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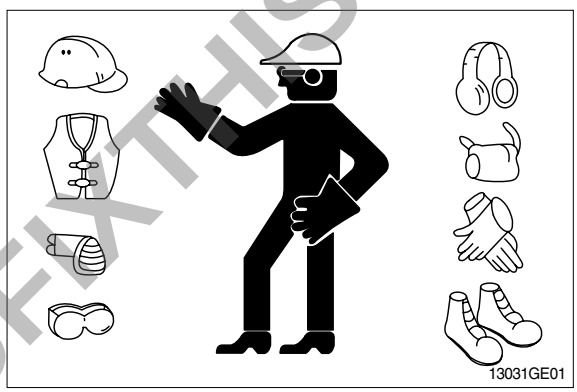
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

Unsafe work practices are dangerous. Understand service procedure before doing work; Do not attempt shortcuts.

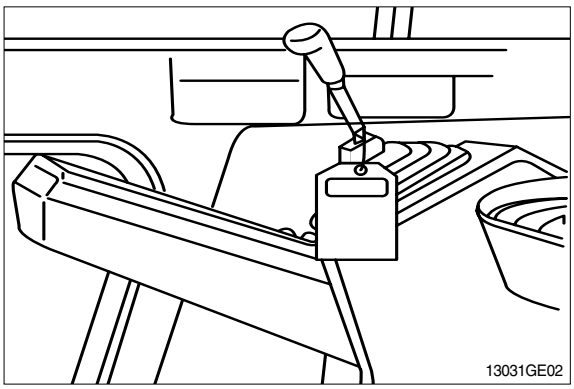
WEAR PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate to the job.



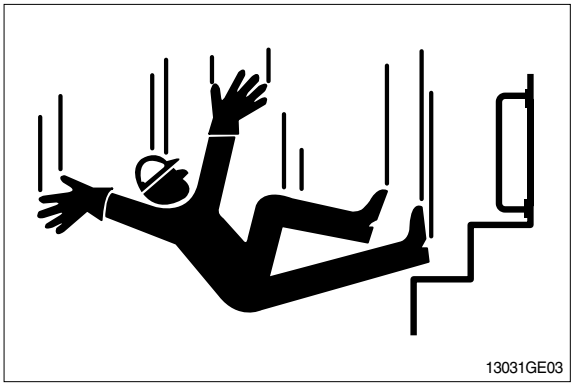
WARN OTHERS OF SERVICE WORK

Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a 「**Do Not Operate**」 tag on the right side control lever.



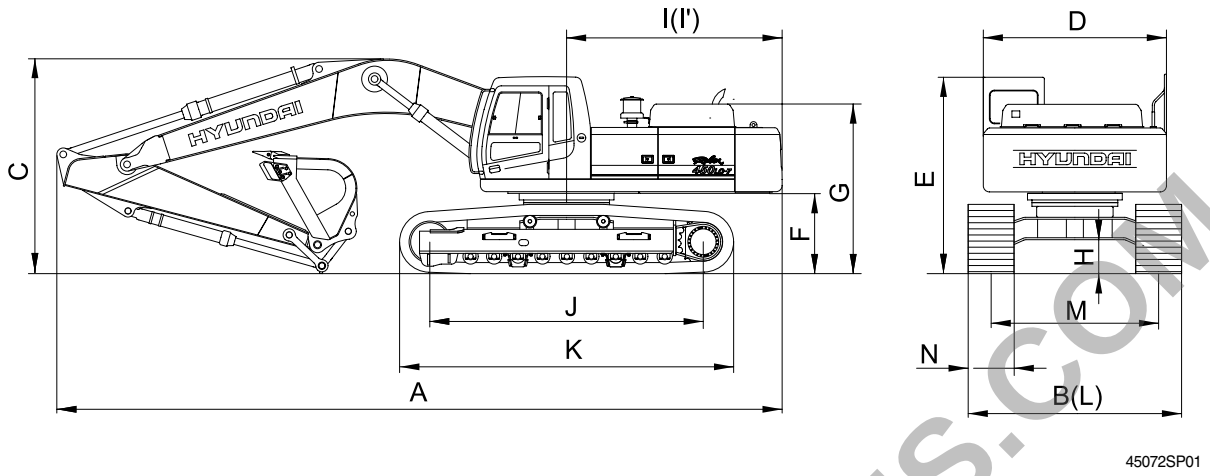
USE HANDHOLDS AND STEPS

Falling is one of the major causes of personal injury.
When you get on and off the machine, always maintain a three point contact with the steps and handrails and face the machine. Do not use any controls as handholds.
Never jump on or off the machine. Never mount or dismount a moving machine.
Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.



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2. SPECIFICATIONS



45072SP01

Description		Unit	Specification
Operating weight		kg(lb)	44900(99000,~#0463) 45200(99650,#0464~)
Bucket capacity(SAE heaped), standard		$m^3(yd^3)$	2.15(2.81)
Overall length	A	mm(ft-in)	12000(39' 4")
Overall width, with 600mm shoe	B		3340(10'11")
Overall height	C		3600(11'10")
Superstructure width	D		2980(9' 9")
Overall height of cab	E		3250(10' 8")
Ground clearance of counterweight	F		1340(4' 5")
Engine cover height	G		2792(9' 2")
Minimum ground clearance	H		555(1'10")
Rear-end distance	I		3665(12' 0")
Rear-end swing radius	I'		3720(12' 2")
Distance between tumblers	J		4470(14' 8")
Undercarriage length	K		5462(17'11")
Undercarriage width	L		3340(10'11")
Track gauge	M		2740(8'12")
Track shoe width, standard	N		600(24")
Travel speed(Low/high)		km/hr(mph)	3.2/5.3(2.0/3.3)
Swing speed		rpm	10.3
Gradeability		Degree(%)	35(70)
Ground pressure(600mm shoe)		$kgf/cm^2(psi)$	0.78(11.09)

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1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

(3) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.

· Hydraulic tank quantity : 250 ℓ

(4) Remove bolts(16) and disconnect pipe (1,2).

(5) Disconnect pilot line hoses(4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14).

(6) Remove bolts(15) and disconnect pump suction tube (3).

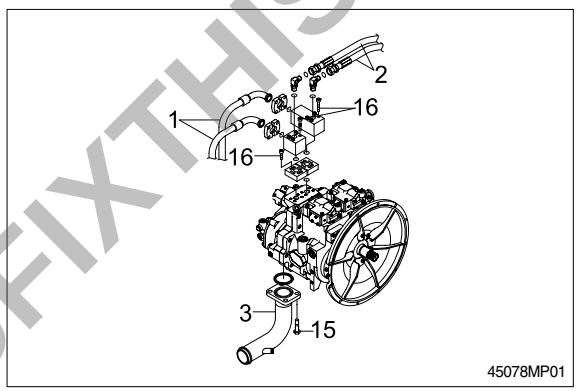
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

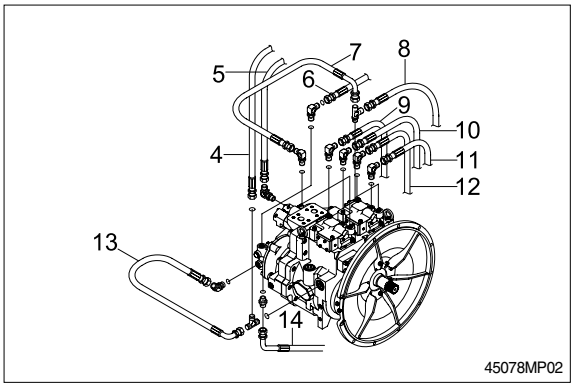
(7) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 240kg(530lb)

※ Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.







