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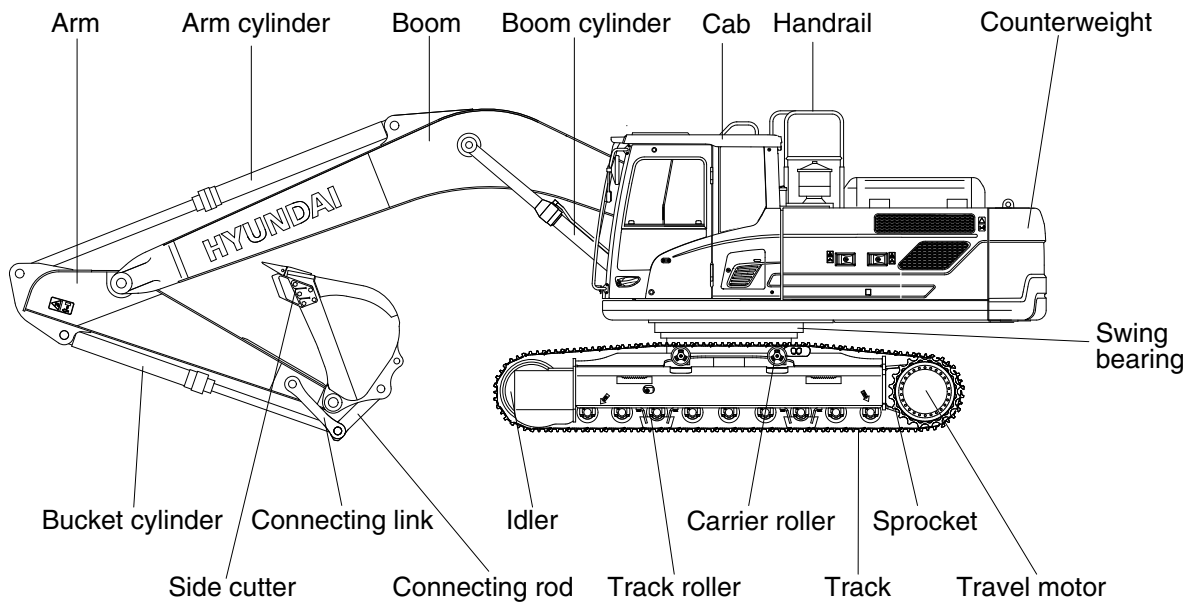
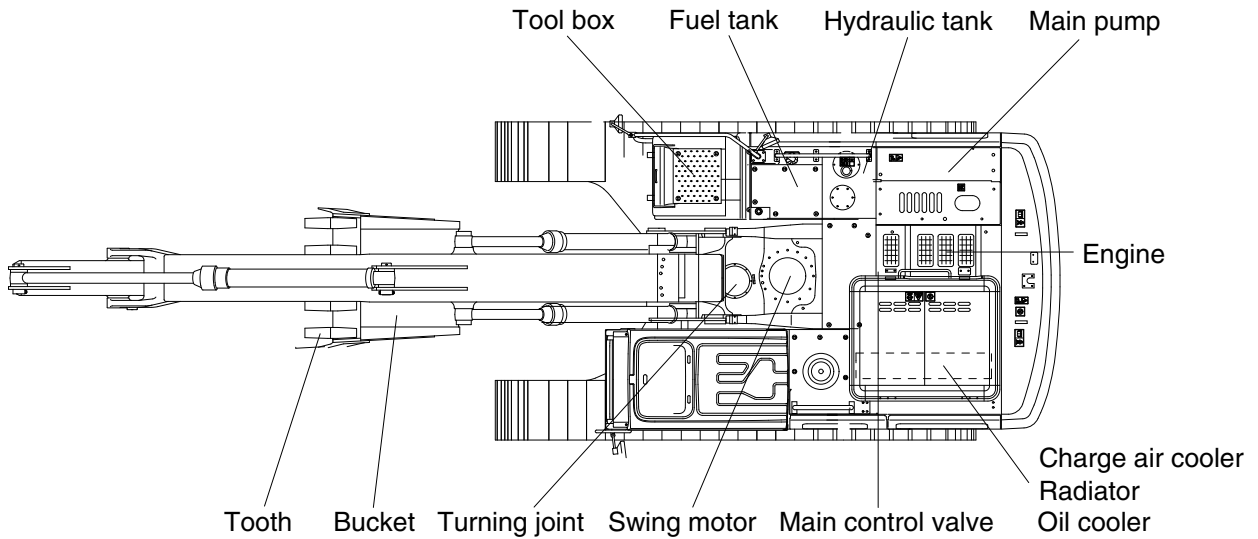
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SECTION 1 GENERAL

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GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT



300HD2SP01

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

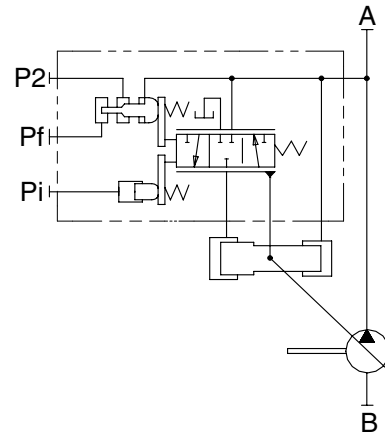
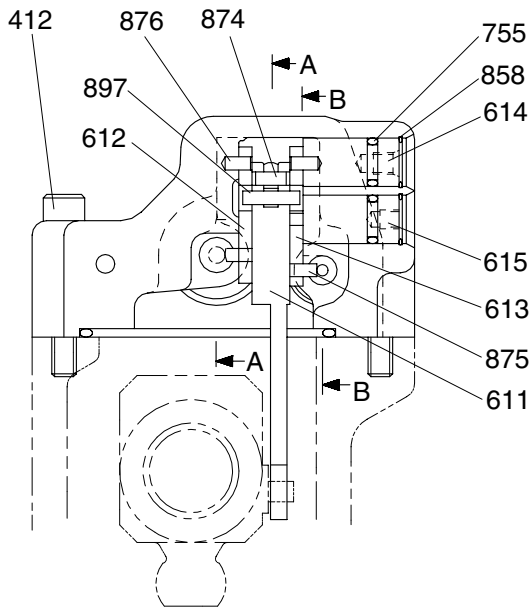
Item	Specification
Model	Hyundai HM8.3
Type	4-cycle turbocharged, charge air cooled diesel engine
Cooling method	Water cooling
Number of cylinders and arrangement	6 cylinders, in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	114 × 134.9 mm (4.49" × 5.31")
Piston displacement	8290 cc (506 cu in)
Compression ratio	18 : 1
Rated net horse power (SAE J1349)	245 Hp (183 kW) at 2200 rpm
Rated gross horse power (SAE J1995)	250 Hp (186 kW) at 2200 rpm
Maximum torque	124 kgf · m (899 lbf · ft) at 1300 rpm
Engine oil quantity	26.5 ℓ (7.0 U.S. gal)
Wet weight	617 kg (1360 lb)
High idling speed	2457 ± 50 rpm
Low idling speed	850 ± 100 rpm
Rated fuel consumption	151 g/Hp · hr at 1400 rpm
Starting motor	24 V-7.2 kW
Alternator	24 V-90 A
Battery	2 × 12 V × 150 Ah

2) MAIN PUMP

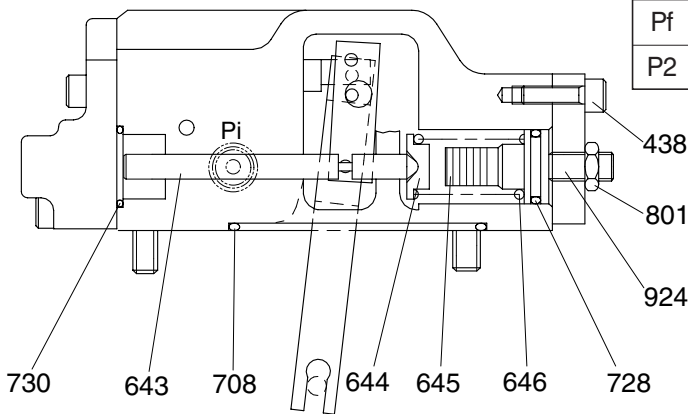
Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 154 cc/rev
Maximum pressure	350 kgf/cm ² (4980 psi) [380 kgf/cm ² (5400 psi)]
Rated oil flow	2 × 285 ℓ /min (75.3 U.S. gpm / 62.7 U.K. gpm)

[] : Power boost

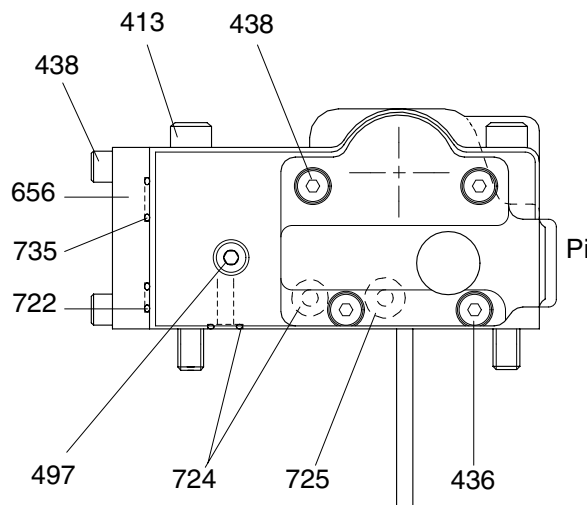
2) REGULATOR (1/2)



Port	Port name	Port size
A	Delivery port	SAE 6000 PSI 1"
B	Suction port	SAE 2500 PSI 3"
Pi	Pilot port	PF 1/4-15
Pf	Power shift pressure	-
P2	Companion delivery pressure	-



SECTION B-B

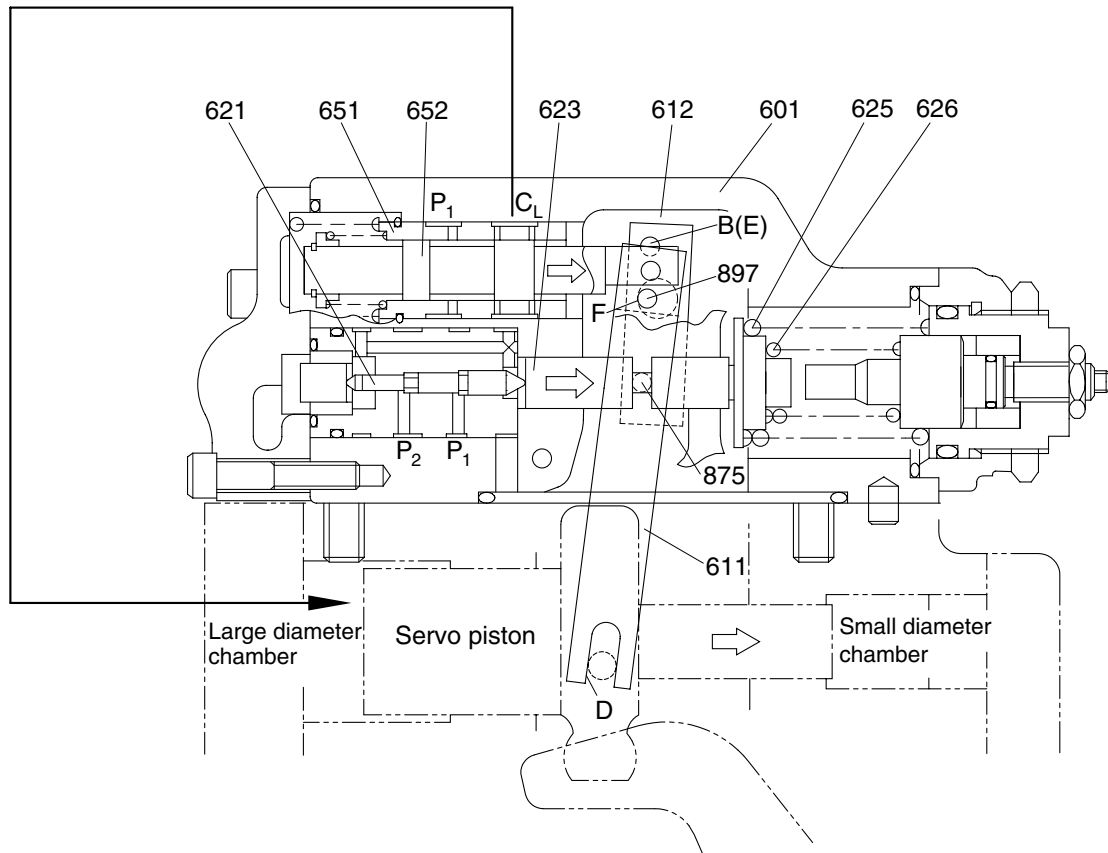


VIEW C

- 412 Hexagon socket screw
- 413 Hexagon socket screw
- 436 Hexagon socket screw
- 438 Hexagon socket screw
- 497 Plug
- 611 Feed back lever
- 612 Lever (1)
- 613 Lever (2)
- 614 Fulcrum plug
- 615 Adjust plug
- 643 Pilot piston
- 644 Spring seat (Q)
- 645 Adjust stem (Q)
- 646 Pilot spring
- 656 Block cover
- 708 O-ring
- 722 O-ring
- 724 O-ring
- 725 O-ring
- 728 O-ring
- 730 O-ring
- 735 O-ring
- 755 O-ring
- 801 Nut
- 858 Snap ring
- 874 Pin
- 875 Pin
- 876 Pin
- 897 Pin
- 924 Set screw

300S2MP06

① Overload preventive function



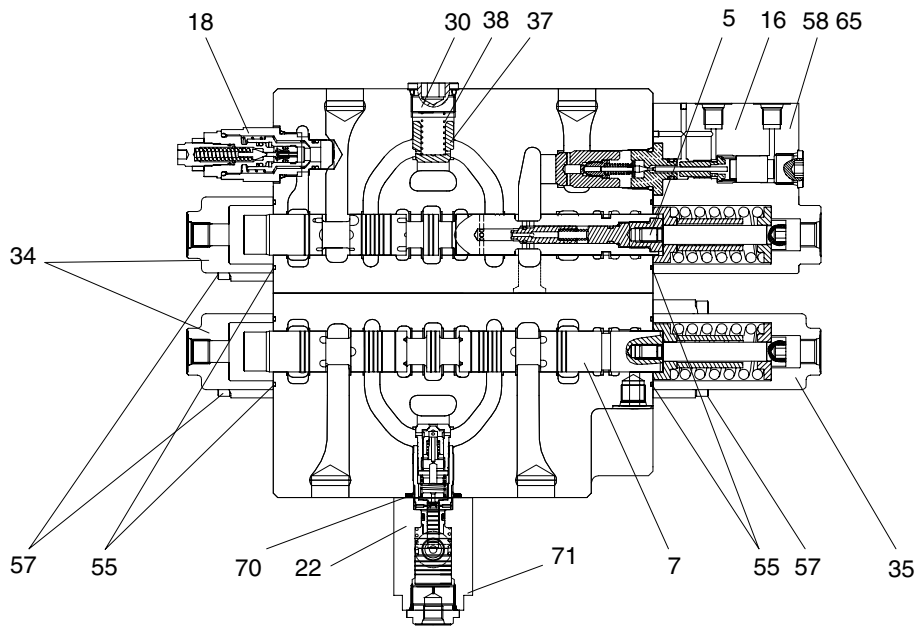
300S2MP11

When the self pump delivery pressure P_1 or the companion pump delivery pressure P_2 rises, it acts on the stepped part of the compensating piston (621). It presses the compensating rod (623) to the right till the force of the outer spring (625) and inner spring (626) balances with the hydraulic force. The movement of the compensating rod is transmitted to lever 1 (612) via pin (875).

