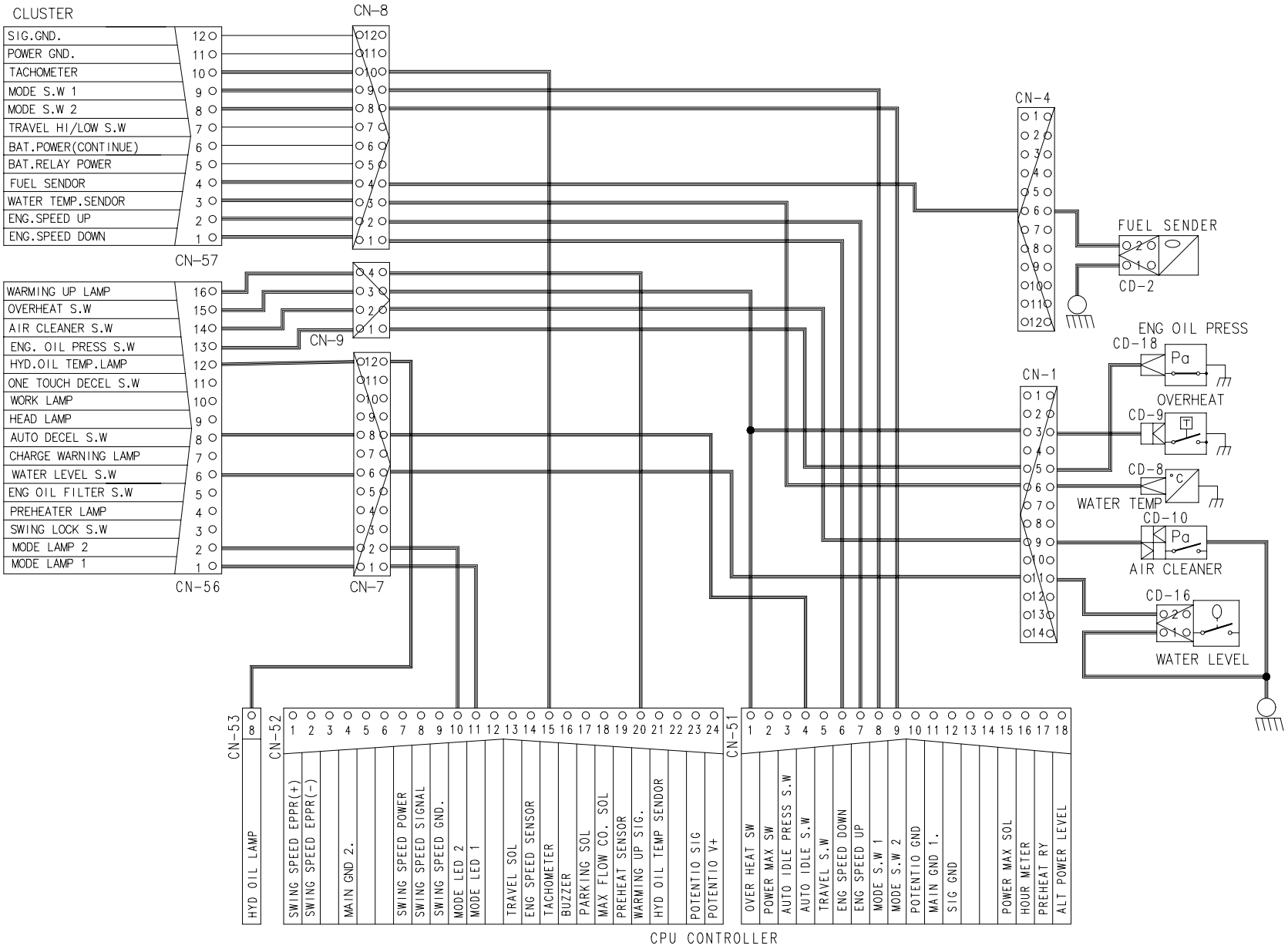
→ Head lamp switch lamp ON 〔CS-39(9)〕
→ Head lamp ON 〔CL-3(2)〕
→ I/conn 〔CN-4(7)〕 → Head lamp ON 〔CL-4(2)〕
→ I/conn 〔CN-7(9)〕 → Cluster head lamp 〔CN-56(9)〕

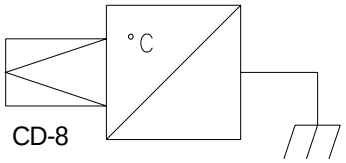
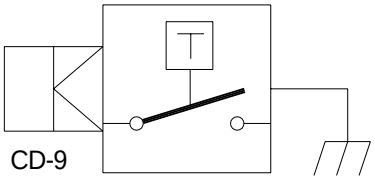
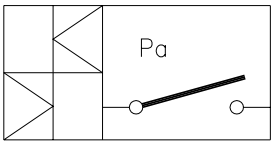
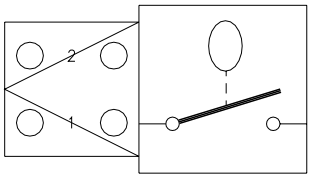
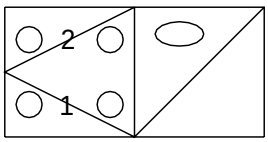
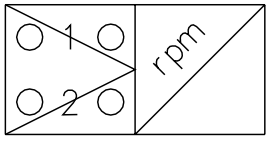
2) CHECK POINT

Engine	Key switch	Check point	Voltage
STOP	ON	① - GND (Fuse box) ② - GND (Switch power input) ③ - GND (Switch power output) ④ - GND (Relay input) ⑤ - GND (Relay coil) ⑥ - GND (Relay output) ⑦ - GND (Head lamp)	20 ~ 25V

※ GND : Ground

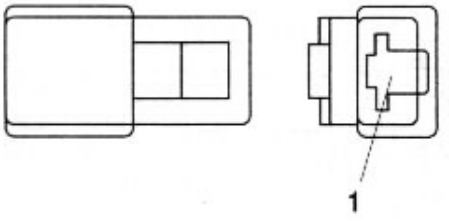
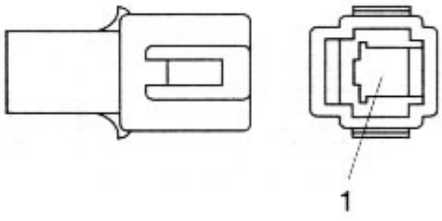
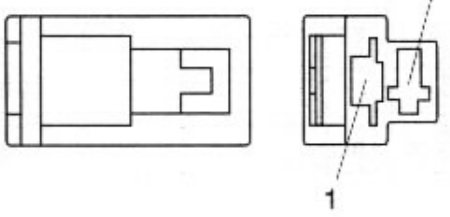
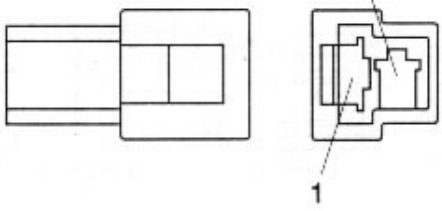
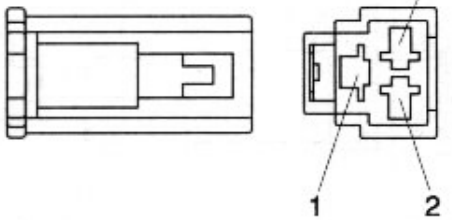
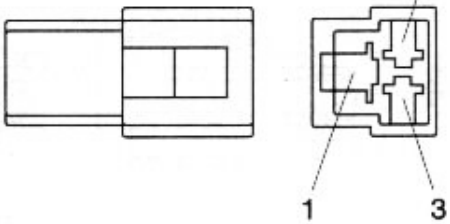
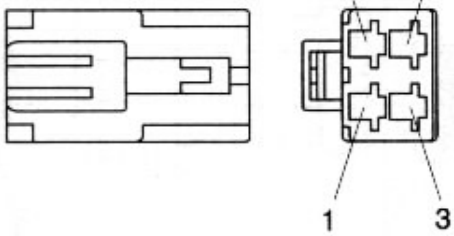
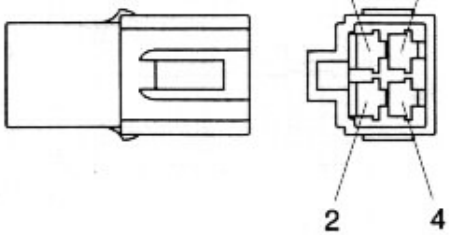
MONITORING CIRCUIT



Part name	Symbol	Specifications	Check
Coolant temperature sensor	 CD-8	-	※ Check resist 50°C : 153.9Ω 80°C : 51.9Ω 100°C: 27.4Ω
Coolant overheat sensor	 CD-9	24V 0.5A	※ Check resist Normal : ∞Ω 105°C over : 0Ω
Air cleaner pressure switch	 CD-10	Pressure:635mm H_2O (N.O TYPE)	※ Check contact Normal : ∞Ω
Coolant level sensor	 CD-16	24V 0.5A	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel sender	 CD-2	-	※ Check resist Full : 3Ω 5/6 : 25Ω 4/6 : 35Ω 3/6 : 68Ω 2/6 : 95Ω 1/6 : 110Ω Empty warning :180Ω
Tacho sensor	 CD-17	-	※ Check contact Normal : Max 0 ~ 3A

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-57	ML	12	Cluster	AMP,174046-2	-
CN-60	58-L	2	Fusible link	S813-030200	S813-130200
CN-61	KET	1	Fuel filler pump	S822-015000	S822-115001
CN-65	KET	1	Travel alarm buzzer	S822-014000	S822-114001
CN-66	KET	2	Breaker solenoid	S814-002000	S814-102000
CN-68	KET	2	Safety solenoid	S814-002000	S814-102000
CN-70	KET	2	Travel solenoid	S814-002000	S814-102000
CN-74	RING-TERM	-	Alternator "I" term	S820-106000	-
CN-75	AMP	2	EPPR valve	174354-2	174352-2
CN-76	58-X	4	Governor motor	S813-060400	S813-160400
CN-77	58-X	3	Potentiometer	S813-060300	S813-160300
CN-78	KET	1	Ether	S822-014000	S822-114001
CN-79	RING-TERM	1	Fuel cut-off solenoid	S820-105000	-
CN-86	SWP	2	Swing lock solenoid	S814-002000	S814-102000
CN-87	SWP	2	Max flow solenoid	S814-002000	S814-102000
CN-88	SWP	2	Power boost solenoid	S814-002000	S814-102000
CN-89	SWP	2	Arm half solenoid	S814-002000	S814-102000
CN-99	SWP	3	Buzzer	S814-003000	S814-103000
CN-124	AMP	2	Swing EPPR valve	174354-2	174352-2
CN-126	SWP	2	Electric socket	S814-002000	S814-102000
· Relay					
CR-1	RING-TERM	-	Battery relay	S820-104000	-
CR-2	CN	4	Horn relay	S810-004202	-
CR-3	CN	4	Work lamp relay	S810-004202	-
CR-4	CN	5	Wiper relay	S810-005202	-
CR-7	CN	4	Air-con relay	S810-004202	-
CR-9	CN	4	Cabin lamp relay	S810-004202	-
CR-13	CN	4	Head lamp relay	S810-004202	-
CR-23	CN	2	Start relay	S816-002003	-
· Switch					
CS-1	KET	1	Door switch	S810-014000	-
CS-2	SWP	6	Start switch	S814-006000	-
CS-3	SWF	10	Wiper switch	SWF,593757	-
CS-4	CN	3	Safety switch	S810-003202	-
CS-5	KET	1	Horn switch	S822-014000	S822-114000
CS-7	CN	6	Prolix switch	S810-006202	-
CS-16	SWF	10	Travel alarm switch	SWF,593757	-
CS-21	SWF	10	Lamp switch	SWF,593757	-
CS-22	SWF	10	Ether switch	SWF,593757	-
CS-23	SWF	10	Beacon lamp switch	SWF,593757	-
CS-24	SWF	10	Cabin lamp switch	SWF,593757	-

