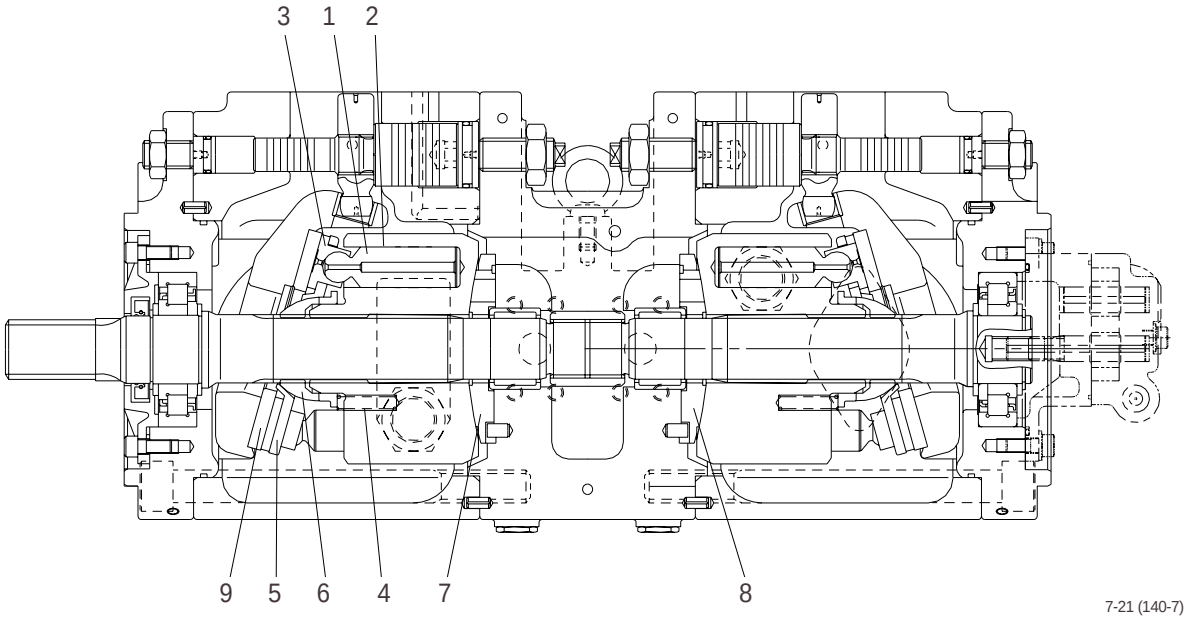
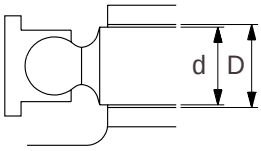
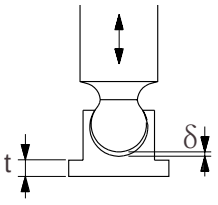
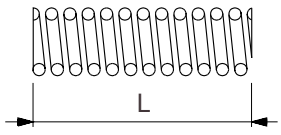
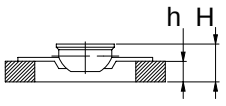
CONTENTS

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP



7-21 (140-7)

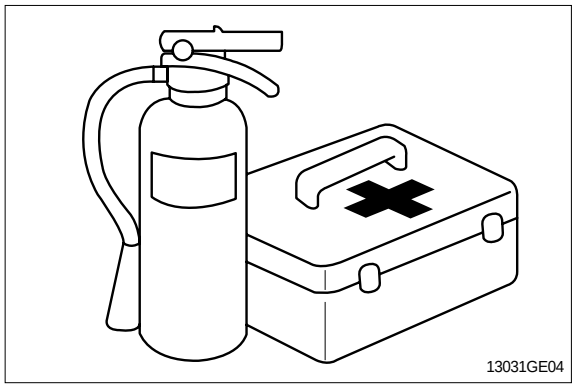
Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston(1) & cylinder bore(2) (D-d)		0.028	0.056	Replace piston or cylinder.
Play between piston(1) & shoe caulking section(3) (δ)		0-0.1	0.3	Replace assembly of piston & shoe.
Thickness of shoe (t)		3.9	3.7	
Free height of cylinder spring(4) (L)		31.3	30.5	Replace cylinder spring.
Combined height of set plate(5) & spherical bushing(6) (H-h)		19.0	18.3	Replace retainer or set plate.
Surface roughness for valve plate(Sliding face)(7,8), swash plate (shoe plate area)(9), & cylinder(2)(Sliding face)	Surface roughness necessary to be corrected	3z		Lapping
	Standard surface roughness (Corrected value)	0.4z or lower		

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

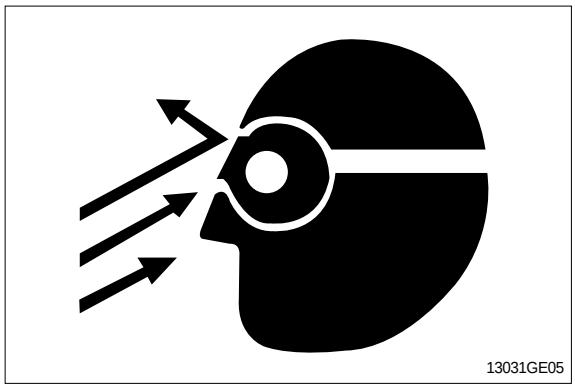
Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



PROTECT AGAINST FLYING DEBRIS

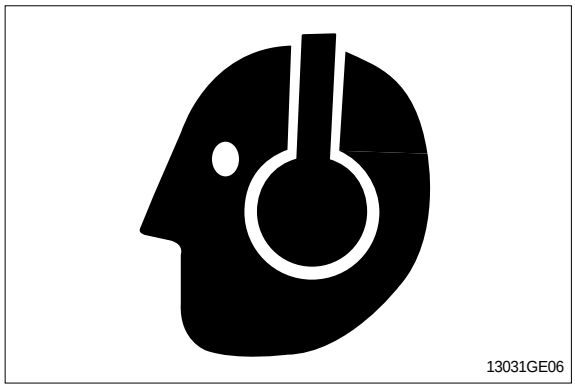
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing.

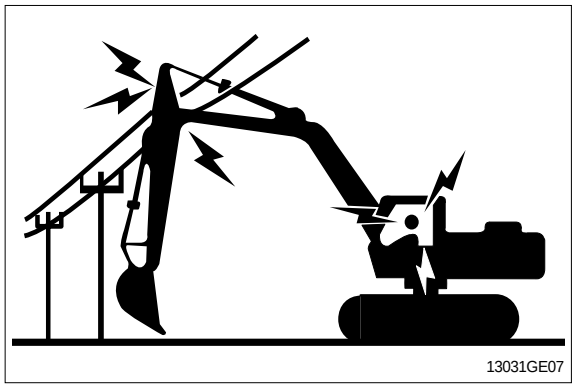
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



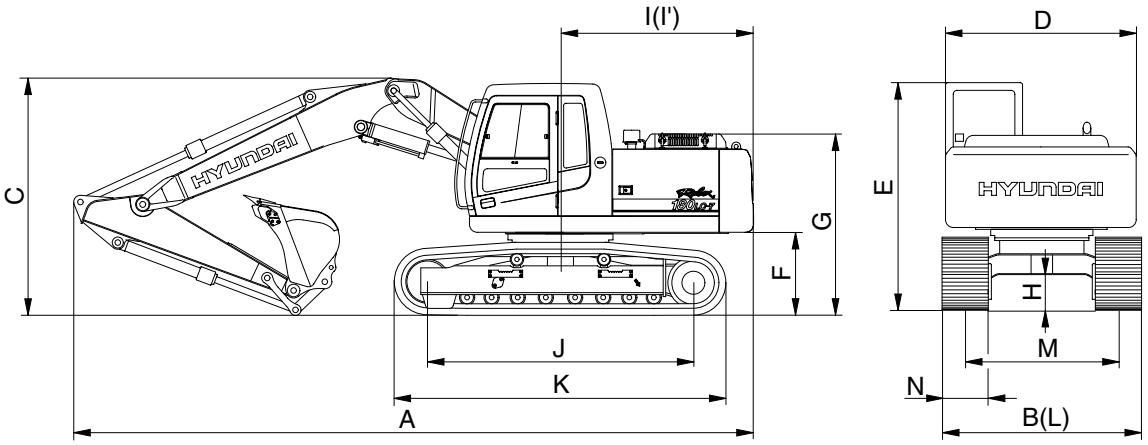
AVOID POWER LINES

Serious injury or death can result from contact with electric lines.

Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



3) 5.1m(16' 9") HYDRAULIC ADJUSTABLE BOOM, 2.6m(8' 6") ARM



18072SP05

Description		Unit	Specification
Operating weight		kg(lb)	18200(40120)
Bucket capacity(SAE heaped), standard		$m^3(yd^3)$	0.76(0.99)
Overall length	A	mm(ft-in)	8570(28' 1")
Overall width, with 600mm shoe	B		2850(9' 4")
Overall height	C		2820(9' 3")
Superstructure width	D		2530(8' 4")
Overall height of cab	E		2915(9' 7")
Ground clearance of counterweight	F		1050(3' 5")
Engine cover height	G		2295(7' 6")
Minimum ground clearance	H		460(1' 6")
Rear-end distance	I		2480(8' 2")
Rear-end swing radius	I'		2530(8' 4")
Distance between tumblers	J		3360(11' 0")
Undercarriage length	K		4190(13' 9")
Undercarriage width	L		2850(9' 4")
Track gauge	M		2250(6' 6")
Track shoe width, standard	N		600(24")
Travel speed(Low/high)		km/hr(mph)	3.3/5.2(2.0/3.2)
Swing speed		rpm	12.0
Gradeability		Degree(%)	30(58)
Ground pressure(600mm shoe)		$kgf/cm^2(psi)$	0.42(5.97)

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

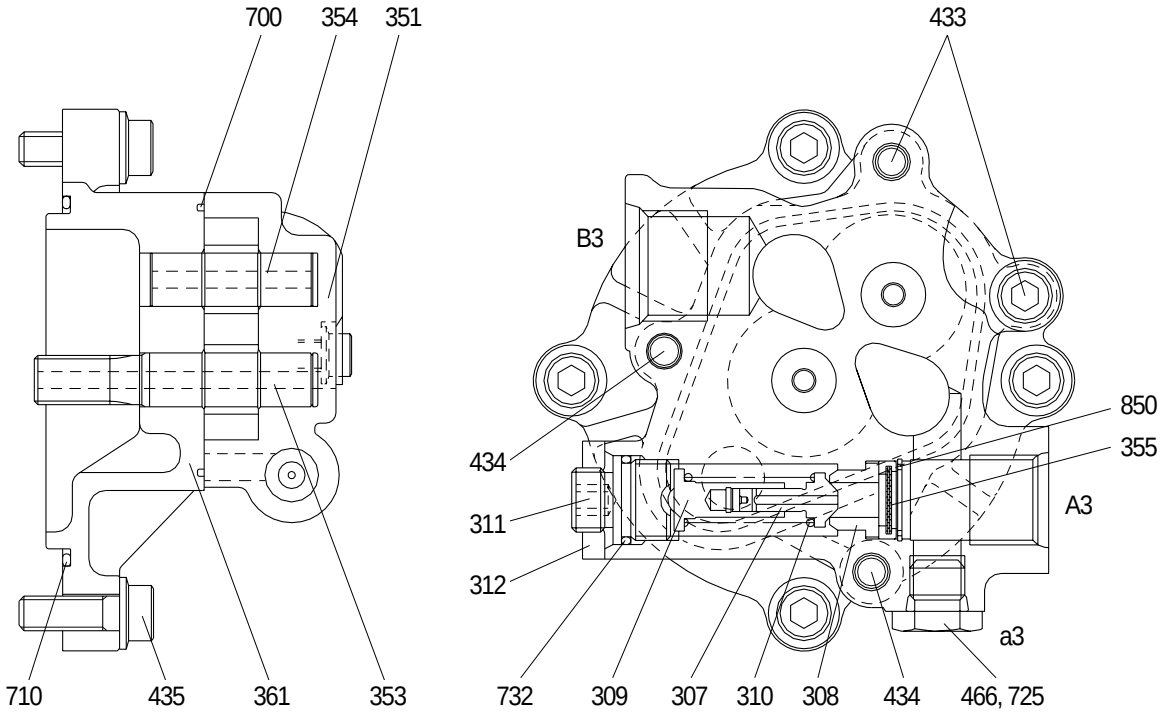
Item	Specification
Model	Mitsubishi S6S-DT
Type	4-cycle turbocharged diesel engine, low emission
Cooling method	Water cooling
Number of cylinders and arrangement	6 cylinders, in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	94 × 120mm(3.70" × 4.72")
Piston displacement	4996cc(305cu in)
Compression ratio	19.5 : 1
Rated gross horse power(SAE J1349)	126Hp at 2100rpm(94kW at 2100rpm)
Maximum torque at 1500rpm	42.5kgf · m(307lbf · ft)
Engine oil quantity	16.5 ℓ (4.4U.S. gal)
Dry weight	355kg(783lb)
High idling speed	2200 + 50rpm
Low idling speed	950 ± 100rpm
Rated fuel consumption	169.3g/Hp · hr at 2100rpm
Starting motor	Mitsubishi 24V-5.0kW
Alternator	Mitsubishi 24V-5.0A
Battery	2 × 12V × 100Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 80cc/rev
Maximum pressure	330kgf/cm^2 (4694psi) [360kgf/cm^2 (5120psi)]
Rated oil flow	2 × 168 ℓ /min (44.3U.S. gpm/ 40U.K. gpm)
Rated speed	2100rpm

[ ]: Pooer boost

3) GEAR PUMP



2-6 (140-7TIER)

307	Poppet	353	Drive gear	466	Plug
308	Seat	354	Driven gear	700	Ring
309	Spring seat	355	Filter	710	O-ring
310	Spring	361	Front case	725	O-ring
311	Screw	433	Flange socket	732	O-ring
312	Nut	434	Flange socket	850	Snap ring
351	Gear case	435	Flange socket		

③ **Low tilting angle(Low flow) command preferential function**

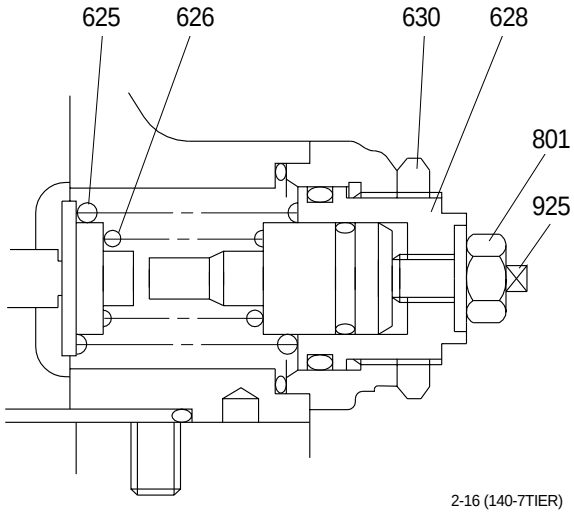
As mentioned above, flow control and horsepower control tilting angle commands are transmitted to the feedback lever and spool via the large-hole sections(C & F) of levers 1 and 2. However, since sections C and F have the pins(Ø4) protruding from the large hole(Ø8), only the lever lessening the tilting angle contacts the pin(897) ; the hole(Ø8) in the lever of a larger tilting angle command is freed without contacting the pin(897). Such a mechanical selection method permits preference of the lower tilting angle command of the flow control and horsepower control.

