

PART NO. TODCR-EN-00

HITACHI

Reliable solutions

Technical Manual

Operational Principle

ZX220LC-GI

Hydraulic Excavator

ZX220LC-GI HYDRAULIC EXCAVATOR TECHNICAL MANUAL OPERATIONAL PRINCIPLE

 **Hitachi Construction Machinery Co., Ltd.**

URL:<http://www.hitachi-c-m.com>

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TODCR-EN-00

Service Manual consists of the following separate Part No.
Technical Manual (Operational Principle) : Vol. No.TODCR-EN
Technical Manual (Troubleshooting) : Vol. No.TTDCR-EN
Workshop Manual : Vol. No.WDCR-EN

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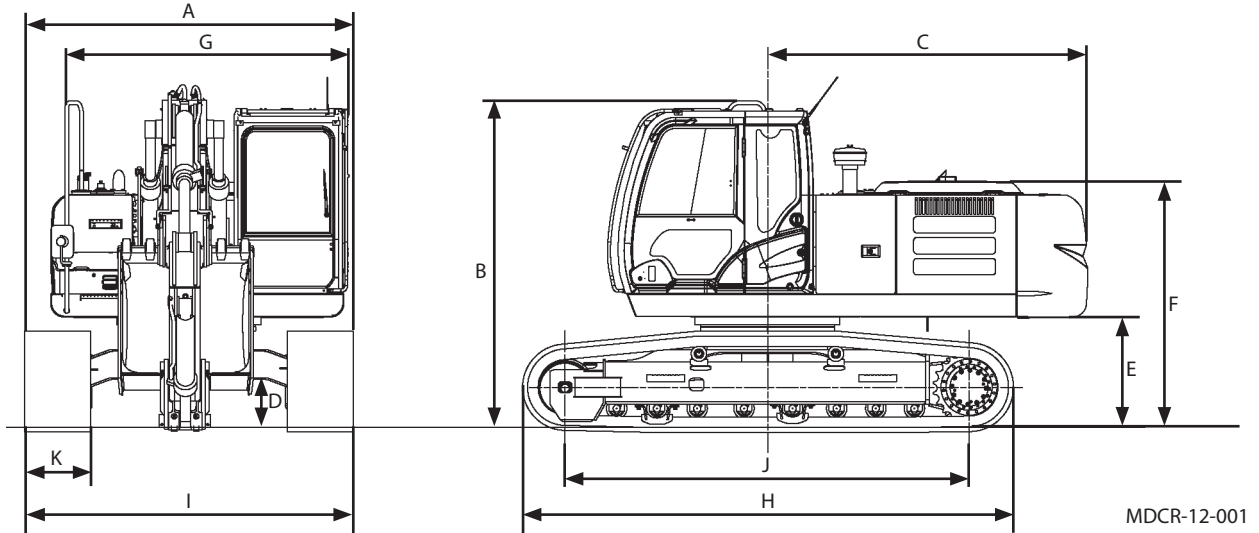
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SECTION 1 GENERAL

Group 1 Specification

Specifications

ZX220LC-GI



MDCR-12-001

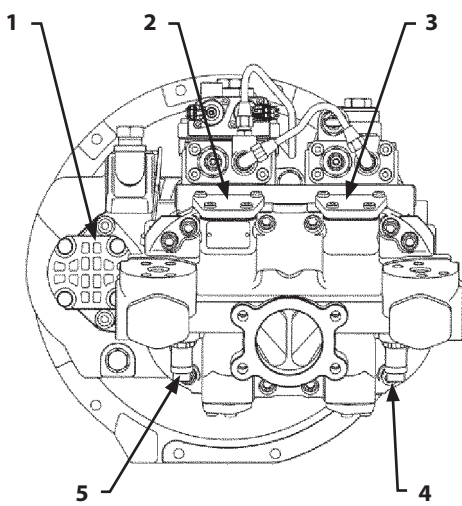
Model		ZX220LC-GI	
Type of Front-End Attachment	-	2.42 m Arm	2.91 m Arm
Bucket Capacity (Heaped)	m ³	PCSA 1.00 m ³ (1.31 yd ³), CECE 0.85 m ³	PCSA 0.90 m ³ (1.18 yd ³), CECE 0.78 m ³
Operating Weight	kg	21200	21400
Base Machine Weight	kg	16500	16500
Engine	-	ISUZU CC-6BG1T 125 kW/2100 min ⁻¹ (170 PS/2100 rpm)	
A: Overall Width (Excluding back mirrors)	mm	2990	
B: Cab Height	mm	2940	
C: Rear End Swing Radius	mm	2910	
D: Minimum Ground Clearance	mm	*450	
E: Counterweight Clearance	mm	*1020	
F: Engine Cover Height	mm	*2240	
G: Overall Width of Upperstructure	mm	2710	
H: Undercarriage Length	mm	4460	
I: Undercarriage Width	mm	2990	
J: Sprocket Center to Idle Center	mm	3660	
K: Track Shoe Width	mm	600 (Grouser shoe)	
Ground Pressure	kPa(kgf/cm ²)	44(0.45)	44(0.45)
Swing Speed	min ⁻¹ (rpm)	13.3 (13.3)	
Travel Speed (fast/slow)	km/h	5.5/3.6	
Gradeability	Degree (%)	35(70)	

*The dimensions do not include the height of the shoe lug.

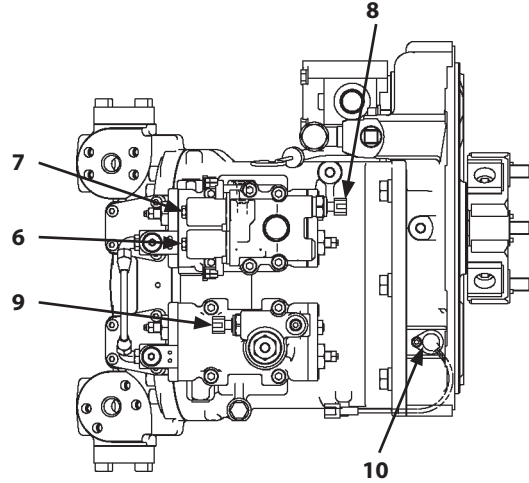
SECTION 1 GENERAL

Group 2 Component Layout

Pump Device



T1V1-01-02-032



TDCD-03-01-004

- | | | |
|------------------------------------|--|-----------------------------------|
| 1- Pilot Pump | 5- Pump 2 Delivery Pressure Sensor | 8- Pump 2 Control Pressure Sensor |
| 2- Pump 2 | 6- Torque Control Solenoid Valve | 9- Pump 1 Control Pressure Sensor |
| 3- Pump 1 | 7- Maximum Pump 2 Flow Rate Limit Control Solenoid Valve | 10- N Sensor |
| 4- Pump 1 Delivery Pressure Sensor | | |

SECTION 1 GENERAL

Group 3 Component Specifications

IMPORTANT: This list shows design specifications, which are not servicing standards.

PERFORMANCE	Fuel Consumption Ratio	240 g/kW/h (177 g/PS·h) at $125^{+1.5}_{-4.4}$ kW / (at Full Load: 2100 min ⁻¹)
		230 g/kW/h (169 g/PS·h) at $118^{+8.6}_{-1}$ kW / (at Working Load: 2000 min ⁻¹)
	Maximum Output Torque	637^{+55}_{-65} N·m ($65^{+5.6}_{-6.6}$ kgf·m) at approx. 1800 min ⁻¹
	Compression Pressure	3.04 MPa (31 kgf/cm ²) at 200 min ⁻¹
	Valve Clearance (Inlet / Exhaust)	0.4 / 0.4 mm (when cool)
	No Load Speed	Slow: (at Full Load: 950±20 min ⁻¹)
		Fast: (at Full Load: 2390 ⁺²⁰ ₋₅₀ min ⁻¹)
Fast: (at Working Load: 2300±50 min ⁻¹)		

SECTION 2

SYSTEM

CONTENTS

Group 1 Controller

Outline	T2-1-1
CAN (Network Provided for Machine)	T2-1-2

Group 2 Control System

Outline	T2-2-1
Engine Control	T2-2-4
Pump Control	T2-2-26
Valve Control	T2-2-36
Other Control	T2-2-48

Group 3 Hydraulic System

Outline	T2-3-1
Pilot Circuit	T2-3-2
Main Circuit	T2-3-12

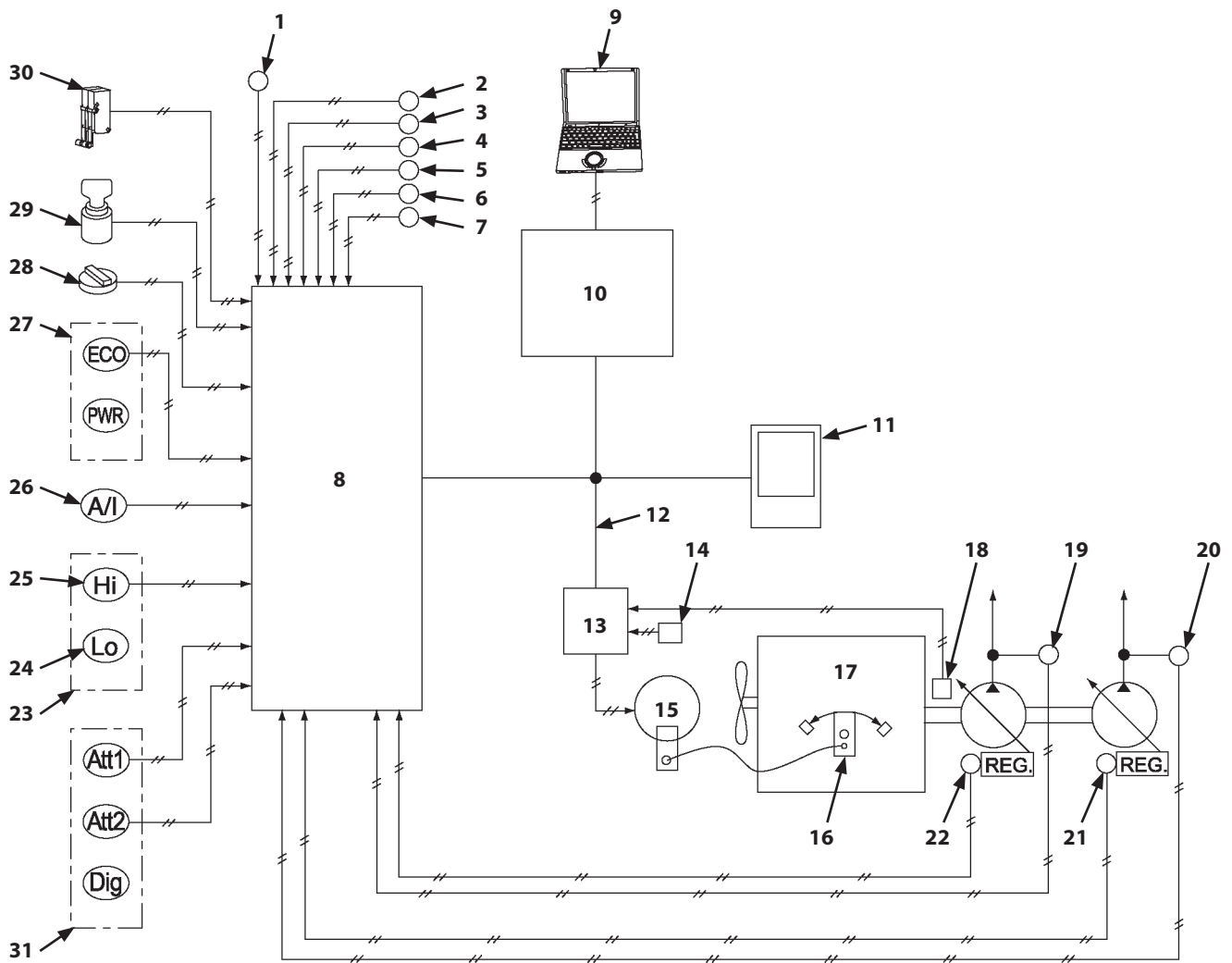
Group 4 Electrical System

Outline	T2-4-1
Main Circuit	T2-4-2
Electric Power Circuit (Key Switch: OFF)	T2-4-4
CAN Circuit	T2-4-6
Accessory Circuit	T2-4-8
Preheating Circuit (Key Switch: ON, START)	T2-4-10
Starting Circuit (Key Switch: START)	T2-4-12
Charging Circuit (Key Switch: ON)	T2-4-16
Surge Voltage Prevention Circuit	T2-4-20
Pilot Shut-Off Circuit (Key switch: ON)	T2-4-22
Engine Stop Circuit	T2-4-24
Accessory Circuit	T2-4-27
Work Light Circuit	T2-4-28
Wiper/Washer Circuit	T2-4-30
Cab Light Circuit	T2-4-32