7) CN TYPE CONNECTOR

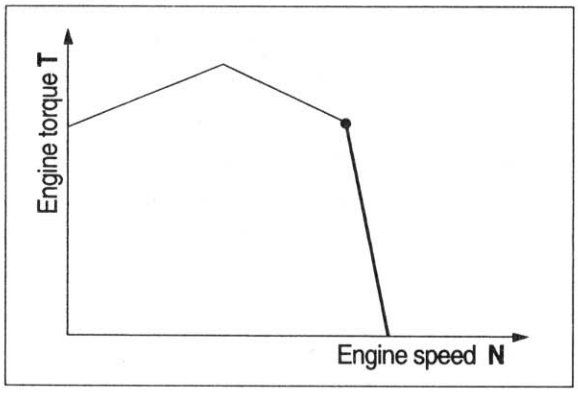
No. of pin	Receptacle connector(Female)	Plug connector(Male)
1	 S810-001202	 S810-10120
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

3. MAXIMUM POWER OF H MODE

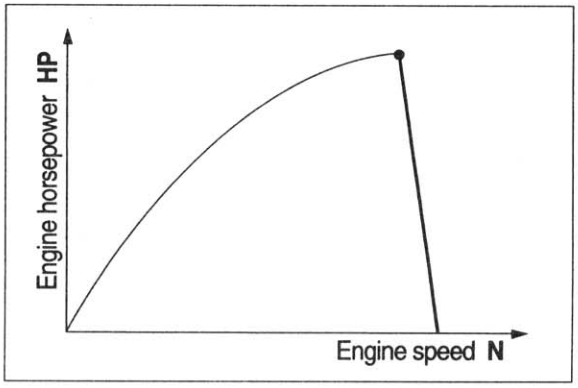
1) When **H** mode is selected in the cluster, CPU controller moves the engine governor motor to set the throttle lever to the full position and sends initial current signal to the EPPR valve to set the pump absorption torque high. So, it is possible to maximize the work performance by using 100% of the engine power at this mode.

2) If the pump load becomes too high and the engine speed drops, the CPU controller reduces the pump discharge amount and momentarily resets the engine speed to the rated point through engine speed sensing.

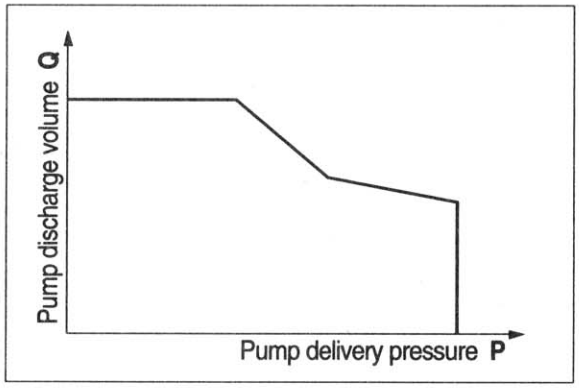
· Engine Torque



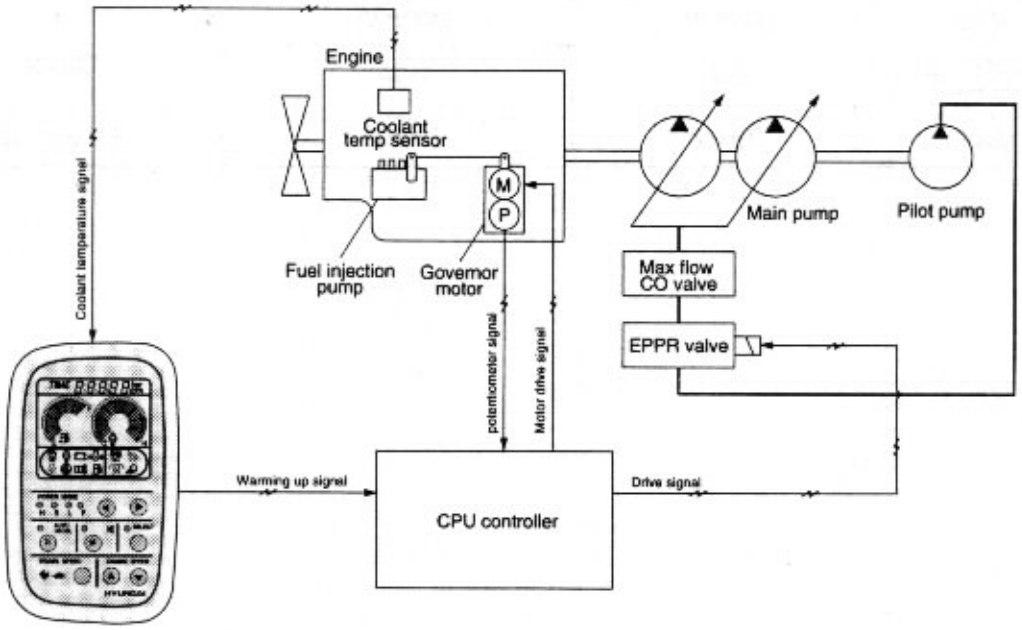
· Engine horsepower



· Main pump delivery



GROUP 9 AUTOMATIC WARMING UP FUNCTION



1. Cluster reads engine coolant temperature through the temperature sensor, and if the coolant temperature is less than 30°C, it turns the warming-up lamp ON and sends warming-up control signal to the CPU controller.
2. When the CPU controller receives the warming-up control signal from the cluster, it changes the governor motor position and set the engine speed to 1250 rpm. At the same time, the mode display on cluster is not changed.
3. If the coolant temperature increases upto 30°C, or an operator changes mode set among the warming up function, the CPU controller cancels the automatic warming up function.

4. Logic table(1)

	Condition	Function
Actuated	- Coolant temperature : less than 30°C (after engine run)	- Mode : Default - Warming up time : at least 10 minutes - Warming-up lamp : ON
Canceled	- Coolant temperature : above 30°C - Warming up time : above 10 minutes - Changed mode set by operator ★ If any of the above conditions is applicable, the automatic warming-up function is canceled	- Default mode - Default mode - Changed mode
Warming-up lamp	Coolant temperature : above 30°C	Warming-up lamp : OFF

SECTION 6 TROUBLESHOOTING

GROUP 1 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

(1) If even a minor fault is left intact and operation is continued, a fatal failure may be caused, entailing a large sum of expenses and long hours of restoration.
Therefore when even a small trouble occurs, do not rely on your intuition and experience, but look for the cause based on the troubleshooting principle and perform maintenance and adjustment to prevent major failure from occurring. Keep in mind that a fault results from a combination of different causes.

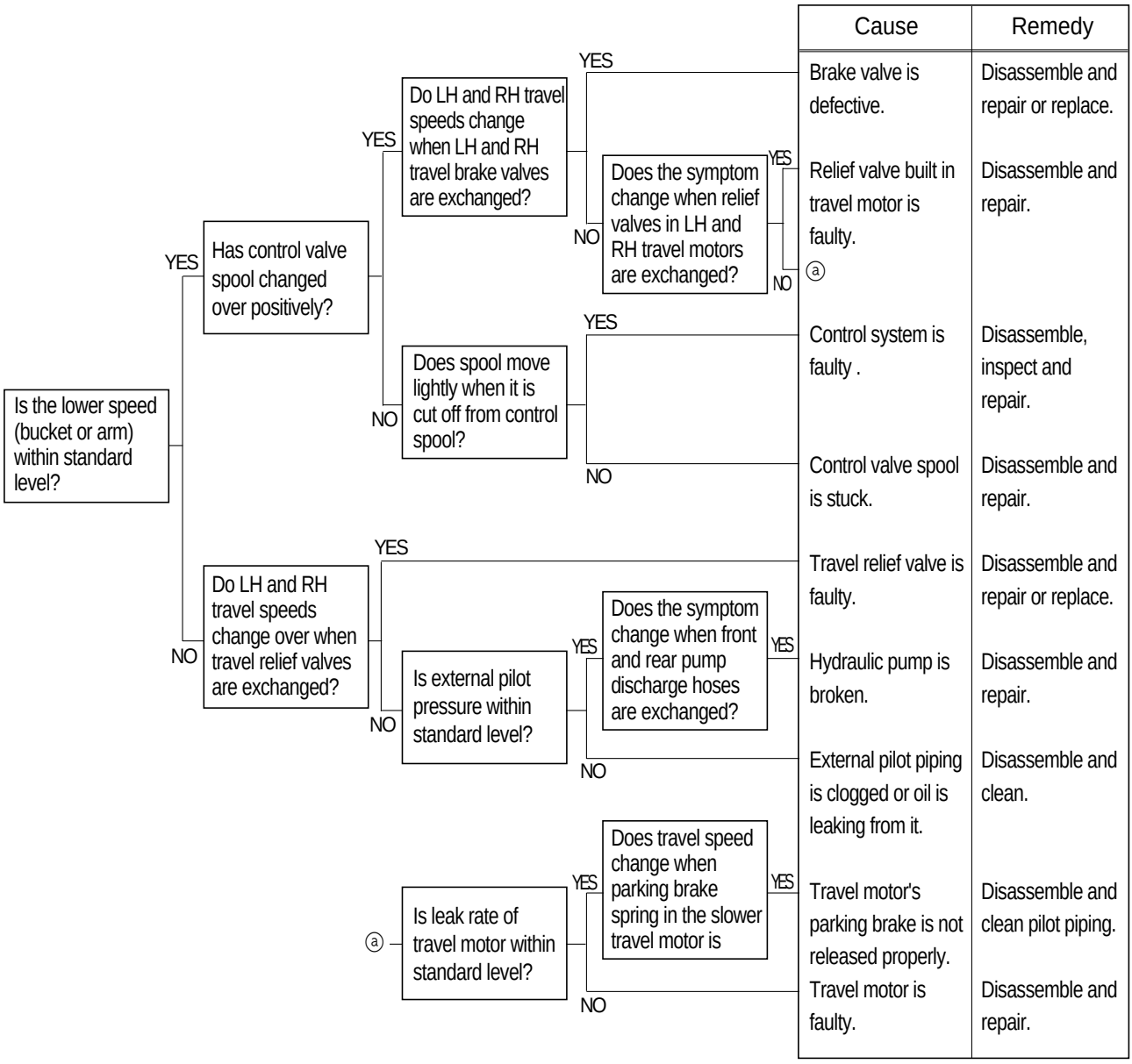
(2) The following lists up commonly occurring faults and possible causes with this machine. For the troubleshooting of the engine, refer to the coming troubleshooting and repair.

(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(4) Ask user or operator the following.
① Was there any strange thing about machine before failure occurred?
② Under what conditions did the failure occur?
③ Have any repairs been carried out before the failure?