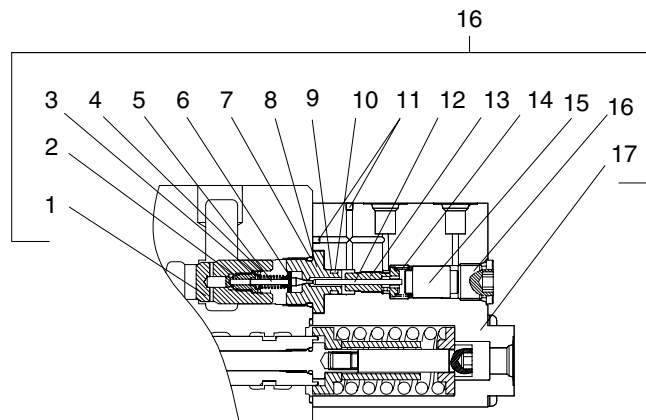
Lever 1 rotates around the pin (875) (E) fixed to the casing (601).

Since the large hole section (F) of lever 1 contains a protruding pin (897) fixed to the feedback lever (611), the feedback lever rotates around the fulcrum of point D as lever 1 rotates, and then the spool (652) is shifted to the right. As the spool moves, the delivery pressure P_1 is admitted to the large diameter section of the servo piston via port CL, causes the servo piston move to the right, reduces the pump delivery, flow rate, and prevents the prime mover from being overloaded. The movement of the servo piston is transmitted to the feedback lever via point D. Then the feedback lever rotates around the fulcrum of point F and the spool is shifted to the left. The spool moves till the opening between the spool (652) and sleeve (651) is closed.

STRUCTURE (5/8)



C-C' (SWING AND BOOM1)



HOLDING VALVE

300S2MC06

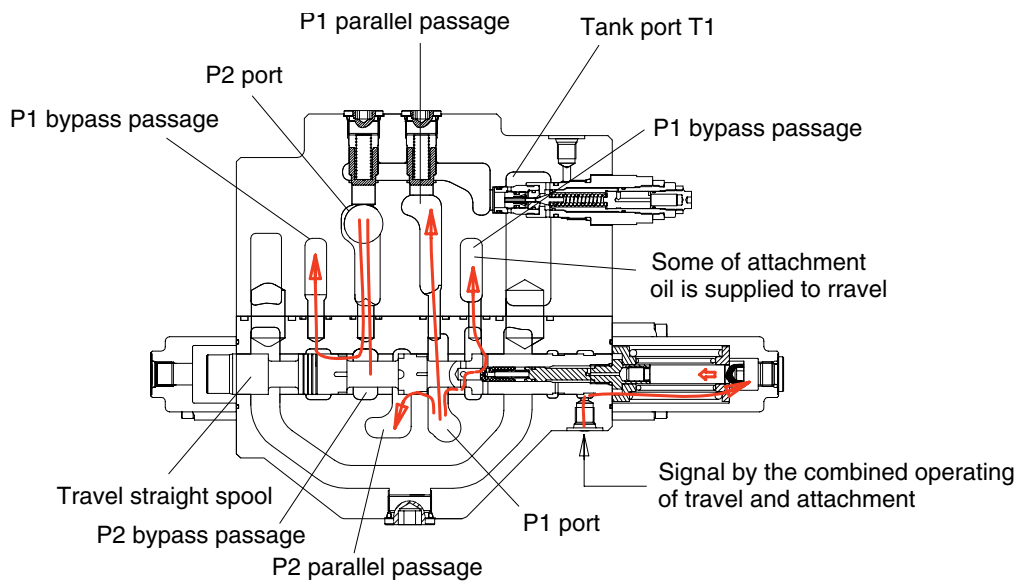
- | | | |
|-----------------------|--------------------------|-------------------------|
| 5 Boom 1 spool kit | 16-9 Back up ring | 30 Plug |
| 7 Swing spool kit | 16-10 O-ring | 34 Pilot cover A |
| 16 Holding valve assy | 16-11 Plug | 35 Pilot cover B |
| 16-1 Main poppet | 16-12 Pilot piston | 37 Check valve poppet 1 |
| 16-2 Restrictor | 16-13 Piston guide | 38 Check valve spring 1 |
| 16-3 Pilot spring | 16-14 Spring | 55 O-ring |
| 16-4 C-ring | 16-15 Main piston | 57 Hex socket head bolt |
| 16-5 Pilot poppet | 16-16 Plug | 58 Hex socket head bolt |
| 16-6 Poppet guide | 16-17 Block | 65 Spring washer |
| 16-7 O-ring | 18 Overload relief valve | 70 O-ring |
| 16-8 Poppet seat | 22 Swing logic valve | 71 Hex socket head bolt |

(3) Travel straight function

This function keeps straight travel in case of simultaneous operation of other actuators (boom, arm, bucket, swing etc) during a straight travel.

In normal conditions, travel straight spool keeps neutral conditions, the pressurized oil of the P1 and P2 pumps is supplied to each passage independently.

When the attachment spool is operated under the travel operation of both sides, the pilot pressure is supplied to the spring side port of the travel straight spool and then the travel straight spool is shifted to the left direction.



A-A' (STRAIGHT TRAVEL AND SUPPLY)

220S2MC20

After changeover of the travel straight spool, the pressurized oil discharged from the P1 pump is connected with P2 port oil and is supplied to the attachment line through both parallel passage of the P1 and P2.

Also, some of the pressurized oil open the check valve of the spool inside through side of the travel straight spool and is connected with the bypass passage of the P2 side.

On the other hand, the pressurized oil discharged from the P2 pump is connected with P1 port oil and is supplied to the travel line through both parallel passage of the P1 and P2.

Accordingly the attachment spool is operated under the travel operation of both sides, the pressurized oil discharged from P2 pump is mainly supplied to left and right travel line and the pressurized oil discharged from P1 pump is mainly supplied to attachment line.

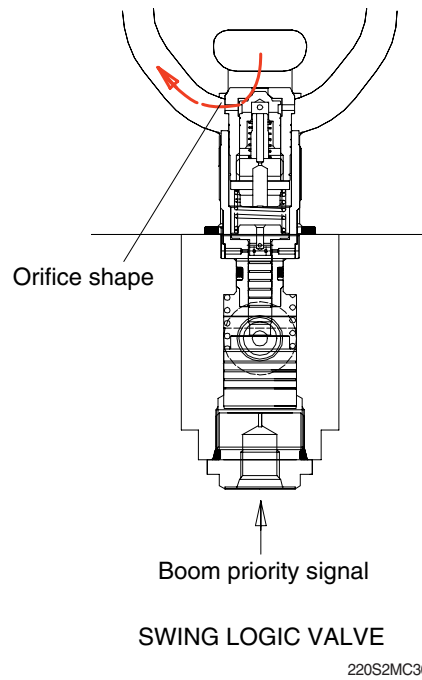
As a result, simultaneous operation of both travel spools and attachment is not influenced to the travel operation of the both sides and the machine keeps straight travel.

(2) Boom priority function

This function is used to speed up of the boom by reducing the swing speed when the swing operation with boom operation simultaneously.

The boom priority signal is supplied the pilot port and the poppet of the swing logic valve is closed and then the pressurized oil from P2 port is reduced by the oil leaking through the orifice.

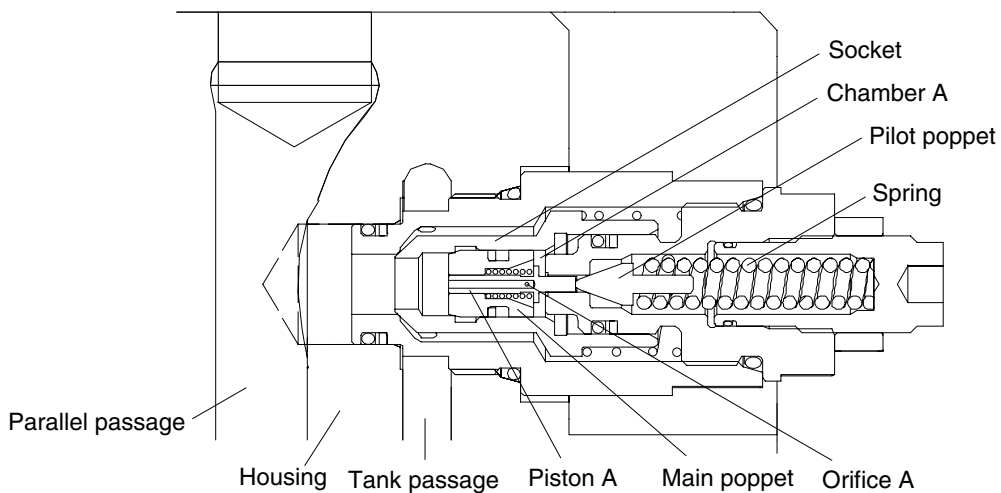
As a result, the swing speed is slowed.



12) OPERATION OF PORT RELIEF VALVE

(1) Function as relief valve

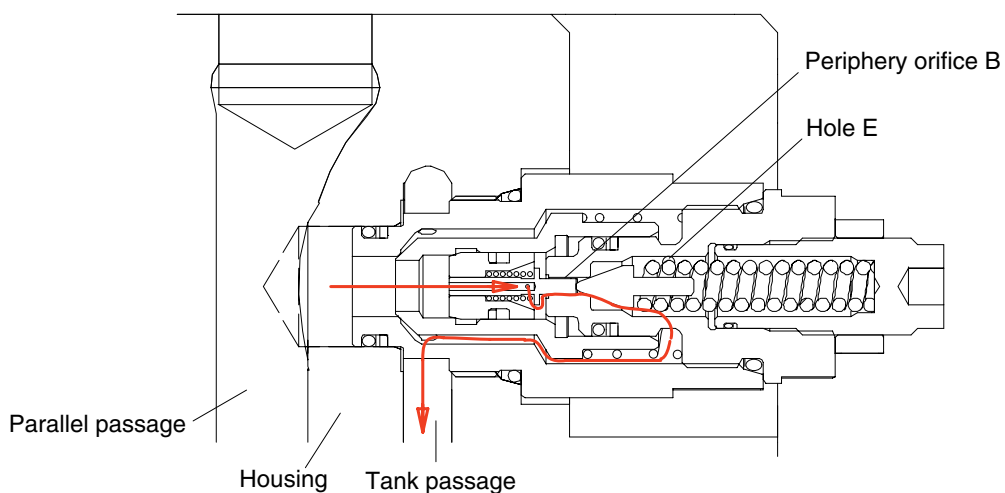
- ① The pressurized oil passes through the internal passage of the piston A, fitted in the main poppet and the orifice A and is filled up in the chamber A of the inside and seats the main poppet against socket and socket against the housing securely.



PORT RELIEF VALVE

220S2MC43

- ② When the pressurized oil from the actuators becomes equal to the set pressure of the spring, the hydraulic oil apply to the pilot poppet and pushes the pilot poppet to the right direction and flows to tank passage through the piston A internal passage, orifice A, chamber A, periphery orifice B and the hole E.



OPERATION 1 OF PORT RELIEF VALVE

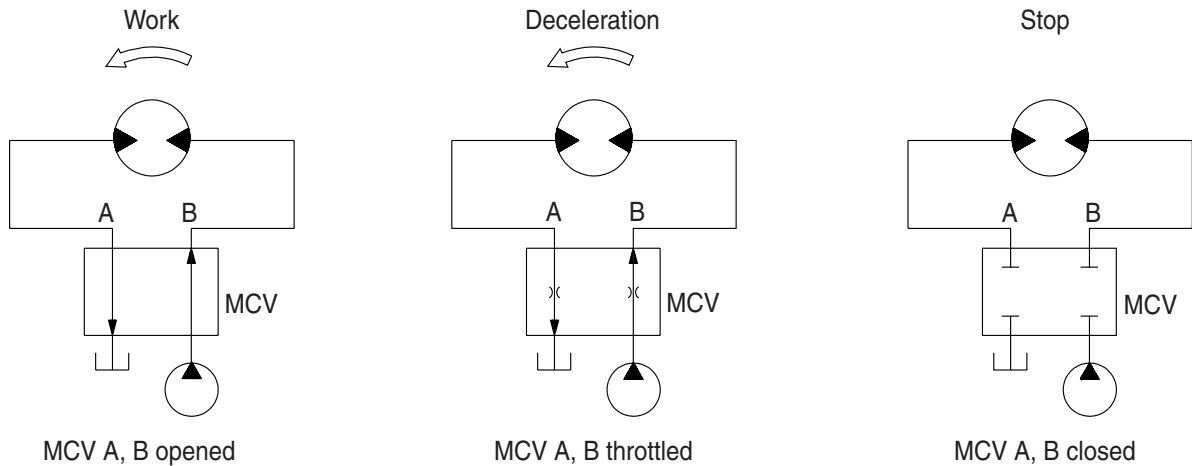
220S2MC44

4) BRAKE SYSTEM

(1) Control valve swing brake system

This is the brake system to stop the swing motion of the excavator during operation.

In this system, the hydraulic circuit is throttled by the swing control valve, and the resistance created by this throttling works as a brake force to slow down the swing motion.



