PART NO. TOCGB-E-00

HITACHI

# Technical Manual

## Operational Principle

# ZAXIS 170W-3 190W-3

## Wheeled Excavator

Service Manual consists of the following separate Part No;

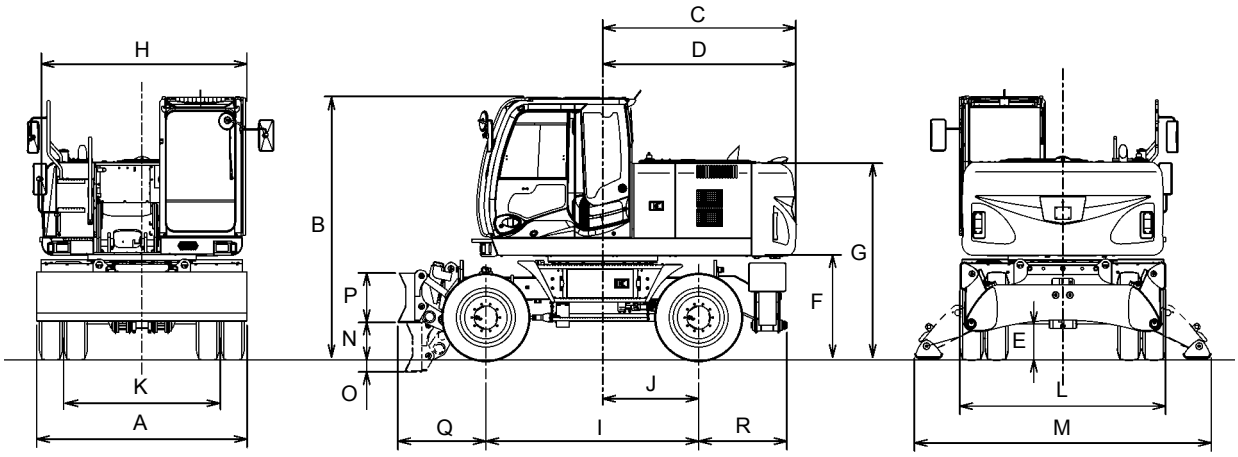
| | |
|---|---|
| Technical Manual (Operational Principle) | : Vol. No.TOCGB-E |
| Technical Manual (Troubleshooting) | : Vol. No.TTCGB-E |
| Workshop Manual | : Vol. No.WCGB-E |

ZAXIS170W-3 • 190W-3 WHEELED EXCAVATOR TECHNICAL MANUAL OPERATIONAL PRINCIPLE

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

PRINTED IN JAPAN (K) 2007, 04

**ZX170W-3 (Standard GAUGE, FRONT BLADE REAR OUTRIGGER)**

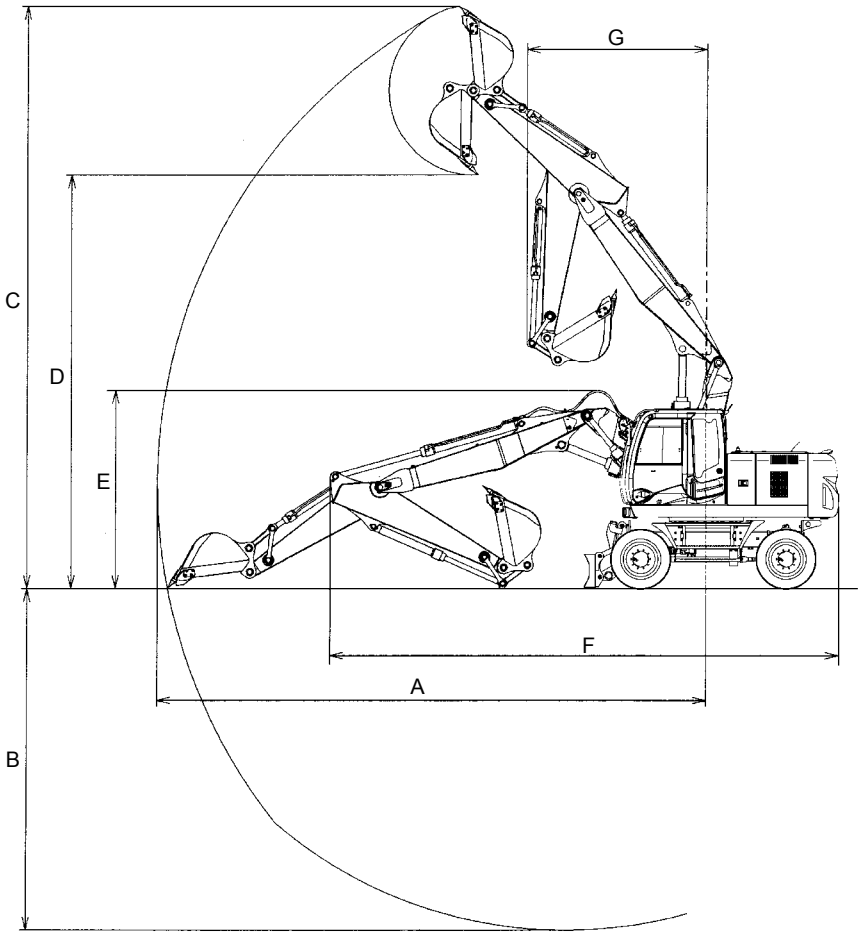



MCGB-12-010

| Type of Front-End Attachment | | Monoblock Boom | 2-Piece Boom |
|---|---|---|---|
| Type of Arm | | 2.58 m (8 ft 6 in) | 2.50 m (8 ft 2 in) |
| Bucket Capacity (Heaped) | | PCSA 0.60 $m^3$ (0.78 $yd^3$), CECE 0.55 $m^3$ | |
| Operating Weight | kg (lb) | 17700 (39000) | 18300 (40300) |
| Basic Machine Weight | kg (lb) | 14700 (32400) | 14700 (32400) |
| Engine | | ISUZU AI-4HK1X | |
| Engine Power | SAE J1349 net<br>ISO 9249 net<br>EEC 80/1269 net | 107 kW/2000 $min^{-1}$ (145 PS/2000 rpm) | |
| A: Overall Width (Excluding Rearview Mirrors) | mm (ft·in) | 2550 (8' 4") | |
| B: Cab Height | mm (ft·in) | 3130 (10' 3") | |
| C: Rear End Swing Radius | mm (ft·in) | 2320 (7' 7") | |
| D: Rear End Length | mm (ft·in) | 2320 (7' 7") | |
| E: Minimum Ground Clearance | mm (ft·in) | 350 (1' 2") | |
| F: Counterweight Clearance | mm (ft·in) | 1235 (4' 1") | |
| G: Engine Cover Height | mm (ft·in) | 2345 (7' 8") | |
| H: Overall Width of Upperstructure | mm (ft·in) | 2450 (8' 1") | |
| I: Wheelbase | mm (ft·in) | 2550 (8' 4") | |
| J: Swing-Center to Rear Axle | mm (ft·in) | 1150 (3' 9") | |
| K: Front Wheel Tread | mm (ft·in) | 1945 (6' 5") | |
| L: Rear Wheel Tread | mm (ft·in) | 1945 (6' 5") | |
| M: Outrigger Spread | mm (ft·in) | 3380 (11' 1") | |
| N: Max. Raising Height | mm (ft·in) | 445 (1' 6") | |
| O: Max. Digging Depth | mm (ft·in) | 145 (6") | |
| P: Blade Height | mm (ft·in) | 590 (1' 11") | |
| Q: Front Axle to Front of Chassis | mm (ft·in) | 1055 (3' 6") | |
| R: Rear Axle to Rear of Chassis | mm (ft·in) | 1060 (3' 6") | |
| Tire Size | | 10.00-20 16PR | |
| Swing Speed | $min^{-1}$ (rpm) | 12.2 | |
| Travel Speed (Fast / Slow / Creeper) * | km/h (mph) | 35/8.6/2.6 (21.7/5.3/1.6) | |
| Gradeability | Degree (%) | 35 (70) | |

*NOTE: "*" The specification not matching the local regulation is excluded.*

**ZX170W-3**
**2-PIECE BOOM**

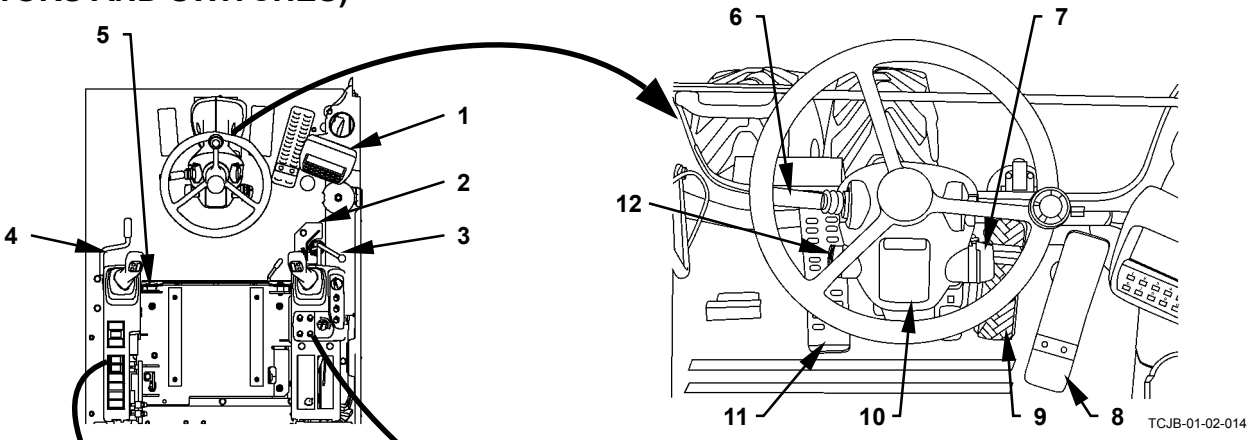



MCGB-12-014

| Type of Front-End Attachment | | 2-Piece Boom | |
|---|---|---|---|
| Item \ Category | | 2.21 m (7 ft 3 in) Arm | 2.50 m (8 ft 2 in) Arm |
| | | Backhoe | Backhoe |
| A: Maximum Digging Reach | mm (ft·in) | 9190 (30' 2") | 9450 (31' 0") |
| B: Maximum Digging Depth | mm (ft·in) | 5430 (17' 10") | 5720 (18' 9") |
| C: Maximum Cutting Height | mm (ft·in) | 10010 (32' 10") | 10200 (33' 6") |
| D: Maximum Dumping Height | mm (ft·in) | 7160 (23' 6") | 7340 (24' 1") |
| E: Transport Height | mm (ft·in) | 3130 (10' 3") | 3130 (10' 3") |
| F: Overall Transport Length | | | |
| Std. Chassis Rear BL. | mm (ft·in) | * 8505 (27' 11") | * 8495 (27' 10") |
| Std. Chassis Rear O/R. | mm (ft·in) | * 8505 (27' 11") | * 8495 (27' 10") |
| Front BL. Rear O/R. | mm (ft·in) | * 8955 (29' 5") | * 8945 (29' 4") |
| Front O/R. Rear BL. | mm (ft·in) | * 9050 (29' 8") | * 9040 (29' 8") |
| Front O/R. Rear O/R. | mm (ft·in) | * 9050 (28' 8") | * 9040 (29' 8") |
| G: Minimum Swing Radius | mm (ft·in) | 3040 (10' 0") | 3030 (9' 11") |

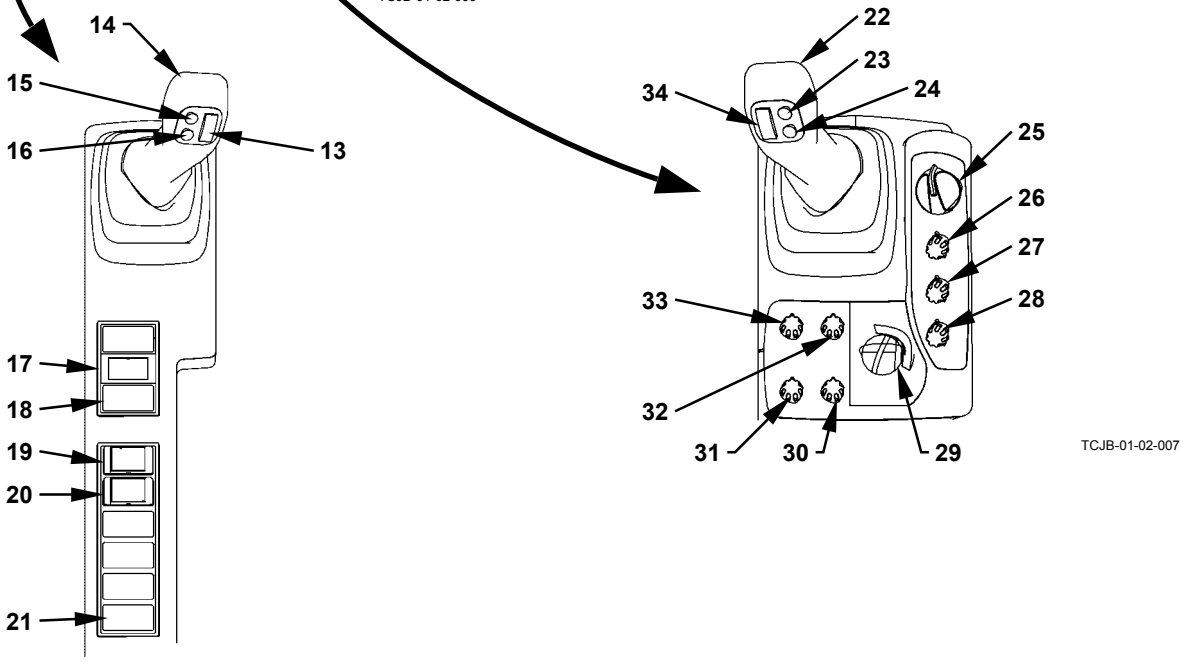
*NOTE: "*" Transport the machine with the rear side facing forward.*
*BL: Blade, O/R: Outrigger*

## ELECTRICAL SYSTEM (MONITORS AND SWITCHES)




TCJB-01-02-006

TCJB-01-02-014




TCJB-01-02-007

TCJB-01-02-008

1 - Monitor Unit (Refer to T1-2-8.)
2 - Swing Lock Lever
3 - Blade/Outrigger Lever
4 - Pilot Shut-Off Lever
5 - Engine Stop Switch
6 - Combination Switch
·Turn Signal Switch
·Light Switch
·Dimmer Switch
·Passing Switch
7 - Brake Switch
8 - Accelerator Pedal
9 - Brake Pedal
10 - Steering Column Monitor (Refer to T1-2-9.)
11 - Auxiliary/Positioning Pedal (Optional)
12 - Horn Switch
13 - Left Analog Switch (Auxiliary)
14 - Horn Switch
15 - Positioning Pedal Selection Switch
16 - Auxiliary Pedal Selection Switch
17 - Hazard Switch
18 - Electrical Control Main Switch (Optional)
19 - Blade/Outrigger Front-Rear Selector Switch
20 - Outrigger Left-Right Selector Switch
21 - Heater Seat Switch (Optional)
22 - FNR Switch
23 - Auxiliary
24 - Auxiliary
25 - Engine Control Dial
26 - Travel Speed Mode Switch
27 - Engine Speed Control Mode Selection Switch
28 - Power Mode Switch
29 - Key Switch
30 - Blade/Outrigger Selector Switch
31 - Auto-Idle Switch
32 - Work Light Switch
33 - Wiper/Washer Switch
34 - Right Analog Switch (Assist) (Optional)

## ENGINE

ZX170W-3

| | |
|---|---|
| Manufacturer | ISUZU |
| Model | 4HK1XYSA |
| Type | Diesel, 4-Cycle, Water-Cooled, Direct Injection Type, Exhaust Turbo Charged Type |
| Cyl. No.- Bore × Stroke | 4-115 mm×125 mm |
| Total Displacement | 5193 $cm^3$ |
| Rated Output | 93±5 kW/1600 $min^{-1}$ (126±7 PS/1600 rpm) HP Mode: 107 kW/2000 $min^{-1}$ (145 PS/2000 rpm) |
| Compression Ratio | 17.5 |
| Dry Weight | 478 kg (1054 lb) |
| Firing Order | 1-3-4-2 |
| Direction of Rotation | Clockwise (Viewed from Fan Side) |
| Dimensions Length × Width × Height | 1043.2×829×1011.8 mm |

ZX190W-3

| | |
|---|---|
| Manufacturer | ISUZU |
| Model | 4HK1XYSA |
| Type | Diesel, 4-Cycle, Water-Cooled, Direct Injection Type, Exhaust Turbo Charged Type |
| Cyl. No.- Bore × Stroke | 4-115 mm×125 mm |
| Total Displacement | 5193 $cm^3$ |
| Rated Output | 114 kW/1800 $min^{-1}$ (155 PS/1800 rpm) HP Mode: 122 kW/2000 $min^{-1}$ (166 PS/2000 rpm) |
| Compression Ratio | 17.5 |
| Dry Weight | 478 kg (1054 lb) |
| Firing Order | 1-3-4-2 |
| Direction of Rotation | Clockwise (Viewed from Fan Side) |
| Dimensions Length × Width × Height | 1043.2×829×1011.8 mm |

### Cooling System

| | |
|---|---|
| Cooling Fan | Diameter 650 mm (25.6 in), 5 Blades, Synthetic Resin, Intake Type with Fan Ring Safety Net |
| Fan Pulley Ratio | Belt Driven Rotation Ratio: 0.95 |
| Thermostat | Cracking Opening at Atmospheric Pressure: 82 °C (179.6 °F) Full Open (Stroke: 10 mm or More): 95 °C (203 °F) |
| Water Pump | Centrifugal Swirl Pump |

**Accumulator Charging Valve**

Accumulation Starting Pressure (Cut-In)..... 14.5 MPa (148 kgf/cm$^2$, 2108 psi)
Accumulation Stopping Pressure (Cut-Out).. 17.7 MPa (180 kgf/cm$^2$, 2573 psi)

**Travel Shockless Valve**

Type..... Flow Regulator Type (with 2-Spools Solenoid Valve)

**Transmission Changeover Solenoid Valve**

Pressure Reducing Valve Set Pressure ..... 3.7 MPa (37.7 kgf/cm$^2$, 538 psi)

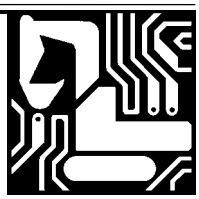
**Oil Cooler Bypass Check Valve**

Cracking Pressure..... 250±15 kPa (2.55±0.153 kgf/cm$^2$, 36±2 psi) @ 5 L/min

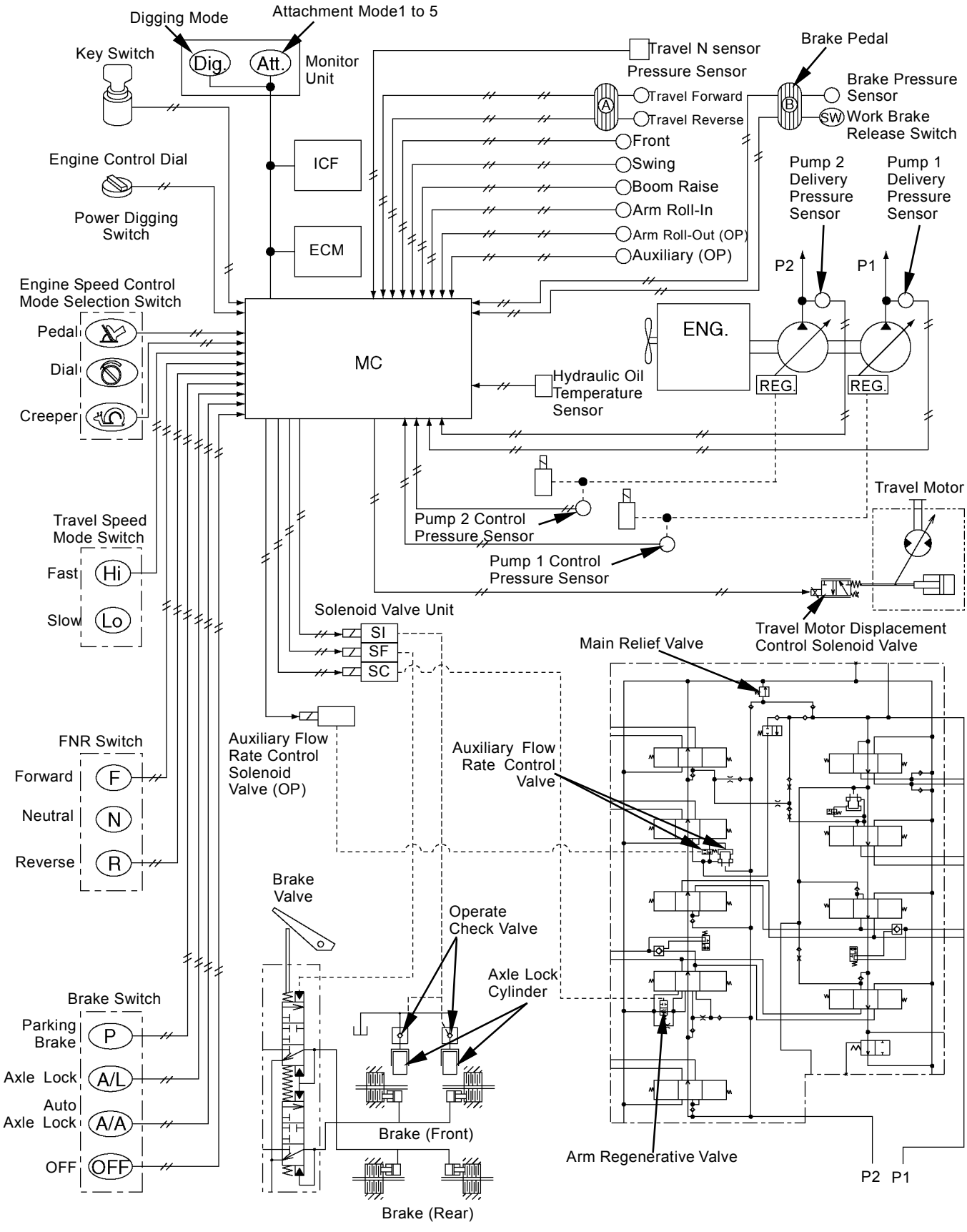
**Bypass Check Valve**

Cracking Pressure..... 600 kPa (6.1 kgf/cm$^2$, 87 psi)

# SECTION 2
# SYSTEM



## CONTENTS




TCGB-02-02-003

- Auto-Idle Display (2)
  When the auto-idle switch on switch panel is turned ON, the data is displayed.
  When the key switch is turned ON with the auto-idle switch ON, the data blinks for 10 seconds.

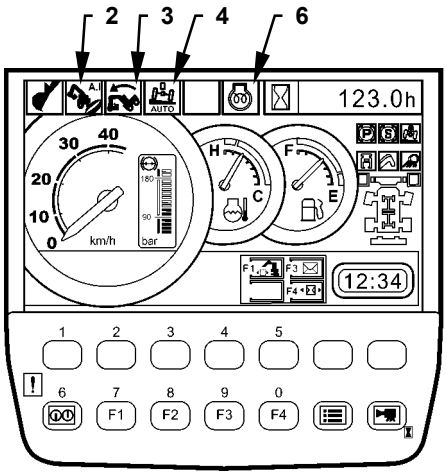
- Overload Alarm (3)

TCJB-05-02-061

  The system measures the load of suspended load from the boom cylinder bottom pressure sensor. When overload is detected, an alarm is displayed.

- Auto Axle Lock Display (4)
  The data is displayed when the brake switch in the auto axle lock position.

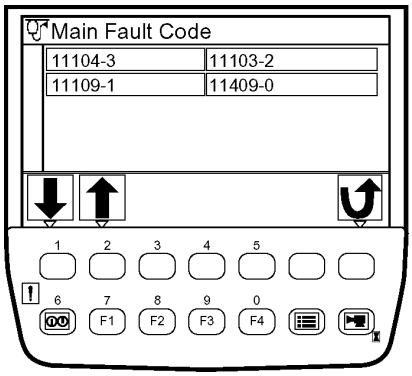
- Glow Signal Display (5)
  While ECM is supplying current to the glow plug, the data is displayed according to the signal from ECM.




