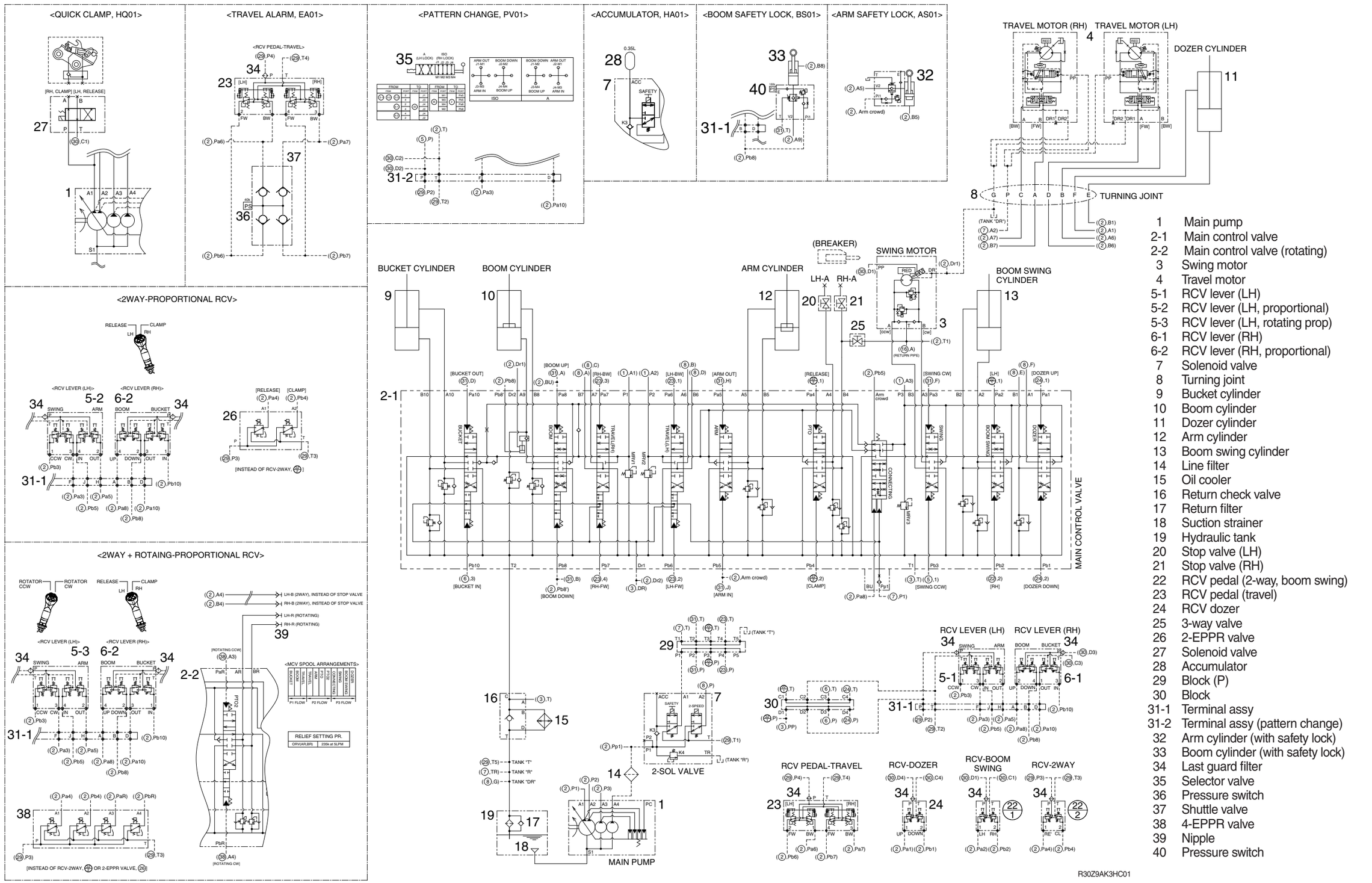
SECTION 3 HYDRAULIC SYSTEM

GROUP 1 HYDRAULIC CIRCUIT



1	Main pump
2-1	Main control valve
2-2	Main control valve (rotating)
3	Swing motor
4	Travel motor
5-1	RCV lever (LH)
5-2	RCV lever (LH, proportional)
5-3	RCV lever (LH, rotating prop)
6-1	RCV lever (RH)
6-2	RCV lever (RH, proportional)
7	Solenoid valve
8	Turning joint
9	Bucket cylinder
10	Boom cylinder
11	Dozer cylinder
12	Arm cylinder
13	Boom swing cylinder
14	Line filter
15	Oil cooler
16	Return check valve
17	Return filter
18	Suction strainer
19	Hydraulic tank
20	Stop valve (LH)
21	Stop valve (RH)
22	RCV pedal (2-way, boom swing)
23	RCV pedal (travel)
24	RCV dozer
25	3-way valve
26	2-EPPR valve
27	Solenoid valve
28	Accumulator
29	Block (P)
30	Block
31-1	Terminal assy
31-2	Terminal assy (pattern change)
32	Arm cylinder (with safety lock)
33	Boom cylinder (with safety lock)
34	Last guard filter
35	Selector valve
36	Pressure switch
37	Shuttle valve
38	4-EPPR valve
39	Nipple
40	Pressure switch

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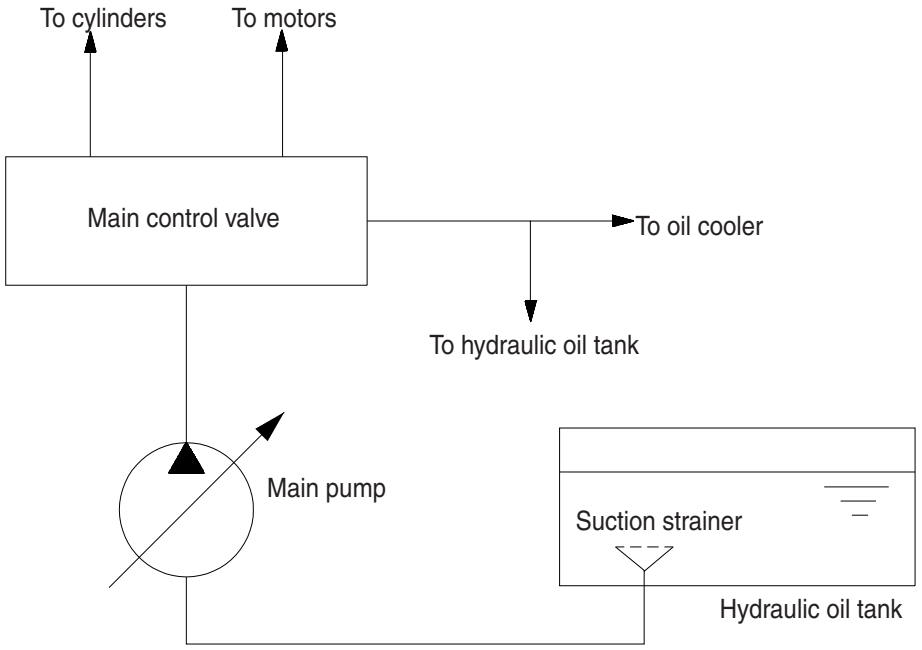
GROUP 2 MAIN CIRCUIT

The main hydraulic circuit consists of suction circuit, delivery circuit, return circuit and drain circuit.
The hydraulic system consists of one main pump, one main control valve, one swing motor, five cylinders and two travel motors.
The swash plate type variable displacement axial piston pump is used as the main pump and is driven by the engine at ratio 1.0 of engine speed.

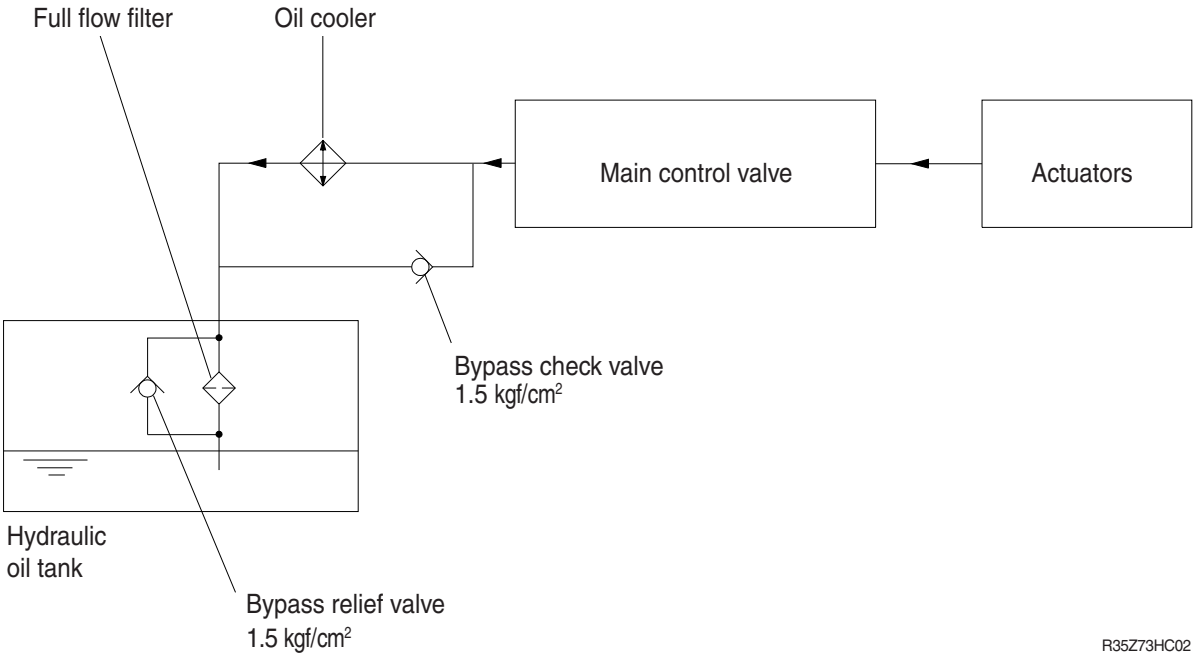
1. SUCTION AND DELIVERY CIRCUIT



3-02 (140-7 TIER)

The pumps receive oil from the hydraulic tank through a suction strainer. The discharged oil from the pump flows into the main control valve and goes out the tank ports.
The oil discharged from the main pump flows to the actuators through the main control valve.
The main control valve controls the hydraulic functions.
The return oil from the actuators flows to the hydraulic tank through the main control valve and the oil cooler.

2. RETURN CIRCUIT



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

The bypass check valves is provided in the return circuit.

The setting pressure of bypass check valves is 1.5 kgf/cm^2 (21 psi). Usually, oil returns to the hydraulic tank from the tank ports of main 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 1.5 kgf/cm^2 (21 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

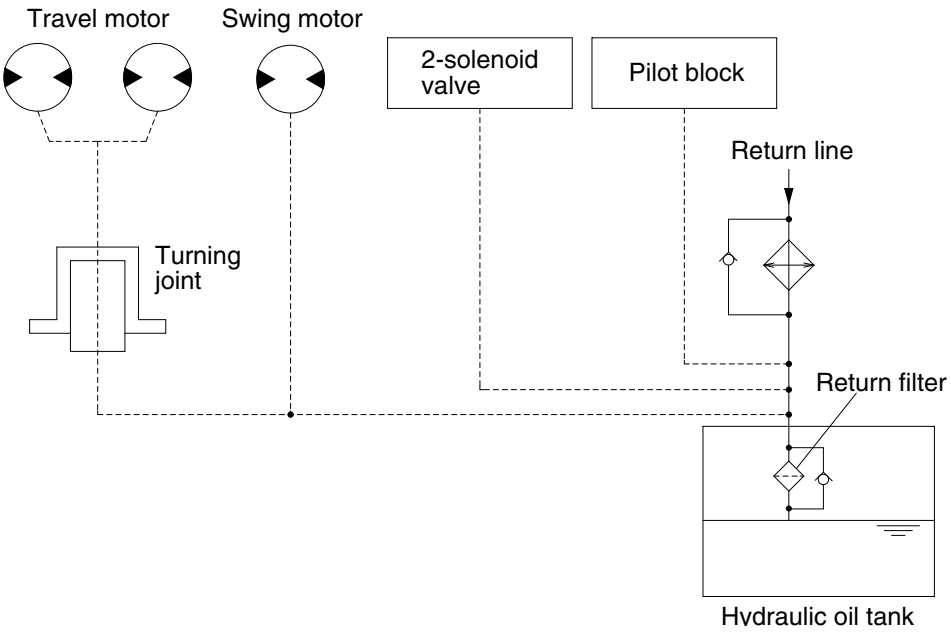
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve.

The full-flow filter and bypass relief valve are provided in the hydraulic tank.

The oil returned from tank ports (T1 and T2) of main control valve is combined and filtered by the full-flow 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/cm^2 (21 psi) differential pressure.

3. DRAIN CIRCUIT



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Internal leaks from the motors and pilot control valves for lubrication circulates.

1) TRAVEL MOTOR DRAIN CIRCUIT

Oil leaked from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and return to the hydraulic tank after being filtered by return filter.

