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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

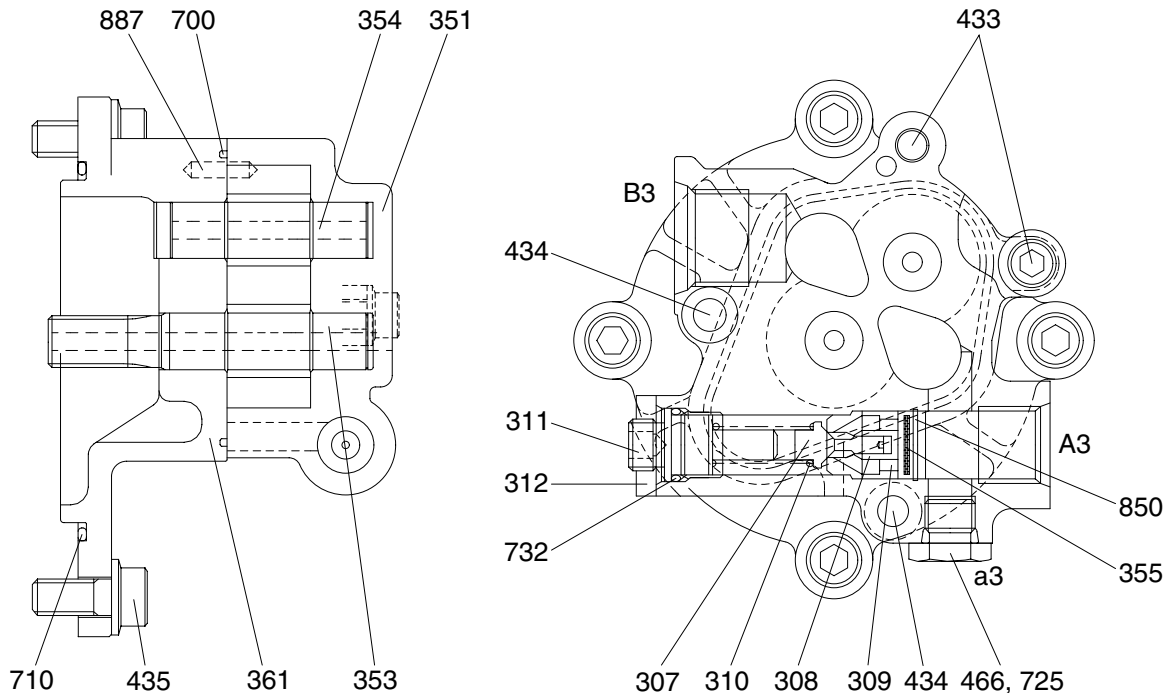
This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

SECTION 9 COMPONENT MOUNTING TORQUE

This section shows bolt specifications and standard torque values needed when mounting components to the machine.

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.

3) GEAR PUMP



21092MP05

- 307 Poppet
- 308 Seat
- 309 Spring seat
- 310 Spring
- 311 Screw
- 312 Nut
- 351 Gear case

- 353 Drive gear
- 354 Driven gear
- 355 Filter
- 361 Front case
- 433 Flange socket
- 434 Flange socket
- 435 Flange socket