TCJB-05-02-042

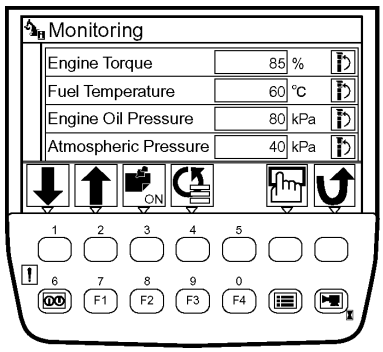
- Service Menu (Built-In Diagnosing System)

  - Troubleshooting
    This screen displays the fault codes according to the signals received from each controller by using CAN.




Fault Code Display T1V5-05-01-097

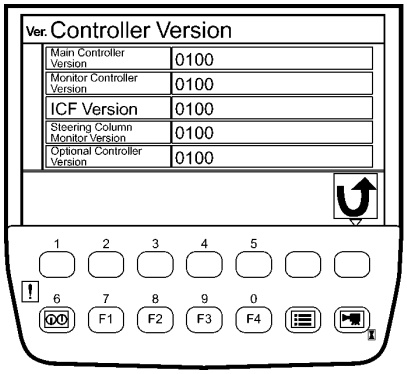
  - Monitoring
    This screen displays temperature and pressure data received from each controller by using CAN. By key operation, the displayed data can be hold.




Monitoring Screen T1V5-05-01-087

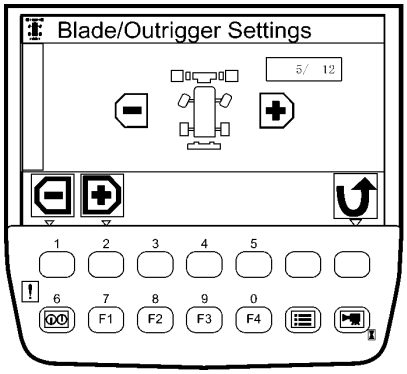
  - Controller Version
    This screen displays the version of MC, ICF, monitor unit, steering column monitor and option controller.

*NOTE: The version of ECM is not displayed.*



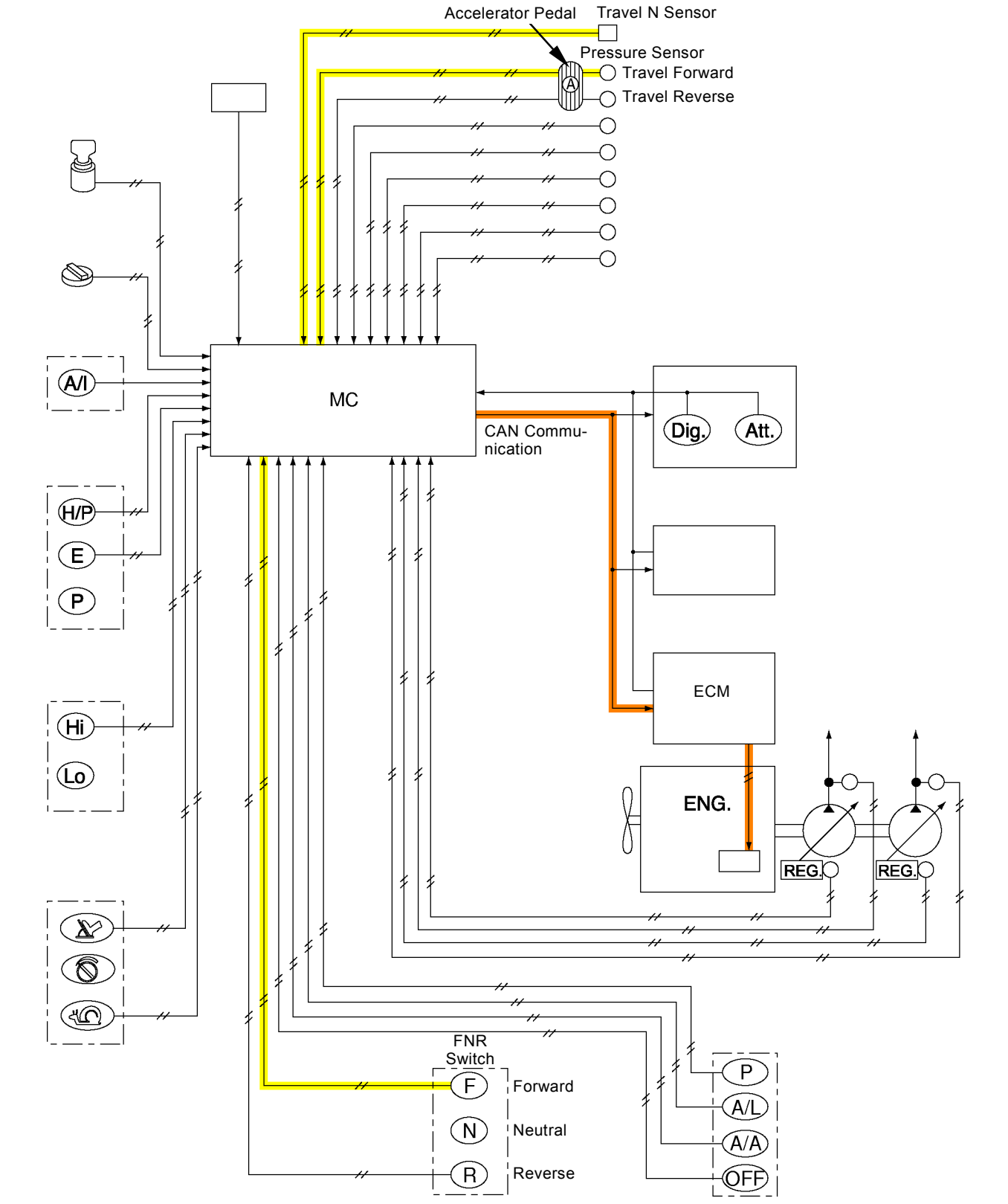

Controller Version Display TCHB-05-02-008

  - Blade/Outrigger Settings
    Combination of blade and outrigger displayed on the primary screen is set.



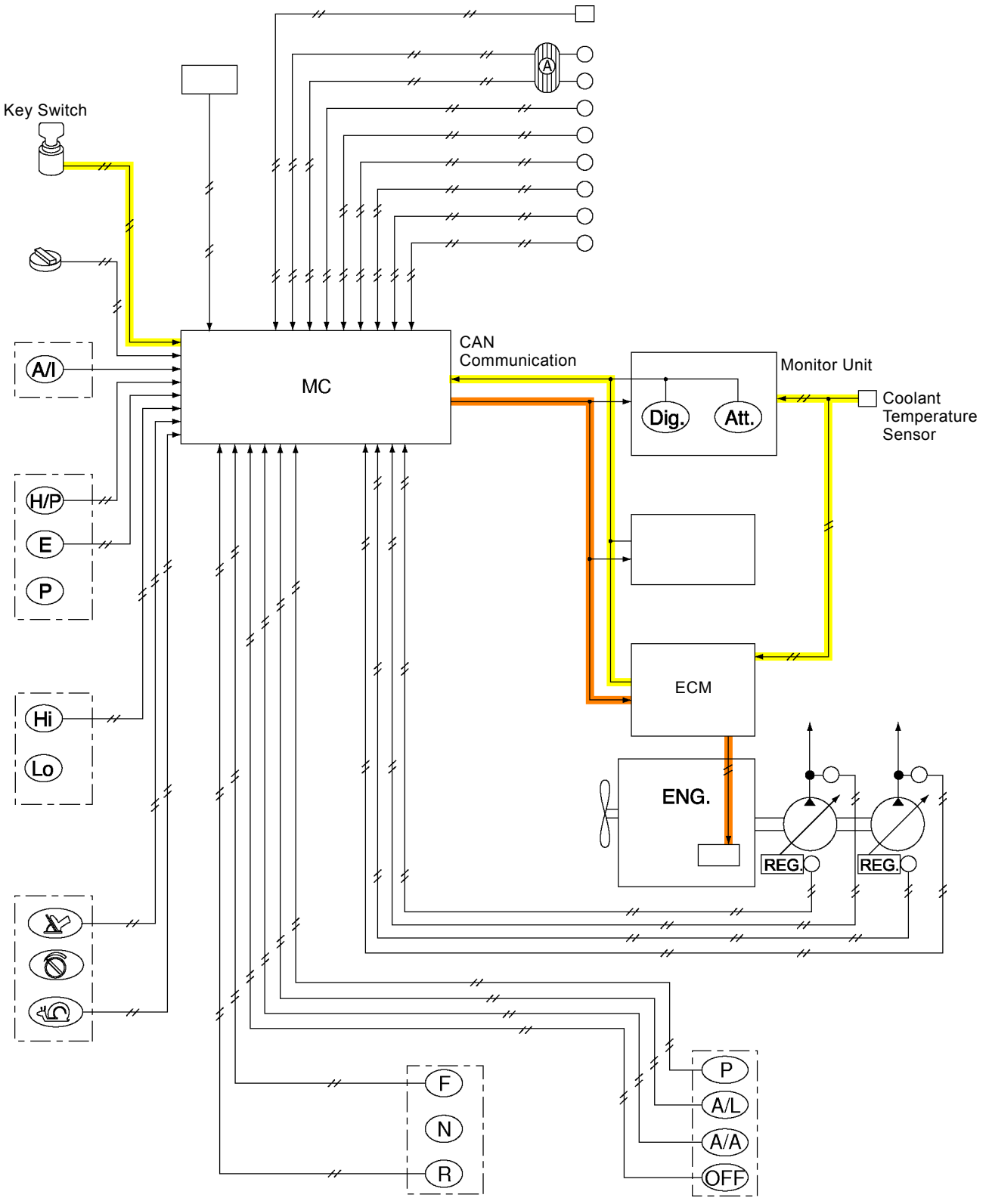

Blade/Outrigger Setup Screen TCHB-05-02-009

(Blank)



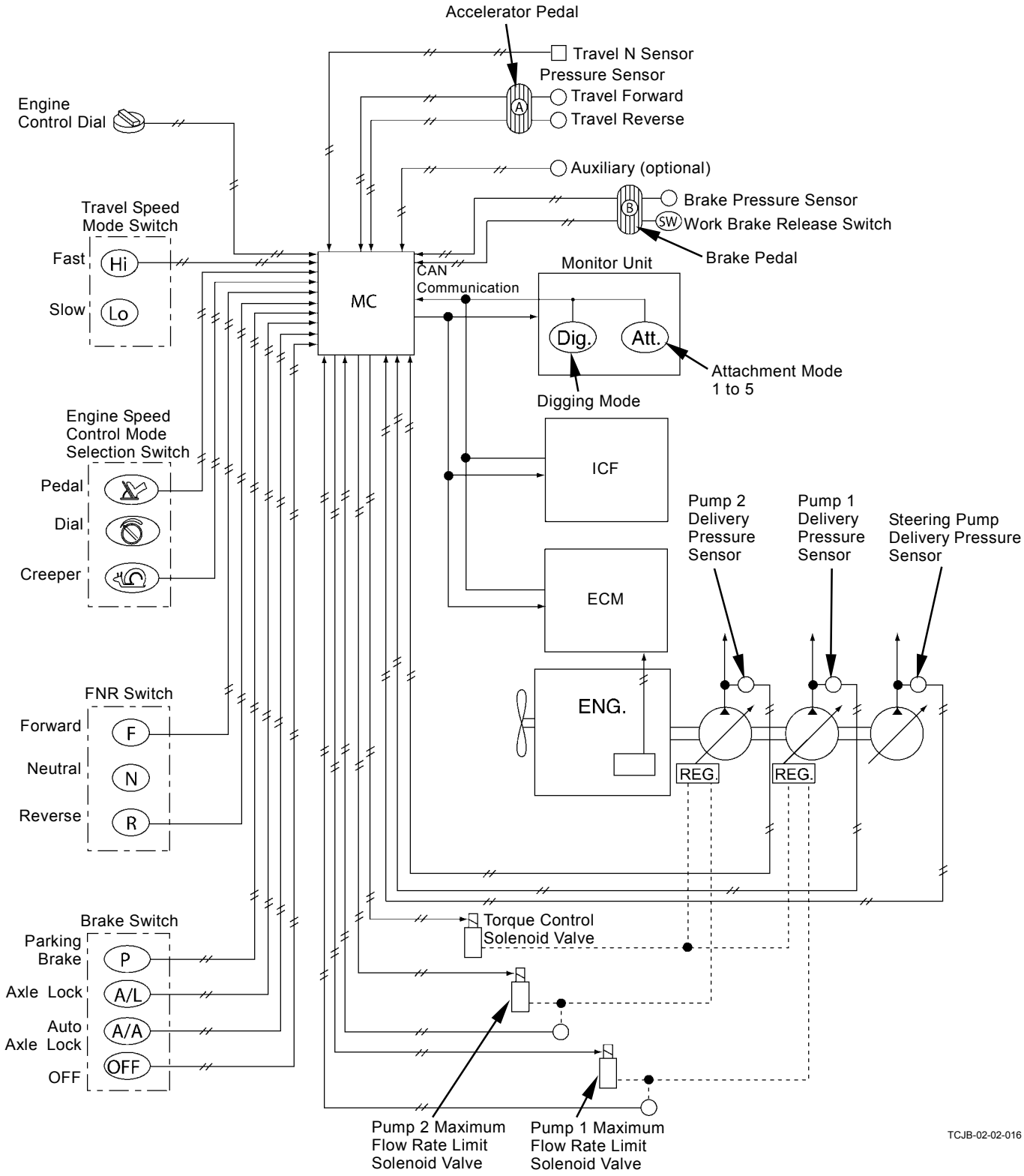

TCJB-02-02-005

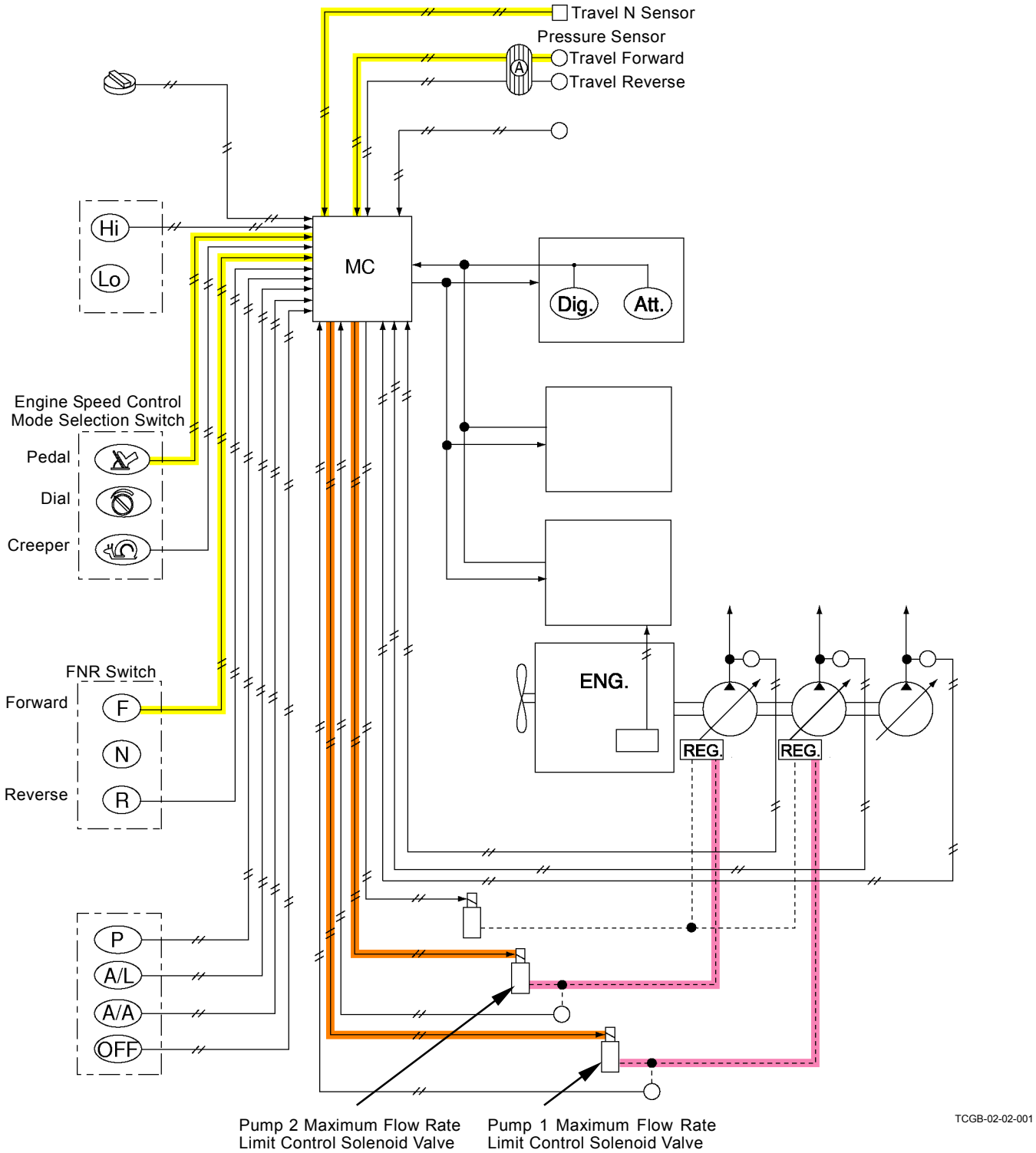
*NOTE: The illustration shows the operation when the switches are in the following positions.*
*FNR Switch: F (Forward)*