2-48(1)

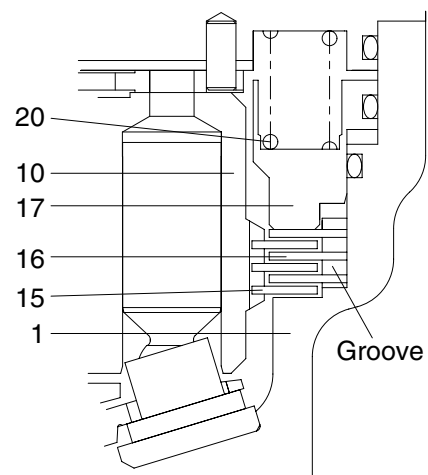
(2) Mechanical swing parking brake system

This is function as a parking brake only when all of the RCV lever (except swing, arm in) are not operated.

① Brake assembly

Circumferential rotation of separate plate (16) is constrained by the groove located at housing (1). When housing is pressed down by brake spring (20) through friction plate (15), separate plate (16) and brake piston (17), friction force occurs there.

Cylinder block (10) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



21092SM15

1	Housing	16	Separate plate
10	Cylinder block	17	Brake piston
15	Friction plate	20	Spring

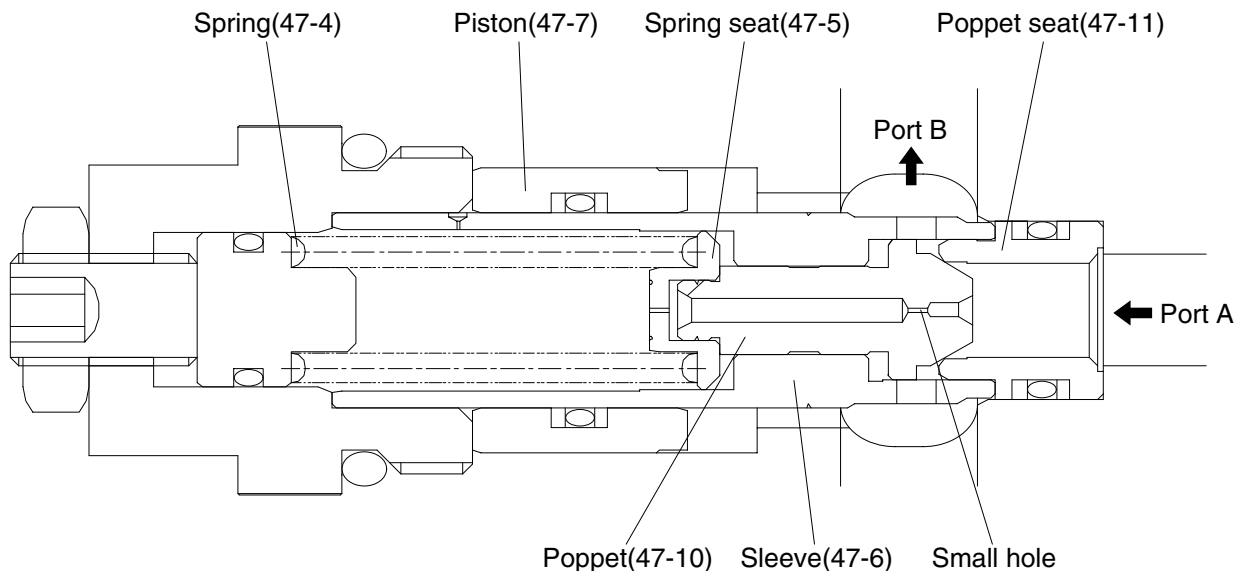
(2) Operation

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

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

When starting, "A" port pressure of overload valve increases, this pressure is applied to the effective diameter of poppet (47-10) which seats on the poppet seat (47-11) and, at the same time, is delivered, via small hole, to the spring seat (47-5) located inside the sleeve (47-6) and the seat bore pressure increases up to "A" port pressure. The poppet (47-10) opposes to spring (47-4) by the force of the pressure exerted on the area difference between poppet seat's effective diameter and spring seat bore and keep the predetermined pressure.

When hydraulically braking, the piston (47-7) is at the left position by the driving pressure, and when "A" port pressure increases, the pressure is applied also to the piston (47-7) through the small hole in the poppet (47-10) and piston (47-7) moves rightward until it touches the stopper in rear cover. In this while, the poppet (47-10) maintains "A" port pressure at comparatively low against the spring (47-4) force and exhaust oil to "B" port side. After the piston reached to the plug, the valve acts the same as at starting.



2609A2TM08

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve that controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure (secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

- (1) Inlet port (P) where oil is supplied from hydraulic pump.
- (2) Output ports (1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.
- (3) Tank port (T) necessary to control the above output pressure.
- (4) Spool to connect output port to inlet port or tank port.
- (5) Mechanical means to control output pressure, including springs that work on the above spools.

2) FUNCTIONS OF MAJOR SECTIONS

Item numbers are based on the type M1.

The functions of the spool (3) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output port pressure oil to tank port T.

The spring (5) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (9) is inserted and can slide in the plug (8).

For the purpose of changing the displacement of the push rod through the swash plate (16) and adjusting nut (17) are provided the handle assy (20) that can be tilted in any direction around the fulcrum of the universal joint (15) center.

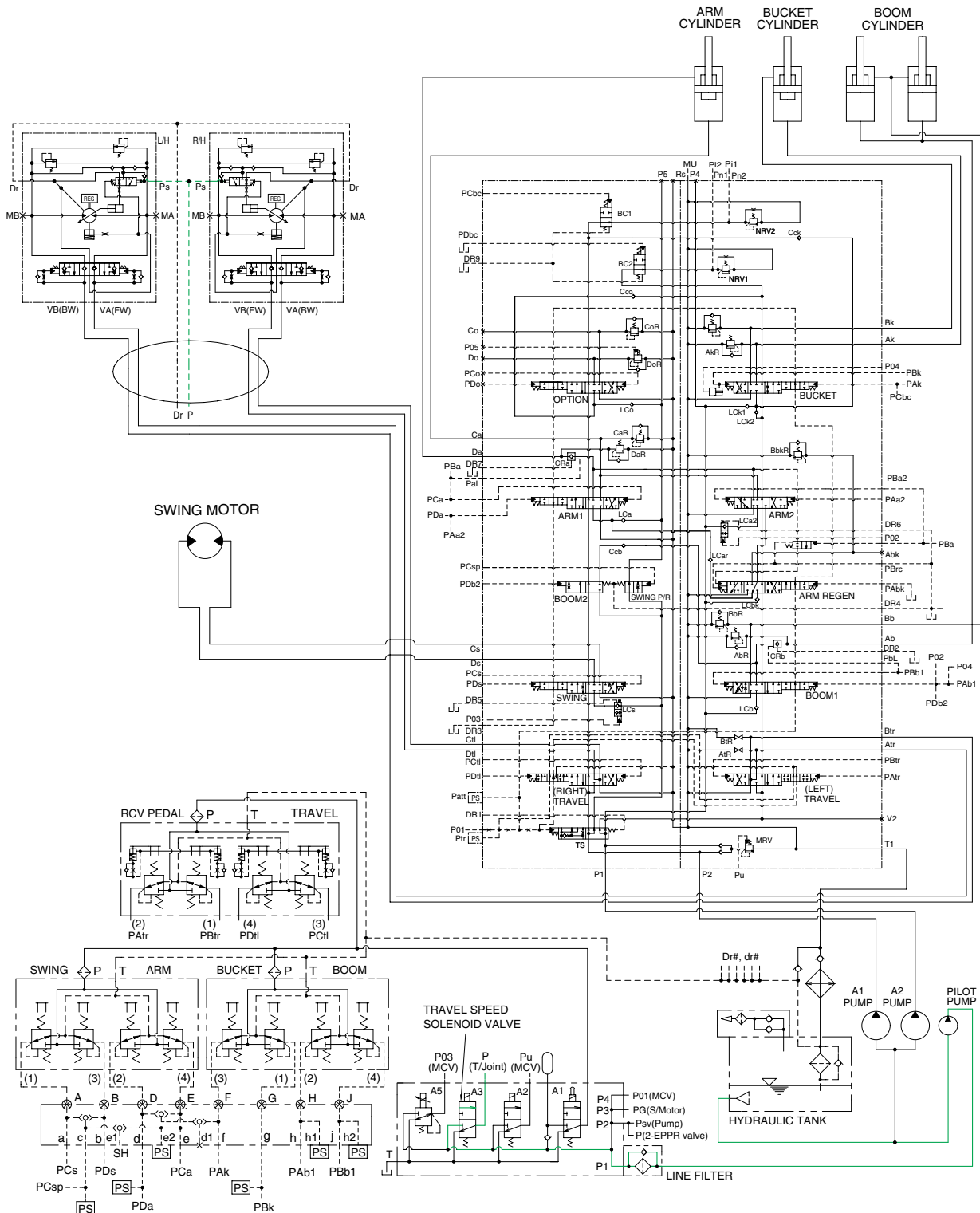
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

SECTION 3 HYDRAULIC SYSTEM

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4. TRAVEL SPEED CONTROL SYSTEM

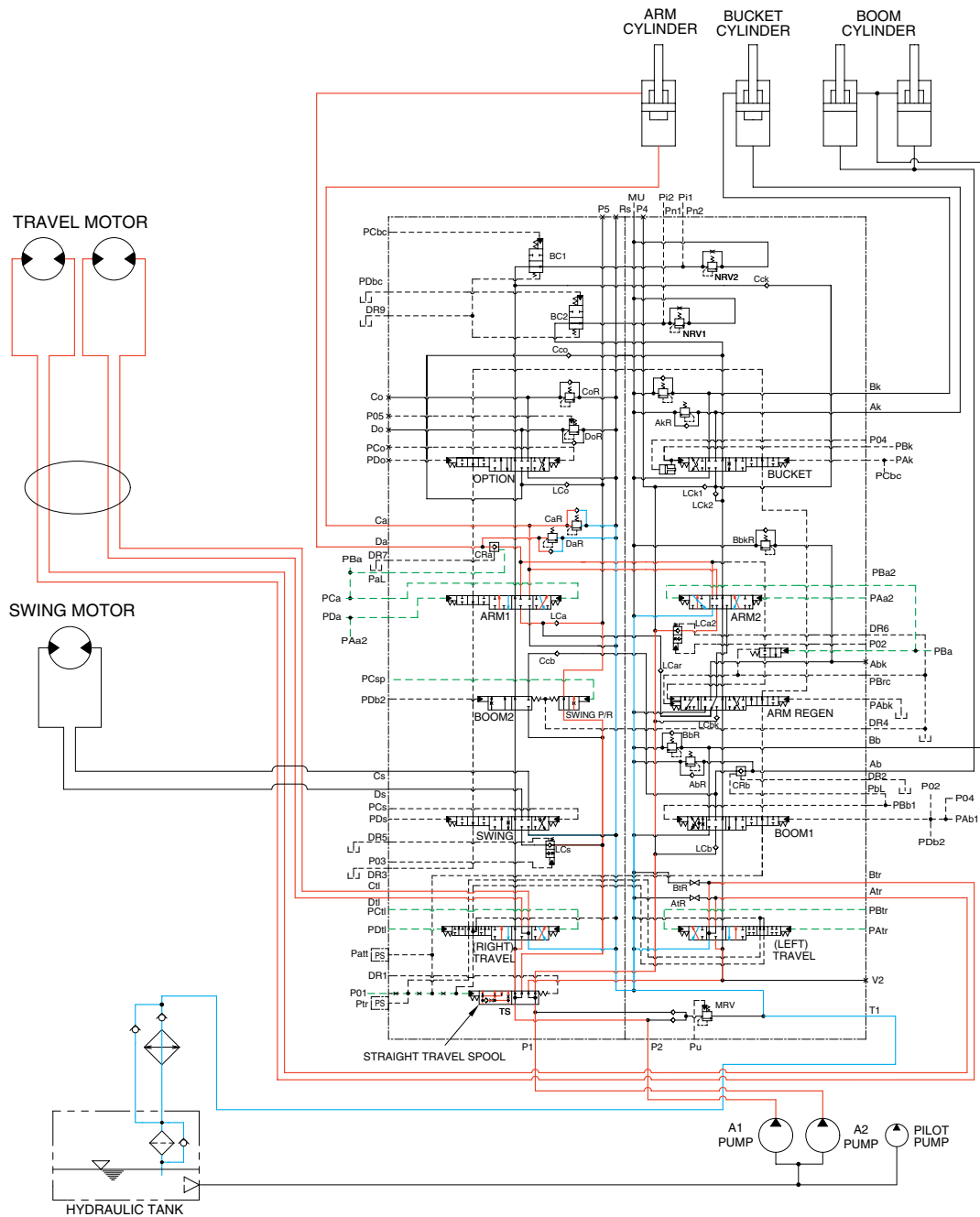


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When the travel speed solenoid valve was placed in the Hi position, the pressure oil from pilot pump through line filter flows to port **Ps** of travel speed change over valve, and the control piston is pushed, thus minimizing the displacement.

When the travel speed solenoid valve was placed in the Lo position, the oil of **Ps** port return to the tank and the control piston is returned, thus maximizing the displacement.

7. COMBINED ARM AND TRAVEL OPERATION



220S3HC23

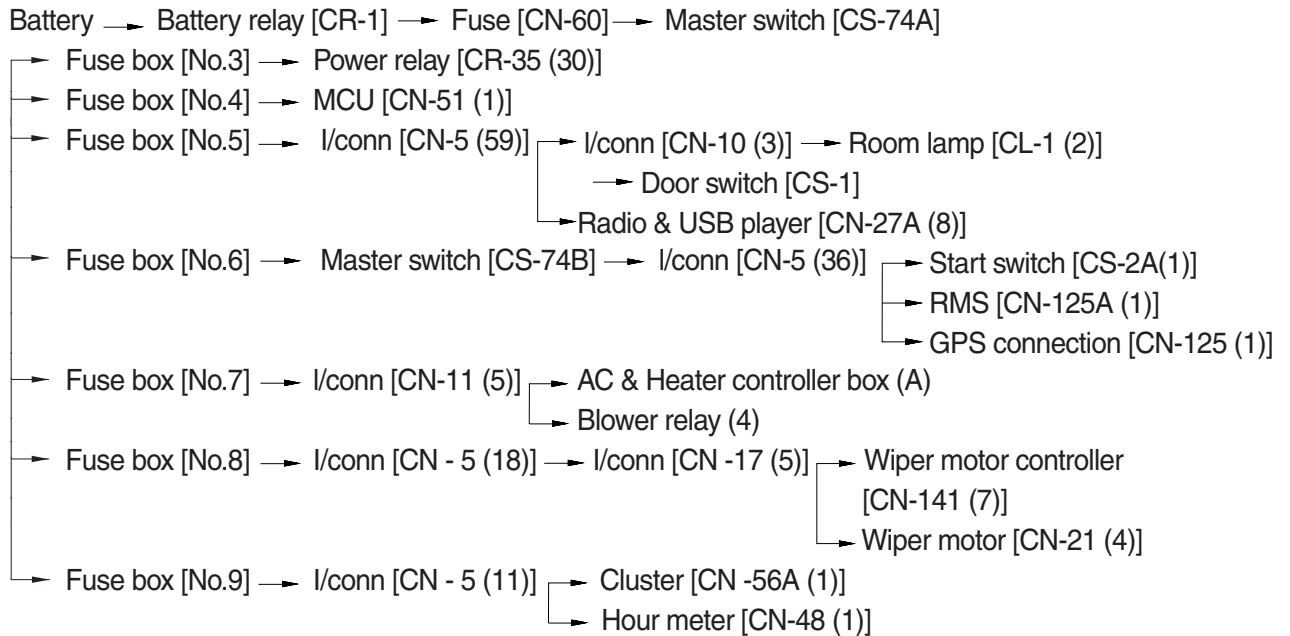
When the arm and travel functions are operated, simultaneously the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump. The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool. The oil from the A2 pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage. When the pressure of the travel motors is lower than the pressure of the arm cylinder, some oil from the A2 pump flows into the travel motors through the check valve and orifice in the straight travel spool. This prevents the rapid slowdown of the travel. The arm is operated and the machine travels straight.

