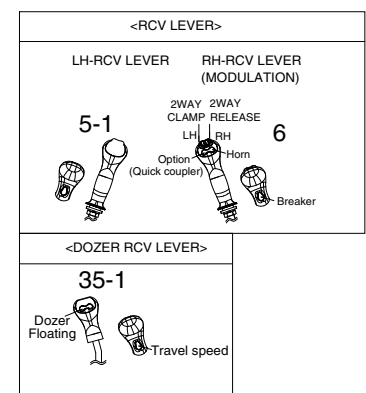
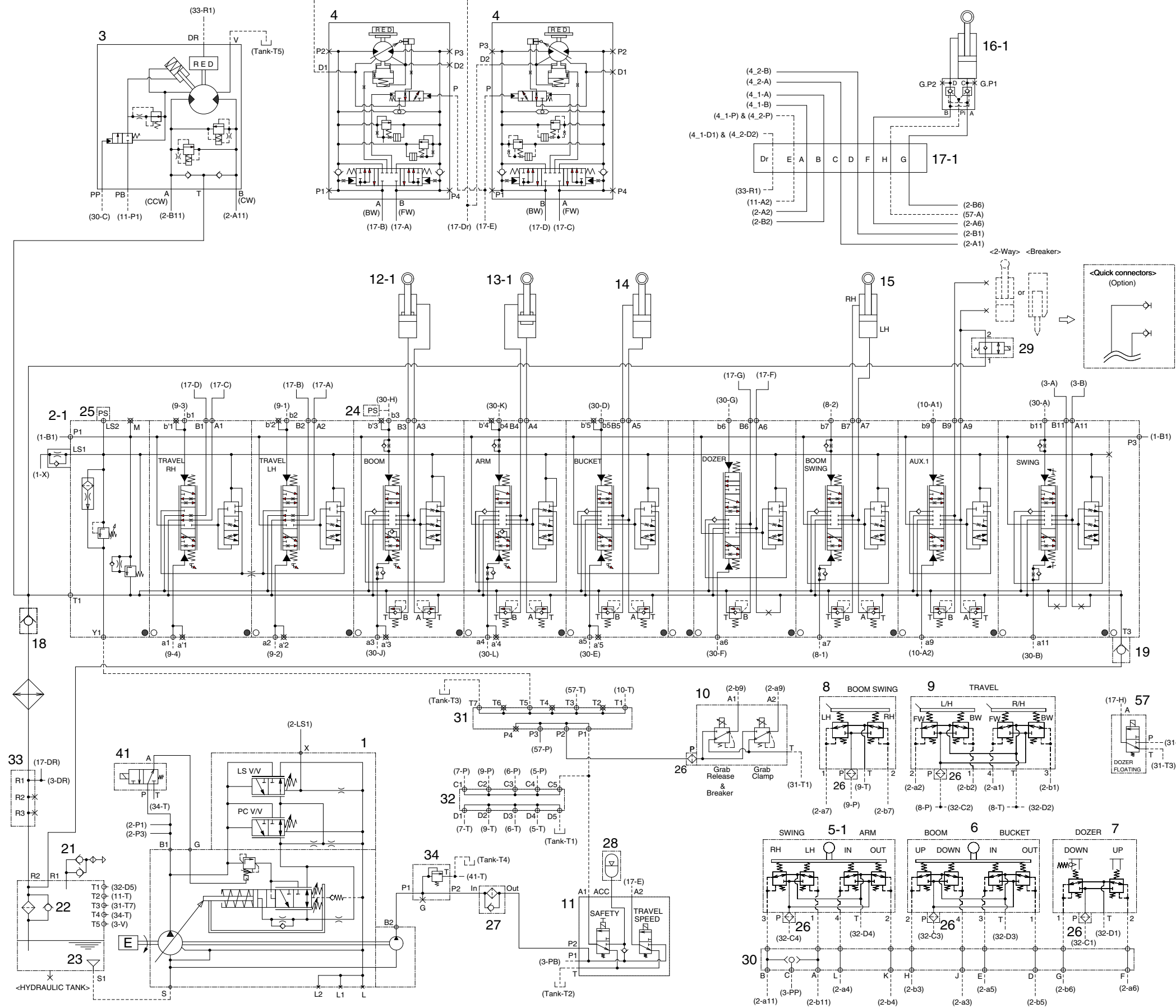


## SECTION 3 HYDRAULIC SYSTEM

Group 1 Hydraulic Circuit .....	3-1
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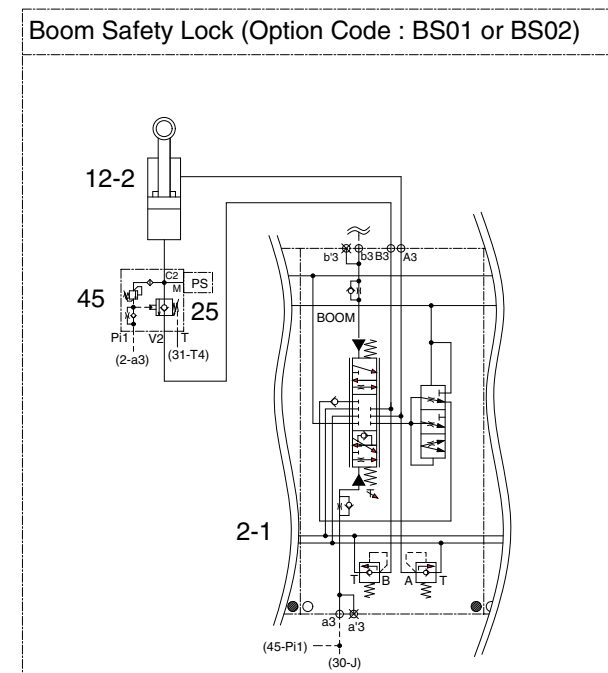
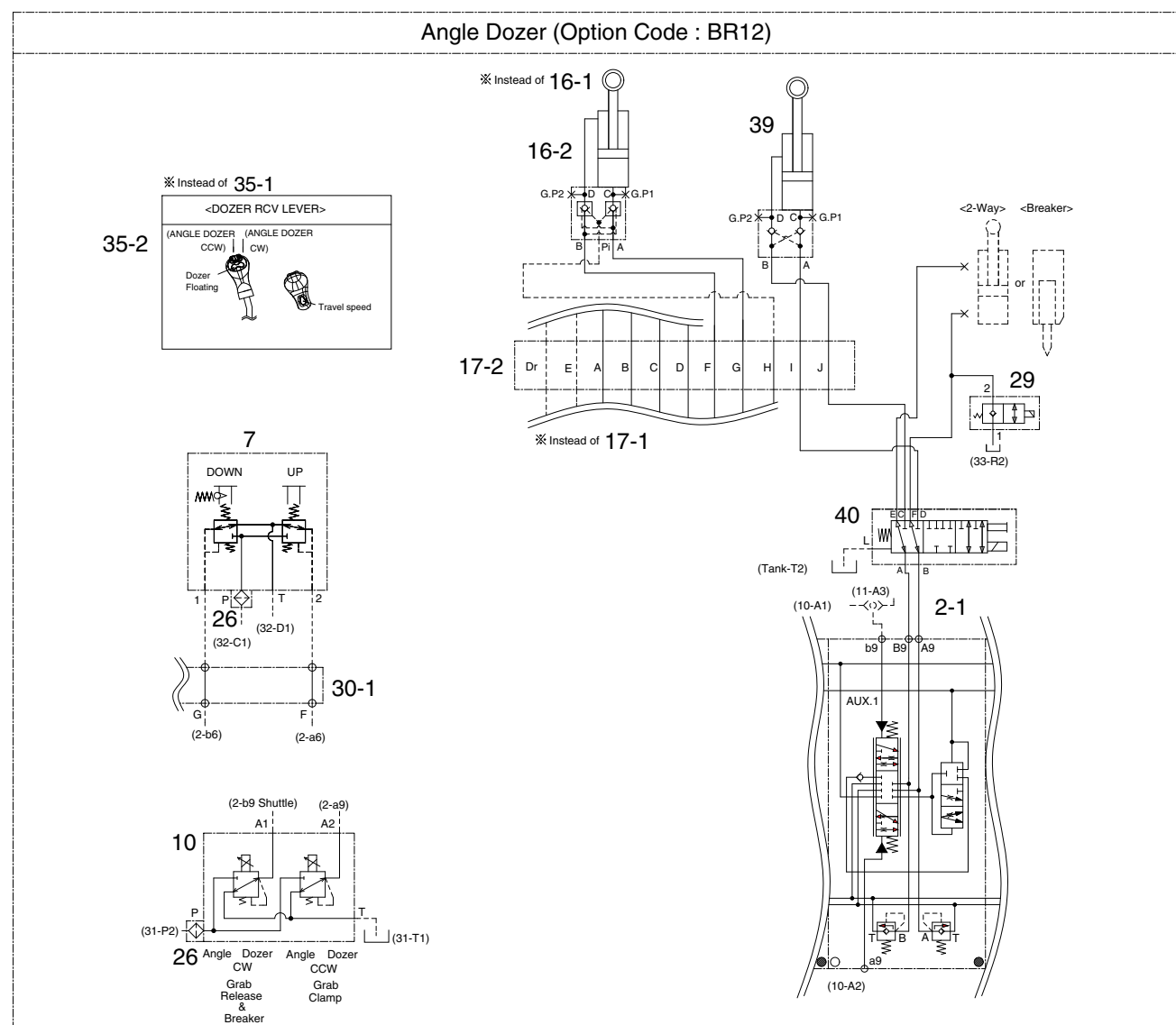
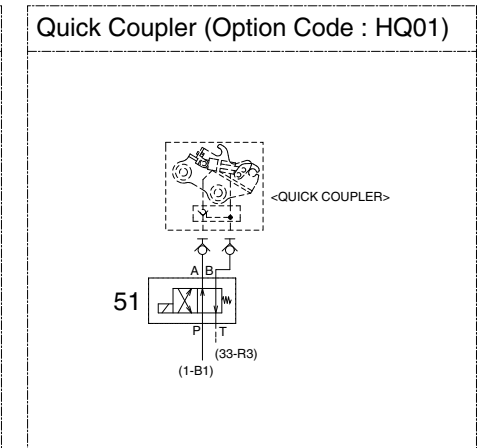
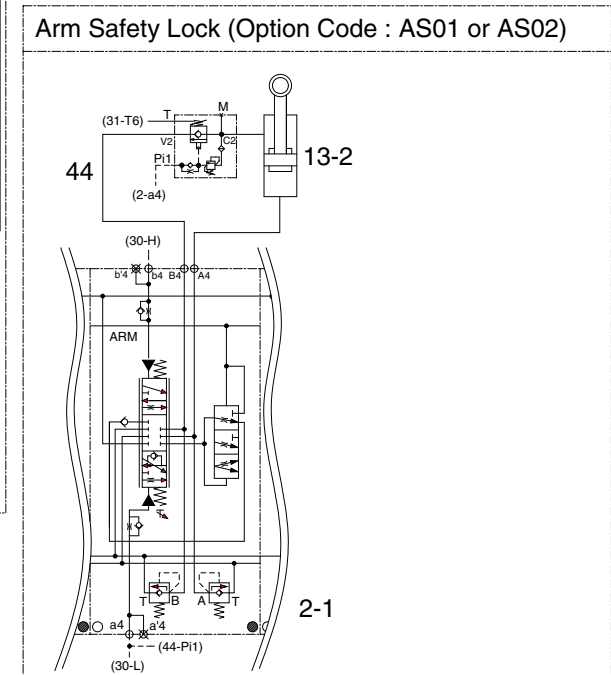
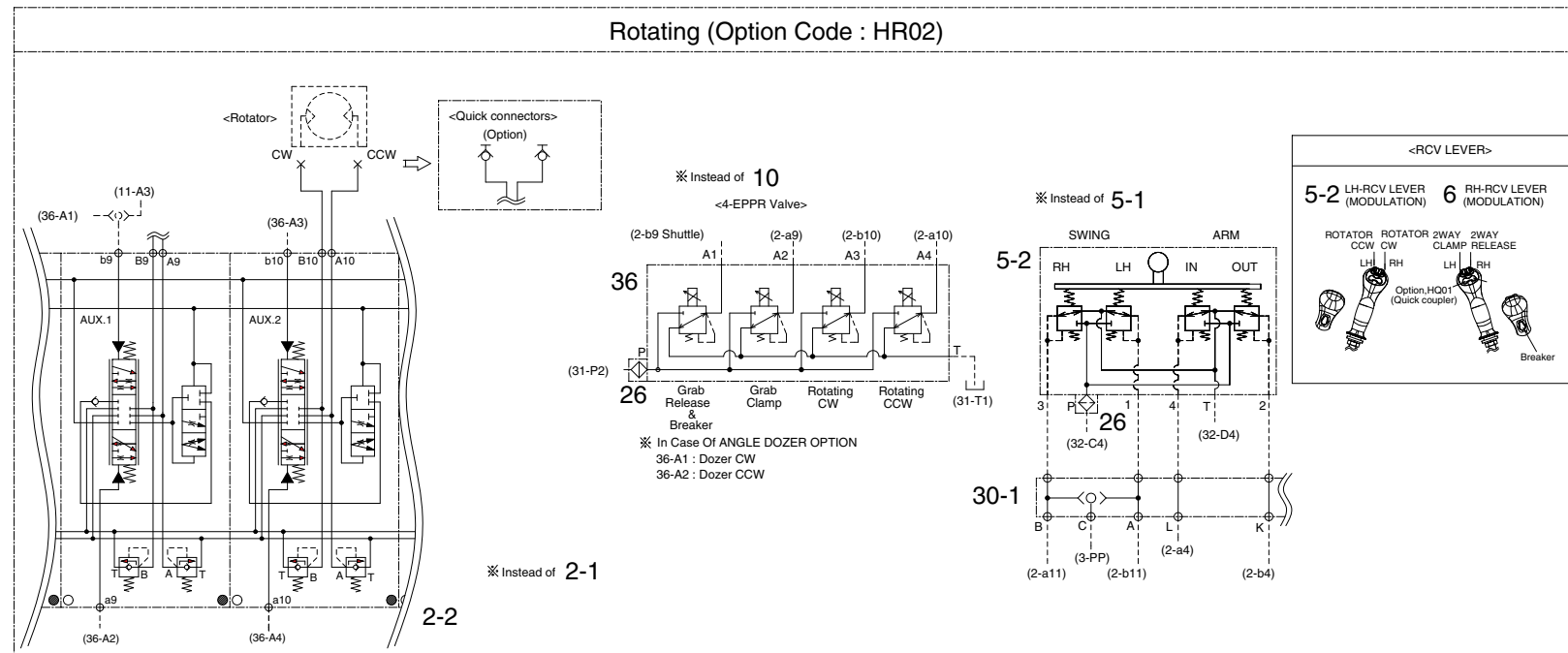
# GROUP 1 HYDRAULIC CIRCUIT

