PART NO. TONEK50-EN-00

HITACHI

Reliable solutions

Technical Manual
Operational Principle

ZW 220-6
Wheel Loader

Service Manual consists of the following separate Part No.

Technical Manual (Operational Principle)	: Vol. No.TONEK50-EN
Technical Manual (Troubleshooting)	: Vol. No.TTNEK50-EN
Workshop Manual	: Vol. No.WNEK50-EN

ZW220-6 WHEEL LOADER TECHNICAL MANUAL OPERATIONAL PRINCIPLE

TONEK50-EN-00

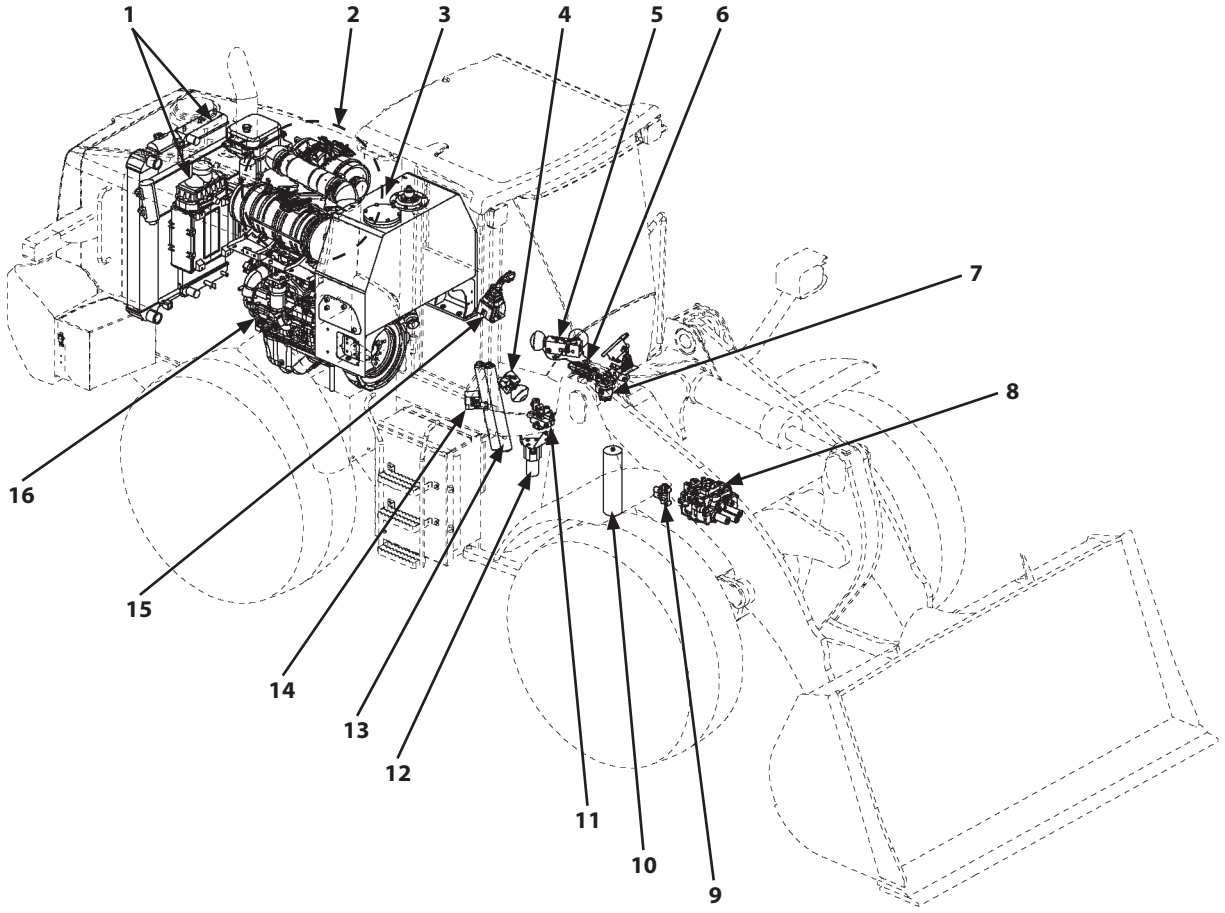
Hitachi Construction Machinery Co., Ltd.
URL:http://www.hitachi-c-m.com

PRINTED IN JAPAN (E) 2016, 1

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.

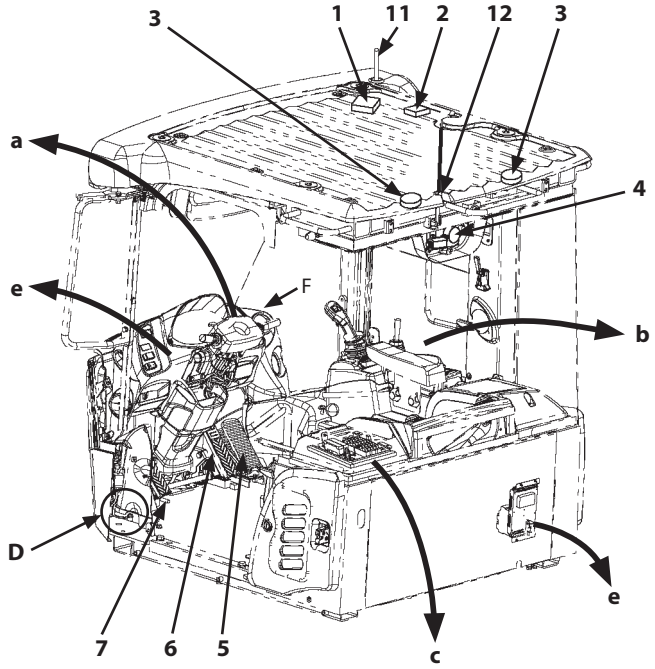
Main Component



TNEK-01-02-001

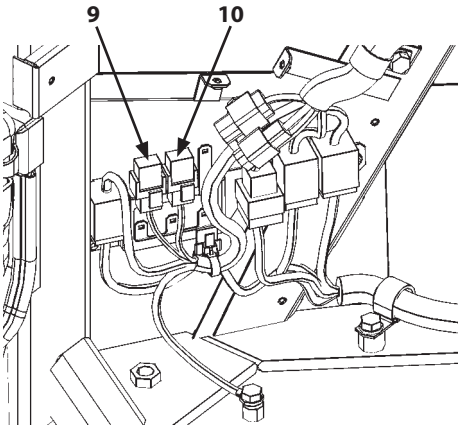
1- Air Cleaner and Radiator Assembly (Refer to T1-2-6.)
2- Aftertreatment Device (Refer to T1-2-20.)
3- Hydraulic Oil Tank (Refer to T1-2-9.)
4- Parking Brake Solenoid Valve (Refer to T1-2-23.)
5- Manifold Valve (Refer to T1-2-23.)
6- Brake Valve
7- Steering Pilot Valve
8- Control Valve (Refer to T1-2-22.)
9- 2-Spool Solenoid Valve Unit (Refer to T1-2-23.)
10- Ride Control Accumulator
11- Brake Charge Valve (Refer to T1-2-23.)
12- Pilot Filter
13- Service Brake Accumulator (2 Used)
14- Flow Regulator Valve (Refer to T1-2-24.)
15- Pilot Valve
16- Engine (Refer to T1-2-19.)

Cab



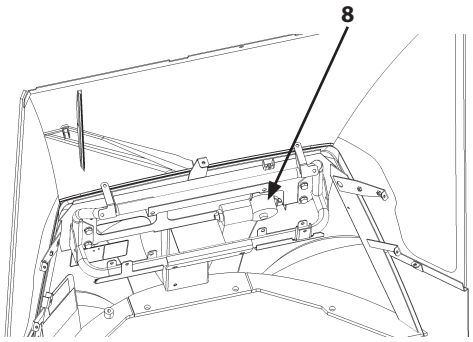
TNEG-01-02-002

Detail D



TNEK-01-02-017

View F

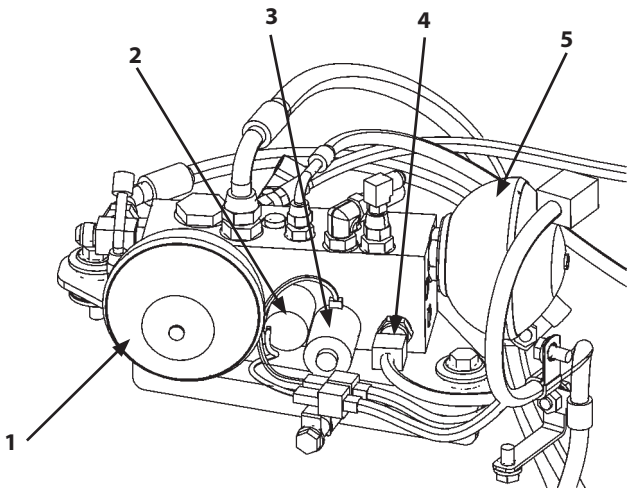


TNEG-01-02-041

a- Front Console (Refer to T1-2-14.)
b- Right Console (Refer to T1-2-15.)
c- Rear Console (Refer to T1-2-16.)
e- Control Unit (Refer to T1-2-17.)

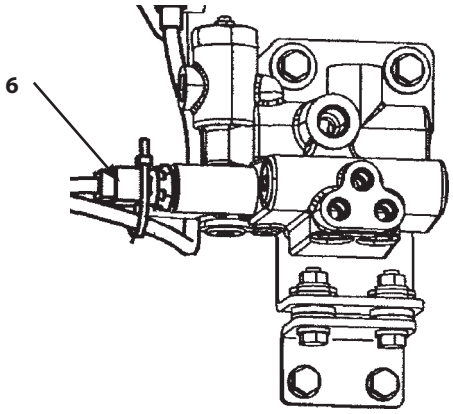
1- Radio
2- Upper Switch Panel (OP)
3- Speaker (2 Used)
4- Rear Wiper Motor
5- Accelerator Pedal Sensor
6- Brake Angle Sensor
7- Brake Light Switch
8- Front Wiper Motor
9- Front Wiper (1) Relay
10- Front Wiper (2) Relay
11- GPS Antenna (OP)
12- Communication Terminal Antenna

Manifold Valve



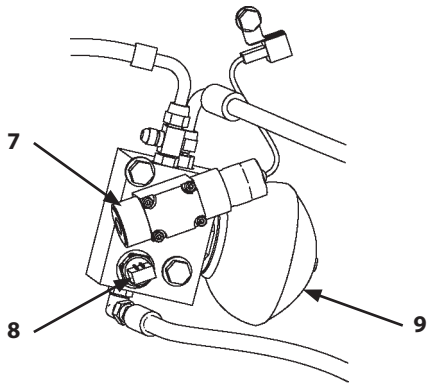
TNED-01-02-013

Brake Charge Valve



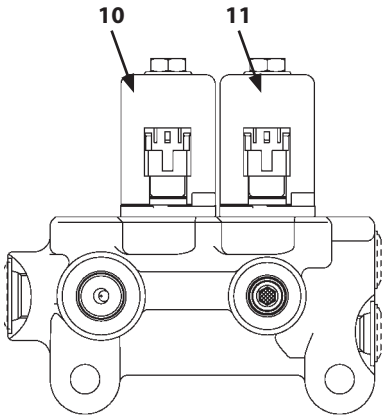
TNED-01-02-021

Parking Brake Solenoid Valve



TNEE-01-02-013

2-Spool Solenoid Valve Unit



TDAA-03-07-002

1- Pilot Accumulator (Steering)
2- Torque Control Solenoid Valve
3- Control Lever Lock Solenoid Valve
4- Pressure Sensor (Primary Pilot Pressure)
5- Pilot Accumulator (Front Attachment)
6- Pressure Sensor (Brake Primary Pressure)
7- Parking Brake Solenoid Valve
8- Parking Brake Pressure Sensor
9- Parking Brake Accumulator
10- Solenoid Valve (SZ)
11- Solenoid Valve (SJ)

STEERING VALVE	Type	Flow Amp Type
	Over Load Relief Set-Pressure	32.4 MPa (330 kgf/cm^2, 4700 psi) at 50 L/min (13 US gpm)
STEERING PILOT VALVE	Type	Orbitrol ® Type
	Gerotor Capacity	80 cm^3/rev (4.9 in^3/rev)
STEERING ACCUMULATOR	Capacity	0.2 L (12 in^3)
	Charging Pressure	8.0 MPa (82 kgf/cm^2,1160 psi)
BRAKE VALVE	Brake Pressure	5.0 MPa (51 kgf/cm^2, 725 psi)
CHARGING VALVE	Charging Pressure	Cut In Pressure : 11.8 MPa (120 kgf/cm^2, 1710 psi)
		Cut Out Pressure : 15.5 MPa (158 kgf/cm^2, 2250 psi)
MANIFOLD VALVE	Function	Main Pump Torque Control, Front Control Lever Lock
	Pilot Relief Valve Set-Pressure	3.7 MPa (37.7 kgf/cm^2, 537 psi) at 40 L/min (10.6 US gpm)
SERVICE BRAKE ACCUMULATOR	Capacity	1.4 L (85.4 in^3)
	Charging Pressure	6.8 MPa (69.3 kgf/cm^2, 986 psi) at 20 ℃
PILOT ACCUMULATOR	Capacity	0.5 L (30.5 in^3)
	Charging Pressure	1.6 MPa (16 kgf/cm^2, 228 psi) at 20 ℃
PARKING BRAKE ACCUMULATOR	Capacity	0.5 L (30.5 in^3)
	Charging Pressure	5.9 MPa (60 kgf/cm^2, 856 psi) at 20 ℃
RIDE CONTROL ACCUMULATOR	Capacity	2.5 L (153 in^3)
	Charging Pressure	3.0 MPa (30.6 kgf/cm^2, 435 psi)
FAN PUMP	Theoretical Displacement	29.9 cm^3/rev (1.8 in^3/rev)
FAN MOTOR	Theoretical Displacement	28.2 cm^3/rev (1.7 in^3/rev)
OIL COOLER BYPASS CHECK VALVE	Cracking Perssure	390 kPa at 5 L/min

NOTE: Orbitrol ® is a trade name of Eaton Corporation.

SECTION 2 SYSTEM

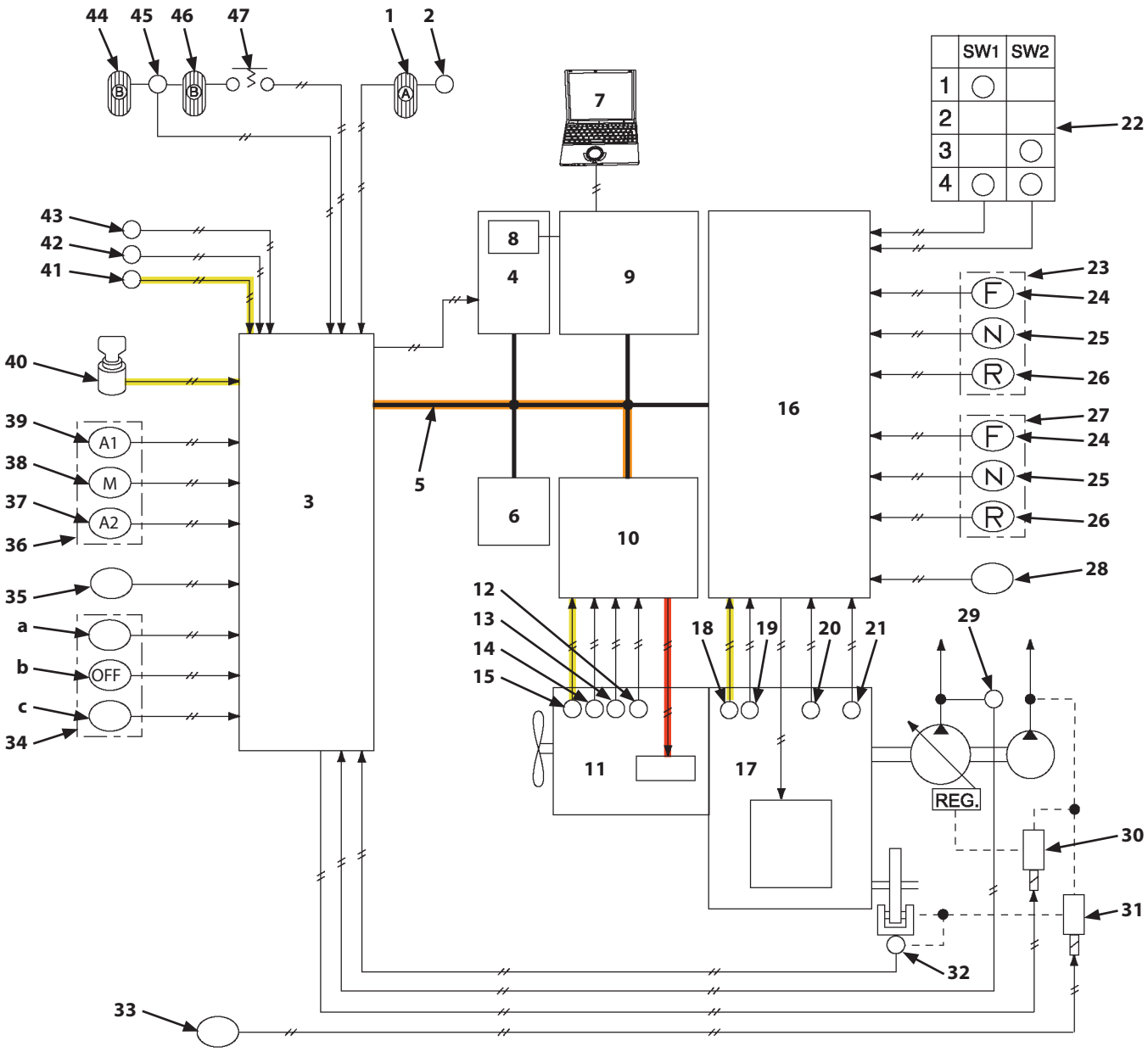
Group 1 Controller

Outline

The following controllers are provided in this machine in order to control functions. Each controller excluding the communication controller communicates by using the CAN circuit and sends or receives the required signal.

Controller	Control	Comment on Control
MC	MC controls the engine speed, pumps, and valves.	T2-2
TCU	TCU controls the transmission.	T2-2
ECM	ECM controls the engine.	T2-3
VGS Controller	The VGS controller controls the engine turbocharger.	T2-3
Monitor Controller	The monitor controller displays the operating information and alarms on the monitor.	T5-2
Column Display Controller	The column display controller controls the wiper and buzzer. Displays the gauge and indicator.	T2-5
Air Conditioner Controller	The air conditioner controller controls the air conditioner.	T2-5, T5-7
Communication Controller	The communication controller sends the mails and operating information.	T5-3

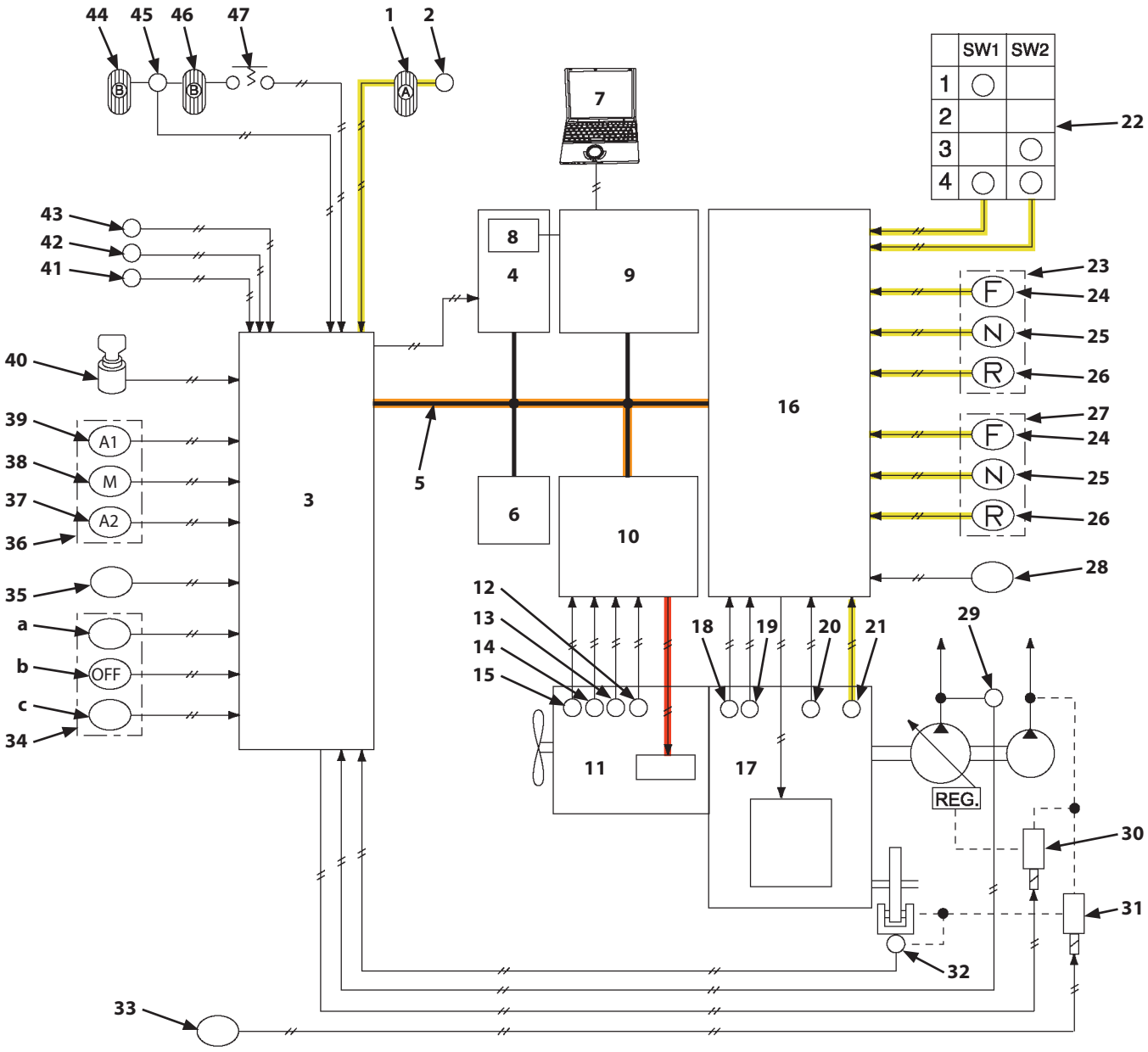
NOTE: Refer to the corresponding group for details of each controller control.