(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

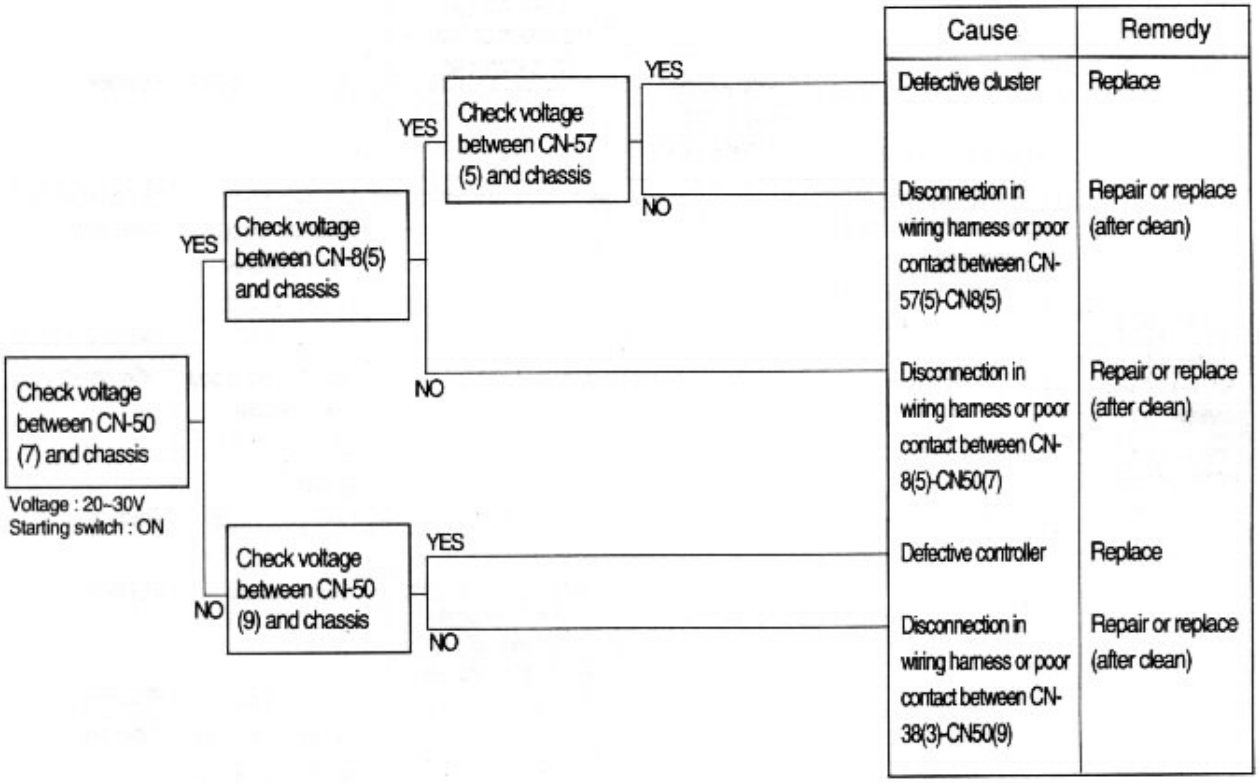
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES

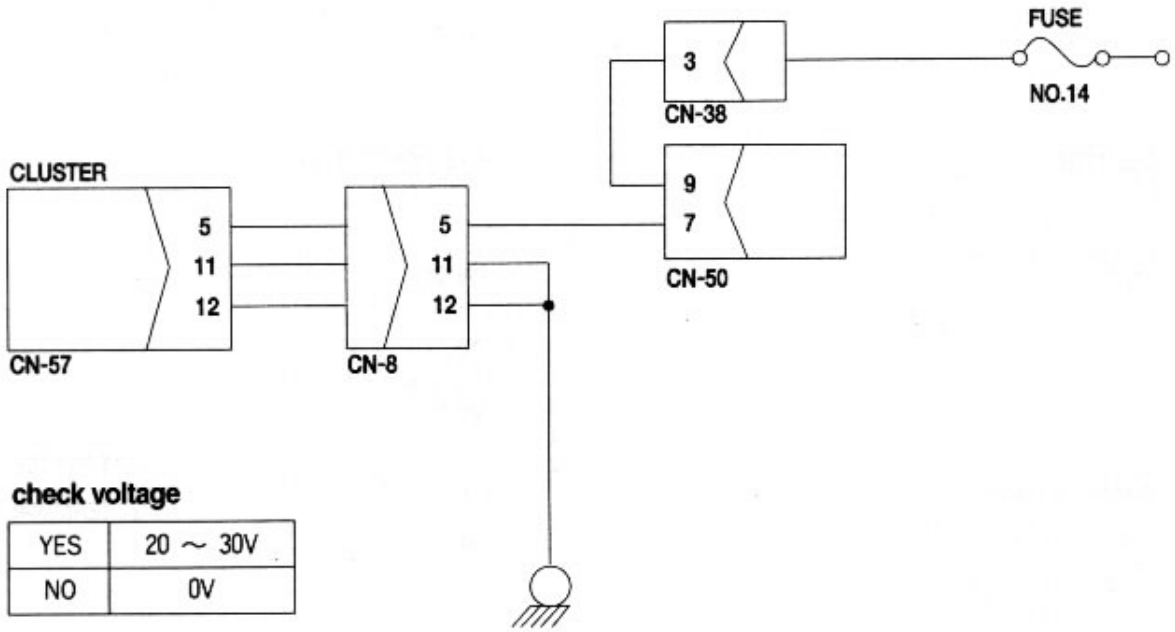


Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
ⓐ	
Control system is faulty .	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic pump is broken.	Disassemble and repair.
External pilot piping is clogged or oil is leaking from it.	Disassemble and clean.
Travel motor's parking brake is not released properly.	Disassemble and clean pilot piping.
Travel motor is faulty.	Disassemble and repair.

1. WHEN STARTING SWITCH IS TURNED ON, MONITOR PANEL DISPLAY DOES NOT APPEAR

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 14.
- After checking, connect the disconnected connectors again immediately unless otherwise specified.





check voltage

YES	20 ~ 30V
NO	0V

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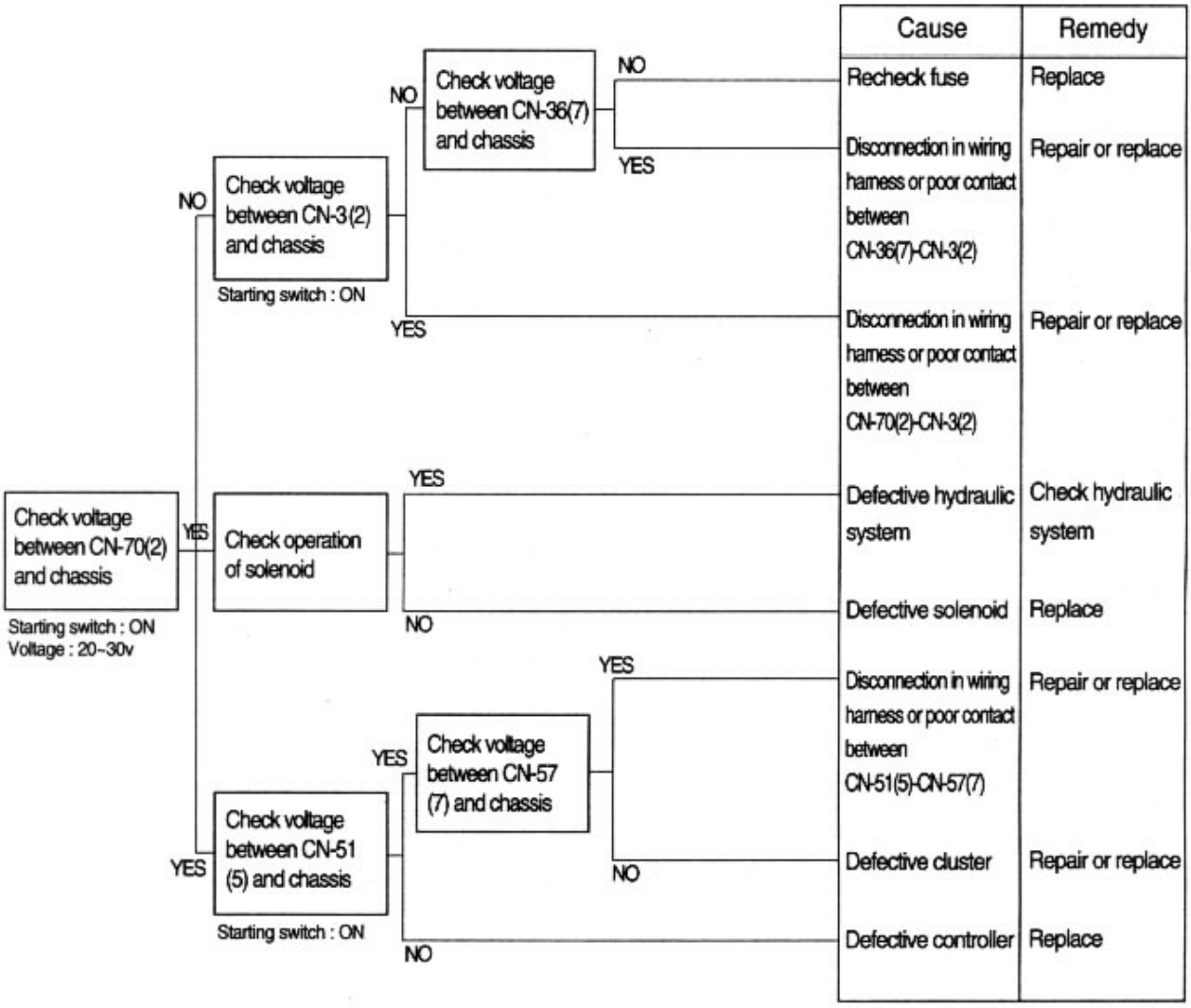
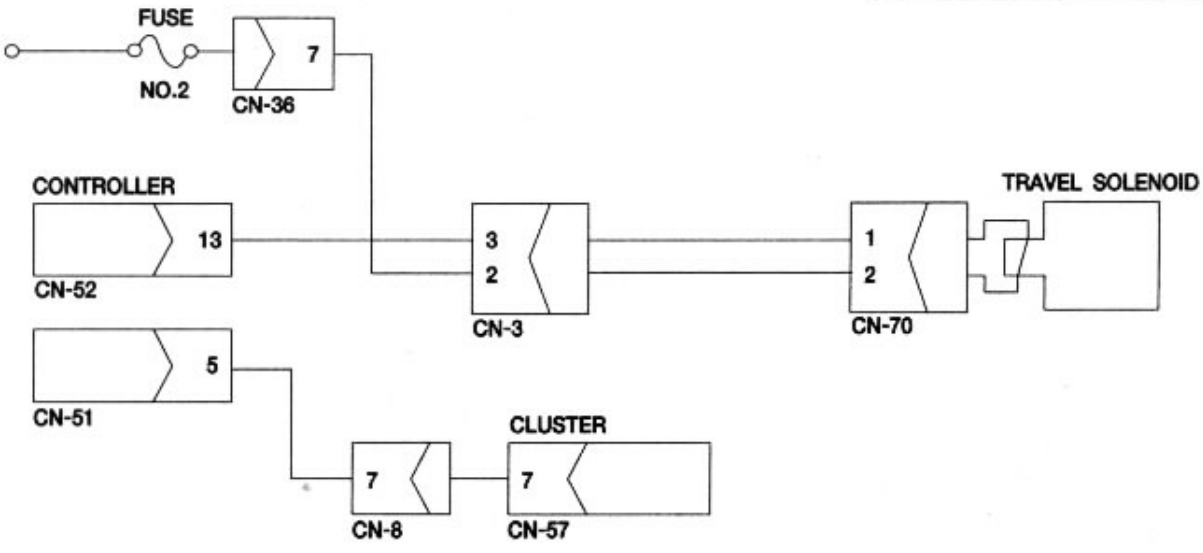
11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 2.
- After checking, connect the disconnected connectors again immediately unless otherwise specified.