1. POWER CIRCUIT

The negative terminal of battery is grounded to the machine chassis directly.

When the start switch is in the OFF position, the current flows from the positive battery terminal as shown below.

1) OPERATING FLOW



※ I/conn : Intermediate connector

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	OFF	① - GND (battery 1EA)	10~12.5V
		② - GND (battery 2EA)	20~25V
		③ - GND (battery relay)	20~25V
		④ - GND (fuse)	20~25V

※ GND : Ground

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Start switch ON

Fuse box (No.14) → Membrane controller [CN-376 (1)]

Fuse box (No.8) → I/conn [CN-5 (18)] → I/conn [CN-17 (5)] → Wiper motor controller [CN-141 (7)]
 → Wiper motor [CN-21 (4)]

Fuse box (No.20) → I/conn [CN-5 (16)] → I/conn [CN-17 (4)] → Wiper motor controller [CN-141 (6)]
 → Washer pump [CN-22 (2)]

(2) Wiper switch ON (Intermittent)

Wiper switch ON [CN-376 (12)] → I/conn [CN-5 (20)] → I/conn [CN-17 (8)]

→ Wiper motor controller [CN-141 (10)→(3)] → Wiper motor [CN-21 (6)] → Intermittently operating

(3) Wiper switch ON (continual)

Wiper switch ON [CN-376 (3)] → I/conn [CN-5 (15)] → I/conn [CN-17 (2)]

→ Wiper motor controller [CN-141 (2) → (4)] → Wiper motor [CN-21 (2)] → Continual operating

(4) Washer switch ON

Washer switch ON [CN-376 (11)] → I/conn [CN-5 (17)] → I/conn [CN-17 (7)]

→ Wiper motor controller [CN-141 (9) → (8)] → I/conn [CN-17 (6)] → I/conn [CN-5 (19)]

→ Washer pump [CN-22 (1)] → Washer operating

Wiper switch ON [CN-376 (3)] → I/conn [CN-5 (15)] → I/conn [CN-17 (2)]

→ Wiper motor controller [CN-141 (2) → (4)] → Wiper motor [CN-21 (2)] → Continual operating

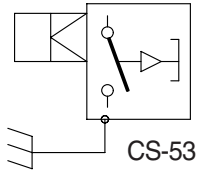
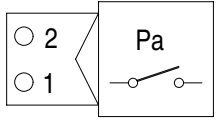
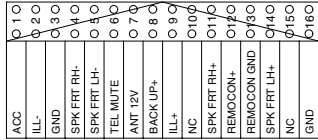
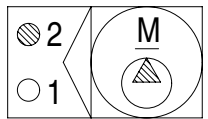
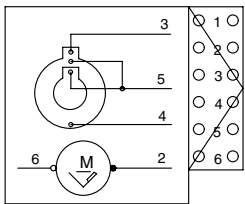
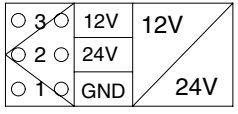
(5) Auto parking (when switch OFF)

Switch OFF [CN-376 (3)] → Wiper motor parking position by wiper motor controller

3) CHECK POINT

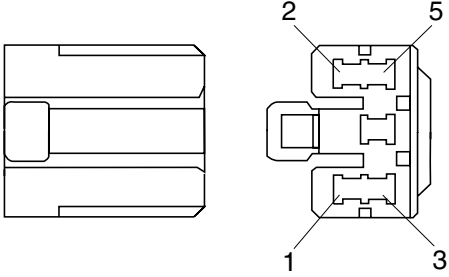
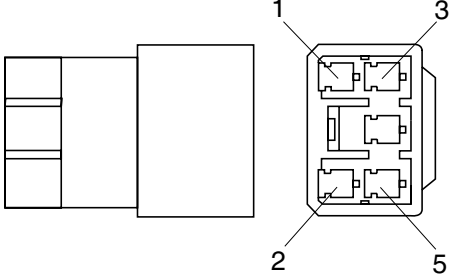
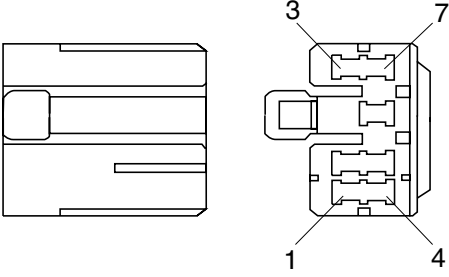
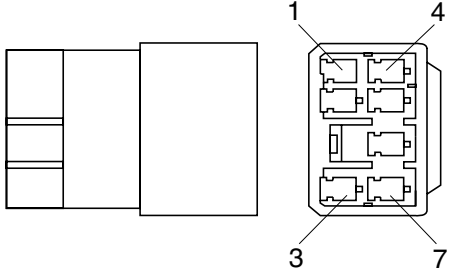
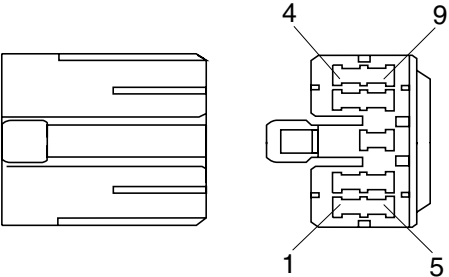
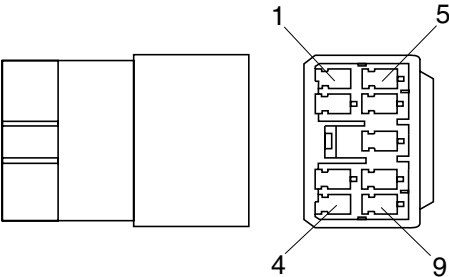
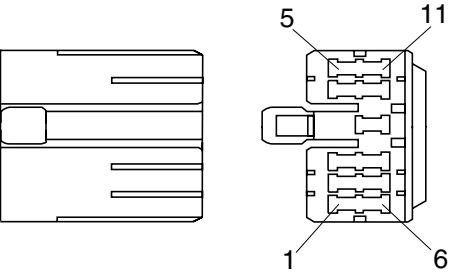
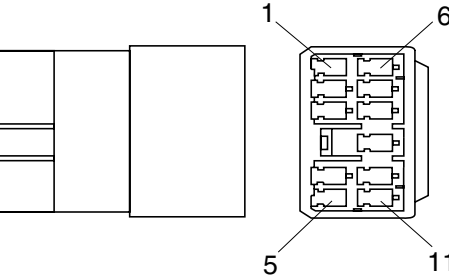
Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box)	20~25V
		② - GND (switch power input)	
		③ - GND (switch power output)	0 ~ 5V
		④ - GND (wiper switch power input)	
		⑤ - GND (wiper power output)	24V
		⑥ - GND (wiper motor)	0 or 24V

※ GND : Ground

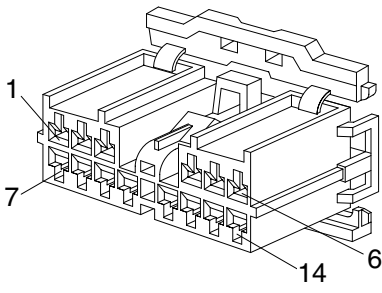
Part name	Symbol	Specifications	Check
Wiper cut switch	 <p>CS-53</p>	24V (N.O TYPE)	※ Check contact Normal : 0Ω (one pin to ground)
Receiver dryer	 <p>CN-29</p>	24V 2.5A	※ Check contact Normal : ∞Ω
Radio & USB player	 <p>CN-27A</p>	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 <p>CN-22</p>	24V 3.8A	※ Check contact Normal : 10.7Ω (for terminal 1-2)
Wiper motor	 <p>CN-21</p>	24V 2A	※ Check disconnection Normal : 7Ω (for terminal 2-6)
DC/DC Converter	 <p>CN-138</p>	12V 3A	※ Check voltage 24V (for terminal 1-2) 12V (for terminal 1-3)

2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
5	 <p style="text-align: center;">S811-005002</p>	 <p style="text-align: center;">S811-105002</p>
7	 <p style="text-align: center;">S811-007002</p>	 <p style="text-align: center;">S811-107002</p>
9	 <p style="text-align: center;">S811-009002</p>	 <p style="text-align: center;">3S811-109002</p>
11	 <p style="text-align: center;">S811-011002</p>	 <p style="text-align: center;">S811-111002</p>

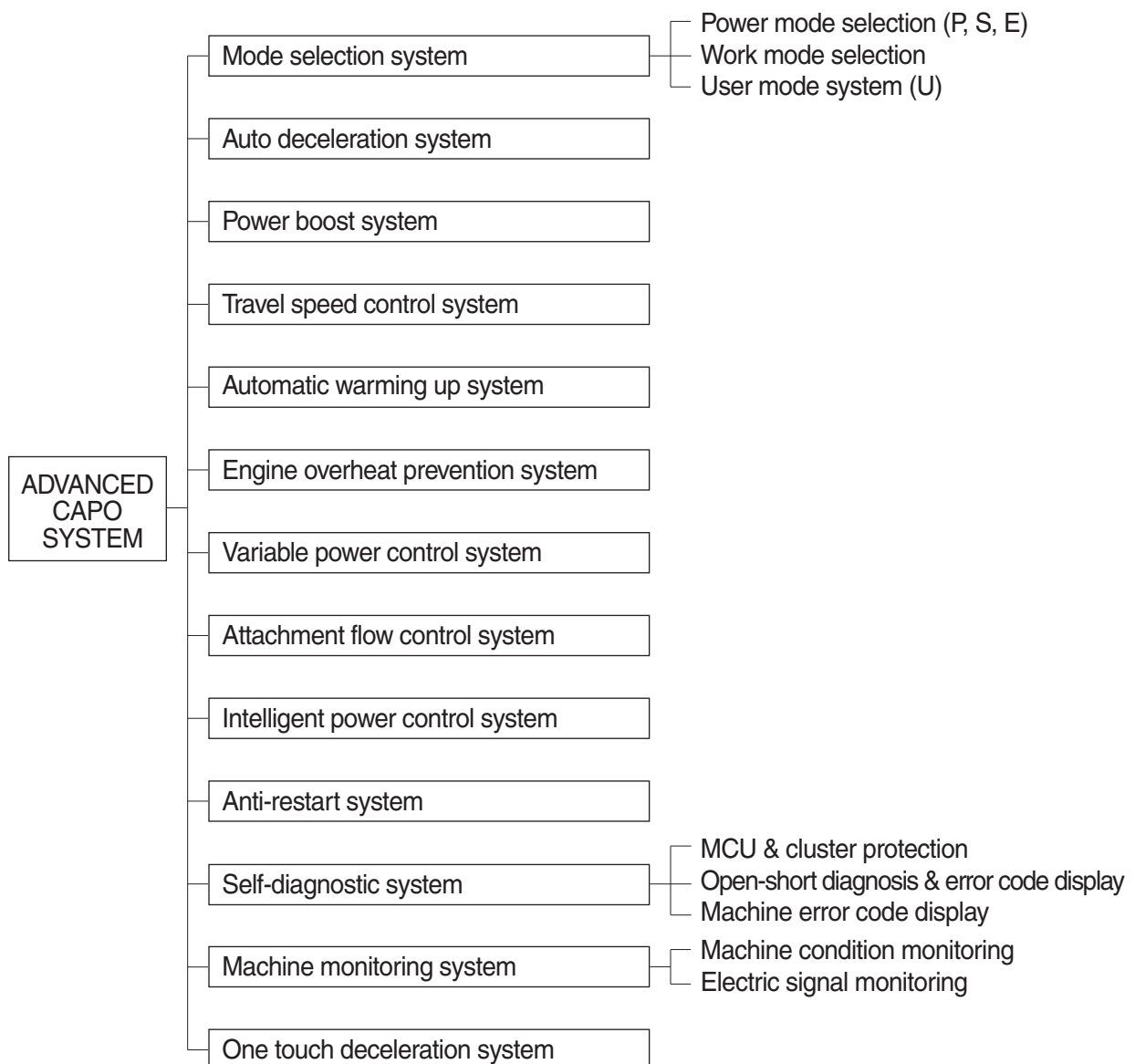
13) KET SDL CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
14	 <p data-bbox="710 683 837 705">MG610406</p>	

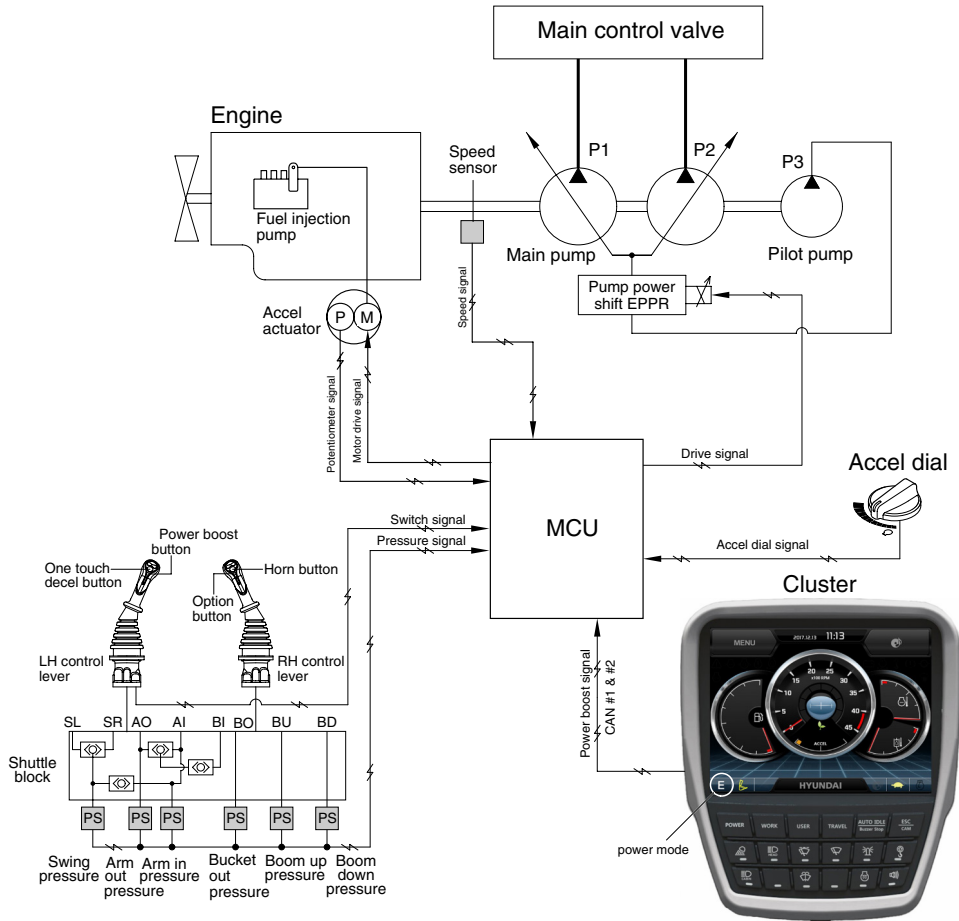
SECTION 5 MECHATRONICS SYSTEM

GROUP 1 OUTLINE

The ADVANCED CAPO (Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, auto-deceleration, power boost function, etc. It monitors machine conditions, for instance, engine speed, coolant temperature, hydraulic oil temperature, and hydraulic oil pressure, etc. It consists of a MCU, a cluster, an accel actuator, EPPR valves, and other components. The MCU and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.