TNED-02-02-064

a- Brake Pedal Depressing Amount: Lightly Depressed
b- OFF
c- Brake Pedal Depressing Amount: Deeply Depressed

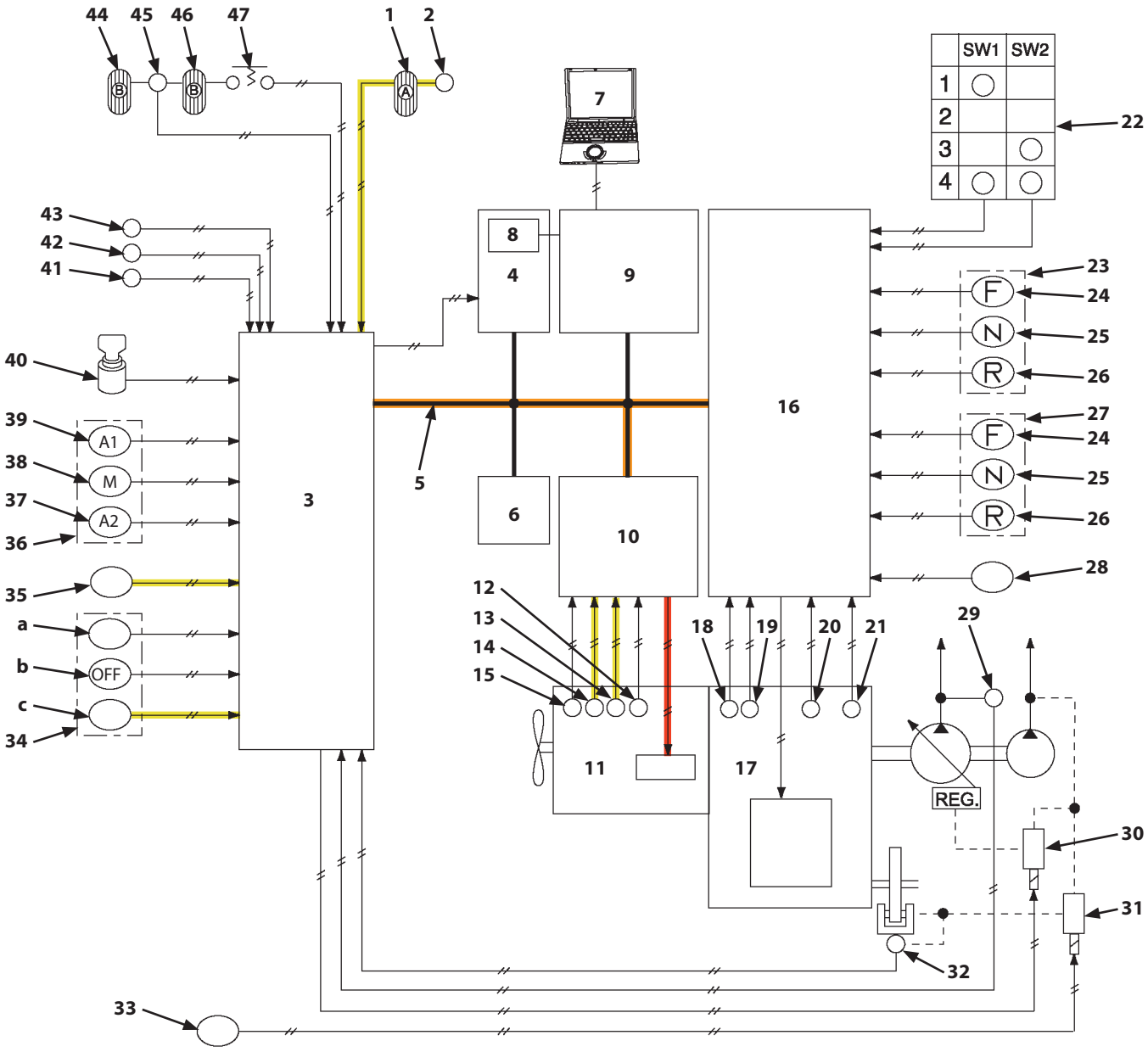
1- Accelerator Pedal
2- Accelerator Pedal Sensor
3- MC
4- Column Display Controller
5- CAN
6- Air Conditioner Controller
7- MPDr.
8- Monitor
9- Monitor Controller
10- ECM
11- Engine
12- Boost Temperature Sensor
13- Crank Speed Sensor
14- Cam Angle Sensor
15- Coolant Temperature Sensor
16- TCU
17- Transmission
18- Torque Converter Oil Temperature Sensor
19- Torque Converter Input Speed Sensor
20- Torque Converter Output Speed Sensor
21- Vehicle Speed Sensor
22- Shift Switch
23- Forward/Reverse Lever
24- Forward Position
25- Neutral Position
26- Reverse Position
27- Forward/Reverse Switch (Option)
28- Forward/Reverse Selector Switch (Option)
29- Pump Delivery Pressure Sensor
30- Torque Control Solenoid Valve
31- Parking Brake Solenoid Valve
32- Pressure Sensor (Parking Brake)
33- Parking Brake Switch
34- Clutch Cut Position Switch
35- Power Mode Switch
36- Driving Mode Switch
37- AUTO 2 Mode
38- Manual Mode
39- AUTO 1 Mode
40- Key Switch
41- Hydraulic Oil Temperature Sensor
42- Pressure Sensor (Lift Arm Raise)
43- Pressure Sensor (Bucket Tilt)
44- Brake Pedal (Left)
45- Pressure Sensor (Brake Secondary Pressure)
46- Brake Pedal (Right)
47- Brake Pedal (Right) Switch



TNED-02-02-010

a- Brake Pedal Depressing Amount: Lightly Depressed
b- OFF
c- Brake Pedal Depressing Amount: Deeple Depressed

1- Accelerator Pedal
2- Accelerator Pedal Sensor
3- MC
4- Column Display Controller
5- CAN
6- Air Conditioner Controller
7- MPDr.
8- Monitor
9- Monitor Controller
10- ECM
11- Engine
12- Boost Temperature Sensor
13- Crank Speed Sensor
14- Cam Angle Sensor
15- Coolant Temperature Sensor
16- TCU
17- Transmission
18- Torque Converter Oil Temperature Sensor
19- Torque Converter Input Speed Sensor
20- Torque Converter Output Speed Sensor
21- Vehicle Speed Sensor
22- Shift Switch
23- Forward/Reverse Lever
24- Forward Position
25- Neutral Position
26- Reverse Position
27- Forward/Reverse Switch (Option)
28- Forward/Reverse Selector Switch (Option)
29- Pump Delivery Pressure Sensor
30- Torque Control Solenoid Valve
31- Parking Brake Solenoid Valve
32- Pressure Sensor (Parking Brake)
33- Parking Brake Switch
34- Clutch Cut Position Switch
35- Power Mode Switch
36- Driving Mode Switch
37- AUTO 2 Mode
38- Manual Mode
39- AUTO 1 Mode
40- Key Switch
41- Hydraulic Oil Temperature Sensor
42- Pressure Sensor (Lift Arm Raise)
43- Pressure Sensor (Bucket Tilt)
44- Brake Pedal (Left)
45- Pressure Sensor (Brake Secondary Pressure)
46- Brake Pedal (Right)
47- Brake Pedal (Right) Switch



TNED-02-02-020

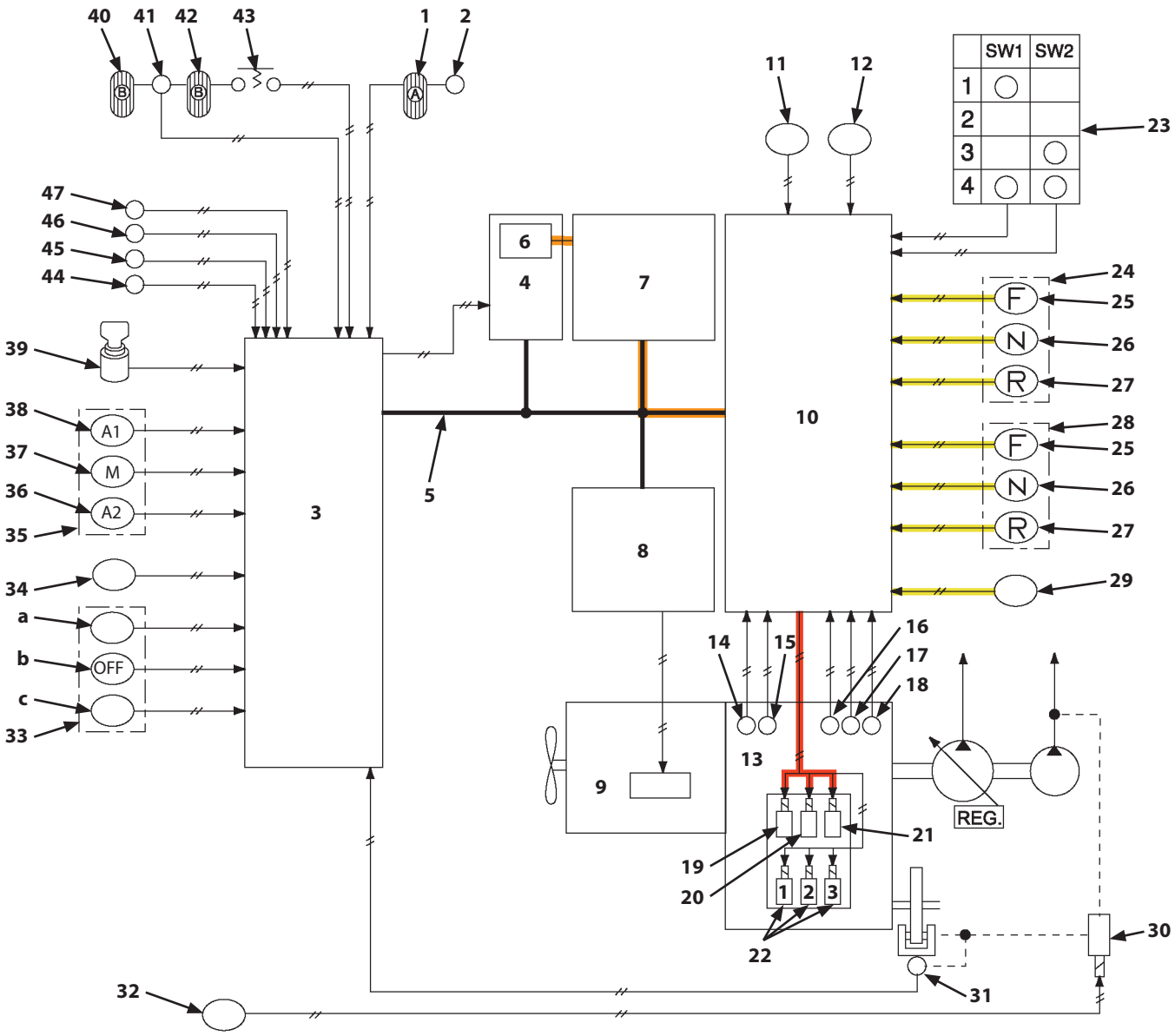
a- Brake Pedal Depressing Amount: Lightly Depressed
b- OFF
c- Brake Pedal Depressing Amount: Deeply Depressed

1- Accelerator Pedal
2- Accelerator Pedal Sensor
3- MC
4- Column Display Controller
5- CAN
6- Air Conditioner Controller
7- MPDr.
8- Monitor
9- Monitor Controller
10- ECM
11- Engine
12- Boost Temperature Sensor
13- Crank Speed Sensor
14- Cam Angle Sensor
15- Coolant Temperature Sensor
16- TCU
17- Transmission
18- Torque Converter Oil Temperature Sensor
19- Torque Converter Input Speed Sensor
20- Torque Converter Output Speed Sensor
21- Vehicle Speed Sensor
22- Shift Switch
23- Forward/Reverse Lever
24- Forward Position
25- Neutral Position
26- Reverse Position
27- Forward/Reverse Switch (Option)
28- Forward/Reverse Selector Switch (Option)
29- Pump Delivery Pressure Sensor
30- Torque Control Solenoid Valve
31- Parking Brake Solenoid Valve
32- Pressure Sensor (Parking Brake)
33- Parking Brake Switch
34- Clutch Cut Position Switch
35- Power Mode Switch
36- Driving Mode Switch
37- AUTO 2 Mode
38- Manual Mode
39- AUTO 1 Mode
40- Key Switch
41- Hydraulic Oil Temperature Sensor
42- Pressure Sensor (Lift Arm Raise)
43- Pressure Sensor (Bucket Tilt)
44- Brake Pedal (Left)
45- Pressure Sensor (Brake Secondary Pressure)
46- Brake Pedal (Right)
47- Brake Pedal (Right) Switch

Pump Control

The pump control consists of the followings.

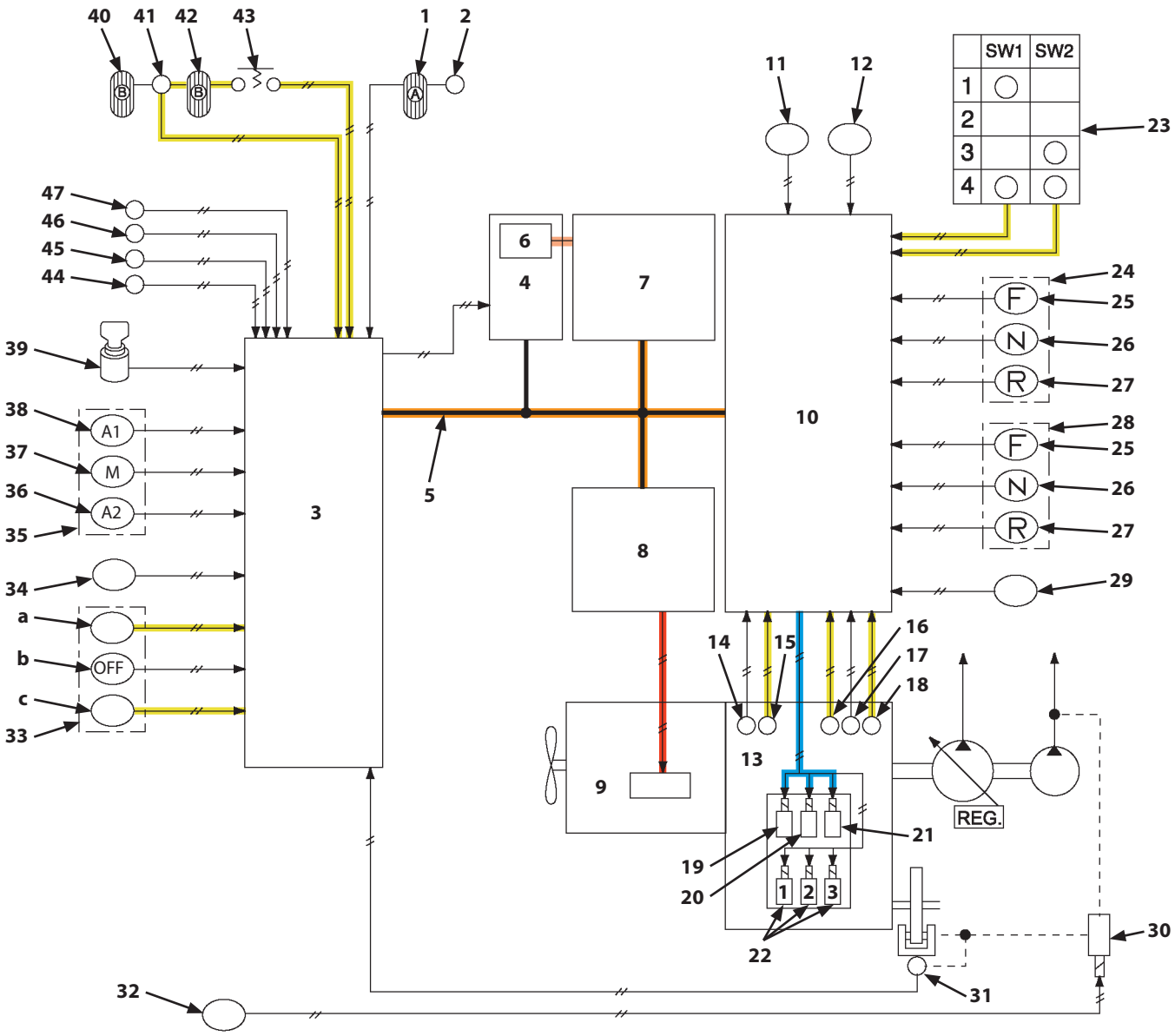
- Base Torque Control
- Torque Decrease Control While Digging



TNEE-02-02-029

a- Brake Pedal Depressing Amount: Lightly Depressed
b- OFF
c- Brake Pedal Depressing Amount: Deeply Depressed

1- Accelerator Pedal
2- Accelerator Pedal Sensor
3- MC
4- Column Display Controller
5- CAN
6- Monitor
7- Monitor Controller
8- ECM
9- Engine
10- TCU
11- Downshift Switch (DSS)
12- Hold Switch
13- Transmission
14- Torque Converter Oil Temperature Sensor
15- Torque Converter Input Speed Sensor
16- Torque Converter Output Speed Sensor
17- Transmission Intermediate Shaft Speed Sensor
18- Vehicle Speed Sensor
19- Slow-Speed Forward Clutch Solenoid Valve (Y5)
20- Fast-Speed Forward Clutch Solenoid Valve (Y1)
21- Reverse Clutch Solenoid Valve (Y2)
22- Speed Shift Solenoid Valve (1 (Y3), 2 (Y6), 3 (Y4))
23- Shift Switch
24- Forward/Reverse Lever
25- Forward Position
26- Neutral Position
27- Reverse Position
28- Forward/Reverse Switch (Option)
29- Forward/Reverse Selector Switch (Option)
30- Parking Brake Solenoid Valve
31- Pressure Sensor (Parking Brake)
32- Parking Brake Switch
33- Clutch Cut Position Switch
34- Power Mode Switch
35- Driving Mode Switch
36- AUTO 2 Mode
37- Manual Mode
38- AUTO 1 Mode
39- Key Switch
40- Brake Pedal (Left)
41- Pressure Sensor (Brake Secondary Pressure)
42- Brake Pedal (Right)
43- Brake Pedal (Right) Switch
44- Lift Arm Angle Sensor
45- Pressure Sensor (Lift Arm Raise)
46- Pressure Sensor (Bucket Dump)
47- 1st Speed Fixed Switch