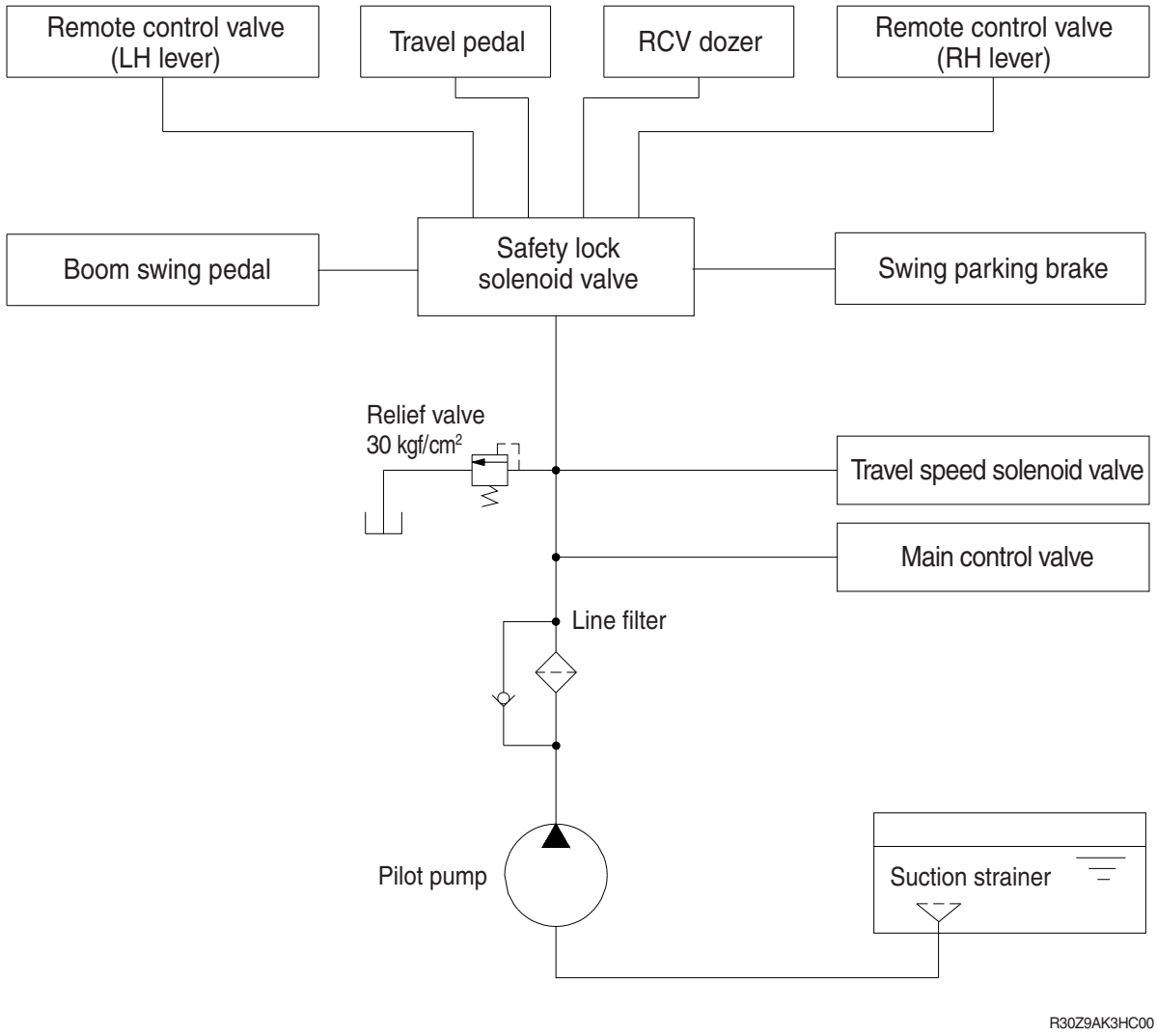
2) SWING MOTOR DRAIN CIRCUIT

Oil leaked from the swing motor returns to the hydraulic tank passing through a return filter with oil drained from the travel circuit .

3) PILOT LINE DRAIN CIRCUIT

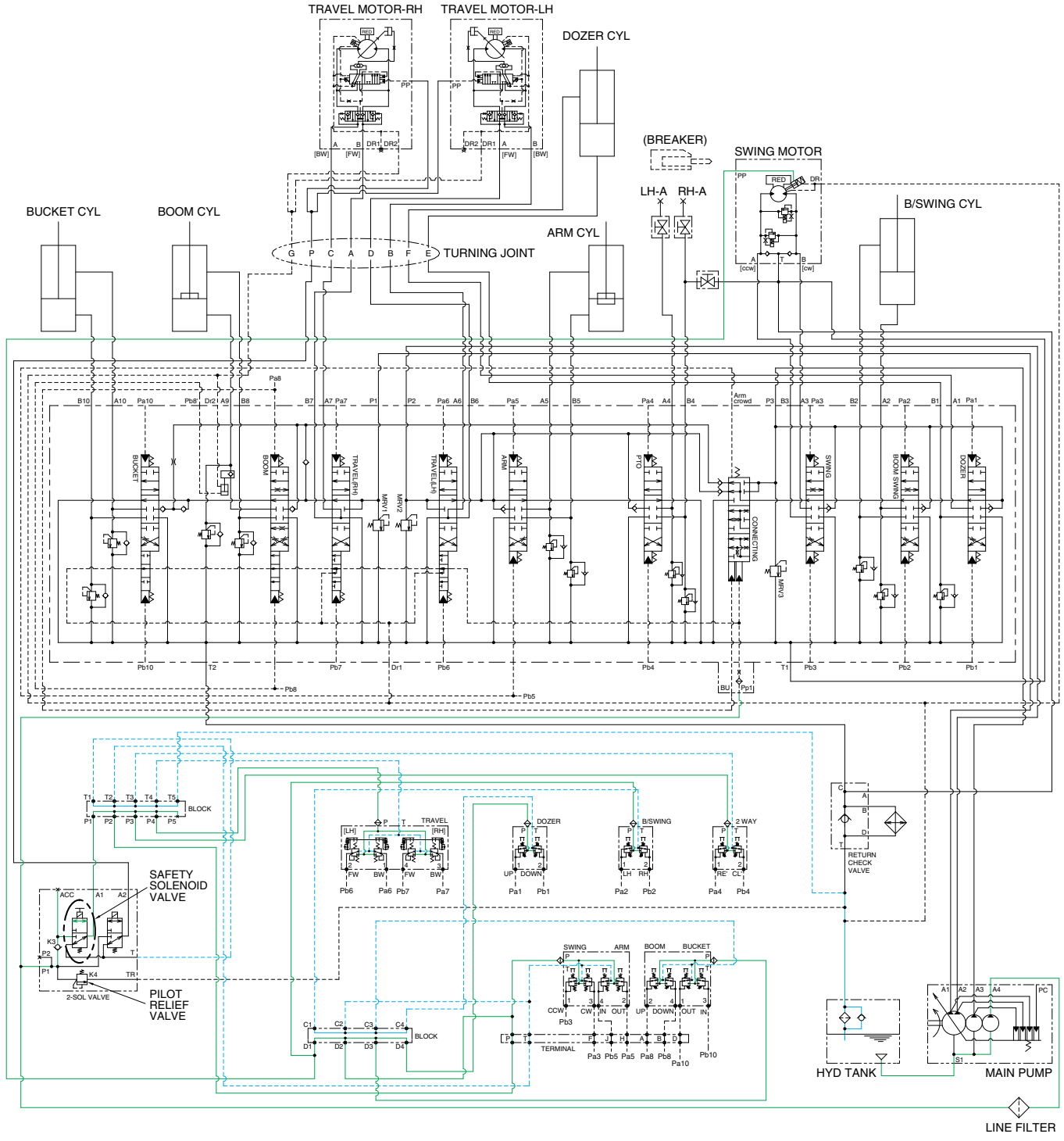
Oil leaked from the 2-solenoid valve and pilot block respectively returns to the hydraulic tank passing through the return filter.

GROUP 3 PILOT CIRCUIT



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 main control valve, travel solenoid valve and safety lock solenoid valve through line filter.
And the oil from safety lock solenoid valve flows to the RCV levers and pedals and swing parking brake.

1. SUCTION, DELIVERY AND RETURN CIRCUIT



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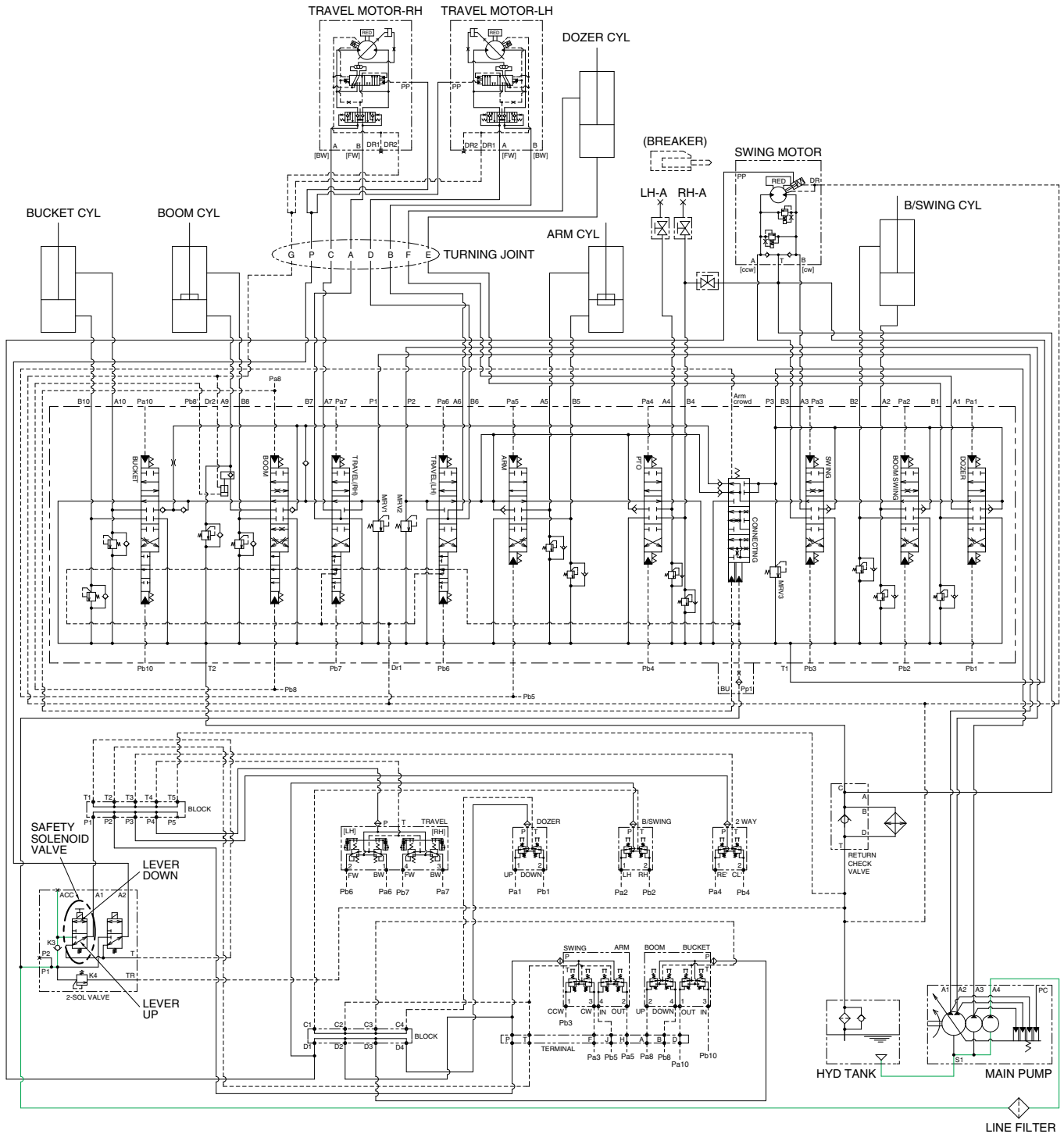
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the 2-solenoid valve for limiting the pilot circuit pressure.

The oil filtered by line filter flows main control valve, travel solenoid valve and safety solenoid valve and the oil from safety solenoid valve flows remote control valve and swing parking brake.

2. SAFETY VALVE (SAFETY LEVER)



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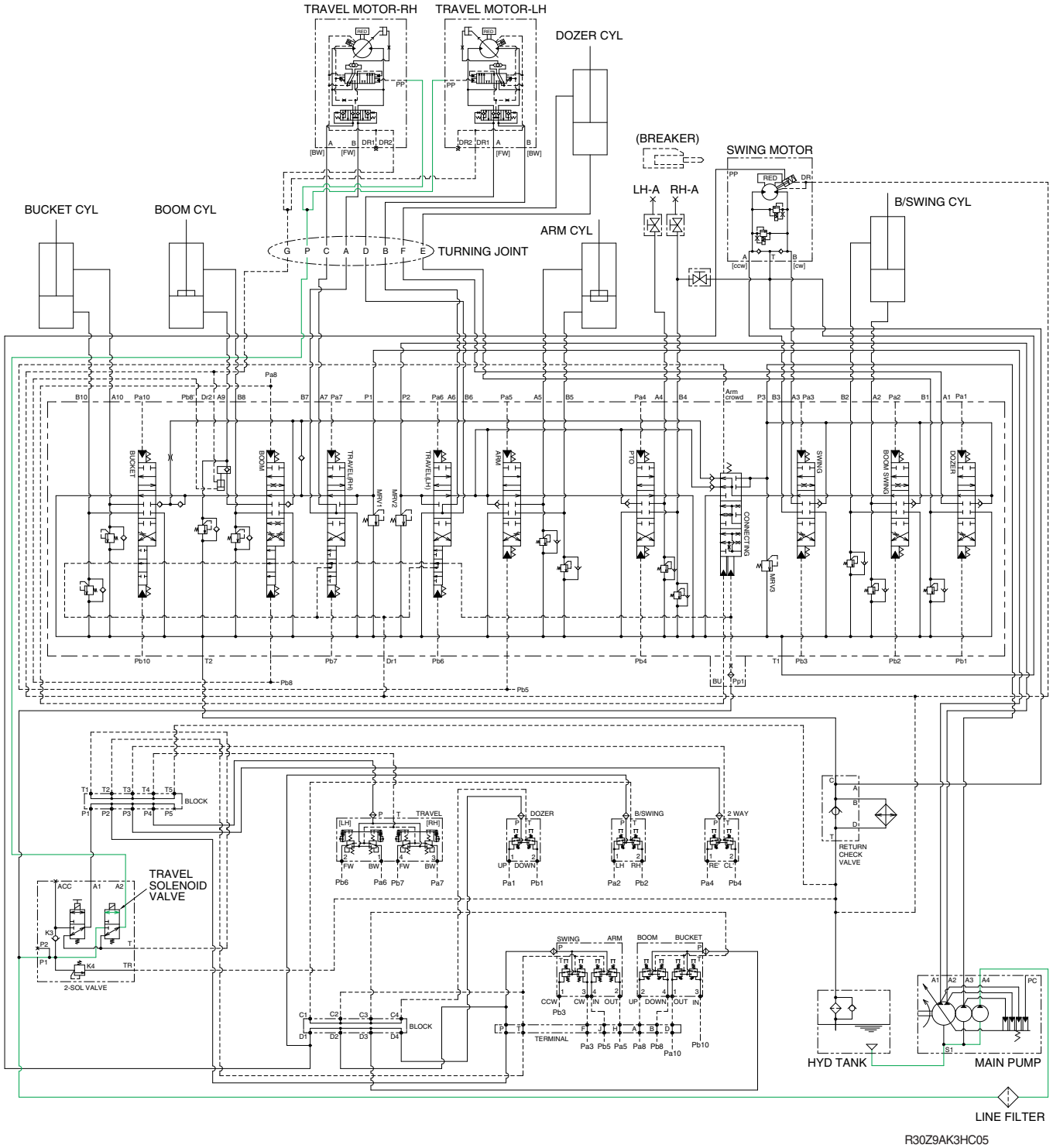
When the lever of the safety solenoid valve is moved downward, oil flows into the remote control valve and swing parking brake through solenoid valve and line filter.

When the lever of the safety solenoid valve is moved upward, oil does not flow into the remote control valve and swing parking brake, because of the blocked port.

3. TRAVEL SPEED CONTROL SYSTEM



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When the travel speed switch is pushed, the travel speed solenoid valve is actuated and the discharged oil from the pilot pump flows to the PP port of pilot valve in the travel motors.

