

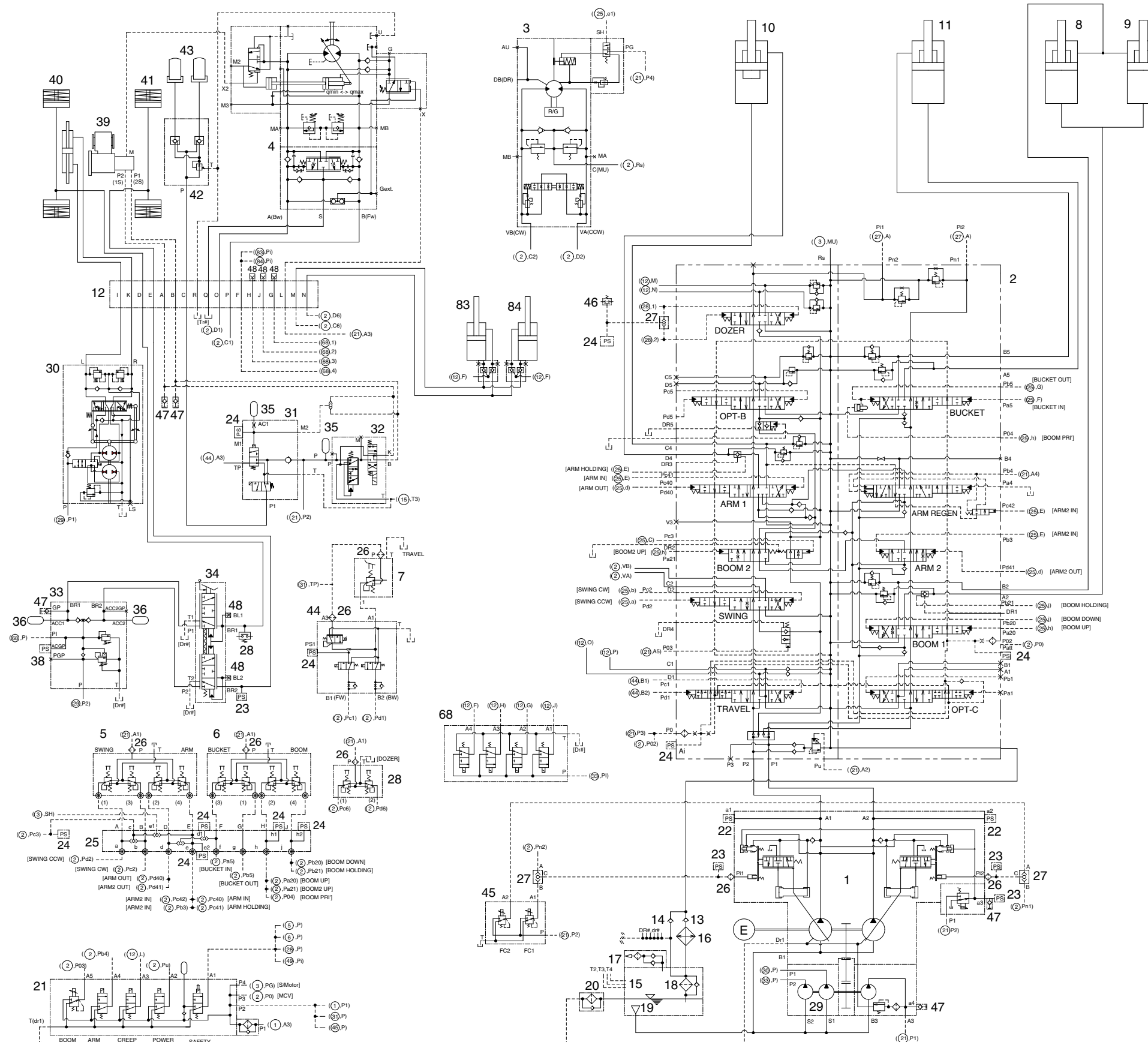
SECTION 3 HYDRAULIC SYSTEM

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SECTION 3 HYDRAULIC SYSTEM

GROUP 1 HYDRAULIC CIRCUIT

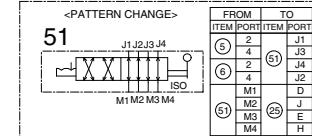
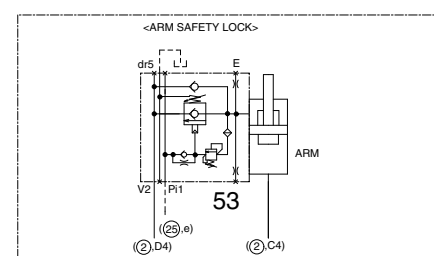
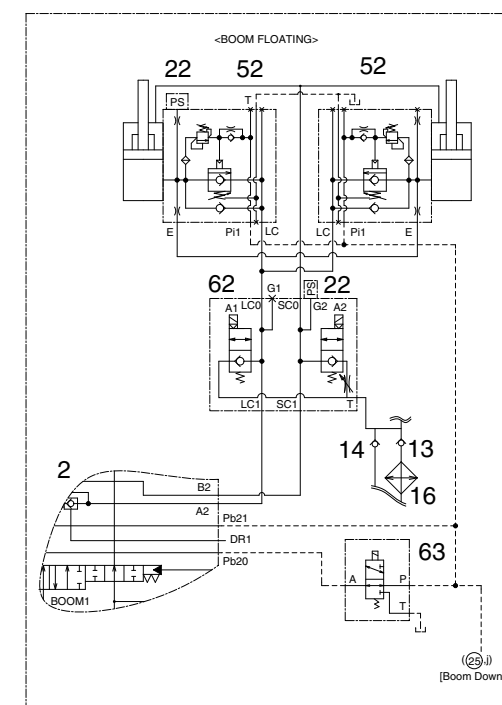
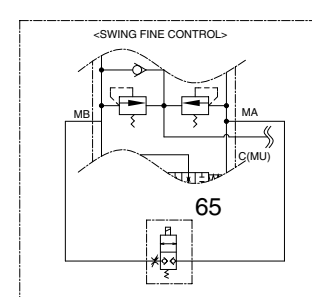
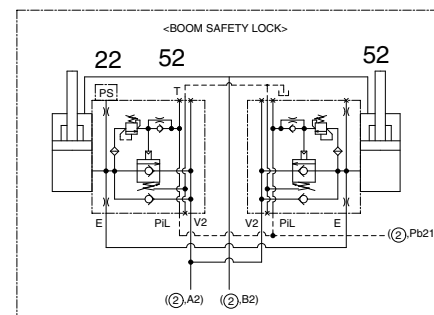
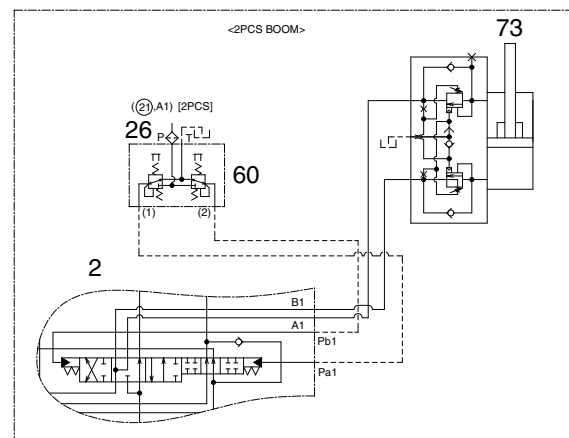
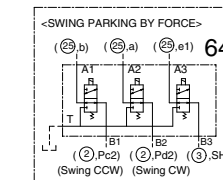
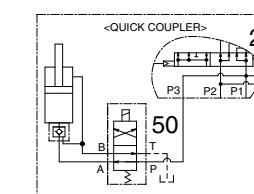
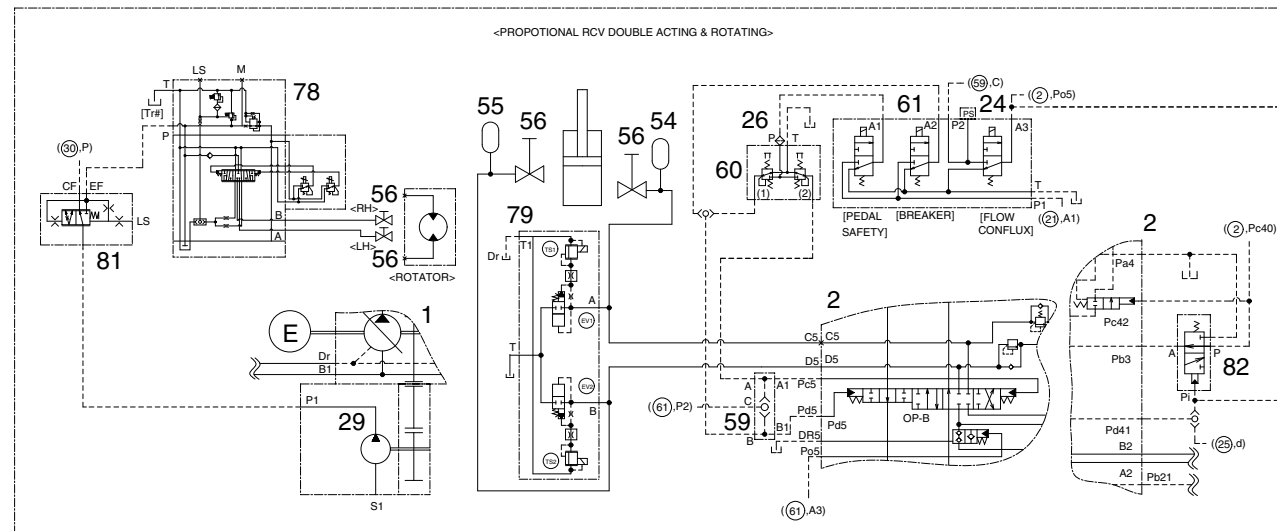
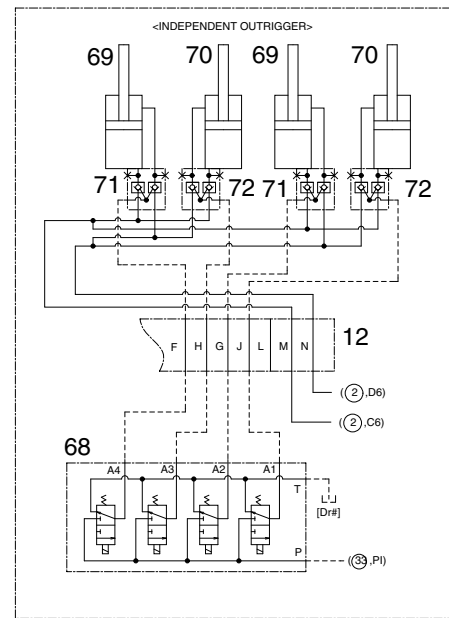
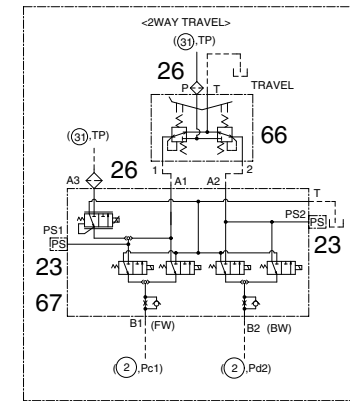
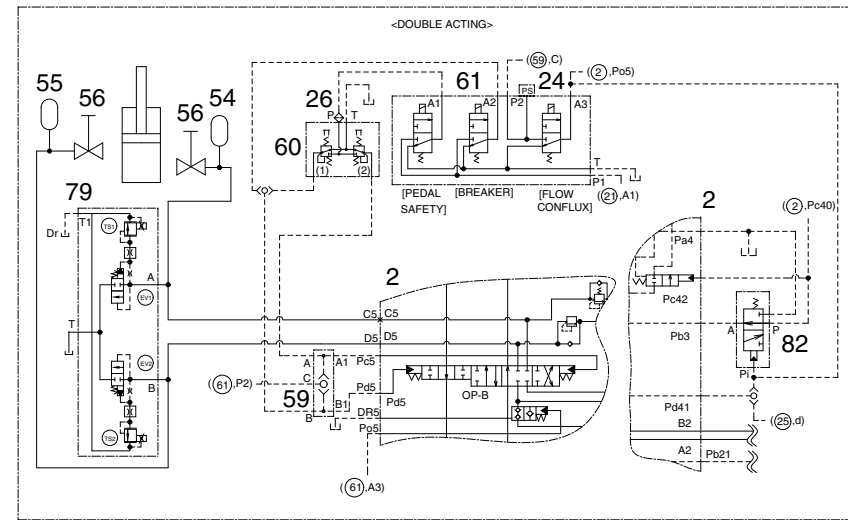
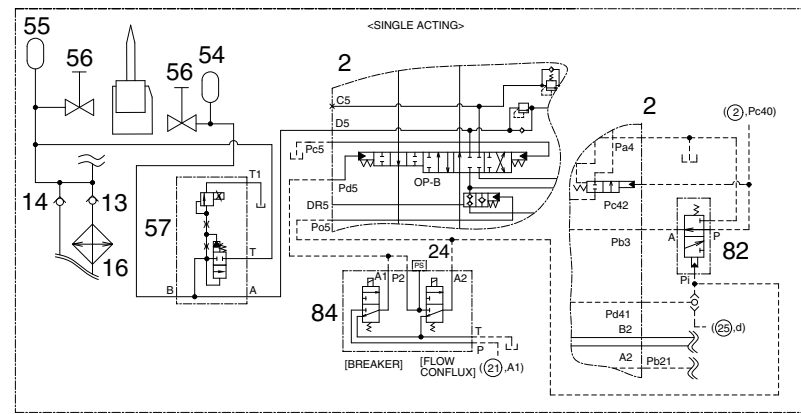
1. HYDRAULIC CIRCUIT (1/2)



- 1 Main pump
- 2 Main control valve
- 3 Swing motor
- 4 Travel motor
- 5 RCV lever (LH)
- 6 RCV lever (RH)
- 7 Accelerator pedal (1 way)
- 8 Boom cylinder (LH)
- 9 Boom cylinder (RH)
- 10 Arm cylinder
- 11 Bucket cylinder
- 12 Turning joint
- 13 Check valve
- 14 Check valve
- 15 Hydraulic tank
- 16 Oil cooler
- 17 Air breather
- 18 Return filter
- 19 Suction strainer
- 20 Drain filter
- 21 5 cartridge valve
- 22 Pressure sensor
- 23 Pressure sensor
- 24 Pressure sensor
- 25 Shuttle block
- 26 Last guard filter
- 27 Shuttle valve
- 28 RCV dozer (option)
- 29 Power train pump
- 30 Steering valve
- 31 Travel control valve
- 32 Transmission control valve
- 33 Brake supply valve
- 34 Brake valve
- 35 Accumulator
- 36 Accumulator
- 37 Pressure sensor
- 38 Pressure sensor
- 39 Transmission
- 40 Front axle
- 41 Rear axle
- 42 Locking valve
- 43 Oscillating cylinder
- 44 3 cartridge valve
- 45 2-EPPR cartridge valve
- 46 Pressure switch
- 47 Solenoid valve
- 48 Solenoid valve
- 49 Pilot selector valve

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2. HYDRAULIC CIRCUIT (2/2)



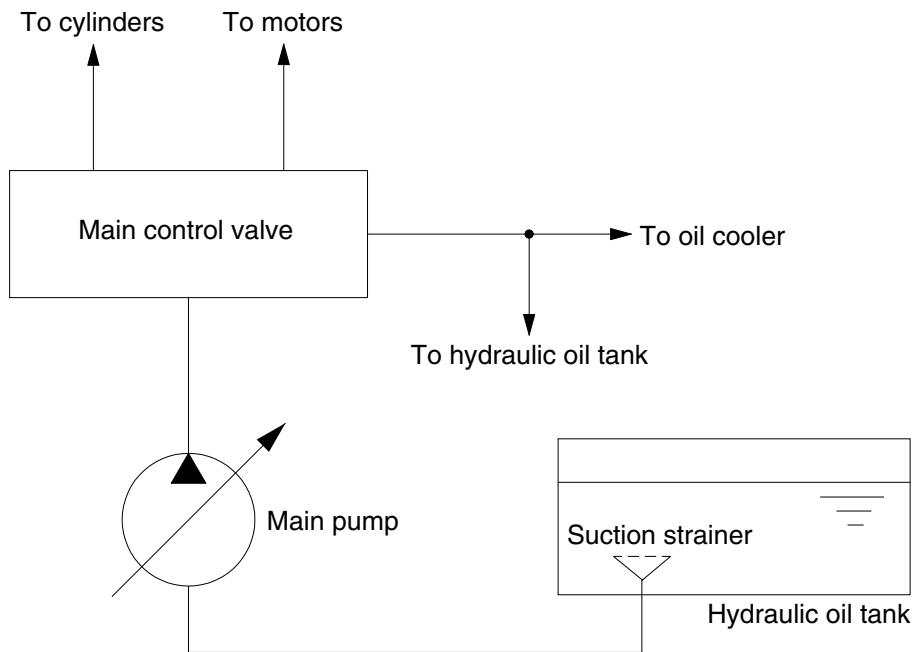
- 1 Main pump
- 2 Main control valve
- 8 Boom cylinder (LH)
- 9 Boom cylinder (RH)
- 10 Arm cylinder
- 13 Check valve
- 14 Check valve
- 16 Oil cooler
- 22 Pressure sensor (option)
- 23 Pressure sensor (option)
- 24 Pressure sensor (option)
- 26 Last guard filter (option)
- 50 Solenoid valve (option)
- 51 Pattern change valve (option)
- 52 Boom safety lock valve (option)
- 53 Arm safety lock valve (option)
- 54 Accumulator (option)
- 55 Accumulator (option)
- 56 Stop valve (option)
- 57 Proportional relief valve (LH, option)
- 59 Shuttle valve (option)
- 60 2 way pedal (option)
- 61 Solenoid valve (option)
- 62 Float cartridge valve (option)
- 63 Solenoid valve (option)
- 64 Solenoid valve (option)
- 65 Solenoid valve (option)
- 66 Accelerator pedal (2 way, option)
- 67 5 cartridge valve (option)
- 68 4 cartridge valve (option)
- 69 Outrigger cylinder (LH, option)
- 70 Outrigger cylinder (RH, option)
- 71 Double pilot check valve (LH, option)
- 72 Double pilot check valve (RH, option)
- 73 2 pcs boom cylinder (option)
- 78 Proportional valve (option)
- 79 Proportional relief valve (RH, option)
- 80 2 EPPR valve (option)
- 82 Pilot selector valve (option)
- 83 3 way valve (option)
- 84 Solenoid valve (option)