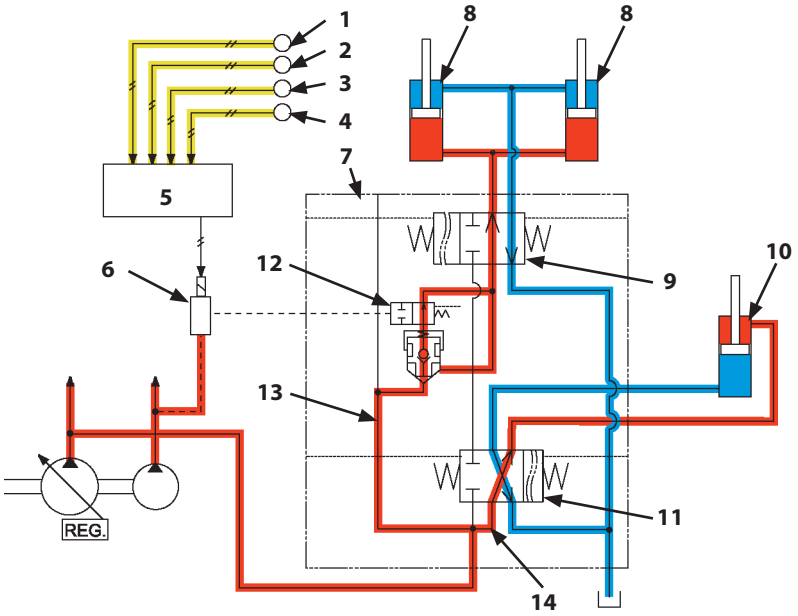


TNEE-02-02-034

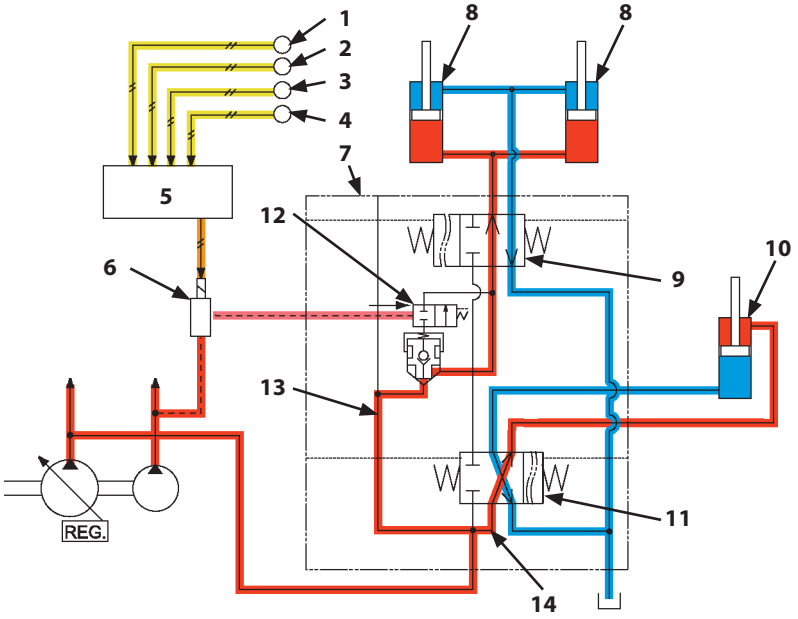
a- Brake Pedal Depressing Amount: Lightly Depressed
b- OFF
c- Brake Pedal Depressing Amount: Deeply Depressed

1- Accelerator Pedal
2- Accelerator Pedal Sensor
3- MC
4- Column Display Controller
5- CAN
6- Monitor
7- Monitor Controller
8- ECM
9- Engine
10- TCU
11- Downshift Switch (DSS)
12- Hold Switch
13- Transmission
14- Torque Converter Oil Temperature Sensor
15- Torque Converter Input Speed Sensor
16- Torque Converter Output Speed Sensor
17- Transmission Intermediate Shaft Speed Sensor
18- Vehicle Speed Sensor
19- Slow-Speed Forward Clutch Solenoid Valve (Y5)
20- Fast-Speed Forward Clutch Solenoid Valve (Y1)
21- Reverse Clutch Solenoid Valve (Y2)
22- Speed Shift Solenoid Valve (1 (Y3), 2 (Y6), 3 (Y4))
23- Shift Switch
24- Forward/Reverse Lever
25- Forward Position
26- Neutral Position
27- Reverse Position
28- Forward/Reverse Switch (Option)
29- Forward/Reverse Selector Switch (Option)
30- Parking Brake Solenoid Valve
31- Pressure Sensor (Parking Brake)
32- Parking Brake Switch
33- Clutch Cut Position Switch
34- Power Mode Switch
35- Driving Mode Switch
36- AUTO 2 Mode
37- Manual Mode
38- AUTO 1 Mode
39- Key Switch
40- Brake Pedal (Left)
41- Pressure Sensor (Brake Secondary Pressure)
42- Brake Pedal (Right)
43- Brake Pedal (Right) Switch
44- Lift Arm Angle Sensor
45- Pressure Sensor (Lift Arm Raise)
46- Pressure Sensor (Bucket Dump)
47- 1st Speed Fixed Switch

When deactivated:

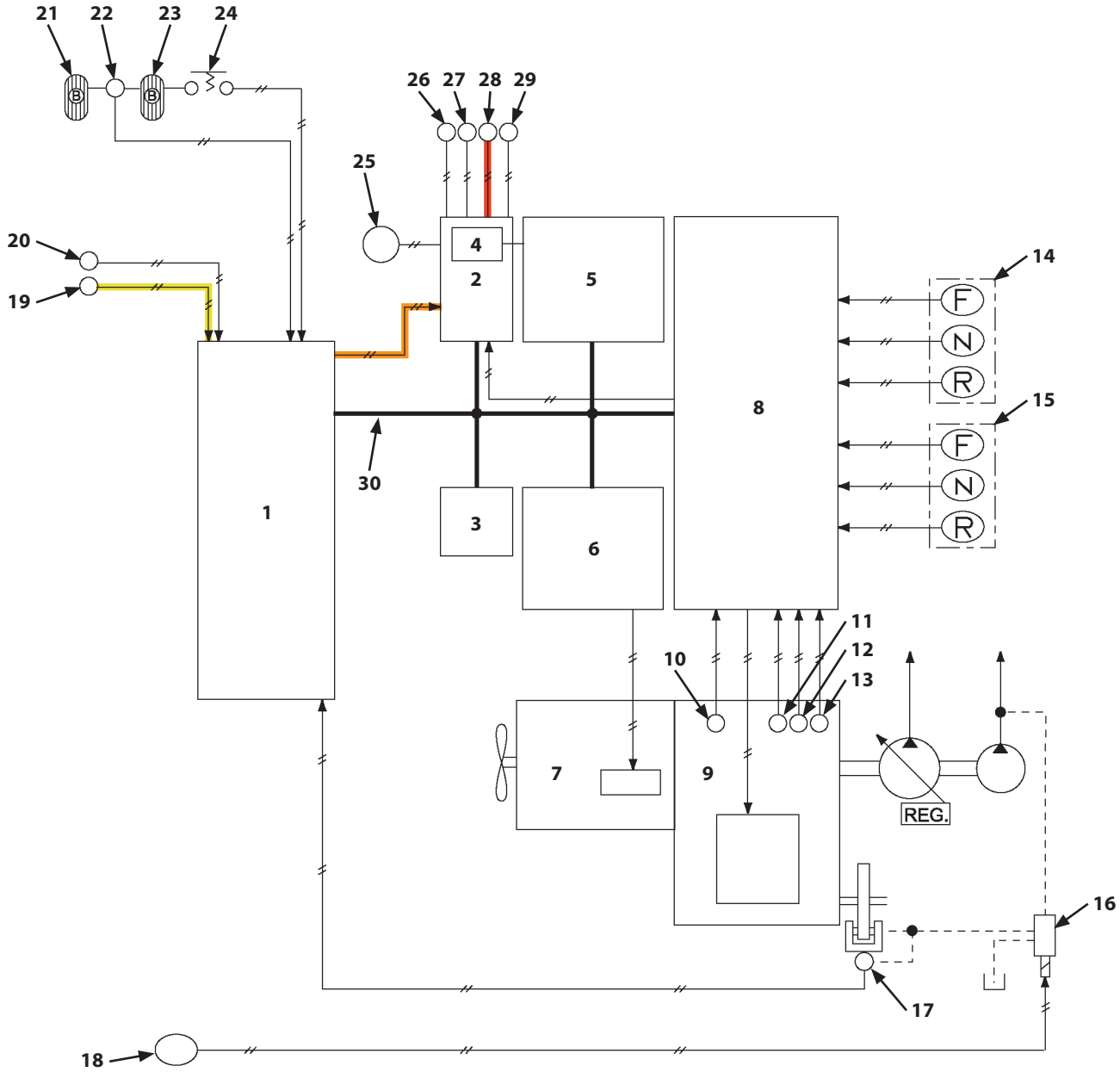


When operated:



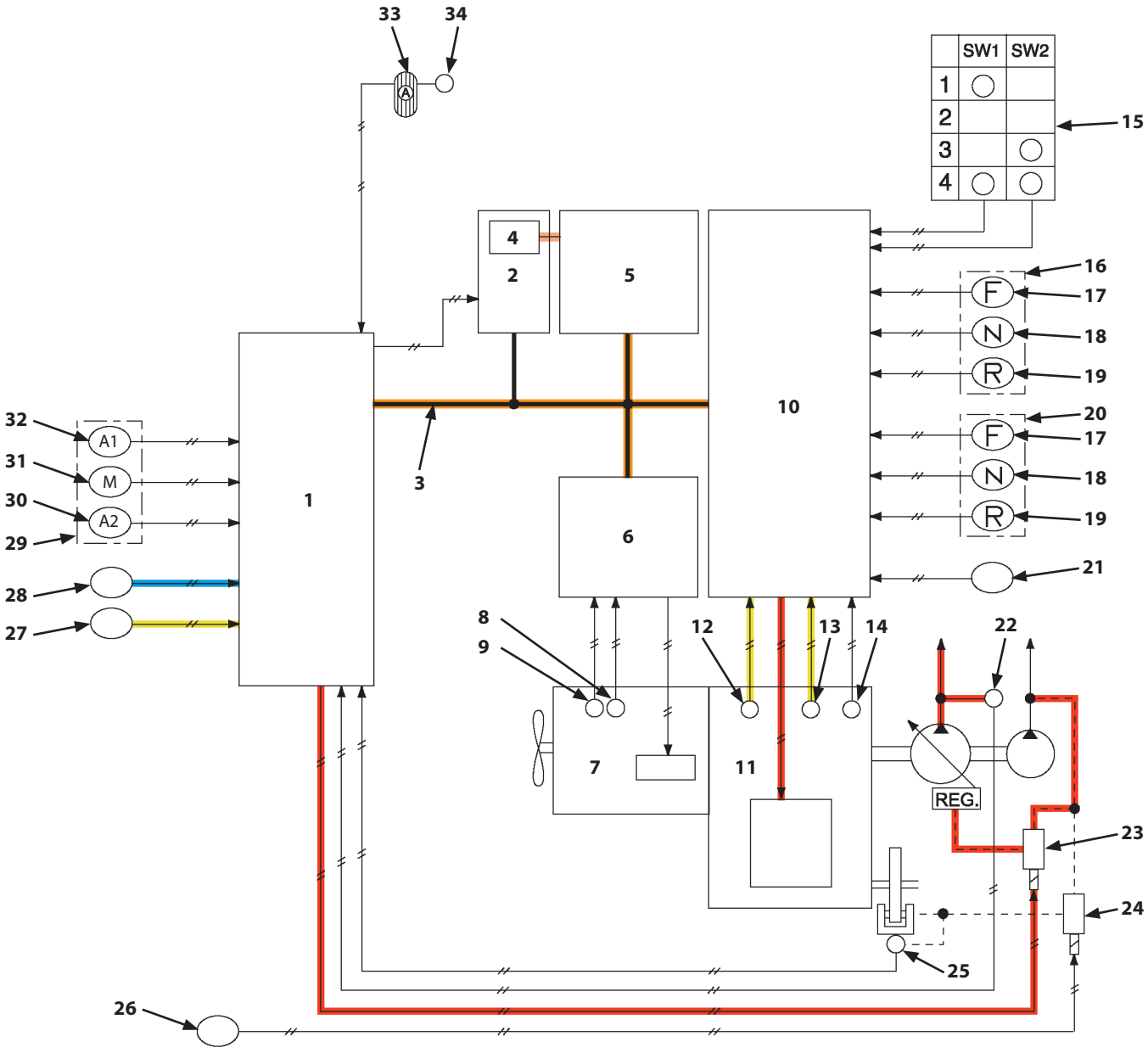
TNED-02-02-051

1- Lift Arm Angle Sensor
2- Pressure Sensor (Lift Arm Raise)
3- Pressure Sensor (Bucket Tilt)
4- Pressure Sensor (Bucket Dump)
5- MC
6- 2-Spool Solenoid Valve Unit (SY)
7- Control Valve
8- Lift Arm Cylinder
9- Lift Arm Spool
10- Bucket Cylinder
11- Bucket Spool
12- Selector Valve
13- Parallel Circuit
14- Tandem Circuit



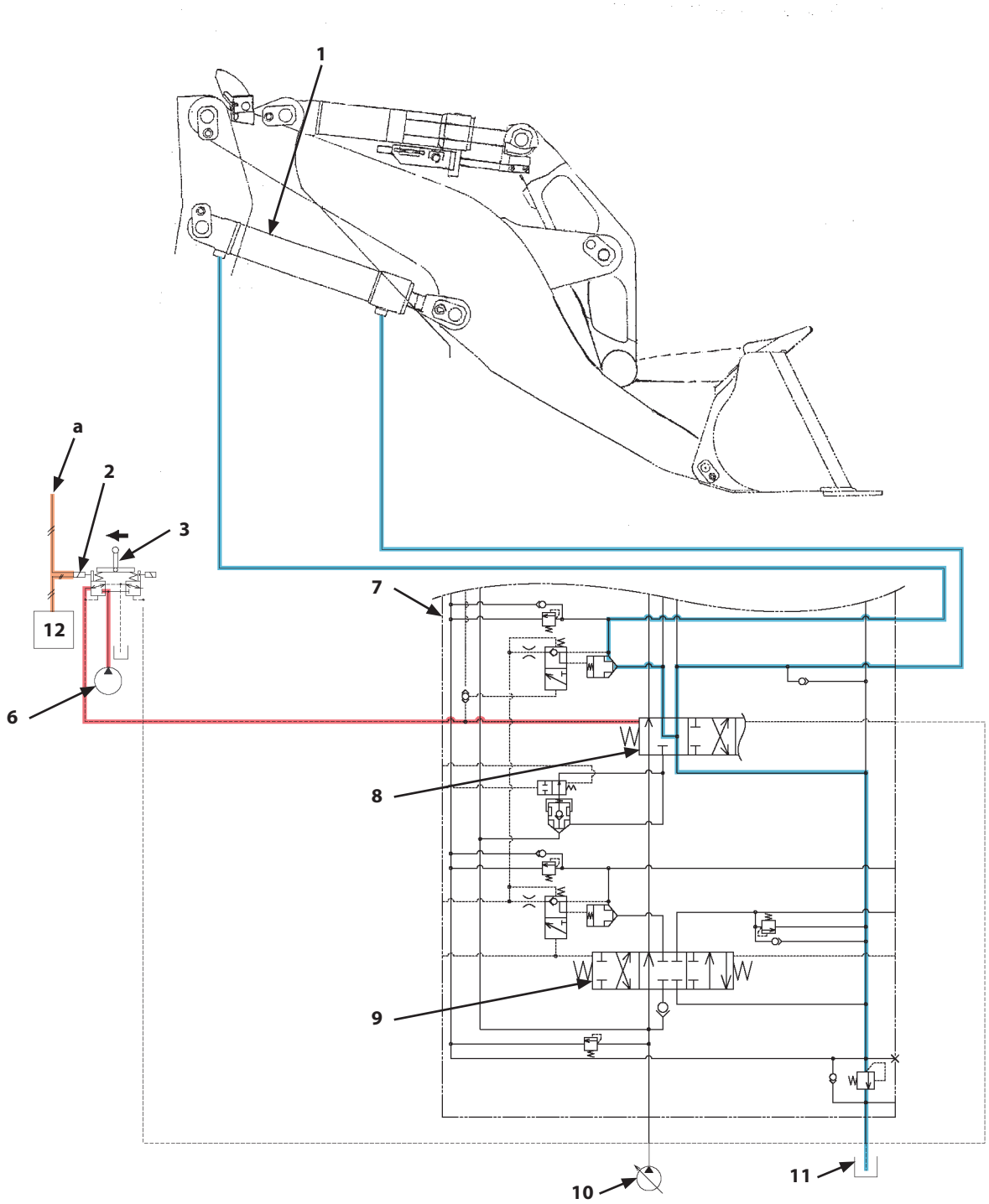
TNED-02-02-038

1- MC
2- Column Display Controller
3- Air Conditioner Controller
4- Monitor
5- Monitor Controller
6- ECM
7- Engine
8- TCU
9- Transmission
10- Torque Converter Input Speed Sensor
11- Torque Converter Output Speed Sensor
12- Transmission Intermediate Shaft Speed Sensor
13- Vehicle Speed Sensor
14- Forward/Reverse Lever
15- Forward/Reverse Switch (Option)
16- Parking Brake Solenoid Valve
17- Pressure Sensor (Parking Brake)
18- Parking Brake Switch
19- Pressure Sensor (Brake Primary Pressure)
20- Steering Pressure Switch (Option)
21- Brake Pedal (Left)
22- Pressure Sensor (Brake Secondary Pressure)
23- Brake Pedal (Right)
24- Brake Pedal (Right) Switch
25- Buzzer
26- Transmission Warning Indicator
27- Parking Brake Indicator
28- Brake Oil Low Pressure Indicator
29- Low Steering Oil Pressure Indicator
30- CAN



TNED-02-02-048

1- MC
2- Column Display Controller
3- CAN
4- Monitor
5- Monitor Controller
6- ECM
7- Engine
8- Crank Speed Sensor
9- Cam Angle Sensor
10- TCU
11- Transmission
12- Torque Converter Input Speed Sensor
13- Torque Converter Output Speed Sensor
14- Vehicle Speed Sensor
15- Shift Switch
16- Forward/Reverse Lever
17- Forward Position
18- Neutral Position
19- Reverse Position
20- Forward/Reverse Switch (Option)
21- Forward/Reverse Selector Switch (Option)
22- Pump Delivery Pressure Sensor
23- Torque Control Solenoid Valve
24- Parking Brake Solenoid Valve
25- Pressure Sensor (Parking Brake)
26- Parking Brake Switch
27- Quick Power Switch
28- Power Mode Switch
29- Driving Mode Switch
30- AUTO 2 Mode
31- Manual Mode
32- AUTO 1 Mode
33- Accelerator Pedal
34- Accelerator Pedal Sensor

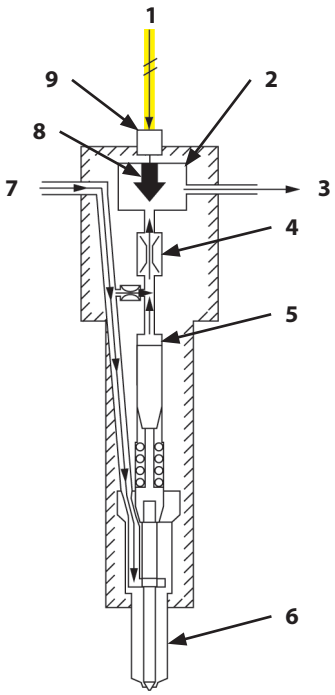


TNED-02-02-061

a- From Fuse Box B (Fuse #16)

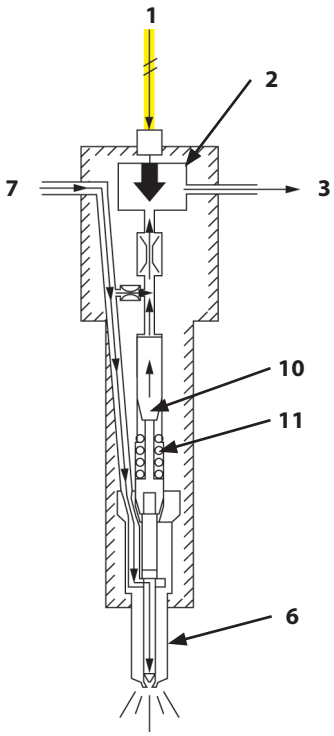
1- Lift Arm Cylinder
2- Coil on Lift Arm Lower Side
3- Pilot Valve (Lift Arm Control Lever)
6- Pilot Pump
7- Control Valve
8- Lift Arm Spool
9- Bucket Spool
10- Main Pump
11- Hydraulic Oil Tank
12- MC