SECTION 2 SYSTEM

Group 2 Control System

Engine Control System Layout

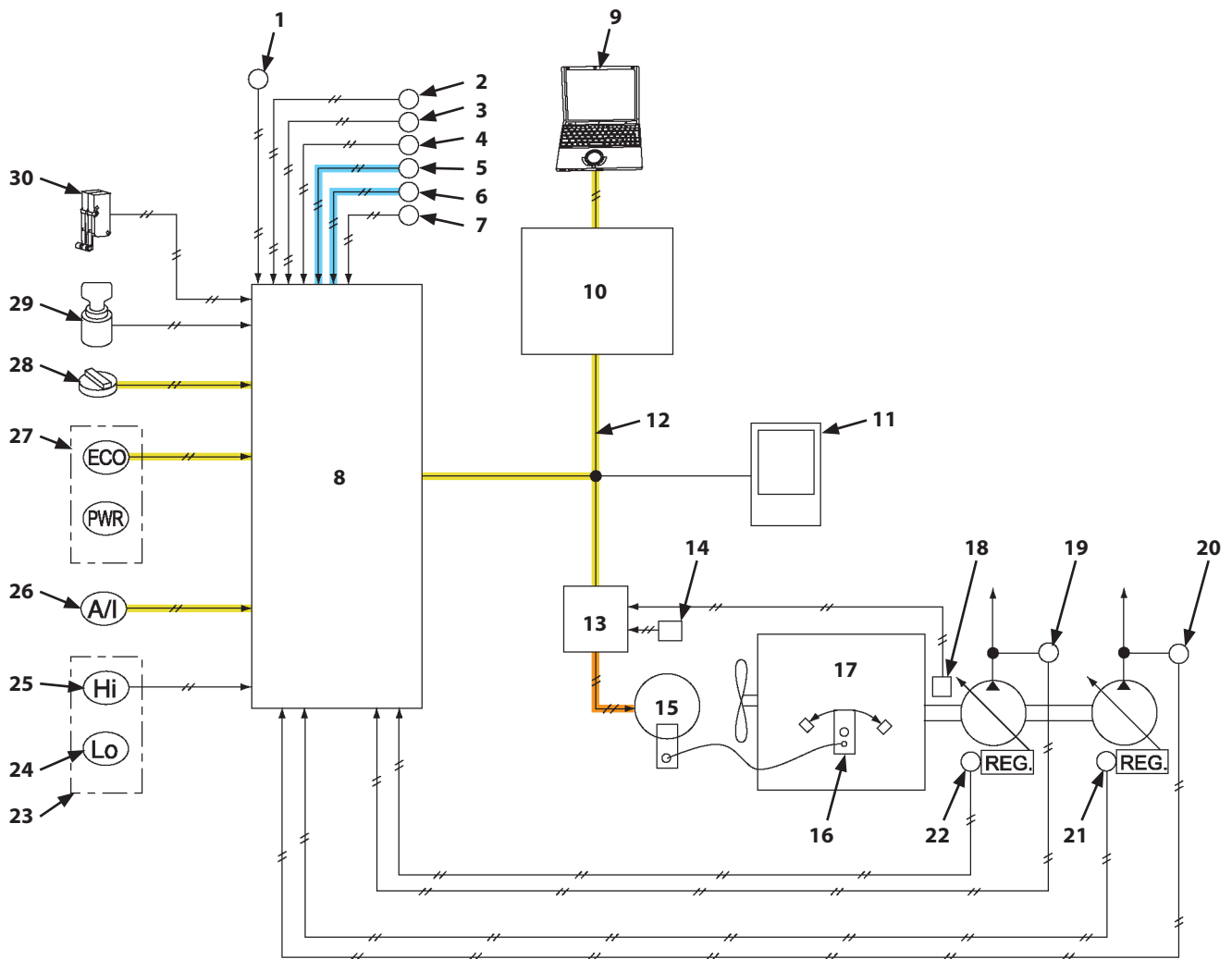


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|---------------------------------------|----------------------------|-------------------------------------|-----------------------------|
| 1- Hydraulic Oil Temperature Sensor | 8- MC | 18- N Sensor | 24- Slow Speed Position |
| 2- Pressure Sensor (Boom Raise) | 9- MPDr. | 19- Pump 2 Delivery Pressure Sensor | 25- Fast Speed Position |
| 3- Pressure Sensor (Arm Roll-In) | 10- Information Controller | 20- Pump 1 Delivery Pressure Sensor | 26- Auto-Idle Switch |
| 4- Pressure Sensor (Swing) | 11- Monitor | 21- Pump 1 Control Pressure Sensor | 27- Power Mode Switch |
| 5- Pressure Sensor (Travel) | 12- CAN | 22- Pump 2 Control Pressure Sensor | 28- EC Dial |
| 6- Pressure Sensor (Front Attachment) | 13- ECF | 23- Travel Mode Switch | 29- Key Switch |
| 7- Pressure Sensor (Auxiliary 1) (OP) | 14- EC Sensor | | 30- Pilot Shut-Off Switch |
| | 15- EC Motor | | 31- Work Mode Select Switch |
| | 16- Governor Lever | | |
| | 17- Engine | | |

SECTION 2 SYSTEM

Group 2 Control System

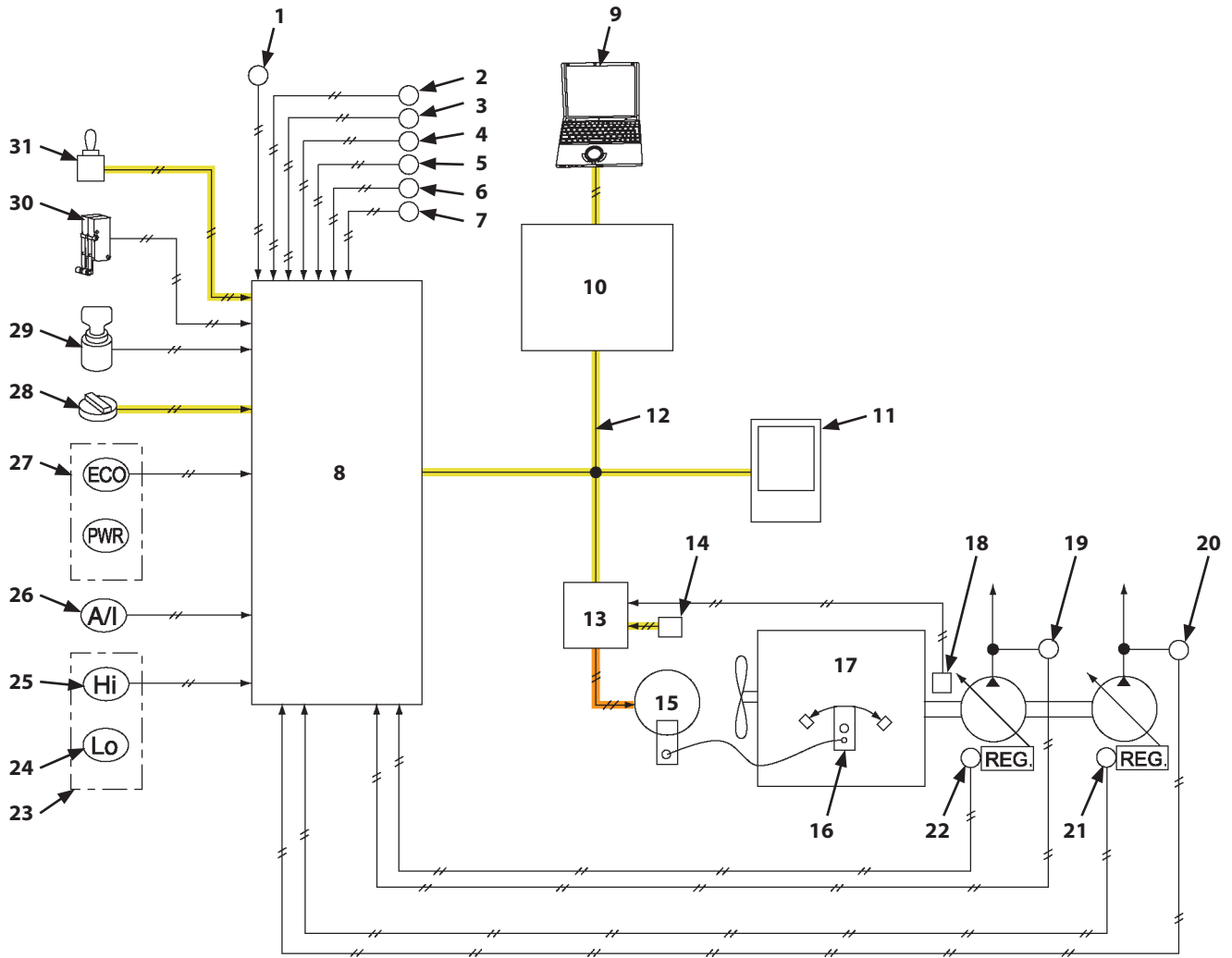


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|---------------------------------------|----------------------------|-------------------------------------|---------------------------|
| 1- Hydraulic Oil Temperature Sensor | 8- MC | 18- N Sensor | 24- Slow Speed Position |
| 2- Pressure Sensor (Boom Raise) | 9- MPDr. | 19- Pump 2 Delivery Pressure Sensor | 25- Fast Speed Position |
| 3- Pressure Sensor (Arm Roll-In) | 10- Information Controller | 20- Pump 1 Delivery Pressure Sensor | 26- Auto-Idle Switch |
| 4- Pressure Sensor (Swing) | 11- Monitor | 21- Pump 1 Control Pressure Sensor | 27- Power Mode Switch |
| 5- Pressure Sensor (Travel) | 12- CAN | 22- Pump 2 Control Pressure Sensor | 28- EC Dial |
| 6- Pressure Sensor (Front Attachment) | 13- ECF | 23- Travel Mode Switch | 29- Key Switch |
| 7- Pressure Sensor (Auxiliary 1) (OP) | 14- EC Sensor | | 30- Pilot Shut-Off Switch |
| | 15- EC Motor | | |
| | 16- Governor Lever | | |
| | 17- Engine | | |

SECTION 2 SYSTEM

Group 2 Control System

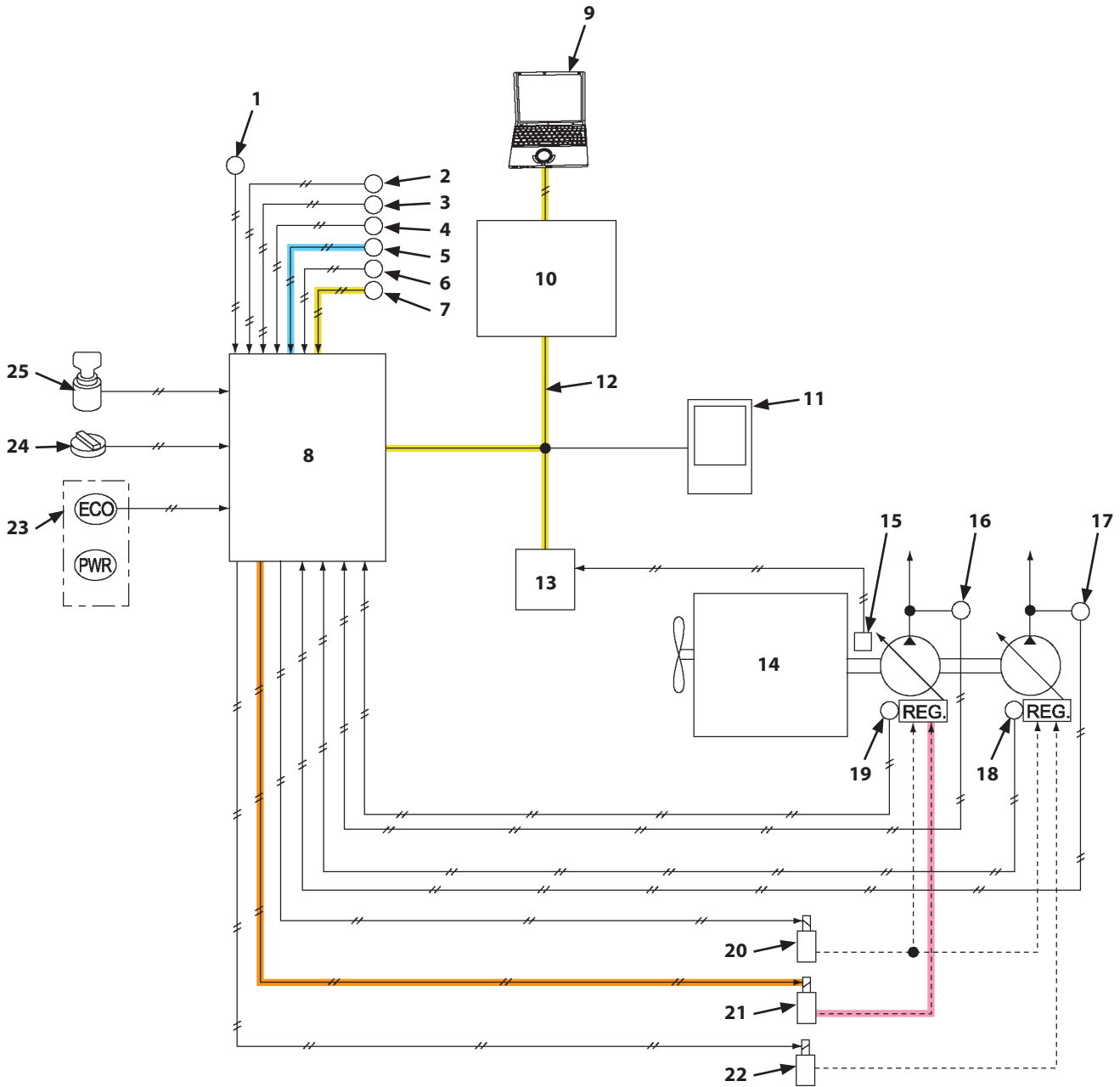


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|---------------------------------------|----------------------------|-------------------------------------|---------------------------|
| 1- Hydraulic Oil Temperature Sensor | 8- MC | 18- N Sensor | 24- Slow Speed Position |
| 2- Pressure Sensor (Boom Raise) | 9- MPDr. | 19- Pump 2 Delivery Pressure Sensor | 25- Fast Speed Position |
| 3- Pressure Sensor (Arm Roll-In) | 10- Information Controller | 20- Pump 1 Delivery Pressure Sensor | 26- Auto-Idle Switch |
| 4- Pressure Sensor (Swing) | 11- Monitor | | 27- Power Mode Switch |
| 5- Pressure Sensor (Travel) | 12- CAN | | 28- EC Dial |
| 6- Pressure Sensor (Front Attachment) | 13- ECF | 21- Pump 1 Control Pressure Sensor | 29- Key Switch |
| 7- Pressure Sensor (Auxiliary 1) (OP) | 14- EC Sensor | 22- Pump 2 Control Pressure Sensor | 30- Pilot Shut-Off Switch |
| | 15- EC Motor | 23- Travel Mode Switch | 31- Learning Switch |
| | 16- Governor Lever | | |
| | 17- Engine | | |