## 1. HYDRAULIC CIRCUIT (1/3)



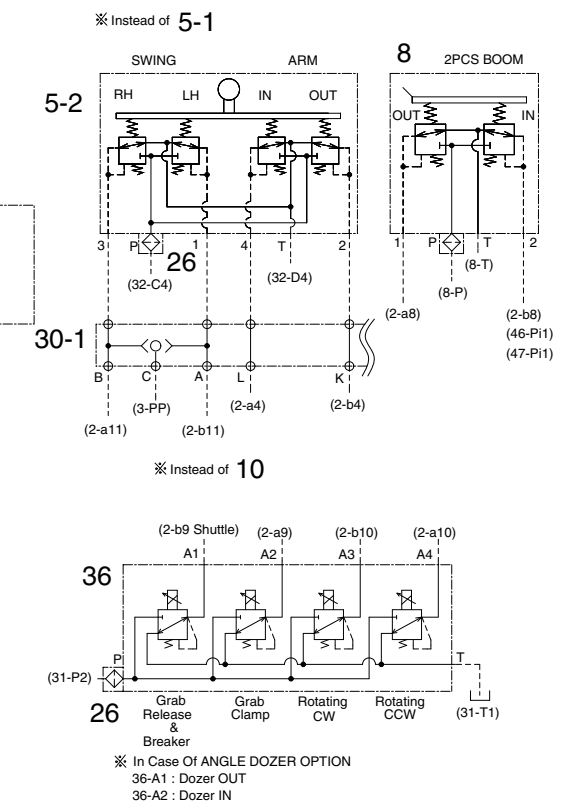
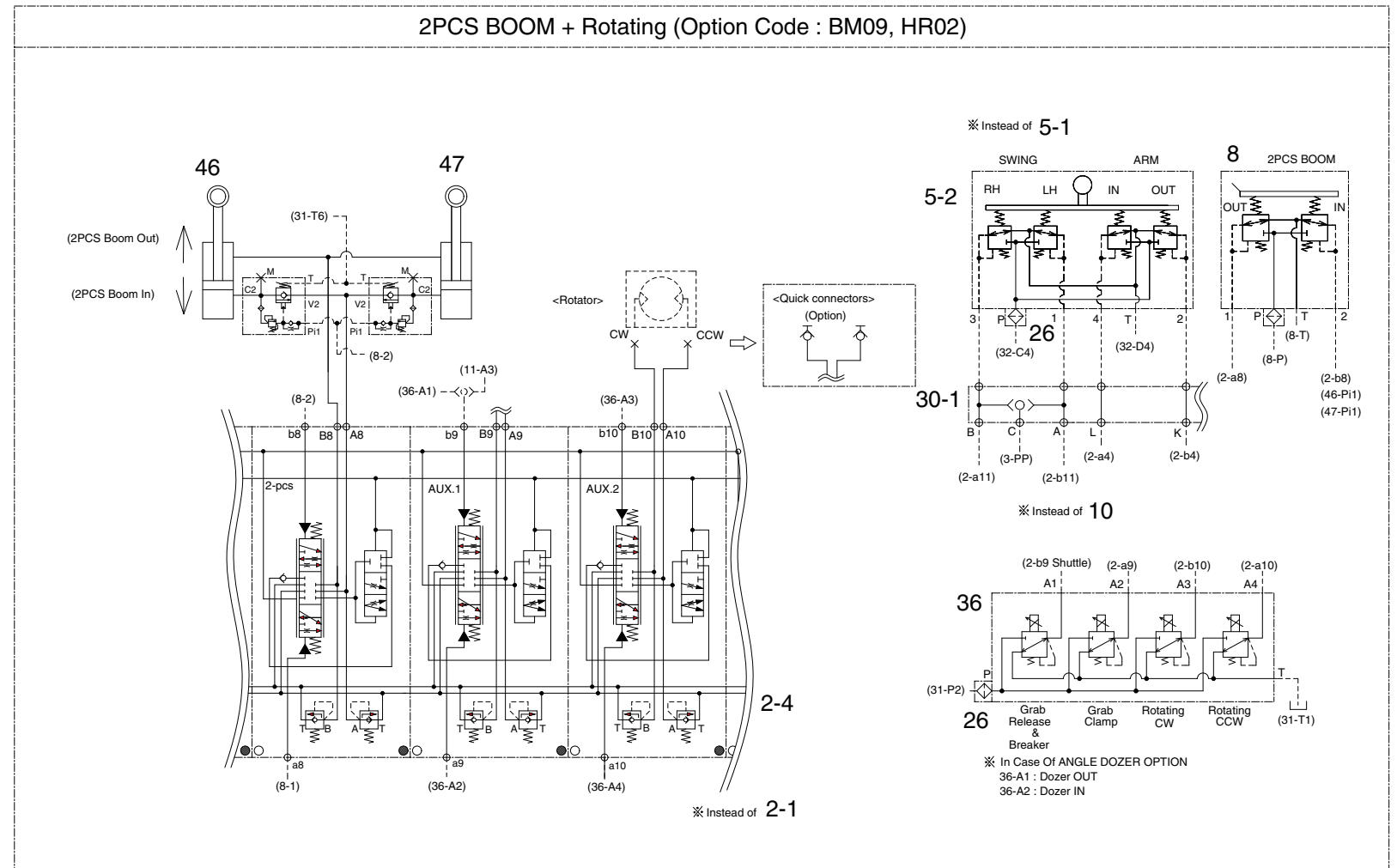
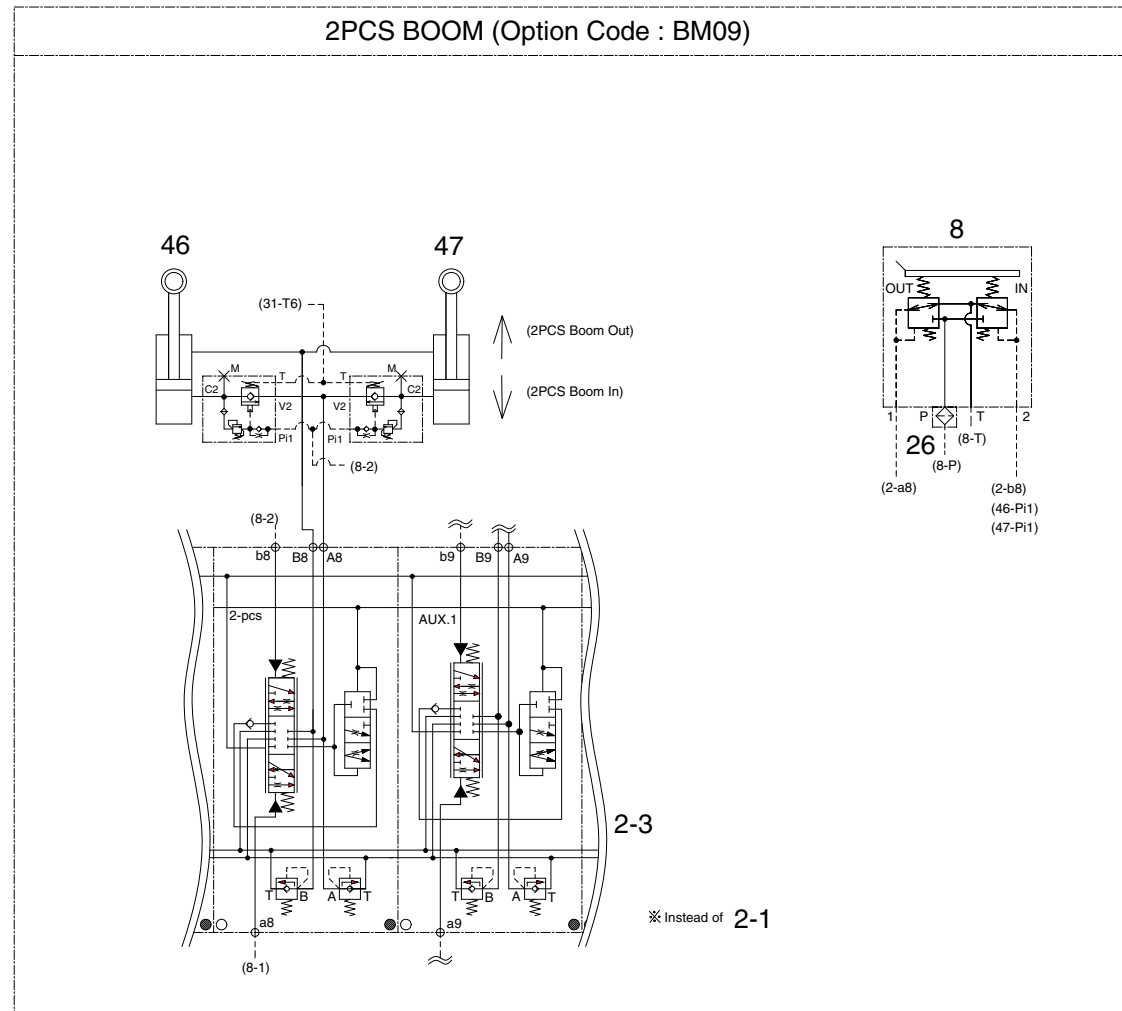
- 1 Main pump
- 2-1 Main control valve
- 3 Swing motor
- 4 Travel motor
- 5-1 RCV lever(LH)
- 6 RCV lever(RH)
- 7 RCV lever(dozer)
- 8 O.P.T pedal
- 9 Travel pedal
- 10 2 EPPR valve
- 11 Solenoid valve assy
- 12-1 Boom cylinder
- 13-1 Arm cylinder
- 14 Bucket cylinder
- 15 Boom swing cylinder
- 16-1 Dozer cylinder
- 17-1 Turning joint
- 18 Return check valve
- 19 Return check valve
- 20 Radiator total assy
- 21 Air breather
- 22 Return filter w/bypass valve
- 23 Suction strainer
- 24 Pressure sensor
- 25 Pressure sensor
- 26 Last guard filter
- 27 Pilot filter
- 28 Accumulator
- 29 Solenoid valve
- 30-1 Terminal assy
- 31 Block(A)
- 32 Block(B)
- 33 Return pipe
- 34 Relief valve
- 35-1 Dozer handle
- 55 Solenoid valve
- 57 Shuttle tee
- 57 Solenoid valve

## 2. HYDRAULIC CIRCUIT (2/3)

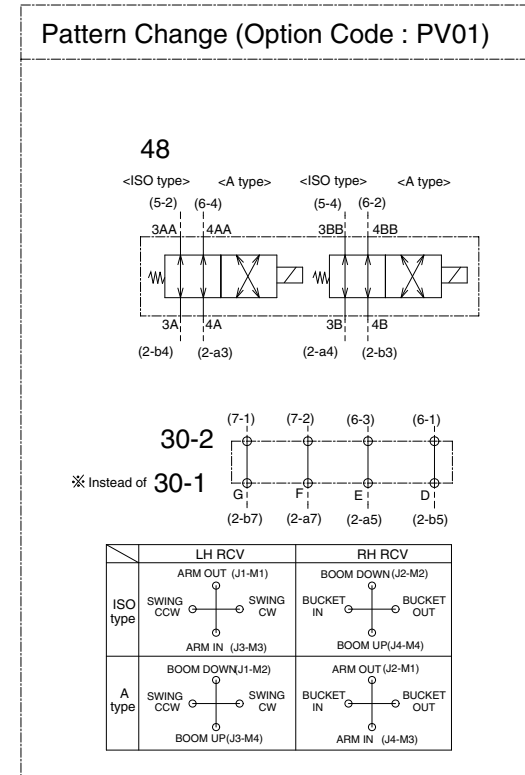
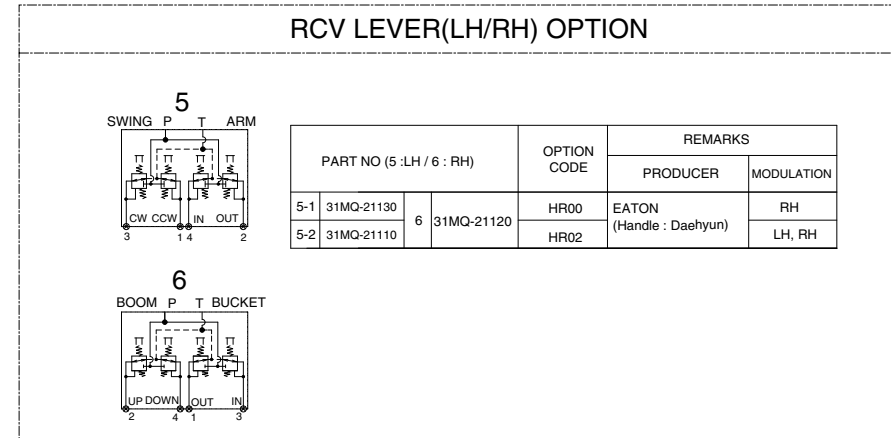
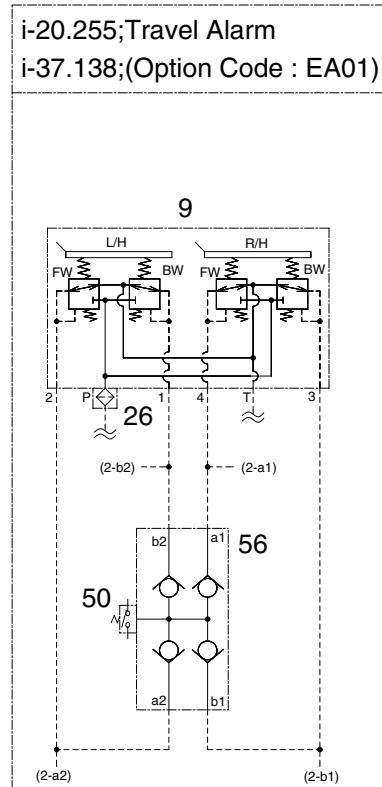


- 2-2 Main control valve
- 5-2 RCV lever(LH)
- 12-2 Boom cylinder
- 13-2 Arm cylinder
- 16-2 Dozer cylinder
- 17-2 Turning joint
- 25 Pressure sensor
- 26 Last guard filter
- 35-2 Dozer handle
- 36 4 EPPR valve
- 39 Angle dozer cylinder
- 40 Selector valve
- 44 Safety lock valve
- 45 Safety lock valve
- 51 Cartridge valve

### 3. HYDRAULIC CIRCUIT (3/3)



- 2-3 Main control valve
- 2-4 Main control valve
- 5-2 RCV lever(LH)
- 8 O.P.T pedal
- 26 Last guard filter
- 30-2 Terminal assy
- 35-2 Dozer handle
- 36 4 EPPR valve
- 46 2 pcs boom cylinder(LH)
- 47 2 pcs boom cylinder(RH)
- 48 Pattern change valve
- 50 Pressure switch
- 56 Shuttle valve



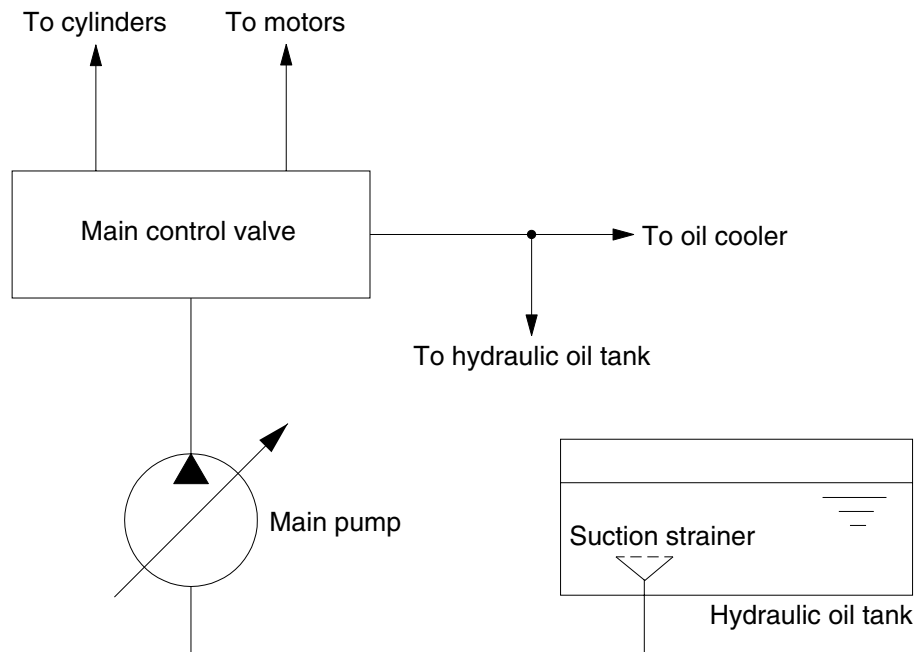
## GROUP 2 MAIN CIRCUIT

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

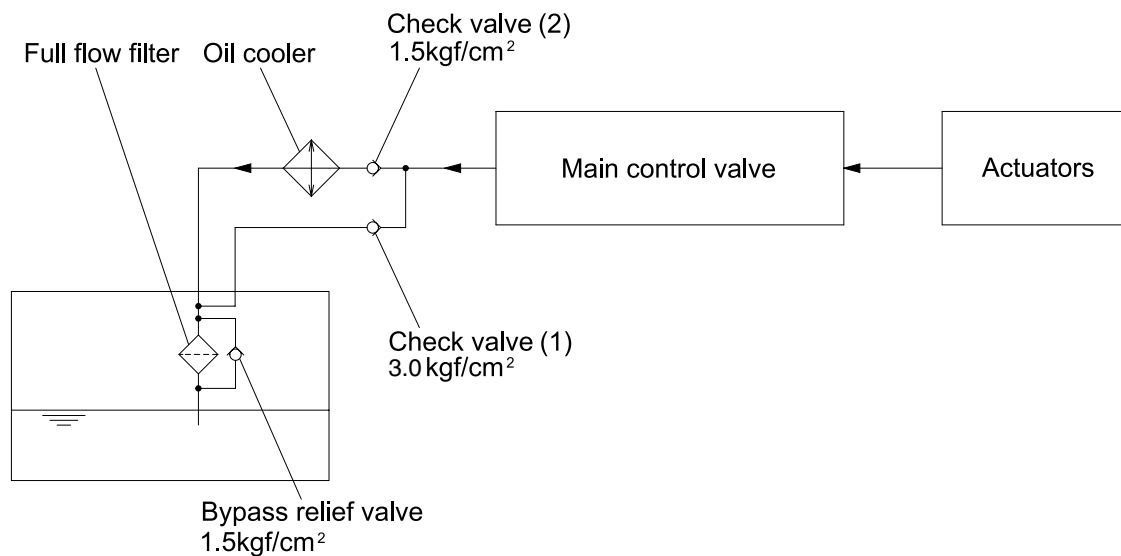
The pumps receive oil from the hydraulic tank through a suction strainer. The discharged oil from the pump flows into the control valve and goes out the tank ports.