TCJB-02-02-010

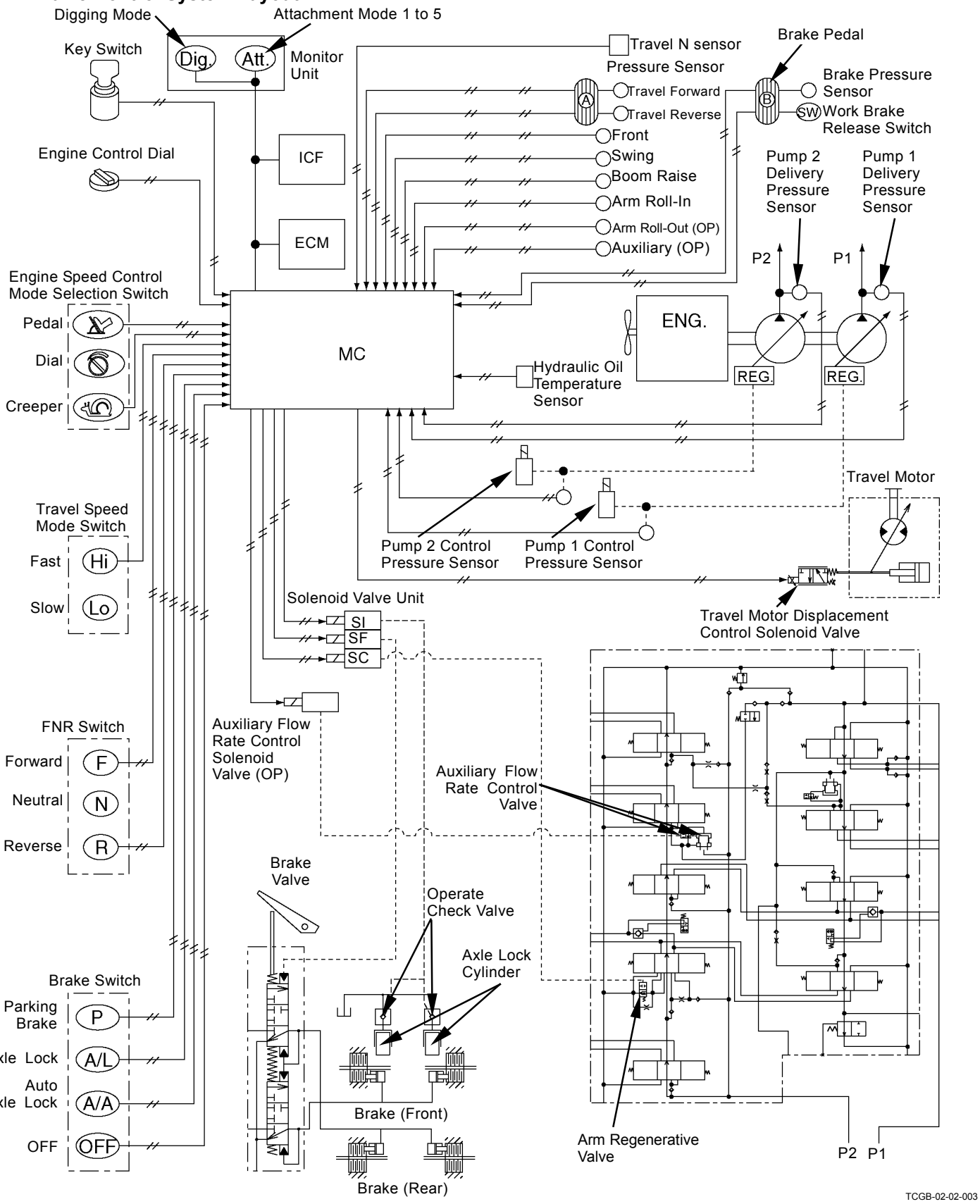
**Pump Control System Layout**

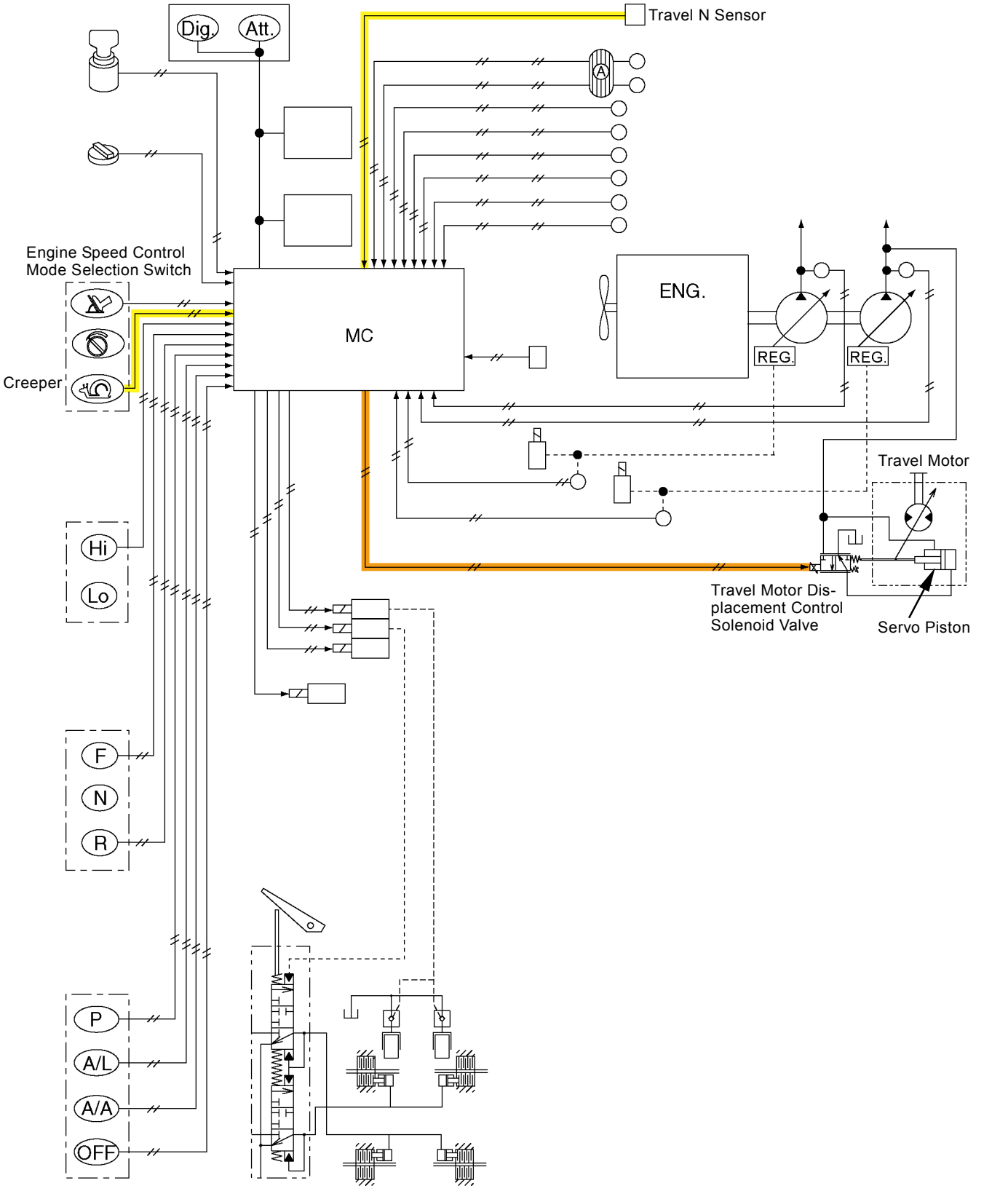




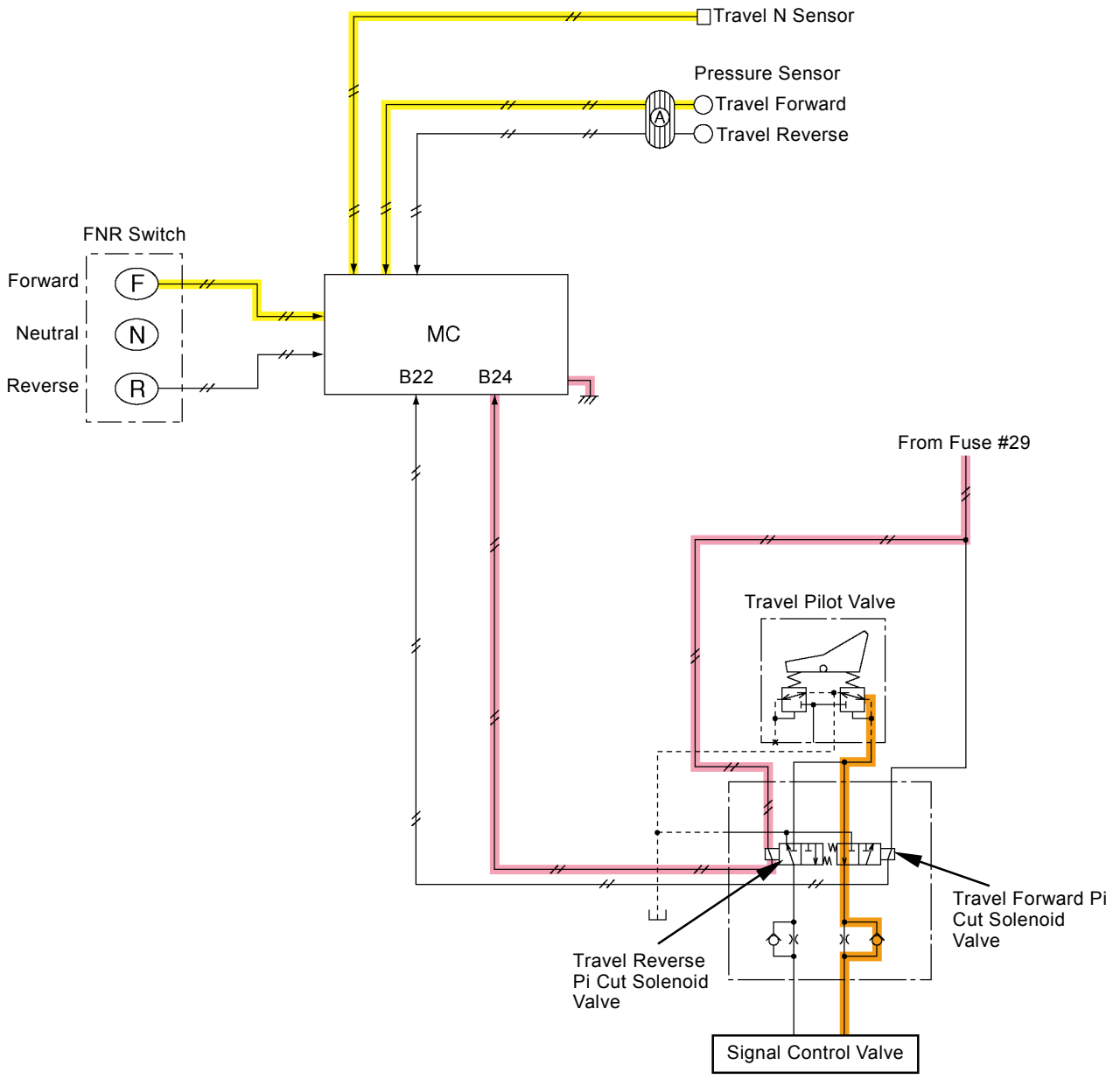

*NOTE: The illustration shows the operation when the switches are in the following positions.*
*Engine Speed Control Mode Selection Switch: Pedal mode*
*FNR Switch: F (Forward)*

## Valve Control System Layout

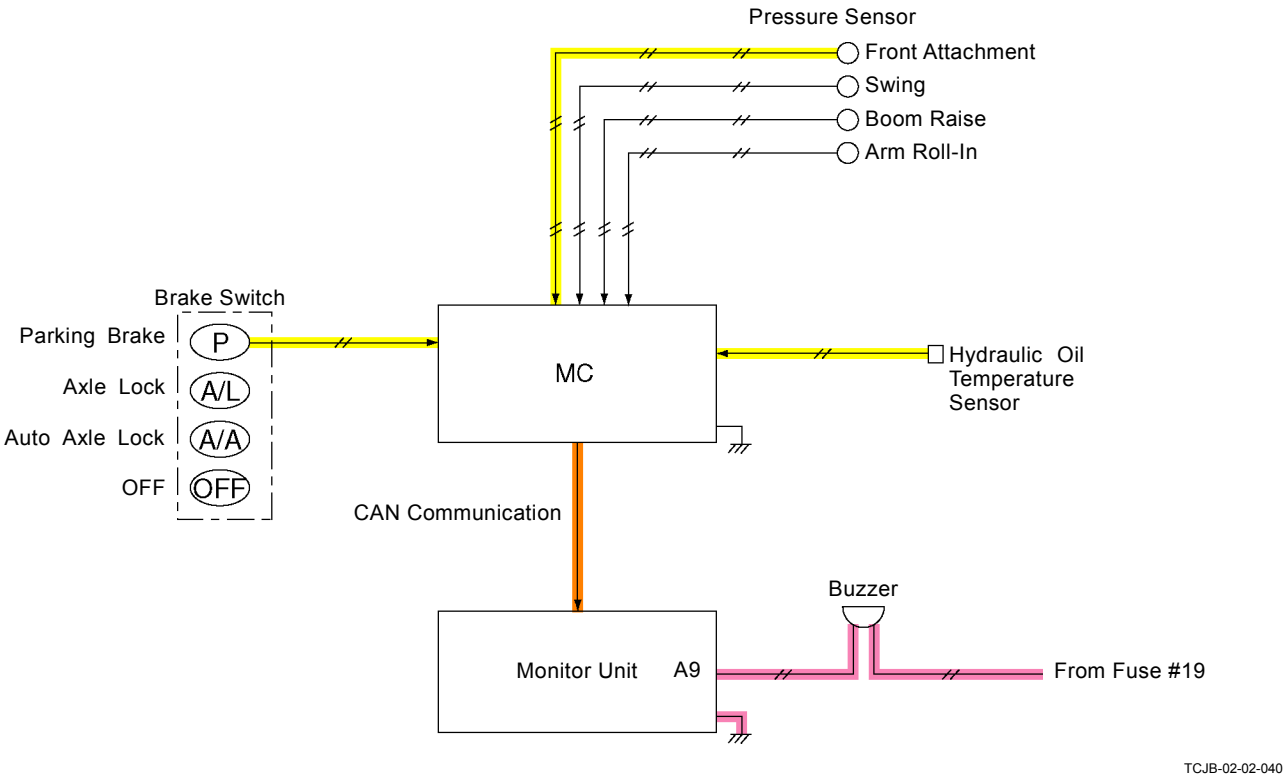




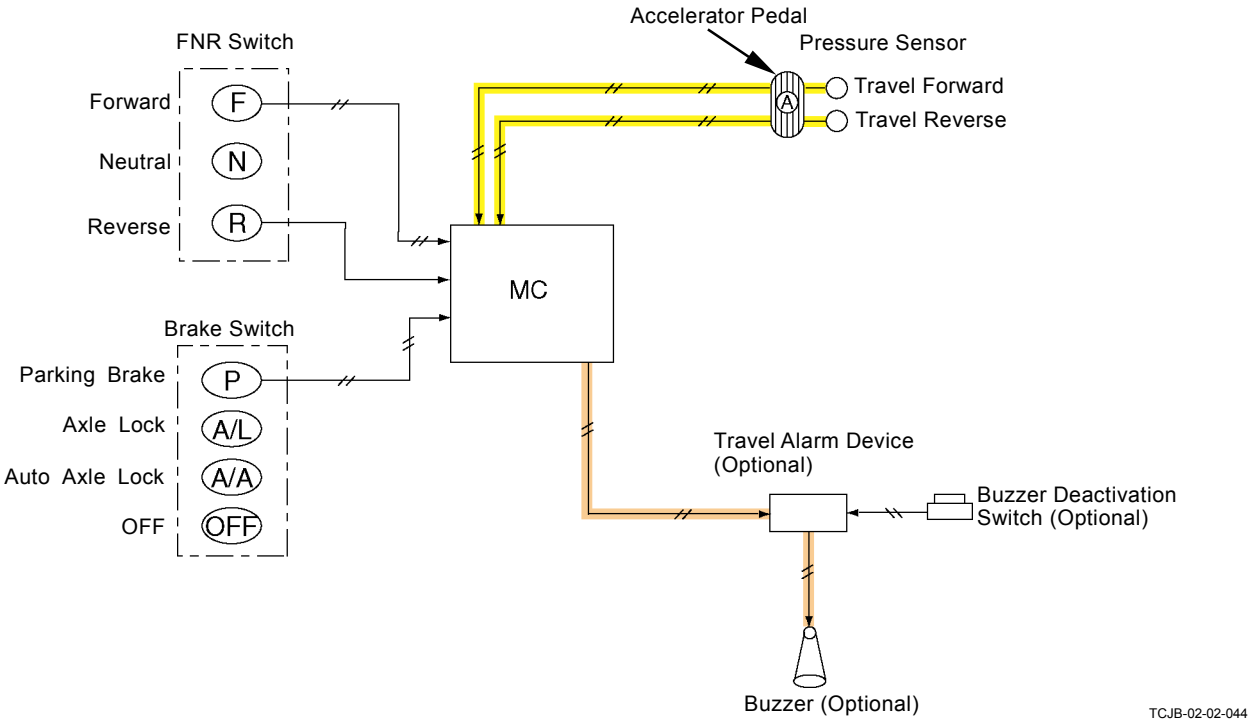

TCGB-02-02-008

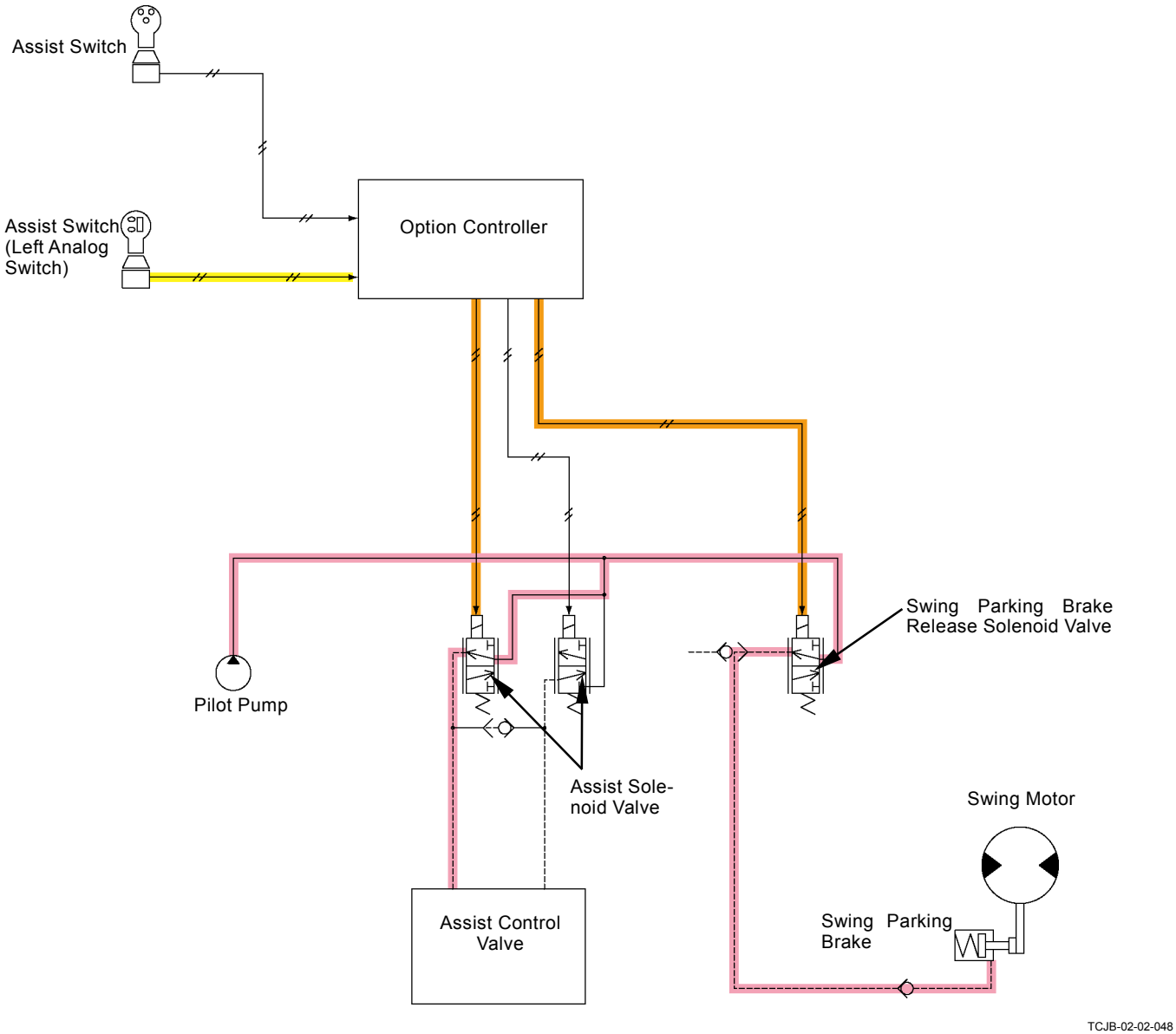


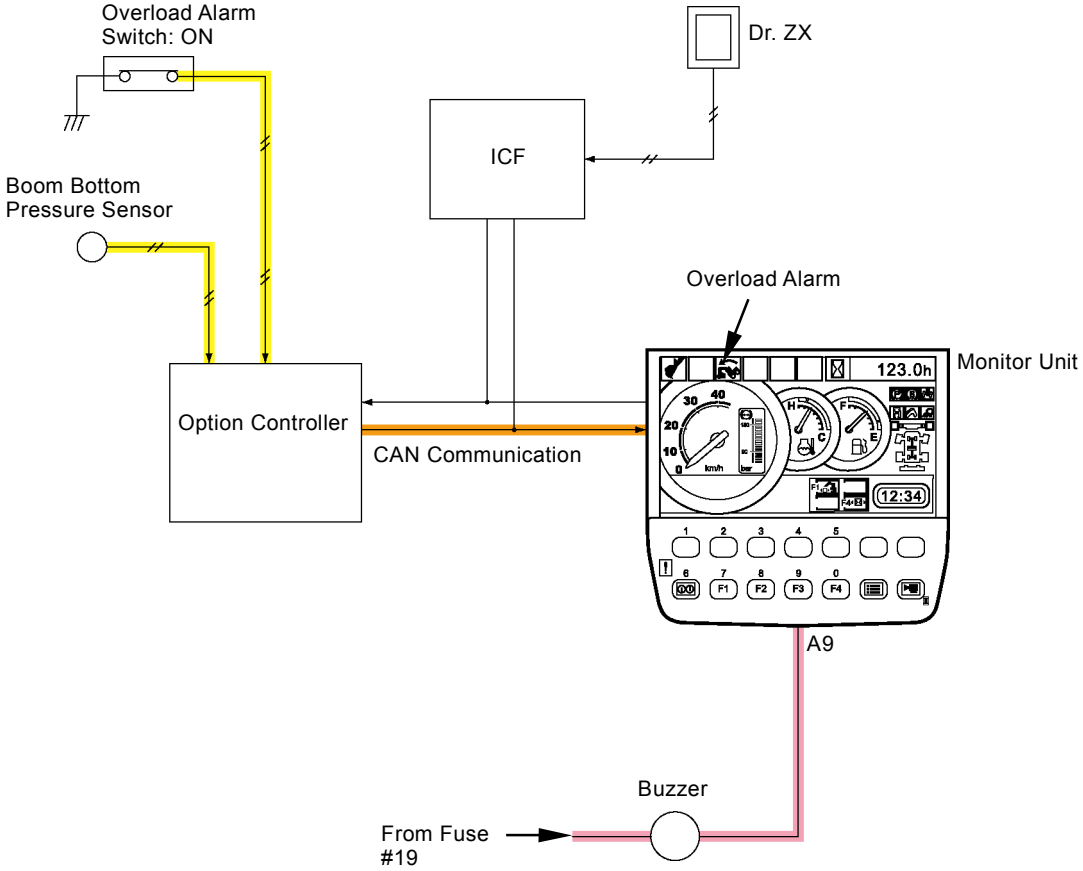

*NOTE: The illustration shows the operation when the switches are in the following positions.*
*FNR Switch: F (Forward)*

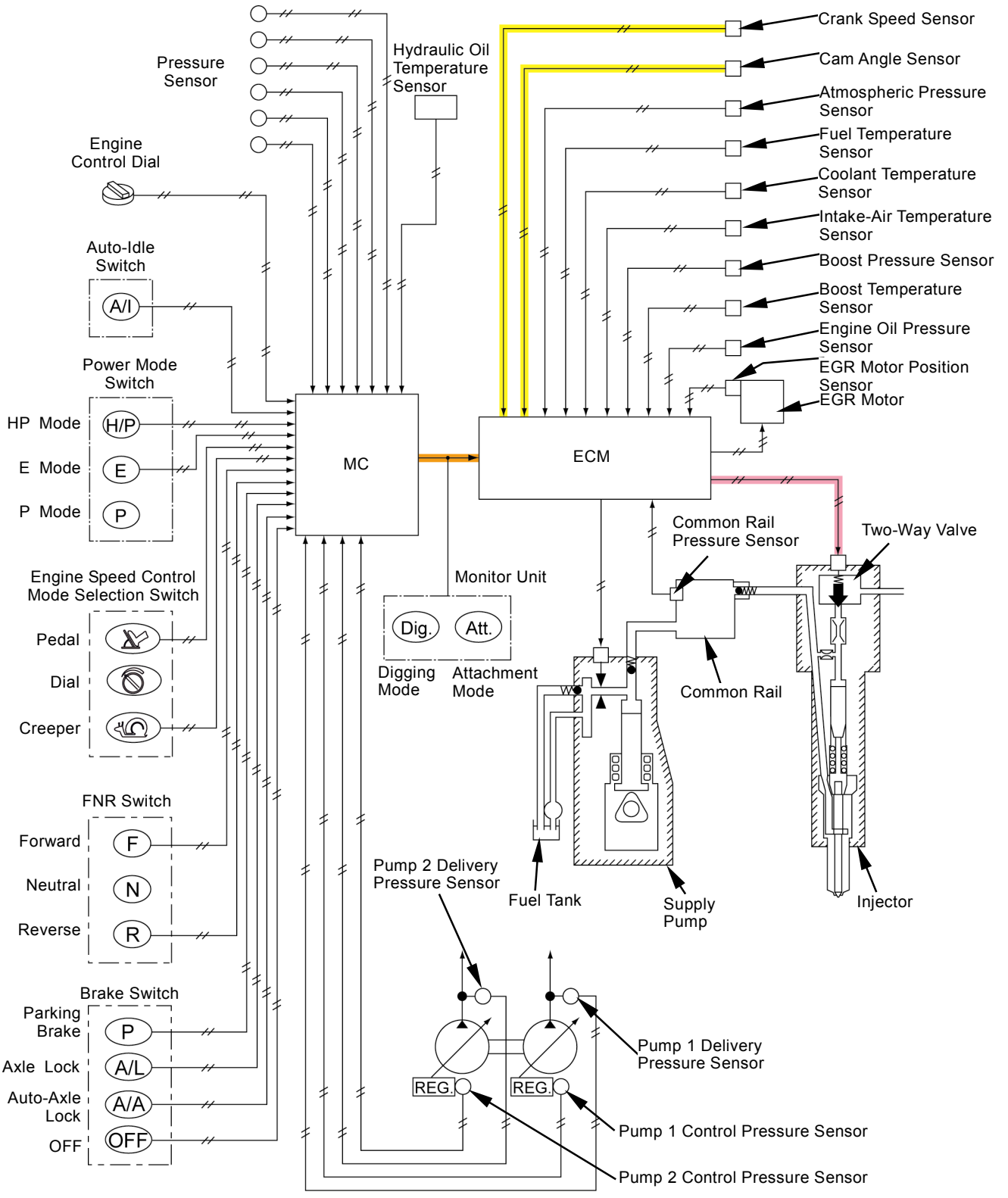



*NOTE: This illustration shows the operation when the front attachment is operated.*


Accelerator Pedal
Pressure Sensor
FNR Switch
Forward
F
Neutral
N
Reverse
R
A
Travel Forward
Travel Reverse
MC
Brake Switch
Parking Brake
P
Axle Lock
A/L
Auto Axle Lock
A/A
OFF
OFF
Travel Alarm Device
(Optional)
Buzzer Deactivation
Switch (Optional)
Buzzer (Optional)
TCJB-02-02-044