④ **Adjustment of input horsepower**

Since the regulator is of total cumulative horsepower type, adjust the adjusting screws of both the front and rear pumps, when changing the horsepower set values. The pressure change values by adjustment are based on two pumps pressurized at the same time, and the values will be doubled when only one pump is loaded.

a. Adjustment of outer spring

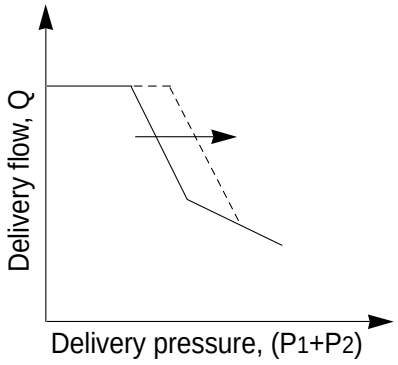
Adjust it by loosening the hexagon nut(630) and by tightening(or loosening) the adjusting screw C(628). Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C by N turns changes the setting of the inner spring(626), return the adjusting screw QI(925) by N×A turns at first.(A=1.85)



2-16 (140-7TIER)

※ **Adjusting values are shown in table**

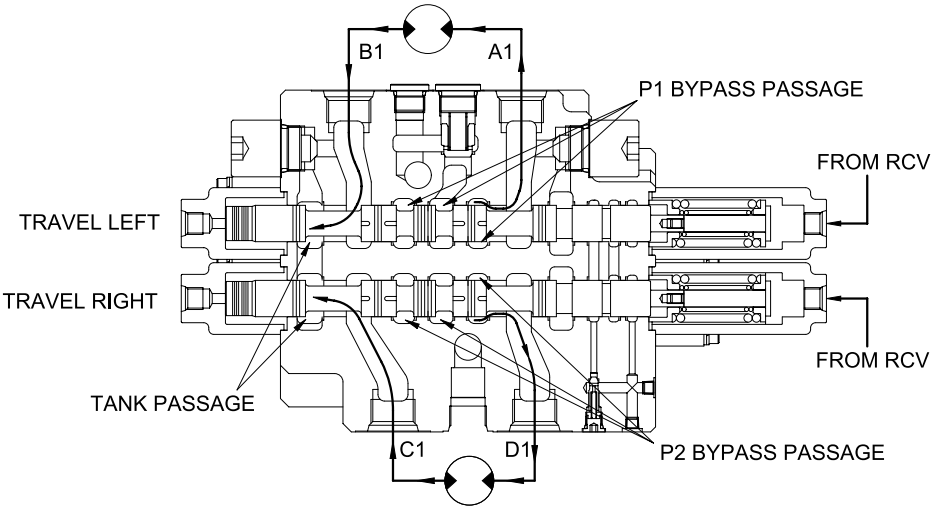
Speed	Adjustment of outer spring		
	Tightening amount of adjusting screw(C) (924)	Compens-ating control starting pressure change amount	Input torque change amount
(min $^{-1}$)	(Turn)	(kgf/cm^2)	(kgf · m)
2100	+1/4	+17.8	+3.54



2) EACH SPOOL OPERATION

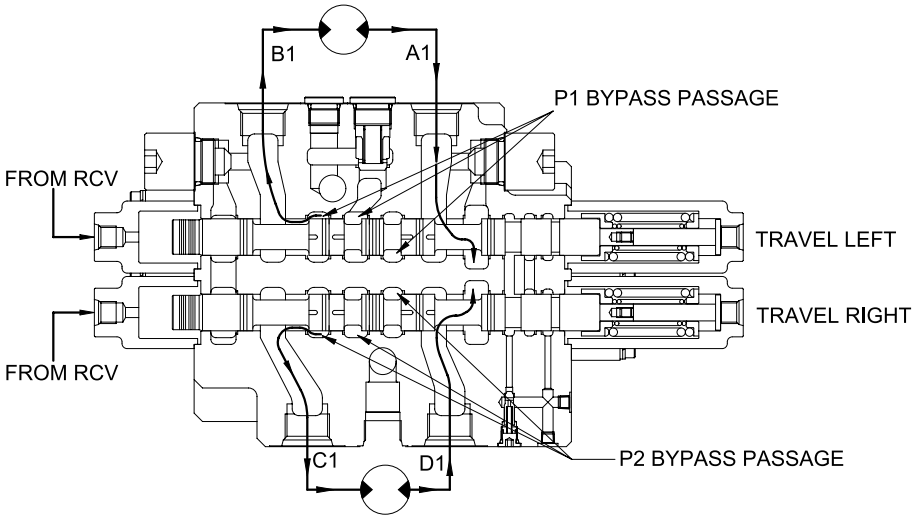
(1) TRAVEL OPERATION

① Travel forward operation



14072SF17

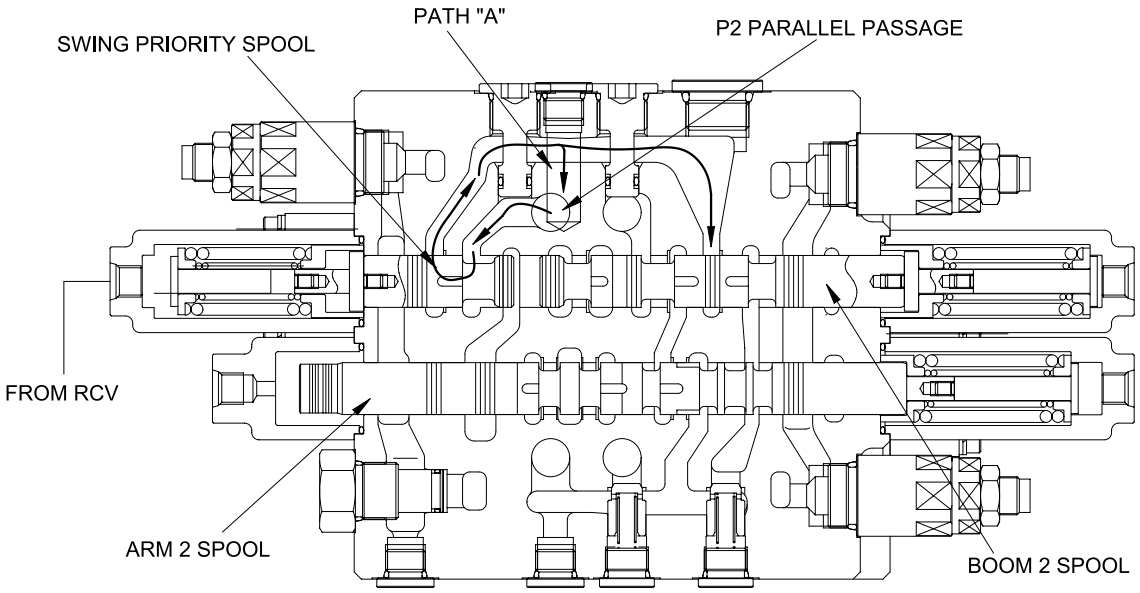
② Travel backward operation



14072SF18

During the travel operation, the hydraulic fluid of the pump P1 is supplied to the travel motor and the hydraulic fluid of the pump P2 is supplied to the other travel motor.
The pilot pressure from the pilot control valve is supplied to the spring side of pilot port (pa1, pd1).
And it shifts travel right and left spools in the left direction against springs. Hydraulic fluid from the pump P1 flow into the travel left spool through the bypass passage and hydraulic fluid from the pump P2 flow into the travel right spool through the bypass passage.
Then they are directed to the each travel motor through port A1 and D1. As a result, the travel motors turn and hydraulic fluid returns to the tank passage through the travel spools.
In case of the opposite operation, the operation is similar.

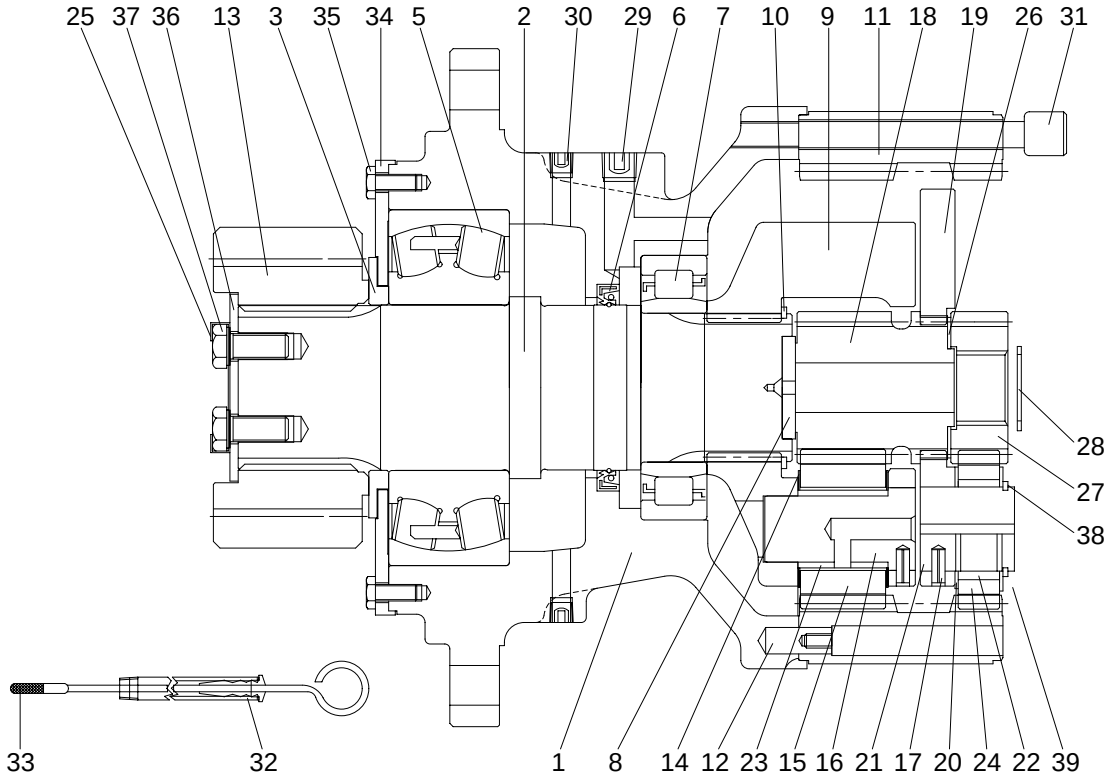
(7) SWING PRIORITY FUNCTION



14072SF27

During swing priority operation, the pilot pressure is supplied to the port Pc3 and shift swing priority spool in the right direction.
The hydraulic fluid from P2 parallel passage flows into the parallel passage of arm1 side through swing priority spool and the passage "A" and also flows into the boom2 spool.
Due to shifting of the swing priority spool, the fluid from pump P2 flows to swing side more then next spools to make the swing operation most preferential.

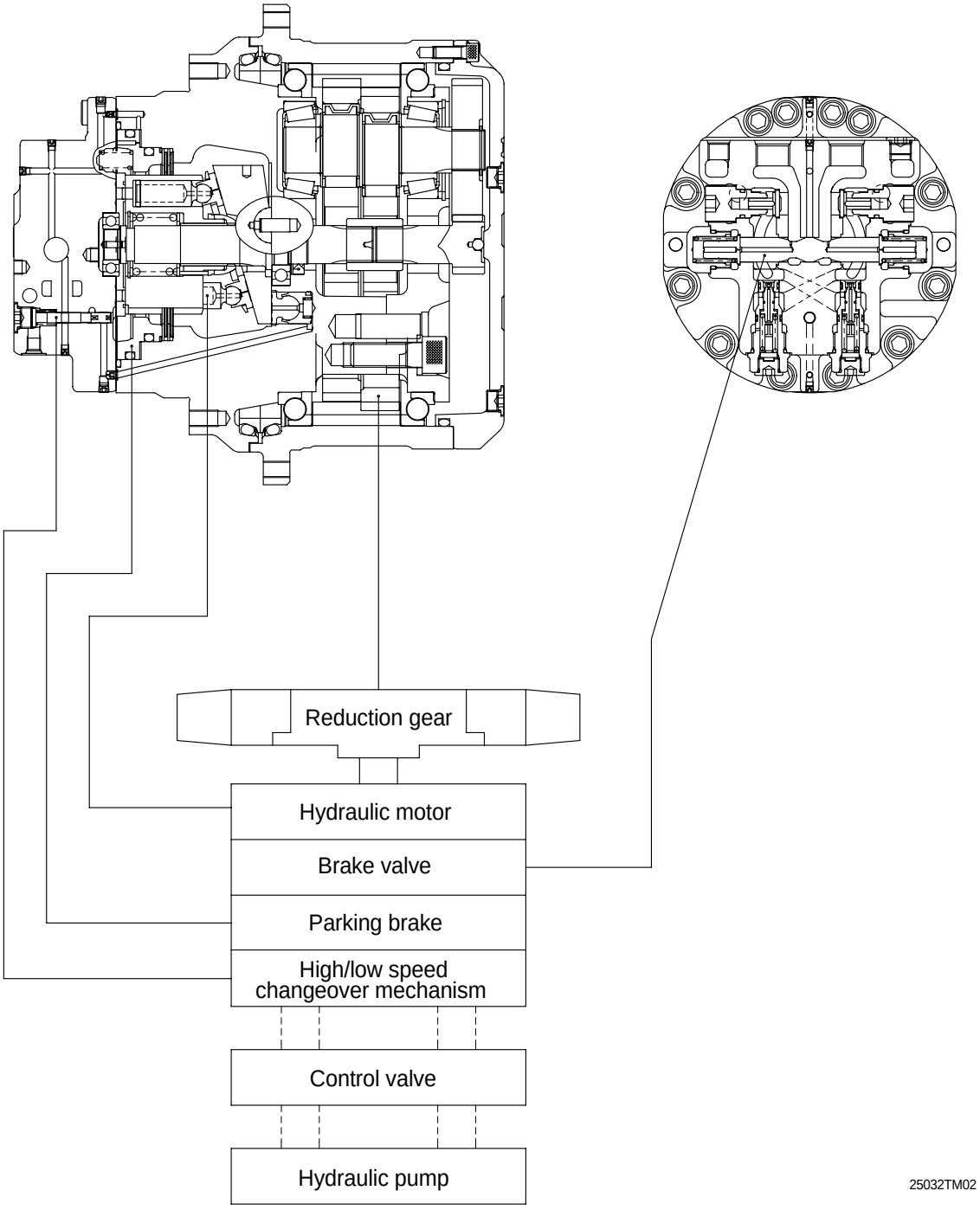
2) REDUCTION GEAR



17W72SM03

1	Casing	15	Planet gear 2	28	Stop ring
2	Drive shaft	16	Pin 2	29	Plug
3	Spacer	17	Spring pin	30	Plug
5	Roller bearing	18	Sun gear 2	31	Socket bolt
6	Oil seal	19	Carrier 1	32	Gauge pipe
7	Roller bearing	20	Side plate 1	33	Gauge bar
8	Thrust plate	21	Pin 1	34	Cover plate
9	Carrier 2	22	Needle cage	35	Hexagon bolt
10	Stop ring	23	Bush 2	36	Lock plate
11	Ring gear	24	Planet gear 1	37	Hexagon bolt
12	Knock pin	25	Lock washer	38	Stop ring
13	Pinion gear	26	Side plate 3	39	Side plate 2
14	Thrust washer	27	Sun gear 1		

