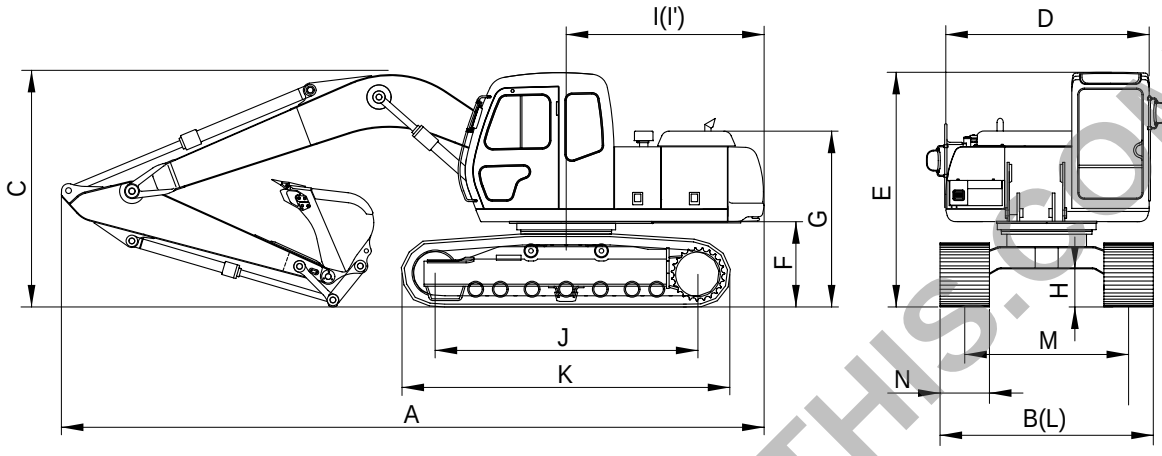
2. SPECIFICATION

1) ROBEX 160LC-3

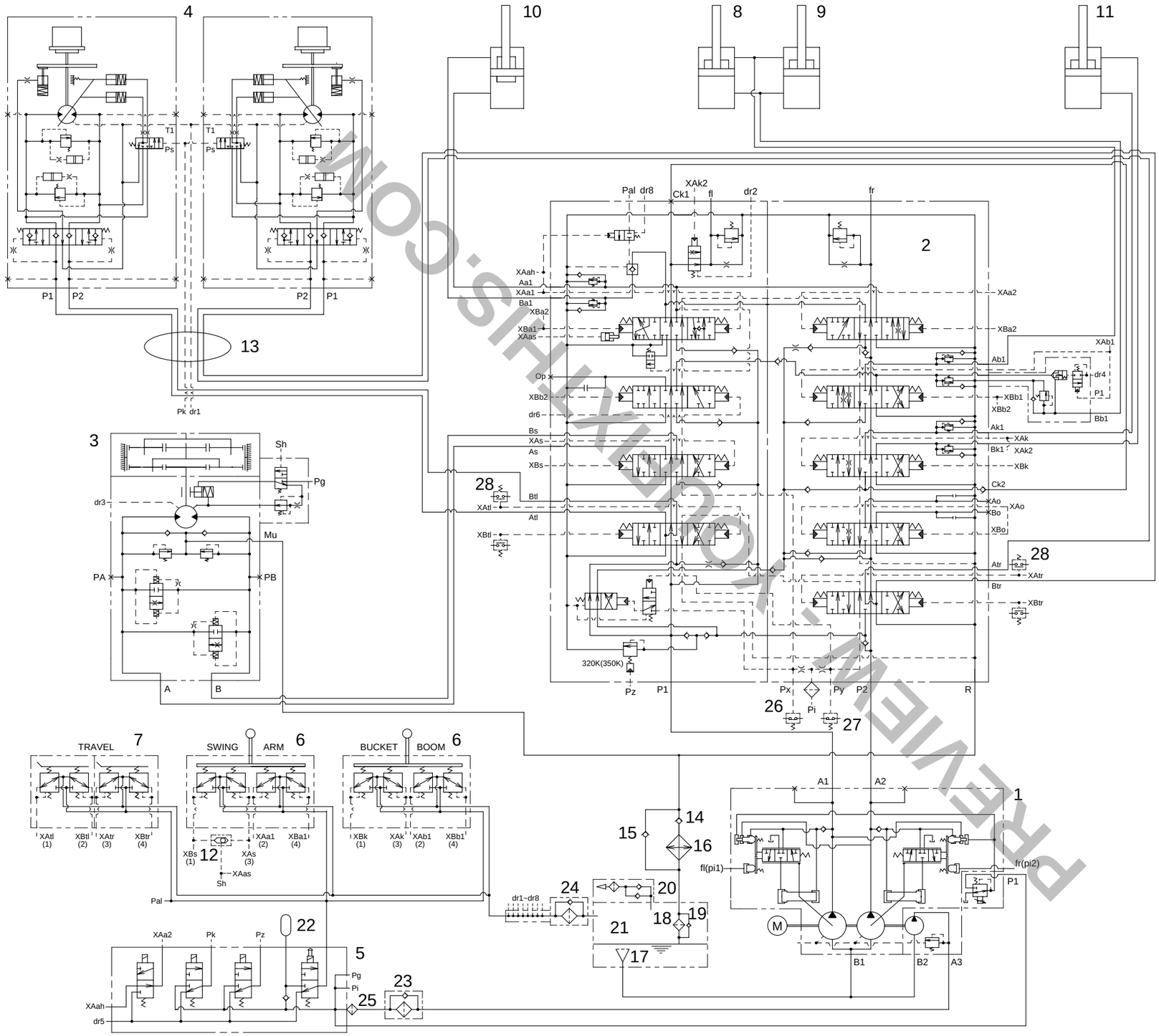


Description		Unit	Specification
Operating weight		kg(lb)	16600(36600)
Bucket capacity(PCSA heaped), standard		$m^3(yd^3)$	0.65(0.85)
Overall length	A	mm(ft-in)	8530(28' 0")
Overall width, with 600mm shoe	B		2590(8' 6")
Overall height	C		2870(9' 5")
Superstructure width	D		2470(8' 1")
Overall height of cab	E		2850(9' 4")
Ground clearance of counterweight	F		1035(3' 5")
Engine cover height	G		2135(7' 0")
Minimum ground clearance	H		460(1' 6")
Rear-end distance	I		2400(7'10")
Rear-end swing radius	I'		2490(8' 2")
Distance between tumblers	J		3190(10' 6")
Undercarriage length	K		3980(13' 1")
Undercarriage width	L		2590(8' 6")
Track gauge	M		1990(6' 6")
Track shoe width, standard	N		600(24")
Travel speed(Low/high)		km/hr(mph)	3.5/5.5(2.2/3.4)
Swing speed		rpm	12.1
Gradeability		Degree(%)	35(70)
Ground pressure(600mm shoe)		$kg/cm^2(psi)$	0.40(5.69)