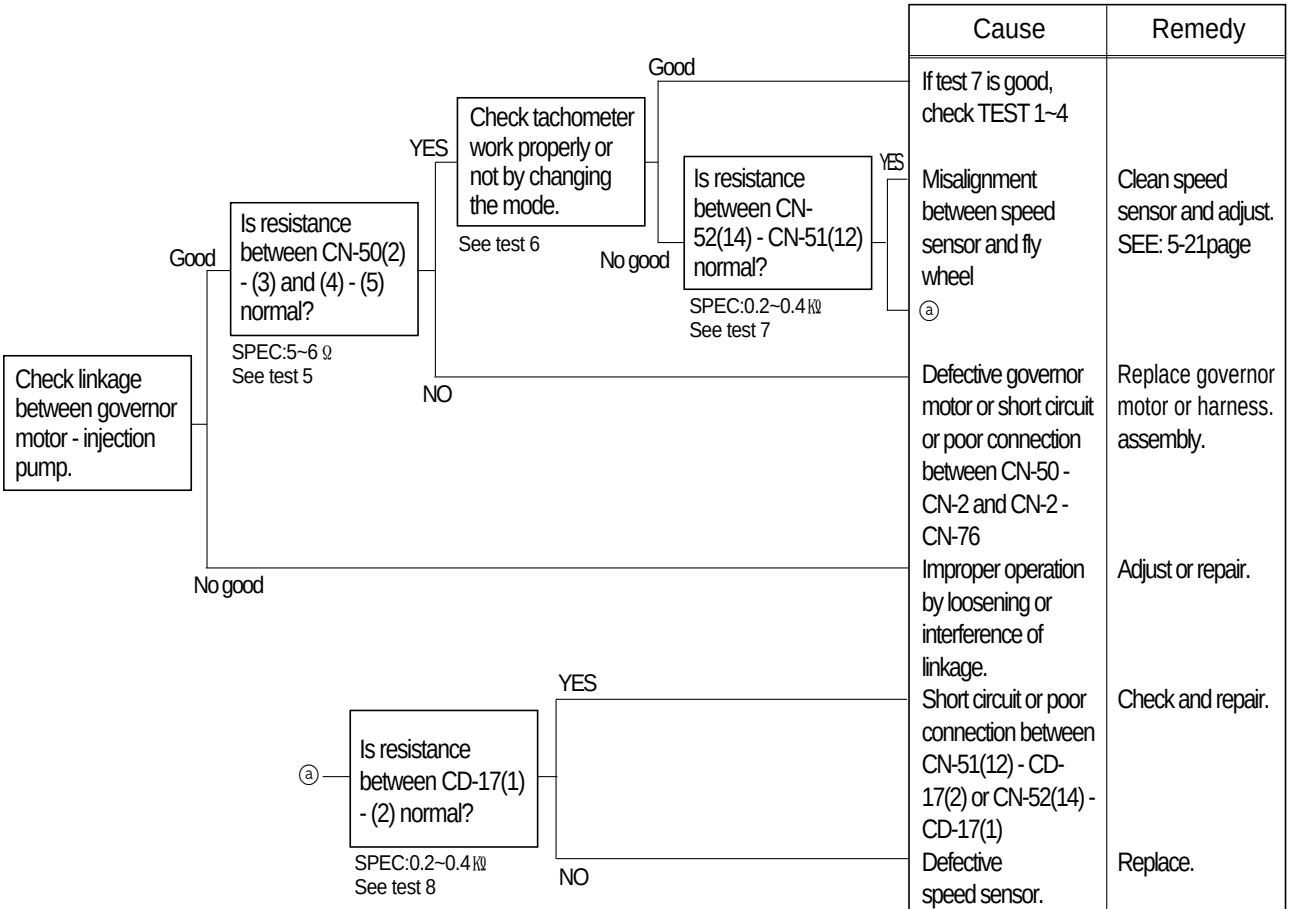




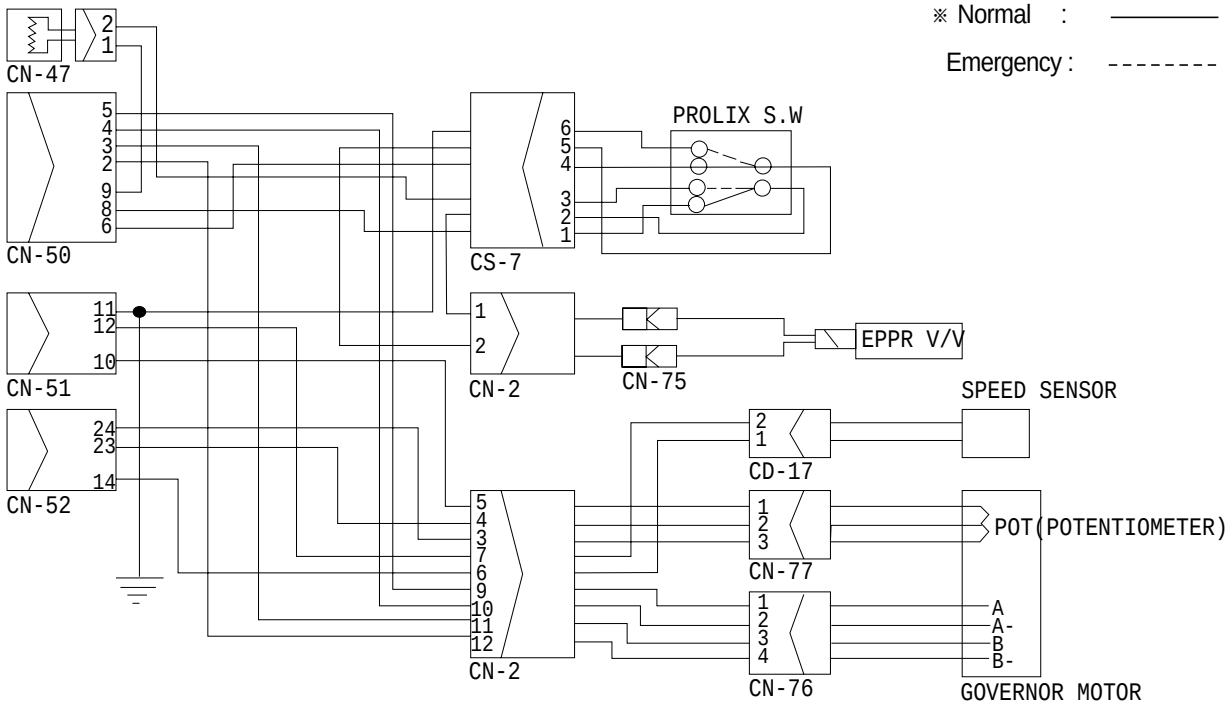
2. ENGINE SPEED IS SLOW AT ALL MODE

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE

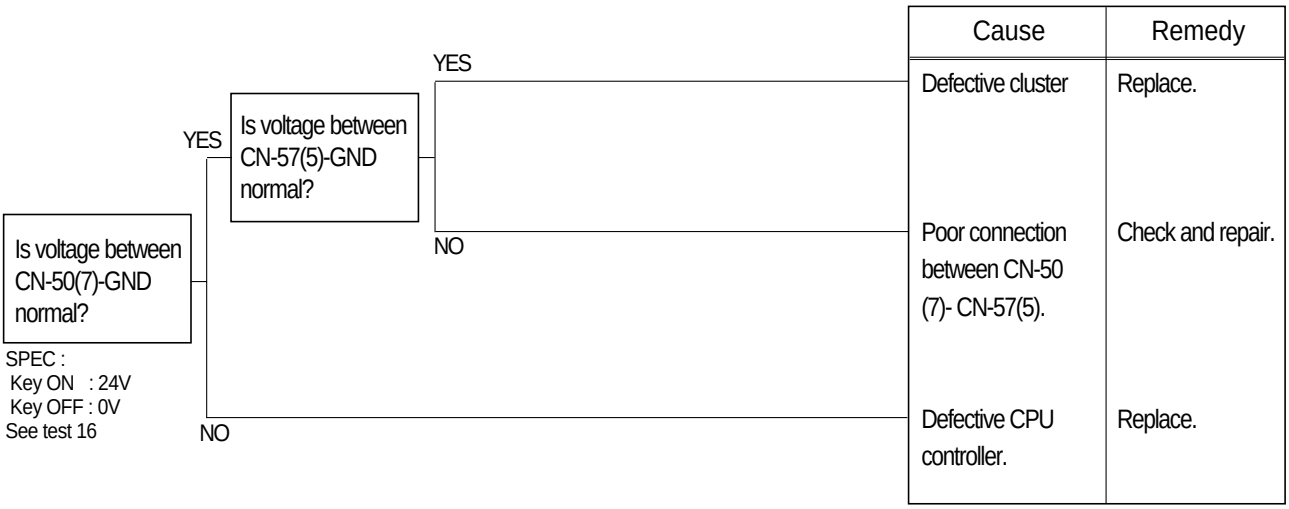


Wiring diagram



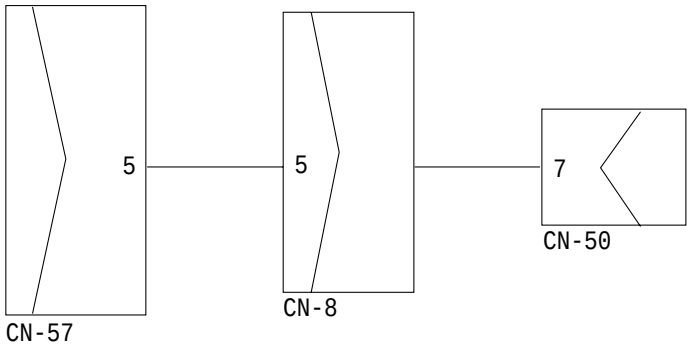
6-1. ALL CLUSTER LAMPS ARE OFF WHEN START KEY SWITCH IS ON POSITION.

※ Before carrying out below procedure, check all the related connectors are properly inserted.



Cause	Remedy
Defective cluster	Replace.
Poor connection between CN-50 (7)- CN-57(5).	Check and repair.
Defective CPU controller.	Replace.

Wiring diagram



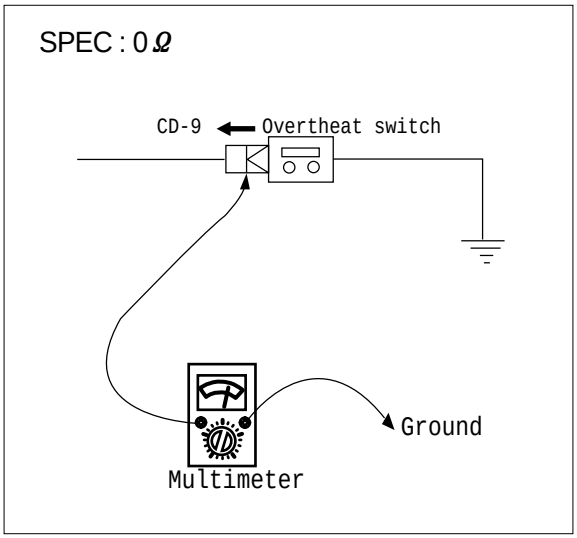
2) TEST PROCEDURE

(1) **Test 22 :** Check resistance between connector CD-9 - GND.

① Starting key OFF.

② Disconnect connector CD-9 of overheat switch at engine head.

③ Check resistance as Figure.



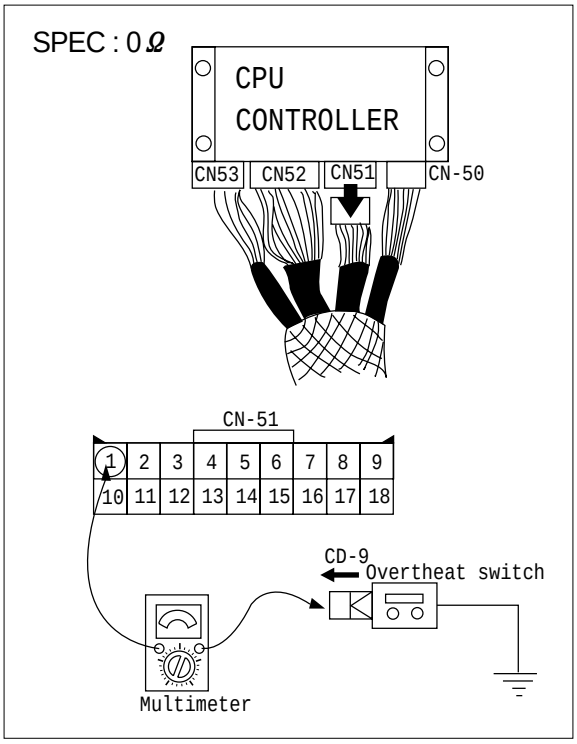
(2) **Test 23 :** Check resistance between connector (1) of CN-51 - CD-9.

① Starting key OFF.

② Remove CPU controller and disconnect connector CN-51 from CPU controller.

