Manual No. : KM-178E
Vol. No. : TO178E-02

Technical Manual

(Operational Principle)

ZAXIS

200 class

200•200LC•210H•210LCH•210•210LC•210N

225 class

225US•225USLC•225USR•225USRLC

230 class

230•230LC•240H•240LCH•250•250LC

270 class

270•270LC•280LC

Excavator

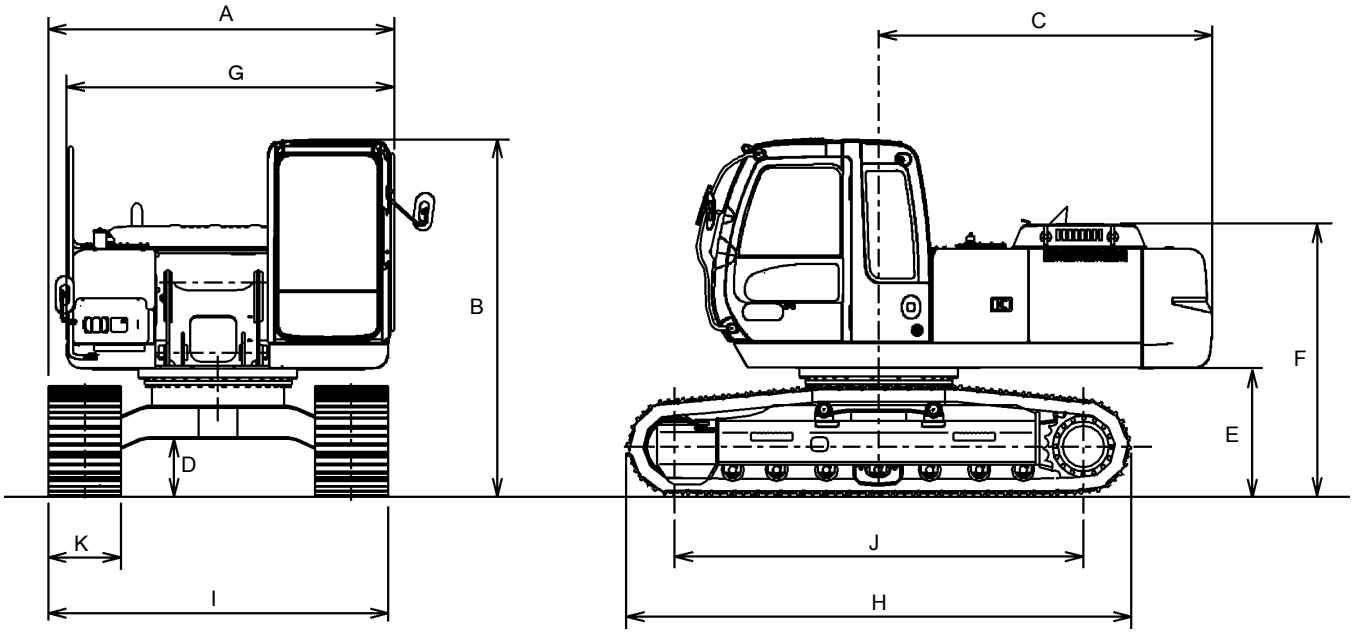
Service Manual (Manual No. KM-178E) consists of the following three separate volumes;

Technical Manual (Operational Principle)	: Vol. No. TO178E
Technical Manual (Troubleshooting)	: Vol. No. TT178E
Workshop Manual	: Vol. No. W178E