SECTION 2 SYSTEM

Group 2 Control System

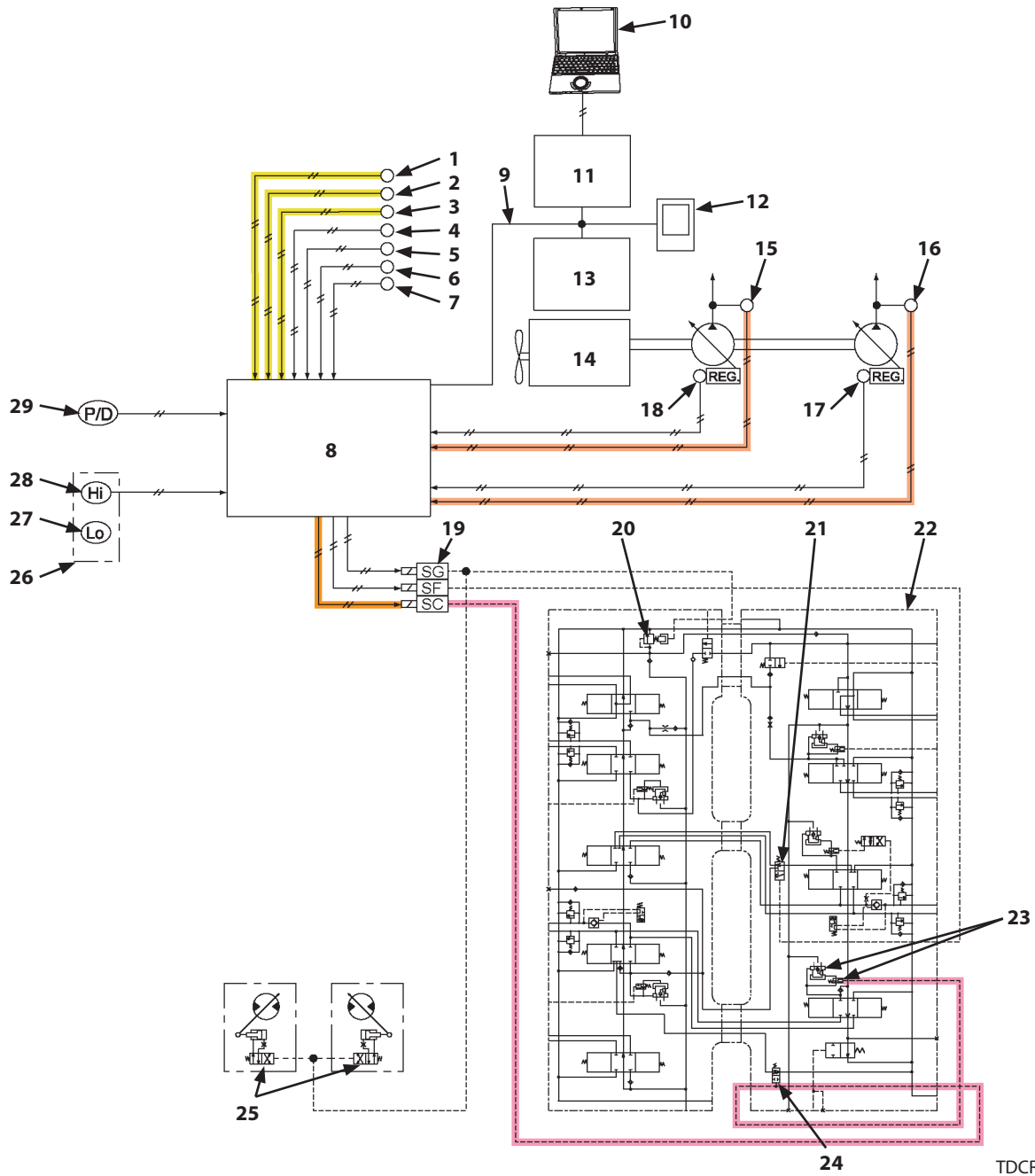


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|---------------------------------------|---------------------------------------|-------------------------------------|--|
| 1- Hydraulic Oil Temperature Sensor | 7- Pressure Sensor (Auxiliary 1) (OP) | 15- N Sensor | 20- Torque Control Solenoid Valve |
| 2- Pressure Sensor (Boom Raise) | 8- MC | 16- Pump 2 Delivery Pressure Sensor | 21- Maximum Pump 2 Flow Rate Limit Control Solenoid Valve |
| 3- Pressure Sensor (Arm Roll-In) | 9- MPDR | 17- Pump 1 Delivery Pressure Sensor | 22- Maximum Pump 1 Flow Rate Limit Control Solenoid Valve (OP) |
| 4- Pressure Sensor (Swing) | 10- Information Controller | 18- Pump 1 Control Pressure Sensor | 23- Power Mode Switch |
| 5- Pressure Sensor (Travel) | 11- Monitor | 19- Pump 2 Control Pressure Sensor | 24- EC Dial |
| 6- Pressure Sensor (Front Attachment) | 12- CAN | | 25- Key Switch |
| | 13- ECF | | |
| | 14- Engine | | |

SECTION 2 SYSTEM

Group 2 Control System

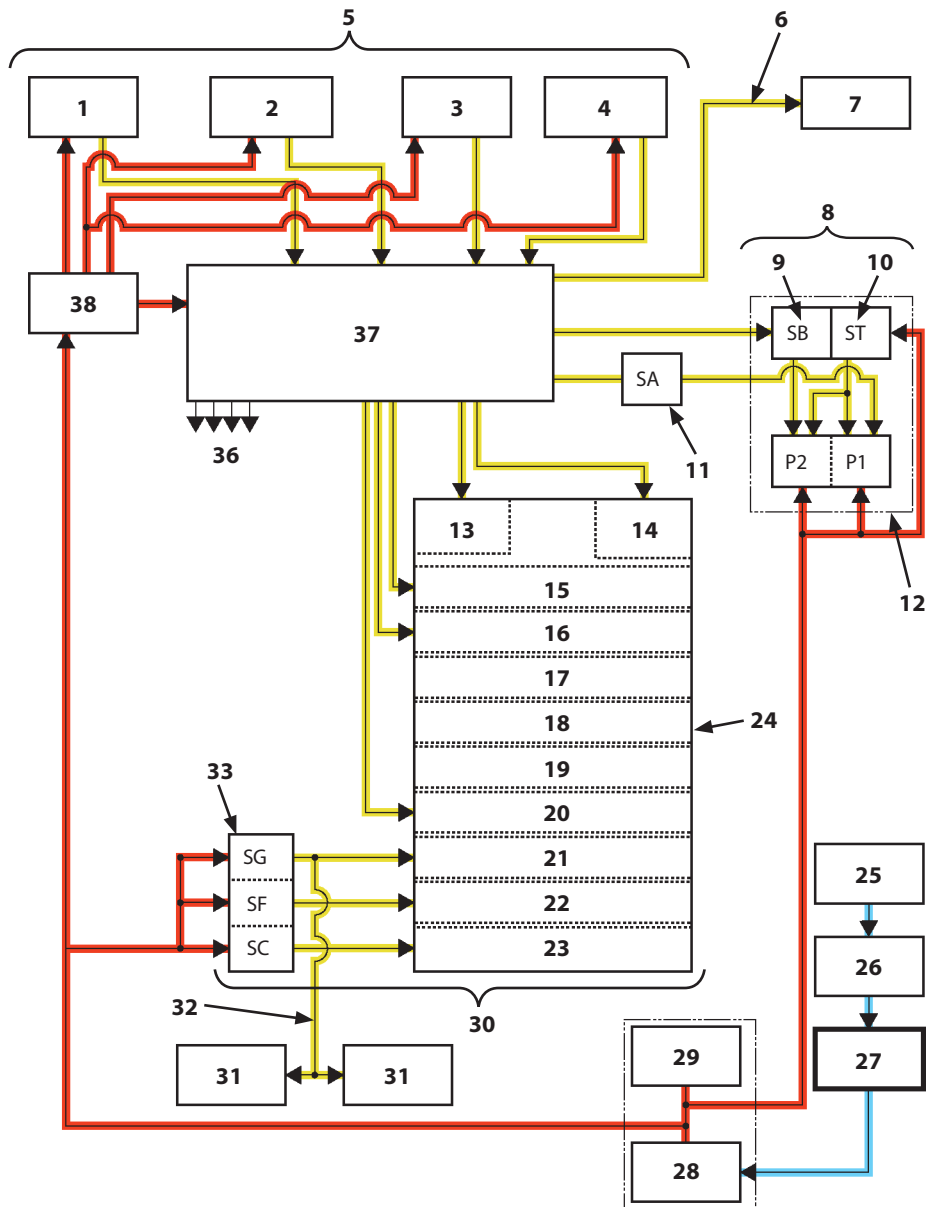


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|--|-------------------------------------|-------------------------------------|---|
| 1- Pressure Sensor (Boom Raise) | 8- MC | 16- Pump 1 Delivery Pressure Sensor | 23- Arm 2 Flow Rate Control Valve |
| 2- Pressure Sensor (Arm Roll-In) | 9- CAN | 17- Pump 1 Control Pressure Sensor | 24- Arm Regenerative Valve |
| 3- Pressure Sensor (Swing) | 10- MPDr. | 18- Pump 2 Control Pressure Sensor | 25- Travel Motor Displacement Angle Control Valve |
| 4- Pressure Sensor (Travel) | 11- Information Controller | 19- Solenoid Valve Unit | 26- Travel Mode Switch |
| 5- Pressure Sensor (Front Attachment) | 12- Monitor | 20- Main Relief Valve | 27- Slow Speed Position |
| 6- Pressure Sensor (Auxiliary 1) (OP) | 13- ECF | 21- Digging Regenerative Valve | 28- Fast Speed Position |
| 7- Pressure Sensor (Arm Roll-Out) (OP) | 14- Engine | 22- Control Valve | 29- Power Digging Switch |
| | 15- Pump 2 Delivery Pressure Sensor | | |

SECTION 2 SYSTEM

Group 3 Hydraulic System

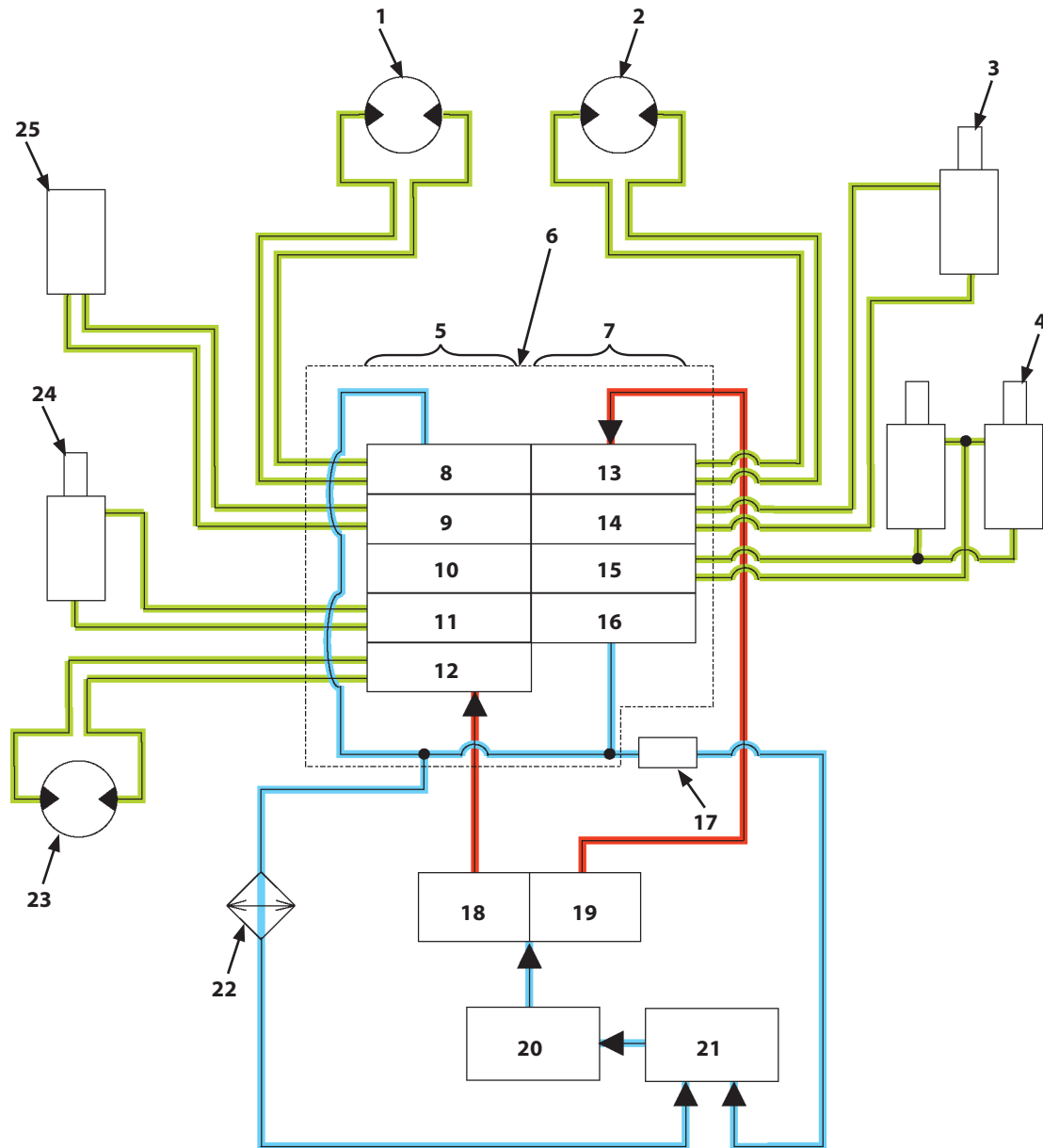


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|--|------------------------------------|-----------------------------------|-----------------------------------|
| 1- Pilot Valve (Left) | 10- Torque Control Solenoid Valve | 19- Unused | 29- Pilot Relief Valve |
| 2- Travel Pilot Valve | 11- Pump 1 Maximum Flow Rate | 20- Arm 1 Flow Rate Control Valve | 30- Valve Control Circuit |
| 3- Pilot Valve (Right) | Limit Control Solenoid Valve (OP) | 21- Main Relief Valve | 31- Travel Motor |
| 4- Auxiliary Pilot Valve | | 22- Digging Regenerative Valve | 32- Travel Motor Displacement |
| 5- Operation Control Circuit | | 23- Arm Regenerative Valve, Arm 2 | Angle Control Circuit |
| 6- Swing Parking Brake Release Circuit | 12- Regulator | Flow Rate Control Valve | 33- Solenoid Valve Unit |
| 7- Swing Motor | 13- Flow Combiner Valve | 24- Control Valve | 36- To Control Valve Spool |
| 8- Pump Control Circuit | 14- Bucket Flow Rate Control Valve | 25- Hydraulic Oil Tank | 37- Signal Control Valve |
| 9- Pump 2 Maximum Flow Rate Limit Control Solenoid Valve | 15- Boom Anti-Drift Valve | 26- Suction Filter | 38- Pilot Shut-Off Solenoid Valve |
| | 16- Arm Anti-Drift Valve | 27- Pilot Pump | |
| | 17- Unused | 28- Pilot Filter | |
| | 18- Bypass Shut-Out Valve | | |