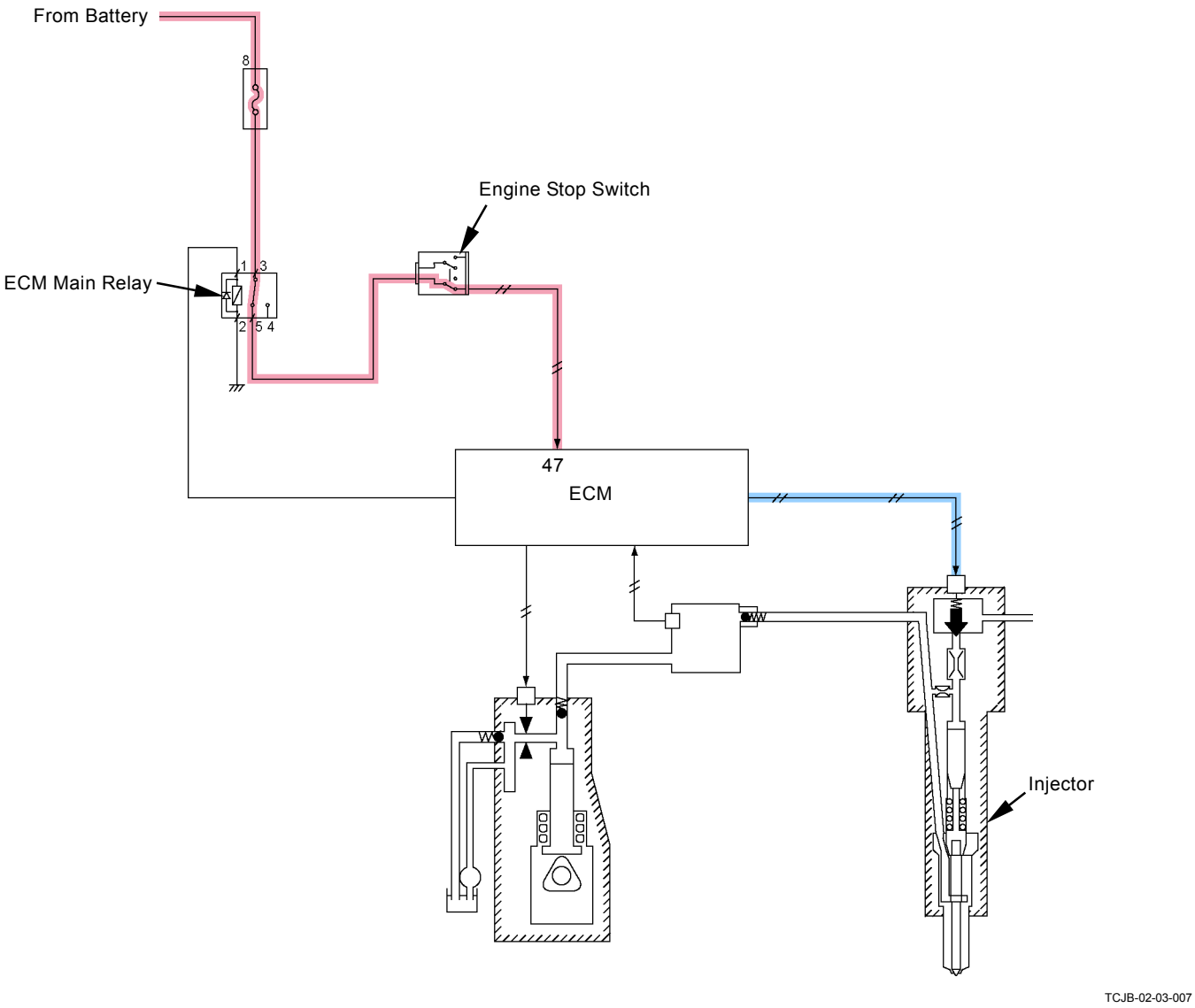

Assist Switch
Assist Switch (Left Analog Switch)
Option Controller
Swing Parking Brake Release Solenoid Valve
Pilot Pump
Assist Sole-noid Valve
Swing Motor
Assist Control Valve
Swing Parking Brake
TCJB-02-02-048

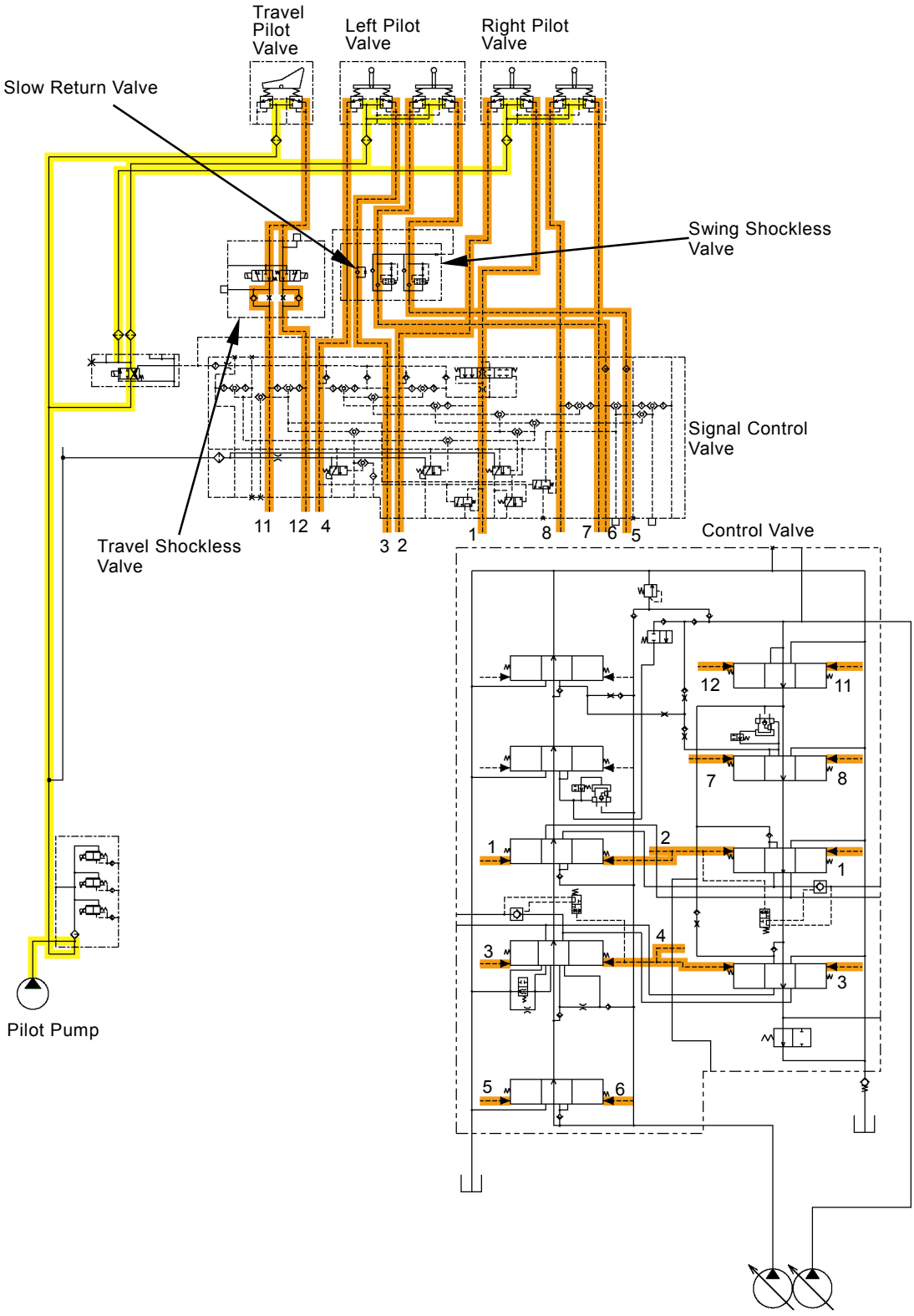

Overload Alarm
Switch: ON
Dr. ZX
ICF
Boom Bottom
Pressure Sensor
Overload Alarm
Monitor Unit
123.0h
Option Controller
CAN Communication
12:34
A9
Buzzer
From Fuse
#19
TCJB-02-02-053




TCJB-02-03-002

*NOTE: The illustration shows when sending the signals of target engine speed are sent to ECM from MC.*


From Battery
8
Engine Stop Switch
ECM Main Relay
1
3
2
5
4
47
ECM
Injector
TCJB-02-03-007

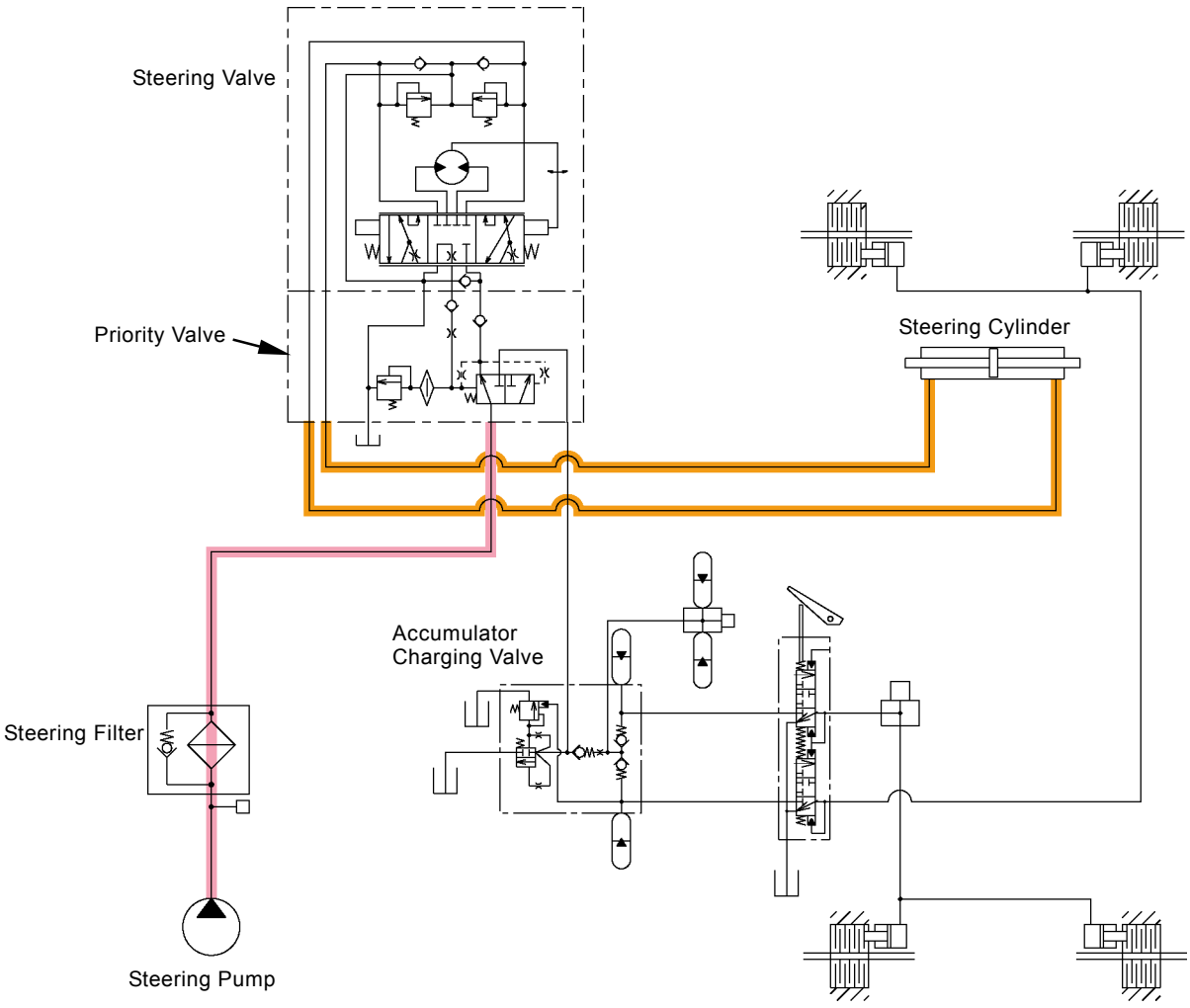



TCGB-02-04-009

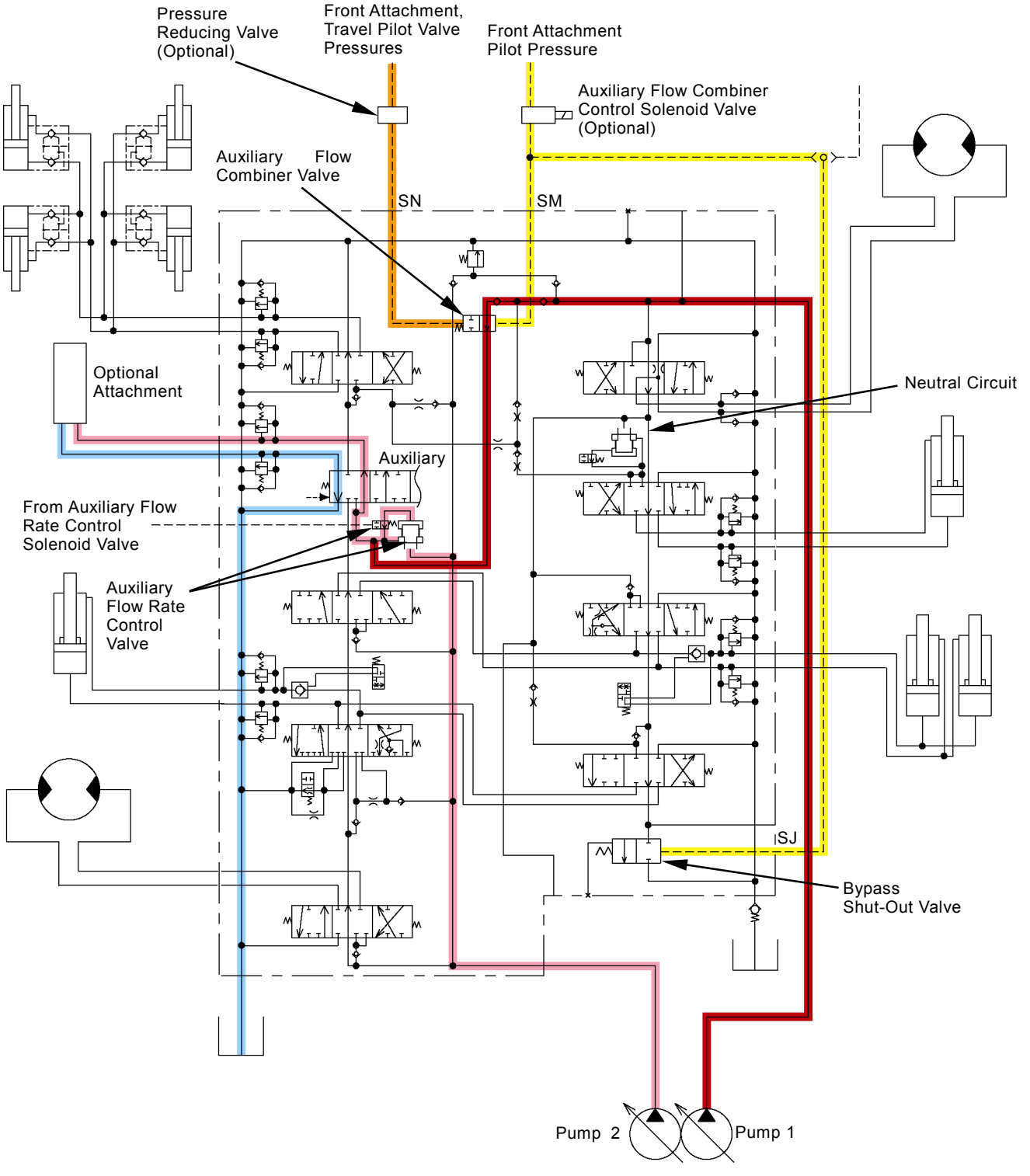
1 - Boom Raise
2 - Boom Lower
3 - Arm Roll-Out
4 - Arm Roll-In
5 - Left Swing
6 - Right Swing
7 - Bucket Roll-In
8 - Bucket Roll-Out
11 - Travel Reverse
12 - Travel Forward

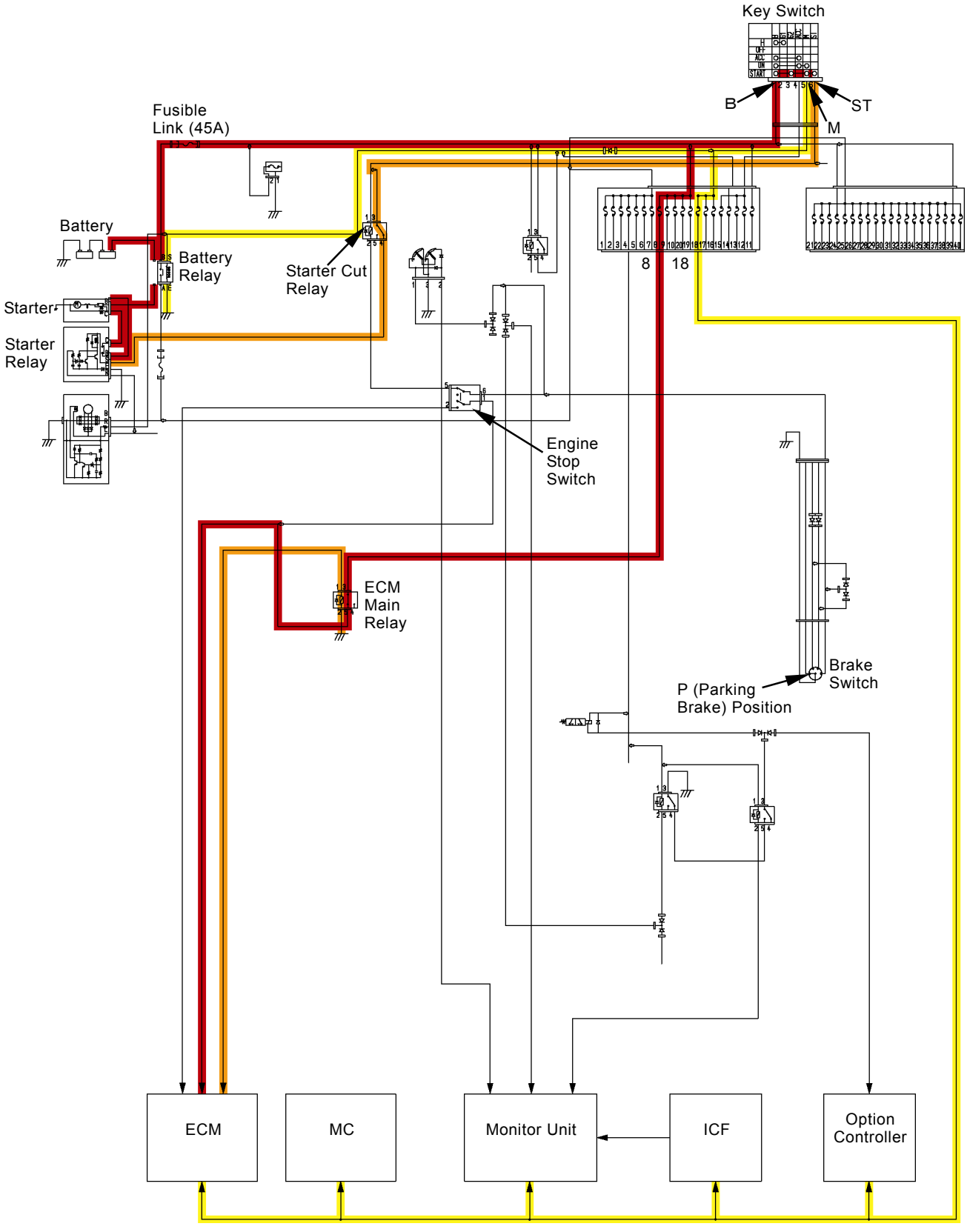
## STEERING CIRCUIT

- Pressure oil from the steering pump flows to the steering valve through the steering filter and priority valve.
  (Refer to the COMPONENT OPERATION / Steering Valve group.)
- The steering valve is actuated by rotation of the steering wheel and pressure oil flows to the steering cylinder so that the front wheels changes their directions.

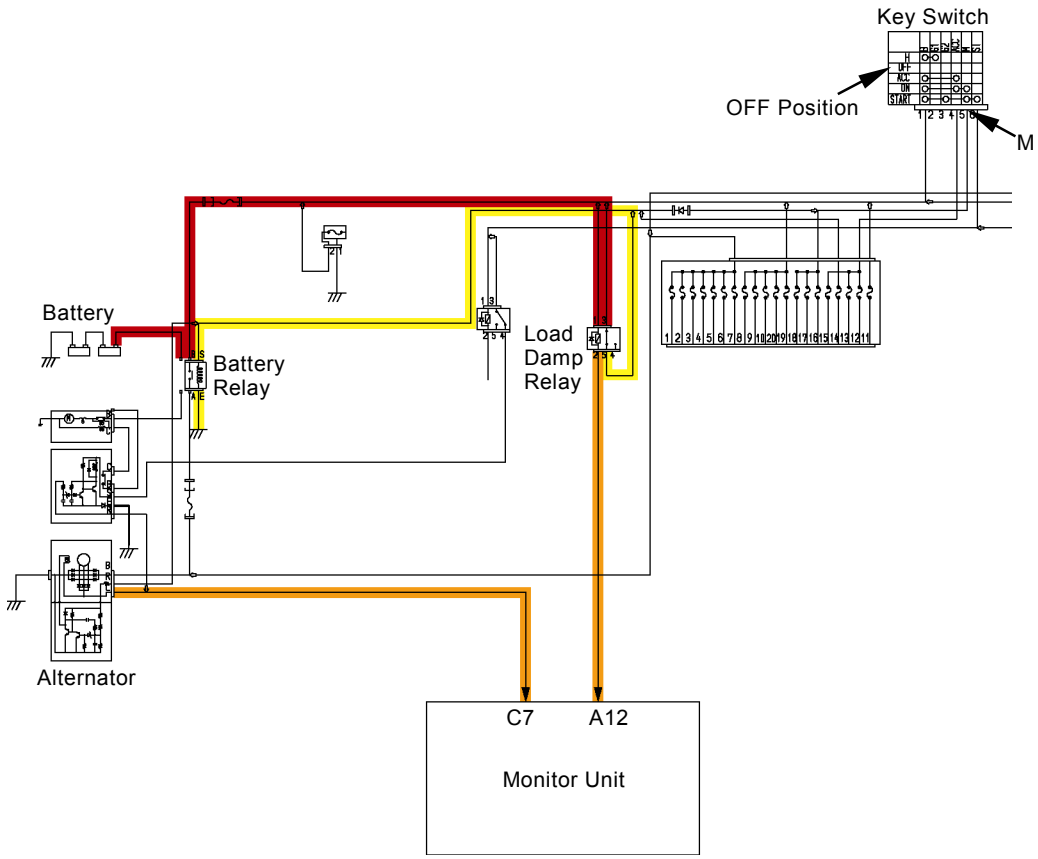



TCJB-02-04-013

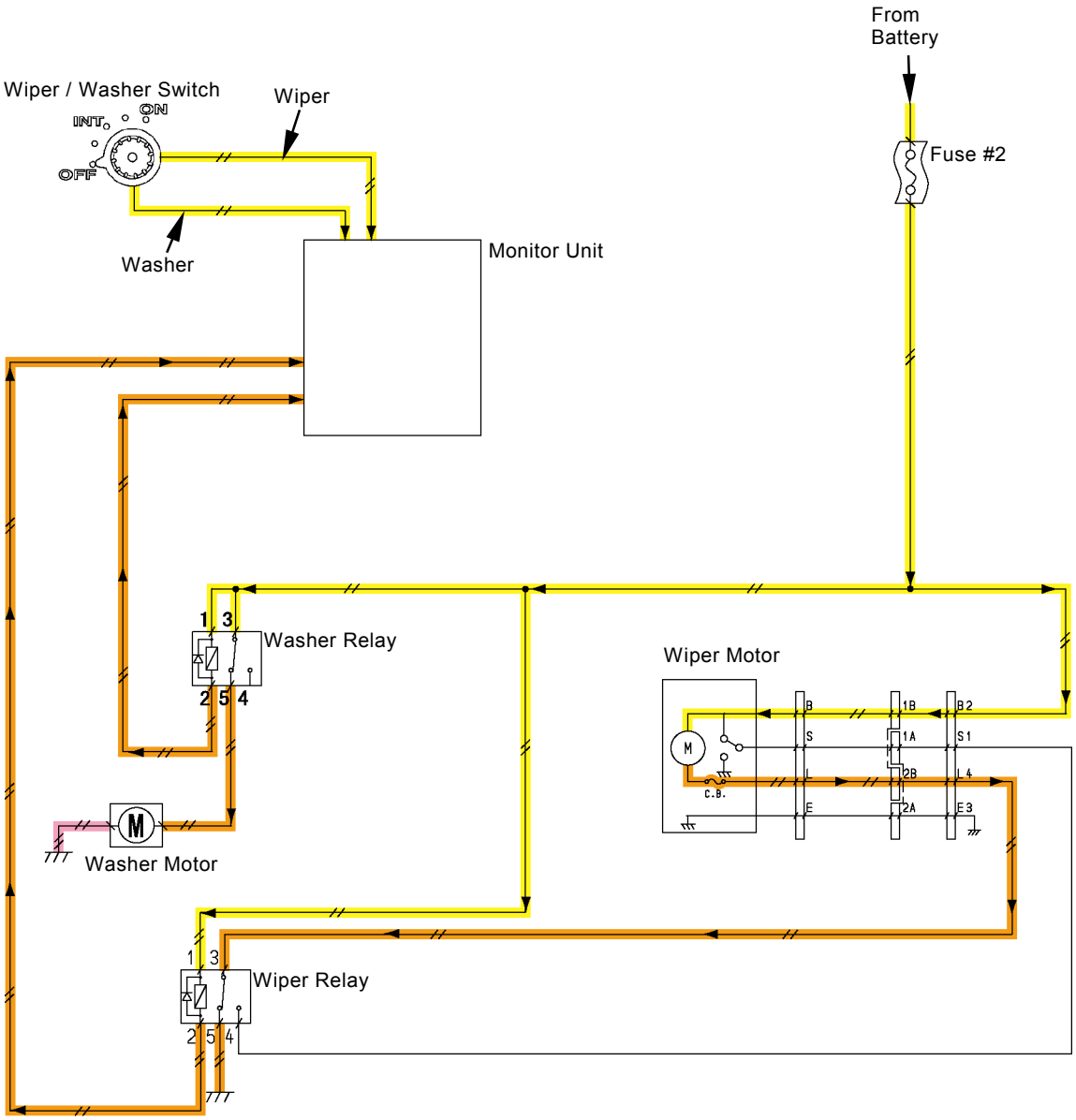

Pressure Reducing Valve (Optional)
Front Attachment, Travel Pilot Valve Pressures
Front Attachment Pilot Pressure
Auxiliary Flow Combiner Control Solenoid Valve (Optional)
Auxiliary Flow Combiner Valve
SN
SM
Optional Attachment
Neutral Circuit
Auxiliary
From Auxiliary Flow Rate Control Solenoid Valve
Auxiliary Flow Rate Control Valve
SJ
Bypass Shut-Out Valve
Pump 2
Pump 1
TCGB-02-04-011