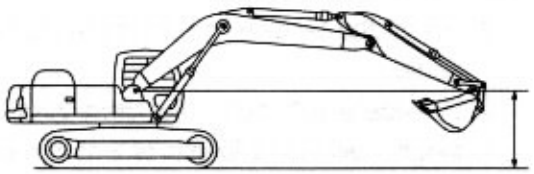
③ Disconnect connector CD-9 of overheat switch at engine head.

④ Check resistance as Figure.



6) SWING SPEED

(1) Measure the time required to swing three complete turns.



(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Keep the hydraulic oil temperature at 50±5°C.

(3) Measurement

① Select the following switch positions:

· MODE selector : Each mode

② Operate swing control lever fully.

③ Swing 1 turn, and measure time taken to swing next 3 revolutions.

④ Repeat steps ② and ③ three time and calculate the average values.

(4) Evaluation

The time required for 5 swings should meet the following specifications:

Unit : Seconds / 3 revolutions

Model	Power selector switch	Standard	Maximum allowable
R210LC-3	H mode	12.6±1.5	13.0
	S mode	10.4±1.5	-
	L mode	13.0±2.3	-
	F mode	14.0±2.3	-

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

① Stop the engine.

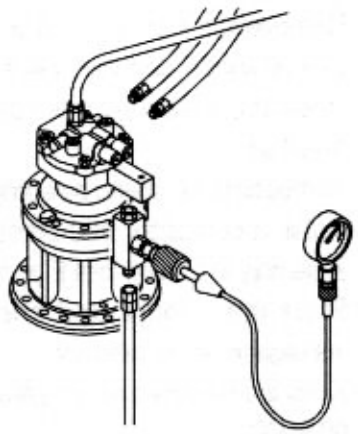
② Remove the top cover of the hydraulic tank oil supply port with a wrench.

③ The pressure release L wrench to bleed air.

④ Install a connector and pressure gauge assembly to swing motor SH port, as shown.

⑤ Start the engine and check for oil leakage from the adapter.

⑥ Keep the hydraulic oil temperature at 50±5°C.



(2) Measurement

① Select the following switch positions:

- MODE selector : H mode

② Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.

Repeat step ② three times and calculate the average values.

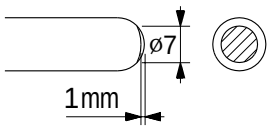
(3) Evaluation

The average measured pressure should be within the following specifications:

Unit : kgf / cm²

Model		Standard	Allowable limits	Remarks
R210LC-3	Brake disengaged	40	20 ~ 50	
	Brake applied	0	-	

5. RCV LEVER

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage becomes more than 1000cc/m at neutral handle position, or more than 2000cc/m during operation.	Conditions : Primary pressure : 30kgf/cm² Oil viscosity : 23cSt
Spool	This is to be replaced when the sliding surface has worn more than 10㎛, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6. Troubleshooting, replace the related parts.	

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.
2. When loosening the hexagon socket head cap screw(125), replace the seal washers(121) without fail.

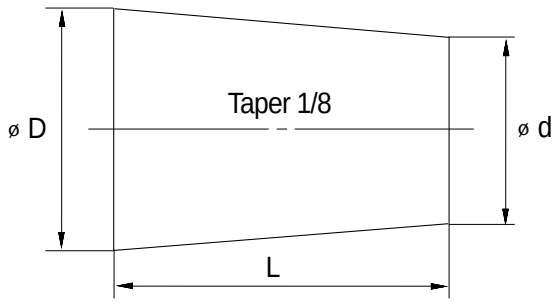
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

1) Lower the work equipment completely to the ground.
   If the coolant contains antifreeze, dispose of it correctly.
2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
3) When draining oil, prepare a container of adequate size to catch the oil.
4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.
6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
7) Check the number and thickness of the shims, and keep in a safe place.
8) When raising components, be sure to use lifting equipment of ample strength.
9) When using forcing screws to remove any components, tighten the forcing screws alternately.
10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.
11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.
12) If the part is not under hydraulic pressure, the following corks can be used.

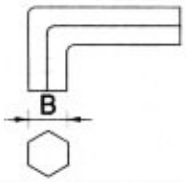
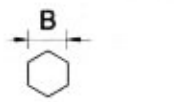
Nominal number	Dimensions		
06	6	5	8
08	8	6.5	11
10	10	8.5	12
12	12	10	15
14	14	11.5	18
16	16	13.5	20
18	18	15	22
20	20	17	25
22	22	18.5	28
24	24	20	30
27	27	22.5	34



2) TOOLS AND TIGHTENING TORQUE

(1) Tools

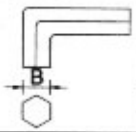
The tools necessary to disassemble/reassemble the pump are shown in the follow list.

Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP-1/ 8	-	M10
	6	M 8	BP-1/ 4	PO-1/4	M12, M14
	8	M10	BP-3/ 8	PO-3/8	M16, M18
	17	M20, M22	BP-1	PO-1, 1 1/4, 1 1/2	-
Double ring spanner, socket wrench, double(single) open end spanner 	-	Hexagon Headed bolt	Hexagon nut	VP plug (PF thread)	
	19	M12	M12	VP-1/4	
	24	M16	M16	-	
	27	M18	M18	VP-1/2	
	30	M20	M20	-	
	36	-	-	VP-3/4	
Adjustable angle wrench		Medium size, 1 set			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		Steel bar of key material approx. 10x8x200			
Torque wrench		Capable of tightening with the specified torques.			

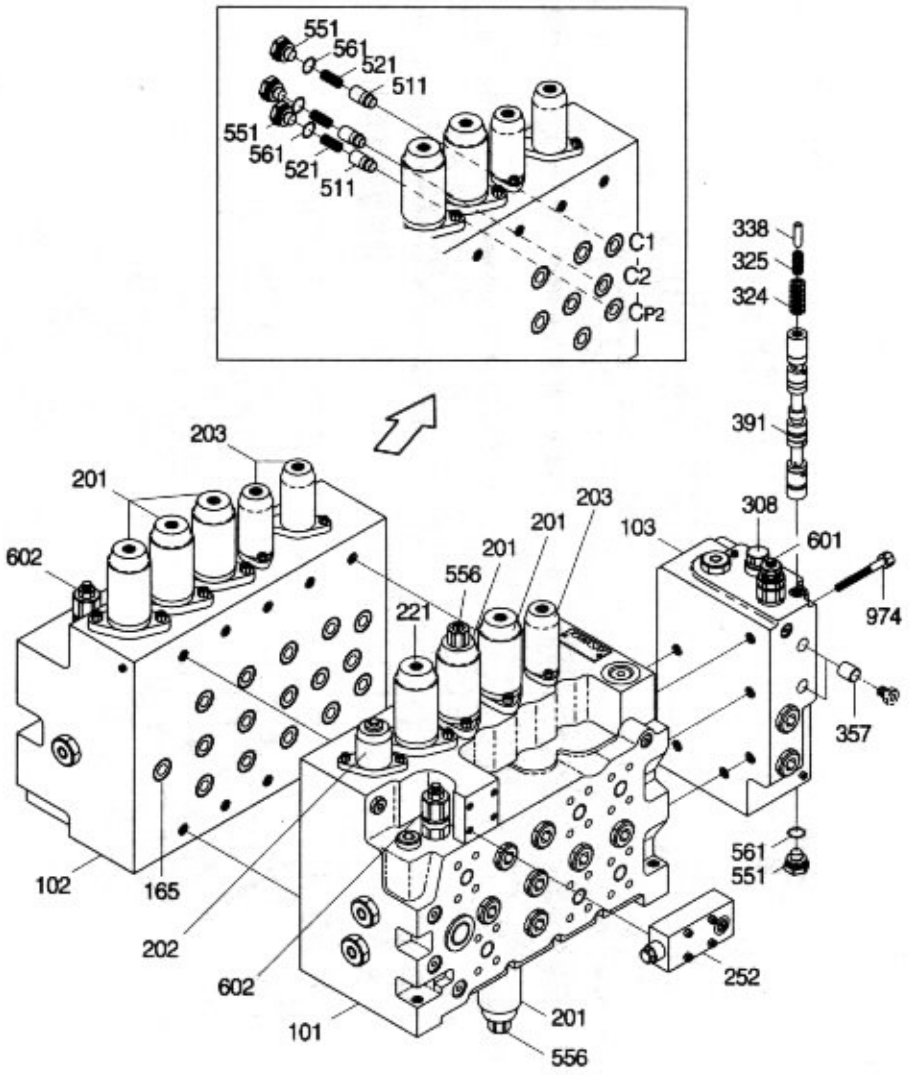
2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

Tool name & size		Part name			
Name	B	Hexagon socket head bolt	PT plug (PT thread)	PO plug (PF thread)	Hexagon socket head setscrew
Allen wrench 	4	M 5	BP-1/16	-	M 8
	5	M 6	BP-1/8	-	M10
	6	M 8	BP-1/4	PO-1/4	M12, M14
Double ring spanner, socket wrench, double(single) open end spanner 	-	Hexagon Headed bolt	Hexagon nut	VP plug (PF thread)	
	6	M8	M8	-	
Adjustable angle wrench		Small size, Max 36mm			
Screw driver		Minus type screw driver, Medium size, 2 sets			
Hammer		Plastic hammer, 1 set			
Pliers		For snap ring, TSR-160			
Steel bar		4 × 100mm			
Torque wrench		Capable of tightening with the specified torques.			
Pincers		-			
Bolt		M4, Length : 50mm			

2. STRUCTURE(1/3)



101	Casing A	252	Lock valve	515	Poppet
102	Casing B	308	Arm confluence spool	551	Plug
103	Straight travel block	324	Spring	556	Plug
165	O-ring	325	Spring	601	Relief valve assembly
201	Cover	338	Stopper	602	Port relief valve
202	Cover	357	Orifice	974	Socket screw
203	Cover	391	Straight travel spool		

4. DISASSEMBLY AND ASSEMBLY

1) PRECAUTION

(1) All hydraulic components are worked with precision working. Then, before disassembling and assembling them, it is essential to select an especially clean place.

(2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.

(3) When a control valve is to be removed from the machine, apply caps to all ports.
Before disassembling the valve, recheck that these caps are fitted completely, and then clean the outside of the assembly. Use a proper bench for working, spread a paper or rubber mat on the bench, and disassemble the valve on it.

(4) Support the body section carefully in carrying, transferring and so on of the control valve. Do not support the lever, exposed spool, end cover section or so on without fail.

(5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but the hydraulic test equipment is necessary to these tests.
Therefore, even when its disassembling can be carried out technically, do not disassemble such component that cannot be tested, adjusted, and so on.
Besides, prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

(10) Assembling of covers

① Fit spool covers (202, 204) to sides reverse to spring sides of travel, option, swing, arm 1, boom 1, bucket and arm 2 spools, and tighten hexagon socket head bolts (273) to specified torque.

※ Confirm that O-rings (165, 264) have been fitted.

② Fit spring covers (203, 201) to spring sides of travel, option, bypass cut, swing, boom 2, arm 1, bucket, swing preferential boom, and arm 2 spools, and tighten hexagon socket head bolts (273) to specified torque.

※ Confirm that O-ring (261 & 262) have been fitted.

(11) Assembling of straight travel valve block

Fit O-rings (165, 166, 167, 266) to straight travel valve block (103), and tighten hexagon socket head bolt to specified torque.

※ Assembling procedures for straight travel valve block itself are to be as shown in the following.

- Hold casing (103) in vise.
- Fit main relief valve (601) to casing and tighten it to specified torque. (Assembling procedures for main relief valve itself are shown separately.)
- Fit poppet (511) and spring (521), and tighten plug (551) to specified torque.
- Tighten orifice (357) with hexagon wrench to specified torque. Further, fit O-ring (163) to plug (156) and tighten plug to specified torque.
- Fit piston (309), spool (308), sleeve (344), spring seat (376) and spring (375), paying attention not to fit them in wrong direction. Then, fit O-ring (266) to plug (356) and tighten plug to specified torque.
- Fit spool (391), springs (324, 325) and stopper (338). Fit O-ring (266) to plug (251) and tighten plug to specified torque.