SECTION 2 SYSTEM

Group 3 Hydraulic System

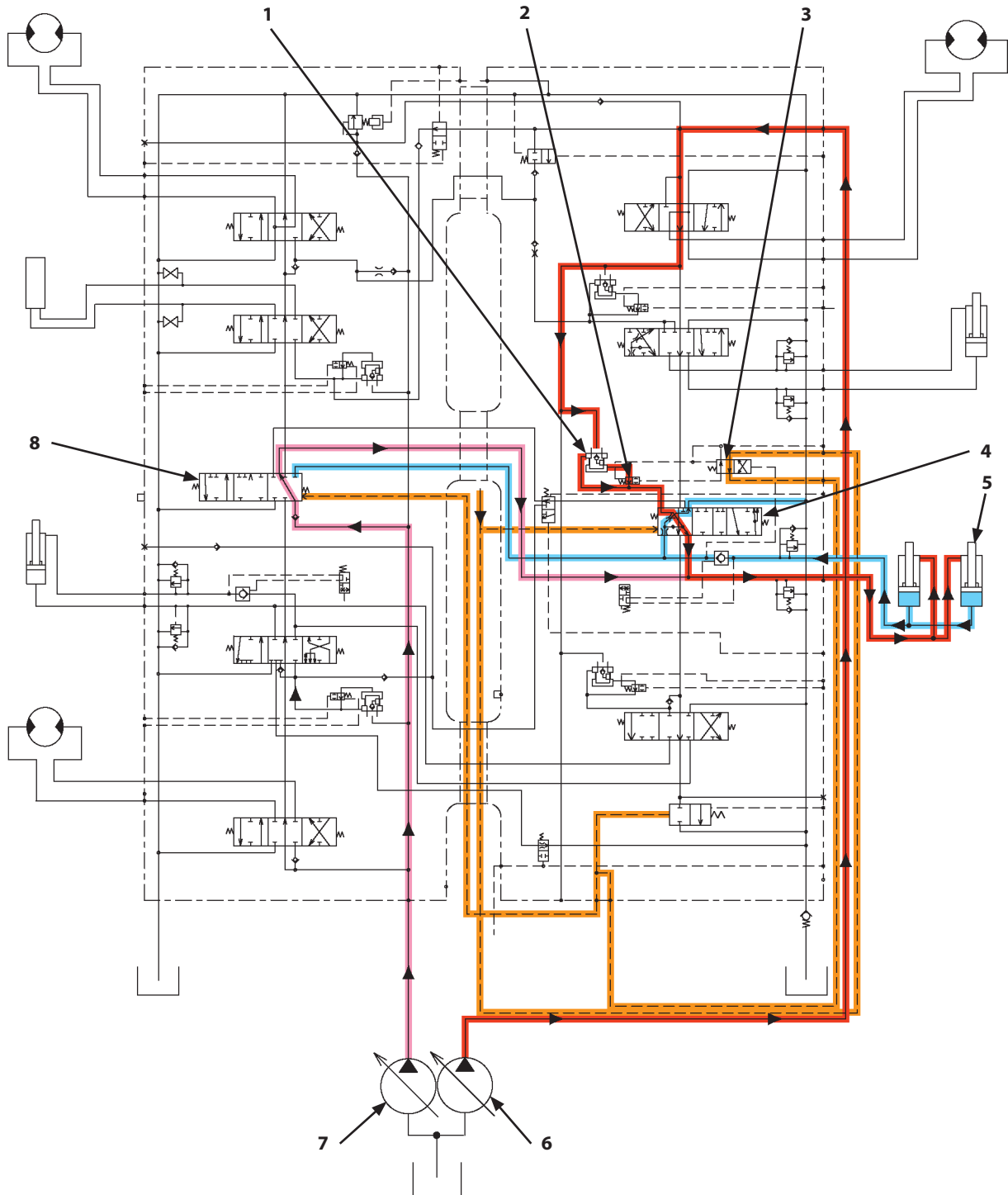


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|-------------------------|--------------------------|------------------------|------------------|
| 1- Travel Motor (Left) | 8- Travel (Left) Spool | 15- Boom 1 Spool | 22- Oil Cooler |
| 2- Travel Motor (Right) | 9- Auxiliary Spool | 16- Arm 2 Spool | 23- Swing Motor |
| 3- Bucket Cylinder | 10- Boom 2 Spool | 17- Bypass Check Valve | 24- Arm Cylinder |
| 4- Boom Cylinder | 11- Arm 1 Spool | 18- Pump 2 | 25- Attachments |
| 5- 5-Spool Side | 12- Swing Spool | 19- Pump 1 | |
| 6- Control Valve | 13- Travel (Right) Spool | 20- Suction Filter | |
| 7- 4-Spool Side | 14- Bucket Spool | 21- Hydraulic Oil Tank | |

SECTION 2 SYSTEM

Group 3 Hydraulic System

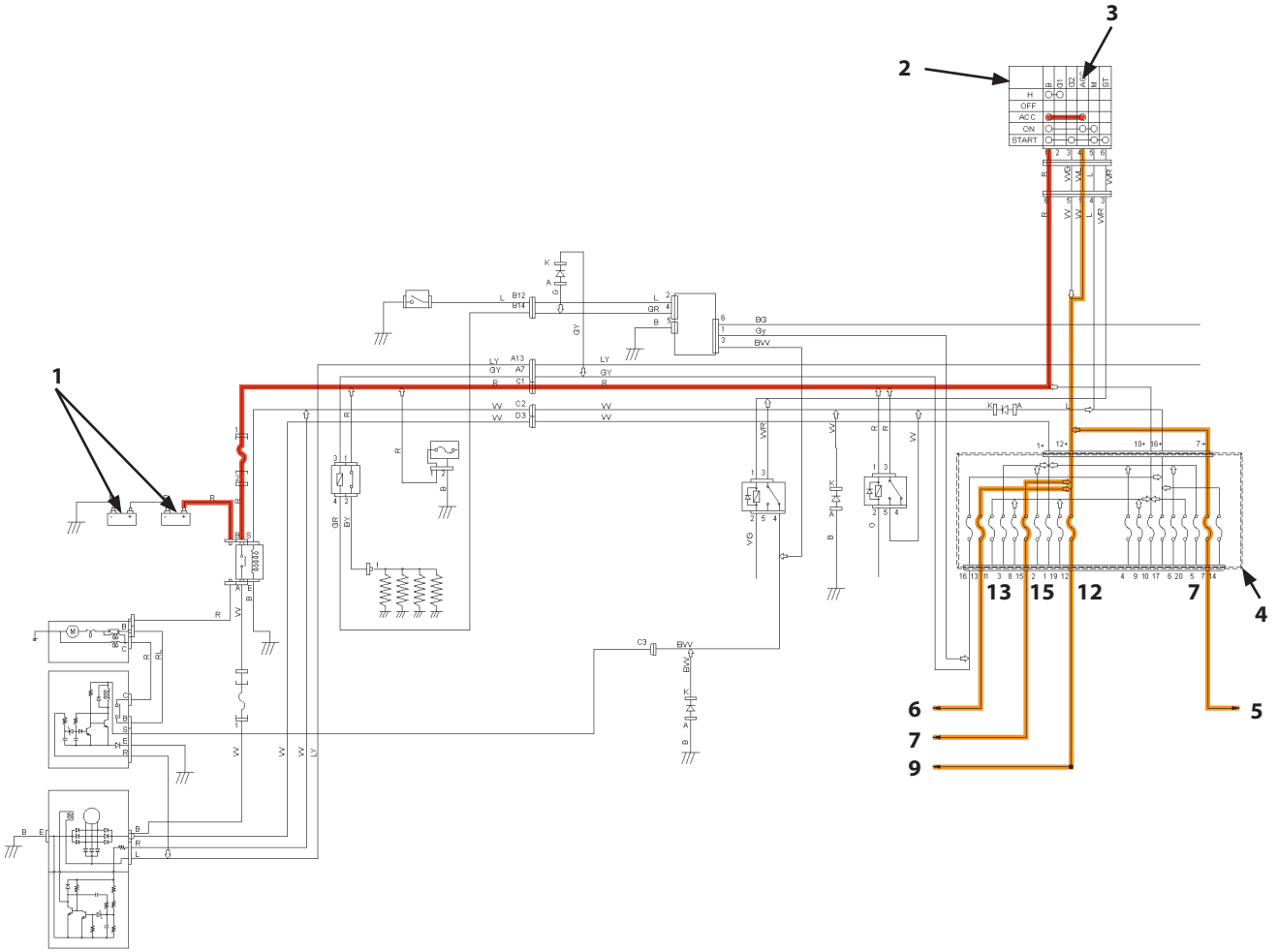


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- | | | |
|--|----------------------------------|-----------------|
| 1- Boom Flow Rate Control Valve (Poppet Valve) | 3- Boom Lower Meter-In Cut Valve | 6- Pump 1 |
| 2- Boom Flow Rate Control Valve (Switch Valve) | 4- Boom 1 Spool | 7- Pump 2 |
| | 5- Boom Cylinder | 8- Boom 2 Spool |

SECTION 2 SYSTEM

Group 4 Electrical System



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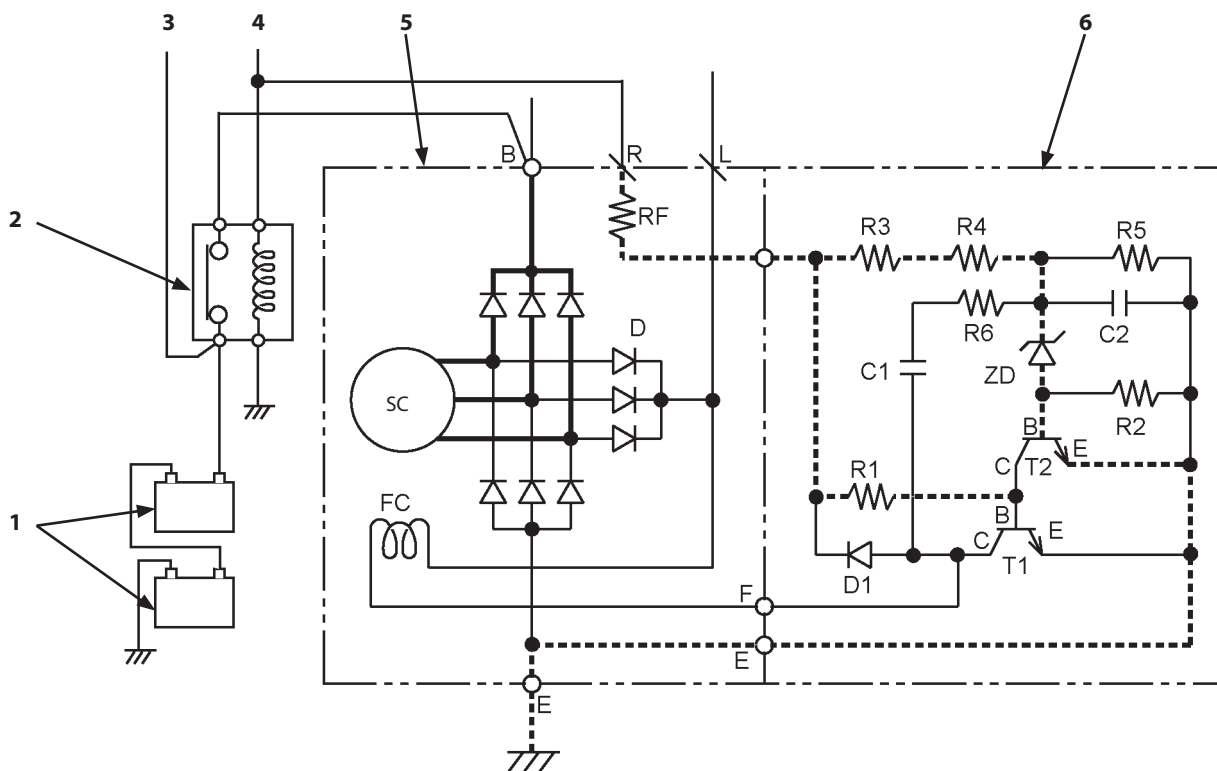
- 1- Battery
- 2- Key Switch
- 3- Terminal ACC
- 4- Fuse Box
- 5- Cab Light
- 6- Cigar Lighter
- 7- Auxiliary
- 9- Radio

SECTION 2 SYSTEM

Group 4 Electrical System

Regulator (6) Operation

- When generating voltage increases more than the set voltage of Zener diode ZD, current flows to base B of transistor T2 and collector C is connected to emitter E.
 - Current flowing to base B of transistor T1 disappears due to transistor T2 operation so that transistor T1 is turned OFF.
 - No current flows through field coil FC and generating voltage at stator coil SC decreases.
 - When generating voltage decreases lower than the set voltage of Zener diode ZD, transistor T2 is turned OFF and transistor T1 is turned ON again.
 - Current flows through field coil FC and generating voltage at stator coil SC increases.
- The above operation is repeated so that alternator (5) generating voltage is kept constant.