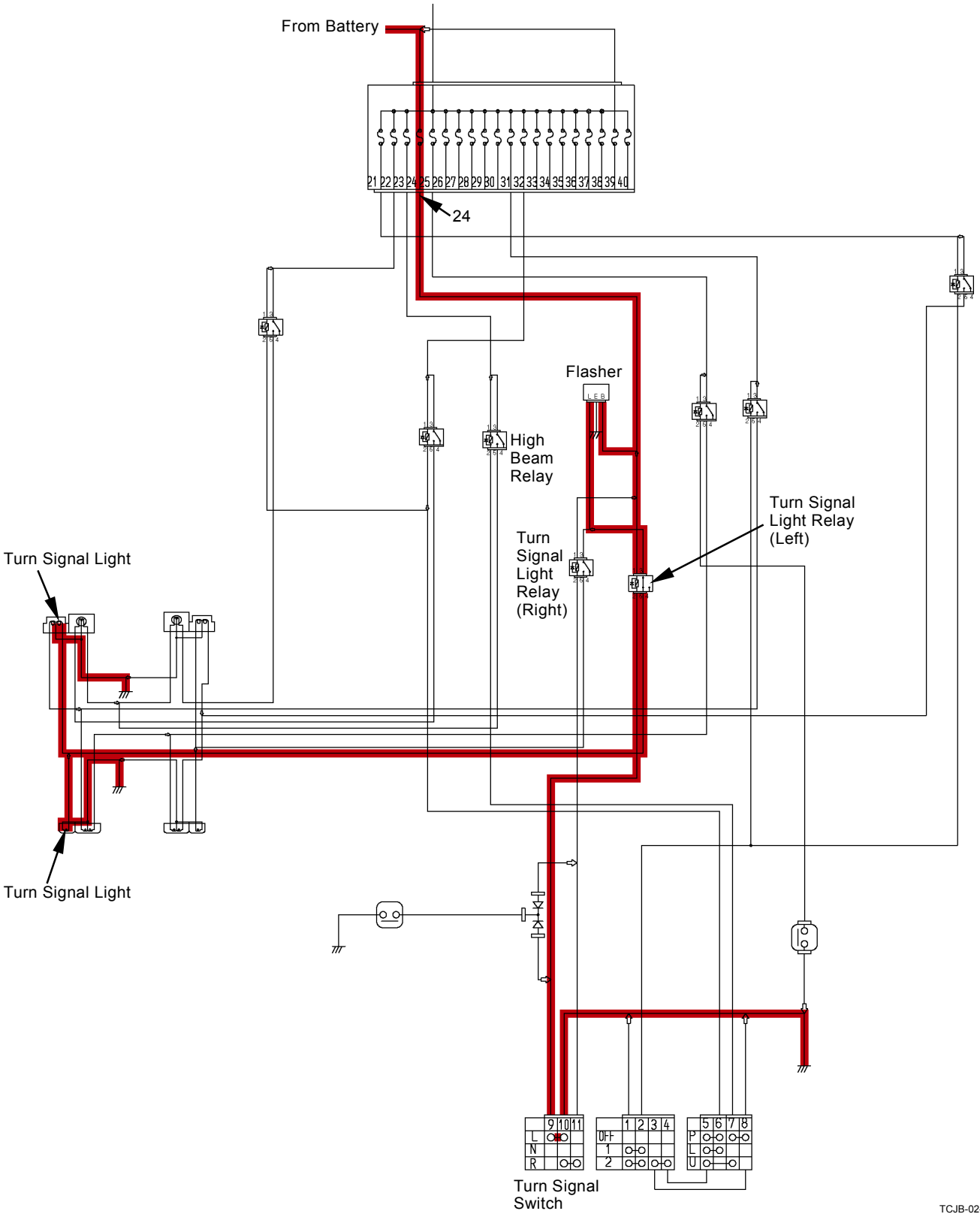

TCJB-02-05-004




TCJB-02-05-007



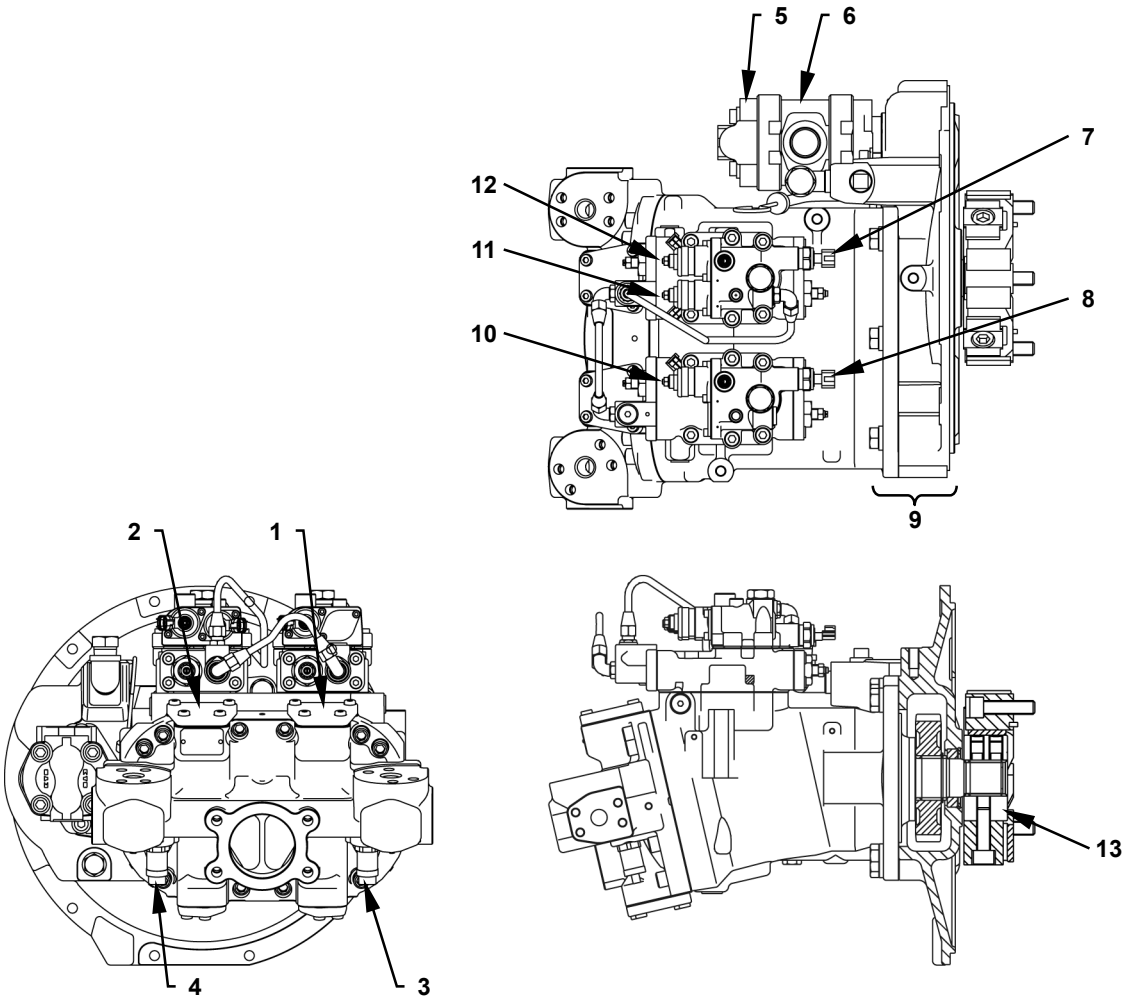

T1V1-02-05-005


From Battery
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
24
Flasher
L E B
High Beam Relay
Turn Signal Light Relay (Left)
Turn Signal Light Relay (Right)
Turn Signal Light
Turn Signal Light
9 10 11
L
N
R
1 2 3 4
OFF
1
2
5 6 7 8
P
L
U
Turn Signal Switch
TCJB-02-05-016

## OUTLINE

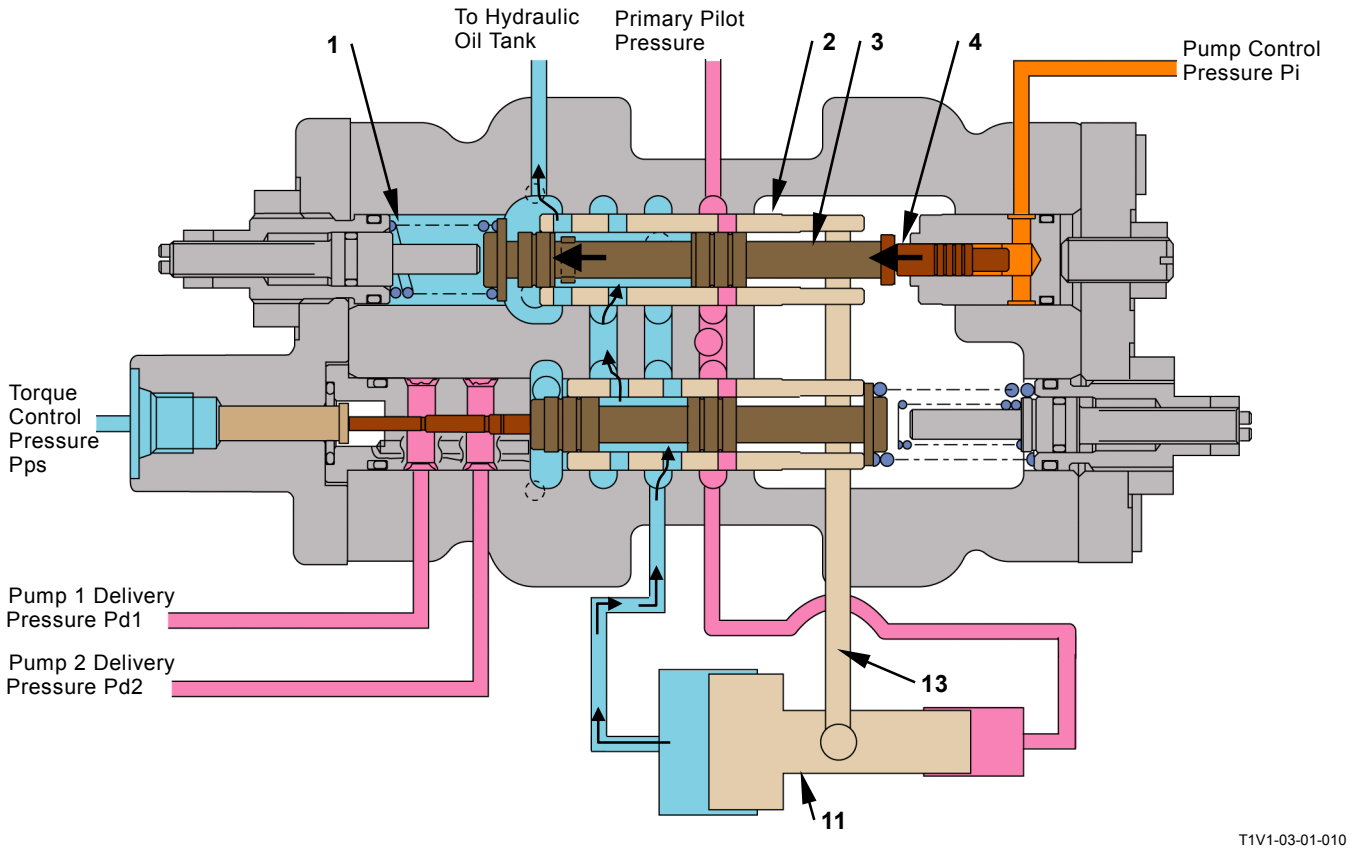
The pump device consists of transmission (9), main pump (pump 1 (1), pump 2 (2)), pilot pump (5) and steering pump (6).
The engine output is transmitted to transmission (9) via coupling (13). After being distributed by the gear, the engine power drives pump 1 (1), 2 (2), pilot pump (5) and steering pump (6). The reduction gear ratios of the main pump, pilot pump (5) and steering pump (6) are 1:1. Transmission (9) is lubricated with engine oil.

The main pump is a bent-axis type variable displacement axial plunger pump. Pump 1 (1) and pump 2 (2) are integrated as two units in one housing.
Pilot pump (5) and steering pump (6) are gear pumps.
Pump delivery pressure sensors (3, 4) and pump control pressure sensors (7, 8) are installed in order to control the pump and valve.
(Refer to the SYSTEM / Control System group.)

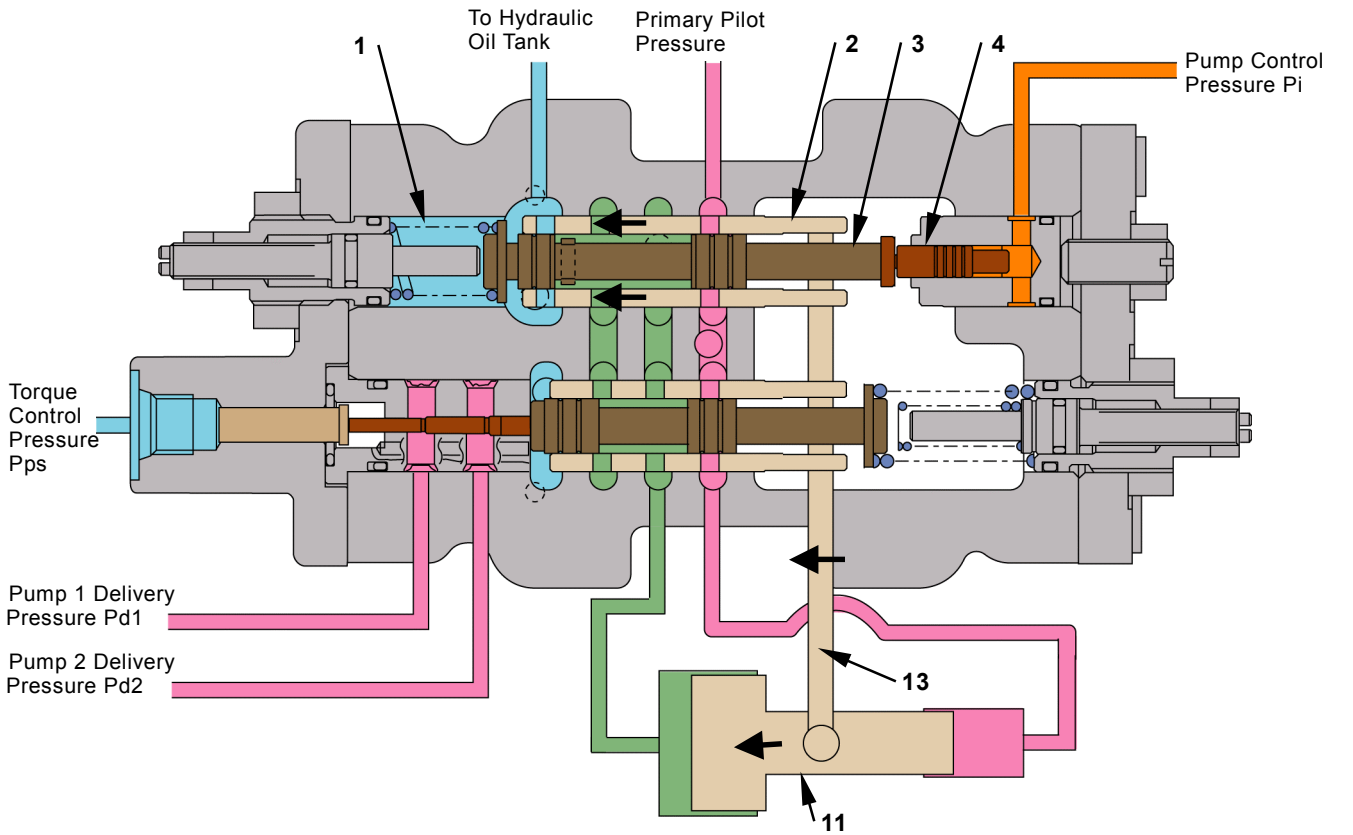



TCEB-03-01-004

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

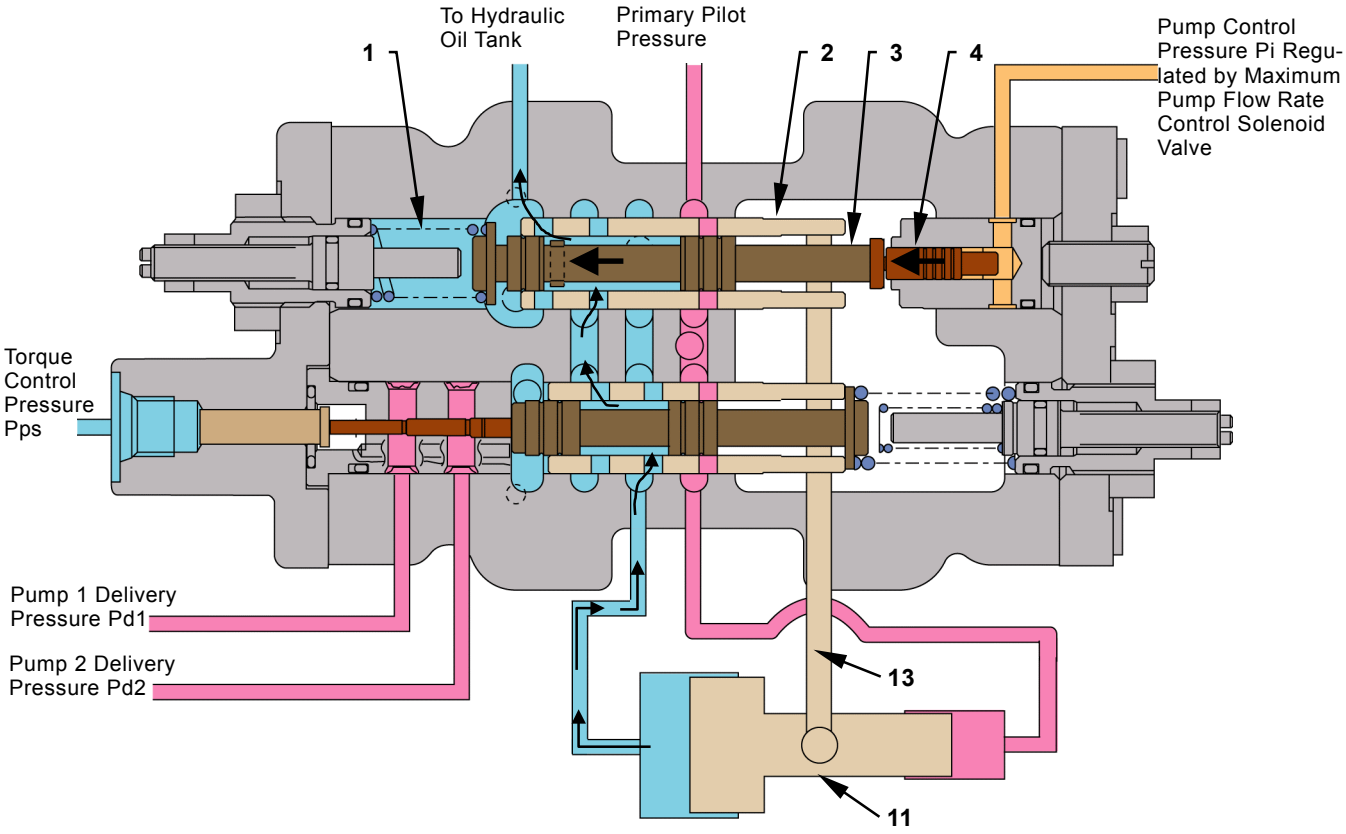



T1V1-03-01-010

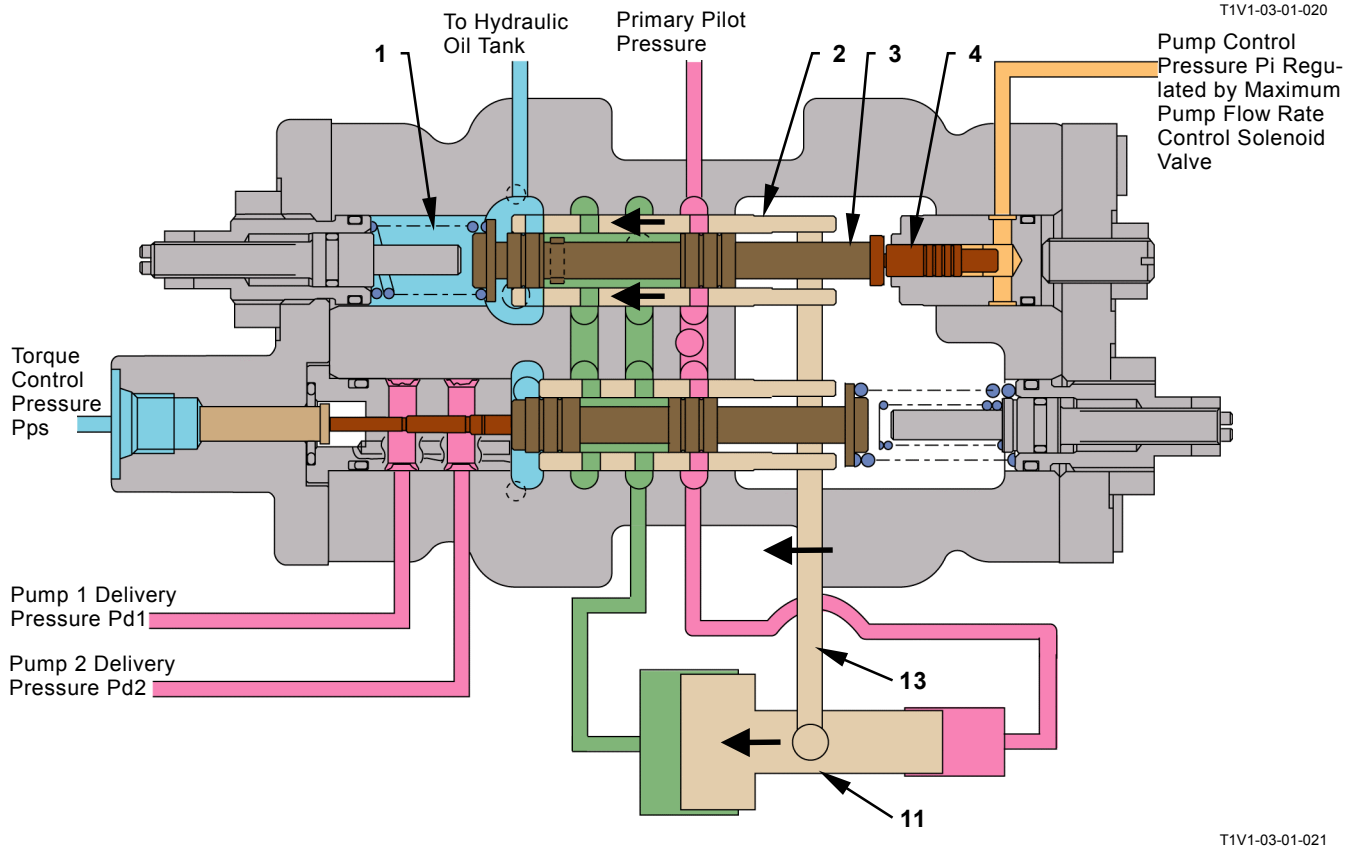



T1V1-03-01-011

1 - Spring
2 - Sleeve A
3 - Spool A
4 - Piston
11 - Servo Piston
13 - Link




T1V1-03-01-020




T1V1-03-01-021

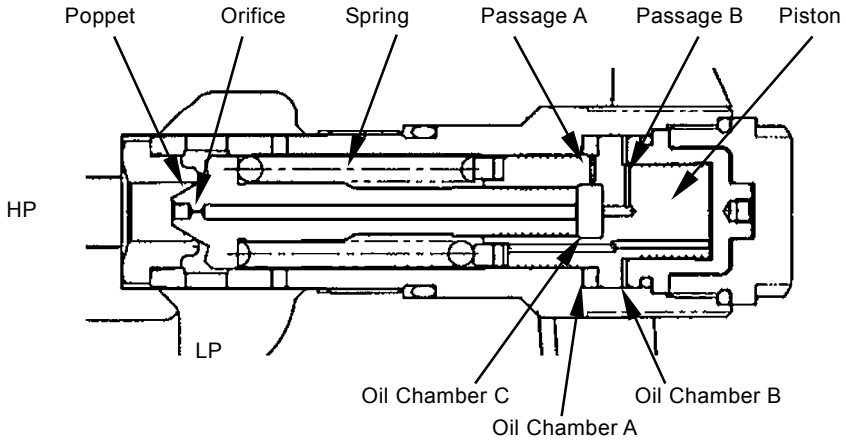
1 - Spring
2 - Sleeve A
3 - Spool A
4 - Piston
11 - Servo Piston
13 - Link