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GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

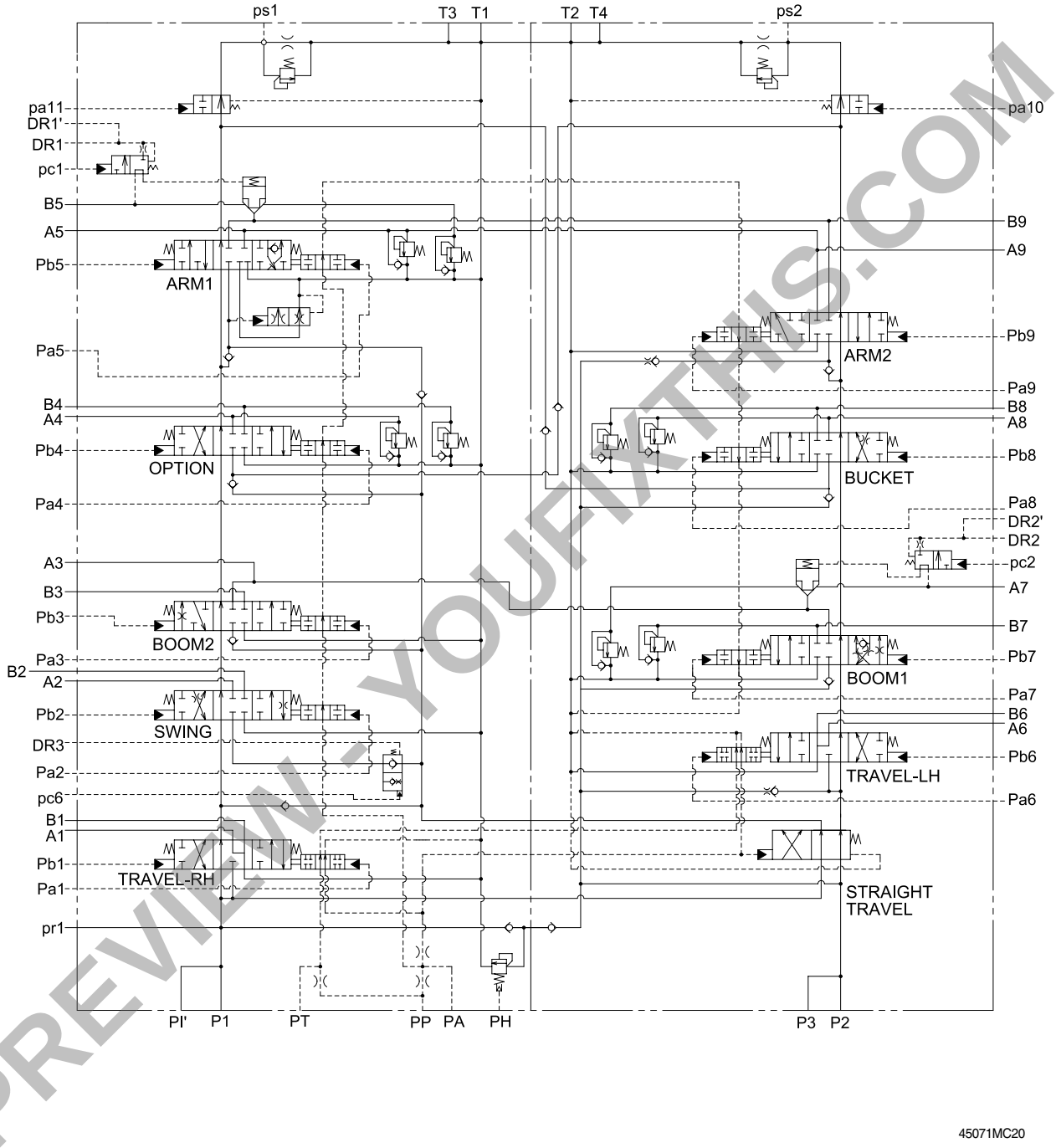
No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt, nut	M20 × 2.5	46.4 ± 4.6	336 ± 33
2		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
3		Coupling mounting socket bolt	M10 × 1.5	4.6 ± 1.0	33 ± 7.9
4		Main pump housing mounting bolt	M10 × 1.5	4.6 ± 1.0	33 ± 7.9
5	Hydraulic system	Main pump mounting bolt	M20 × 2.5	4.4 ± 0.6	318 ± 47.7
6		Main control valve mounting nut	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4
7		Fuel tank mounting bolt	M20 × 2.5	45 ± 5.1	325 ± 36.8
8		Hydraulic oil tank mounting bolt	M20 × 2.5	45 ± 5.1	325 ± 36.8
9		Turning joint mounting bolt, nut	M16 × 2.5	29.7 ± 4.5	215 ± 32.5
10	Power train system	Swing motor mounting bolt	M20 × 2.5	58.4 ± 6.4	422 ± 46.2
11		Swing bearing upper part mounting bolt	M24 × 3.0	94.5 ± 10.5	683 ± 75.9
12		Swing bearing lower part mounting bolt	M24 × 3.0	94.5 ± 10.5	683 ± 75.9
13		Travel motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
14		Sprocket mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
15	Under carriage	Carrier roller mounting bolt, nut	M16 × 1.5	31.3 ± 4.7	226 ± 33.9
16		Track roller mounting bolt	M22 × 2.5	83.2 ± 12.5	601 ± 90.4
17		Track tension cylinder mounting bolt	M16 × 2.0	76 ± 8	550 ± 58
18		Track shoe mounting bolt, nut (-#0595)	M22 × 1.5	105 ± 5.0	760 ± 36
19		Track shoe mounting bolt, nut (#0596-)	M24 × 1.5	140 ± 5.0	1012 ± 36
20	Others	Counterweight mounting bolt	M42 × 3.0	390 ± 40	2821 ± 289
		Center frame support & lower track mounting bolt	M33 × 3.5	220 ± 20	88.2 ± 9.4
21		Cab mounting bolt	M12 × 1.75	12.2 ± 1.3	18.1 ± 3.6
22		Operator's seat mounting bolt	M 8 × 1.25	2.5 ± 0.5	1591 ± 145

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

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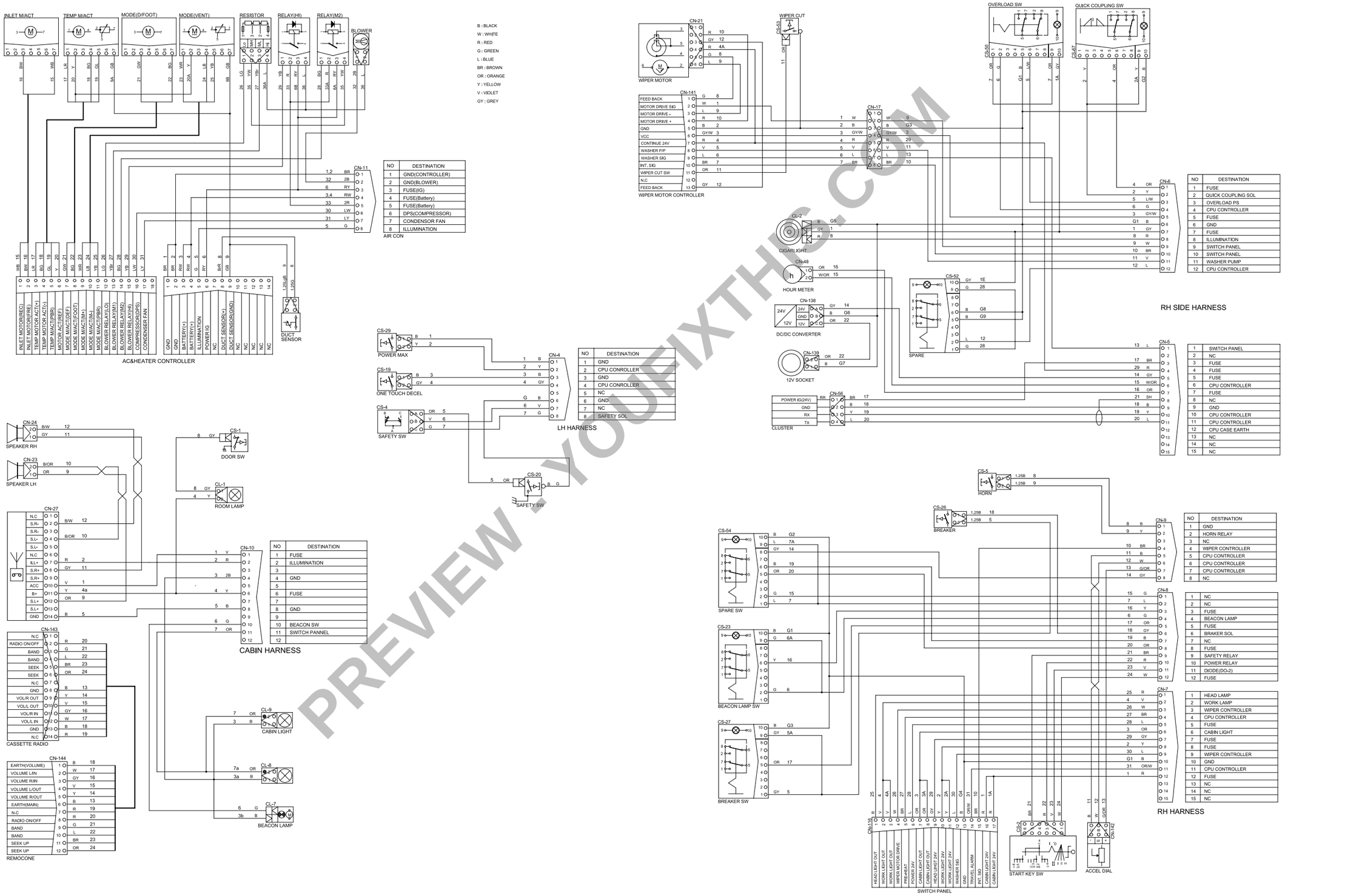
2. HYDRAULIC CIRCUIT