1. Two-way valve: ON



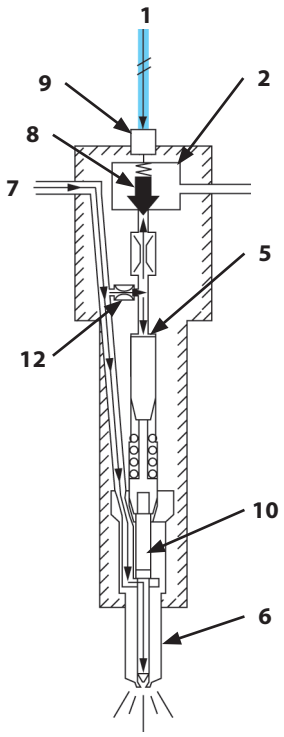
TDAA-02-03-014

2. Injection Start



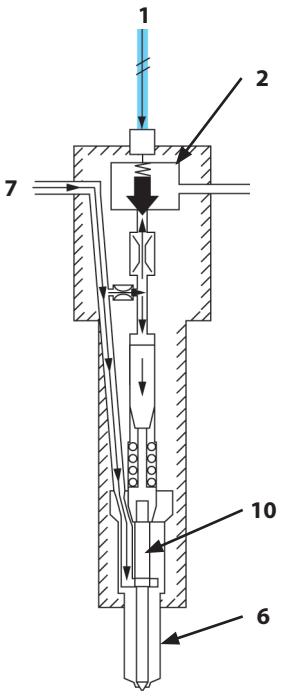
TDAA-02-03-015

3. Two-way valve: OFF



TDAA-02-03-016

4. Injection Stop



TDAA-02-03-017

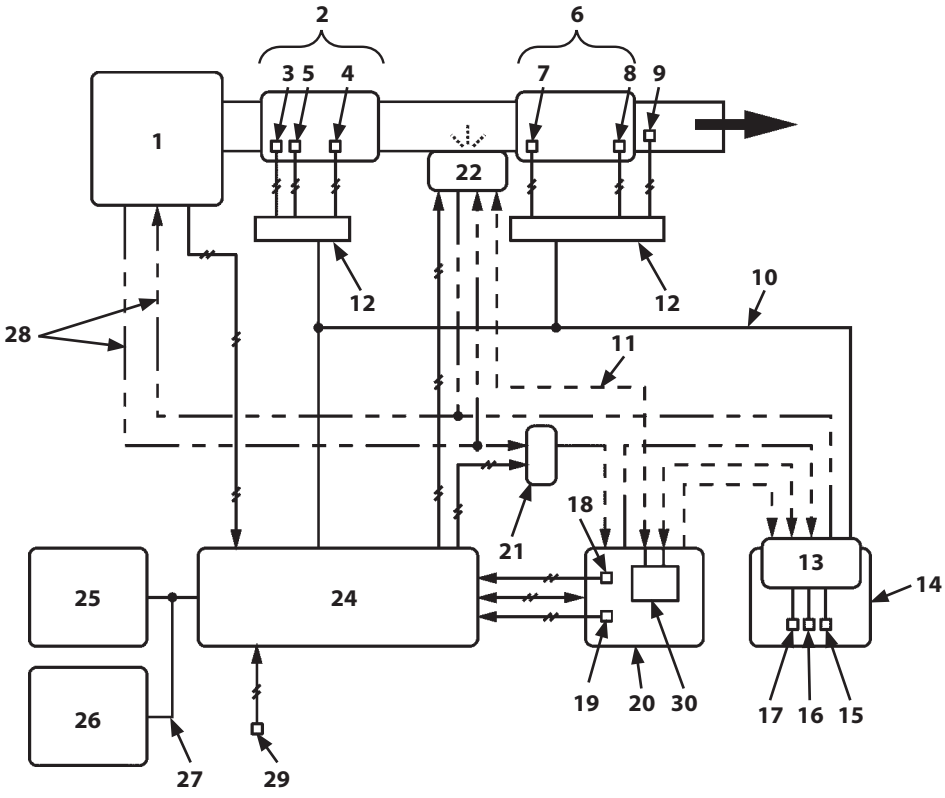
1- From ECM
2- Two-Way Valve
3- Returning to Fuel Tank
4- Orifice A
5- Control Chamber
6- Nozzle
7- From Common Rail
8- Valve
9- Electromagnetic Coil
10- Hydraulic Piston
11- Spring
12- Orifice B

Urea SCR System

The urea SCR system injects the DEF into the exhaust of engine (1) to convert NOx into nitrogen and water. Therefore, the urea SCR system reduces NOx from exhaust gas.
ECM (24) controls the urea SCR system. ECM (24) drives DEF supply module (20) and dosing module (22) according to the signals from the sensors, and controls the following functions.

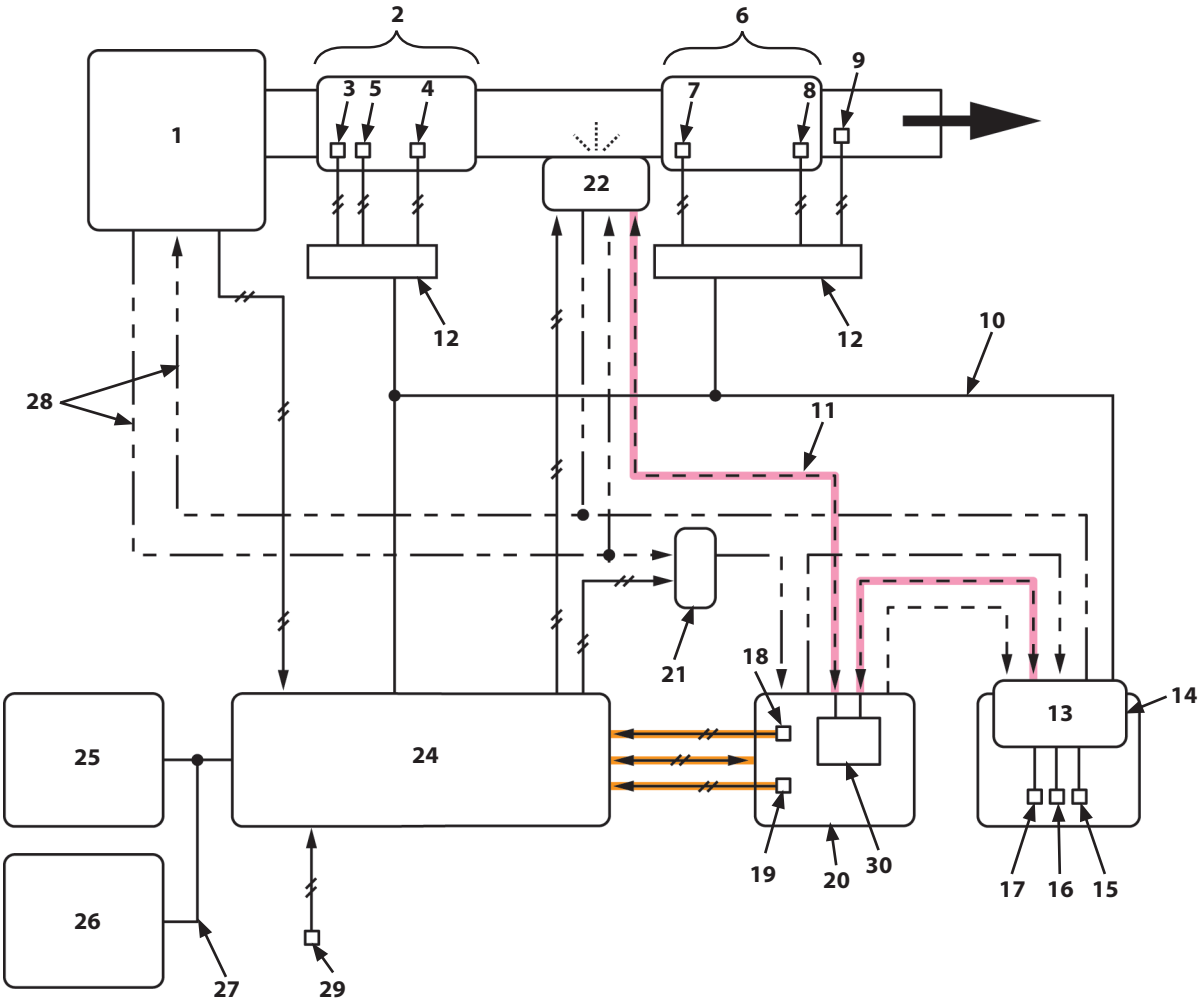
- DEF Injection Control
- Start-Up Control
- DEF Defrosting Control
- DEF Thermal Control
- After-Run Control

DEF supply module (20) pumps the DEF from DEF tank (14) to dosing module (22).
Dosing module (22) injects the DEF according to the signal from ECM (24).



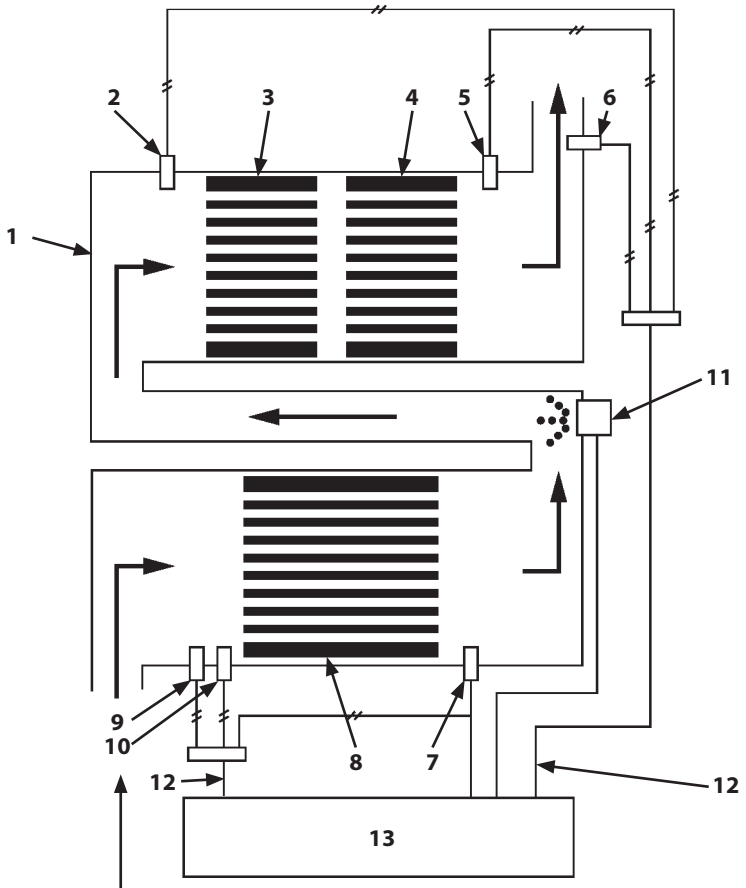
TNEK-02-03-002

1- Engine
2- DOC (Diesel Oxidation Catalyst)
3- DOC Inlet Exhaust Temperature Sensor
4- DOC Outlet Exhaust Temperature Sensor
5- NOx Sensor (DOC Inlet)
6- SCR Catalyst
7- SCR Inlet Exhaust Temperature Sensor
8- SCR Outlet Exhaust Temperature Sensor
9- NOx Sensor (SCR Outlet)
10- CAN3
11- DEF Piping
12- Sensor Board
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- Dosing Module
24- ECM
25- Monitor Controller
26- MC
27- CAN1
28- Coolant Piping
29- TBAP Sensor
30- Reverting Valve

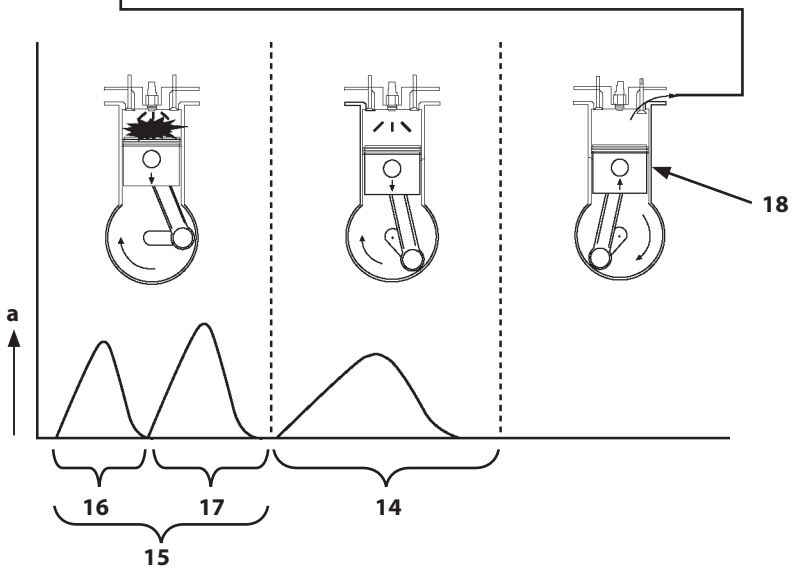


TNEK-02-03-007

1- Engine
2- DOC (Diesel Oxidation Catalyst)
3- DOC Inlet Exhaust Temperature Sensor
4- DOC Outlet Exhaust Temperature Sensor
5- NOx Sensor (DOC Inlet)
6- SCR Catalyst
7- SCR Inlet Exhaust Temperature Sensor
8- SCR Outlet Exhaust Temperature Sensor
9- NOx Sensor (SCR Outlet)
10- CAN3
11- DEF Piping
12- Sensor Board
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- Dosing Module
24- ECM
25- Monitor Controller
26- MC
27- CAN1
28- Coolant Piping
29- TBAP Sensor
30- Reverting Valve



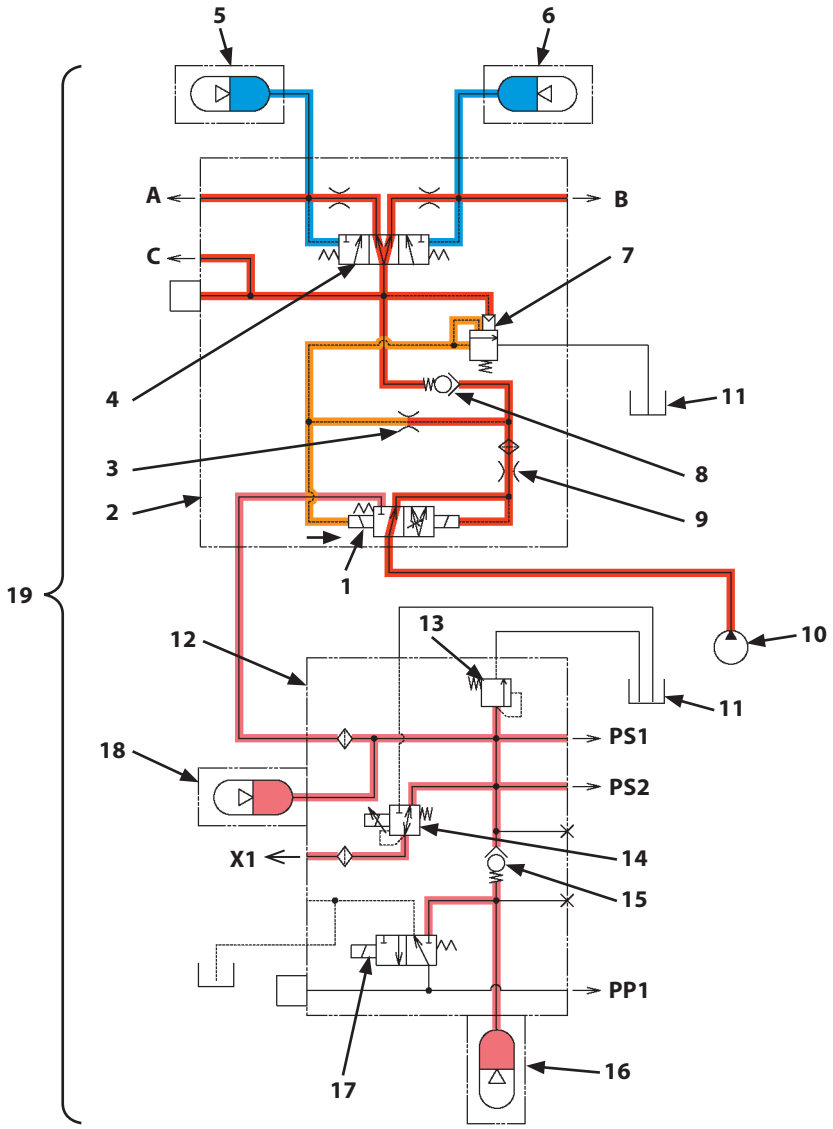
TNEK-02-03-019



TDC2-02-03-018

a- Fuel Injection Amount

1- Aftertreatment Device
2- SCR Inlet Exhaust Temperature Sensor
3- SCR Catalyst
4- Diesel Oxidation Catalyst (DOC) 2
5- SCR Outlet Exhaust Temperature Sensor
6- NOx Sensor (SCR Outlet)
7- DOC Outlet Exhaust Temperature Sensor
8- Diesel Oxidation Catalyst (DOC) 1
9- NOx Sensor (DOC Inlet)
10- DOC Inlet Exhaust Temperature Sensor
11- Dosing Module
12- CAN3
13- ECM
14- Post Injection
15- Multi Injection
16- Pilot Injection
17- Main Injection
18- Cylinder



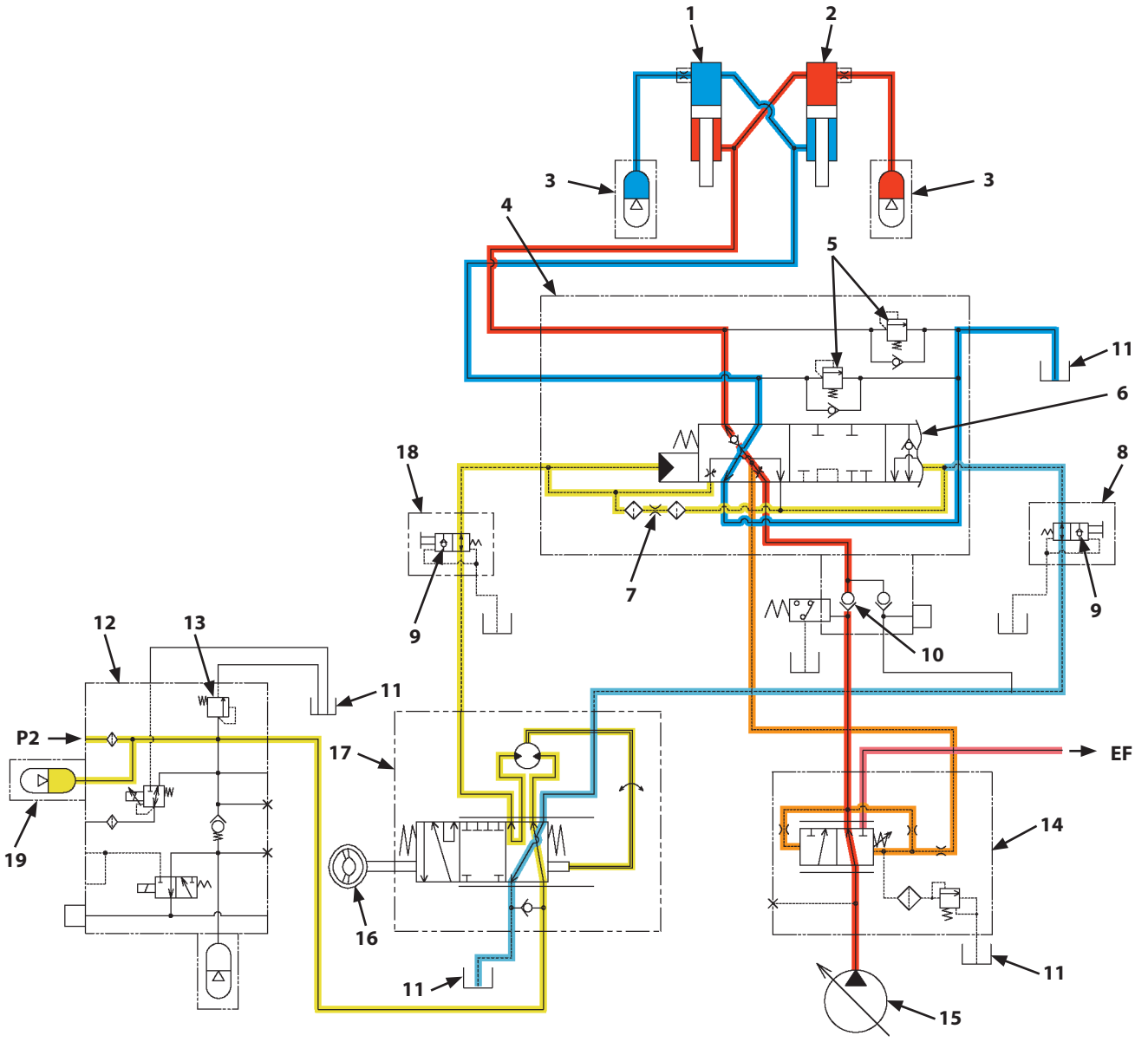
TNED-02-04-031

A- To Service Brake Circuit (Front)
B- To Service Brake Circuit (Rear)
c- To Parking Brake Circuit