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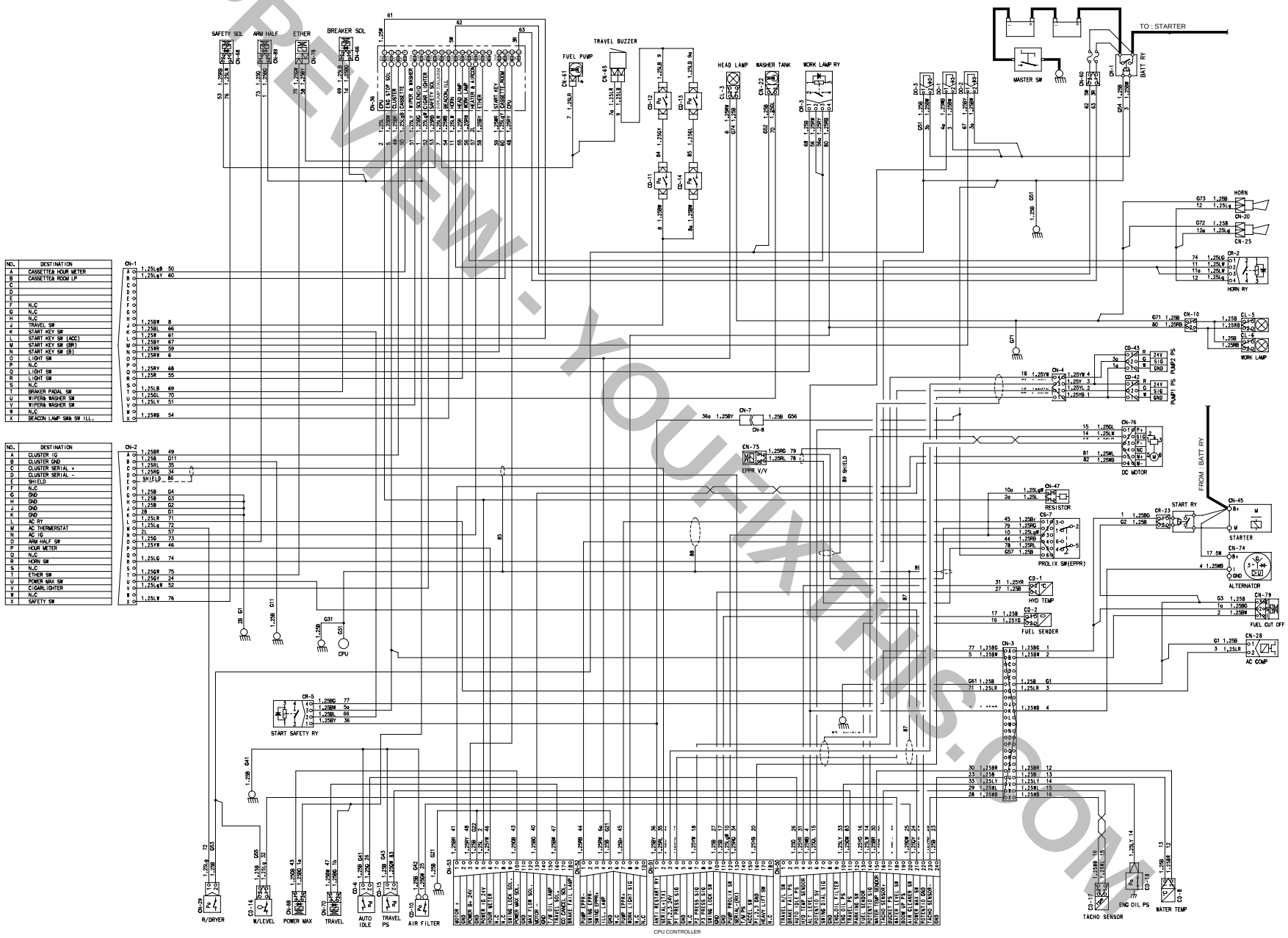
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GROUP 1 HYDRAULIC CIRCUIT



1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 Solenoid valve
6 RCV lever
7 RCV pedal
8 Boom cylinder(RH)
9 Boom cylinder(LH)
10 Arm cylinder
11 Bucket cylinder
12 Shuttle valve
13 Turning joint
14 Check valve
15 Check valve
16 Oil cooler
17 Strainer
18 Return filter
19 Bypass valve
20 Air breather
21 Hydraulic tank
22 Accumulator
23 Line filter
24 Spin filter
25 Last guard filter
26 Last guard filter
27 Pressure switch
28 Pressure switch

MOD'sHEXENOL
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NO.	DESTINATION
A	CASSETTE& HOUR METER
B	CASSETTE& ROOM LP
C	
D	
E	
F	N.C
G	N.C
H	N.C
J	TRAVEL SW
K	START KEY SW
L	START KEY SW (ACC)
M	START KEY SW (BR)
N	START KEY SW (B)
O	LIGHT SW
P	N.C
Q	LIGHT SW
R	LIGHT SW
S	N.C
T	BRAKER PADAL SW
U	WIPER& WASHER SW
V	WIPER& WASHER SW
W	N.C
X	BEACON LAMP SW& SW ILL.

NO.	DESTINATION
A	CLUSTER IG
B	CLUSTER GND
C	CLUSTER SERIAL +
D	CLUSTER SERIAL -
E	SHIELD
F	N.C
G	GND
H	GND
J	GND
K	GND
L	AC RY
M	AC THERMERSTAT
N	AC IG
O	ARM HALF SW
P	HOUR METER
Q	N.C
R	HORN SW
S	N.C
T	ETHER SW
U	POWER MAX SW
V	CIGARLIGHTER
W	N.C
X	SAFETY SW

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1. REMOVAL AND INSTALL

1) REMOVAL

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

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

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

- Hydraulic oil quantity : 210 ℓ

(5) Remove socket bolts(10) and disconnect pipe(1, 2).

(6) Disconnect pilot line hoses(4, 5, 6, 7, 8, 9).

(7) Remove socket bolts(11) and disconnect pump suction tube (3).

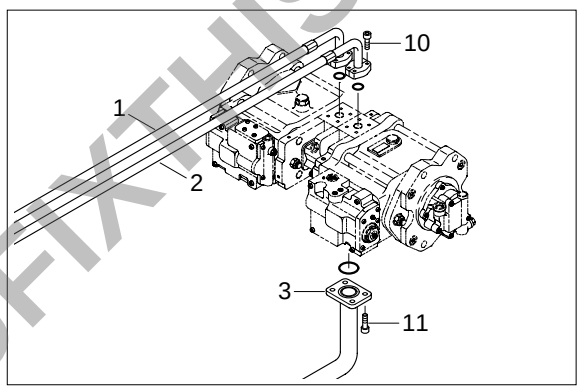
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

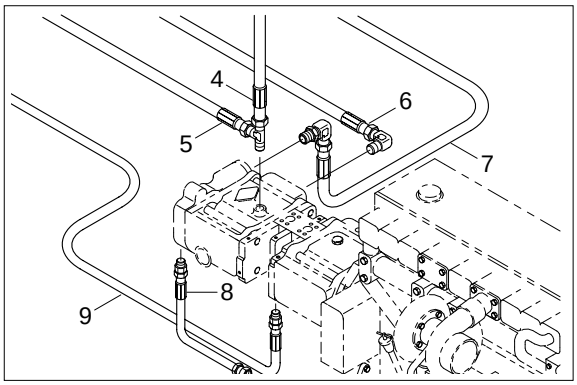
(8) Sling the pump assembly and remove the pump mounting bolts.