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• ELECTRICAL CIRCUIT(1/2)



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45074EL03

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5. ERROR CODES TABLE

Error code No.	Description
1	Short circuit in accel actuator system
2	Potentiometer circuit is shorted to Vcc(5V) or battery +
3	Short circuit in pump EPPR valve system
4	Short circuit in boom down EPPR valve system
5	Short circuit in travel speed solenoid system
6	Short circuit in power boost solenoid system
7	Short circuit in max flow solenoid system
10	Short circuit in hour-meter system
11	Accel dial circuit is shorted to Vcc(5V) or battery +
12	P1 pressure sensor circuit is shorted to power supply(24V) line
13	P2 pressure sensor circuit is shorted to power supply(24V) line
14	P3 pressure sensor circuit is shorted to power supply(24) line
15	Boom down pressure circuit is shorted to power supply(24V) line
16	Accel actuator circuit is open or shorted to ground
17	Potentiometer circuit is open or shorted to ground
18	Pump EPPR valve circuit is open or shorted to ground
19	Boom down EPPR valve circuit is open or shorted to ground
20	Travel speed solenoid circuit is open or shorted to ground
21	Power boost solenoid circuit is open or shorted to ground
22	Max flow solenoid circuit is open or shorted to ground
25	Hour-meter circuit is open or shorted to ground
26	Accel dial circuit is open or shorted to ground
27	P1 pressure sensor circuit is open or shorted to ground
28	P2 pressure sensor circuit is open or shorted to ground
29	P3 pressure sensor circuit is open or shorted to ground
30	Boom down pressure sensor circuit is open or shorted to ground
31	Engine preheater circuit is open or shorted to ground
32	Travel alarm buzzer circuit is open or shorted to ground
33	Alternator circuit is open or shorted to ground
34	Controller input voltage is below 18V
35	Controller input voltage is over 38V
36	Communication error with cluster
37	Engine speed sensor circuit is open or shorted to ground
38	Anti-restart relay circuit is open or shorted to ground
39	Accel actuator does not stop at a target position
40	There is more than 500rpm difference between target speed and actual speed

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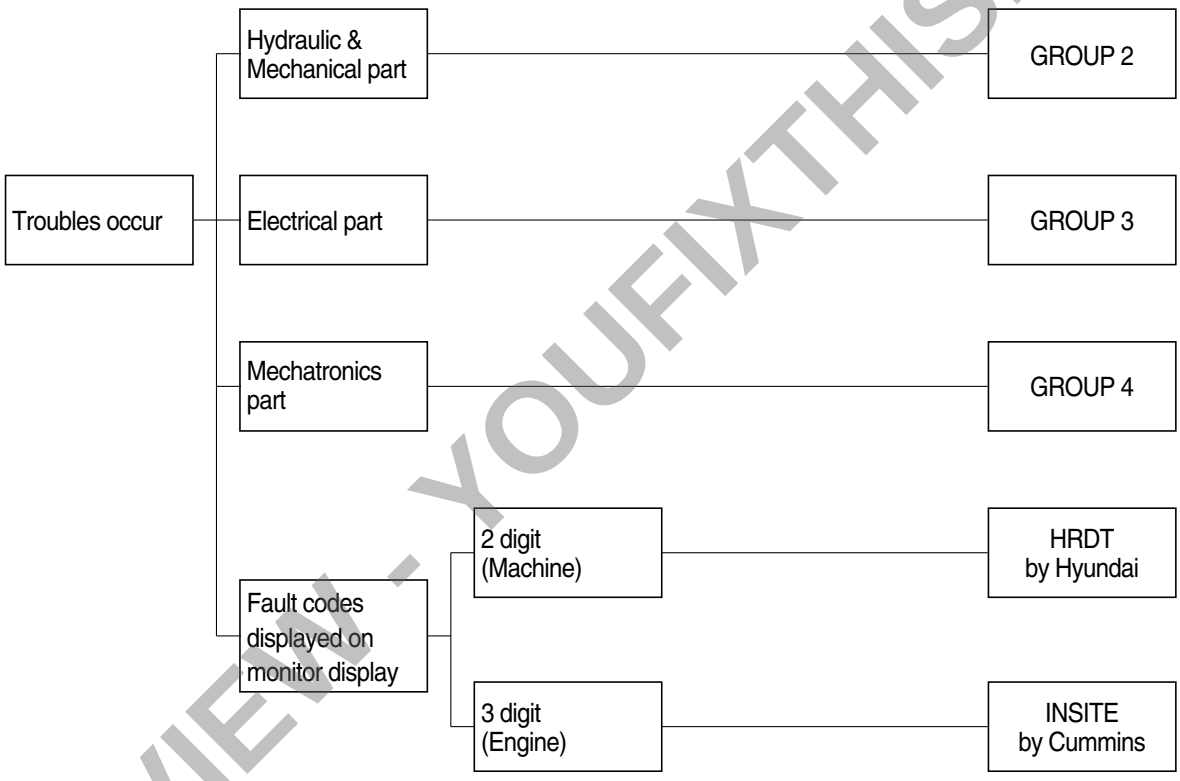
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GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

When a trouble is occurred in the machine, this section will help an operator to maintain the machine with easy.

The trouble of machine is parted Hydraulic & Mechanical system, Electrical system and Mechatronics system. At each system part, an operator can check the machine according to the troubleshooting process diagram.



※ If fault codes (2 or 3 digits) are displayed on the monitor, please contact Hyundai or Cummins.