GROUP 2 MAIN CIRCUIT

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

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

1. SUCTION AND DELIVERY CIRCUIT



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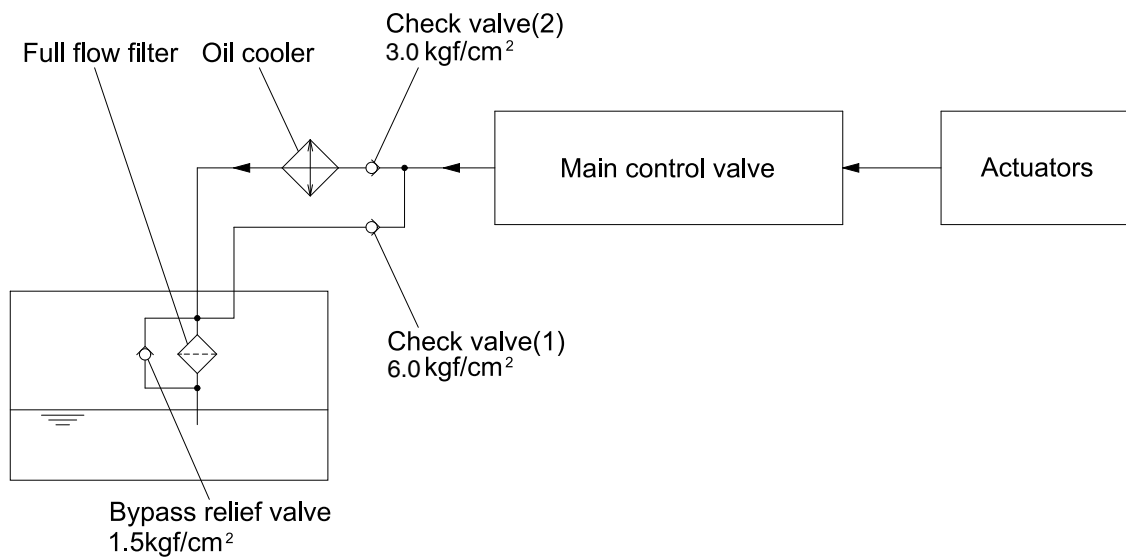
The pumps receive oil from the hydraulic tank through a suction strainer. The discharged oil from the pump flows into the control valve and goes out the tank ports.

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

The control valve controls the hydraulic functions.

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

2. RETURN CIRCUIT



140WF3CI01

All oil from each actuator returns to the hydraulic tank through the control valve.

The bypass check valves are provided in the return circuit.

The setting pressure of bypass check valves are 3.0 kgf/cm² (43 psi) and 6.0 kgf/cm² (85 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. When the oil pressure exceeds 6.0 kgf/cm² (85 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

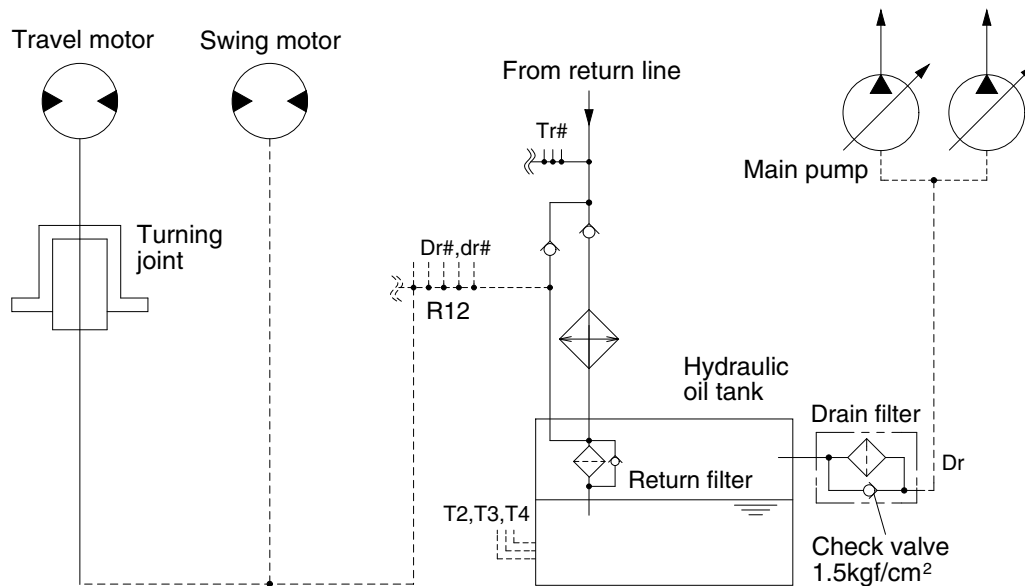
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).

The return filter and bypass relief valve are provided in the hydraulic tank.

The oil returned from right and left side of control valve is combined and filtered by the return filter. A bypass relief valve is provided in the full-flow filter.

When the filter element is clogged, the bypass relief valve opens at 1.5 kgf/cm² (21 psi) differential pressure.

3. DRAIN CIRCUIT



140WF3CI02

Besides internal leaks from the motor, transmission, front and rear axle the oil for lubrication circulates. The main pump drain oil have to be fed to the hydraulic tank passing through drain filter. When the drain oil pressure exceed 1.5 kgf/cm² (21 psi), the oil returns to the hydraulic tank directly.

1) TRAVEL MOTOR DRAIN CIRCUIT

Oil leaking from the travel motor comes out of the drain ports provided in the motor casing. This oil passes through turning joint and returns to the hydraulic tank after being filtered by return filter.

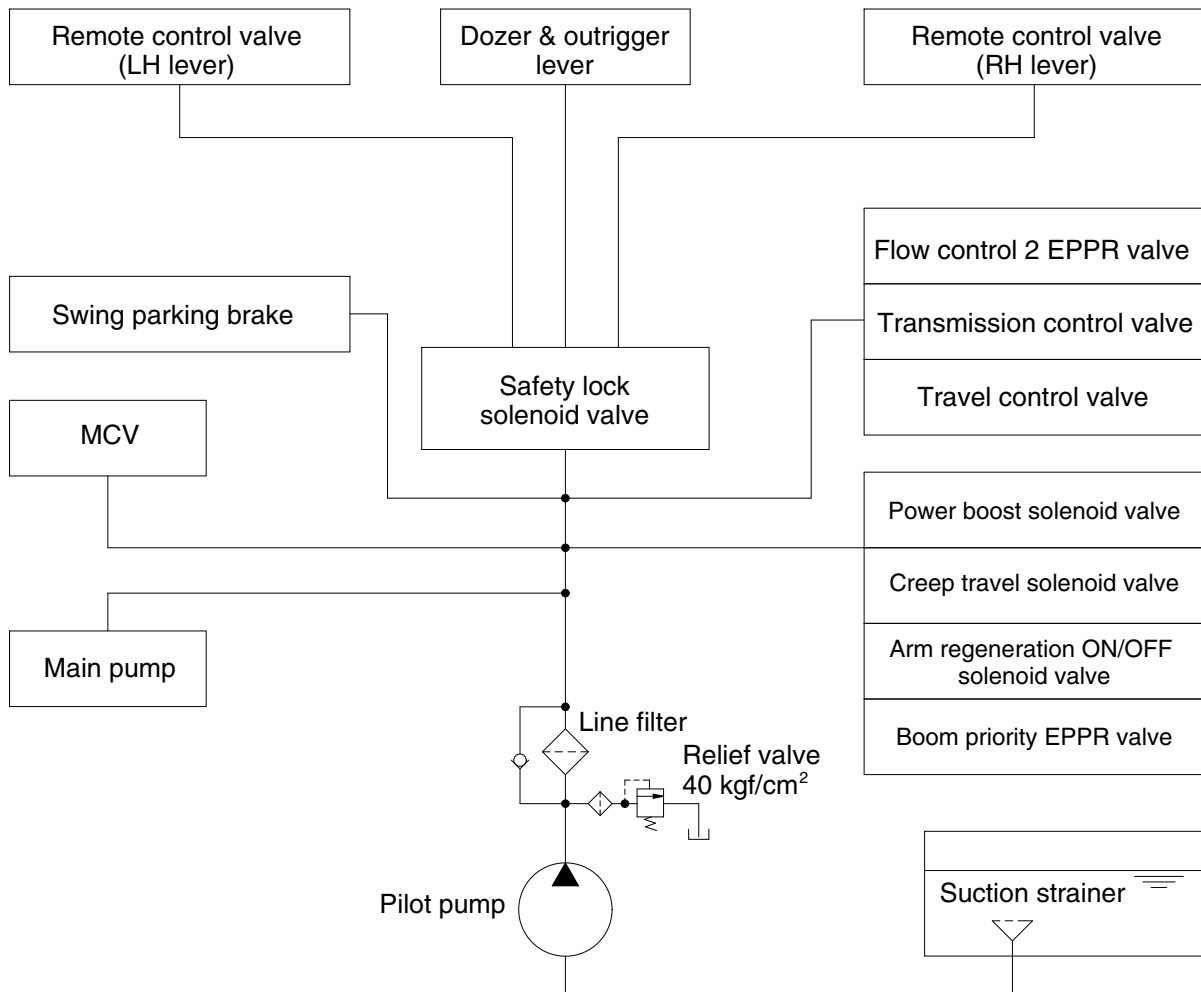
2) SWING MOTOR DRAIN CIRCUIT

Oil leaking from the swing motor comes out and joins the travel motor drain line and return to the hydraulic tank.

3) MAIN PUMP DRAIN CIRCUIT

Oil leaking from main pump come out and return to the hydraulic tank passing through drain filter.

GROUP 3 PILOT CIRCUIT



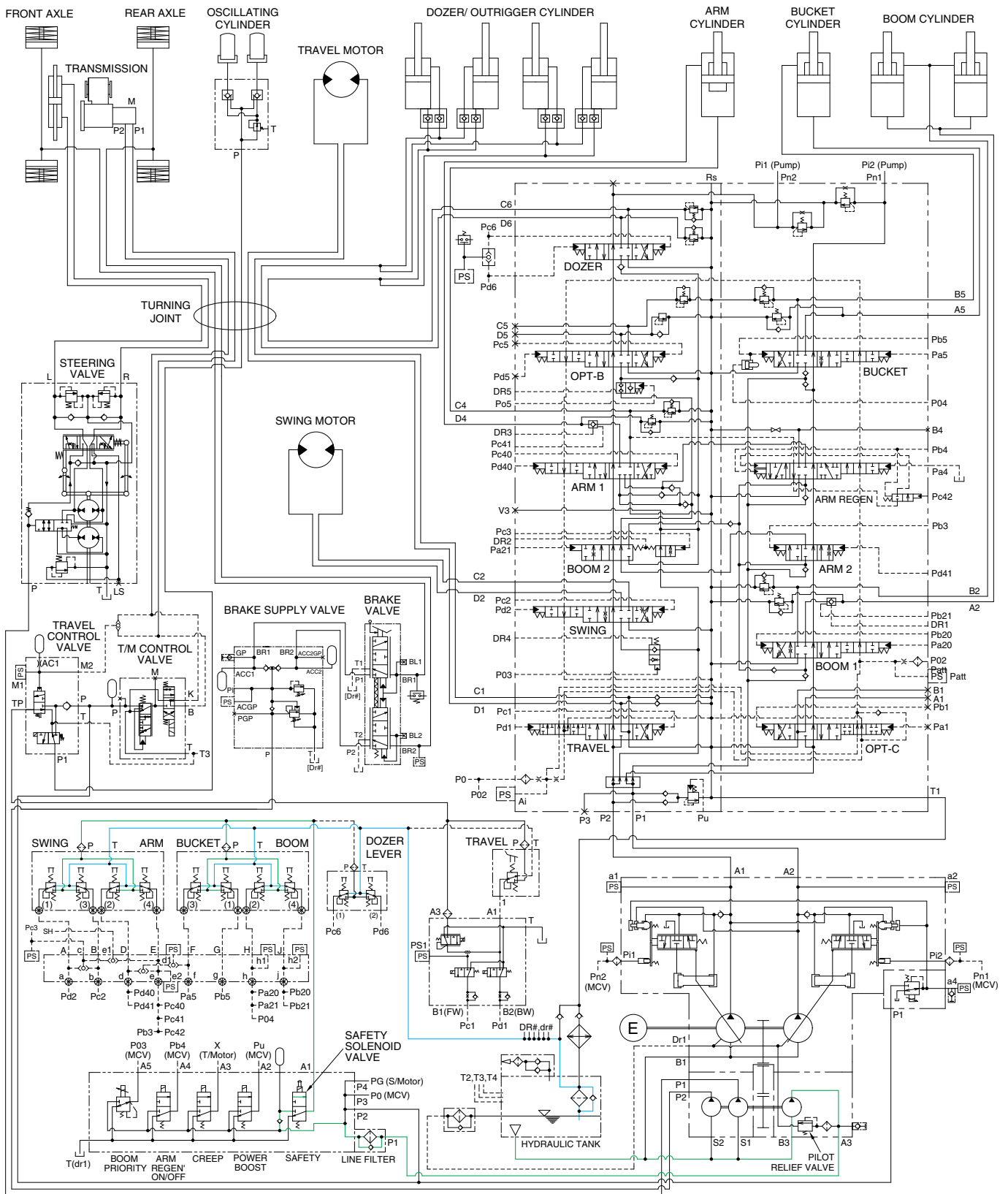
140WF3C103A

The pilot circuit consists of suction circuit, delivery circuit and return circuit.

The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction strainer.

The discharged oil from the pilot pump flows to the remote control valve via safety lock solenoid valve and, EPPR valve, solenoid valve assemblies, swing parking brake, main control valve, main pump and transmission/travel control valve through line filter.

1. SUCTION, DELIVERY AND RETURN CIRCUIT



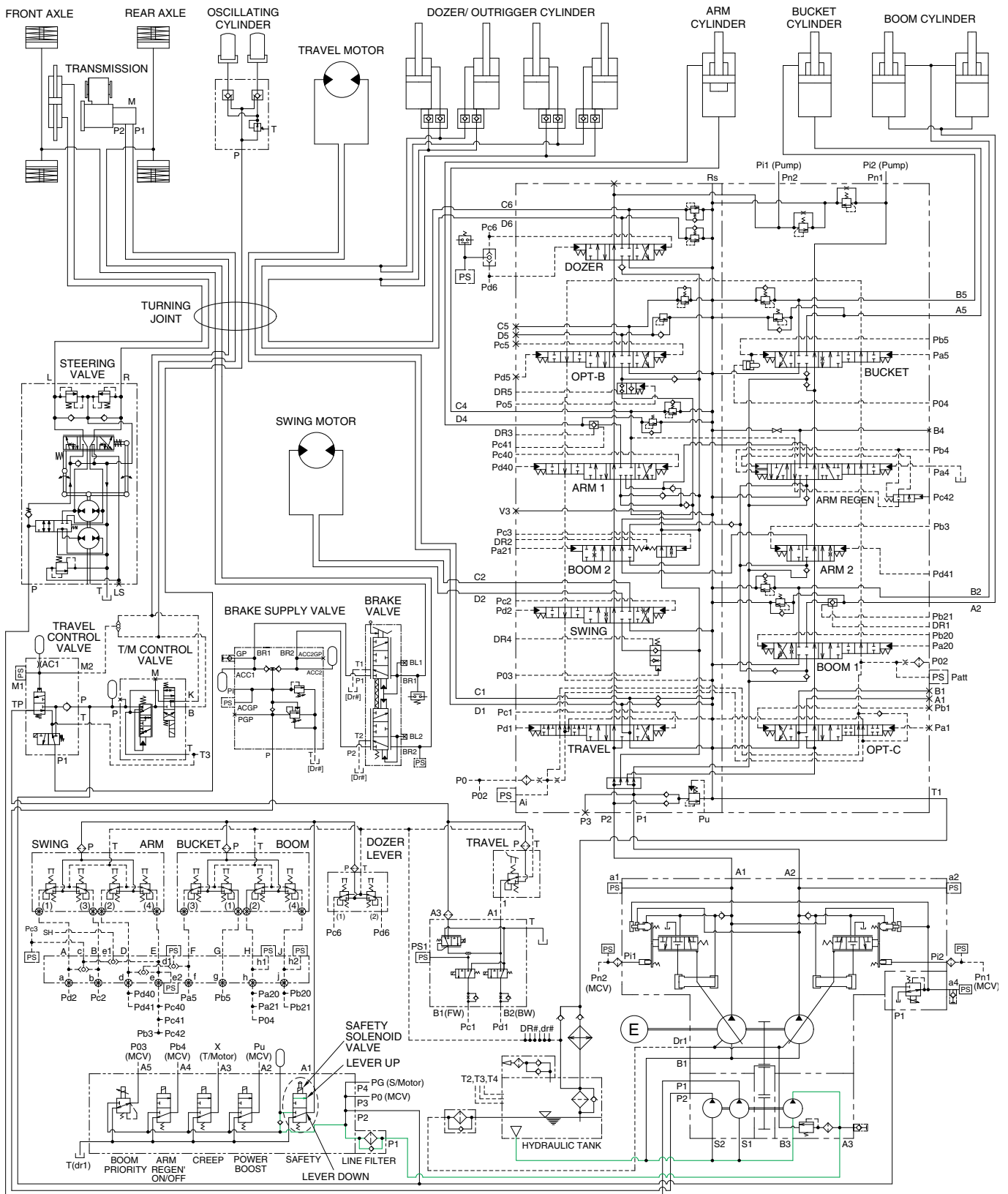
140WF3HC02A

The pilot pump receives oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

The oil filtered by line filter flows remote control valve through safety solenoid valve.