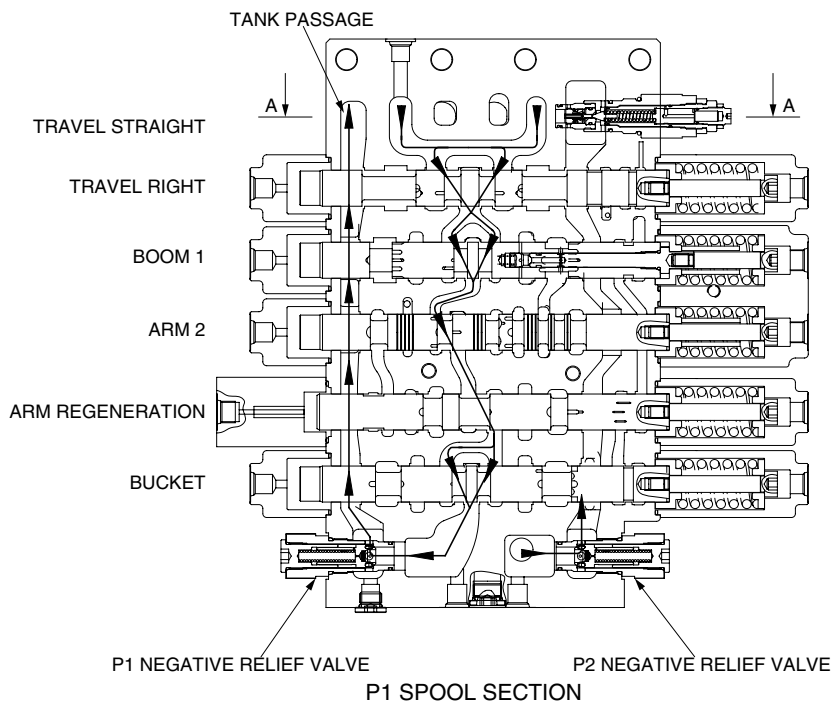
- 466 Plug
- 700 Ring
- 710 O-ring
- 725 O-ring
- 732 O-ring
- 850 Snap ring
- 887 Pin

3. FUNCTION

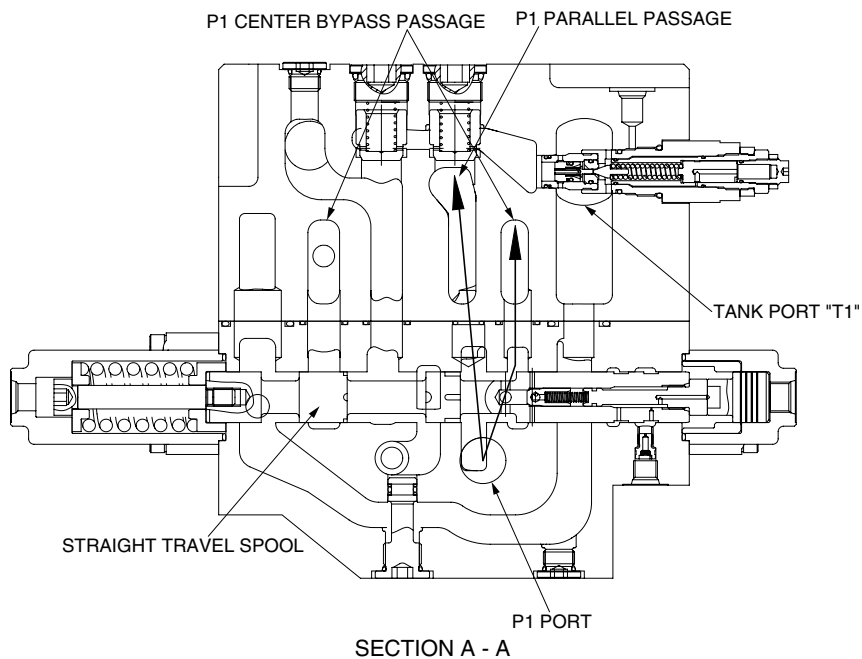
1) CONTROL IN NEUTRAL

(1) P1 SIDE

The hydraulic fluid from pump flows into the main control valve through the inlet port "P1", pass the land of the travel straight spool, into the P1 bypass passage and P1 parallel passage. When the straight travel spool is in neutral position, the bypass passage is not shut off. Then the hydraulic fluid from the pump P1 is directed to the tank through the bypass passage of spools : travel right, boom 1, arm 2, arm regeneration & option A and bucket, the negative relief valve of P1, tank passage, and the tank port "T1"