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



85A3CI02

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 bypass check valves are  $1.5 \text{ kgf/cm}^2$  (21 psi) and  $3.0 \text{ kgf/cm}^2$  (43 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  $3.0 \text{ kgf/cm}^2$  (43 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

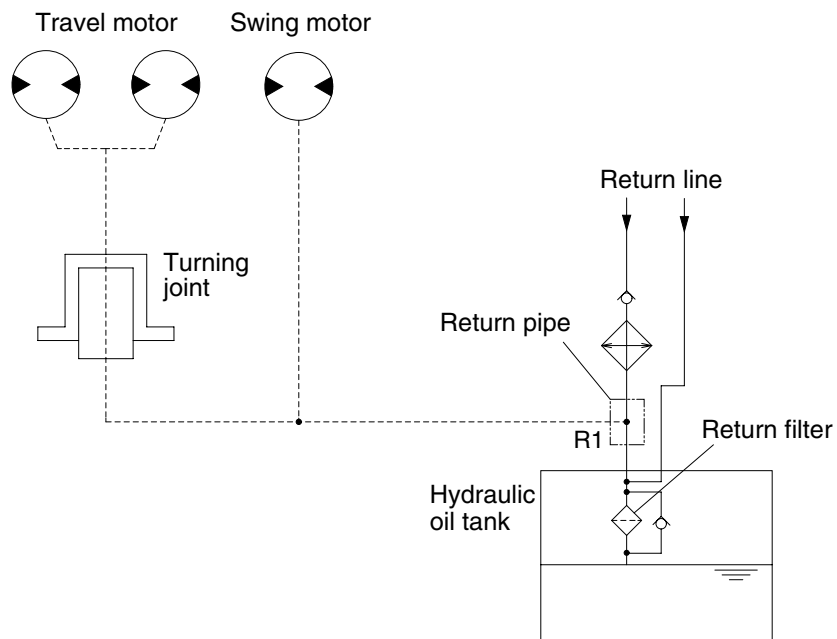
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).

The full-flow 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 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  $1.5 \text{ kgf/cm}^2$  (21 psi) differential pressure.

### 3. DRAIN CIRCUIT



85A3CI03

Besides internal leaks from the motors and main pump, the oil for lubrication circulates.

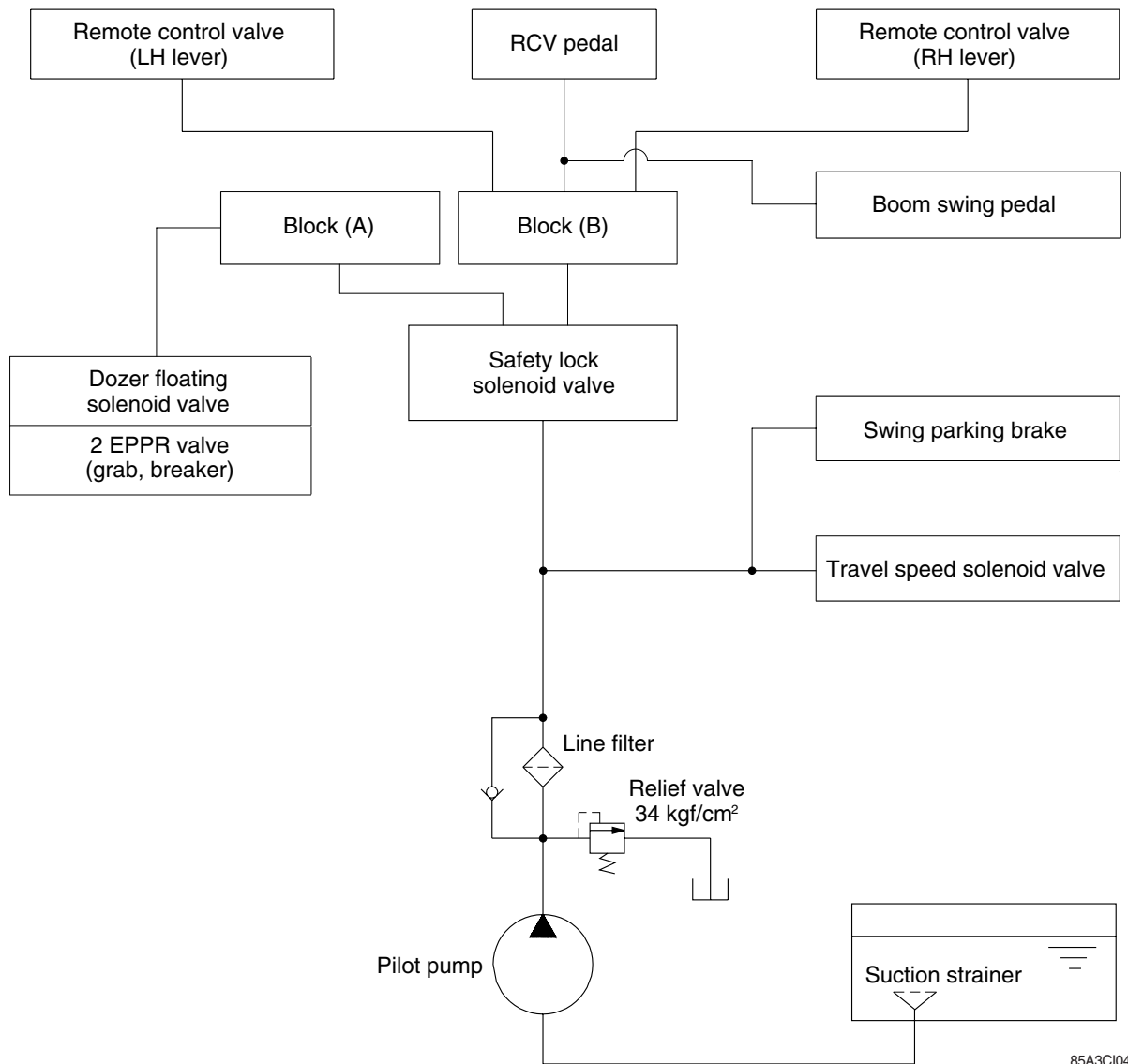
#### 1) TRAVEL MOTOR DRAIN CIRCUIT

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 after being filtered by return filter.

#### 2) SWING MOTOR DRAIN CIRCUIT

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

## GROUP 3 PILOT CIRCUIT



85A3CI04

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

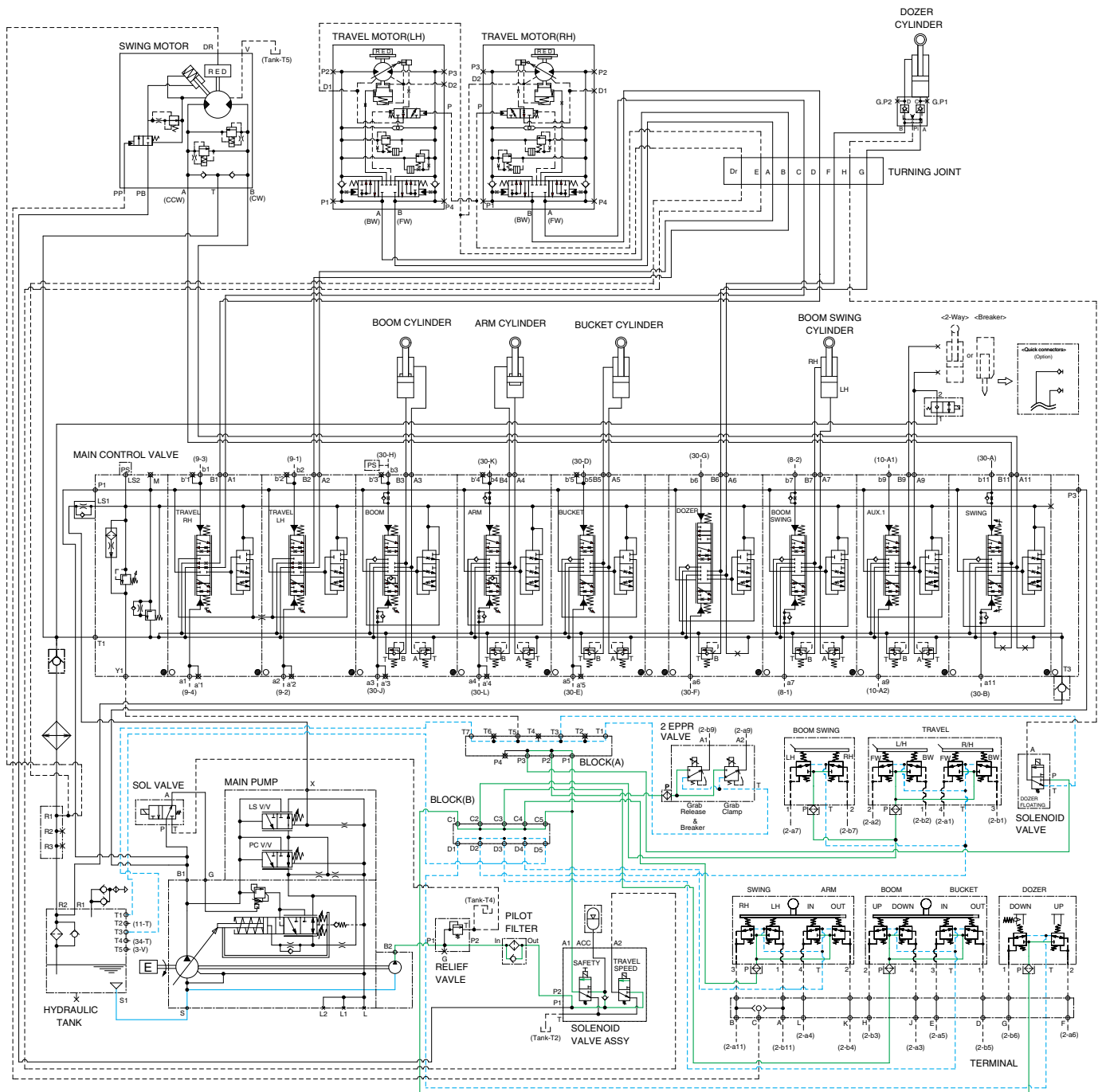
The pilot line is provided with relief valve, receives the oil from the hydraulic tank through the suction strainer.

The discharged oil from the pilot pump flows to the remote control valve through line filter, safety lock solenoid valve and block (B) and flows to the dozer floating solenoid valve and 2 EPPR valve (grab, breaker) through line filter and block (A).

Also, the discharged oil from the pilot pump flows to swing parking brake and travel speed solenoid valve through line filter.



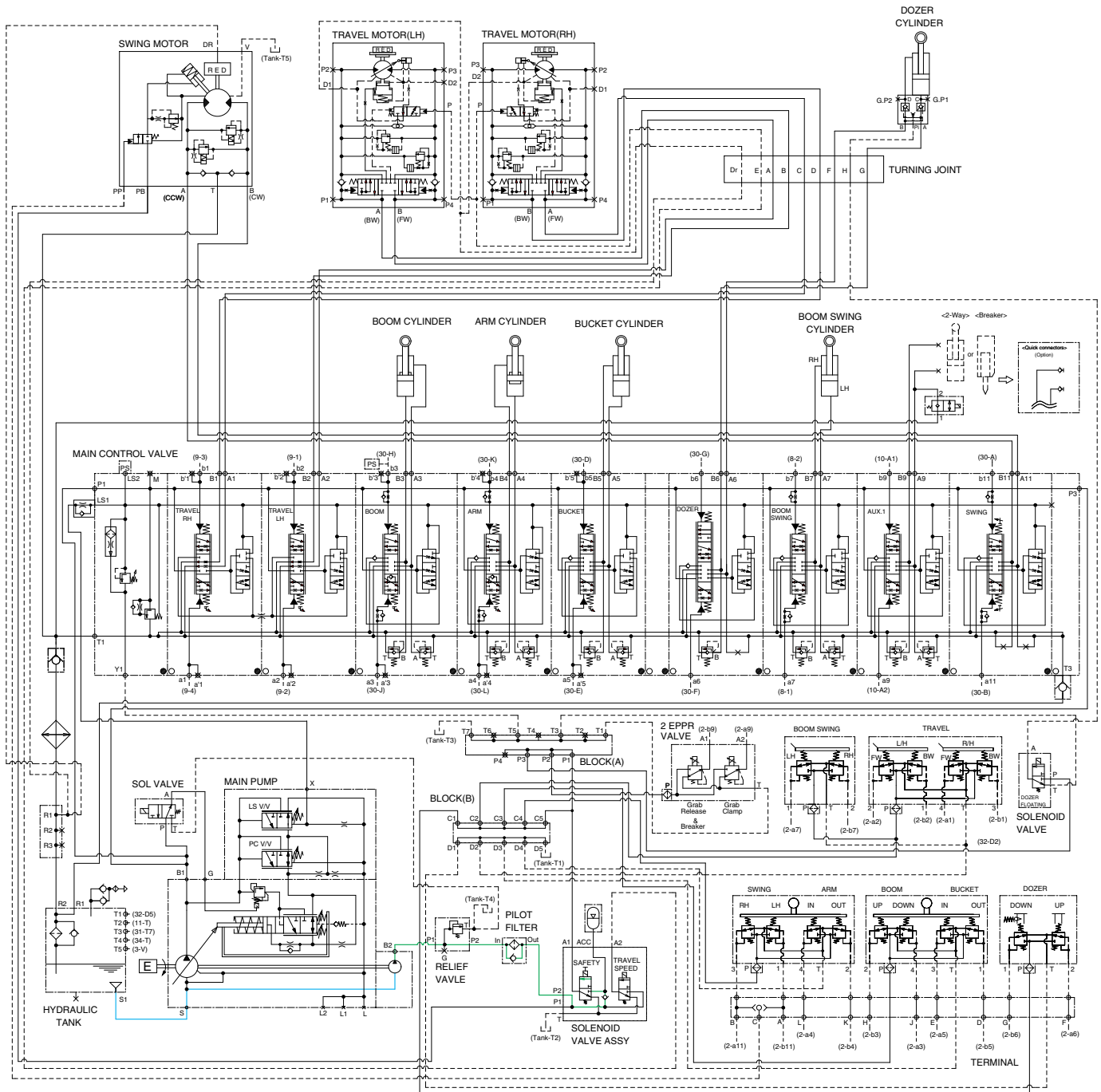
# 1. SUCTION, DELIVERY AND RETURN CIRCUIT



85A3HC02

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 pilot line for limiting the pilot circuit pressure. The oil filtered by line filter flows remote control valve through safety solenoid valve. The return oil flow into the hydraulic tank.