PS1- To Steering Operation Control Circuit
PS2- To Pump Control Circuit, 2-Spool Solenoid Valve Unit

PP1- To Lift Arm/Bucket Operation Control Circuit
X1- To Pump Control Circuit

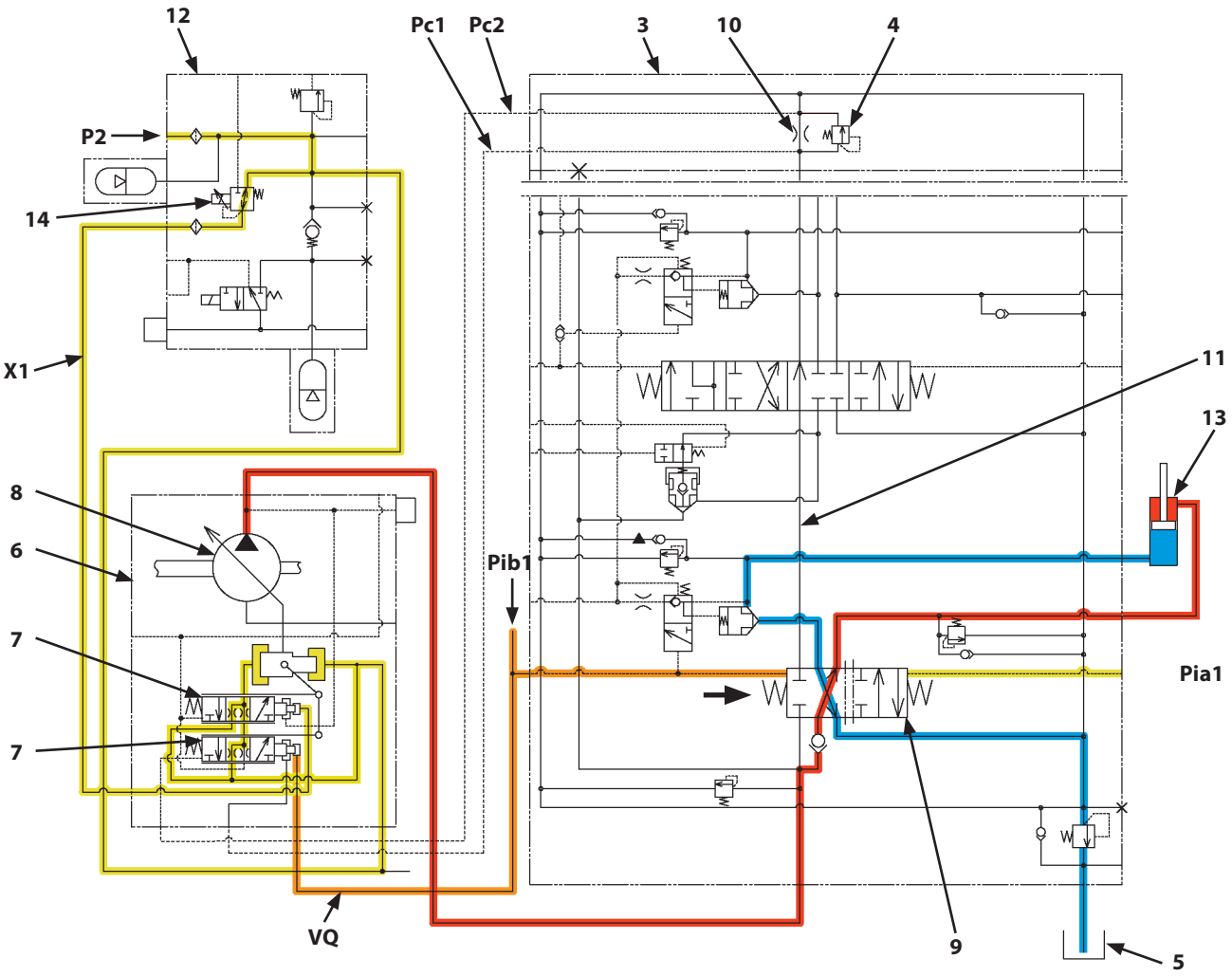
1- Priority Valve (Brake)
2- Brake Charge Valve
3- Orifice
4- Shuttle Valve
5- Service Brake Accumulator (Front)
6- Service Brake Accumulator (Rear)
7- Charge Relief Valve
8- Check Valve
9- Orifice
10- Pilot Pump
11- Hydraulic Oil Tank
12- Manifold Valve
13- Pilot Relief Valve
14- Torque Control Solenoid Valve
15- Check Valve
16- Pilot Accumulator (Front Attachment)
17- Control Lever Lock Solenoid Valve
18- Pilot Accumulator (Steering)
19- Charging Circuit



TNED-02-04-023

P2- From Brake Charge Valve (Pilot Pressure Oil)
EF- To Control Valve

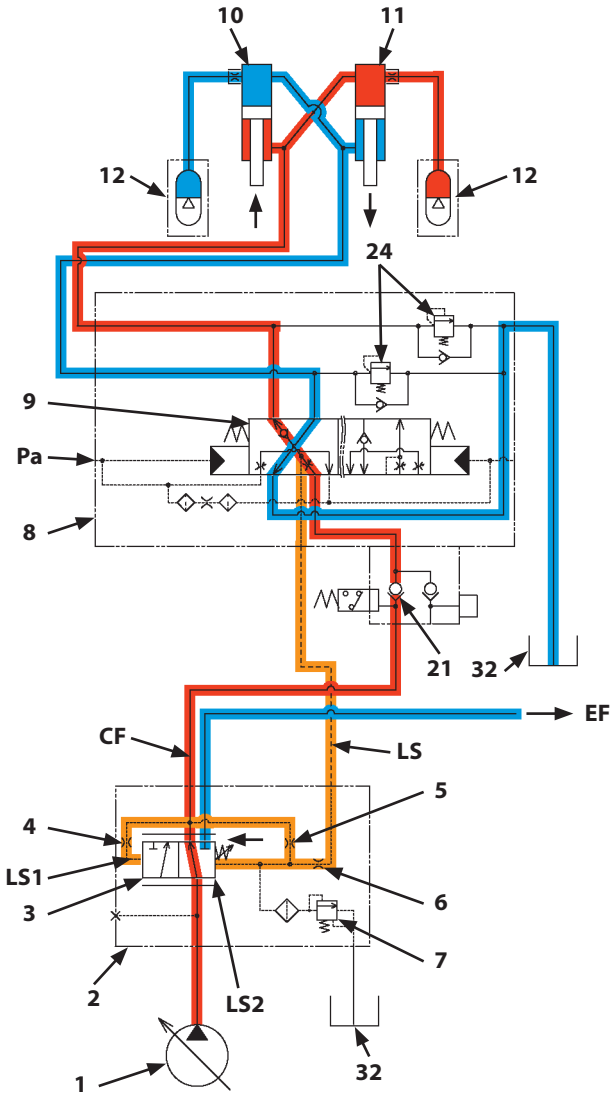
1- Steering Cylinder (Left)
2- Steering Cylinder (Right)
3- Steering Accumulator
4- Steering Valve
5- Overload Relief Valve
6- Steering Spool
7- Orifice
8- Stop Valve (Right)
9- Check Valve
10- Check Valve
11- Hydraulic Oil Tank
12- Manifold Valve
13- Pilot Relief Valve
14- Priority Valve
15- Main Pump
16- Steering Wheel
17- Steering Pilot Valve
18- Stop Valve (Left)
19- Pilot Accumulator (Steering)



TNED-02-04-024

P2- From Brake Charge Valve (Pilot Pressure Oil)
VQ- Pump Control Pressure
X1- Torque Control Pressure
Pia1- Bucket Tilt Pilot Pressure
Pib1- Bucket Dump Pilot Pressure
Pc2- Pump Control Pressure
Pc1- Pump Control Pressure

3- Control Valve
4- Pump Control Valve
5- Hydraulic Oil Tank
6- Pump Device
7- Regulator
8- Main Pump
9- Bucket Spool
10- Orifice
11- Neutral Circuit
12- Manifold Valve
13- Bucket Cylinder
14- Torque Control Solenoid Valve

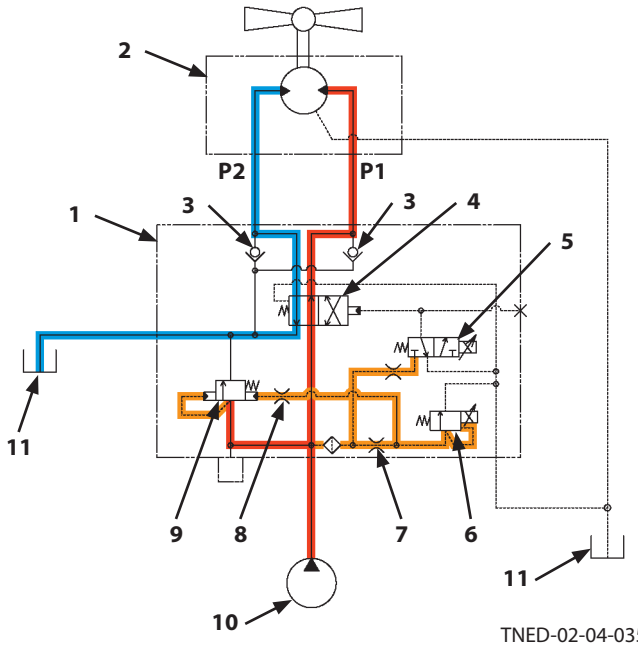


TNED-02-04-026

CF- To Steering Valve
LS1- Port
LS- Pressure Oil to Operate Priority Valve
LS2- Port
EF- To Control Valve
Pa- Steering (Left) (Pilot Pressure Oil)

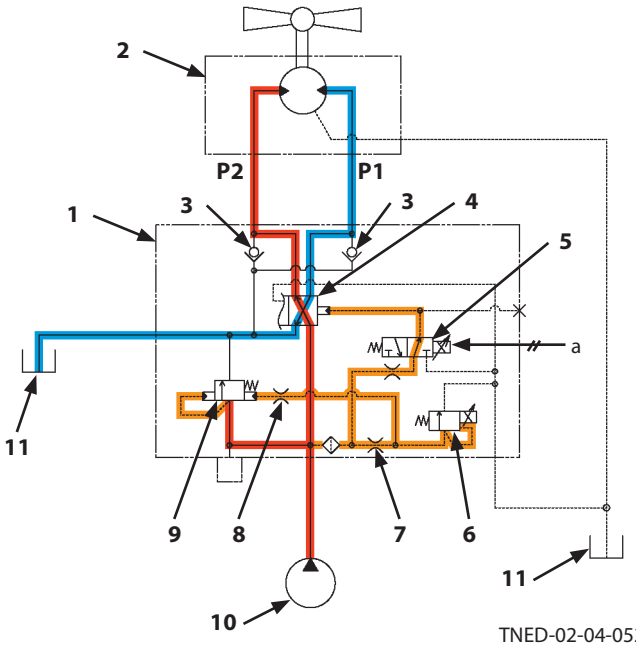
1- Main Pump
2- Priority Valve
3- Priority Spool
4- Orifice
5- Orifice
6- Orifice
7- Main Relief Valve (Steering)
8- Steering Valve
9- Steering Spool
10- Steering Cylinder (Left)
11- Steering Cylinder (Right)
12- Steering Accumulator
21- Check Valve
24- Overload Relief Valve
32- Hydraulic Oil Tank

- Normal rotation



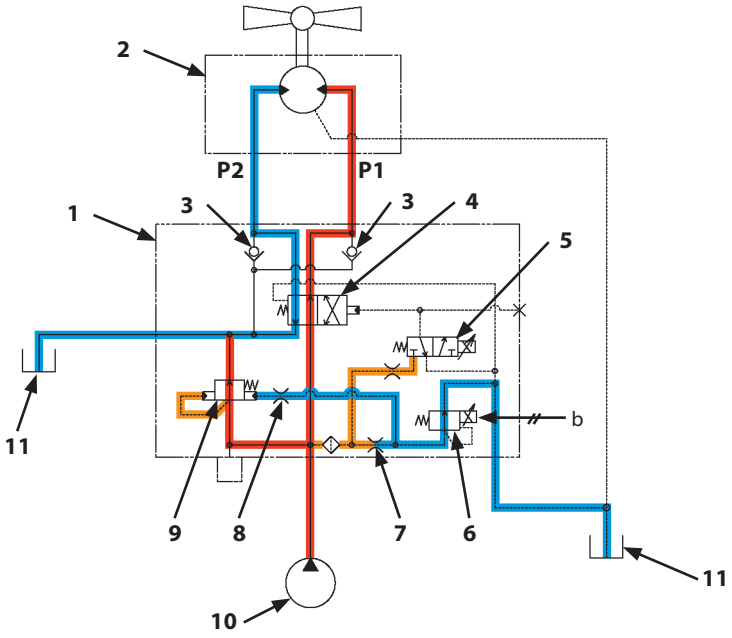
TNED-02-04-035

- Revers rotation



TNED-02-04-052

- Normal rotation when relieving

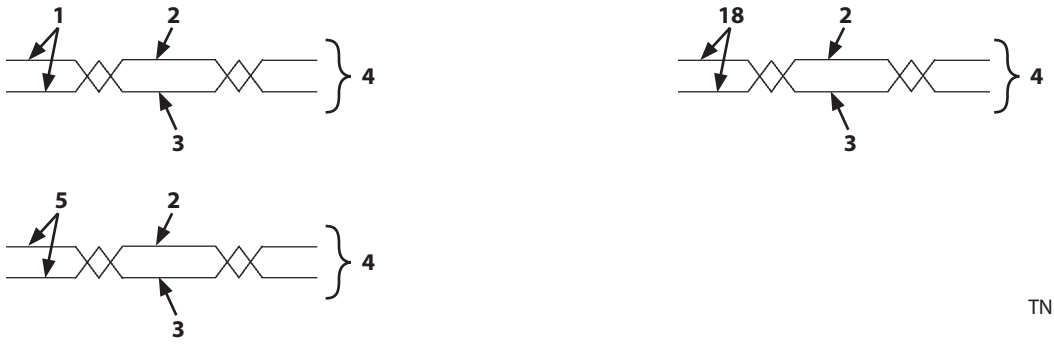


TNED-02-04-036

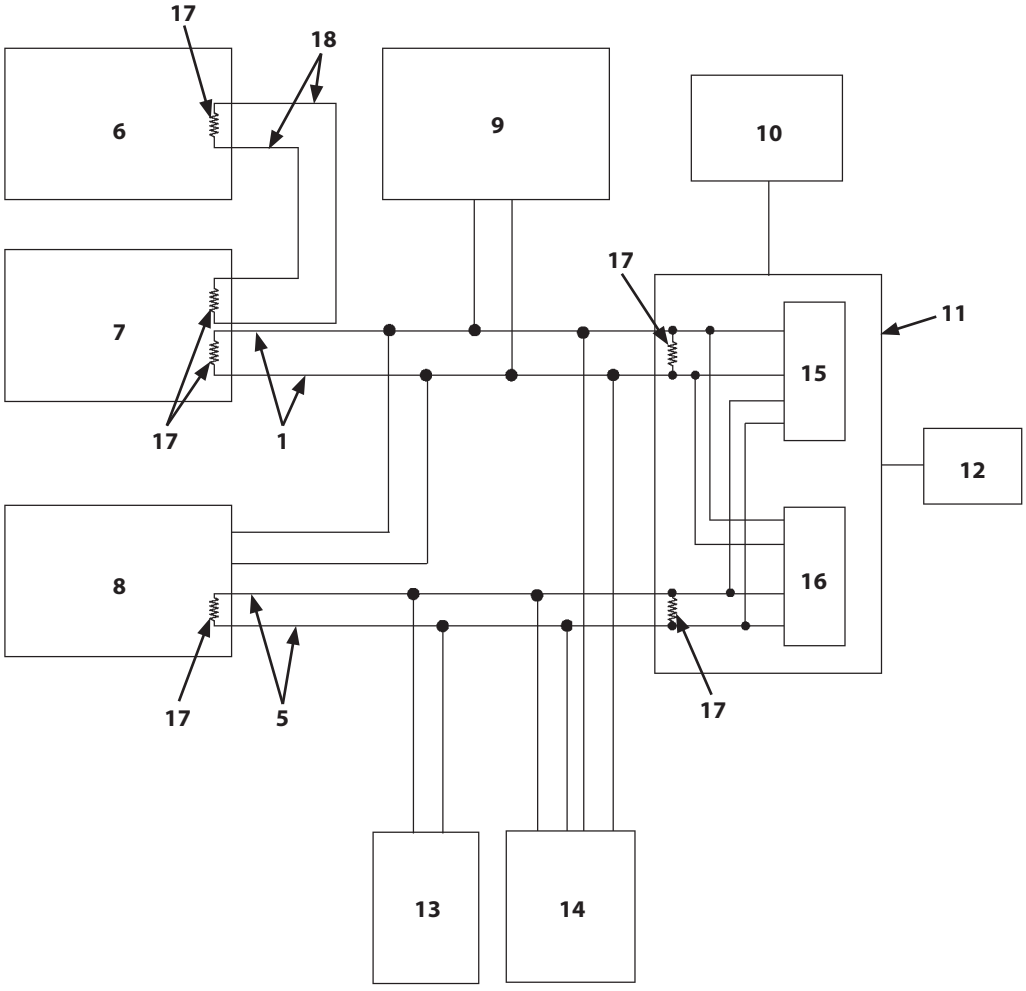
P1- Normal Rotation

P2- Reverse Rotation

1- Fan Valve
2- Fan Motor
3- Anti-Void Valve
4- Fan Reverse Rotation Spool
5- Fan Reverse Rotation Control Solenoid Valve
6- Fan Speed Control Solenoid Valve
7- Orifice
8- Orifice
9- Fan Control Valve
10- Fan Pump
11- Hydraulic Oil Tank