HITACHI

SPECIFICATIONS

ZAXIS200, ZAXIS200LC, ZAXIS210H, ZAXIS210LCH



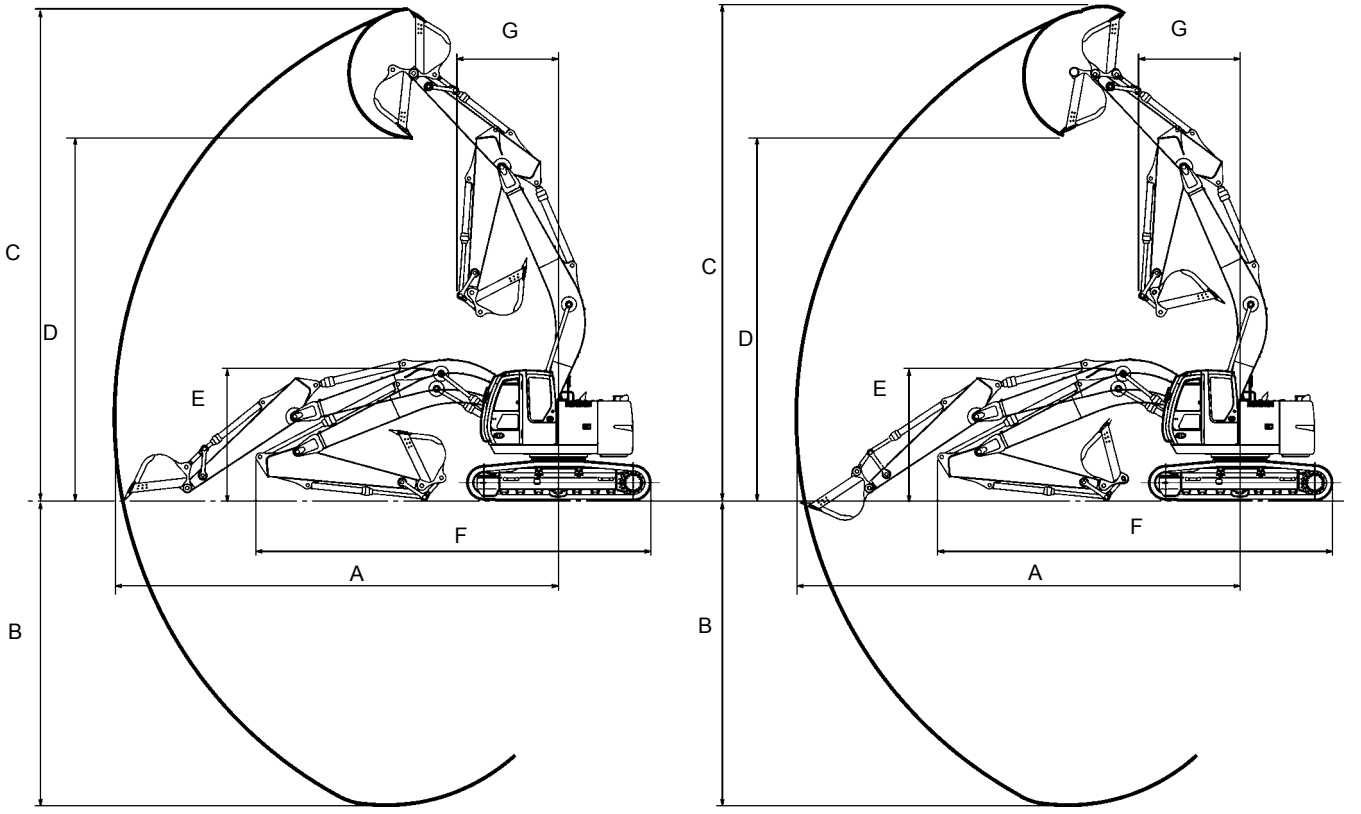
M178-12-001

Model	ZX200 Hydraulic Excavator	ZX200LC Hydraulic Excavator	ZX210H Hydraulic Excavator	ZX210LCH Hydraulic Excavator
Type of Front-End Attachment	2.22 m (7 ft 3 in) Arm or 2.91 m (9 ft 7 in) Arm		2.91 m (9 ft 7 in) H Arm	
Bucket Capacity (Heaped)	PCSA 0.8 m^3 (1.05 yd^3), CECE 0.7 m^3			
Operating Weight	19400 kg (42800 lb)	19900 kg (43900 lb)	20300 kg (44800 lb)	20800 kg (45900 lb)
Basic Machine Weight	15100 kg (33300 lb)	15600 kg (34400 lb)	15800 kg (34800 lb)	16300 kg (35900 lb)
Engine	Isuzu AA-6BG1T 103 kW/1900 min^{-1} (140 PS/1900 rpm) ✸ 110 kW / 2100 min^{-1} (150 PS /2100 rpm)			
A: Overall Width (Excluding back mirrors)	2860 mm (9 ft 5 in)	2990 mm (9 ft 10 in)	2860 mm (9 ft 5 in)	2990 mm (9 ft 10 in)
B: Cab Height	2950 mm (9 ft 8 in)	2950 mm (9 ft 8 in)	2950 mm (9 ft 8 in)	2950 mm (9 ft 8 in)
C: Rear End Swing Radius	2750 mm (9 ft 0 in)	2750 mm (9 ft 0 in)	2750 mm (9 ft 0 in)	2750 mm (9 ft 0 in)
D: Minimum Ground Clearance	* 450 mm (18 in) (Excluding shoe lug)			
E: Counterweight Clearance	* 1030 mm (3 ft 5 in) (Excluding shoe lug)			
F: Engine Cover Height	* 2220 mm (7 ft 3 in) (Excluding shoe lug)			
G: Overall Width of Upperstructure	2710 mm (8 ft 11 in)	2710 mm (8 ft 11 in)	2710 mm (8 ft 11 in)	2710 mm (8 ft 11 in)
H: Undercarriage Length	4170 mm (13 ft 8 in)	4460 mm (14 ft 8 in)	4170 mm (13 ft 8 in)	4460 mm (14 ft 8 in)
I: Undercarriage Width	2800 mm (9 ft 2 in)	2990 mm (9 ft 10 in)	2800 mm (9 ft 2 in)	2990 mm (9 ft 10 in)
J: Sprocket Center to Idler Center	3370 mm (11 ft 1 in)	3660 mm (12 ft 0 in)	3370 mm (11 ft 1 in)	3660 mm (12 ft 0 in)
K: Track Shoe Width	600 mm (24 in) (Grouser shoe)			
Ground Pressure	43 kPa (0.44 kgf/cm^2, 6.3 psi)	41 kPa (0.42 kgf/cm^2, 6.0 psi)	45 kPa (0.46 kgf/cm^2, 6.5 psi)	43 kPa (0.44 kgf/cm^2, 6.1 psi)
Swing Speed	13.3 min^{-1} (rpm)	13.3 min^{-1} (rpm)	13.3 min^{-1} (rpm)	13.3 min^{-1} (rpm)
Travel Speed (fast/slow)	5.5/3.6 km/h (3.4/2.2 mph)			
Gradeability	35° (tanθ = 0.70)			

NOTE: ✸ H/P mode

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

ZAXIS225US, ZAXIS225USLC



Backhoe

Face shovel (Reversed hoe bucket)