The return oil from remote control valve is returned to the hydraulic tank.

2. SAFETY SOLENOID VALVE (SAFETY LEVER)

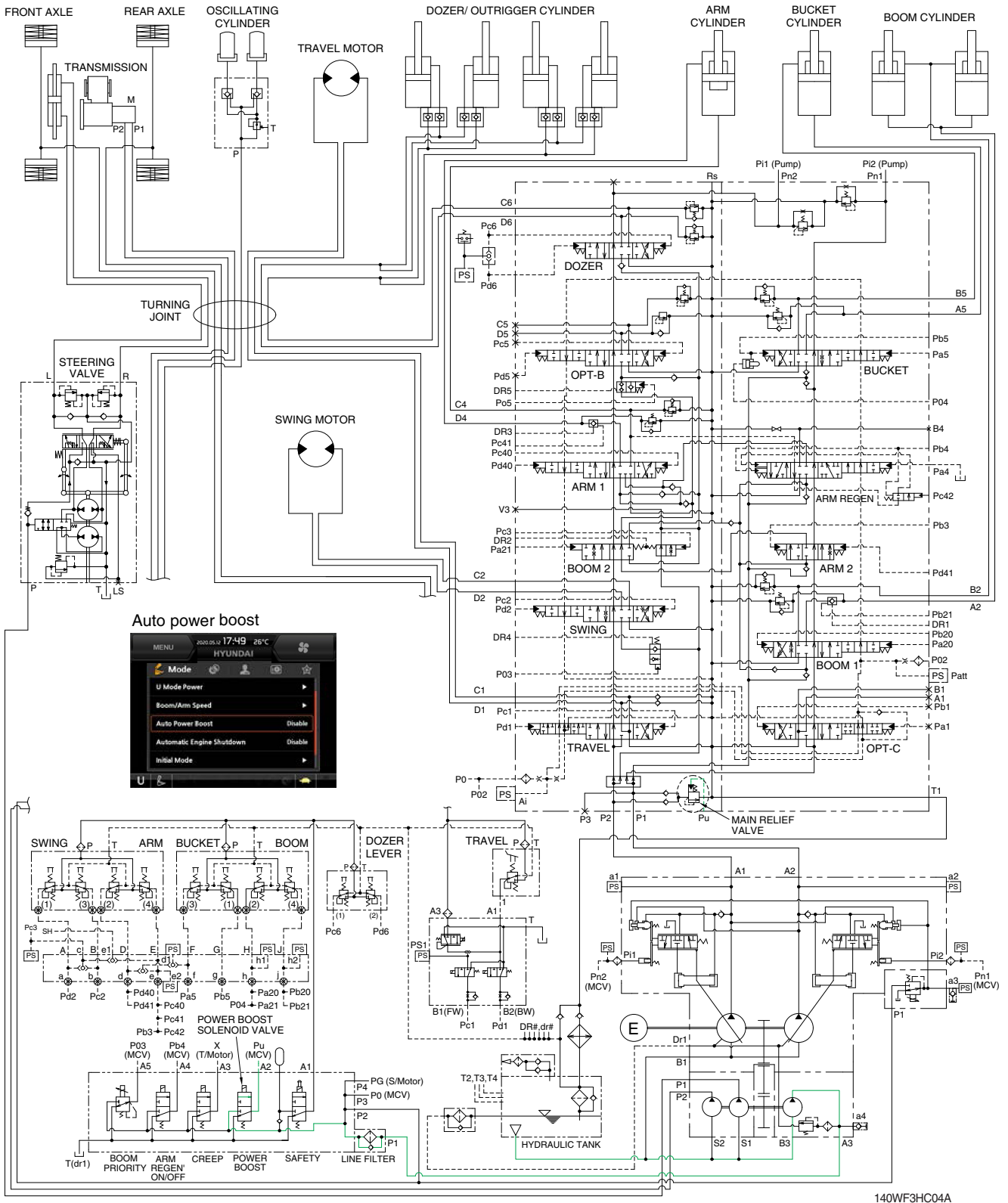


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When the lever of the safety solenoid valve is moved upward, oil flows into the remote control valve through solenoid valve and line filter.

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

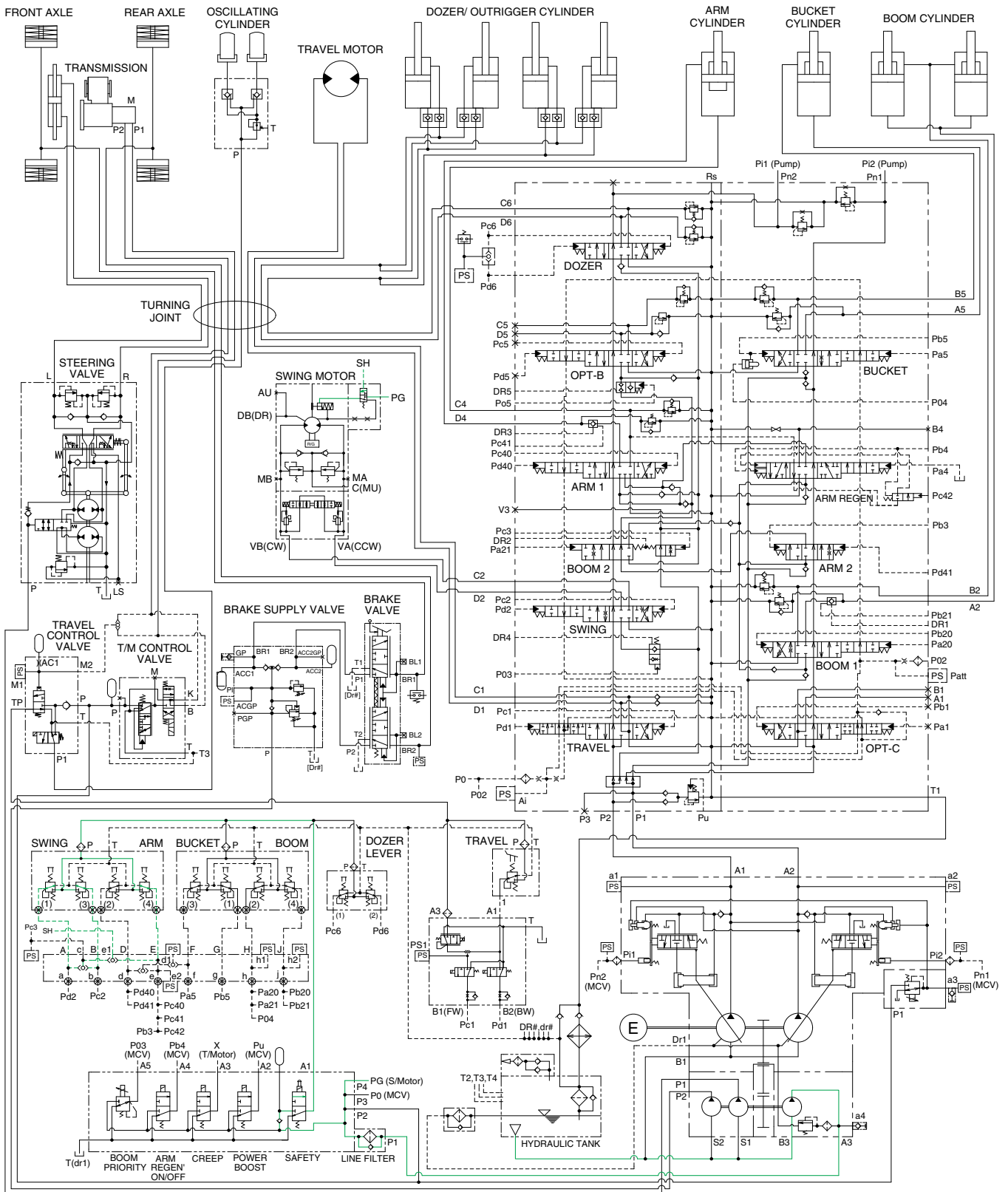
3. MAIN RELIEF PRESSURE CHANGE SYSTEM



When the power boost switch on the left control lever is pushed ON, the power boost solenoid valve is actuated, the discharged oil from the pilot pump flows into **Pu** port of the main relief valve in main control valve ; then the setting pressure of the main relief valve is raises from 350 kgf/cm² to 380 kgf/cm² for increasing the digging power. And even when press continuously, it is canceled after 8 seconds.

When the auto power boost function is selected to **Enable** on the cluster, the pressure of the main relief pressure is automatically increased to 380 kgf/cm² as working condition by the MCU. It is also operated max 8 seconds. Refer to page 5-83.

4. SWING PARKING BRAKE RELEASE

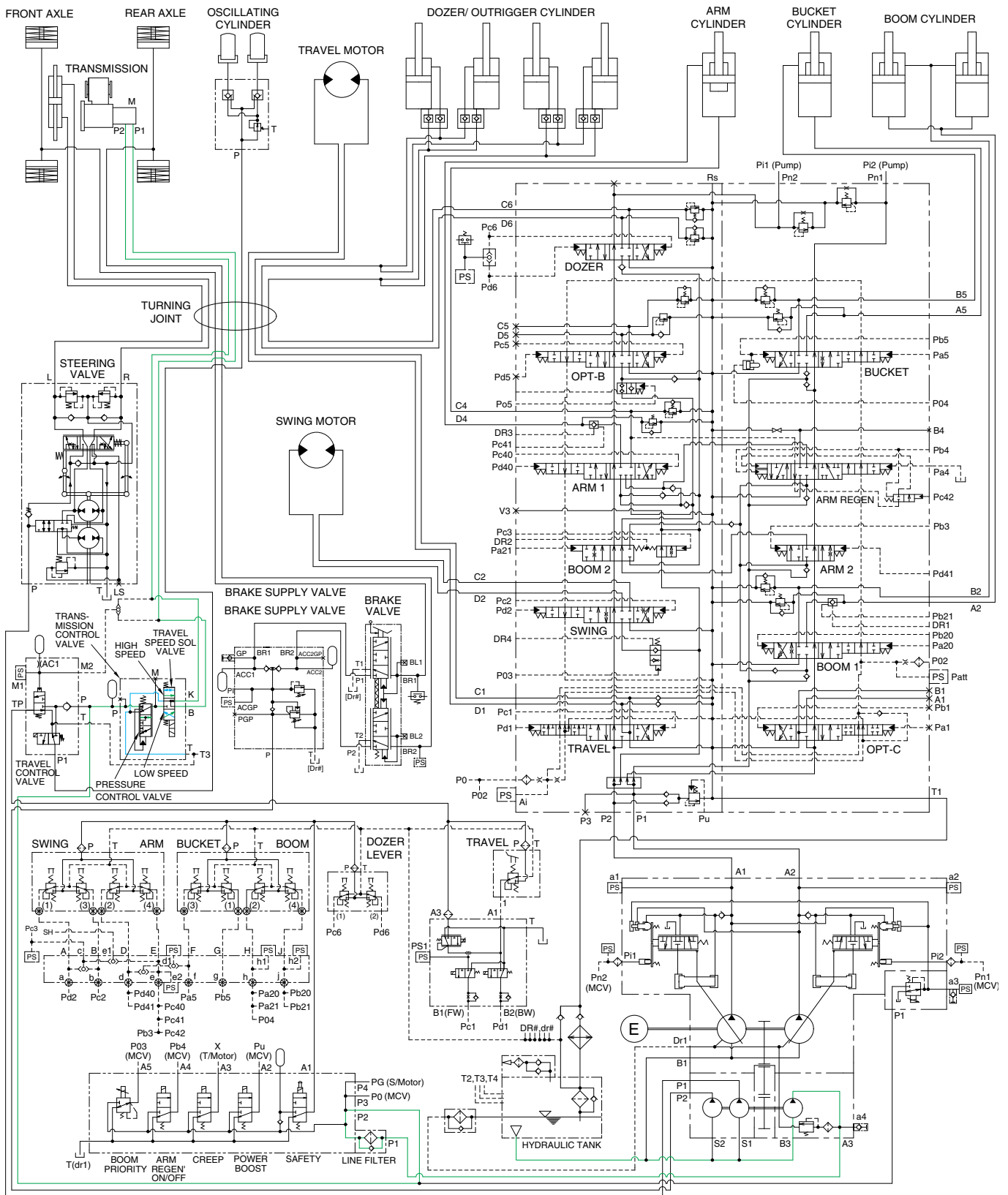


140WF3HC05A

When the swing control lever or arm in control lever is tilted, the pilot oil flows into SH port through main control valve. This pressure move spool so, discharged oil from pilot pump flows into swing motor PG port. This pressure is applied to swing motor disc, thus the brake released.

When the the swing control lever and arm in control lever are set in the neutral position, oil in the swing motor disc cylinder is drained, thus the brake is applied.

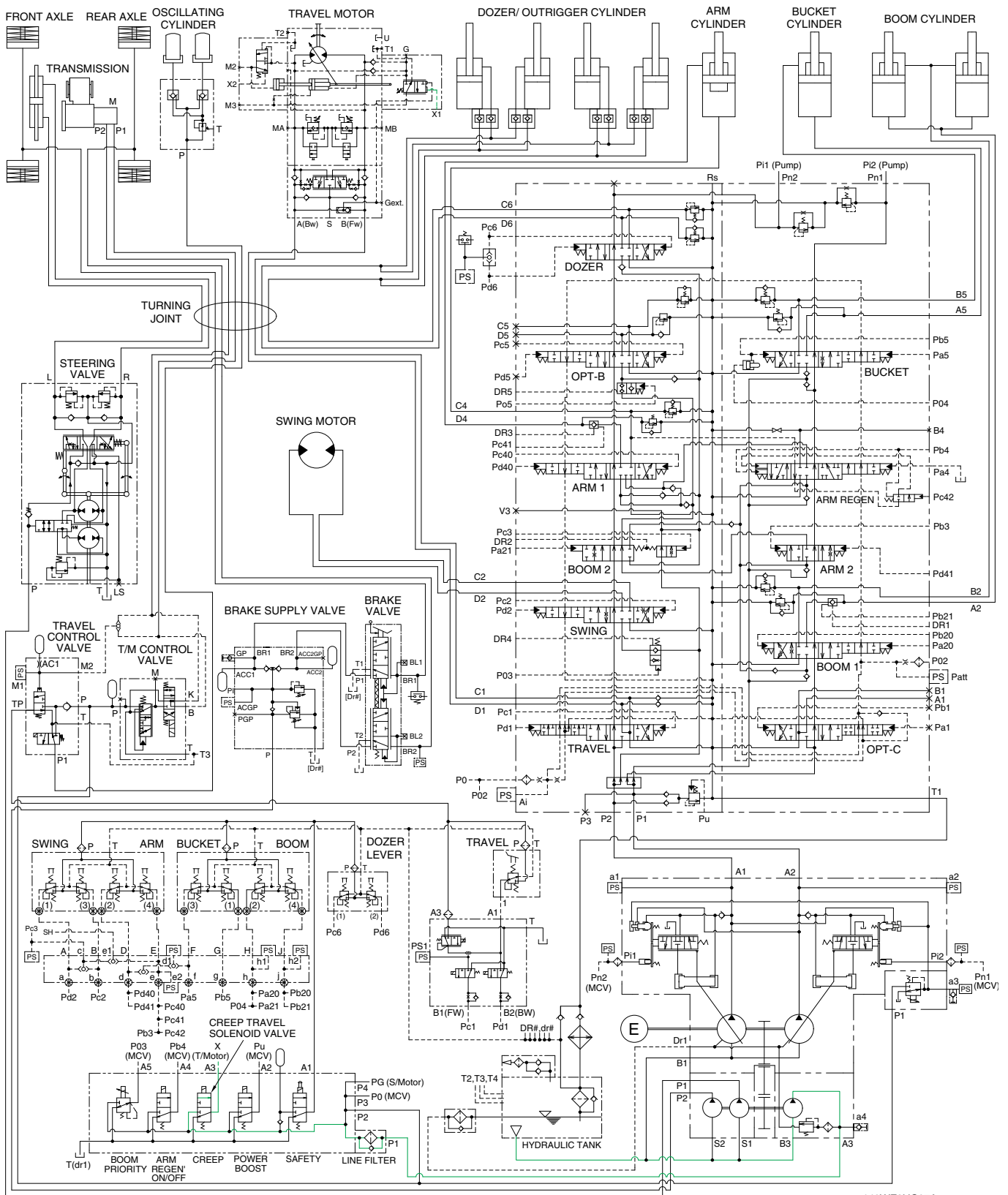
5. TRAVEL SPEED SELECTION SYSTEM



140WF3HC06A

When RH multifunction switch was placed in high or low speed position, the pressure oil from pilot pump flows to travel speed solenoid valve through pressure control valve, thus the transmission is changed into high (P1) or low (P2) speed condition.

