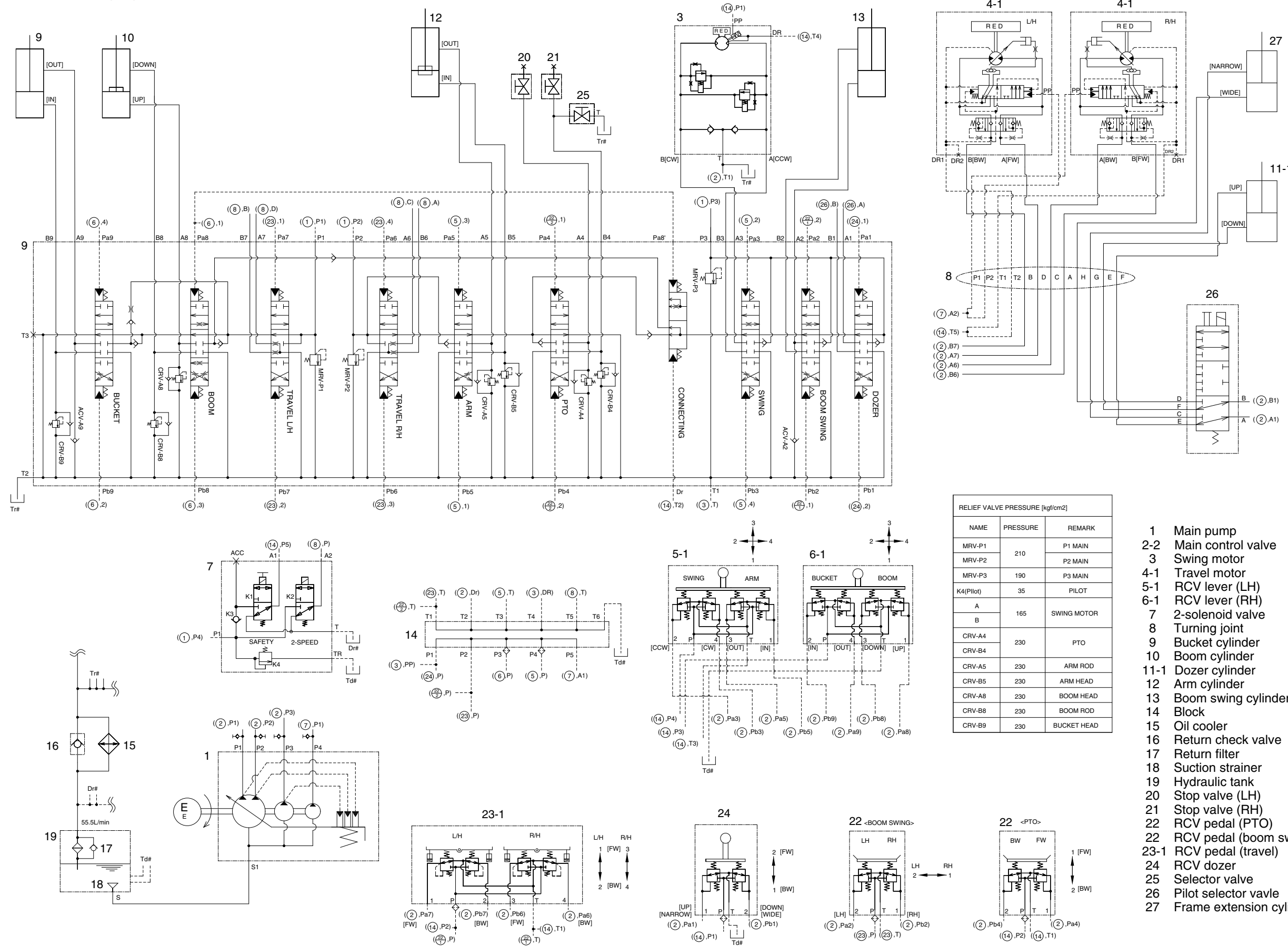


## SECTION 3 HYDRAULIC SYSTEM

Group 1	Hydraulic Circuit .....	3-1
Group 2	Main Circuit .....	3-3
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Group 4	Single Operation .....	3-10
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GROUP 1 HYDRAULIC CIRCUIT

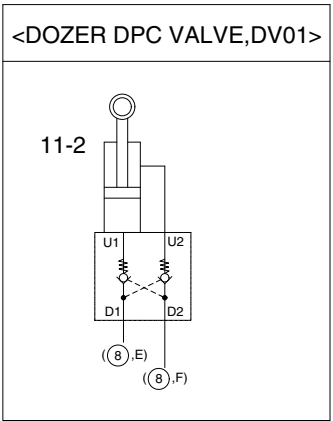
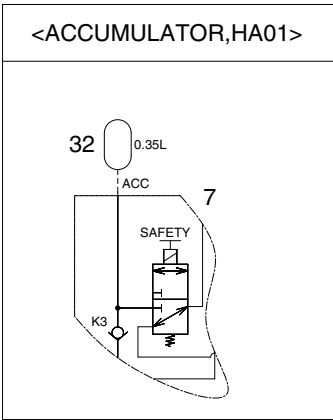
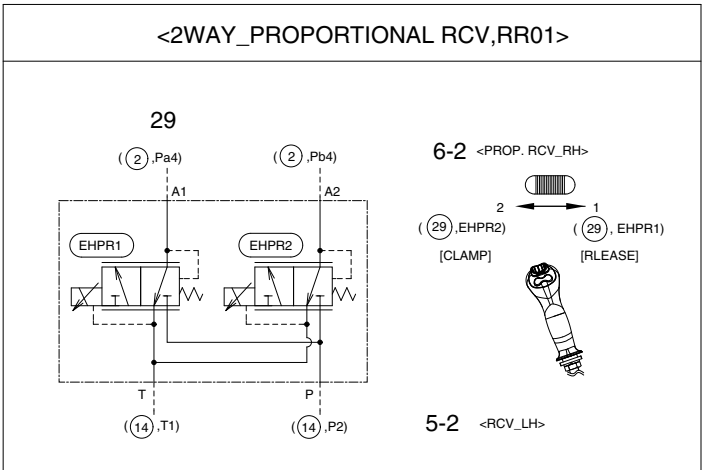
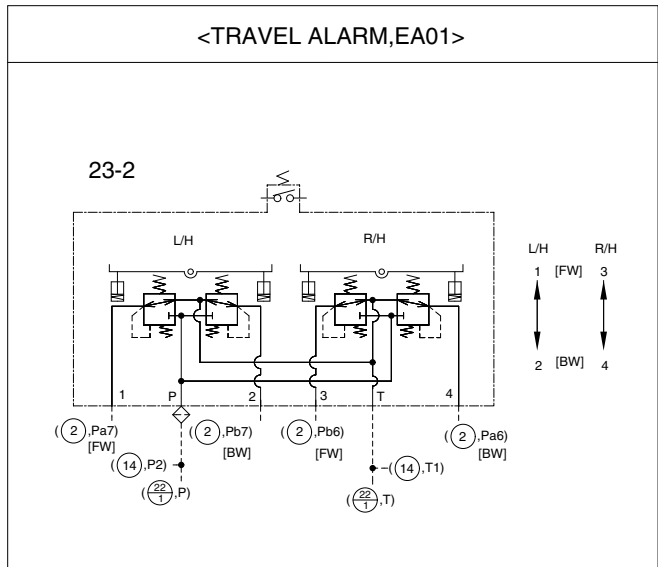
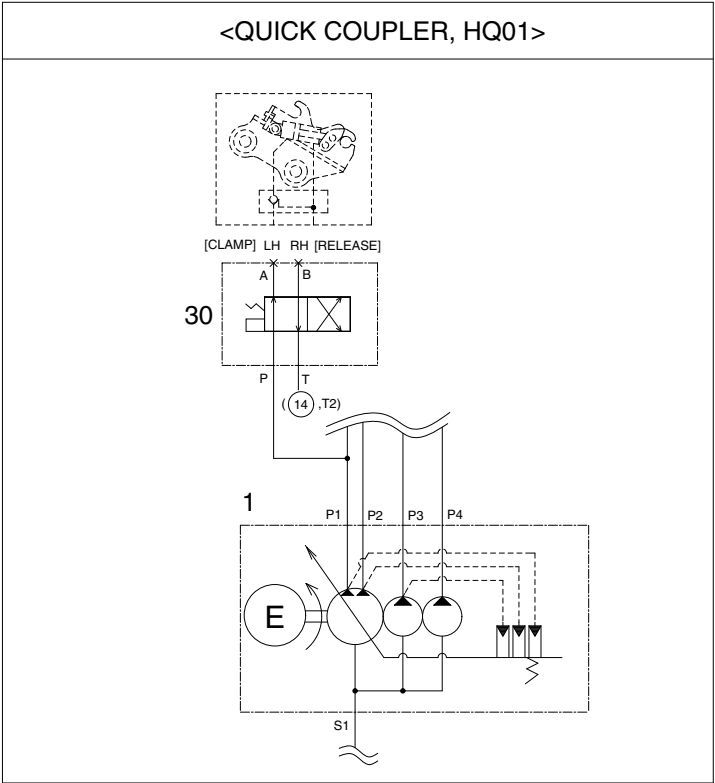
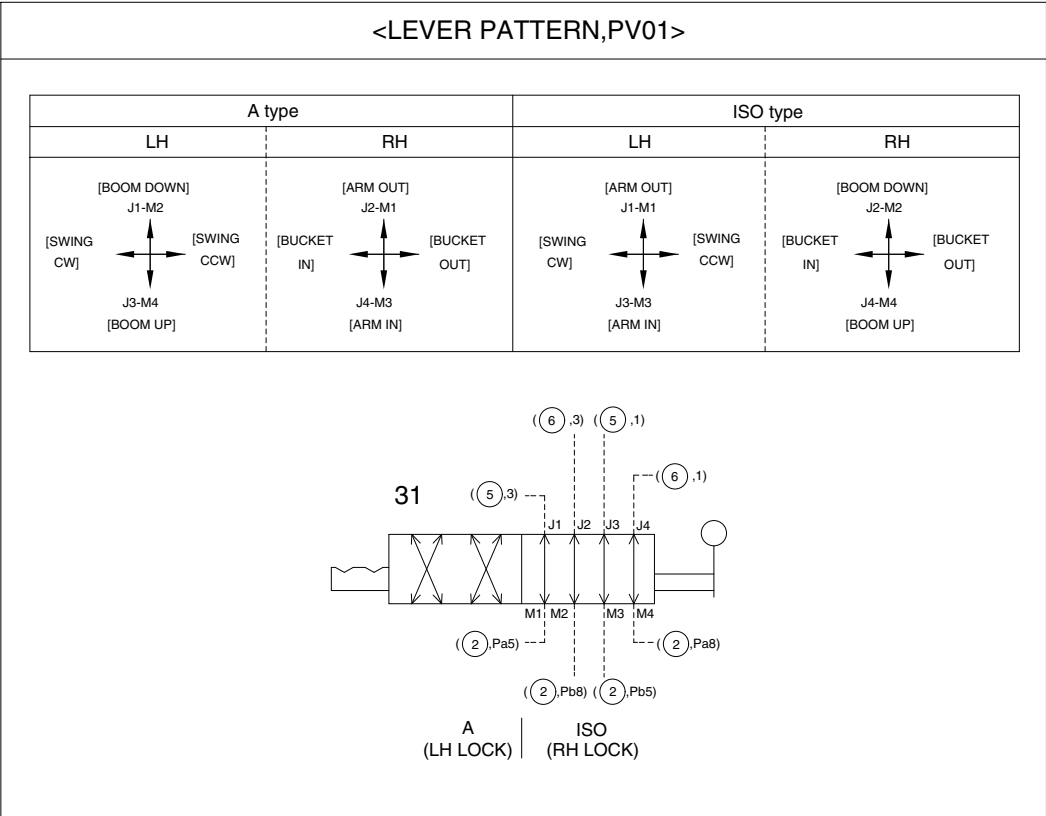
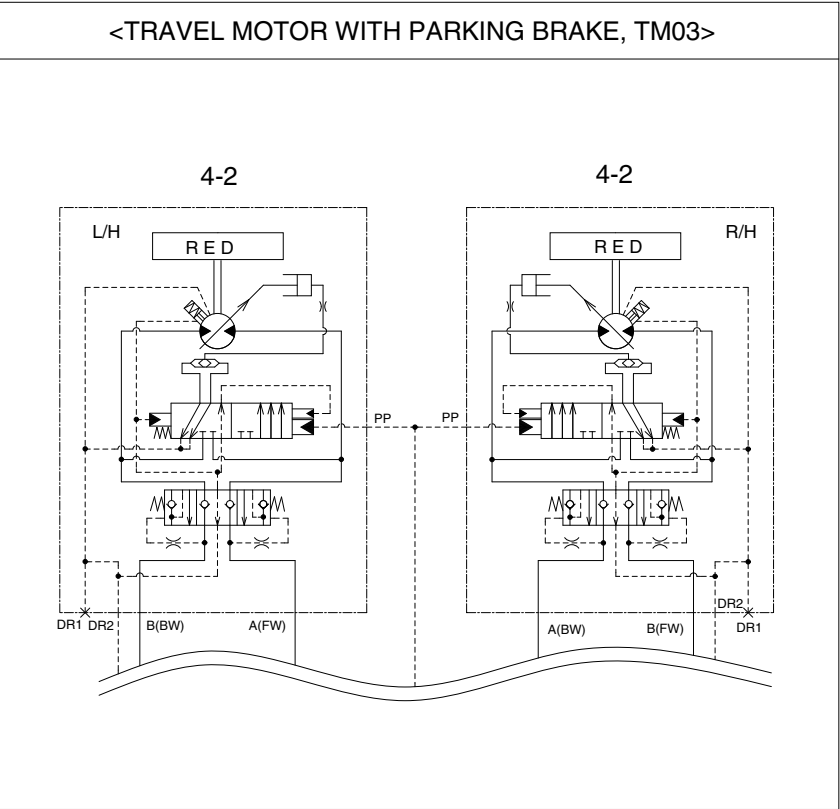
1. HYDRAULIC CIRCUIT (1/2)



RELIEF VALVE PRESSURE [kgf/cm <sup>2</sup> ]		
NAME	PRESSURE	REMARK
MRV-P1	210	P1 MAIN
MRV-P2	190	P2 MAIN
MRV-P3	190	P3 MAIN
K4 (Pilot)	35	PILOT
A	165	SWING MOTOR
B	165	SWING MOTOR
CRV-A4	230	PTO
CRV-B4	230	PTO
CRV-A5	230	ARM ROD
CRV-B5	230	ARM HEAD
CRV-A8	230	BOOM HEAD
CRV-B8	230	BOOM ROD
CRV-A9	230	BUCKET HEAD
CRV-B9	230	BUCKET HEAD