29092MC03B



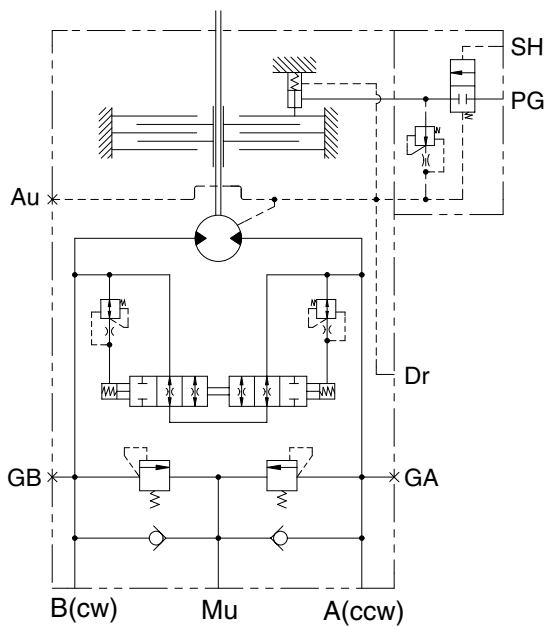
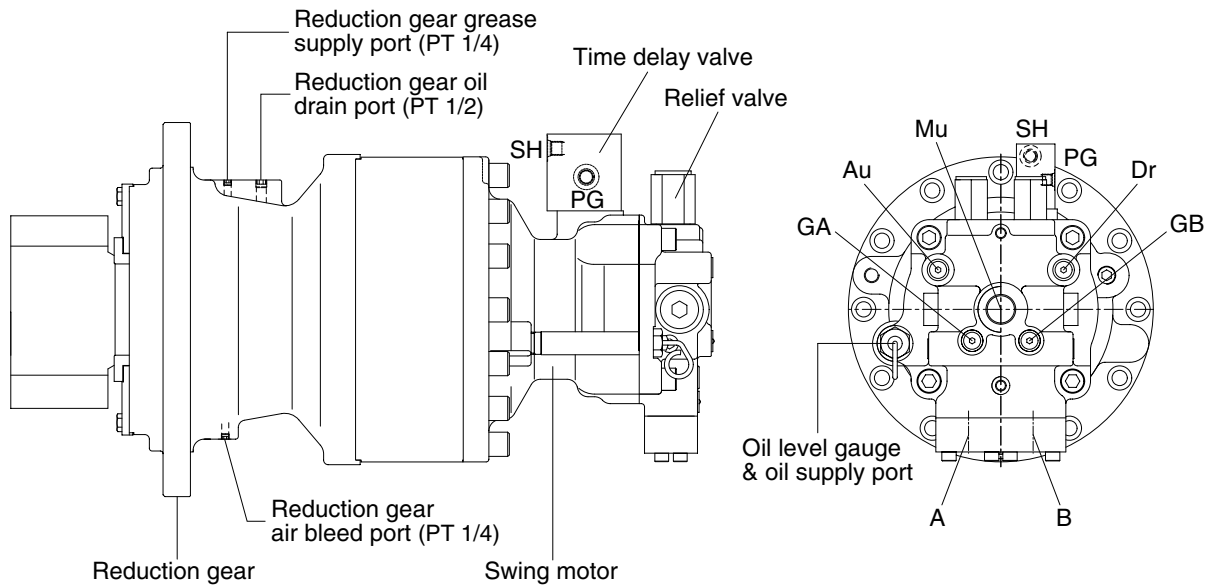
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GROUP 3 SWING DEVICE

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.