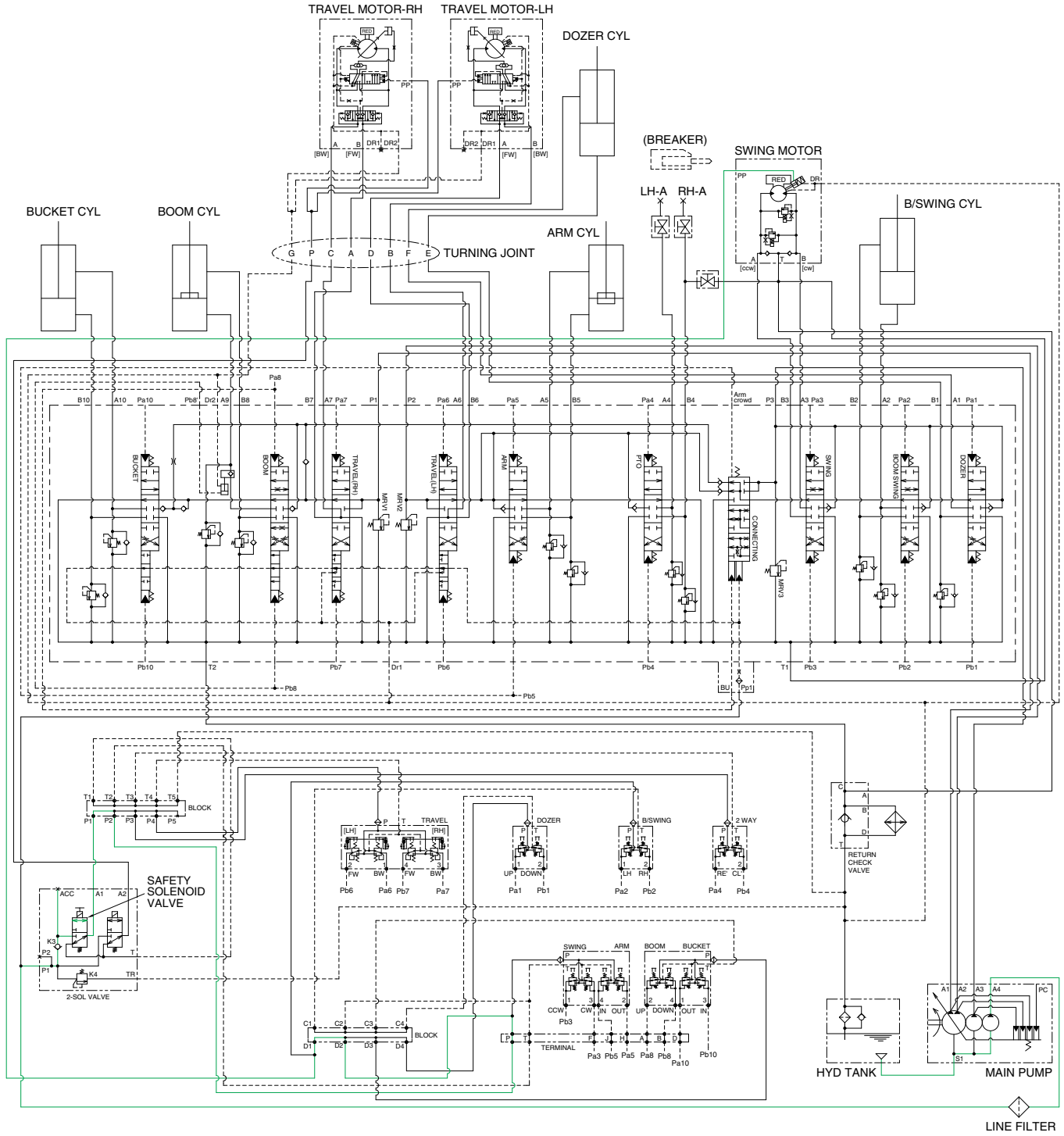
As a result, the control piston is pushed by the main oil flow, thus the displacement is minimized (high speed).

When the travel speed switch is pushed once more, the travel speed solenoid valve is return to original position by the force of spring, the hydraulic oil of PP port returns to the hydraulic tank.

As a result, the control piston is returned by the main oil flow, thus the displacement is maximized (low speed).

Refer to page 2-51.

4. SWING PARKING BRAKE RELEASE



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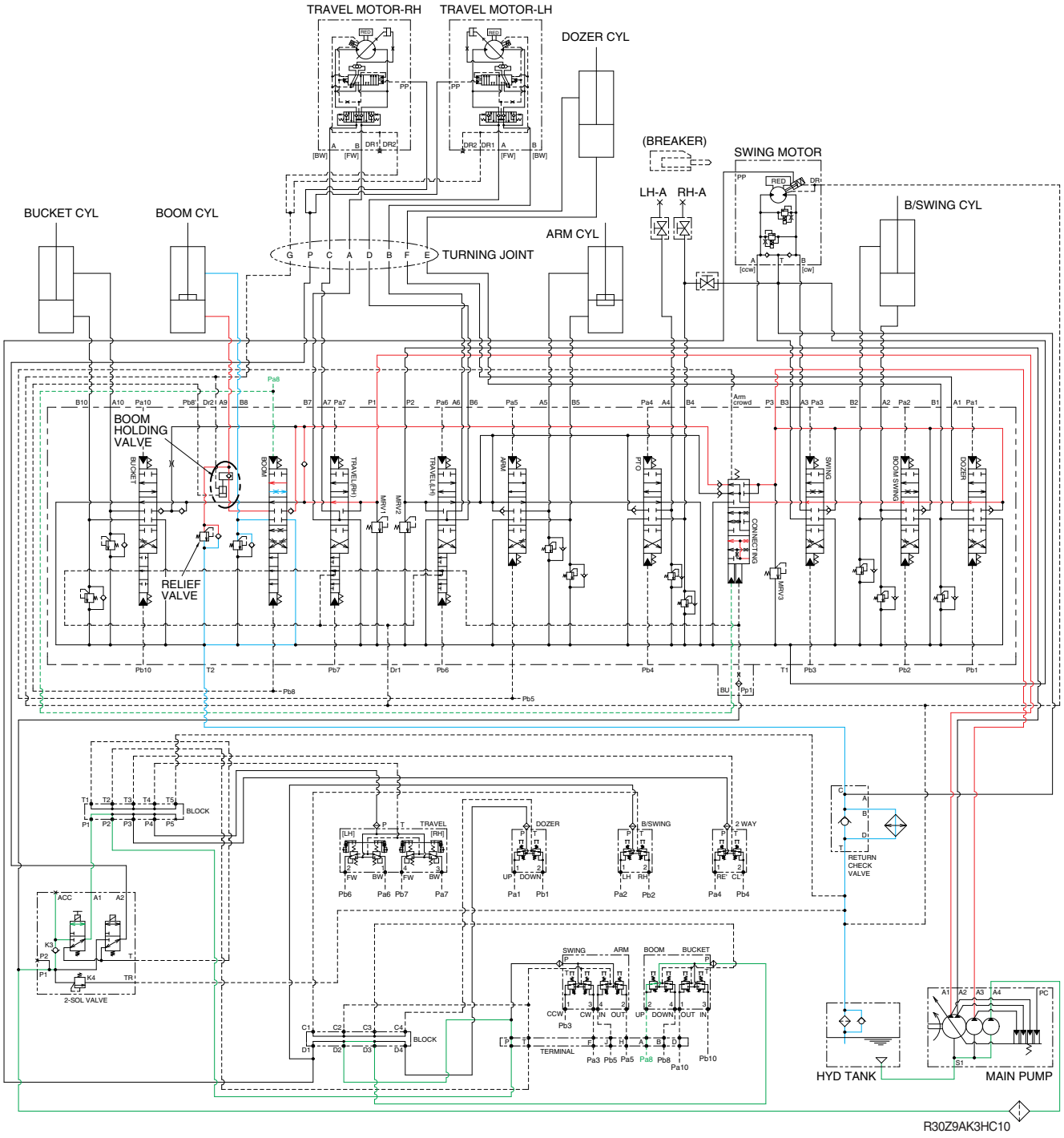
When the safety solenoid lever is moved downward, the pilot oil flow into PP port of the swing motor through solenoid valve and pilot block. This pressure is applied to swing motor disc, thus the brake is released.

When the safety solenoid lever is moved to upward, oil in the swing motor disc cylinder is drained, thus the brake is applied.

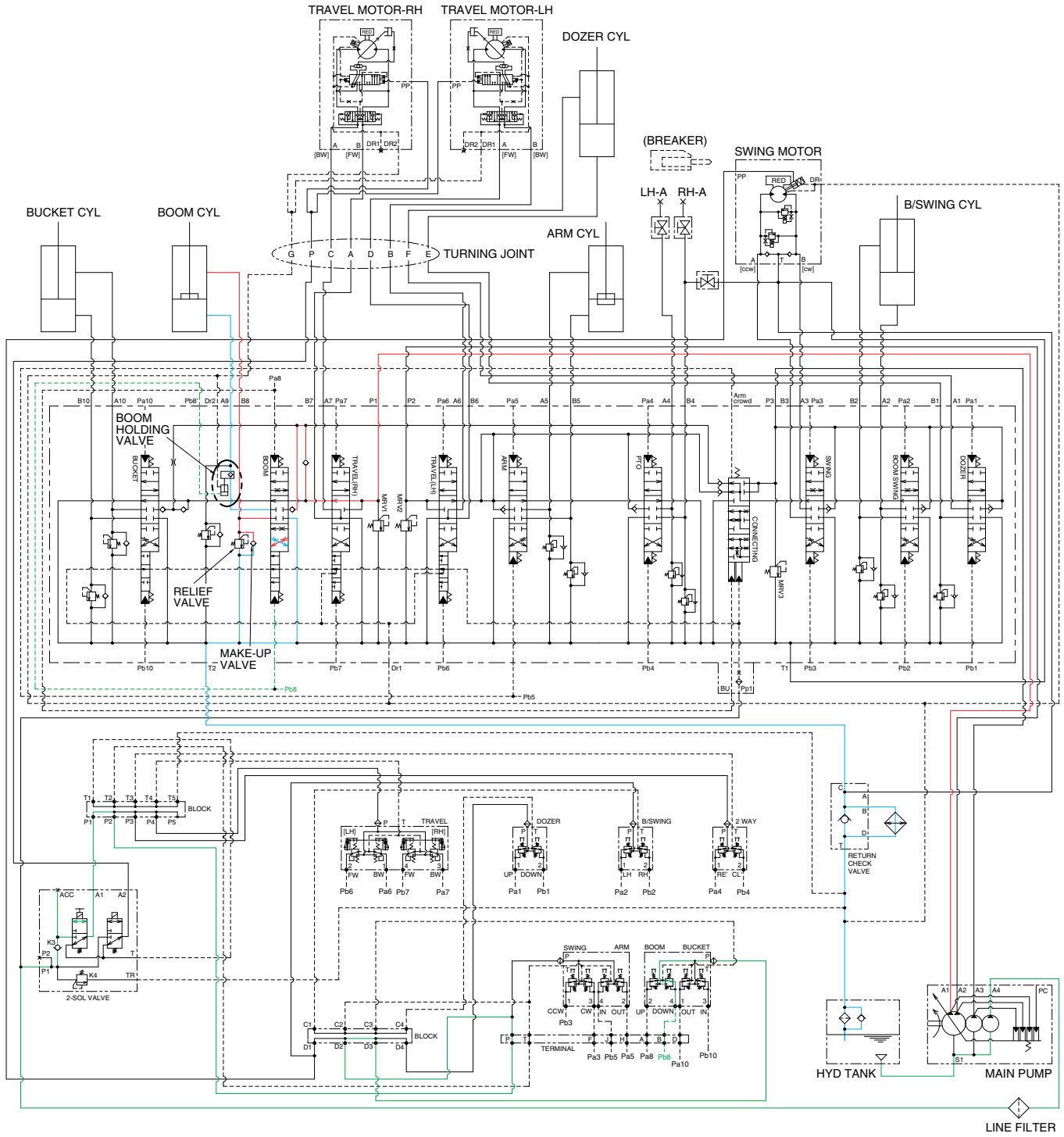
1. BOOM UP OPERATION



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

The oil from the A1 and A3 pump flows into the main control valve and then goes to the large chamber of boom cylinder. At the same time, the oil from the small chamber of boom cylinder returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the boom goes up. The excessive pressure in the boom cylinder bottom end circuit 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 bottom end of the boom cylinder is closed by the boom holding valve. This prevents the hydraulic drift of boom cylinder.

2. BOOM DOWN OPERATION



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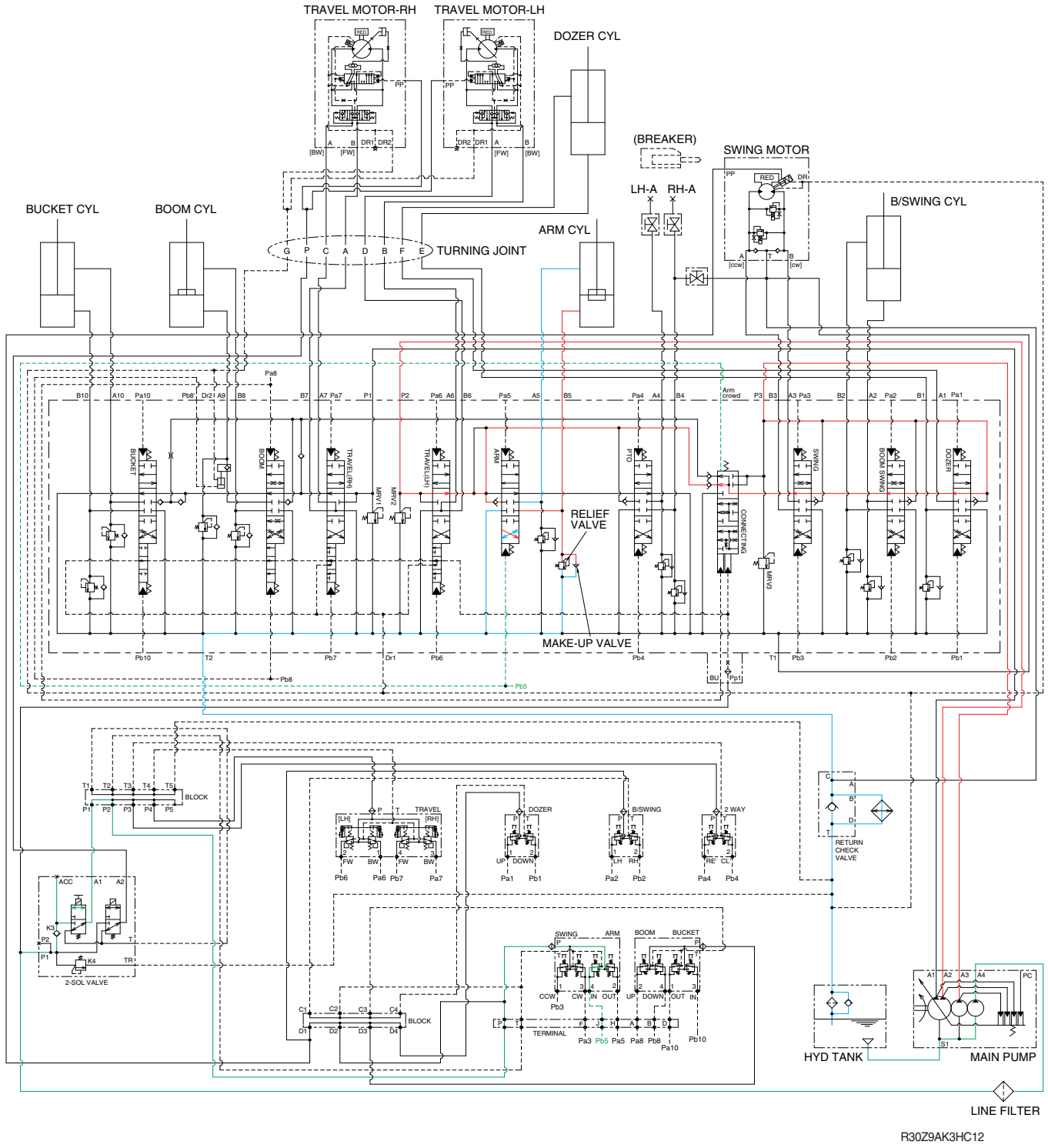
When the right control lever is pushed forward, the boom spool in the main control valve is moved to the down position by the pilot oil pressure from the remote control valve. Since Pb8 port is connected Pb8' port through the piping, boom holding valve is also released.