- 1 Main pump
- 2-2 Main control valve
- 3 Swing motor
- 4-1 Travel motor
- 5-1 RCV lever (LH)
- 6-1 RCV lever (RH)
- 7 2-solenoid valve
- 8 Turning joint
- 9 Bucket cylinder
- 10 Boom cylinder
- 11-1 Dozer cylinder
- 12 Arm cylinder
- 13 Boom swing cylinder
- 14 Block
- 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 (PTO)
- 22 RCV pedal (boom swing)
- 23-1 RCV pedal (travel)
- 24 RCV dozer
- 25 Selector valve
- 26 Pilot selector valve
- 27 Frame extension cylinder

2. HYDRAULIC CIRCUIT (2/2)



- 4-2 Travel motor
- 5-2 RCV (LH)
- 6-2 RCV (proportional, RH)
- 11-2 Dozer cylinder valve
- 23-2 RCV pedal-TR
- 29 2-EPPR valve
- 30 Solenoid valve
- 31 Selector valve
- 32 Accumulator

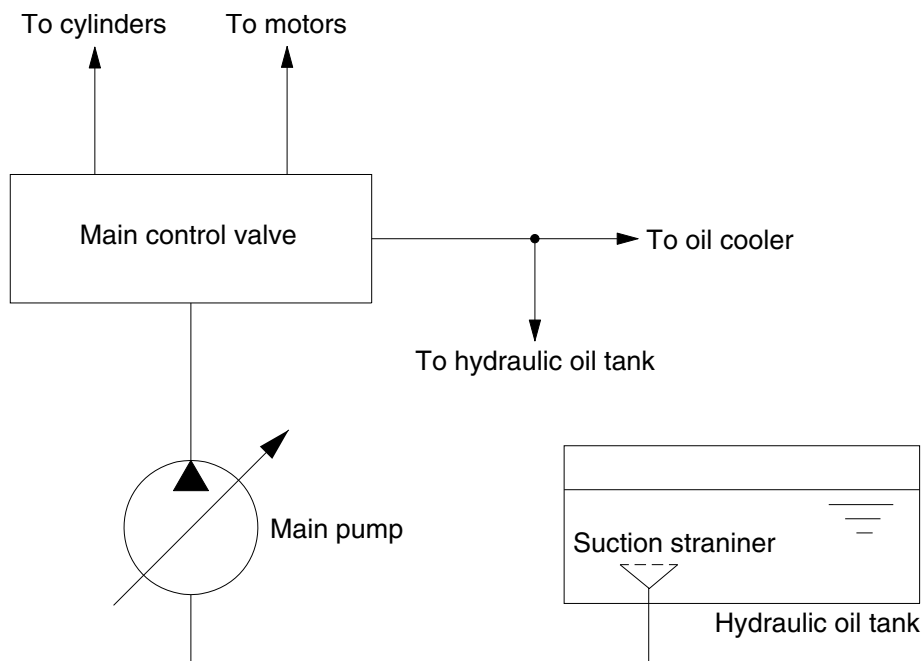
## GROUP 2 MAIN CIRCUIT

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 is driven by the engine at ratio 1.0 of engine speed.

### 1. SUCTION AND DELIVERY CIRCUIT



140L3CI01

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.

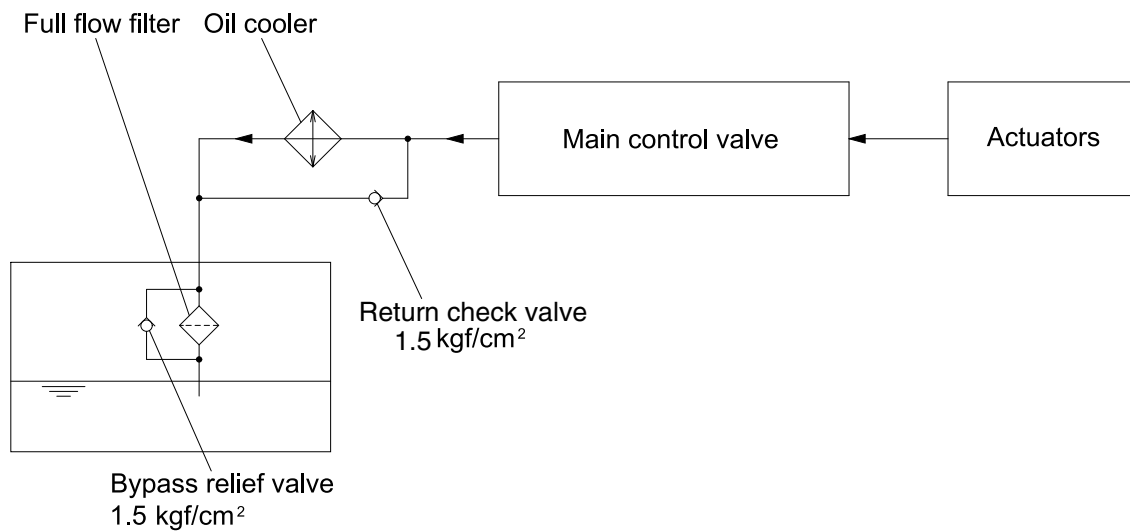
The oil discharged from the main pump flows to the actuators through the main control valve.

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 2. RETURN CIRCUIT



35AZ3CI02

All oil returned 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 return check valve is 1.5 kgf/cm<sup>2</sup> (21 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 1.5 kgf/cm<sup>2</sup> (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 return check valve.

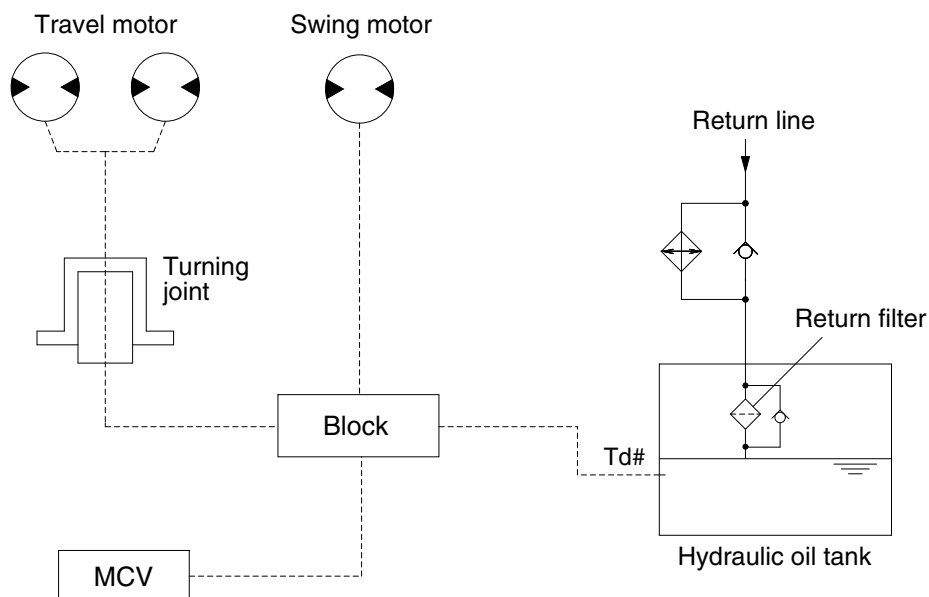
The full-flow filter and bypass relief valve are provided in the hydraulic tank.

The oil returned from the main control valve 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<sup>2</sup> (21 psi) differential pressure.

※ The circuit diagram may differ from the equipment, so please check before a repair.

### 3. DRAIN CIRCUIT



17AZ3CI03

Besides internal leaks from the motors and main pump, the oil 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 through the block.

#### 2) SWING MOTOR DRAIN CIRCUIT

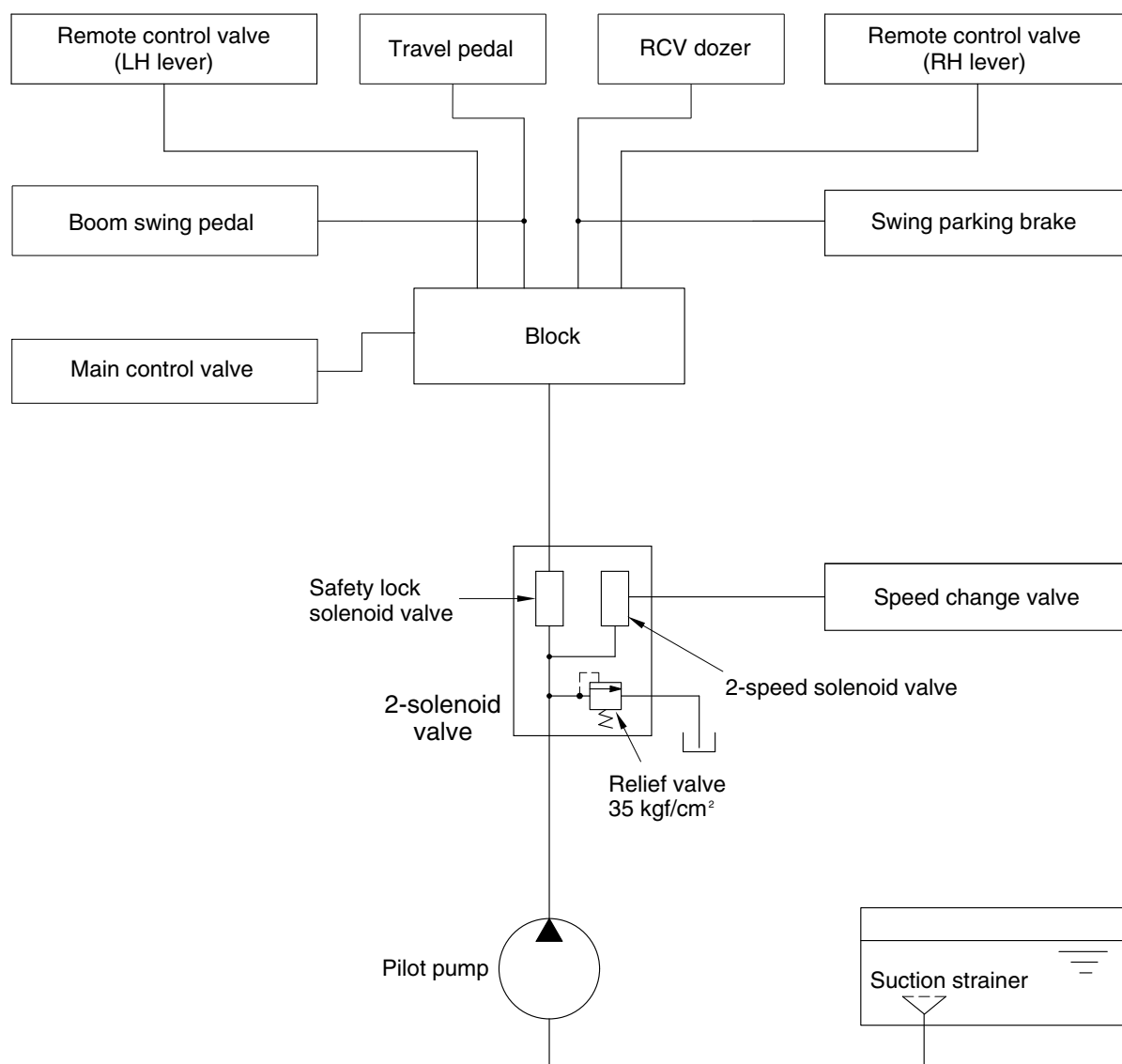
Oil leaked from the swing motor returns to the hydraulic tank passing through the block.

#### 3) MAIN CONTROL VALVE

Oil leaked from the main control valve returns to the hydraulic tank passing through the block.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## GROUP 3 PILOT CIRCUIT



17AZ3CI04

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

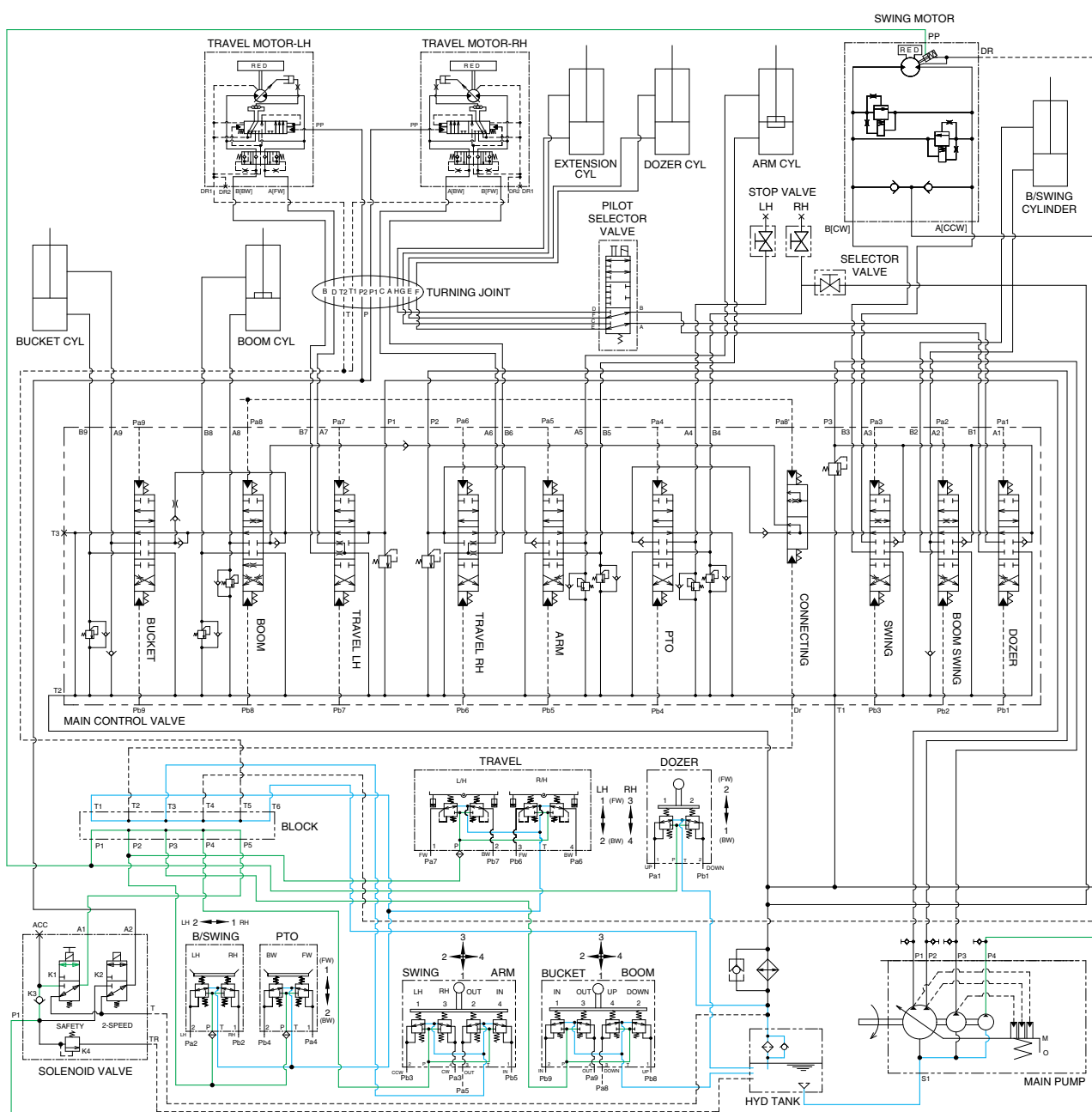
The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction filter.