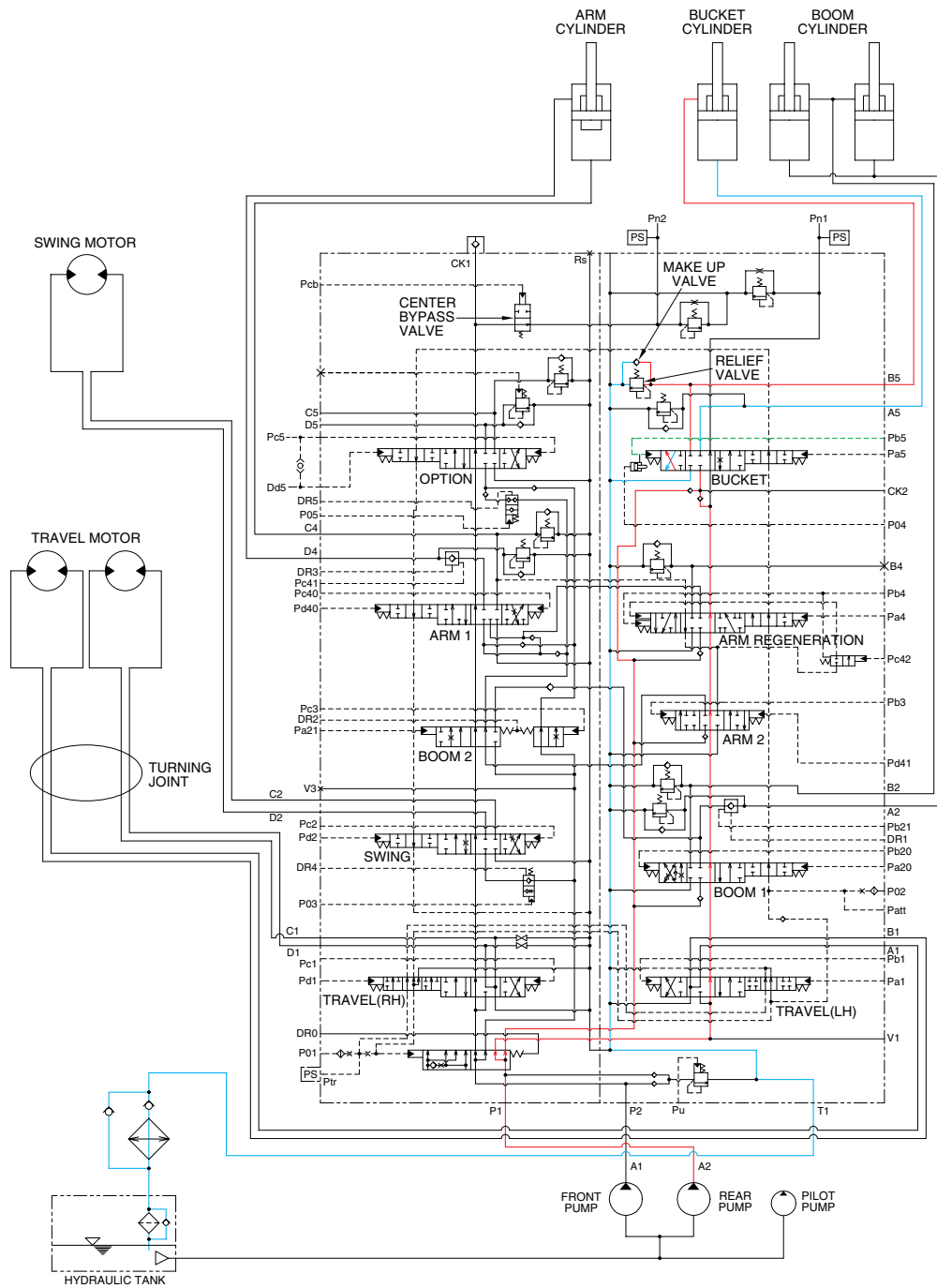


Hydraulic circuit

Port	Port name	Port size
A	Main port	∅ 20
B	Main port	∅ 20
Dr	Drain port	PF 1/2
Mu	Make up port	PF 1
PG	Brake release port	PF 1/4
SH	Stand by port	PF 1/4
GA, GB	Gauge port	PF 1/4
Au	Air vent port	PF 1/4