## 2. SAFETY VALVE (SAFETY LEVER)

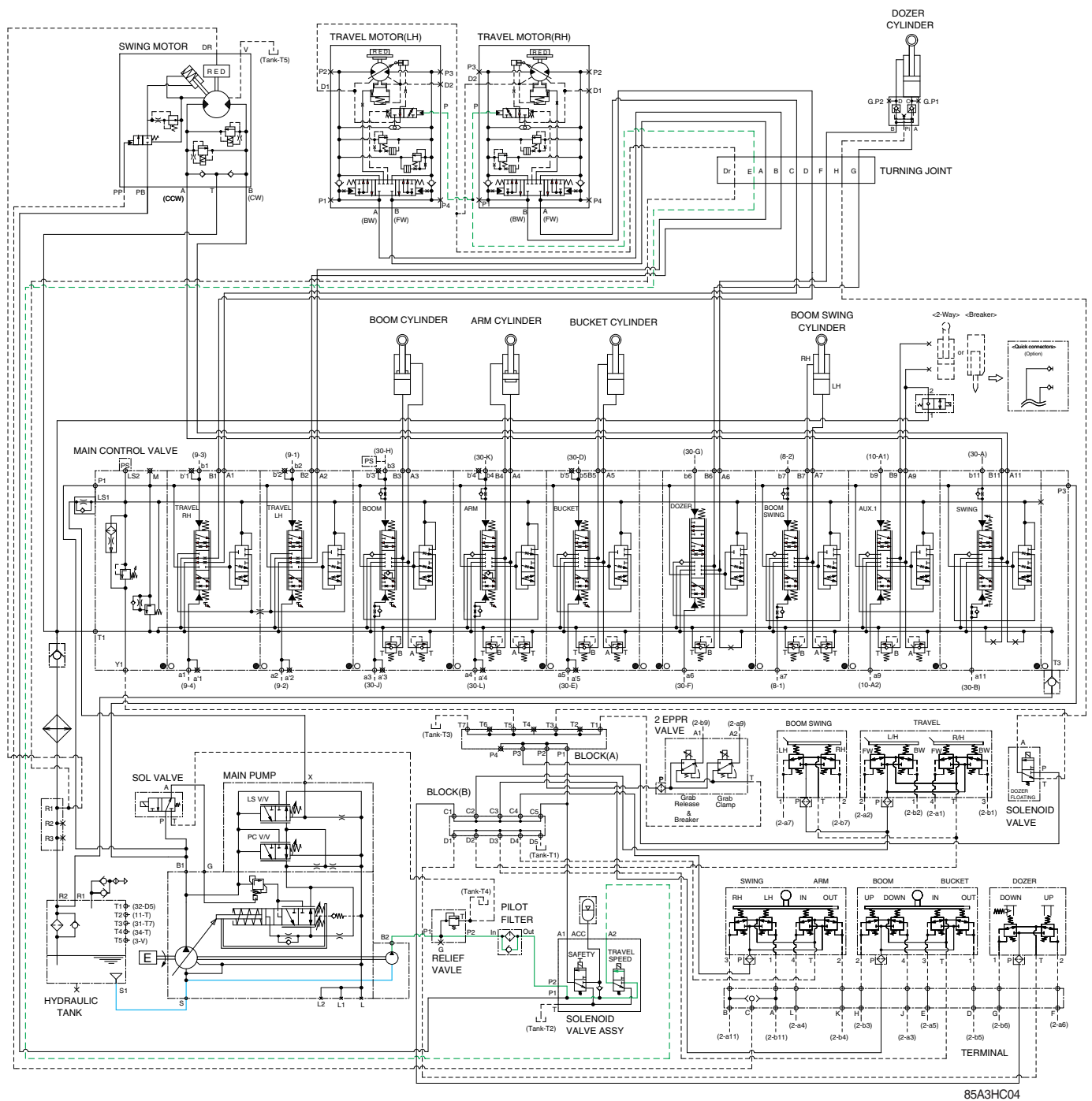


85A3HC03

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

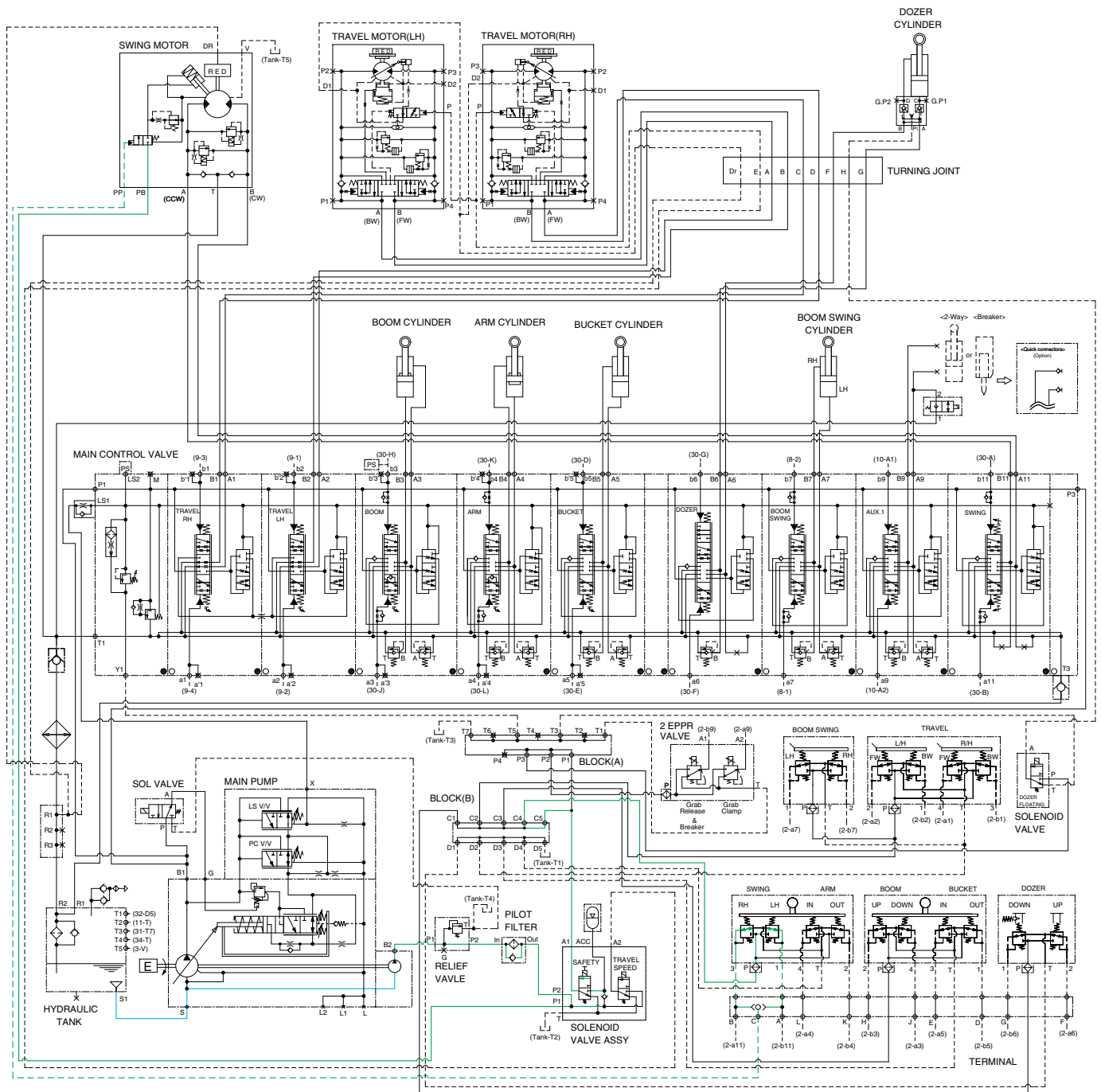
When the lever of the safety solenoid valve is moved upward, oil does not flow into the remote control valve, because of the blocked port.

### 3. TRAVEL SPEED CONTROL SYSTEM



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 P 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 P port returns to the hydraulic tank. As a result, the control piston is returned by the main oil flow, thus the displacement is maximized.

## 4. SWING PARKING BRAKE RELEASE



85A3HC05

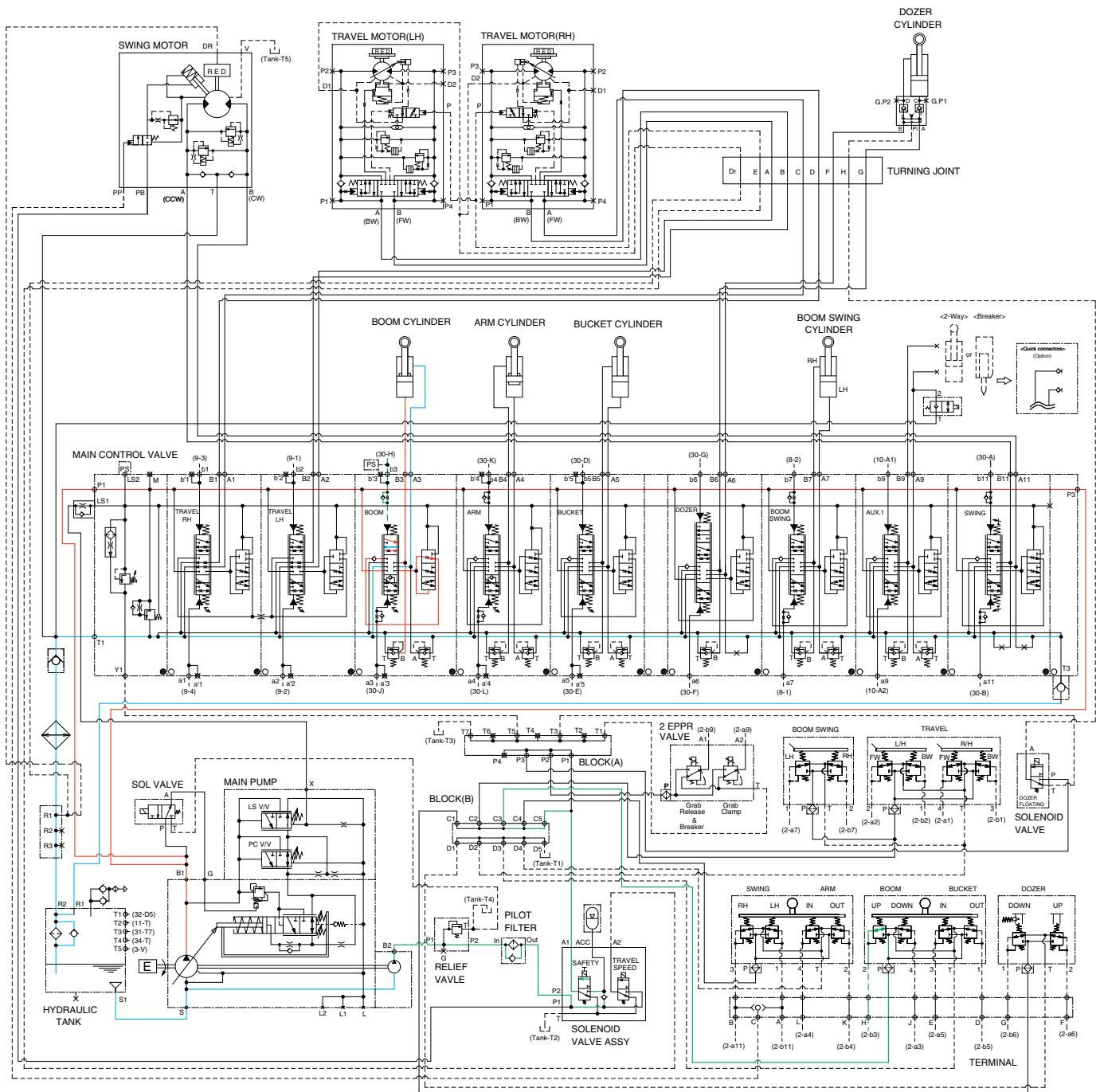
When the swing control lever is tilted, the pilot oil flow into PP port of shuttle valve, this pressure move spool so, discharged oil from pilot valve flow into PB port.

This pressure is applied to swing motor disc, thus the brake is released.

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

# GROUP 4 SINGLE OPERATION

## 1. BOOM UP OPERATION

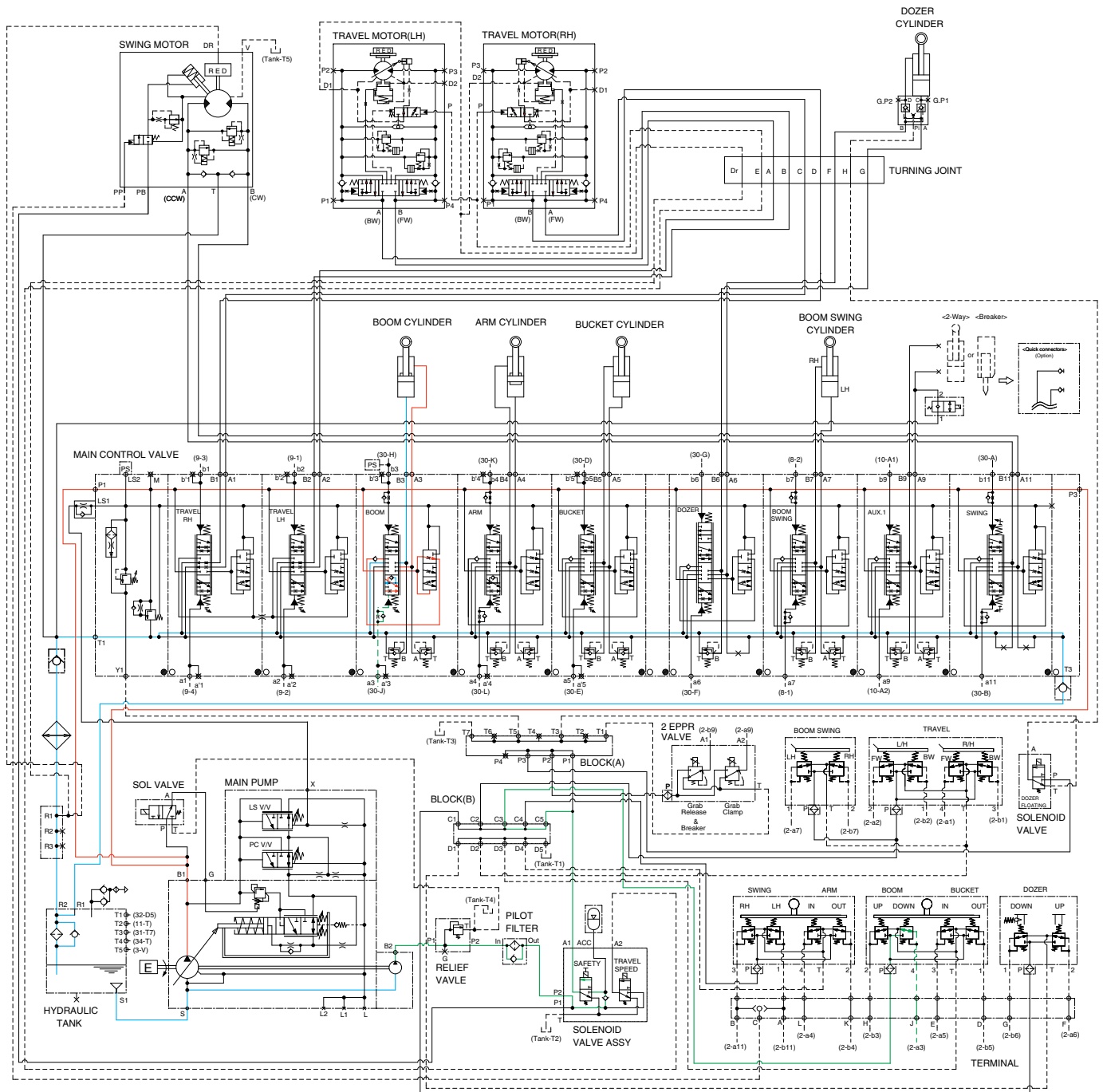


85A3HC10

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 main 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



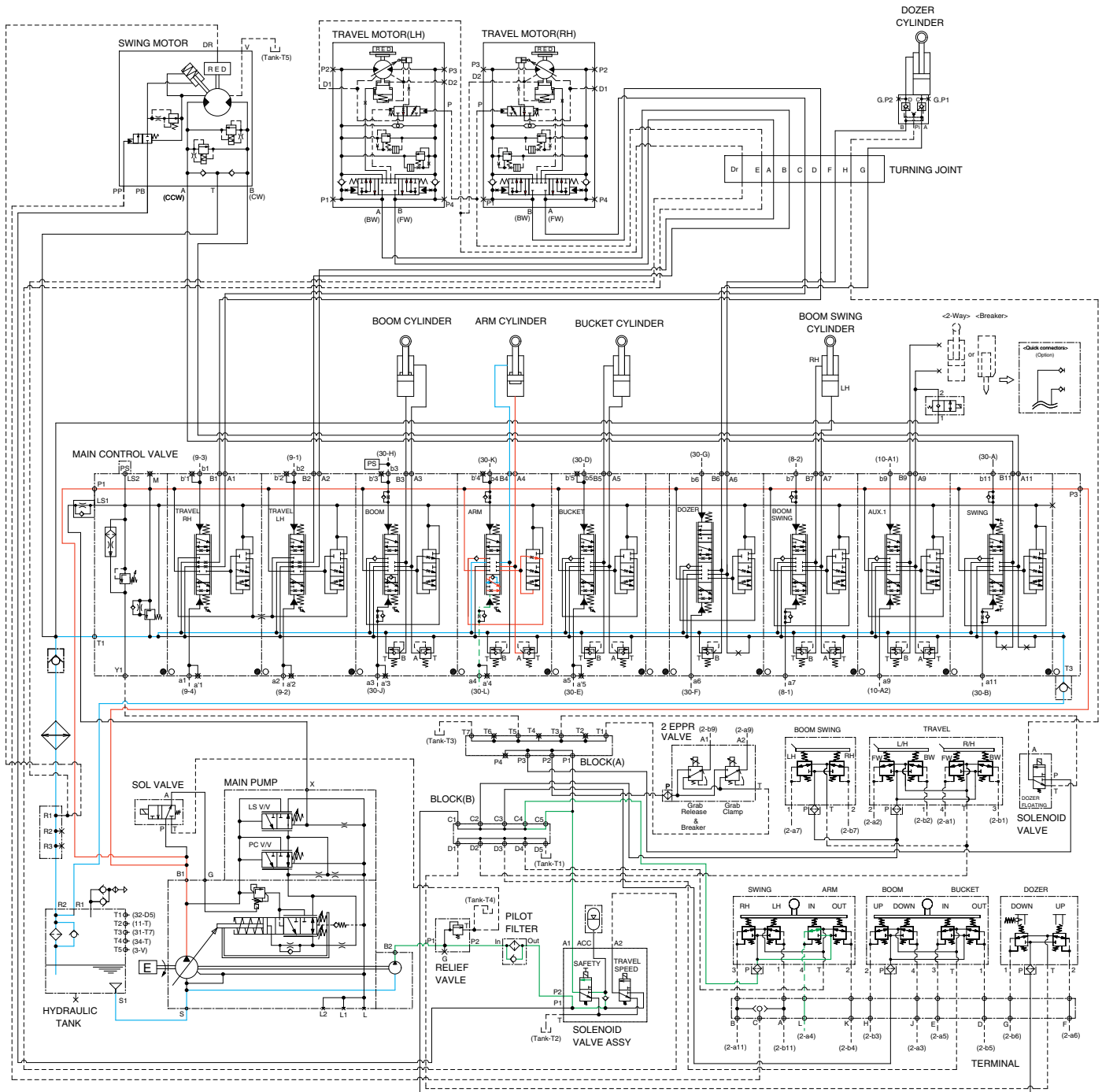
85A3HC11

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.