The oil from the A1 pump flows into the main control valve and then goes to the small chamber of boom cylinder. At the same time, the oil from the large chamber of boom cylinder returns to the hydraulic tank through the boom spool in the main control valve.

The excessive pressure in the boom cylinder rod end circuit is prevented by the relief valve.

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.

3. ARM ROLL IN OPERATION



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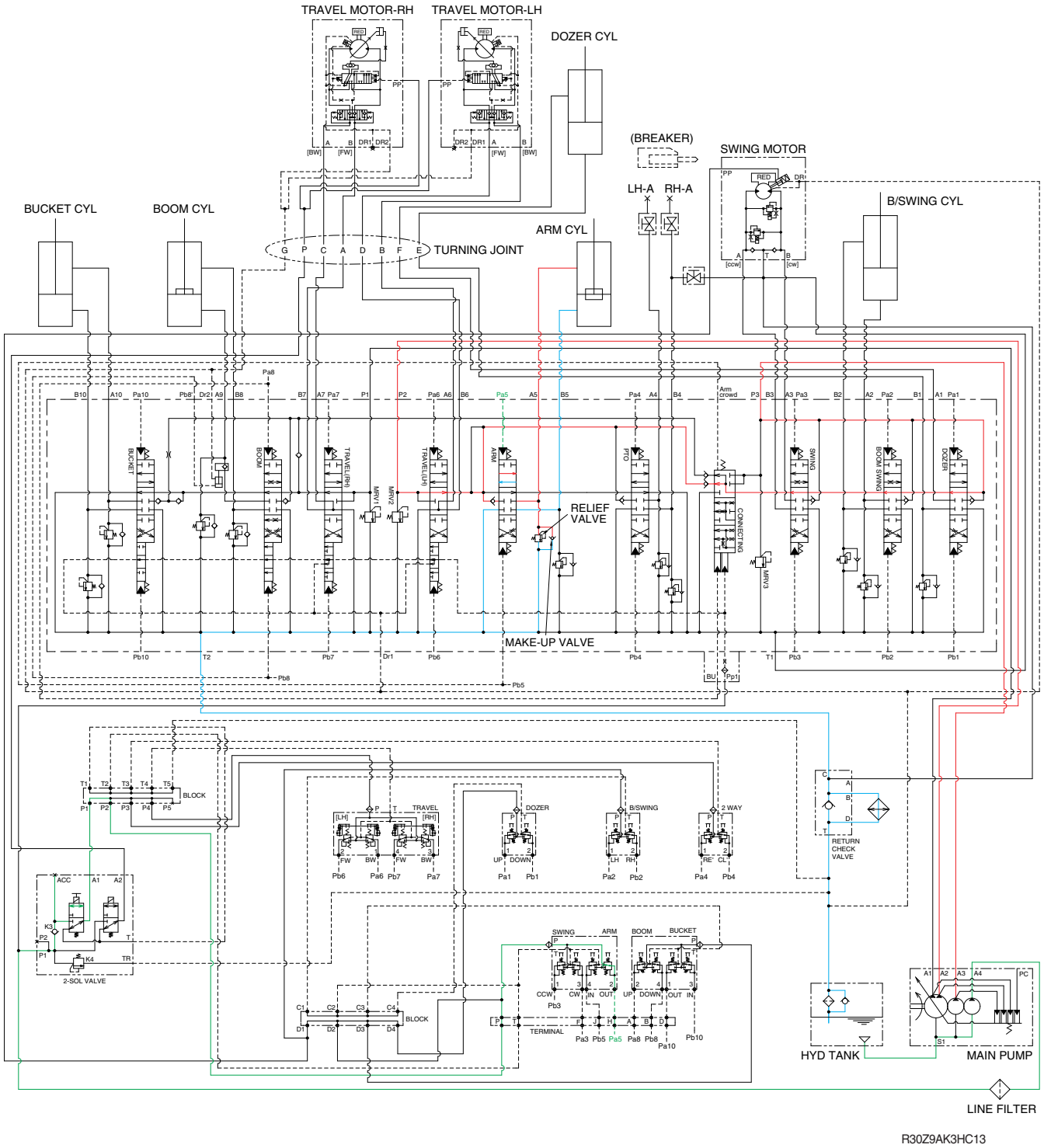
When the left control lever is pulled back, the arm spool in the main control valve is moved the to roll in position by the pilot oil pressure from the remote control valve.

The oil from the A2 and A3 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 spool in the main control valve. When this happens, the arm rolls in. The excessive pressure in the arm cylinder bottom side is prevented by relief valve.

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

4. ARM ROLL OUT OPERATION



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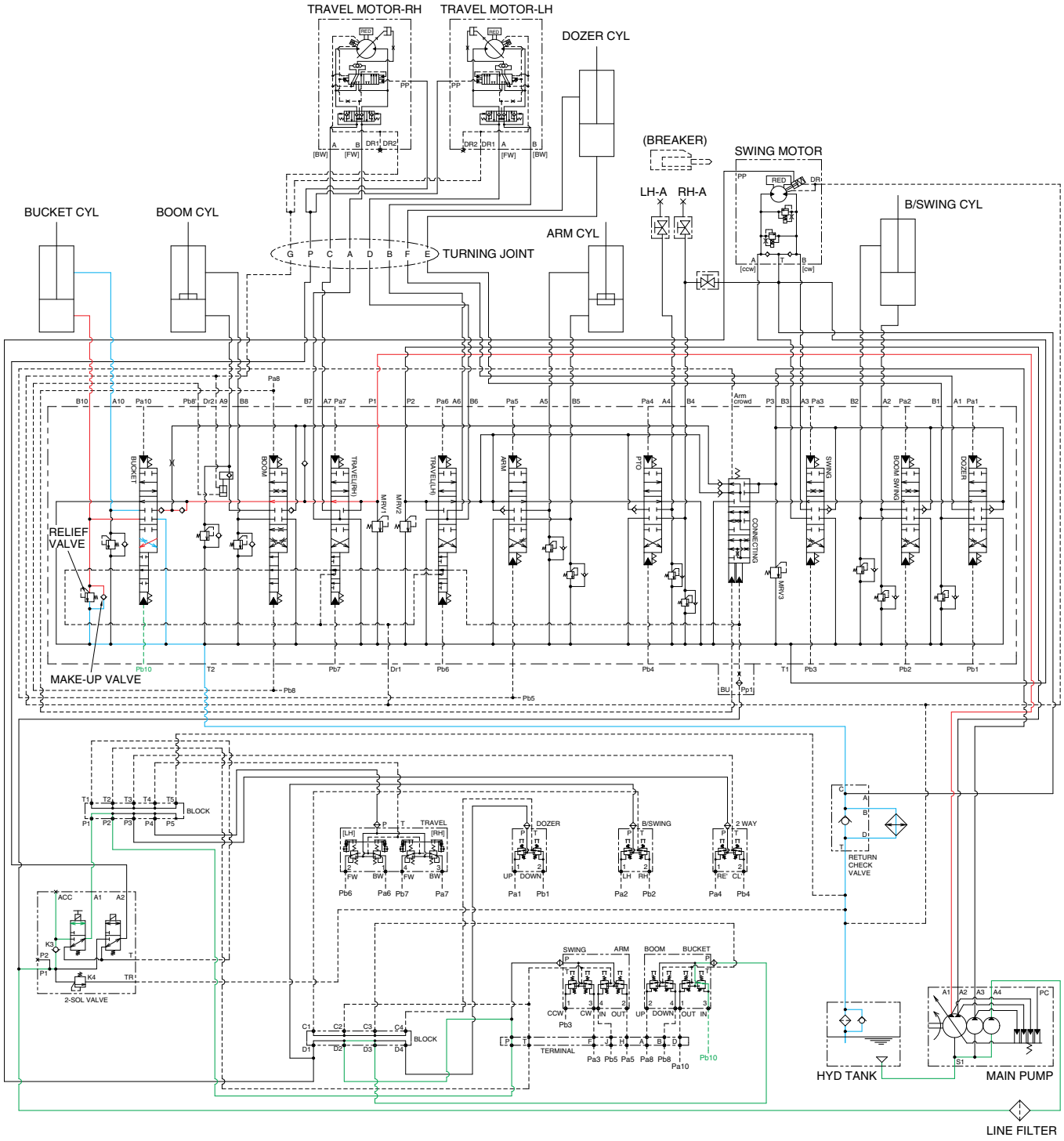
When the left control lever is pushed forward, the arm spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the A2 and A3 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 spool in the main control valve. When this happens, the arm rolls out. The excessive pressure in the arm cylinder rod side is prevented by relief valve.

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

5. BUCKET ROLL IN OPERATION



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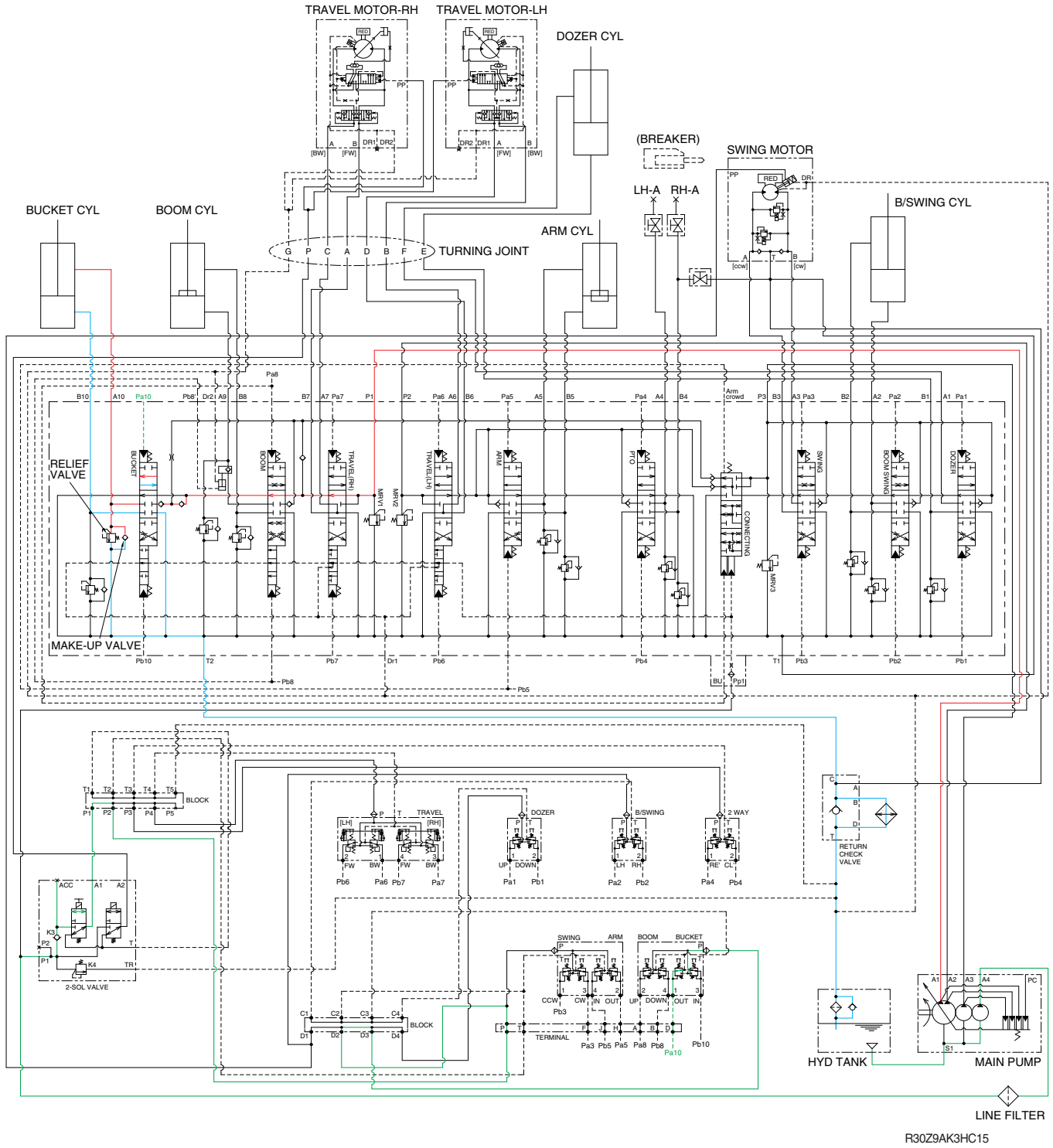
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

The oil from the A1 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 excessive pressure in the bucket cylinder bottom side is prevented by relief valve.

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.

