PART NO. TODDQ50-EN-00

HITACHI

Reliable solutions

Technical Manual
Operational Principle

ZX
350LC-6
350LCN-6
Hydraulic Excavator

Service Manual consists of the following separate Part No.

Technical Manual (Operational Principle)	: Vol. No.TODDQ50-EN
Technical Manual (Troubleshooting)	: Vol. No.TTDDQ50-EN
Workshop Manual	: Vol. No.WDDQ50-EN
Engine Manual	: Vol. No.ETDDN50-EN, EWDDN50-EN

ZX350LC-6 • 350LCN-6 HYDRAULIC EXCAVATOR TECHNICAL MANUAL OPERATIONAL PRINCIPLE

TODDQ50-EN-00

Hitachi Construction Machinery Co., Ltd.
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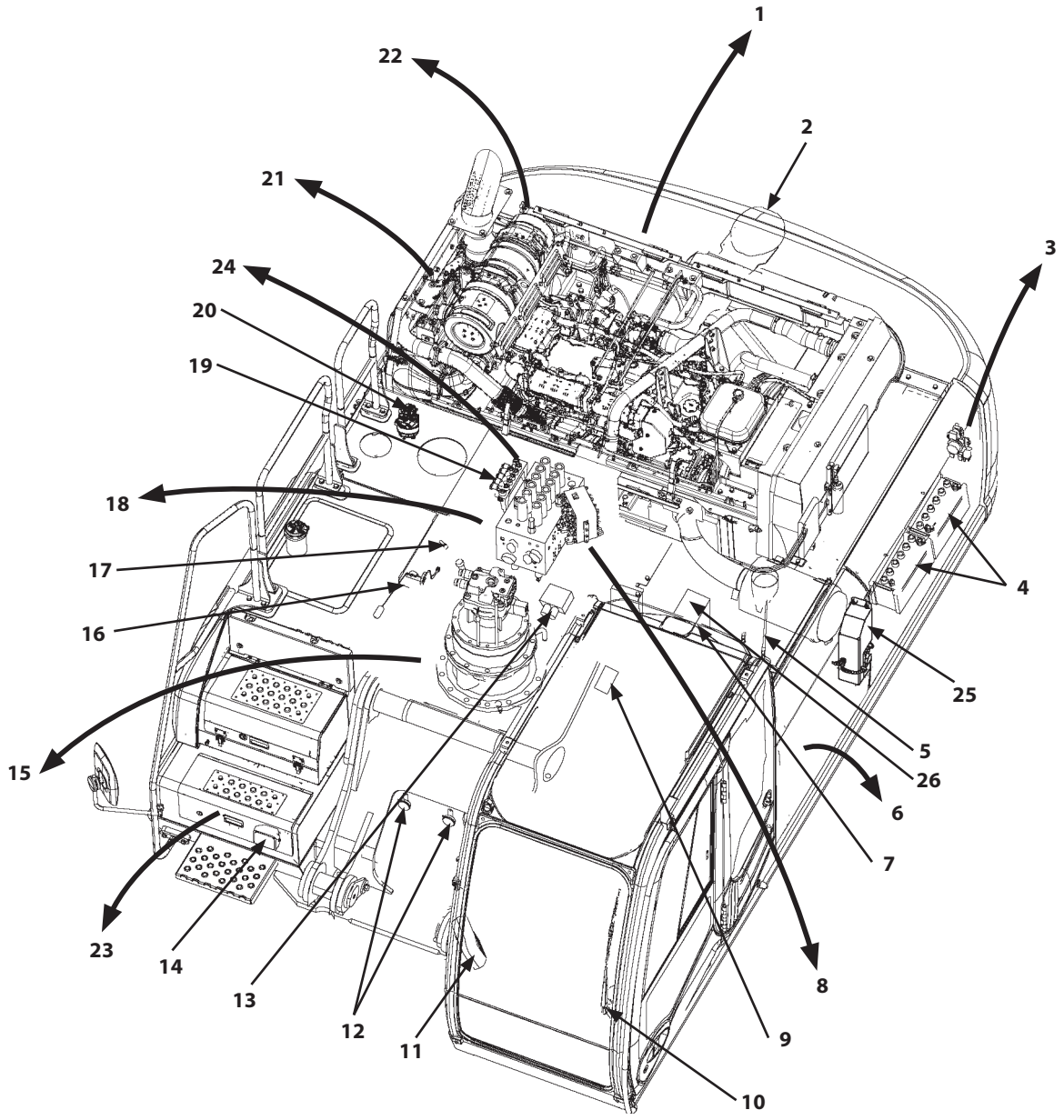
SYMBOL AND ABBREVIATION

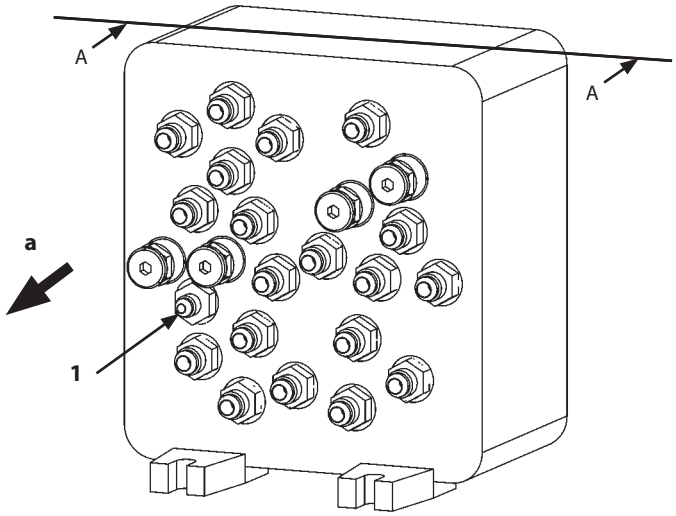
Symbol / Abbreviation	Name	Explanation
TO	Technical manual (Operational principle)	Technical manual (Operational Principle).
TT	Technical manual (Troubleshooting)	Technical manual (Troubleshooting).
T/M	Technical manual	Technical manual.
W, W/M	Workshop manual	Workshop manual (Removal and Installation, Disassembly and Assembly).
MC	Main Controller	Main controller. MC controls the engine, pump, and valve according to the machine operating condition.
ECM	Engine Control Module	Engine controller. ECM controls fuel injection amount according to the machine operating condition.
VGS	Variable Geometry System controller	Variable turbo controller. VGS is an exhaust turbo charged system to supercharge the exhaust energy while running the engine at slow idle speed. VGS optimizes the turbine rotation, improves the performance at slow-speed torque and the acceleration, reduces fuel consumption, and reduces particulate matter (PM) by adjusting the nozzle opening of turbine housing.
GSM	Global System for Mobile communications controller	Communication controller. GSM is a type of wireless communication system, is used in more than on 100 countries around Europe and Asia, and becomes the factual global standards of the mobile telephone.
GPS	Global Positioning System	Global positioning system.
CAN	Controller Area Network	CAN communication. CAN is a serial communications protocol internationally-standardized by ISO (International Organization for Standardization).
A/C	Air Conditioner	Air conditioner.
OP, OPT	Option	Optional component.
MPDr.	Maintenance Pro Dr.	MPDr. is software that troubleshooting, monitoring, and adjustment.
A/I	Auto-Idle	Auto-idle.
WU	Warming-Up	Warming-up.
Li	Low (Slow) Idle	Slow idle engine speed.
ATT	Attachment	Attachment. Attachment is optional parts such as breaker, crusher, and pulverizer in this manual.
HI, Hi	High	Travel fast position.
LO, Lo	Low	Travel slow position.

Electrical System (Overview)



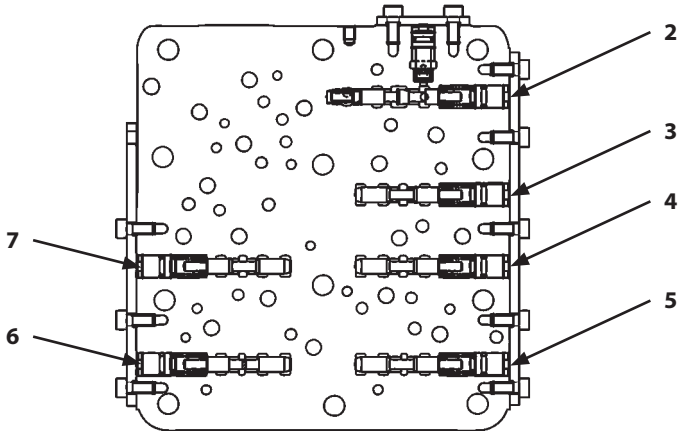
TDDQ-01-02-011

1- Components Related with Engine (Refer to T1-2-8.)
2- Rear Camera
3- Electrical System (Relays) (Refer to T1-2-7.)
4- Battery
5- Antenna (Radio)
6- Electrical System (Utility Space) (Refer to T1-2-6.)
7- GPS Antenna
8- Components Related with Signal Control Valve (Refer to T1-2-12.)
9- Fan Valve
10- Wiper Motor
11- Monitor
12- Horn
13- 2-Spool Solenoid Valve Unit (for Aftertreatment Device Regeneration Control)
14- Work Light
15- Components Related with Swing Device (Refer to T1-2-14.)
16- Fuel Sensor
17- Hydraulic Oil Temperature Sensor
18- Components Related with Control Valve (Refer to T1-2-12.)
19- 5-Spool Solenoid Valve Unit
20- Fuel Solenoid Pump
21- Components Related with Pump Device (Refer to T1-2-10.)
22- Aftertreatment Device (Refer to T1-2-9.)
23- DEF Tank (Refer to T1-2-16.)
24- DEF Supply Module (Refer to T1-2-16.)
25- Battery Disconnect Switch
26- Satellite Communication Antenna (Option)



TDAA-03-06-003

Section A-A



TDAA-03-06-004

a - Pilot Valve Side

1- Pressure Sensor (Auxiliary 2) Connecting Position
2- Shockless Valve
3- Pump 3 Flow Rate Control Valve
4- Pump 2 Flow Rate Control Valve
5- Flow Combiner Valve Control Spool
6- Swing Parking Brake Release Spool
7- Pump 1 Flow Rate Control Valve

Engine

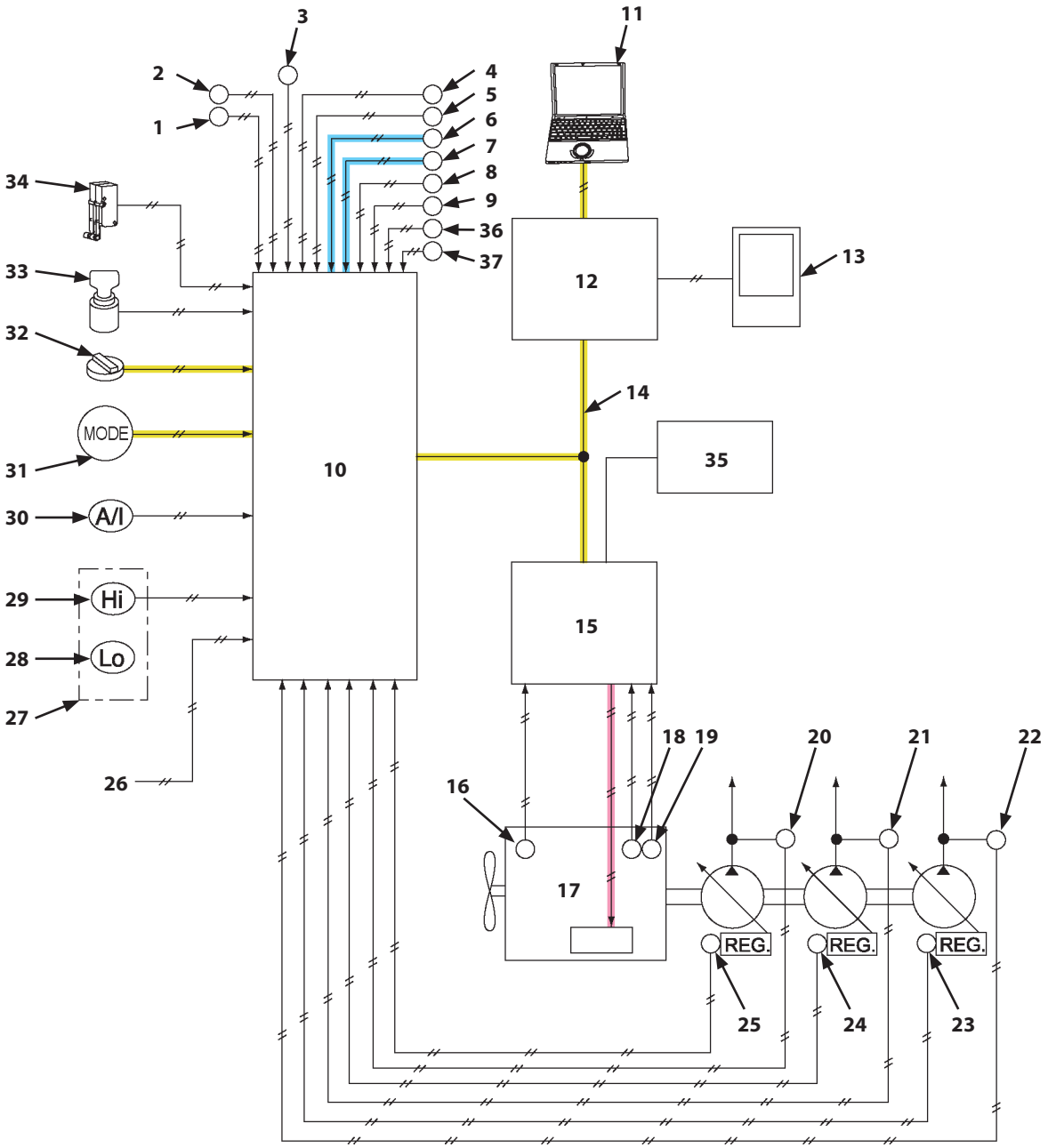
Manufacturer	ISUZU
Model	6HK1XASA-01
Type	Diesel, 4-Cycle, Water-cooled, Direct Injection Type, Exhaust Turbo Charged Type
Cyl. No.- Bore × Stroke	6-115 mm×125 mm
Piston Displacement	7790 cm^3
Rated Output	200 kW/1800 min^{-1}
	Travel HP Mode: 210 kW/1900 min^{-1}
Compression Ratio	16.3
Dry Weight	710 kg
Firing Order	1-5-3-6-2-4
Rotation Direction	Clockwise (Viewed from fan side)

Electrical Component

BATTERY RELAY	Voltage/Current	24 V/100 A
STARTER RELAY	Voltage	24 V
GLOW RELAY	Voltage	24 V
HYDRAULIC OIL TEMPERATURE SENSOR	Operating Temperature	-30 to 120 °C
AIR FILTER RESTRICTION SWITCH	Operating Pressure	6.2±0.6 kPa
HORN	Voltage/Current	24 V/$2.5^{+0.5}_{-1}$ A
	Sound Pressure	113±5 dB (A) at 2 m
ILLUMINATION	Working Light	Halogen 24 V, 70 W
	Cab Light	24 V/0.3 A
AIR CONDITIONER	Refrigerant	134 a
	Cooling Ability	4.5 kW or More
	Cool Air Volume	550 m^3/h or More
	Heating Ability	5.8 kW or More
	Warm Air Volume	390 m^3/h or More
	Temperature Adjusting System	Electronic Type
	Refrigerant Quantity	950±50 g
	Compressor Oil Quantity	160 cm^3

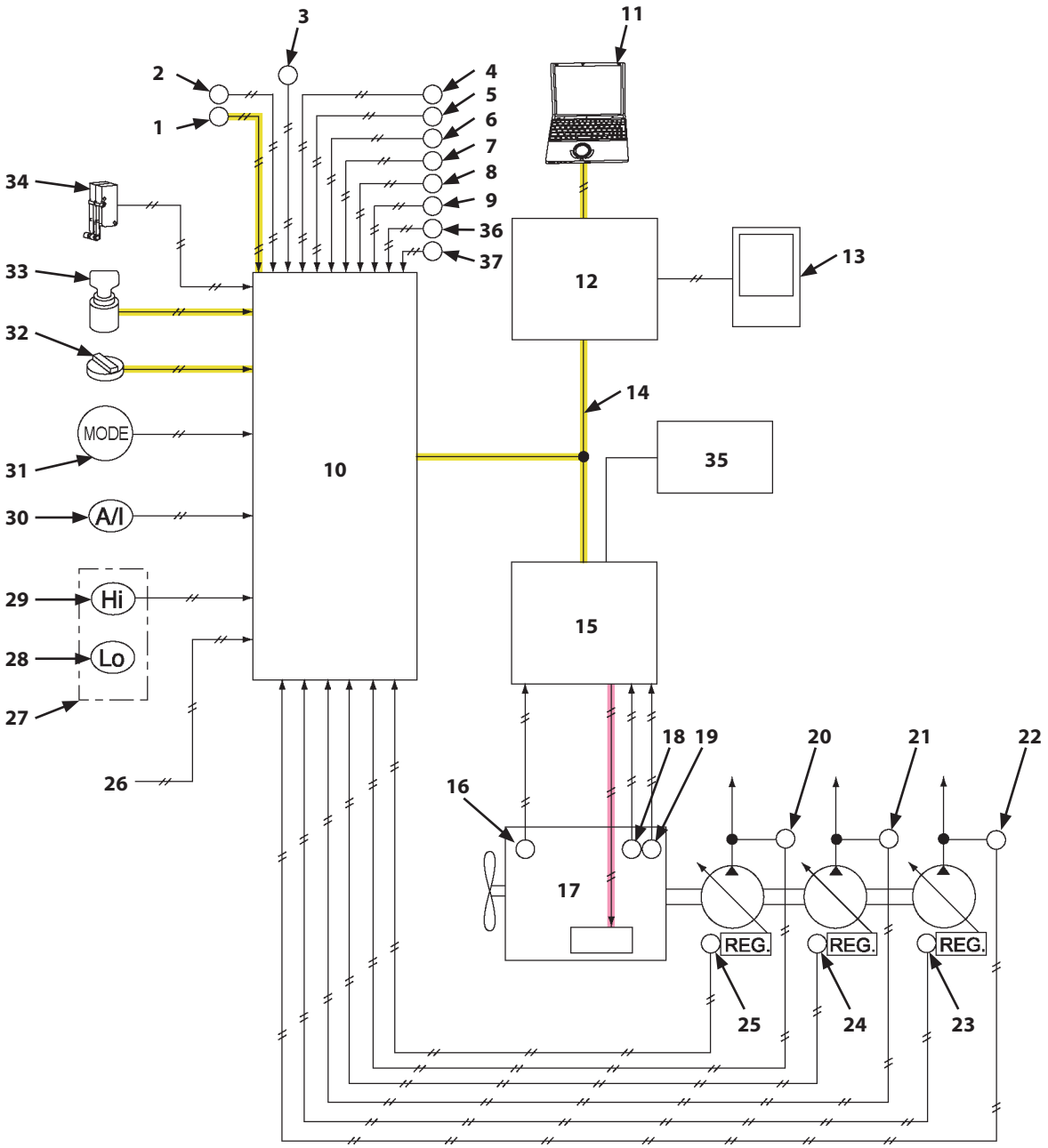
Outline

MC is used in order to control the machine operations.
Signals from the engine control dial, various sensors, and various switches are sent to MC and processed in the logic circuit.
MC sends the signal equivalent to the target engine speed to ECM by using CAN communication in order to control the engine. (Refer to SYSTEM/Engine System.)
In addition, MC drives the solenoid valve unit and torque control solenoid valve in order to control the pump and valve.