The oil from the main 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.

### 3. ARM ROLL IN OPERATION



85A3HC12

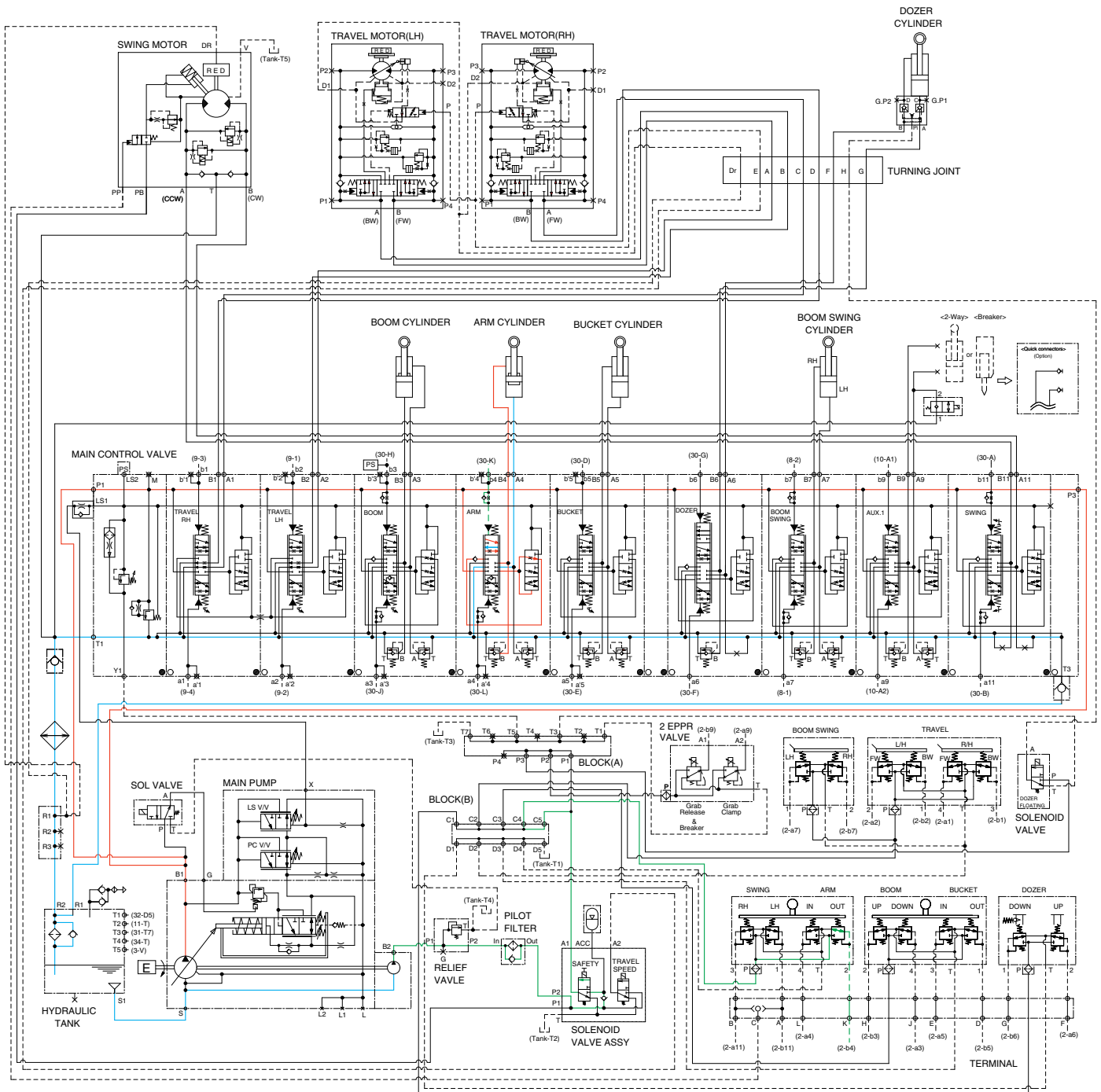
When the left control lever is pulled back, the arm spool in the main control valve is moved to the roll position by the pilot oil pressure from the remote control valve.

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

At the same time, the oil from the small chamber of the 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 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



85A3HC13

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.

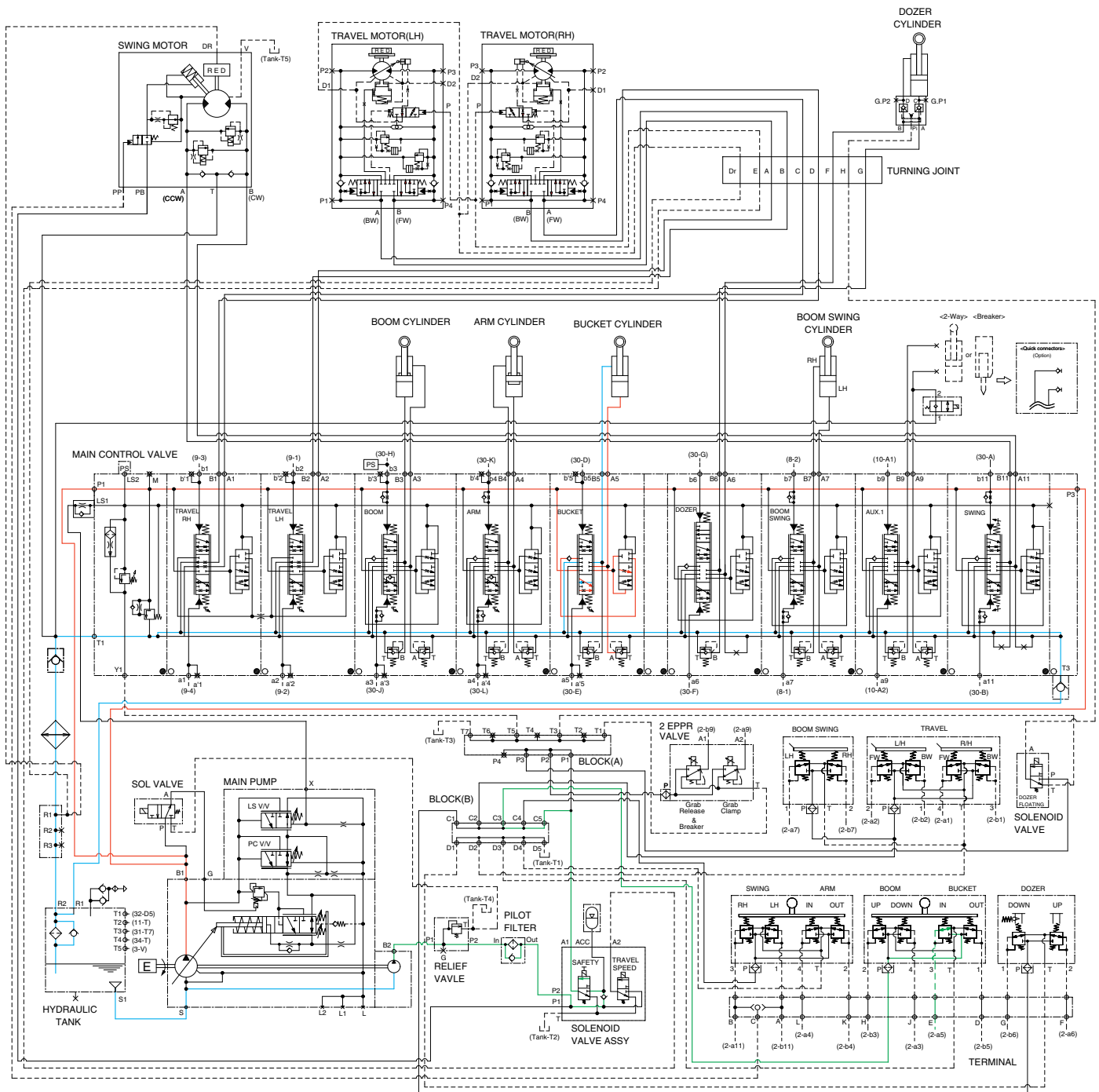
The oil from the main pump flows into the main control valve and then goes to the small chamber of arm cylinder.

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 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



85A3HC14

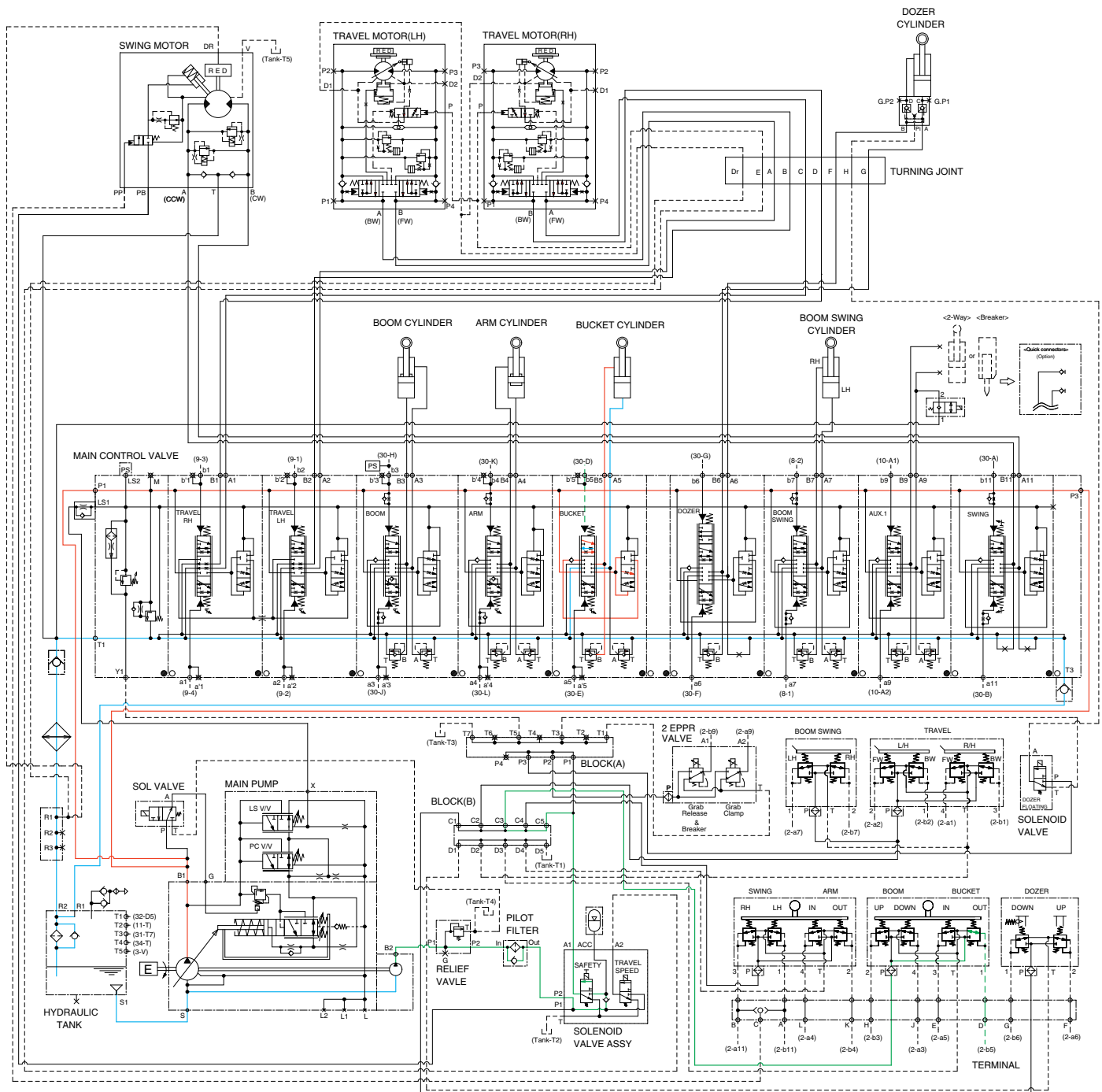
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

The oil from the main 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 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



85A3HC15

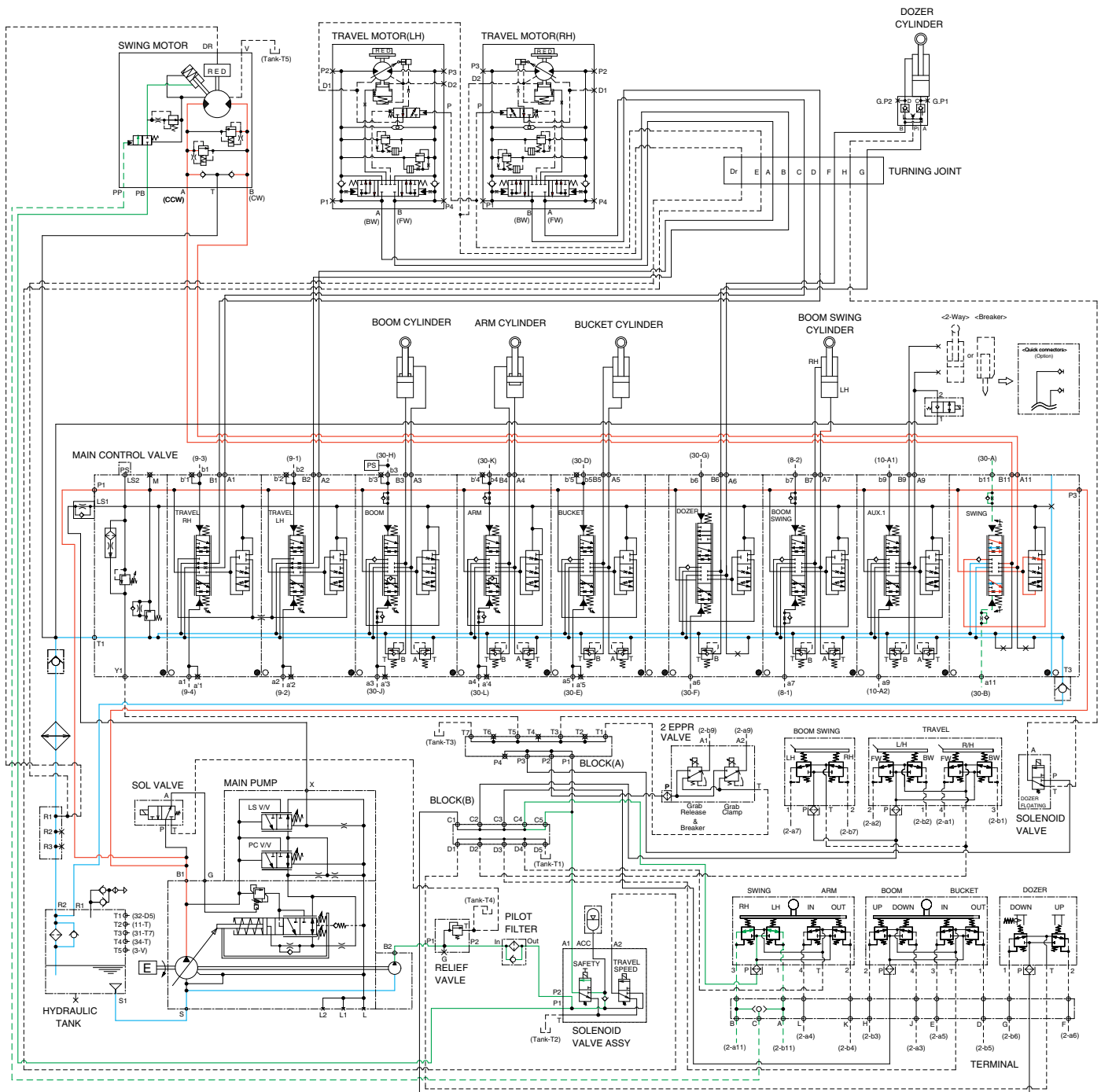
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the main 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.