GROUP 8 VARIABLE POWER CONTROL SYSTEM



220S5MS09

- The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load. It makes fuel saving and smooth control at precise work.

Description	Working condition
Power mode	P, S, E
Work mode	General (bucket)
Pressure sensor	Normal

※ The variable power control function can be activated when the power mode is set to all power mode.

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
135	0	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Swing Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Swing Pilot Press. display failure 2. Control Function – IPC operation, Boom first operation failure (Checking list) 1. CD-24 (#B) – CN-52 (#36) Checking Open/Short 2. CD-24 (#A) – CN-51 (#3) Checking Open/Short 3. CD-24 (#C) – CN-51 (#13) Checking Open/Short				
138	0	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, 0.3V ≤ Attachment Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Attachment Pilot Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-69 (#B) – CN-52 (#33) Checking Open/Short 2. CD-69 (#A) – CN-51 (#3) Checking Open/Short 3. CD-69 (#C) – CN-51 (#13) Checking Open/Short				
139 (NA)	1	10 seconds continuous, 0.3V ≤ Option Pilot Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Option Pilot Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Option Pilot Press. display failure 2. Control Function – Auto Idle operation failure (Checking list) 1. CD-100 (#B) – CN-52 (#21) Checking Open/Short 2. CD-100 (#A) – CN-51 (#3) Checking Open/Short 3. CD-100 (#C) – CN-1 (#6) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
220 (NA)	4	Mounting pressure sensor (HCESPN 128 or 205) (Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage \leq 3.0V (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage $>$ 3.0V	●		
	6	(Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current $>$ 6.5 A (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current \leq 6.5 A	●		
(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-369 (#1) – CN-53 (#35) Checking Open/Short 2. CN-369 (#2) – Fuse box (#17) Checking Open/Short					
221 (NA)	5	Monitor – Selecting attachment(breaker / crusher) (Detection) (When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA (Cancellation) ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current \geq 10 mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current $>$ 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current \leq 1.0 A	●		
(Results / Symptoms) 1. Control Function – Option attachment flow control – P1 relief pressure setting failure (Checking list) 1. CN-365 (#2) – CN-53 (#39) Checking Open/Short 2. CN-365 (#1) – CN-53 (#40) Checking Open/Short					

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

GROUP 14 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

EPPR (Electro Proportional Pressure Reducing) valve consists of electro magnet and spool valve installed at main pump.

(1) Electro magnet valve

Receive electric current from MCU and move the spool proportionally according to the specific amount of electric current value.

(2) Spool valve

Is the two way direction control valve for pilot pressure to reduce main pump flow.

When the electro magnet valve is activated, pilot pressure enters into flow regulator of main pump.

(3) Pressure and electric current value for each mode

Mode		Pressure		Electric current (mA)	Engine rpm (at accel dial 10)
		kgf/cm ²	psi		
Standard (Stage : 1.0)	P	10	142	330 ± 30	1850 ± 50
	S	12 ± 3	171 ± 40	360 ± 30	1750 ± 50
	E	12 ± 3	171 ± 40	360 ± 30	1650 ± 50
Option (Stage : 2.0)	P	3	43	190 ± 30	1950 ± 50
	S	5 ± 3	71 ± 40	250 ± 30	1850 ± 50
	E	10 ± 3	142 ± 40	330 ± 30	1750 ± 50

2) HOW TO SWITCH THE STAGE (1.0 ↔ 2.0) ON THE CLUSTER

You can switch the EPPR valve pressure set by selecting the stage (1.0 ↔ 2.0).

- Management
 - Service menu



- Power shift (standard/option) : Power shift pressure can be set by option menu.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: www.heydownloads.com by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

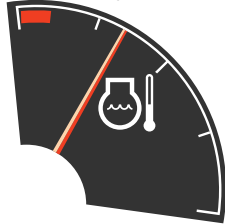
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(3) Engine coolant temperature gauge



Normal type



Premium type



220S3CD553

- ① This gauge indicates the temperature of coolant.
 - White range : 40-100°C (104-212°F)
 - Red range : Above 100°C (212°F)
 - ② If the indicator is in the red range or  lamp pops up and the buzzer sounds turn OFF the engine and check the engine cooling system.
- ※ If the gauge indicates the red range or  lamp blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

(4) Hydraulic oil temperature gauge



Normal type



Premium type



220S3CD554

- ① This gauge indicates the temperature of hydraulic oil.
 - White range : 40-100°C(104-212°F)
 - Red range : Above 100°C(212°F)
 - ② If the indicator is in the red range or  lamp pops up and the buzzer sounds reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.
- ※ If the gauge indicates the red range or  lamp blinks in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.



This switch is used to return to the previous menu or parent menu.

In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).

Please refer to page 5-78 for the camera.

If the camera is not installed, this switch is used only ESC function.

(7) Work light switch



- ① This switch is used to operate the work light.
- ② The pilot lamp is turned ON when operating the switch.

(8) Head light switch



- ① This switch is used to operate the head light.
- ② The pilot lamp is turned ON when operating the switch.

(9) Intermittent wiper switch



- ① This switch is used to wipe operates intermittently.
- ② The pilot lamp is turned ON when operating the switch.

(10) Wiper switch



- ① This switch is used to operate the window wiper.
- ② Note that the wiper will self-park when switched off.
- ③ The pilot lamp is turned ON when operating the switch.
- ※ If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause. If the switch remains ON, motor failure can result.

② Maintenance information



220S3CD131A



220S3CD132A



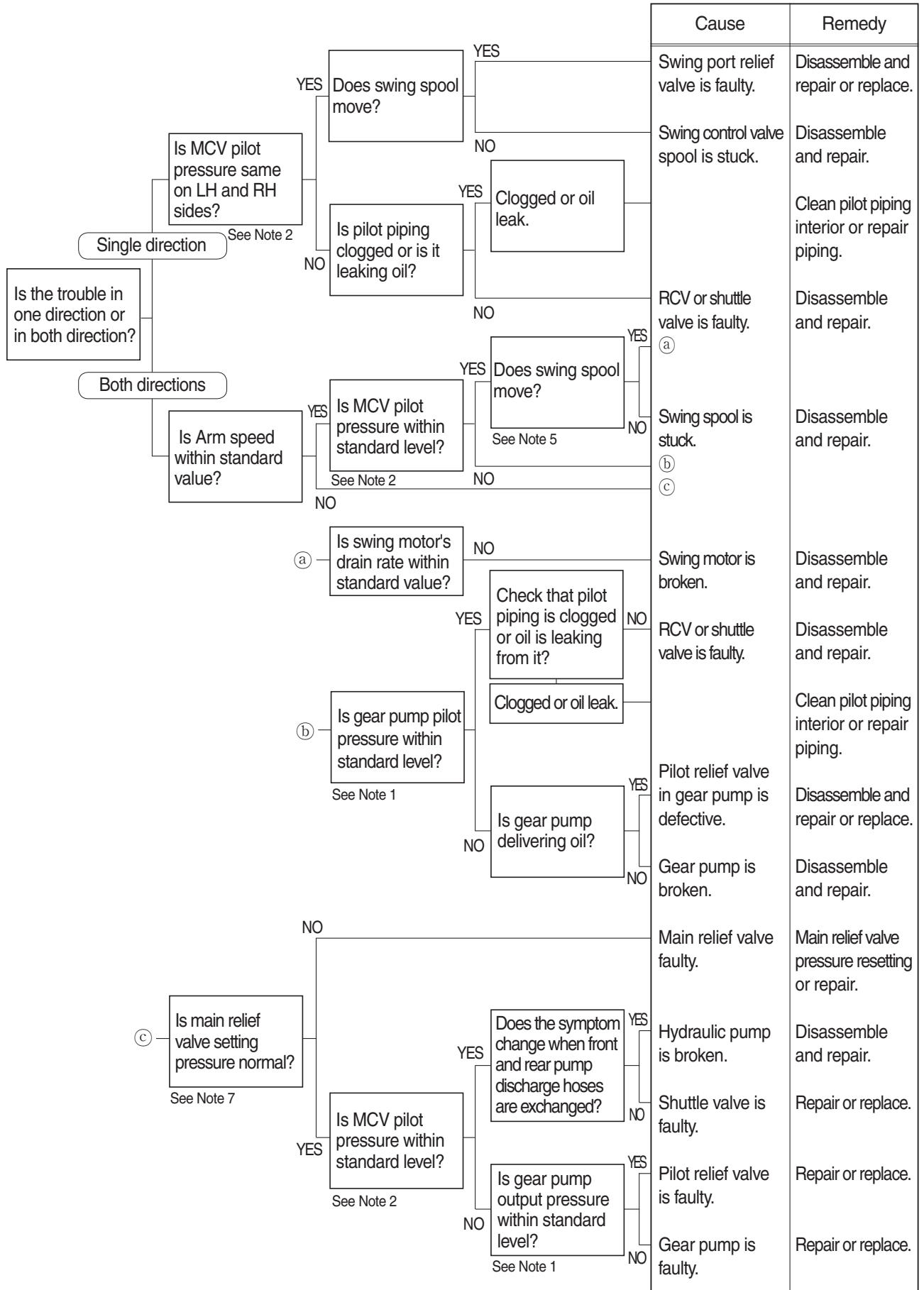
220S3CD133A

- Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
- Replacement : The elapsed time will be reset to zero (0).
- Change interval : The change or replace interval can be changed in the unit of 50 hours.
- ※ **Refer to Maintenance chart for further information of maintenance interval.**

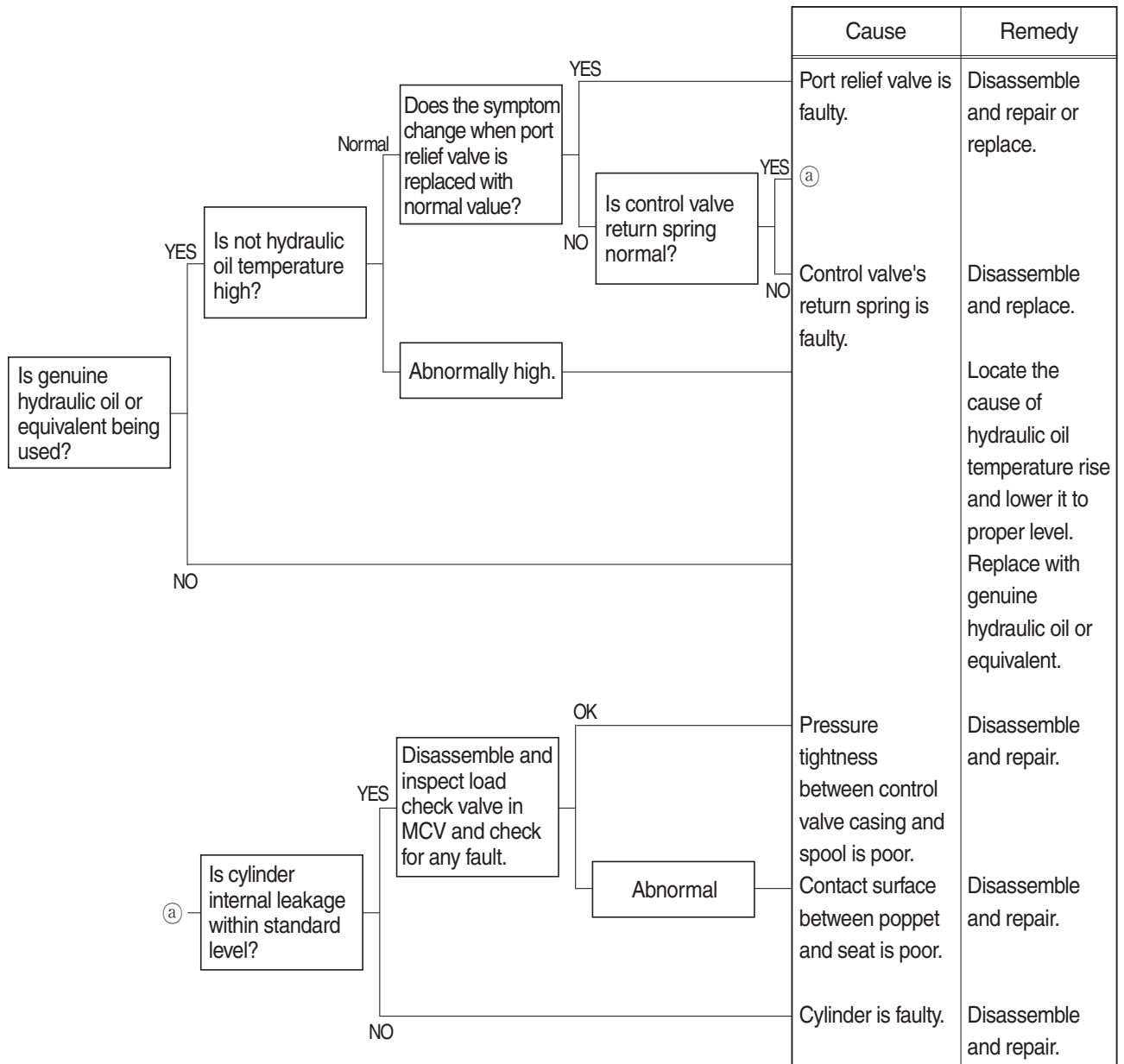
SECTION 6 TROUBLESHOOTING

Group 1 Before Troubleshooting	6-1
Group 2 Hydraulic and Mechanical System	6-4
Group 3 Electrical System	6-24
Group 4 Mechatronics System	6-40