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- | | | |
|------------------|-------------------------------|---------------|
| 1- Battery | 3- To Key Switch Terminal B | 5- Alternator |
| 2- Battery Relay | 4- From Key Switch Terminal M | 6- Regulator |

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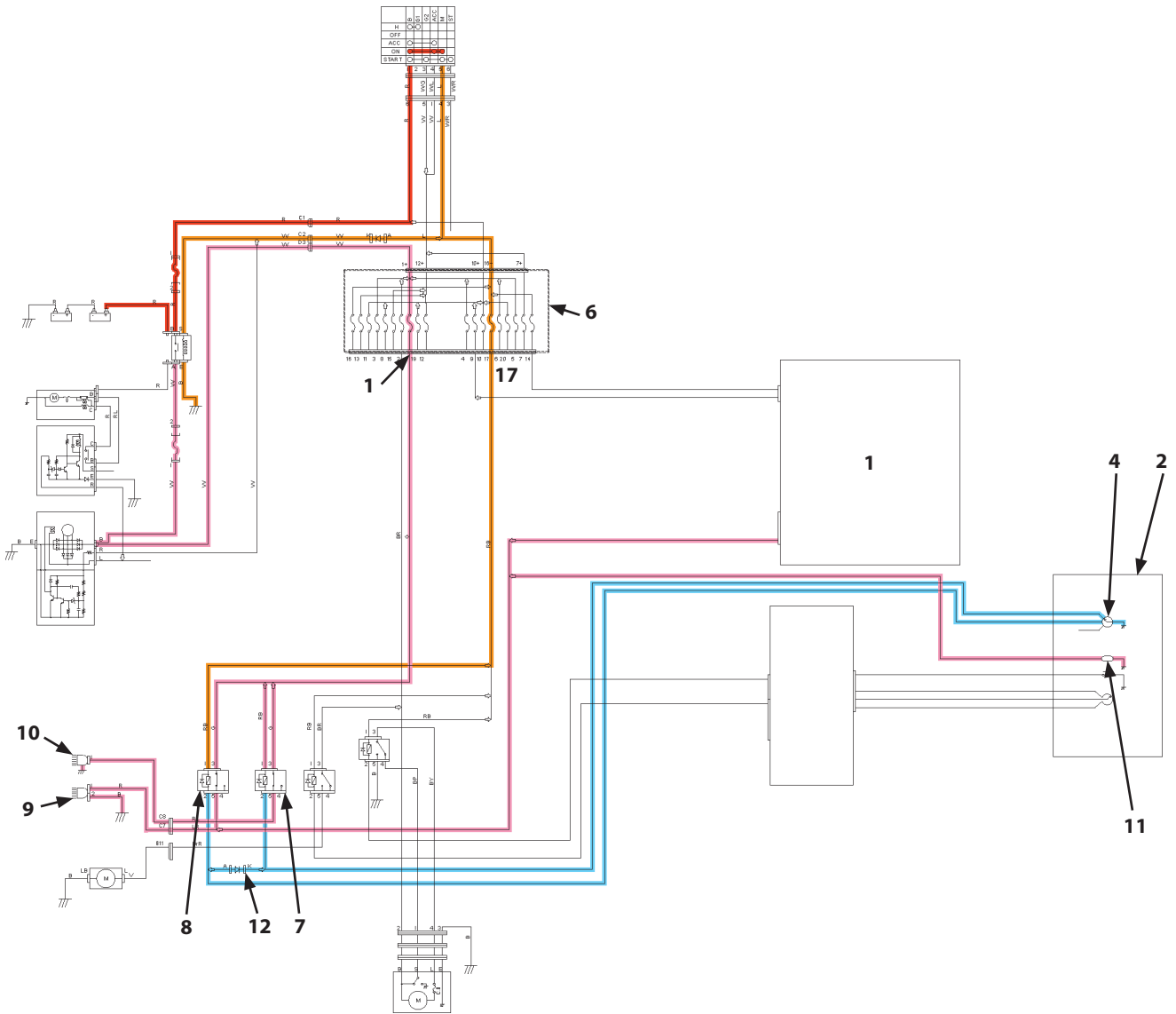


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SECTION 2 SYSTEM

Group 4 Electrical System



TDCR-02-04-010

- | | | | |
|----------------------|-----------------------|--------------------|-----------|
| 1- Monitor | 6- Fuse Box | 9- Work Light | 12- Diode |
| 2- Switch Panel | 7- Work Light Relay 2 | 10- Boom Light | |
| 4- Work Light Switch | 8- Work Light Relay 1 | 11- Interior Light | |

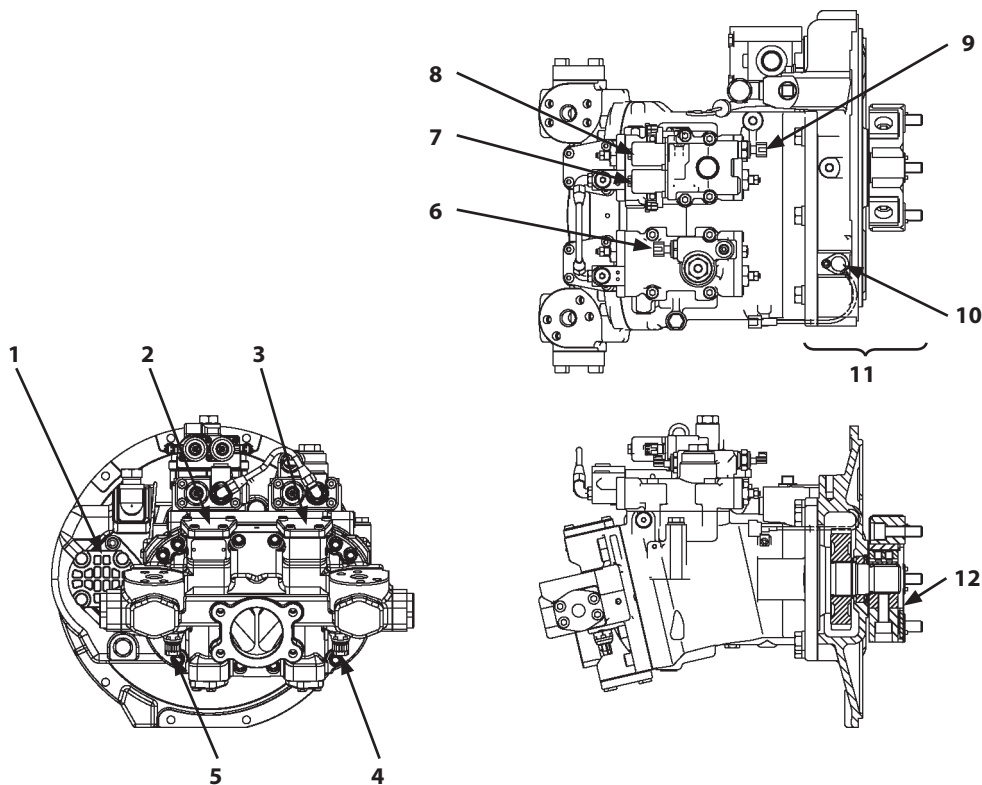
SECTION 3 COMPONENT OPERATION

Group 1 Pump Device

Outline

The pump device consists of transmission (11), main pump (pump 1 (3), pump 2 (2)), and pilot pump (1). The engine output power is transmitted to transmission (11) via coupling (12). After being distributed by the gear, the engine output power drives pump 1 (3), pump 2 (2), and pilot pump (1).

The main pump is a bent-axis type variable displacement axial plunger pump. Pump 1 (3), and pump 2 (2) are integrated as two units in one housing. Pilot pump (1) is a gear pump. Torque control solenoid valve (7), and maximum pump 2 flow rate limit control solenoid valve (8) are installed in order to control the pump. Pump delivery pressure sensors (4, 5), pump control pressure sensors (6, 9), and N sensor (engine speed sensor) (10) are installed in order to control the engine, pump and valve. (Refer to SYSTEM / Control System.)



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- | | | | |
|------------------------------------|------------------------------------|--|------------------|
| 1- Pilot Pump | 5- Pump 2 Delivery Pressure Sensor | 8- Maximum Pump 2 Flow Rate Limit Control Solenoid Valve | 11- Transmission |
| 2- Pump 2 | 6- Pump 1 Control Pressure Sensor | 9- Pump 2 Control Pressure Sensor | 12- Coupling |
| 3- Pump 1 | 7- Torque Control Solenoid Valve | 10- N Sensor | |
| 4- Pump 1 Delivery Pressure Sensor | | | |

SECTION 3 COMPONENT OPERATION

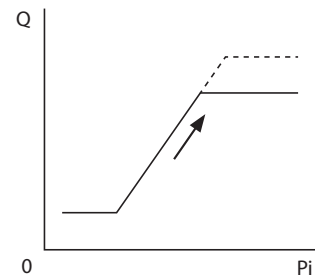
Group 1 Pump Device

- Control by Pilot Pressure from Maximum Pump 2 Flow Rate Limit Control Solenoid Valve (14) (only Pump 2)
 Rate Limit Control Solenoid Valve (14) (only Pump 2)
 When the work mode is set to attachment, MC (main controller) sends the signals to maximum pump 2 flow rate limit control solenoid valve (14) according to the settings.

Maximum pump 2 flow rate limit control solenoid valve (14) reduces pump control pressure P_i in response to the signals from MC.

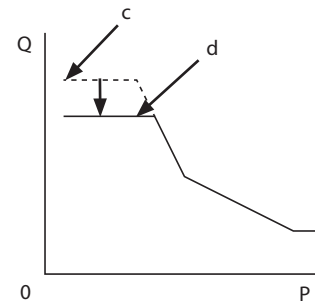
Therefore, the upper limit pump delivery flow rate is limited. (Pump Flow Rate Limit Control)

(Refer to SYSTEM / Control System.)



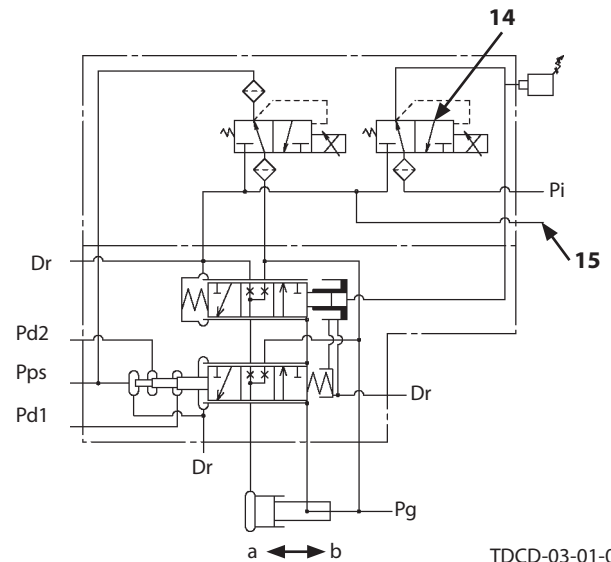
Q- Flow Rate

P_i - Pump Control Pressure



Q- Flow Rate
 P- Pressure

c- Maximum Flow Rate
 d- Upper Limit Flow Rate




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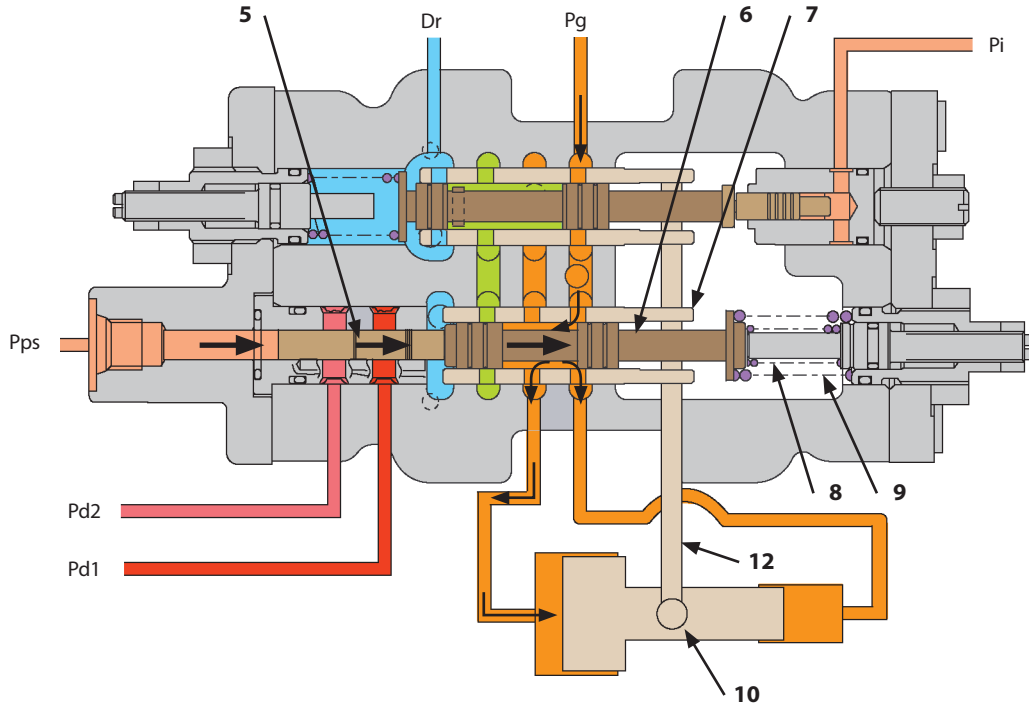
- | | |
|-------------------------------------|--|
| Pd1- Pump 1 Delivery Pressure | Pg- Primary Pilot Pressure (From Pilot Pump) |
| Pd2- Pump 2 Delivery Pressure | a- Displacement Angle Increase |
| Dr- Returning to Hydraulic Oil Tank | b- Displacement Angle Decrease |
| P_i - Pump Control Pressure | |
| Pps- Torque Control Pressure | |

- | | |
|---|--------------------------|
| 14- Maximum Pump 2 Flow Rate Limit Control Solenoid Valve | 15- Air Bleeding Circuit |
|---|--------------------------|

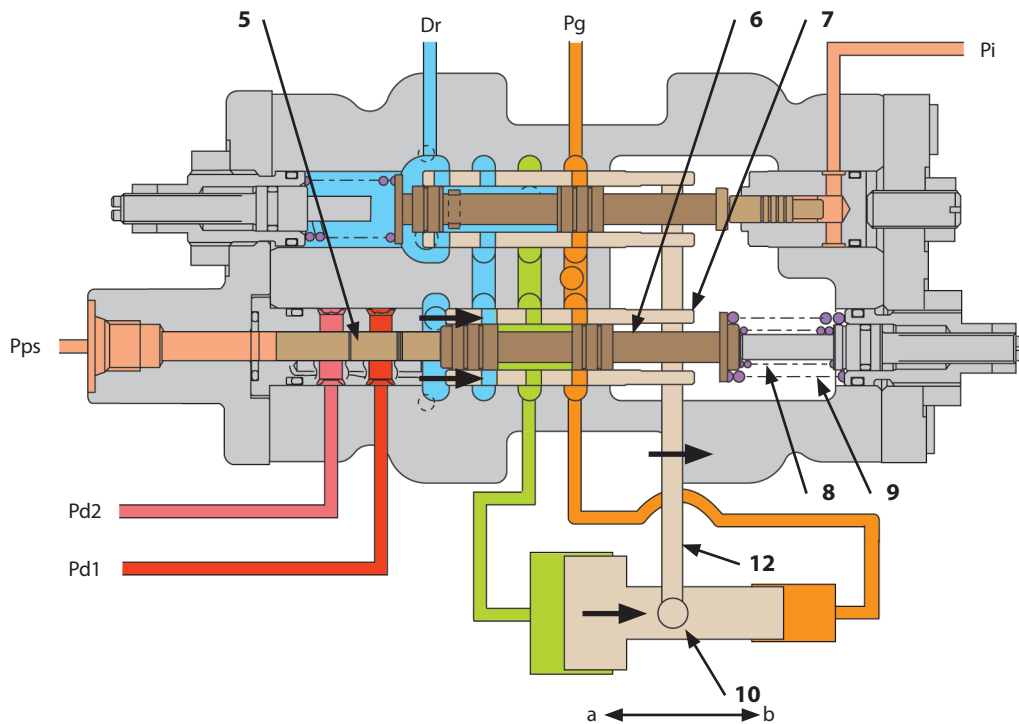
SECTION 3 COMPONENT OPERATION

Group 1 Pump Device

 NOTE: The illustration shows the pump2 regulator.