6. BUCKET ROLL OUT OPERATION



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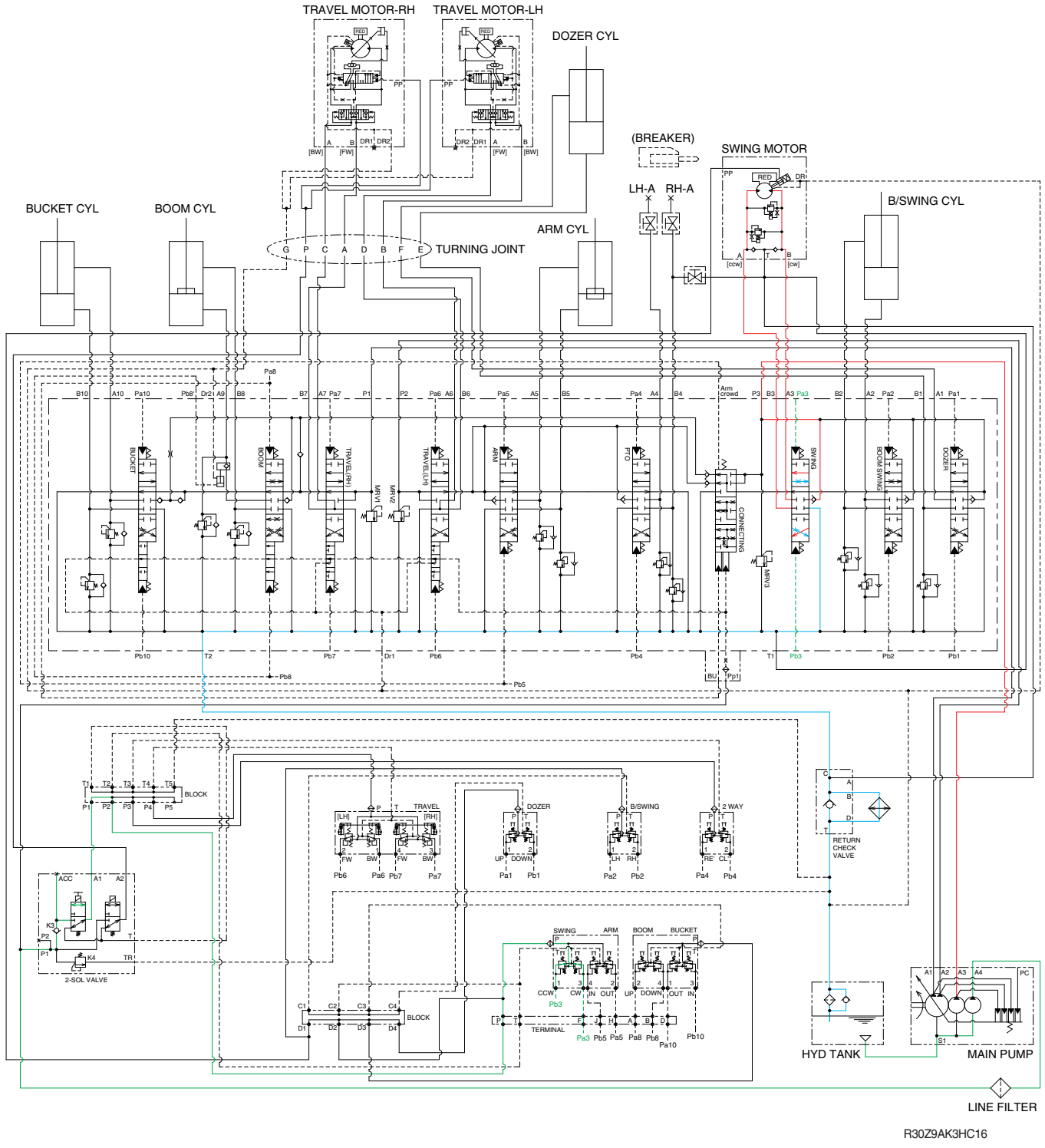
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the main control valve and then goes to the small chamber of 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 excessive pressure in the arm cylinder rod side is prevented by relief valve.

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

7. SWING OPERATION

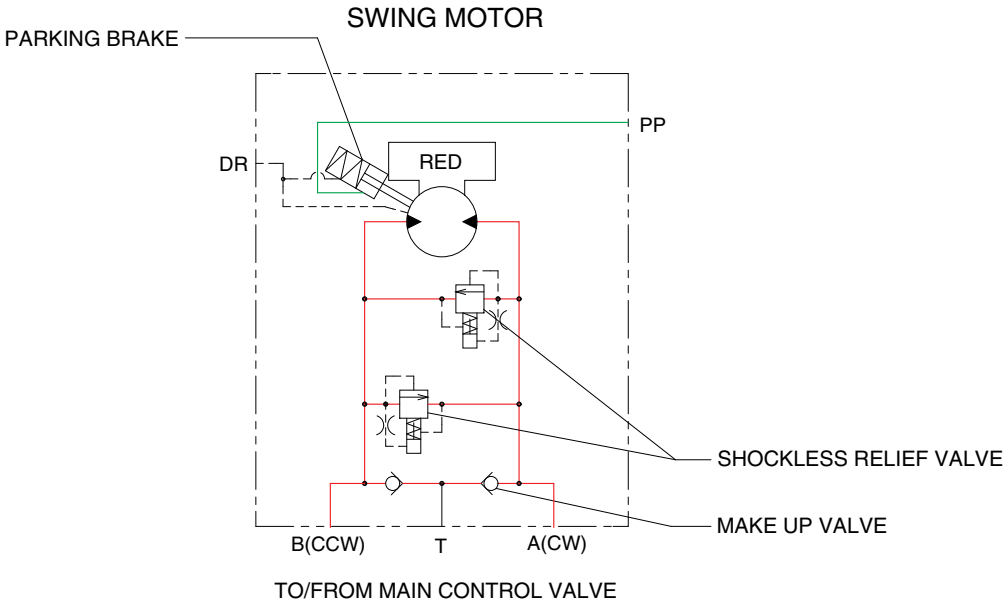


When the left control lever is pushed left or right, the swing spool in the main control valve is moved to the left or right swing position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the main control valve and then goes to the swing motor.

At the same time, the return oil from the swing motor returns to the hydraulic oil tank through the swing spool in the main control valve. When this happens, the superstructure swings to the left or right. The swing parking brake, make up valve and the shockless relief valve are provided in the swing motors. The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself. Refer to following page for each function.

SWING CIRCUIT OPERATION



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1) SHOCKLESS RELIEF VAVLE

Shockless relief valve for the swing motor limits the starting and stopping pressure of swing operation.

Consequently, it prevents the shock of stopping and starting motion of the swing motor.

2) MAKE UP VALVE

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

3) PARKING BRAKE

PARKING BRAKE "ON" OPERATION

When the safety solenoid lever is moved to upward, the oil in the parking brake is drained to the tank. So, parking brake is applied.

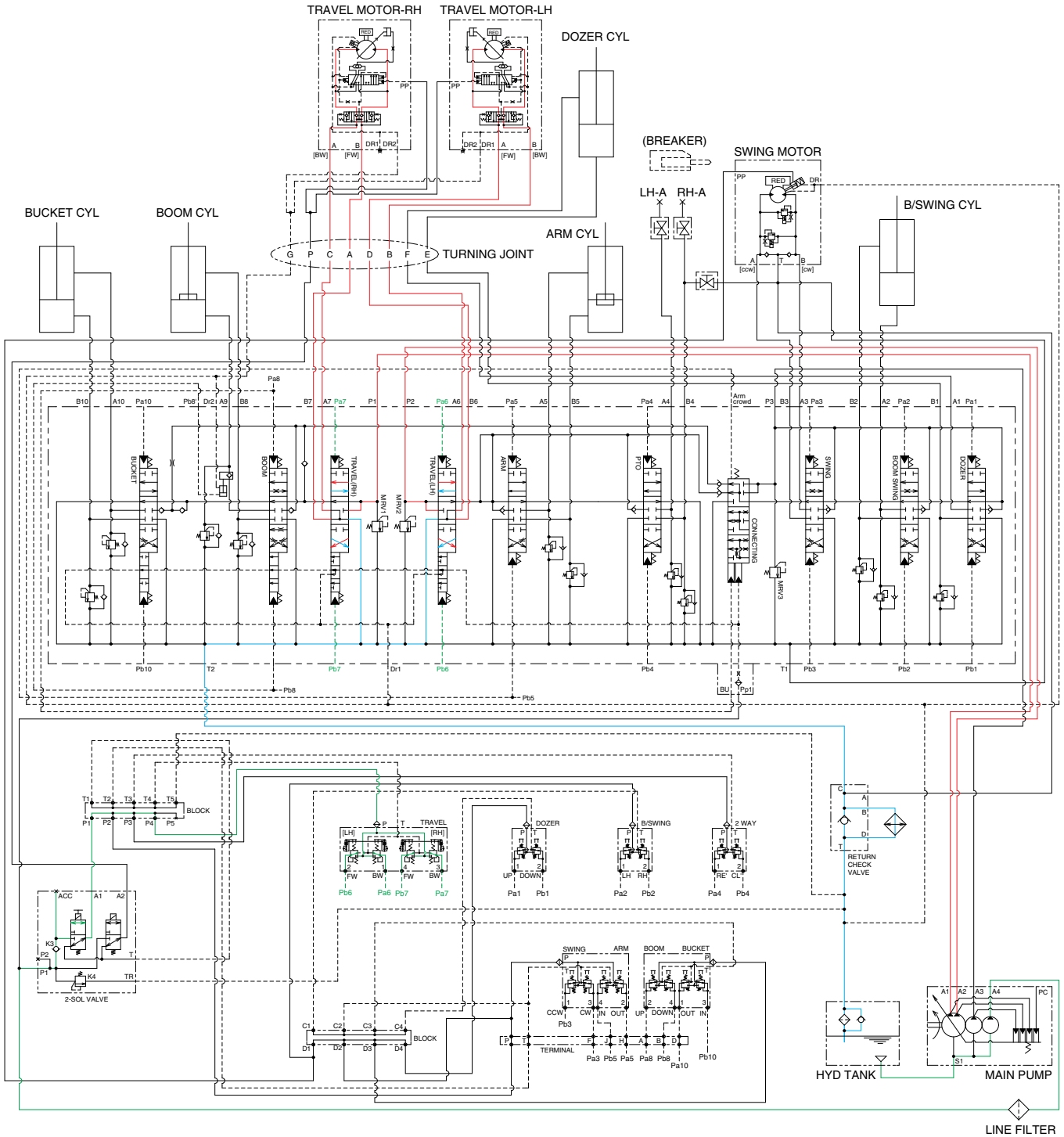
PARKING BRAKE "OFF" OPERATION

The parking brake is released by the pilot pressure oil from pilot pump.

When the safety solenoid lever is moved to downward, the pilot pressure oil from the A4 pilot pump flows into parking brake through safety solenoid valve.

Then the pilot pressure lift the brake piston and release the parking brake.

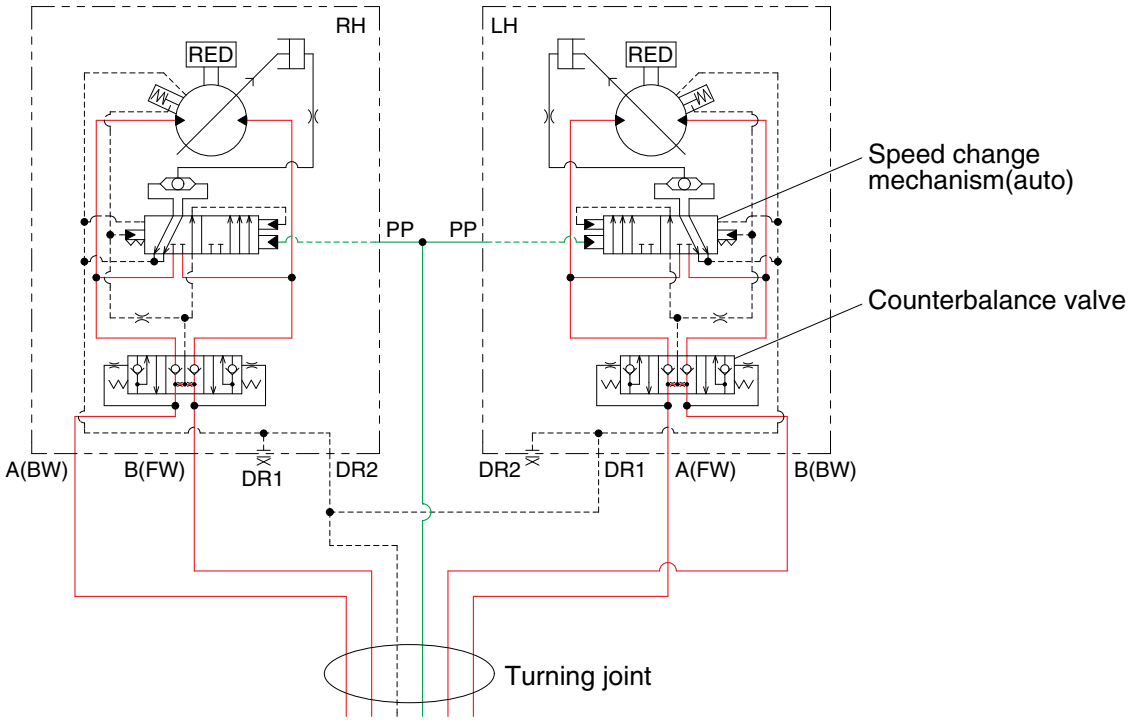
8. TRAVEL FORWARD AND REVERSE OPERATION



R30Z9AK3HC17

When the travel levers are pushed forward or reverse position, the travel spools in the main control valve are moved to the forward or reverse travel position by pilot pressure oil. The oil from the A1 and A2 pumps flows into the main control valve and then goes to the right and left travel motors through the turning joint. The return oil from both travel motors returns to the hydraulic oil tank through the turning joint and the travel spools in the main control valve. When this happens, the machine moves to the forward or reverse.