2) SWING SPEED IS LOW

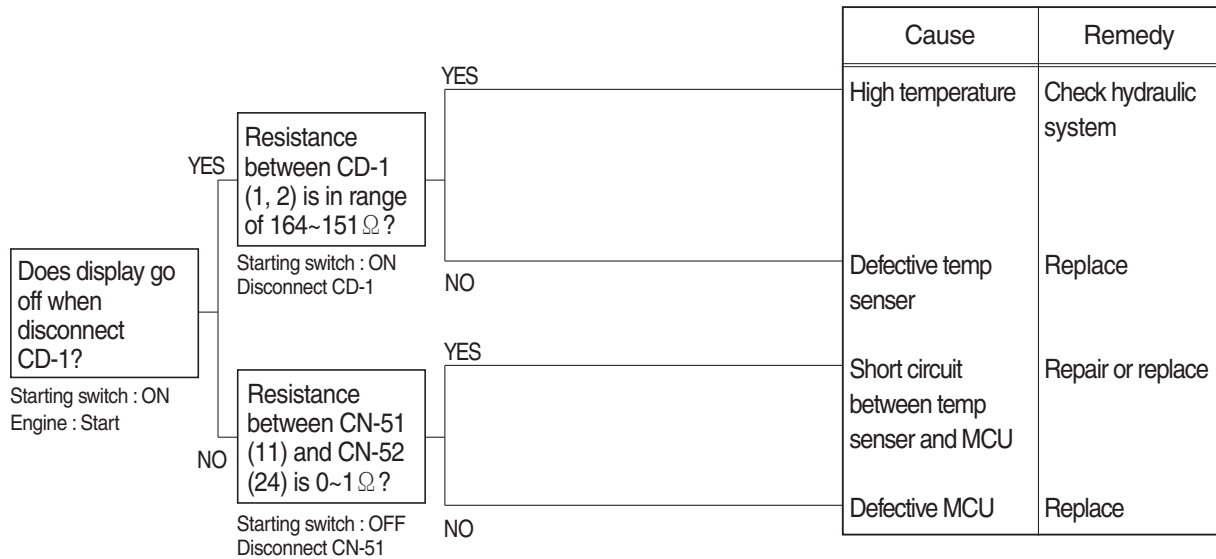


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



7. WHEN HYDRAULIC OIL TEMPERATURE WARNING LAMP LIGHTS UP (engine is started)

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Normal type

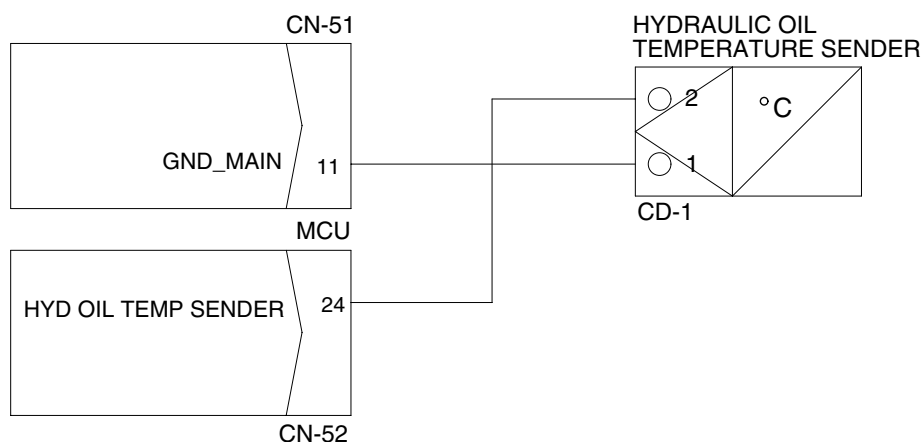


Premium type



Check Table

Temperature (°C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 0.151



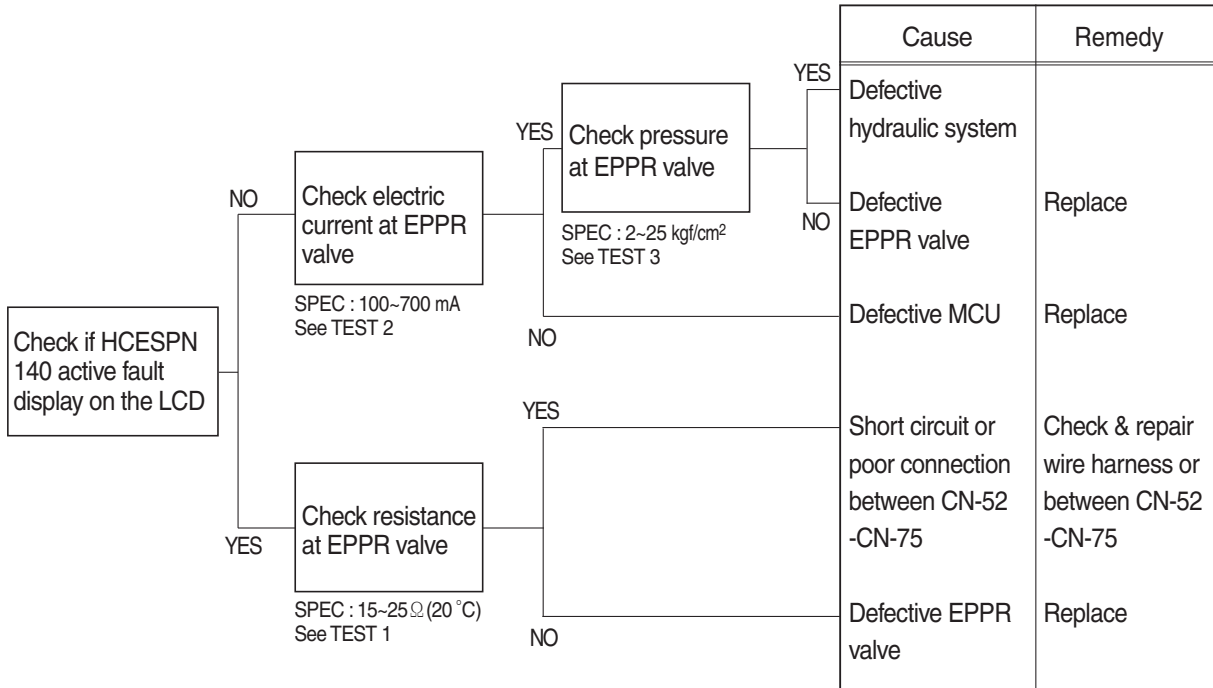
220S6ES08

GROUP 4 MECHATRONICS SYSTEM

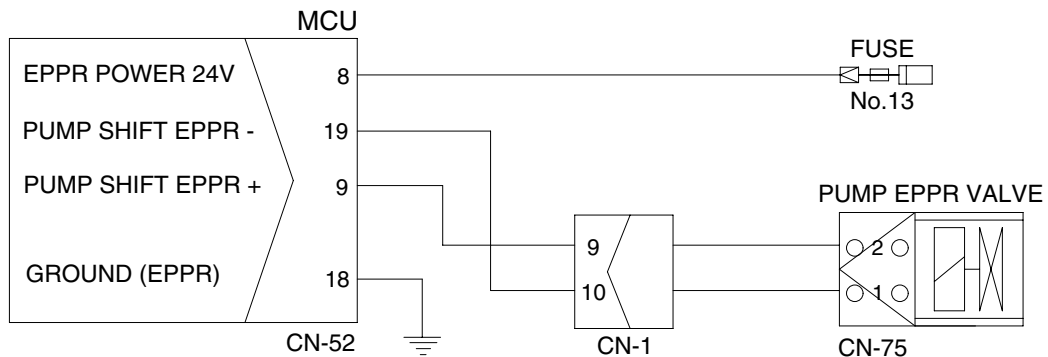
1. ALL ACTUATORS SPEED ARE SLOW

- ※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.
- ※ Spec : P-mode 1950 ± 50 rpm S-mode 1850 ± 50 rpm E-mode 1750 ± 50 rpm
- ※ Before carrying out below procedure, check all the related connectors are properly inserted and fault code on the cluster.

1) INSPECTION PROCEDURE



Wiring diagram



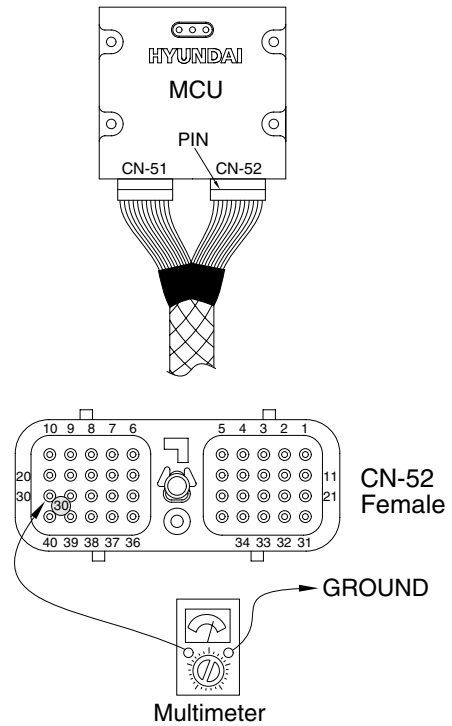
300S6MS01

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-52 (30) and ground.

- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors : One pin to (30) of CN-52.
- ③ Starting switch ON.
- ④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



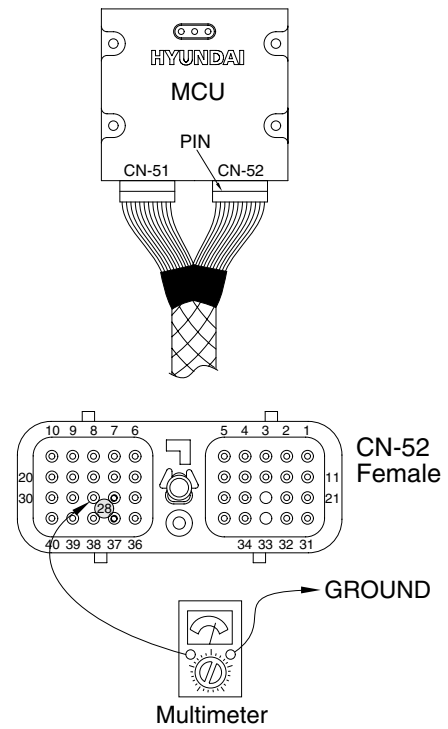
220S6MS08

2) TEST PROCEDURE (NA)

(1) **Test 15** : Check voltage at CN-52 (28) and ground.

- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors : One pin to (28) of CN-52.
- ③ Starting key ON.
- ④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

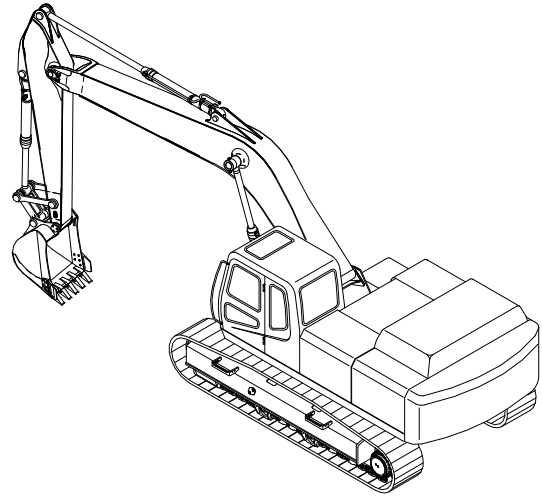


220S6MS18

2. TERMINOLOGY

1) STANDARD

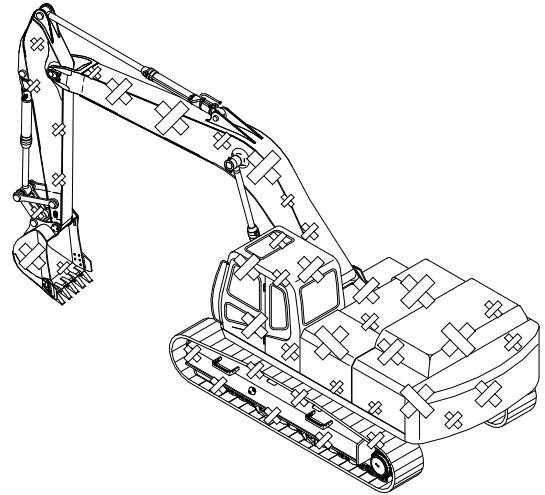
Specifications applied to the brand-new machine, components and parts.



21077MS02

2) SERVICE LIMIT

The lowest acceptable performance level. When the performance level of the machine falls below this level, the machine must be removed from work and repaired. Necessary parts and components must be replaced.



21077MS03

- Bucket cylinders

Measure the time it takes to roll in the bucket, and the time it takes to roll out the bucket. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

- Repeat each measurement 3 times and calculate the average values.

(4) Evaluation

The average measured time should meet the following specifications.