TDCD-03-01-017



TDCD-03-01-018

Pd1- Pump 1 Delivery Pressure
 Pd2- Pump 2 Delivery Pressure
 5- Load Piston
 6- Spool B

Dr- Returning to Hydraulic Oil Tank
 7- Sleeve B
 8- Inner Spring

Pi- Pump Control Pressure
 Pps- Torque Control Pressure
 9- Outer Spring
 10- Servo Piston

Pg- Primary Pilot Pressure (From Pilot Pump)
 12- Link

SECTION 3 COMPONENT OPERATION

Group 2 Swing Device

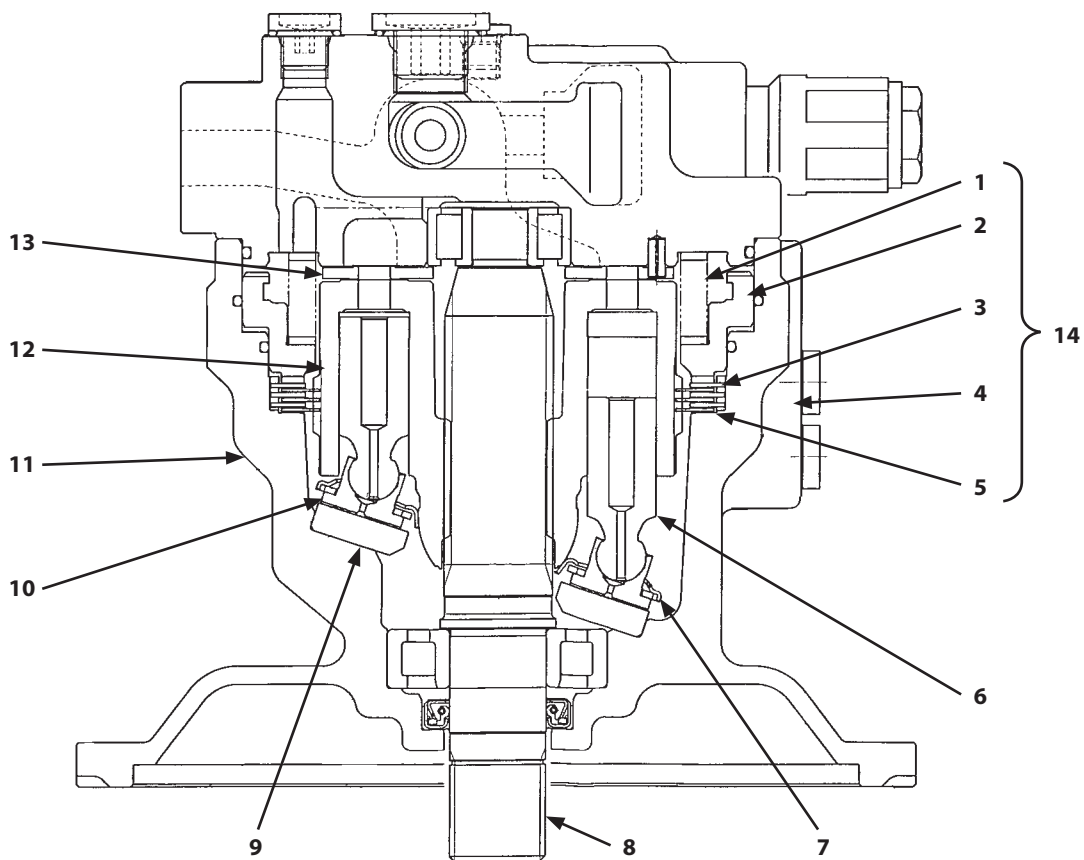
Swing Motor

The swing motor consists of swash plate (9), rotor (12), plunger (6), valve plate (13), housing (11), and swing parking brake (14) (spring (1), brake piston (2), plates (3), friction plates (5), and swing parking brake selection valve (4)).

Shaft (8) is connected to rotor (12) by a spline joint, and plunger (6) is inserted into rotor (12).

When pressure oil is supplied from the pump, plunger (6) is pushed. As swash plate (9) is inclined, shoe (10) on the end of plunger (6) slides along swash plate (9) and rotor (12) rotates.

The end of shaft (8) is connected to the first stage sun gear in the swing reduction gear by a spline joint. Therefore, the rotation of shaft (8) is transmitted to the swing reduction gear.



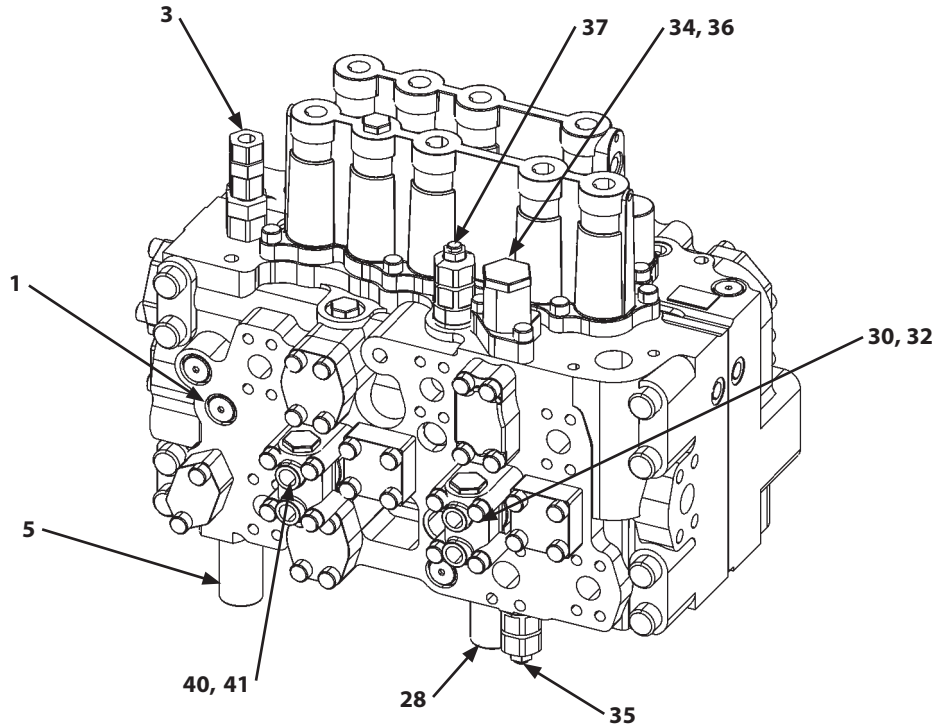
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- | | | |
|--|-------------------|-------------------------|
| 1- Spring | 5- Friction Plate | 10- Shoe |
| 2- Brake Piston | 6- Plunger | 11- Housing |
| 3- Plate | 7- Retainer | 12- Rotor |
| 4- Swing Parking Brake Selection Valve | 8- Shaft | 13- Valve Plate |
| | 9- Swash Plate | 14- Swing Parking Brake |

SECTION 3 COMPONENT OPERATION

Group 3 Control Valve

5-Spool Section



T1V1-03-03-072

a- Machine Upper Side

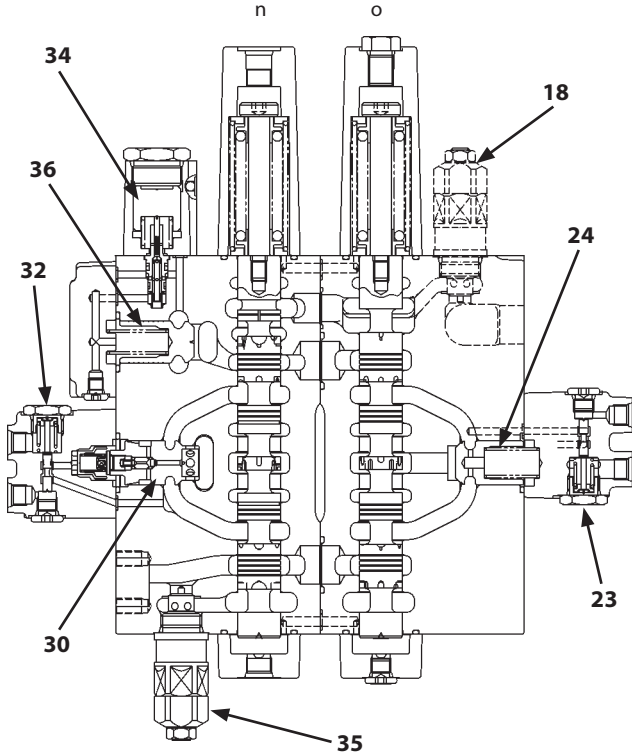
e- Machine Lower Side

- | | | | |
|--|---|---|---|
| 1- Load Check Valve (Travel (Left) Parallel Circuit) | 12- Bucket Regenerative Valve | 22- Boom Anti-Drift Valve (Selector Valve) | 33- Load Check Valve (Arm Regenerative Circuit) |
| 2- Check Valve (Main Relief Circuit) | 13- Overload Relief Valve (Bucket: Rod Side) | 23- Arm 2 Flow Rate Control Valve (Selector Valve) | 34- Arm Anti-Drift Valve (Selector Valve) |
| 3- Main Relief Valves | 14- Overload Relief Valve (Bucket: Bottom Side) | 24- Load Check Valve (Arm 2 Tandem Circuit) | 35- Overload Relief Valve (Arm: Bottom Side) |
| 4- Check Valve (Auxiliary Flow Combiner Circuit) | 15- Boom Flow Rate Control Valve (Poppet Valve) | 25- Bypass Shut-Out Valve | 36- Arm Anti-Drift Valve (Check Valve) |
| 5- Unused | 16- Boom Lower Meter-In Cut Valve | 26- Arm 2 Flow Rate Control Valve (Poppet Valve) | 37- Overload Relief Valve (Arm: Rod Side) |
| 6- Check Valve (Flow Combiner Circuit) | 17- Boom Flow Rate Control Valve (Selector Valve) | 27- Arm Regenerative Valve | 38- Check Valve (Digging Regenerative Circuit) |
| 7- Flow Combiner Valve | 18- Overload Relief Valve (Boom: Bottom Side) | 28- Digging Regenerative Valve | 39- Load Check Valve (Boom 2 Parallel Circuit) |
| 8- Load Check Valve (Orifice) (Bucket) | 19- Boom Anti-Drift Valve (Check Valve) | 29- Load Check Valve (Digging Regenerative Circuit) | 40- Unused |
| 9- Check Valve (Main Relief Circuit) | 20- Overload Relief Valve (Boom: Rod Side) | 30- Arm 1 Flow Rate Control Valve (Poppet Valve) | 41- Unused |
| 10- Bucket Flow Rate Control Valve (Poppet Valve) | 21- Boom Regenerative Valve | 31- Load Check Valve (Swing Circuit) | 42- Load Check Valve (Travel (Left) Tandem Circuit) |
| 11- Bucket Flow Rate Control Valve (Selector Valve) | | 32- Arm 1 Flow Rate Control Valve (Selector Valve) | |