- Weight : 125kg(276lb)

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







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5. ERROR CODES TABLE

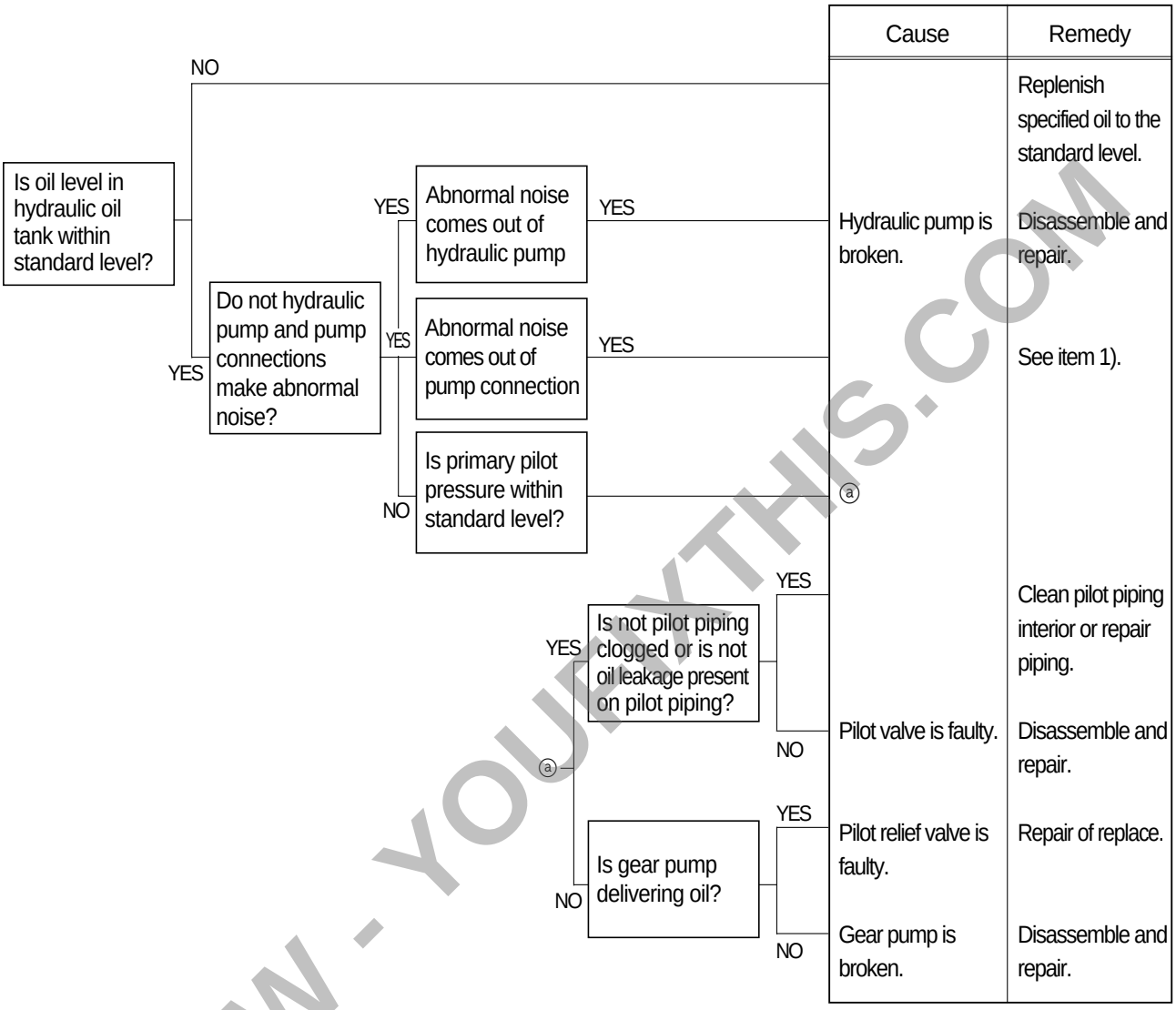
Display		Problems
Current error	Recorded error	
Err : 00	TIME Err : 00	No problem
Err : 01	TIME Err : 01	Short circuit in accel actuator 2 lines
Err : 02	TIME Err : 02	Potentiometer is shorted to Vcc(5V) or battery(+)
Err : 03	TIME Err : 03	Short circuit in pump EPPR valve 2 lines
Err : 04	TIME Err : 04	Short circuit in swing EPPR valve 2 lines
Err : 05	TIME Err : 05	Short circuit in travel solenoid 2 lines
Err : 06	TIME Err : 06	Short circuit in power max solenoid 2 lines
Err : 07	TIME Err : 07	Short circuit in max flow solenoid 2 lines
Err : 08	TIME Err : 08	Short circuit in cut off cancel solenoid 2 lines
Err : 09	TIME Err : 09	Short circuit in swing lock solenoid 2 lines
Err : 10	TIME Err : 10	Short circuit in hourmeter 2 lines
Err : 12	TIME Err : 12	P1 pressure sensor is shorted to battery(+)
Err : 13	TIME Err : 13	P2 pressure sensor is shorted to battery(+)
Err : 14	TIME Err : 14	P3 pressure sensor is shorted to battery(+)
Err : 16	TIME Err : 16	Accel actuator circuit is open or shorted to ground
Err : 17	TIME Err : 17	Potentiometer circuit is open or shorted to ground
Err : 18	TIME Err : 18	Pump EPPR valve circuit is open or shorted to ground
Err : 19	TIME Err : 19	Swing EPPR valve circuit is open or shorted to ground
Err : 20	TIME Err : 20	Travel solenoid circuit is open or shorted to ground
Err : 21	TIME Err : 21	Power max solenoid circuit is open or shorted to ground
Err : 22	TIME Err : 22	Max flow solenoid circuit is open or shorted to ground
Err : 23	TIME Err : 23	Cut off cancel solenoid circuit is open or shorted to ground
Err : 24	TIME Err : 24	Swing lock solenoid circuit is open or shorted to ground
Err : 25	TIME Err : 25	Hourmeter circuit is open or shorted to ground
Err : 26	TIME Err : 26	Swing speed dial circuit is open or shorted to ground
Err : 27	TIME Err : 27	P1 pressure sensor circuit is open or shorted to ground
Err : 28	TIME Err : 28	P2 pressure sensor circuit is open or shorted to ground
Err : 29	TIME Err : 29	P3 pressure sensor circuit is open or shorted to ground
Err : 32	TIME Err : 32	Battery power input circuit is open
Err : 33	TIME Err : 33	No alternator voltage input
Err : 34	TIME Err : 34	Controller input voltage is less than 18V
Err : 35	TIME Err : 35	Controller input voltage is greater than 38V
-	TIME Err : 36	Error in data receiving from cluster
Err : 37	TIME Err : 37	Engine speed sensor circuit is open or shorted to ground or sensor signal is less than 1V
Err : 38	TIME Err : 38	Anti-restart relay circuit is open or shorted to ground
Err : 39	TIME Err : 39	Accel actuator does not stop at a target position
Err : 40	TIME Err : 40	There is more than 500rpm difference between target speed and actual speed
Err : 41	TIME Err : 41	Hydraulic oil temperature sensor circuit is shorted to ground
Err : 42	TIME Err : 42	Fuel level sensor circuit is shorted to ground
Err : 43	TIME Err : 43	Coolant temperature sensor circuit is shorted to ground
Err : 45	TIME Err : 45	Hydraulic oil temperature sensor circuit is open or shorted to battery(+)
Err : 46	TIME Err : 46	Fuel level sensor circuit is open or shorted to battery(+)
Err : 47	TIME Err : 47	Coolant temperature sensor circuit is open or shorted to battery(+)

※ Every machine may not have all of the above error codes. For example, machines not equipped pressure sensors will not have the error codes 12, 13, 14, 27, 28, 29.