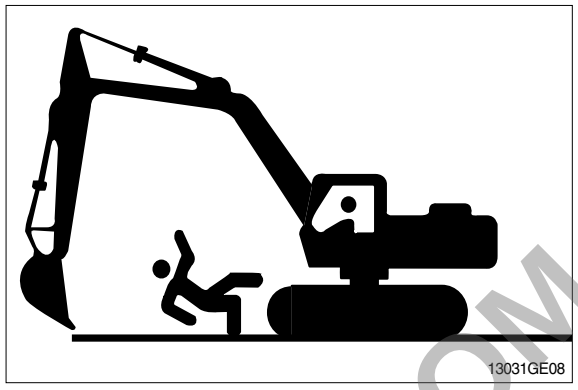
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KEEP RIDERS OFF EXCAVATOR

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

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

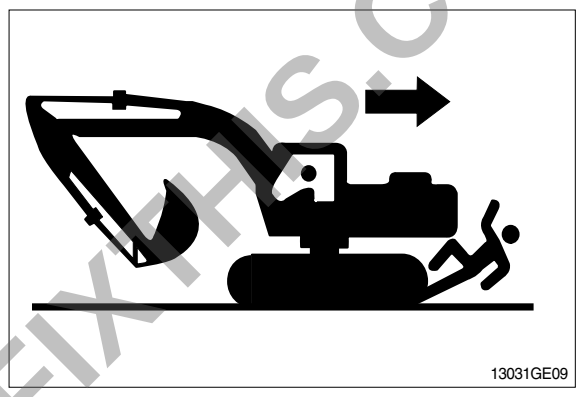


MOVE AND OPERATE MACHINE SAFELY

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

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

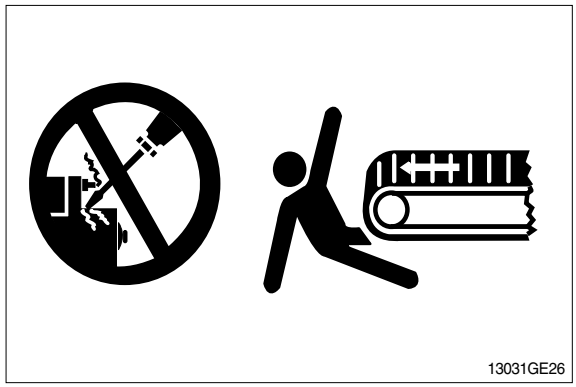
Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the excavator.



OPERATE ONLY FORM OPERATOR'S SEAT

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

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



PARK MACHINE SAFELY

Before working on the machine:

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

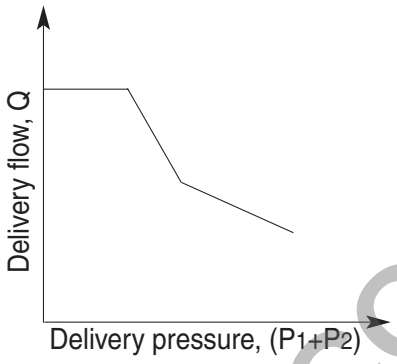
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(2) Total horsepower control

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

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

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



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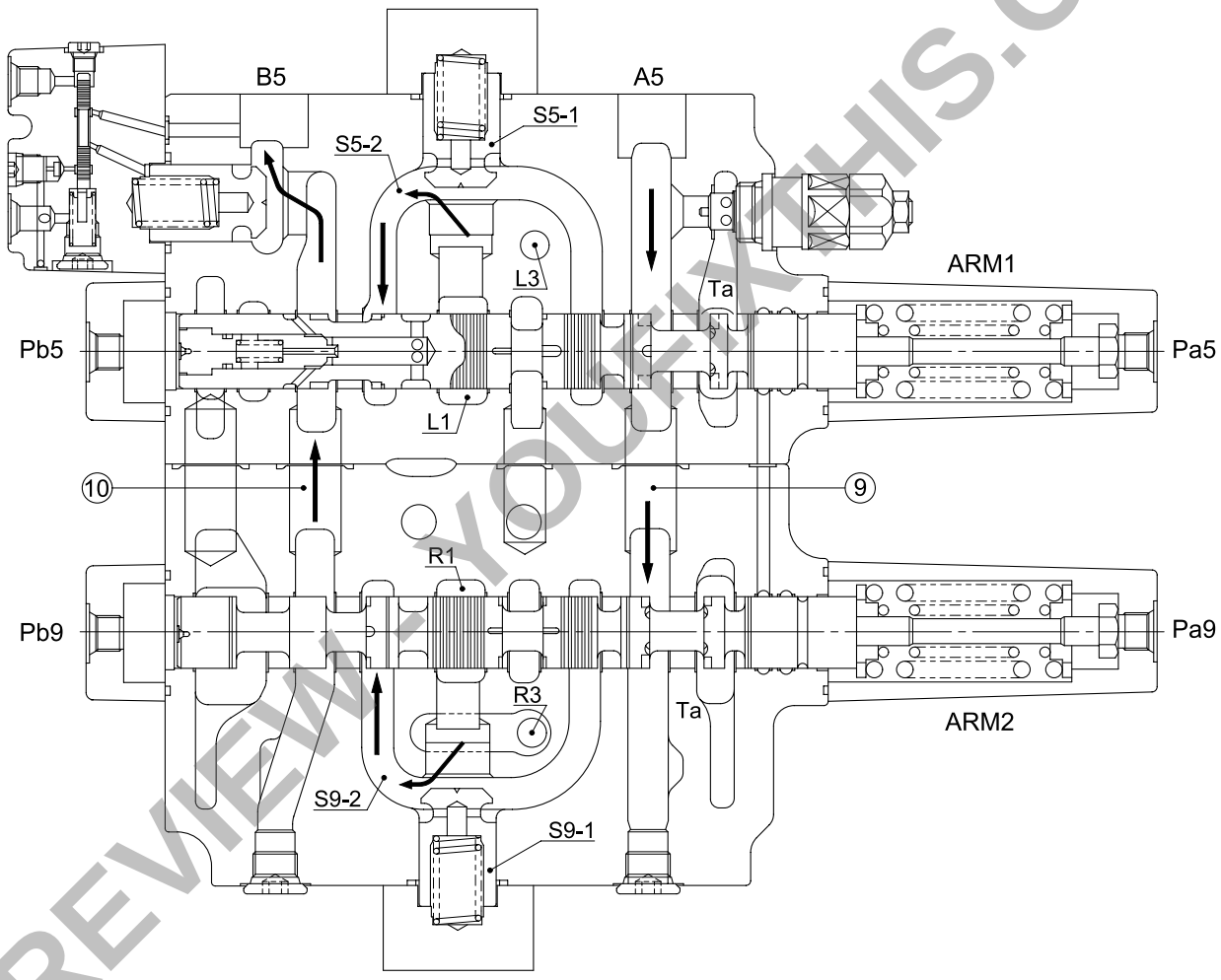
6) ARM SPOOL

(1) Arm out (flow summation)

When the arm 1 spool is pushed to the right by the pilot pressure of port Pb5, the oil discharged from pump P1 flows into the port B5 via neutral passage(L1), the load check valve(S5-1) and passage(S5-2).

When the arm 2 spool is pushed to the right by the pilot pressure of port Pb9, the oil discharged from pump P2 flows together the port B5 the passage(⑩) via the neutral passage(R1), the load check valve(S9-1) and passage(S9-2).

The return oil from port A5 flows into the tank via the tank passage(Ta).