SECTION 3 COMPONENT OPERATION

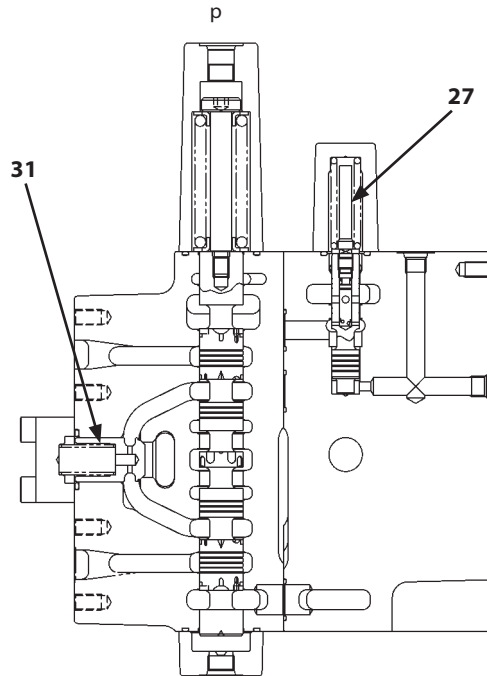
Group 3 Control Valve

Section H-H



T1V1-03-03-008

Section I-I



T1V1-03-03-009

a- Machine Upper Side
e- Machine Lower Side

n- Arm 1
o- Arm 2

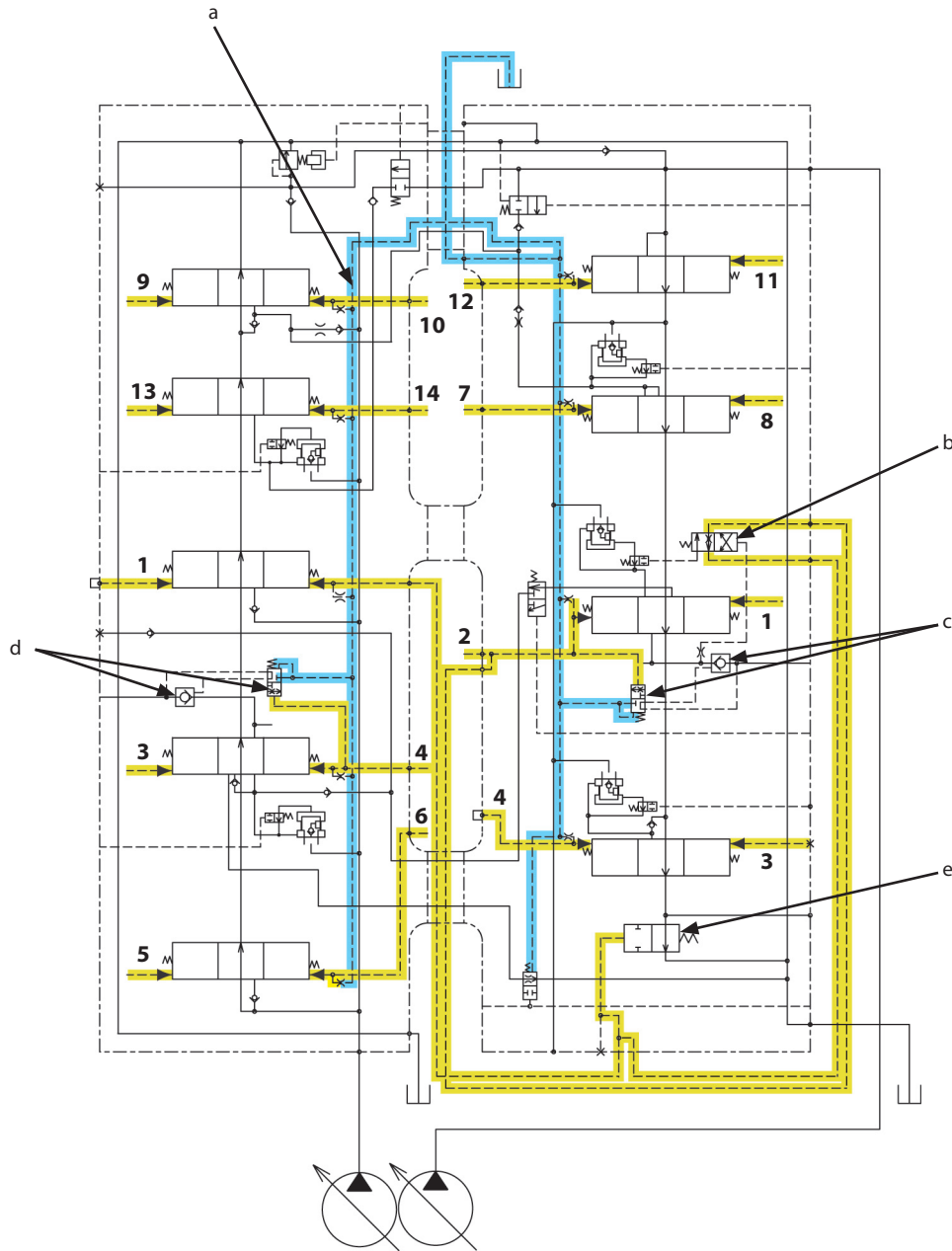
P- Swing

- | | | | |
|--|---|---|---|
| 1- Load Check Valve (Travel (Left) Parallel Circuit) | 12- Bucket Regenerative Valve | 22- Boom Anti-Drift Valve (Selector Valve) | 33- Load Check Valve (Arm Regenerative Circuit) |
| 2- Check Valve (Main Relief Circuit) | 13- Overload Relief Valve (Bucket: Rod Side) | 23- Arm 2 Flow Rate Control Valve (Selector Valve) | 34- Arm Anti-Drift Valve (Selector Valve) |
| 3- Main Relief Valves | 14- Overload Relief Valve (Bucket: Bottom Side) | 24- Load Check Valve (Arm 2 Tandem Circuit) | 35- Overload Relief Valve (Arm: Bottom Side) |
| 4- Check Valve (Auxiliary Flow Combiner Circuit) | 15- Boom Flow Rate Control Valve (Poppet Valve) | 25- Bypass Shut-Out Valve | 36- Arm Anti-Drift Valve (Check Valve) |
| 5- Unused | 16- Boom Lower Meter-In Cut Valve | 26- Arm 2 Flow Rate Control Valve (Poppet Valve) | 37- Overload Relief Valve (Arm: Rod Side) |
| 6- Check Valve (Flow Combiner Circuit) | 17- Boom Flow Rate Control Valve (Selector Valve) | 27- Arm Regenerative Valve | 38- Check Valve (Digging Regenerative Circuit) |
| 7- Flow Combiner Valve | 18- Overload Relief Valve (Boom: Bottom Side) | 28- Digging Regenerative Valve | 39- Load Check Valve (Boom 2 Parallel Circuit) |
| 8- Load Check Valve (Orifice) (Bucket) | 19- Boom Anti-Drift Valve (Check Valve) | 29- Load Check Valve (Digging Regenerative Circuit) | 40- Unused |
| 9- Check Valve (Main Relief Circuit) | 20- Overload Relief Valve (Boom: Rod Side) | 30- Arm 1 Flow Rate Control Valve (Poppet Valve) | 41- Unused |
| 10- Bucket Flow Rate Control Valve (Poppet Valve) | 21- Boom Regenerative Valve | 31- Load Check Valve (Swing Circuit) | 42- Load Check Valve (Travel (Left) Tandem Circuit) |
| 11- Bucket Flow Rate Control Valve (Selector Valve) | | 32- Arm 1 Flow Rate Control Valve (Selector Valve) | |

SECTION 3 COMPONENT OPERATION

Group 3 Control Valve

Pilot Operation Control Circuit



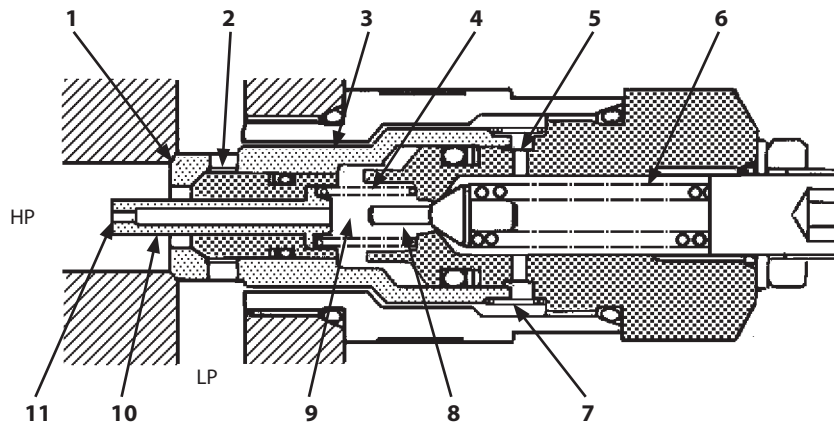
TDCD-03-03-027

- | | | | |
|-----------------------|-----------------------------------|----------------------------|---------------------------|
| a - Air Bleed Circuit | b - Boom Lower Meter-In Cut Valve | c - Boom Anti-Drift Valve | e - Bypass Shut-out Valve |
| | d - Arm Anti-Drift Valve | | |
| 1- Boom Raise | 5- Left Swing | 9- Travel (Left Forward) | 13- Auxiliary (Open) |
| 2- Boom Lower | 6- Right Swing | 10- Travel (Left Reverse) | 14- Auxiliary (Close) |
| 3- Arm Roll-Out | 7- Bucket Roll-In | 11- Travel (Right Forward) | |
| 4- Arm Roll-In | 8- Bucket Roll-Out | 12- Travel (Right Reverse) | |

SECTION 3 COMPONENT OPERATION

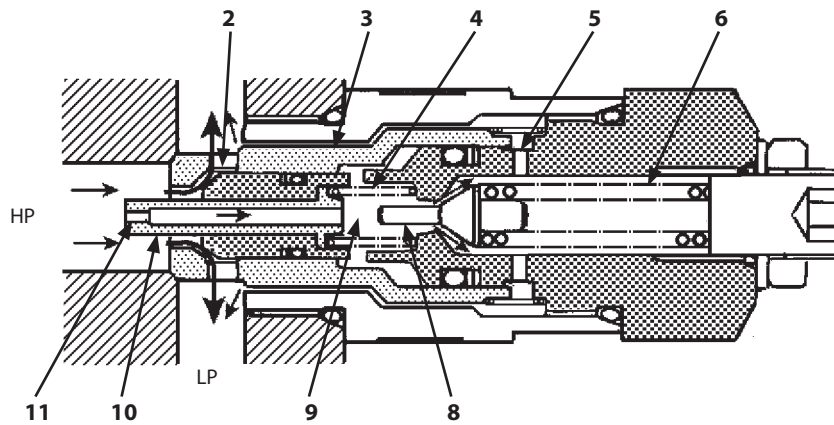
Group 3 Control Valve

During Normal Operation:



T107-02-05-019

During Relief Operation:



T178-03-03-049

HP - Actuator Circuit

LP - Hydraulic Oil Tank

- 1- Make-Up Valve
- 2- Main Poppet
- 3- Sleeve

- 4- Spring A
- 5- Passage A
- 6- Spring B

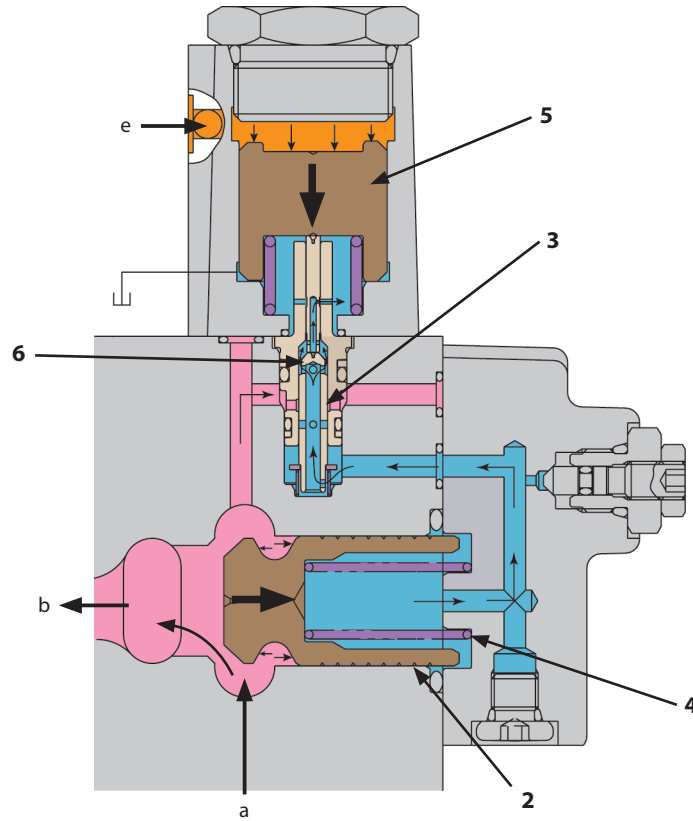
- 7- Spring C
- 8- Pilot Poppet
- 9- Spring Chamber

- 10- Piston
- 11- Orifice

SECTION 3 COMPONENT OPERATION

Group 3 Control Valve

Releasing Operation:



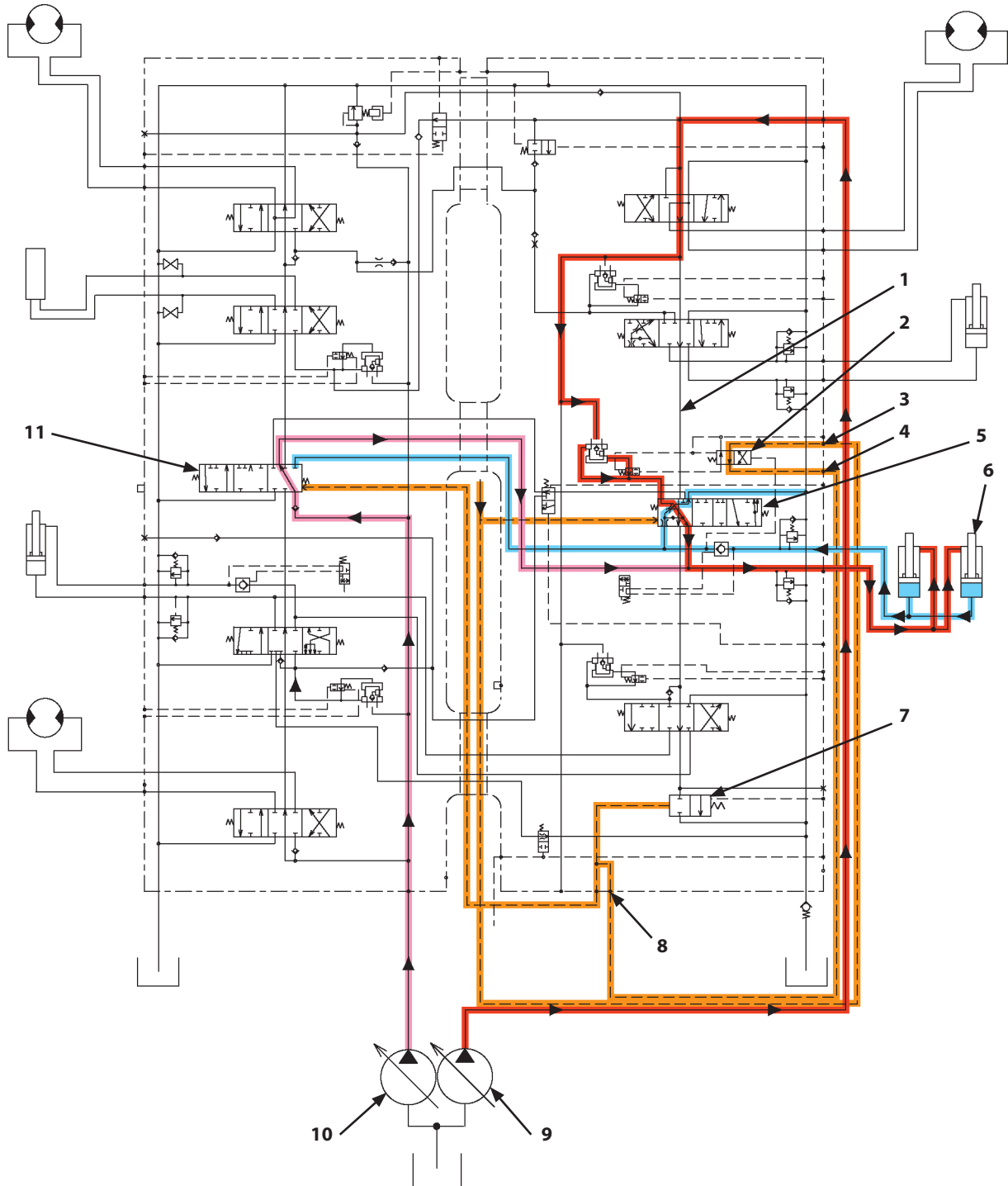
TDCD-03-03-009

- a - Returning Oil from Cylinder (1)
(Boom Cylinder: Bottom Side,
Arm Cylinder: Rod or Bottom
Side)
- b - To Main Spool
- e - Pressure Oil from Pilot Valve