6. CREEP TRAVEL SYSTEM

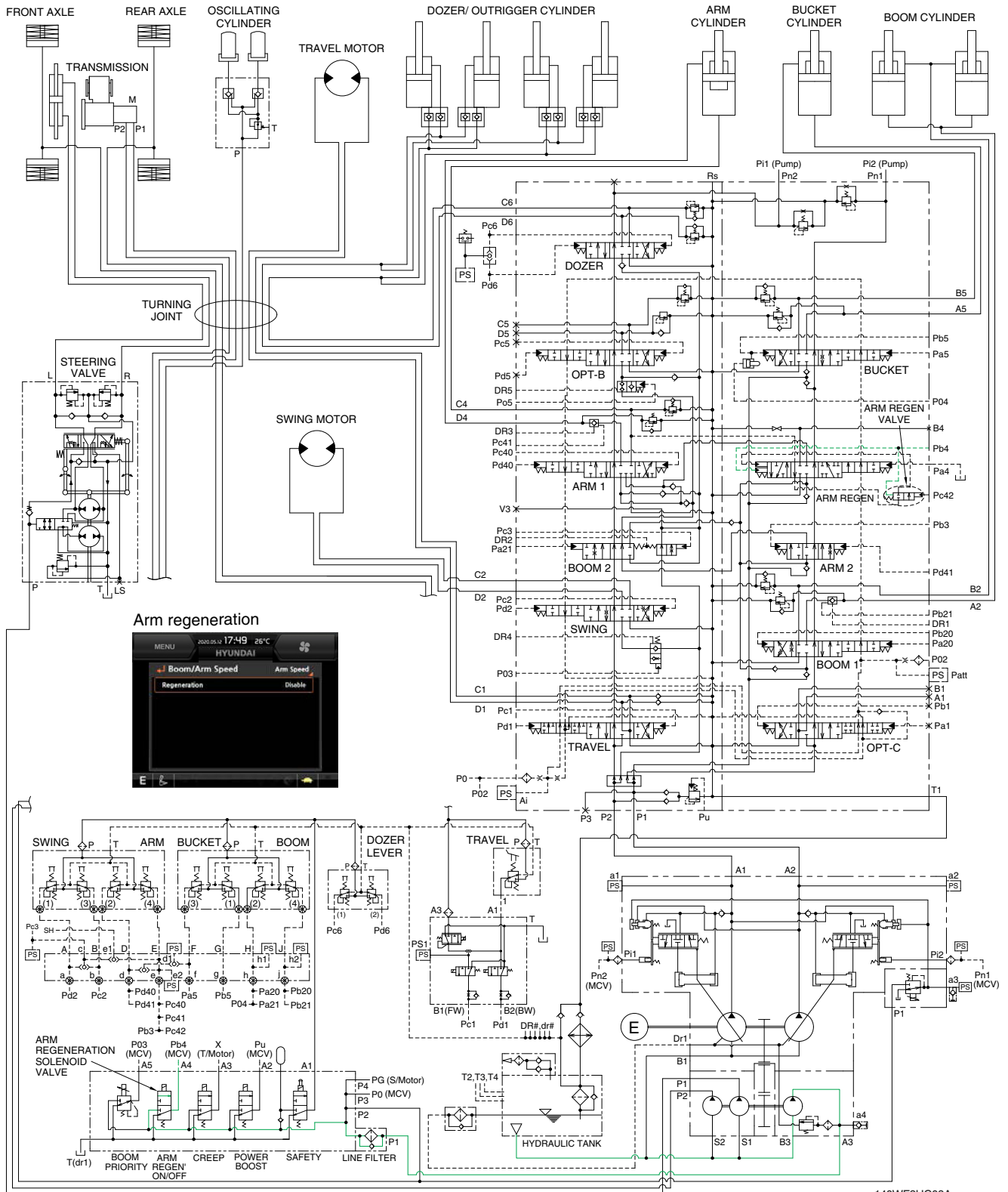


When the creep switch on the dashboard of the steering column is pushed ON, the creep travel solenoid valve is actuated.

The discharged oil from the pilot pump flows into X port of travel motor through solenoid valve.

Then, the machine speed is very low travelling more than 1st speed.

7. ARM REGENERATION CUT SYSTEM



140WF3HC08A

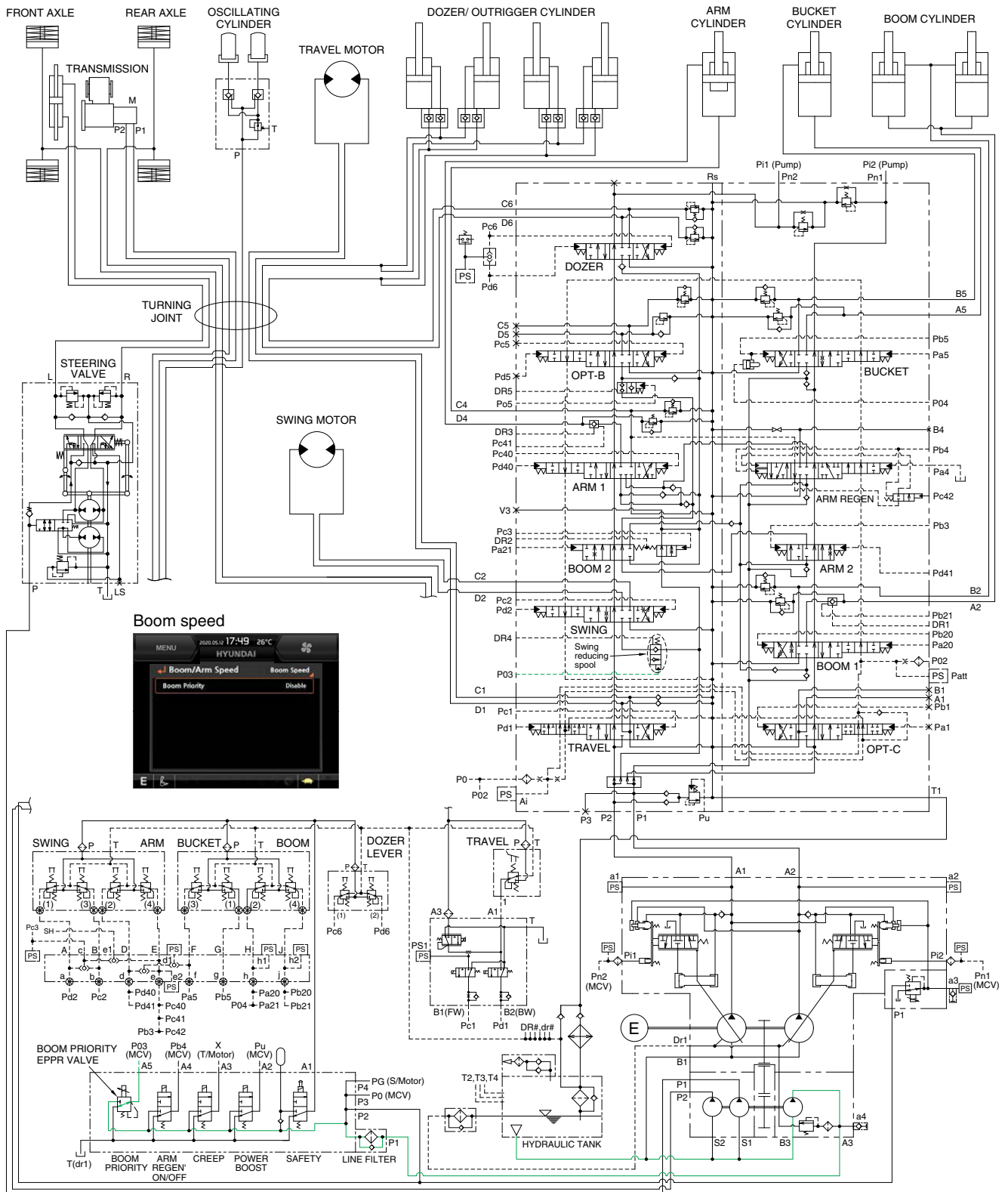
When the arm regeneration is selected to **Disable** on the cluster, the arm regeneration solenoid valve is activated. The pilot oil from pilot pump flows into **Pb4** port in main control valve through solenoid valve and the arm regeneration spool is shifted to right.

Then, the oil from arm regeneration passage returns to tank and the arm regeneration function is deactivated.

When the arm regeneration is selected to **Enable** on the cluster, the arm regeneration function is activated and arm in operation speed is increased.

Refer to page 2-37 for the arm regeneration function.

8. BOOM PRIORITY SYSTEM



140WF3HC09A

When carrying out the combined operation of swing and boom up, the boom up operating speed is lowered then normal operation.

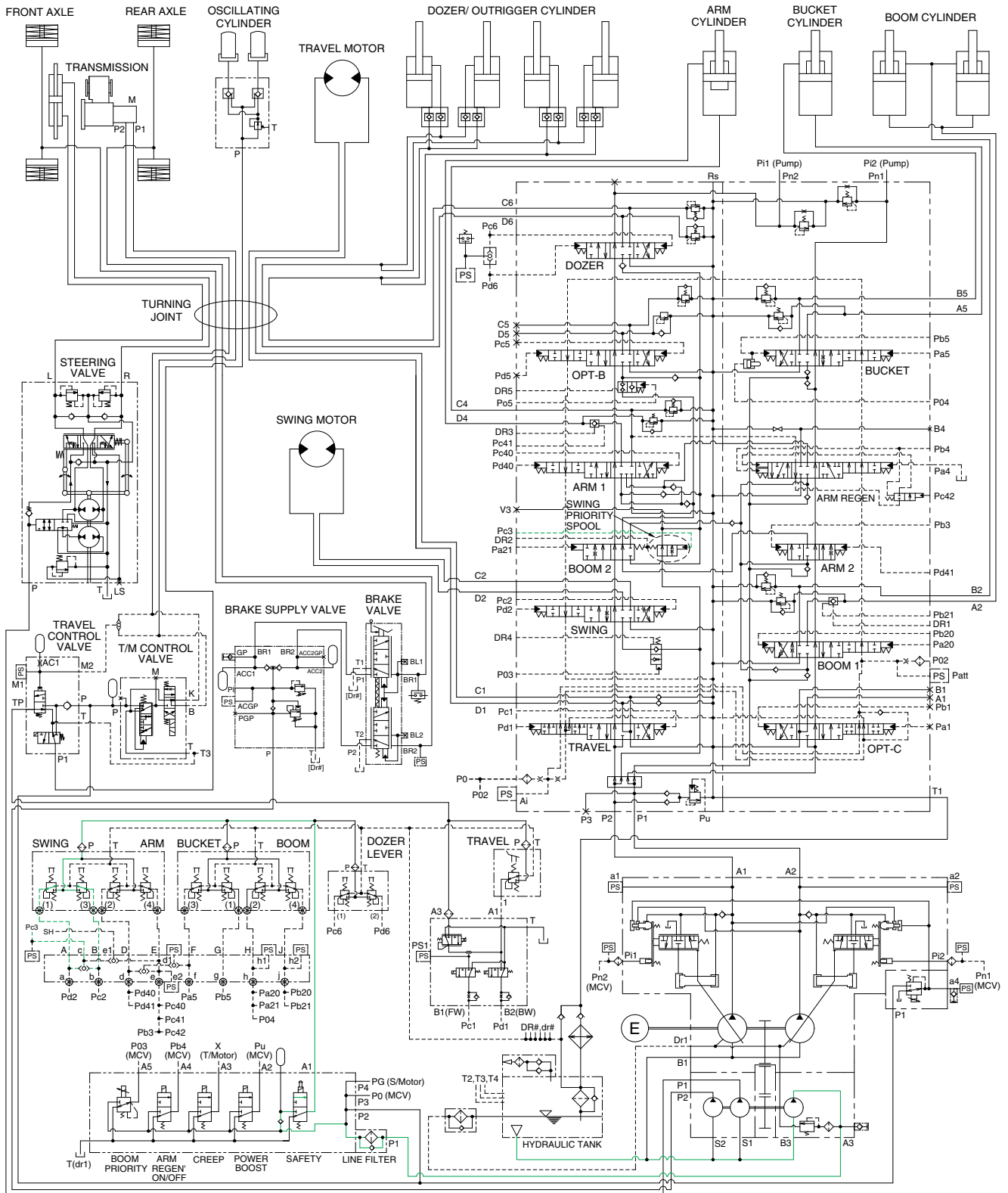
To increase working efficiency, swing speed reducing system is used.

The pilot oil from pilot pump flow into **P03** port in main control valve through boom priority EPPR valve. **P03** oil pressure moves swing reducing spool to upper position and oil flow rate to the swing motor decreased.

Then, the boom up speed is increased. This is called the boom priority system.

The boom up speed can be adjusted by the cluster. Refer to page 5-82.

9. SWING PRIORITY SYSTEM



140WF3HC30A

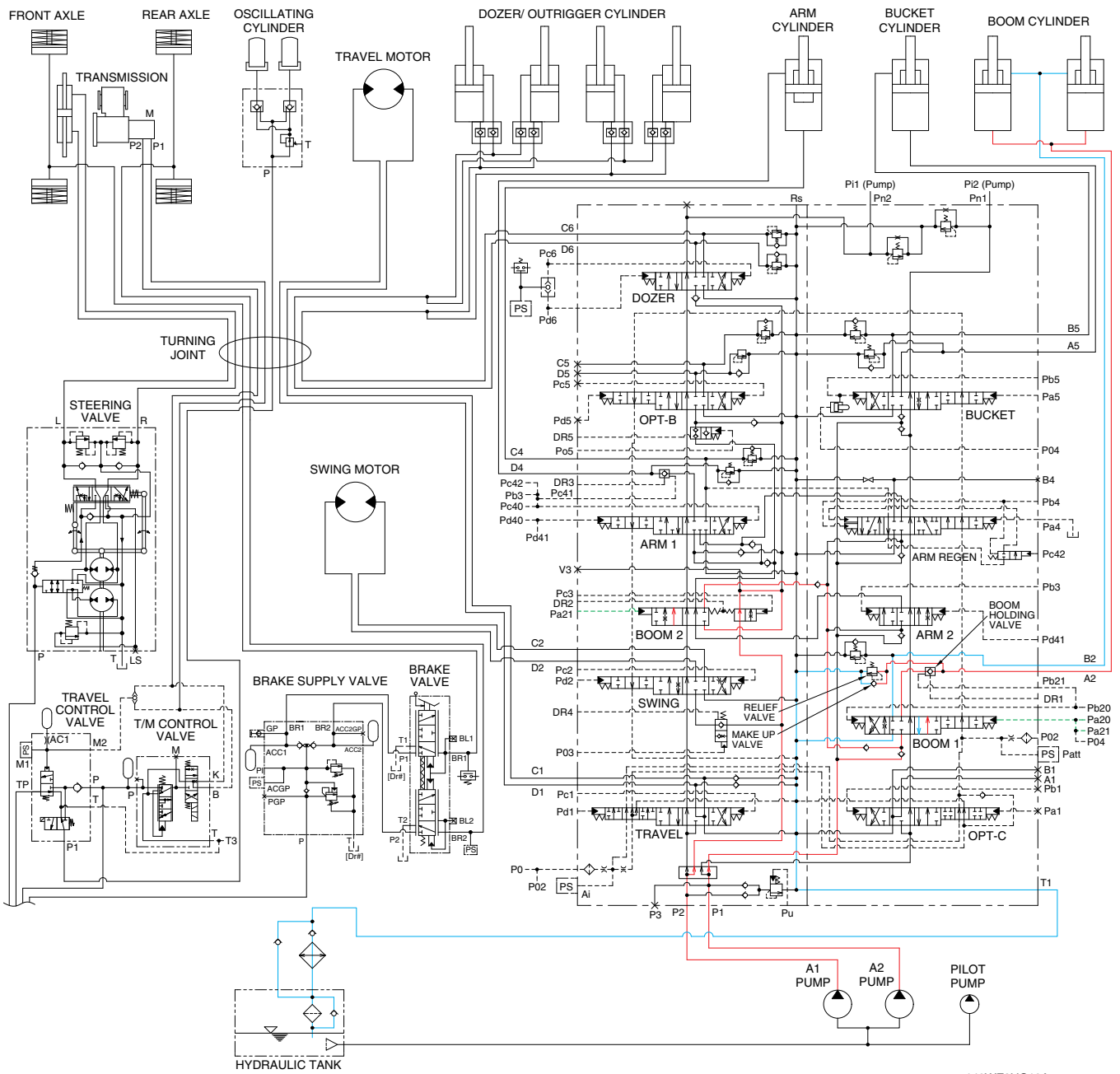
When carrying out the combined operation of swing and arm of the left control valve, the swing speed can be lowered than arm speed.

Pc3 pressure from the swing shuttle block changes the swing priority spool and then the oil flow rate is decreased to the next section to make the swing operation most preferential.

This is called the swing priority system. For details, refer to page 2-39.