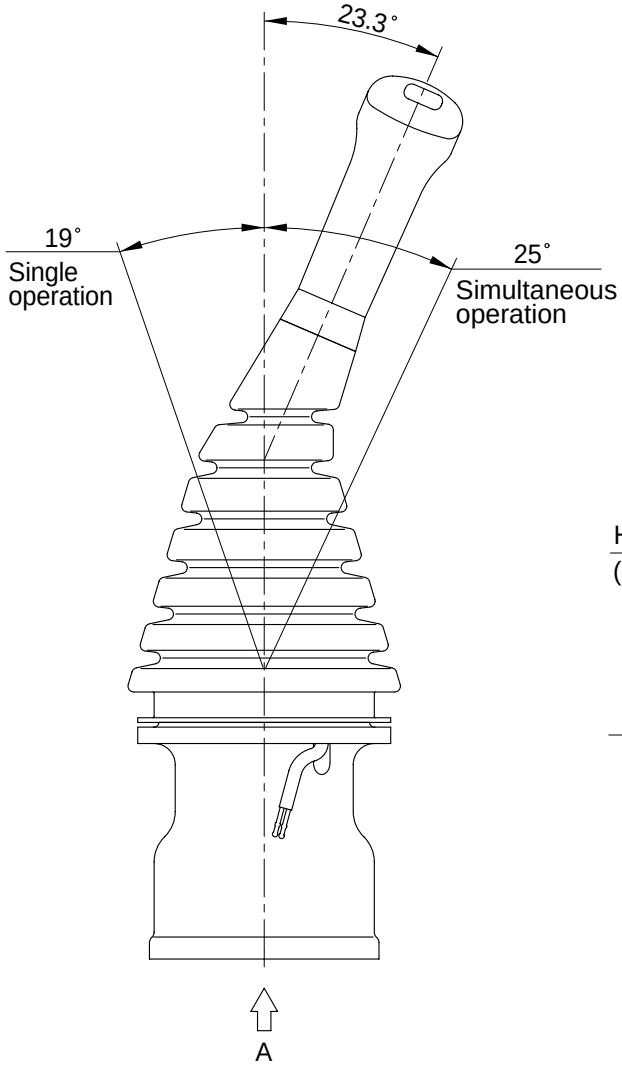
1) BASIC STRUCTURE

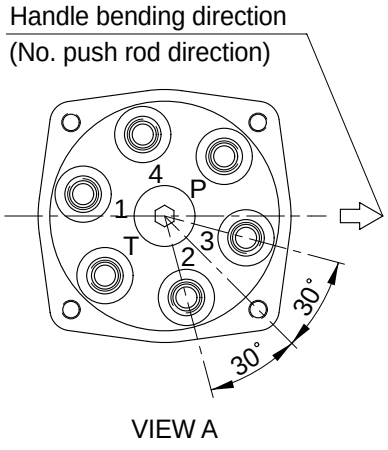


GROUP 5 RCV LEVER

1. STRUCTURE

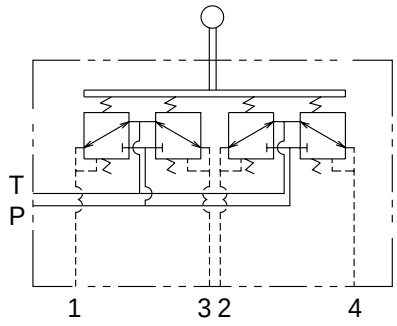
The casing has the oil inlet port P(Primary pressure) and the oil outlet port T(Tank). In addition the secondary pressure is taken out through ports 1,2,3 and 4 provided at the bottom face.





VIEW A

25032RL01



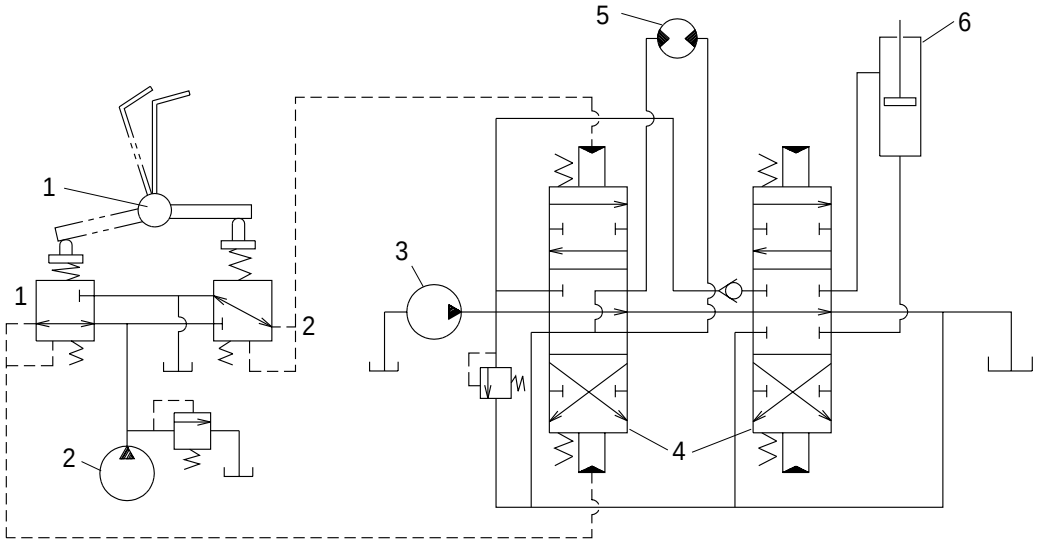
Hydraulic circuit

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	

3) OPERATION

The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below ant the attached operation explanation drawing.

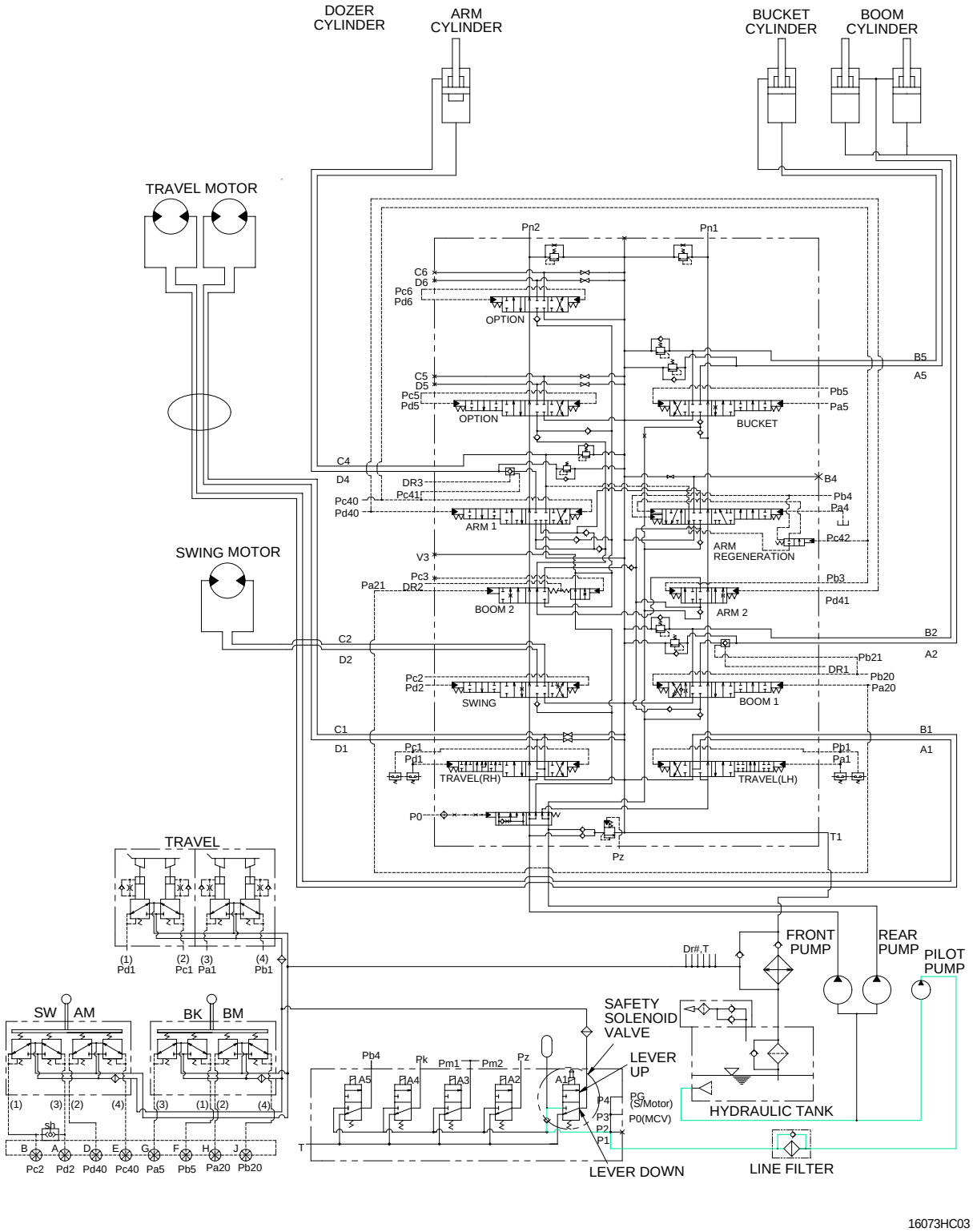
The diagram shown below is the typical application example of the pilot valve.



2-76 (140-7 TIER)

1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

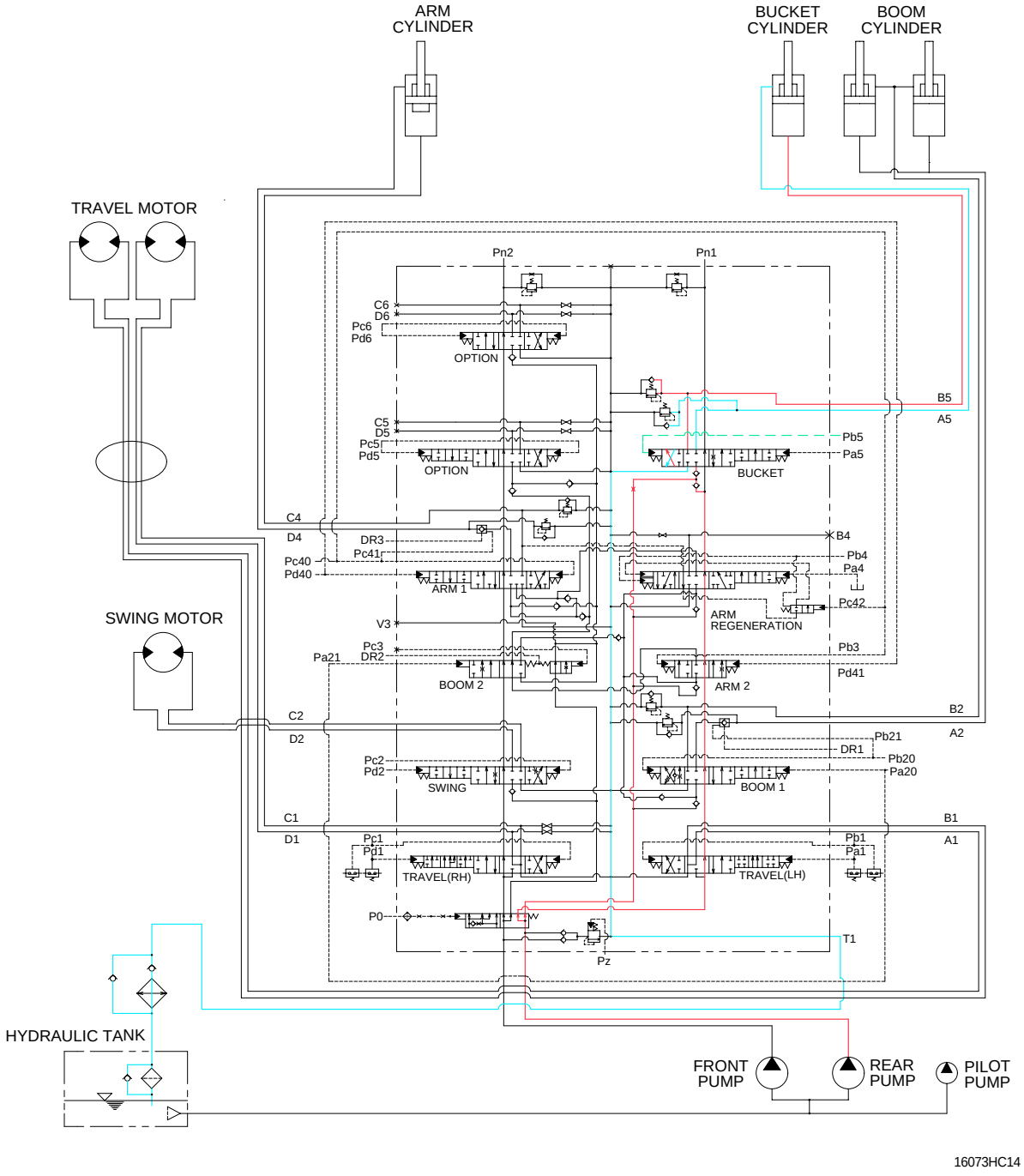
2. SAFETY VALVE(SAFETY LEVER)



When the lever of the safety solenoid valve is moved upward, oil flows into the remote control valve through solenoid valve and line filter.

When the lever of the safety solenoid valve is moved downward, oil does not flow into the remote control valve, because of the blocked port.

5. BUCKET ROLL IN OPERATION



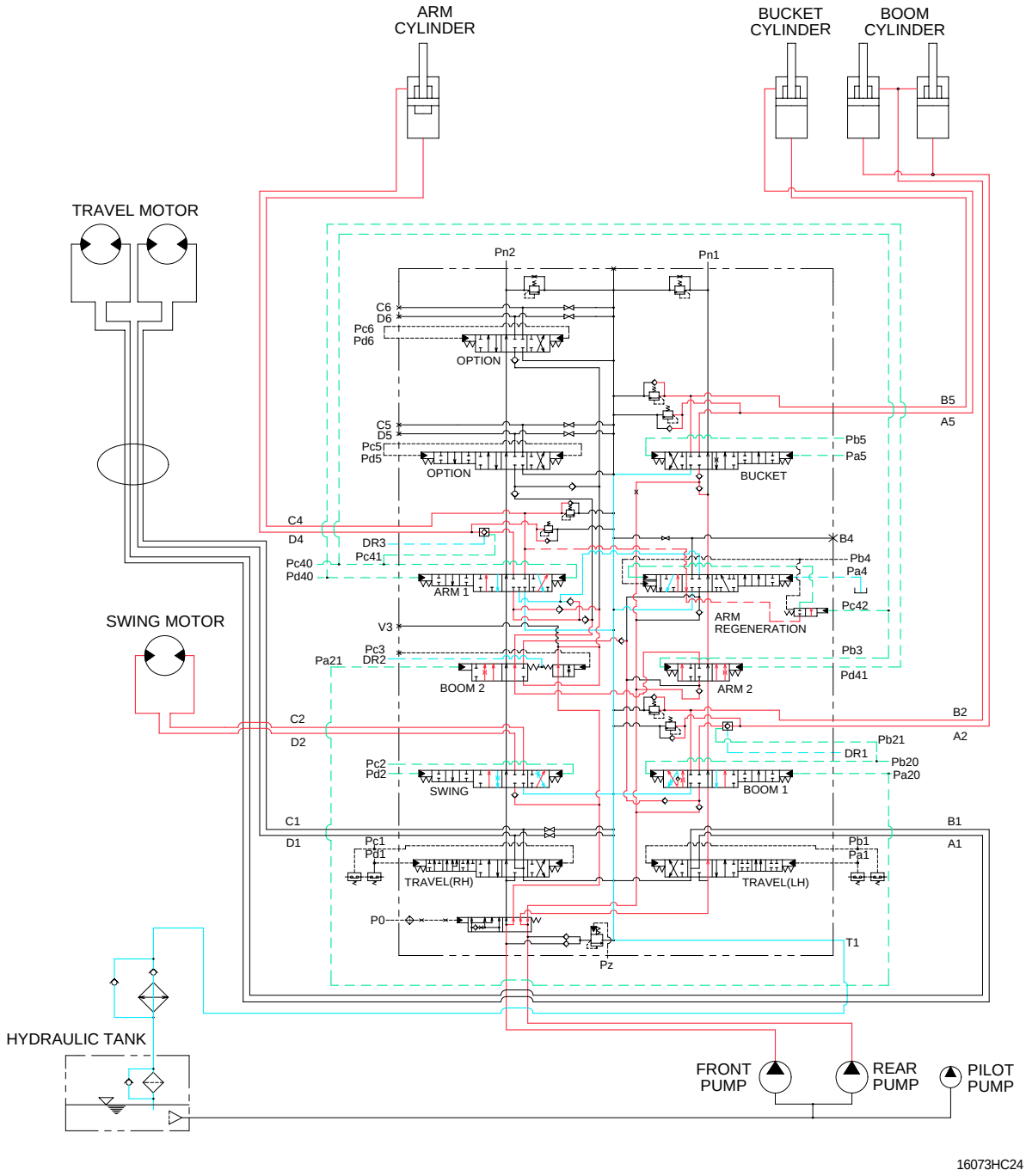
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

The oil from the rear pump flows into the main control valve and then goes to the large chamber of bucket cylinder.