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2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



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Millimeters to inches

1mm = 0.03937in

	0	1	2	3	4	5	6	7	8	9
0		0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

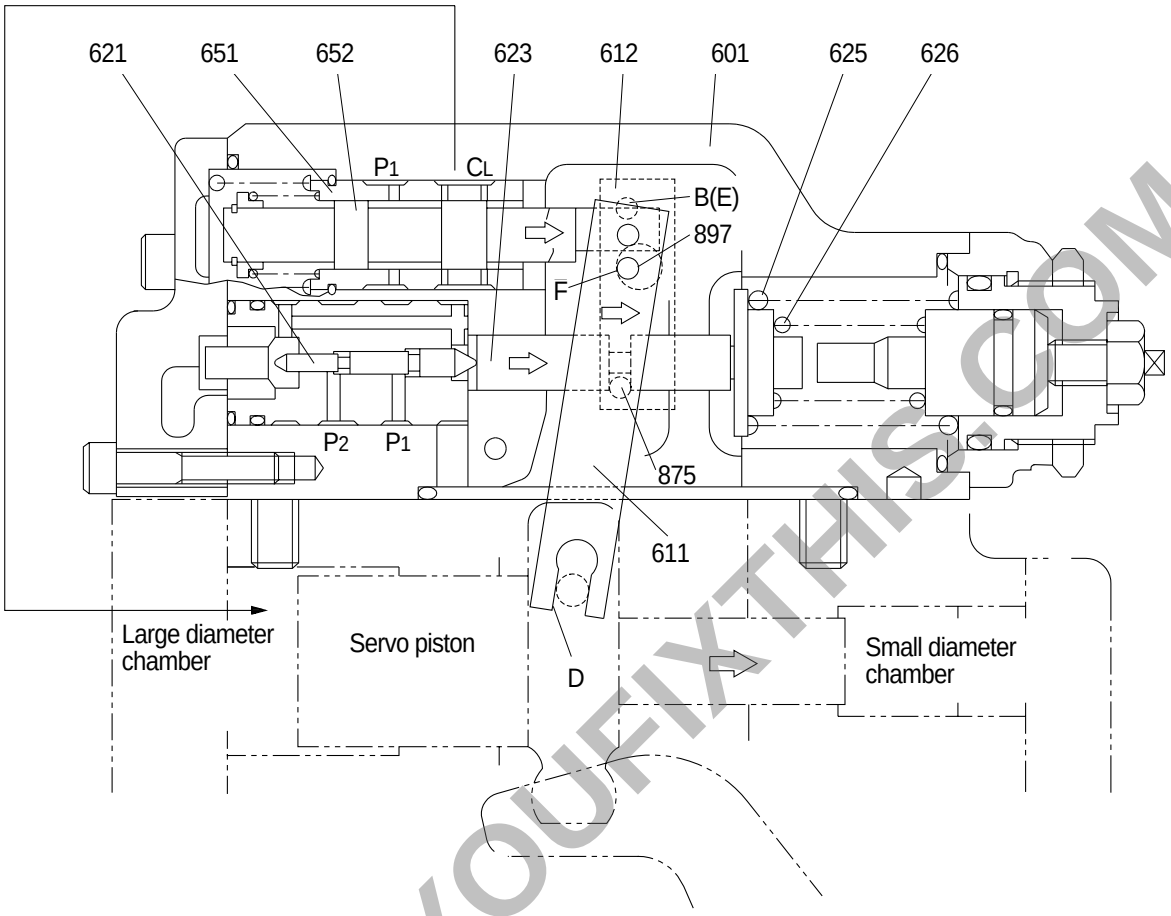
1kg = 2.2046lb

	0	1	2	3	4	5	6	7	8	9
0		2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.5.	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

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① Overload preventive function



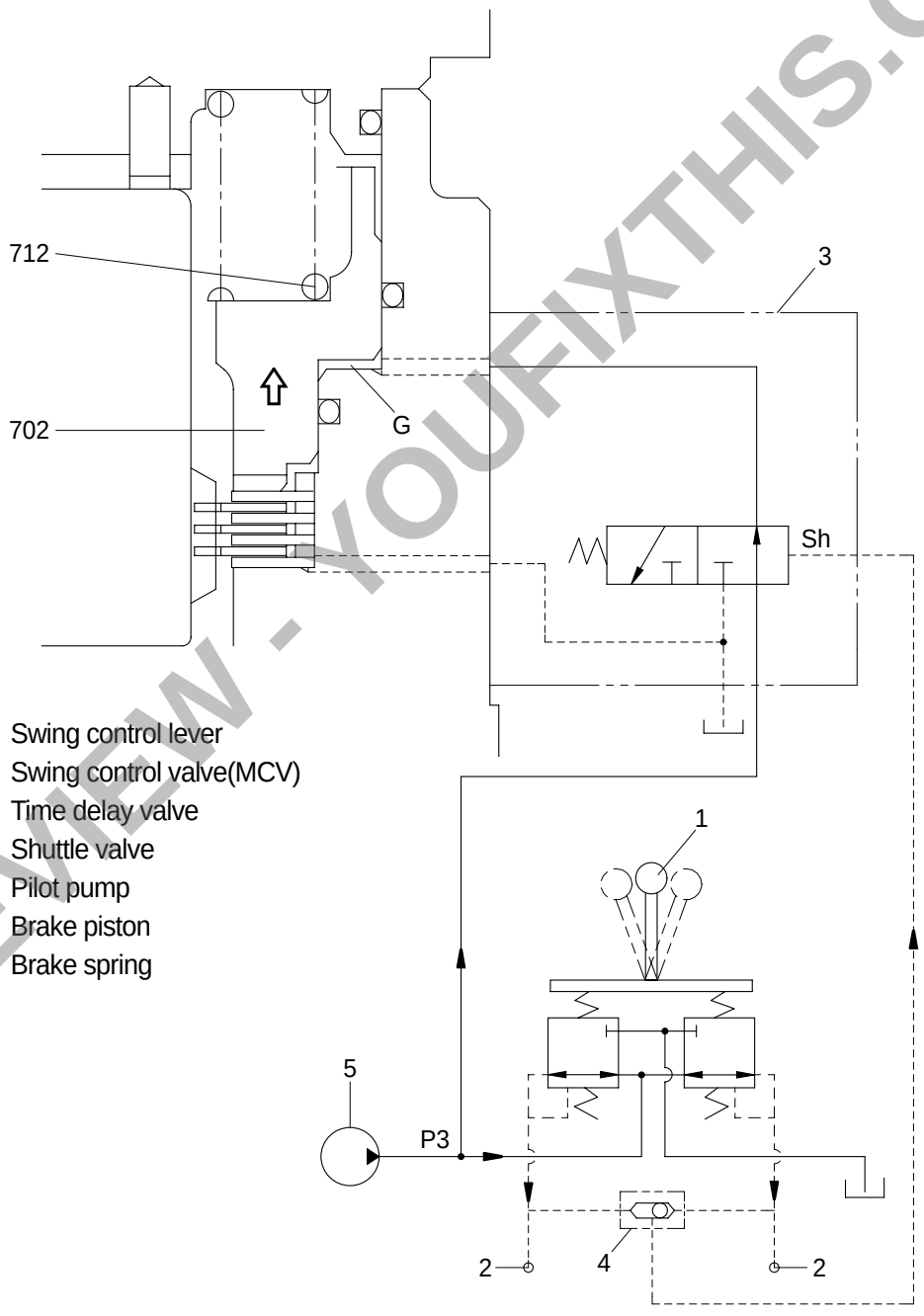
When the self pump delivery pressure P1 or the companion pump delivery pressure P2 rises, it acts on the stepped part of the compensating piston(621). It presses the compensating rod(623) to the right till the force of the outer spring(625) and inner spring(626) balances with the hydraulic force. The movement of the compensating rod is transmitted to lever 1(612) via pin(875).
Lever 1 rotates around the pin(875) (E) fixed to the casing(601).
Since the large hole section(F) of lever 1 contains a protruding pin(897) fixed to the feedback lever(611), the feedback lever rotates around the fulcrum of point D as lever 1 rotates, and then the spool(652) is shifted to the right. As the spool moves, the delivery pressure P1 is admitted to the large diameter section of the servo piston via port CL, causes the servo piston move to the right, reduces the pump delivery, flow rate, and prevents the prime mover from being overloaded.
The movement of the servo piston is transmitted to the feedback lever via point D. Then the feedback lever rotates around the fulcrum of point F and the spool is shifted to the left. The spool moves till the opening between the spool(652) and sleeve(651) is closed.