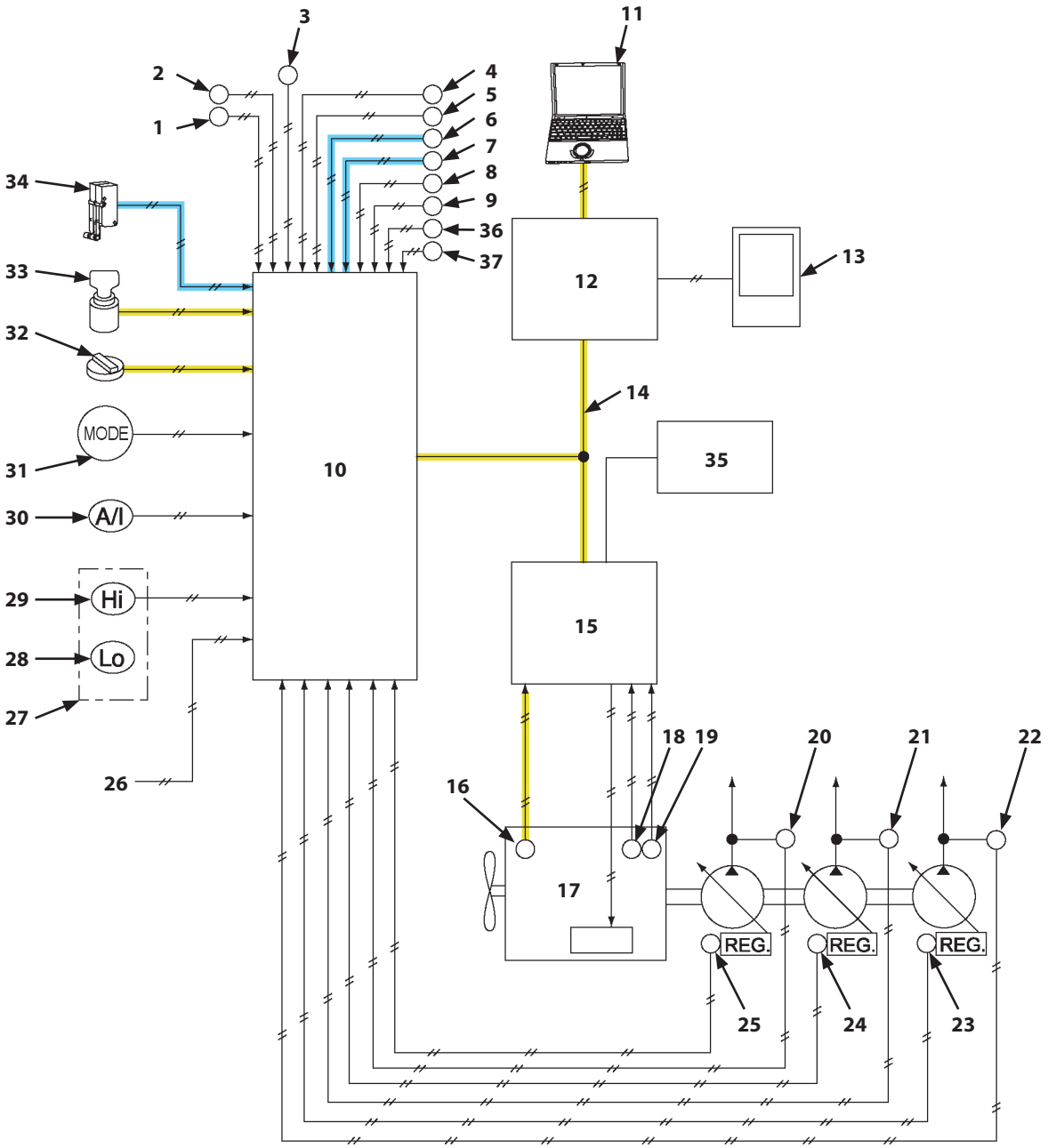
TDC1-02-02-004

1- Hydraulic Oil Temperature Sensor
2- Pressure Sensor (Boom Raise)
3- Pressure Sensor (Arm Roll-In)
4- Pressure Sensor (Bucket Roll-In)
5- Pressure Sensor (Swing)
6- Pressure Sensor (Travel)
7- Pressure Sensor (Front Attachment)
8- Pressure Sensor (Auxiliary 1) (OP)
9- Pressure Sensor (Auxiliary 2) (OP)
10- MC
11- MPDr.
12- Monitor Controller
13- Monitor
14- CAN
15- ECM
16- Coolant Temperature Sensor
17- Engine
18- Cam Angle Sensor
19- Crank Speed Sensor
20- Pump 1 Delivery Pressure Sensor
21- Pump 3 Delivery Pressure Sensor
22- Pump 2 Delivery Pressure Sensor
23- Pump 2 Control Pressure Sensor
24- Pump 3 Control Pressure Sensor
25- Pump 1 Control Pressure Sensor
26- Auto Shut-Down Signal
27- Travel Mode Switch
28- Slow Speed Position
29- Fast Speed Position
30- Auto-Idle Switch
31- Power Mode Switch
32- Engine Control Dial
33- Key Switch
34- Pilot Shut-Off Switch
35- DCU
36- Pressure Sensor (Arm Roll-Out)
37- Pressure Sensor (Bucket Roll-Out)



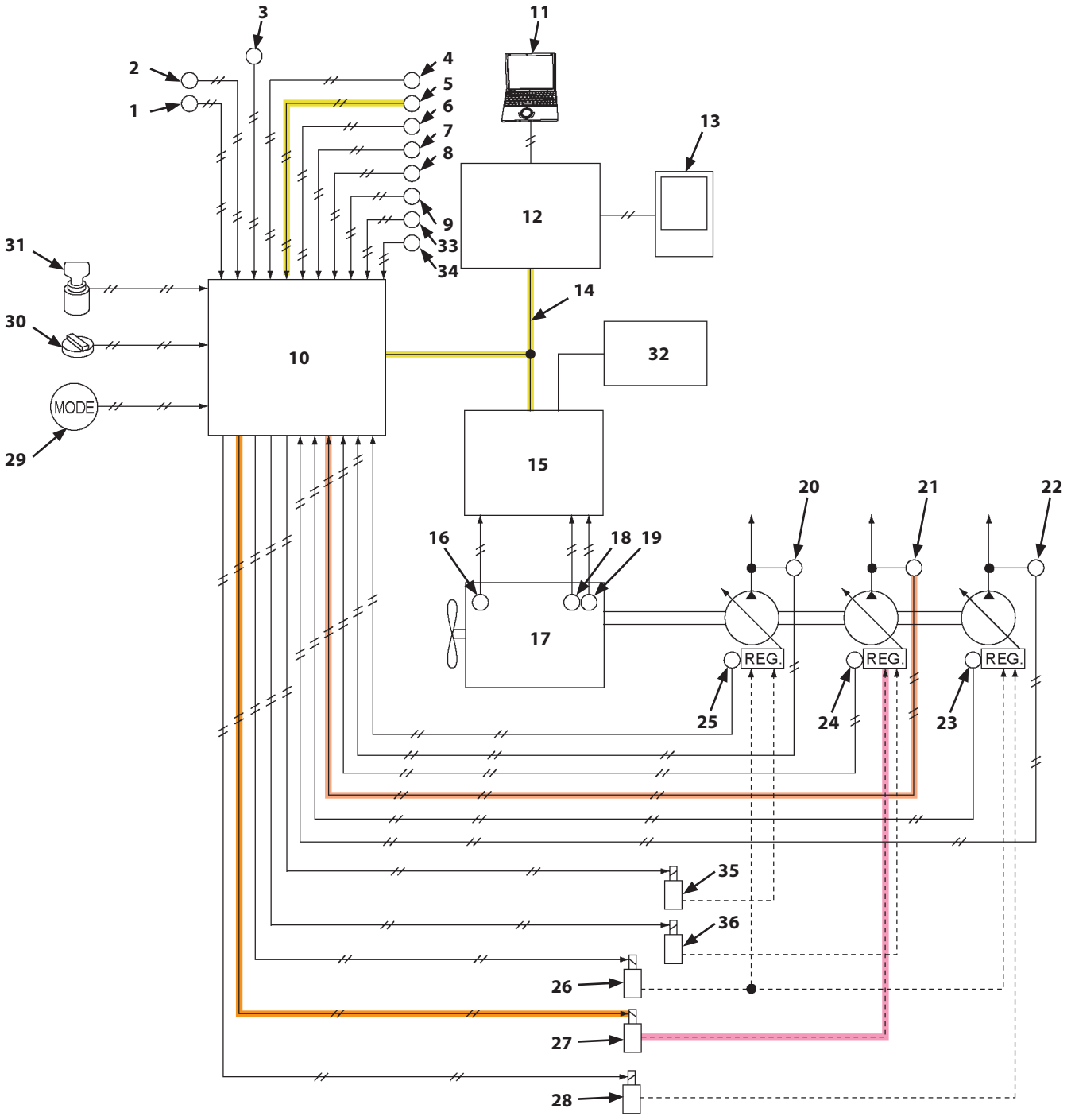
TDC1-02-02-009

1- Hydraulic Oil Temperature Sensor
2- Pressure Sensor (Boom Raise)
3- Pressure Sensor (Arm Roll-In)
4- Pressure Sensor (Bucket Roll-In)
5- Pressure Sensor (Swing)
6- Pressure Sensor (Travel)
7- Pressure Sensor (Front Attachment)
8- Pressure Sensor (Auxiliary 1) (OP)
9- Pressure Sensor (Auxiliary 2) (OP)
10- MC
11- MPDr.
12- Monitor Controller
13- Monitor
14- CAN
15- ECM
16- Coolant Temperature Sensor
17- Engine
18- Cam Angle Sensor
19- Crank Speed Sensor
20- Pump 1 Delivery Pressure Sensor
21- Pump 3 Delivery Pressure Sensor
22- Pump 2 Delivery Pressure Sensor
23- Pump 2 Control Pressure Sensor
24- Pump 3 Control Pressure Sensor
25- Pump 1 Control Pressure Sensor
26- Auto Shut-Down Signal
27- Travel Mode Switch
28- Slow Speed Position
29- Fast Speed Position
30- Auto-Idle Switch
31- Power Mode Switch
32- Engine Control Dial
33- Key Switch
34- Pilot Shut-Off Switch
35- DCU
36- Pressure Sensor (Arm Roll-Out)
37- Pressure Sensor (Bucket Roll-Out)



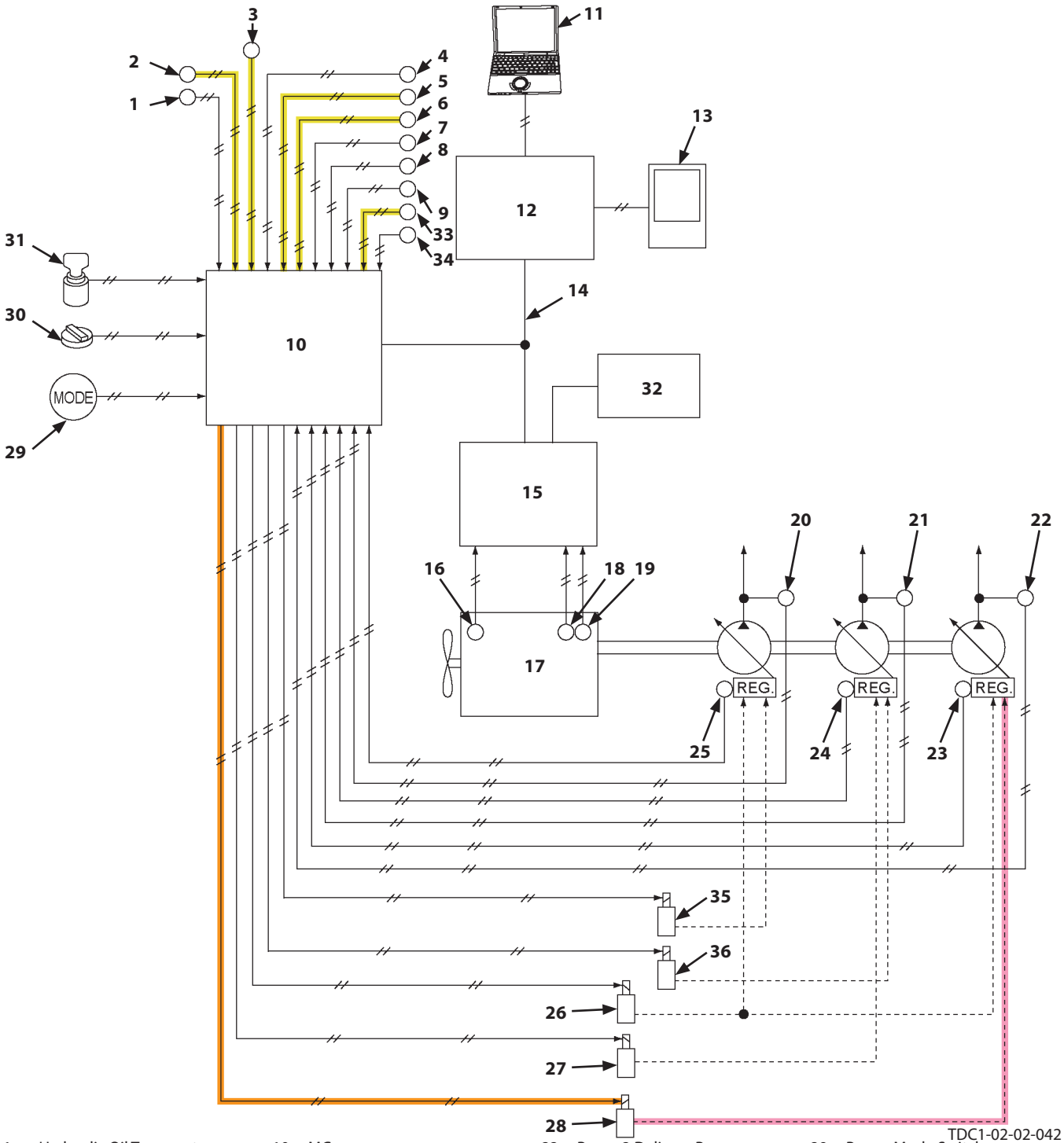
TDC1-02-02-015

1- Hydraulic Oil Temperature Sensor
2- Pressure Sensor (Boom Raise)
3- Pressure Sensor (Arm Roll-In)
4- Pressure Sensor (Bucket Roll-In)
5- Pressure Sensor (Swing)
6- Pressure Sensor (Travel)
7- Pressure Sensor (Front Attachment)
8- Pressure Sensor (Auxiliary 1) (OP)
9- Pressure Sensor (Auxiliary 2) (OP)
10- MC
11- MPDr.
12- Monitor Controller
13- Monitor
14- CAN
15- ECM
16- Coolant Temperature Sensor
17- Engine
18- Cam Angle Sensor
19- Crank Speed Sensor
20- Pump 1 Delivery Pressure Sensor
21- Pump 3 Delivery Pressure Sensor
22- Pump 2 Delivery Pressure Sensor
23- Pump 2 Control Pressure Sensor
24- Pump 3 Control Pressure Sensor
25- Pump 1 Control Pressure Sensor
26- Auto Shut-Down Signal
27- Travel Mode Switch
28- Slow Speed Position
29- Fast Speed Position
30- Auto-Idle Switch
31- Power Mode Switch
32- Engine Control Dial
33- Key Switch
34- Pilot Shut-Off Switch
35- DCU
36- Pressure Sensor (Arm Roll-Out)
37- Pressure Sensor (Bucket Roll-Out)



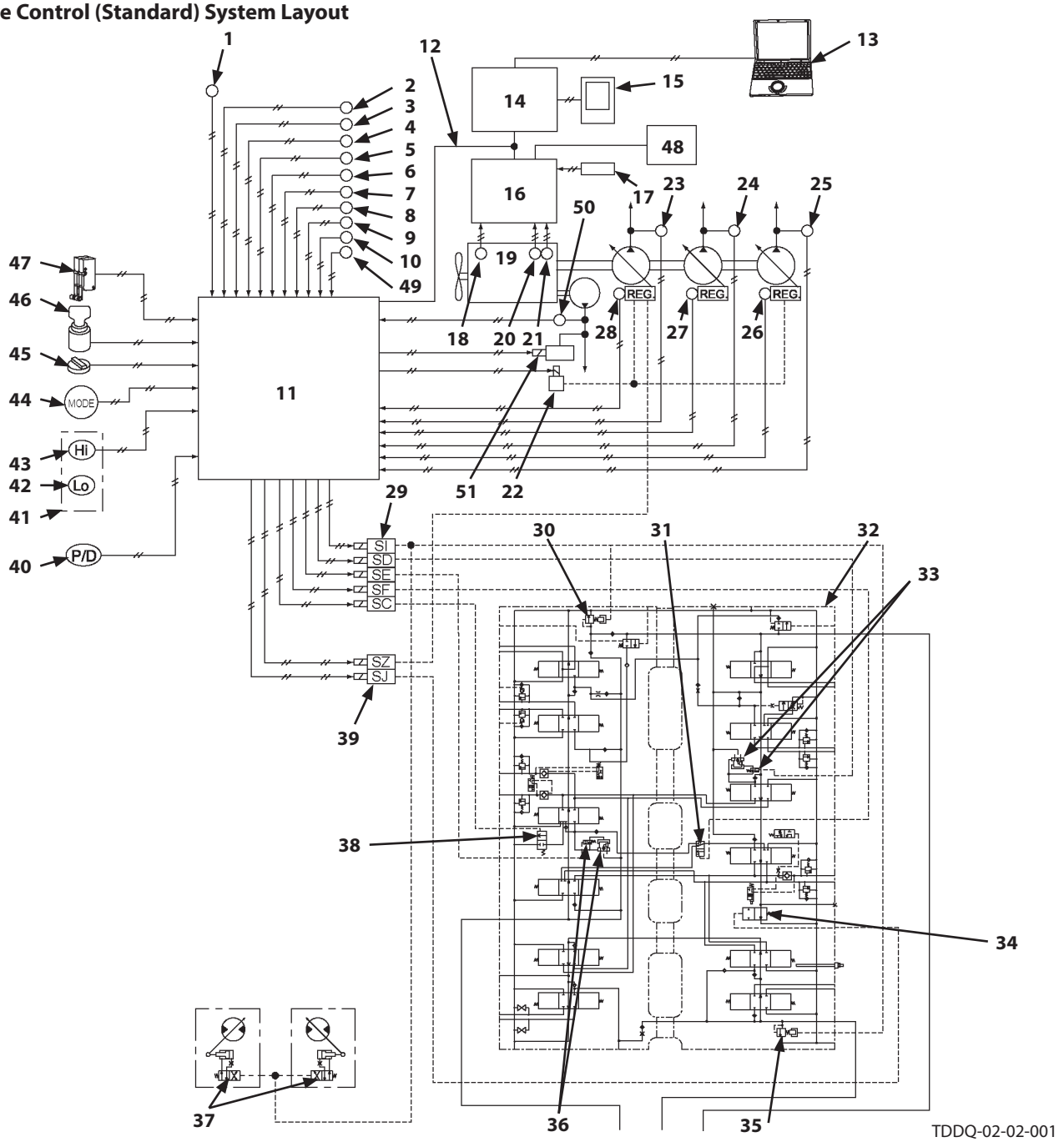
TDC1-02-02-020

1- Hydraulic Oil Temperature Sensor
2- Pressure Sensor (Boom Raise)
3- Pressure Sensor (Arm Roll-In)
4- Pressure Sensor (Bucket Roll-In)
5- Pressure Sensor (Swing)
6- Pressure Sensor (Travel)
7- Pressure Sensor (Front Attachment)
8- Pressure Sensor (Auxiliary 1) (OP)
9- Pressure Sensor (Auxiliary 2) (OP)
10- MC
11- MPDr.
12- Monitor Controller
13- Monitor
14- CAN
15- ECM
16- Coolant Temperature Sensor
17- Engine
18- Cam Angle Sensor
19- Crank Speed Sensor
20- Pump 1 Delivery Pressure Sensor
21- Pump 3 Delivery Pressure Sensor
22- Pump 2 Delivery Pressure Sensor
23- Pump 2 Control Pressure Sensor
24- Pump 3 Control Pressure Sensor
25- Pump 1 Control Pressure Sensor
26- Pump 1 and 2 Torque Control Solenoid Valve
27- Pump 3 Torque Control Solenoid Valve
28- Maximum Pump 2 Flow Rate Limit Control Solenoid Valve
29- Power Mode Switch
30- Engine Control Dial
31- Key Switch
32- DCU
33- Pressure Sensor (Arm Roll-Out)
34- Pressure Sensor (Bucket Roll-Out)
35- Maximum Pump 1 Flow Rate Limit Control Solenoid Valve
36- Maximum Pump 3 Flow Rate Limit Control Solenoid Valve