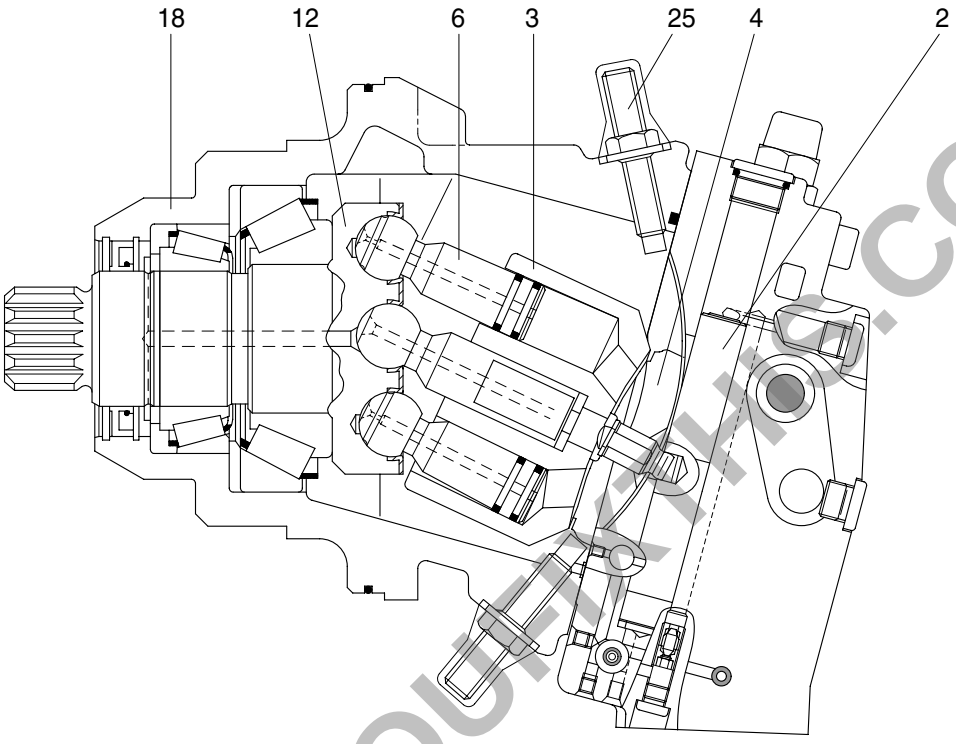
45071MC10

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2. FUNCTION

1) HYDRAULIC MOTOR(plug-in motor with intergrated counter balance valve)



450A2TO02

The variable displacement motor has a rotary group in bent axis design.
The torque is generated directly at the drive shaft(12).
The cylinder barrel(3) is driven by a tapered piston(6) arrangement.
The change of displacement is generated by the control lens(4) via positioning piston(2). The control lens(4) slides on a circular shaped surface.

In case of constant pump flow volume and high pressure
- The output speed is increased at smaller swivel angle, the torque is reduced
- The torque rises at swivel angle increase, the output speed is decreased.

The max. swivel angle is 25° , the min. swivel angle is 5° .

The variable displacement motor with integrated counterbalance valve is designed to be operated in open loop.

The min. displacement is limited by a threaded pin(25) in the housing(18). Min. displacement is set according to requirement. Stepless adjustment to various higher values is possible.

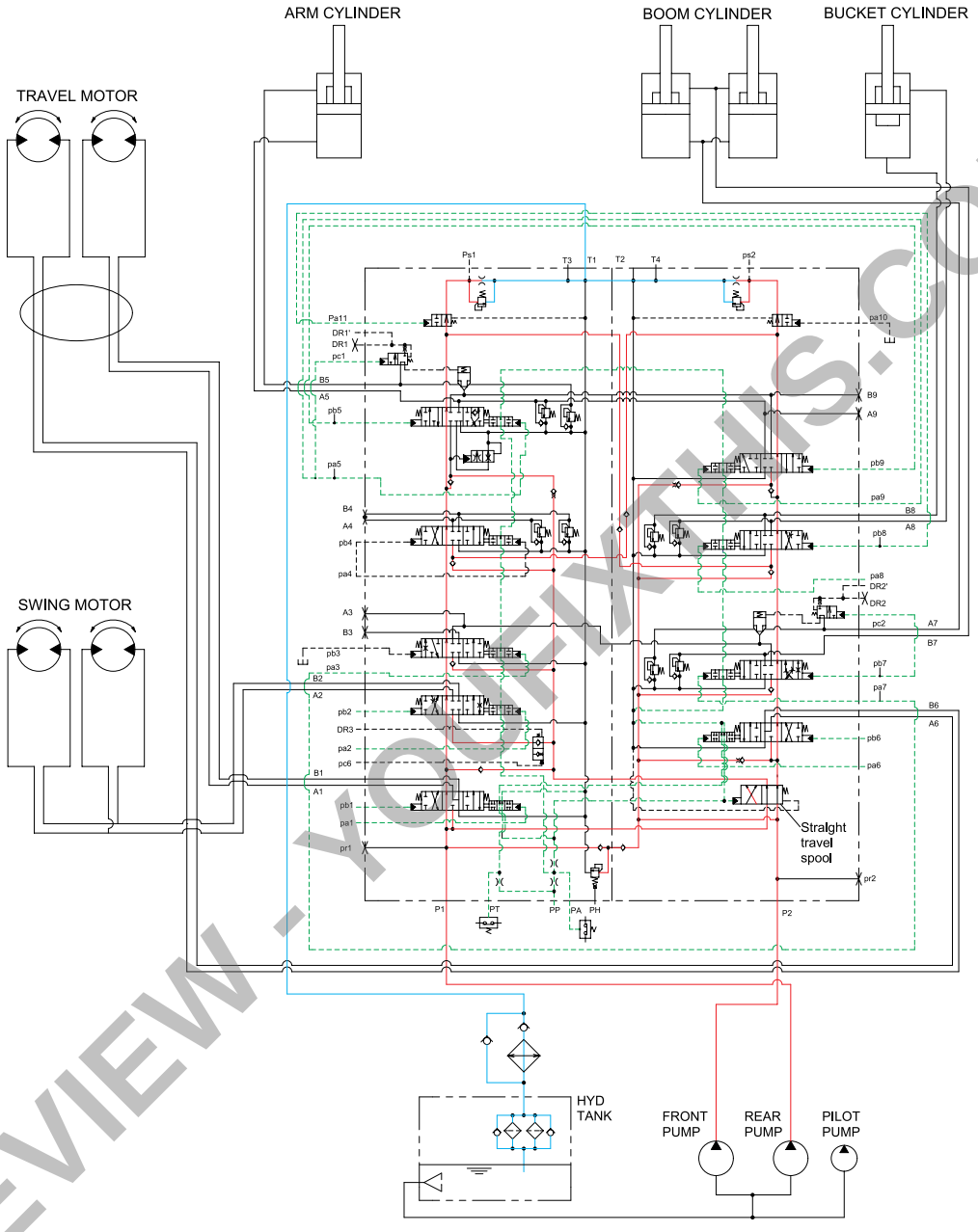
※ **Reduction to smaller displacement may result in overspeeding the motor.**

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GROUP 5 COMBINED OPERATION

1. OUTLINE



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

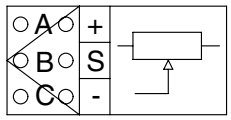
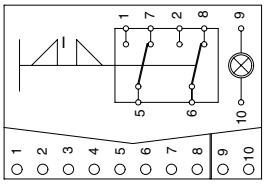
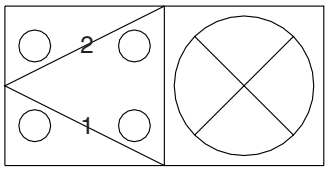
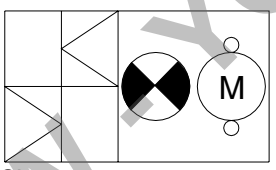
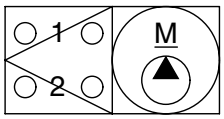
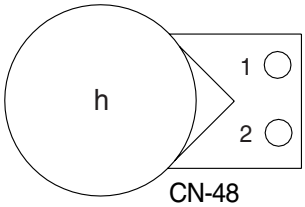
STRAIGHT TRAVEL SPOOL

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

If any actuator is operated when traveling, the straight travel spool is pushed to the left by the pilot oil pressure(PP) from the pilot pump. 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.