M1GF-12-002

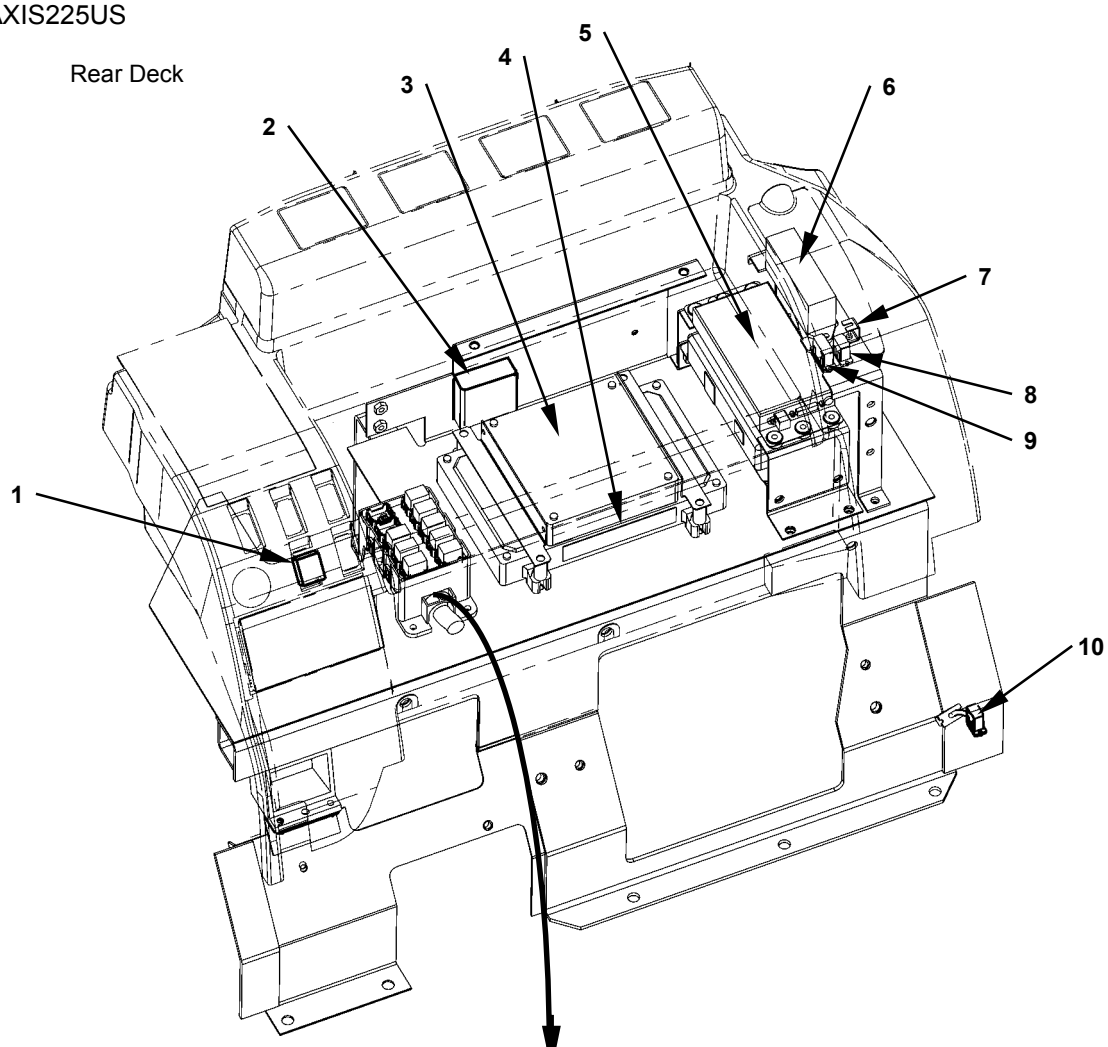
Item \ Category	2.22 m (7 ft 3 in) Arm				2.91 m (9 ft 7 in) Standard Arm			
	Backhoe		Shovel		Backhoe		Shovel	
	mm	ft·in	mm	ft·in	mm	ft·in	mm	ft·in
A: Maximum Digging Reach	9350	30′ 8″	9490	31′ 2″	10010	32′ 10″	10150	33′ 4″
B: Maximum Digging Depth	*6100	*20′ 0″	*6240	*20′ 6″	*6790	*22′ 3″	*6930	*22′ 9″
C: Maximum Cutting Height	*10550	*34′ 7″	*10710	*35′ 2″	*11100	*36′ 5″	*11250	*36′ 11″
D: Maximum Dumping Height	*7640	*25′ 1″	*7730	*25′ 4″	*8190	*26′ 10″	*8340	*27′ 4″
E: Transport Height	3160	10′ 4″	3100	10′ 2″	2990	9′ 10″	2950	9′ 8″
F: Overall Transport Length	9040	29′ 8″	9030	29′ 8″	8920	29′ 3″	8910	29′ 3″
G: Minimum Swing Radius	2590	8′ 6″	2590	8′ 6″	2300	7′ 7″	2300	7′ 7″

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

ELECTRICAL SYSTEM (Relays and Related Equipment)

Except ZAXIS225US

Rear Deck



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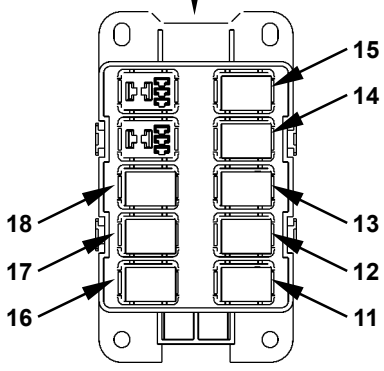