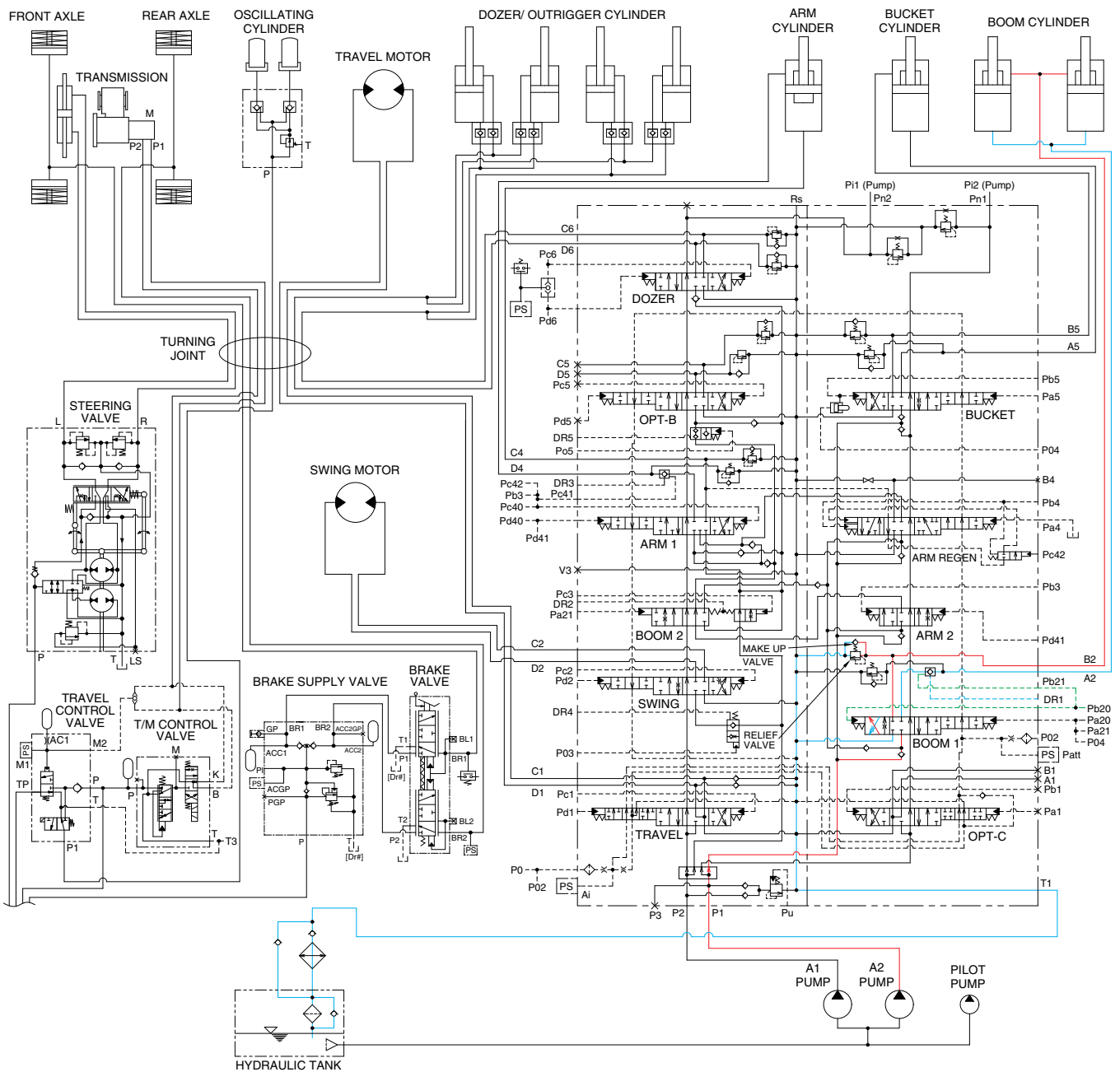
GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION



When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure from the remote control valve. The oil from the A1 and A2 pump flows into the main control valve and then goes to the large chamber of boom cylinders. At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom 1 spool in the main control valve. When this happens, the boom goes up. The excessive pressure in the boom cylinder head side is prevented by relief valve. When the boom is up and the control lever is returned to neutral position, the circuit for the holding pressure at the head side of the boom cylinder is closed by the boom holding valve. This prevents the hydraulic drift of boom cylinders.

2. BOOM DOWN OPERATION



140WF3HC11A

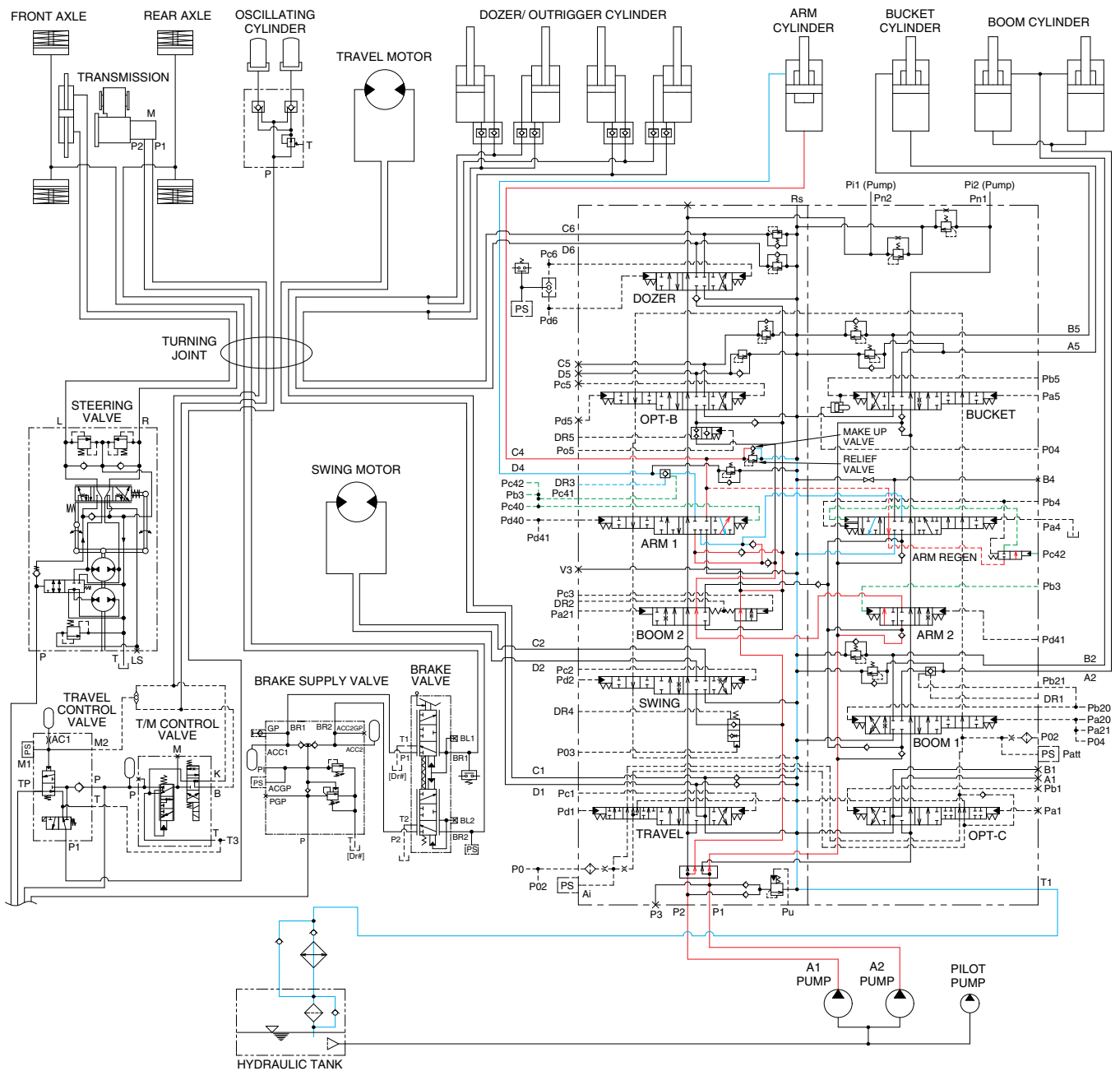
When the right control lever is pushed forward, the boom 1 spool in the main control valve is moved to the down position by the pilot oil pressure from the remote control valve.

The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom 1 spool in the main control valve.

When the down speed of boom is faster, the oil returned from the large chamber of boom cylinder combines with the oil from the A2 pump, and flows into the small chamber of the cylinder.

This prevents cylinder cavitation by the negative pressure when the A2 pump flow can not match the boom down speed. And the excessive pressure in the boom cylinder rod side is prevented by the relief valve.

3. ARM IN OPERATION



140WF3HC12A

When the left control lever is pulled back, the arm spools in the main control valve are moved to the arm in position by the pilot oil pressure from the remote control valve.

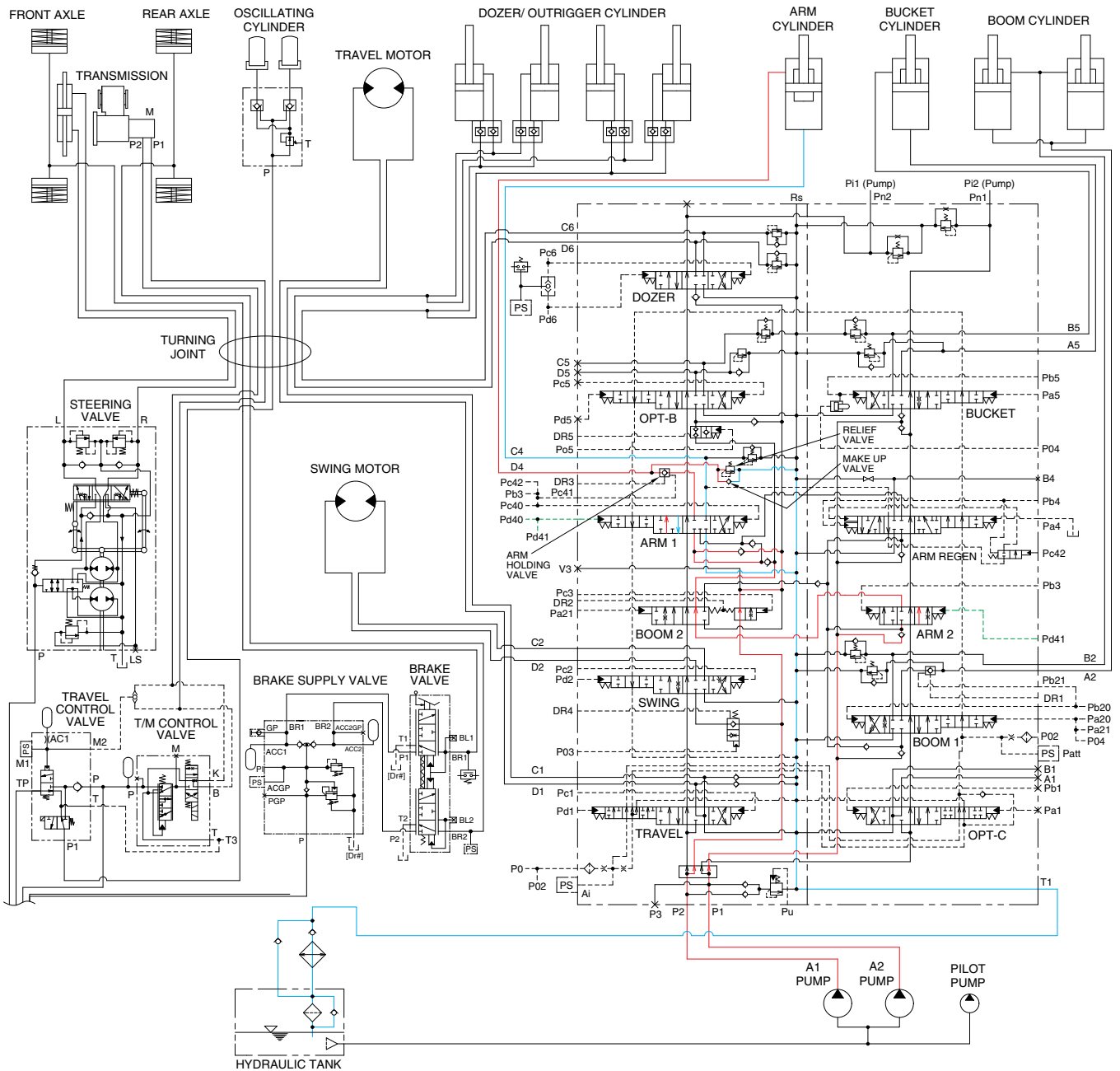
The oil from the A1 and A2 pump flows into the main control valve and then goes to the large chamber of arm cylinder.

At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls in.

The excessive pressure in the arm cylinder head side is prevented by relief valve.

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

4. ARM OUT OPERATION

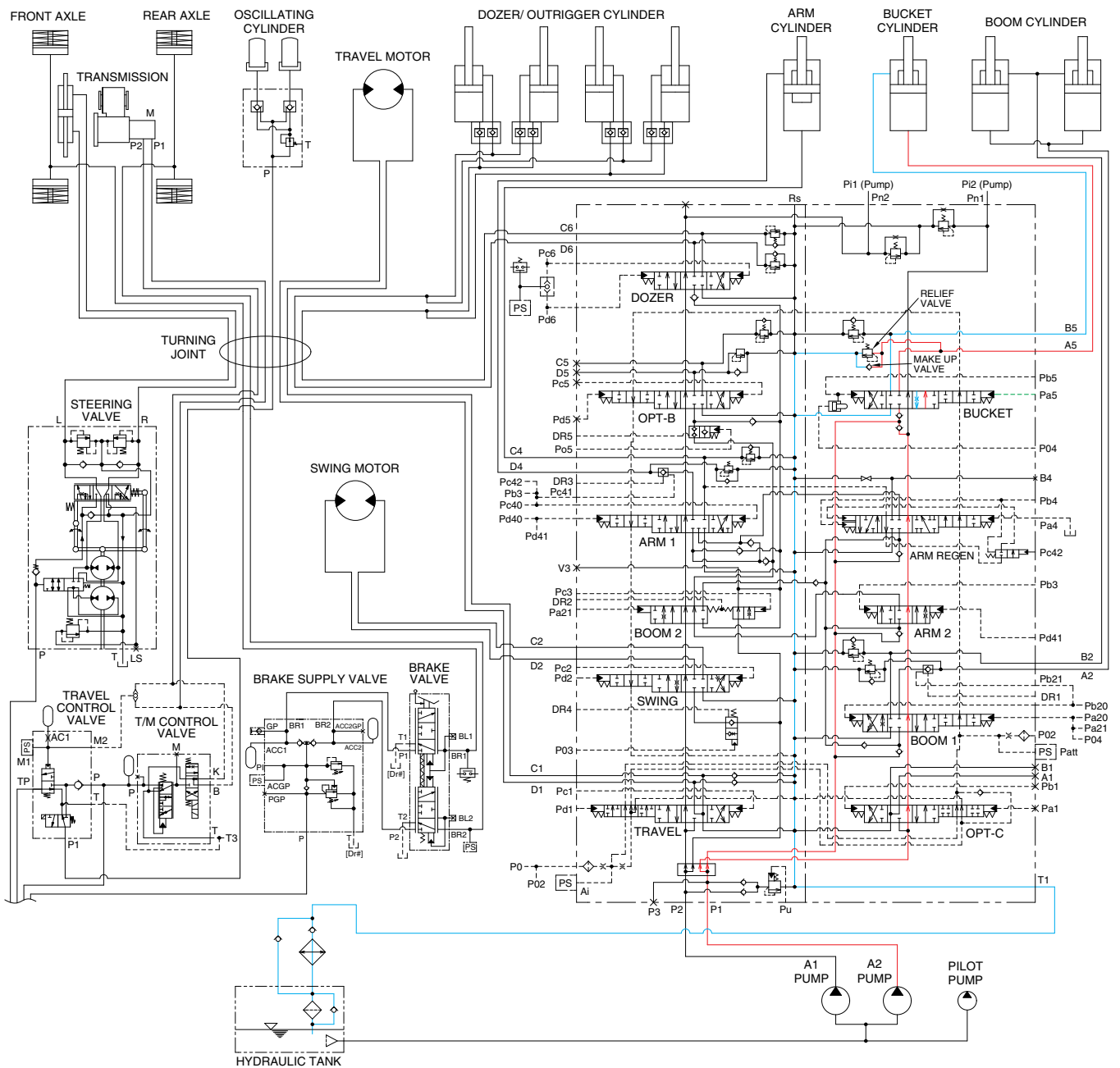


140WF3HC13A

When the left control lever is pushed forward, the arm spools in the main control valve are moved to the arm out position by the pilot oil pressure from the remote control valve.

The oil from the A1 and A2 pump flows into the main control valve and then goes to the small chamber of arm cylinder. At the same time, the oil from the large chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls out. The cavitation which will happen to the rod side of the arm cylinder is also prevented by the make-up valve in the main control valve. When the arm is roll out and the control lever is returned to neutral position, the circuit for the holding pressure at the rod side of the arm cylinder is closed by the arm holding valve. This prevent the hydraulic drift of arm cylinder.

5. BUCKET IN OPERATION



140WF3HC14A

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.