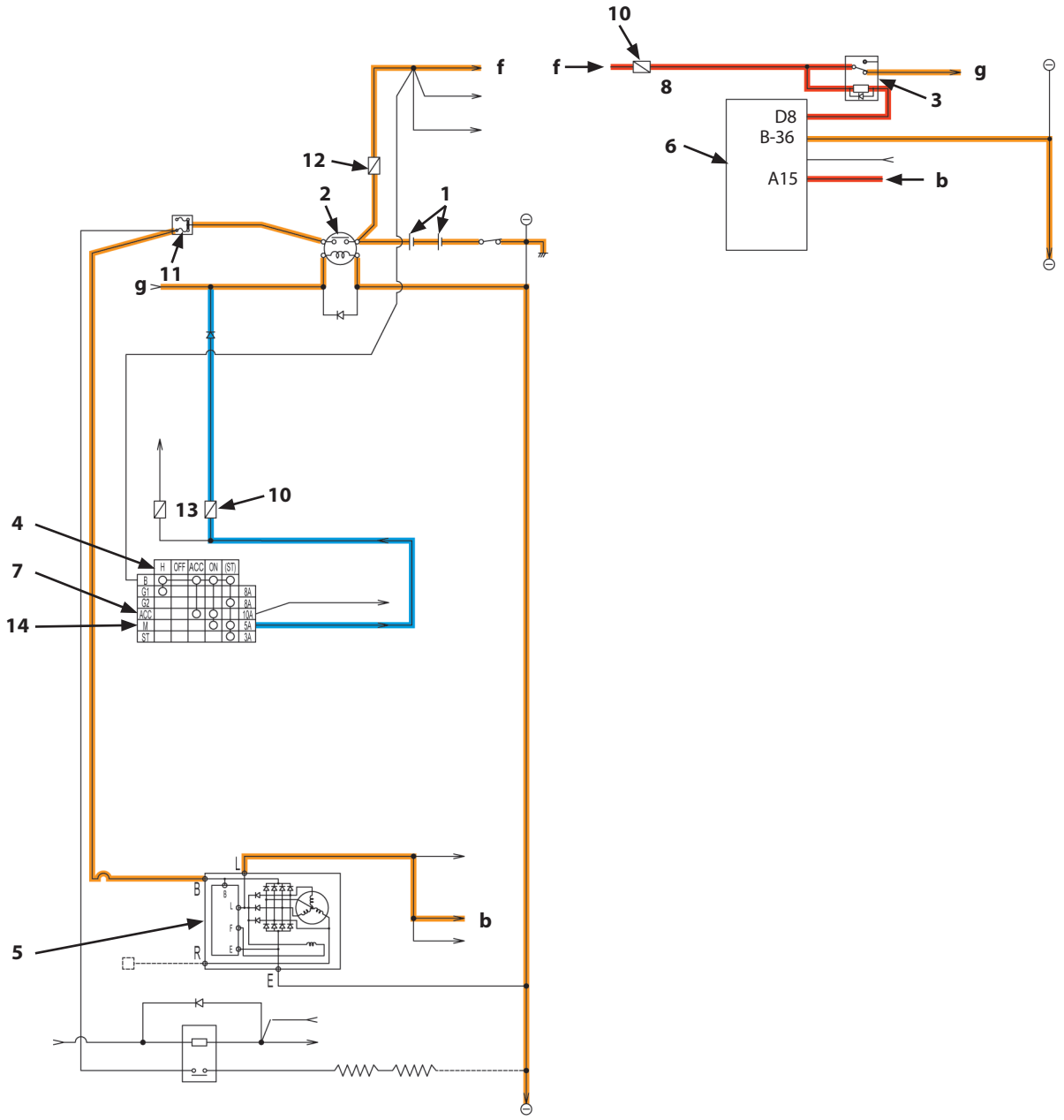


TNEK-02-01-001



TNEK-02-01-002

1- CAN1
2- CAN-H(High)
3- CAN-L(Low)
4- CAN Bus
5- CAN2
6- VGS Controller (Variable Turbo Controller)
7- ECM (Engine Controller)
8- MC (Main Controller)
9- TCU (Transmission Controller)
10- Communication Controller
11- Monitor Controller
12- MPDr.
13- Air Conditioner Controller
14- Column Display Controller
15- Monitor Control Unit
16- Information Control Unit
17- Termination Resistor (120 Ω)
18- CAN3

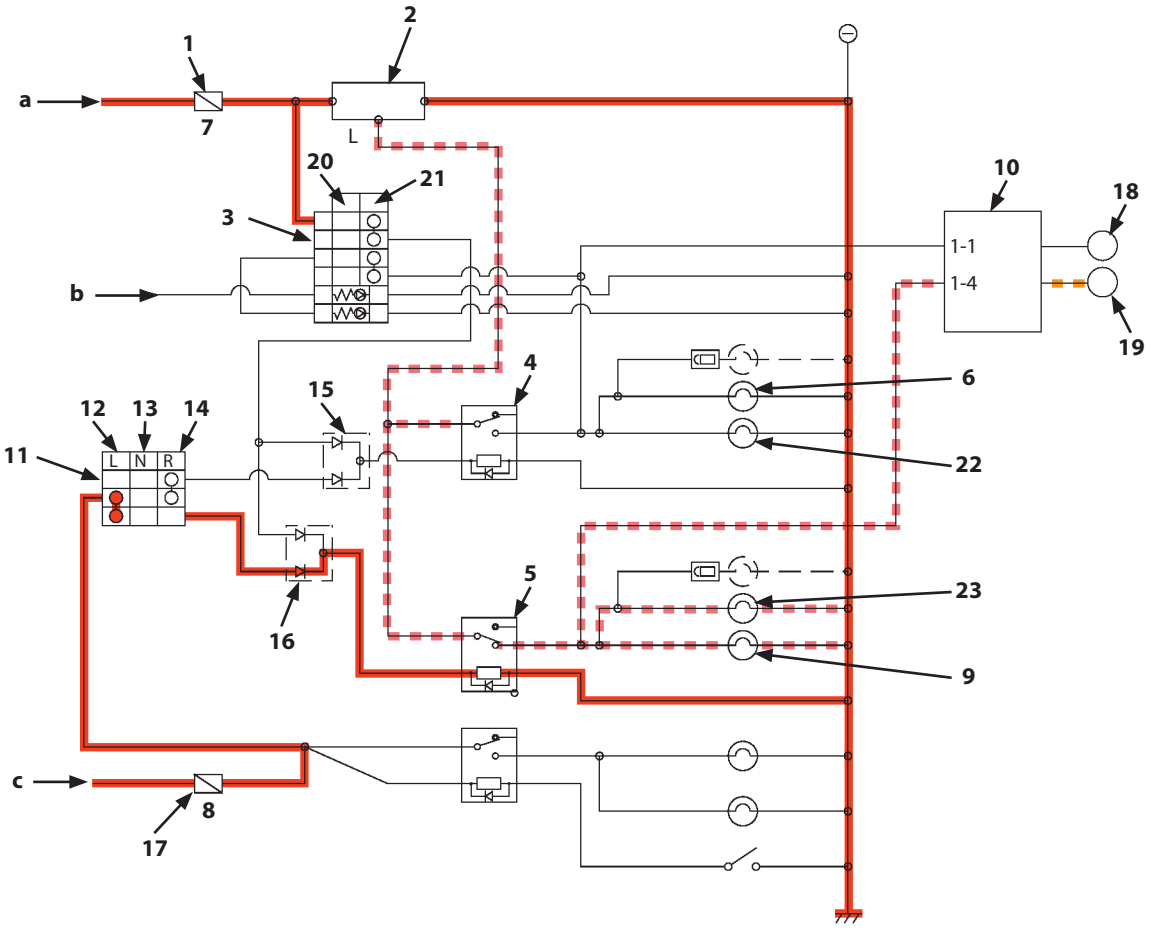


TNEK-02-05-005

1- Battery
2- Battery Relay
3- Load Dump Relay
4- Key Switch
5- Alternator
6- Monitor Controller
7- Terminal ACC
10- Fuse Box B
11- Fusible Link (70 A)
12- Fusible Link A (65A)
14- Terminal M

Steering Column Box Circuit

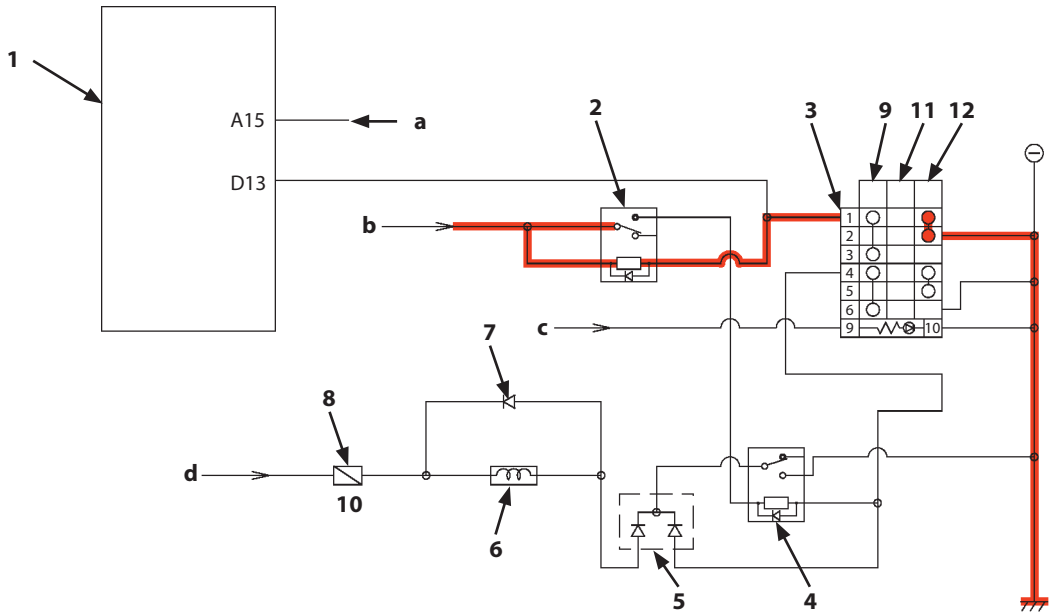
- The headlight circuit turns on and off the headlights, clearance lights, license lights, and tail lights.
- The hazard light circuit turns on and off the hazard lights.
- The turn signal light circuit turns on and off the turn signal lights.
- The horn circuit sounds the horn.
- The back buzzer circuit activates and deactivates the back buzzer.
- The brake light circuit turns on and off the brake lights.
- The parking brake circuit applies and releases the parking brake.



TNED-02-05-015

a- From Battery
b- From Fuse #12 in Fuse Box B
c- From Battery Through Battery Relay and Fusible Link (70A)

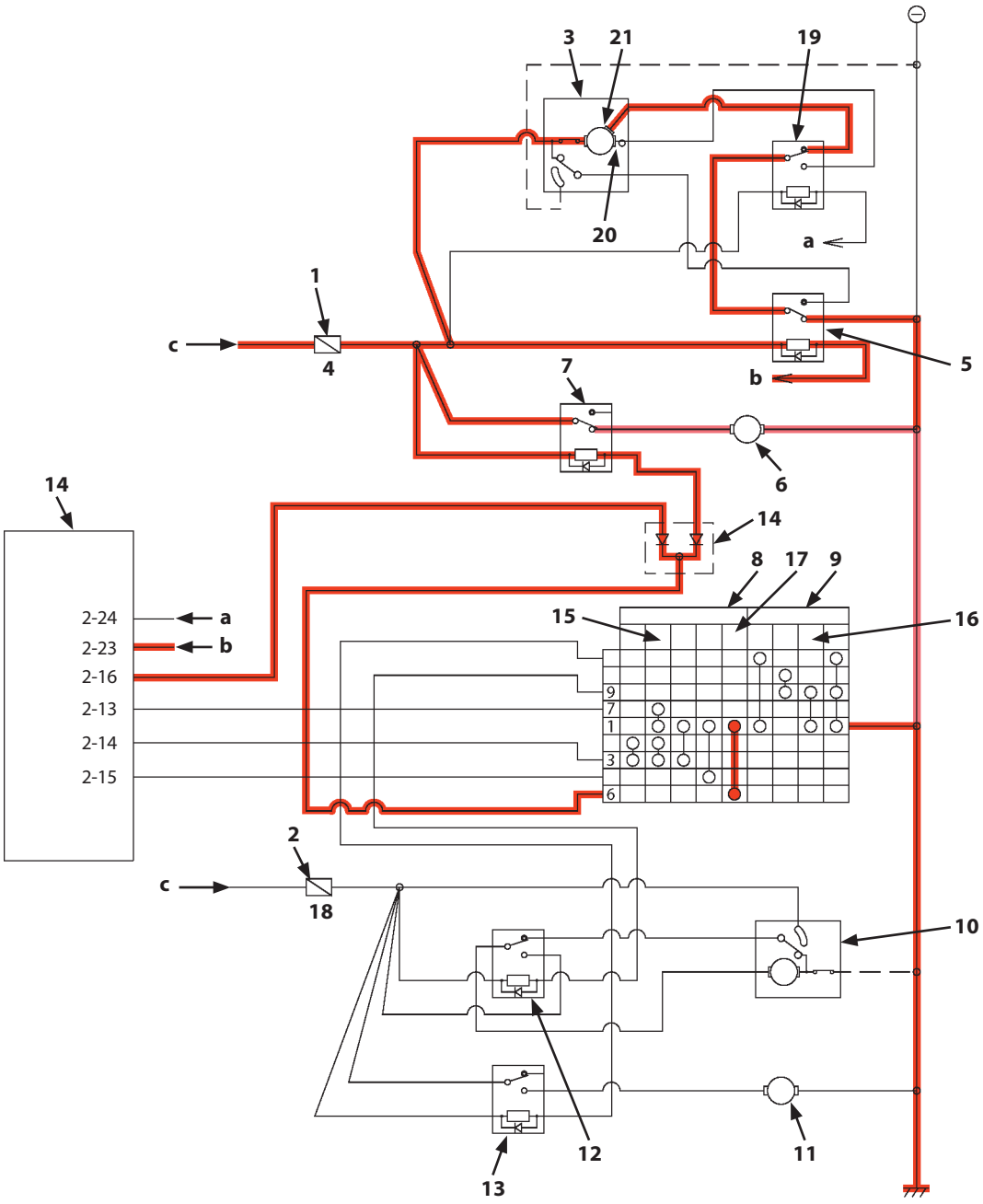
1- Fuse Box B
2- Flasher Relay
3- Hazard Light Switch
4- Turn Signal Light Relay (Right)
5- Turn Signal Light Relay (Left)
6- Turn Signal Light (Right Front)
9- Turn Signal Light (Left Rear)
10- Column Display Controller
11- Turn Signal Lever
12- Left Turn Position
13- Neutral Position
14- Right Turn Position
15- Diode P
16- Diode K
17- Fuse Box A
18- Right Turn Signal Indicator
19- Left Turn Signal Indicator
20- OFF Position
21- ON Position
22- Turn Signal Light (Right Rear)
23- Turn Signal Light (Left Front)



TNED-02-05-020

a- From Terminal L in Alternator
b- From Fuse #14 in Fuse Box B
c- From Fuse #12 in Fuse Box B
d- From Battery Relay

1- Monitor Controller
2- Parking Brake Relay 1
3- Parking Brake Switch
4- Parking Brake Relay 2
5- Diode G
6- Parking Brake Solenoid Valve
7- Diode F
8- Fuse Box A
9- Release Position
11- Neutral Position
12- Apply Position



TNED-02-05-024

a- From Front Wiper Relay 2
b- From Front Wiper Relay 1
c- From Battery Relay

1- Fuse Box A
2- Fuse Box B
3- Front Wiper Motor
5- Front Wiper Relay 1
6- Front Washer Motor
7- Front Washer Relay
8- Front Wiper/Washer Switch
9- Rear Wiper/Washer Switch
10- Rear Wiper Motor
11- Rear Washer Motor
12- Rear Wiper Relay
13- Rear Washer Relay
14- Column Display Controller
15- INT. Position
16- LOW Position
17- Washer Position
19- Front Wiper Relay 2
20- Slow
21- Fast

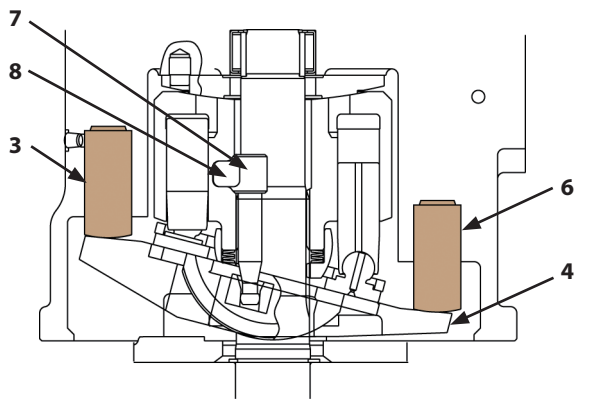
Increasing and Decreasing Flow Rate

The displacement angle of swash plate (4) is changed by the movement of servo piston 1 (3) and servo piston 2 (6).
Movement of the servo pistons is controlled by the regulator. In addition, the displacement angle of swash plate (4) is fed back to the regulator by feedback lever (7) and link (8).

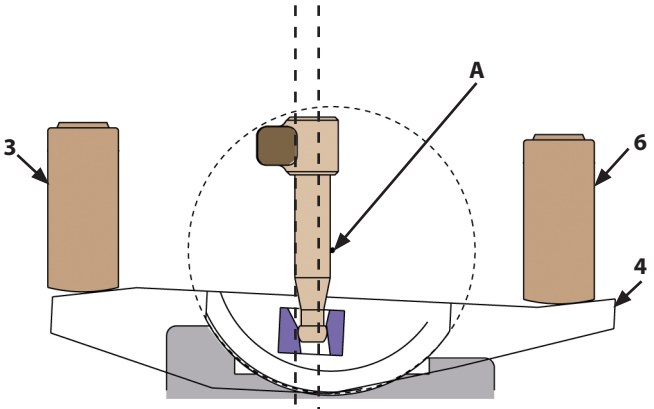
NOTE: Refer to the following pages as for operation of the regulator.

- Tilting Change Operation
  1. The center of swash plate (4) inclination is located at A in the drawings on the right.
  2. Pilot pressure is always routed to servo piston 2 (6).
  3. Therefore, when the circuit of servo piston 1 (3) is connected to the hydraulic oil tank, swash plate (4) is rotated clockwise around A.
  4. Conversely, as there are two servo pistons 1 (3) and when pilot pressure is routed to both of servo piston 1 (3) and servo piston 2 (6), swash plate (4) is rotated counterclockwise around A.

- Feedback Operation
  1. End of feedback lever (7) is inserted into protrusion part (D) on the side of swash plate (4).
  2. When swash plate (4) rotates, protrusion part (D) is also rotated and feedback lever (7) moves together.
  3. For example, when swash plate (4) is rotated from the minimum to the maximum, the center of feedback lever (7) is moved from positions B to C as illustrated to the right.
  4. Therefore, link (8) is moved by feedback lever (7) and the movement is fed back to the regulator.

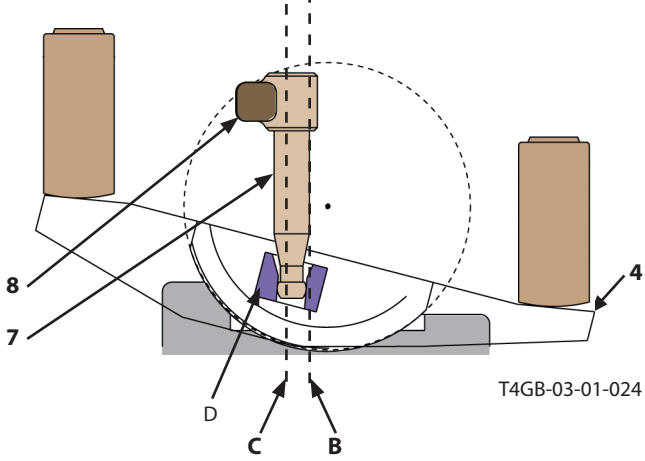


T4GB-03-01-022

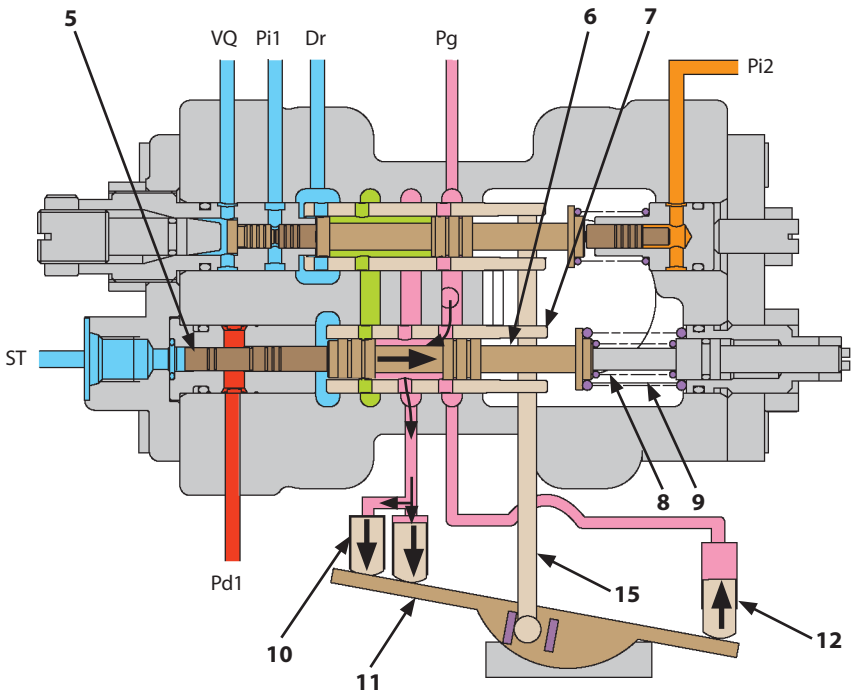


T4GB-03-01-023

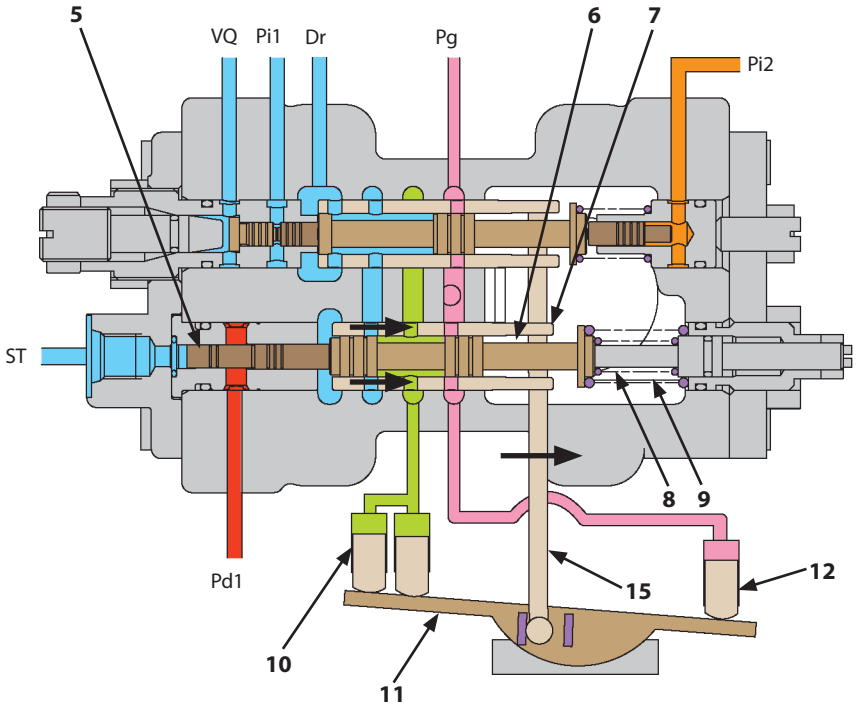
Maximum Tilting:



T4GB-03-01-024



TNED-03-01-015



TNED-03-01-016

Pd1- Own Pump Delivery Pressure
ST- Torque Control Pressure

5- Load Piston
6- Spool 2
7- Sleeve 2

Dr- Returning to Hydraulic Oil Tank
Pi1- Pump Control Pressure 1

8- Inner Spring
9- Outer Spring
10- Servo Piston 1

Pi2- Pump Control Pressure 2
Pg- Primary Pilot Pressure (From Pilot Pump)

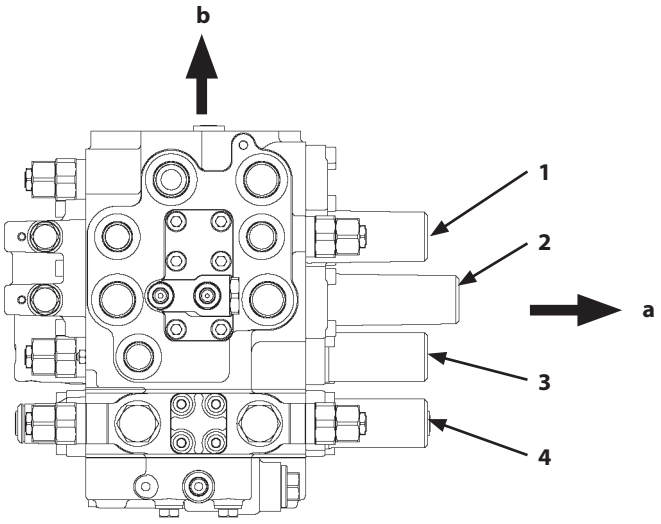
11- Swash Plate
12- Servo Piston 2
15- Feedback Lever Link

VQ- Bucket Dump Pilot Pressure

Outline

The control valve controls the pressure, flow rate, and flow direction in the hydraulic circuit. The major parts are the main relief valve, overload relief valve, anti-drift valve, lift arm flow rate control valve, pump flow rate control valve, and spools. The spools are operated by the pilot oil pressure.

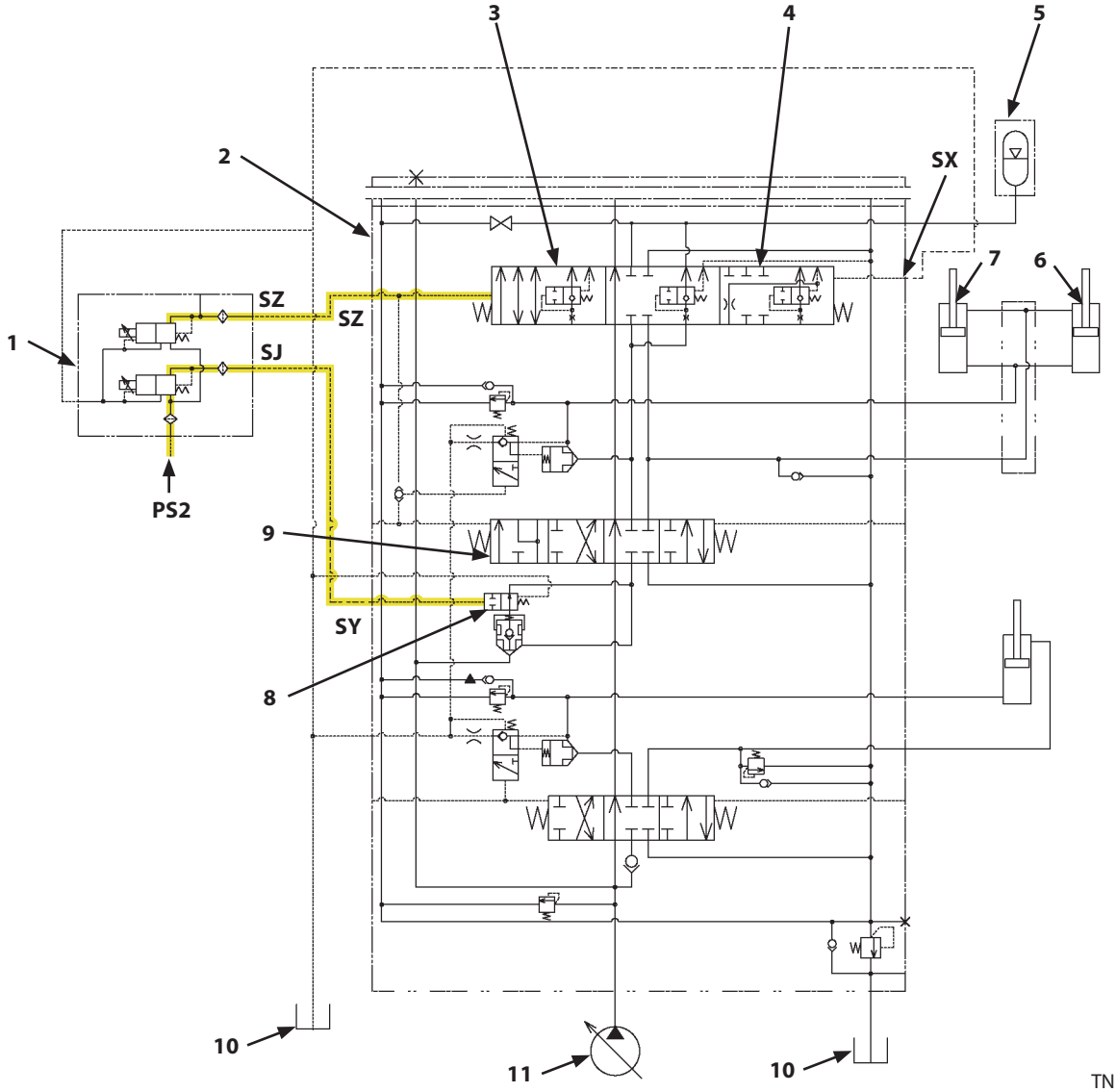
Control Valve



TNED-03-02-003

a- Front Side of Machine
b- Left Side of Machine
1- Bucket
2- Lift Arm
3- Ride Control
4- Auxiliary

External Pilot Pressure Circuit:

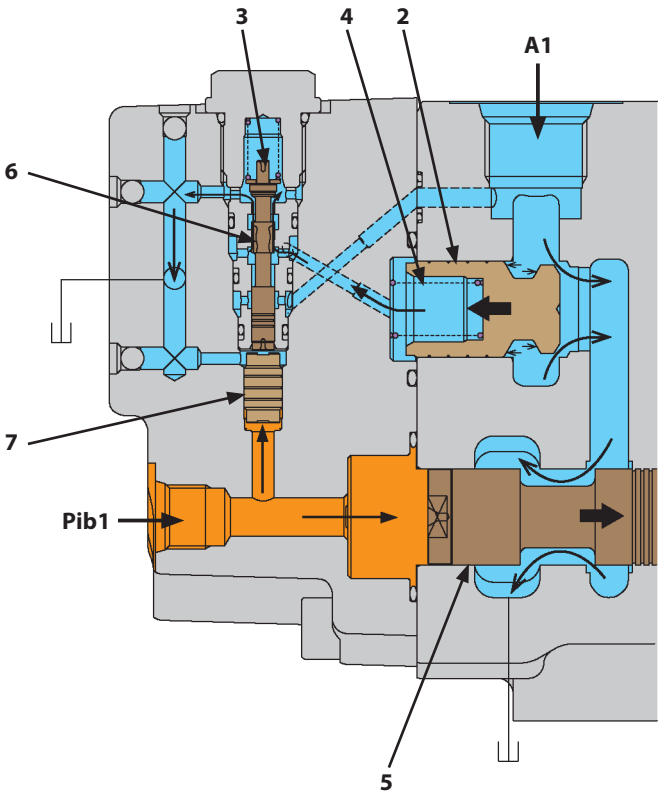


TNEK-03-02-002

PS2- Pilot Pressure Oil from Manifold Valve (Port PS2)
SX- Port SX (To Hydraulic Oil Tank)
SY- Port SY (Pilot Pressure from 2-Spool Solenoid Valve Unit (SJ))
SZ- Port SZ (Pilot Pressure from 2-Spool Solenoid Valve Unit (SZ))

1- 2-Spool Solenoid Valve Unit
2- Control Valve
3- Ride Control Spool
4- (Not Used)
5- Ride Control Accumulator
6- Lift Arm Cylinder (Right)
7- Lift Arm Cylinder (Left)
8- Lift Arm Flow Rate Control Valve (Selector Valve)
9- Lift Arm Spool
10- Hydraulic Oil Tank
11- Main Pump

Releasing Operation:



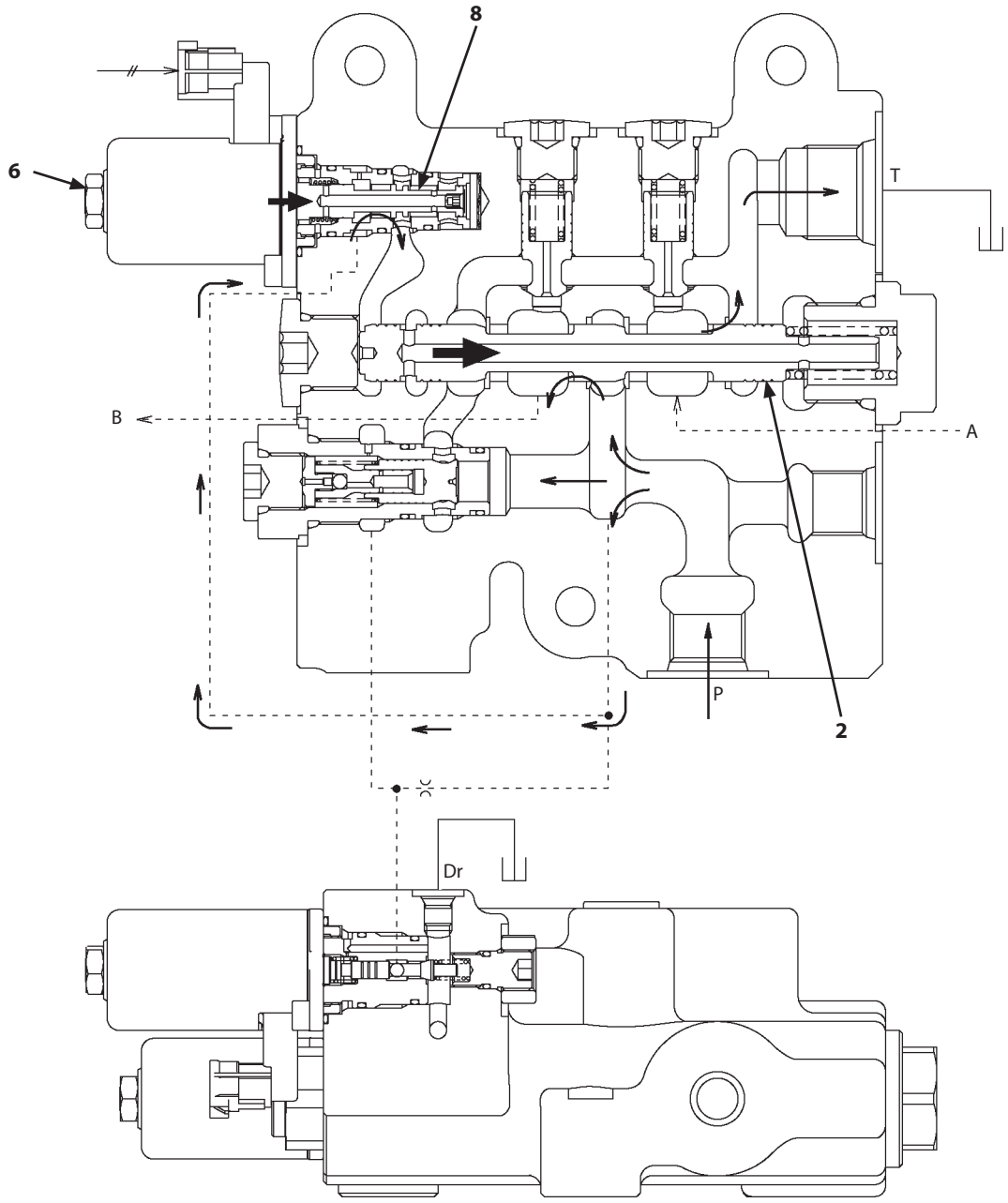
TNED-03-02-021

A1- Port A1 (Bucket Cylinder: Bottom Side)

Pib1- Port Pib1 (Bucket Dump Pilot Pressure)

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

(Blank)



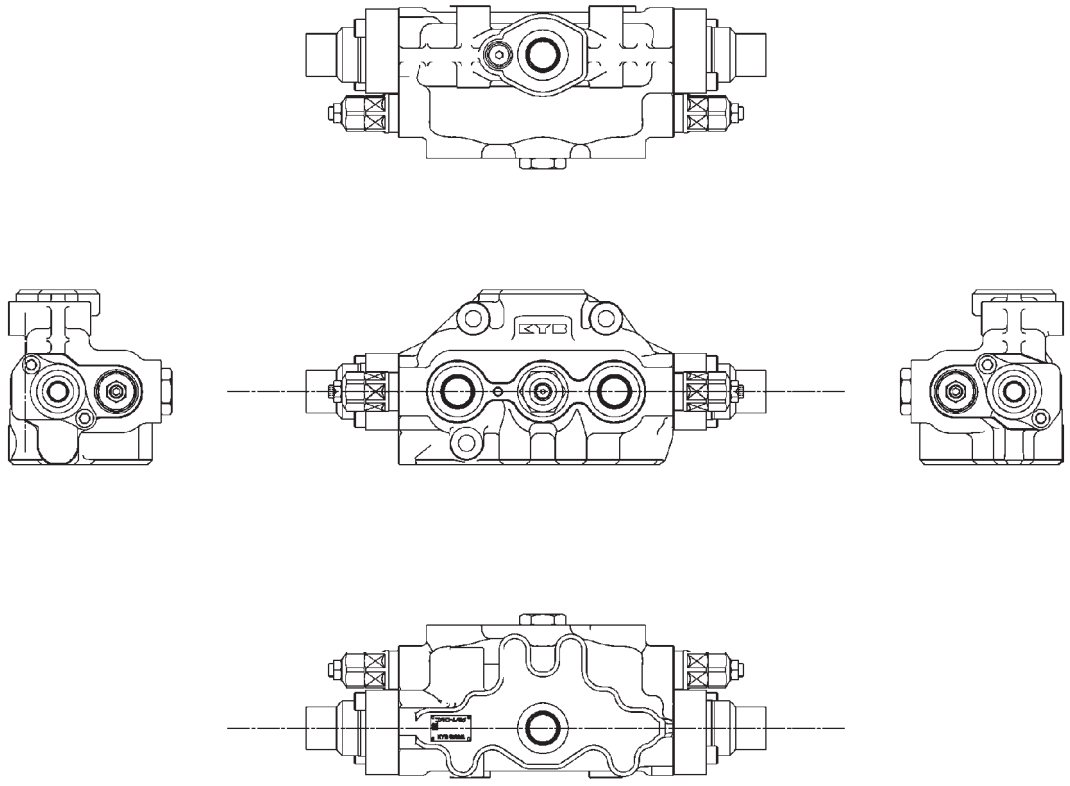
TNED-03-03-006

P- From Pilot Pump
T- To Hydraulic Oil Tank
Dr- To Hydraulic Oil Tank
A- To Fan Motor (Normal Rotation Side)
B- To Fan Motor (Reverse Rotation Side)

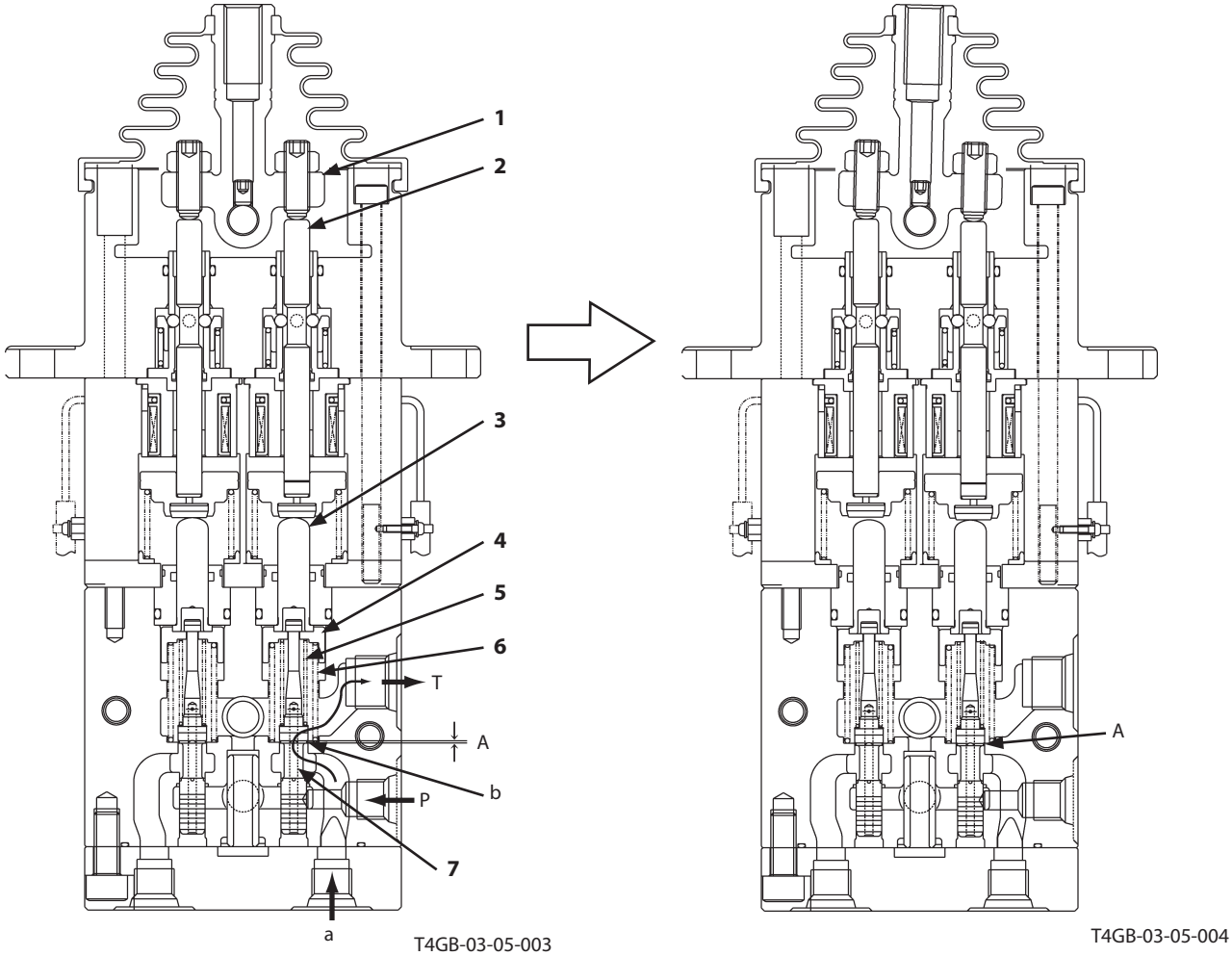
2- Fan Reverse Rotation Spool
6- Fan Reverse Rotation Control Solenoid Valve
8- Spool

Outline

Steering valve is located between the main pump and the steering cylinder.
Steering valve supplies pressure oil from the main pump to the steering cylinder in response to pilot pressure of the steering pilot valve.
Steering cylinder is provided with the overload relief valve.