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② Operating principle

a. When the swing control lever(1) is set to the swing position, the pilot oil go to the swing control valve(2) and to Sh of the time delay valve(3) via the shuttle valve(4), this pressure shift time delay vlave so, pilot pump charged oil(P_3) go to the chamber G.
This pressure is applied to move the piston(702) to the upward against the force of the spring(712) thus releasing the brake force.

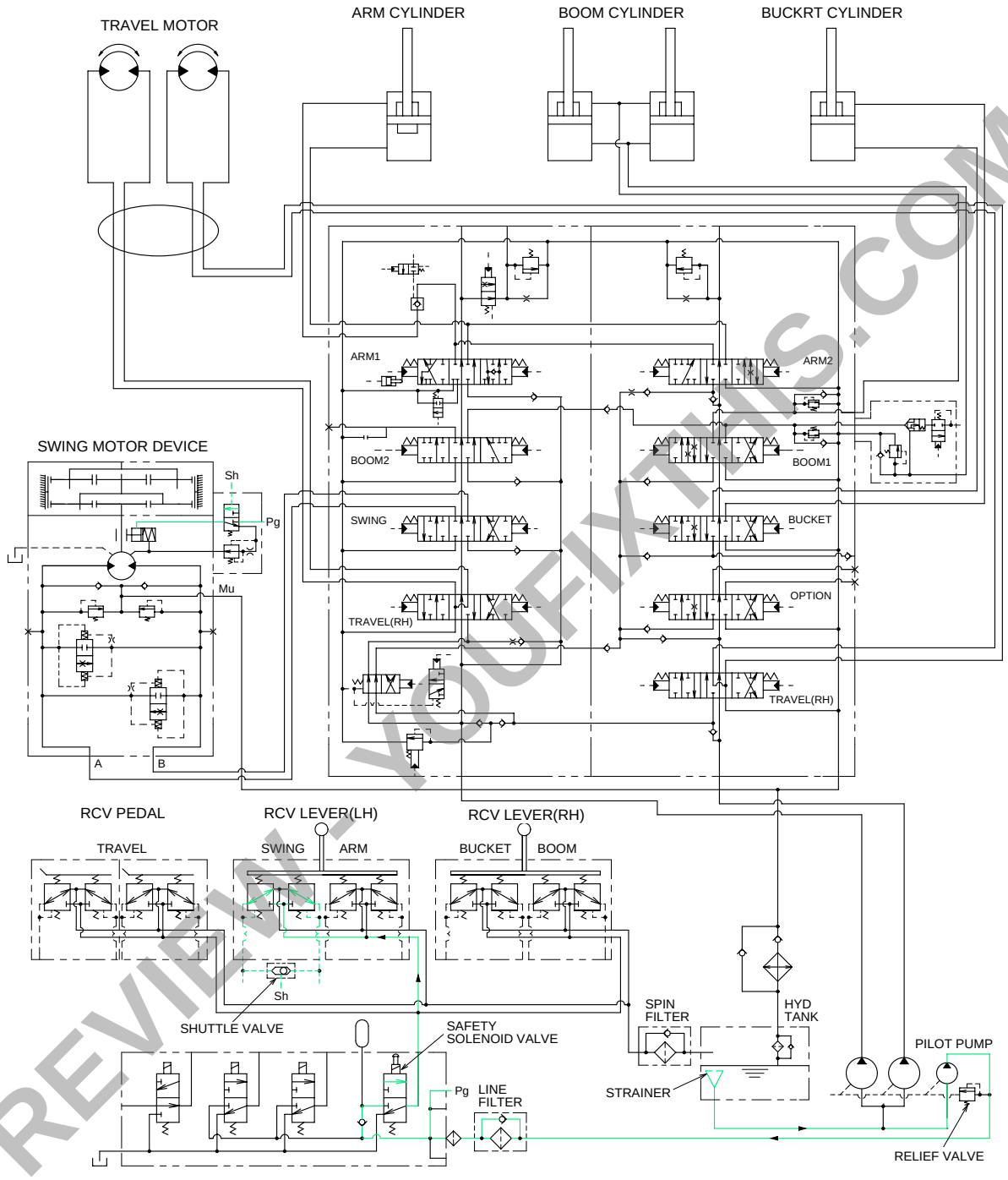


1 Swing control lever
2 Swing control valve(MCV)
3 Time delay valve
4 Shuttle valve
5 Pilot pump
702 Brake piston
712 Brake spring

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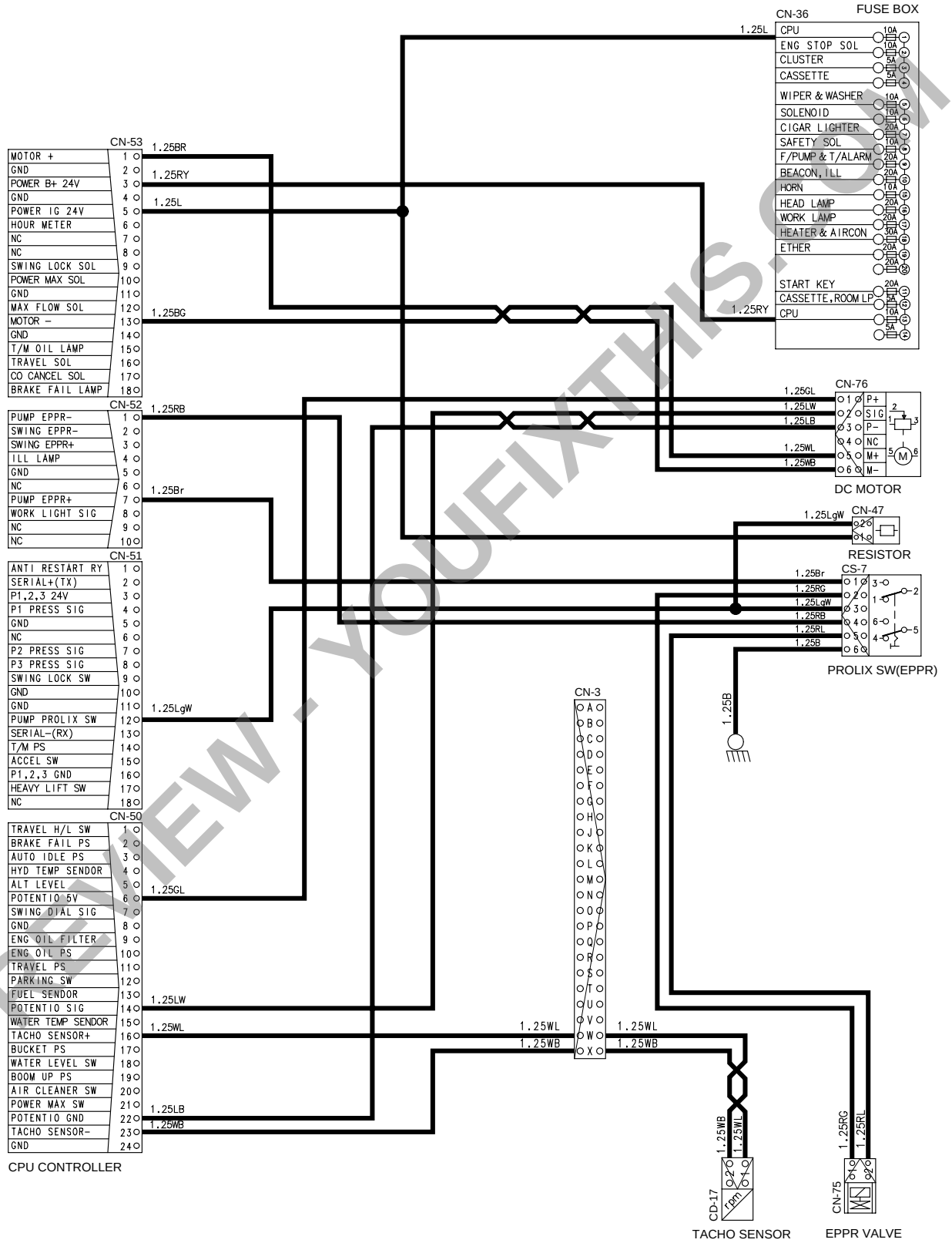
4. SWING PARKING BRAKE RELEASE