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Part name	Symbol	Specifications	Check
Accel dial	 CN-142	-	※ Check resist Normal : About 5kΩ (For terminal A-C) Normal : Abowt 5V (For terminal A-C) : 2~4.5V (For terminal C-B)
Switch	 CS-67	24V 8A	※ Check disconnection Normal : 1.0Ω ON : 0Ω (For terminal 1-5, 2-6) ∞Ω (For terminal 5-7, 6-8) OFF : ∞Ω (For terminal 1-5, 6-8) 0Ω (For terminal 5-7, 6-8)
Head lamp, Work lamp, Room lamp, Cab lamp	 CL-1 CL-4 CL-5 CL-6 CL-8 CL-9	24V 70W (H3 Type) 24V 10W (Room lamp)	※ Check disconnection Normal : A few Ω
Beacon lamp	 CL-7	21V 70A (H1 type)	※Check disconnection Normal : A few Ω
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※Check resistance Normal : 1.0Ω
Hour meter	 CN-48	16~32V	※Check operation Supply power(24V) to terminal No.2 and connect terminal No.1 and ground

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6. ENGINE FAULT CODE INFORMATION (For QSM11)

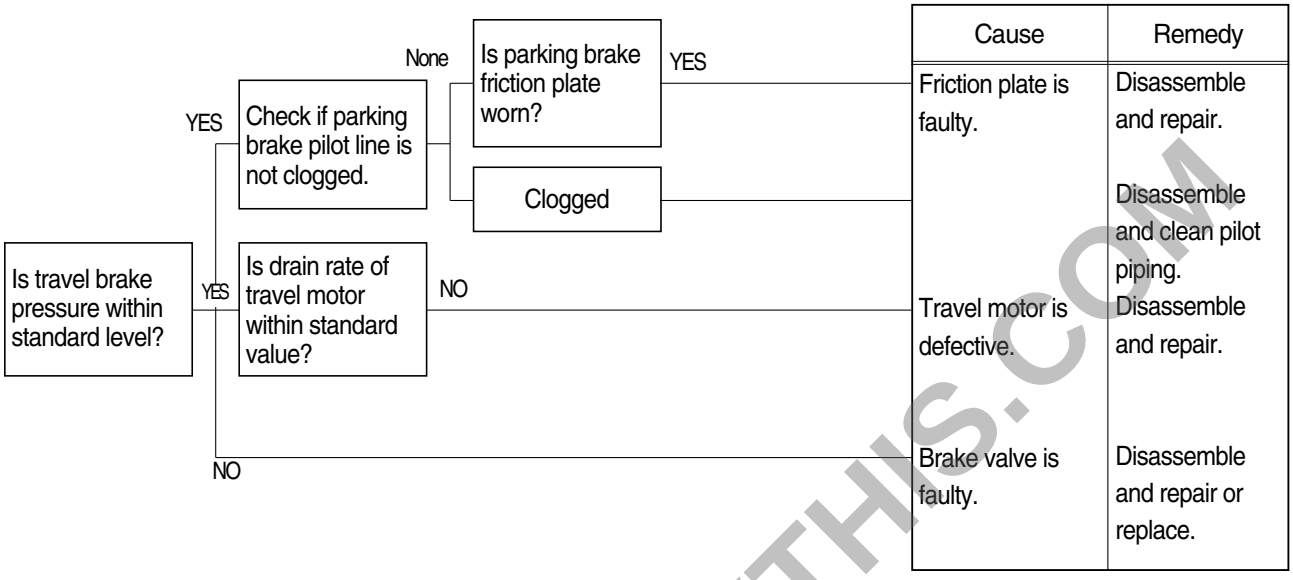
Fault code No.	Reason	Effect(only when fault code is active)
111	Error internal to the ECM related to memory hardware failures or internal ECM voltage supply circuits.	Engine will not start.
115	No engine speed signal detected at both engine position sensor circuits.	Engine will die and will not start.
121	No engine speed signal detected from one of the engine position sensor circuits.	None on performance.
122	High voltage detected on the intake manifold pressure circuit.	Derate in power output of the engine.
123	Low voltage detected on the intake manifold pressure circuit.	Derate in power output of the engine.
131	High voltage detected at the throttle position signal circuit.	Severe derate(power and speed). Limp home power only.
132	Low voltage detected at the throttle position signal circuit.	Severe derate(power and speed). Limp home power only.
133	High voltage detected at the remote throttle position signal circuit.	None on performance if remote throttle is not used.
134	Low voltage detected at the remote throttle position signal circuit.	None on performance if remote throttle is not used.
135	High voltage detected at the oil pressure circuit.	No engine protection for oil pressure.
141	Low voltage detected at the oil pressure circuit.	No engine protection for oil pressure.
143	Oil pressure signal indicates oil pressure below the low oil pressure engine protection limit.	Progressive power and speed derate with increasing time after alert. If engine protection shutdown feature is enable, engine will shut down 30 seconds after red lamp starts flashing.
144	High voltage detected at the coolant temperature circuit.	Possible white smoke. Fan will stay on if controlled by the electronic control module (ECM). No engine protection for coolant temperature.
145	Low voltage detected at the coolant temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
147	A frequency of less then 100Hz was detected at the frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration dependent power and speed derate.
148	A frequency of more than 100Hz was detected at the frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration dependent power and speed derate.
151	Coolant temperature signal indicates coolant temperature above 104°C(220°F).	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
153	High voltage detected at the intake manifold temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
154	Low voltage detected at the intake manifold temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
155	Intake manifold temperature signal indicates temperature above 87.8°C(190°F).	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
187	Low voltage detected on the ECM voltage supply line to some sensors(VSEN2 supply).	Engine will run derated. No engine protection for oil pressure and coolant level.

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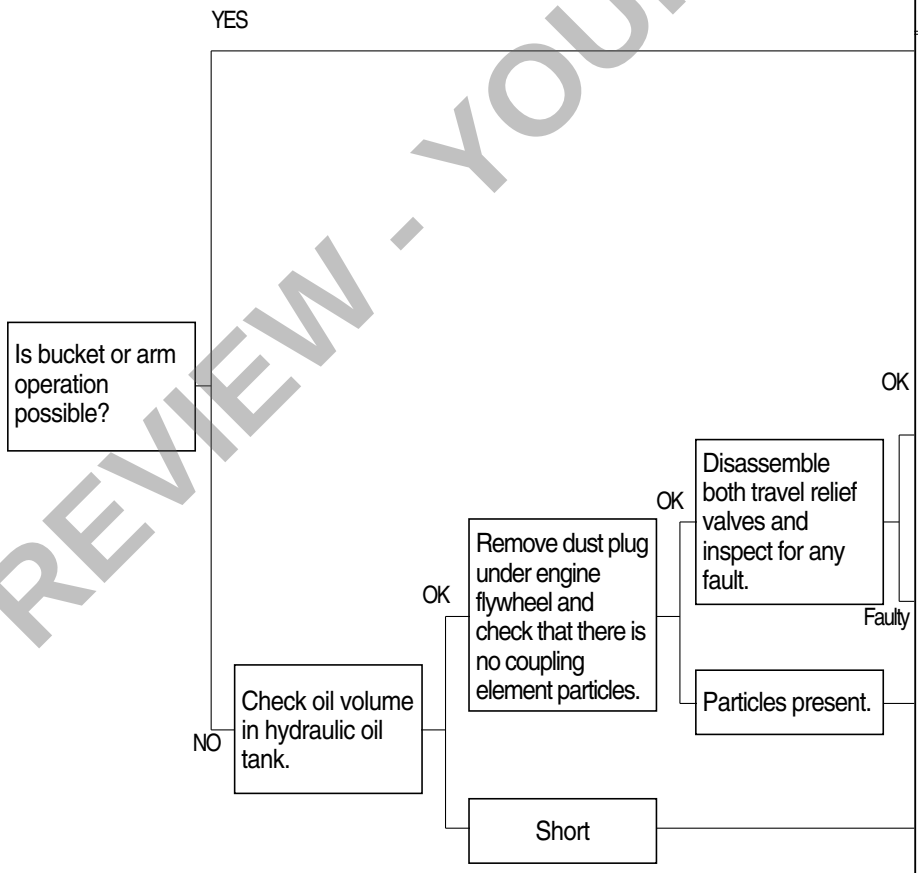
3) MACHINE DOES NOT STOP ON A SLOPE

Machine is pulled forward as sprocket rotates during digging operation.