**Relief Valve**

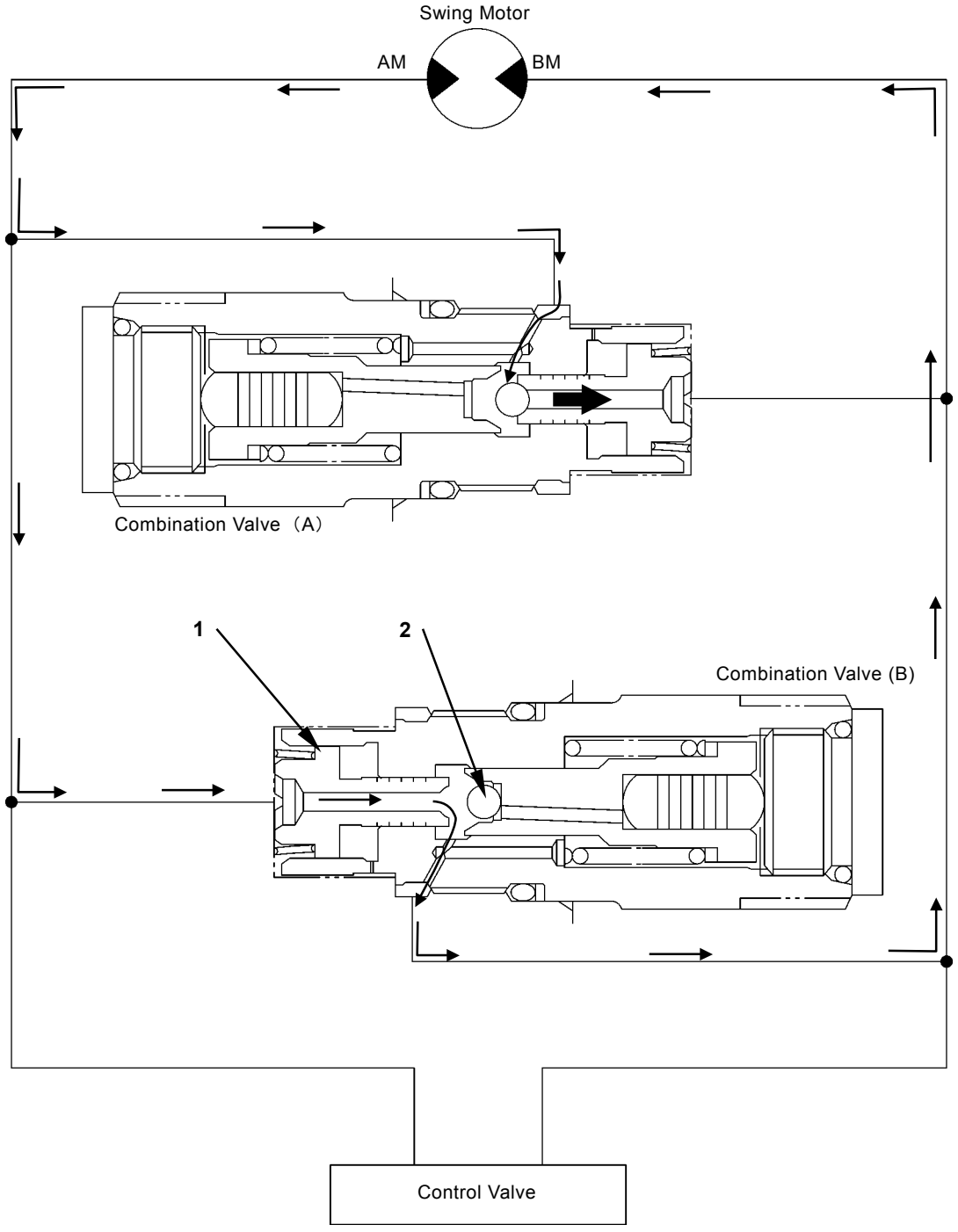
During starting or stopping swing operation, oil pressure in the swing circuit becomes high. The relief valve prevents the circuit pressure from rising higher than the set-pressure.

- Low Pressure Relief Operation (Shockless Function):
  1. Pressure at port HP (swing circuit) is routed to oil chamber C through the poppet orifice.
  2. Pressure oil in oil chamber C is further routed to oil chambers A and B via passages A and B respectively.
  3. The pressure receiving area in oil chamber B is larger than oil chamber A so that the piston moves to the left.
  4. As long as the piston keeps moving, a pressure difference is developed between the front and the rear of poppet by the orifice. When this pressure difference is increased more than spring force, the poppet is unseated, pressure oil flows to port LP.
  5. When the piston is moved to full stroke, the pressure difference between the front and the rear of poppet disappears and the poppet is seated.

- High Pressure Relief Operation (Overload Prevention):
  1. After the piston is moved to full stroke, the spring is compressed so that the circuit pressure becomes the set-pressure.
  2. If pressure at port HP increases more than the spring set-pressure, the poppet is unseated and pressure oil flows to port LP.
  3. When pressure at port HP is reduced to the specified level, the poppet is seated by the spring force.



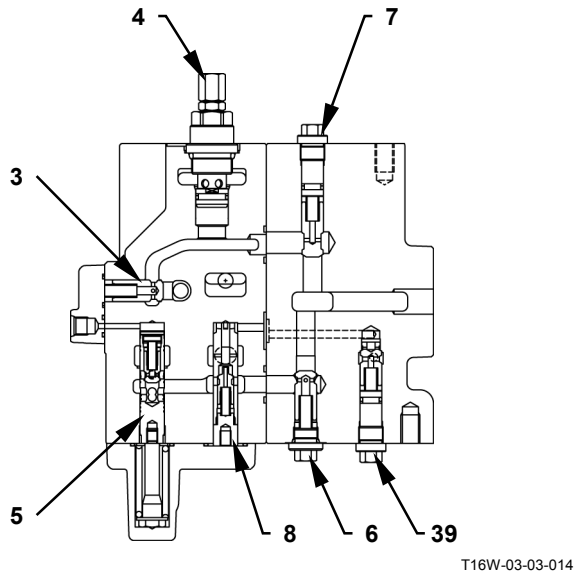

T178-03-02-005



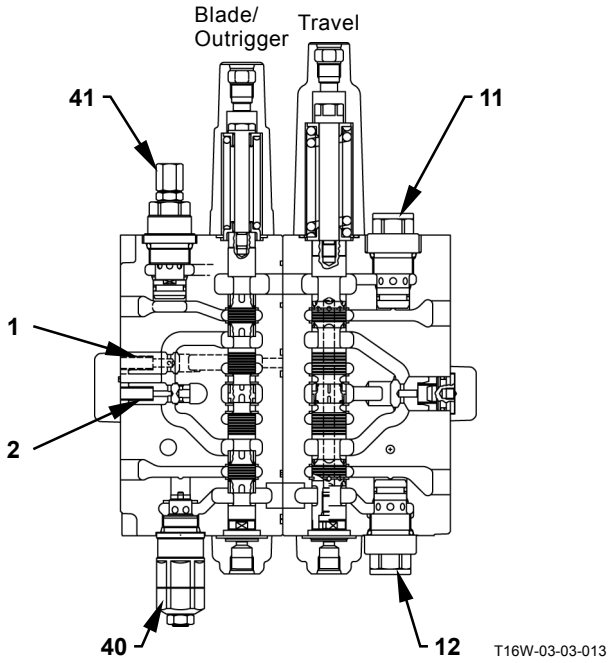

T1V1-03-02-016

1 - Poppet 2 - Ball

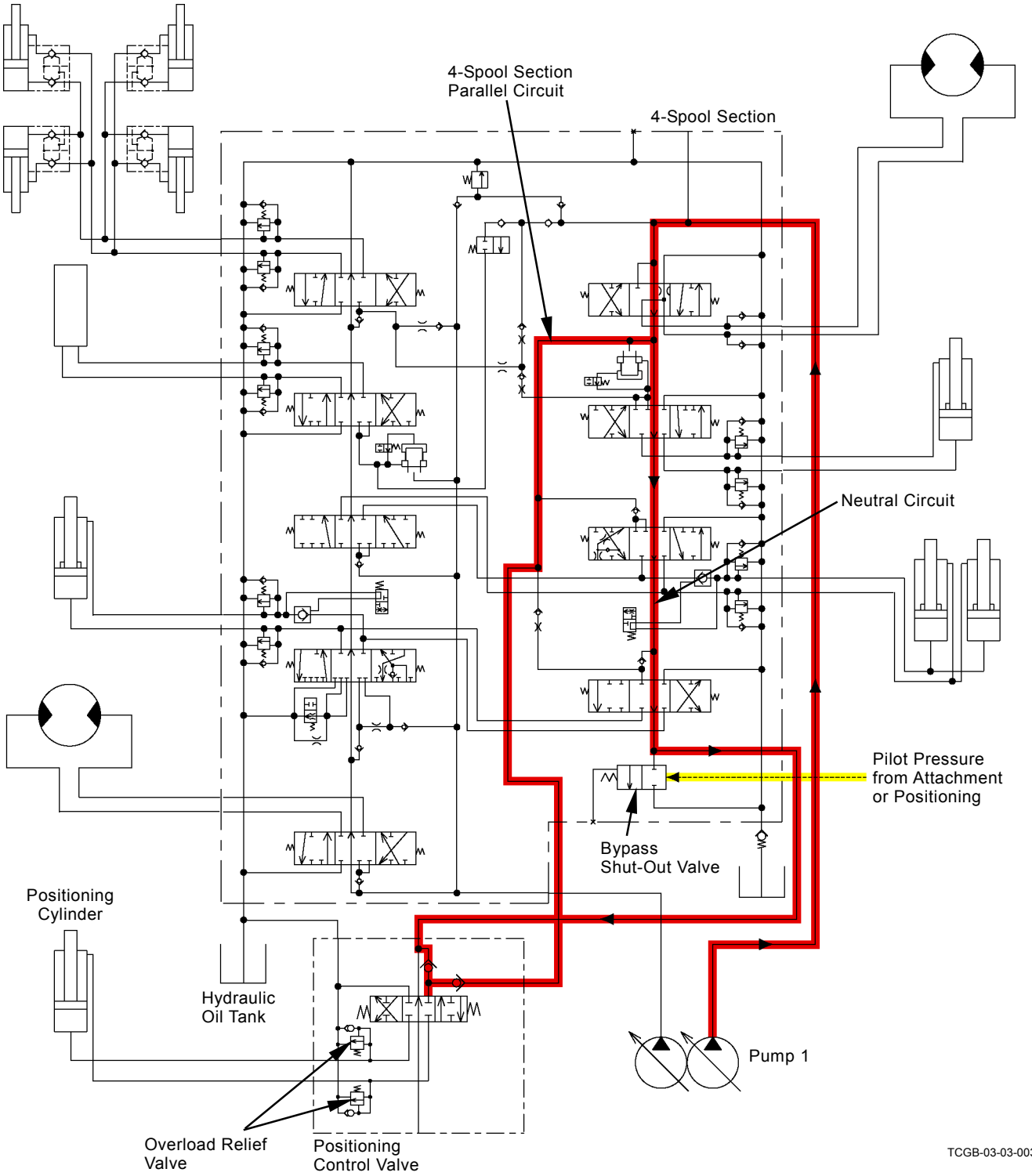
Cross Section C-C



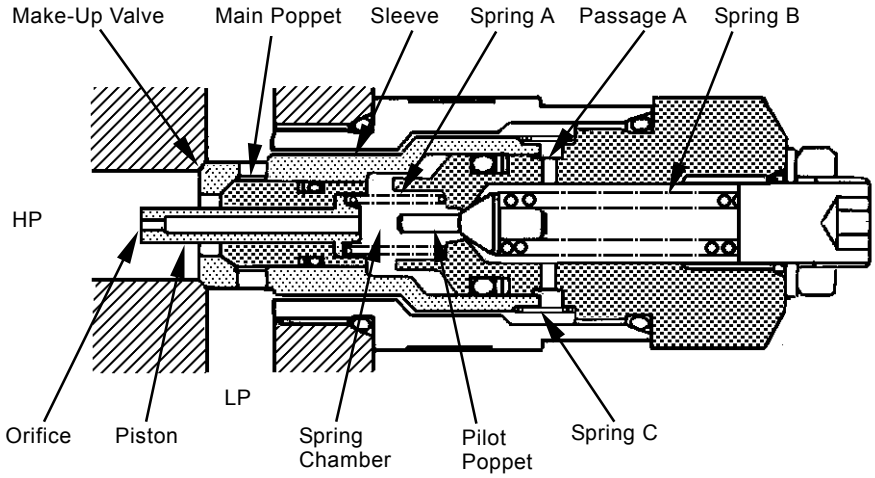

Cross Section D-D




1 - Load Check Valve (Blade/Outrigger Tandem Circuit)
2 - Load Check Valve (Blade/Outrigger Parallel Circuit)
3 - Check Valve (Main Relief Circuit)
4 - Main Relief Valve
5 - Auxiliary Flow Combiner Valve
6 - Check Valve (Auxiliary Flow Combiner Circuit)
7 - Check Valve (Main Relief Circuit)
8 - Check Valve (Flow Combiner Circuit)
9 - Bucket Flow Rate Control Valve (Selector Valve)
10 - Bucket Flow Rate Control Valve (Poppet Valve)
11 - Make-Up Valve (Travel Reverse Side)
12 - Make-Up Valve (Travel Forward Side)
13 - Bucket Regenerative Circuit (Only ZX190W-3)
14 - Overload Relief Valve (Bucket Rod Side)
15 - Overload Relief Valve (Bucket Bottom Side)
16 - Load Check Valve (Boom 1 Parallel Circuit)
17 - Boom Regenerative Circuit
18 - Overload Relief Valve (Boom Bottom Side)
19 - Overload Relief Valve (Boom Rod Side)
20 - Boom Anti-Drift Valve (Check Valve)
21 - Boom Anti-Drift Valve (Selector Valve)
22 - Load Check Valve (Arm 2 Tandem Circuit)
23 - Bypass Shut-Out Valve
24 - Check Valve (Orifice) (Arm 2 Parallel Circuit)
25 - Load Check Valve (Arm 1 Parallel Circuit)
26 - Load Check Valve (Arm 1 Tandem Circuit)
27 - Load Check Valve (Swing Circuit)
28 - Arm Regenerative Valve (Selector Valve)
29 - Arm Regenerative Circuit
30 - Overload Relief Valve (Arm Bottom Side)
31 - Overload Relief Valve (Arm Rod Side)
32 - Arm Anti-Drift Valve (Check Valve)
33 - Arm Anti-Drift Valve (Selector Valve)
34 - Load Check Valve (Boom 2 Parallel Circuit)
35 - Aux. Flow Rate Control Valve (Poppet Valve)
36 - Aux. Flow Rate Control Valve (Selector Valve)
37 - Overload Relief Valve (Auxiliary)
38 - Overload Relief Valve (Auxiliary)
39 - Load Check Valve (Bucket Parallel Circuit)
40 - Overload Relief Valve (Blade/Outrigger Rod Side)
41 - Overload Relief Valve (Blade/Outrigger Bottom Side)

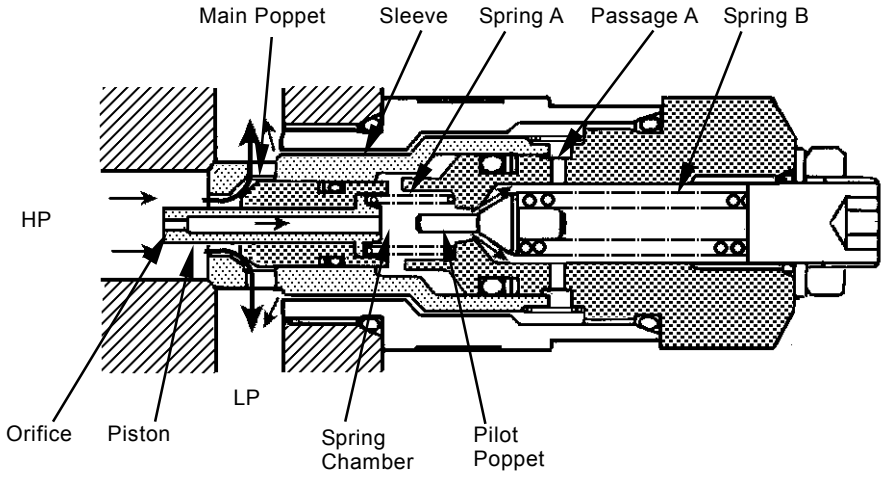

4-Spool Section
Parallel Circuit
4-Spool Section
Neutral Circuit
Pilot Pressure
from Attachment
or Positioning
Bypass
Shut-Out Valve
Positioning
Cylinder
Hydraulic
Oil Tank
Pump 1
Overload Relief
Valve
Positioning
Control Valve
TCGB-03-03-003

During Normal Operation:



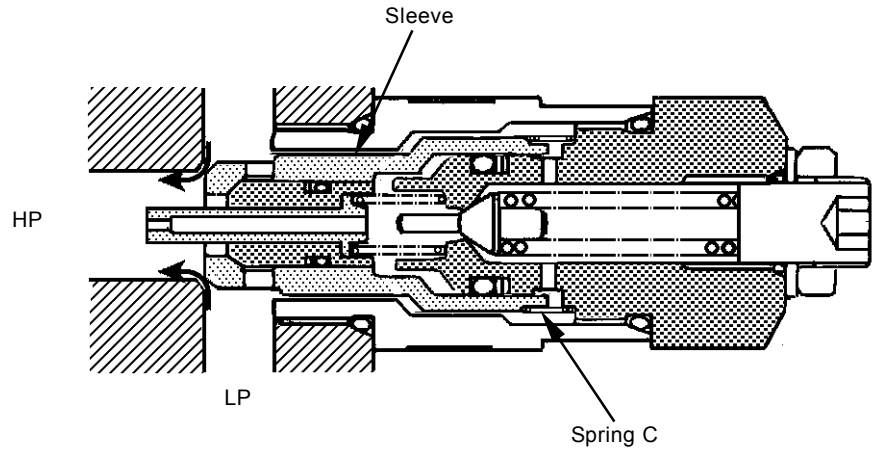

T107-02-05-019

During Relief Operation:

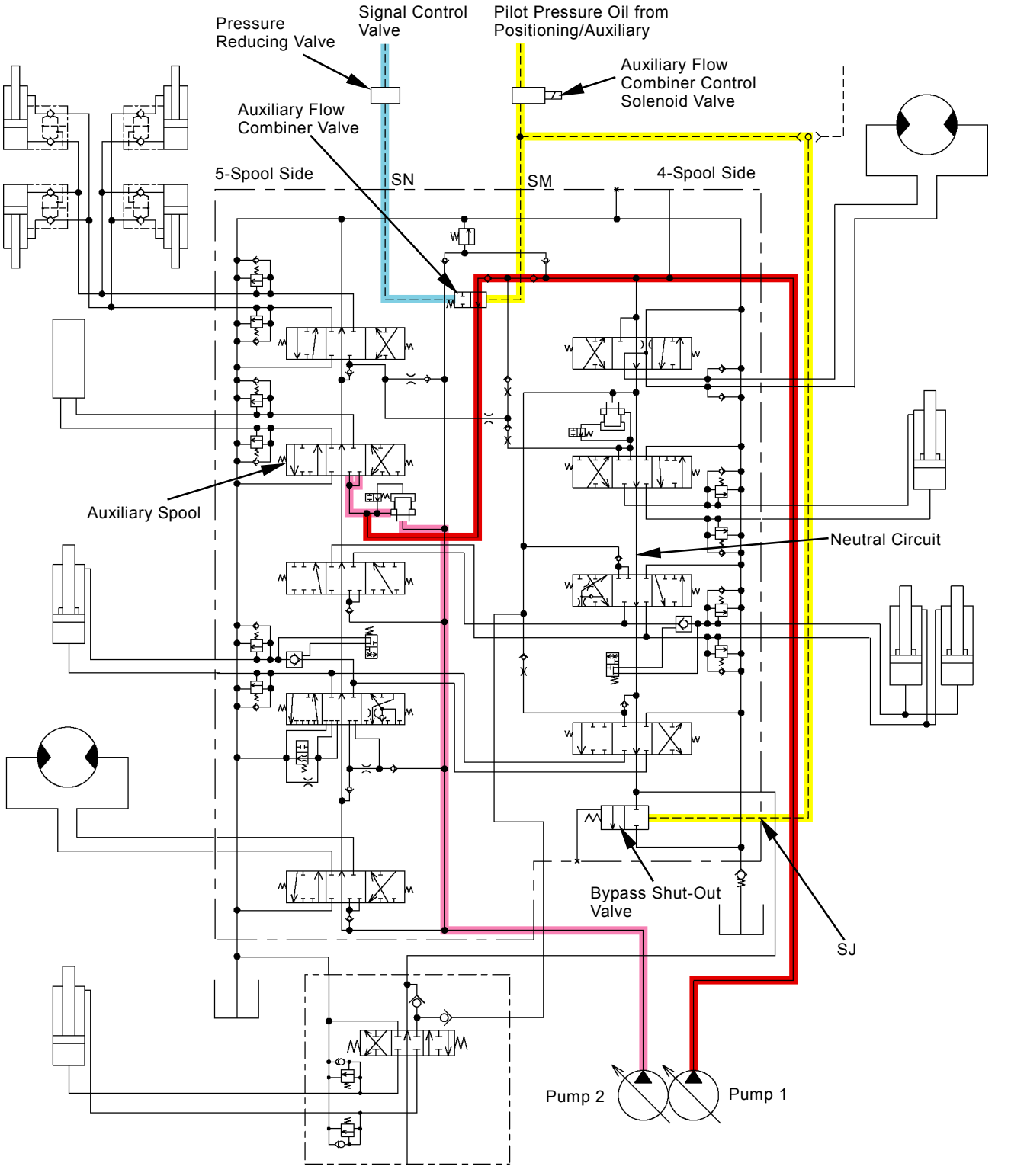



T178-03-03-049

During Make-Up Operation:



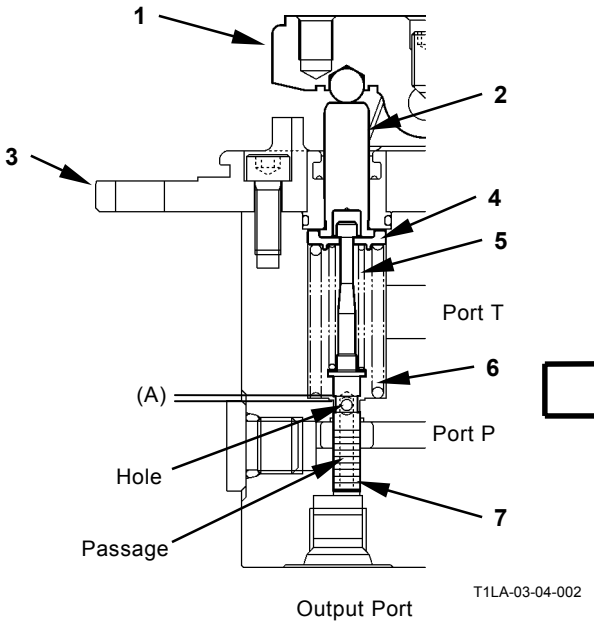

T178-03-03-050



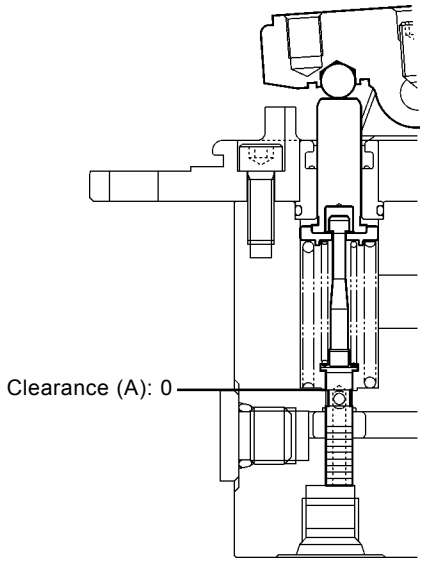

TCGB-03-03-006

*NOTE: The pressure reducing valve and the auxiliary flow combiner control solenoid valve are installed only on the machines equipped with the optional parts.*

**Pusher Stroke: A to B**

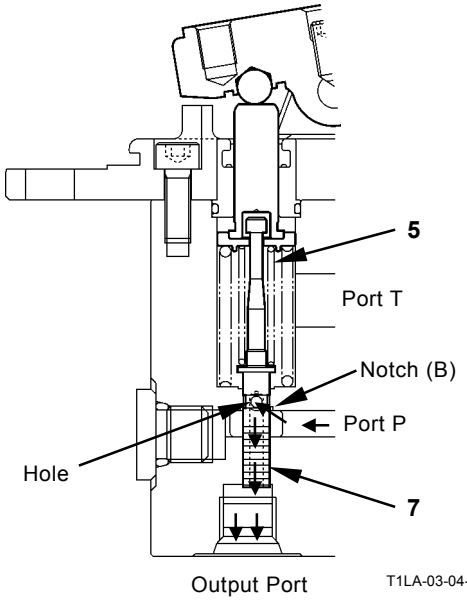



T1LA-03-04-002



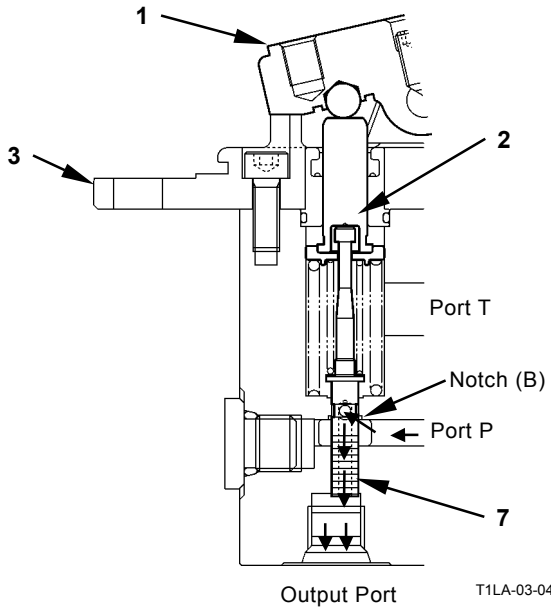

T1LA-03-04-003

**Pusher Stroke: C to D**



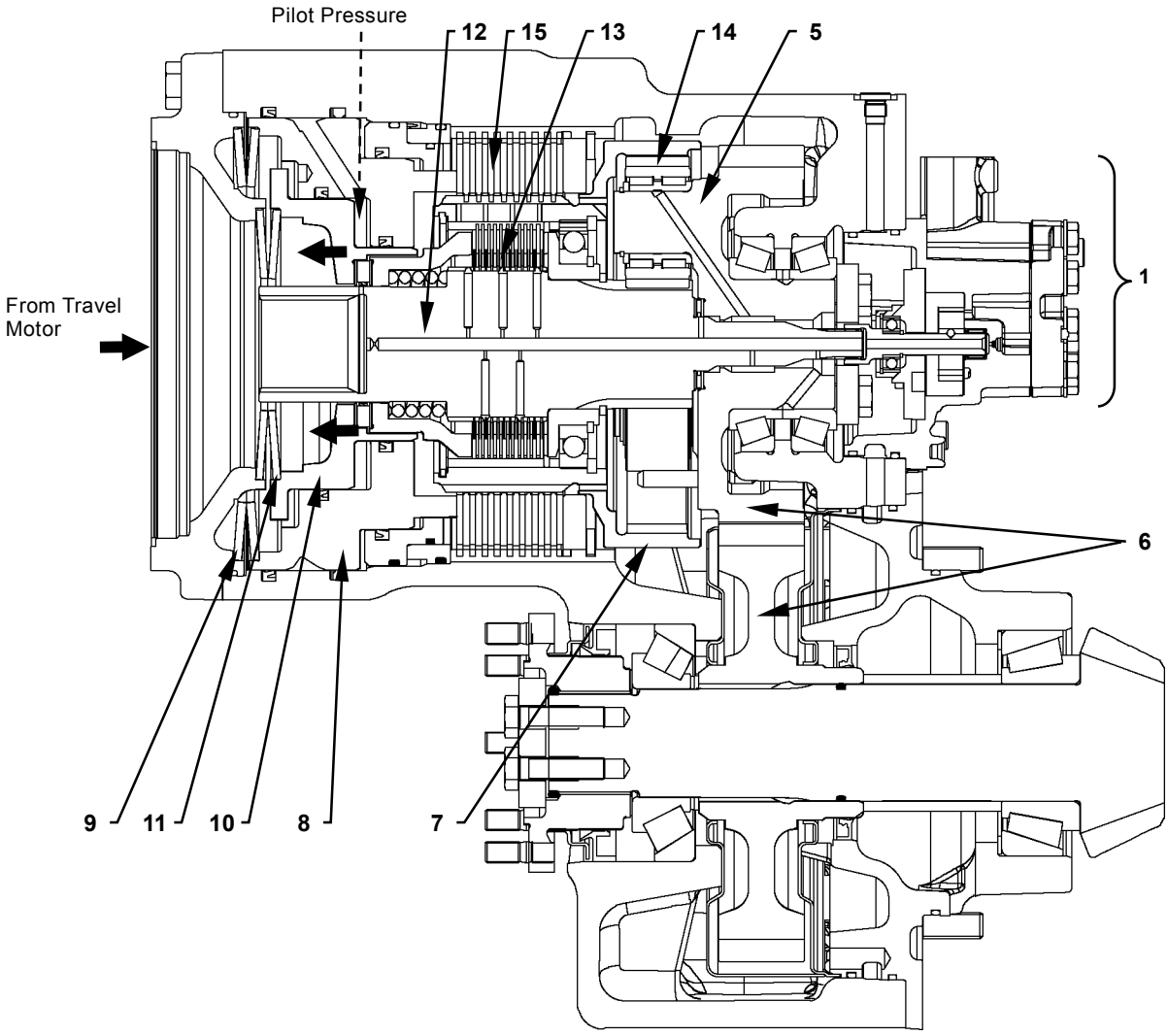

T1LA-03-04-004

**Pusher Stroke: E to F**

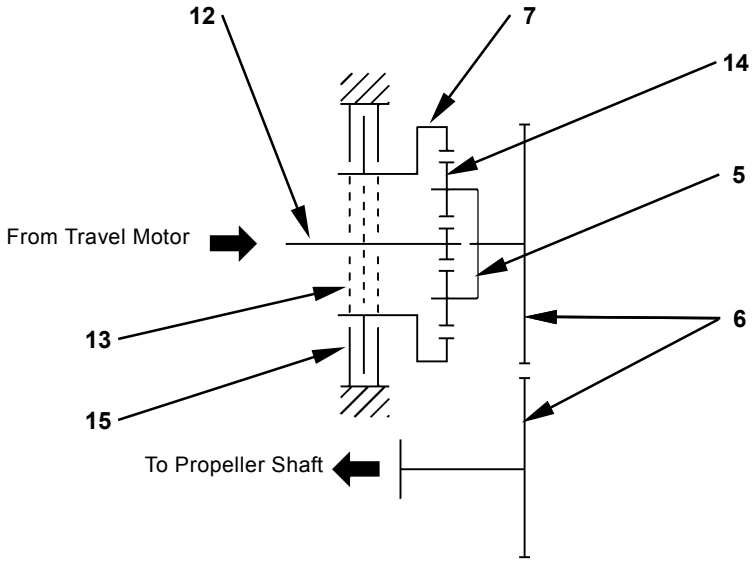



T1LA-03-04-005

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




T21W-03-05-017

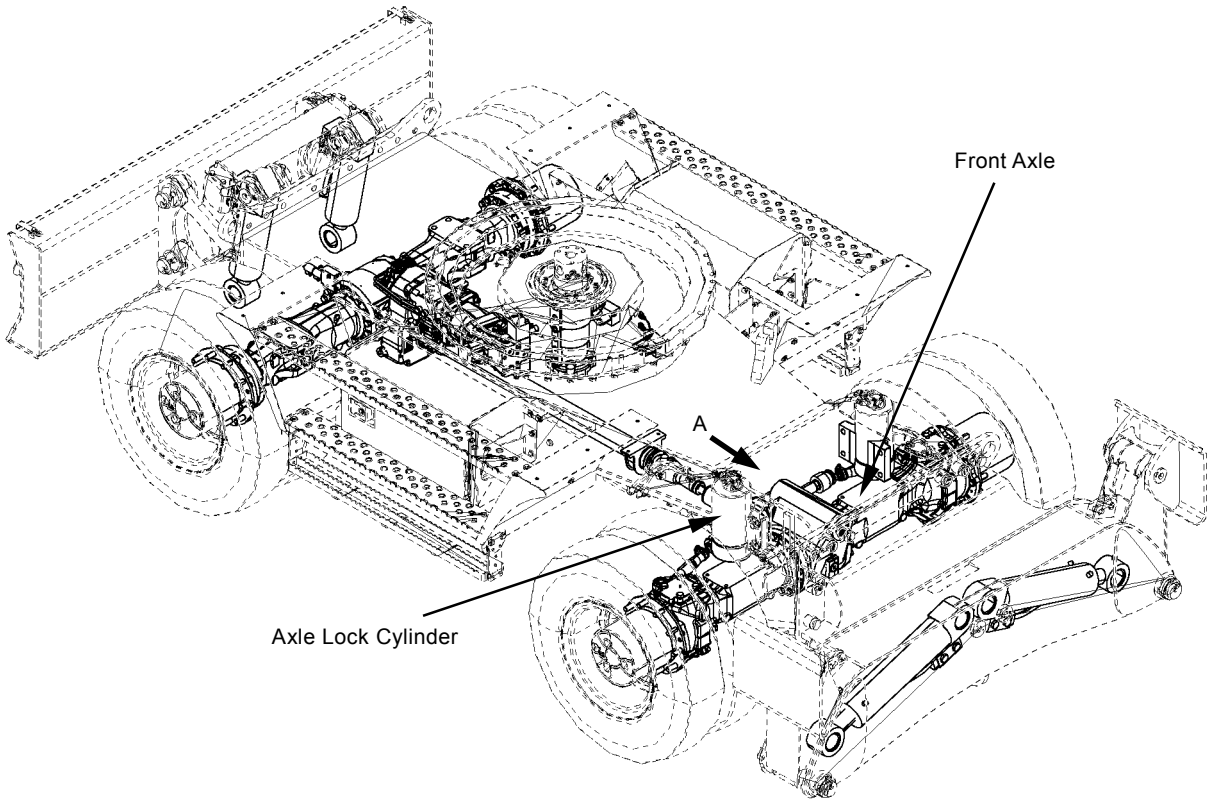



TCDB-03-05-001

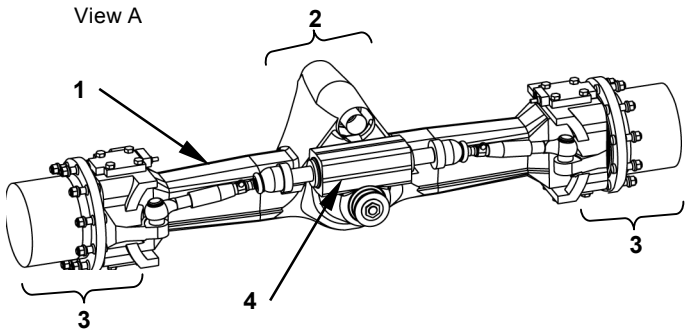
1 - Gearshift Piston
5 - Carrier
6 - Final Gear
7 - Ring Gear
8 - Brake Piston
9 - Disc Spring
10 - Clutch Piston
11 - Disc Spring
12 - Shaft
13 - Disc Clutch
14 - Planetary Gear
15 - Disc Brake

## FRONT AXLE

The front axle consists of body (1), differential gear (2), reduction gears (3) and steering cylinder (4). The front axle functions to change the machine travel direction, to support the machine weight, and to transfer the front propeller shaft power to the wheels. The front axle is controlled by the axle lock cylinders. When the axle lock cylinders are released, the front axle is allowed to oscillate so that the machine vibration is reduced during traveling (auto axle lock control). (Refer to the SYSTEM / Control System group.)




TCJB-01-02-011



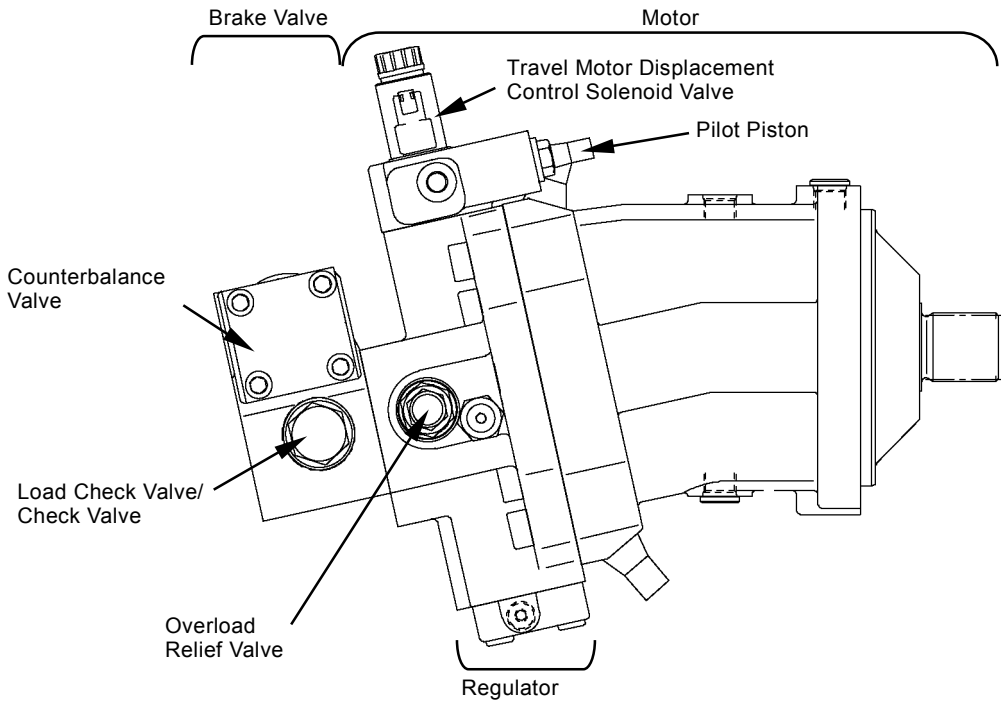

T1GL-03-05-020

## OUTLINE

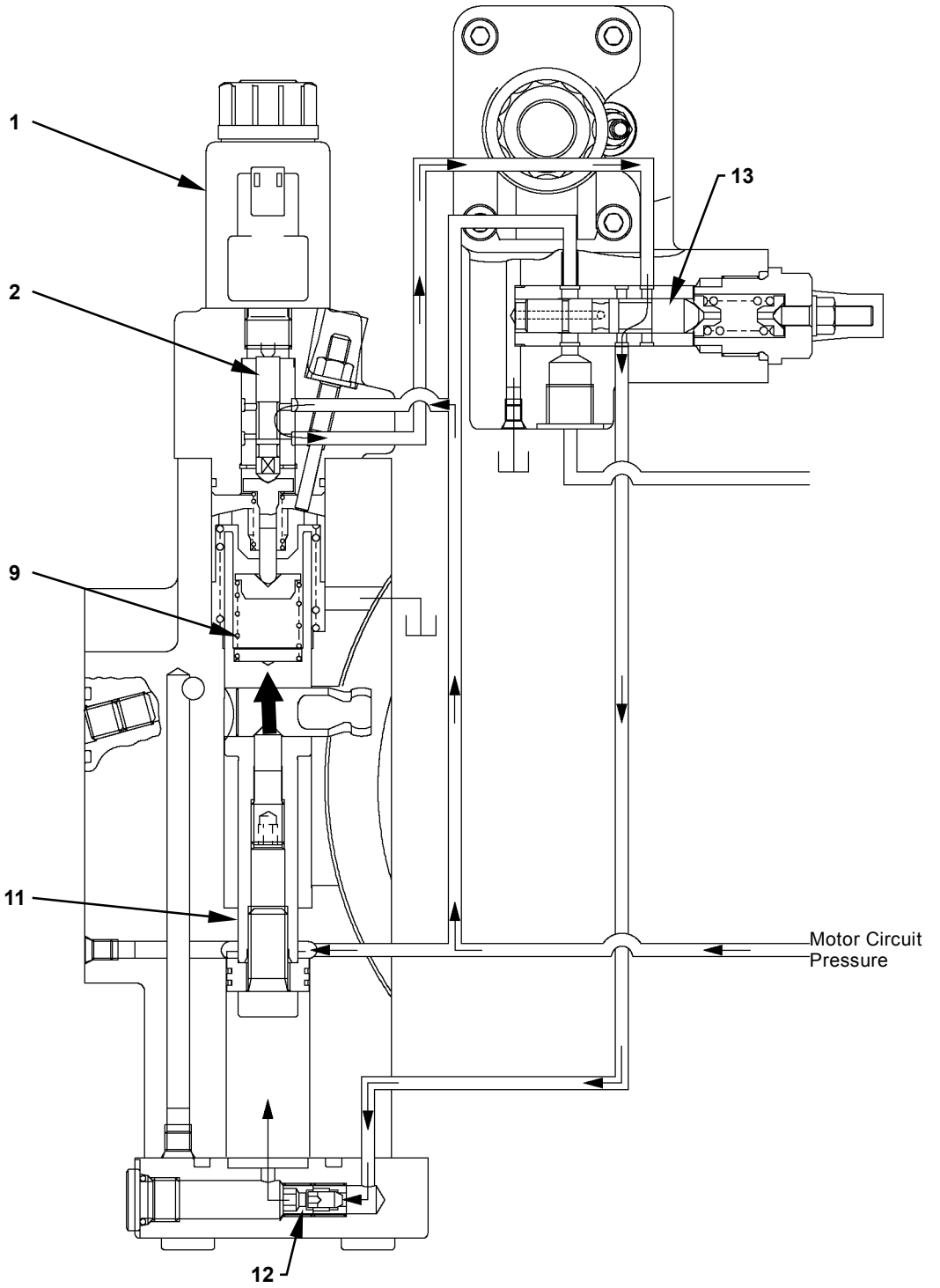
The travel motor consists of the motor section and brake valve. The motor section is rotated by pressure oil from the main pump and transfers the motor rotation to the transmission. The motor section consists of the regulator, overload relief valve, pilot piston and travel motor displacement control solenoid valve. The pilot piston and travel motor displacement control solenoid valve control the regulator by the signals from motor driving oil pressure and MC.
The regulator controls the motor displacement angle so that the motor is rotated at the displacement angle in proportion to the pilot pressure oil.
The overload relief valves prevent surge pressure due to overloads from occurring in the motor circuit.

The brake valve consists of the counterbalance valve, load check valves, check valves and shuttle valve and prevents the machine from running away.