At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the bucket rolls in.

The cavitation which will happen to the bottom of the bucket cylinder is also prevented by the make-up valve in the main control valve.

5. COMBINED SWING, BOOM, ARM AND BUCKET OPERATION



When the swing, boom, arm and bucket functions are operated, simultaneously each spool in the main control valve is moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the front pump flows into the swing motor, boom cylinders and arm cylinder through the swing spool, boom 2 spool, arm 1 spool, and the parallel and confluence oil passage.

The oil from the rear pump flows into the boom cylinders, arm cylinder and bucket cylinder through the boom 1 spool, arm 2 spool, bucket spool and the parallel and confluence oil passage.

The superstructure swings and the boom, arm and bucket are operated.

1. POWER CIRCUIT

The negative terminal of battery is grounded to the machine chassis.
When the start switch is in the OFF position, the current flows from the positive battery terminal as shown below.

1) OPERATING FLOW

Battery → Battery relay → Fusible link (CN-60) →

- Fuse box [No.1] → I/conn [CN-8(12)] → Start switch [CS-2(1)]
  - Power relay [CR-35(30)]
- Fuse box [No.2] → I/conn [CN-10(6)]
  - Room lamp [CL-1(2)]
  - Cassette radio [CN-27(11)]
- Fuse box [No.3] → I/conn [CN-11(4)] → AC & Heater controller [Battery(+)]
- Fuse box [No.4] → I/conn [CN - 5(4)] → I/conn [CN -17(5)]
  - Wiper motor Controller [CN-141(7)]
  - Wiper motor [CN-21(4)]
- Fuse box [No.5] → CPU controller [CN-50(7)]
- Fuse box [No.6] → I/conn [CN-11(5)] → Relay(Hi, M2)
- Fuse box [No.7] → Engine stop relay [CR-43(2,3)]

※ I/conn : Intermediate connector

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OFF	OFF	① - GND (Battery 2 EA) ② - GND (Battery 2 EA) ③ - GND (Fusible link)	20~25V 20~25V 20~25V

※ GND : Ground

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.12) → I/conn [CN-7(5)] → Switch panel [CN-116(6)]

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

→ Wiper motor [CN-21(4)]

Fuse box (No.14) → I/conn [CN-6(5)] → I/conn [CN-17(4)] → Wiper motor controller [CN-141(6)]

→ Washer pump [CN-22(2)]

(2) Wipe switch ON : 1st step(Intermittent)

Wiper switch ON [CN-116(15)] → I/conn[CN-9(4)] → I/conn[CN-6(10)] → I/conn[CN-17(8)] →
Wiper motor controller [CN-141(10) → (3)] → Wiper motor intermittently operating [CN-21(6)]

(3) Wiper switch ON : 2nd step(Low speed)

Wiper switch ON [CN-116(4)] → I/conn [CN-7(3)] → I/conn [CN-6(9)] → I/conn[CN-17(2)] →
Wiper motor controller [CN-141(2) → (4)] → Wiper motor operating [CN-21(2)]

(4) Washer switch ON

Washer switch ON [CN-116(12)] → I/conn [CN-7(9)] → I/conn [CN-5(1)] → I/conn [CN-17(7)]
→ Wiper motor controller [CN-141(9) → (8)] → I/conn [CN-17(6)] → I/conn [CN-6(11)]
→ Washer operating [CN-22(1)]

Wiper switch ON [CN-116(4)] → I/conn [CN-7(3)] → I/conn [CN-6(9)] → I/conn[CN-17(2)] →
Wiper motor controller [CN-141(2) → (4)] → Wiper motor operating [CN-21(2)]

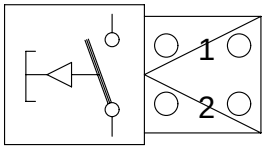
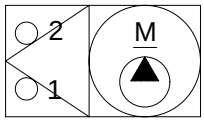
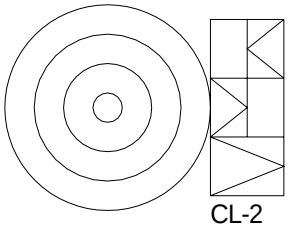
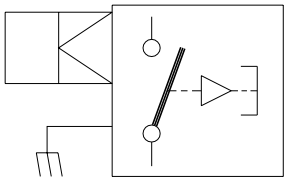
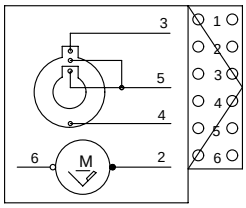
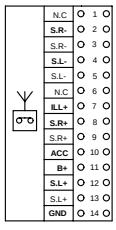
(5) Auto parking(When switch OFF)

Switch OFF [CN-116(4)] → Wiper motor parking position by wiper motor controller

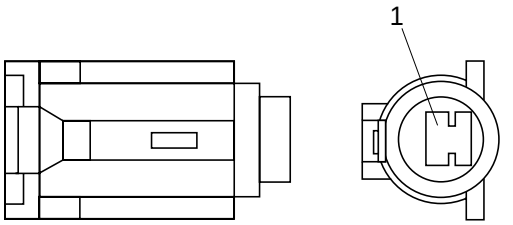
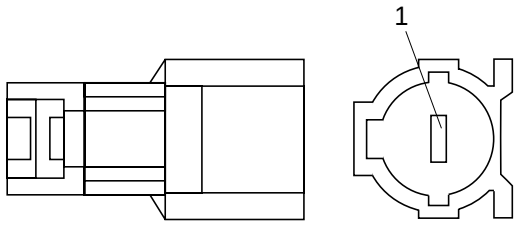
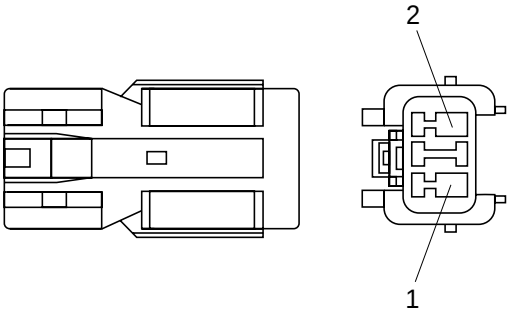
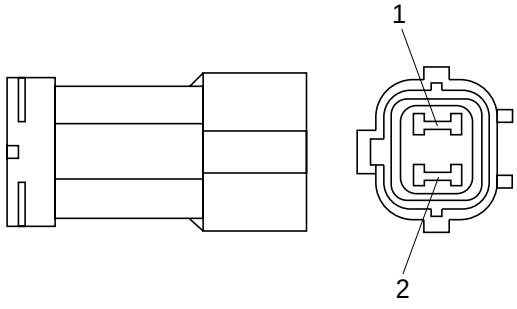
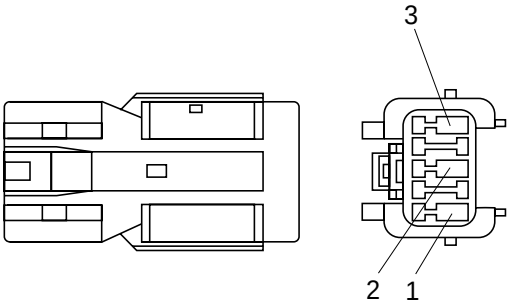
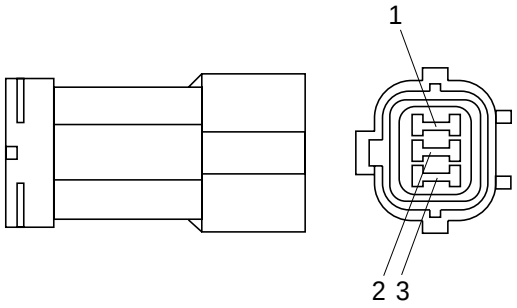
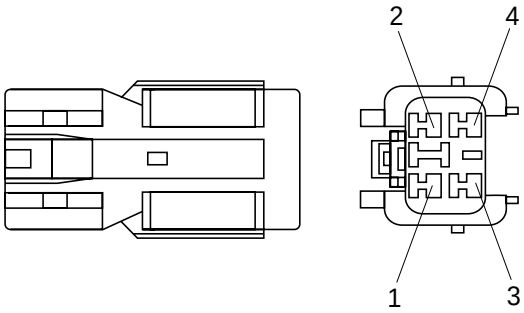
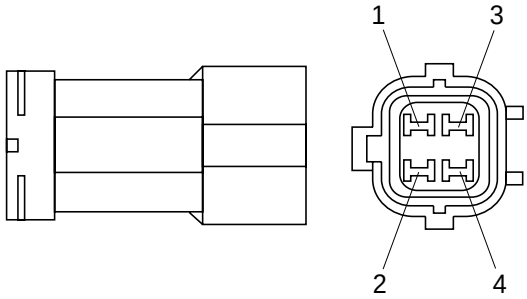
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND(Fuse box) ② - GND(Switch power input)	24V
		③ - GND(Switch power output) ④ - GND(Wiper Power input)	0~5V
		⑤ - GND(Wiper power output)	24V
		⑥ - GND(Wiper motor)	0 or 24V

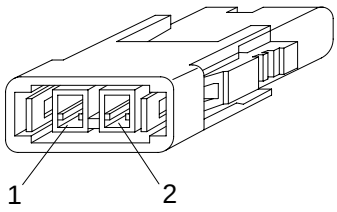
※ GND : Ground

Part name	Symbol	Specification	Check
Switch (Power max, One touch decal, Breaker, Horn)	 CS-5 CS-19 CS-26 CS-29	24V 6A	※Check contact Normal : ∞Ω
Washer pump	 CN-22	24V 3.8A	※Check contact Normal : 10.7Ω(For terminal 1-2)
Cigar lighter	 CL-2	24V 5A 1.4W	※Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞Ω Operating time : 5~15sec
Switch	 CS-1, CS-20, CS-53	24V 2W	※Check resistance Normal : About 5MΩ
Wiper motor	 CN-21	24V 2A	※Check contact Normal : 7Ω(For terminal 2-6)
Cassette radio	 CN-27	24V 2A	※ Check voltage 20 ~ 25V (For terminal 10-14,11-14)

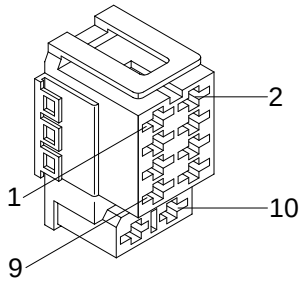
3) SWP TYPE CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
1	 S814-001000	 S814-101000
2	 S814-002000	 S814-102000
3	 S814-003000	 S814-103000
4	 S814-004000	 S814-104000

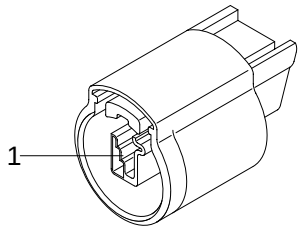
15) MOLEX 2CKTS CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
2	 35215-0200	

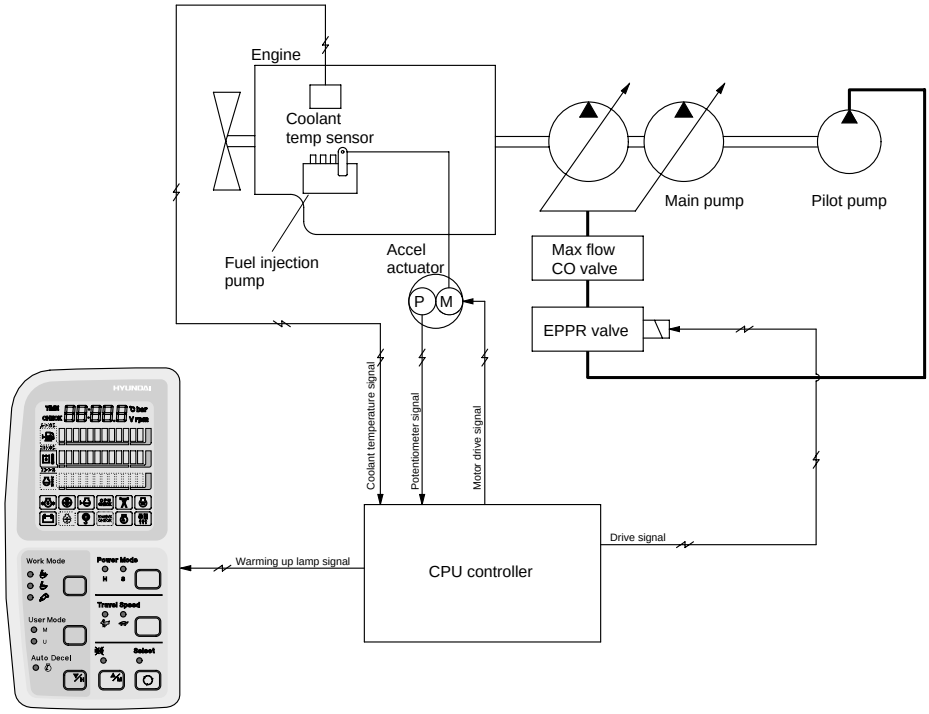
16) ITT SWF CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
10	 SWF593757	

17) MWP NMWP CONNECTOR

No. of pin	Receptacle connector(Female)	Plug connector(Male)
1	 NMWP01F-B	

GROUP 6 AUTOMATIC WARMING UP FUNCTION



140W75MS08

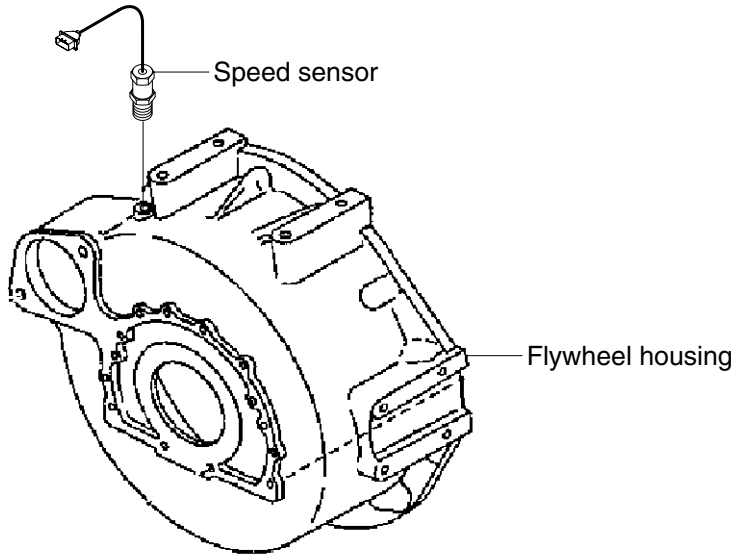
1. CPU controller reads engine coolant temperature through the temperature sensor, and if the coolant temperature is less than 30°C, it increases the engine speed from key start rpm to 1200rpm. At this time the mode does not change.
2. In case of the coolant temperature increases up to 30°C, the engine speed is decreased to key start speed. And if an operator changes mode set during the warming up function, the CPU controller cancels the automatic warming up function.

