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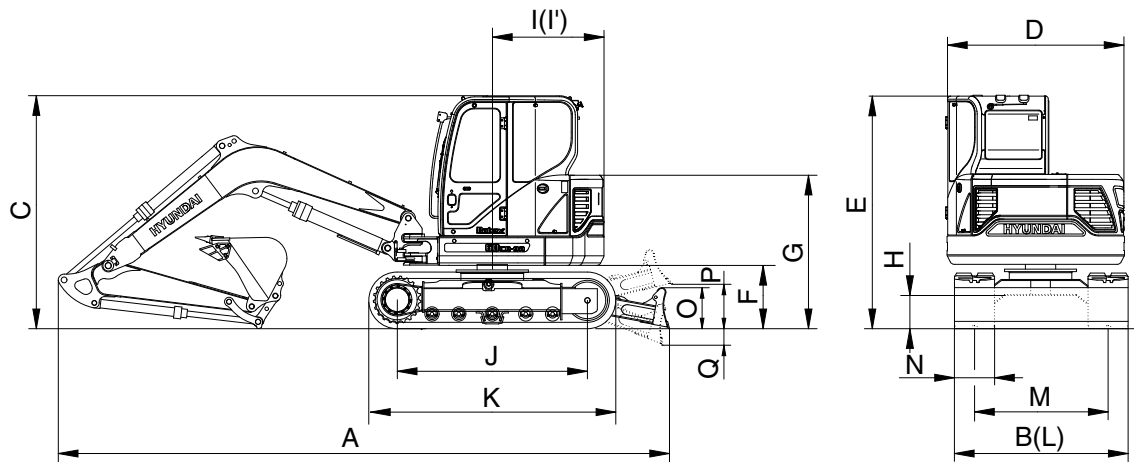
SECTION 1 GENERAL



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2. SPECIFICATIONS

1) 2.9 m (9' 6") MONO BOOM, 1.48 m (4' 10") ARM, WITH BOOM SWING SYSTEM



60CR9A2SP02

Description		Unit	Specification	
Operating weight		kg (lb)	5900 (13010)	
Bucket capacity (SAE heaped), standard		m ³ (yd ³)	0.18 (0.24)	
Overall length	A	mm (ft-in)	5600 (18' 3")	
Overall width, with 380 mm shoe	B		1980 (6' 6")	
Overall height	C		2550 (8' 4")	
Superstructure width	D		1950 (6' 5")	
Overall height of cab	E		2550 (8' 4")	
Ground clearance of counterweight	F		660 (2' 2")	
Engine cover height	G		1670 (5' 6")	
Minimum ground clearance	H		380 (1' 3")	
Rear-end distance	I		1080 (3' 7")	
Rear-end swing radius	I'		1080 (3' 7")	
Distance between tumblers	J		1990 (6' 6")	
Undercarriage length	K		2530 (8' 4")	
Undercarriage width	L		1980 (6' 6")	
Track gauge	M		1600 (5' 3")	
Track shoe width, standard	N		380 (15")	
Height of blade	O		350 (1' 2")	
Ground clearance of blade up	P		200 (8")	
Depth of blade down	Q		700 (2' 4")	
Travel speed (low/high)			km/hr (mph)	2.2/4.0 (1.4/2.5)
Swing speed			rpm	8.8
Gradeability		Degree (%)	35 (70)	
Ground pressure (380 mm shoe)		kgf/cm ² (psi)	0.36 (5.12)	
Max traction force		kg (lb)	5300 (11680)	

3) GEAR PUMP (P3, P4)

Item	Specification
Type	Fixed displacement gear pump double stage
Capacity	18.3/4.5 cc/rev
Maximum pressure	220/30 kgf/cm ² (3130/430 psi)
Rated oil flow	36.6/9 ℓ /min (9.7/2.4 U.S. gpm / 8.1/2.0 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	Sectional, 10 spools+1 option
Operating method	Hydraulic pilot system+Mechanical control system
Main relief valve pressure	220 kgf/cm ² (3130 psi)
Overload relief valve pressure	240 kgf/cm ² (3410 psi)

5) SWING MOTOR

Item	Specification	
	Type 1	Type 2
Type	Fixed displacement axial piston motor	
Capacity	28 cc/rev	31.5 cc/rev
Gear ratio	23.2	19.46
Relief pressure	220 kgf/cm ² (3130 psi)	220 kgf/cm ² (3130 psi)
Braking torque	11.8 kgf · m (85 lbf · ft)	14.5 kgf · m (105 lbf · ft)
Brake release pressure	30~50 kgf/cm ² (427~711 psi)	12~20 kgf/cm ² (171~284 psi)
Reduction gear type	2 - stage planetary	2 - stage planetary
Braking system	Automatic, spring applied hydraulic released	

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	220 kgf/cm ² (3130 psi)
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	9 kgf/cm ² (128 psi)
Braking torque	8.4 kgf · m (61 lbf · ft)
Capacity (1 st speed / 2 nd speed)	43.7 / 22.7 cc/rev
Gear ratio	53.706

- (14) When the motor has reached the operation speed, check the operation while applying the load to the actuator.
- (15) Check the monitoring or measuring instrument if installed.
- (16) Check the noise level.
- (17) Check the oil level in the tank. Supply the oil. If required.
- (18) Check the setting of the pressure control valve while applying the load to the actuator.
- (19) Check the parts for any leakage.
- (20) Stop the motor.
- (21) Retighten all the bolts and plugs even when they have proved to be free from Leakage.
(Be sure to remove the pressure from the circuit before retightening.)
- (22) Check the oil level in the tank.
- (23) Check if the pump and actuator function correctly.
- (24) Irregular operation of the actuator indicates that an air is left still in the circuit. When the air is bled completely from the circuit, all the parts operate smoothly without any irregular movement and there is no bubble in the oil of the tank.
- (25) Check the oil temperature.
- (26) Stop the motor.
- (27) Check the filter if the element is fouled.
- (28) If the element is heavily fouled, carry out flashing in the circuit.

※ To prevent damage to the pump, be sure to observe the following cautions during the operation which may allow entry of the actuator, hydraulic oil change, etc :

- (1) After oil supply, fill the pump housing with the hydraulic oil.
- (2) Start the pump with the speed of 1000 rpm or less and take care not to allow the oil level to lower below the specified level of the oil level gauge.
- (3) When bleeding an air from the hydraulic circuit, keep the motor speed at 1000 rpm or less. Operate each actuator for three or more cycles and carry out idling for 5 minutes or more.

8. MAINTENANCE

The maintenance of this hydraulic pump is limited mainly to the tank, in particular, the hydraulic oil change.

Since the maintenance interval varies depending on respective operation and use conditions, the cautions described below for the users should be for reference only.

(1) Checking the filter

- ① Every day for the initial period after start up.
- ② Once a week when the operation becomes stable.
- ③ Once a month when the operation hours exceed about 100 hours.

※ When any part of the hydraulic system is changed (e.g., assembling of an additional part, change and repair of the piping), check the filter newly as in the case of startup.

(2) Changing the filter

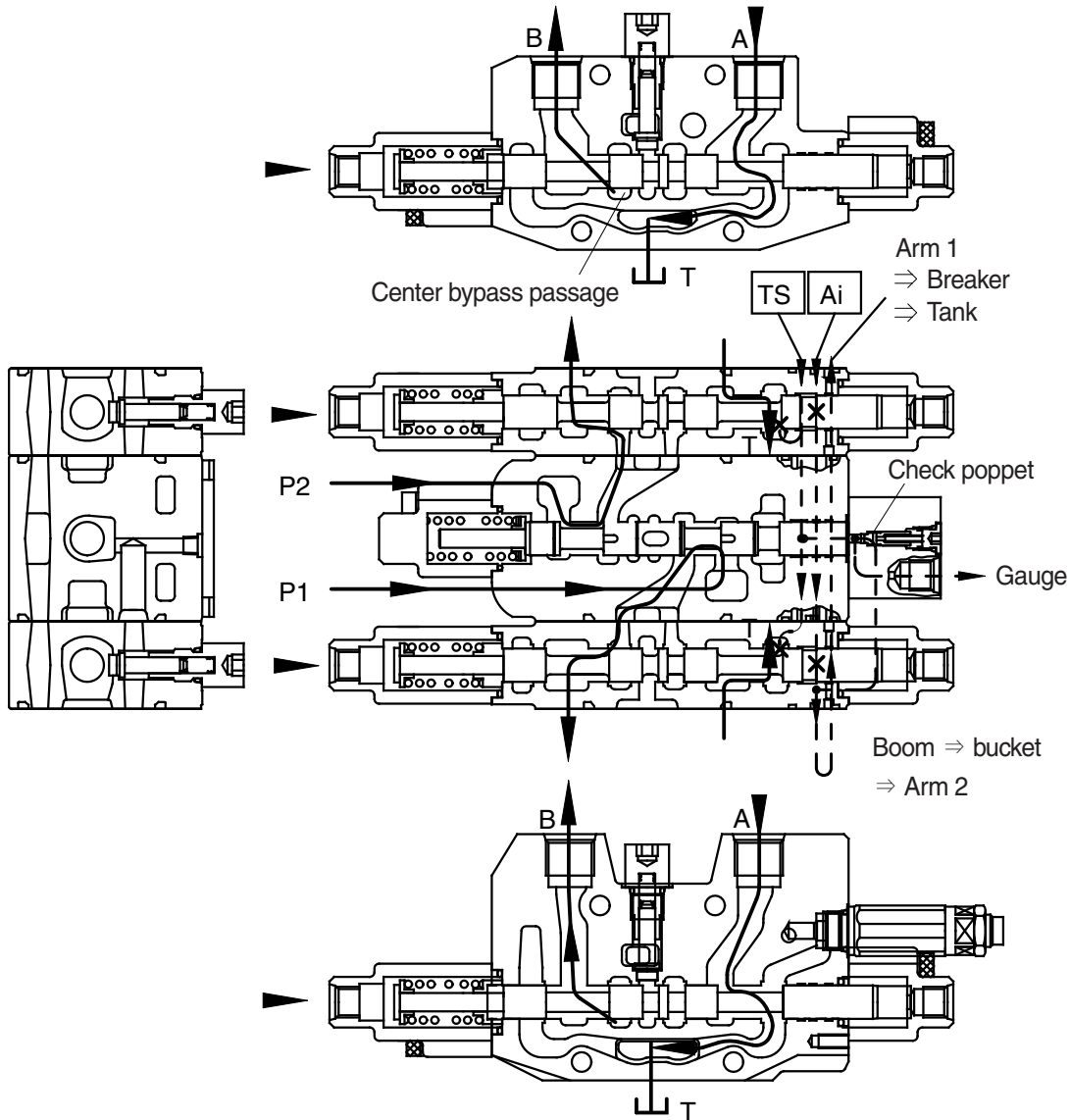
- ① After startup
- ② After 500 hours of operation
- ③ Every 500 hours of operation after that, and each time the hydraulic oil is changed or the failure occurs. If any abnormal fouling of the filter is observed during daily check up to the first filter change after startup, find out the cause.

In this case, do not extend the check and filter change intervals to 500 hours.

※ The paper filter can not be cleaned. Change the filter as a whole.

2) EACH SPOOL OPERATION

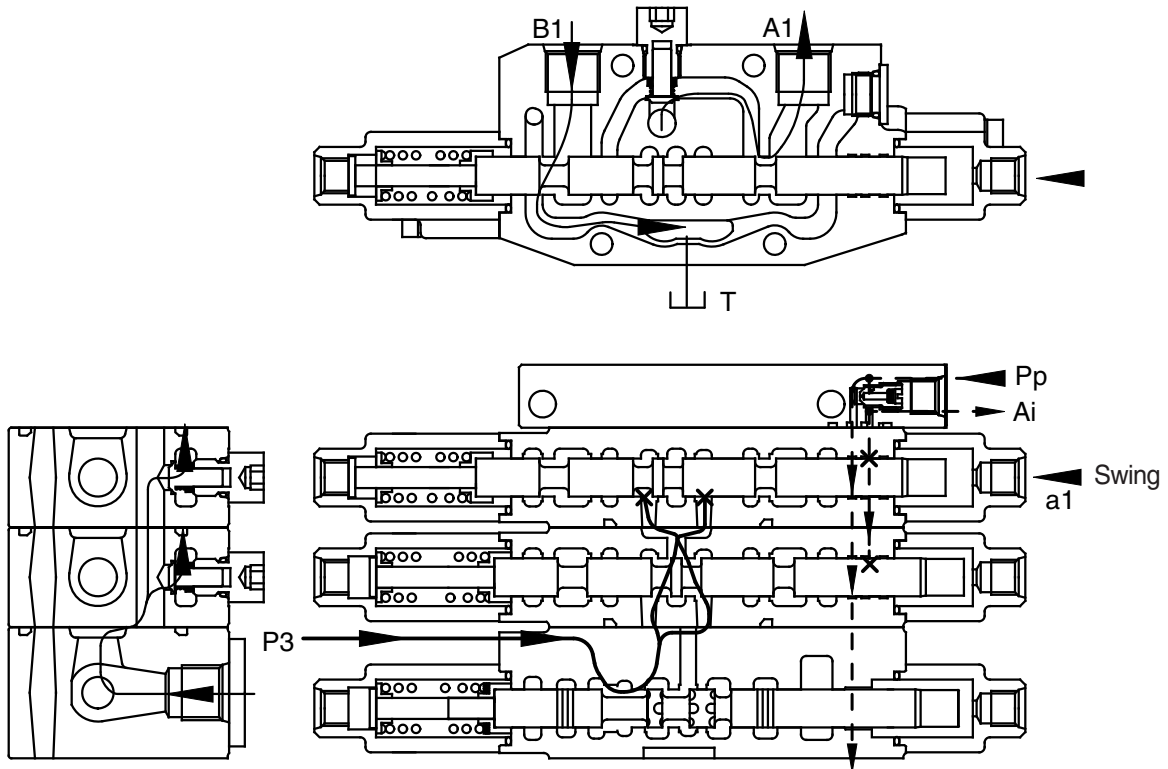
(1) Travel operation (forward / backward)



555C92MC08

- During travel (forward/backward) operation, the pilot pressure from RCV is supplied into the travel pilot port and shift the travel spool in the right direction.
- The hydraulic oil fluid from pump is entered center bypass passage of inlet block (P1, P2) and then flows into the port of travel motor.
- The oil from the port A of travel motor flows into the main control valve and return to the hydraulic oil tank through the tank passage.
- The TS signal passage is shut off by shifting of the travel spool, but it is connected with Ai signal passage and drain to the hydraulic oil tank. As a result, the travel straight spool is not shifted.
- The Ai signal passage is connected with travel block through swing and dozer block and it is shut off by shifting of the travel spool and then signal pressure of auto idle is raised.