The discharged oil from the pilot pump flows to the 2-solenoid valve and provides oil to each control valve as below.

- RCV lever (LH & RH), RCV dozer, travel pedal, boom swing pedal and option pedal through the safety lock solenoid valve and block.
- Swing parking brake through the safety lock solenoid valve.
- Travel speed change valve through the 2-speed solenoid valve.

※ The circuit diagram may differ from the equipment, so please check before a repair.

# 1. SUCTION, DELIVERY AND RETURN CIRCUIT



17AZ3HC03

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

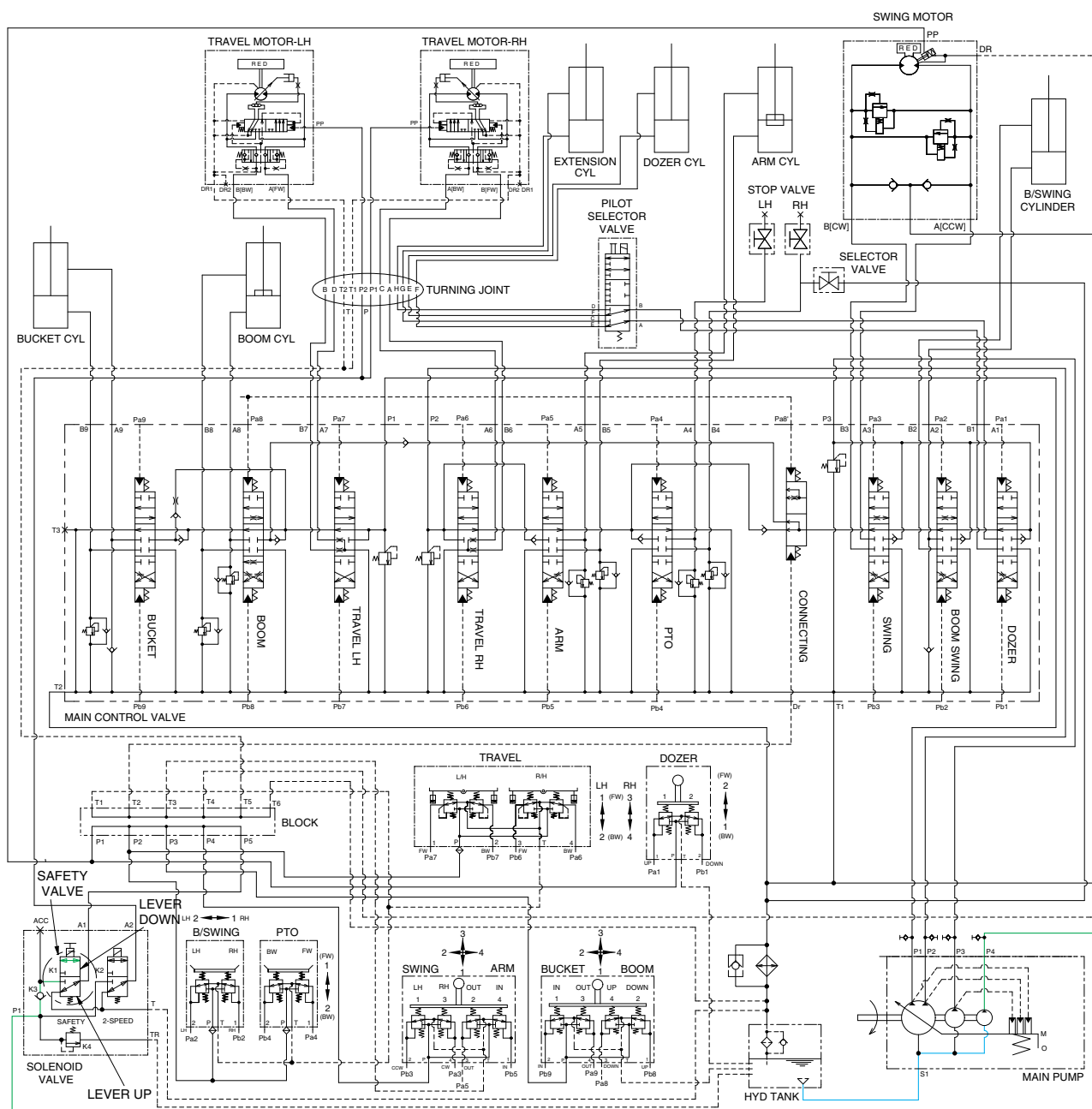
The oil flows remote control valve, MCV and swing motor through safety solenoid valve.

The return oil flow into the hydraulic tank.

※ The circuit diagram may differ from the equipment, so please check before a repair.



## 2. SAFETY SOLENOID VALVE (SAFETY LEVER)



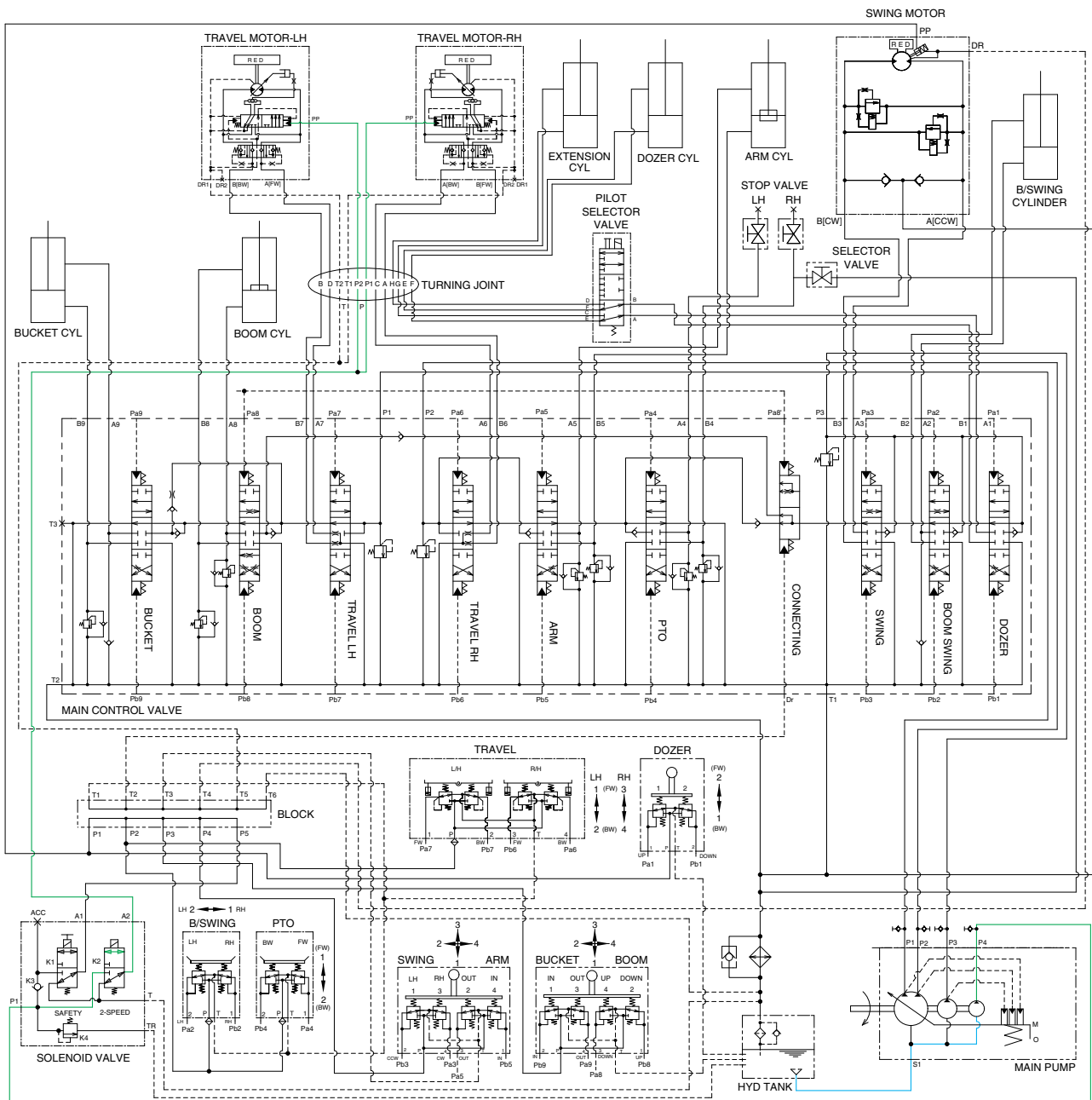
17AZ3HC04

When the lever of the safety solenoid valve is moved downward, oil flows into the remote control valve through safety solenoid valve.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

### 3. TRAVEL SPEED CONTROL SYSTEM



17AZ3HC05

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.

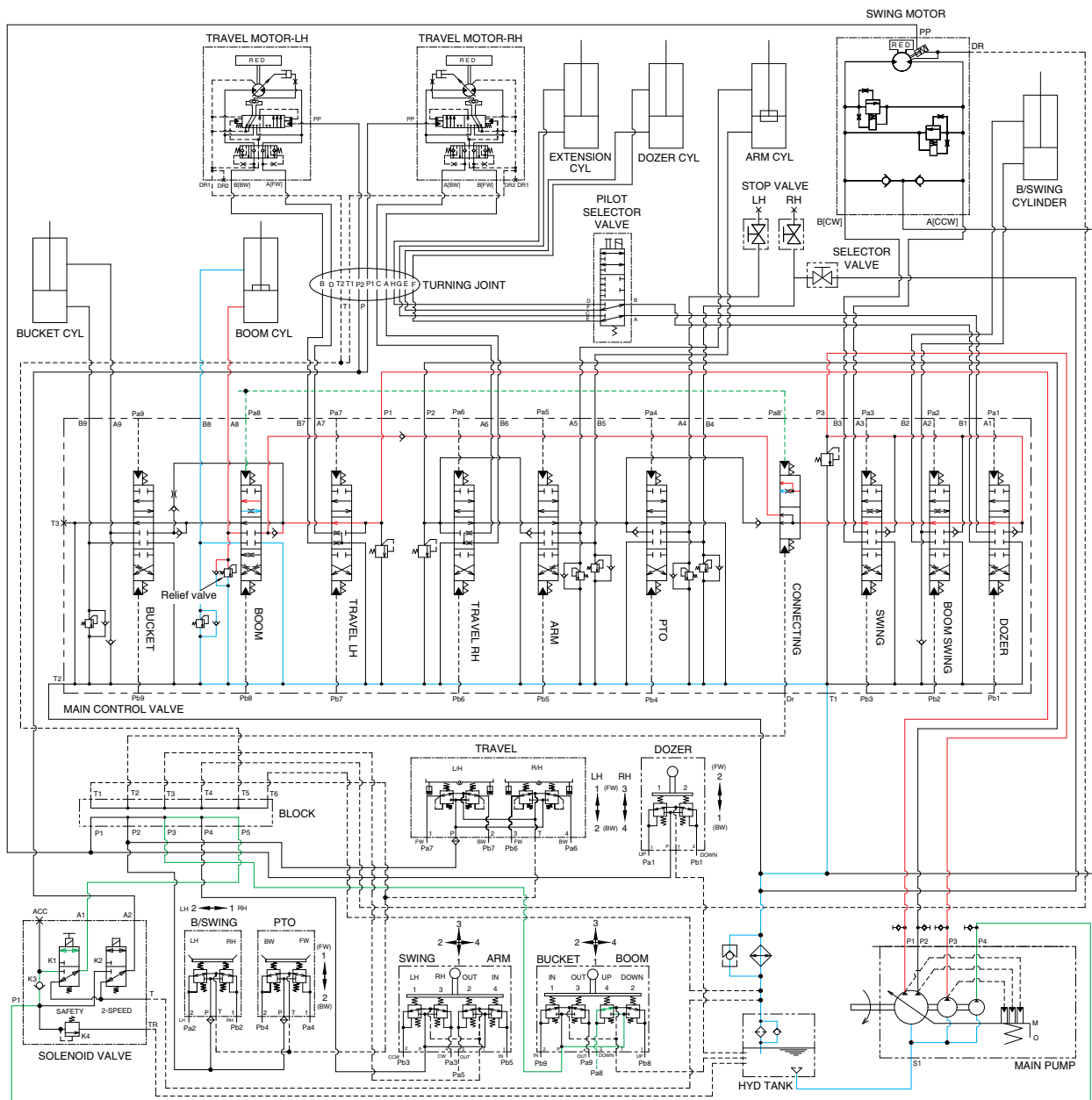
When the travel speed switch is pushed once more, the travel speed solenoid valve is return to original position by the force of spring, the hydraulic oil of PP port returns to the hydraulic tank.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