3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : Less than 30°C(After engine run) - Accel dial position is under **3**	- Mode : Default(**S** mode) - Warming up time : 10 minutes(Max) - Warming up lamp : ON
Canceled	- Coolant temperature : Above 30°C - Warming up time : Above 10 minutes - Changed mode set by operator - Increase engine speed by rotating accel dial clockwise ※ If any of the above conditions is applicable, the automatic warming up function is canceled	- Default mode - Default mode - Changed mode
Warming up lamp	- Coolant temperature : Above 30°C	- Warming up lamp : OFF

5. ENGINE SPEED SENSOR

1) DETECT ACTUAL ENGINE RPM AND SEND SIGNAL TO TACHOMETER



18075MS20

2) INSTALLATION

(1) Clean contacting point of sensor.

(2) Screw speed sensor into flywheel housing.

(3) Turn it back 180° when it contacts with gear teeth.

3) INSPECTION

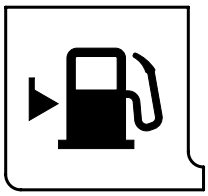
(1) Check resistance

- SPEC : 2.3±0.2 kΩ (at 25°C)

(2) Check voltage while engine run.

- SPEC : 10Vac or over, dependent on the engine speed(rpm)

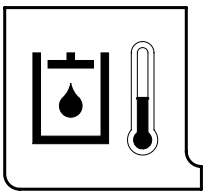
5) FUEL LOW LEVEL WARNING LAMP



21073CD04A

① This lamp blinks and the buzzer sounds when the level of fuel is below 38 ℓ (10.0U.S. gal).
② Fill the fuel immediately when the lamp blinks.

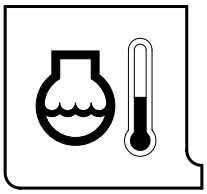
6) HYDRAULIC OIL TEMPERATURE WARNING LAMP



21073CD05A

① This warning lamp operates and the buzzer sounds when the temperature of hydraulic oil is over 105 ℃(221 ℉) .
② Check the hydraulic oil level when the lamp blinks.
③ Check for debris between oil cooler and radiator.

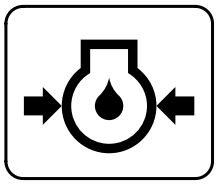
7) OVERHEAT WARNING LAMP



21073CD06A

① This lamp blinks and the buzzer sounds when the temperature of coolant is over the normal temperature 110℃(230℉) .
② Check the cooling system when the lamp blinks.

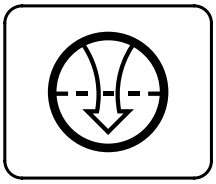
8) ENGINE OIL PRESSURE WARNING LAMP



21073CD07

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

9) AIR CLEANER WARNING LAMP



21073CD08

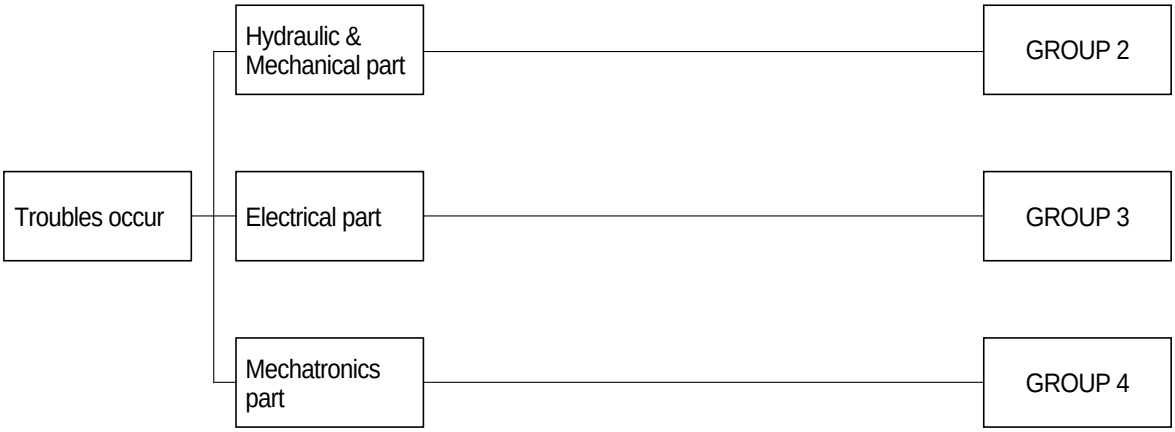
① This lamp is operated by the vacuum caused inside when the filter of air cleaner is clogged which supply air to the engine.
② Check the filter and clean or replace it when the lamp blinks.

GROUP 1 BEFORE TROUBLESHOOTING

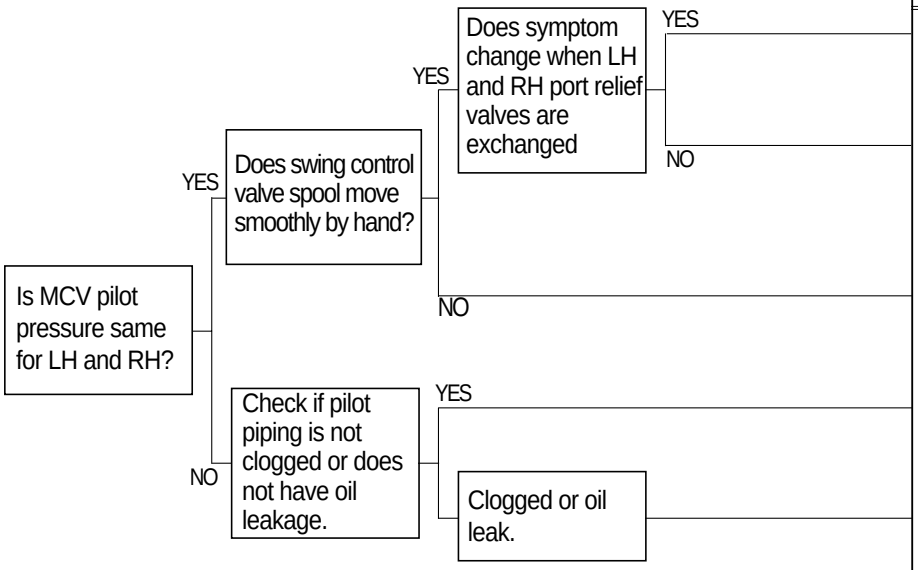
1. INTRODUCTION

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.

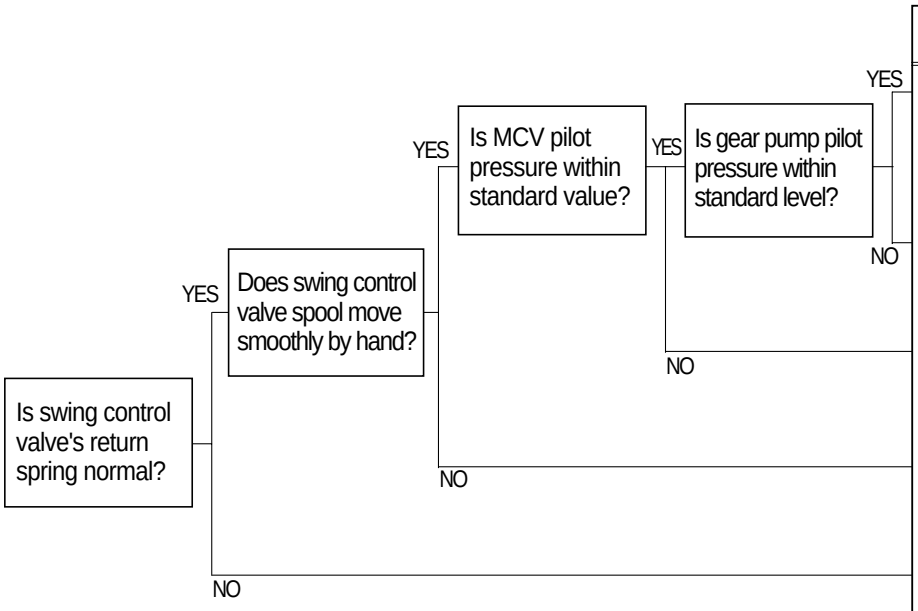


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



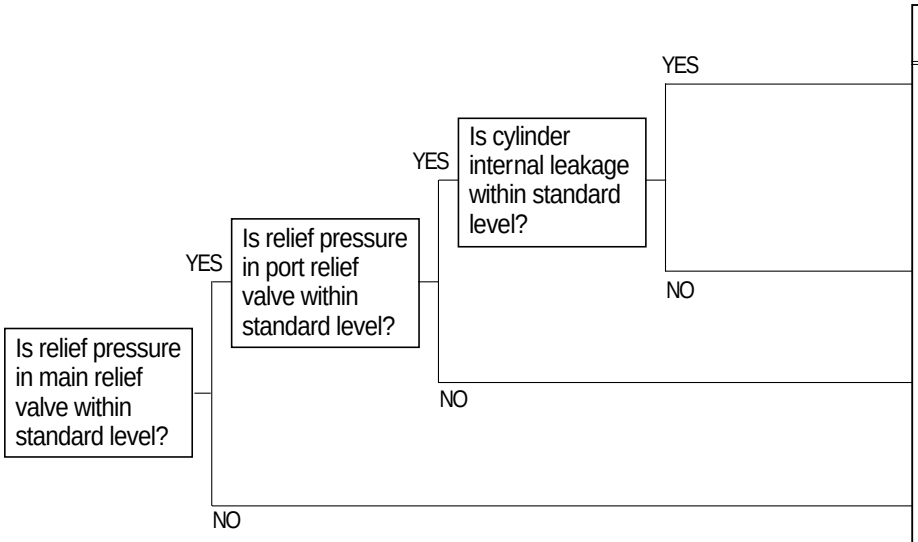
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



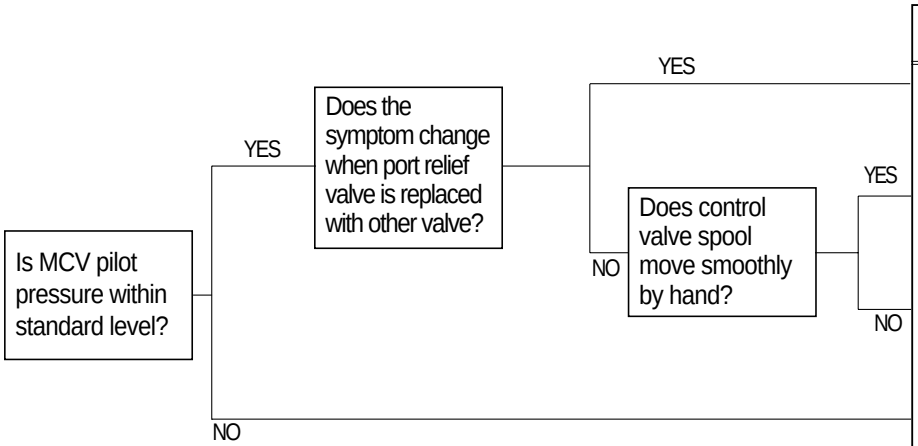
Cause	Remedy
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Return spring is faulty.	Disassemble and replace.

4) BOOM, ARM OR BUCKET POWER IS WEAK



Cause	Remedy
Cylinder is faulty.	Check according to the procedure in Item "Speed is low". Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

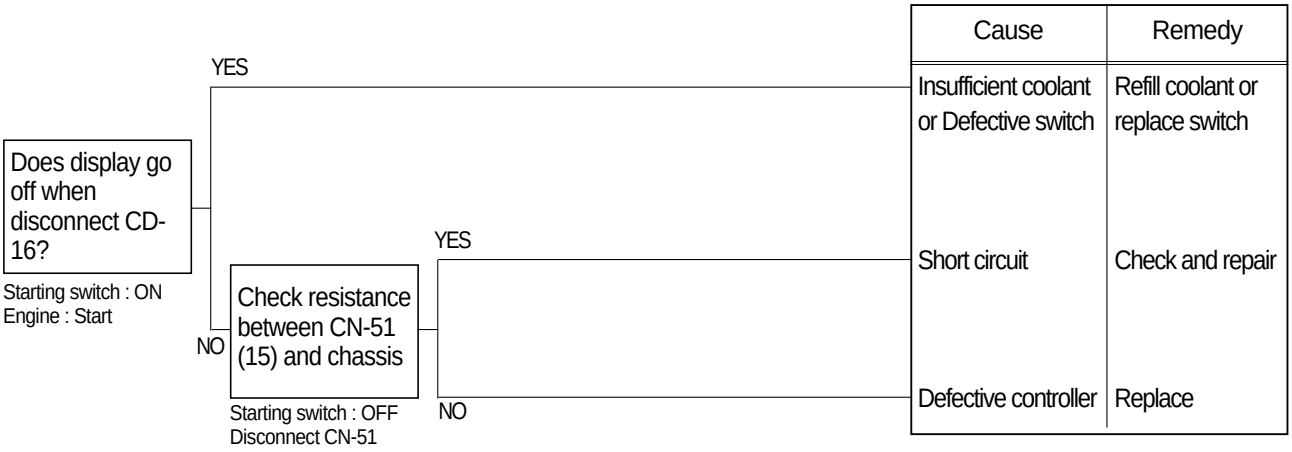
5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



Cause	Remedy
Port relief valve is defective.	Disassemble and repair or replace.
Cylinder interior is broken.	Disassemble and repair.
Control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.

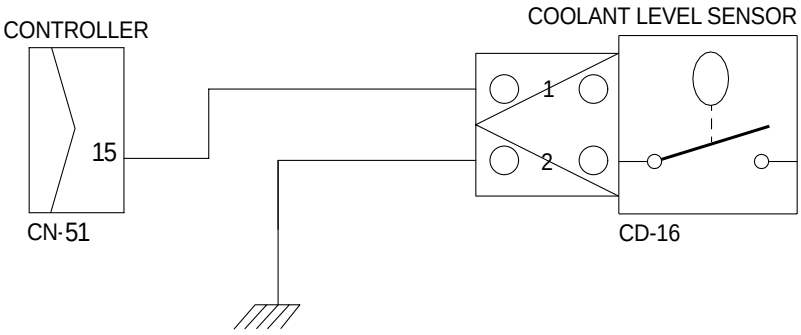
8. WHEN COOLANT LEVEL WARNING LAMP LIGHTS UP(Engine is started)