TNED-03-05-001



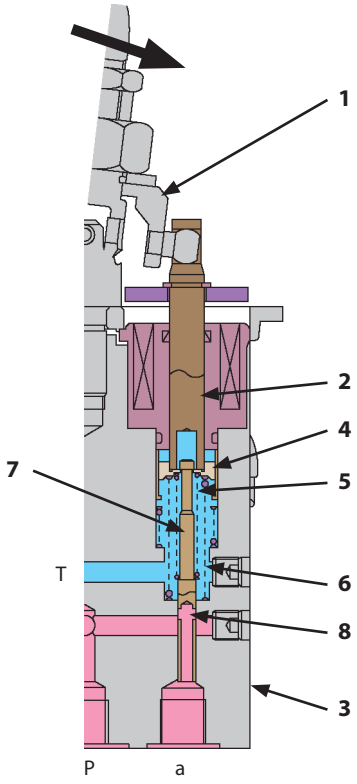
T4GB-03-05-003

T4GB-03-05-004

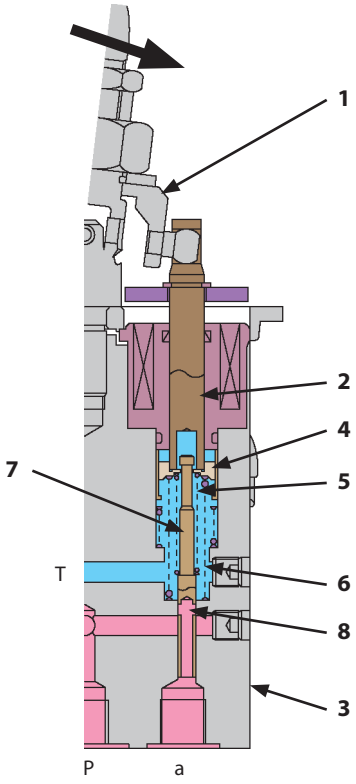
P- Port P
T- Port T
a- Output Port

A- Clearance
b- Notch Part

1- Lever
2- Push Rod
3- Pusher
4- Spring Guide
5- Balance Spring
6- Return Spring
7- Spool



TNED-03-06-005



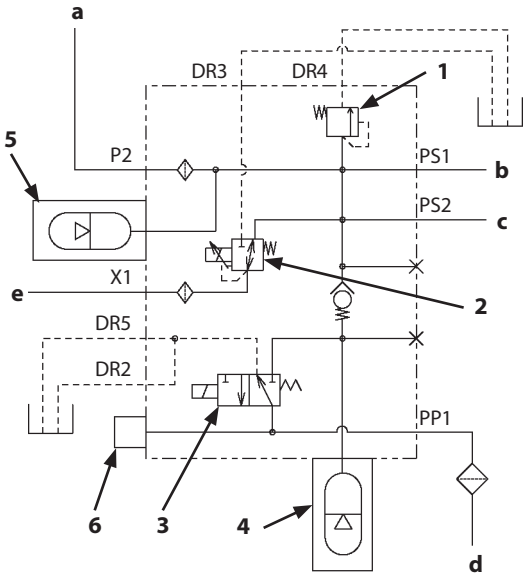
TNED-03-06-006

P- Port P
T- Port T
a- Output Port

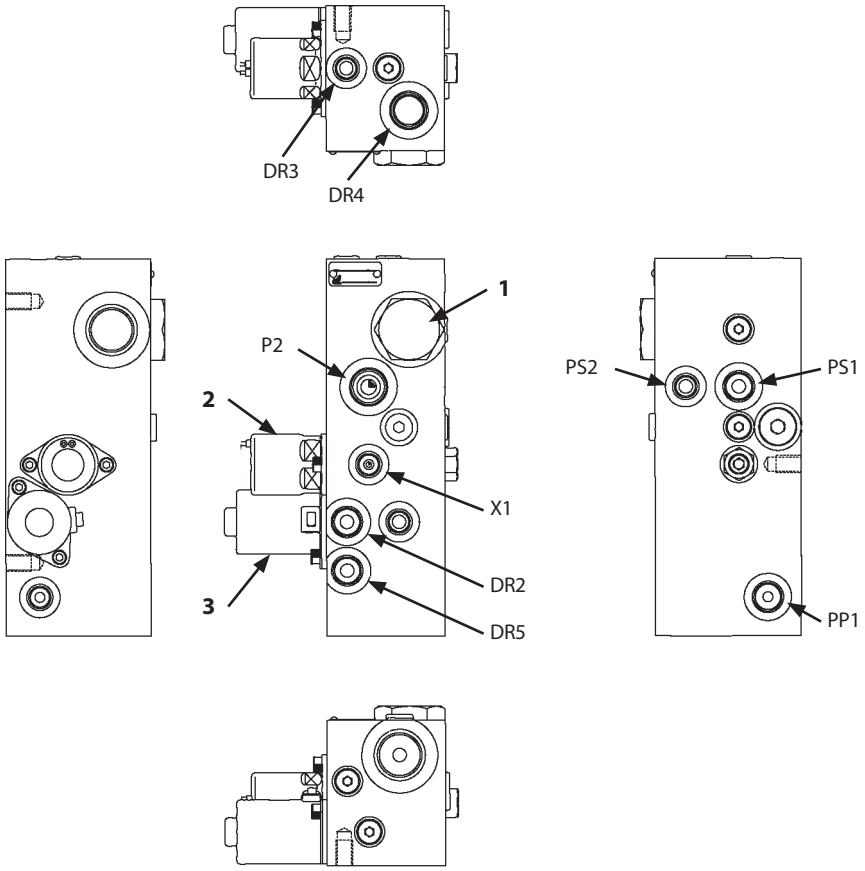
1- Cam
2- Pusher
3- Casing
4- Spring Guide
5- Balance Spring
6- Return Spring
7- Spool
8- Hole

Manifold Valve

The manifold valve consists of pilot relief valve (1), torque control solenoid valve (2), control lever lock solenoid valve (3), and pilot accumulators (4, 5).



TNED-03-07-016



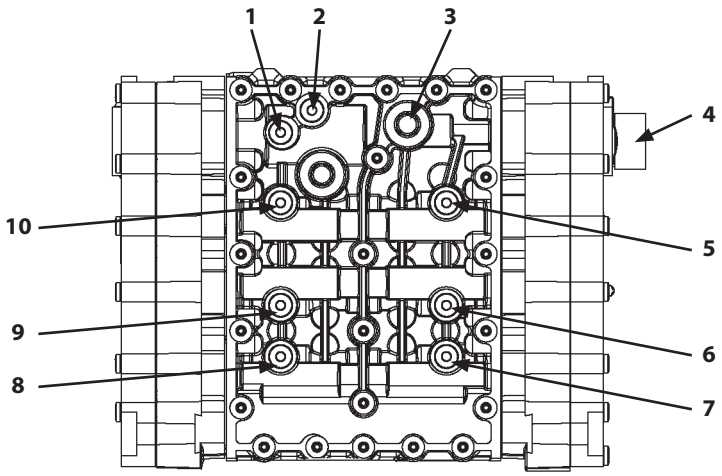
TNED-03-07-007

a- From Brake Charge Valve
b- To Steering Pilot Valve
c- To Pump Regulator, 2-spool solenoid valve unit
d- To Pilot Valve
e- To Pump Regulator

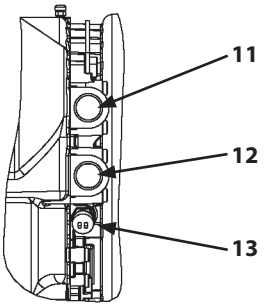
1- Pilot Relief Valve
2- Torque Control Solenoid Valve
3- Control Lever Lock Solenoid Valve
4- Pilot Accumulator (Front)
5- Pilot Accumulator (Steering)
6- Pressure Sensor (Primary Pilot Pressure)

Transmission Pressure Test Port

View B

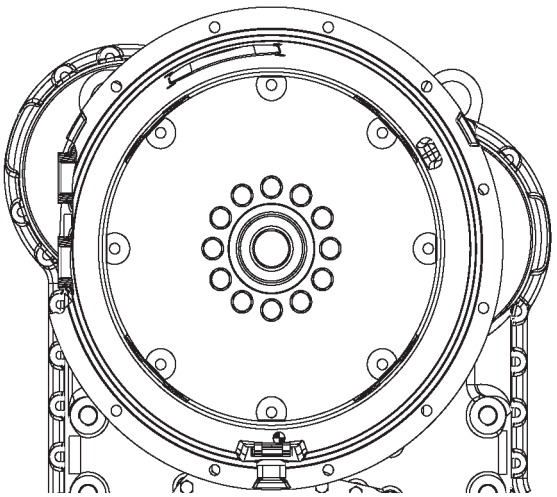


View Y



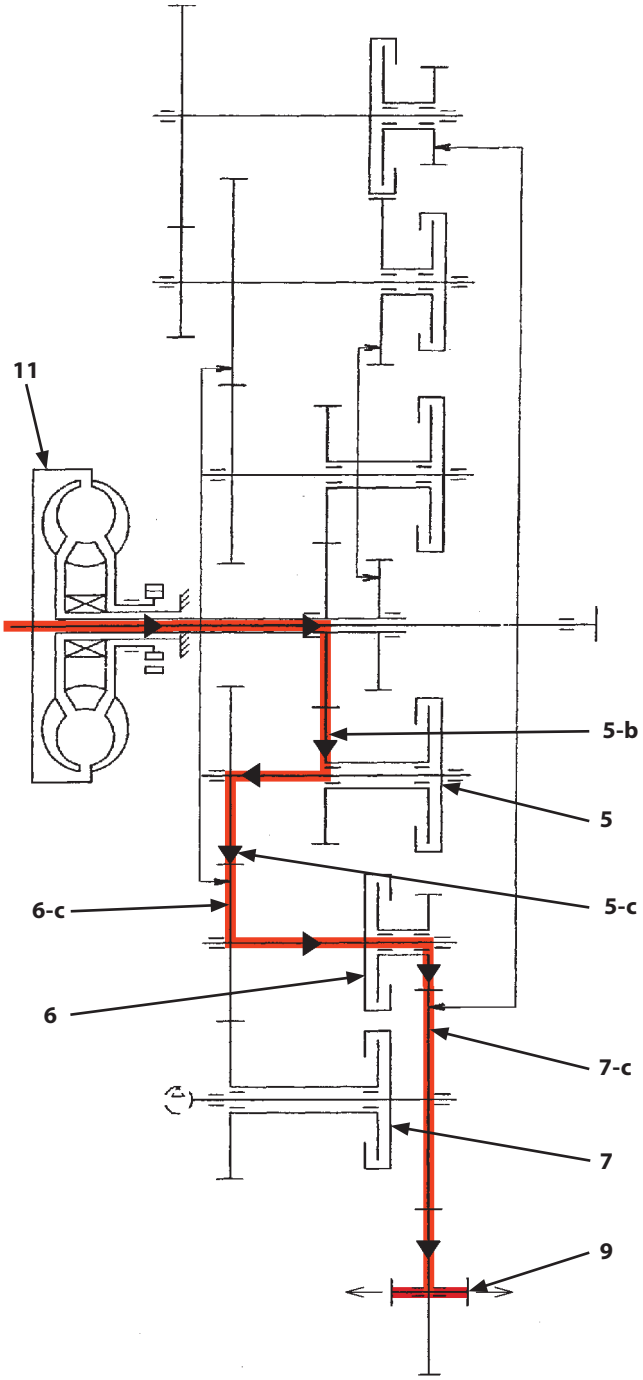
Y

View A



T4GB-03-09-009

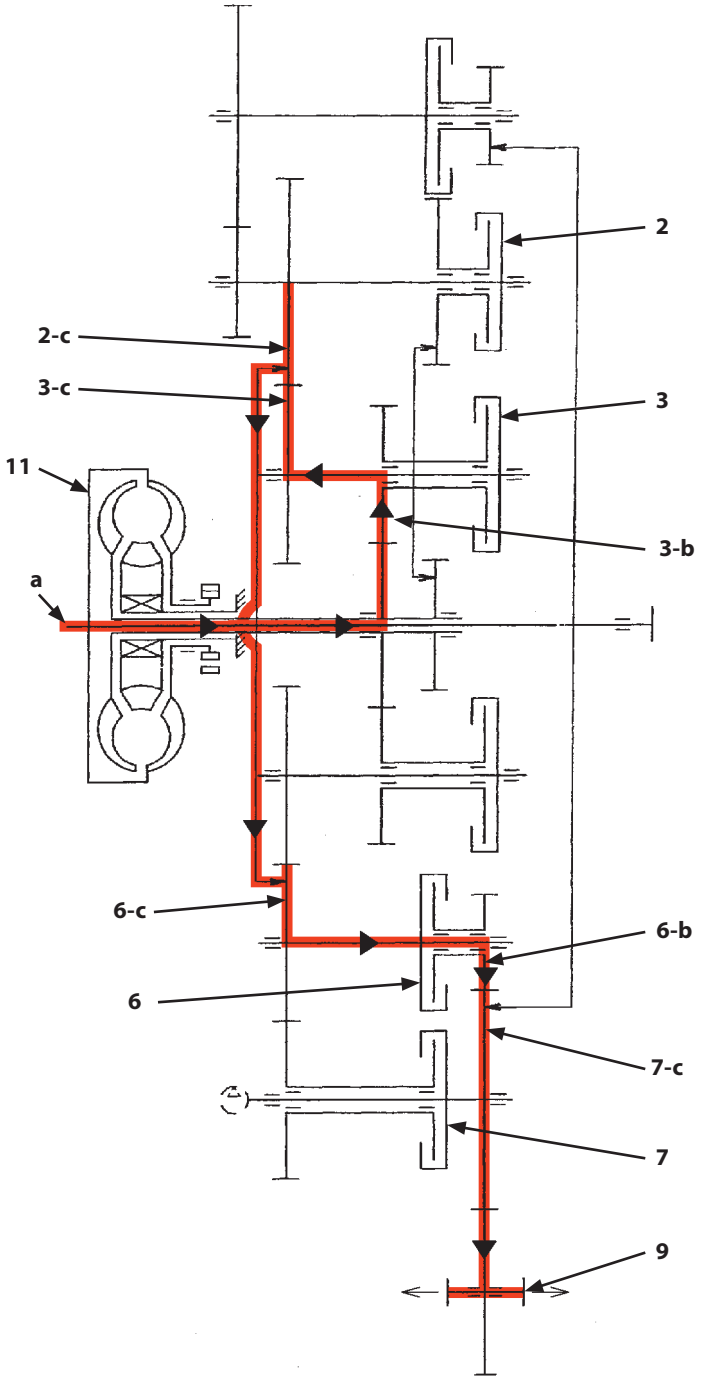
1- System Main Pressure Test Port
2- Torque Converter Input Pressure Test Port
3- Reduced Oil Pressure Test Port
4- Harness Connector
5- High-Speed Forward Clutch Pressure Test Port
6- Reverse Clutch Pressure Test Port
7- First Speed Clutch Pressure Test Port
8- Third Speed Clutch Pressure Test Port
9- Low-Speed Forward Clutch Pressure Test Port
10- Second Speed Clutch Pressure Test Port
11- Transmission Oil Cooler Returning Oil Pressure Test Port
12- Transmission Oil Cooler Output Oil Pressure Test Port
13- Torque Converter Oil Temperature Sensor (Torque Converter Outlet Temperature Test Port)



TNEE-03-08-002

a- Input (From Torque Converter)
b- Drive Gear
c- Output Gear

5- Low-Speed Forward Clutch
6- Second Speed Clutch
7- Third Speed Clutch
9- Output Shaft Gear
11- Torque Converter

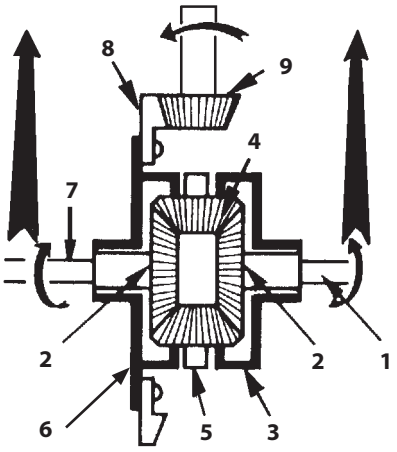


TNEE-03-08-008

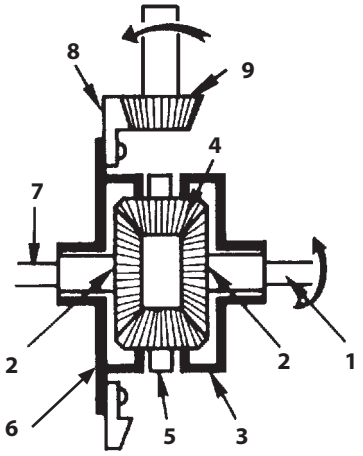
a- Input (From Torque Converter)
b- Drive Gear
c- Output Gear

2- High-Speed Forward Clutch
3- Reverse Clutch
6- Second Speed Clutch
7- Third Speed Clutch
9- Output Shaft Gear
11- Torque Converter

- Operation of Differential
  1. In case resistances applied to axle shafts (1, 7) connected to side gear (2) by spline joint are the same or in case the vehicle body is traveling straight on plane roads, idle gear (4) remains unrotated.
  2. Idle gear (4) and side gear (2) remain fixed by being mutually geared, and rotate in unison with half case (6) and half gear (3)which are connected to ring gear (8).
  3. In case the constituent portion of the whole is rotating solidly like this, the differential function of the differential does not work, but side gear (2), idle gear (4), and spider (5) play only the role of joints for connecting axle shafts (1, 7).
  4. When the vehicle body swings, uneven resistances are applied to the drive wheels. Therefore, idle gear (4) begins revolving on side gear (2) while rotating around spider (5) due to the difference of the resistances applied to the inner and outer wheels.
  5. Consequently, in case the resistance force applied to axle shaft (1) is large, idle gear (4) rotates in the same direction as the rotational direction on side gear (2). And the speed of axle shaft (1) is lowered and the amount of the speed reduction is applied to axle shaft (7), working the differential function.
  6. Suppose ring gear (8) is driven by pinion shaft (9) at the speed of 100. In the condition that the vehicle body is traveling straight, the drive wheels on the both sides rotate at the same speed.
  7. However, in case the vehicle body swings and the speed of the right drive wheel is lowered to 90, the left wheel turns at the speed of 100+(100-90)=110 as the speed of 10 (100-90=10) is added to the speed of the left wheel.
  8. If ring gear (8) rotates at the speed of 100, the summation of the speeds of the left and right wheels becomes always 200 regardless of movement of the respective wheels.



T202-03-05-007



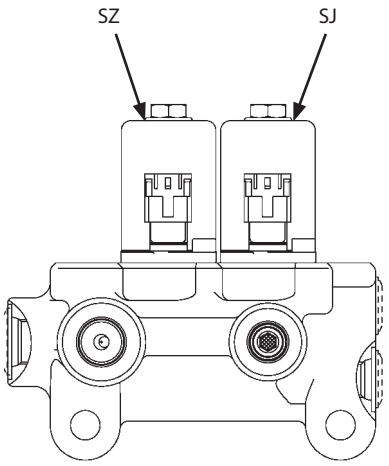
T202-03-05-008

(Blank)

2-Spool Solenoid Valve Unit

The 2-spool solenoid valve unit is installed between the manifold valve and control valve. The 2-spool solenoid valve unit controls the control valve according to the signal from MC (main controller). (Refer to SYSTEM/ Control System.)
The 2-spool solenoid valve unit consists of two proportional solenoid valves (SZ, SJ).

SZ : This valve controls the ride control in control valve.
SJ : This valve controls the lift arm flow rate control valve (selector valve) in control valve.



TDAA-03-07-002