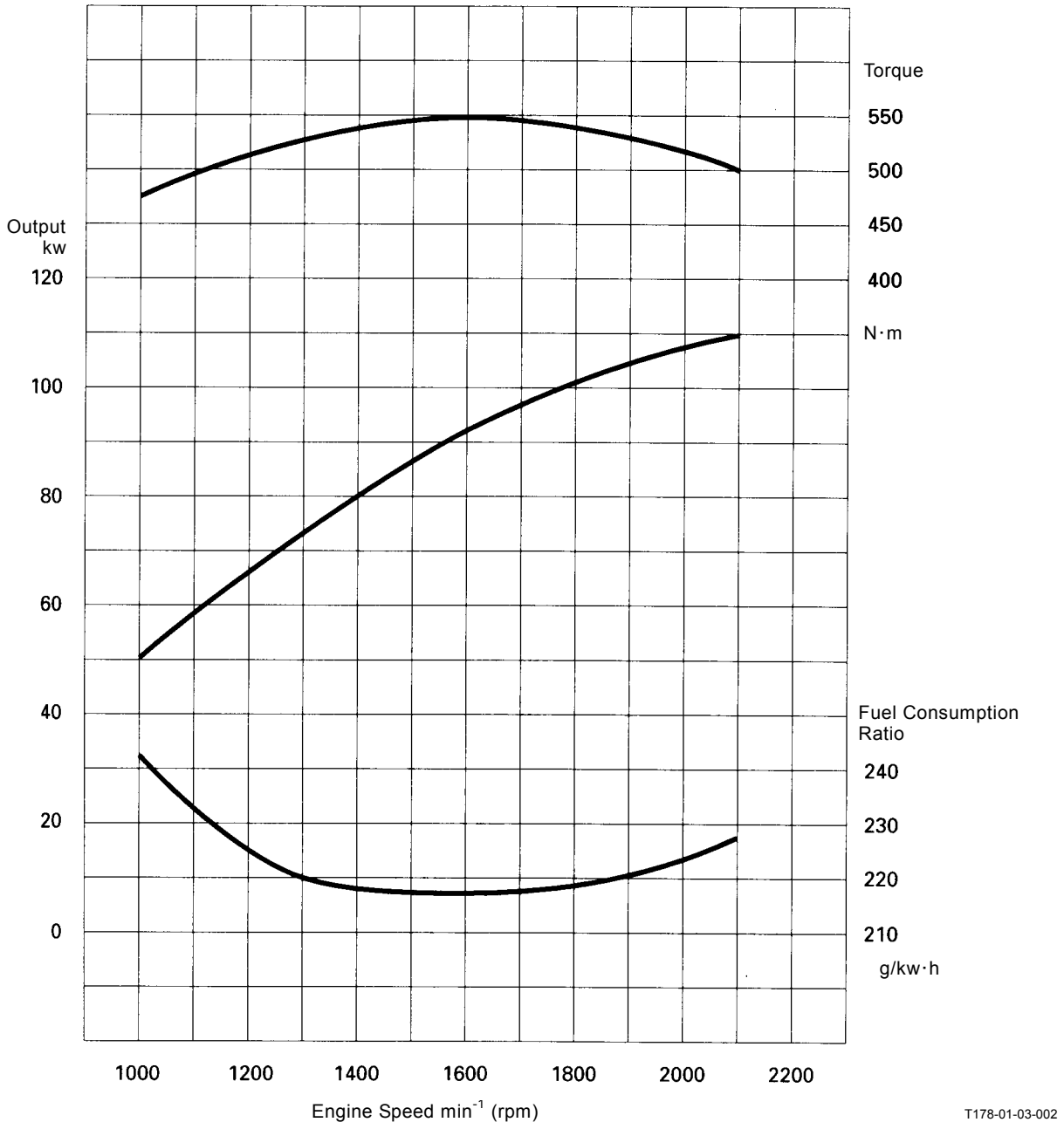
T178-01-02-007

1- Satellite Terminal ON/OFF Switch (Satellite Navigation System Equipped Machines only)
2- QOS Controller
3- ICX (Information Controller)
4- MC (Main Controller)
5- Satellite Terminal (Optional)
6- Fuse Box
7- Learning Switch
8- Dr. ZX Connector to MC
9- Download Connector (Not connected in Satellite Terminal equipped machines)
10- Dr. ZX Connector to ICX
11- Load Damp Relay (R1)
12- Washer Relay (R2)
13- Work Light Relay 2 (R3)
14- Work Light Relay 1 (R4)
15- Horn Relay (R5)
16- Wiper Relay A (R6)
17- Wiper Relay B (R7)
18- Wiper Relay C (R8)

ZX200 class, ZX225 class:

Engine Performance Curve (AA-6BG1TRA)

Test Condition: 1. In conformity with JIS D1005 (Performance Test Method for Diesel Engine Used for Construction Machinery) under standard atmospheric pressure.
2. Equipped with the fan and alternator.



FRONT ATTACHMENT PILOT VALVE
Model HVP06A-040-101

TRAVEL PILOT VALVE
Model HVP05F-040-101

SOLENOID VALVE UNIT
Function . . . . . · SC : Arm Regenerative Control
· SE* : Arm Flow Rate Control
· SG : Power Digging Control
· SI : Travel Motor Swash Angle Control

*NOTE: * Up to serial No.104678 (ZX200 class and 225 class)*
Up to serial No.010326 (ZX230 class)
Up to serial No.020042 (ZX270 class)

PILOT PRESSURE SIGNAL CONTROL VALVE
Function . . . . . · Shock Reducing (Boom Lower)
· Pump Flow Rate Control
· Bucket Flow Rate Control
· Swing Parking Brake Release
· Flow Combiner Valve Control
· Arm Flow Rate Control**

*NOTE:** Serial No.104679 and up (ZX200 class and 225 class)*
Serial No.010327 and up (ZX230 class)
Serial No.020043 and up (ZX270 class)

PILOT SHUT-OFF VALVE
Type . . . . . Rotary Type

OIL COOLER BYPASS CHECK VALVE
Cracking Pressure . . . . . 490 kPa (5 kgf/cm^2) at 5 L/min