## GROUP 4 SINGLE OPERATION

### 1. BOOM UP OPERATION



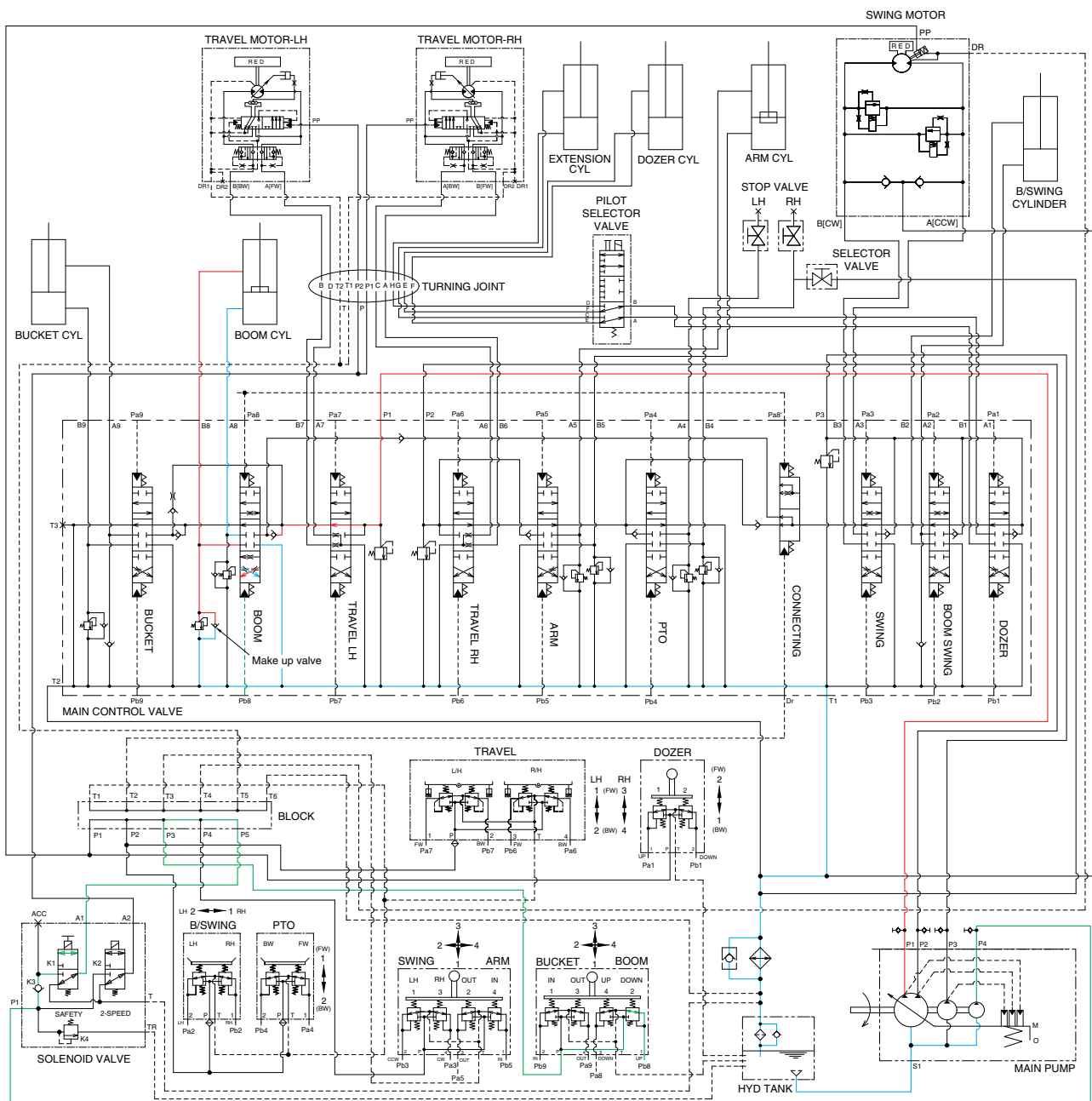
17AZ3HC10

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 (Pa8) from the remote control valve.

The oil from the P1 and P3 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 2. BOOM DOWN OPERATION



17AZ3HC11

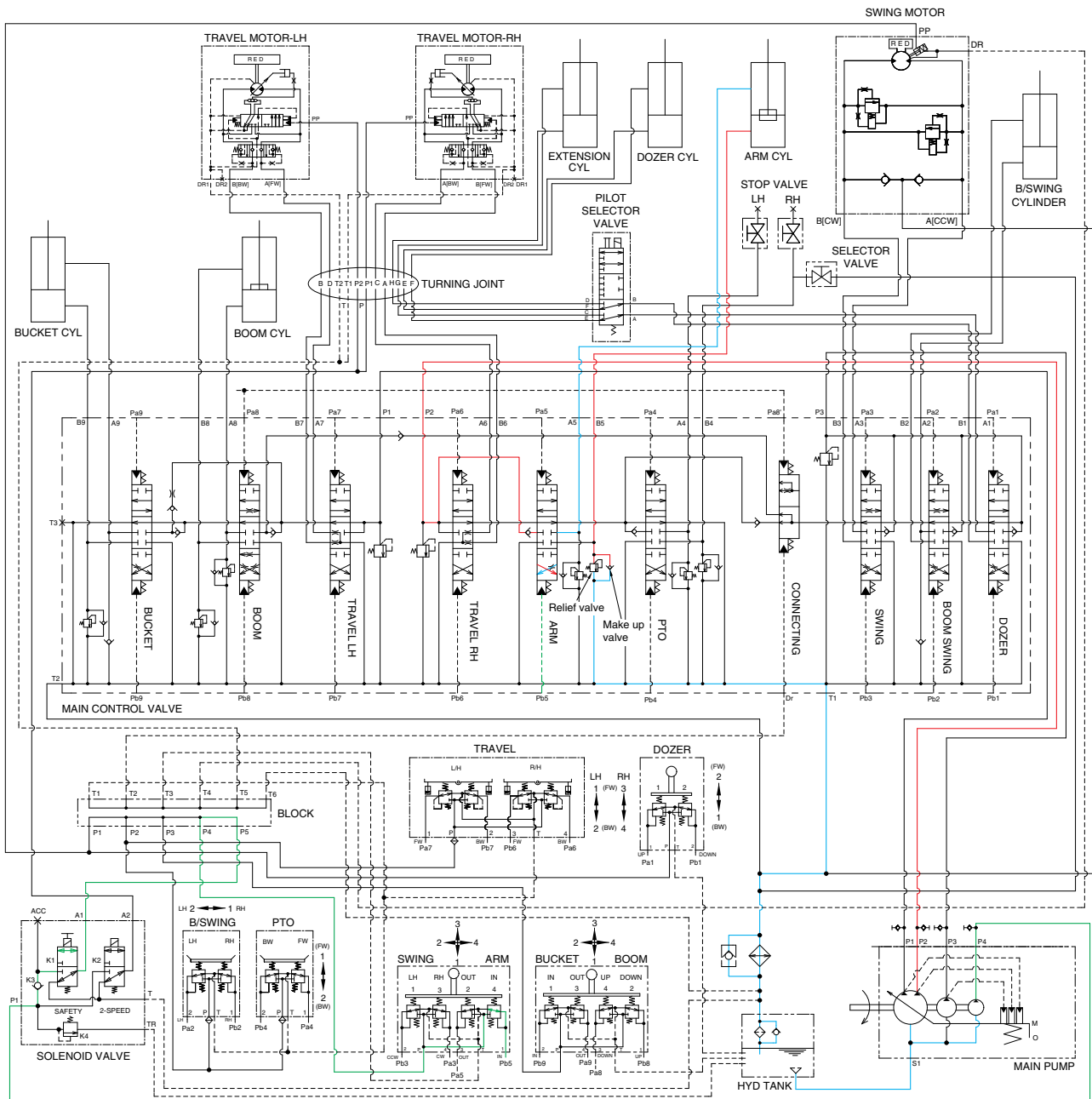
When the right control lever is pushed forward, the boom spool in the main control valve is moved to the down position by the pilot oil pressure (Pb8) from the remote control valve.

The oil from the P1 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 cavitation in the boom cylinder rod end circuit is prevented by the make-up valve.

※ The circuit diagram may differ from the equipment, so please check before a repair.

### 3. ARM ROLL IN OPERATION



17AZ3HC12

When the left control lever is pulled back, the arm spool in the main control valve is moved to the roll in position by the pilot oil pressure (Pb5) from the remote control valve.

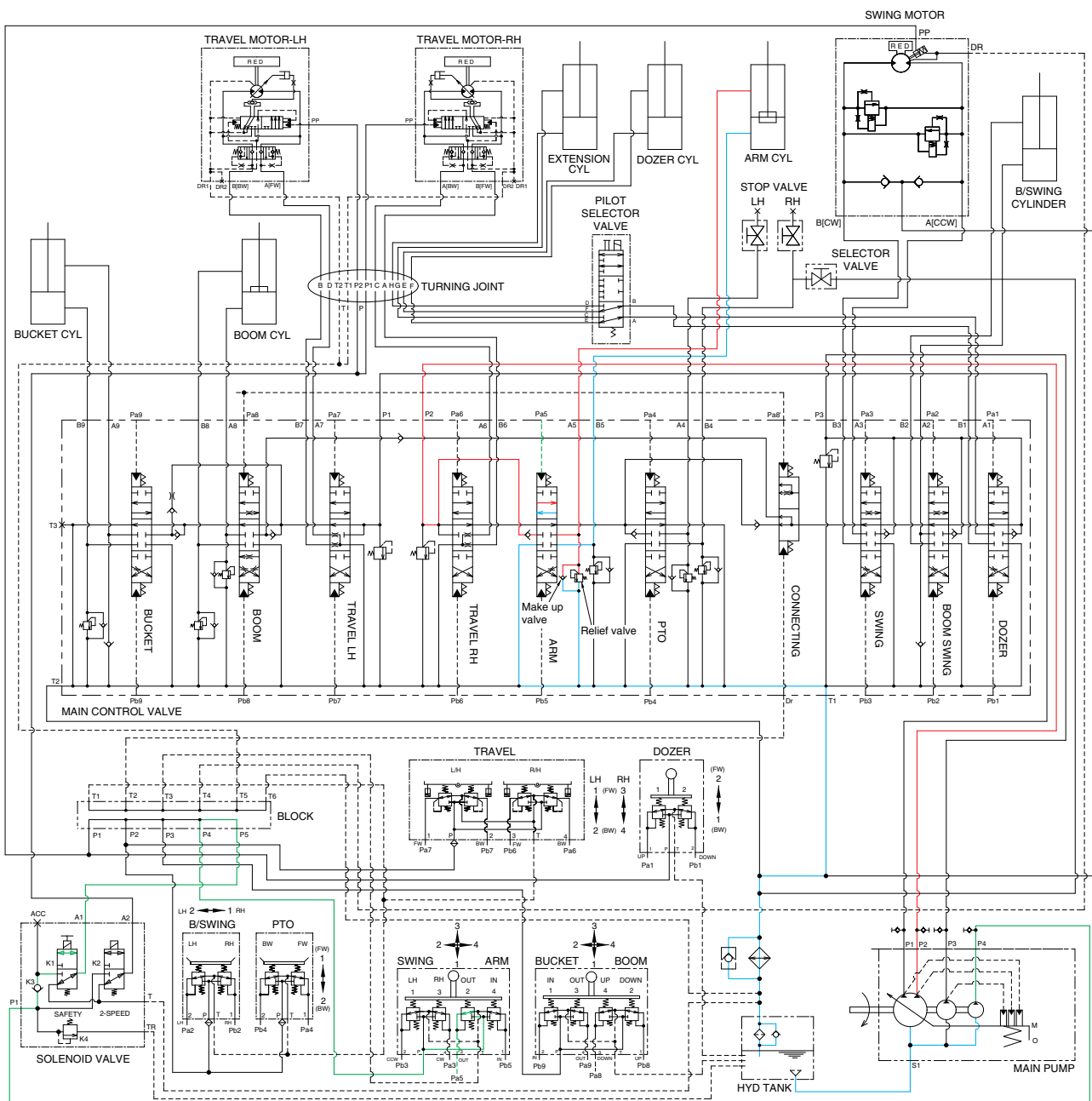
The oil from the P2 pump flows into the main control valve and then goes to the large chamber of arm cylinder.

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 cavitation and excessive pressure in the bottom of the arm cylinder is also prevented by the make-up valve and the relief valve in the main control valve.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 4. ARM ROLL OUT OPERATION



17AZ3HC13

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 (Pa5) from the remote control valve.

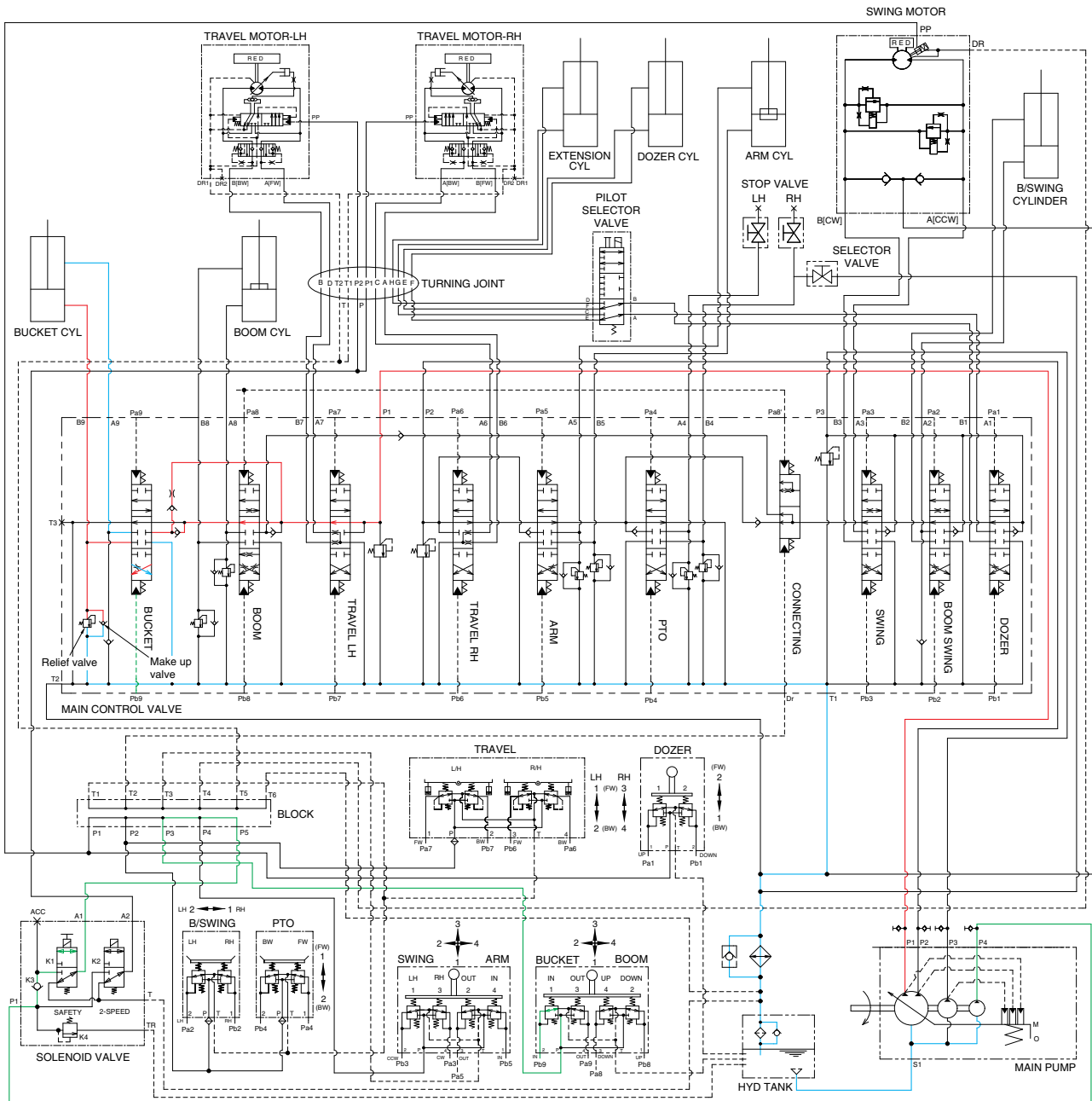
The oil from the P2 pump flows into the main control valve and then goes to the small chamber of arm cylinder.