Cause	Remedy
Friction plate is faulty.	Disassemble and repair.
Clogged	Disassemble and clean pilot piping.
Travel motor is defective.	Disassemble and repair.
Brake valve is faulty.	Disassemble and repair or replace.

4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



Cause	Remedy
	Inspect according to the procedure "Travel does not function at all on one side." However, a case where both LH and RH travel motions are disabled is extremelyseldom statistically.
Hydraulic pump is faulty.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Coupling at pump connection is broken.	Disassemble and repair.
	Replenish hydraulic oil.

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3) TRAVEL SPEED

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

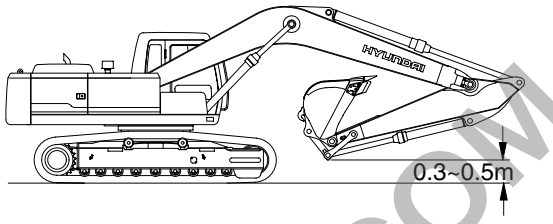
(2) Preparation

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±5℃.



290LC7MS01

(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, then select the following switch positions.

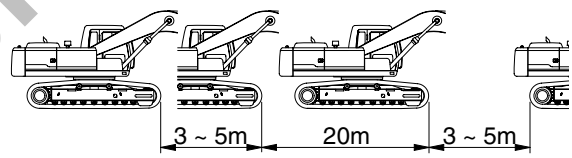
· Mode selector : H mode

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.



290LC7MS02

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard	Maximum allowable	Remarks
R450LC-7	1 Speed	22.5±2.0	28.0	
	2 Speed	13.6±1.0	17.0	

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2) PIPE AND HOSE

Thread size	Width across flat(mm)	kgf · m	lbf · ft
1/4"	19	3	21.7
3/8"	22	4	28.9
1/2"	27	5	36.2
3/4"	36	12	86.8
1"	41	14	101

3) 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	6	43.4
3/4"	36	13	94.0
1"	41	15	109

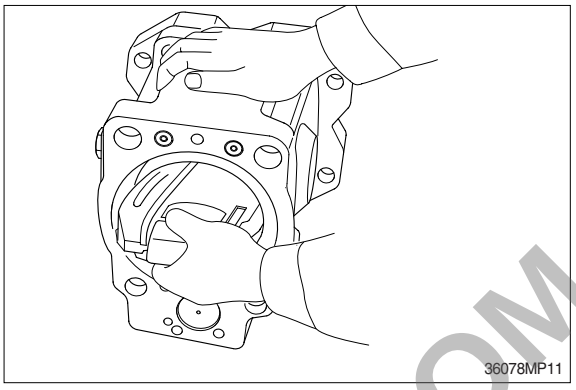
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(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin(531) and fit swash plate (212) to swash plate support(251) correctly.

※ Confirm with fingers of both hands that swash plate can be removed smoothly.

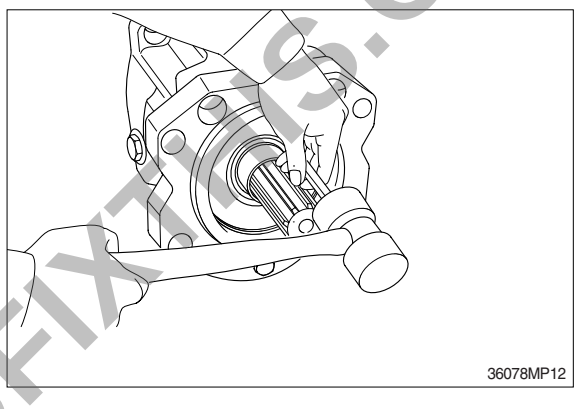
※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.



(4) To swash plate support(251), fit drive shaft(111) set with bearing(123), bearing spacer(127) and snap ring(824).

※ Do not tap drive shaft with hammer or so on.

※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.
Fit them fully, using steel bar or so on.

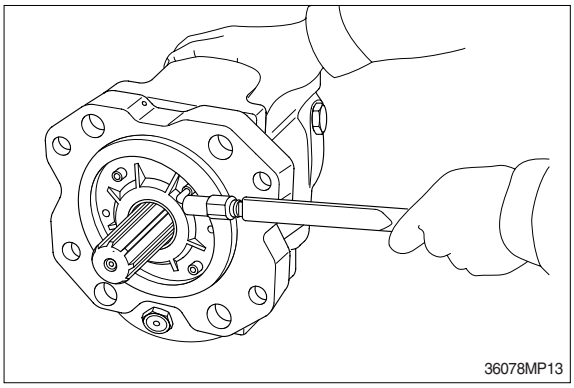


(5) Assemble seal cover(F, 261) to pump casing(271) and fix it with hexagon socket head bolts(406).

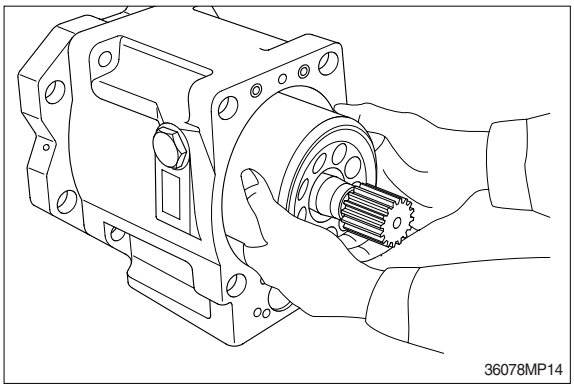
※ Apply grease lightly to oil seal in seal cover(F).

※ Assemble oil seal, taking full care not to damage it.

※ For tandem type pump, fit rear cover(263) and seal cover(262) similarly.



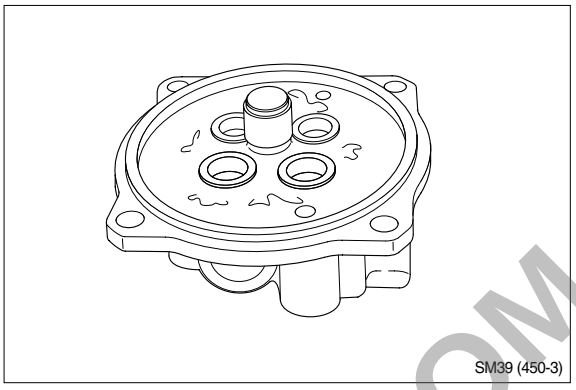
(6) Assemble piston cylinder subassembly 〔cylinder block(012), piston subassembly (151, 152), set plate(153), spherical bushing(156) and cylinder spring (157)〕.
Fit spline phases of retainer and cylinder.
Then, insert piston cylinder subassembly into pump casing(271).



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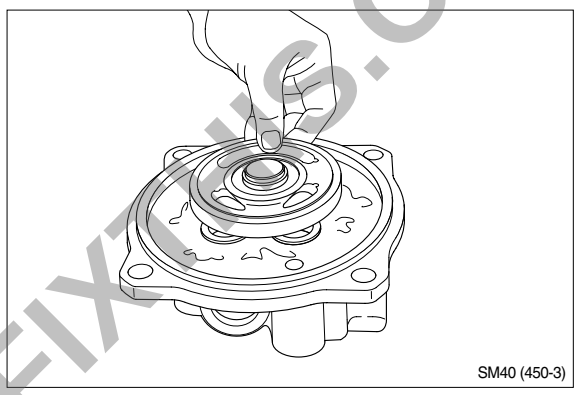
(12) Lubricate locating pin for antirotation of balance plate(22) of cover(34) with grease sufficiently and install locating pin to housing.


SM39 (450-3)

(13) Assembly of balance plate

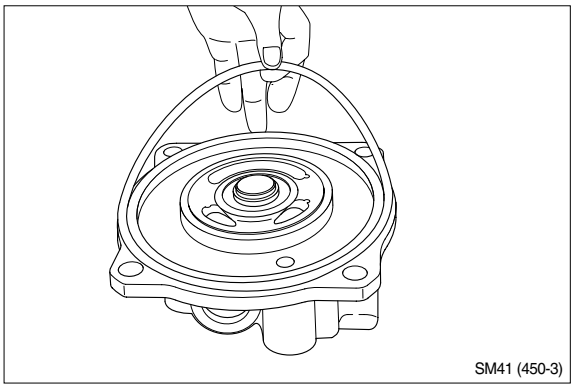
Assemble balance plate(22) to cover(34).