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



Check resistance

YES	MAX 1Ω
NO	MIN 1MΩ

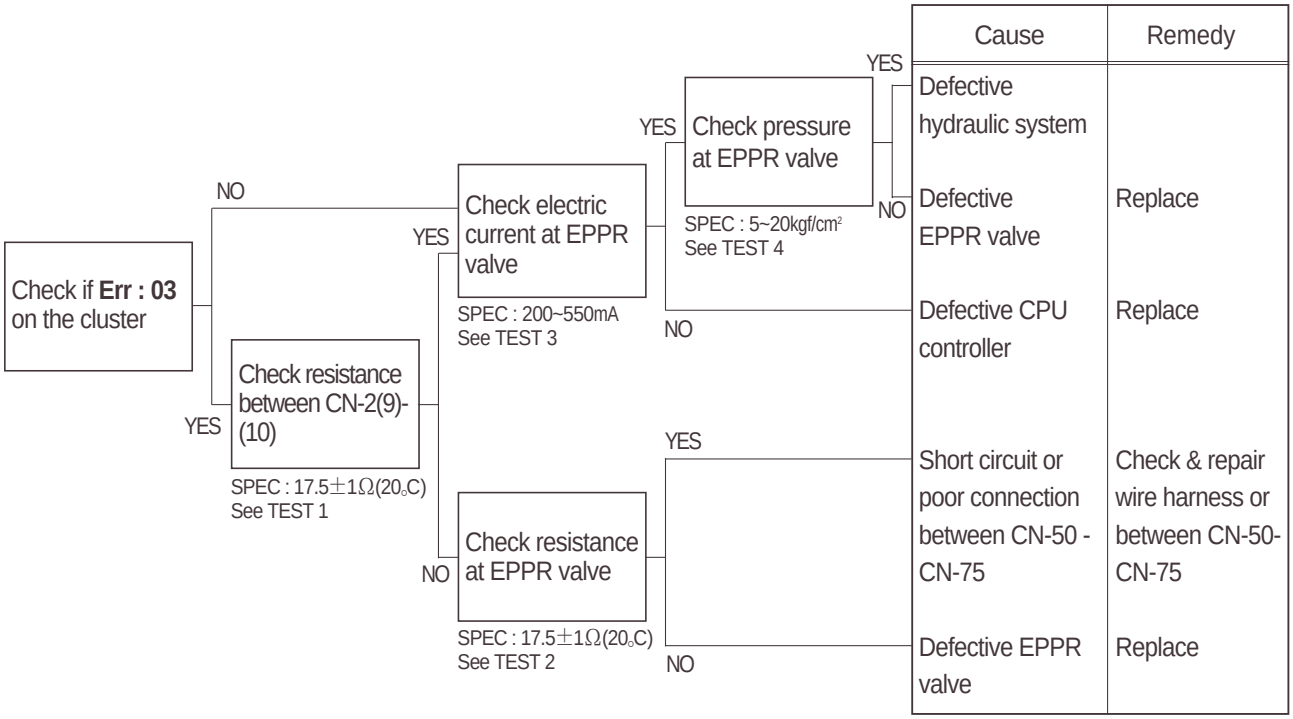


25036EL08

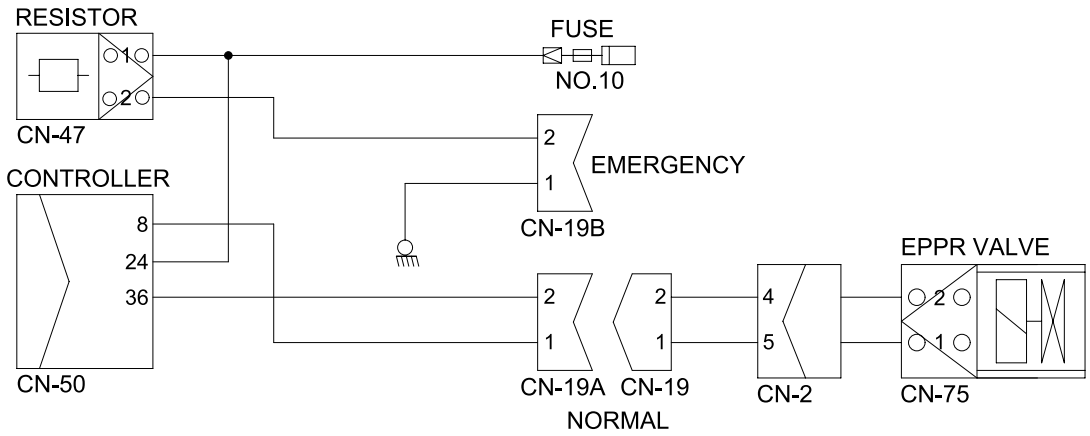
1. ALL ACTUATORS SPEED ARE SLOW

※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.
※ Spec : M-mode 2200±50rpm H-mode 2000±50rpm S-mode 1900±50rpm
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



16075MS30

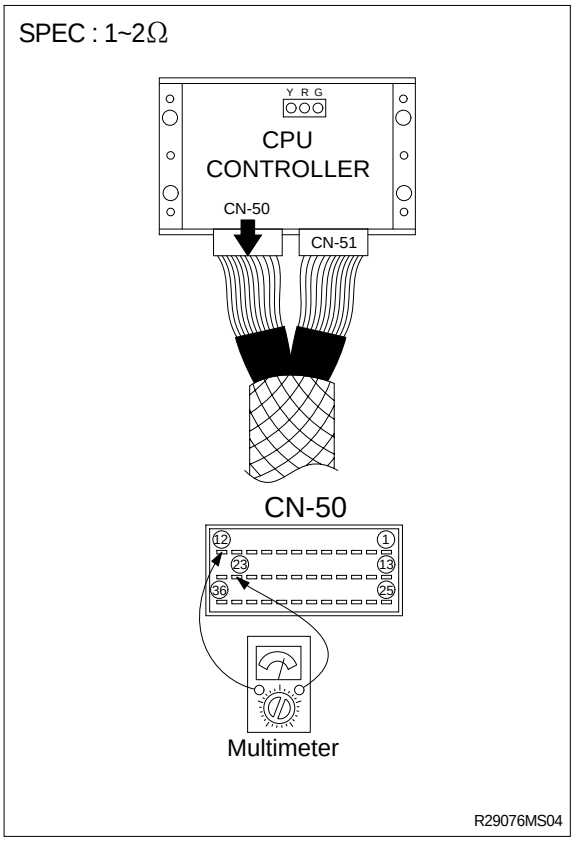
2) TEST PROCEDURE

(1) **Test 11 :** Check resistance.

① Starting key OFF.

② Disconnect connector CN-50 from CPU controller.

③ Check resistance between CN-50(12)-(23) as figure.



3. OPERATION FOR PERFORMANCE TESTS

1) Observe the following rules in order to carry out performance tests accurately and safely.

(1) The machine

Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

(2) Test area

① Select a hard, flat surface.

② Secure enough space to allow the machine to run straight more than 20m, and to make a full swing with the front attachment extended.

③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

(3) Precautions

① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.

② Operate the machine carefully and always give first priority to safety.

③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.

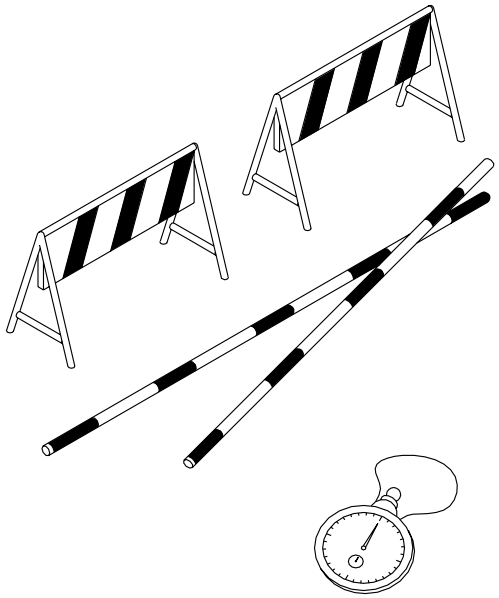
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(4) Make precise measurements

① Accurately calibrate test instruments in advance to obtain correct data.

② Carry out tests under the exact test conditions prescribed for each test item.

③ Repeat the same test and confirm that the test data obtained can be procured repeatedly. Use mean values of measurements if necessary.



7-3 (140-7 TIER)

10) DIG FUNCTION DRIFT CHECK

(1) Measure dig function drift, which can be caused by oil leakage in the control valve and boom, standard arm, and standard bucket cylinders, with the loaded bucket. When testing the dig function drift just after cylinder replacement, slowly operate each cylinder to its stroke end to purge air.

(2) Preparation

① Load bucket fully. Instead of loading the bucket, weight(W) of the following specification can be used.

· $W=M^3 \times 1.5$

Where :

M^3 = Bucket heaped capacity(m^3)

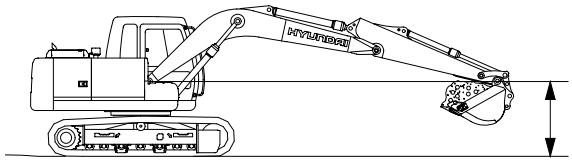
1.5 = Soil specific gravity

② Position the arm cylinder with the rod 20 to 30㎜ extended from the fully retracted position.

③ Position the bucket cylinder with the rod 20 to 30㎜ retracted from the fully extended position.

④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

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



160LC7MS11

(3) Measurement

① Stop the engine.

② Five minutes after the engine has been stopped, measure the changes in the positions of the boom, arm and bucket cylinders.

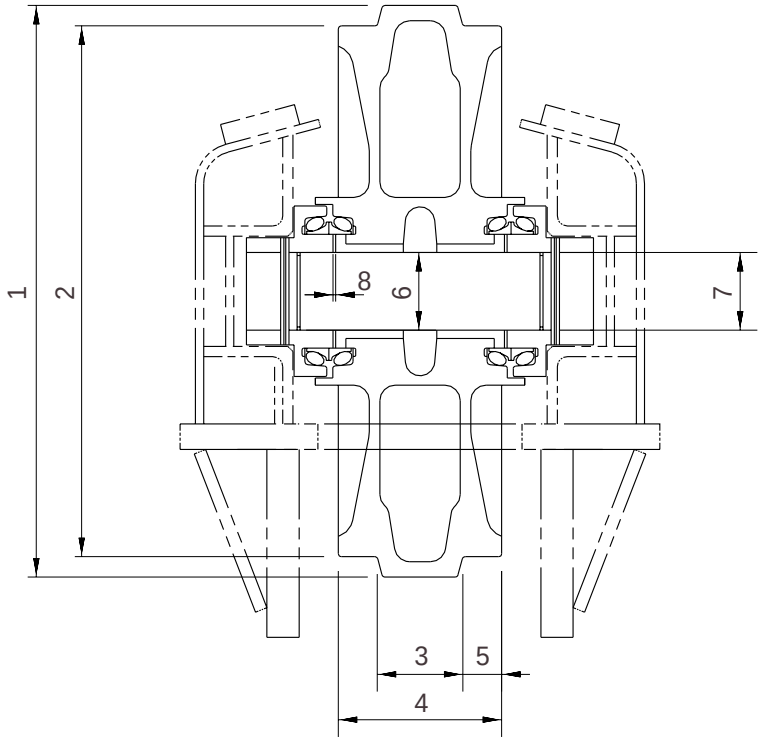
③ Repeat step ② three times and calculate the average values.

(4) The measured drift should be within the following specifications.

Unit : mm / 5min

Model	Drift to be measured	Standard	Maximum allowable	Remarks
R180LC-7	Boom cylinder	10 below	20	
	Arm cylinder	10 below	20	
	Bucket cylinder	40 below	50	

3) IDLER



21037MS03

Unit : mm

No.	Check item	Criteria				Remedy
1	Outside diameter of protrusion	Standard size		Repair limit		Rebuild or replace
		Ø560		Ø550		
2	Outside diameter of tread	Ø520		Ø510		
3	Width of protrusion	84		74		
4	Total width	160		-		
5	Width of tread	38		43		
6	Clearance between shaft and bushing	Standard size & Tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		Ø75 $^{0}_{-0.03}$	Ø75.35 $^{+0.05}_{0}$	0.35 to 0.43	2.0	
7	Clearance between shaft and support	Ø75 $^{0}_{-0.03}$	Ø75 $^{+0.07}_{+0.03}$	0.03 to 0.1	1.2	Replace
8	Side clearance of idler (Both side)	Standard clearance		Clearance limit		Replace
		0.4 to 1.2		2.0		

3) 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

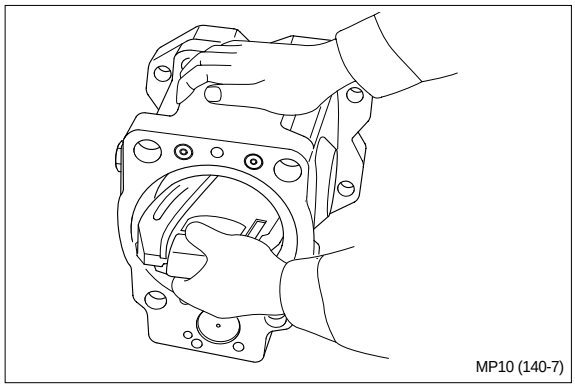
4) FITTING

Thread size	Width across flat(mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	6	43.4
3/4"	36	13	94.0
1"	41	15	109

(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.

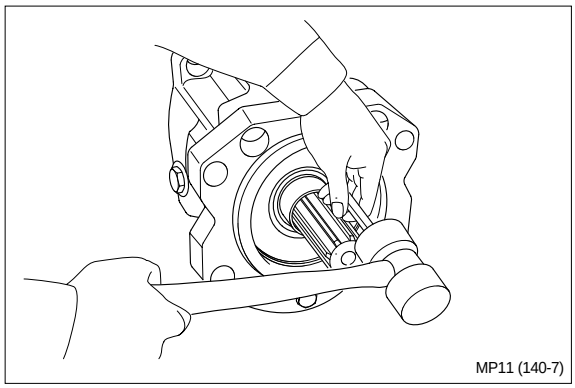


MP10 (140-7)

(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.



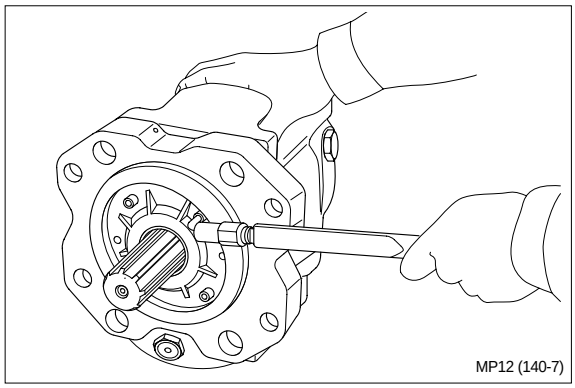
MP11 (140-7)

(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).

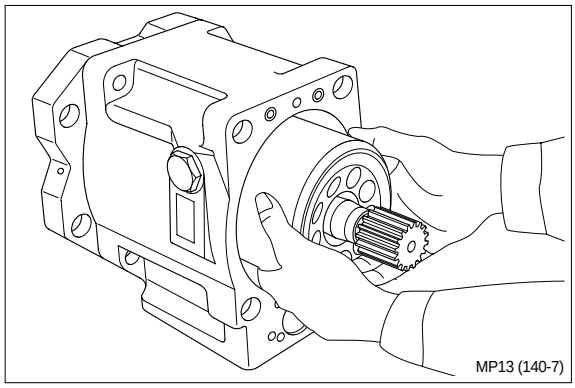
※ Assemble oil seal, taking full care not to damage it.

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



MP12 (140-7)

(6) Assemble piston cylinder subassembly 〔cylinder block(141), piston subassembly (151, 152), set plate(153), spherical bush (156), spacer(158) and cylinder spring (157)〕.
Fit spline phases of retainer and cylinder.
Then, insert piston cylinder subassembly into pump casing.



MP13 (140-7)

4) ASSEMBLY

(1) For assembly, reverse disassembly procedures, but pay attention to the following items.

① Always repair parts that were scored at disassembly.

② Get replacement parts ready beforehand. Mixing of foreign matter will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

③ Always tighten bolts, plugs, etc. to their specified torques.

④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.

⑤ Replace seals such as O-ring with new ones as a rule.

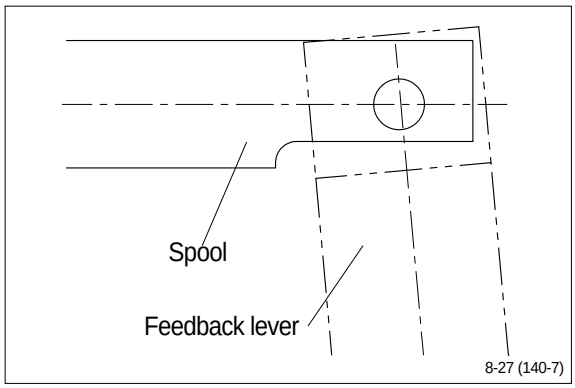
(2) Put compensating rod(623) into compensating hole of casing(601).

(3) Put pin force-fitted in lever(1, 612) into groove of compensating rod and fit lever (1) to pin force-fitted in casing.

(4) Fit spool(652) and sleeve(651) into hole in spool of casing.