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 cavitation and excessive pressure in the rod of the arm cylinder is also prevented by the make-up valve and relief valve in the main control valve.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 5. BUCKET ROLL IN OPERATION



17AZ3HC14

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 (Pb9) from the remote control valve.

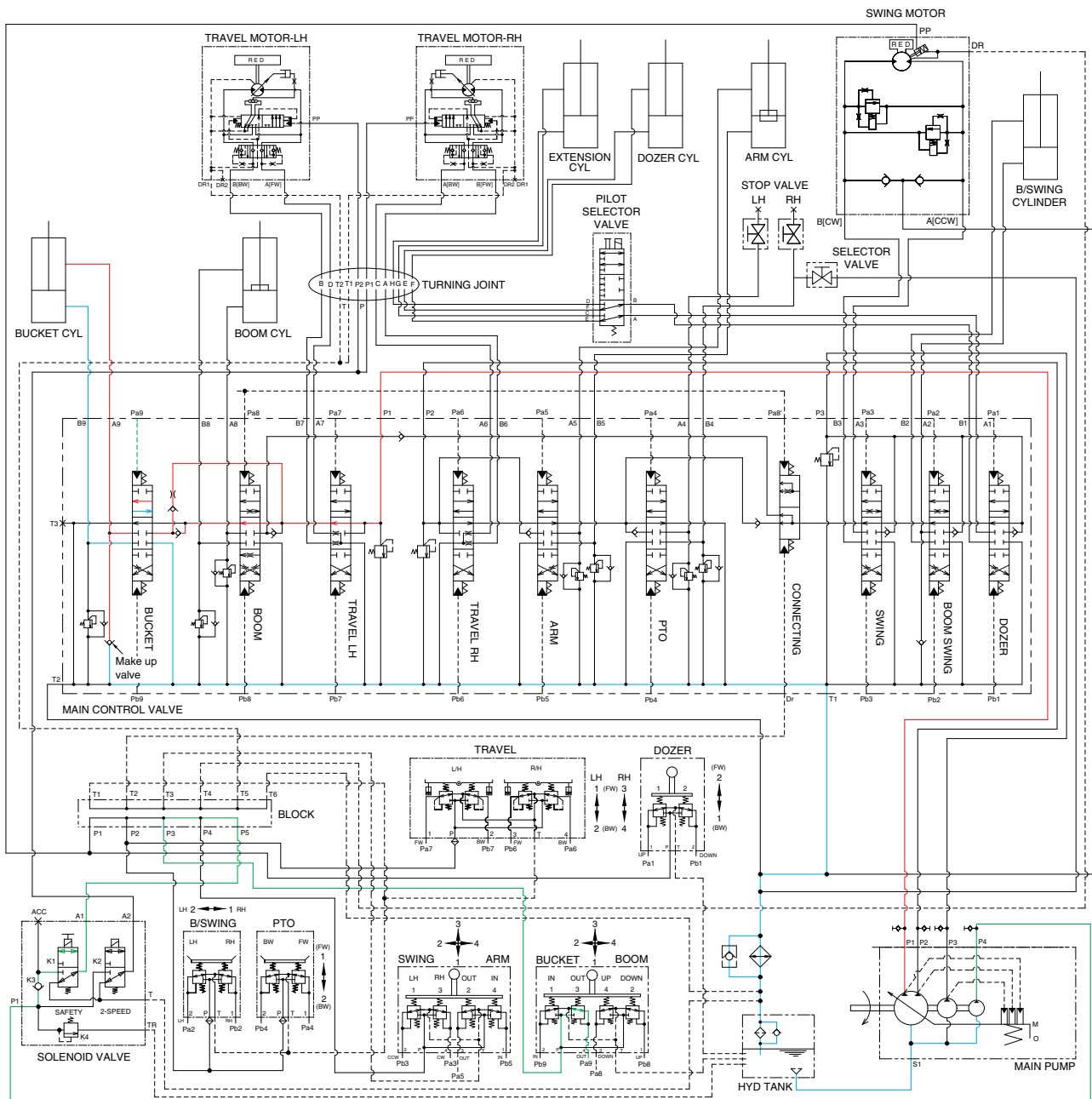
The oil from the P1 pump flows into the main control valve and then goes to the large chamber of bucket cylinder.

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 and excessive pressure in the bottom of the bucket cylinder is also prevented by the make-up valve and relief valve in the main control valve.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 6. BUCKET ROLL OUT OPERATION



17AZ3HC15

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 (Pa9) from the remote control valve.

The oil from the P1 pump flows into the main control valve and then goes to the small chamber of bucket cylinder.

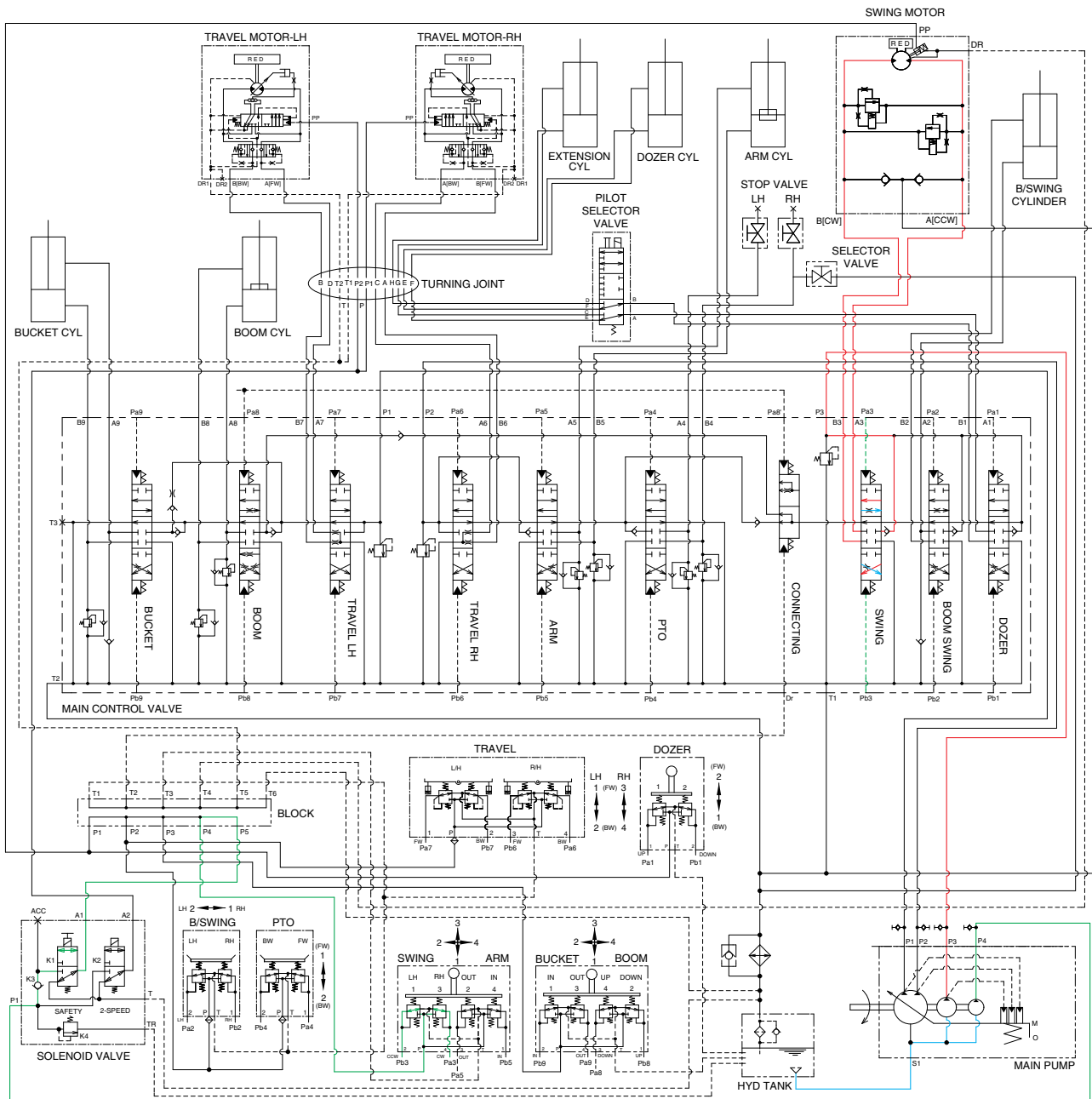
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.



## 7. SWING OPERATION

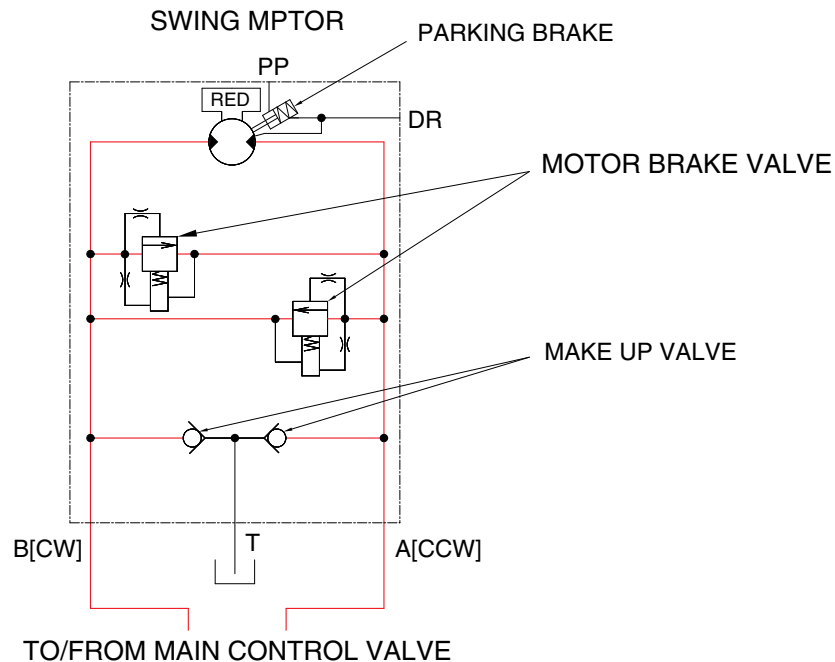


17AZ3HC16

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 (Pa3, Pb3) from the remote control valve. The oil from the P3 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 make up valve and the overload relief valve are provided in the swing motor. The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## SWING CIRCUIT OPERATION



17AZ3HC20

### 1) MOTOR BRAKE VALVE

Motor brake valve for the swing motor limits to cushion the starting and stopping pressure of swing operation.

### 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

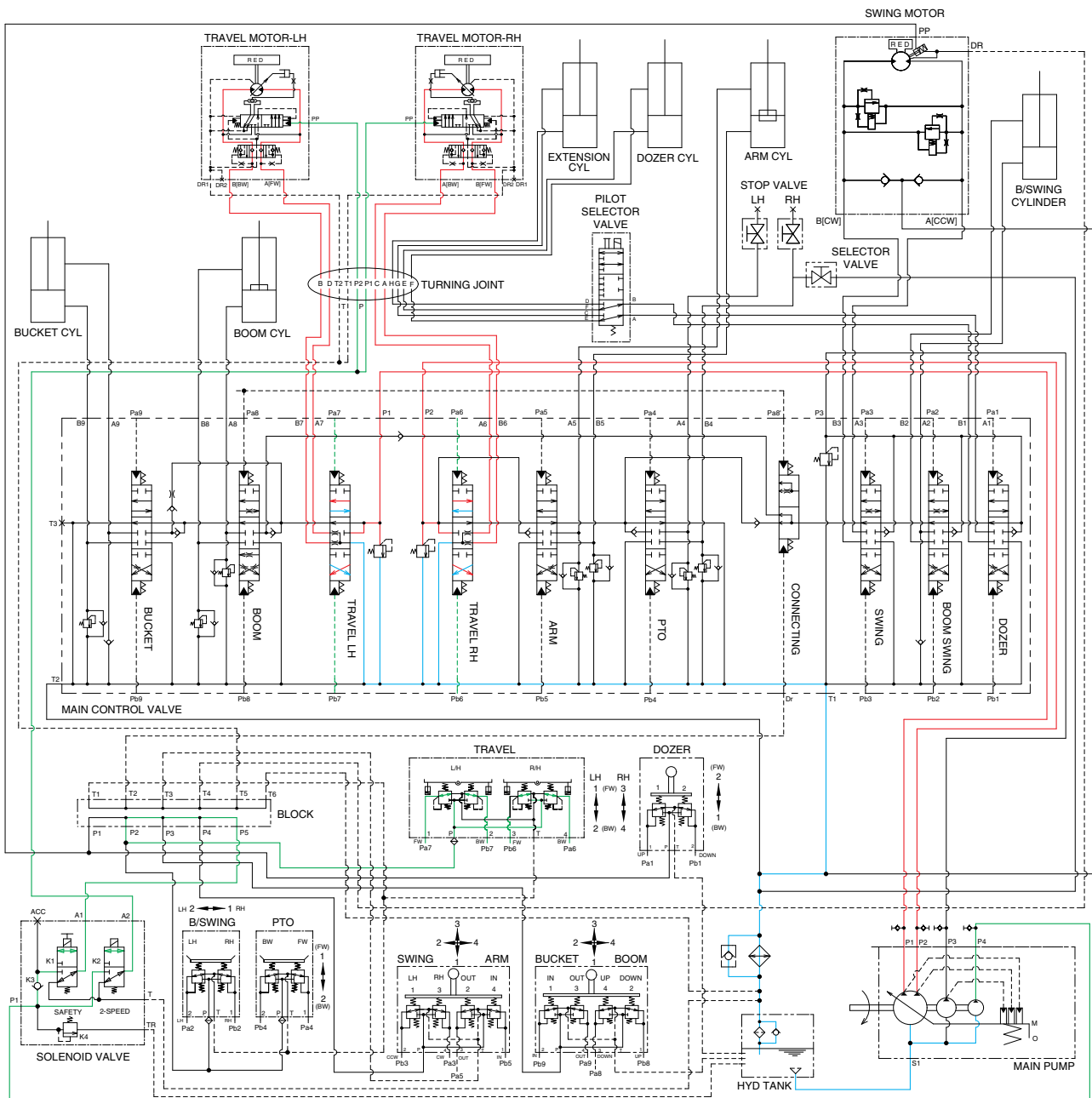
The parking brake is released by the pilot pressure oil (PP) from pilot pump.