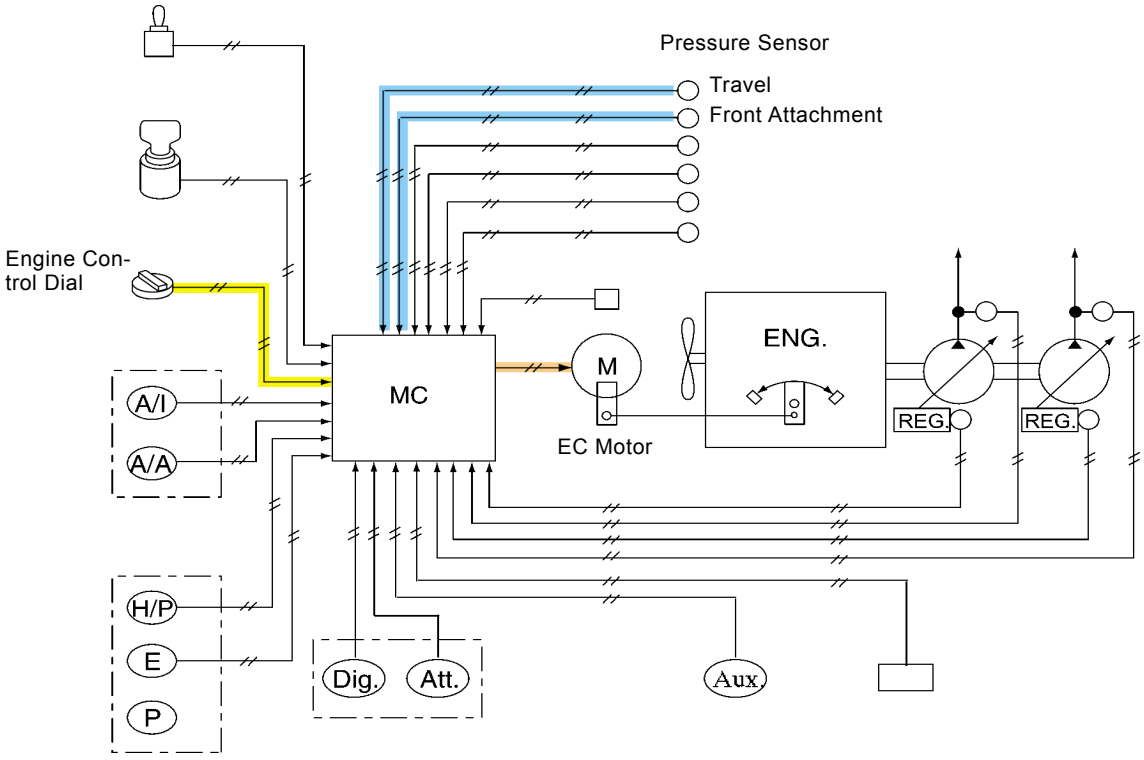
ELECTRICAL COMPONENT

BATTERY RELAY
Voltage / Current. . . . . 24 V / 100 A

GLOW RELAY
Voltage . . . . . 24 V

HORN
Voltage / Current. . . . . 24 V·1.5±0.5 A
Sound Pressure . . . . . 113 dB (A)

ILLUMINATION
Specifications . . . . . Work Light : Halogen 24V, 70 W / 60 W
Cab Light : ZX200 class, ZAXIS225USR,
ZX230 class, ZX270 class
24 V, 12 W
ZAXIS225US,
24 V, 12 W



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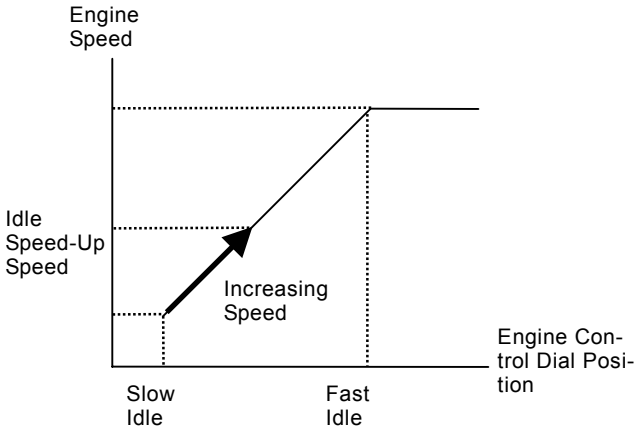
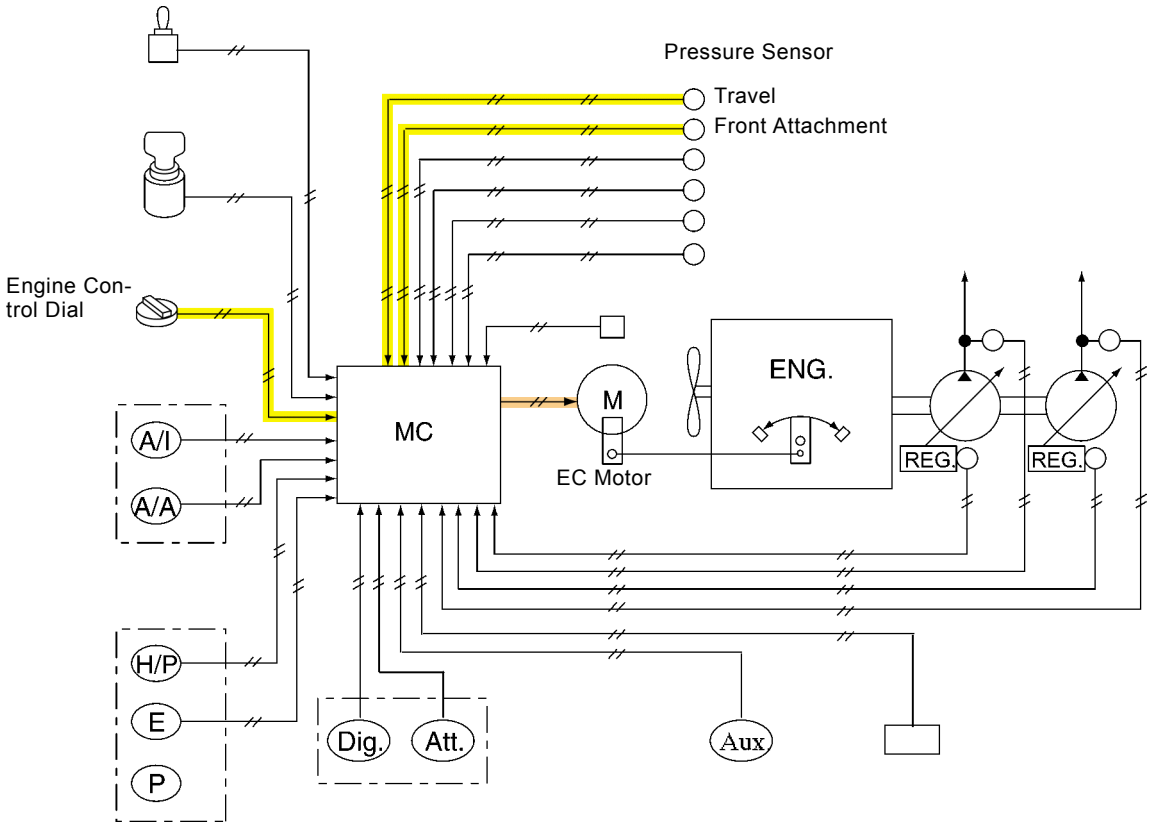
Idle Speed-Up Control