21092SM01

6. BUCKET OUT OPERATION



2209S3HC15

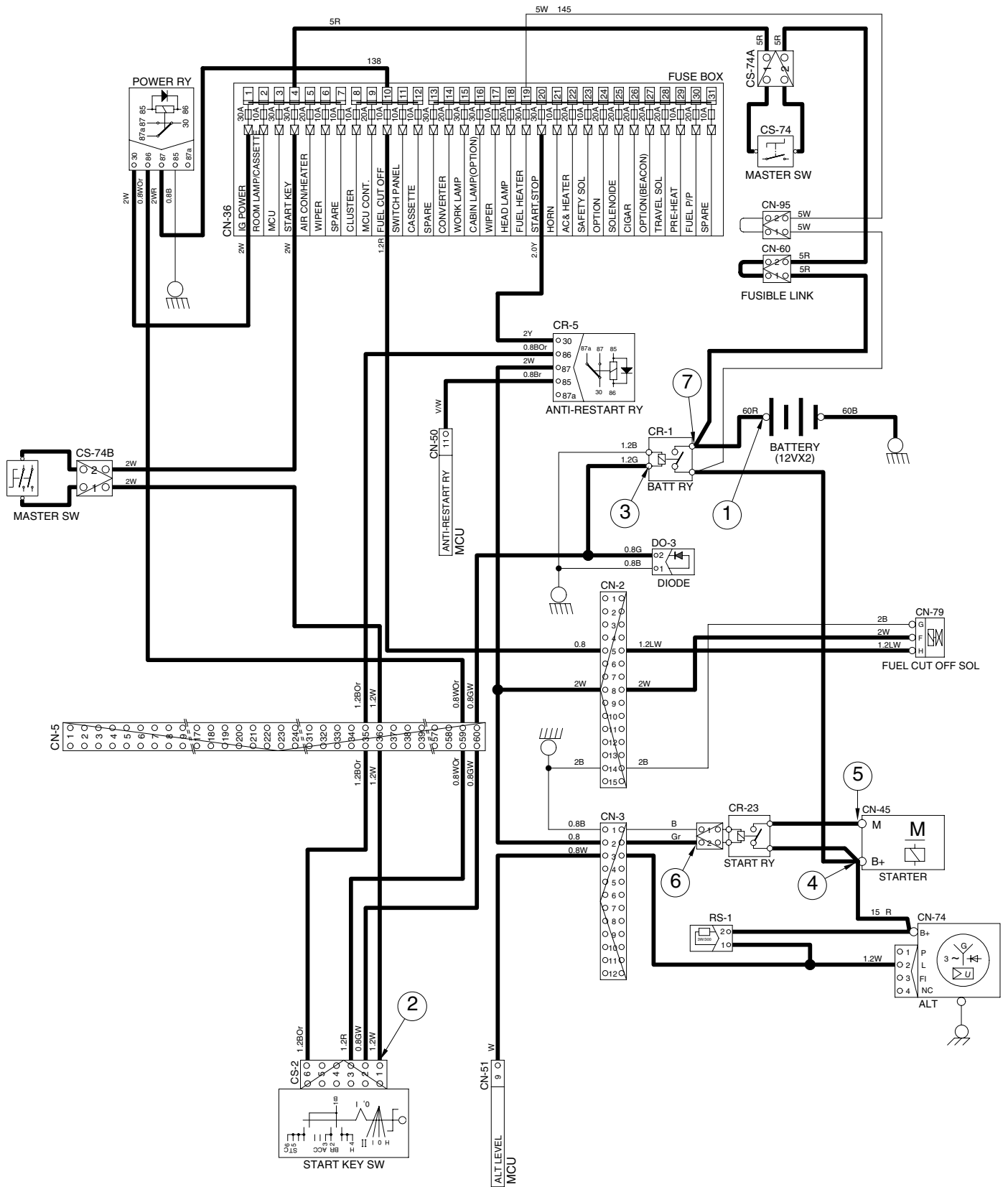
When the RH control lever is manually placed in the bucket roll out position. Then the oil flows from pilot pump through the pilot valve to bucket section of the main control valve. Here the spool position is moved to bucket roll out position.