When the swing control lever is operated, the pilot oil flows to Sh port of shuttle valve, this pressure move spool so, discharged oil from pilot pump flows to Pg port.
This pressure is applied to swing motor disc cylinder, thus the brake released.
When the swing control lever is set neutral position, oil in the swing motor disc cylinder is drain, thus the brake is applied.

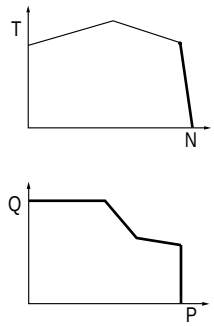
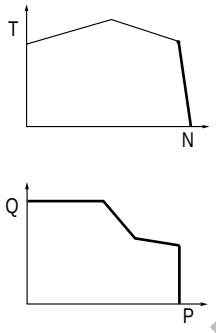
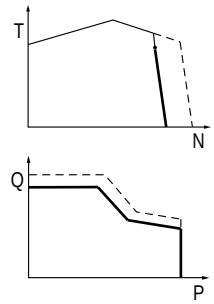
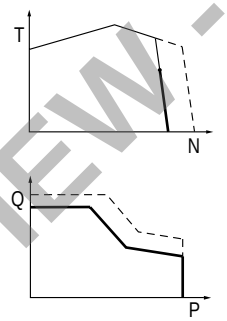
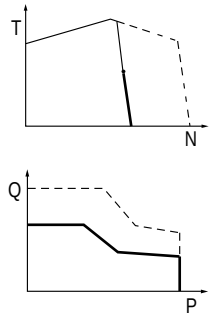
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CONTROLLER CIRCUIT



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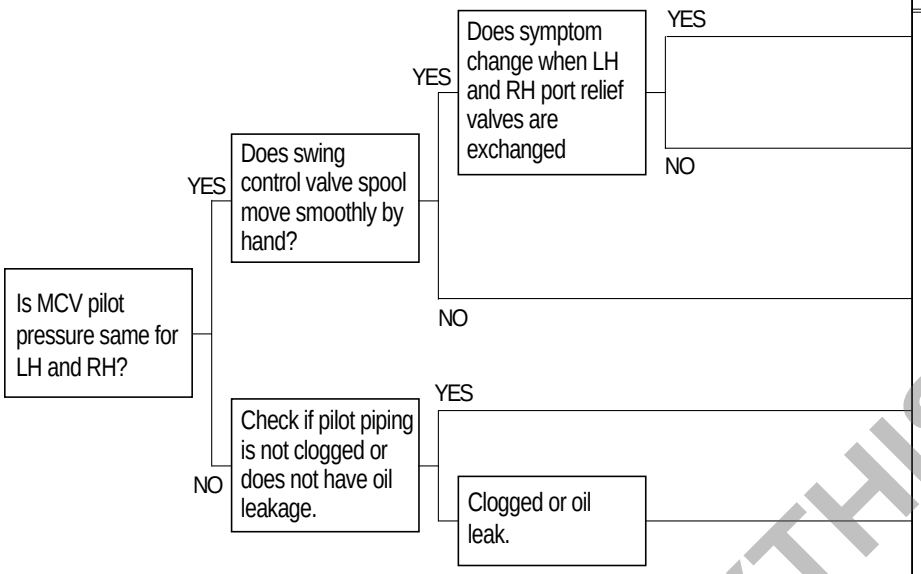
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Mode	Power boost switch OFF		Power boost switch ON		Other functions	
	Power set	Level of achievement	Power set	Level of achievement	Auto decel	Overheat prevention
H	100HP/ 2200rpm	· Full power used by engine speed sensing. 	161HP/ 2200rpm	· Full power used by engine speed sensing. · Power increased by power boost solenoid valve. 	ON /OFF	ON
S	85HP/ 2000rpm	· Fuel consumption improved by partial use of engine power. 			ON / OFF	ON
L	70HP/ 2000rpm	· Slow and precise machine operation. 		←	ON / OFF	ON
F	50HP/ 1500rpm	· Increase of fine control range. · High improvement in fuel consumption by lowering engine speed. 		←	ON / OFF	ON

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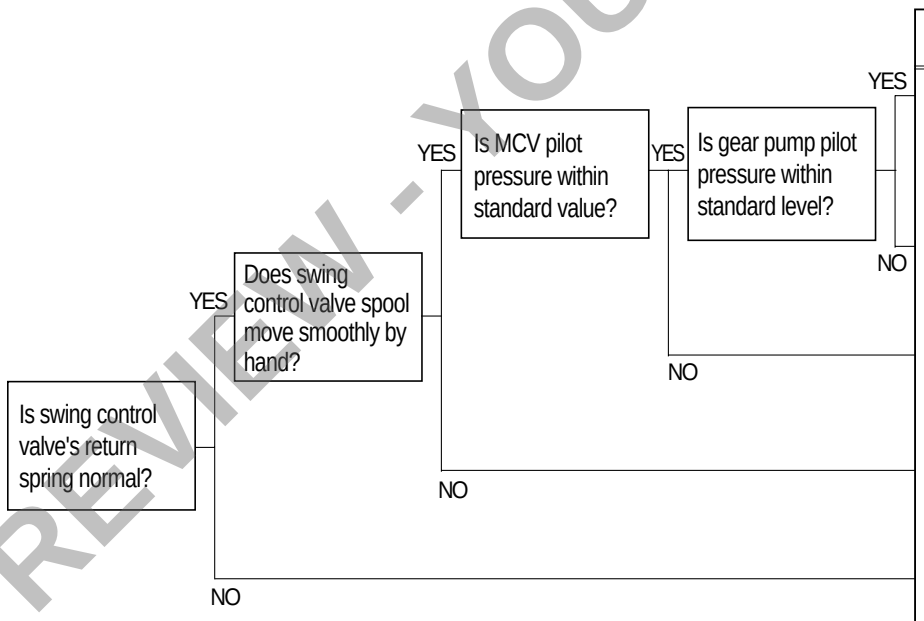
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3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



Cause	Remedy
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Return spring is faulty.	Disassemble and replace.