(12) Assembling of main relief valve

① Fit spacer (122), C-ring (121), O-rings (163, 561), and back up ring (562) to plug (103).

② Fit piston (614) and O-ring (661) to stopper (613). Fit them to adjusting plug (104) and assemble them temporarily with adjusting screw (652) and lock nut (671).

③ Fit poppet (611) and spring (621) to plug (103), and fit adjusting plug (104) fitted with O-ring (663, 664).

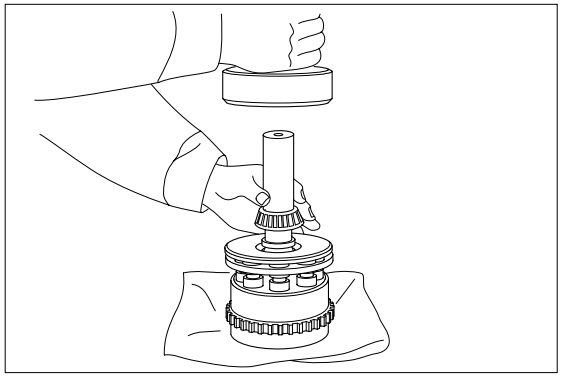
※ Confirm that poppet (611) has been fitted to seat section of plug (103) securely.

④ Fit plunger (512) and spring (521) to seat (541).

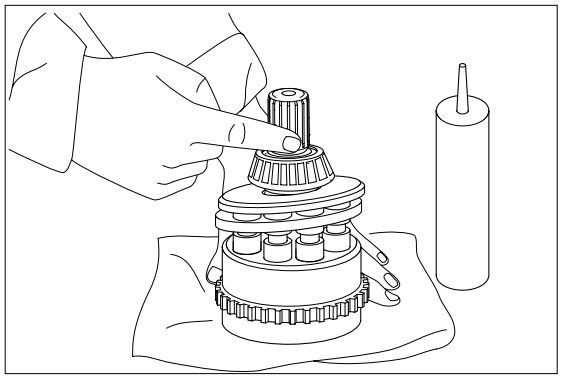
⑤ Fit seat to plug (103) assembly, and fix it with C-ring (121).

⑥ Since pressure adjustment is carried out according to **maintenance standards**, keep adjusting plug (104) and adjusting screw (652) as being assembled temporarily.

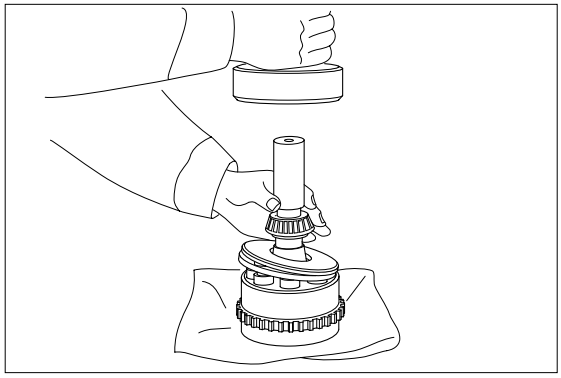
⑤ Assemble inner race of taper roller bearing(3) to cylinder(25).



⑥ Apply loctite to bearing mounting area of inner race of cylinder(25) lightly.



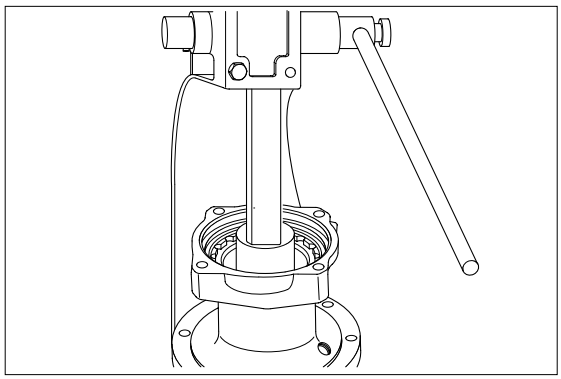
⑦ Assemble inner race(1) to cylinder(25).



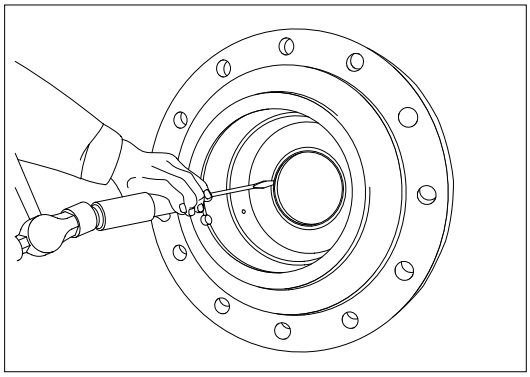
(3) Assembly of oil seal

Apply three bond of white color on outer surface of oil seal(2) and assemble and insert it.

※ Before assembling, lubricate lip of oil seal with grease.



④ Remove oil seal(9) from gear casing(6).

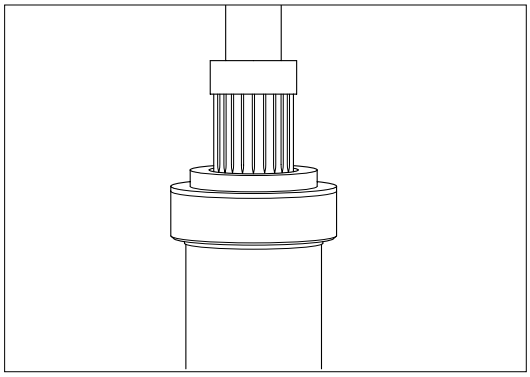


(6) Disassembly of pinion shaft assembly

① Remove roller bearing(5), plate(4) and collar(2) by pressing output pinion shaft(1) and end face of the other side.

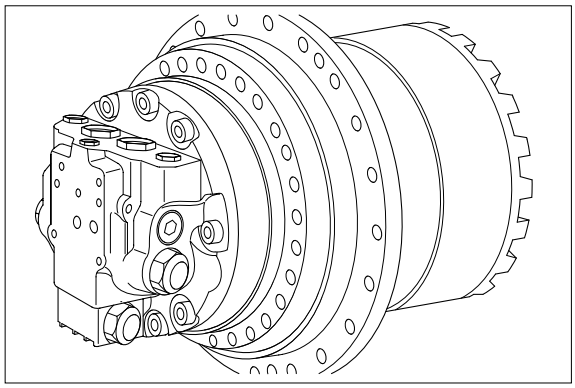
※ Exchange pinion shaft assy if they have defect.

This completes disassembly.



2) DISASSEMBLING PROCEDURE

(1) Disassembling the brake valve section and the hydraulic motor section

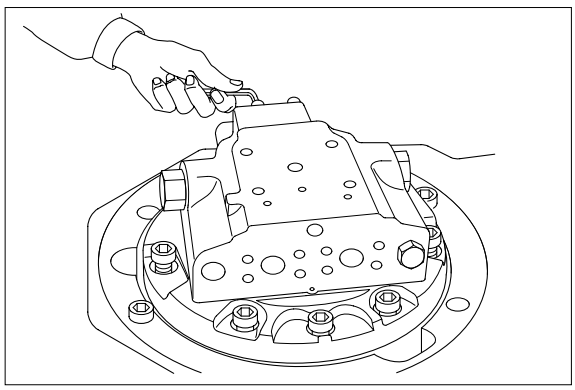


※ When inspecting or repairing the motor, use the disassembling procedures described below.

※ Numbers in parentheses ( ) following the part name denote the item numbers shown in the attached assembly drawings.

Prior to disassembly, install the motor on an inversion working bench.

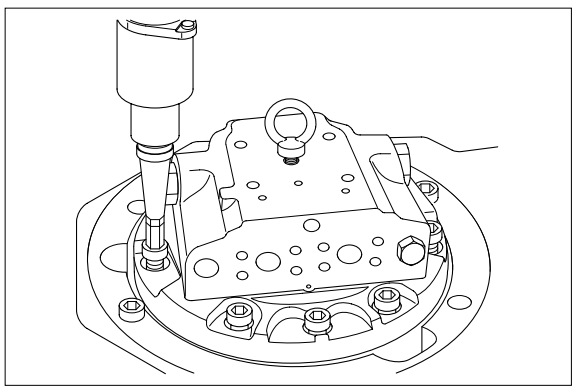
① Loosen the four hexagon socket head bolts(170) and remove the SCV valve ② body(136) from the rear flange(101).



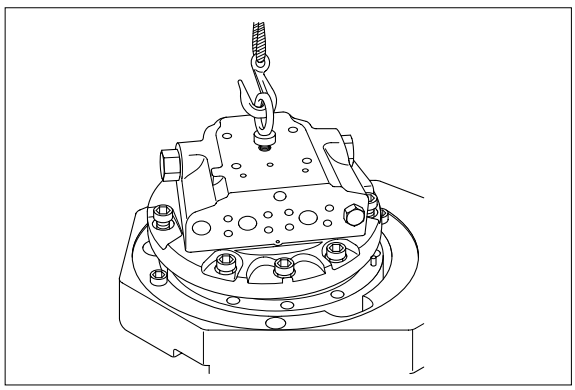
※ Remove the two O-rings(140,180) from the rear flange.

Do not reuse the O-rings(140,180) after removal.

③ Remove the nine hexagon socket head bolts(182).



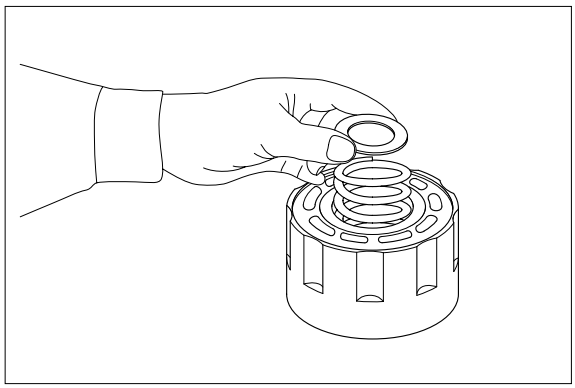
④ Remove the rear flange(101) from the spindle(2).



Proceed to pages 8-83 through 8-88 to see the brake valve disassembling procedure.

② Remove the snap ring(145) the washer(110), the spring(114), and the washer(110), in that order, from the cylinder block(104).

※ Remove the spring(114) only if it is to be replaced.

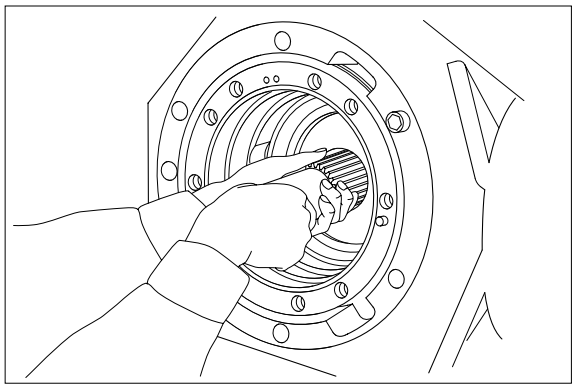


(4) Disassembly of the shaft(102) and the roller bearing(149)

① Remove the shaft(102) from the spindle(2).

At this time, the roller bearing(149) can also be removed in conjunction with the shaft(102).

The oil seal(132), however, cannot be removed.

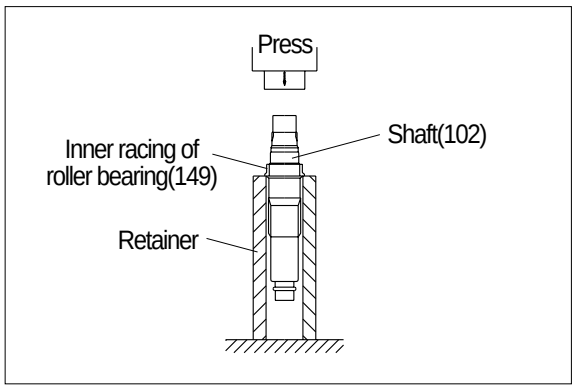


② After placing a retainer on the press working bench, insert the shaft(102) into the retainer without removing the roller bearing(149) from the shaft.