The oil flows from A2 pump through bucket section of main control valve to the rod end of the bucket cylinder, and to roll out bucket.

The return oil flows from the bottom end of the cylinder through the bucket section returned to the hydraulic tank.

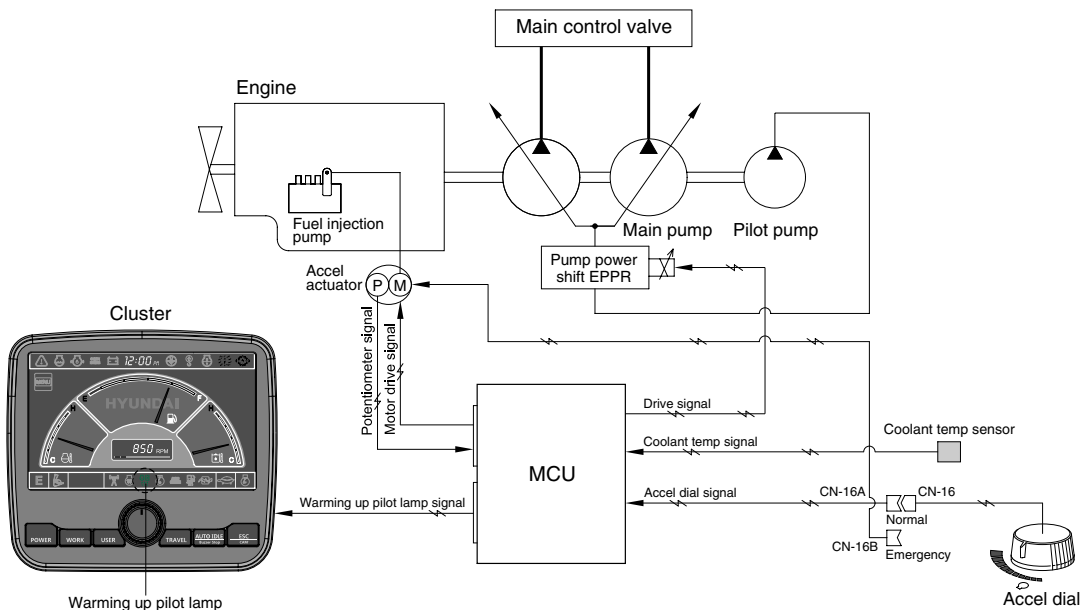
The cavitation which will happen to the rod of the bucket cylinder is prevented by a make up valve, on other hand. The excessive pressure is also prevented by an overload relief valve in the main control valve.

STARTING CIRCUIT (CLUSTER TYPE 2)



2209S4EL06-1

GROUP 6 AUTOMATIC WARMING UP SYSTEM (CLUSTER TYPE 1)



1409S5MS09

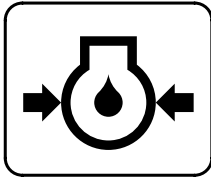
1. The MCU reads engine coolant temperature through the temperature sensor and if the coolant temperature is below 30°C, it increases the engine speed from key start rpm to 1150 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.
2. In case of the coolant temperature increases up to 30°C, the engine speed is decreased to key start speed. And if an operator changes power mode set during the warming up function, the MCU cancels the automatic warming up function.