When the safety solenoid lever is moved to downward, the pilot oil from the pilot pump (P4) is flow into parking brake through safety solenoid valve.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 8. TRAVEL FORWARD AND REVERSE OPERATION

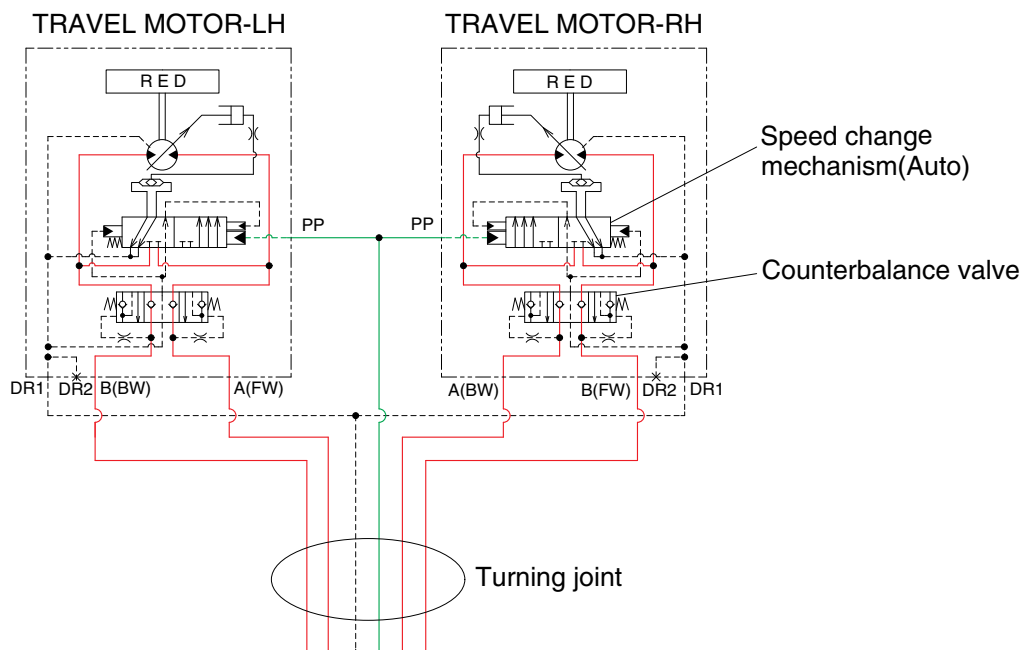


17AZ3HC17

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 (Pa6, Pb6, Pa7, Pb7). The oil from the both pumps flows into the main control valve and then goes to the both 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## TRAVEL CIRCUIT OPERATION



17AZ3HC21

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

### 1) COUNTERBALANCE VALVE

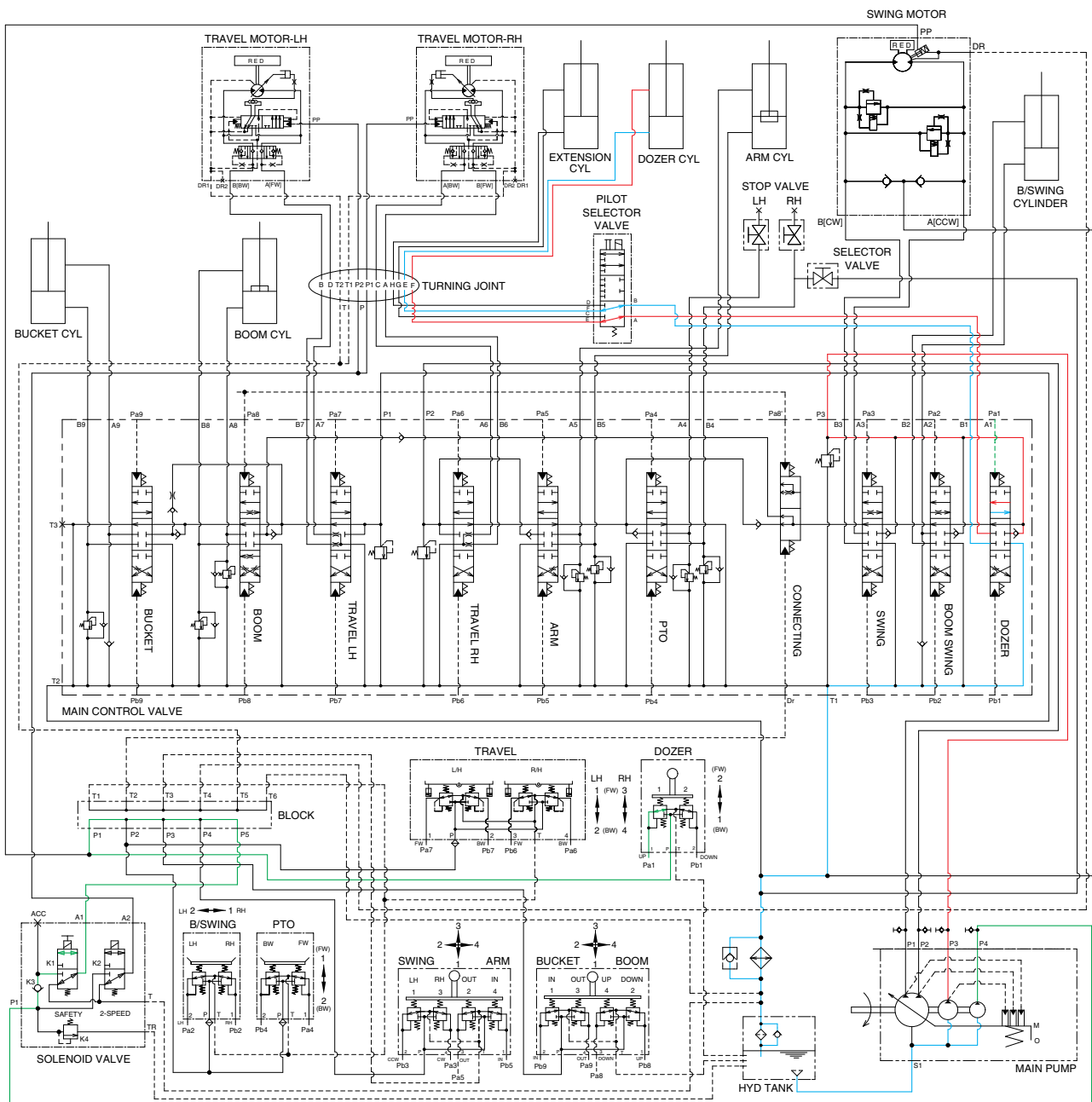
When stopping the motor of slope descending, this valve to prevent the motor over run.

### 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 9. DOZER UP OPERATION



17AZ3HC18

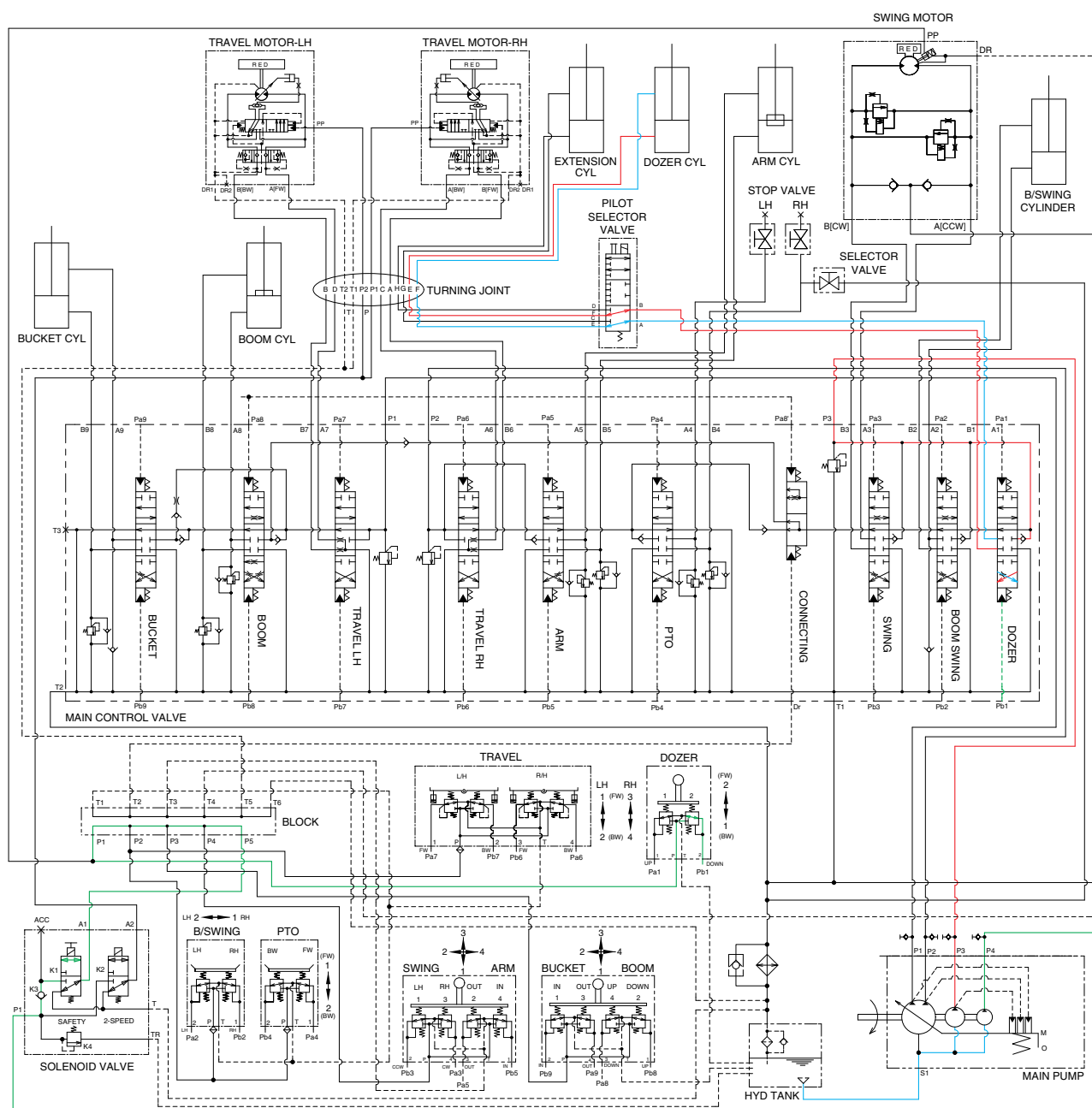
When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure (Pa1) from the remote control valve.

The oil from the P3 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 10. DOZER DOWN OPERATION



17AZ3HC19

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 (Pb1) from the remote control valve.

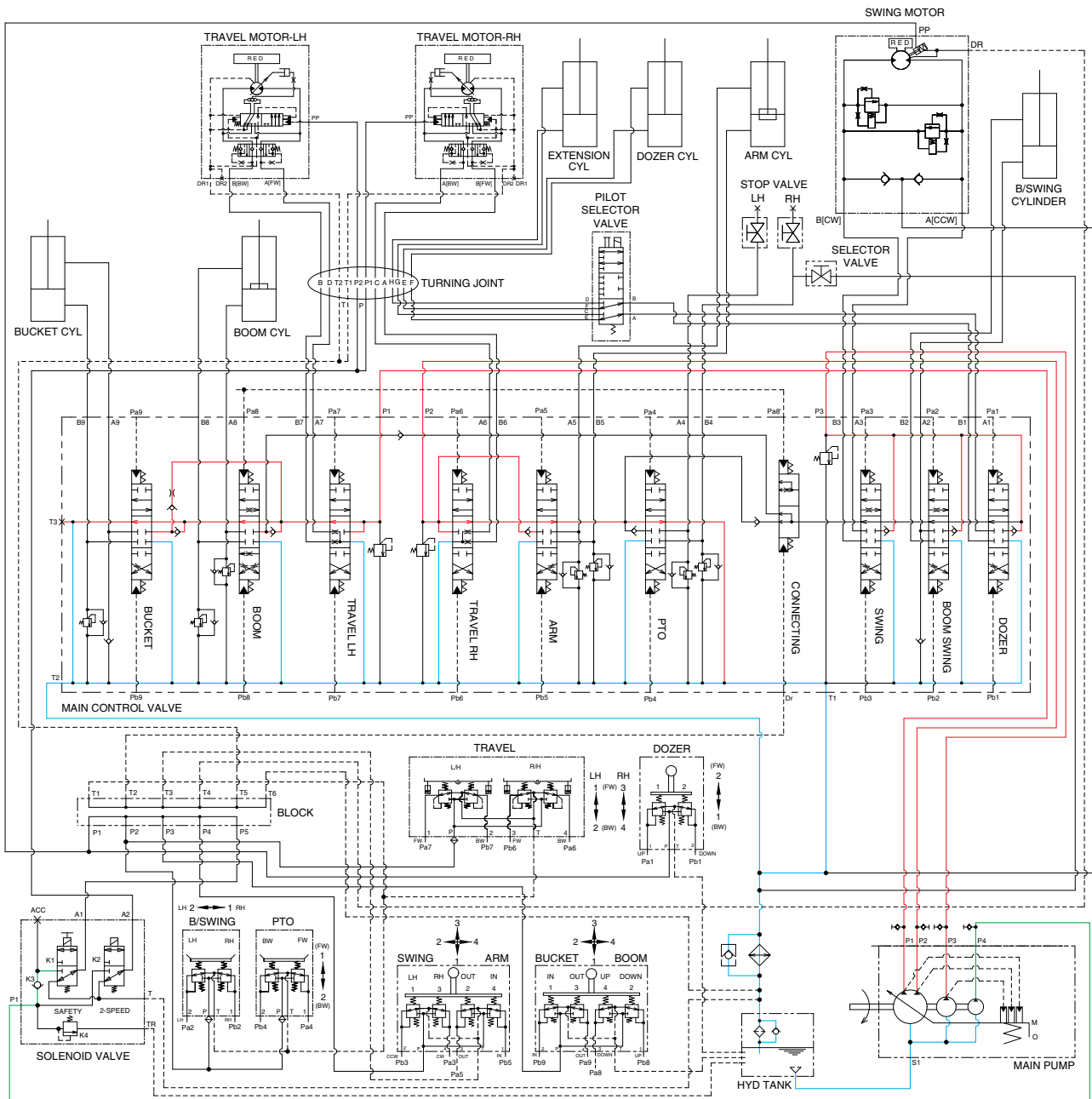
The oil from the P3 pump flows into the main control valve and then goes to the large chamber of dozer cylinder.