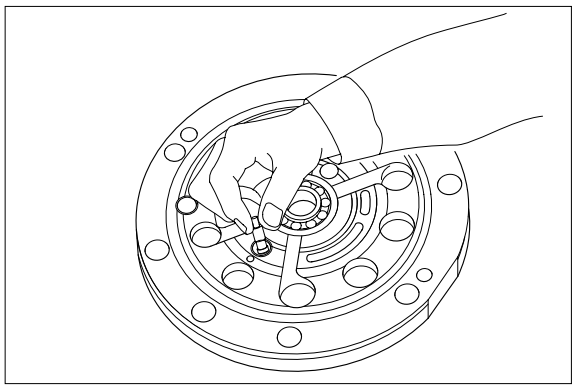
Then, hold down the end of the shaft using a press and remove the inner lacing of the roller bearing(149).

※ Remove the roller bearing(149) only when it is to be replaced.

※ Do not reuse the roller bearing(149) after removal.



(5) Assembly of the valve(163)



① Holding the rear flange(101) with its surface contacting the spindle(2) upward, place the rear flange on a working bench.

② Insert the valve(163) into the rear flange(101).

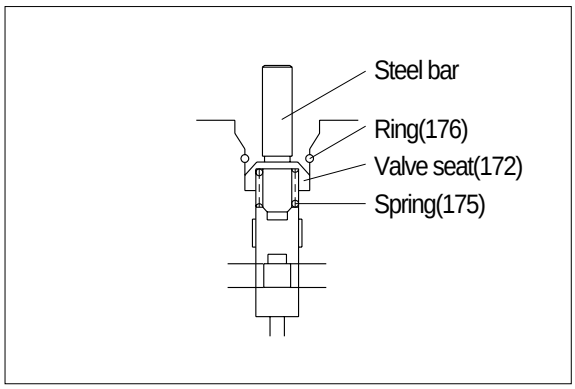
③ Fit the spring(166) into the valve(163), and mount the stopper(164) on it.

④ Slightly bench a new ring(165) and insert it into the rear flange(101) from the top of the stopper(164).
Then, fit the new ring into the ring groove of the rear flange.

※ The ring(165) used must be fitted snugly into the ring groove of the rear flange(101).
Improper insertion of the ring(165) into the ring groove may cause unstable action of the valve(163), thus disabling high/low speed selection.

※ The ring(165) must be a new one.

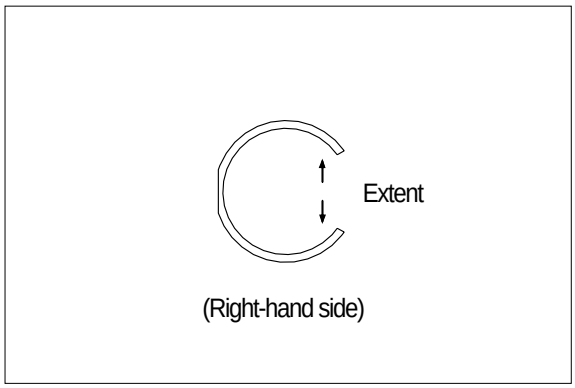
(6) Assembly of the valve(142)



① Assemble the reducing valve assembly, the valve seat(172), and the spring(175) into the rear flange(101).

② Press and hold down the valve seat(172) using a steel bar, and in that state, mount the ring(176) in the ring groove of the rear flange(101).

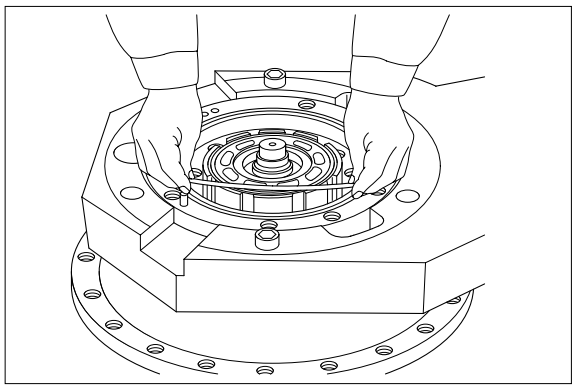
※ The ring(176) will remain deformed while inside the rear falgne(101).
Before inserting the ring(176) into the ring groove of the rear flange(101), therefore, both ends of the ring must be extended using snap-ring pliers(special ones for holes).
The ring(176) must be a new one.



⑤ Fit the two O-rings(39) and the O-ring(29) in the O-ring grooves of the spindle(2).

※ Apply a thin coat of grease to the two O-rings(39).

※ Remount the O-ring(29) without greaseing it.
If this O-ring is greased and remounted, possible oozing of the grease from the contact surfaces of the rear flange(101) and the spindle(2) during motor operation may be mistaken for oil leakage.



⑥ Fill the spindle(2) with a working fluid.
Quantity required : 1.2 liters.

(13) Assembly of the rear flange(101) back in the spindle(2)

① Mount the ball bearing(150) in the rear flange(101).

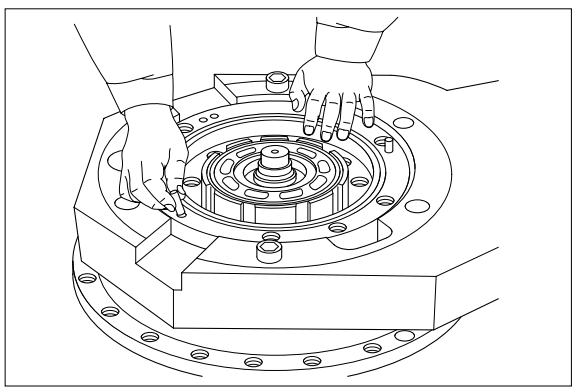
※ Apply molybdenum disulfide grease to the outer contact surface of the ball bearing(150).

② Fit the two dowel pins(141) into the pin holes of the rear flange(101).

③ Using the dowel pins(141) as a guide, mount the timing plate(109) in the rear flange(101).
At this time, apply grease to the contact surfaces of the timing plate(109) and the rear flange(101).

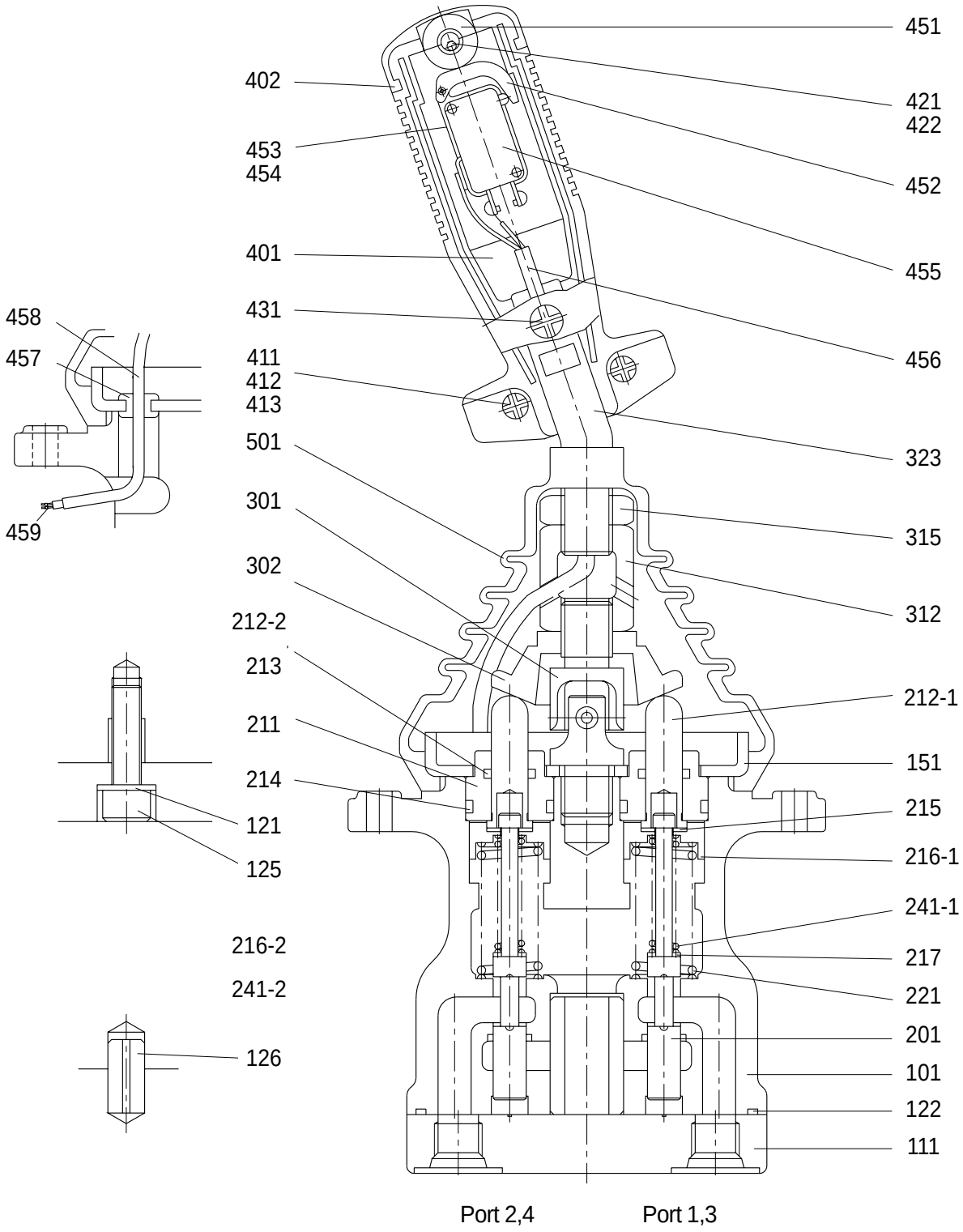
④ Fit the two dowel pins(181) into the spindle(2).

※ Mount the timing plate(109) firmly in the rear flange(101) to prevent the former from falling out of the latter.



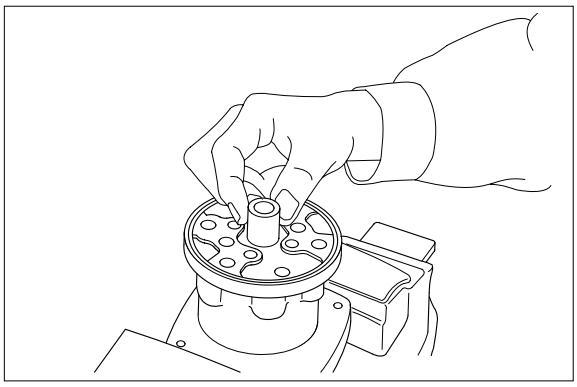
2. DISASSEMBLY AND ASSEMBLY

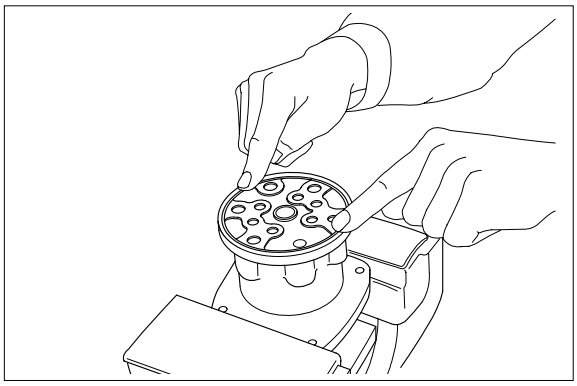
1) STRUCTURE



4) ASSEMBLY

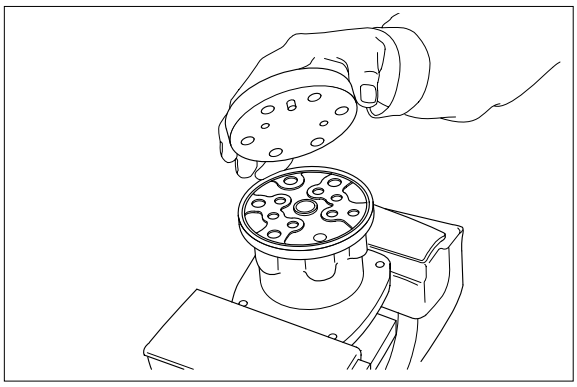
(1) Assemble bushing(131) and O-ring(122) into casing(101).