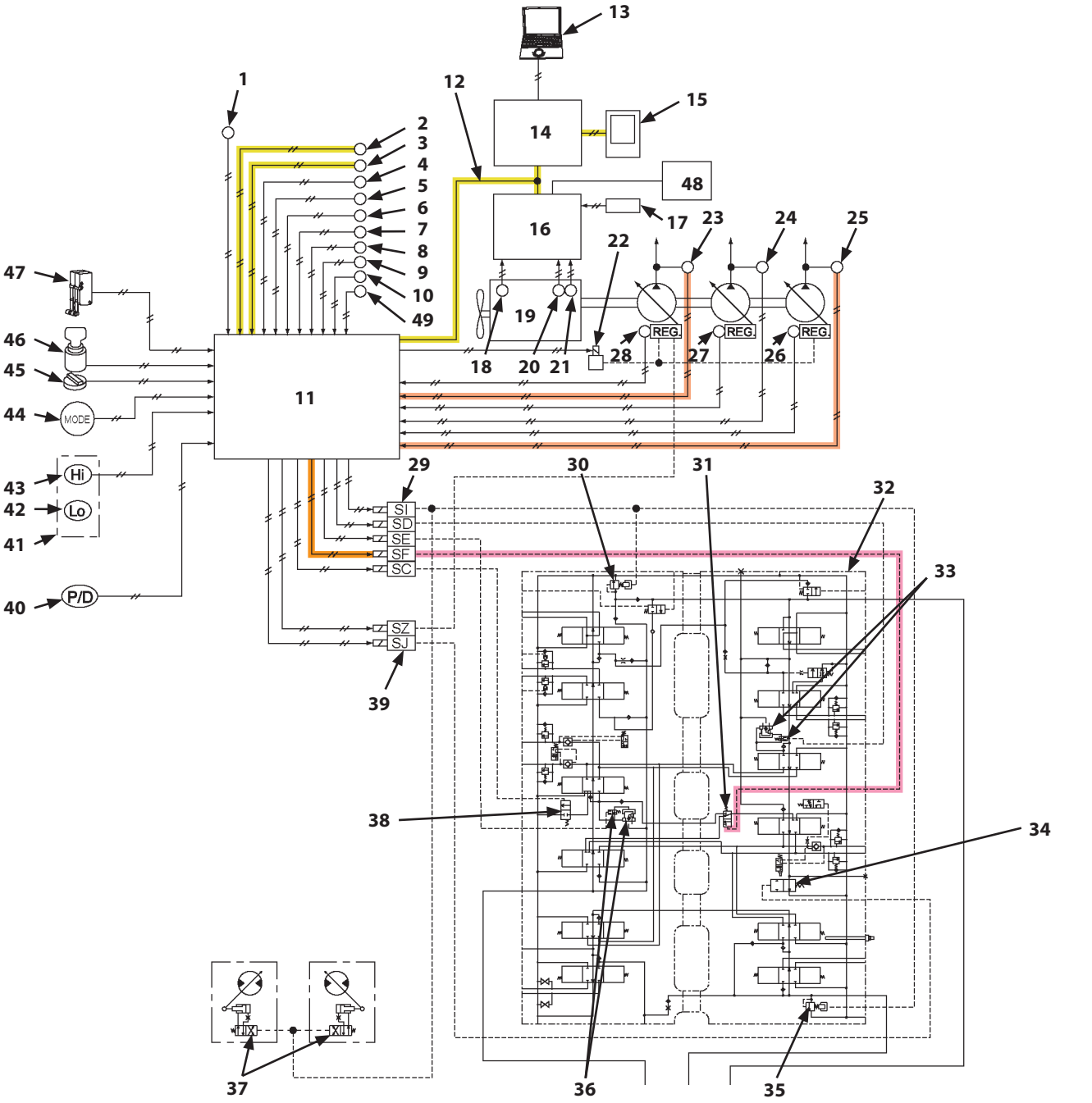
1- Hydraulic Oil Temperature Sensor
2- Pressure Sensor (Boom Raise)
3- Pressure Sensor (Arm Roll-In)
4- Pressure Sensor (Bucket Roll-In)
5- Pressure Sensor (Swing)
6- Pressure Sensor (Travel)
7- Pressure Sensor (Front Attachment)
8- Pressure Sensor (Auxiliary 1) (OP)
9- Pressure Sensor (Auxiliary 2) (OP)
10- MC
11- MPDr.
12- Monitor Controller
13- Monitor
14- CAN
15- ECM
16- Coolant Temperature Sensor
17- Engine
18- Cam Angle Sensor
19- Crank Speed Sensor
20- Pump 1 Delivery Pressure Sensor
21- Pump 3 Delivery Pressure Sensor
22- Pump 2 Delivery Pressure Sensor
23- Pump 2 Control Pressure Sensor
24- Pump 3 Control Pressure Sensor
25- Pump 1 Control Pressure Sensor
26- Pump 1 and 2 Torque Control Solenoid Valve
27- Pump 3 Torque Control Solenoid Valve
28- Maximum Pump 2 Flow Rate Limit Control Solenoid Valve
29- Power Mode Switch
30- Engine Control Dial
31- Key Switch
32- DCU
33- Pressure Sensor (Arm Roll-Out)
34- Pressure Sensor (Bucket Roll-Out)
35- Maximum Pump 1 Flow Rate Limit Control Solenoid Valve
36- Maximum Pump 3 Flow Rate Limit Control Solenoid Valve

Valve Control (Standard) System Layout



TDDQ-02-02-001

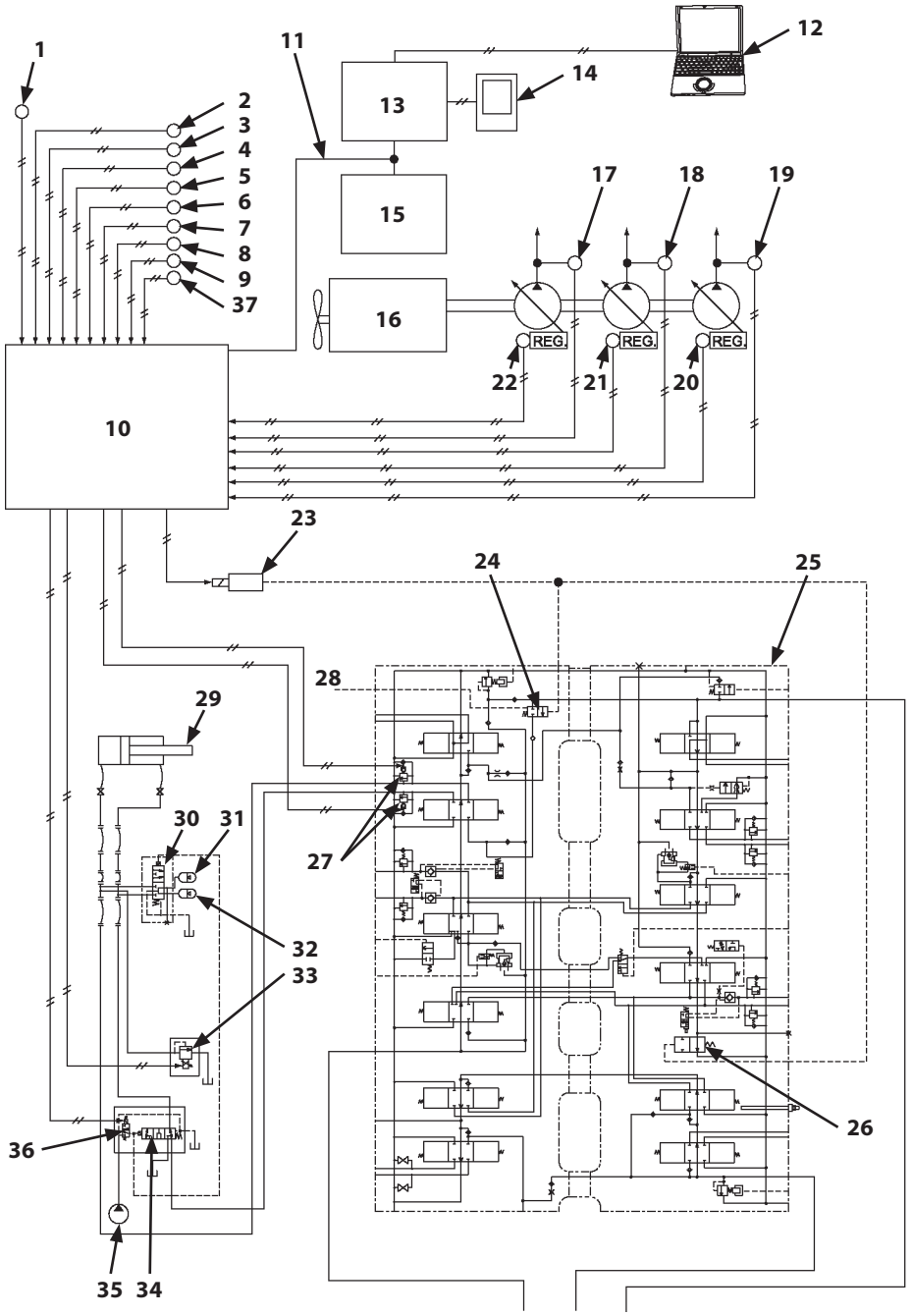
1- Hydraulic Oil Temperature Sensor
2- Pressure Sensor (Boom Raise)
3- Pressure Sensor (Arm Roll-In)
4- Pressure Sensor (Bucket Roll-In)
5- Pressure Sensor (Swing)
6- Pressure Sensor (Travel)
7- Pressure Sensor (Front Attachment)
8- Pressure Sensor (Auxiliary 1) (OP)
9- Pressure Sensor (Auxiliary 2) (OP)
10- Pressure Sensor (Arm Roll-Out)
11- MC
12- CAN
13- MPDr.
14- Monitor Controller
15- Monitor
16- ECM
17- Manual Regeneration Switch
18- Coolant Temperature Sensor
19- Engine
20- Cam Angle Sensor
21- Crank Speed Sensor
22- Pump 1 and 2 Torque Control Solenoid Valve
23- Pump 1 Delivery Pressure Sensor
24- Pump 3 Delivery Pressure Sensor
25- Pump 2 Delivery Pressure Sensor
26- Pump 2 Control Pressure Sensor
27- Pump 3 Control Pressure Sensor
28- Pump 1 Control Pressure Sensor
29- 5-Spool Solenoid Valve Unit
30- Main Relief Valve (P1, P2)
31- Digging Regenerative Valve
32- Control Valve
33- Arm 2 Flow Rate Control Valve
34- Bypass Shut-Out Valve
35- Main Relief Valve (P3)
36- Arm 1 Flow Rate Control Valve
37- Travel Motor Displacement Angle Control Valve
38- Arm Regenerative Valve
39- 2-Spool Solenoid Valve Unit
40- Power Digging Switch
41- Travel Mode Switch
42- Slow Speed Position
43- Fast Speed Position
44- Power Mode Switch
45- Engine Control Dial
46- Key Switch
47- Pilot Shut-Off Switch
48- DCU
49- Pressure Sensor (Bucket Roll-Out)
50- Fan Pump Delivery Pressure Sensor
51- Fan Speed Control Solenoid Valve



TDDQ-02-02-006

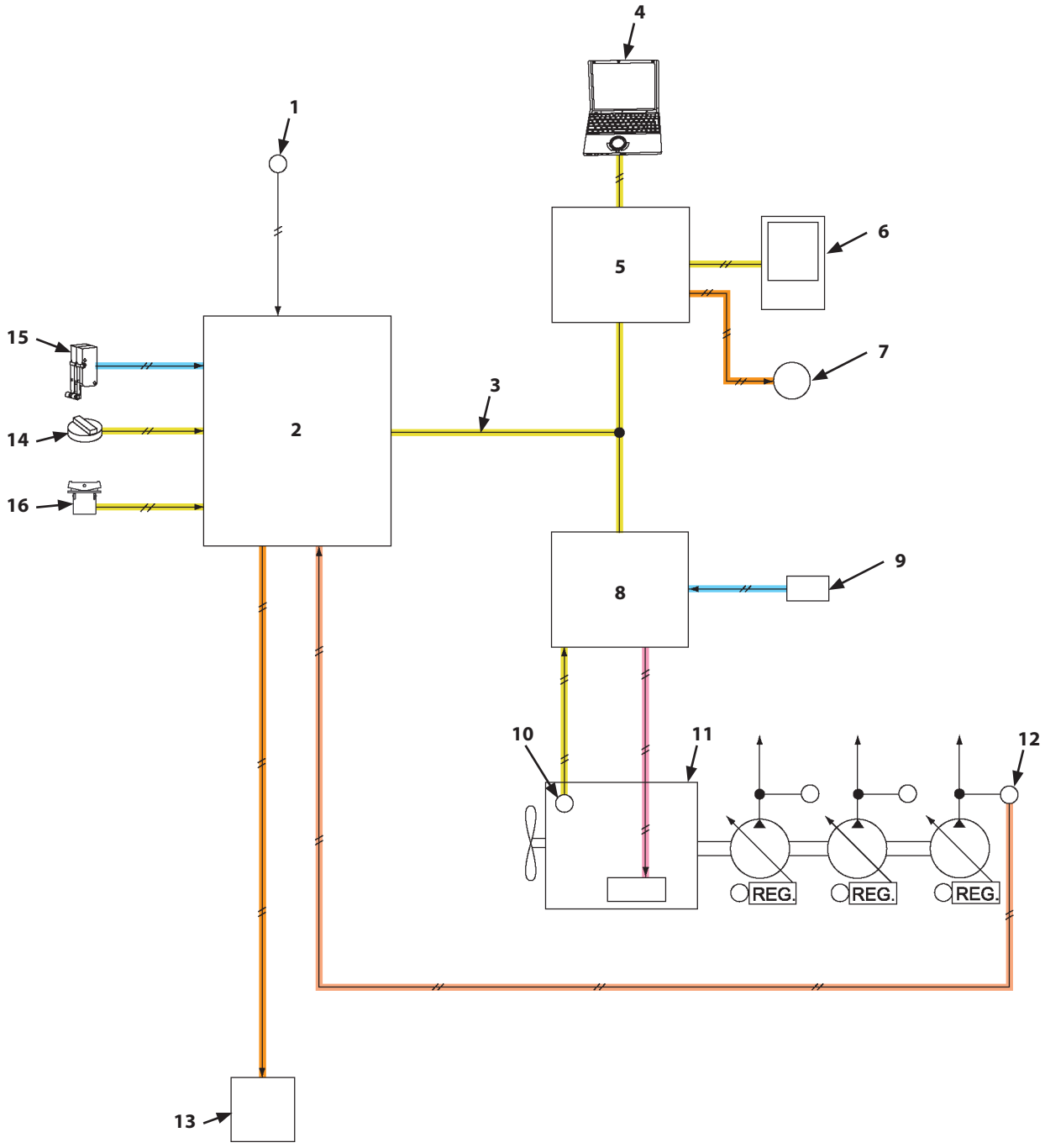
1- Hydraulic Oil Temperature Sensor
2- Pressure Sensor (Boom Raise)
3- Pressure Sensor (Arm Roll-In)
4- Pressure Sensor (Bucket Roll-In)
5- Pressure Sensor (Swing)
6- Pressure Sensor (Travel)
7- Pressure Sensor (Front Attachment)
8- Pressure Sensor (Auxiliary 1) (OP)
9- Pressure Sensor (Auxiliary 2) (OP)
10- Pressure Sensor (Arm Roll-Out)
11- MC
12- CAN
13- MPDr.
14- Monitor Controller
15- Monitor
16- ECM
17- Manual Regeneration Switch
18- Coolant Temperature Sensor
19- Engine
20- Cam Angle Sensor
21- Crank Speed Sensor
22- Pump 1 and 2 Torque Control Solenoid Valve
23- Pump 1 Delivery Pressure Sensor
24- Pump 3 Delivery Pressure Sensor
25- Pump 2 Delivery Pressure Sensor
26- Pump 2 Control Pressure Sensor
27- Pump 3 Control Pressure Sensor
28- Pump 1 Control Pressure Sensor
29- 5-Spool Solenoid Valve Unit
30- Main Relief Valve (P1, P2)
31- Digging Regenerative Valve
32- Control Valve
33- Arm 2 Flow Rate Control Valve
34- Bypass Shut-Out Valve
35- Main Relief Valve (P3)
36- Arm 1 Flow Rate Control Valve
37- Travel Motor Displacement Angle Control Valve
38- Arm Regenerative Valve
39- 2-Spool Solenoid Valve Unit
40- Power Digging Switch
41- Travel Mode Switch
42- Slow Speed Position
43- Fast Speed Position
44- Power Mode Switch
45- Engine Control Dial
46- Key Switch
47- Pilot Shut-Off Switch
48- DCU
49- Pressure Sensor (Bucket Roll-Out)

Valve Control (Optional) System Layout



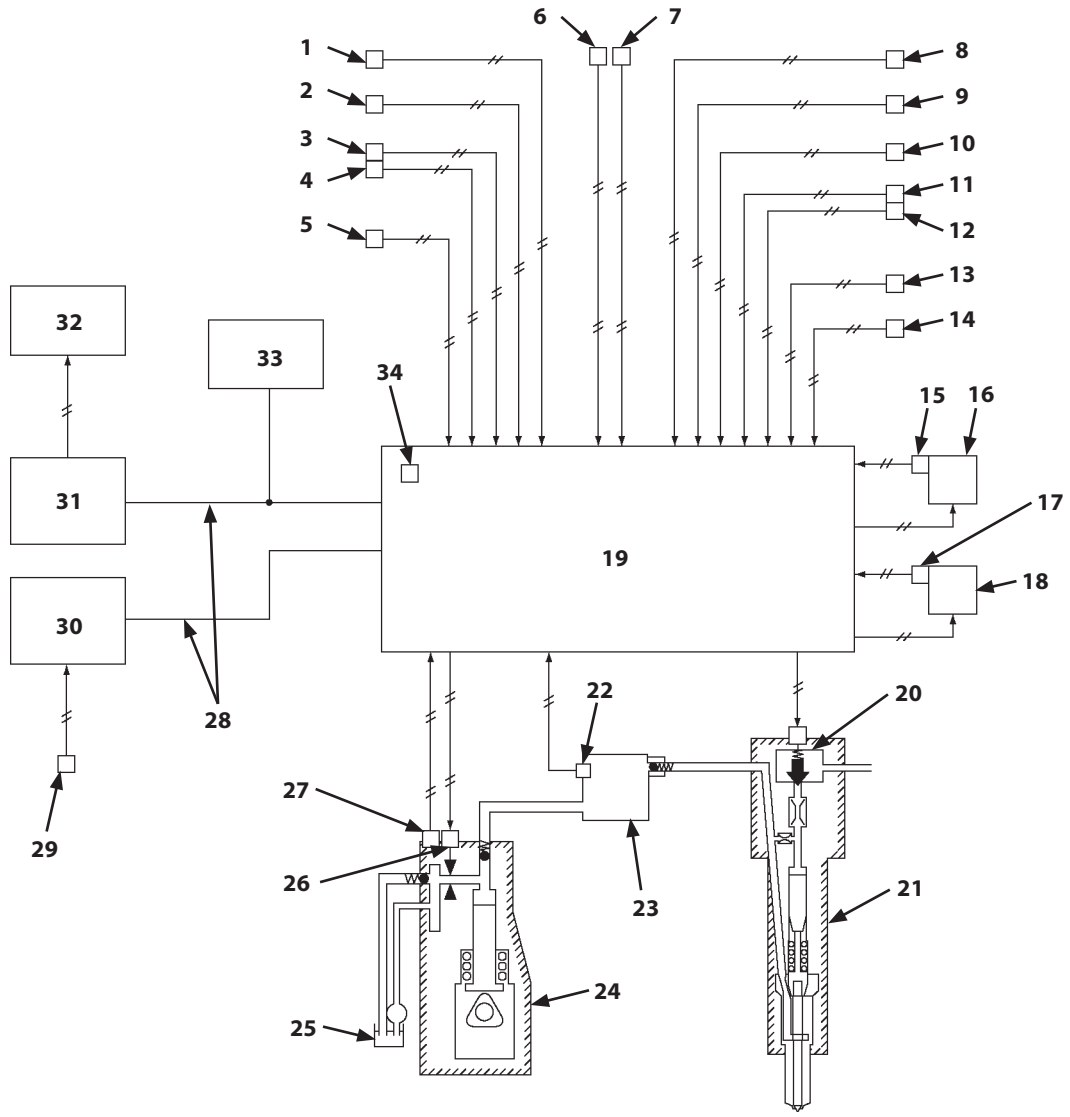
TDDQ-02-02-011

1- Hydraulic Oil Temperature Sensor
2- Pressure Sensor (Boom Raise)
3- Pressure Sensor (Arm Roll-In)
4- Pressure Sensor (Bucket Roll-In)
5- Pressure Sensor (Swing)
6- Pressure Sensor (Travel)
7- Pressure Sensor (Front Attachment)
8- Pressure Sensor (Auxiliary) (OP)
9- Pressure Sensor (Arm Roll-Out)
10- MC
11- CAN
12- MPDr.
13- Monitor Controller
14- Monitor
15- ECM
16- Engine
17- Pump 1 Delivery Pressure Sensor
18- Pump 3 Delivery Pressure Sensor
19- Pump 2 Delivery Pressure Sensor
20- Pump 2 Control Pressure Sensor
21- Pump 3 Control Pressure Sensor
22- Pump 1 Control Pressure Sensor
23- Auxiliary Flow Combiner Control Solenoid Valve
24- Auxiliary Flow Combiner Valve
25- Control Valve
26- Bypass Shut-Out Valve
27- Overload Relief Valve (Auxiliary 1)
28- Boom, Arm, Bucket, or Travel (Right) Pilot Pressure
29- Attachment
30- Accumulator Control Valve
31- Accumulator (High Pressure)
32- Accumulator (Low Pressure)
33- Breaker Relief Solenoid Valve
34- Selector Valve
35- Pilot Pump
36- Selector Valve Control Solenoid Valve
37- Pressure Sensor (Bucket Roll-Out)