※ Confirm that spool and sleeve slide smoothly in casing without binding.

※ Pay attention to orientation of spool.



8-27 (140-7)

(2) Disassembly of spools with holding valve(Boom 1, Arm 1 spool)

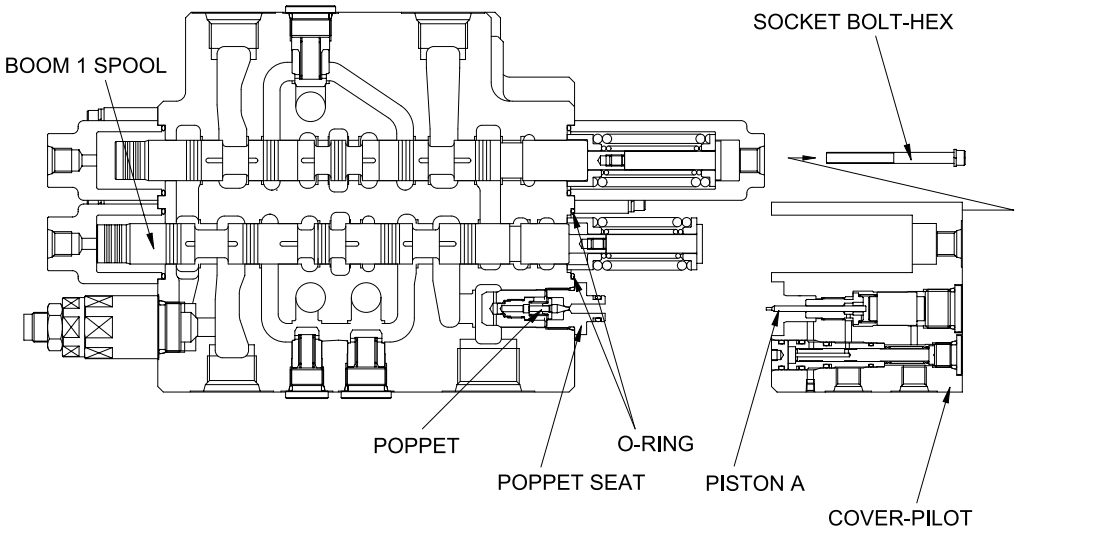
① Loosen hexagon socket head bolts with washer
(Hexagon wrench : 5㎜)

② Remove the pilot cover with internal parts.

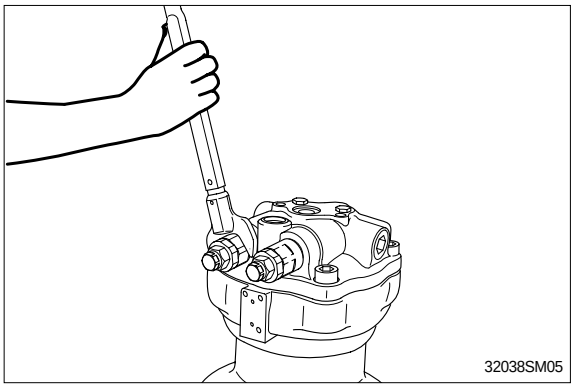
※ Pay attention not to lose the O-ring and the poppet under the pilot cover.
※ Pay attention not to damage the "piston A" under pilot cover.

③ Remove the spool assembly from the body by hand slightly.

※ When extracting each spool from its body, pay attention not to damage the body.
※ When extracting each spool assembly, it must be extracted from spring side only.
※ When any abnormal parts are found, replace it with completly new spool assembly.
※ When disassembled, tag the components for identification so that they can be reassembled correctly.

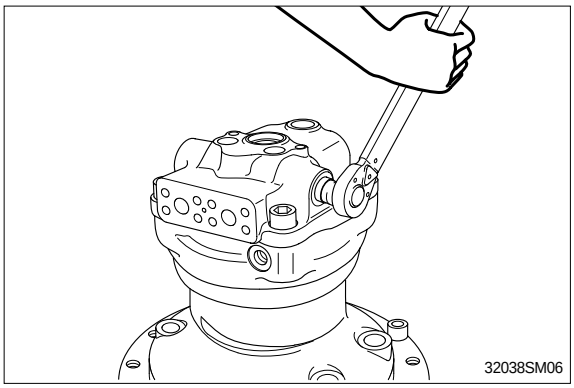


(5) Remove the relief valve(051) from valve casing(303).

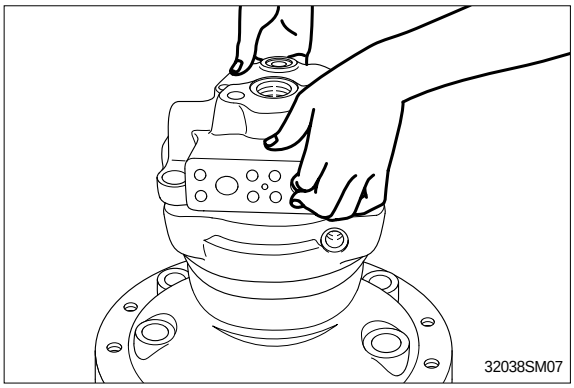


(6) Remove plug(469) from valve casing (303) and spring(355), plunger(351).

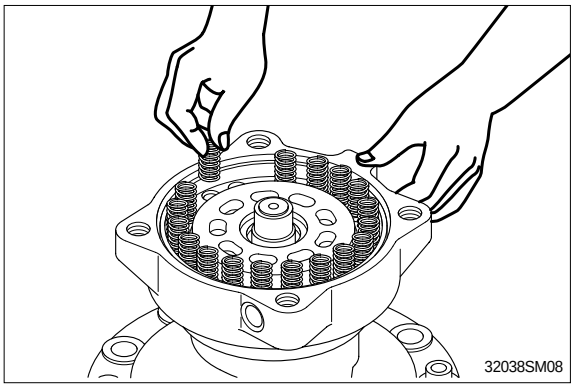
※ Be careful not to damage the plunger seat assembly.



(7) Remove valve casing(303) from casing (301). Then, remove the valve plate(131) from valve casing(303) with care.



(8) Remove the brake spring(712) from brake piston(702).



3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

(1) Remove the swing motor assembly.
For details, see **removal of swing motor assembly**.

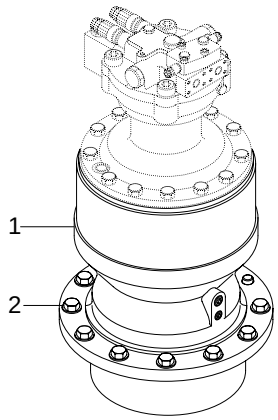
(2) Sling reduction gear assembly(1) and remove mounting bolts(2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 180kg (396lb)


13031GE18

2) INSTALL

(1) Carry out installation in the reverse order to removal.
· Tightening torque : 49.2±66.6kgf · m (356±481lbf · ft)



21078DA05

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90° and lower it completely to the ground.

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

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

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

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

(4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly**.

(5) Remove the cover.

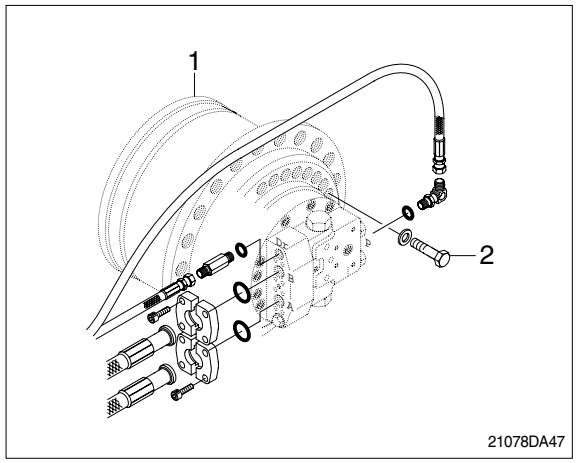
(6) Remove the hose.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly(1).

(9) Remove the mounting bolts(2), then remove the travel device assembly.
· Weight : 240kg(530lb)



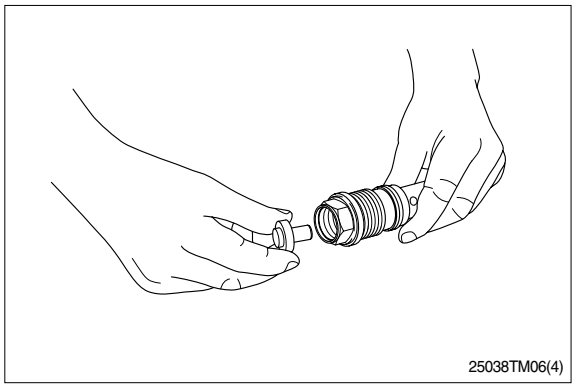
2) INSTALL

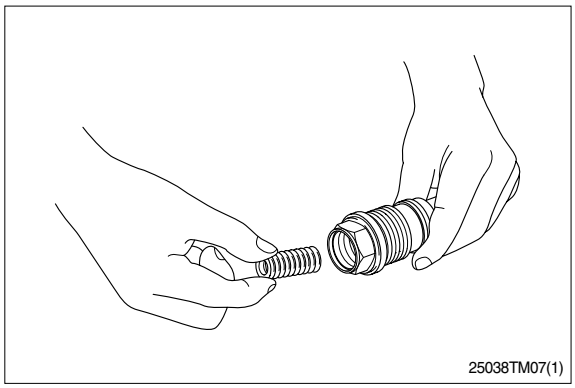
(1) Carry out installation in the reverse order to removal.

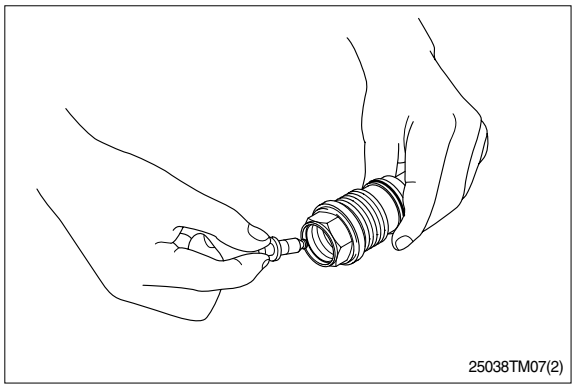
(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

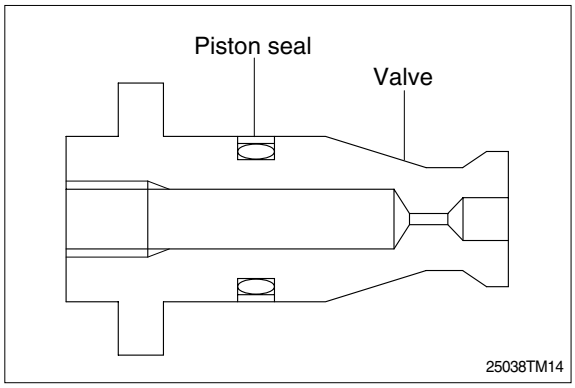
④ Take out spring retainer(203), spring (206) and valve(201) in that order.







⑤ Remove piston seal(220) from valve (201).



2) ASSEMBLY OF BRAKE VALVE

(1) Assembly of the check valve

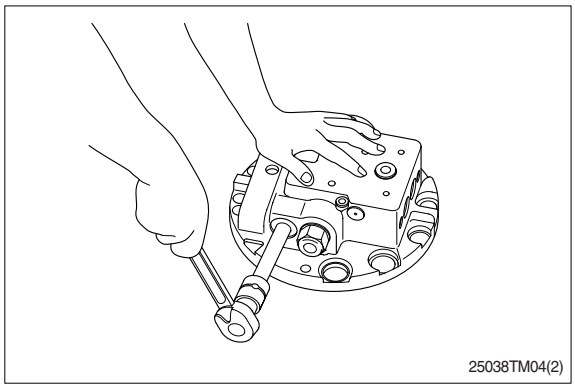
① Fit the O-ring(337) on the plug(326).

② Insert the spring(330) and the valve(327) into the plug(326), and then grease the spring(330) and the valve(327) and hand-lock the former.

③ Insert the plug(326) in conjunction with the spring(330) and the valve(327) into the rear flange(301), and tighten the plug to the required torque.

※ Apply grease to the O-ring(337).

※ Tighten the plug(326) to a torque of 26±4kgf · m(188±29lbf · ft).



(2) Assembly of the spool

① Insert the spool(323) into the rear flange (301).

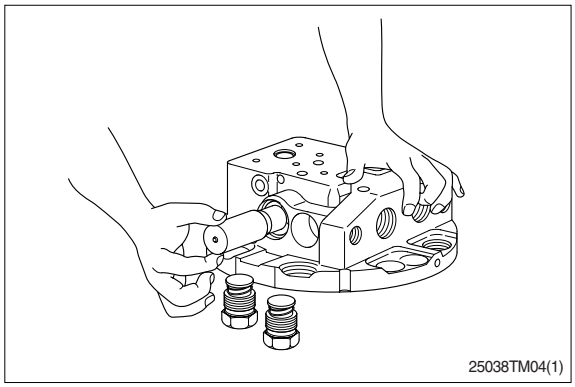
※ Apply a working fluid to the spool(323) and insert it into the rear flange(301).

※ Align the center of the hole in the rear flange with the axial center of the spool to prevent damage to the inner surface of the rear flange and the outer surface of the spool due to contact.

※ Above mentioned damage causes internal leakage after reassembly, thus degrading the motor performance.

② Attach the O-ring(336) to the plug(324).

※ Apply grease to O-ring(336).

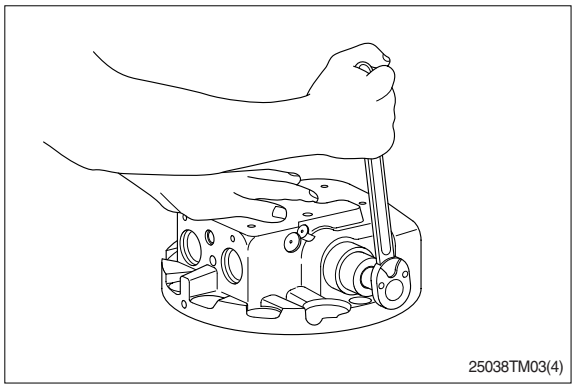


③ Install stopper(325) and the spring(328) into both plugs(324) and tighten the plugs(324) into the rear flange(301) at the required torque.

※ Apply grease to the O-ring(355).

※ Required torque : 45±9kgf · m (325±65lbf · ft)

※ Even if either the rear flange(301) or the spool(323) is to be replaced, their entire assembly(kit) must be replaced.



(11) Assembly of the shaft(102)

① Install ball bearing(149) on shaft(102) by shrunk fitting.

※ Wear thick leather groves in handling the heated bearing.

※ Be sure to push the bearing all the way down until inner race seats on the shoulder.

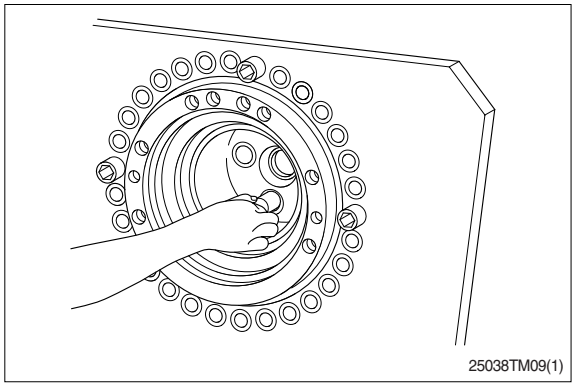
(12) Assembly of the piston assembly(161, 162)

① Install spring(193) into piston assembly (161, 162).

② Install it into spindle(2).

※ Apply grease to spring(193).

※ Apply hydraulic oil to piston assembly (161, 162).



(13) Assembly of the pivots(167)

① Fit two parallel pins(171) into spindle(2).

② Fit two pivots(167) to parallel pins(171).