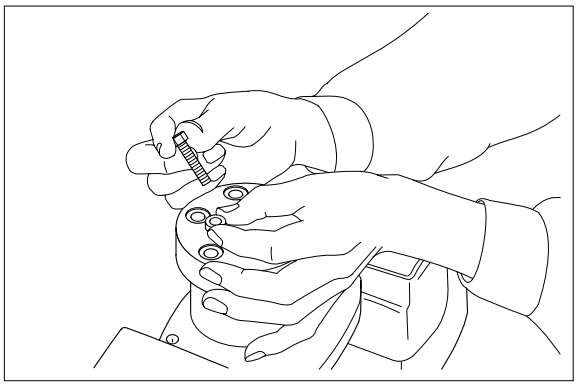




(2) Fit port plate to casing(101) with hexagon socket head cap screws(125) and seal washers(121).

※ Keep such assembling position that spring pin(126) can enter into casing hole.

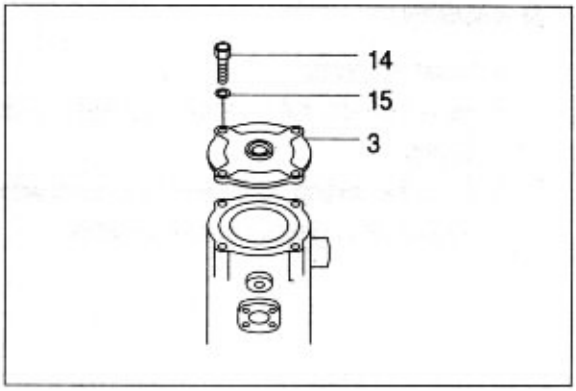




2) DISASSEMBLY

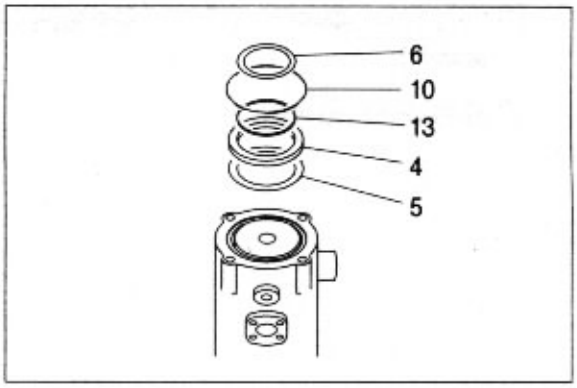
※ Before the disassembly, clean the turning joint.

(1) Remove bolts(14), washer(15) and cover(3).



(2) Remove shim(6) and O-ring(10).

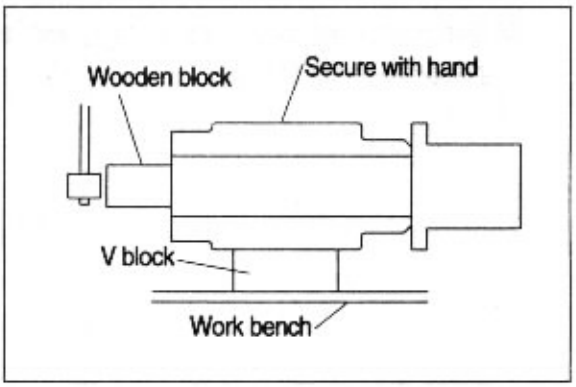
(3) Remove retainer ring(13), spacer(4) and shim(5).



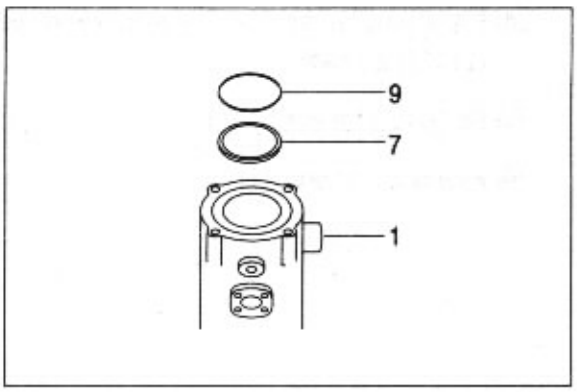
(4) Place body(1) on a V-block and by using a wood buffer at the shaft end, hit out shaft(2) to about 1/2 from the body with a hammer.

※ Take care not to damage the shaft(2) when remove body(1) or rest it sideway.

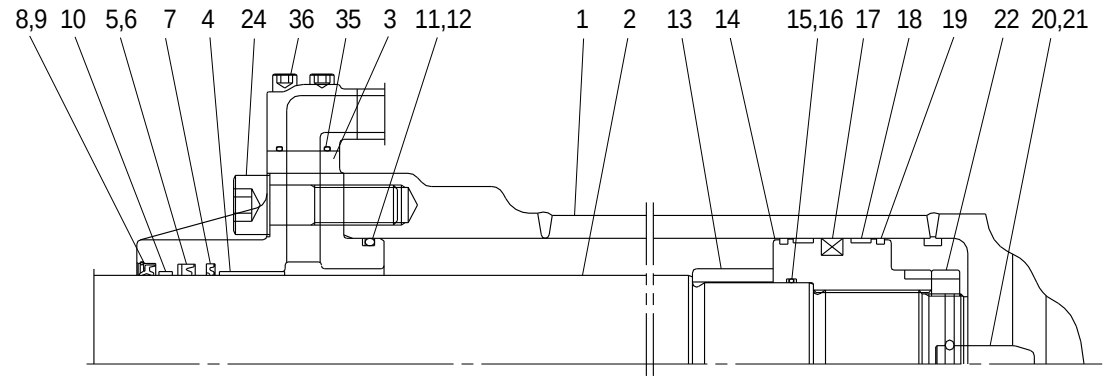
※ Put a fitting mark on body(1) and shaft(2).



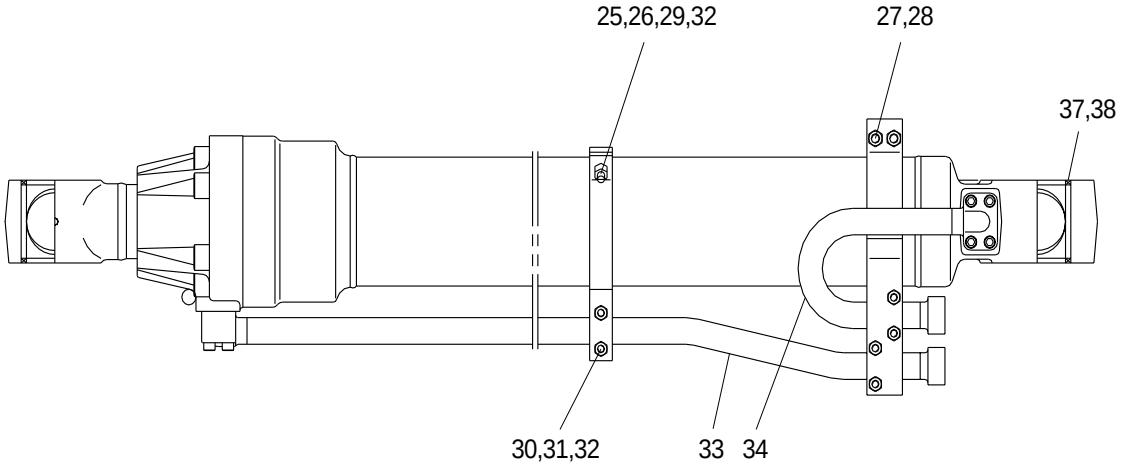
(5) Remove six slipper seals(7) and O-ring(9) from body(1).



(2) Arm cylinder



Internal detail



1	Tube assembly	14	Piston	28	Band(B)
2	Rod assembly	15	O-ring	29	Hexagon bolt
3	Gland	16	Back up ring	30	U-bolt
4	Du bushing	17	Piston seal	31	Hexagon nut
5	rod seal	18	Wear ring	32	Spring washer
6	Back up ring	19	Dust ring	33	Pipe assembly(R)
7	Buffer ring	20	Cushion spear	34	Pipe assembly(B)
8	Dust wiper	21	Steel ball	35	O-ring
9	Snap ring	22	Lock nut	36	Hexagon socket head bolt
10	Wear ring	24	Hexagon socket head bolt	37	Pin bush
11	O-ring	25	Band assembly(R)	38	Dust seal
12	Back up ring	26	Band(R)		
13	Cushion ring	27	Band assembly(B)		

1. TRACK LINK

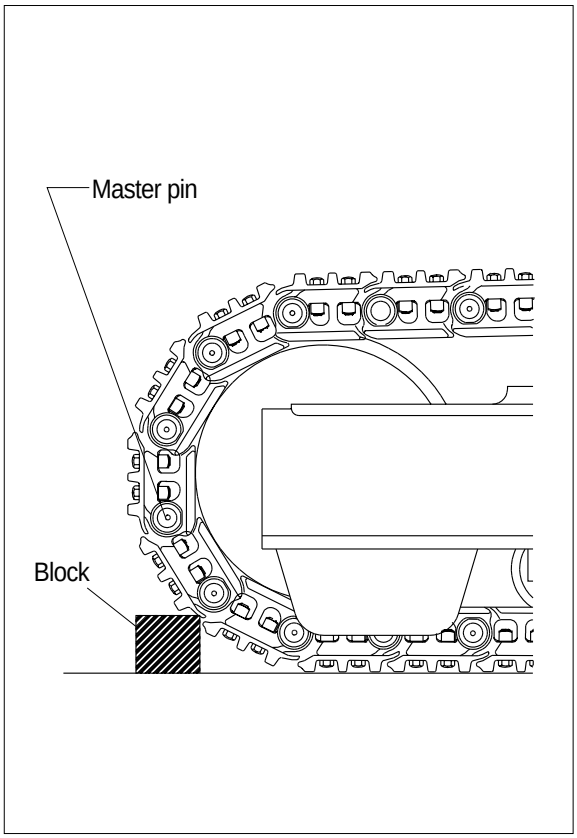
1) REMOVAL

(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

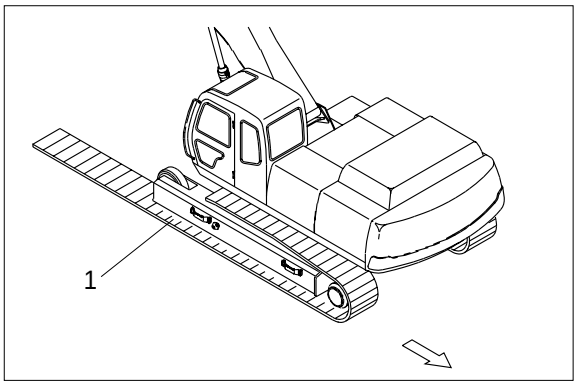
(3) Push out master pin by using a suitable tool.



(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

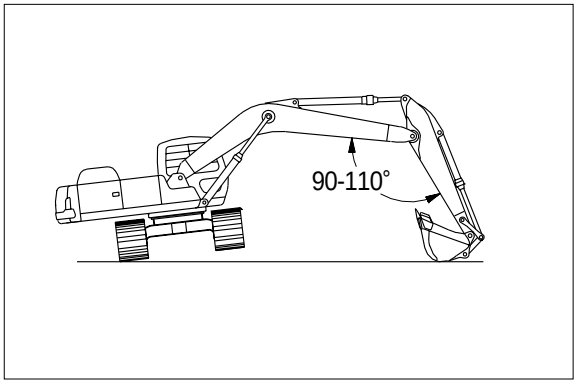
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

(1) Carry out installation in the reverse order to removal.

※ Adjust the tension of the track link.



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