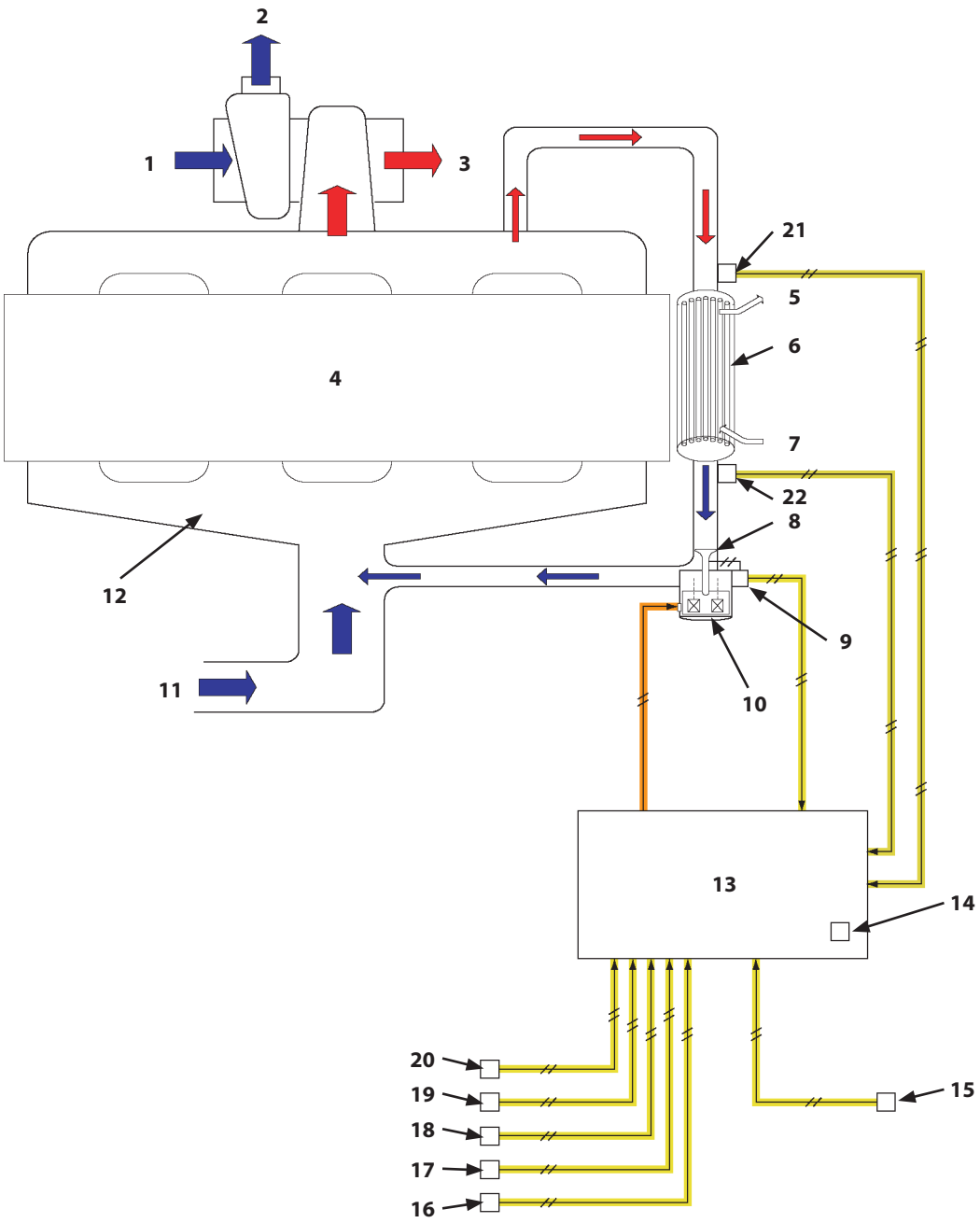
TDC1-02-02-044

1- Hydraulic Oil Temperature Sensor
2- MC
3- CAN
4- MPDr.
5- Monitor Controller
6- Monitor
7- Buzzer
8- ECM
9- Manual Regeneration Switch
10- Coolant Temperature Sensor
11- Engine
12- Pump 1 Delivery Pressure Sensor
13- Auto Shut-Down Relay
14- Engine Control Dial
15- Pilot Shut-Off Switch
16- Overload Alarm Switch



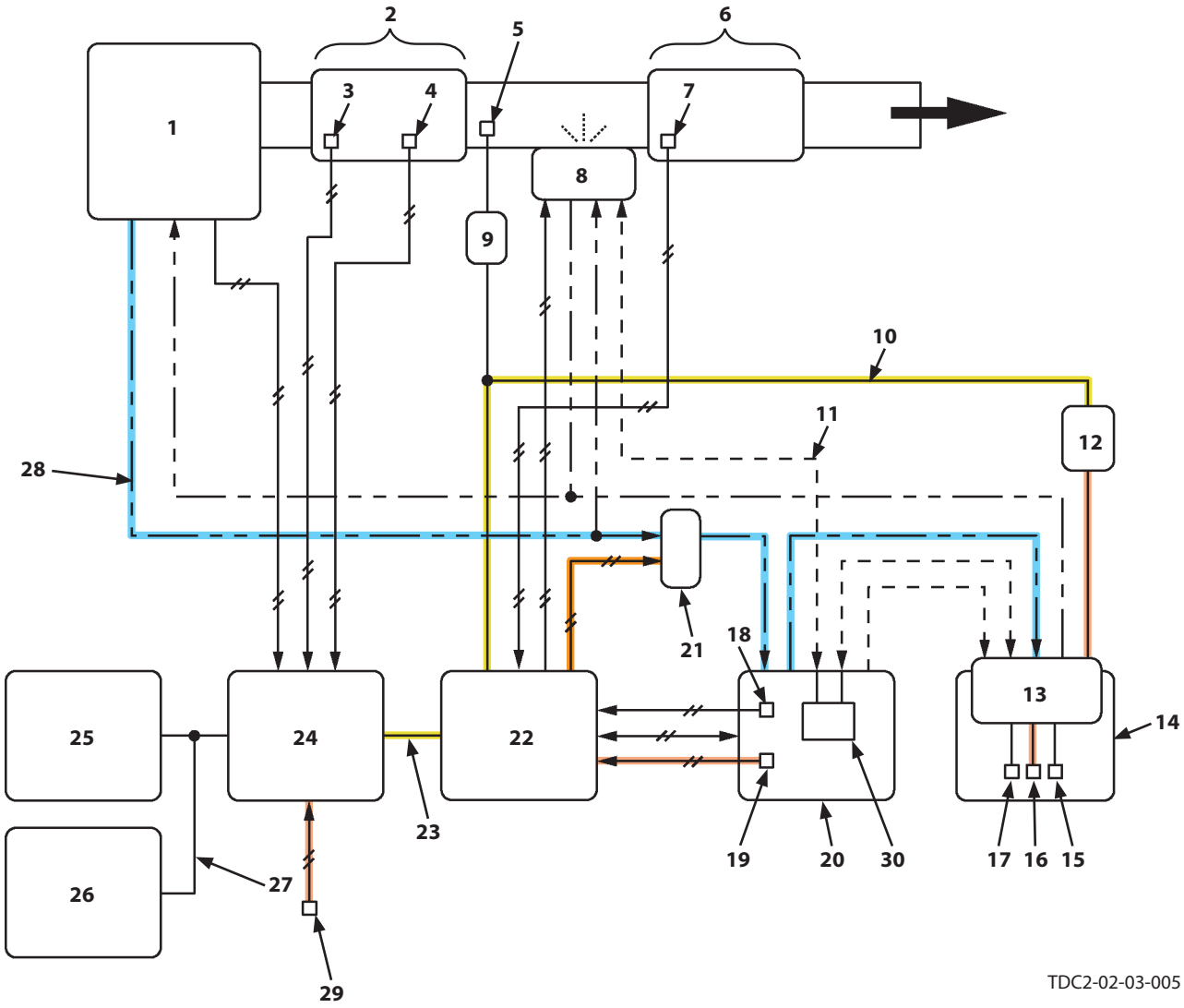
TDC2-02-03-009

1- EGR Cooler Inlet Temperature Sensor
2- EGR Cooler Outlet Temperature Sensor
3- Intake-Air Temperature Sensor
4- MAF Sensor
5- Intercooler Inlet Temperature Sensor
6- DOC Inlet Exhaust Temperature Sensor
7- DOC Outlet Exhaust Temperature Sensor
8- Crank Speed Sensor
9- Cam Angle Sensor
10- Coolant Temperature Sensor
11- Boost Pressure Sensor
12- Boost Temperature Sensor
13- Engine Oil Pressure Sensor
14- Intake Manifold Temperature Sensor
15- EGR Motor Position Sensor
16- EGR Motor
17- Intake Throttle Position Sensor
18- Intake Throttle
19- ECM
20- Two-Way Valve
21- Injector
22- Common Rail Pressure Sensor
23- Common Rail
24- Supply Pump
25- Fuel Tank
26- Suction Control Valve
27- Fuel Temperature Sensor
28- CAN
29- Engine Oil Level Switch
30- MC
31- VGS Controller
32- VGS Actuator
33- DCU
34- Atmospheric Pressure Sensor



TDC2-02-03-013

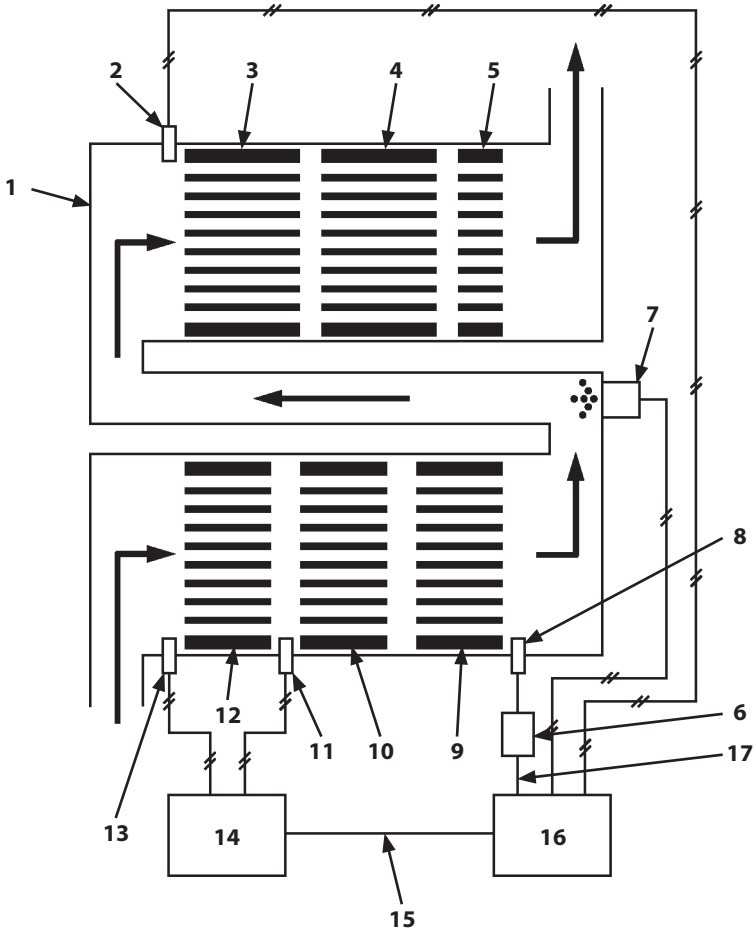
1- From Air Cleaner
2- To Intercooler
3- Exhaust (To Aftertreatment Device)
4- Engine
5- Outlet of Coolant
6- Cooling System
7- Inlet of Coolant
8- EGR Valve
9- EGR Motor Position Sensor
10- EGR Motor
11- Intake-Air (From Suction Intercooler)
12- Intake Manifold
13- ECM
14- Atmospheric Pressure Sensor
15- MAF Sensor (Intake-Air Temperature Sensor)
16- Intake Manifold Temperature Sensor
17- Common Rail Pressure Sensor
18- Coolant Temperature Sensor
19- Cam Angle Sensor
20- Crank Speed Sensor
21- EGR Cooler Inlet Temperature Sensor
22- EGR Cooler Outlet Temperature Sensor



1- Engine
2- DOC (Diesel Oxidation Catalyst)
3- DOC Inlet Exhaust Temperature Sensor
4- DOC Outlet Exhaust Temperature Sensor
5- NOx Sensor (Sensor Part)
6- SCR Catalyst
7- SCR Exhaust Temperature Sensor
8- Dosing Module
9- NOx Sensor (Controller Part)
10- Local-CAN
11- DEF Piping
12- DEF Sensor Unit Controller
13- DEF Sensor Unit
14- DEF Tank
15- DEF Tank Level Sensor
16- DEF Tank Temperature Sensor
17- DEF Quality Sensor
18- DEF Pressure Sensor
19- DEF Supply Module Temperature Sensor
20- DEF Supply Module
21- Coolant Control Valve
22- DCU
23- ISO-CAN
24- ECM
25- Monitor Controller
26- MC
27- CAN0
28- Coolant Piping
29- MAF/Intake-Air Temperature Sensor
30- Reverting Valve

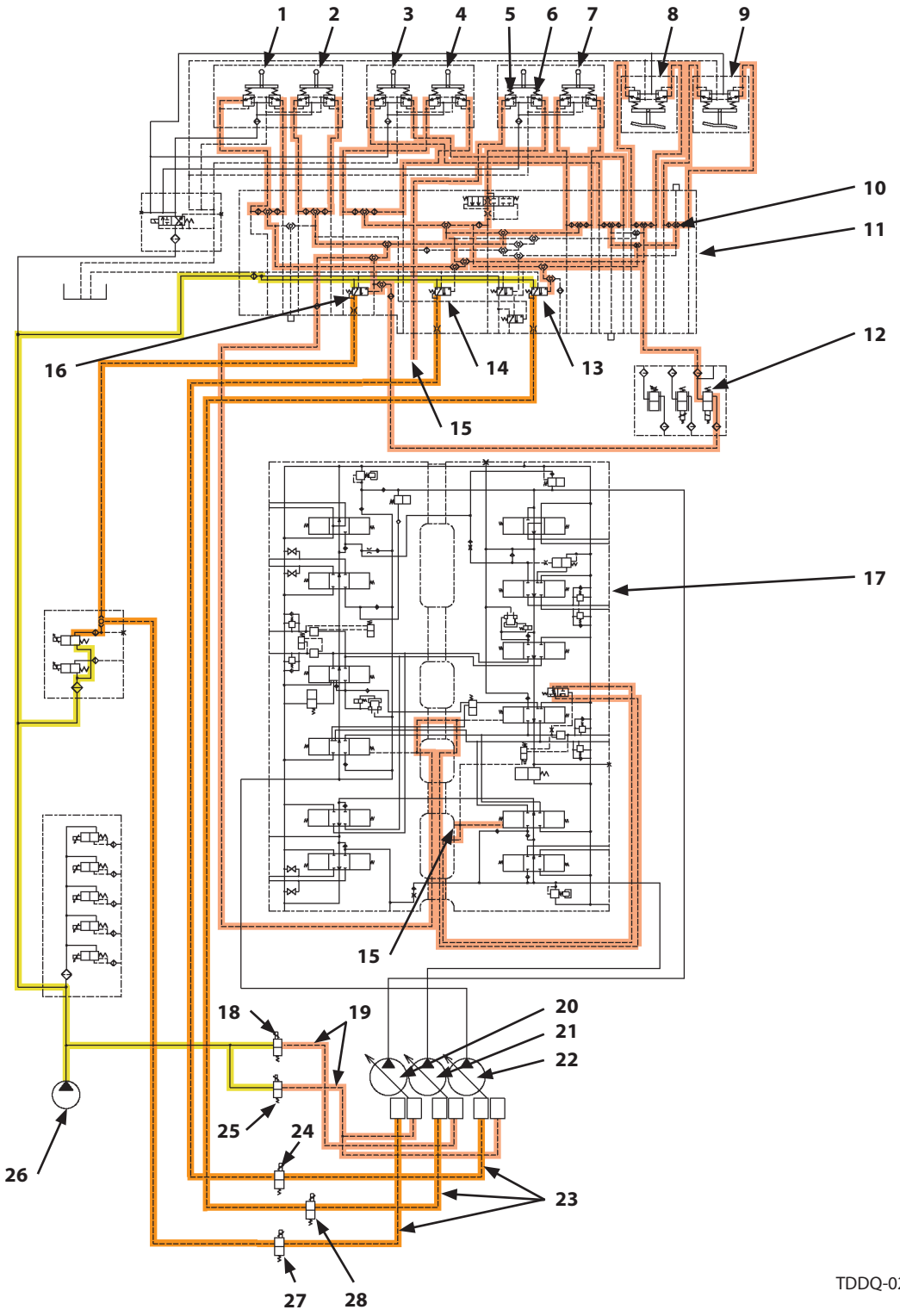
Operation

1. Exhaust gas which burns in the engine cylinder flows into aftertreatment device (1).
2. Diesel oxidation catalysts (DOC) 1 (12), 2(10), and 3 (9) reduce harmful substances contained in exhaust gas such as carbon monoxide by initiating a chemical reaction.
3. DCU (16) controls dosing module (7) according to the signals from NOx sensor (8).
4. Dosing module (7) injects DEF into aftertreatment device (1).
5. At this time, DEF breaks down into ammonia (NH_3) and carbon dioxide (CO_2).
6. SCR catalysts 1 (3) and 2 (4) initiate a chemical reaction of ammonia (NH_3) and NOx in exhaust gas, so that, NOx is broken down into nitrogen and water.
7. Diesel oxidation catalysts (DOC) 4 (5) breaks down ammonia (NH_3) into nitrogen (N_2) and water (H_2O).
8. As a result, NOx is reduced from exhaust gas and any remaining ammonia (NH_3) is removed.



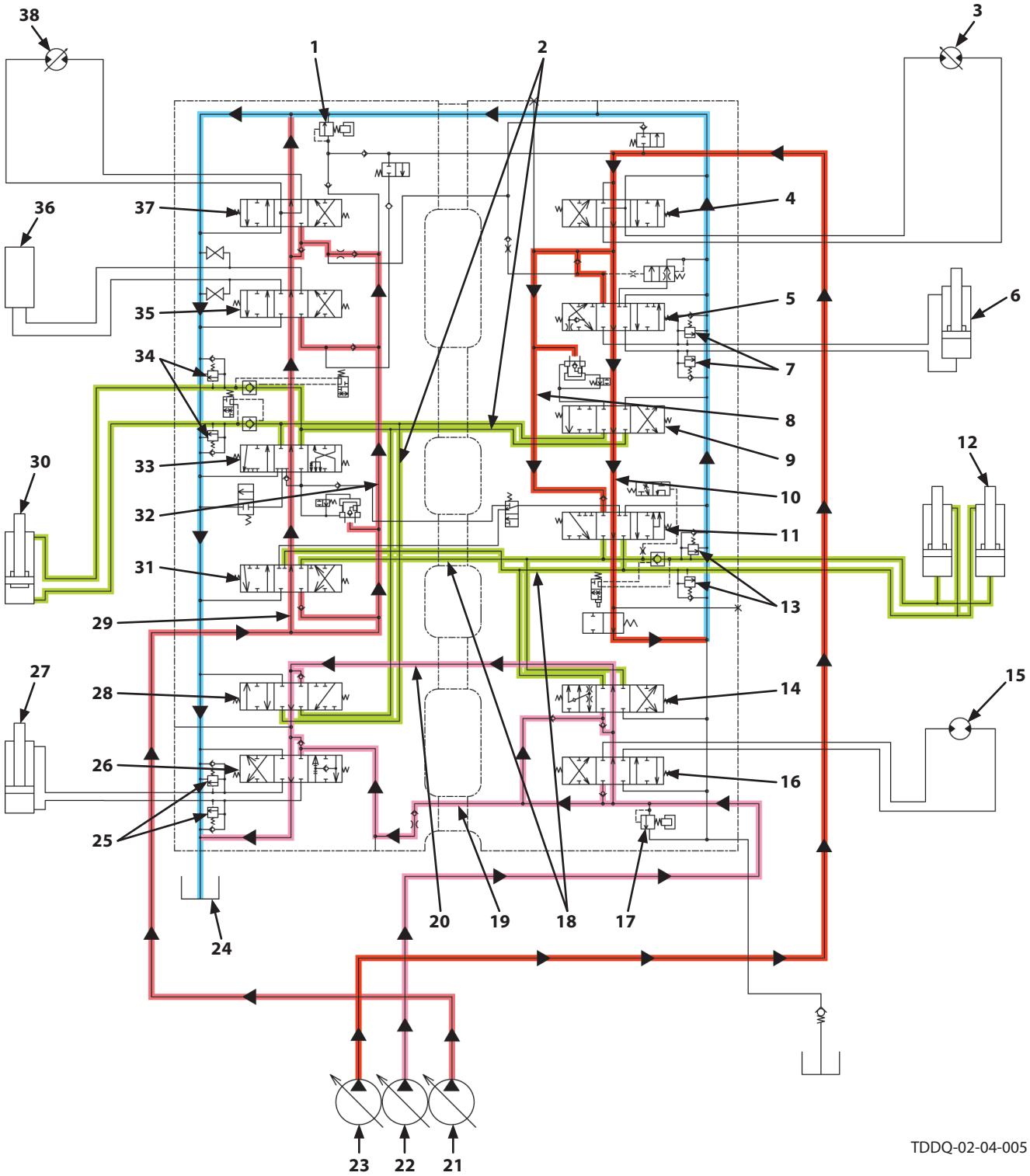
TDC2-02-03-017

1- Aftertreatment Device
2- SCR Exhaust Temperature Sensor
3- SCR Catalyst 1
4- SCR Catalyst 2
5- Diesel Oxidation Catalyst (DOC) 4
6- NOx Sensor Controller
7- Dosing Module
8- NOx Sensor
9- Diesel Oxidation Catalyst (DOC) 3
10- Diesel Oxidation Catalyst (DOC) 2
11- DOC Outlet Exhaust Temperature Sensor
12- Diesel Oxidation Catalyst (DOC) 1
13- DOC Inlet Exhaust Temperature Sensor
14- ECM
15- ISO-CAN
16- DCU
17- Local-CAN