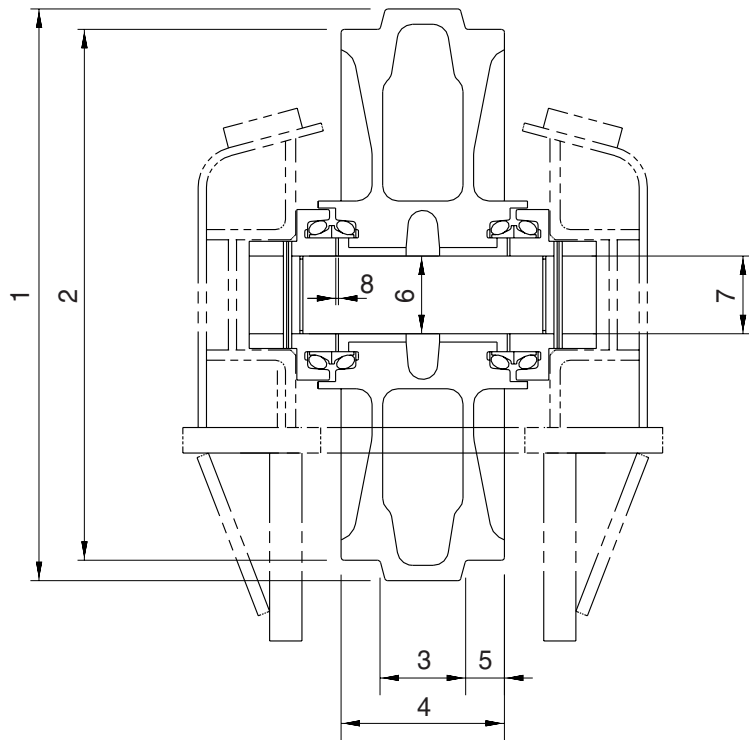
Unit : Seconds

Model	Function	Standard	Maximum allowable	Remarks
HX300HD	Boom raise	3.7 ± 0.4	4.7	
	Boom lower	3.0 ± 0.4	3.8	
	Arm in Regen ON	3.1 ± 0.4	3.9	
	Arm out	3.1 ± 0.3	3.9	
	Bucket load	2.5 ± 0.4	3.2	
	Bucket dump	2.5 ± 0.3	3.2	
HX300HD Long reach	Boom raise	4.0 ± 0.4	5.0	
	Boom lower	3.0 ± 0.4	3.8	
	Arm in	3.5 ± 0.4	4.6	
	Arm out	4.1 ± 0.3	4.8	
	Bucket load	1.4 ± 0.4	2.2	
	Bucket dump	1.5 ± 0.3	2.2	

2. MAIN CONTROL VALVE

Part name	Inspection item	Criteria & measure
Casing	<ul style="list-style-type: none"> · Existence of scratches, rust or corrosion. 	<ul style="list-style-type: none"> · In case of damage in following section, replace casing. - Sliding sections of casing hole and spool, especially land sections applied with held pressure. - Seal pocket section where spool is inserted. - Sealing section of port where O-ring contacts. - Sealing section of each relief valve for main and port. - Sealing section of plug. - Other damages that may damage normal function.
Spool	<ul style="list-style-type: none"> · Existence of scratch, gnawing, rusting or corrosion. · O-ring seal sections at both ends. · Insert spool into casing hole, rotate and reciprocate it. 	<ul style="list-style-type: none"> · Replacement when its outside sliding section has scratch (especially on seals-contacting section). · Replacement when its sliding section has scratch. · Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	<ul style="list-style-type: none"> · Damage of spring · Damage of poppet · Insert poppet into casing and function it. 	<ul style="list-style-type: none"> · Replacement. · Correction or replacement when sealing is incomplete. · Normal when it can function lightly and smoothly without sticking.
Spring and related parts	<ul style="list-style-type: none"> · Rusting, corrosion, deformation or breakage of spring, spring seat, plug or cover. 	<ul style="list-style-type: none"> · Replacement for significant damage.
Around seal for spool	<ul style="list-style-type: none"> · External oil leakage. · Rusting, corrosion or deformation of seal plate. 	<ul style="list-style-type: none"> · Correction or replacement. · Correction or replacement.
Main relief valve, port relief valve & negative control valve	<ul style="list-style-type: none"> · External rusting or damage. · Contacting face of valve seat. · Contacting face of poppet. · O-rings and back up rings. 	<ul style="list-style-type: none"> · Replacement. · Replacement when damaged. · Replacement when damaged. · Replacement in principle.

3) IDLER



21037MS03

Unit : mm

No.	Check item	Criteria		Remedy		
		Standard size	Repair limit			
1	Outside diameter of protrusion	Ø646	—	Rebuild or replace		
2	Outside diameter of tread	Ø594	Ø588			
3	Width of protrusion	102	—			
4	Total width	203	—			
5	Width of tread	50.5	56.5			
6	Clearance between shaft and bushing	Standard size & tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		Ø90 ⁰ _{-0.035}	Ø90.35 ^{+0.05} ₀	0.35 to 0.435	2.0	
7	Clearance between shaft and support	Ø90 ⁰ _{-0.035}	Ø90 ^{+0.09} _{+0.036}	0.036 to 0.125	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance 0.4 to 1.2		Clearance limit 2.0		Replace

2) PIPE AND HOSE (FLARE TYPE)

Thread size (PF)	Width across flat (mm)	kgf.m	lbf.ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

3) PIPE AND HOSE (ORFS TYPE)

Thread size (UNF)	Width across flat (mm)	kgf.m	lbf.ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

4) FITTING

Thread size	Width across flat (mm)	kgf.m	lbf.ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

4) ASSEMBLY

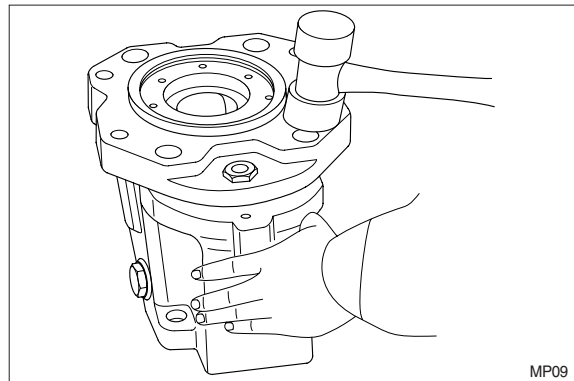
(1) For reassembling reverse the disassembling procedures, paying attention to the following items.

- ① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.
- ② Clean each part fully with cleaning oil and dry it with compressed air.
- ③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.
- ④ In principle, replace seal parts, such as O-rings, oil seals, etc.
- ⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in Section 2-3.
- ⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

(2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.

- ※ After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.

In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply lock-tight (medium strength) to their threaded sections.



- (11) Remove lever (1, 612). Do not draw out pin (875).
- (12) Draw out pilot piston (643) and spool (652).
- (13) Draw out piston case (622), compensating piston (621) and compensating rod (623).
- ※ Piston case (622) can be taken out by pushing compensating rod (623) at opposite side of piston case.

This completes operation.

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

- (1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.
In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.
- (2) When a control valve is to be removed from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread paper or a rubber mat on the bench, and disassemble the valve on it.
- (3) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.
- (4) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

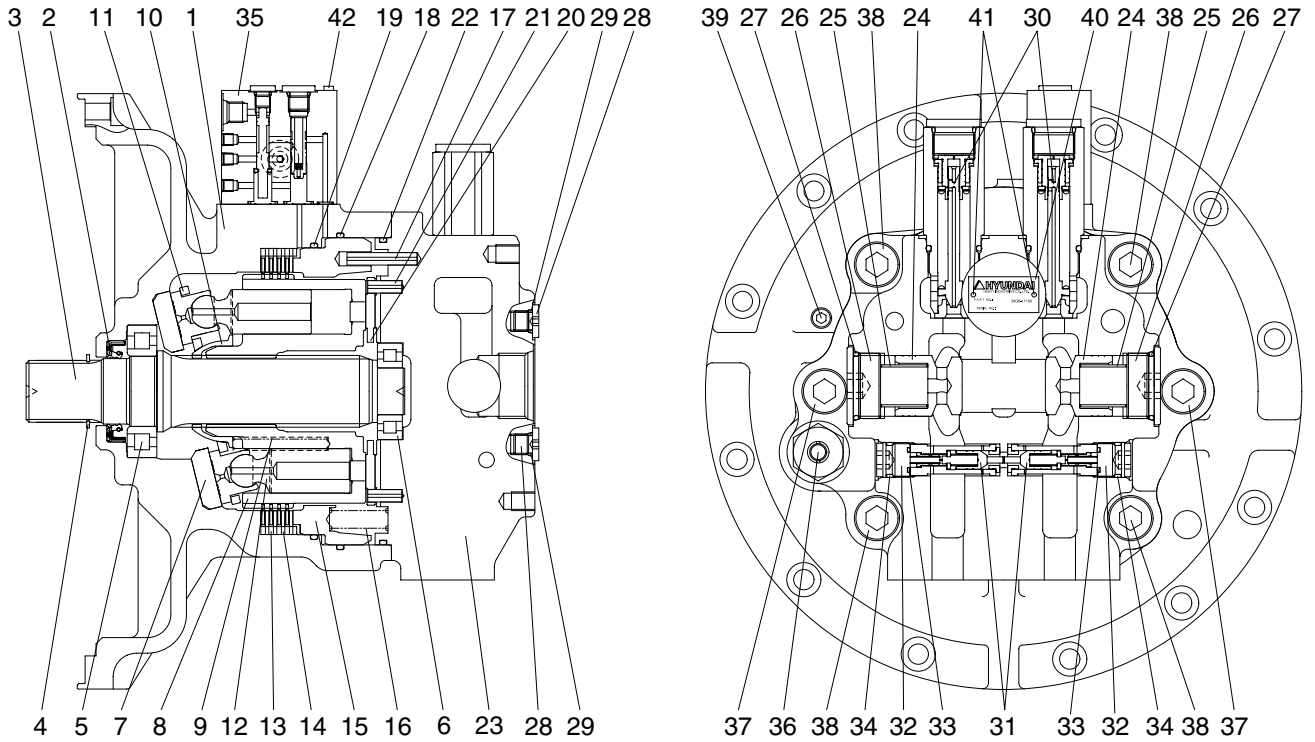
2) TOOLS

Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)
Torque wrench	1	-
Extension bar	1	-
Hexagon bit socket	Each 1	6, 8, 10
Hex socket	1	36
Spanner	Each 1	32, 34, 38
Loctite #262	1	-

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



300L2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Needle bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Time delay valve assy
8	Cylinder block	22	O-ring	36	Level gauge
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

- ⑨ Lift up valve casing (23) on casing (1) by a crane and assemble it with socket bolts (37, 38).

- Tightening torque : $33 \pm 3.3 \text{ kgf} \cdot \text{m}$
($239 \pm 23.9 \text{ lbf} \cdot \text{ft}$)



2209A8SM86

- ⑩ Assemble level gauge (36) and plug (39) into casing (1).

- Tightening torque (36) : $15 \pm 1.0 \text{ kgf} \cdot \text{m}$
($108.5 \pm 7.2 \text{ lbf} \cdot \text{ft}$)
- Tightening torque (39) : $3 \pm 0.3 \text{ kgf} \cdot \text{m}$
($21.7 \pm 2.2 \text{ lbf} \cdot \text{ft}$)



2209A8SM87

- ⑪ Assemble time delay valve assy (35) into valve casing (23) with socket bolt (42).

- Time delay valve $\times 1\text{EA}$
- Socket bolt $\times 3\text{EA}$
- Tightening torque (42) : $1.3 \pm 0.1 \text{ kgf} \cdot \text{m}$
($9.4 \pm 0.72 \text{ lbf} \cdot \text{ft}$)



2209A8SM88

- ⑫ Air pressing test

Be sure of leakage, after press air into assembled motor and put it in water for 1 minute (pressure : 2 kgf/cm^2).

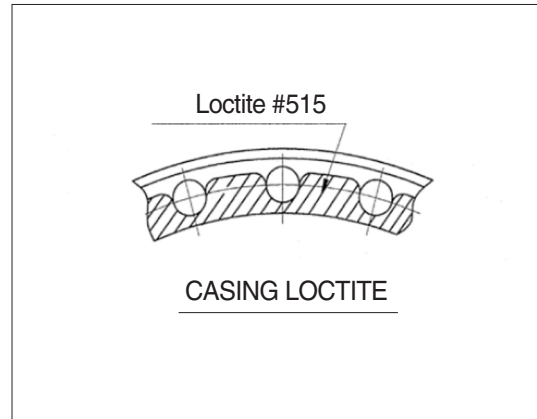


2209A8SM89

(4) Assemble ring gear (1).

① Spread the loctite #515 on the casing (9) with reference to the right detail view.

※ Loctite should not flow into casing (9).



300L8SR20

② After press-fitting parallel pin (31) with a hammer on the casing (9). Then spreading loctite #262 on hex.head bolt (32), screw them.

※ Tightening torque : $33 \pm 3.3 \text{ kgf} \cdot \text{m}$
($239 \pm 23.9 \text{ lbf} \cdot \text{ft}$)

※ Screwing when rust inhibitor is not removed.



300L8SR21

(5) Assemble carrier No.1 assy

① After assembling thrust plate No.1 (27) on carrier No.1 (20), assemble thrust washer No.1 (23), planetary gear No.1 (21), then assemble carrier pin No.1 (24) by using the hammer.

※ Assembly method of carrier No.2 assy is same.



300L8SR22

(11) Disassemble pivot (16, 2EA) into casing (1).



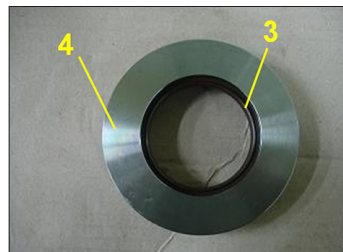
2609A8TM24

(12) Disassemble snap ring (6) using pliers.



2609A8TM25

(13) Disassemble trust block (4) and oil-seal (3) into casing (1).



2609A8TM26

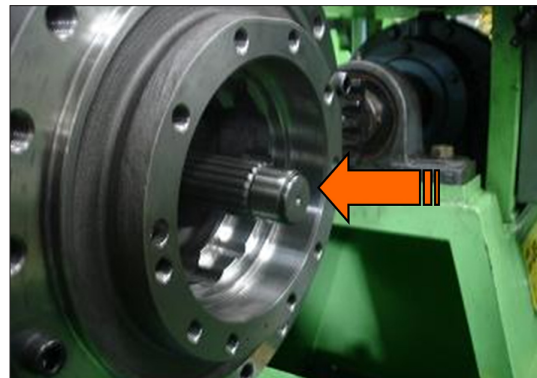


2609A8TM27

(14) In the casing (1), the arrow part of the shaft (8) using a rubber mallet taps and then disassemble the shaft (8) and bearing-roller (10) to the other side.



2609A8TM28



2609A8TM29

(26) Put on the rear cover (34) on the casing (1).



2609A8TM86

(27) Assemble rear cover (34) into casing (1) and then tighten the wrench bolt (54, 55) using torque wrench.