(5) Swing operation



555C92MC16

- The pilot pressure from the RCV is supplied to the a1 and shift the swing spool in left direction. The hydraulic fluid from pump P3 flows into swing spool through the parallel passage. Then it is directed to swing motor through the port A1. As a result, swing motor turns and flow from the swing motor returns to the hydraulic oil tank through the port B1, swing spool and the tank passage.

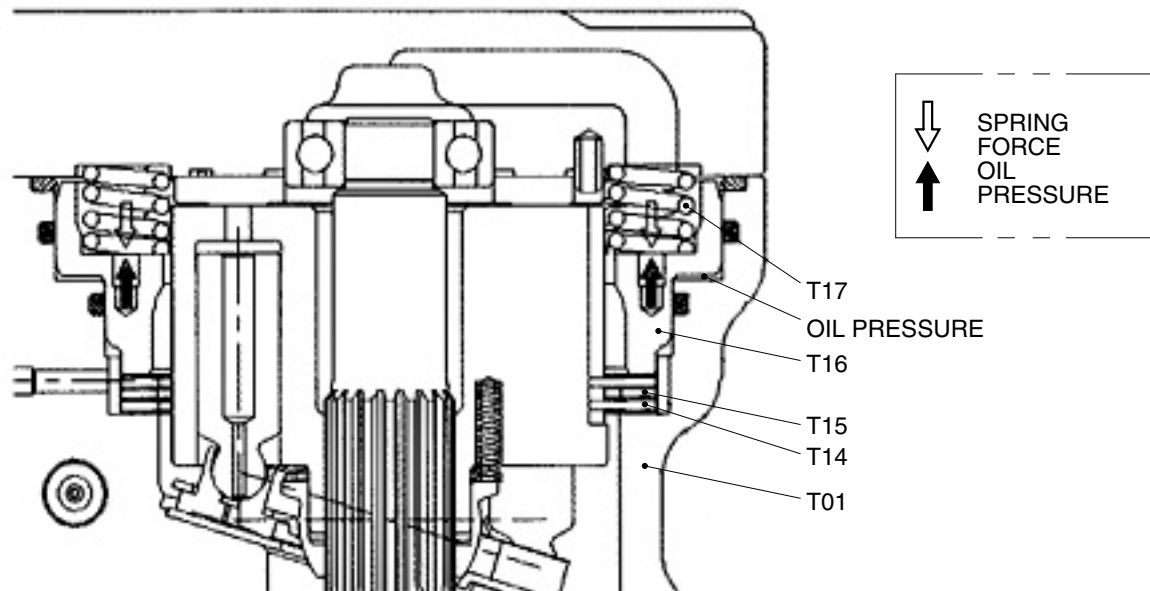
In case of swing left operation, the operation is similar.

- The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
- The Ai signal passage oil from the Pp port is shut off by shifting of the swing spool and then signal pressure of auto idle is raised.

3) BRAKE PART

The swing brake is spring applied and hydraulically released. Friction plate (T14) are splined to and rotate with cylinder block. Separation plates (T15) are splined to the motor casing (T01).

When the swing controller blocks pilot pressure at port (SH), the brake springs (T17) force on brake piston (T16) squeeze the separation and friction plates together to prevent the upper structure from swinging.



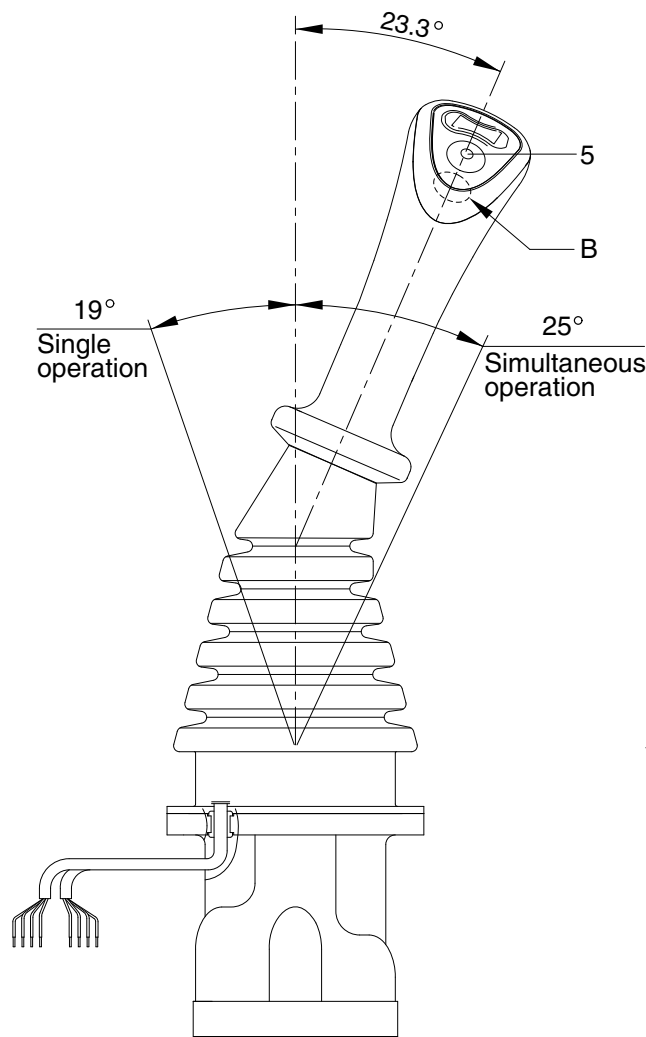
Brake working description

55Z9SM005

GROUP 5 RCV LEVER

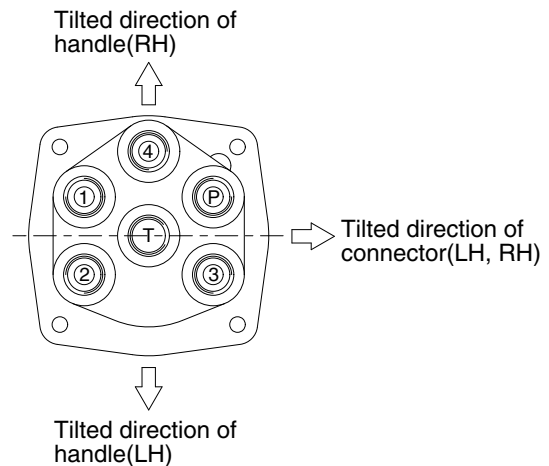
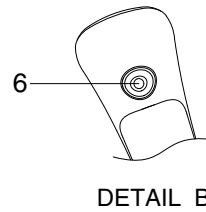
1. STRUCTURE

The casing has the oil inlet port P (primary pressure) and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.



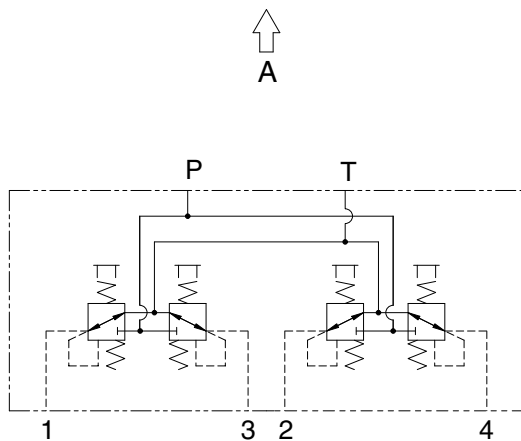
Switches

No.	LH	RH
5	One touch decel	Horn
6	-	Breaker



VIEW A

21092RL01



Hydraulic circuit

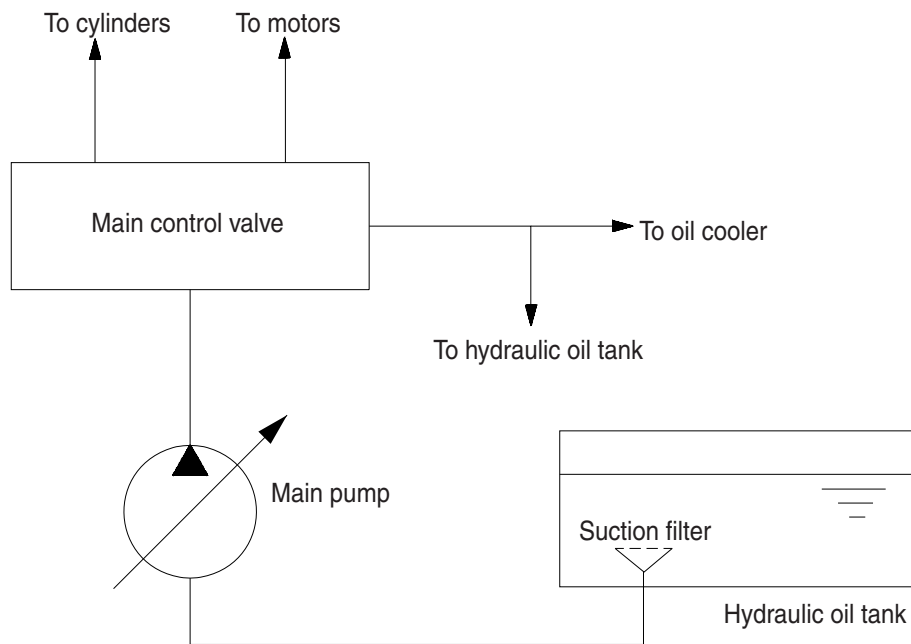
Port	LH	RH	Port size
P	Pilot oil inlet port	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	Pilot oil return port	
1	Left swing port	Bucket out port	
2	Arm in port	Boom down port	
3	Right swing port	Bucket in port	
4	Arm out port	Boom up port	

GROUP 2 MAIN CIRCUIT

The main hydraulic circuit consists of suction circuit, delivery circuit, return circuit and drain circuit. The hydraulic system consists of one main pump, one control valve, one swing motor, four cylinders and two travel motors.

The swash plate type variable displacement axial piston pump is used as the main pump and is driven by the engine at ratio 1.0 of engine speed.

1. SUCTION AND DELIVERY CIRCUIT



3-02 (140-7 TIER)

The pumps receive oil from the hydraulic tank through a suction filter. The discharged oil from the pump flows into the control valve and goes out the tank ports.

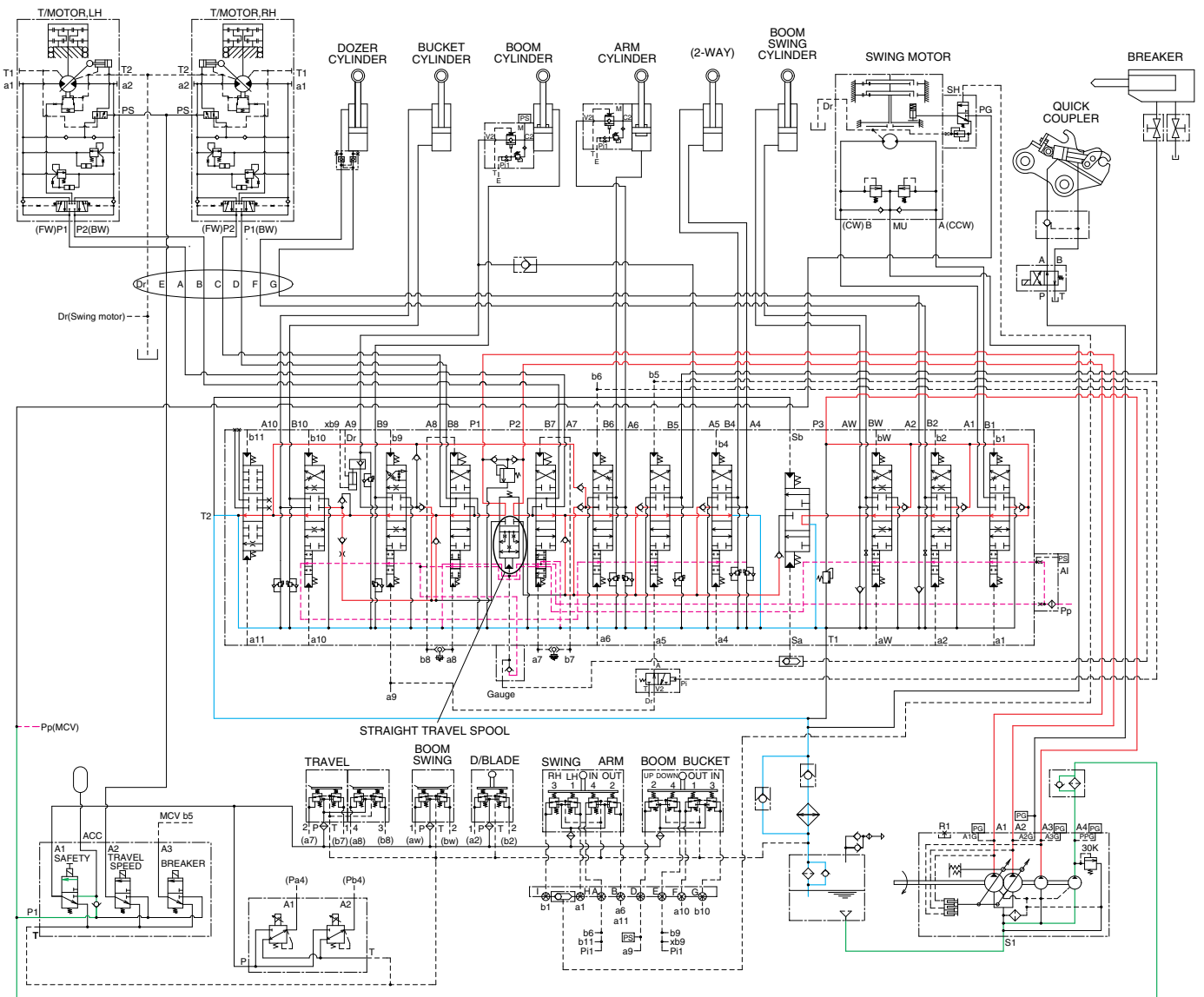
The oil discharged from the main pump flows to the actuators through the control valve.