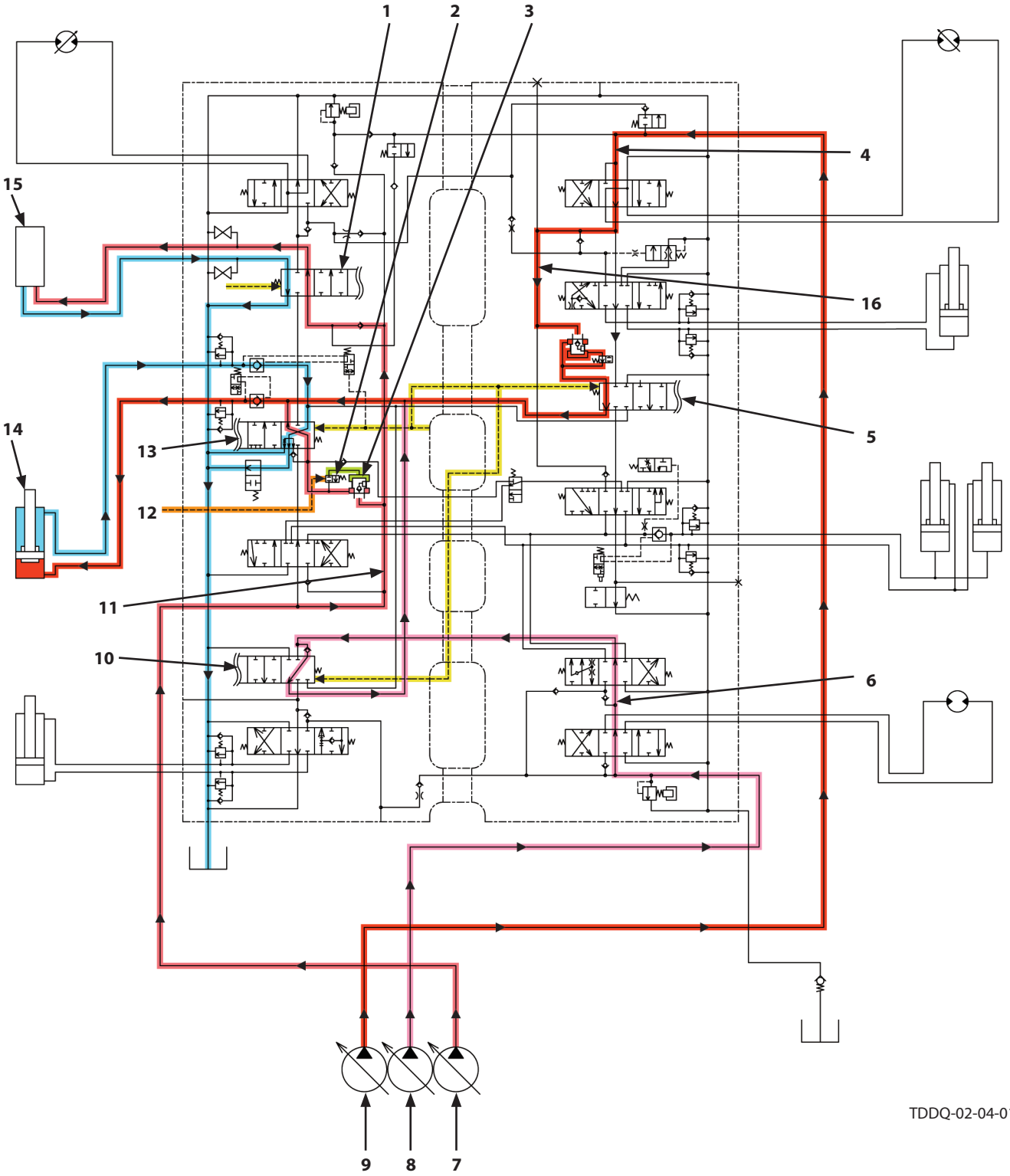
TDDQ-02-04-002

1- Travel (Left)
2- Travel (Right)
3- Swing
4- Arm
5- Boom Lower
6- Boom Raise
7- Bucket
8- Auxiliary 1
9- Positioning/Auxiliary 2
10- Shuttle Valve
11- Signal Control Valve
12- Auxiliary Flow Combiner Control Solenoid Valve (Optional)
13- Pump 3 Flow Rate Control Valve
14- Pump 2 Flow Rate Control Valve
15- Boom Lower Pilot Pressure
16- Pump 1 Flow Rate Control Valve
17- Control Valve
18- Pump 3 Torque Control Solenoid Valve
19- Torque Control Pressure Ppc
20- Pump 1
21- Pump 3
22- Pump 2
23- Pump Control Pressure Pi
24- Maximum Pump 2 Flow Rate Limit Control Solenoid Valve
25- Pump 1 and 2 Torque Control Solenoid Valve
26- Pilot Pump
27- Maximum Pump 1 Flow Rate Limit Control Solenoid Valve
28- Maximum Pump 3 Flow Rate Limit Control Solenoid Valve



TDDQ-02-04-005

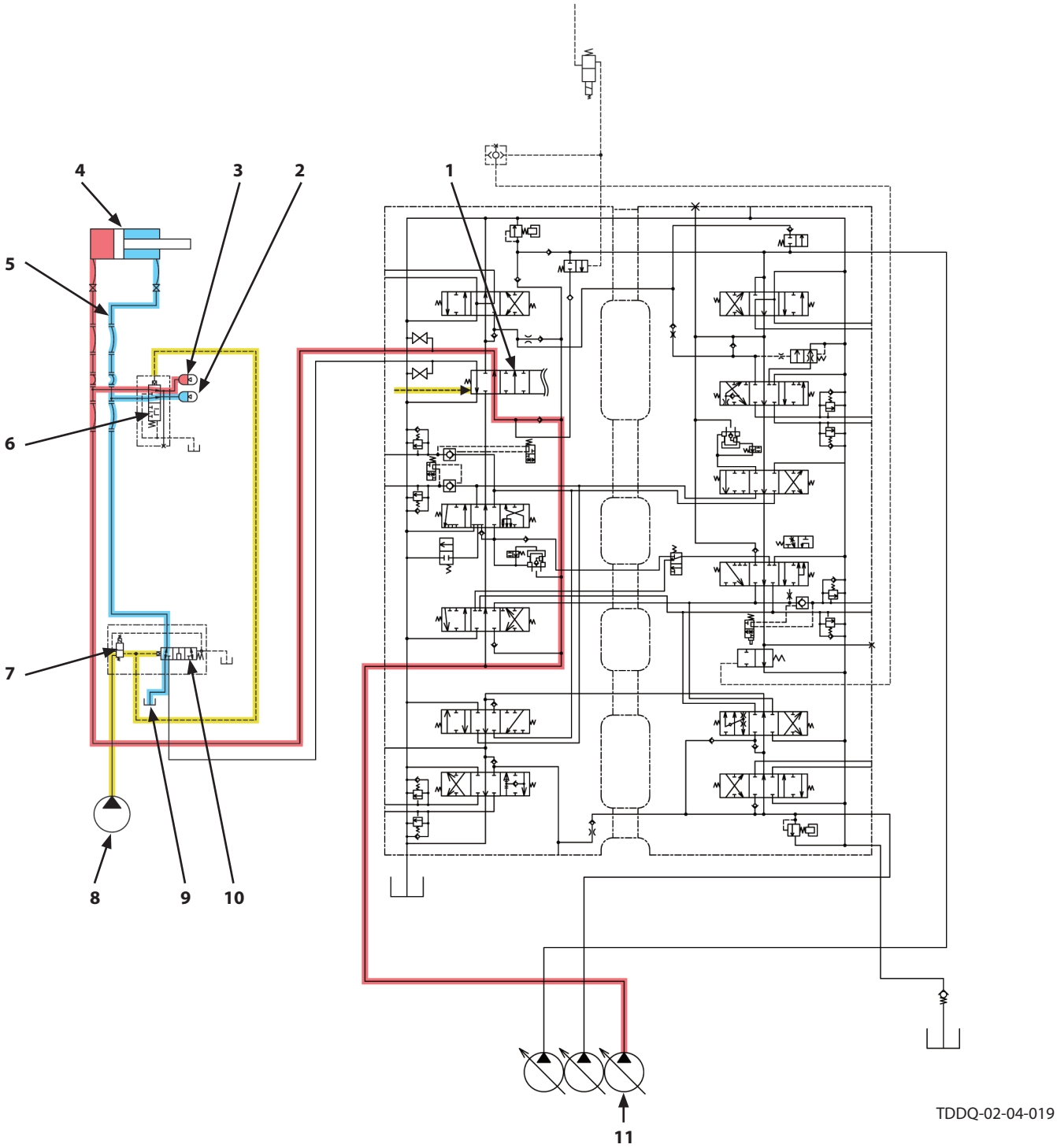
1- Main Relief Valve (P1, P2)
2- Flow Combiner Circuit (Arm)
3- Travel Motor (Right)
4- Travel (Right) Spool
5- Bucket Spool
6- Bucket Cylinder
7- Overload Relief Valve
8- Parallel Circuit (Pump 1)
9- Arm 2 Spool
10- Neutral Circuit (Pump 1)
11- Boom 1 Spool
12- Boom Cylinder
13- Overload Relief Valve
14- Boom 3 Spool
15- Swing Motor
16- Swing Spool
17- Main Relief Valve (P3)
18- Flow Combiner Circuit (P3)
19- Parallel Circuit (Pump 3)
20- Neutral Circuit (Pump 3)
21- Pump 2
22- Pump 3
23- Pump 1
24- Hydraulic Oil Tank
25- Overload Relief Valve
26- Positioning/Auxiliary 2 Spool
27- Positioning Cylinder
28- Arm 3 Spool
29- Neutral Circuit (Pump 2)
30- Arm Cylinder
31- Boom 2 Spool
32- Parallel Circuit (Pump 2)
33- Arm 1 Spool
34- Overload Relief Valve
35- Auxiliary 1 Spool
36- Attachment
37- Travel (Left) Spool
38- Travel Motor (Left)



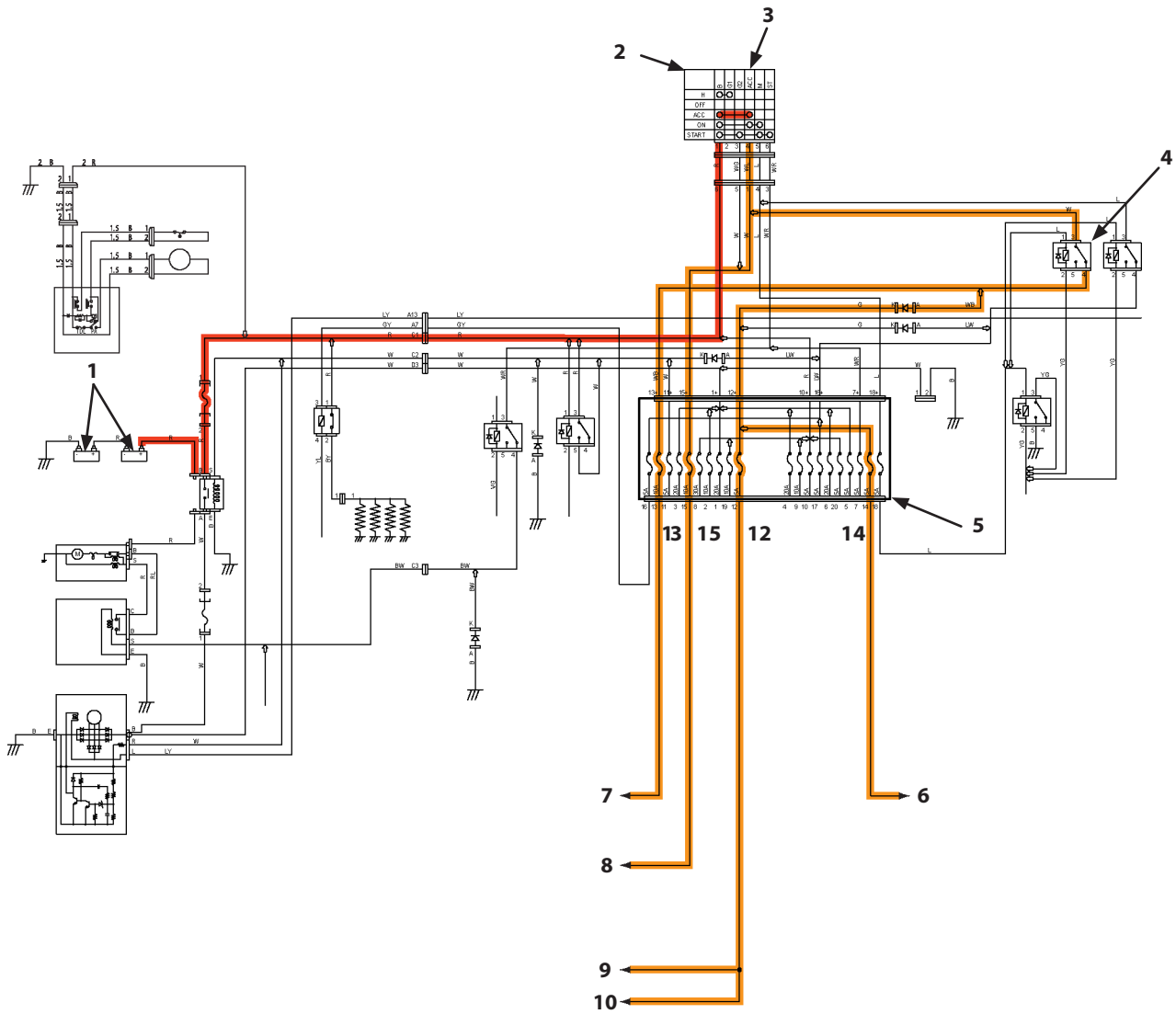
TDDQ-02-04-010

1- Auxiliary 1 Spool
2- Arm 1 Flow Rate Control Valve (Selector Valve)
3- Arm 1 Flow Rate Control Valve (Poppet Valve)
4- Neutral Circuit (Pump 1)
5- Arm 2 Spool
6- Neutral Circuit (Pump 3)
7- Pump 2
8- Pump 3
9- Pump 1
10- Arm 3 Spool
11- Parallel Circuit (Pump 2)
12- Pilot Pressure from 5-Spool Solenoid Valve Unit (SE)
13- Arm 1 Spool
14- Arm Cylinder
15- Attachment
16- Parallel Circuit (Pump 1)

(Blank)

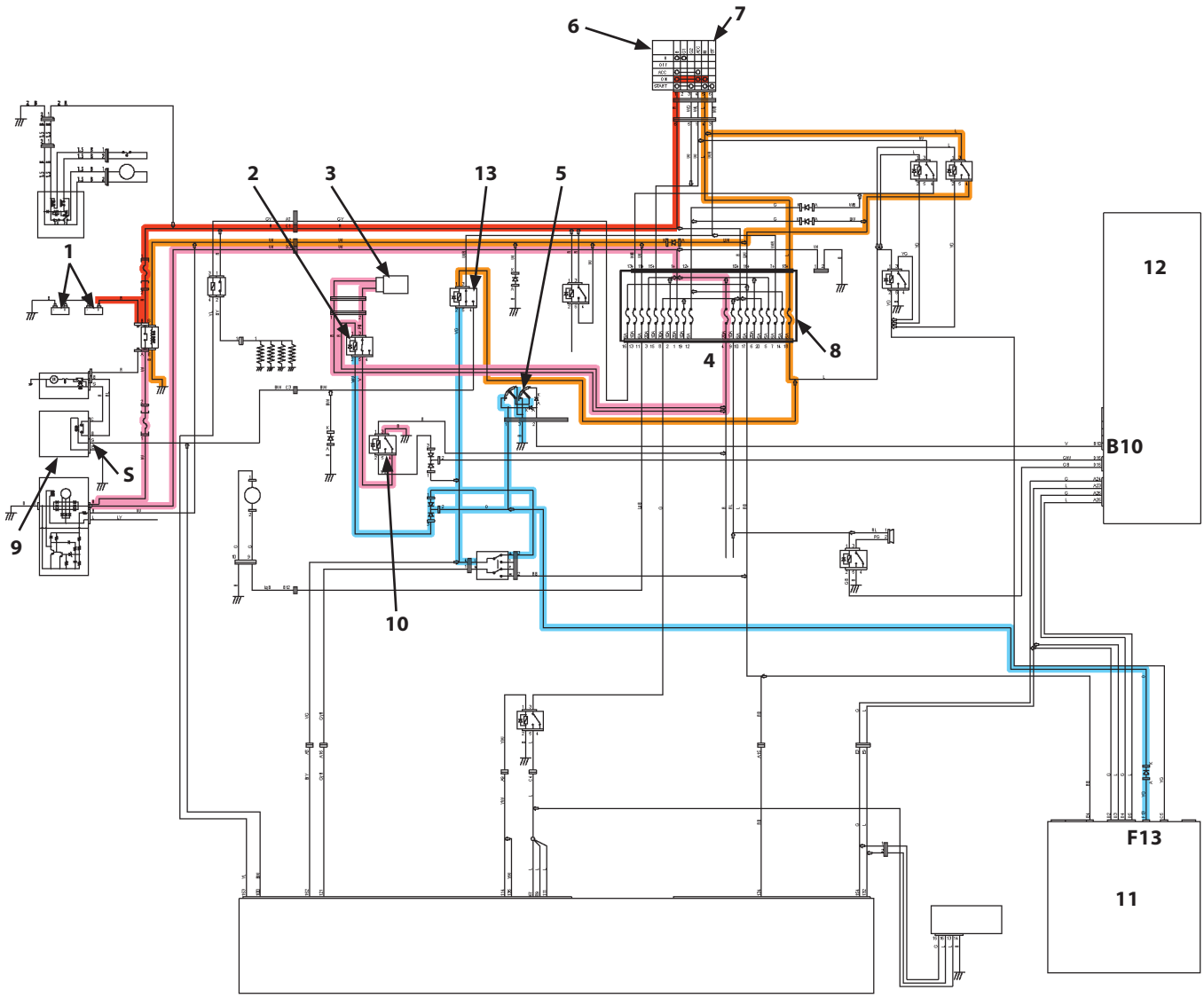


1- Auxiliary 1 Spool
2- Accumulator (Low-Pressure Side)
3- Accumulator (High-Pressure Side)
4- Breaker
5- Return Circuit
6- Accumulator Control Valve
7- Selector Valve Control Solenoid Valve
8- Pilot Pump
9- Hydraulic Oil Tank
10- Selector Valve
11- Pump 2



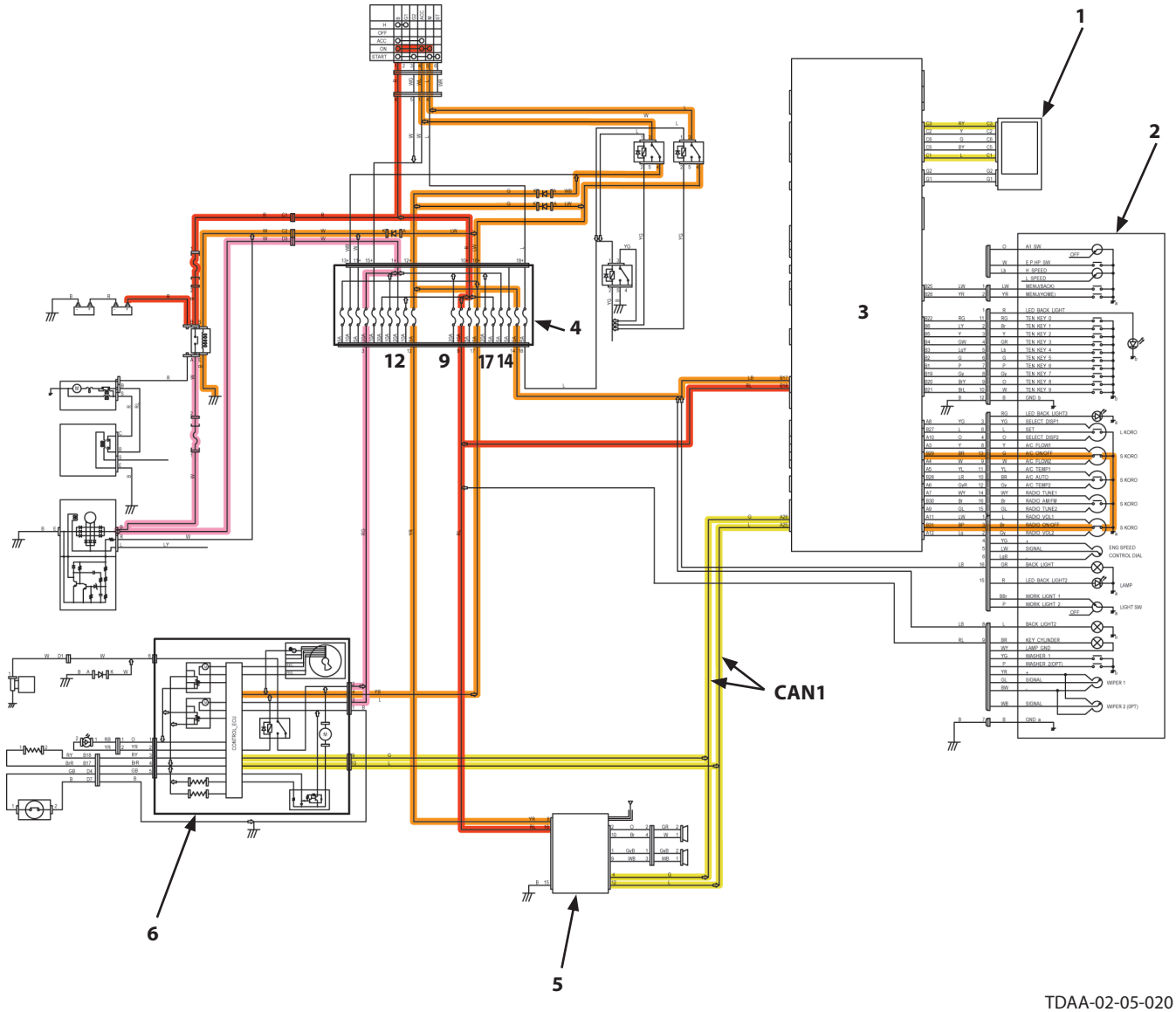
TDC1-02-05-008

1- Battery
2- Key Switch
3- Terminal ACC
4- ACC Cut Relay
5- Fuse Box 1
6- Monitor Controller
7- Cigar Lighter
8- Auxiliary
9- Wiper/Light Controller
10- Radio