- 2 - Check Valve
- 3 - Selector Valve
- 4 - Spring
- 5 - Piston
- 6 - Orifice

SECTION 3 COMPONENT OPERATION

Group 3 Control Valve



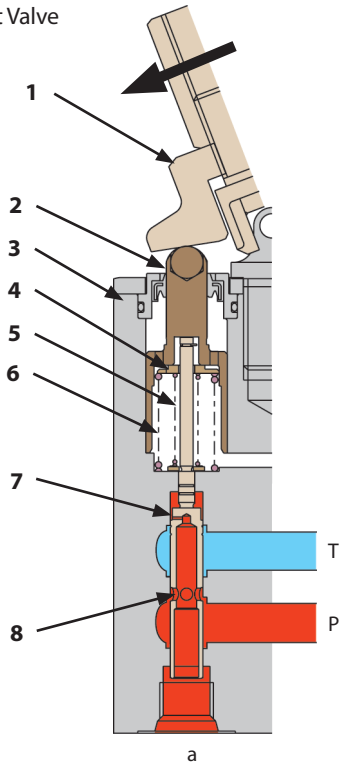
TDCD-02-04-012

- | | | | |
|---------------------------------------|------------------|--------------------------|------------------|
| 1- Neutral Circuit in 4-Spool Section | 3- Port PI7 | 7- Bypass Shut-Out Valve | 11- Boom 2 Spool |
| 2- Boom Lower Meter-In Cut Valve | 4- Port PI9 | 8- Port SJ | |
| | 5- Boom 1 Spool | 9- Pump 1 | |
| | 6- Boom Cylinder | 10- Pump 2 | |

SECTION 3 COMPONENT OPERATION

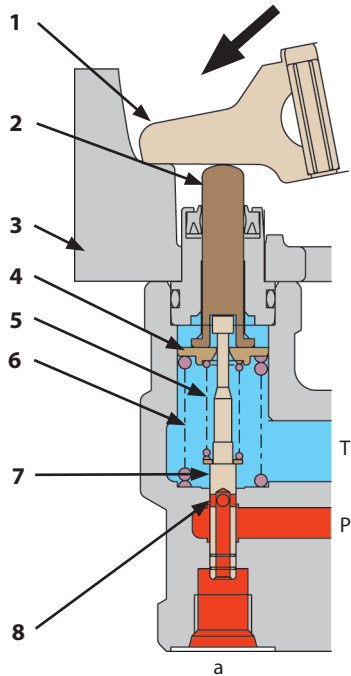
Group 4 Pilot Valve

Front Attachment /
Swing Pilot Valve



TPPP-03-04-009

Travel Pilot Valve



TPPP-03-04-014

P- Port P

T- Port T

a- Output Port

1- Cam
2- Pusher

3- Casing
4- Spring Guide

5- Balance Spring
6- Return Spring

7- Spool
8- Hole

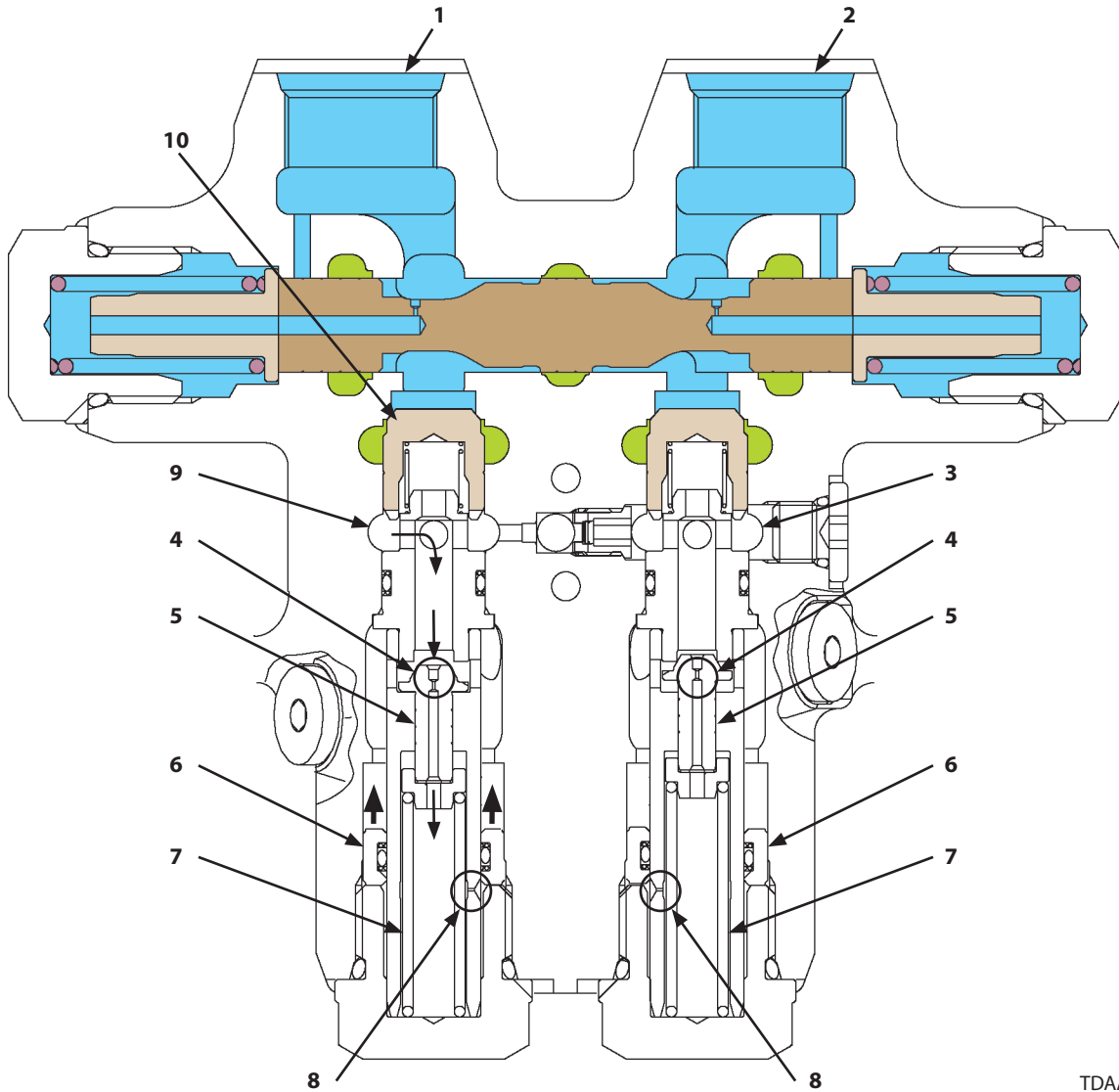
SECTION 3 COMPONENT OPERATION
Group 5 Travel Device

(Blank)

SECTION 3 COMPONENT OPERATION

Group 5 Travel Device

Relief Operation (at Port BV Side):



TDAА-03-05-004

- 1- Port BV
- 2- Port AV
- 3- Motor Port AM

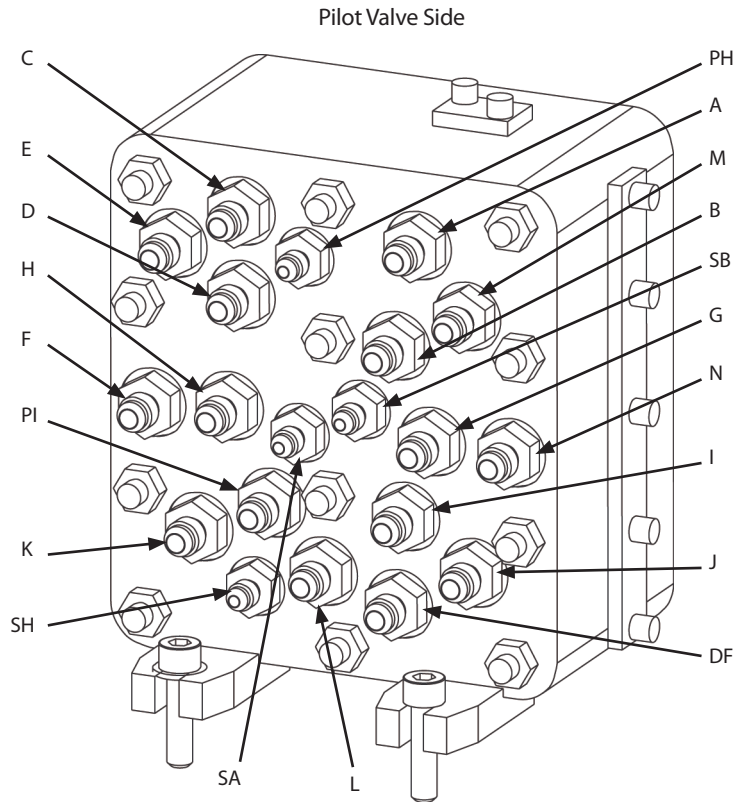
- 4- Orifice
- 5- Poppet
- 6- Piston

- 7- Spring
- 8- Orifice
- 9- Motor Port BM

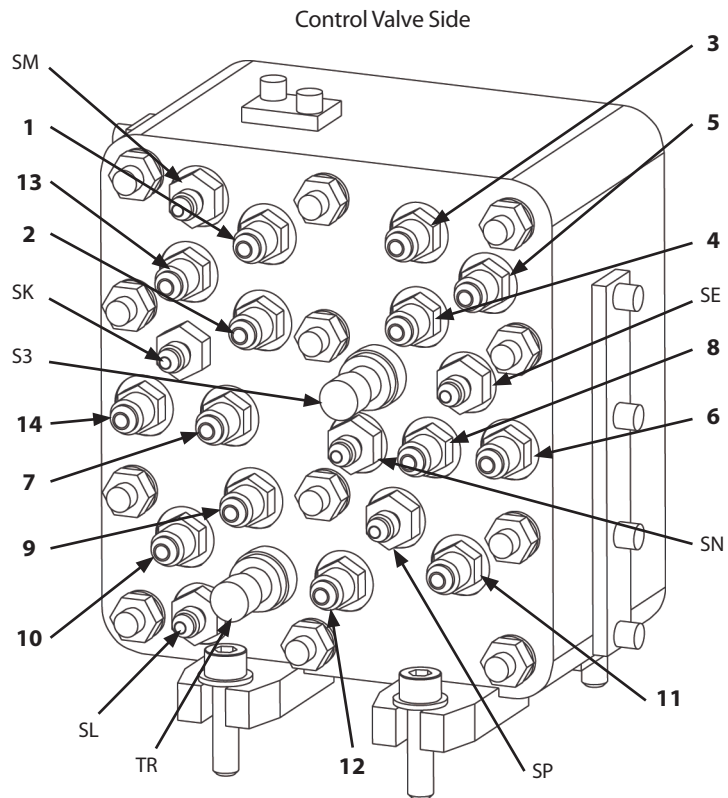
- 10- Check Valve BC

SECTION 3 COMPONENT OPERATION

Group 6 Signal Control Valve



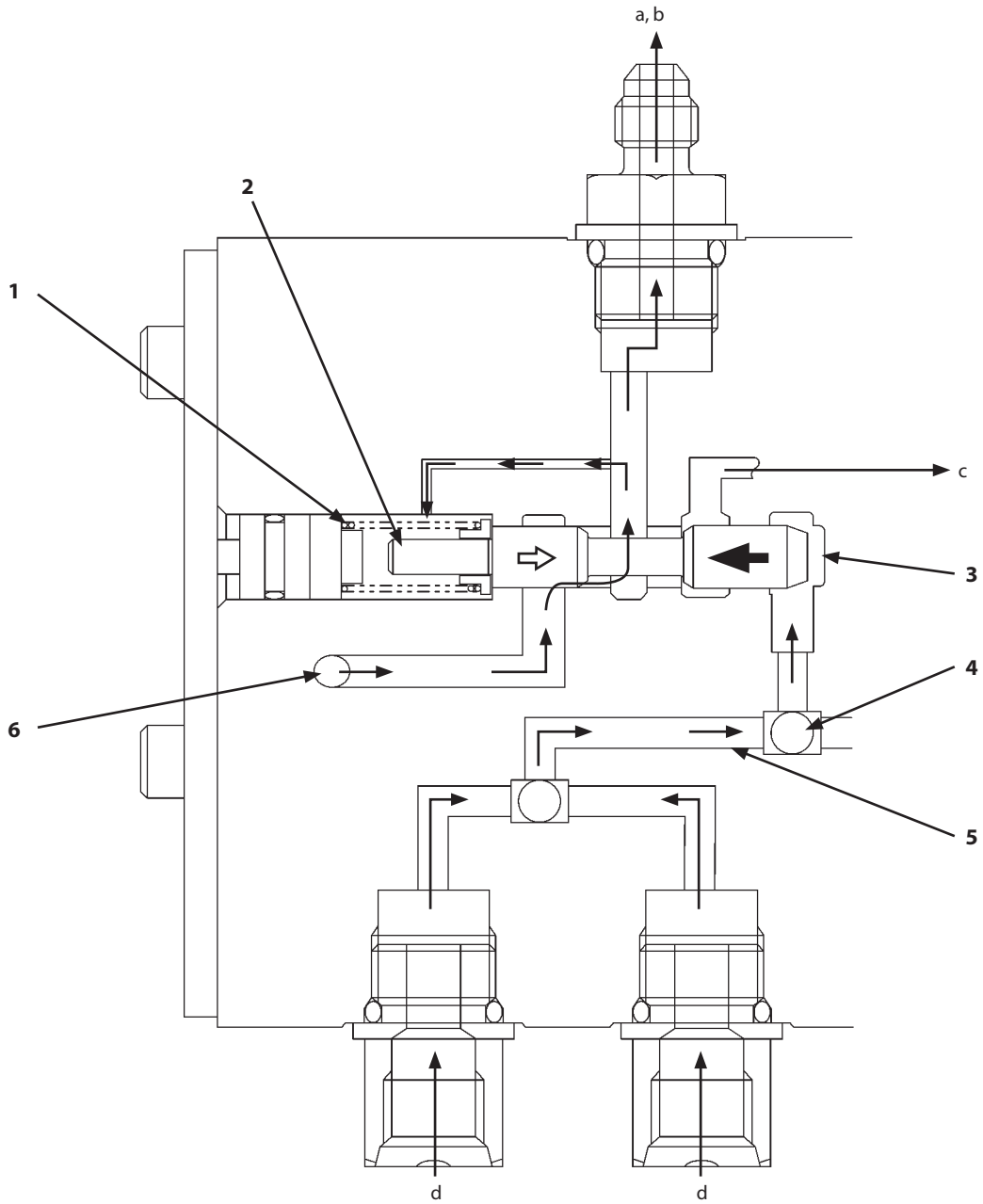
TDCD-03-06-002



TDCD-03-06-003

SECTION 3 COMPONENT OPERATION

Group 6 Signal Control Valve



T1V1-03-06-005

a- To Port SA
b- To Port SB

c- To Hydraulic Oil Tank

d- From Pilot Valve

1- Spring
2- Spool

3- Chamber A
4- Shuttle Valve

5- Pilot Pressure
6- Primary Pilot Pressure

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