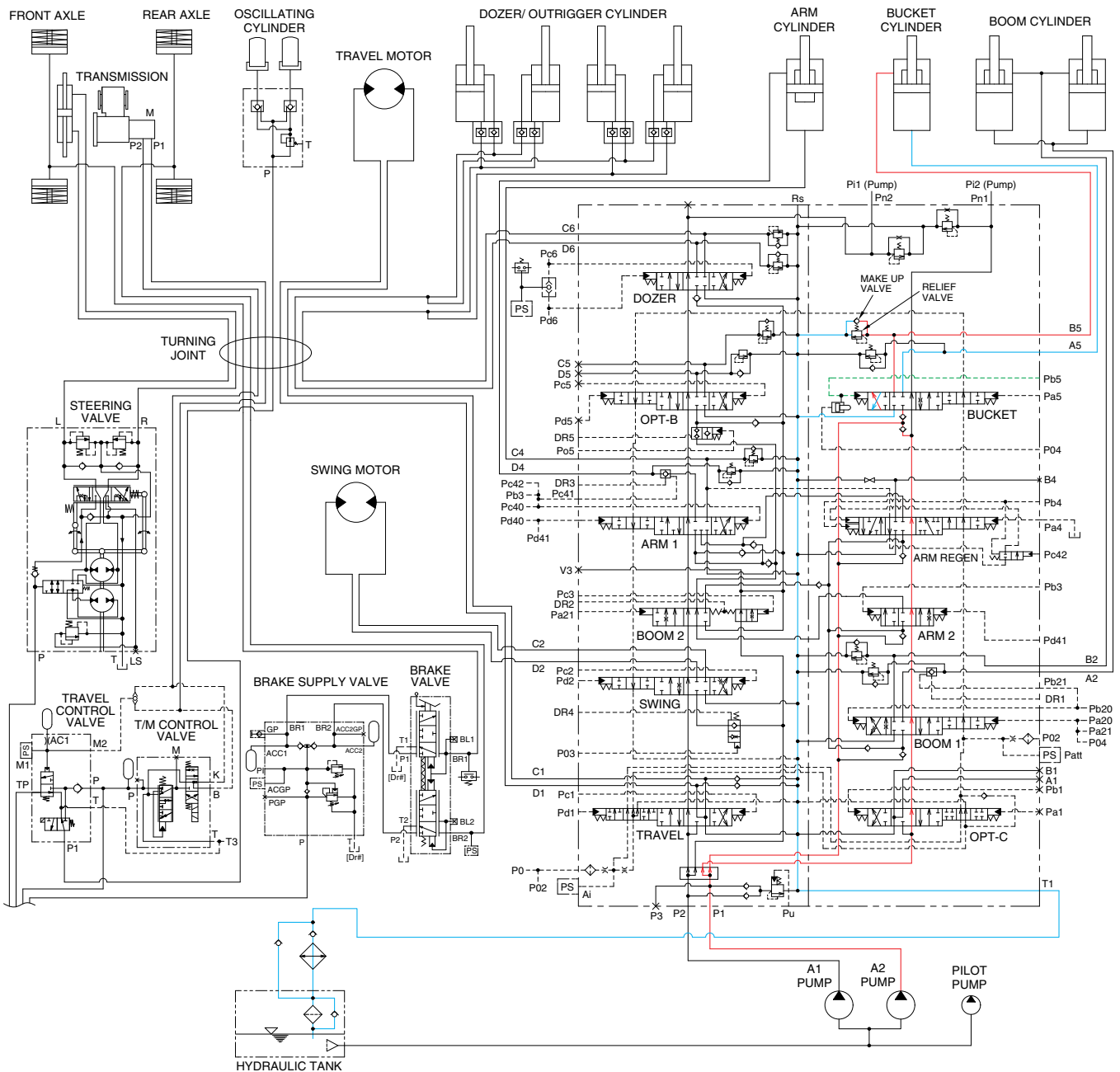
The oil from the A2 pump flows into the main control valve and then goes to the large chamber of bucket cylinder.

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

The excessive pressure in the bucket cylinder head side is prevented by relief valve.

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

6. BUCKET OUT OPERATION



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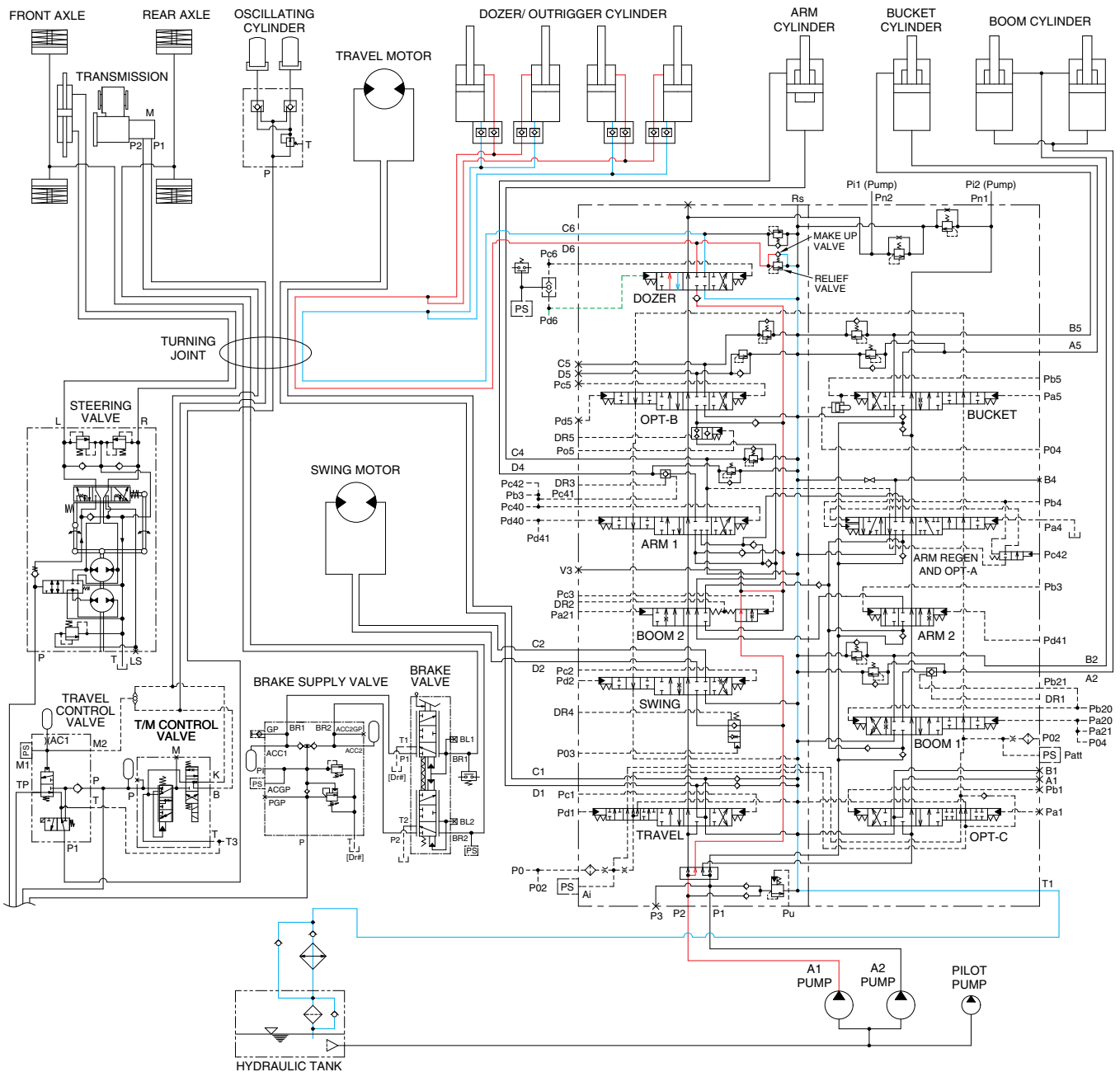
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the bucket out position by the pilot oil pressure from the remote control valve.

The oil from the A2 pump flows into the main control valve and then goes to the small chamber of bucket cylinder.

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

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

7. DOZER/OUTRIGGER UP OPERATION



140WF3HC16A

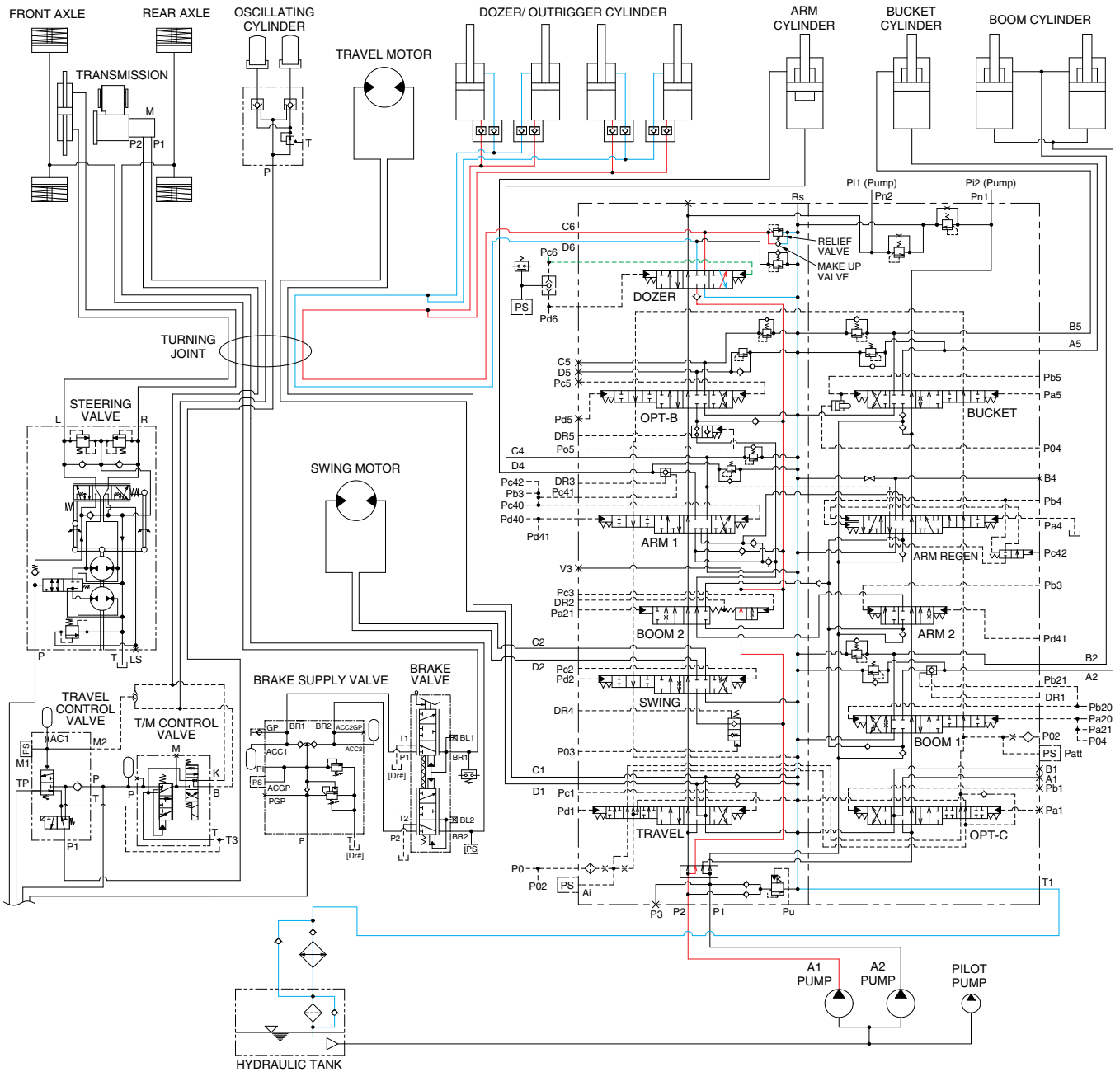
When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the main control valve and then goes to the small chamber of rear actuator cylinders (dozer or outrigger).

The other case, the oil flows into the small chamber of front actuator cylinders (dozer or outrigger).

At the same time, the oil from the large chamber of dozer (outrigger) cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer (outrigger) goes up.

8. DOZER/OUTRIGGER DOWN OPERATION



140WF3HC17A

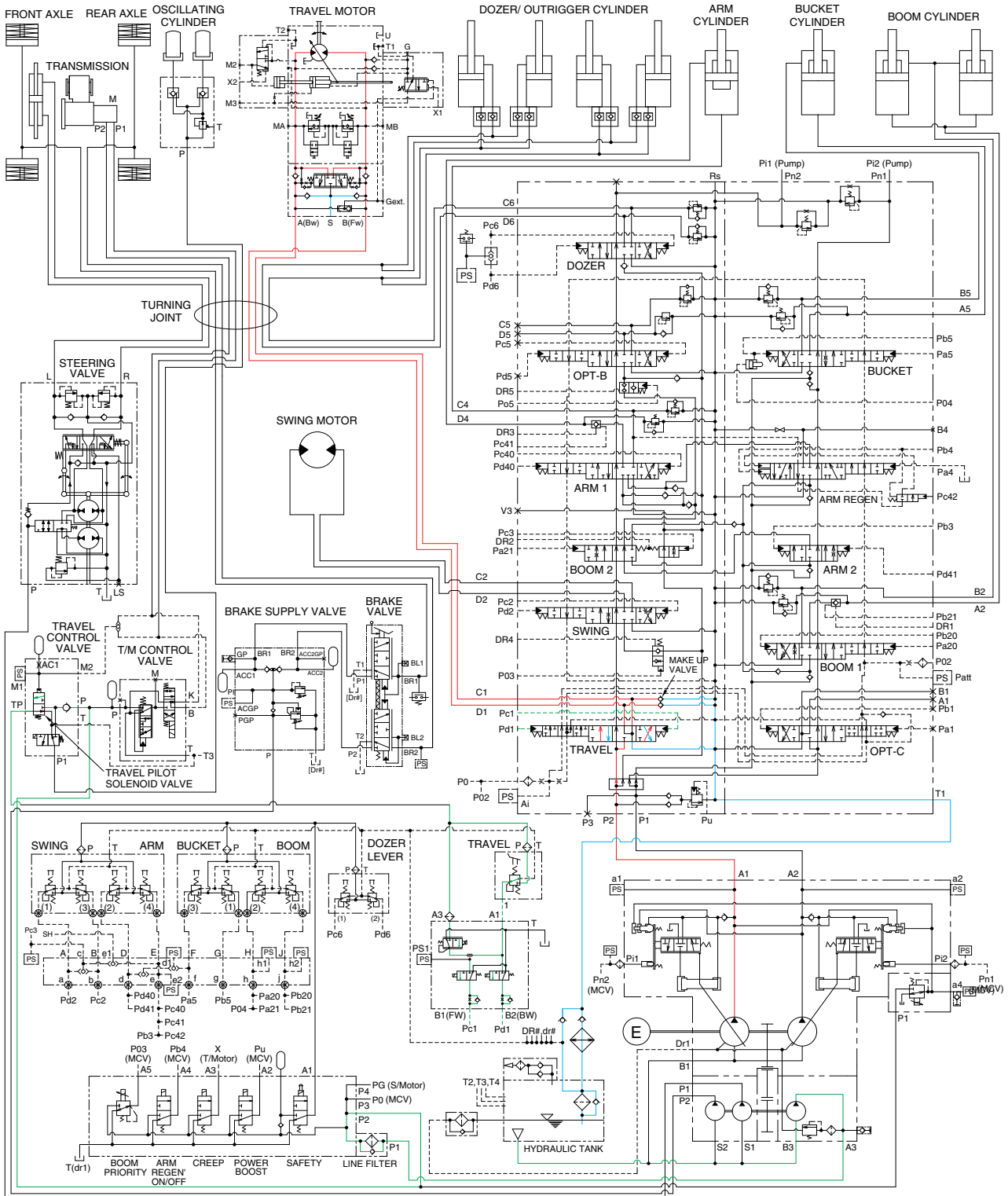
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the main control valve and then goes to the large chamber of rear actuator cylinders (dozer or outrigger).

The other case, the oil flows into the large chamber of front actuator cylinders (dozer or outrigger).

At the same time, the oil from the small chamber of dozer (outrigger) cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer (outrigger) goes down.

10. TRAVEL FORWARD AND REVERSE OPERATION



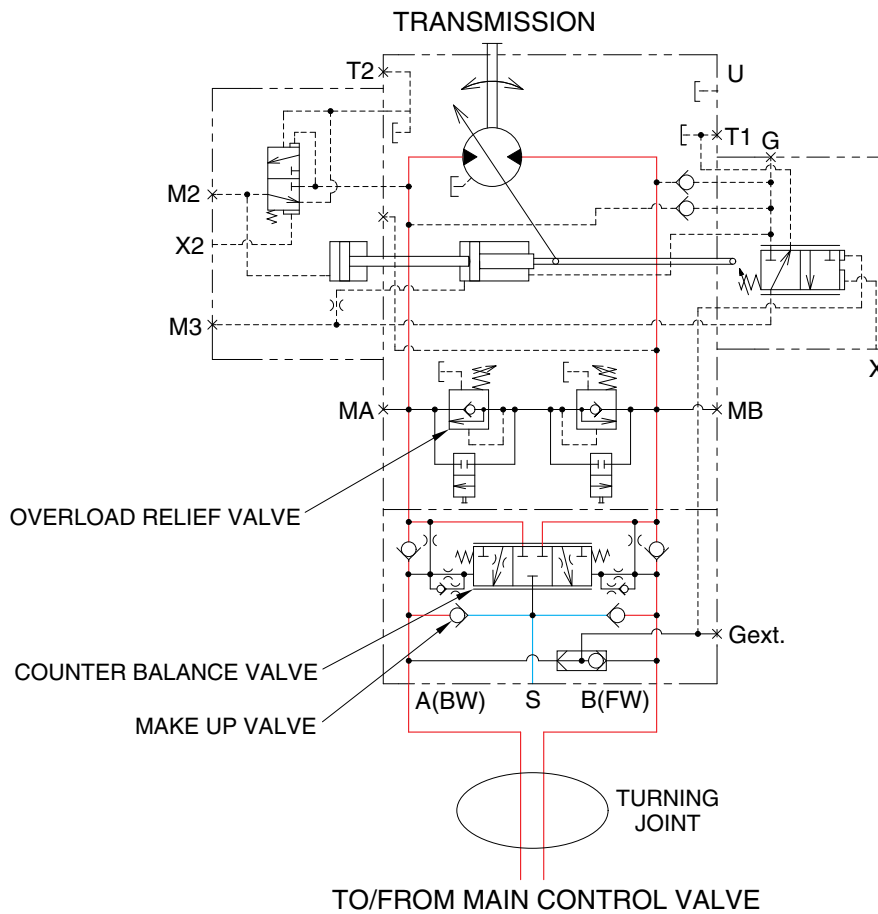
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When the RH multifunction switch is placed in forward or reverse position, the travel spool in the main control valve is moved to the forward or reverse position by the pilot oil pressure from pilot pump through the travel pilot solenoid valve of travel control valve. The oil from the A1 pump flows into the main control valve and then goes to the travel motor. At the same time, the oil returned from the travel motor returns to the hydraulic oil tank through the turning joint and travel spool in the main control valve.