TDC1-02-05-004

1- Battery
2- Pilot Shut-Off Relay
3- Pilot Shut-Off Solenoid Valve
5- Pilot Shut-Off Switch (Pilot Shut-Off Lever)
6- Key Switch
7- Terminal ST
8- Fuse Box 1
9- Starter Relay 1
10- Security Relay
11- MC
12- Monitor Controller
13- Starter Cut Relay

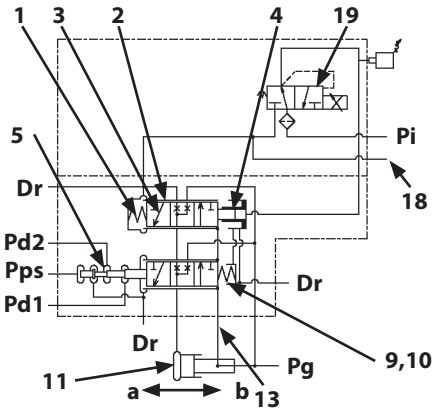


TDAA-02-05-020

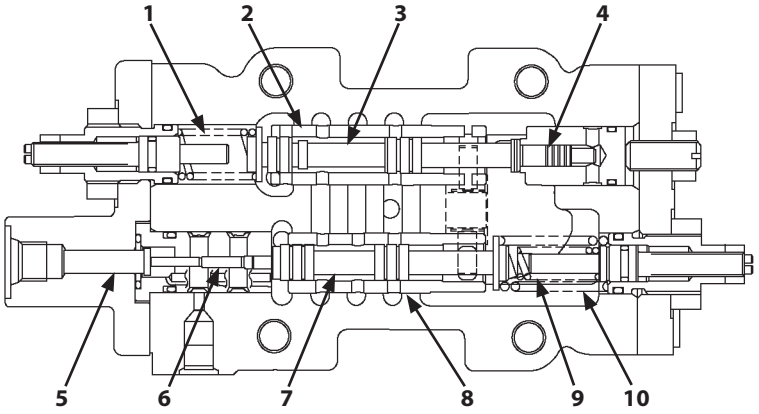
1- Monitor
2- Switch Panel
3- Monitor Controller
4- Fuse Box 1
5- Radio
6- Air Conditioner Unit

MEMO

Pump 1 Regulator

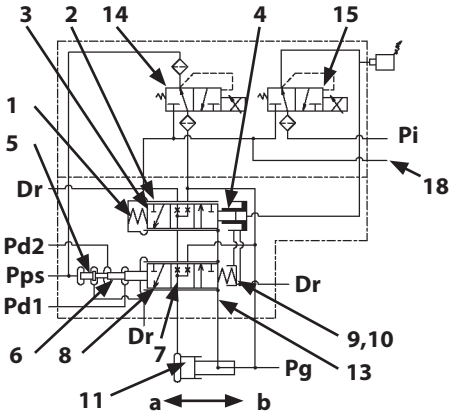


Regulators for Pump 1 and Pump 2



TDC1-03-01-003

Pump 2 Regulator



Pd1- Pump 1 Delivery Pressure

Pd2- Pump 2 Delivery Pressure

Dr- Returning to Hydraulic Oil Tank

Pi- Pump Control Pressure

Pps- Torque Control Pressure

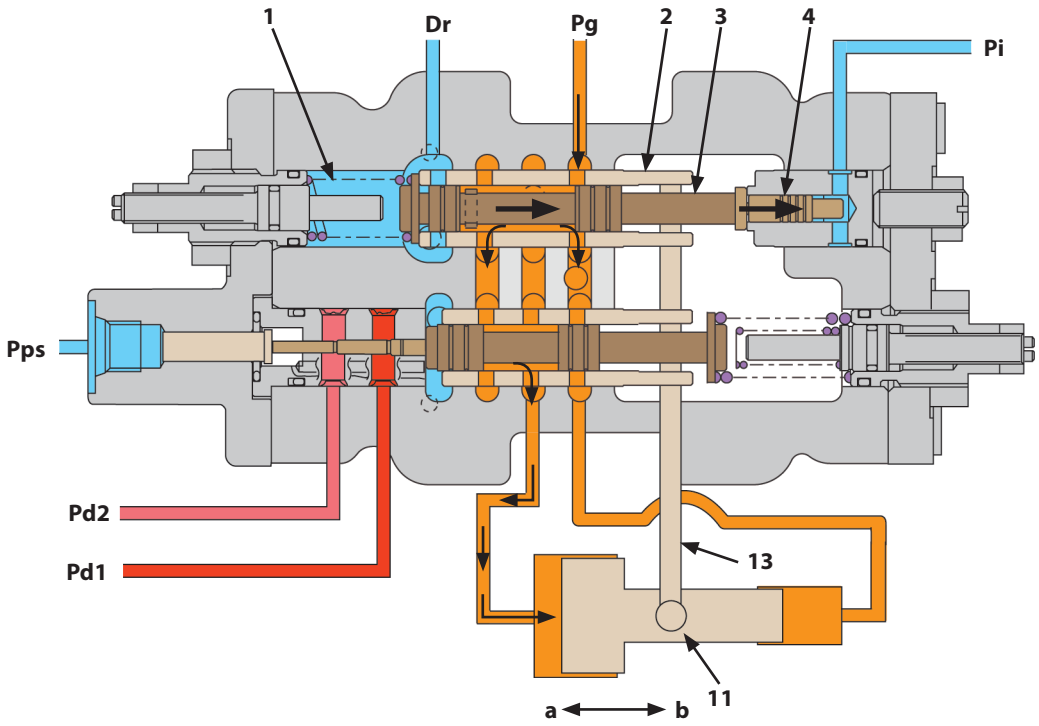
Pg- Primary Pilot Pressure (From Pilot Pump)

a- Displacement Angle Increase

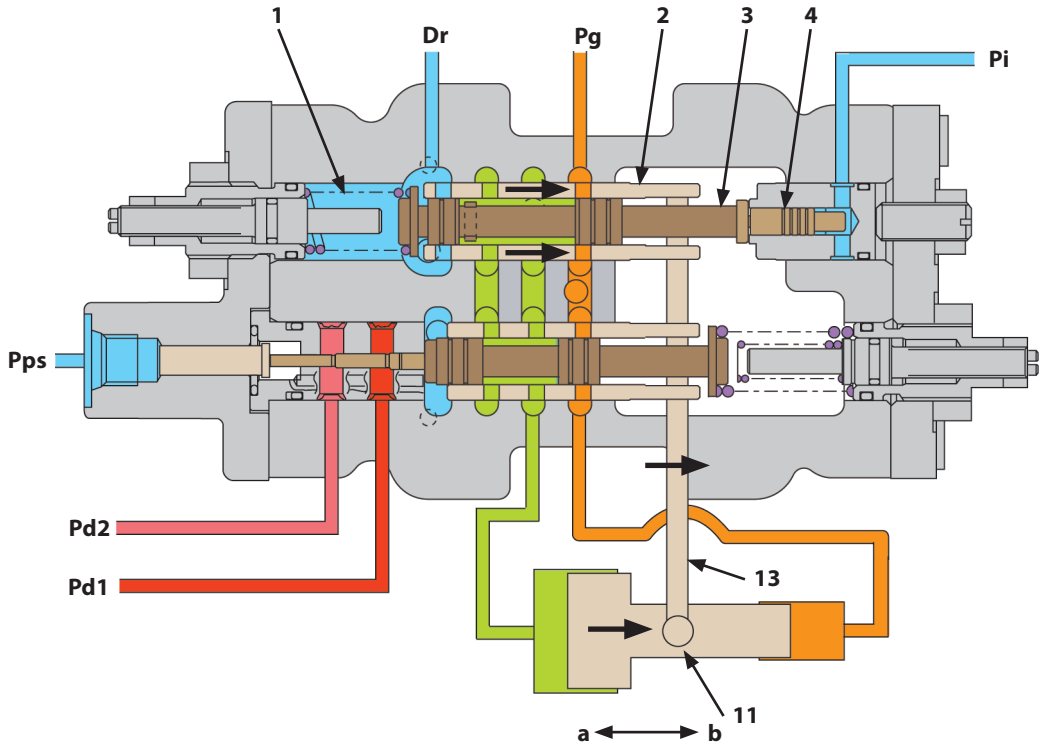
b- Displacement Angle Decrease

1- Spring
2- Sleeve A
3- Spool A
4- Piston
5- Load Piston 1
6- Load Piston 2
7- Spool B
8- Sleeve B
9- Inner Spring
10- Outer Spring
11- Servo Piston
13- Link
14- Pump 1 and 2 Torque Control Solenoid Valve
15- Maximum Pump 2 Flow Rate Limit Control Solenoid Valve
18- Air Bleeding Circuit
19- Maximum Pump 1 Flow Rate Limit Control Solenoid Valve

NOTE: The illustration shows the pump1 regulator.



TPPP-03-01-018



TPPP-03-01-019

Pd1- Pump 1 Delivery Pressure
Pd2- Pump 2 Delivery Pressure

Dr- Returning to Hydraulic Oil Tank
Pi- Pump Control Pressure

Pps- Torque Control Pressure
Pg- Primary Pilot Pressure (From Pilot Pump)

a- Displacement Angle Increase
b- Displacement Angle Decrease

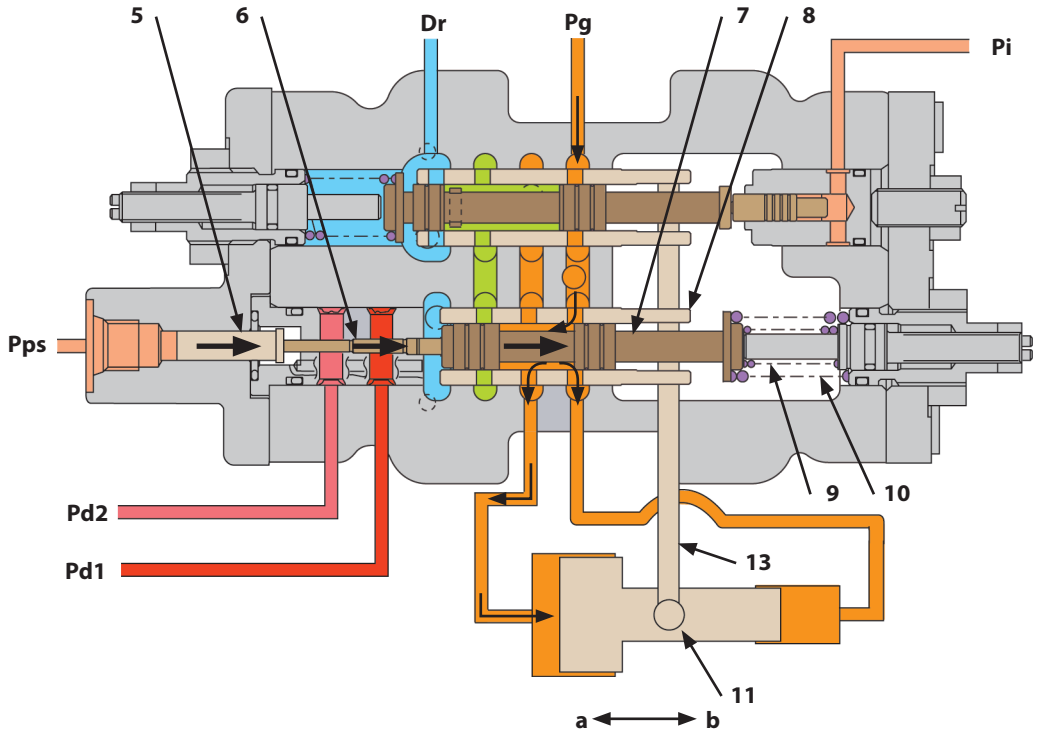
1- Spring
2- Sleeve A

3- Spool A
4- Piston

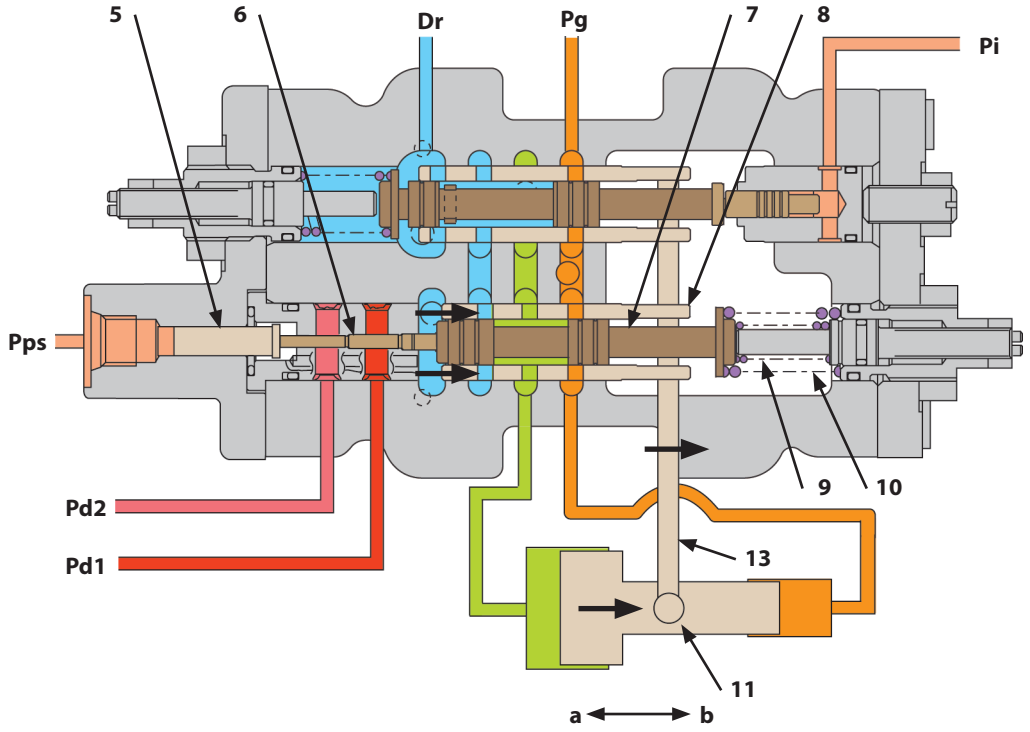
11- Servo Piston

13- Link

NOTE: The illustration shows the pump2 regulator.



TPPP-03-01-022



TPPP-03-01-023

Pd1- Pump 1 Delivery Pressure
Pd2- Pump 2 Delivery Pressure

Dr- Returning to Hydraulic Oil Tank
Pi- Pump Control Pressure

Pps- Torque Control Pressure
Pg- Primary Pilot Pressure (From Pilot Pump)

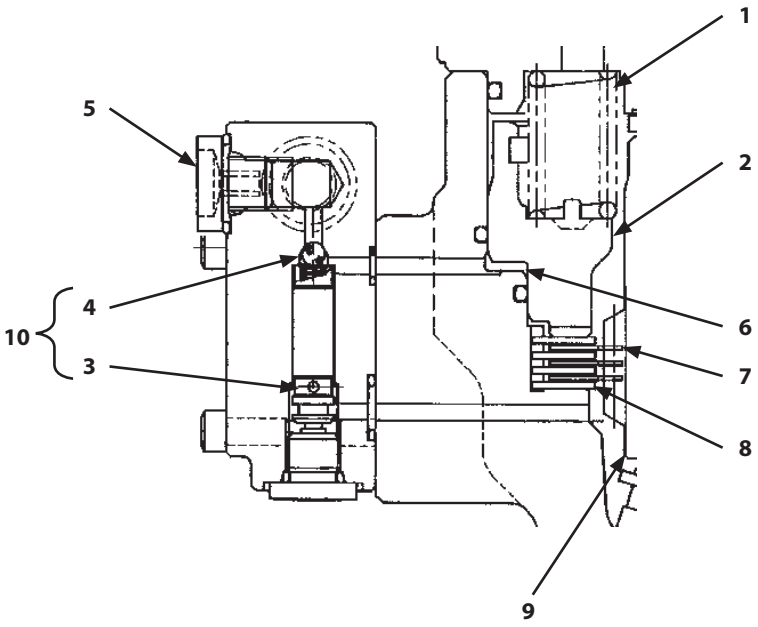
a- Displacement Angle Increase
b- Displacement Angle Decrease

5- Load Piston 1
6- Load Piston 2

7- Spool B
8- Sleeve B

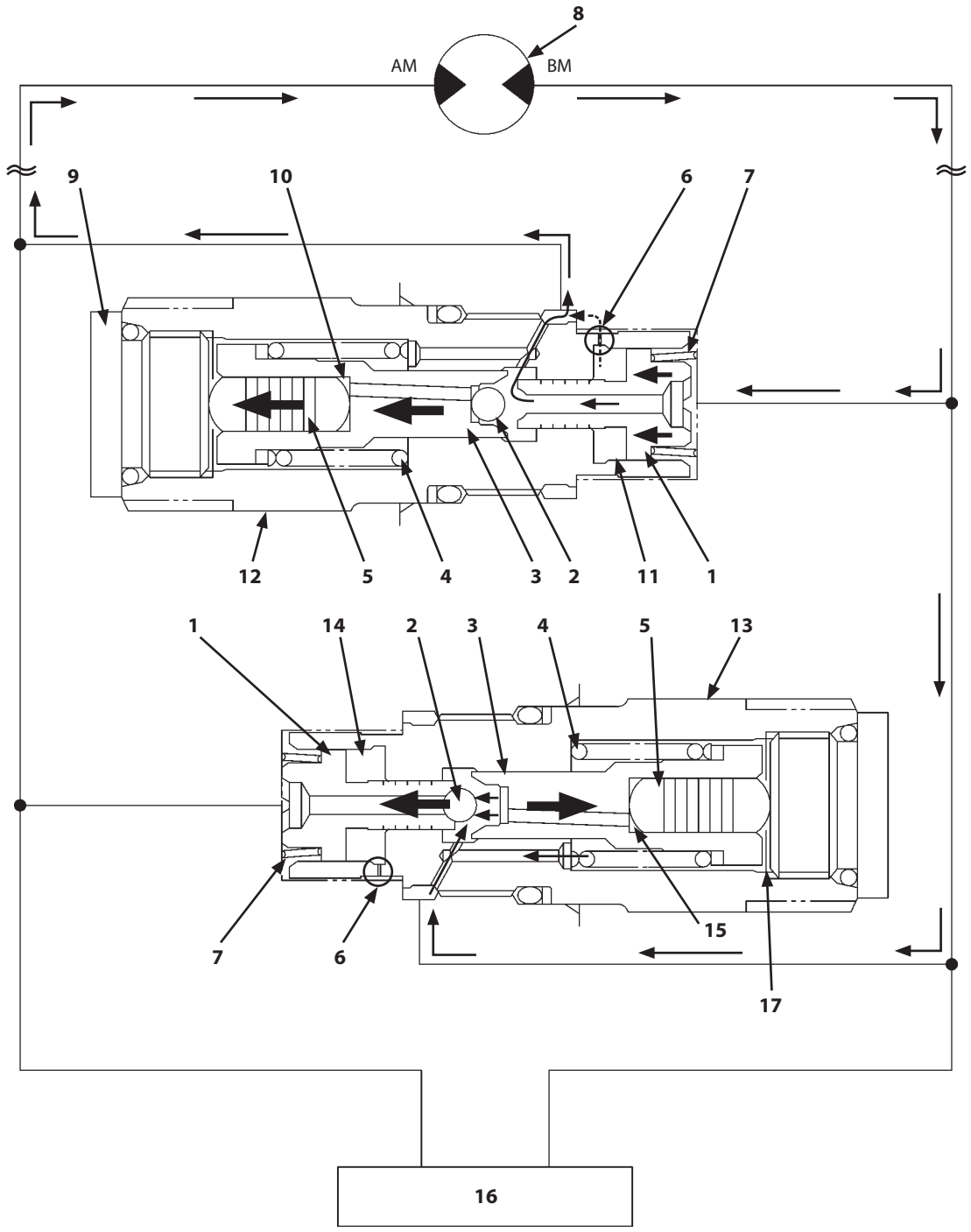
9- Inner Spring
10- Outer Spring

11- Servo Piston
13- Link



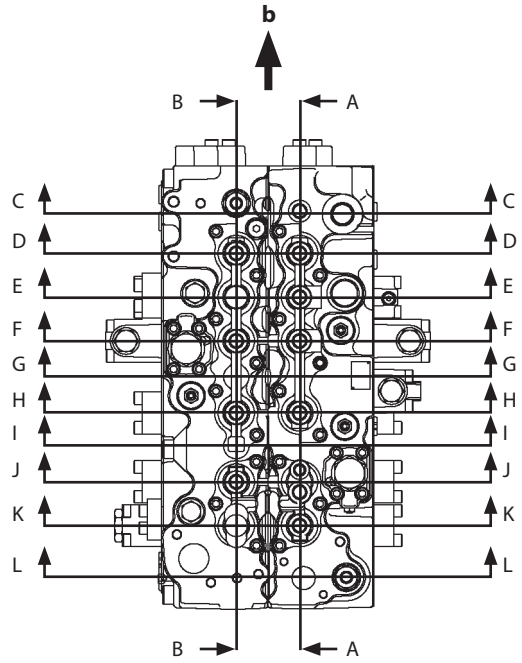
T1V7-03-02-002

1- Spring
2- Brake Piston
3- Orifice
4- Check Valve
5- Port SH (Brake Release Pressure)
6- Brake Piston Chamber
7- Friction Plate
8- Plate
9- Rotor
10- Swing Parking Brake Selection Valve