3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : below 30°C (after engine run)	- Power mode : Default (E mode) - Warming up time : 10 minutes (max) - Warming up pilot lamp : ON
Canceled	- Coolant temperature : Above 30°C - Warming up time : Above 10 minutes - Changed power mode set by operator - RCV lever or pedal operating - Auto idle cancel ※ If any of the above conditions is applicable, the automatic warming up function is canceled	- Power mode : set mode - Warming up pilot lamp : OFF

5) WARNING AND PILOT LAMP

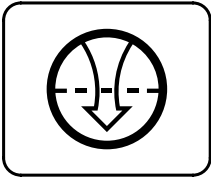
(1) Engine oil pressure warning lamp



21073CD07

- ① This lamp blinks and the buzzer sounds after starting the engine because of the low oil pressure.
- ② If the lamp blinks during engine operation, shut OFF engine immediately. Check oil level.

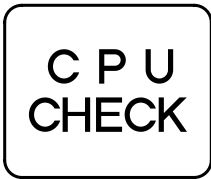
(2) Air cleaner warning lamp



21073CD08

- ① This lamp blinks and the buzzer sounds when the filter of air cleaner is clogged.
- ② Check the filter and clean or replace it.

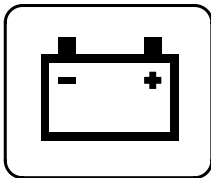
(3) MCU check warning lamp



21073CD10

- ① If any fault code is received from MCU, this lamp blinks and the buzzer sounds.
- ② Check the communication line between MCU and cluster.

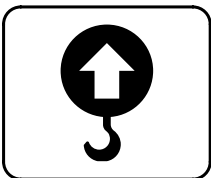
(4) Battery charging warning lamp



21073CD13

- ① This lamp blinks and the buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.
- ② Check the battery charging circuit when this lamp blinks during engine operation.

(5) Overload warning lamp

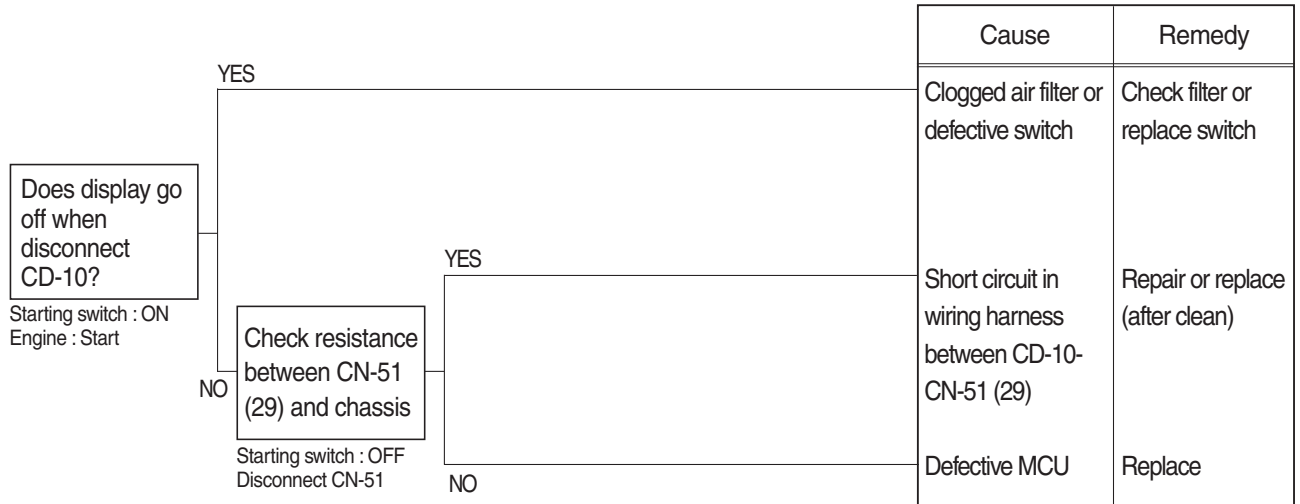


21073CD15

- ① When the machine is overload, the overload warning lamp blinks during the overload switch is ON.