When this happens, the machine moves forward or reverse.

The cavitation which will happen to the travel motor is prevented by the make-up valves in the main control valve and make up valves in the travel motor itself.

TRAVEL CIRCUIT OPERATION



140WF3HC19A-A

Valves are provided on travel motor to offer the following functions.

1) COUNTER BALANCE VALVE

When stopping the motor on a slope descending, this valve prevents the motor from over running.

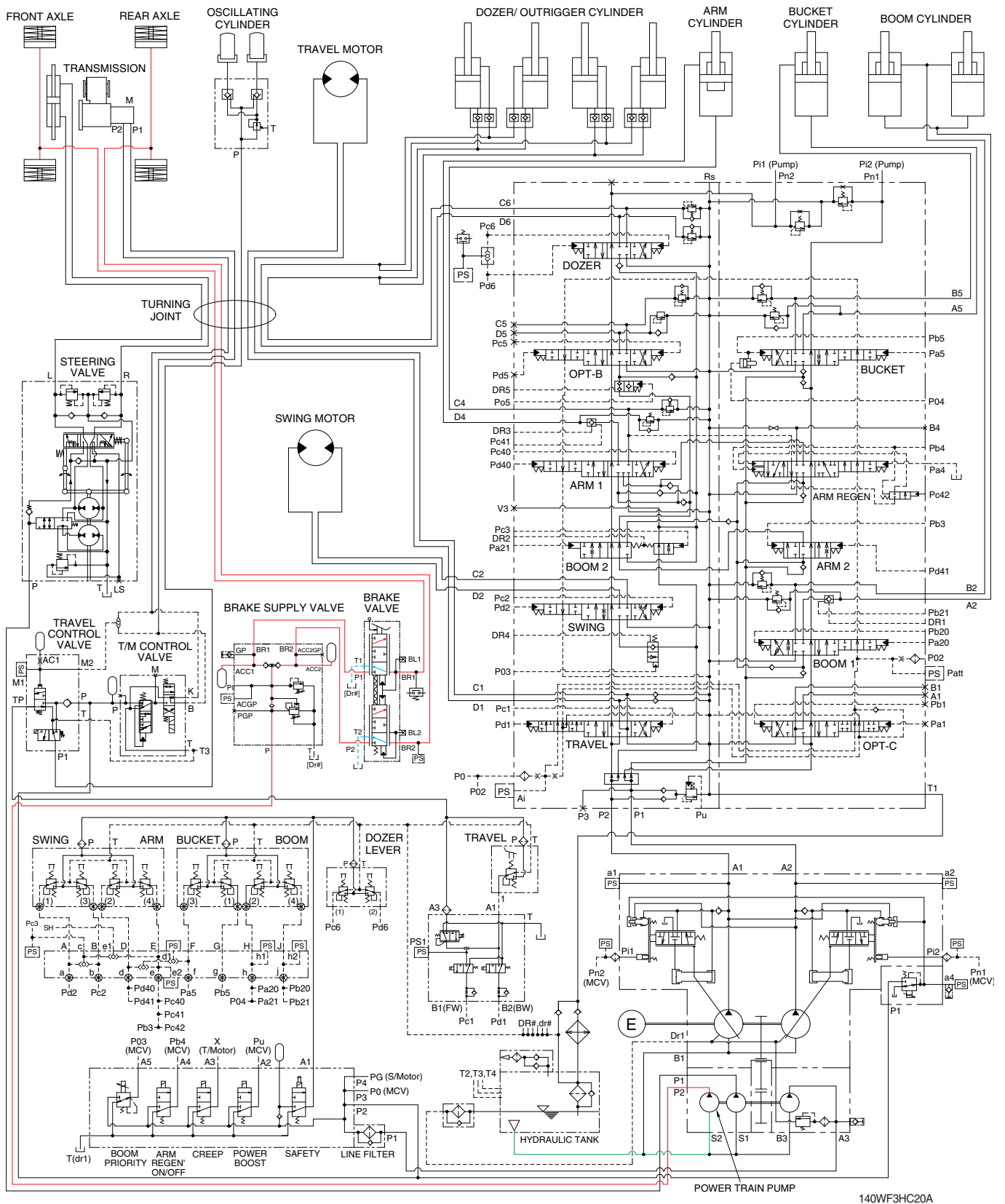
2) OVERLOAD RELIEF VALVE

Relief valve limits the circuit pressure below 380 kgf/cm² to prevent high pressure from being generated at the time of stopping the machine. When stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

3) MAKE UP VALVE

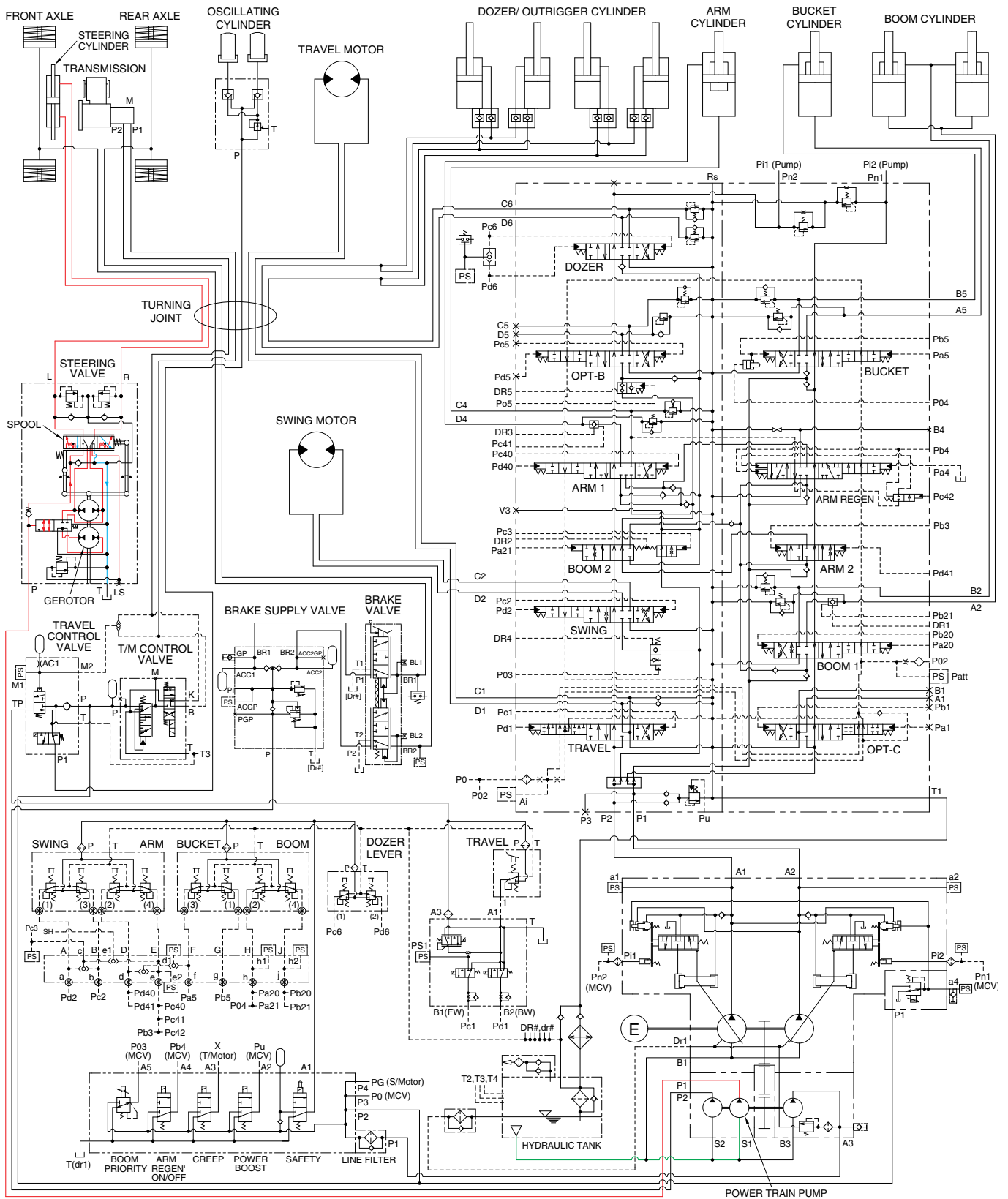
The make up valves prevent cavitation by supplying return oil to the vacuum side of the motor.

11. FRONT AND REAR AXLE BRAKE SYSTEM (SERVICE BRAKE)



When the brake pedal (valve) is pushed, the discharged oil from the transmission pump (P2) flows into the front and rear axle brake disc through the brake supply valve. This pressure is applied to axle brake disc, thus the brake is applied.

12. STEERING CIRCUIT OPERATION

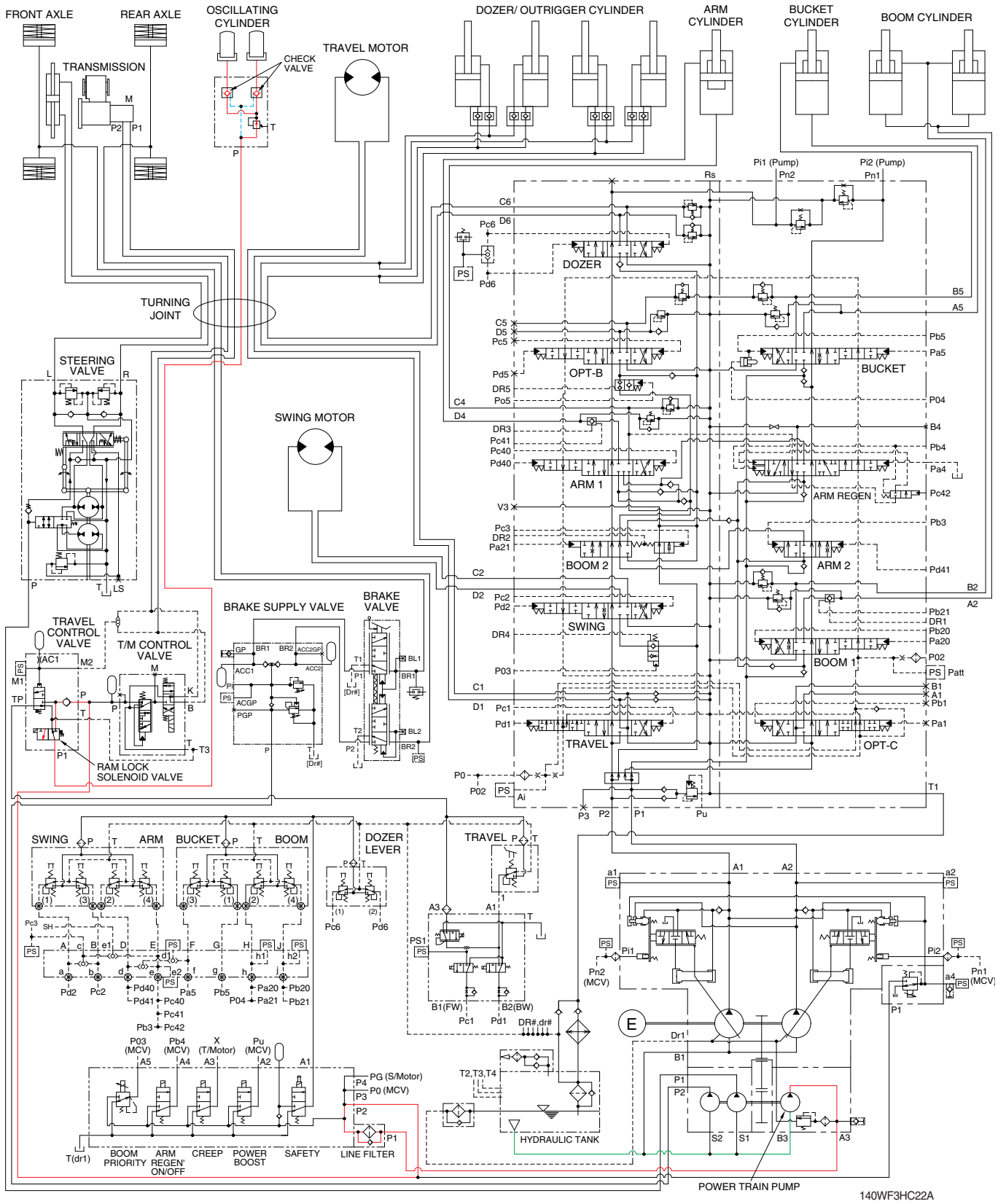


When the steering wheel is turned to the left or right, the spool within the steering valve turns left or right hand direction : Because the spool is connected with steering column.

At this time, the oil discharged from the transmission pump (P1) flows into steering cylinder through spool and gerotor within the steering valve.

Then the steering direction is applied.

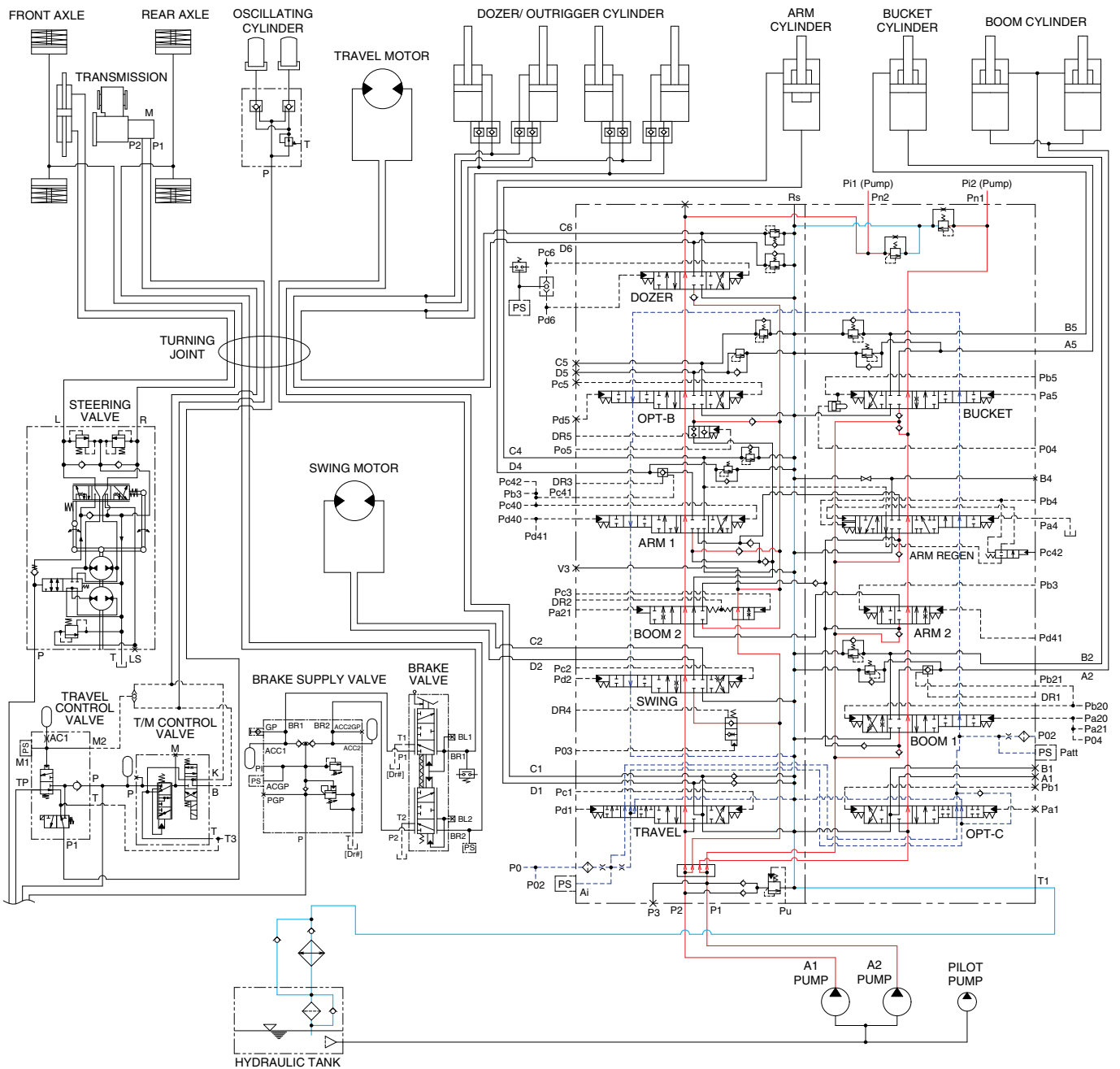
13. RAM LOCK CIRCUIT OPERATION



When the ram lock switch on the dashboard of the steering column is selected OFF position, the ram lock solenoid valve is changed over. Thus, the oil discharged from the pilot pump flows into oscillating cylinder through ram lock solenoid and locking valve. This pressure is applied to check valve and oscillating cylinder, thus the oscillating function is operated (Ram lock released).