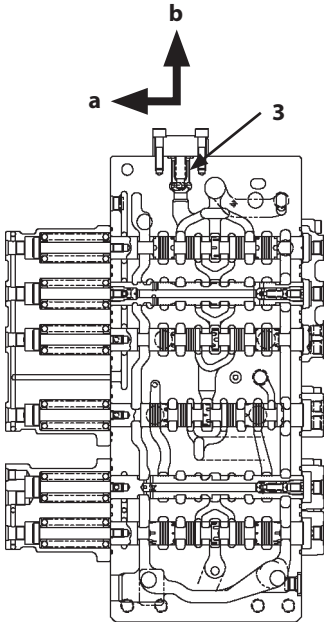
T1V1-03-02-015

1- Poppet
2- Ball
3- Plunger
4- Spring
5- Piston
6- Orifice
7- Spring
8- Swing Motor
9- Plug
10- Chamber N (Combination Valve A)
11- Chamber M (Combination Valve A)
12- Combination Valve A
13- Combination Valve B
14- Chamber M (Combination Valve B)
15- Chamber N (Combination Valve B)
16- Control Valve
17- Spring Chamber



TDAB-03-03-004

Section A-A



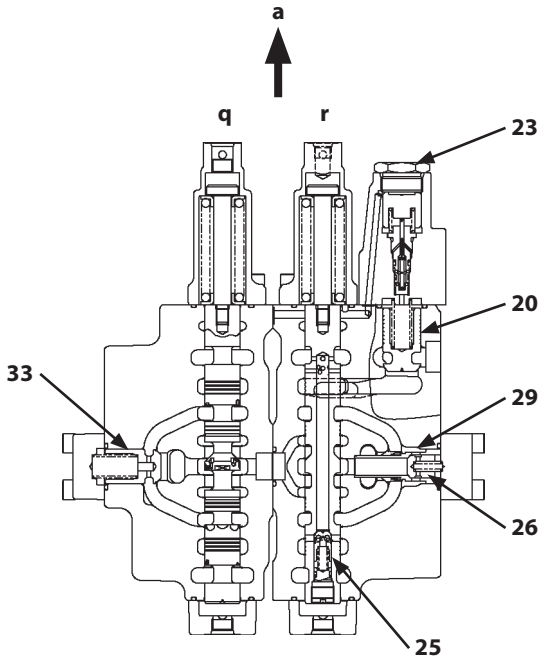
TDAA-03-03-008

a- Machine Upper Side

b- Machine Front Side

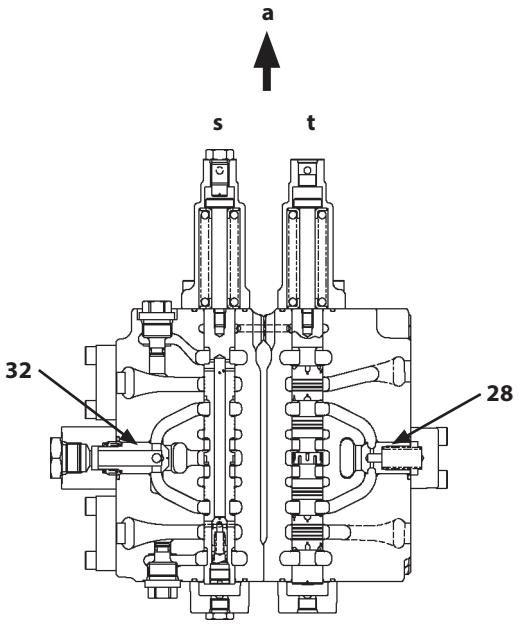
1- Check Valve (Main Relief Circuit)
2- Main Relief Valve (P1, P2)
3- Check Valve (Main Relief Circuit)
4- Load Check Valve (Travel (Left) Parallel Circuit)
5- Auxiliary Flow Combiner Valve
6- Check Valve (Auxiliary Flow Combiner Circuit)
7- Load Check Valve (Orifice) (Bucket)
8- Check Valve (Bucket Tandem Circuit)
9- Check Valve (Flow Combiner Circuit)
10- Flow Combiner Valve
11- Bucket Regeneration Cut Valve
12- Bucket Regenerative Valve
13- Arm 2 Flow Rate Control Valve (Poppet Valve)
14- Arm 2 Flow Rate Control Valve (Selector Valve)
15- Overload Relief Valve (Bucket: Rod Side)
16- Overload Relief Valve (Bucket: Bottom Side)
18- Load Check Valve (Boom 1 Parallel Circuit)
19- Boom Lower Meter-In Cut Valve
20- Boom Anti-Drift Valve (Check Valve)
21- Overload Relief Valve (Boom: Bottom Side)
22- Overload Relief Valve (Boom: Rod Side)
23- Boom Anti-Drift Valve (Selector Valve)
24- Bypass Shut-Out Valve
25- Boom Regenerative Valve
26- Load Check Valve (Boom 3 Tandem Circuit)
27- Main Relief Valve (P3)
28- Load Check Valve (Swing Tandem Circuit)
29- Load Check Valve (Boom 3 Parallel Circuit)
30- Digging Regenerative Valve
31- Load Check Valve (Auxiliary 2 Parallel Circuit)
32- Load Check Valve (Auxiliary 2 Tandem Circuit)
33- Load Check Valve (Arm 3 Tandem Circuit)
34- Overload Relief Valve (Positioning/Auxiliary 2)
35- Overload Relief Valve (Positioning/Auxiliary 2)
36- Load Check Valve (Boom 2 Parallel Circuit)
37- Arm 1 Flow Rate Control Valve (Poppet Valve)
38- Arm 1 Flow Rate Control Valve (Selector Valve)
39- Load Check Valve (Digging Regenerative Circuit)
40- Arm Regenerative Valve
41- Load Check Valve (Arm Regenerative Circuit)
42- Arm Bottom Anti-Drift Valve (Check Valve)
43- Overload Relief Valve (Arm: Bottom Side)
44- Arm Rod Anti-Drift Valve (Selector Valve)
45- Arm Bottom Anti-Drift Valve (Selector Valve)
46- Arm Rod Anti-Drift Valve (Check Valve)
47- Overload Relief Valve (Arm: Rod Side)
48- Load Check Valve (Auxiliary Parallel Circuit)
49- Load Check Valve (Travel (Left) Tandem Circuit)
50- Pump 2
51- Pump 3
52- Pump 1

Section J-J



TDAA-03-03-017

Section K-K

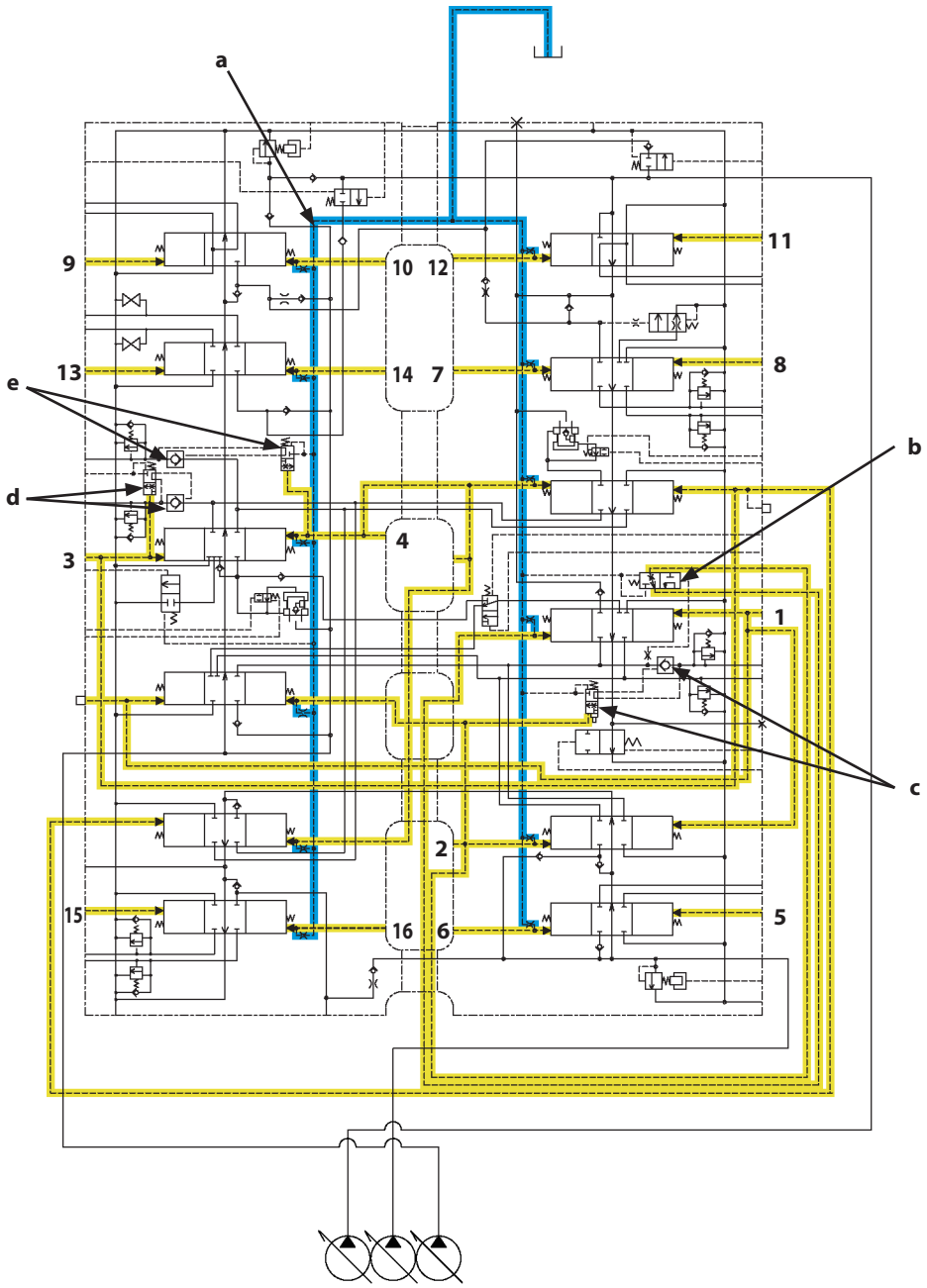


TDAB-03-03-008

a- Machine Upper Side
q - Arm 3
r - Boom 3
s - Positioning/Auxiliary 2
t - Swing

1- Check Valve (Main Relief Circuit)
2- Main Relief Valves (P1, P2)
3- Check Valve (Main Relief Circuit)
4- Load Check Valve (Travel (Left) Parallel Circuit)
5- Auxiliary Flow Combiner Valve
6- Check Valve (Auxiliary Flow Combiner Circuit)
7- Load Check Valve (Orifice) (Bucket)
8- Check Valve (Bucket Tandem Circuit)
9- Check Valve (Flow Combiner Circuit)
10- Flow Combiner Valve
11- Bucket Regeneration Cut Valve
12- Bucket Regenerative Valve
13- Arm 2 Flow Rate Control Valve (Poppet Valve)
14- Arm 2 Flow Rate Control Valve (Selector Valve)
15- Overload Relief Valve (Bucket: Rod Side)
16- Overload Relief Valve (Bucket: Bottom Side)
18- Load Check Valve (Boom 1 Parallel Circuit)
19- Boom Lower Meter-In Cut Valve
20- Boom Anti-Drift Valve (Check Valve)
21- Overload Relief Valve (Boom: Bottom Side)
22- Overload Relief Valve (Boom: Rod Side)
23- Boom Anti-Drift Valve (Selector Valve)
24- Bypass Shut-Out Valve
25- Boom Regenerative Valve
26- Load Check Valve (Boom 3 Tandem Circuit)
27- Main Relief Valve (P3)
28- Load Check Valve (Swing Tandem Circuit)
29- Load Check Valve (Boom 3 Parallel Circuit)
30- Digging Regenerative Valve
31- Load Check Valve (Auxiliary 2 Parallel Circuit)
32- Load Check Valve (Auxiliary 2 Tandem Circuit)
33- Load Check Valve (Arm 3 Tandem Circuit)
34- Overload Relief Valve (Positioning/Auxiliary 2)
35- Overload Relief Valve (Positioning/Auxiliary 2)
36- Load Check Valve (Boom 2 Parallel Circuit)
37- Arm 1 Flow Rate Control Valve (Poppet Valve)
38- Arm 1 Flow Rate Control Valve (Selector Valve)
39- Load Check Valve (Digging Regenerative Circuit)
40- Arm Regenerative Valve
41- Load Check Valve (Arm Regenerative Circuit)
42- Arm Bottom Anti-Drift Valve (Check Valve)
43- Overload Relief Valve (Arm: Bottom Side)
44- Arm Rod Anti-Drift Valve (Selector Valve)
45- Arm Bottom Anti-Drift Valve (Selector Valve)
46- Arm Rod Anti-Drift Valve (Check Valve)
47- Overload Relief Valve (Arm: Rod Side)
48- Load Check Valve (Auxiliary Parallel Circuit)
49- Load Check Valve (Travel (Left) Tandem Circuit)
50- Pump 2
51- Pump 3
52- Pump 1

Pilot Operation Control Circuit

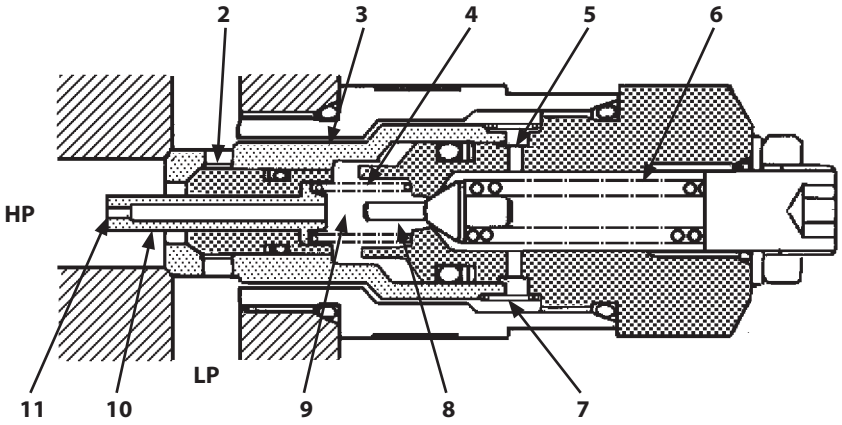


TDDQ-03-03-008

a - Air Bleed Circuit
b - Boom Lower Meter-In Cut Valve
c - Boom Anti-Drift Valve
d - Arm Bottom Anti-Drift Valve
e - Arm Rod Anti-Drift Valve

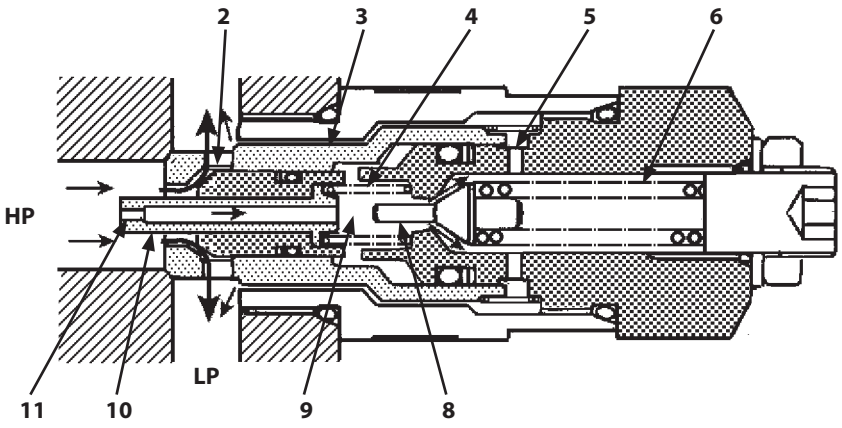
1- Boom Raise
2- Boom Lower
3- Arm Roll-Out
4- Arm Roll-In
5- Swing (Left)
6- Swing (Right)
7- Bucket Roll-In
8- Bucket Roll-Out
9- Travel (Left Forward)
10- Travel (Left Reverse)
11- Travel (Right Forward)
12- Travel (Right Reverse)
13- Auxiliary 1 (Open)
14- Auxiliary 1 (Close)
15- Positioning Raise/Auxiliary 2 (Open)
16- Positioning Lower/Auxiliary 2 (Close)

When Performing Normal Operation:



T107-02-05-019

When Performing Relief Operation:

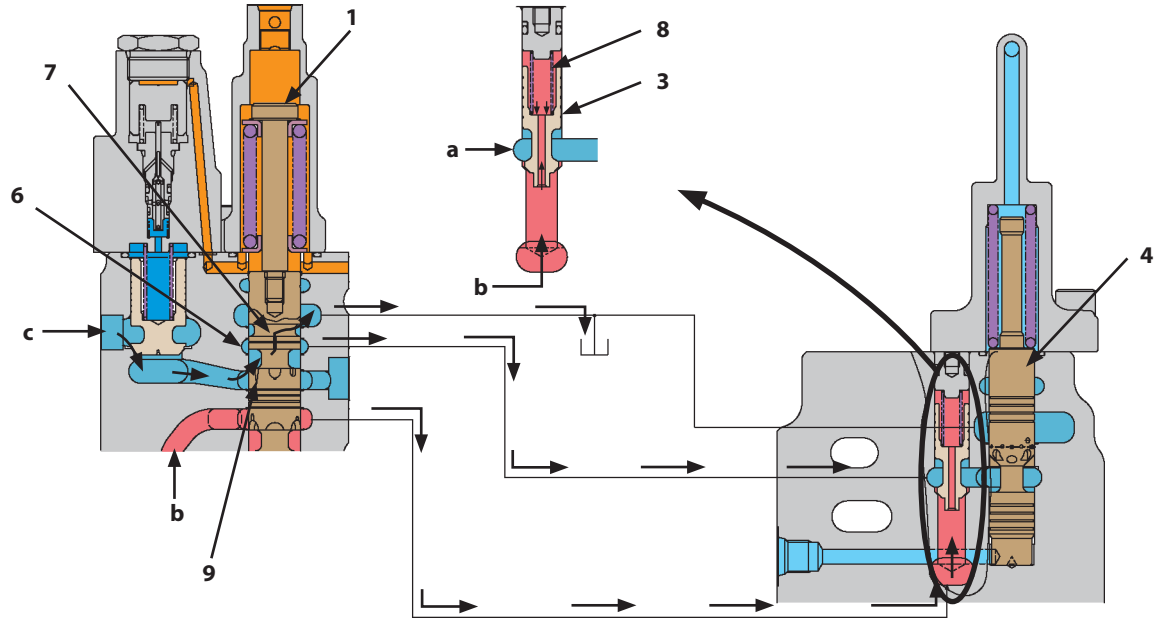


T178-03-03-049

HP- Actuator Circuit
LP- Hydraulic Oil Tank

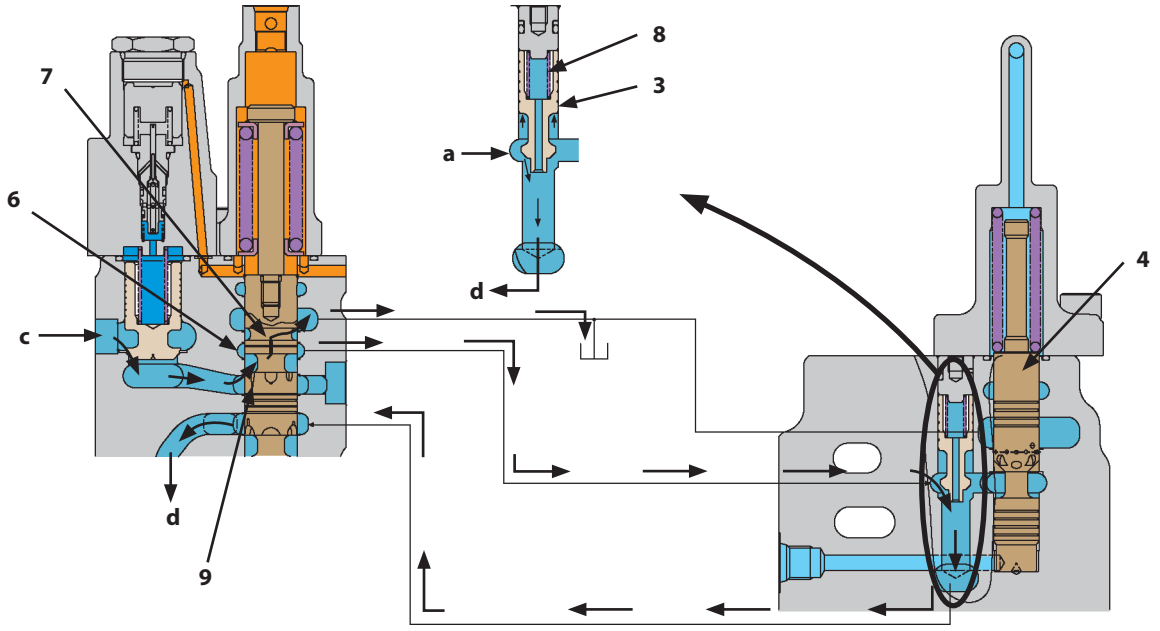
2- Main Poppet
3- Sleeve
4- Spring A
5- Passage A
6- Spring B
7- Spring C
8- Pilot Poppet
9- Spring Chamber
10- Piston
11- Orifice

Before Regeneration Operation:



TDAA-03-03-035

After Regeneration Operation:

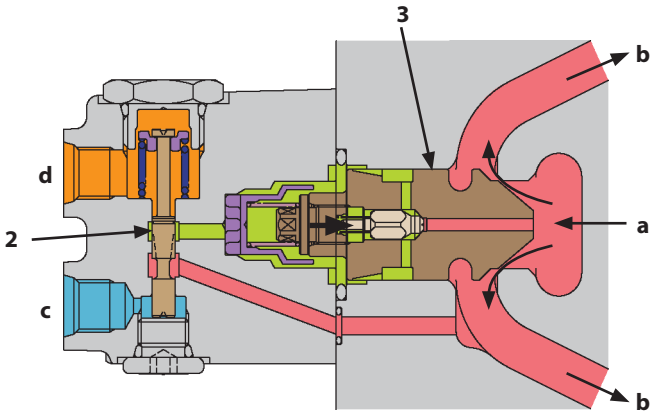


TDAA-03-03-036

a- Pressure in Chamber A (6)
b- Pressure from Pump 2 (2)
c- Returning Oil from Arm Cylinder (5) Rod Side
d- Pressure Oil to Arm Cylinder (5) Bottom Side

1- Arm 1 Spool
3- Check Valve
4- Spool (Arm Regenerative Valve)
6- Chamber A
7- Notch
8- Spring
9- Notch

When Performing Flow Rate Control Operation:



TDAA-03-03-046

a- Pressure Oil from Pump 2

b- To Arm 1 Spool

c- To Hydraulic Oil Tank

d- Pilot Pressure from Signal Control Valve

2- Selector Valve

3- Poppet Valve

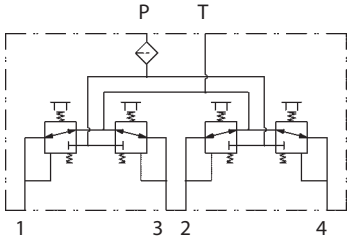
Outline

The pilot valve controls pilot pressure oil in order to move the spool in the control valve.
The pilot valve outputs pressure according to the control lever stroke by PPC (Pressure Proportional Control Valve) function.
The 4-port pilot valves for front attachment/swing and for travel are standard.
The 2-port pilot valve is for auxiliary (optional) and for positioning (only 2-piece boom spec. machine).