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## GROUP 5 COMBINED OPERATION

### 1. OUTLINE

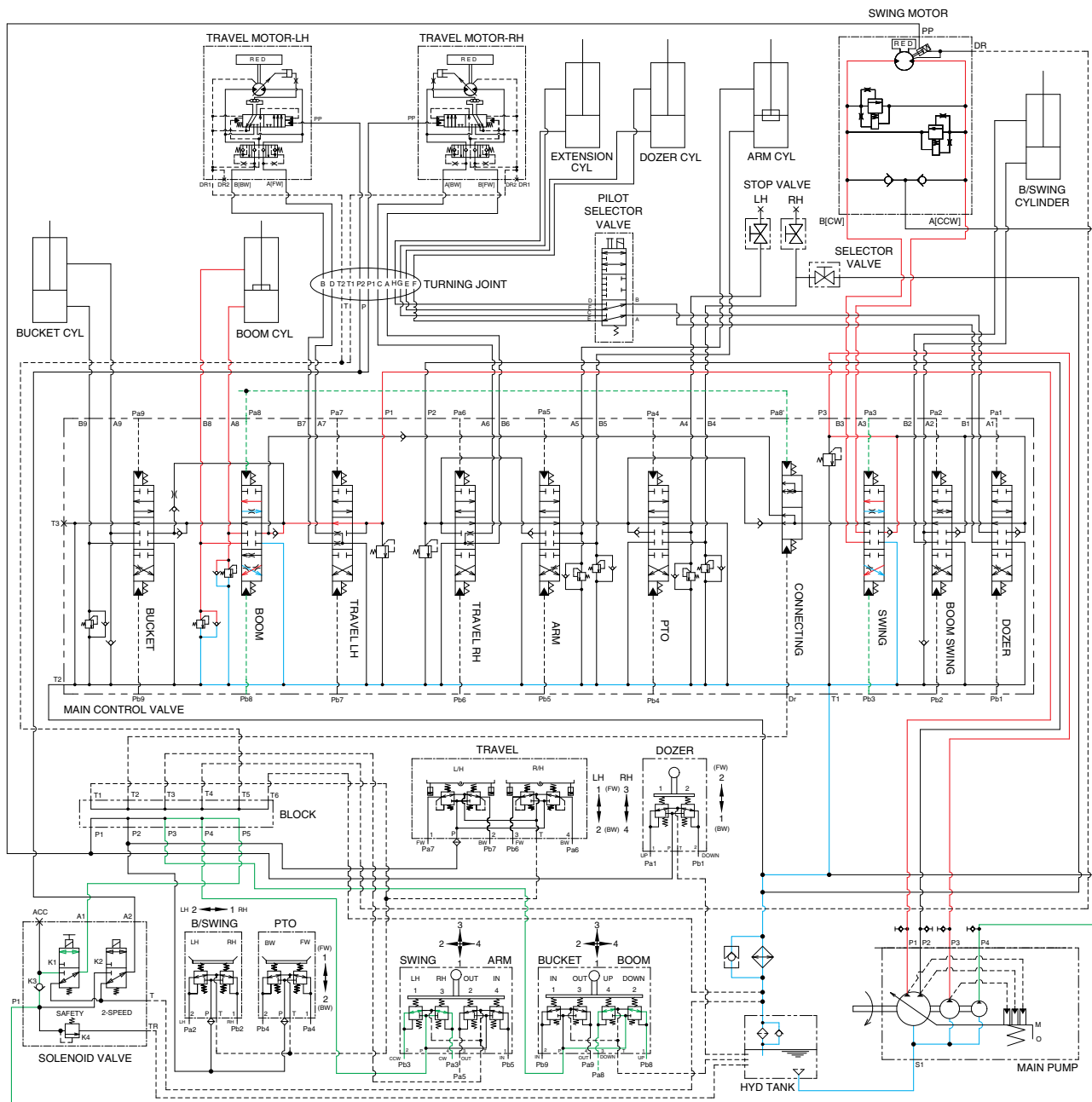


17AZ3HC30

The oil from the P1, P2, P3 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 2. COMBINED SWING AND BOOM OPERATION



17AZ3HC31

When the swing and boom 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 (Pa3, Pb3, Pa8, Pb8) from the remote control valve.

The oil from the P1 pump flows into the boom cylinder through boom.

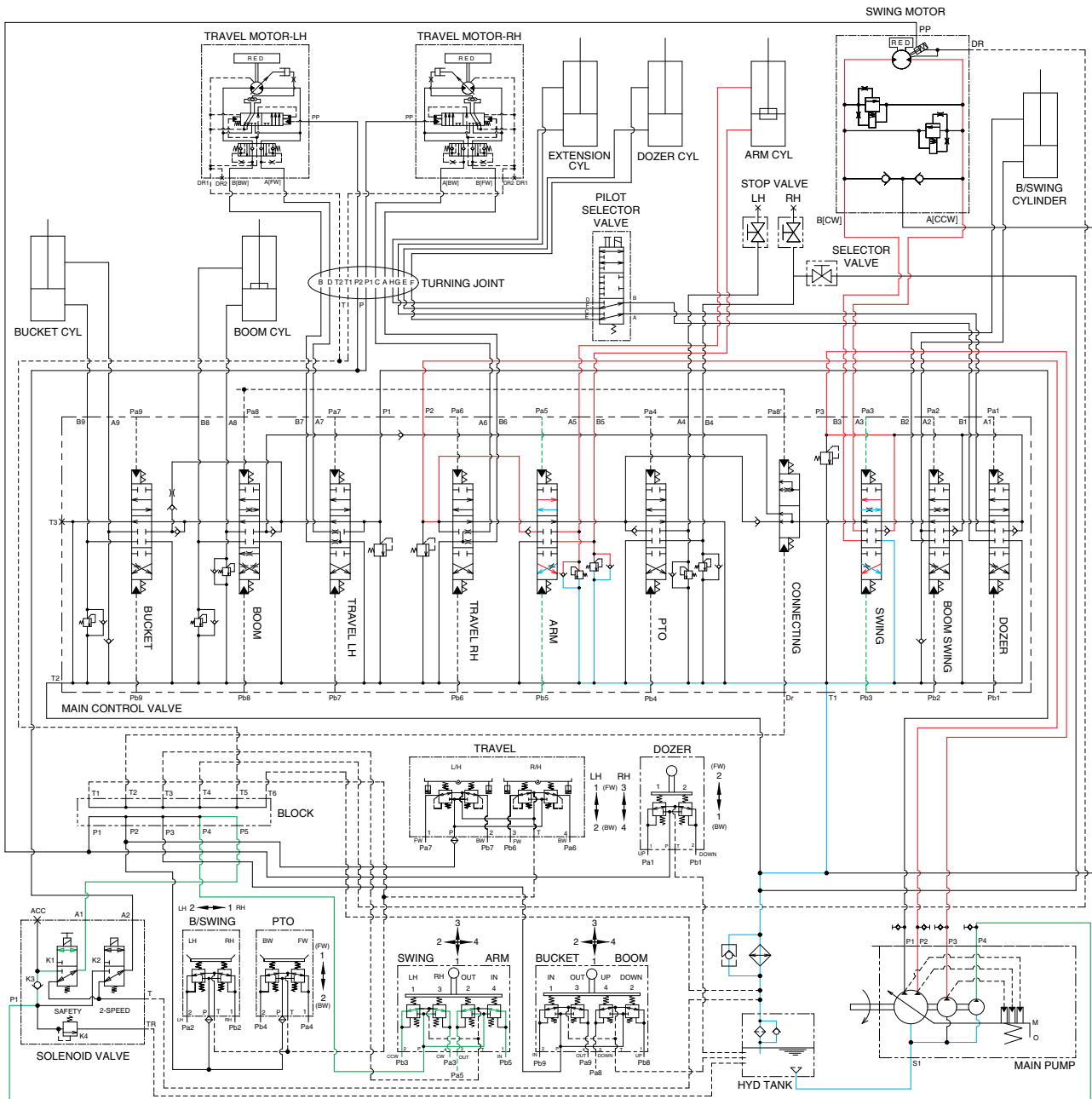
The oil from the P3 pump flows into the swing motor through the swing spool.

The superstructure swings and the boom is operated.

※ The circuit diagram may differ from the equipment, so please check before a repair.



### 3. COMBINED SWING AND ARM OPERATION



17AZ3HC32

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 (Pa3, Pb3, Pa5, Pb5) from the remote control valve.

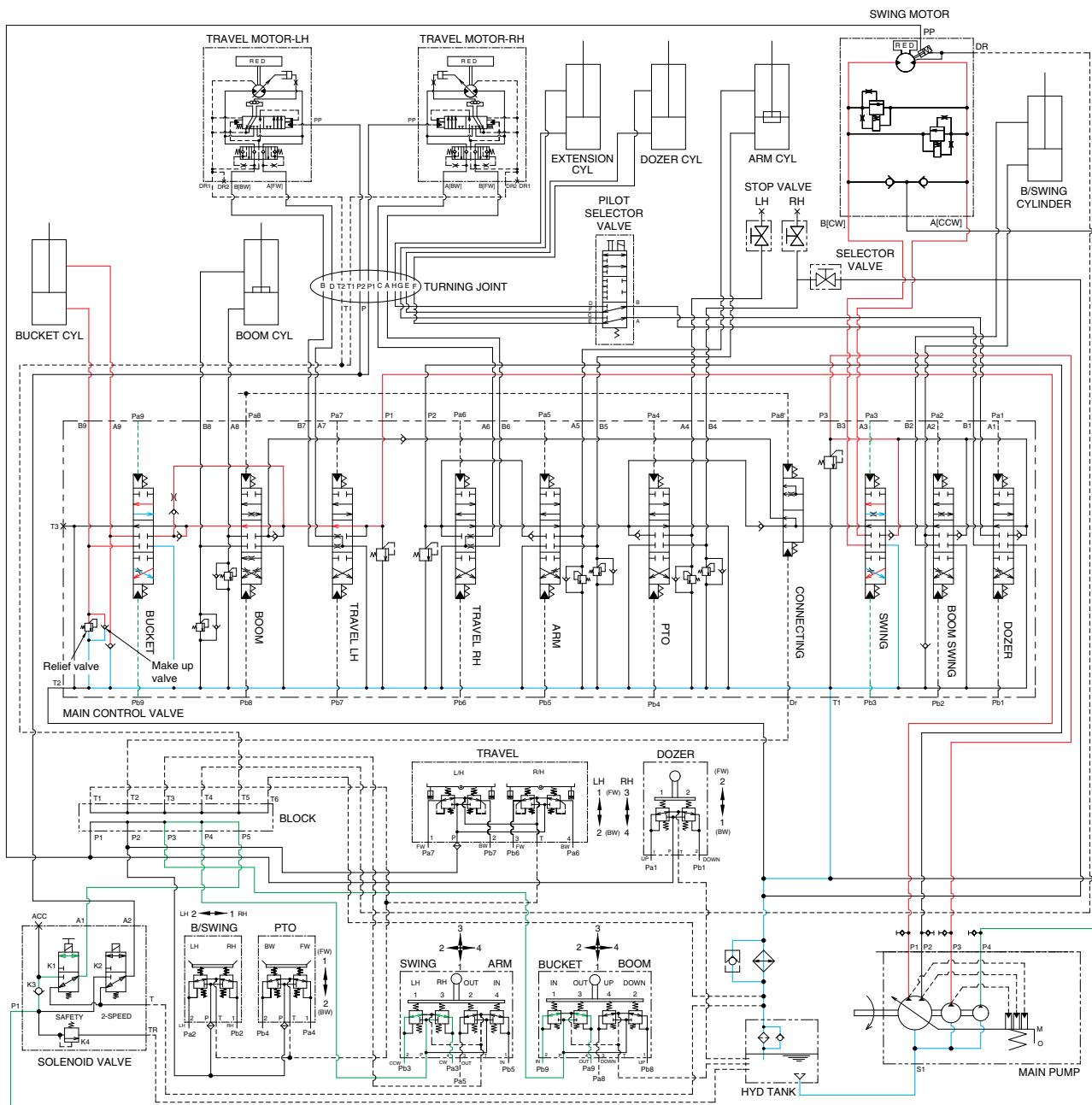
The oil from the P3 pump flows into the swing motor through swing spool.

The oil from the P2 pump flows into the arm cylinder through the arm.

The superstructure swings and the arm is operated.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 4. COMBINED SWING AND BUCKET OPERATION



17AZ3HC33

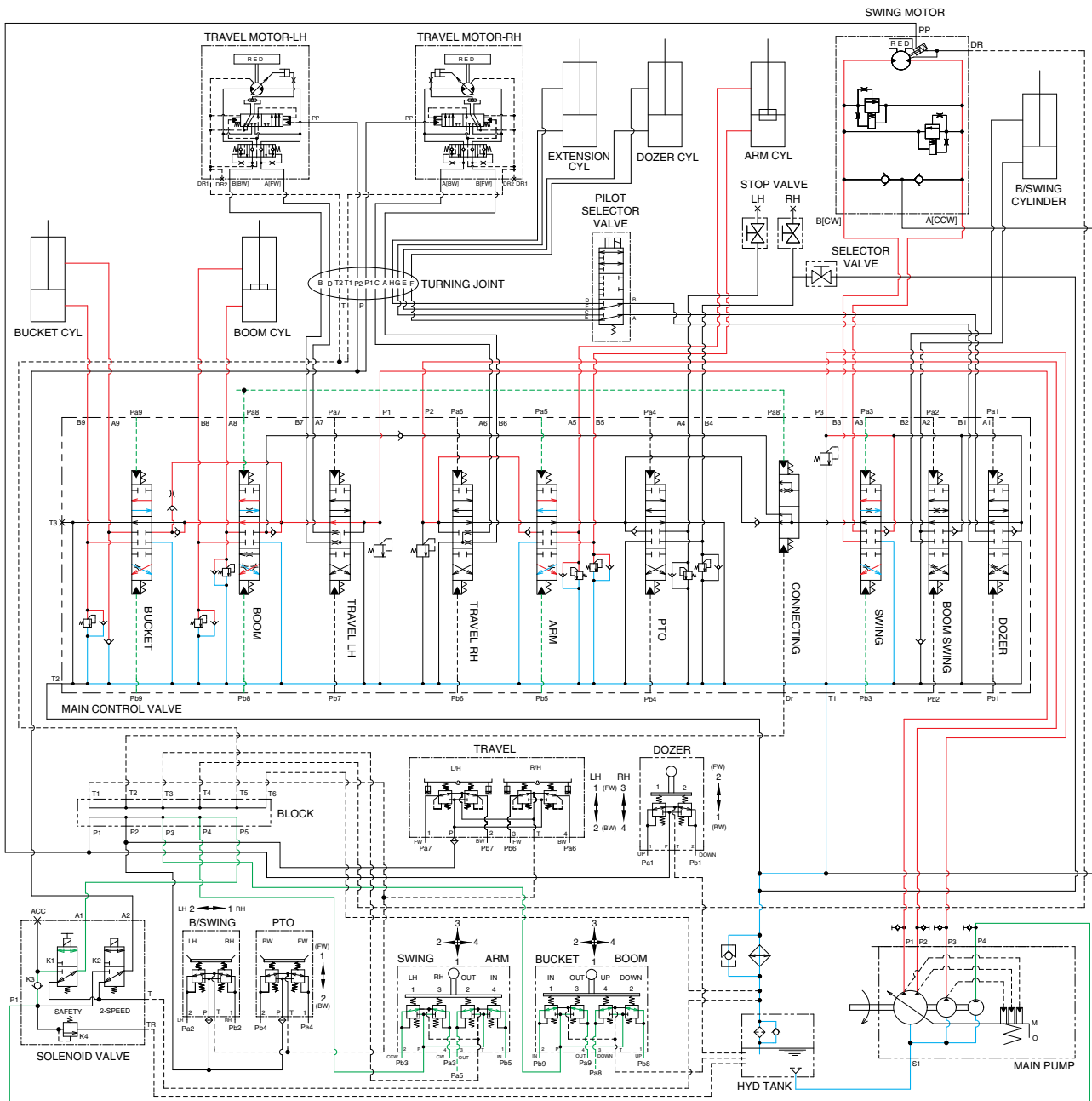
When the swing and bucket functions are operated, simultaneously the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure (Pa3, Pb3, Pa9, Pb9) from the remote control valve.