The control valve controls the hydraulic functions.

The return oil from the actuators flows to the hydraulic tank through the control valve and the oil cooler.

GROUP 5 COMBINED OPERATION

1. OUTLINE



60CR9A3HC21

The oil from the A1, A2, A3 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.

STRAIGHT TRAVEL SPOOL

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

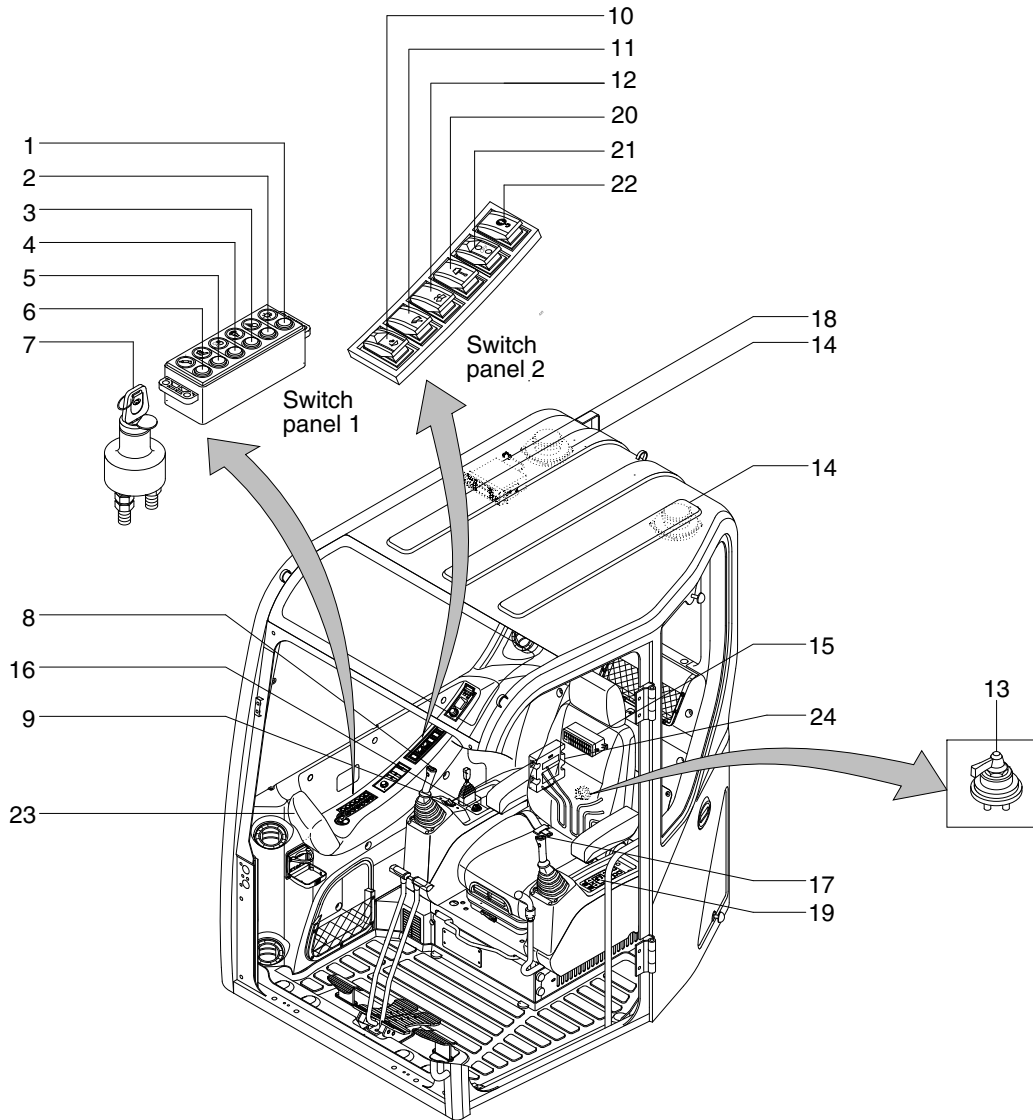
If any actuator is operated when traveling, the straight travel spool is pushed to the up by the pilot oil pressure.

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.

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

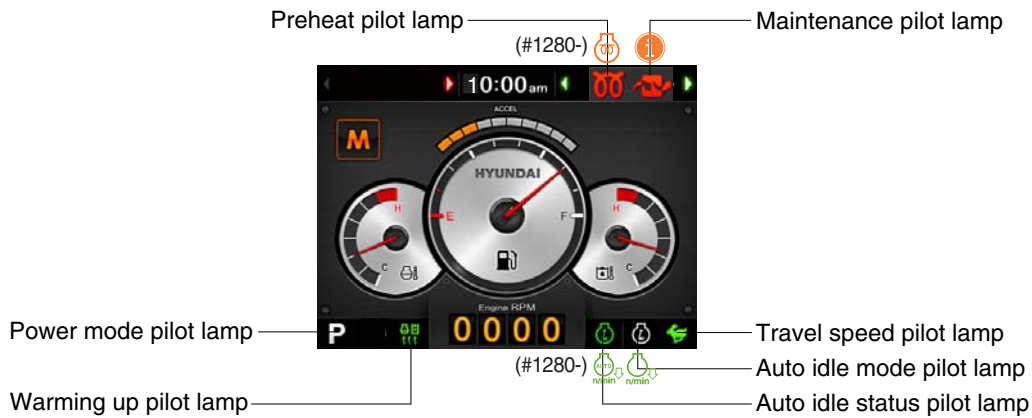
1. LOCATION 1



60CR9A4EL03

- | | | | | | |
|---|--------------------------|----|--------------------|----|----------------------------|
| 1 | Illumination switch | 9 | Accel dial switch | 17 | Horn switch |
| 2 | Work light switch | 10 | Quick clamp switch | 18 | Radio & USB player |
| 3 | Travel alarm switch | 11 | Wiper switch | 19 | Aircon & heater controller |
| 4 | Cab light switch | 12 | Washer switch | 20 | Boom offset switch(-#0014) |
| 5 | Beacon lamp switch | 13 | Master switch | 21 | DPF switch |
| 6 | Breaker selection switch | 14 | Speaker | 22 | Overload switch |
| 7 | Start switch | 15 | Fuse box | 23 | Cluster |
| 8 | Breaker operation switch | 16 | Cigar lighter | 24 | Machine control unit |

5) PILOT LAMPS



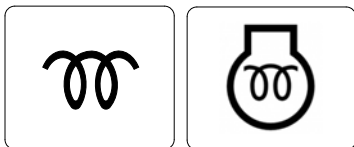
559A3CD02E

※ When the pilot lamps light ON more than 3, you can check all lamps with next page button (◀, ▶).

(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode		Heavy duty power work mode
			Standard power mode
2	Travel mode		Low speed traveling
			High speed traveling
3	Auto idle mode		Auto idle status
			Auto idle mode

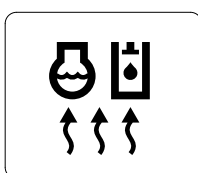
(2) Preheat pilot lamp



55I3CD39

- ① Turning the start key switch ON position starts preheating in cold weather.
- ② Start the engine after this lamp is OFF.

(3) Warming up pilot lamp



21093CD40

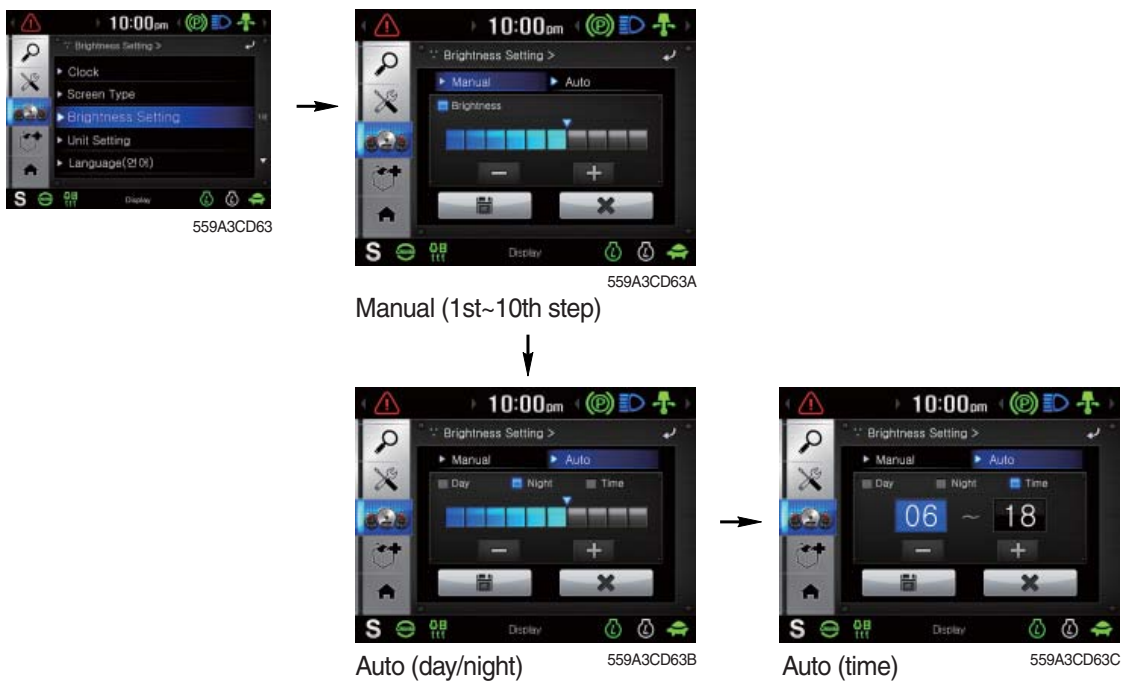
- ① This lamp is turned ON when the coolant temperature is below 30°C (86°F).
- ② The automatic warming up is cancelled when the engine coolant temperature is above 30°C, or when 10 minutes have passed since starting the engine.

② Screen type



- The screen type (A,B,C) of the LCD can be selected by this menu.

③ Brightness setting calibration



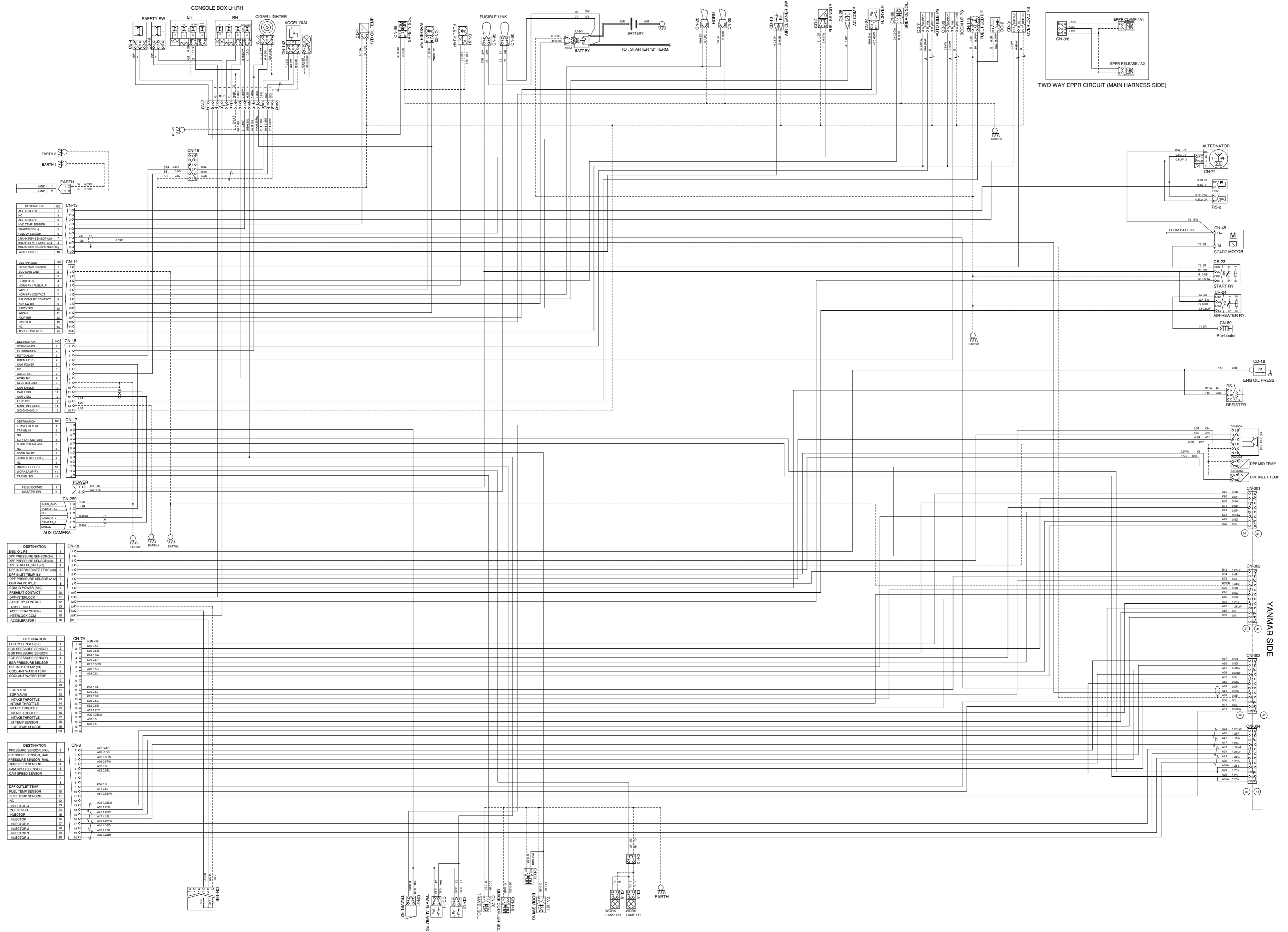
- If "Auto" is chosen, brightness for day and night can be differently set up. Also, users can define which day time interval. (Set day starting time and ending time)