TRAVEL CIRCUIT OPERATION



R30Z9AK3HC42

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

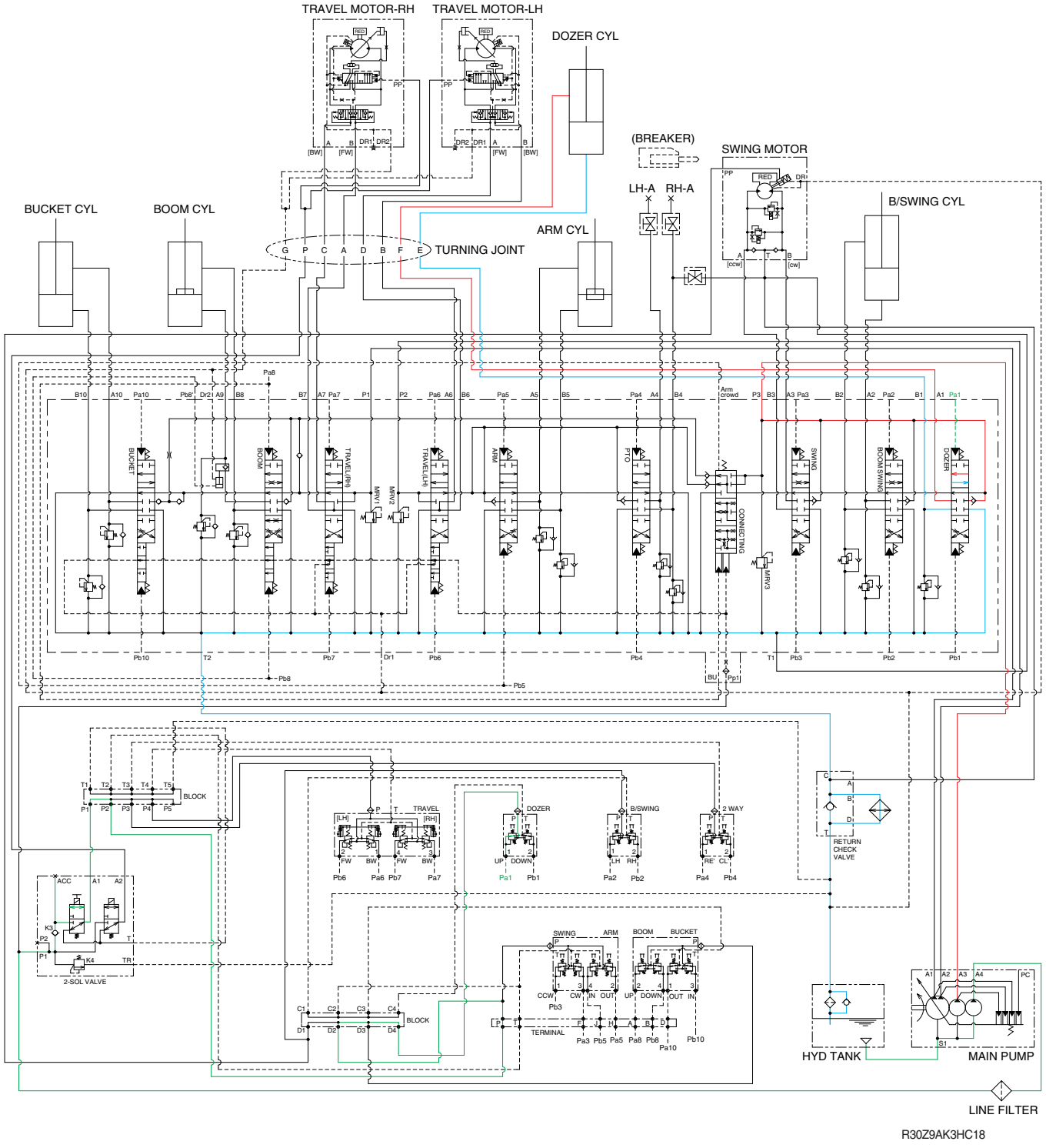
1) COUNTERBALANCE VALVE

When stopping the motor of slope descending, this valve prevents the motor over run.

2) SPEED CHANGE MECHANISM (auto)

Auto two speed control mechanism consists of two spools and spring. This valve automatically changes motor displacement in portion to motor pressure. Refer to page 2-52.

9. DOZER UP OPERATION

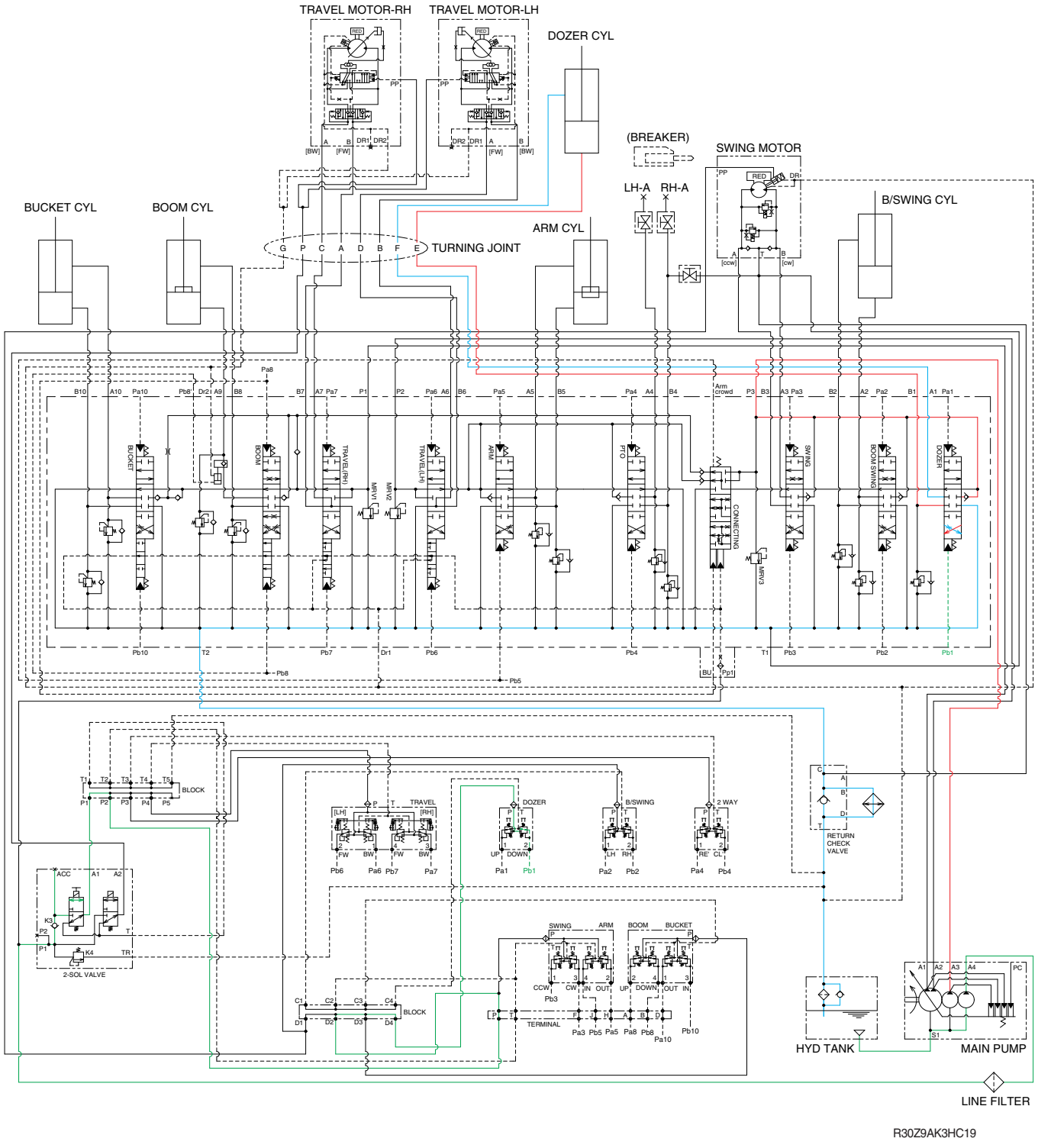


When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the main control valve and then goes to the small chamber of dozer cylinder.

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

10. DOZER DOWN OPERATION



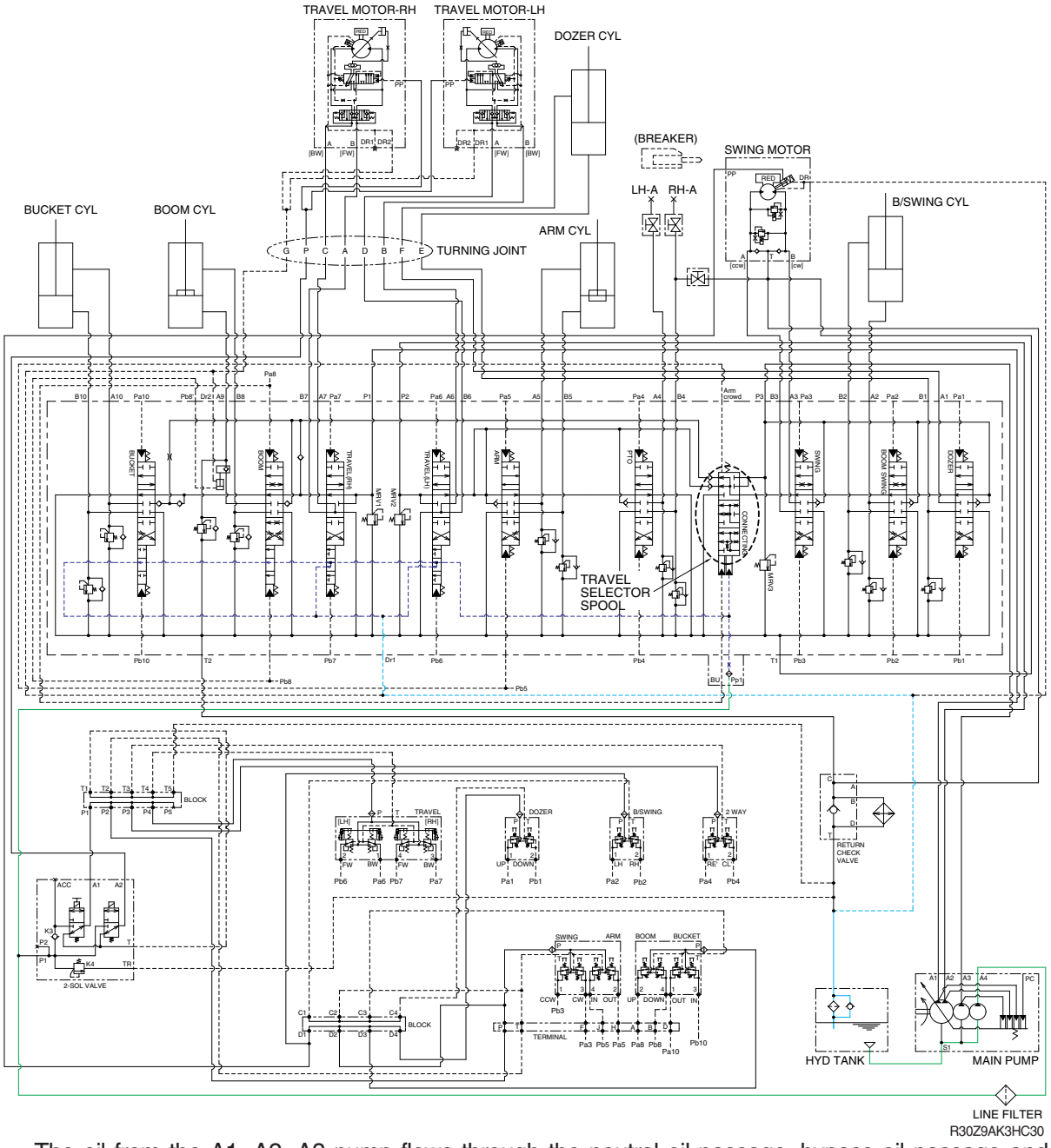
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the main control valve and then goes to the large chamber of dozer cylinder.

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

GROUP 5 COMBINED OPERATION

1. OUTLINE



The oil from the A1, A2, A3 pump flows through the neutral oil passage, bypass oil passage and confluence oil passage in the main control valve. Then the oil goes to each actuator and operates them. Check valves and orifices are located on these oil passage in the main control valve. These control the oil from the main pumps so as to correspond to the operation of each actuator and smooth the combined operation.

INDEPENDENT TRAVEL SYSTEM

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

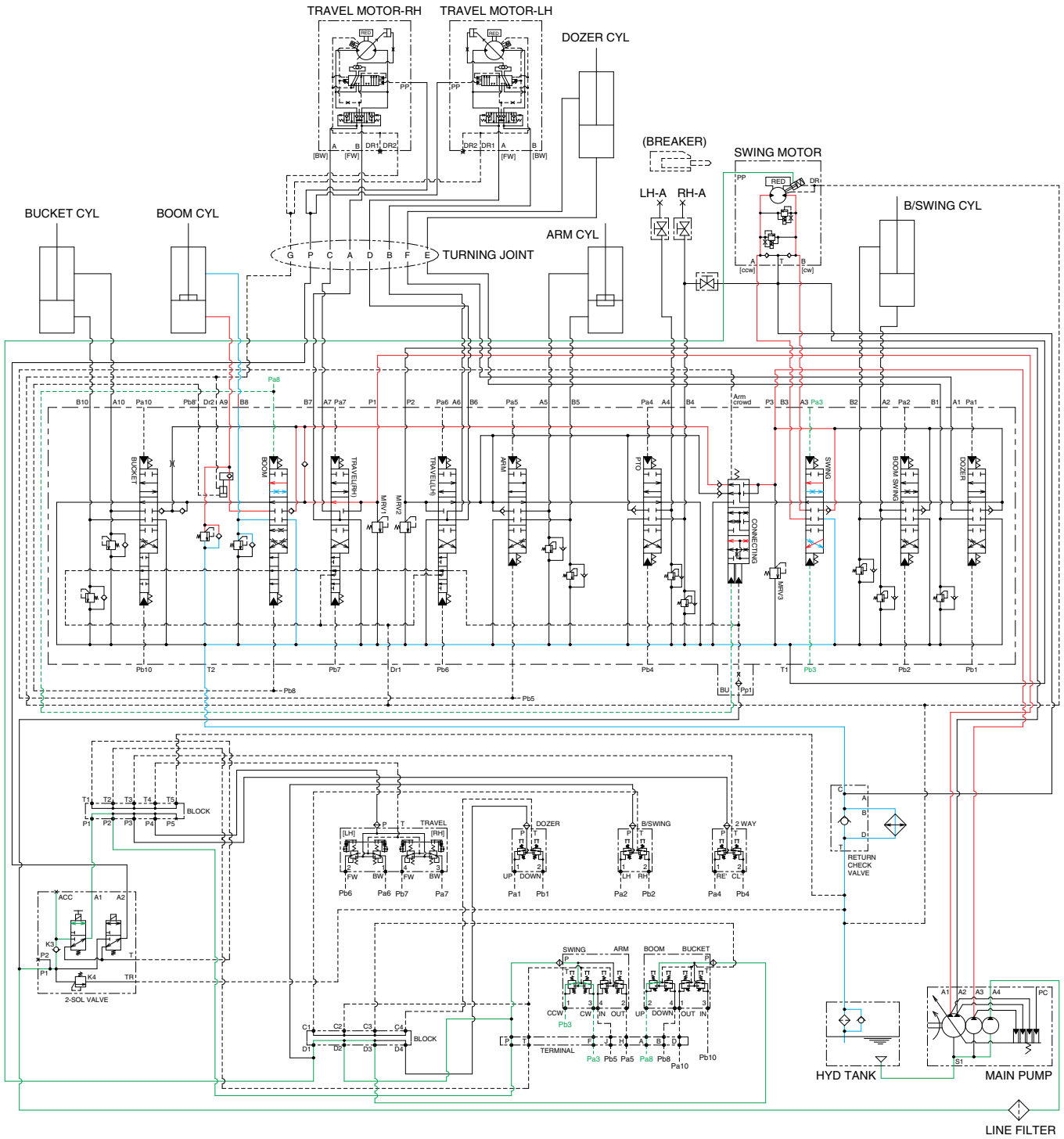
If the both travel spools are shifted, the neutral passes of A1 and A2 pump side are blocked by travel spools and then the oil from A1 and A2 pump does not flow any other spool.