## 7. SWING OPERATION



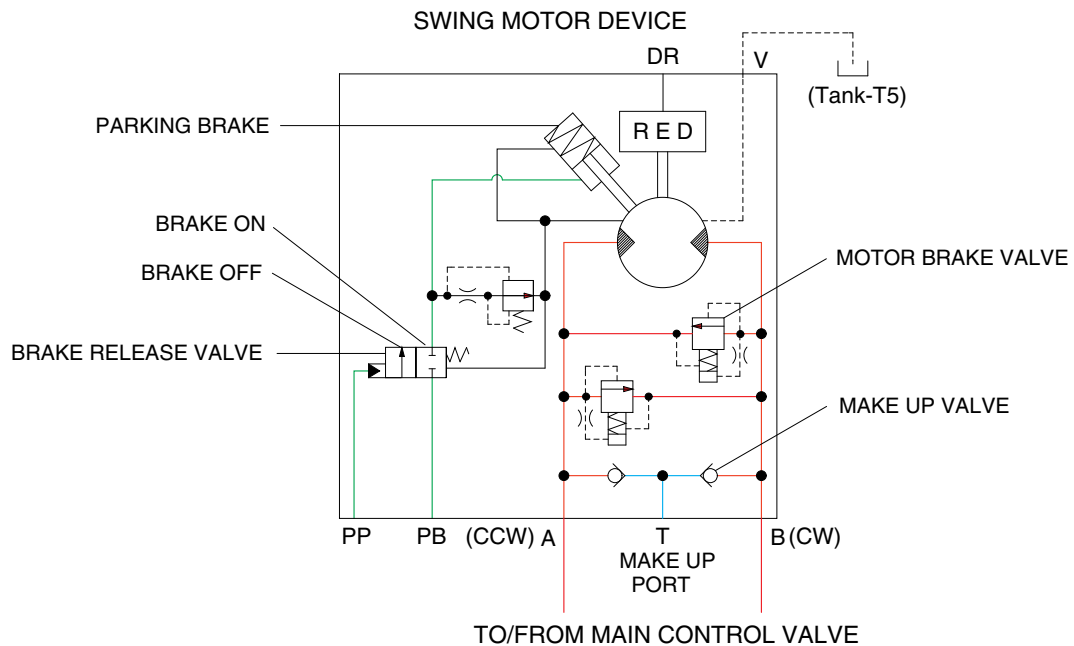
85A3HC16

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 main 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 overload 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.

## SWING CIRCUIT OPERATION



85A3HC17

### 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

In case that the parking, of the machine at slope is required during operation, there is the danger of involuntary swing caused by the self weight of the machine. The brake is connected to prevent this involuntary swing.

#### PARKING BRAKE "OFF" OPERATION

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

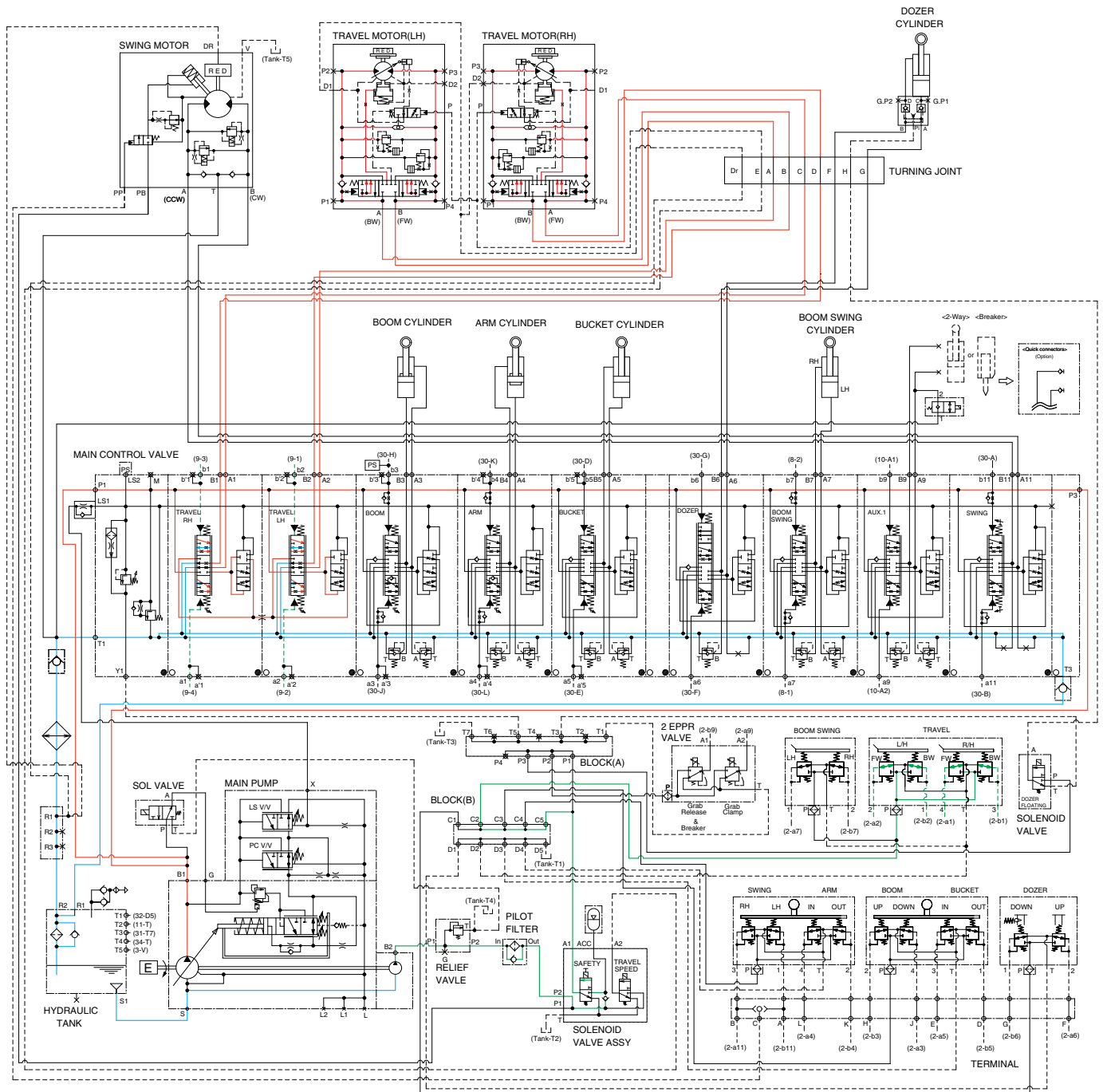
When the left control lever placed in the swing position, the pilot pressure (PP) at the shuttle valve is transferred to the brake release valve and the brake release valve is change over. Then the pilot pressure (PB) lift the brake piston and release the parking brake.

#### PARKING BRAKE "ON" OPERATION

When the control lever placed in the neutral position, the pressure of the pilot oil passage down.

Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the tank. And the brake is set to 'ON'.

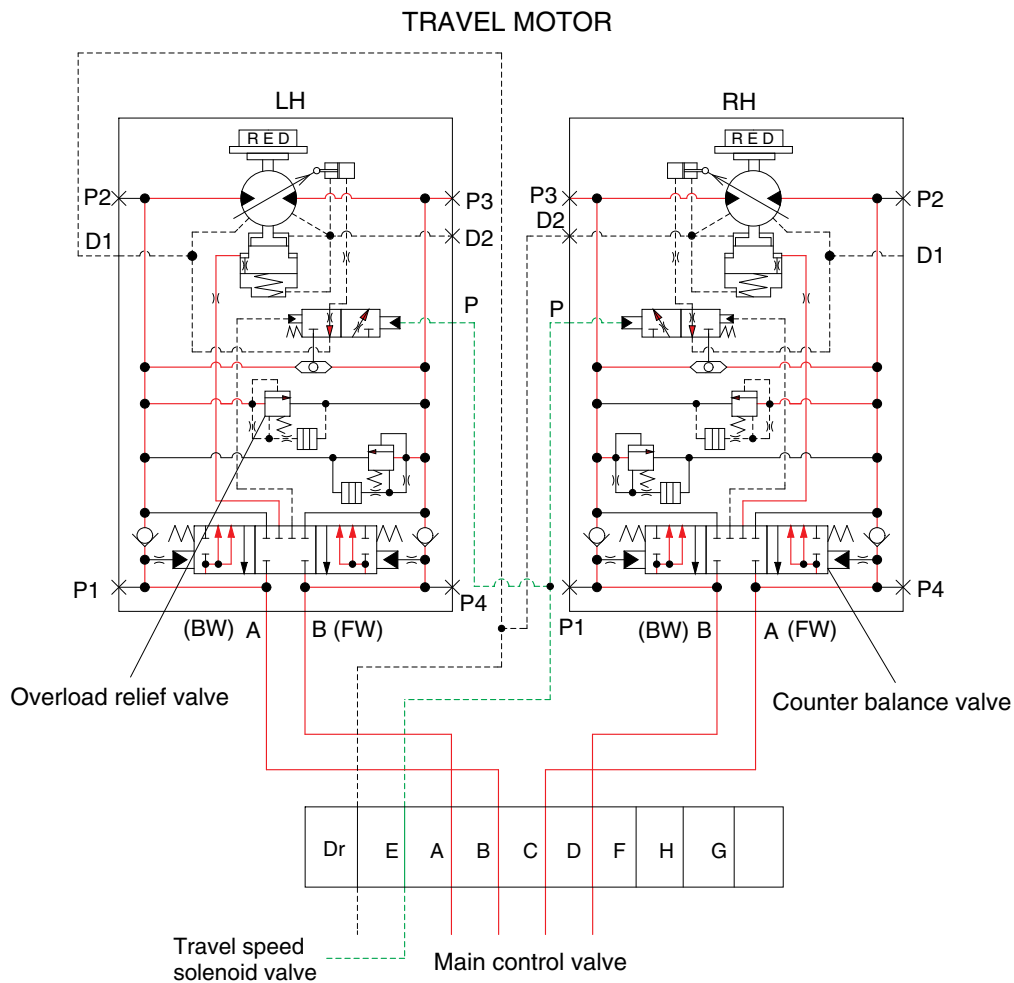
## 8. TRAVEL FORWARD AND REVERSE OPERATION



85A3HC18

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 the pilot oil pressure from the remote control valve. The oil from the main pump 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.

## TRAVEL CIRCUIT OPERATION



85A3HC19

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

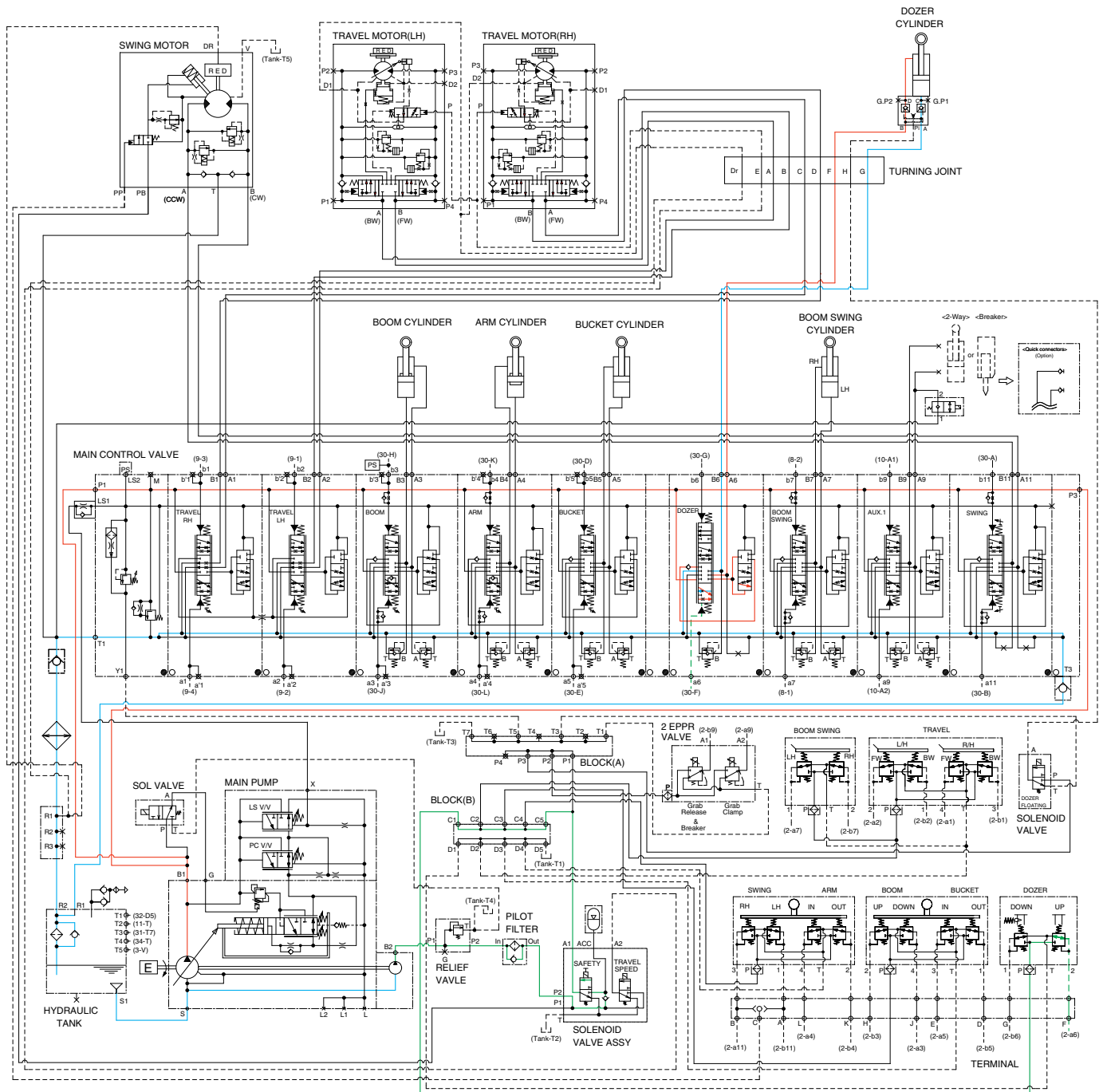
### 1) COUNTER BALANCE VALVE

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

### 2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 286 kgf/cm<sup>2</sup> (4068 psi) to prevent high pressure generated at at time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

## 9. DOZER UP OPERATION



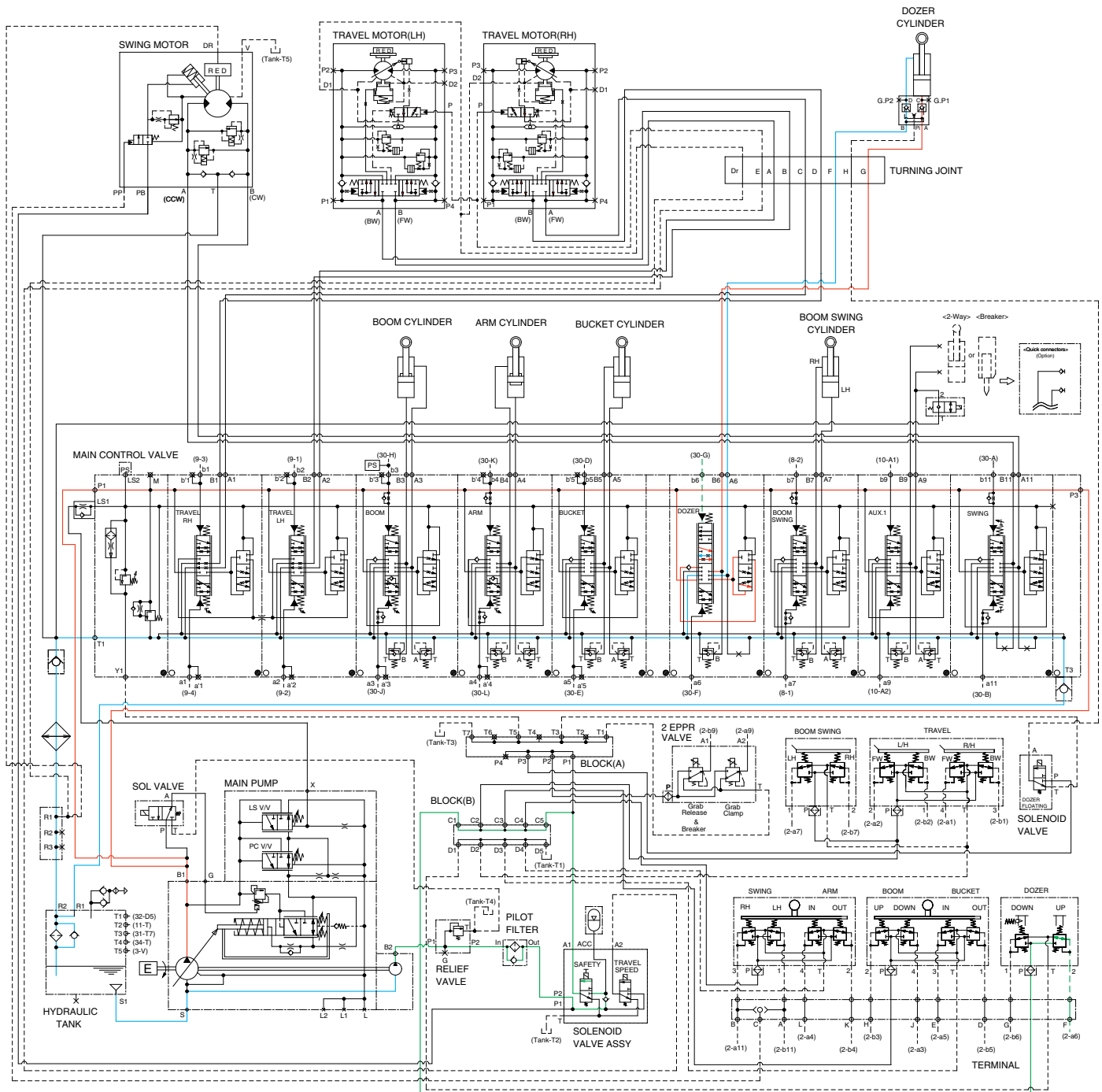
85A3HC20

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 main pump flows into the main control valve and then goes to the small chamber of dozer cylinders through the turning joint.