④ Unit setting



- Temperature : °C ↔ °F
- Pressure : bar ↔ MPa ↔ kgf/cm² ↔ psi

ELECTRICAL CIRCUIT (2/2)



DESTINATION	NO.	UNIT	TYPE
ALT. LEVEL 'R'	1	TC	
ALT. LEVEL 'L'	2	TC	
HYD TEMP SENSOR	4	TC	
SPRAYING SOL	5	TC	
FUEL U. SENSOR	6	TC	
CRANK REV SENSOR (A)	7	TC	
CRANK REV SENSOR (B)	8	TC	
AIR CLEANER	10	TC	

DESTINATION	NO.	UNIT	TYPE
OVERLOAD SENSOR	1	TC	
SOLENOID	2	TC	
IGNITION SW	3	TC	
IGNITION SW	4	TC	
HORN RY (JUEL P.)	5	TC	
WATER	6	TC	
HORN RY CONTACT	7	TC	
AIR COMP RY CONTACT	8	TC	
BATTY SOL	9	TC	
WATER	10	TC	
WATER	11	TC	
WATER	12	TC	
WATER	13	TC	
WATER	14	TC	
12V OUTPUT (M)	15	TC	

DESTINATION	NO.	UNIT	TYPE
BOOKING PS	1	TC	
ILLUMINATION	2	TC	
BOOKING PS	3	TC	
BOOK UP PS	4	TC	
COMP POWER	5	TC	
AC	6	TC	
ACCEL RY	7	TC	
WATER	8	TC	
CLUSTER (GND)	9	TC	
CAM SHAFT	10	TC	
CAM SHAFT	11	TC	
CAM SHAFT	12	TC	
FEED AIR	13	TC	
FEED AIR	14	TC	
TRAVEL SW	15	TC	

DESTINATION	NO.	UNIT	TYPE
TRAVEL ALARM	1	TC	
TRAVEL SW	2	TC	
AC	3	TC	
SUPPLY PUMP (A)	4	TC	
SUPPLY PUMP (B)	5	TC	
AC	6	TC	
BOOK SW RY	7	TC	
SPRAYER RY CONTACT	8	TC	
AC	9	TC	
SHOCK COUPLER	10	TC	
TRAVEL SW	11	TC	
TRAVEL SW	12	TC	

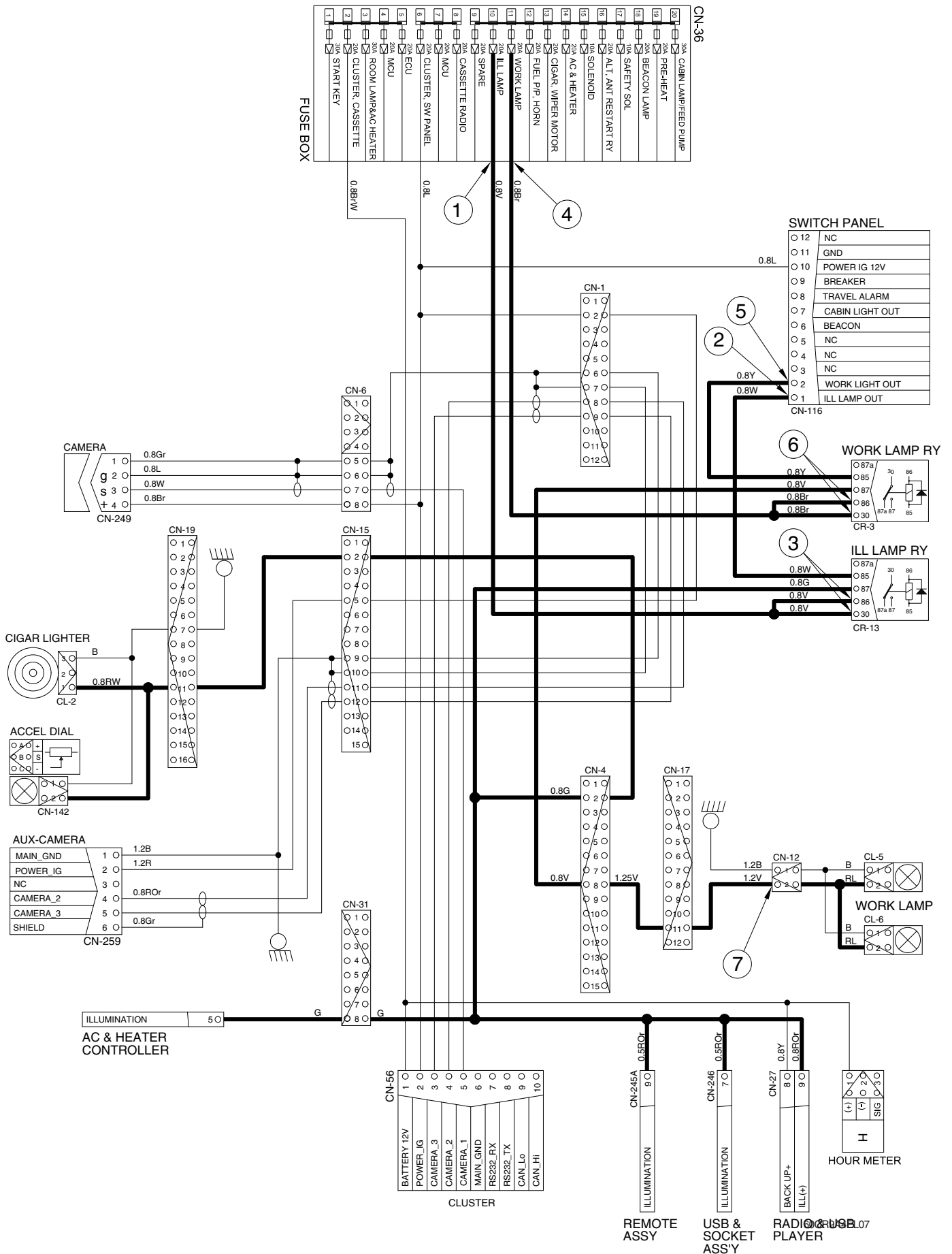
DESTINATION	NO.	UNIT	TYPE
MAIN GND	1	TC	
POWER GND	2	TC	
CAMERA P	3	TC	
CAMERA S	4	TC	
SHIELD	5	TC	

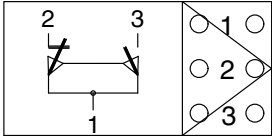
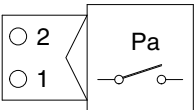
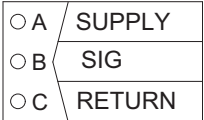
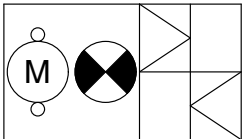
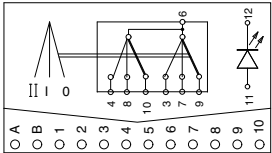
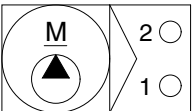
DESTINATION	NO.	UNIT	TYPE
ENG OIL PS	1	TC	
DIFF PRESSURE SENSOR (A)	2	TC	
DIFF PRESSURE SENSOR (B)	3	TC	
DIFF INTERMEDIATE TEMP (A)	4	TC	
DIFF INLET TEMP (A)	5	TC	
DIFF INLET TEMP (B)	6	TC	
DIFF PRESSURE SENSOR (A)	7	TC	
DIFF PRESSURE SENSOR (B)	8	TC	
DIFF PRESSURE SENSOR (C)	9	TC	
DIFF PRESSURE SENSOR (D)	10	TC	
DIFF PRESSURE SENSOR (E)	11	TC	
DIFF PRESSURE SENSOR (F)	12	TC	
DIFF PRESSURE SENSOR (G)	13	TC	
DIFF PRESSURE SENSOR (H)	14	TC	
DIFF PRESSURE SENSOR (I)	15	TC	
DIFF PRESSURE SENSOR (J)	16	TC	

DESTINATION	NO.	UNIT	TYPE
EGR PRESSURE SENSOR	1	TC	
EGR PRESSURE SENSOR	2	TC	
EGR PRESSURE SENSOR	3	TC	
EGR PRESSURE SENSOR	4	TC	
EGR PRESSURE SENSOR	5	TC	
EGR PRESSURE SENSOR	6	TC	
EGR PRESSURE SENSOR	7	TC	
EGR PRESSURE SENSOR	8	TC	
EGR PRESSURE SENSOR	9	TC	
EGR PRESSURE SENSOR	10	TC	
EGR PRESSURE SENSOR	11	TC	
EGR PRESSURE SENSOR	12	TC	
EGR PRESSURE SENSOR	13	TC	
EGR PRESSURE SENSOR	14	TC	
EGR PRESSURE SENSOR	15	TC	
EGR PRESSURE SENSOR	16	TC	
EGR PRESSURE SENSOR	17	TC	
EGR PRESSURE SENSOR	18	TC	
EGR PRESSURE SENSOR	19	TC	
EGR PRESSURE SENSOR	20	TC	

DESTINATION	NO.	UNIT	TYPE
PRESSURE SENSOR (A)	1	TC	
PRESSURE SENSOR (B)	2	TC	
PRESSURE SENSOR (C)	3	TC	
PRESSURE SENSOR (D)	4	TC	
PRESSURE SENSOR (E)	5	TC	
PRESSURE SENSOR (F)	6	TC	
PRESSURE SENSOR (G)	7	TC	
PRESSURE SENSOR (H)	8	TC	
PRESSURE SENSOR (I)	9	TC	
PRESSURE SENSOR (J)	10	TC	
PRESSURE SENSOR (K)	11	TC	
PRESSURE SENSOR (L)	12	TC	
PRESSURE SENSOR (M)	13	TC	
PRESSURE SENSOR (N)	14	TC	
PRESSURE SENSOR (O)	15	TC	
PRESSURE SENSOR (P)	16	TC	
PRESSURE SENSOR (Q)	17	TC	
PRESSURE SENSOR (R)	18	TC	
PRESSURE SENSOR (S)	19	TC	
PRESSURE SENSOR (T)	20	TC	

ILLUMINATION AND WORK LAMP CIRCUIT



Part name	Symbol	Specification	Check
Safety switch	 <p>CS-4</p>	Micro	※ Check contact Normal : 0Ω (for terminal A-B) : ∞Ω (for terminal A-C) Operating : ∞Ω (for terminal A-B) : 0Ω (for terminal A-C)
Pressure switch	 <p>CD-11 CD-12</p>	DC12V 2A 10bar (N.O type)	※ Check contact Normal : 0.1Ω
Pressure sensor	 <p>CD-7 CD-31 CD-32</p>	8~30V	※ Check contact Normal : 0.1Ω
Beacon lamp	 <p>CL-7</p>	12V (Strobe type)	※ Check disconnection Normal : a fewΩ
Wiper switch	 <p>CS-3</p>	12V 16A	※ Check contact Normal : ∞Ω
Washer pump	 <p>CN-22</p>	12V 3.8A	※ Check contact Normal : 3Ω (for terminal 1-2)

2. ENGINE FAULT CODE

Fault code		Description	
YANMAR SPN	FMI	Area	Status
522400	2	Crankshaft speed sensor	Crankshaft signal error
	5		No signal from crankshaft
522401	2	Camshaft speed sensor	Camshaft signal error
	5		No signal from camshaft
	7		Angle offset error
523249	5	Crankshaft speed sensor, Camshaft speed sensor	Crankshaft/camshaft, speed sensor non-input (simultaneous)
91	3	Accelerator sensor 1	Accelerator sensor 1 error (voltage high)
	4		Accelerator sensor 1 error (voltage low)
28	3	Accelerator sensor 2	Accelerator sensor 2 error (voltage high)
	4		Accelerator sensor 2 error (voltage low)
522624	7	Accelerator sensor 1 + 2	Dual accelerator sensor error (closed position)
522623	7		Dual accelerator sensor error (open position)
29	3	Accelerator sensor 3	Accelerator sensor 3 error (voltage high)
	4		Accelerator sensor 3 error (voltage low)
	8	Pulse sensor	Pulse accelerator sensor error (pulse communication)
28	0	Accelerator sensor 3	Accelerator sensor 3 error (foot pedal in open position)
	1		Accelerator sensor 3 error (foot pedal in closed position)
51	3	Intake throttle position sensor	Intake throttle position sensor error (voltage high)
	4		Intake throttle position sensor error (voltage low)
102	3	EGR low pressure side pressure sensor	ERG low pressure side pressure sensor error (excessive sensor output)
	4		ERG low pressure side pressure sensor error (insufficient sensor output)
	13		ERG low pressure side pressure sensor error (abnormal learning value)
	10		ERG low pressure side pressure sensor error (detected value error)
1209	3	EGR pressure sensor (high-pressure side)	ERG high pressure side pressure sensor error (excessive sensor output)
	4		ERG high pressure side pressure sensor error (insufficient sensor output)
	13		ERG high pressure side pressure sensor error (abnormal learning value)
	10		ERG high pressure side pressure sensor error (detected value error)
110	3	Engine coolant temperature sensor	Engine coolant temperature sensor error (excessive sensor output)
	4		Engine coolant temperature sensor error (insufficient sensor output)
	10		Engine coolant temperature sensor error (detected value error)
	0		Engine coolant temperature high (overheat)
172	3	Ambient air temperature sensor	Ambient air temperature sensor error (voltage high)
	4		Ambient air temperature sensor error (voltage low)

GROUP 2 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.