GROUP 5 COMBINED OPERATION

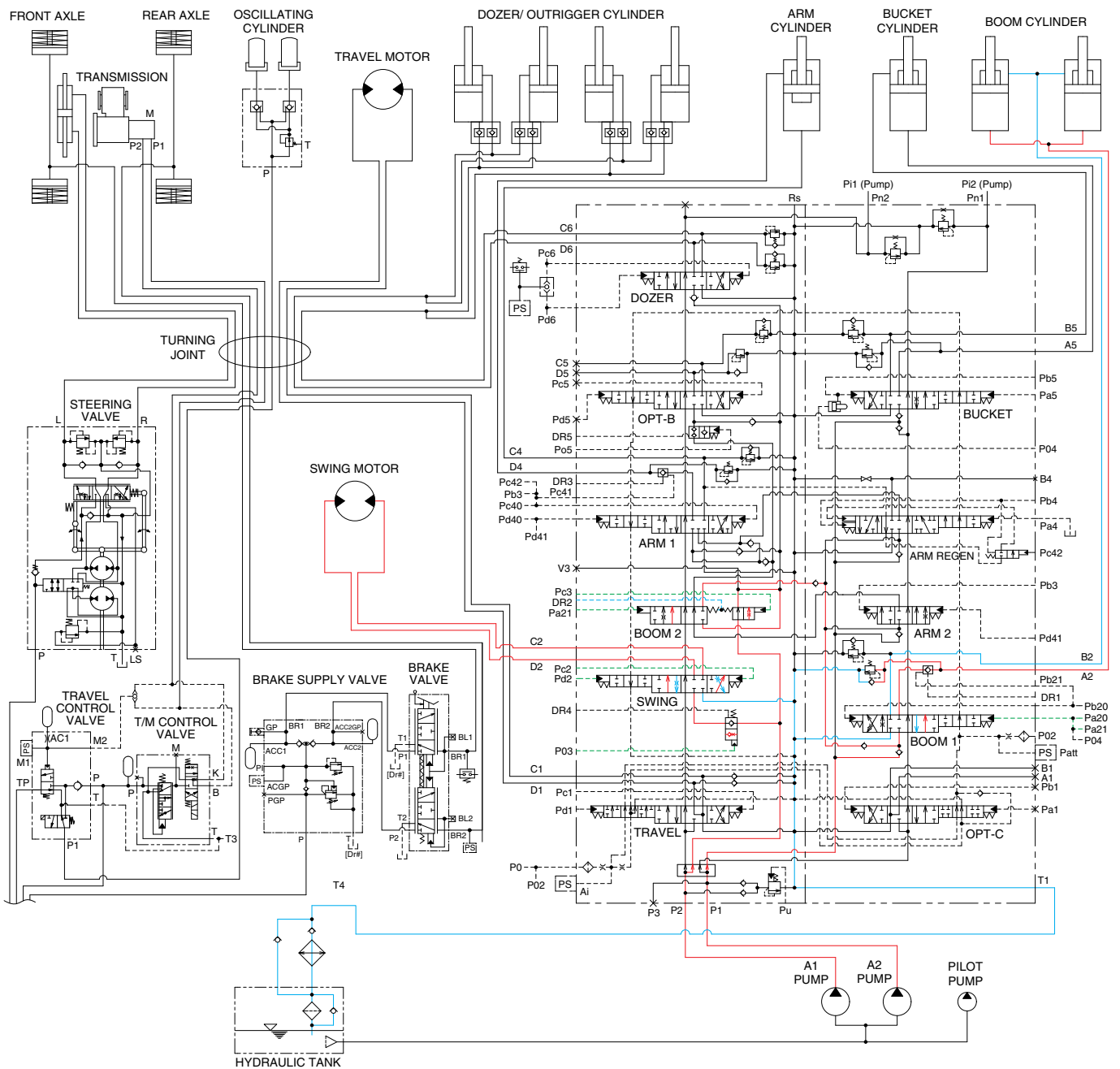
1. OUTLINE



140WF3HC23A

The oil from the A1 and A2 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.

2. COMBINED SWING AND BOOM UP OPERATION



140WF3HC24A

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

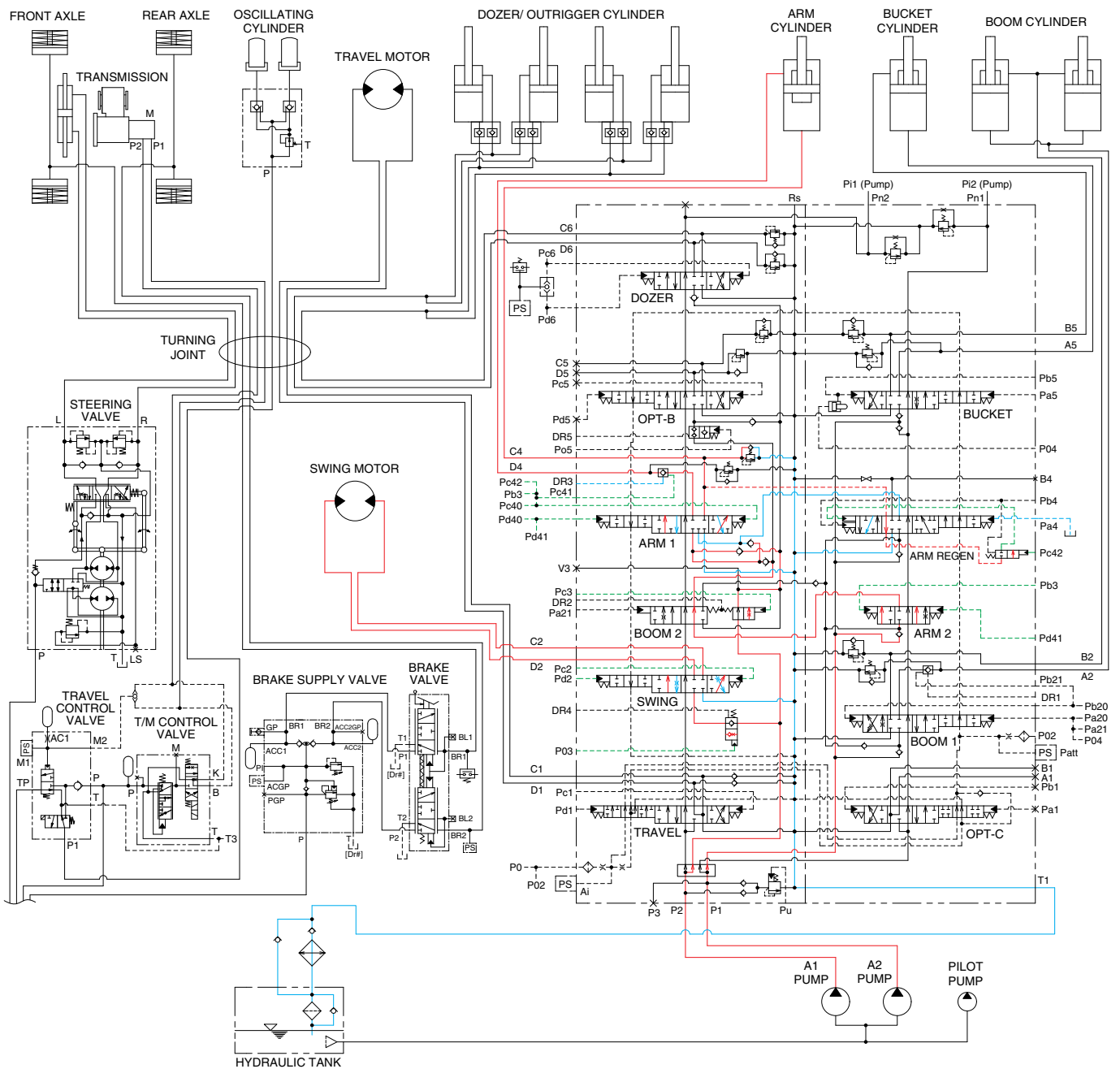
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinders through boom 2 spool.

The oil from the A2 pump flows into the boom cylinders through the boom 1 spool in the right control valve.

The upper structure swings and the boom goes up.

Refer to page 3-14 for the boom priority system.

3. COMBINED SWING AND ARM OPERATION



140WF3HC25A

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

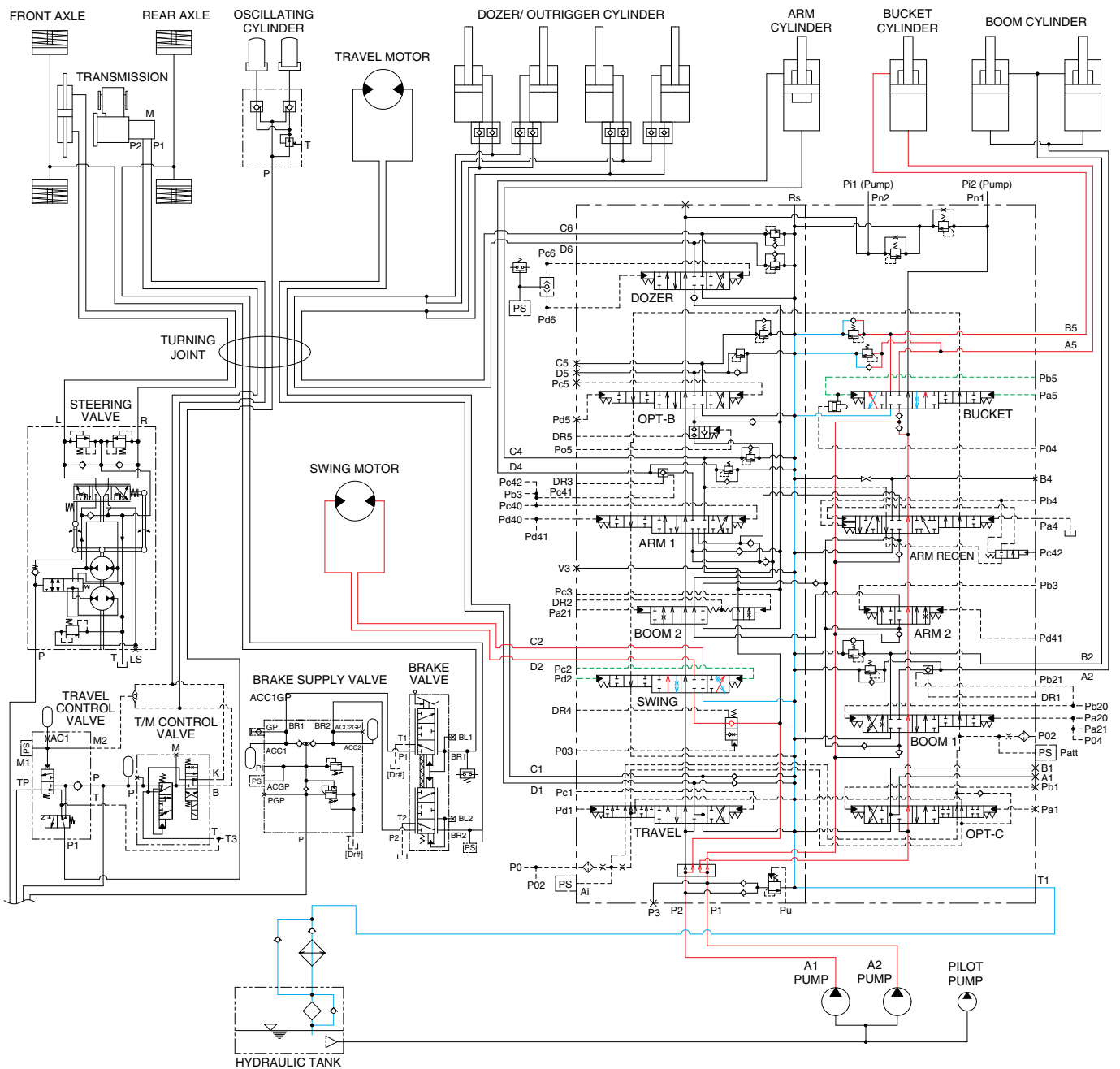
The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

The oil from the A2 pump flows into the arm cylinder through the arm 2 spool of the right control valve.

The upper structure swings and the arm is operated.

Refer to page 3-15 for the swing operation preference function.

4. COMBINED SWING AND BUCKET OPERATION



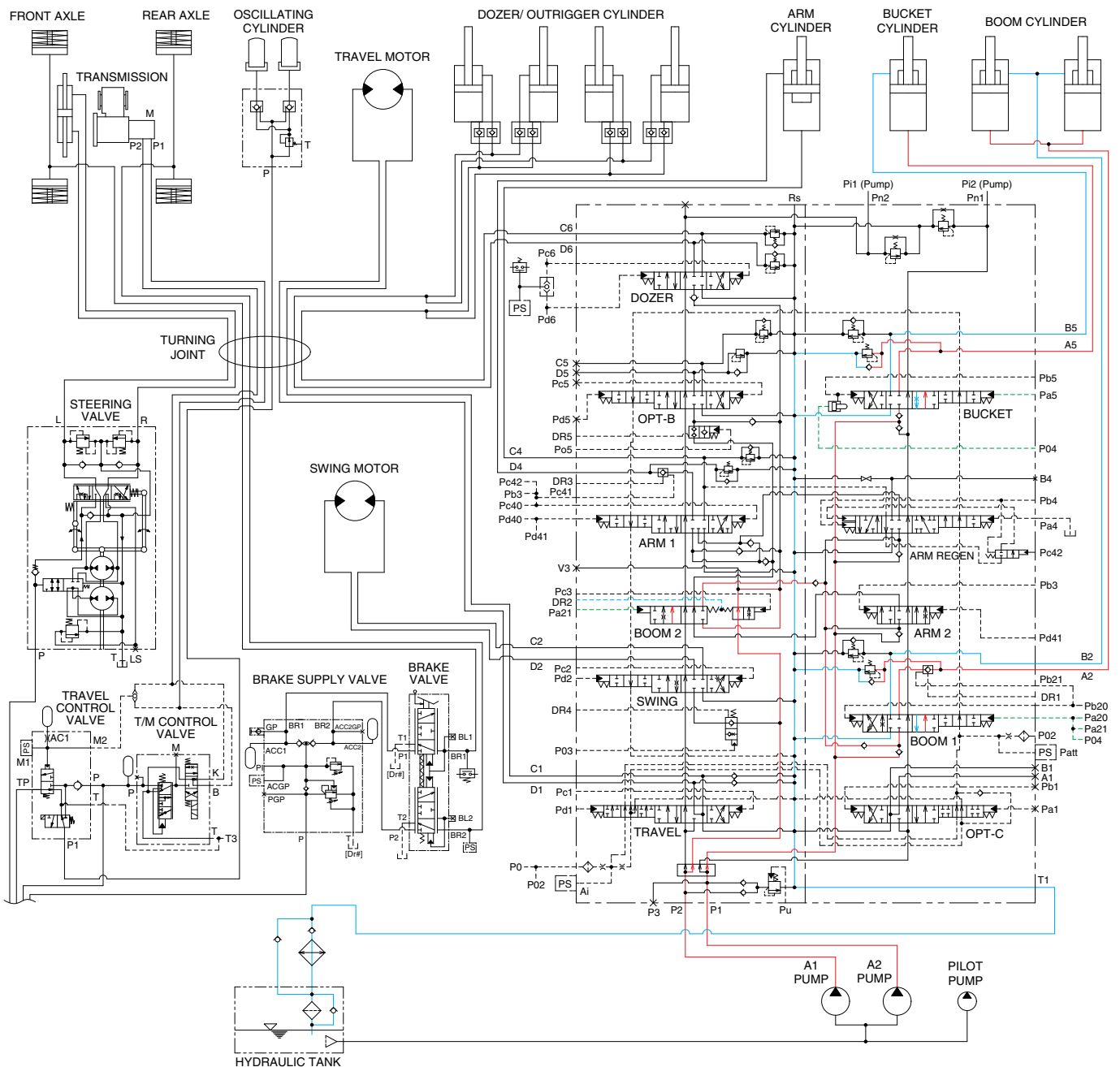
140WF3HC26A

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

The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve. The oil from the A2 pump flows into the bucket cylinder through the bucket spool in the right control valve.

The upper structure swings and the bucket is operated.

5. COMBINED BOOM UP AND BUCKET IN OPERATION



140WF3HC27A

When the boom up 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 A1 pump flows into the boom cylinders through the boom 2 spool in the left control valve. The oil from the A2 pump flows into the boom cylinders and bucket cylinder through the boom 1 spool, bucket spool and the parallel and confluence oil passage in the right control valve.

Also, when the boom up and bucket in functions are operated simultaneously, the boom up operation preference function is operated by the pilot pressure **P04** and then the the bucket spool transfers in the half stroke not full stroke (refer to page 2-32). Therefore, the most of pressurized oil flows into boom 1 spool than the bucket spool to make the boom up operation more preferential.

The boom and bucket are operated.