※ Apply grease to the hemisphere surface of pivots(167).

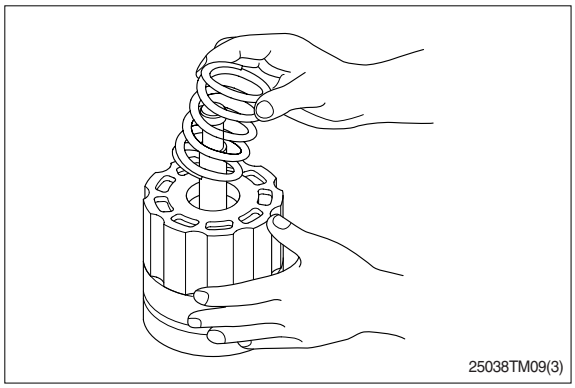
(14) Assembly of the cylinder block(104)

① Insert washer(110), spring(114), washer (110) in that order, into the shaft(102) bore of cylinder block(104).

② Set cylinder block(104) in the press in order to compress spring(114).

※ Wear thick leather groves in handling the heated bearing.

※ Be sure to push the bearing all the way down until inner race seats on the shoulder.



GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

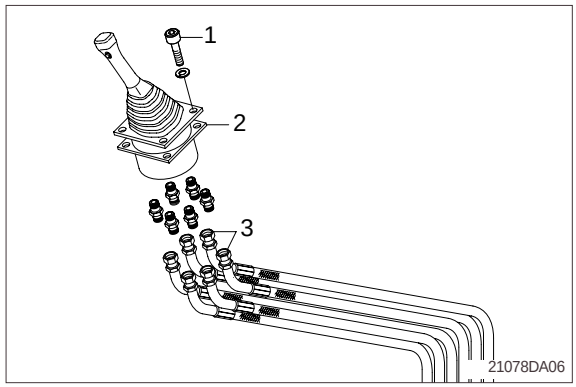
(4) Loosen the socket bolt(2).

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses(3).

(7) Remove the pilot valve assembly(1).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.



2) INSTALL

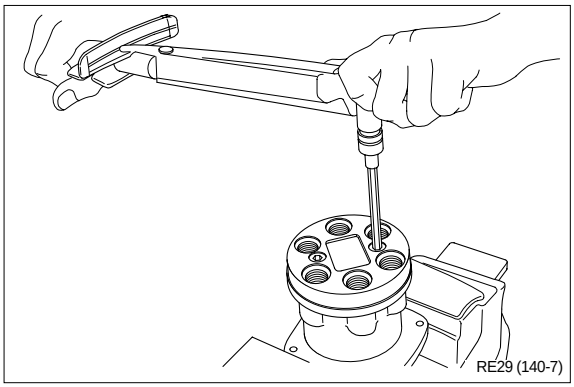
(1) Carry out installation in the reverse order to removal.

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

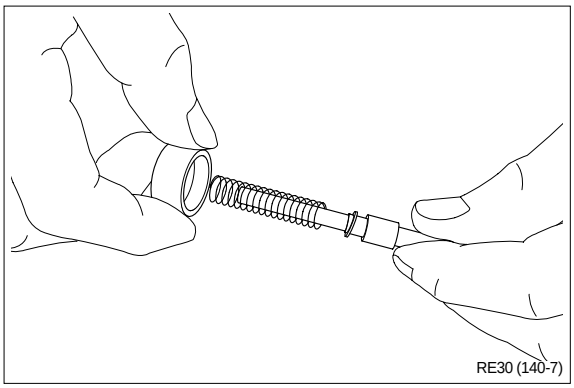
4) ASSEMBLY

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

※ Tighten two bolts alternately and slowly.

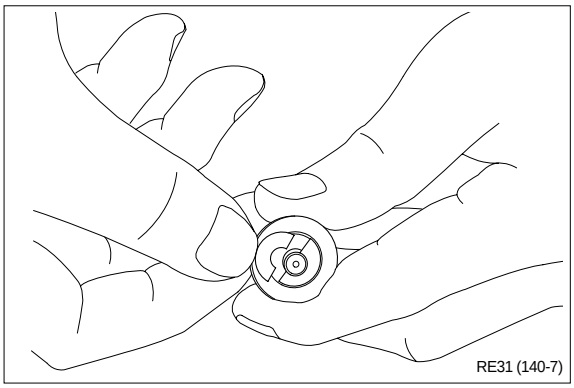

RE29 (140-7)

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


RE30 (140-7)

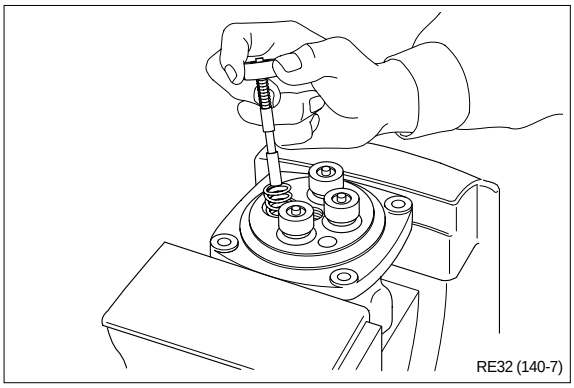
(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper(9) on spring seat without piling them on.

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


RE31 (140-7)

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

※ Assemble them to their original positions.


RE32 (140-7)

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

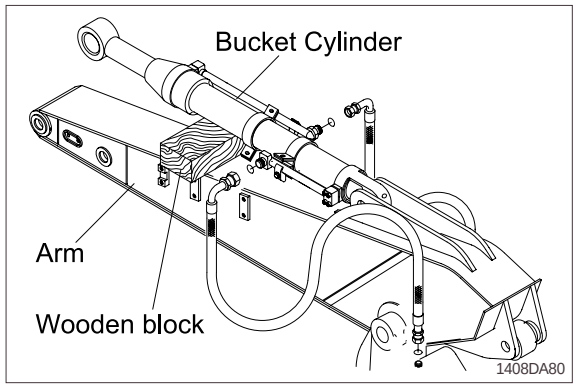
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.

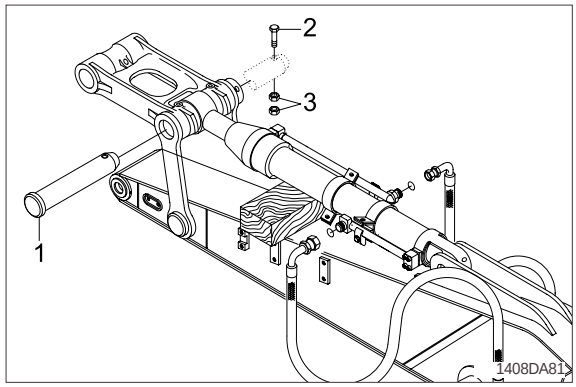
※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

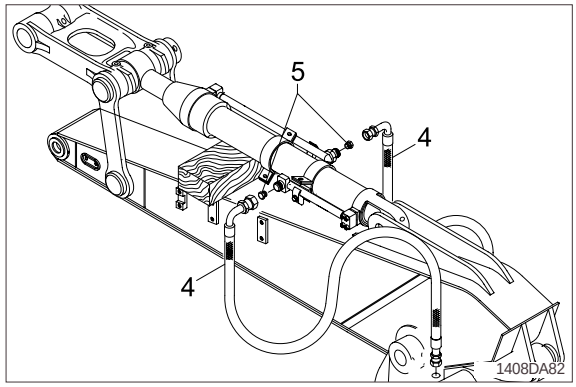


② Remove bolt(2), nut(3) and pull out pin (1).

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



③ Disconnect bucket cylinder hoses(4) and put plugs(5) on cylinder pipe.



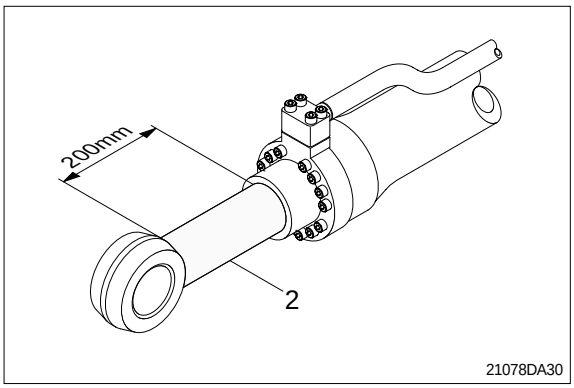
3) DISASSEMBLY

(1) Remove cylinder head and piston rod

① Hold the clevis section of the tube in a vise.

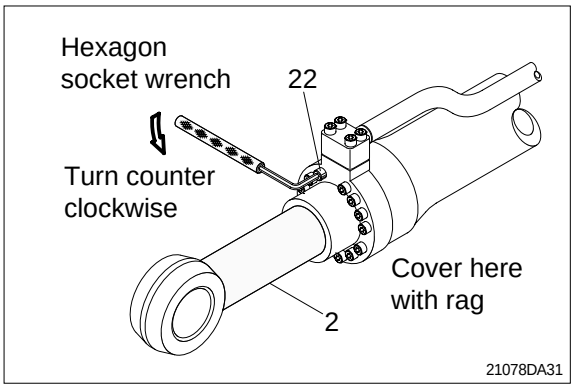
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



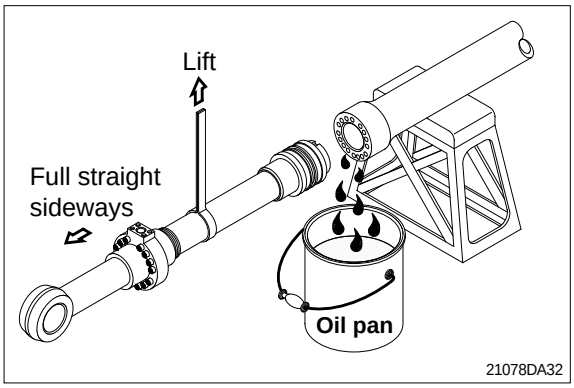
③ Loosen and remove socket bolts(22) of the gland in sequence.

※ Cover the extracted rod assembly(2) with rag to prevent it from being accidentally damaged during operation.



④ Draw out cylinder head and rod assembly together from tube assembly(1).

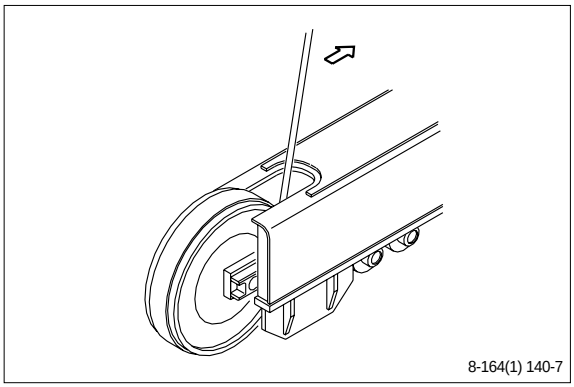
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly(2) with a crane or some means and draw it out. However, when rod assembly(2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



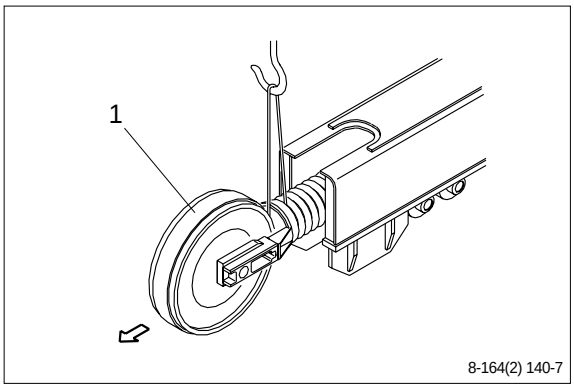
4. IDLER AND RECOIL SPRING

1) REMOVAL

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

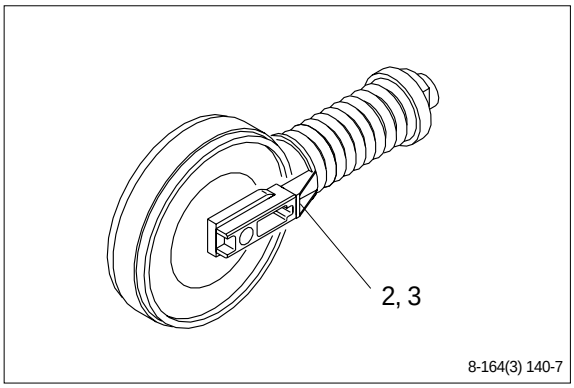

8-164(1) 140-7

(2) Sling the recoil spring(1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 300kg(660lb)



8-164(2) 140-7

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

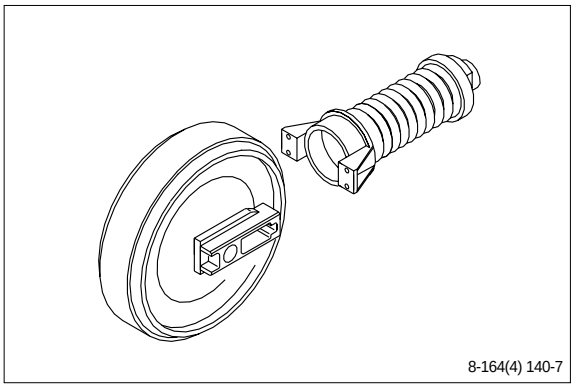


8-164(3) 140-7

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.

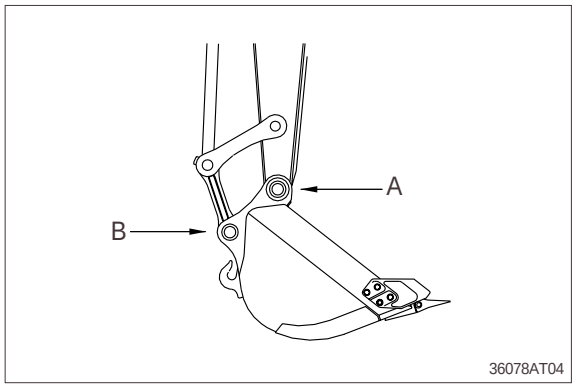

8-164(4) 140-7

2. REMOVAL AND INSTALL

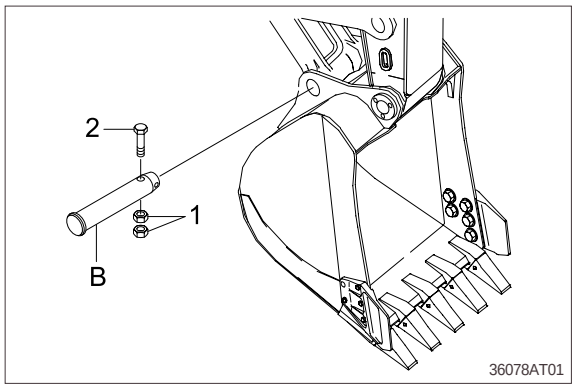
1) BUCKET ASSEMBLY

(1) Removal

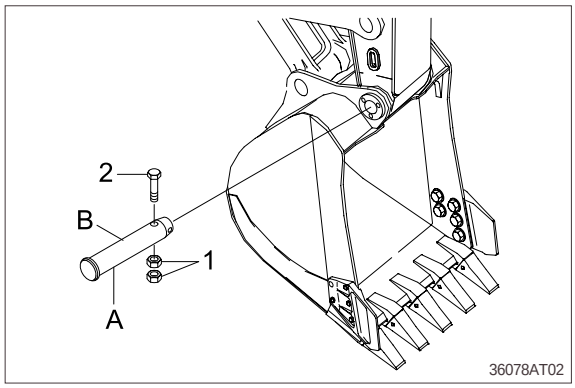
① Lower the work equipment completely to ground with back of bucket facing down.



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



③ Remove nut(3), bolt(4) and draw out the pin(B) then remove the bucket assembly.
· Weight : 570kg(1260lb)



(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.**