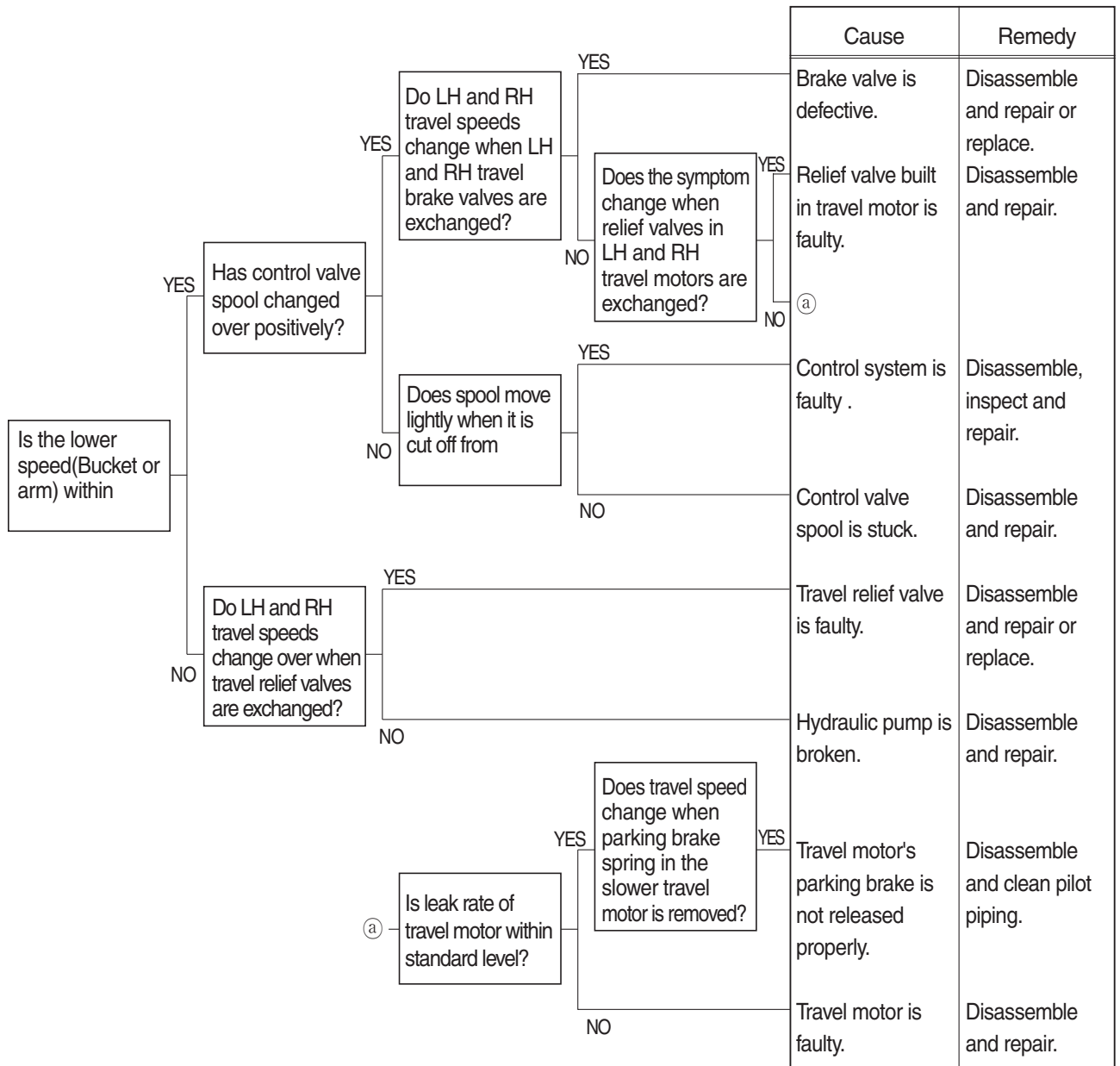
(4) Ask user or operator the following.

- 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



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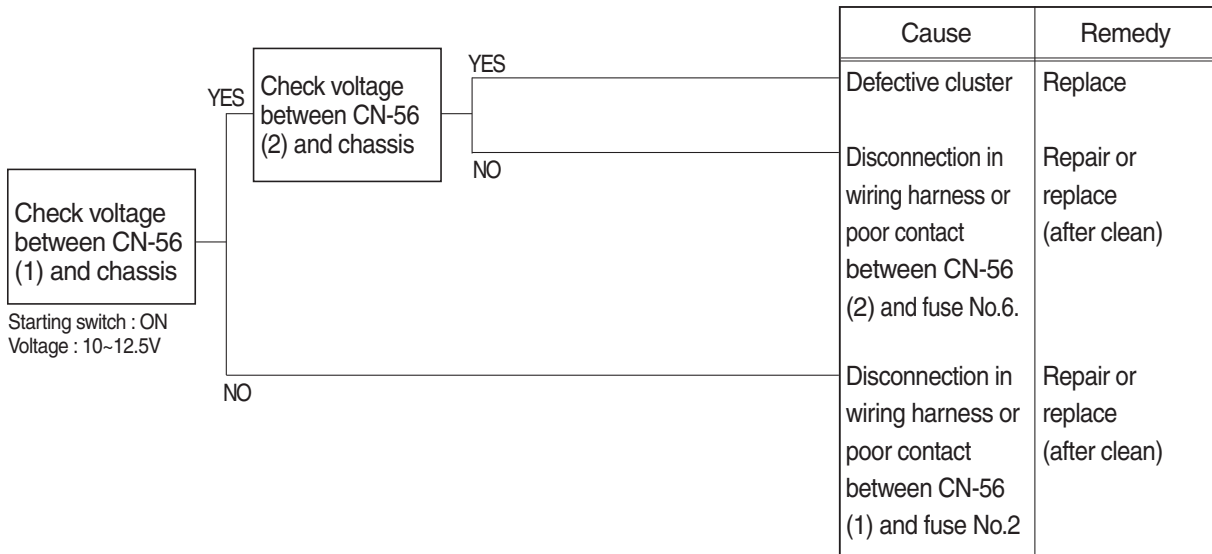
- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

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GROUP 3 ELECTRICAL SYSTEM

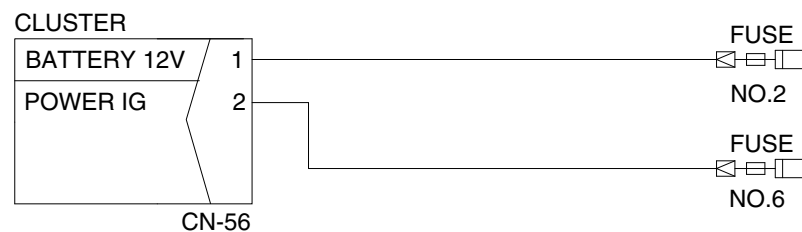
1. WHEN STARTING SWITCH IS TURNED ON, MONITOR PANEL DISPLAY DOES NOT APPEAR

- 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.2 and No.6.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check voltage

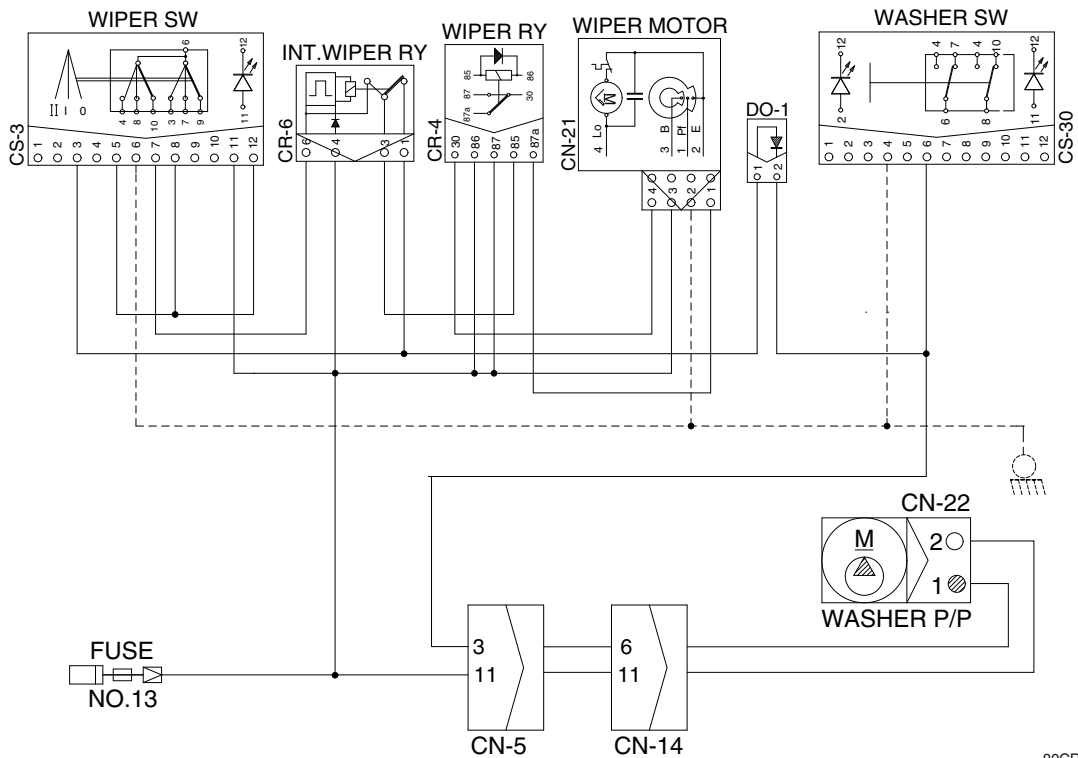
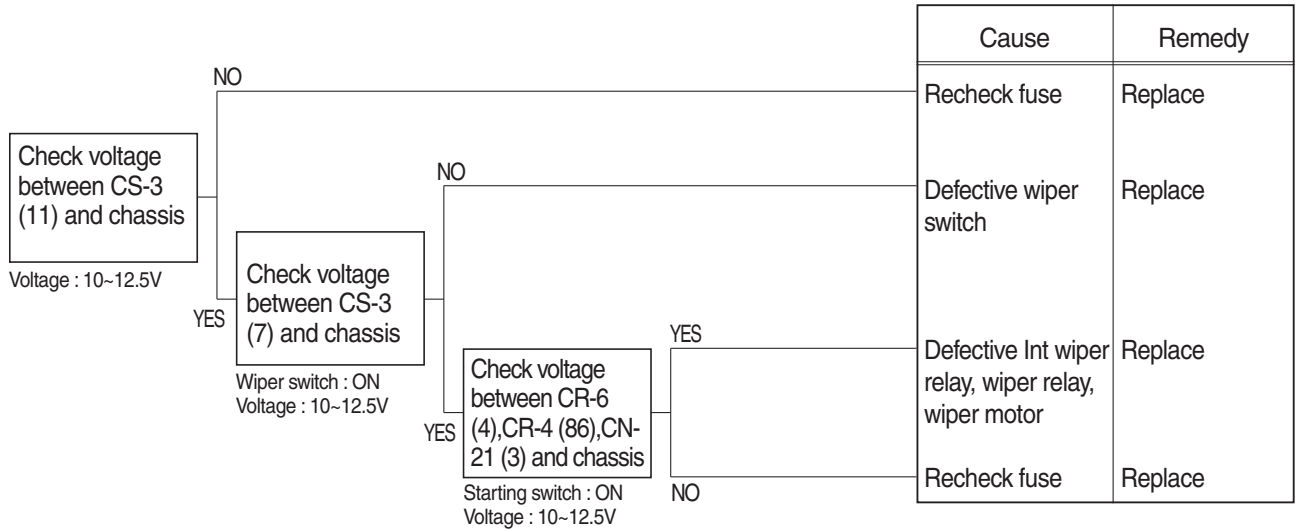
YES	10 ~ 12.5V
NO	0V



80CR9A5TS10

11. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR 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 the fuse No.13 is not blown out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



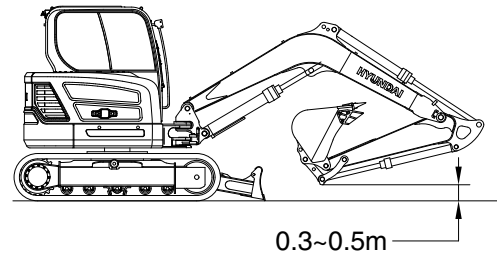
80CR9A5TS21

3) TRAVEL SPEED

(1) Measure the time required for the excavator to travel a 20m test track.

(2) Preparation

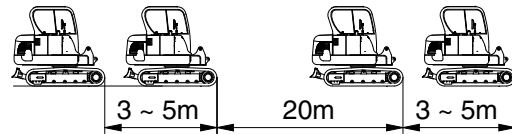
- ① Adjust the tension of both tracks to be equal.
- ② Prepare a flat and solid test track 20m in length, with extra length of 3 to 5m on both ends for machine acceleration and deceleration.
- ③ Hold the bucket 0.3 to 0.5m above the ground with the arm and bucket rolled in.
- ④ Keep the hydraulic oil temperature at $50 \pm 5^{\circ}\text{C}$.



55Z96MC04

(3) Measurement

- ① Measure both the low and high speeds of the machine.
- ② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.
- ③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.
- ④ Measure the time required to travel 20m.
- ⑤ After measuring the forward travel speed, turn the upperstructure 180° and measure the reverse travel speed.
- ⑥ Repeat steps ④ and ⑤ three times in each direction and calculate the average values.