If boom up, bucket in or out spool on A1 and A2 pump side is operated when traveling, the travel selector spool is moved to the selected side by the pilot oil pressure.

Consequently, the pressure oil from A1 and A2 pump are supplied to the right and left travel motor only and oil from A3 pump flows into the other operated actuator.

This keeps the straight travel.

2. COMBINED SWING AND BOOM UP OPERATION



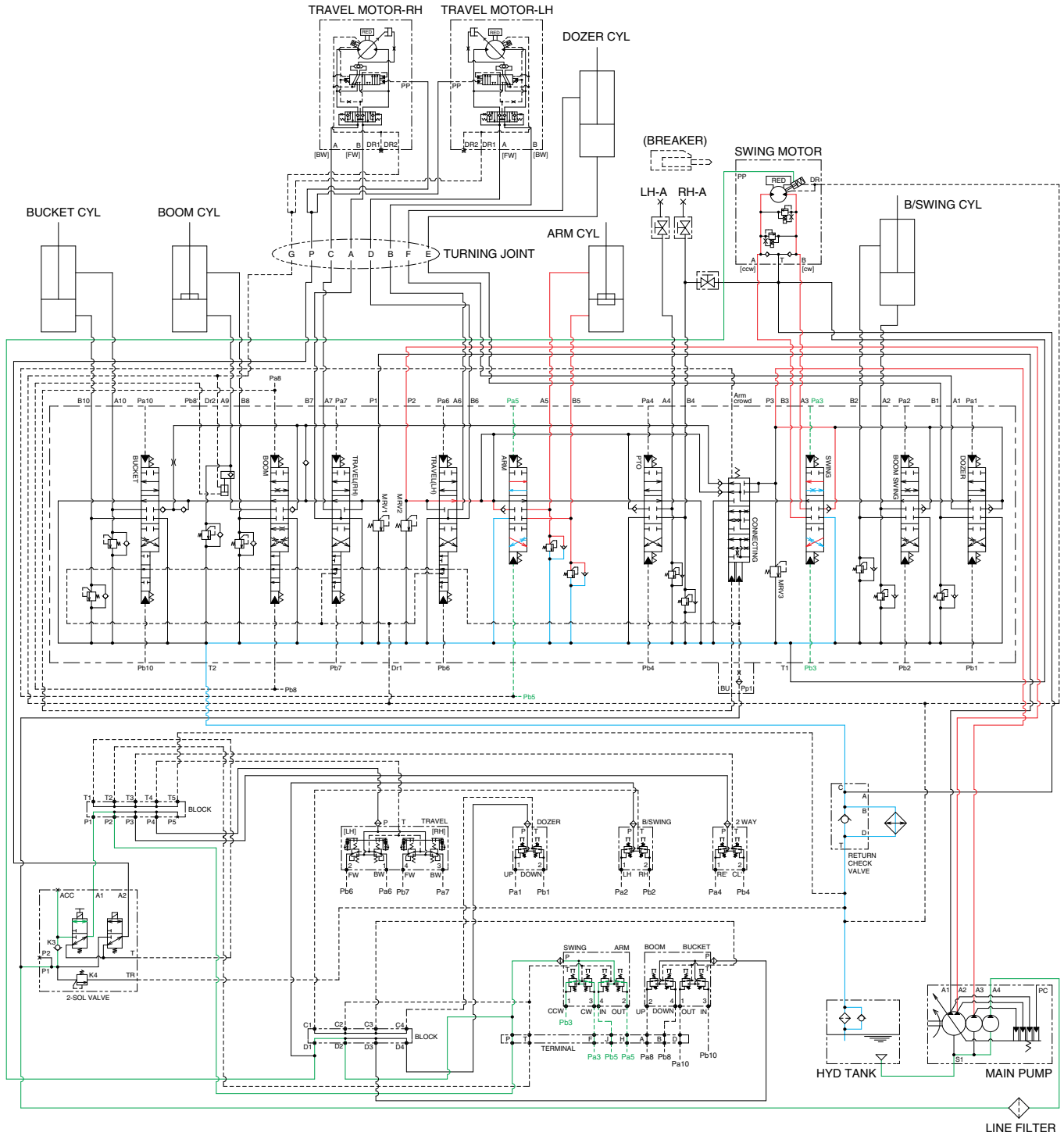
When the swing and boom up functions are operated simultaneously, the selector spool, swing spool and boom spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump flows into the boom cylinder through boom up spool.

The oil from the A3 pump flows into the swing motor through the swing spool and boom up spool through the selector spool.

The superstructure swings and the boom is operated.

3. COMBINED SWING AND ARM OPERATION



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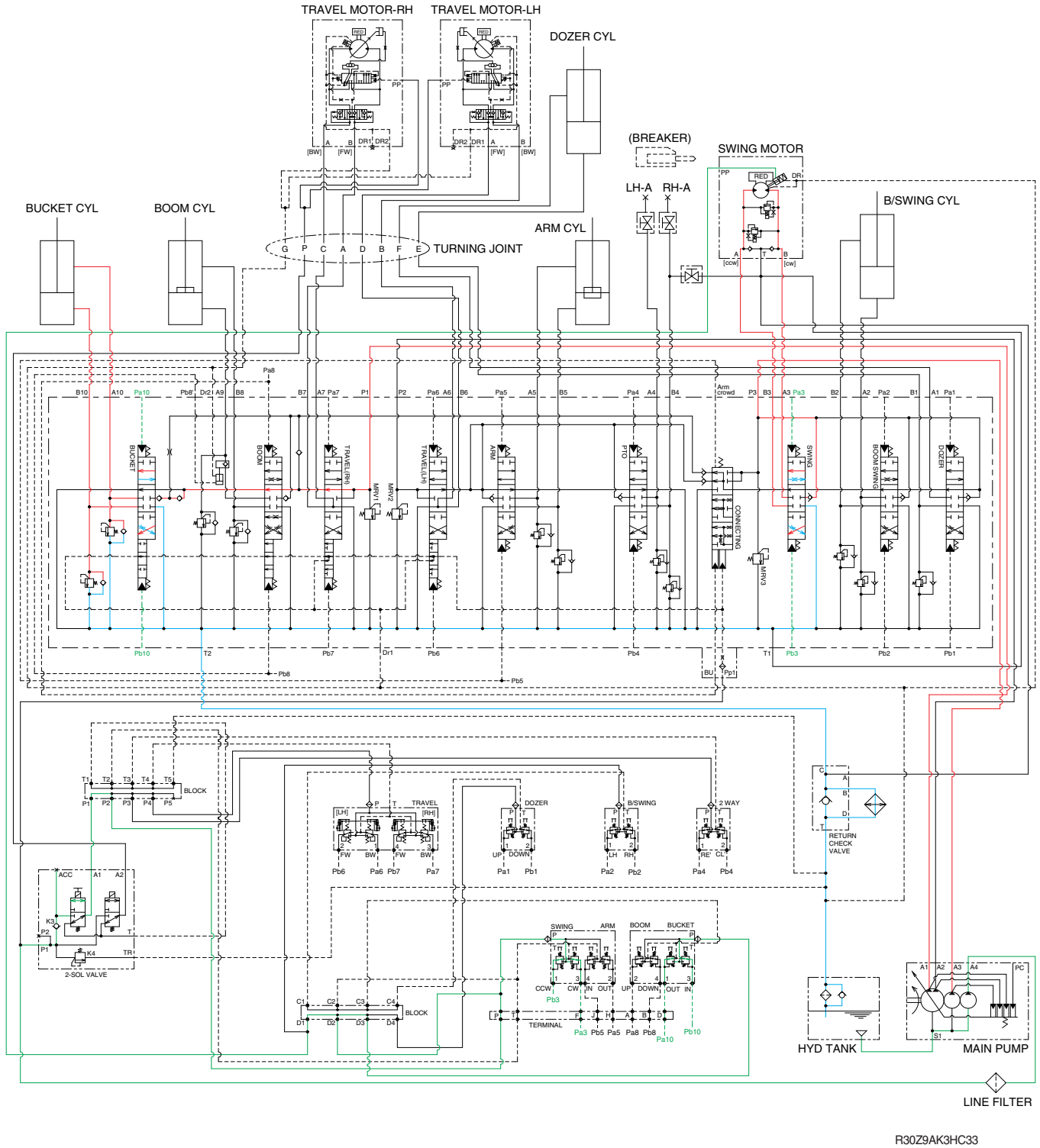
When the swing and arm functions are operated simultaneously, the swing spool and arm spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the swing motor through swing spool.

The oil from the A2 pump flows into the arm cylinder through the arm spool.

The superstructure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION



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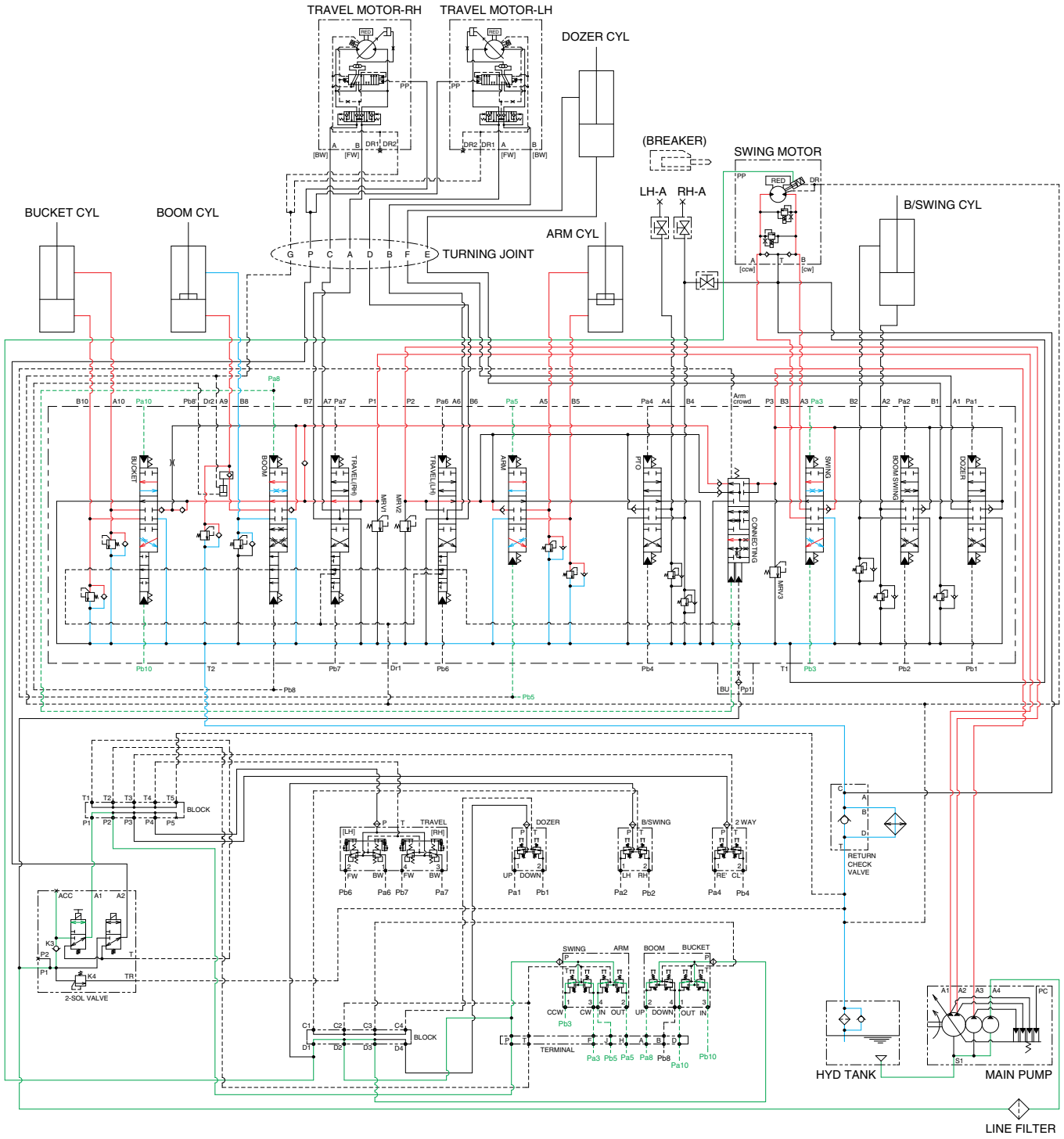
When the swing and bucket functions are operated simultaneously, the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the swing motor through the swing spool.

The oil from the A1 pump flows into the bucket cylinder through the bucket spool.

The superstructure swings and the bucket is operated.

5. COMBINED SWING, BOOM UP, ARM AND BUCKET OPERATION



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When the swing, boom up, 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.

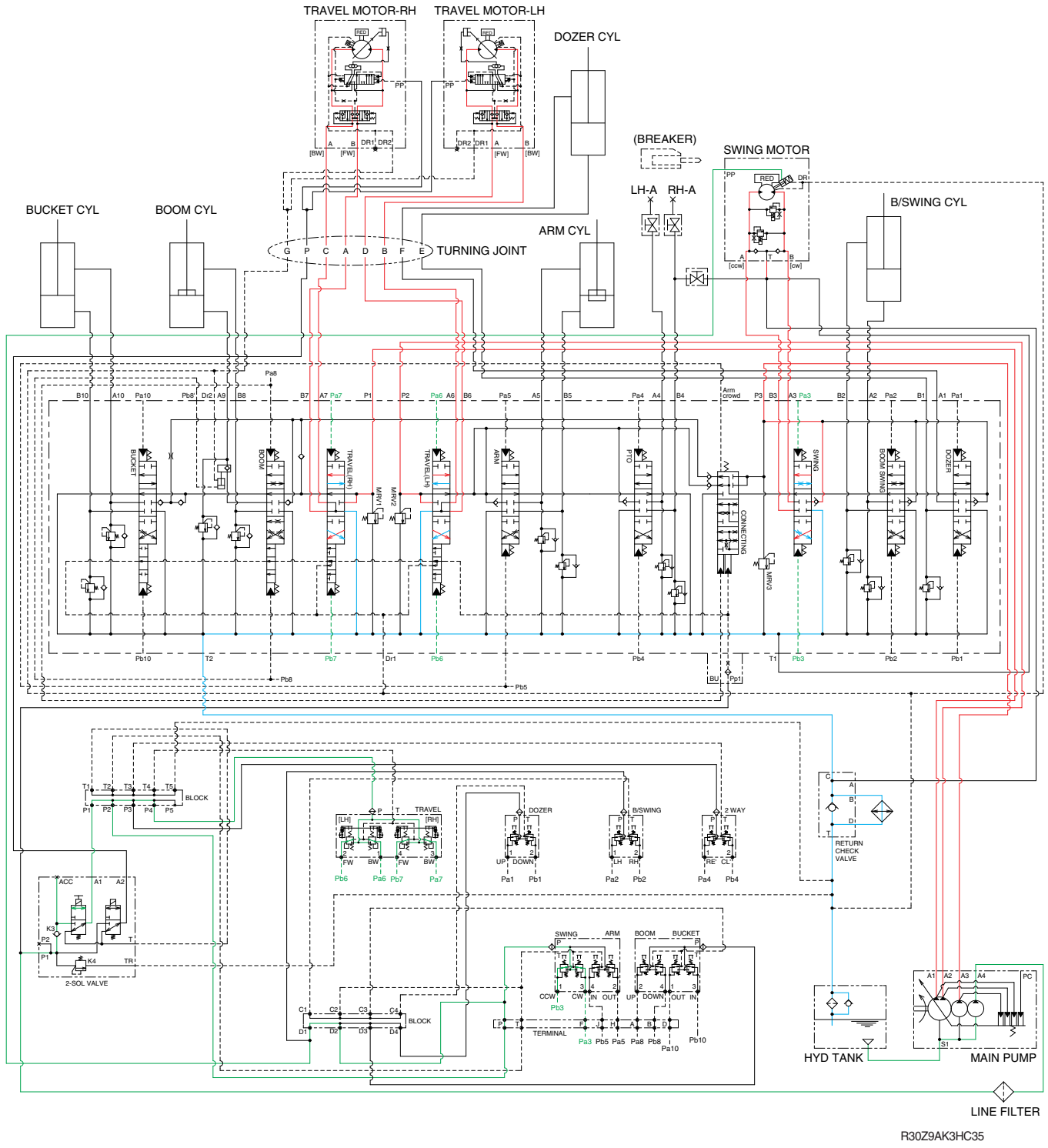
The oil from the A2 pump flows into the arm cylinder through arm spool.