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

## 10. DOZER DOWN OPERATION



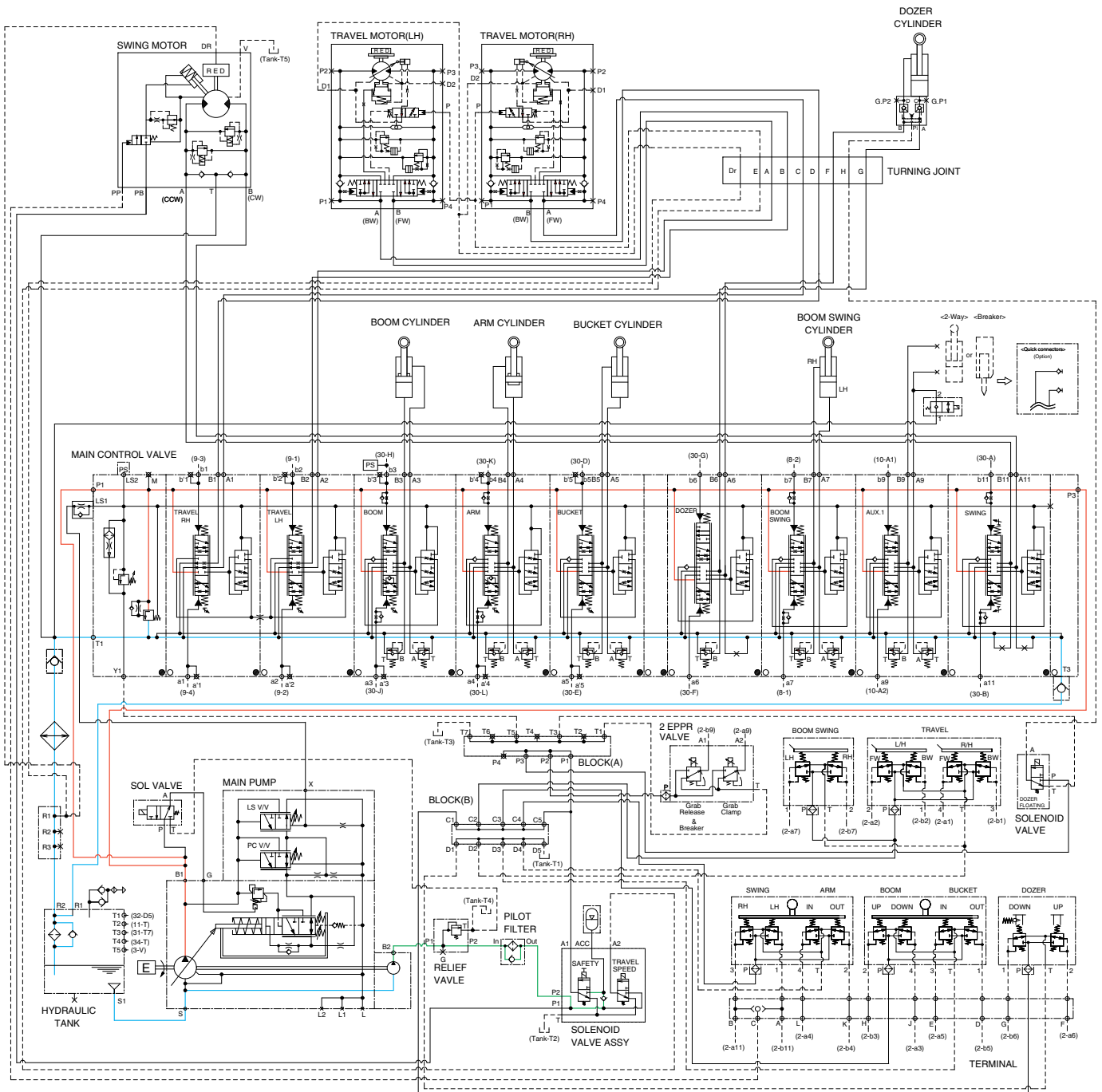
85A3HC21

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 main pump flows into the main control valve and then goes to the large chamber of dozer cylinders through the turning joint. At the same time, the oil from the small chamber of dozer cylinders returns to the hydraulic oil tank through the turning joint and dozer spool in the main control valve. When this happens, the dozer blade is down.



# GROUP 5 COMBINED OPERATION

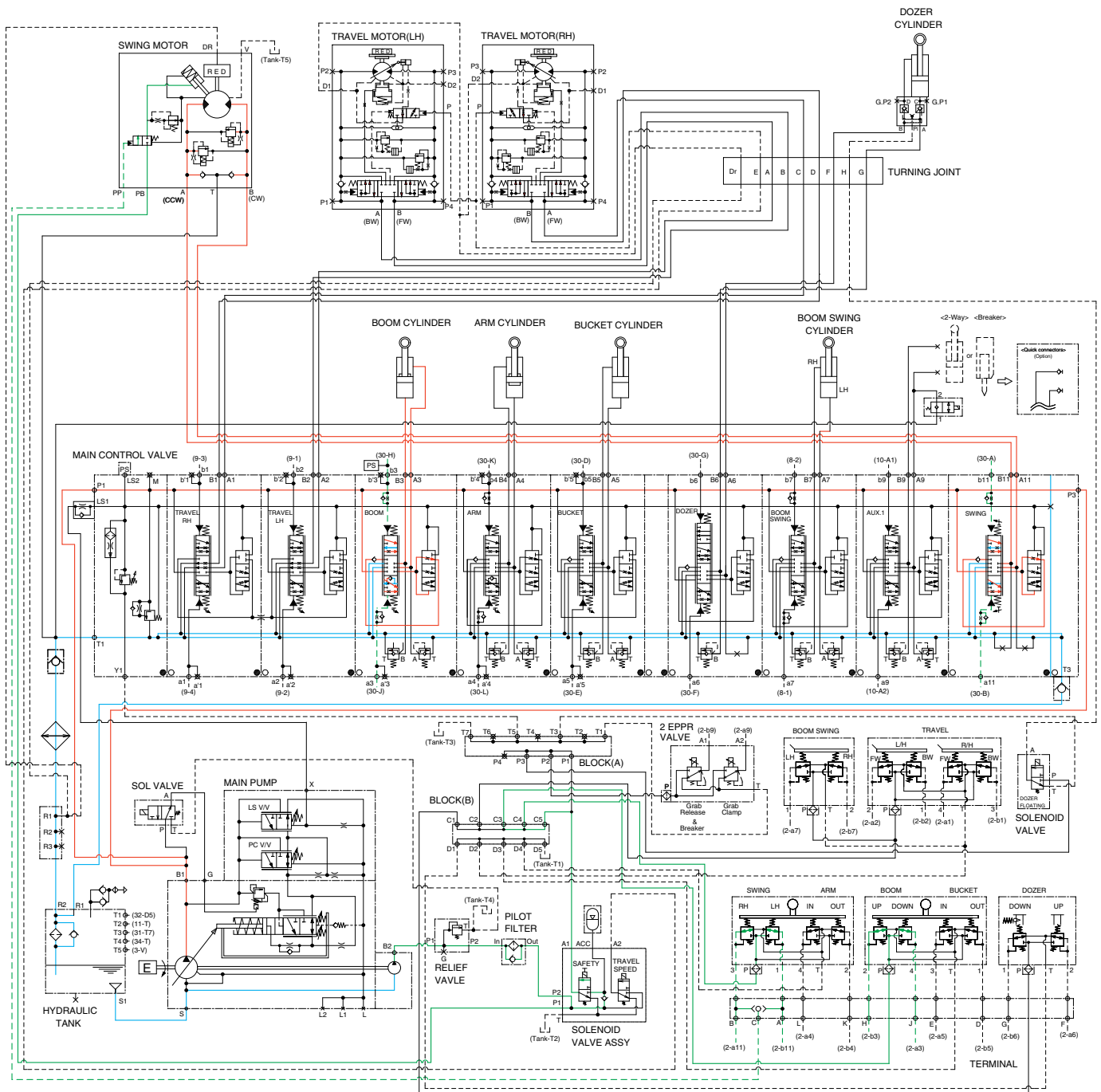
## 1. OUTLINE



85A3HC30

The oil from the main pump flows through the parallel oil passage in the main control valve. Then the oil goes to each pump 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 OPERATION



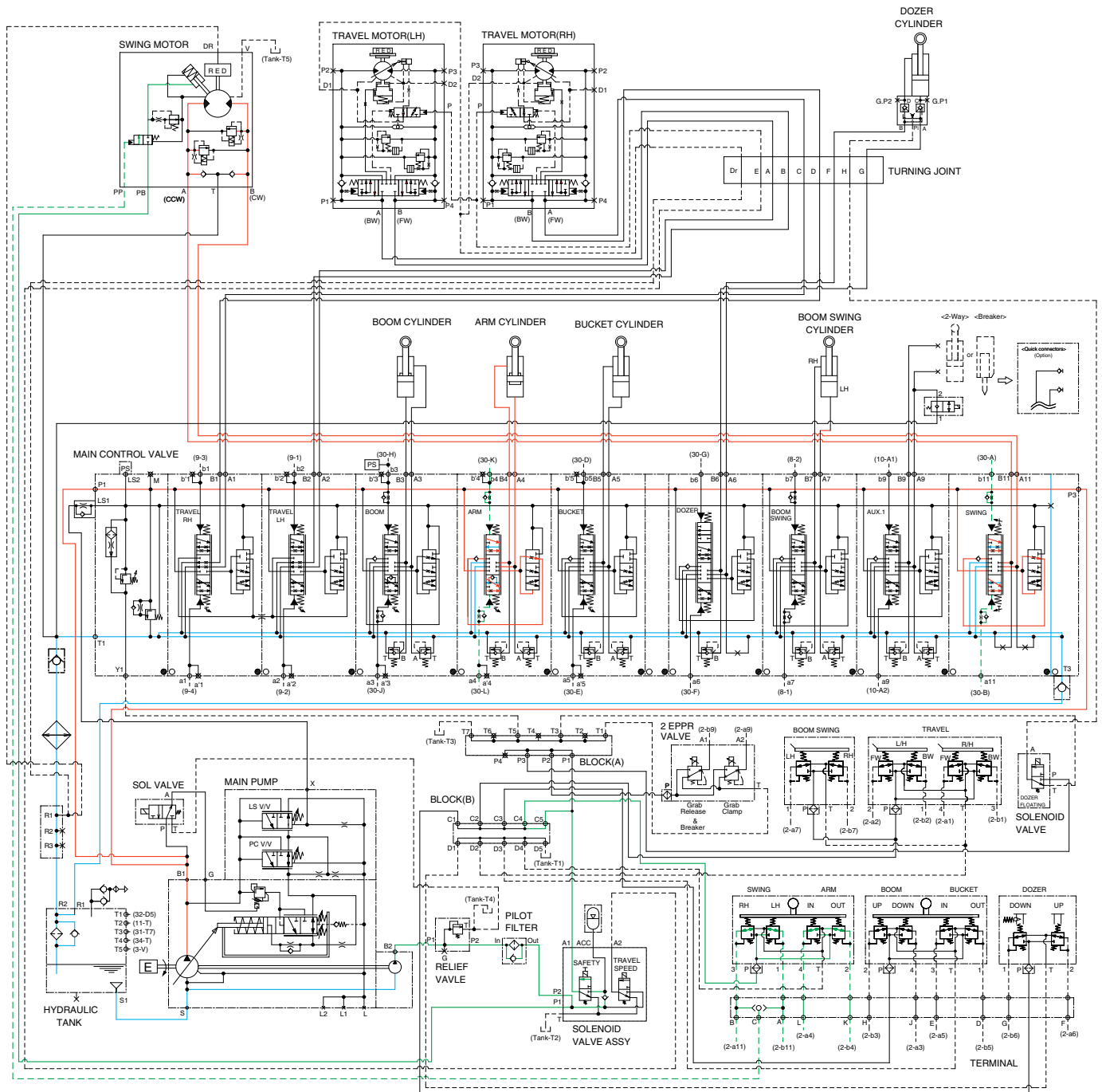
85A3HC31

When the swing and boom functions are operated, simultaneously the 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 main pump flows into the boom cylinder through boom spool and flows into the swing motor through the swing spool via the parallel passage.

The superstructure swings and the boom is operated.

### 3. COMBINED SWING AND ARM OPERATION



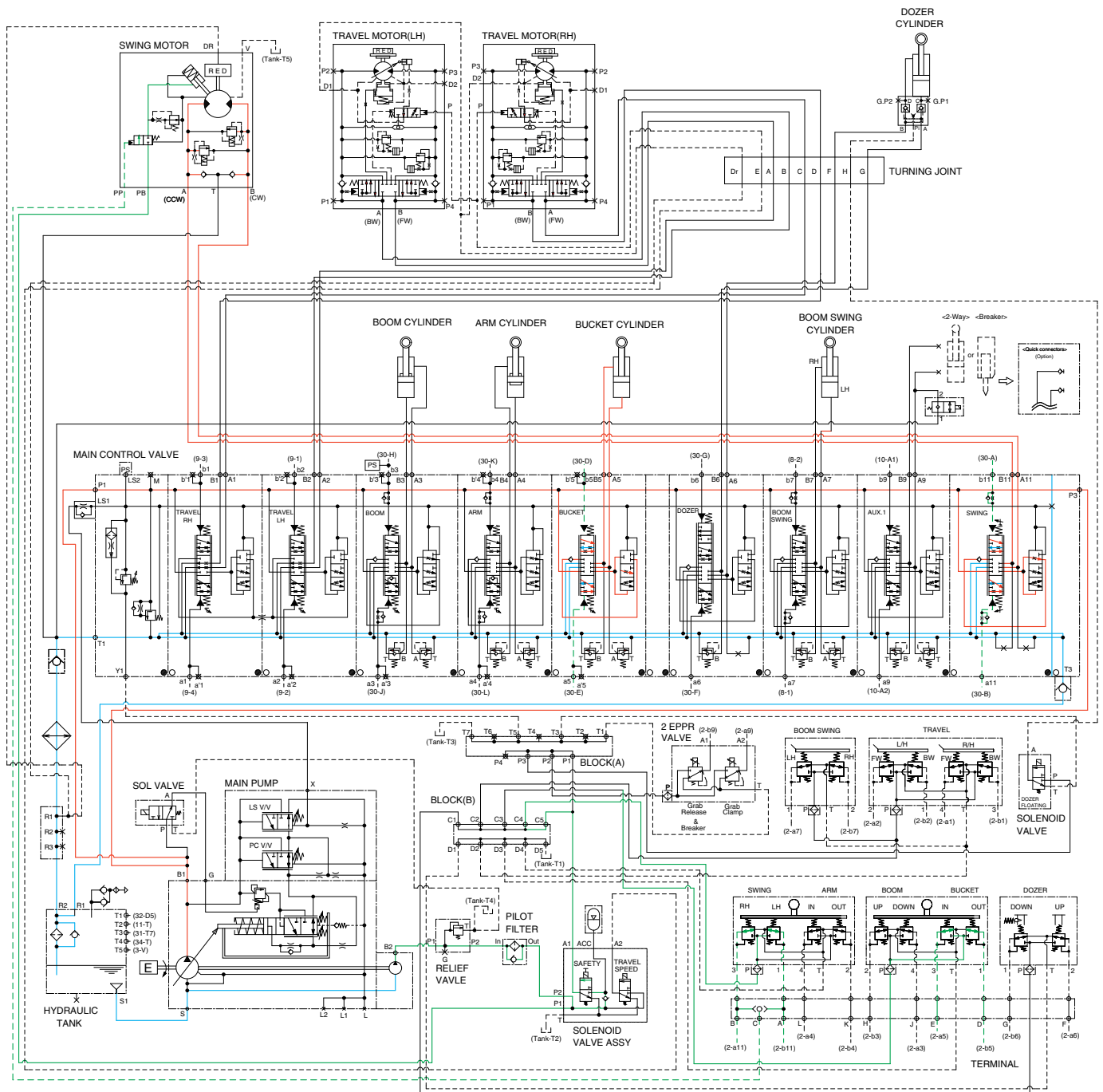
85A3HC32

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 main pump flows into the swing motor through swing spool via the parallel passage and flows into the arm cylinder through the arm spool.