555C96MC05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard	Maximum allowable	Remarks
R60CR-9A	1 Speed	32.7 ± 2.0	41	
	2 Speed	18.0 ± 1.0	23	

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
R60CR-9A	Boom lever	87 ± 10	109	
	Arm lever	87 ± 10	109	
	Bucket lever	87 ± 10	109	
	Swing lever	87 ± 10	109	
	Travel lever	86 ± 10	105	

3) CONDITION & COUNTERMEASURES OF TROUBLES

(1) Motor does not rotation

Condition	Cause	Remedy
The pressure of the circuit is not increasing	<ul style="list-style-type: none"> · Setting pressure of relief valve is incorrect · Working defectiveness of relief valve <ul style="list-style-type: none"> - Plunger stick - Close up an orifice hole of plunger · Seat defectiveness of plunger 	<ul style="list-style-type: none"> · Reset the pressure to correct value - Revise or exchange of stick face - disassembly or cleaning · Replace for damaged seat part
The pressure of the circuit is increasing	<ul style="list-style-type: none"> · Overload · Stick of motion portion · The brake dose not release · Stick of brake piston · Stick of friction plate 	<ul style="list-style-type: none"> · Load removes · Do repair or inspect the piston/shoe, cylinder block, valve plate etc. - Do repair or inspect circuit - Check for the brake valve - Disassembly and inspection - Disassembly and inspection · Replace for the stick parts · Replace for the stick parts

(2) The revolutionary direction is reverse

Condition	Cause	Remedy
The revolutionary direction is reverse	<ul style="list-style-type: none"> · The revolutionary direction of motor is reverse · The inlet and outlet in piping is reversely connected 	<ul style="list-style-type: none"> · Reassemble them after disassembling · Correct piping

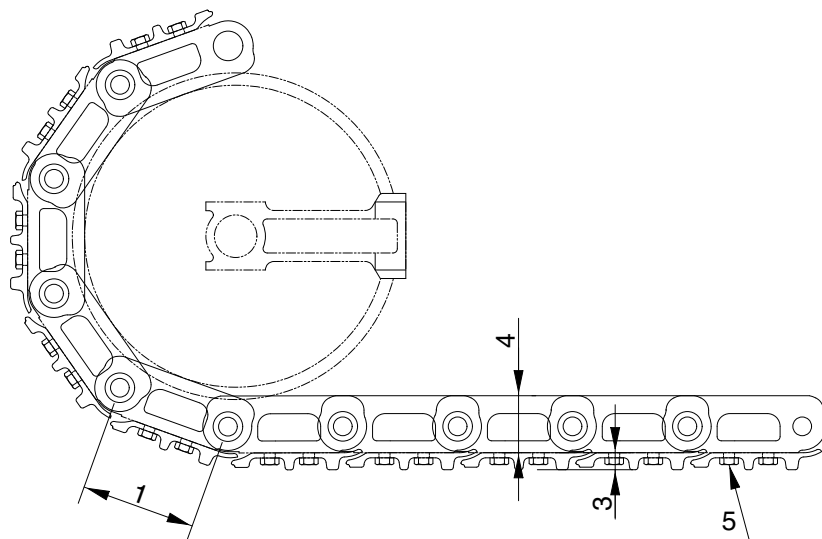
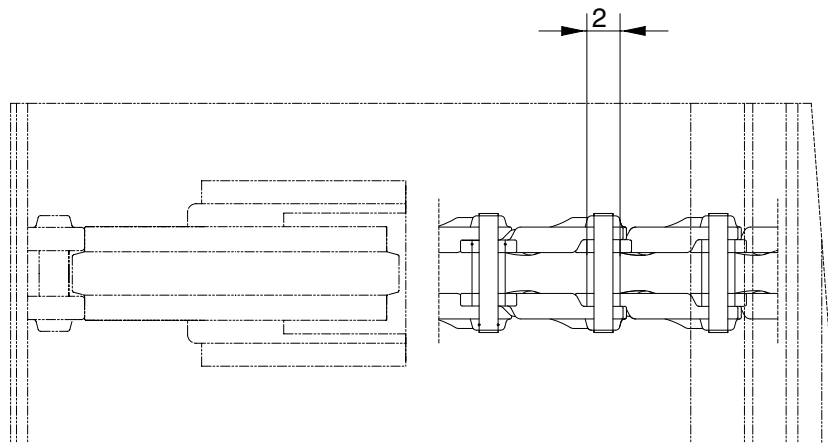
(3) The number of revolution does not reach the established value

Condition	Cause	Remedy
The number of revolution does not reach the established value	<ul style="list-style-type: none"> · The volume of flowing is not sufficient · The temperature is too high and too much oil is leaking · Valves/pistons/rings etc. are worn away and broken 	<ul style="list-style-type: none"> · Check discharge volume of pump and circuit up to the motor · Reduce the oil temperature · Replace it

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK SHOE

1) STEEL SHOE SPEC



R5576MC16

Unit : mm

No	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Link pitch	135	138.6	Replace bushing and pin and link assembly
2	Outside diameter of bushing	39	35.4	
3	Height of grouser	20	17	Lug welding, rebuild or replace
4	Height of link	70	64.5	
5	Tightening torque	Initial tightening torque : $19 \pm 1.0 \text{ kgf} \cdot \text{m}$		Retighten

2. INSTALL WORK

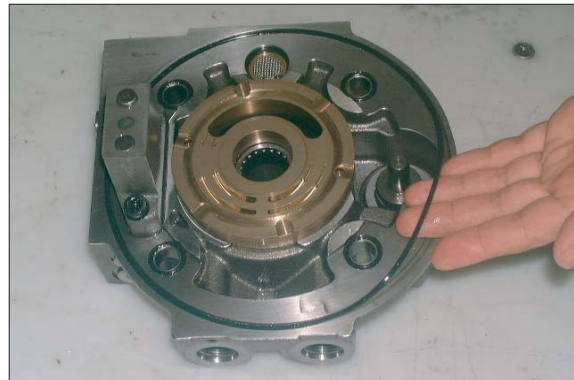
- 1) Tighten all bolts and nuts(Sleeve nuts) to the specified torque.
- 2) Install the hoses without twisting or interference.
- 3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- 4) Bend the cotter pin or lock plate securely.
- 5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.
- 6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- 7) Clean all parts, and correct any damage, dents, burrs, or rust.
- 8) Coat rotating parts and sliding parts with engine oil.
- 9) When press fitting parts, coat the surface with antifriction compound(LM-P).
- 10) After installing snap rings, check that the snap ring is fitted securely in the ring groove(Check that the snap ring moves in the direction of rotation).
- 11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
- 12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.
- 13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
- 14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:
 - (1) Start the engine and run at low idling.
 - (2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100mm before the end of the stroke.
 - (3) Next, operate the piston rod to the end of its stroke to relieve the circuit. (The air bleed valve is actuated to bleed the air.)
 - (4) After completing this operation, raise the engine speed to the normal operating condition.
 - ※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to the work equipment.
 - ※ Carry out the same operation on machines that have been in storage for a long time after completion of repairs.

- ③ This photo shows the state with the cover removed.



R55NM7HP07

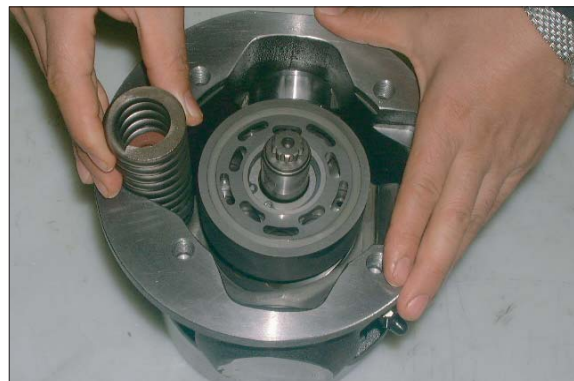
- ④ Remove the O-ring from the cover.



R55NM7HP08

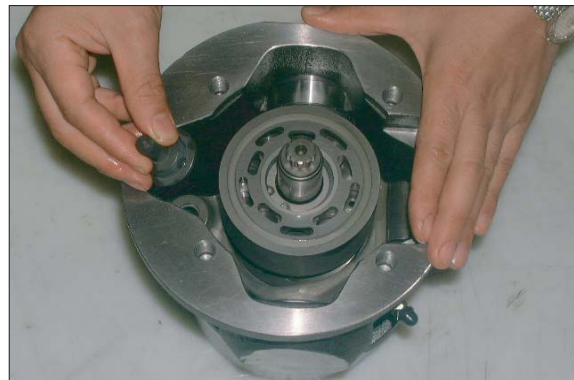
(1) The removal of the control spring

- ① Remove 2 springs (inner and outer).



R55NM7HP09

- ② Remove the spring seat.



R55NM7HP10

4. ASSEMBLING PROCEDURE

1) ASSEMBLING THE MAIN PUMP

(1) Assembling the hanger.



R55NM7HP50

(2) Install the bearing.



R55NM7HP50A

(3) Install the distance piece.

Confirm that pre-load is 0.1 ± 0.2 .



R55NM7HP51

(4) Fix the plate with the hexagonal socket headed bolts (M6 × 16, 4pieces).

Hexagonal bar spanner

(Hex. side distance : 5)

Tightening torque : 1.2 ~ 1.5 kgf · m

(8.7 ~ 10.8 lbf · ft)

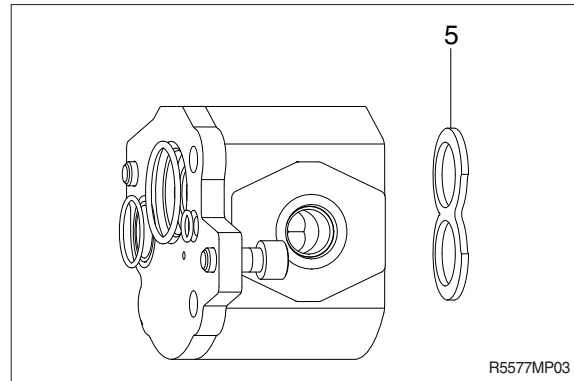


R55NM7HP52

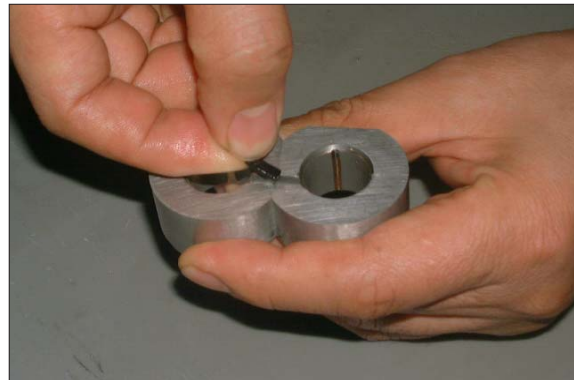
4) REASSEMBLING THE GEARED PUMP

(1) Reassembling the geared pump (P3)

- ① Insert the plate (5) to the pump housing.



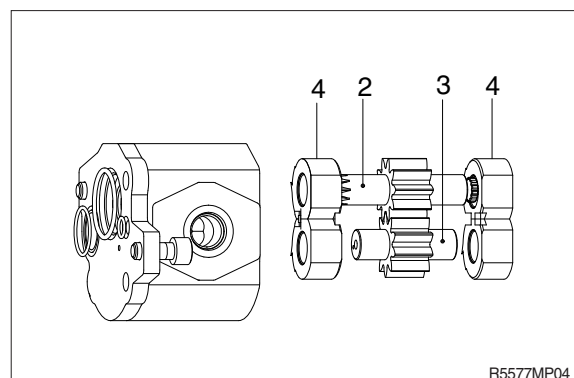
- ② Insert the square ring into the side plate.
※ Be careful to suction and discharge side.



- ③ Assemble the side plate to the drive and idle gear.



- ④ Assemble the gear assembly into the gear casing.



3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

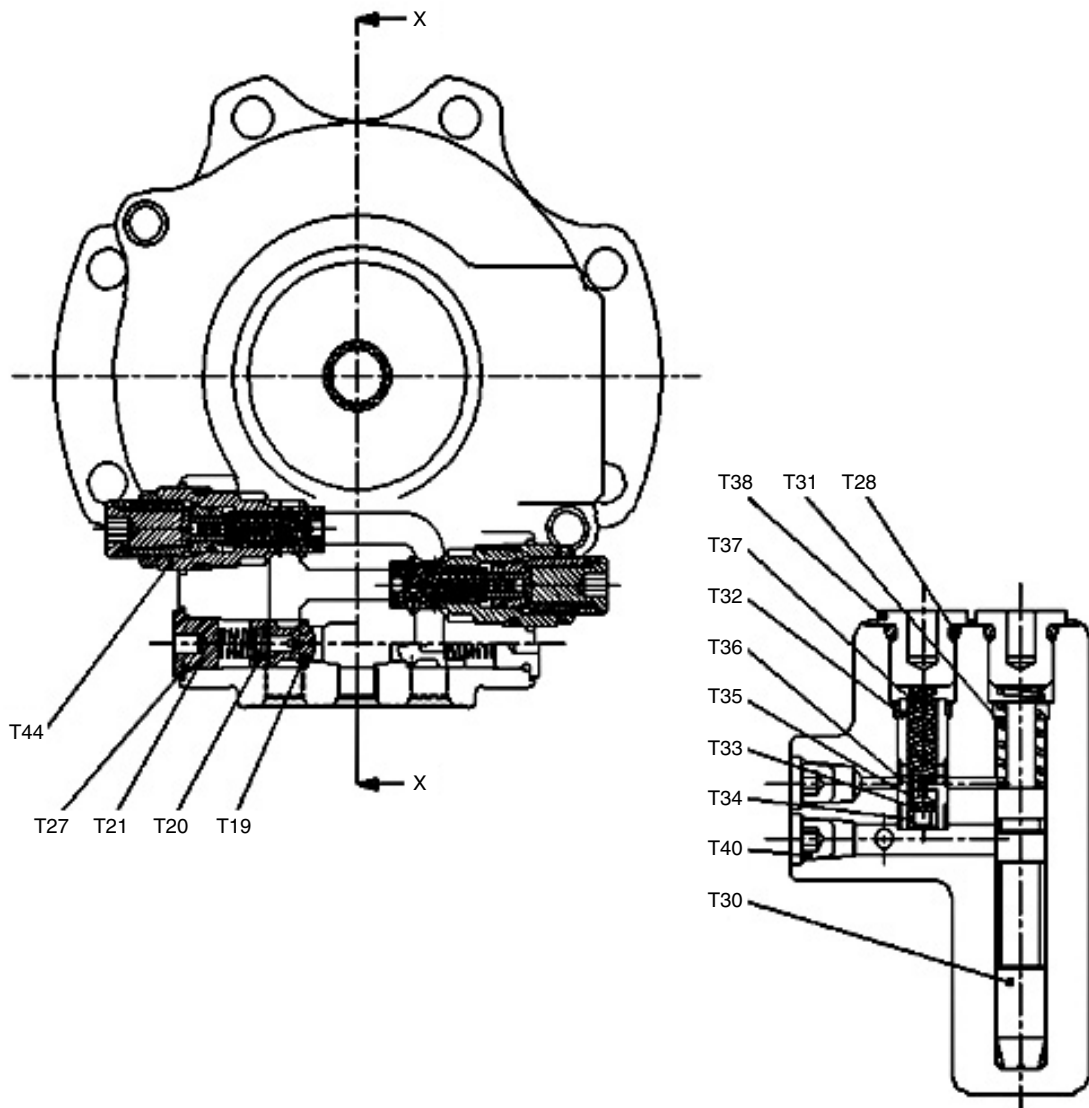
- (1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.
- (2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.
- (3) When a control valve is to be removed from the machine, apply caps 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.
- (4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.
- (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 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)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	5 and 6
Spanner	Each 1 piece	13, 21 and 30
Rod	1 piece	Less than 10 × 250