The oil from the P3 pump flows into the swing motor through the swing spool.

The oil from the P1 pump flows into the bucket cylinder through the bucket spool.

※ The circuit diagram may differ from the equipment, so please check before a repair.

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



17AZ3HC34

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 (Pa3, Pb3, Pa8, Pb8, Pa5, Pb5, Pa9, Pb9) from the remote control valve.

The oil from the P2 pump flows into the arm cylinder through, arm spool.

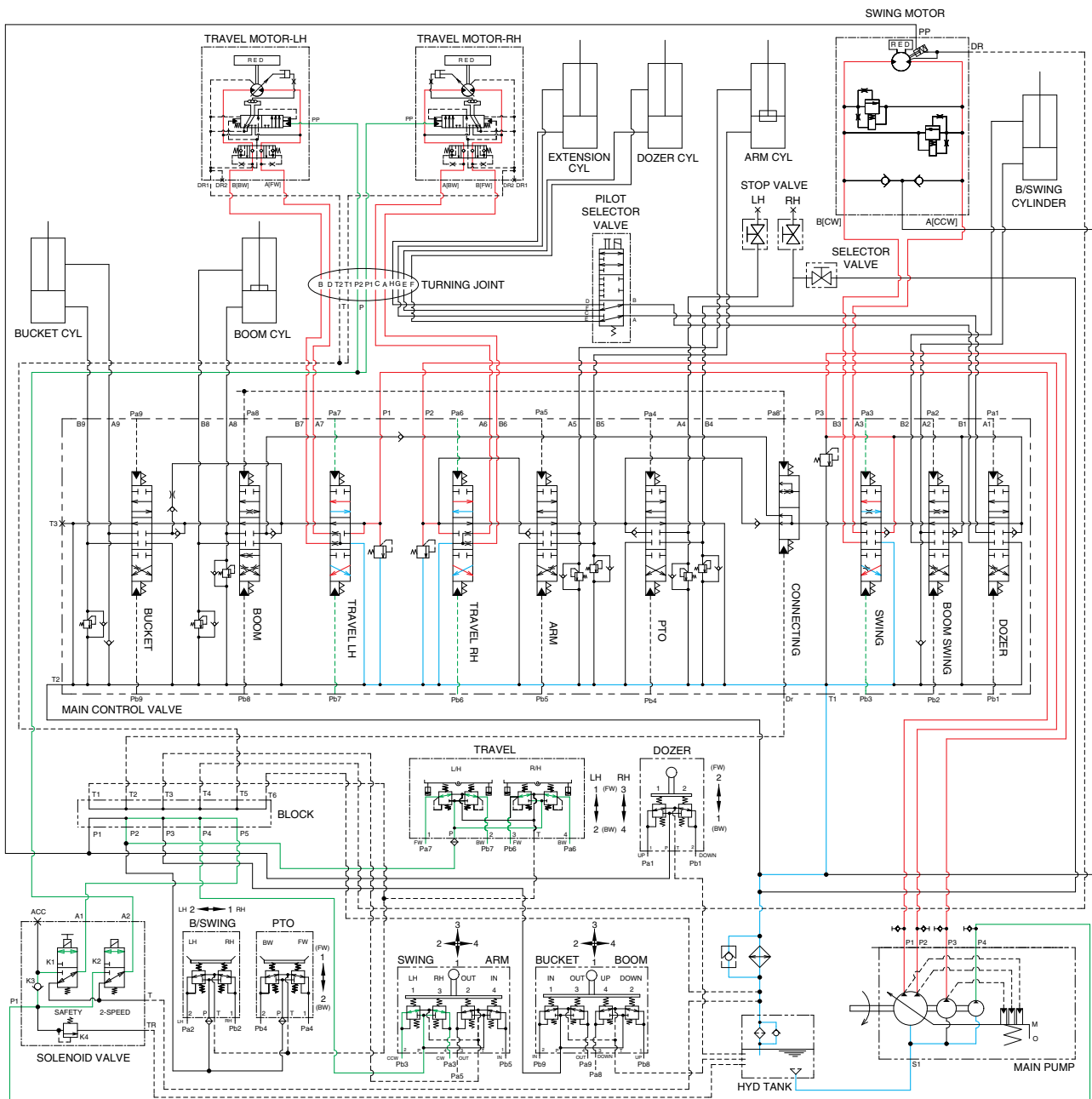
The oil from the P1 pump flows into the boom cylinder and bucket cylinder through the boom spool, bucket spool.

The oil from the P3 pump flows into the swing motor through the swing spool.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 6. COMBINED SWING AND TRAVEL OPERATION



17AZ3HC35

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 (Pa3, Pb3, Pa6, Pb6, Pa7, Pb7) from the remote control valve and the travel levers.

The oil from the P3 pump flows into the swing motor through the swing spool.

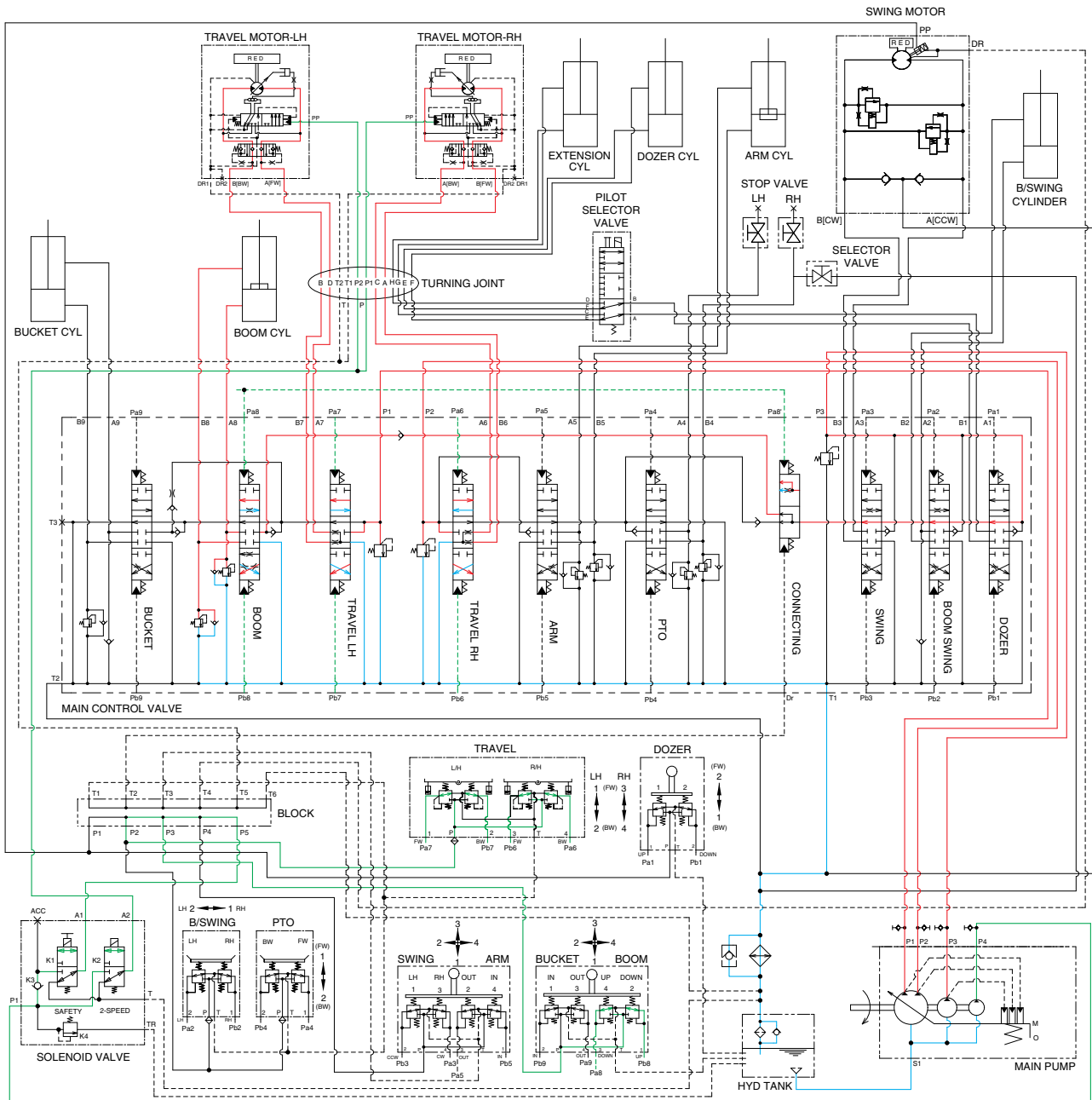
The oil from the P1 pump flows into the travel motor through the LH travel spool.

The oil from the P2 pump flows into the travel motor through the RH travel spool.

The superstructure swings and the machine travels straight.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 7. COMBINED BOOM AND TRAVEL OPERATION



17AZ3HC36

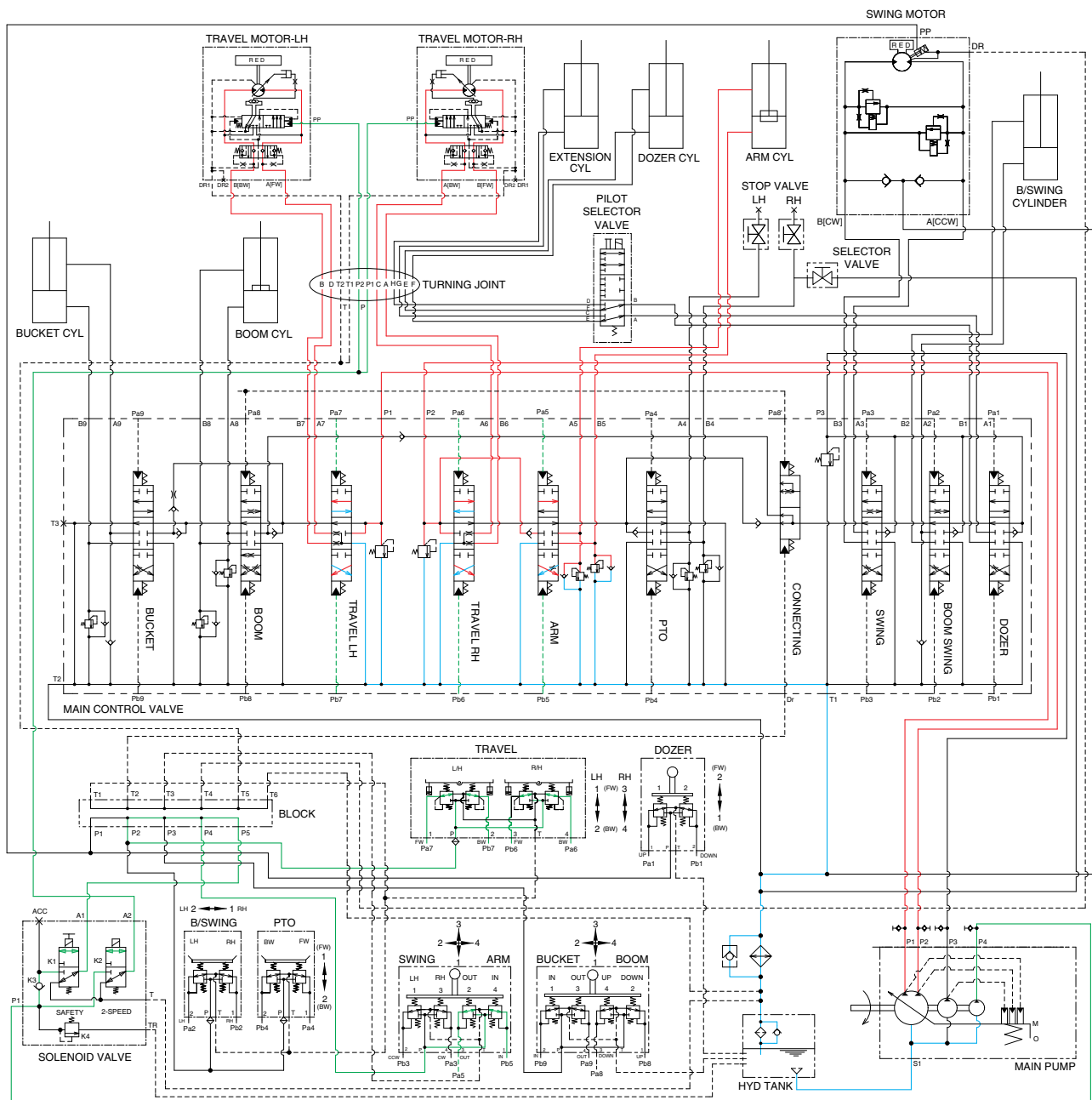
When the boom and travel functions are operated, simultaneously the boom spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (Pa8, Pb8, Pa6, Pb6, Pa7, Pb7) from the remote control valve.

The oil from the P1 and P2 pumps flows into the travel motors through travel LH and travel RH spools.

The oil from the P3 pump flows into the boom cylinder through boom spool via the connecting spool. The boom is operated and the machine travels straight.

※ The circuit diagram may differ from the equipment, so please check before a repair.

## 8. COMBINED ARM AND TRAVEL OPERATION



17AZ3HC37

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 (Pa8, Pb8, Pa6, Pb6, Pa7, Pb7) from the remote control valve.

The oil from the P1 and P2 pumps flows into the travel motors through travel spools.

The oil from the P2 pump flows into the arm cylinder through arm spool.

The arm is operated and the machine travels.

※ The circuit diagram may differ from the equipment, so please check before a repair.