Function: Prevents the engine from hunting when running the engine at slow speed.

Operation: When the travel or front attachment function is operated while the engine is running at a speed between the minimum speed and the Idle Speed-Up Speed, the MC drives the EC motor so that the engine speed is increased to the Idle Speed-Up Speed.





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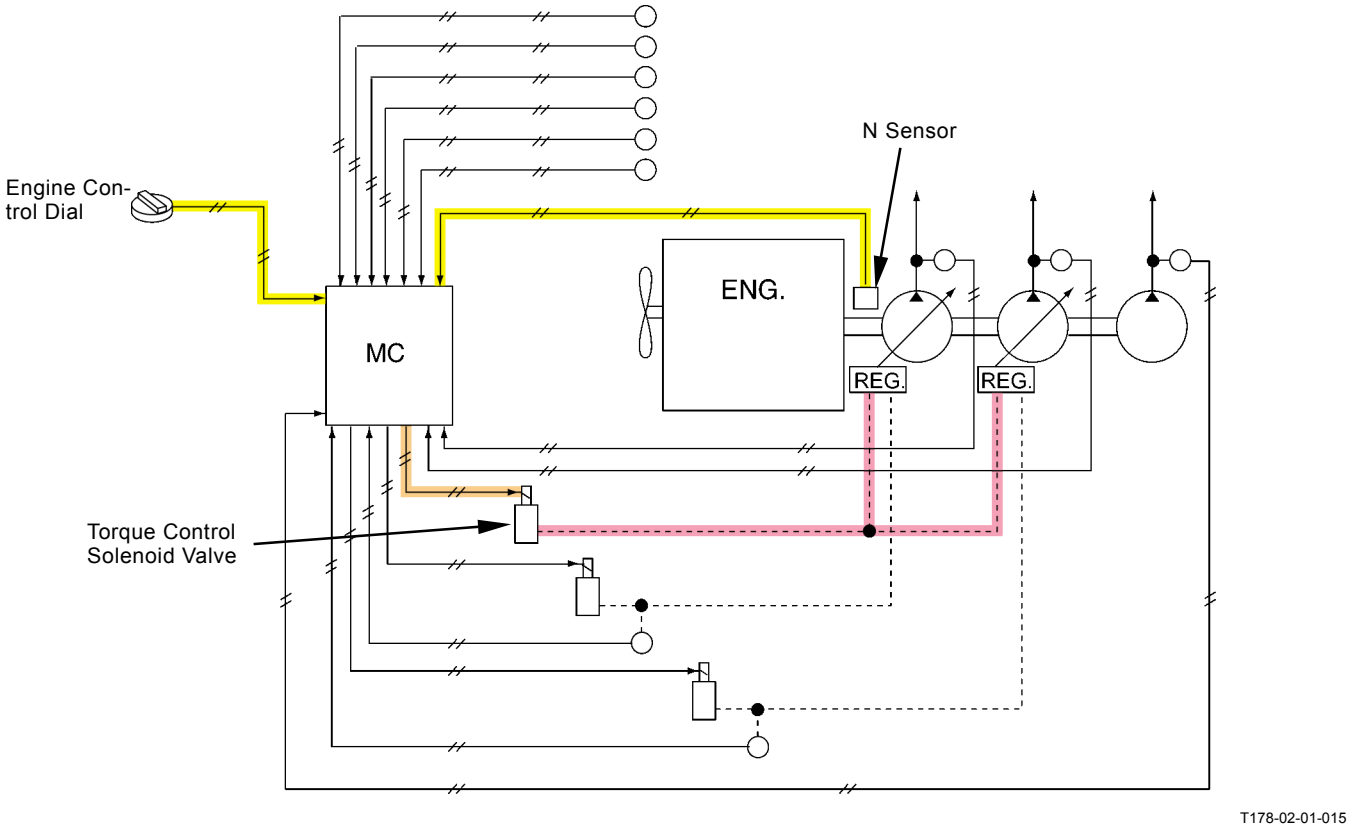
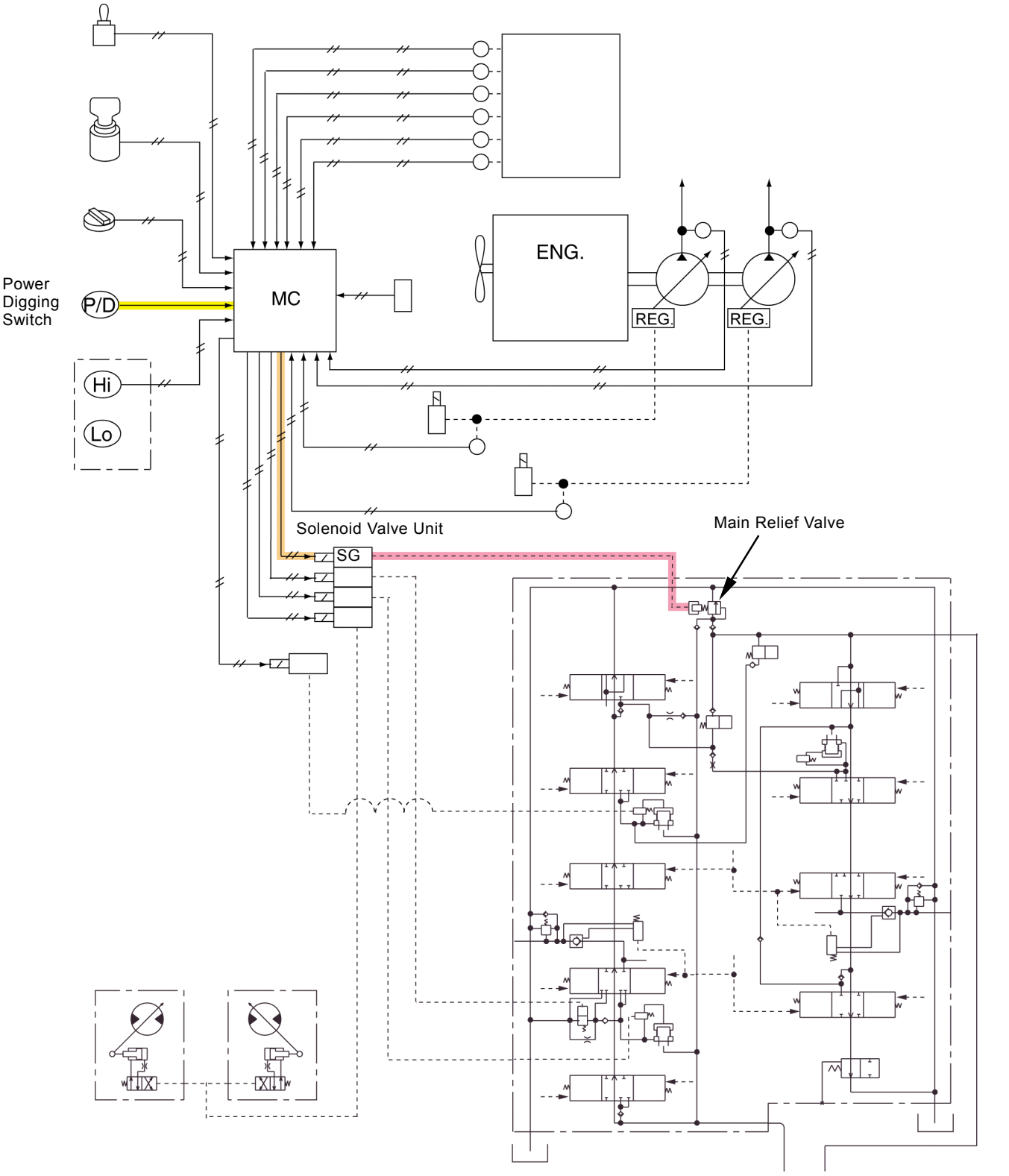