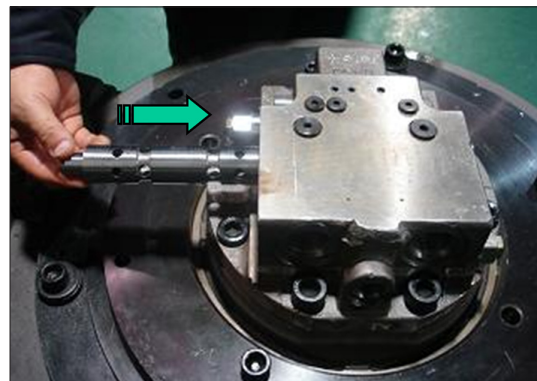


2609A8TM87

(28) Assemble main spool assy (35) into rear cover (34) after checking the direction to be correct.



2609A8TM88



2609A8TM89

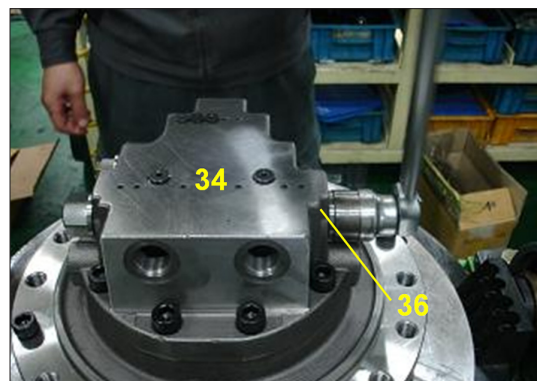
(29) Assemble spring (37), plug (36) into rear cover (34) in regular sequence and then plug (36) into rear cover (34) using torque wrench.



2609A8TM90



2609A8TM91

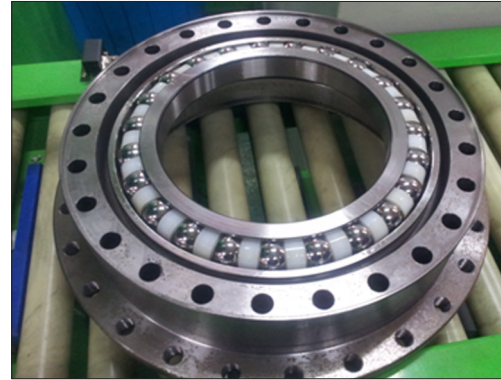


2609A8TM92

4) ANGULAR BEARING

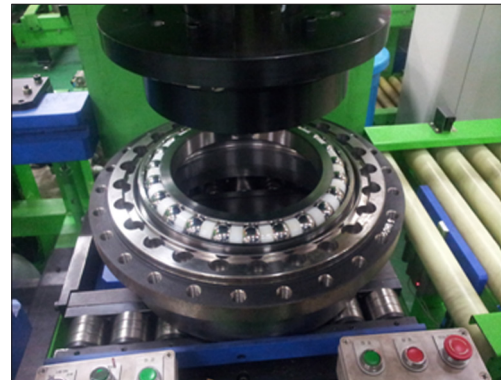
(1) Put the jig on housing (7) and insert angular bearing (2) into it with pressing machine, and turn down the upside of housing (7) by reversing machine.

※ Check the direction of bearing when inserting it.



2609A8TM24

(2) Insert angular bearing (2) into reversed housing (7) on the same way.



2609A8TM25

5) ASSEMBLING FLOATING SEAL

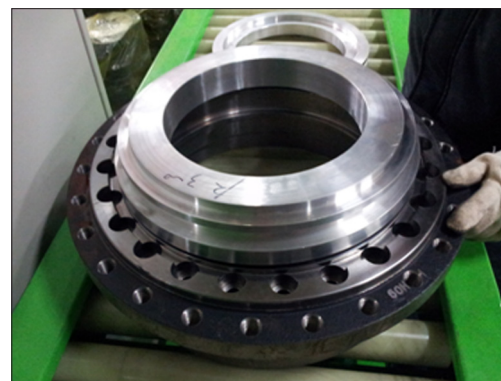
(1) Paint alchole on floating seal (3) and polish it.



2609A8TM26

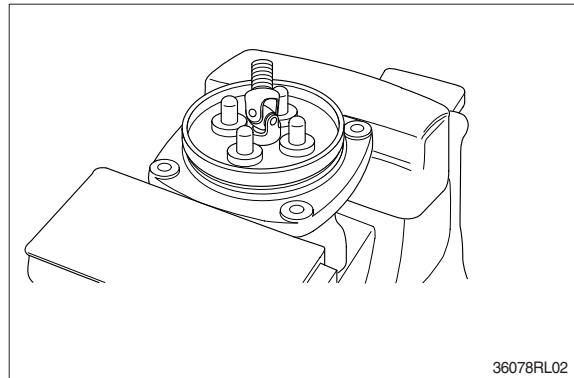
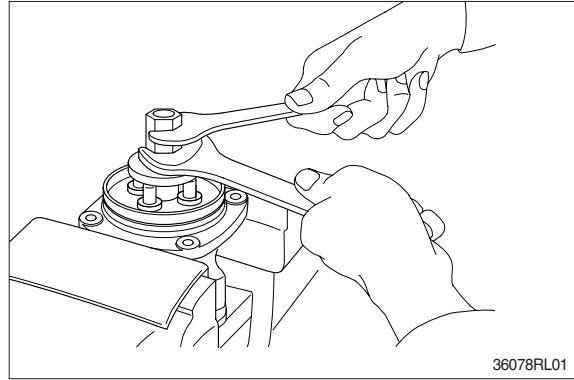
(2) Put floating seal (3) on the right position of housing (3) and insert it by pressing jig. After complete, check the condition by lifting with hand softly.

※ Keep clean on surface of floating seal while assembling.



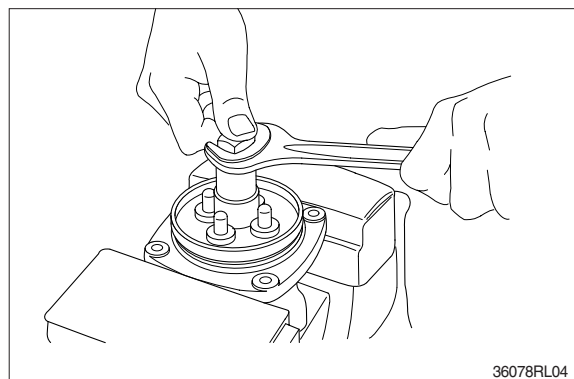
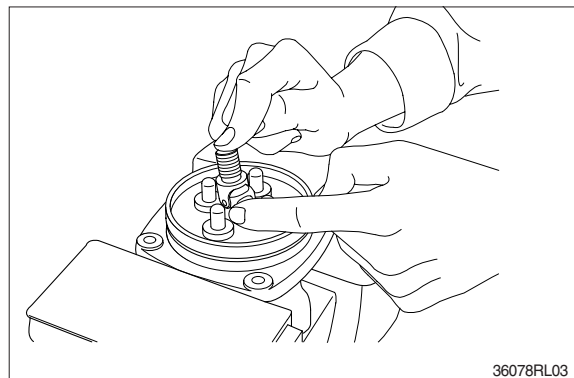
2609A8TM27

- (6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.



- (7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

- ※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint. Pay attention to this.



GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

- (1) Lower the work equipment to the ground and stop the engine.
- (2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.
- (3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

▲ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

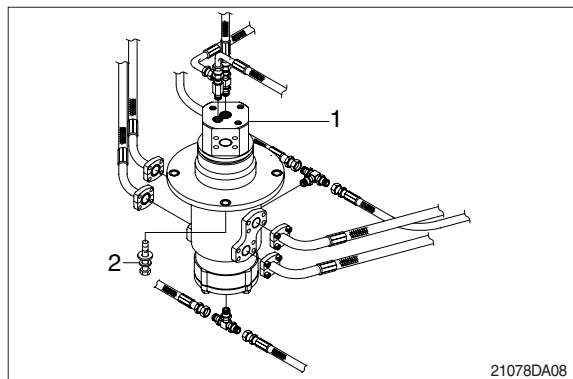
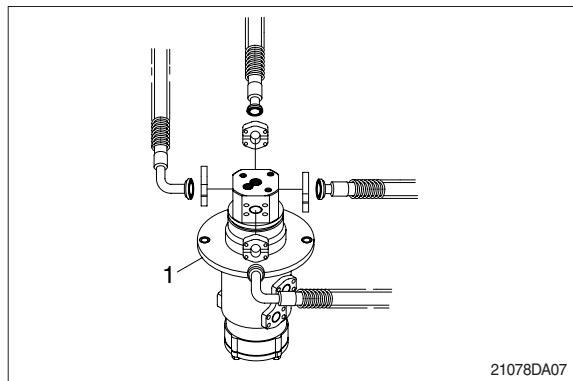
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

- (4) Disconnect all hoses.
- (5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
 - Weight : 55 kg (120 lb)
 - Tightening torque : 12.3 ± 1.3 kgf · m
(89 ± 9.4 lbf · ft)

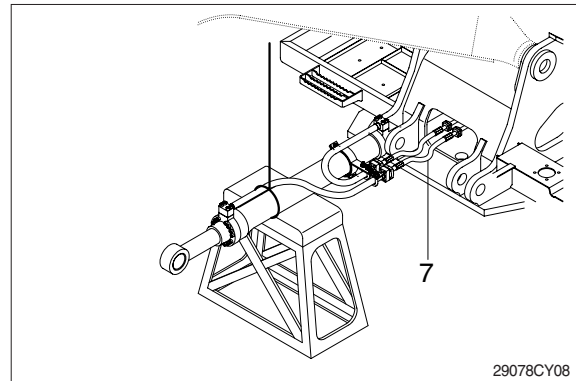
- (6) Remove the turning joint assembly.
 - ※ When removing the turning joint, check that all the hoses have been disconnected.

2) INSTALL

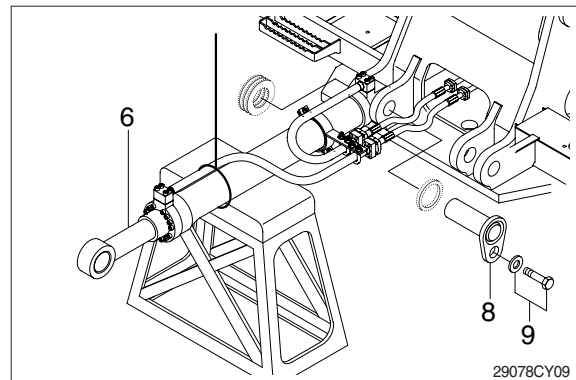
- (1) Carry out installation in the reverse order to removal.
 - ※ Take care of turning joint direction.
 - ※ Assemble hoses to their original positions.Confirm the hydraulic oil level and check the hydraulic oil leak or not.



- ⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



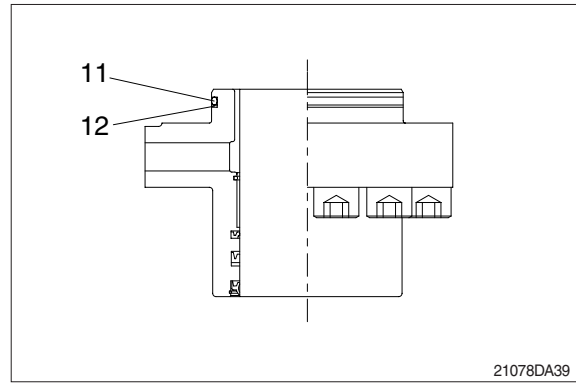
- ⑥ Remove bolt (9) and pull out pin (8).
⑦ Remove boom cylinder assembly (6).
· Weight : 270 kg (600 lb)



(2) Install

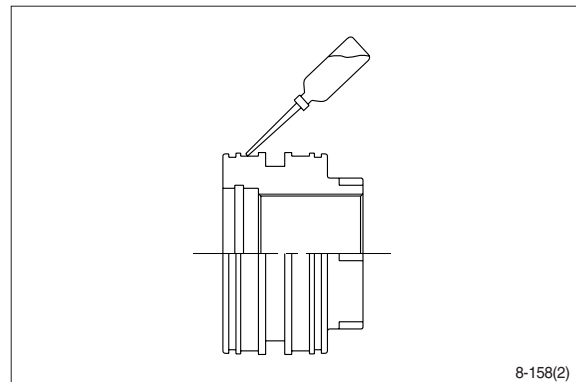
- ① Carry out installation in the reverse order to removal.
- ▲ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**
- ※ Bleed the air from the boom cylinder.
 - ※ Confirmed the hydraulic oil level and check the hydraulic oil leak or not.

- ⑤ Fit back up ring (12) to gland (3).
- ※ Put the backup ring in the warm water of 30~50°C.
- ⑥ Fit O-ring (11) to gland (3).

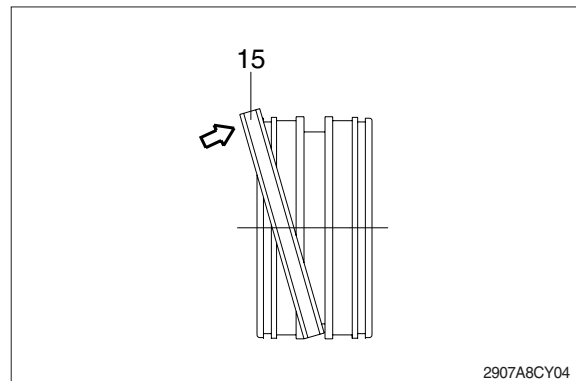


(2) Assemble piston assembly

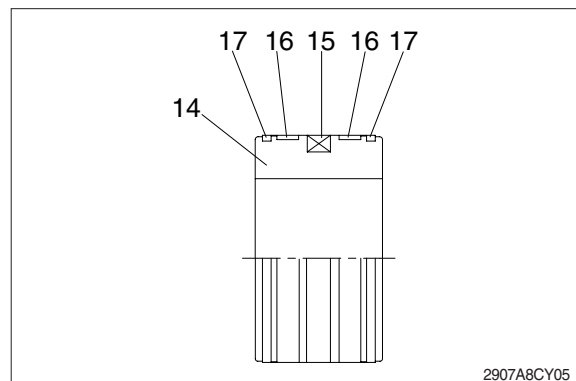
- ※ Check for scratches or rough surfaces. If found smooth with an oil stone.
- ① Coat the outer face of piston (14) with hydraulic oil.



- ② Fit piston seal (15) to piston.
- ※ Put the piston seal in the warm water of 60~100°C for more than 5 minutes.
- ※ After assembling the piston seal, press its outer diameter to fit in.



- ③ Fit wear ring (16) and dust ring (17) to piston (14).



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