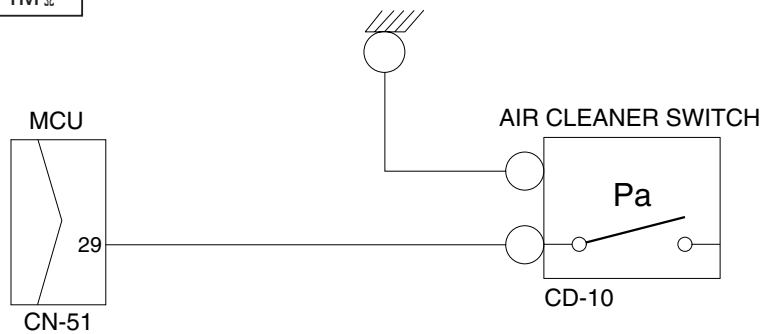
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

- 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.



Check resistance

YES	MAX 1Ω
NO	MIN 1MΩ



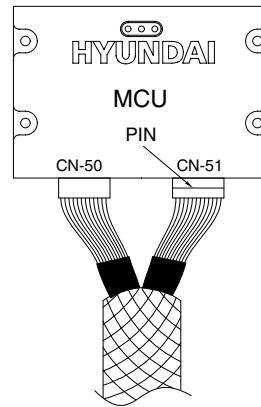
1409S6ES05

2) TEST PROCEDURE

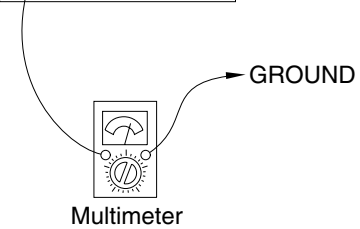
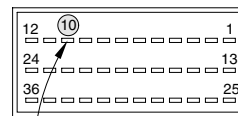
(1) **Test 9** : Check voltage at CN-51(10) and ground.

- ① Prepare 1 piece of thin sharp pin, steel or copper.
- ② Insert prepared pin to rear side of connectors : One pin to (10) of CN-51.
- ③ Starting key ON.
- ④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



CN-51 Female



1409S6MS56A

12) CONTROL LEVER STROKE

(1) Measure each lever stroke at the lever top using a ruler.

※ When the lever has play, take a half of this value and add it to the measured stroke.

(2) Preparation

Keep the hydraulic oil temperature at $50 \pm 5^\circ\text{C}$.

(3) Measurement

- ① Stop the engine.
- ② Measure each lever stroke at the lever top from neutral to the stroke end using a ruler.
- ③ Repeat step ② three times and calculate the average values.

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
R220LC-9S	Boom lever	112 ± 10	134	
	Arm lever	112 ± 10	134	
	Bucket lever	90 ± 10	112	
	Swing lever	90 ± 10	112	
	Travel lever	139 ± 10	178	

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

- (1) As hydraulic equipments, not only this valve are constructed precisely with very small clearances, disassembling and assembling must be carefully done in a clean place with preventing dusts and contaminants from entering.
- (2) Prepare the section drawing and study the structure of MCV and then start disassembly work.
- (3) When removing the control valve from the machine, install caps on every ports, and wash the outside of the assembly with confirming the existence of caps before disassembling.
Prepare a suitable table and some clean papers or rubber mat on the table for disassembling.
- (4) If the components are left disassembled, they may get rust. Make sure to measure the greasing and sealing.
- (5) For carrying the control valve, never hold with pilot cover or relief valve and overload relief valve and carefully treat the valves.
- (6) Do not tap the valve even if the spool movement is not smooth.
- (7) Several tests for such as relief characteristics, leakage, overload relief valve setting and flow resistance are required after re-assembling, and the hydraulic test equipments for those tests are needed.
Therefore, do not disassemble what cannot perform test adjustment, even if it can disassemble.

※ Be sure to observe the mark (※) description in the disassembly and assembly procedures.

2) TOOLS

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

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	27 and 32
Spanner	Each 1 piece	26 and 32 (main relief valve)