※ Be cautious of assembling direction.

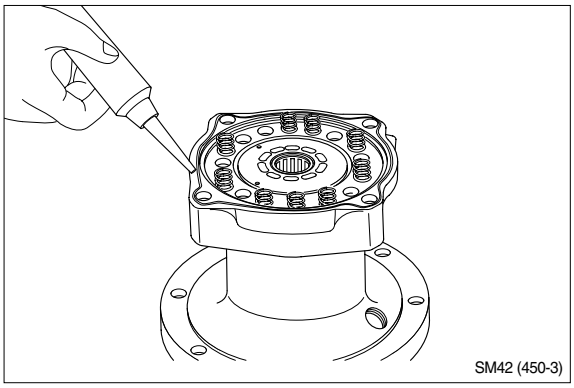

SM40 (450-3)

(14) Assemble O-ring(13) to cover(34).

※ Lubricate O-ring with grease.


SM41 (450-3)

(15) Apply three bond of white color to distinguish oil leakage from remaining oil in bolt hole(M16) of cover(34).


SM42 (450-3)

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3) DISASSEMBLY

(1) General precautions

① Before disassembling the motor, check the items to be inspected and, for remedy against trouble, closely examine the nature of the trouble, so that the motor can be disassembled effectively.

② To disassemble the motor, use the disassembling procedures described in section 2) and select a clean place.

③ Place a rubber or vinyl sheet or other such protective materials on your working bench to protect the surface of the motor to be serviced.

④ During disassembly, give a match mark to the mating surfaces of each part.

⑤ Arrange removed parts in order so that they will not become damaged or missing during disassembly.

⑥ Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

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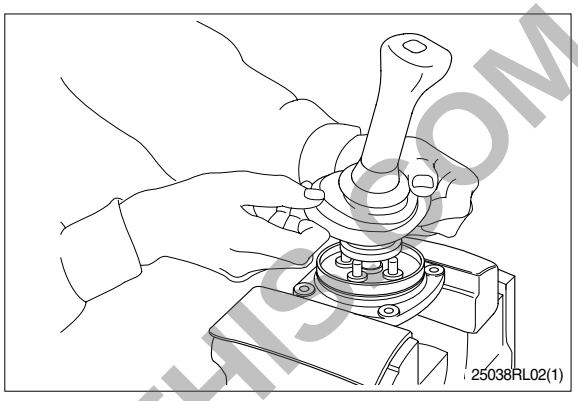
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

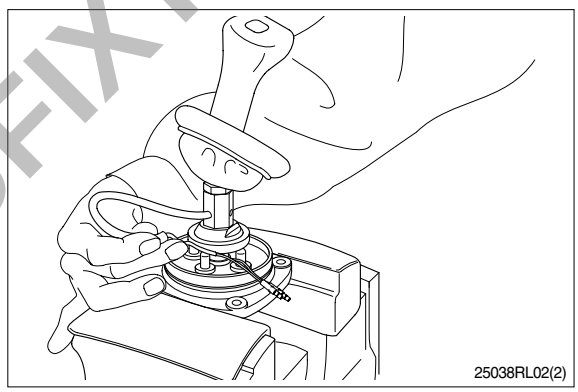
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper(or lead) sheets.

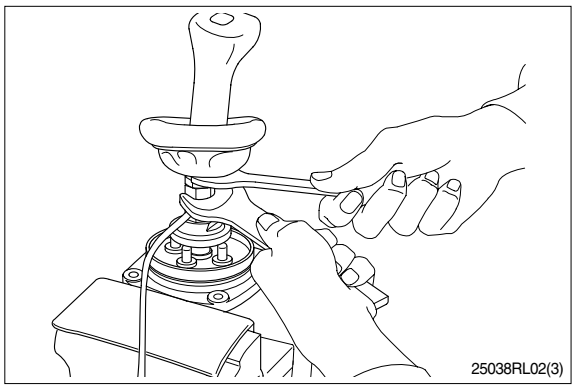
(3) Remove end of boot(25) from case(1) and take it out upwards.



※ For valve with switch, remove cord also through hole of casing.



(4) Loosen lock nut(20) and adjusting nut(19) with spanners on them respectively, and take out handle section as one body.



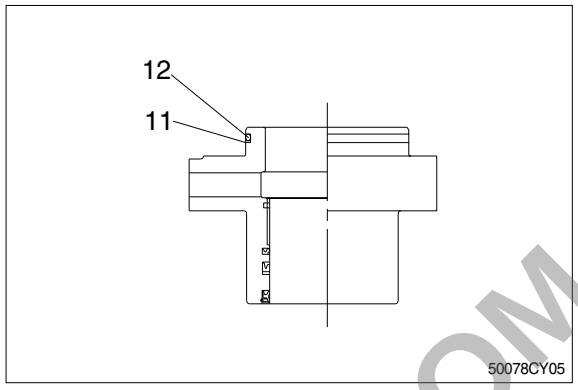
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⑤ Fit back up ring(12) to gland(3).

※ Put the backup ring in the warm water of 30~50℃.

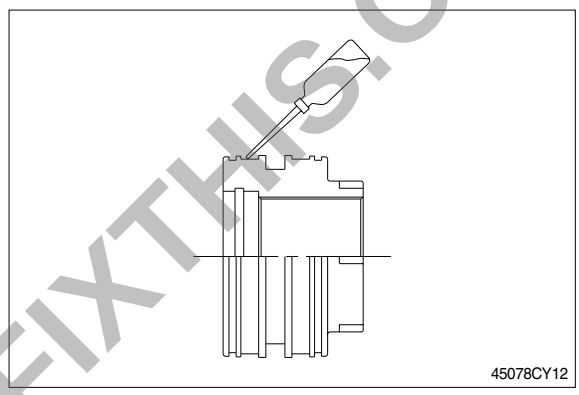
⑥ Fit O-ring(11) to gland(3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

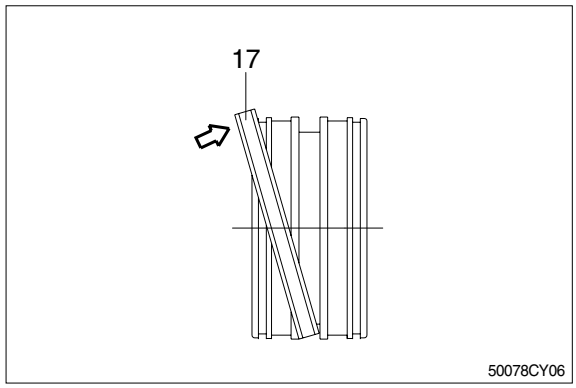
① Coat the outer face of piston(14) with hydraulic oil.



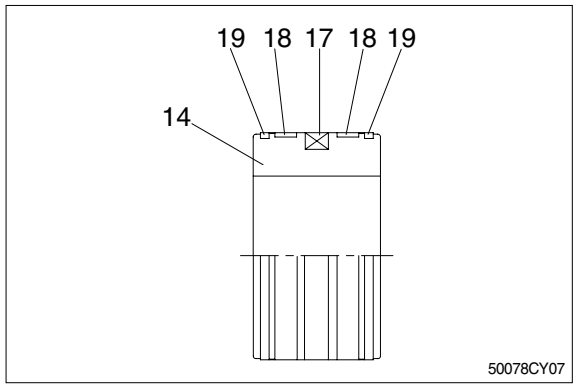
② Fit piston seal(17) to piston.

※ Put the piston seal in the warm water of 60~100℃ for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



③ Fit wear ring(18) and piston ring(19) to piston(14).



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