The oil from the A1 pump flows into the boom cylinder and bucket cylinder through the boom spool and bucket spool.

The oil from the A3 pump flows into the swing motor, bucket spool and boom up spool through the each spool respectively.

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

6. COMBINED SWING AND TRAVEL OPERATION



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

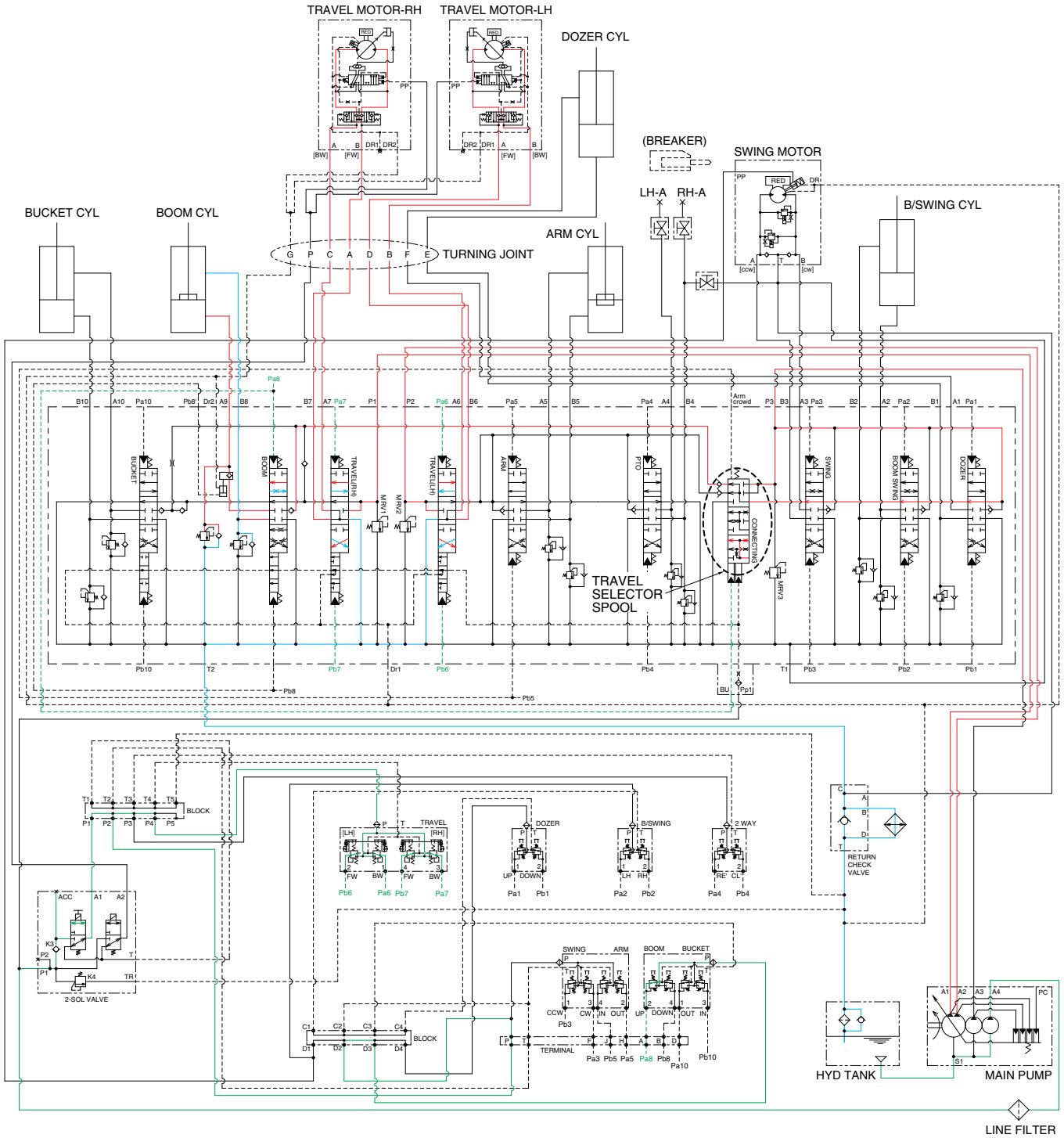
The oil from the A3 pump flows into the swing motor through the swing spool.

The oil from the A1 pump flows into the RH travel motor through the RH travel spool.

The oil from the A2 pump flows into the LH travel motor through the LH travel spool.

The superstructure swings and the machine travels straight.

7. COMBINED BOOM UP AND TRAVEL OPERATION



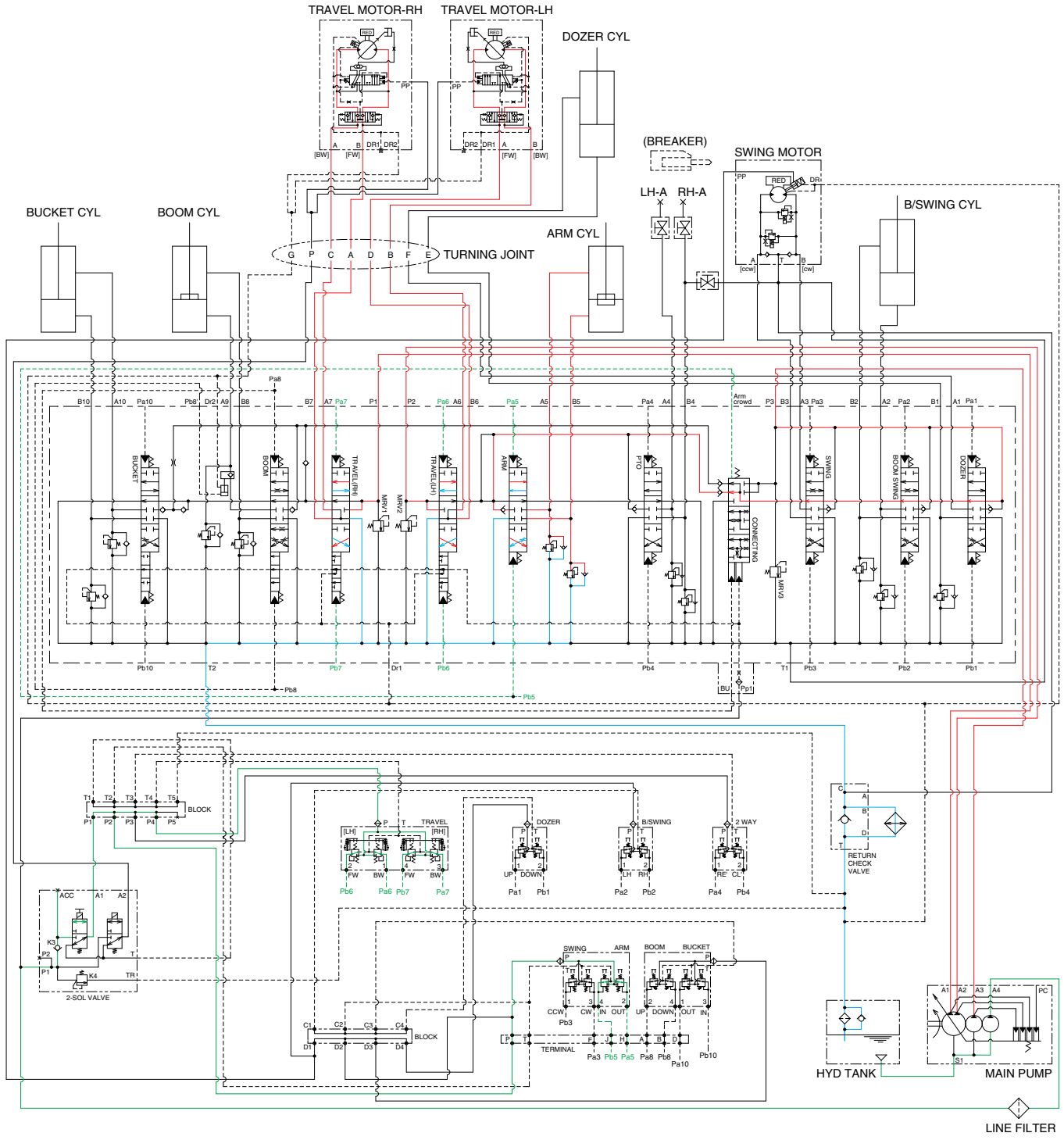
R30Z9AK3HC36

When the boom up and travel functions are operated simultaneously, the boom spool and travel 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 and A2 pumps flows into the travel motors through travel RH and travel LH spools.

The oil from the A3 pump flows into the boom cylinder through boom spool via the travel selector spool. The boom up is operated and the machine travels straight.

8. COMBINED ARM AND TRAVEL OPERATION



R30Z9AK3HC37

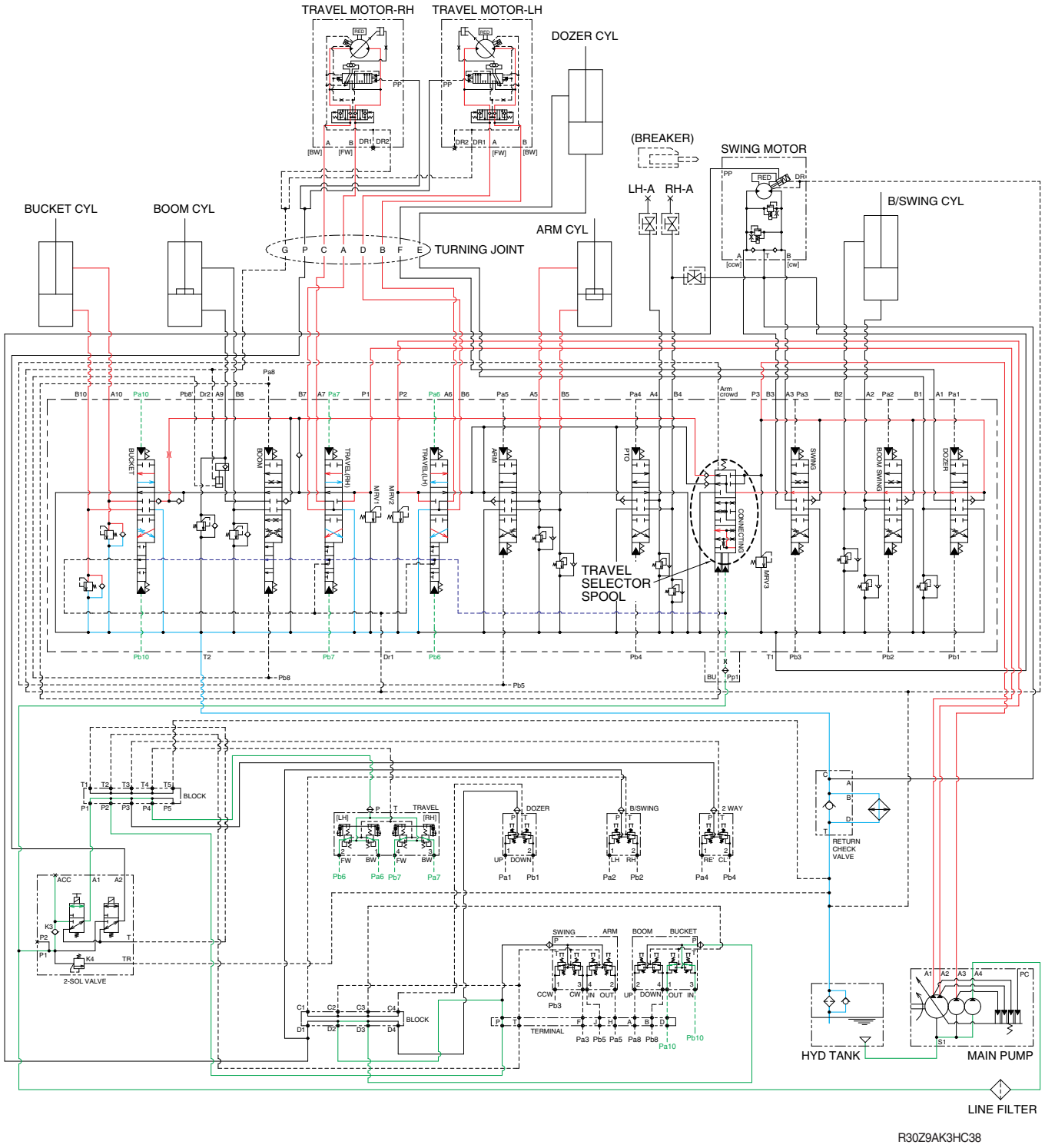
When the arm and travel functions are operated simultaneously, the arm spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1 and A2 pumps flows into the travel motors through travel spools.

The oil from the A3 pump flows into the arm cylinder through arm spool via the travel selector spool.

The arm is operated and the machine travels straight.

9. COMBINED BUCKET AND TRAVEL OPERATION



When the bucket and travel functions are operated simultaneously, the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve, and the travel selector spool is pushed to the up by the oil pressure from pilot pump. The oil from the A1 and A2 pumps flows into the RH and LH travel motors.

The oil from the A3 pump flows into the bucket cylinder through bucket spool via the travel selector spool.

The bucket is operated and the machine travels straight.