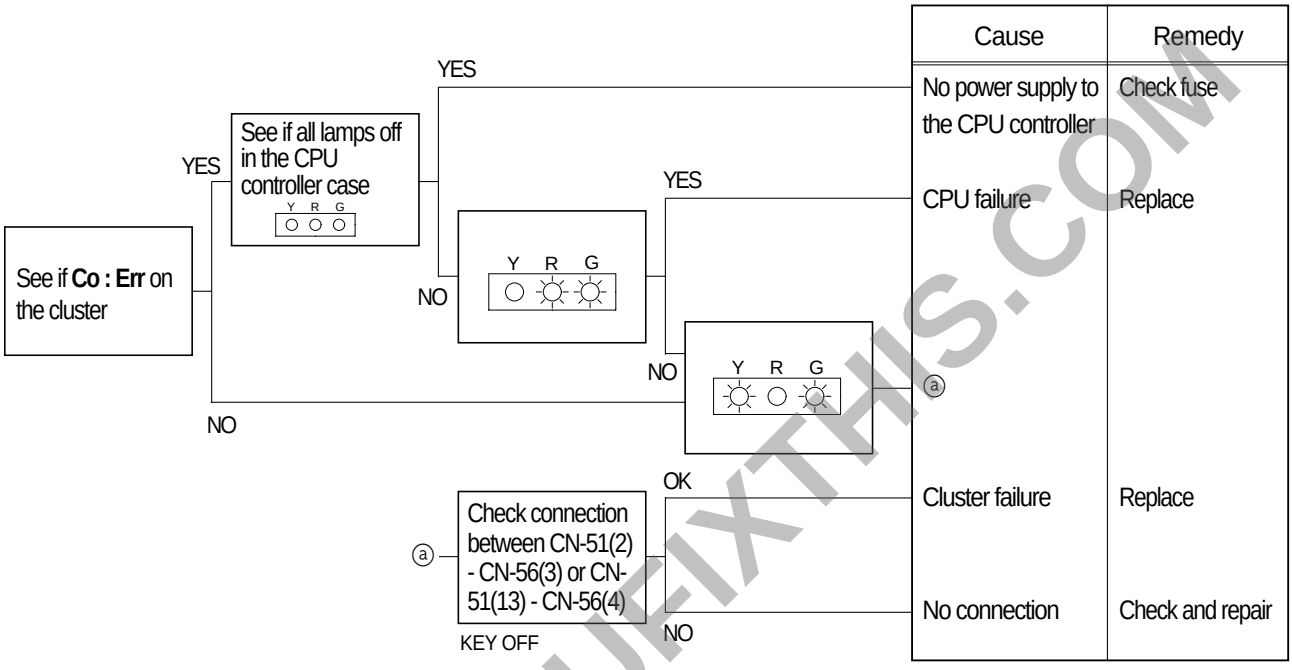
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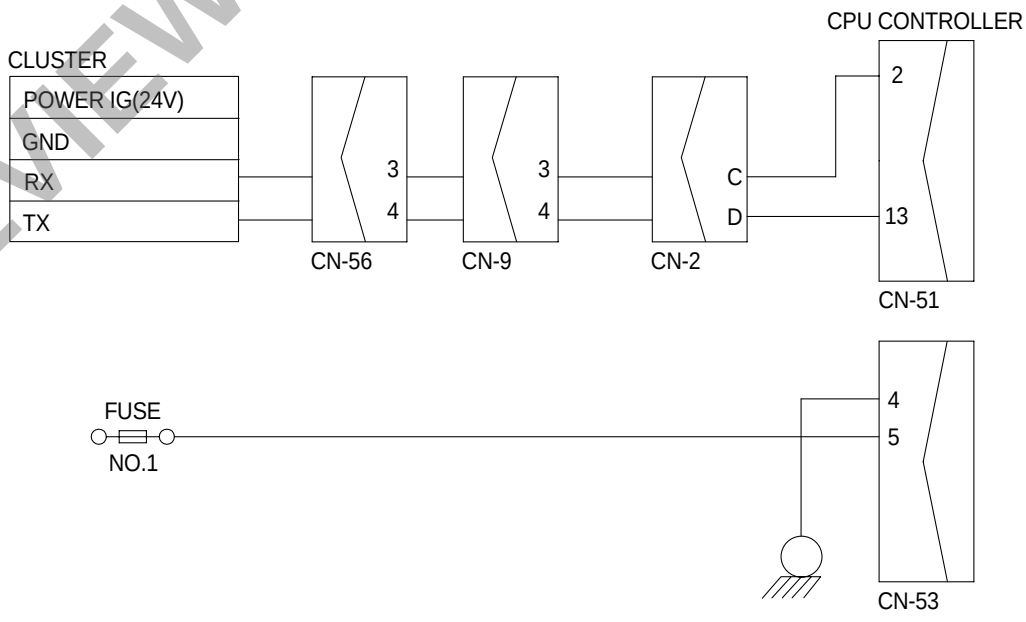
4. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