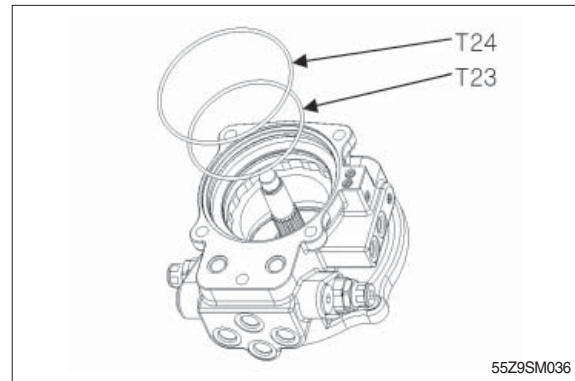
SWING MOTOR/REDUCTION GEAR (2/2)



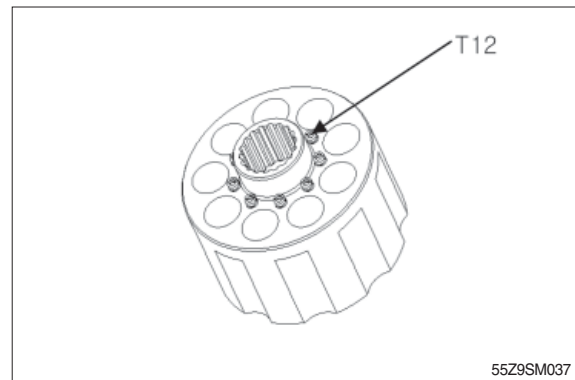
55Z9SM002

T19	Plunger	T33	Filter
T20	Check spring	T34	Bush
T21	Plug	T35	Spacer
T27	O-ring	T36	Throttle plate
T28	O-ring	T37	Spring
T30	Spool	T38	RO Plug
T31	Spring	T40	Plug
T32	Plunger A	T44	Relief valve

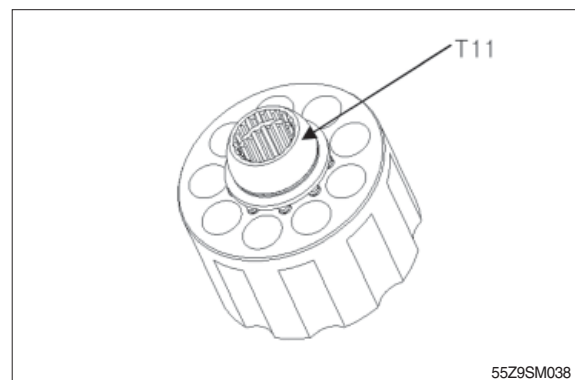
- ⑧ Apply grease to the O-ring (T23, T24) and assemble it.



- ⑨ Assemble the cylinder spring (T12).

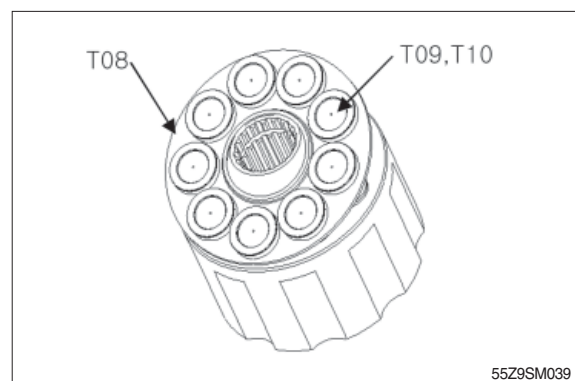


- ⑩ Assemble the spherical bush (T11).

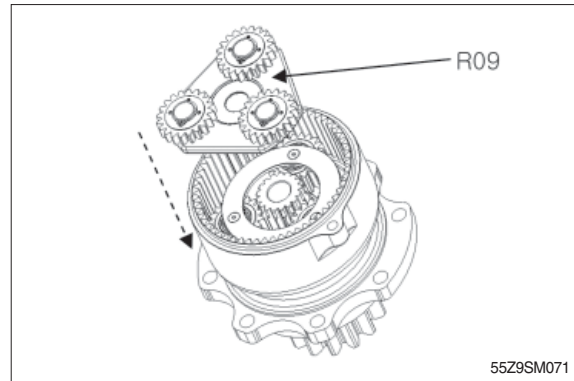


- ⑪ Set the piston assembly (T09, T10) on the retainer plate (T08) and assemble it in the cylinder block (T13).

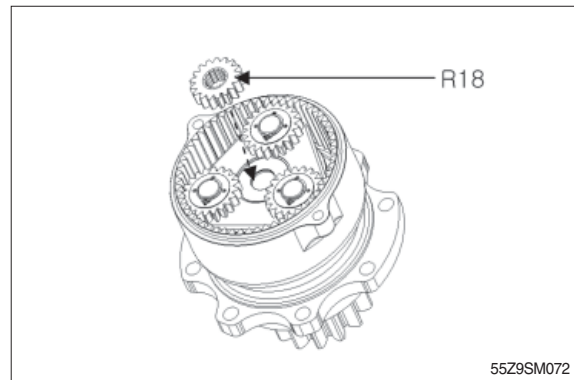
※ Apply an ample amount of hydraulic fluid to the sliding part before assembling.



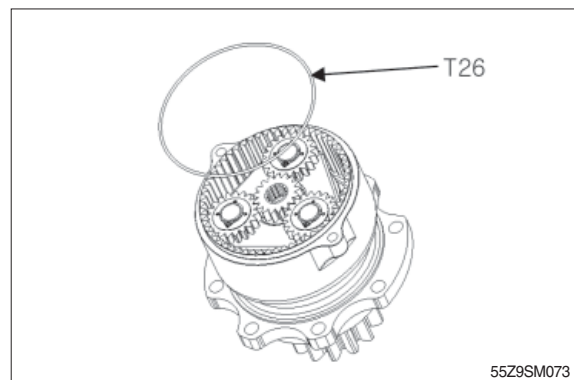
- ⑫ Install the carrier No.1 sub-assembly (R09).
Turn the carrier slowly by hand to adjust the matching holes when assembling.



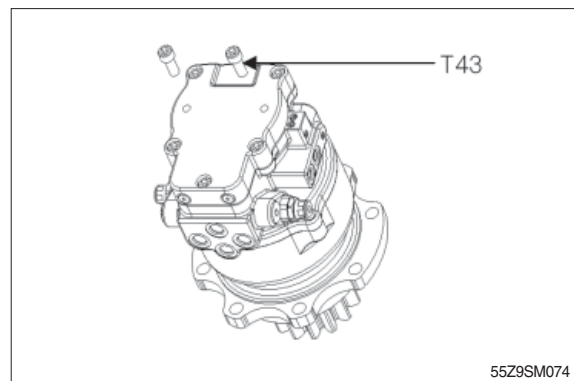
- ⑬ Install the sun gear No1 (R18).
Be sure to check the direction of sun gear when assembling.



- ⑭ Install the O-ring (T26).



- ⑮ Place the motor assembly on the reduction gear assembly and loosely tighten the socket bolt (T43), then tighten it the specified torque.



(4) Reduction gear

- ① Using L-wrench, disassemble wrench bolt (83) and then ring gear cover (80), O-ring (82) from ring gear (59).



7078TM17/17A

- ② Disassemble thrust plate (79) from ring gear (59).



7078TM18/18A

- ③ Disassemble planetary gear (76), drive gear (78) in that order from ring gear (59).



7078TM19/19A

- ④ Disassemble 3 needle bearing (77) from ring gear (59).



7078TM20/20A

- ⑦ Fit O-ring (51) to plug (49) and O-ring (53) to plug (52) and then assemble them to rear cover (26) by a torque wrench.



555K7TM26/26A

- ⑧ Assemble 2 plug (50) to rear cover (26) by a torque wrench.



555K7TM27

- ⑨ Assemble ball bearing (54) with grease to rear cover (26) and insert 2 pin (55) by using hammer.



555K7TM28

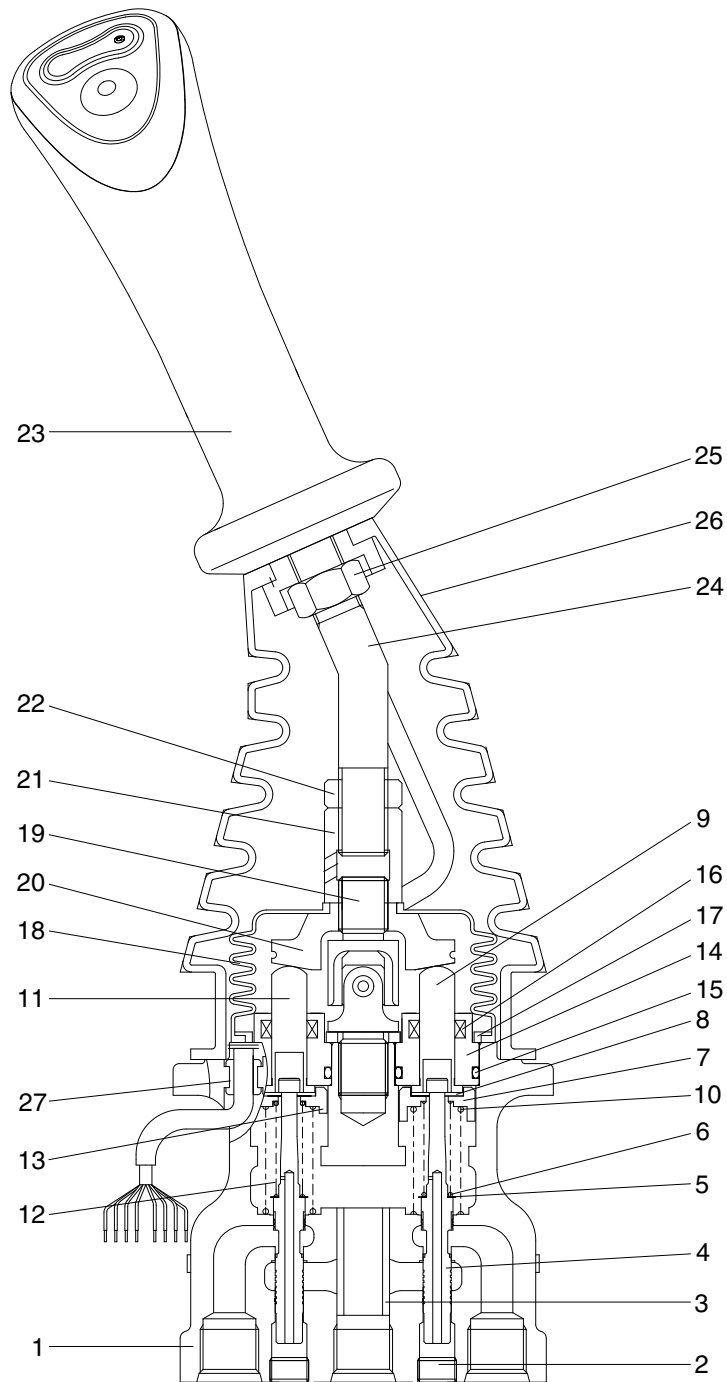
- ⑩ Assemble valve plate (56) with grease to rear cover (26).



555K7TM12/12A

2. DISASSEMBLY AND ASSEMBLY

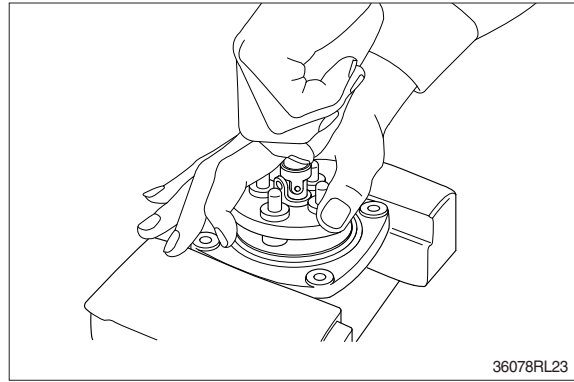
1) STRUCTURE



555C92RL02

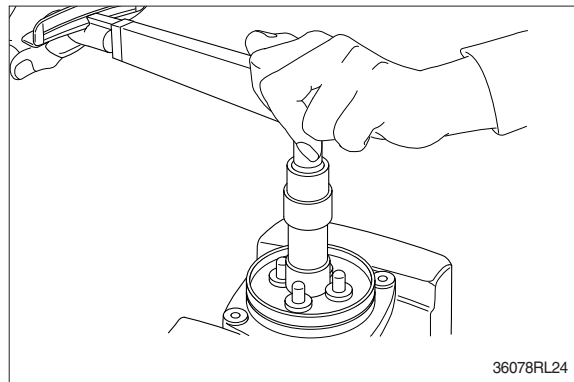
1	Case	8	Stopper	15	O-ring	22	Lock nut
2	Plug	9	Push rod	16	Rod seal	23	Handle assembly
3	Bushing	10	Spring	17	Plate	24	Handle bar
4	Spool	11	Push rod	18	Boot	25	Nut
5	Shim	12	Spring	19	Joint assembly	26	Boot
6	Spring	13	Spring seat	20	Swash plate	27	Bushing
7	Spring seat	14	Plug	21	Adjusting nut		

- (9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (17), and tighten joint (19) temporarily.