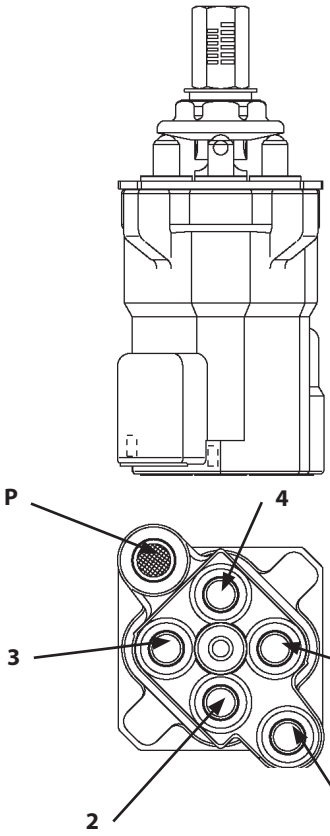
- Front Attachment/Swing Pilot Valve

	Port No.	ISO Control Pattern	Hitachi Pattern
Right	1	Bucket Roll-Out	←
	2	Boom Lower	←
	3	Bucket Roll-In	←
	4	Boom Raise	←
Left	1	Swing (Right)	Arm Roll-In
	2	Arm Roll- Out	Swing (Right)
	3	Swing (Left)	Arm Roll- Out
	4	Arm Roll-In	Swing (Left)

Hydraulic Symbol



TPPP-03-04-002



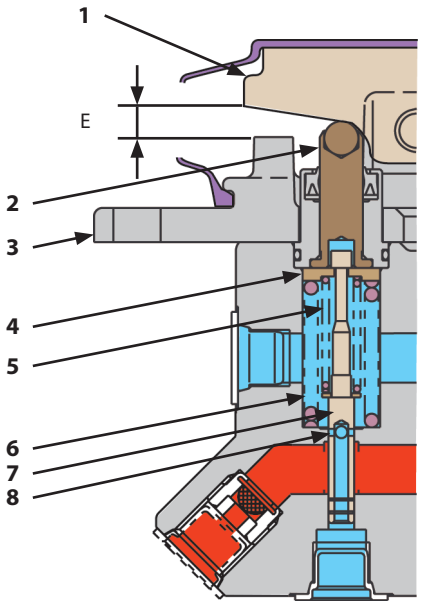
TDC1-03-04-001

P- Port P (Pressure Oil from Pilot Pump)
T- Port T (To Hydraulic Oil Tank)

Operation (Auxiliary, Positioning Pilot Valves)

The spool (7) head is hanged from the upper surface of spring guide (4). Spring guide (4) is kept raised by return spring (6).

NOTE: Total lever stroke is determined by stroke dimension (E) of cam (1).

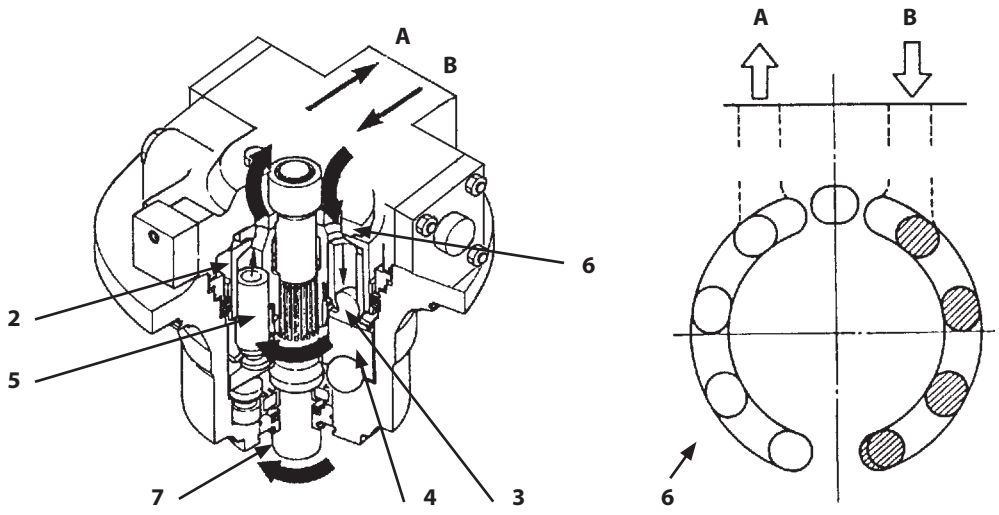


TDAA-03-04-001

1- Cam
2- Pusher
3- Plate
4- Spring Guide
5- Balance Spring
6- Return Spring
7- Spool
8- Hole

Operation

1. Pressure oil flows to port B in valve plate (6), enters one side in rotor (2), and pushes plungers (5).
2. Shoes (3) at the ends of plungers (5) slide on swash plate (4) due to this force, and rotates rotor (2) and output shaft (7).
3. As rotor (2) rotates, plungers (5) rotates. When plungers (5) reach port A, plungers (5) are pushed back and pressure oil is returned to the hydraulic oil tank.
4. Whether forward travel or reverse travel depends on whether pressure oil is supplied to port A or port B.



T183-03-05-009

A- Port A (Pressure oil from main pump or returning oil to hydraulic oil tank)

B- Port B (Pressure oil from main pump or returning oil to hydraulic oil tank)

2- Rotor

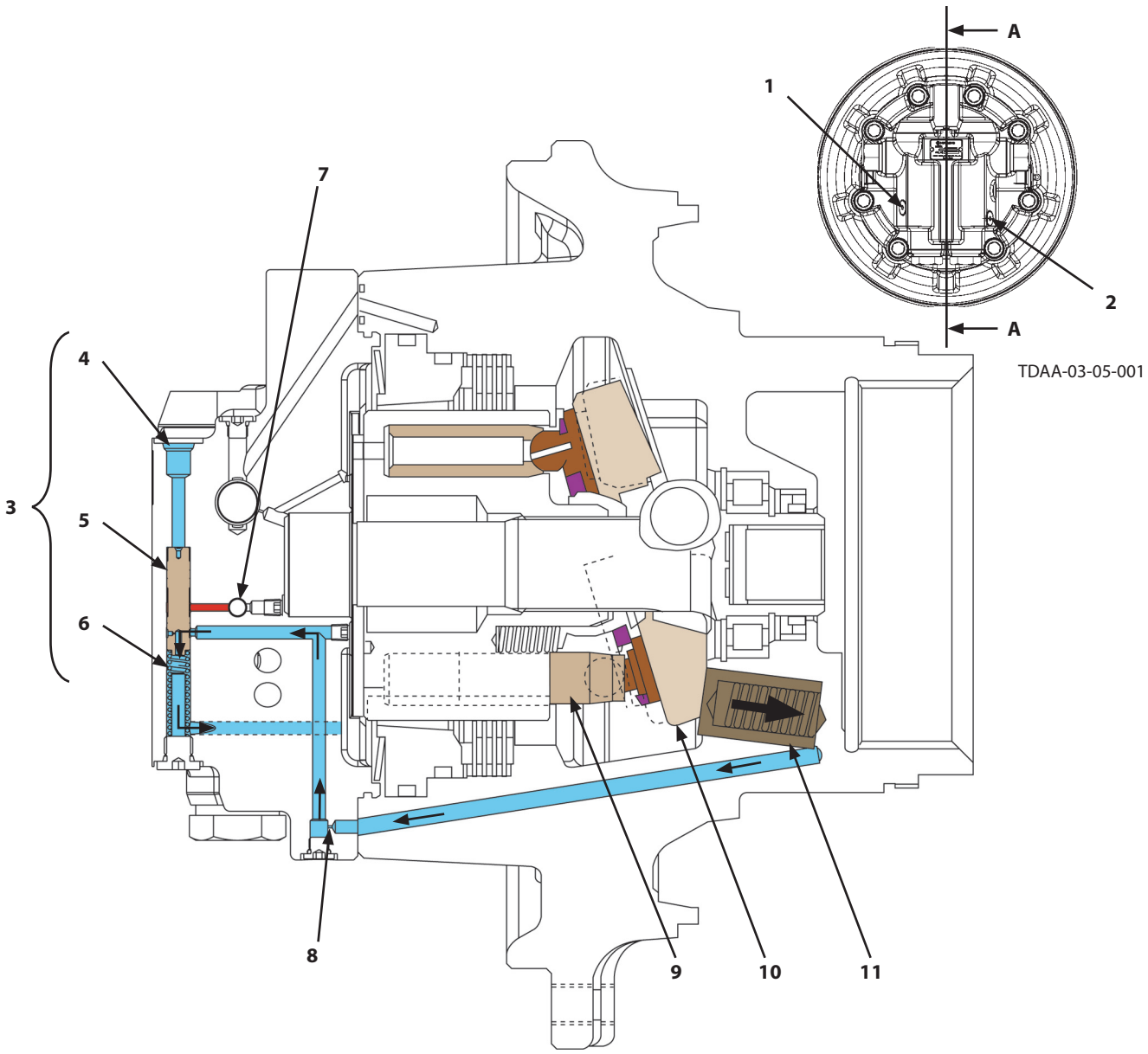
3- Shoe

4- Swash Plate

5- Plunger

6- Valve Plate

7- Output Shaft



TDAA-03-05-001

TDAB-03-05-007

1- Motor Port AM
2- Motor Port BM
3- Travel Motor Displacement Angle Control Valve
4- Pilot Port
5- Spool
6- Spring
7- Piston Control Shuttle Valve
8- Orifice (for slow/fast speed)
9- Plunger
10- Swash Plate
11- Piston

Shuttle Valve

The shuttle valve selects pilot pressure used to perform each operation and routes pilot pressure to the corresponding control valves and/or control spools. The spools corresponding to each operation are as follows:

	Pump 1 Flow Rate Control Valve	Pump 2 Flow Rate Control Valve	Pump 3 Flow Rate Control Valve	Flow Combiner Valve Control Spool	Swing Parking Brake Release Spool
Boom Raise	○	○	○	-	○
Boom Lower	*○	-	-	-	○
Arm Roll-Out	○	○	-	-	○
Arm Roll-In	○	○	-	-	○
Bucket Roll-In	○	-	-	-	○
Bucket Roll-Out	○	-	-	-	○
Swing (Right)	-	-	○	-	○
Swing (Left)	-	-	○	-	○
Travel (Right)	○	-	-	○	-
Travel (Left)	-	○	-	-	-
Auxiliary 1	**○	○	-	-	○
Positioning/ Auxiliary 2	-	-	○	-	○

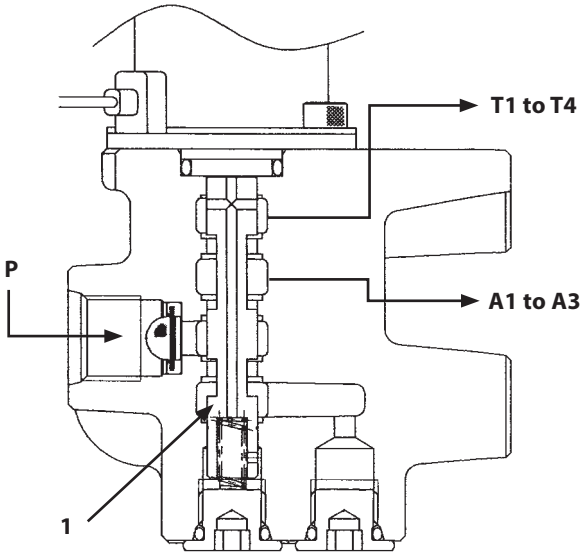
*NOTE: *: The boom lower pilot pressure is routed to the pump 1 flow rate control valve in the signal control valve through the control valve.*

*NOTE: **: As for only the machine with attachment (pulverizers 1 to 5 and crushers 1 to 5) equipped, the pump 1 flow rate control valve is operated by pressure from the auxiliary 1 pilot valve.*

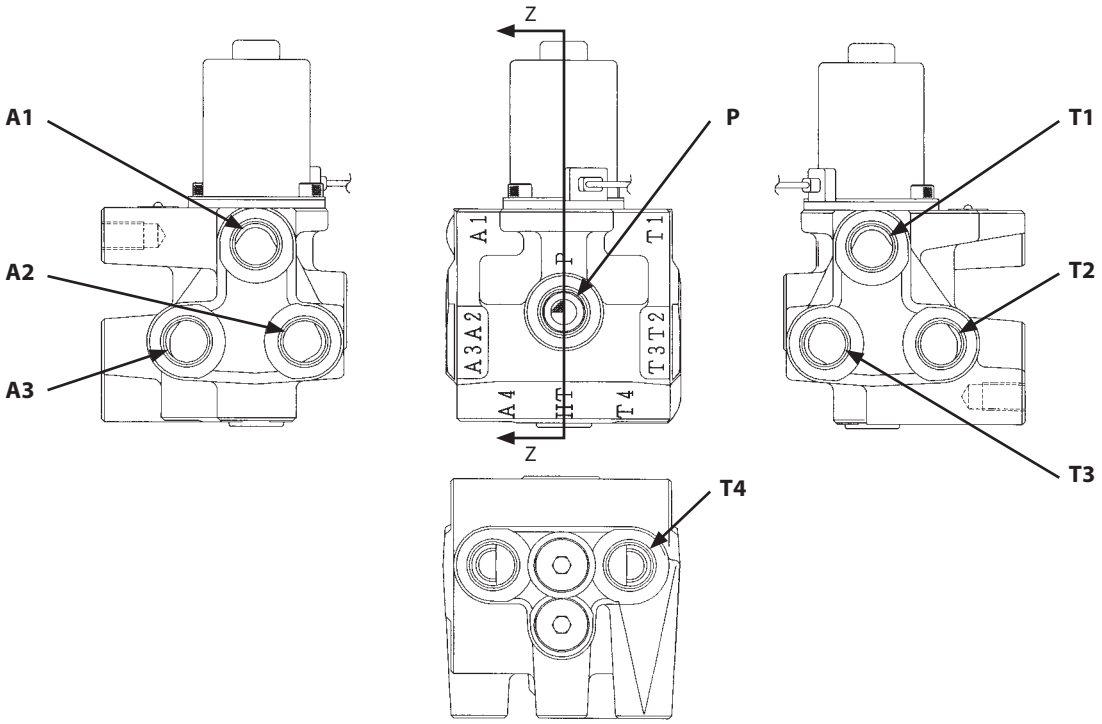
Pilot Shut-Off Solenoid Valve

The pilot shut-off solenoid valve is a switch valve of the solenoid valve type.
Spool (1) in the pilot shut-off solenoid valve is shifted by the pilot shut-off lever and turns ON/OFF pilot pressure oil to the pilot valve and signal control valve.

Section Z-Z



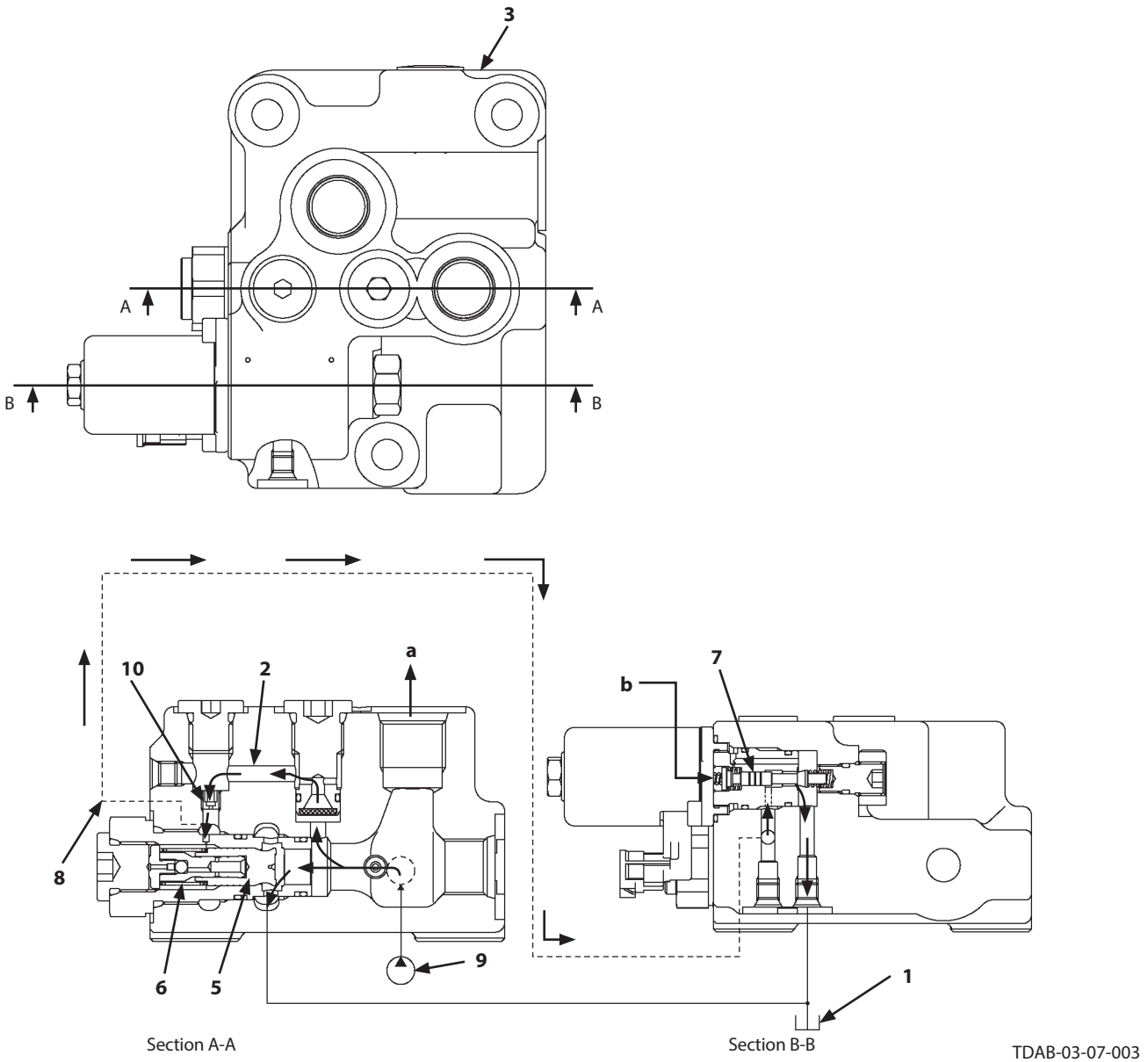
TDEN-03-06-005



TDEN-03-06-006

P- Pressure Oil from Pilot Pump
A1- Pilot Pressure to Travel Pilot Valve
A2- Pilot Pressure to Boom, Bucket Pilot Valve
A3- Pilot Pressure to Arm, Swing, Auxiliary1, Positioning/ Auxiliary 2 Pilot Valve
T1- Returning Oil from Travel Pilot Valve
T2- Returning Oil from Boom, Bucket, Auxiliary 1, Positioning/Auxiliary 2 Pilot Valve
T3- Returning Oil from Arm, Swing Pilot Valve
T4- Returning Oil to Hydraulic Oil Tank

1- Spool



a- Pressure Oil to Fan Motor

b- Signal from MC (Main Controller)

1- Hydraulic Oil Tank
2- Circuit A
3- Fan Valve

5- Poppet (Fan Control Valve)
6- Spring

7- Spool (Fan Speed Control Solenoid Valve)
8- Circuit B

9- Fan Pump
10- Orifice