The superstructure swings and the arm is operated.

## 4. COMBINED SWING AND BUCKET OPERATION



85A3HC33

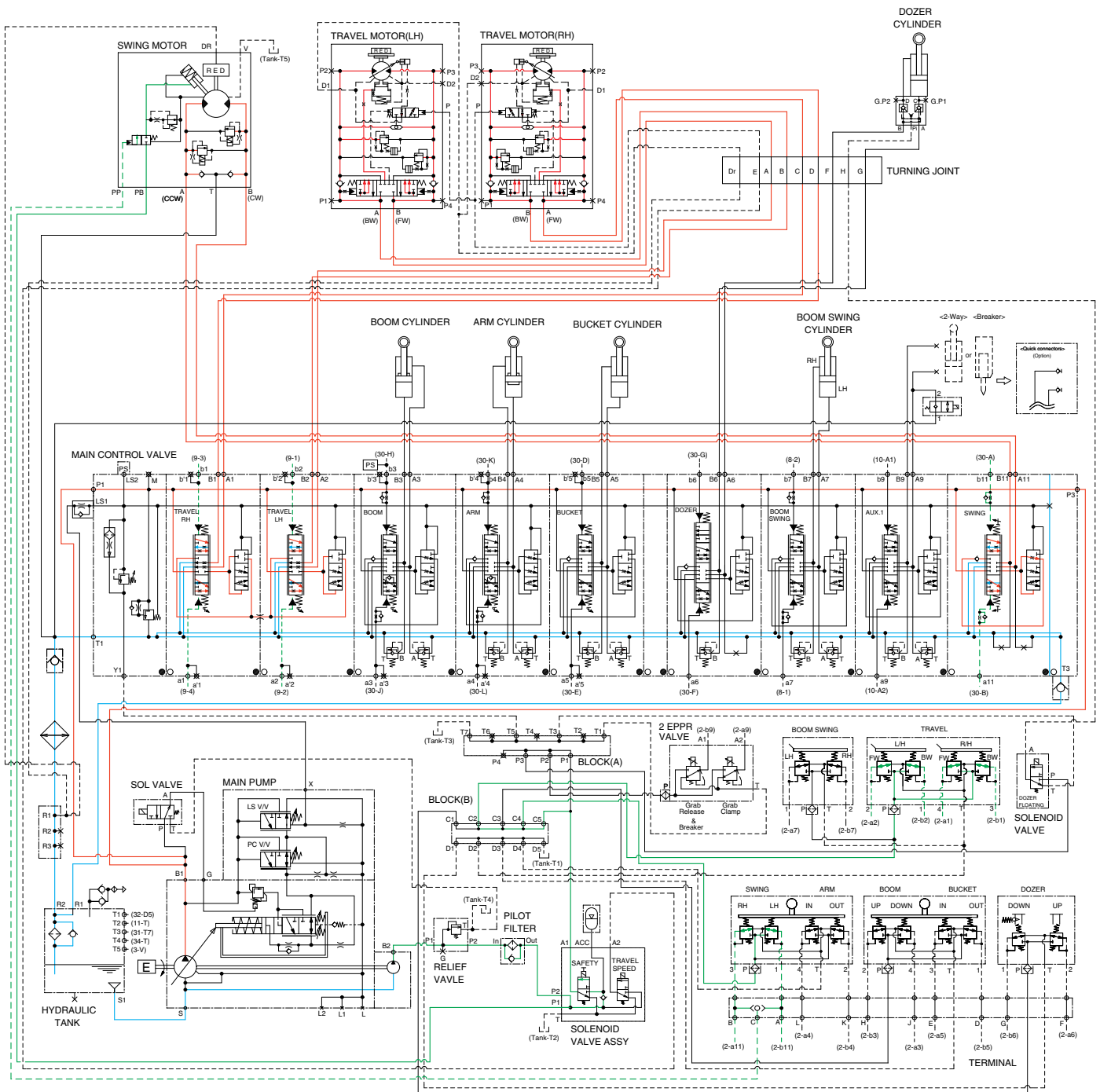
When the swing and bucket functions are operated, simultaneously the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the swing motor through the swing spool via the parallel passage and flows into the bucket cylinder through the bucket spool.

The superstructure swings and the bucket is operated.



## 6. COMBINED SWING AND TRAVEL OPERATION



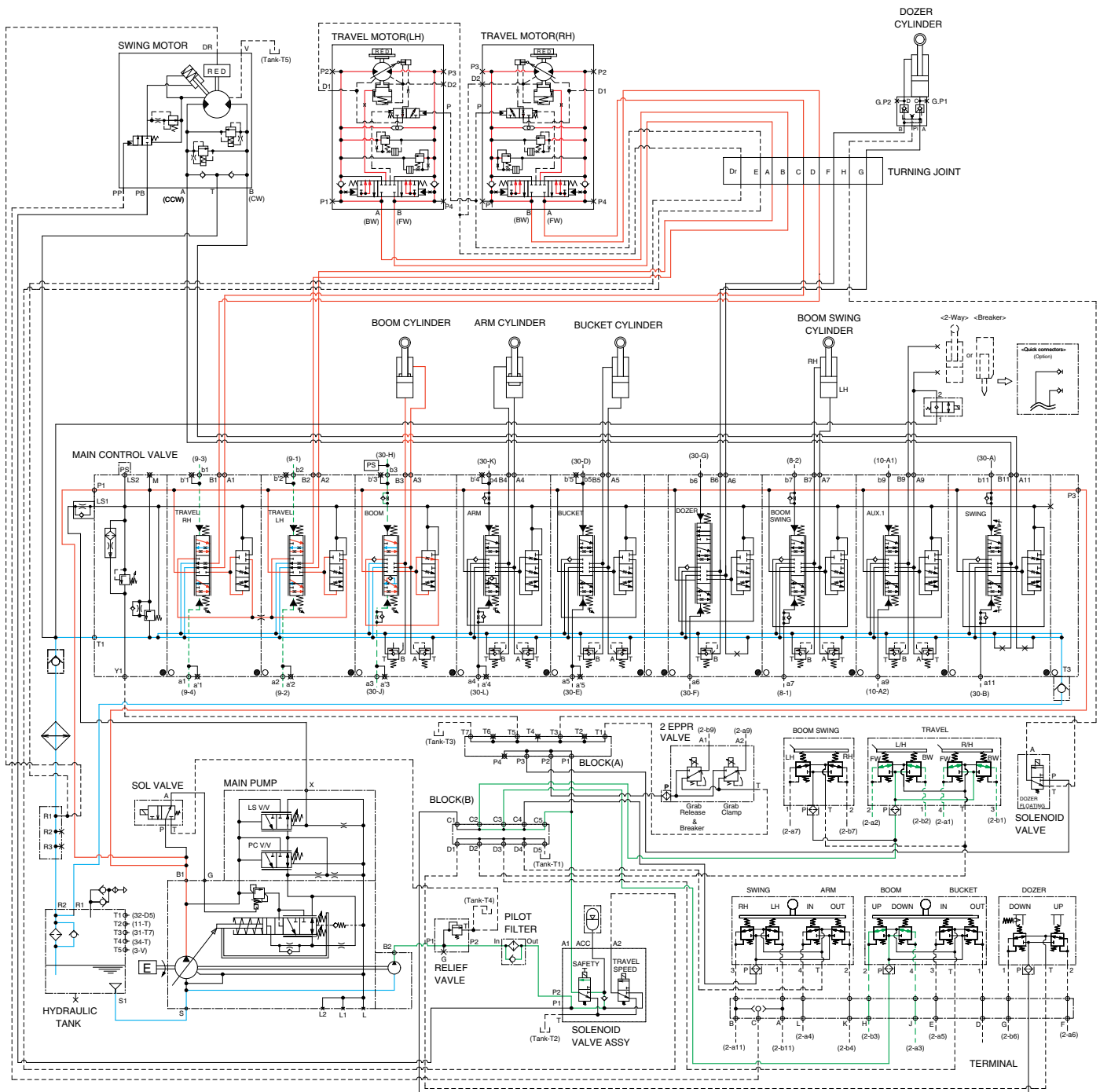
85A3HC35

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 main pump flows into the swing motor and LH and RH travel motors through the swing spool and both travel spools via the parallel passage.

The superstructure swings and the machine travels straight.

## 7. COMBINED BOOM AND TRAVEL OPERATION



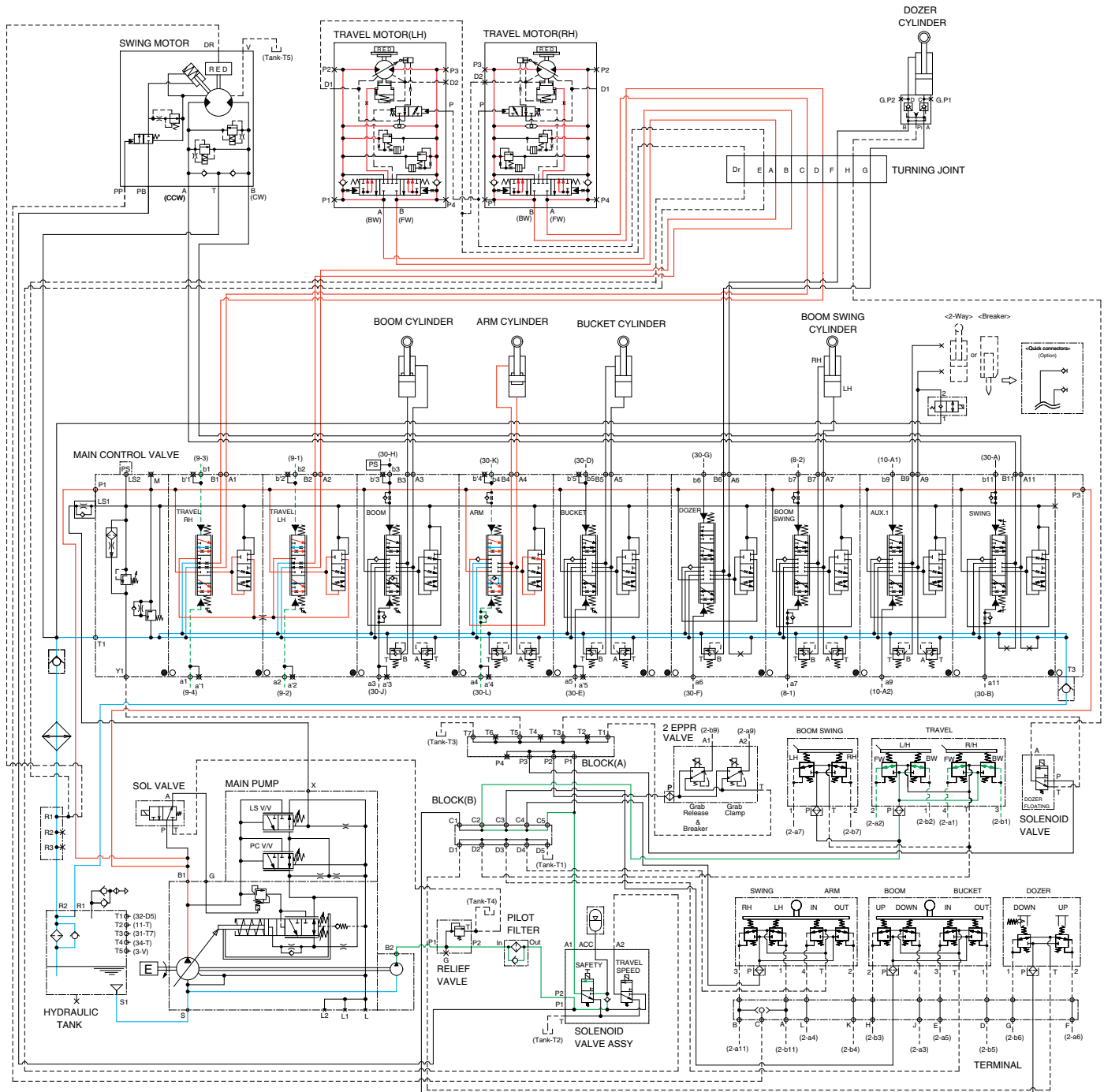
85A3HC36

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 from the remote control valve.

The oil from the main pump flows into the boom cylinder and the travel motors through boom, travel LH and travel RH spools via the parallel passage.

The boom is operated and the machine travels straight.

## 8. COMBINED ARM AND TRAVEL OPERATION



85A3HC37

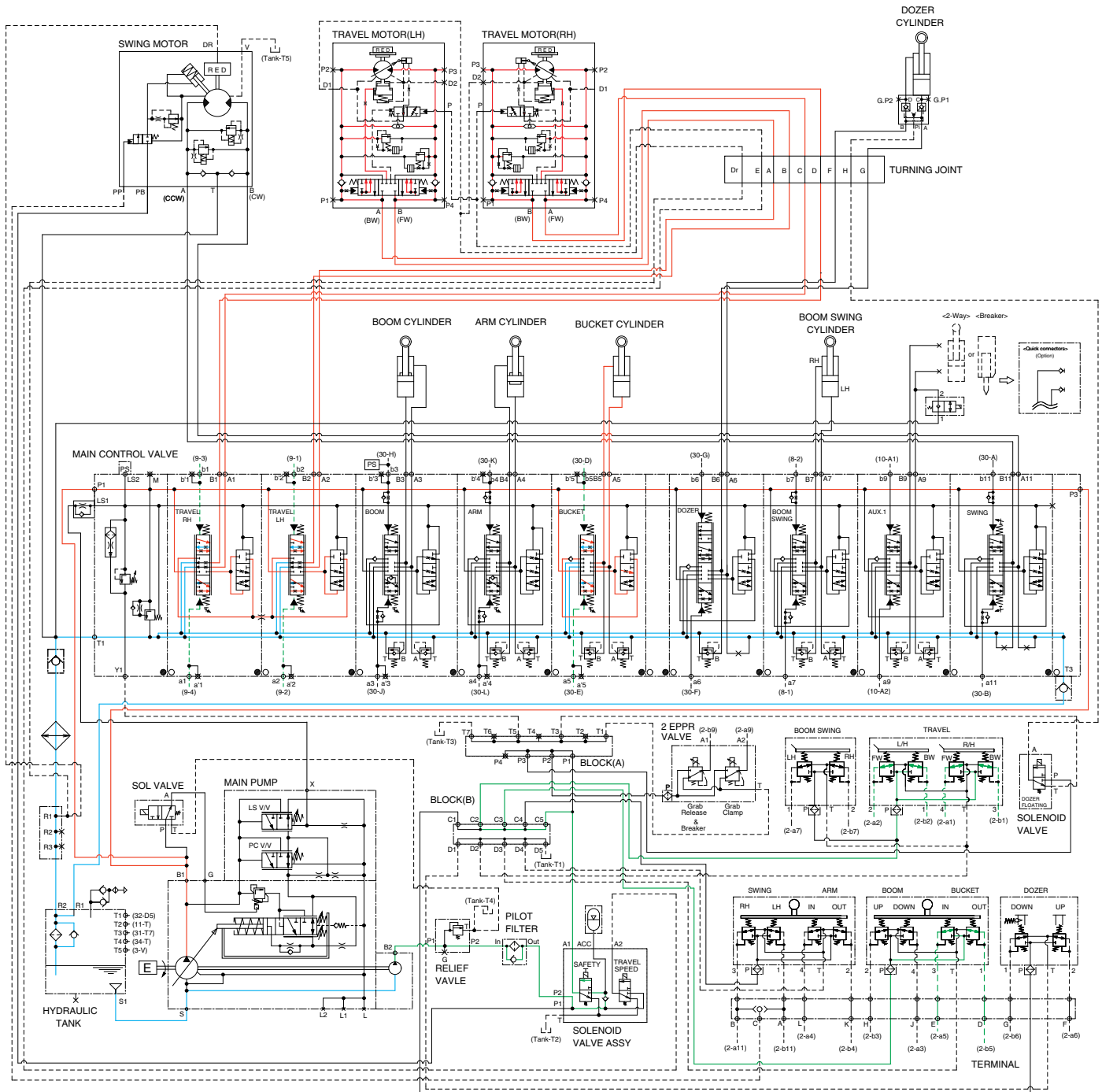
When the arm and travel functions are operated, simultaneously the arm spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the main pump flows into the travel motors and the arm cylinder through travel spools and arm spools via the parallel passage.

The arm is operated and the machine travels straight.



## 9. COMBINED Bucket and Travel Operation



85A3HC38

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. The oil from the main pump flows into the travel motors and the bucket cylinder through the travel spools and the bucket spool via the parallel passage. The bucket is operated and the machine travels straight.