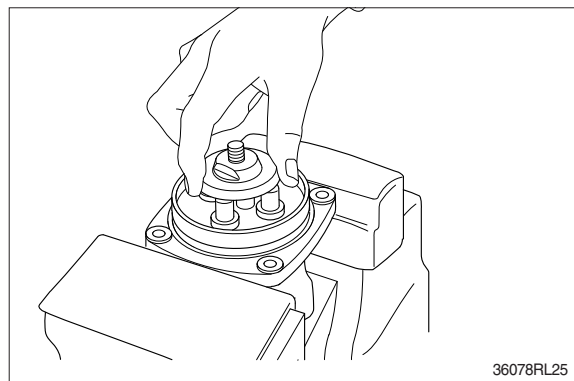
- (10) Fit plate (17).

- (11) Tighten joint (19) with the specified torque to casing, utilizing jig.



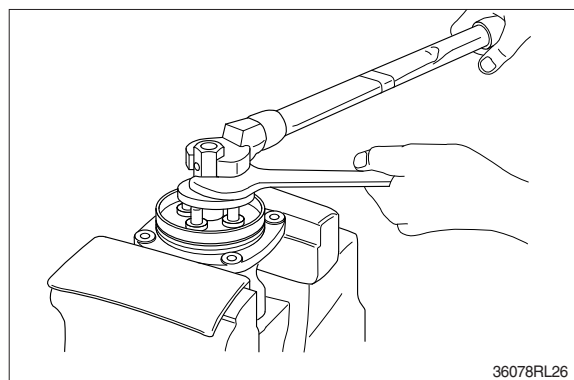
- (12) Assemble plate (20) to joint (19).

- ※ Screw it to position that it contacts with 4 push rods evenly.
- ※ Do not screw it over.



- (13) Assemble adjusting nut (21), apply spanner to width across flat of swash plate (20) to fix it, and tighten adjusting nut to the specified torque.

- ※ During tightening, do not change position of disk.



2) ARM CYLINDER

(1) Removal

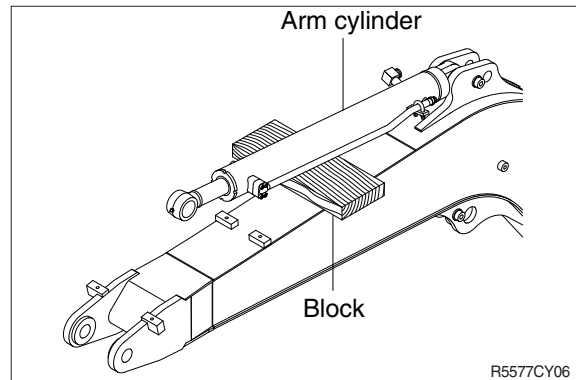
- ※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.
- ※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

▲ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

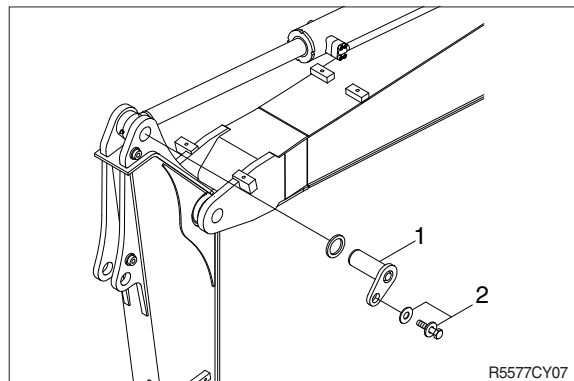
- ※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



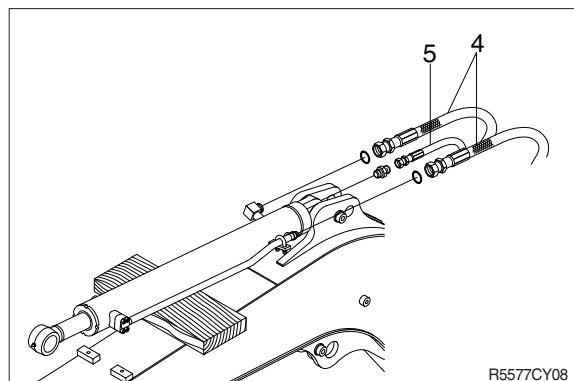
② Remove bolt (2) and pull out pin (1).

- ※ Tie the rod with wire to prevent it from coming out.



③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).

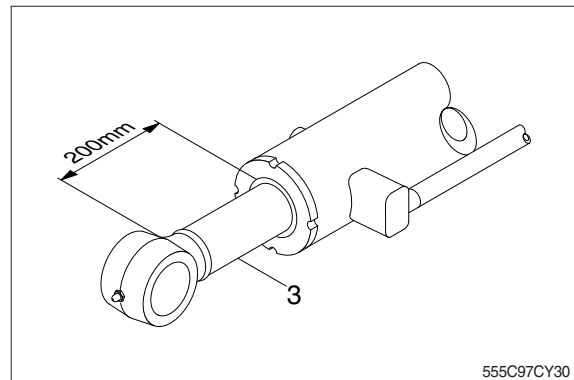


3) DISASSEMBLY

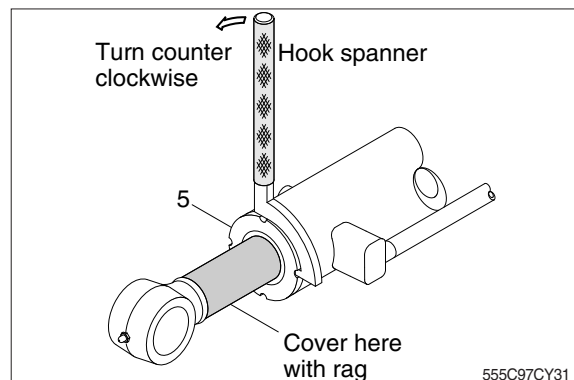
(1) Remove cylinder head and piston rod

- ① Hold the clevis section of the tube in a vise.
- ※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

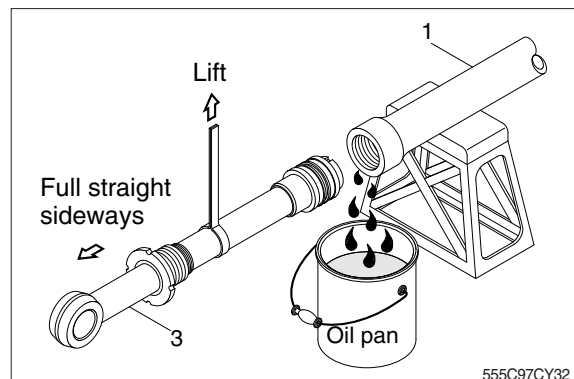
- ② Pull out rod assembly (3) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



- ③ Remove rod cover (5) by hook spanner.
- ※ Cover the extracted rod assembly (3) with rag to prevent it from being accidentally damaged during operation.



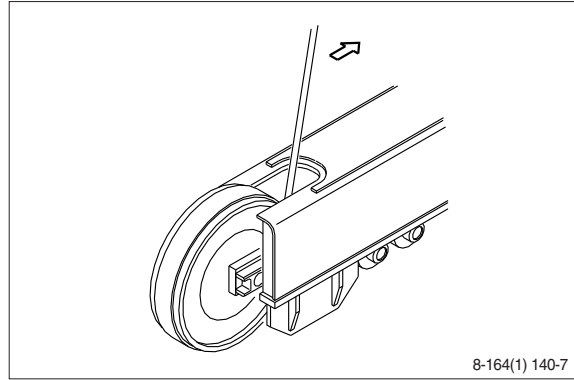
- ④ Draw out cylinder head and rod assembly (3) together from tube assembly (1).
- ※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (3) with a crane or some means and draw it out. However, when rod assembly (3) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



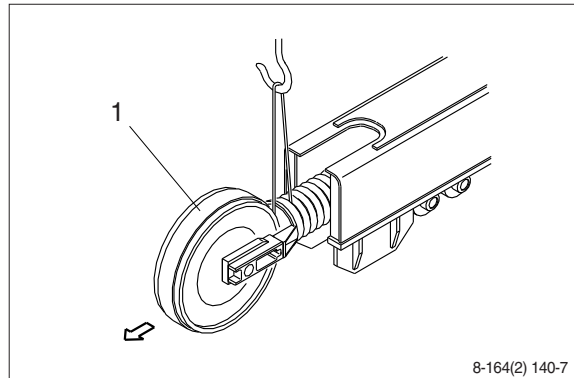
4. IDLER AND RECOIL SPRING

1) REMOVAL

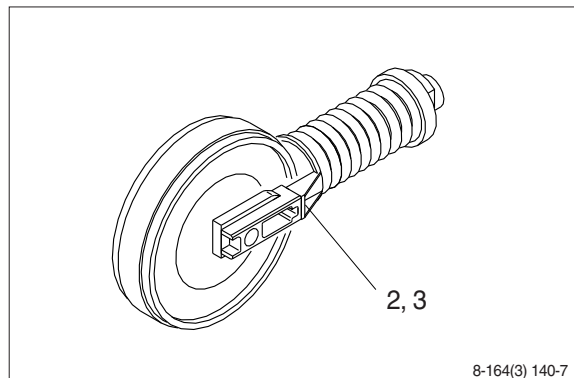
- (1) Remove the track link.
For detail, see removal of track link.



- (2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 100 kg (220 lb)

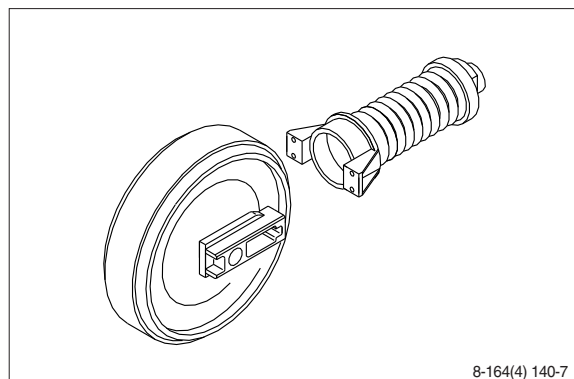


- (3) Remove the bolts (2), washers (3) and separate idler from recoil spring.



2) INSTALL

- (1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.

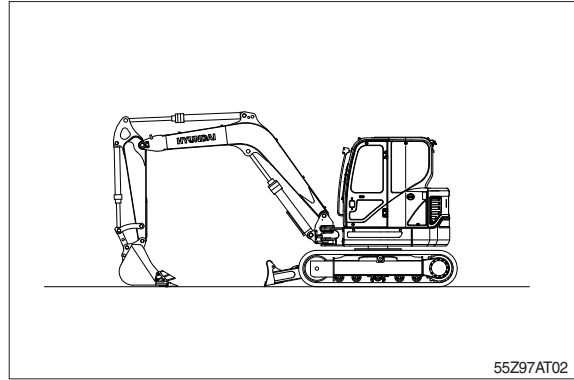


2. REMOVAL AND INSTALL

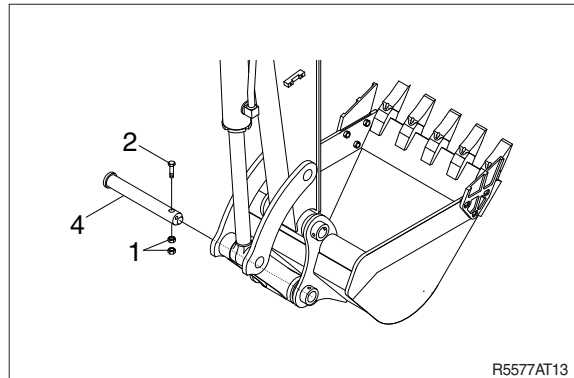
1) BUCKET ASSEMBLY

(1) Removal

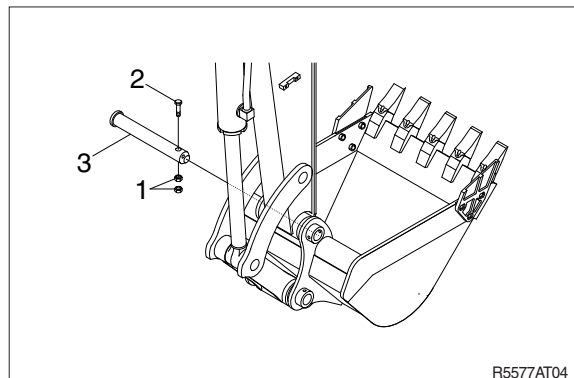
- ① Lower the work equipment completely to ground with back of bucket facing down.



- ② Remove nut (1), bolt (2) and draw out the pin (4).



- ③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly.
· Weight : 170 kg (370 lb)

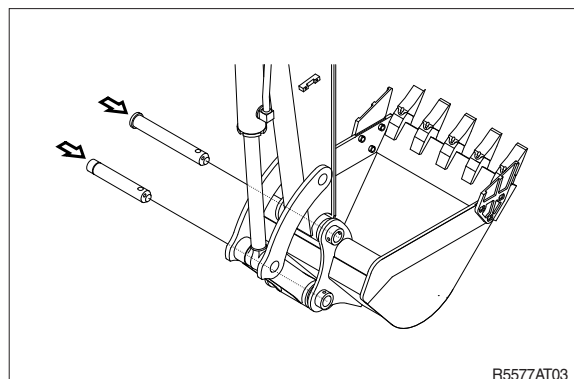


(2) Install

- 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.

- ※ Adjust the bucket clearance.
For detail, see operation manual.



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