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

1) INSPECTION PROCEDURE



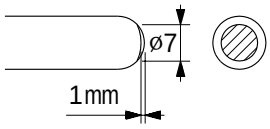
Wiring diagram



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6. RCV PEDAL

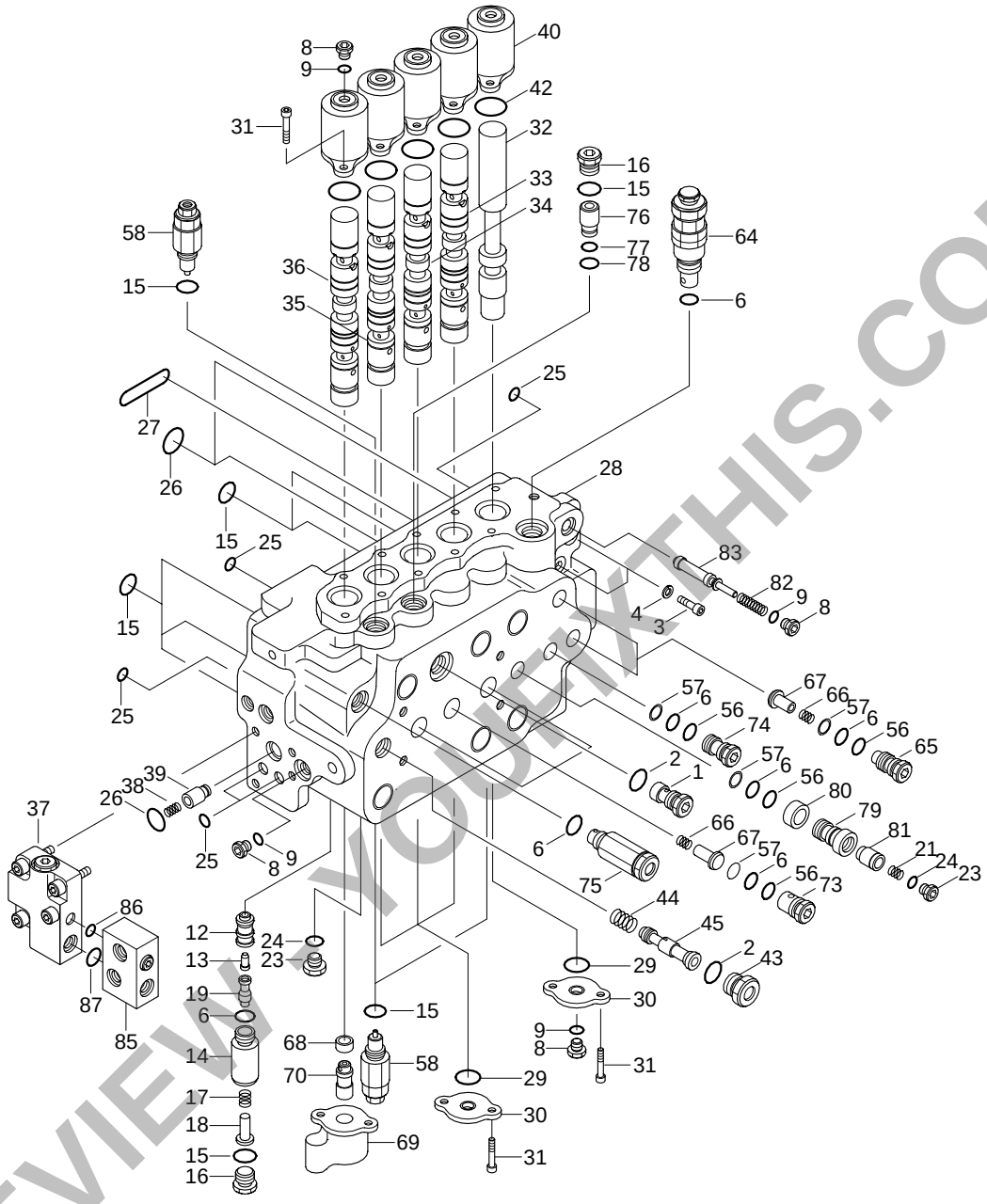
Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage effect to the system. For example, the primary pressure drop.	Conditions : Primary pressure : 30kgf/cm^2 Oil viscosity : 23cSt
Spool	This is to be replaced when the sliding surface has worn more than 10μm, compared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

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

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2. STRUCTURE(1/2)



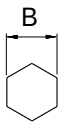
1	Cap	14	Cap	27	O-ring
2	O-ring	15	O-ring	28	Housing
3	Socket bolt	16	Cap	29	O-ring
4	Spring washer	17	Spring	30	Retainer
5	Overload assy	18	Spring guide	31	Socket bolt
6	O-ring	19	Spring guide	32	Plunger assy(TS)
7	Orifice	20	Cap	33	Plunger assy(TL, TR)
8	Cap	21	Spring	34	Plunger assy(SW)
9	O-ring	22	Check	35	Plunger assy(BM2)
10	Cover	23	Cap	36	Plunger assy(AM1)
11	Socket bolt	24	O-ring	37	Cover assy
12	Sleeve	25	O-ring		
13	Check	26	O-ring		

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2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	2.5	
	4	
	6	
	8	
	14	
Socket for socket wrench	27	
Spanner	27	
Torque wrench	Capable of tightening with the specified torques	
Pliers	-	
(-) Driver	6 × 100	
Hammer	Steel and plastic	
Eye bolt	M10, M16	

(2) Tightening torque

Part name	Item	Size	Torque		Wrench size	
			kgf · m	lbf · ft	in	mm
Plug	5	M20 × 1.5	10~12	72.3~86.8	0.75	19
Socket head bolt	9	M10 × 1.5	5.5~6.5	39.8~47.0	0.31	8
Relief valve	16	1 5/16	36~40	260~289	1.06	27
Plug	33, 80	NPT 1/16	0.9~1.1	6.5~8.0	0.16	4
Plug	36	PF 3/8	6.7~7.3	48.5~52.8	0.31	8
Orifice	38, 39, 43	M5 × 0.8	0.2~0.3	1.4~2.2	0.10	2.5
Socket head bolt	66	M16 × 2.0	28~32	203~232	0.55	14
Plug	81	PT 1/4	1.5~2.0	10.8~14.4	0.24	6

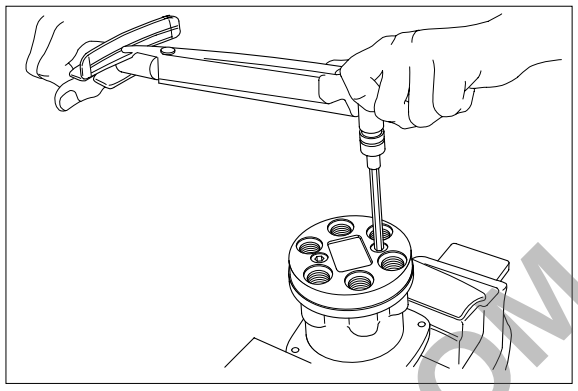
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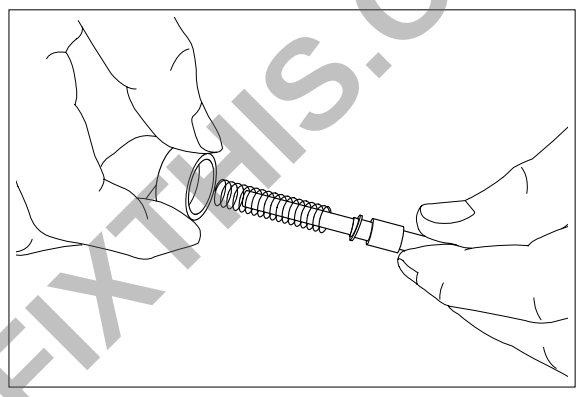
4) ASSEMBLY

(1) Tighten hexagon socket head plug(2) to the specified torque.

※ Tighten two bolts alternately and slowly.

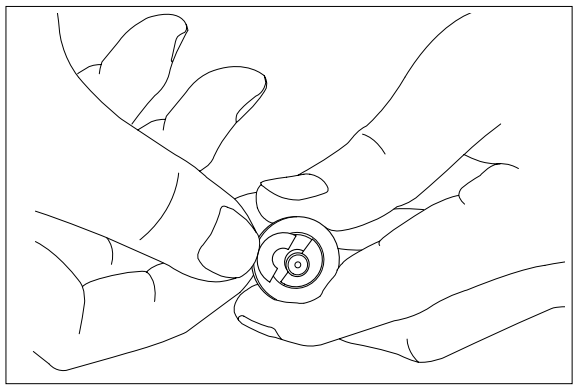


(2) Put shim(6), springs(7, 30) and spring seat(8, 31) onto spool(5) in this order.



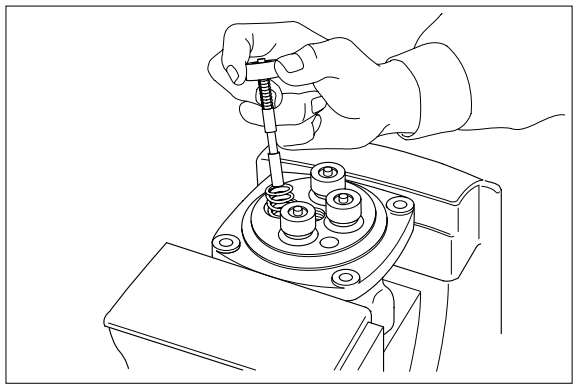
(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper(9) on spring seat without piling them on.

※ Assemble stopper(9) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6mm.



(4) Assemble spring(10) into casing.
Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



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