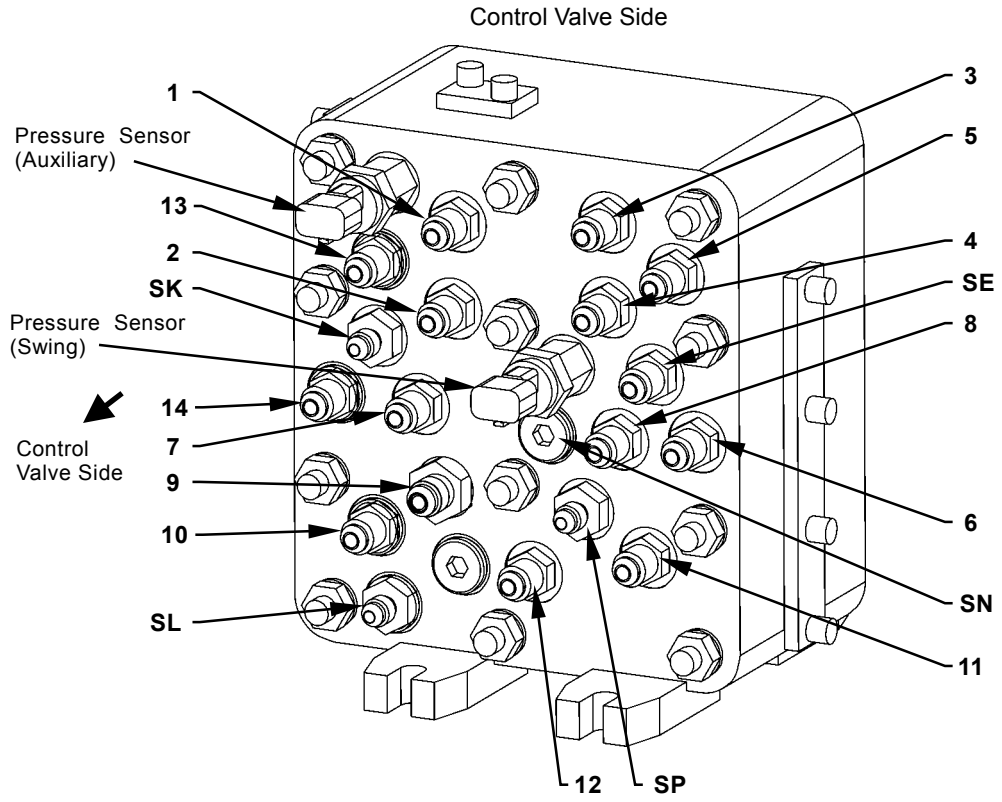
*NOTE: The make-up valve in control valve prevents occurrence of cavitation in the motor circuit. (Make-up function)*




TCJB-03-07-001




1 - Travel Motor Displacement Control Solenoid Valve
2 - Spool
9 - Balance Spring
11 - Servo Piston
13 - Orifice
14 - Pilot Piston




T1F3-03-06-003

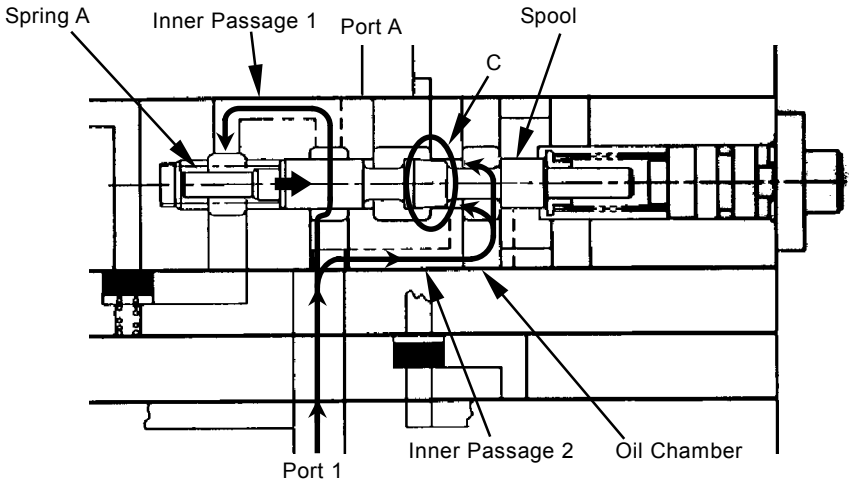
Control Valve Side

| Port Name | Connecting to | Remark |
|---|---|---|
| Port 1 | Control Valve | Boom Raise Pilot Pressure |
| Port 2 | Control Valve | Boom Lower Pilot Pressure |
| Port 3 | Control Valve | Arm Roll-Out Pilot Pressure |
| Port 4 | Control Valve | Arm Roll-In Pilot Pressure |
| Port 5 | Control Valve | Left Swing Pilot Pressure |
| Port 6 | Control Valve | Right Swing Pilot Pressure |
| Port 7 | Control Valve | Bucket Roll-In Pilot Pressure |
| Port 8 | Control Valve | Bucket Roll-Out Pilot Pressure |
| Port 9 | Hydraulic Oil Tank | Returning to Hydraulic Oil Tank |
| Port 10 | - | Plug |
| Port 11 | Control Valve | Travel Reverse Pilot Pressure |
| Port 12 | Control Valve | Travel Forward Pilot Pressure |
| Port 13 | - | Plug |
| Port 14 | - | Plug |
| Port SE | - | Plug |
| Port SN | - | Plug |
| Port SP | Hydraulic Oil Tank | Returning to Hydraulic Oil Tank |
| Port SL | - | Plug |
| Port SK | Control Valve | Bucket Flow Rate Control Valve Control Pressure |

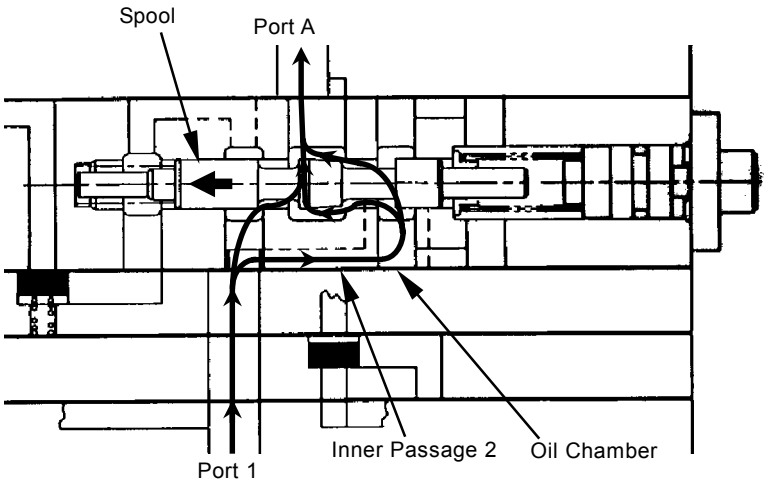
2-Piece Boom Specification Machine

| | | |
|---|---|---|
| Port SP | Positioning Solenoid Valve | Pump 1 Control Pressure |

During Boom Lowering Operation (Shockless Operation)

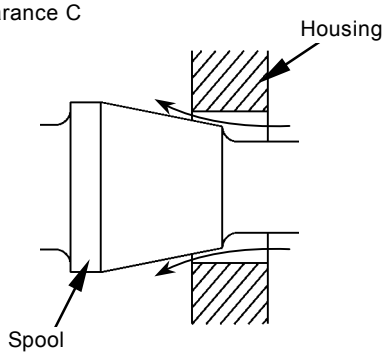



TCJB-03-09-004




TCJB-03-09-005

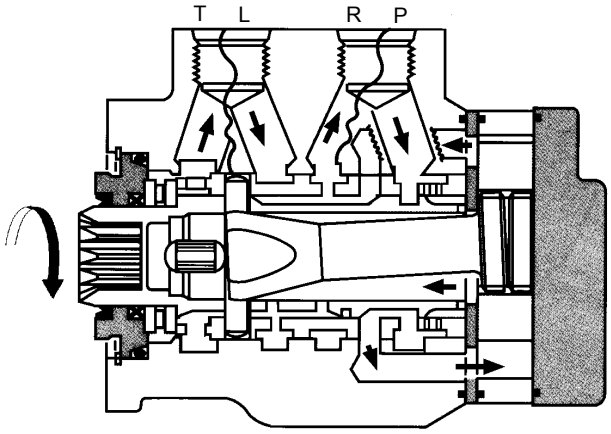
Detail of Clearance C




T1V1-03-06-008

**Right Steering:**

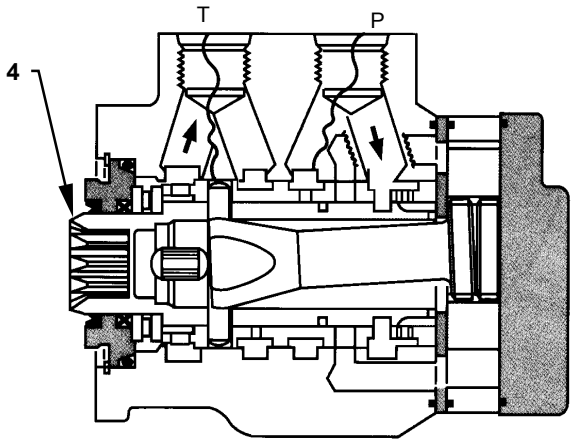
1. When the steering wheel is turned clockwise, pressure oil from the steering pump as follows:
   Port P → Port R → Steering Cylinders
   The steering cylinders are operated so that the front wheel is turned to the right.
2. The returning oil from the steering cylinder flows back to the hydraulic oil tank via port L and port T.




T487-03-02-010

**In Neutral:**

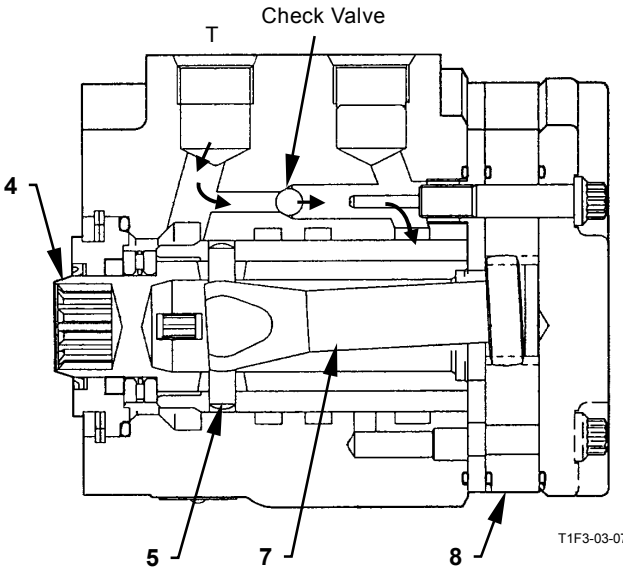
1. When the steering wheel is in neutral, pressure oil from the steering pump is routed to port P on the steering valve. As port P is blocked by spool (4), pressure oil do not flow to the steering cylinders.
2. Then, the steering cylinders are inoperative.




T487-03-02-011

**When Steering Pump Stops (When Engine Stops):**

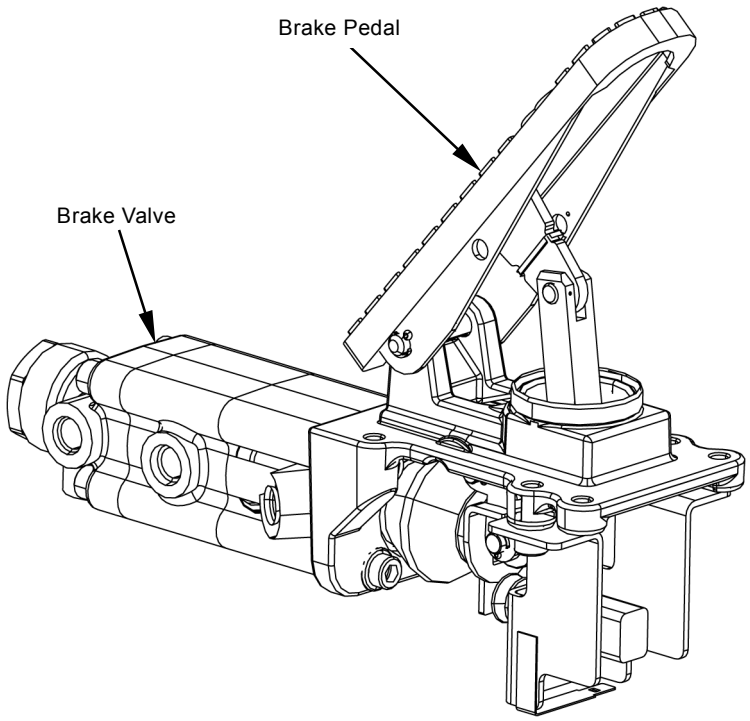
1. When the steering wheel is turned to a certain angle, spool (4) touches pin (5) so that drive (7) rotates.
2. Drive (7) rotates gerotor (8) and functions as the hand pump to send oil to the steering cylinder.
3. Oil is inhaled up from the tank port via the check valve.
4. As results, the steering operation is performed even if the steering pump is completely stopped.




T1F3-03-07-002

## OUTLINE

The brake valve is operated by the brake pedal and MC (work brake control). (Refer to the SYSTEM / Control System group.)
The brake valve delivers pilot oil pressure in proportion to the brake pedal stroke and both the front and rear wheel brakes are applied.
In addition, when the work brake control is enabled, pilot pressure from solenoid valve unit (SF) shifts the brake valve so that the brake is constantly applied.

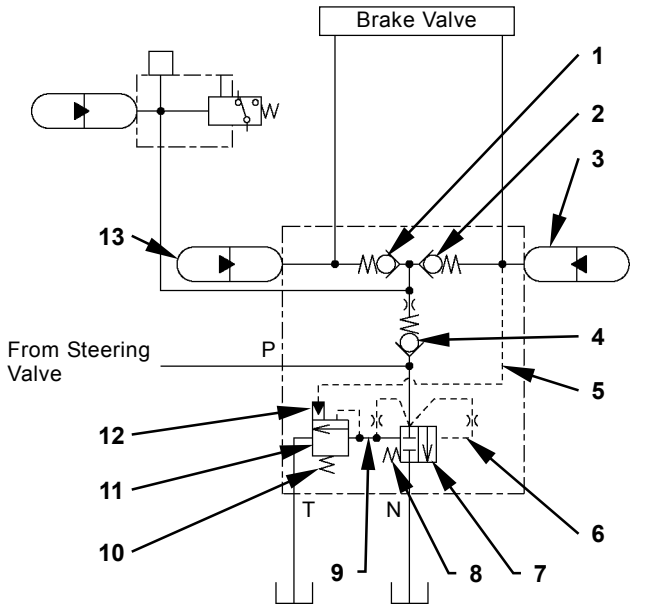



TCJB-03-11-001

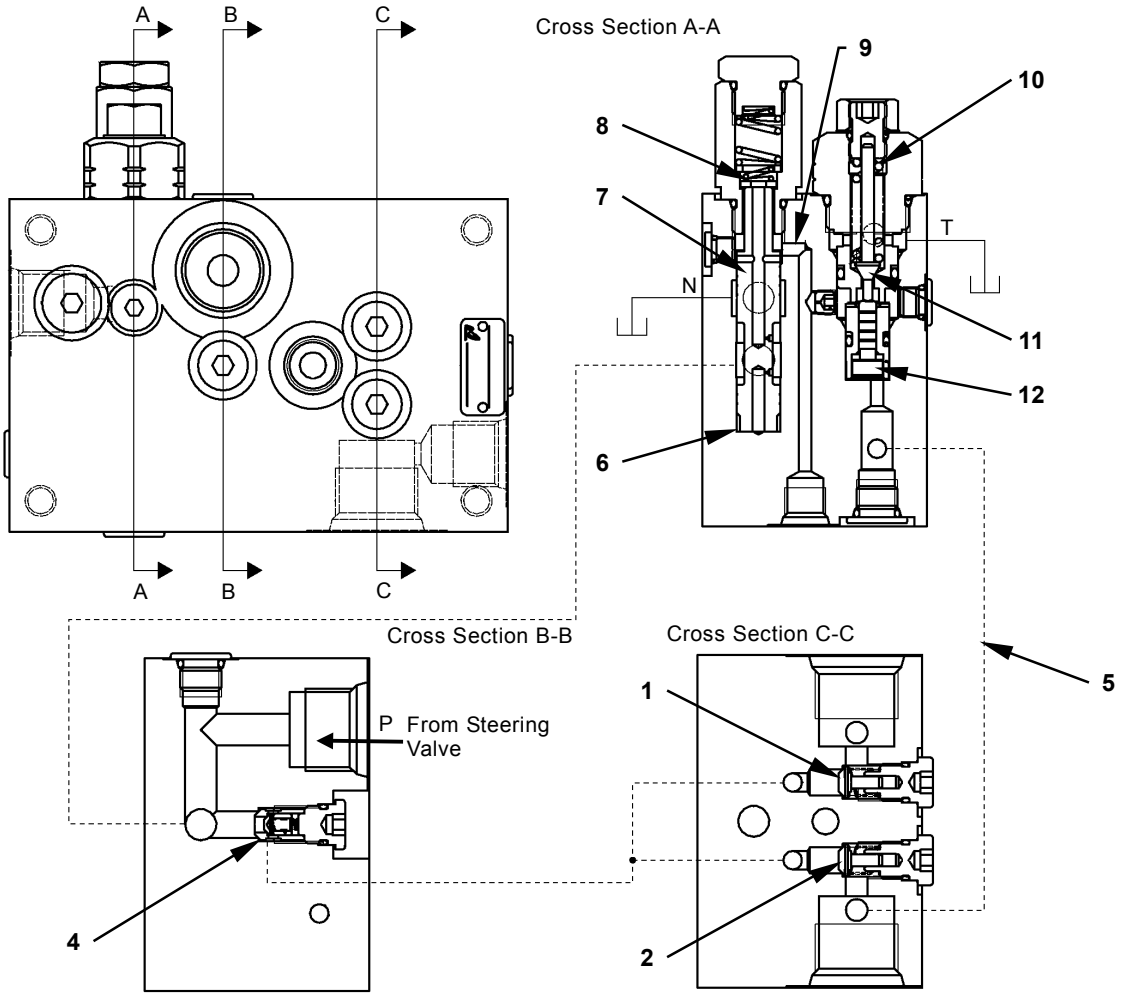
(Blank)

## ACCUMULATOR CHARGING VALVE

The accumulator charging valve is located between the steering valve and the brake valve circuit. The accumulator charging valve functions to give the pressure oil priority to flow to the brake circuit and simultaneously charges the accumulator in the brake circuit with the pressure oil. (Refer to the SYSTEM / Hydraulic System group.)

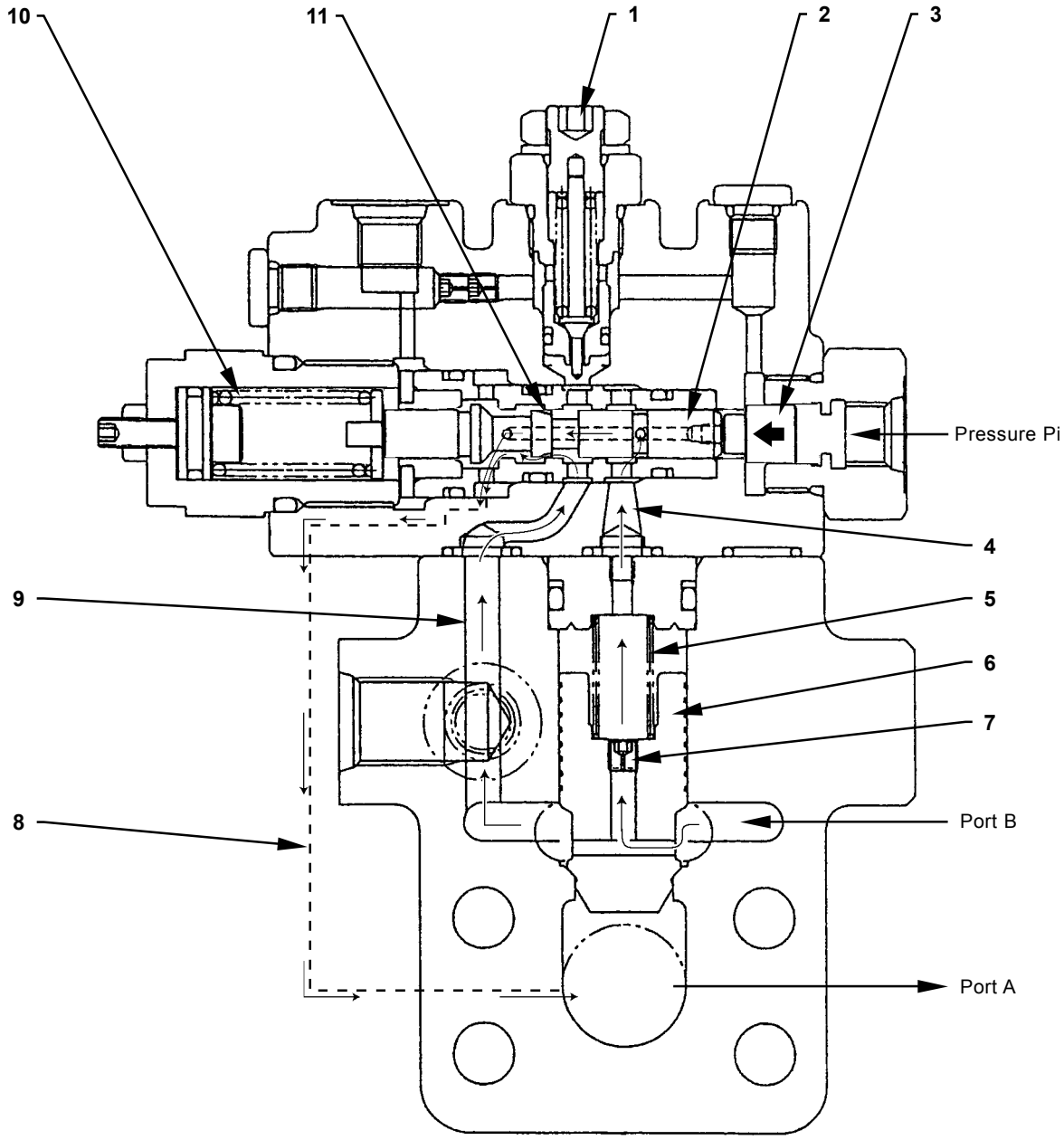



TCJB-03-12-008



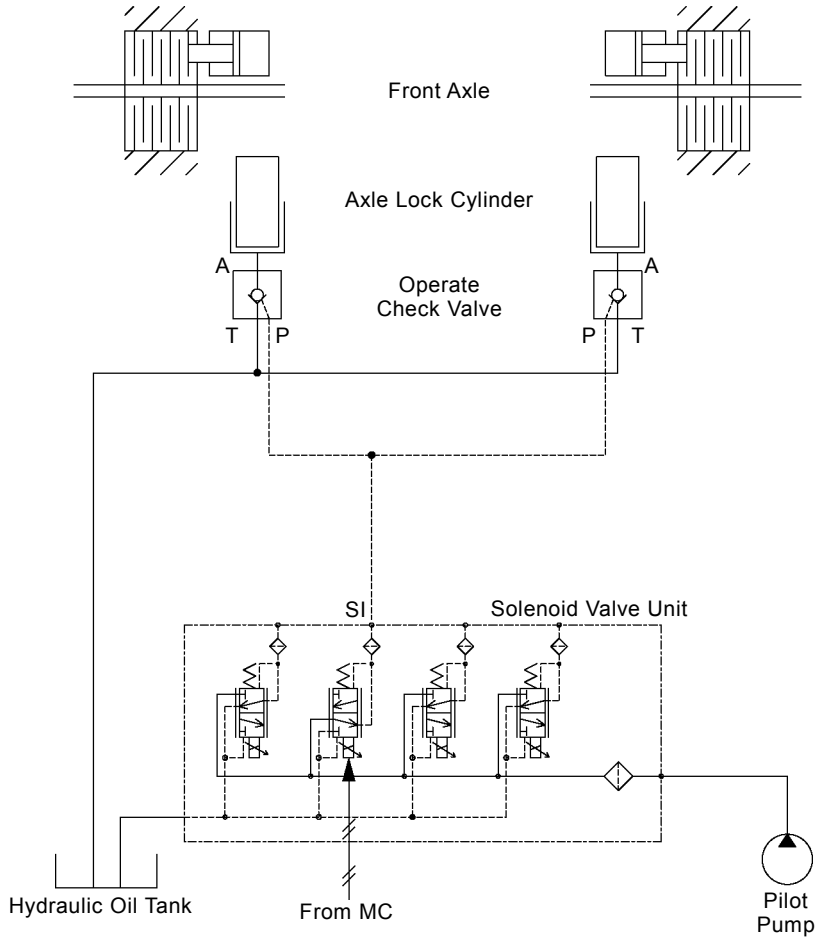

TCJB-03-12-012

1 - Check Valve
2 - Check Valve
3 - Accumulator
4 - Check Valve
5 - Passage
6 - Chamber A
7 - Spool
8 - Spring
9 - Passage
10 - Spring
11 - Pilot Piston
12 - Piston
13 - Accumulator
14 - Accumulator

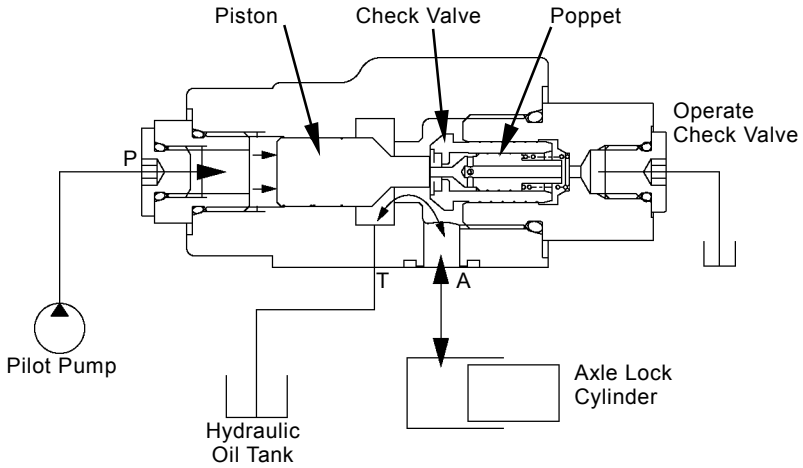



T1V1-03-07-016

1 - Relief Valve
2 - Spool
3 - Piston
4 - Passage A
5 - Spring
6 - Poppet
7 - Orifice
8 - Passage B
9 - Passage C
10 - Spring
11 - Orifice




TCJB-03-13-007




TCJB-03-13-005