Engine Con-
trol Dial
N Sensor
ENG.
MC
REG.
REG.
Torque Control
Solenoid Valve
T178-02-01-015



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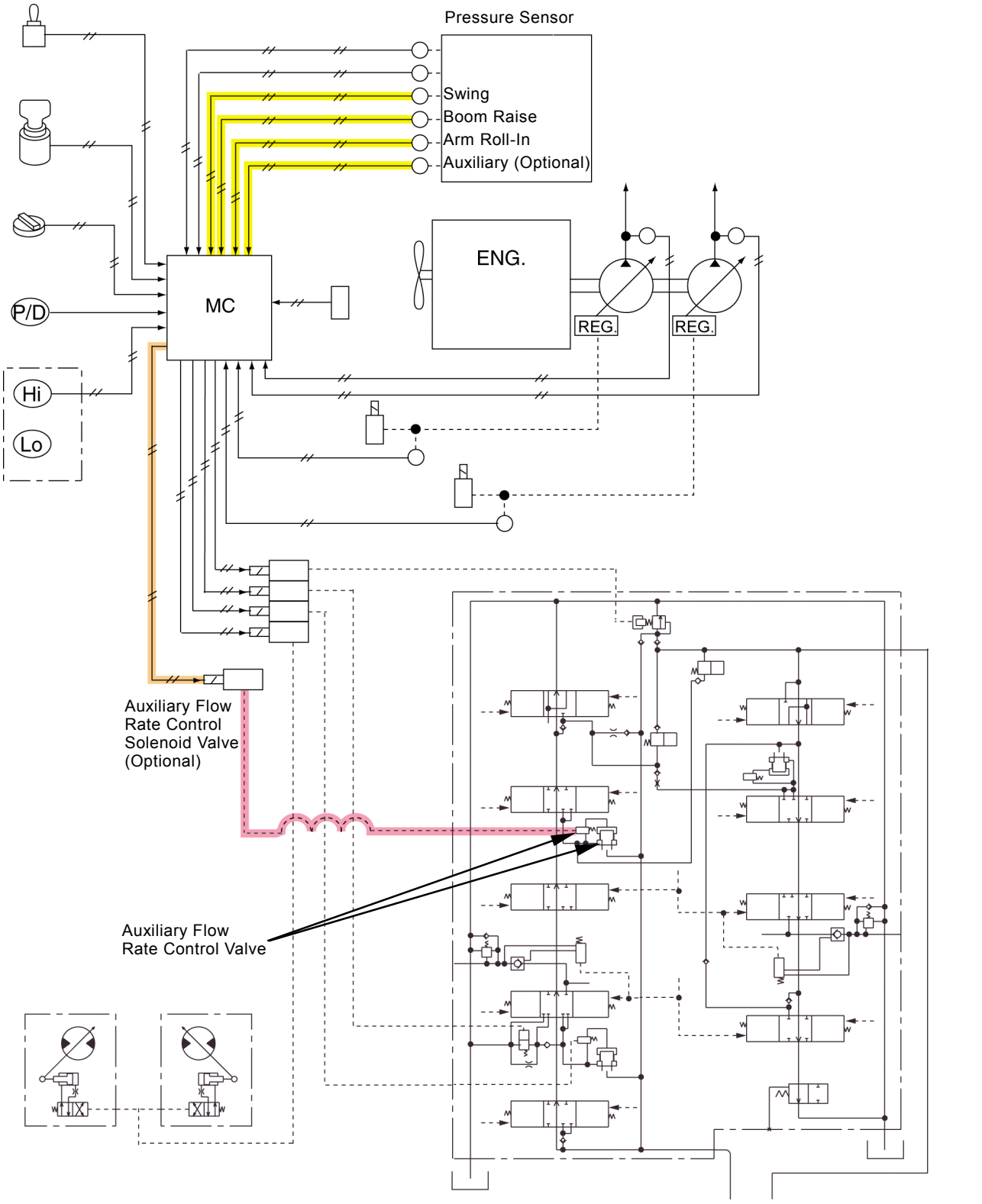
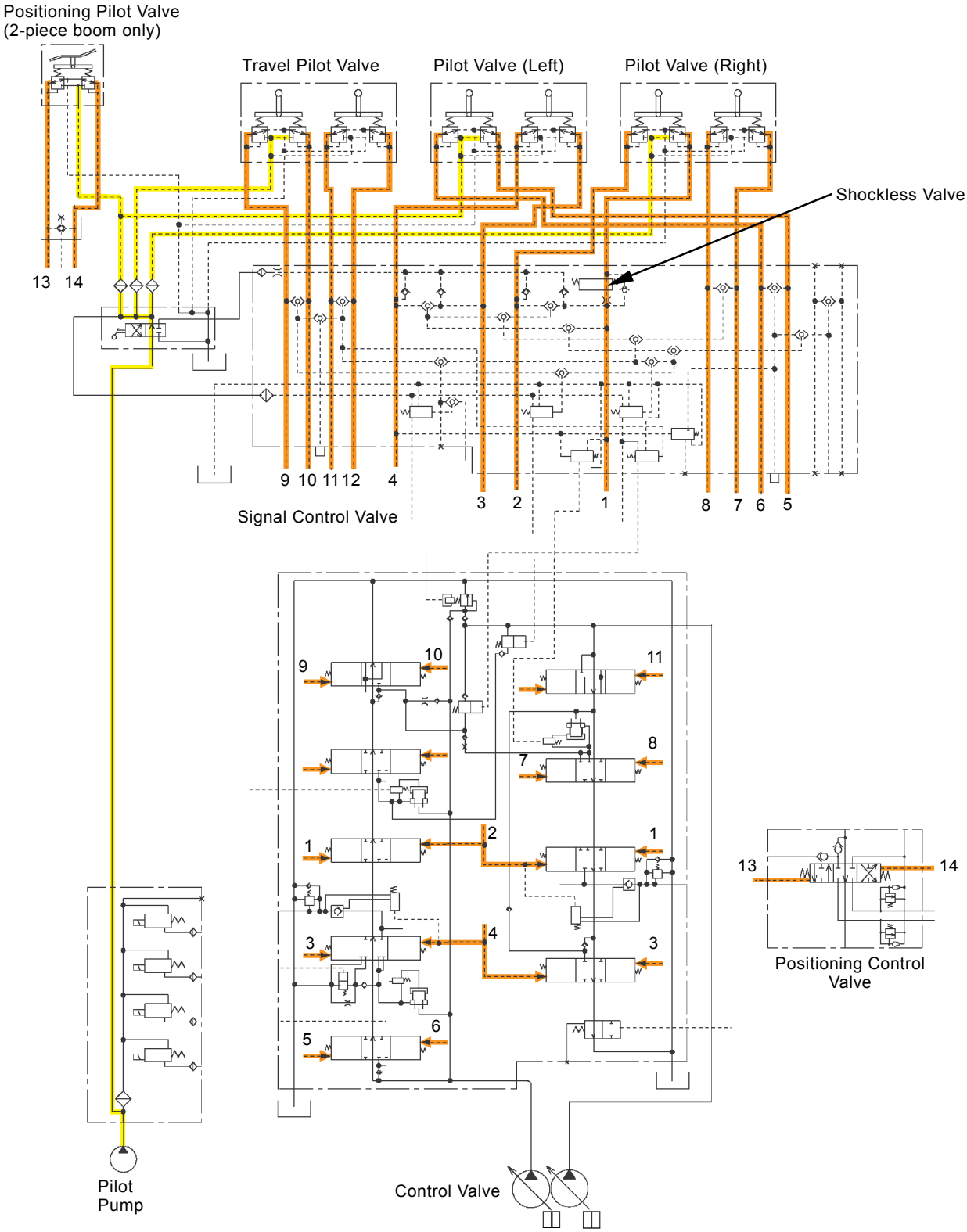


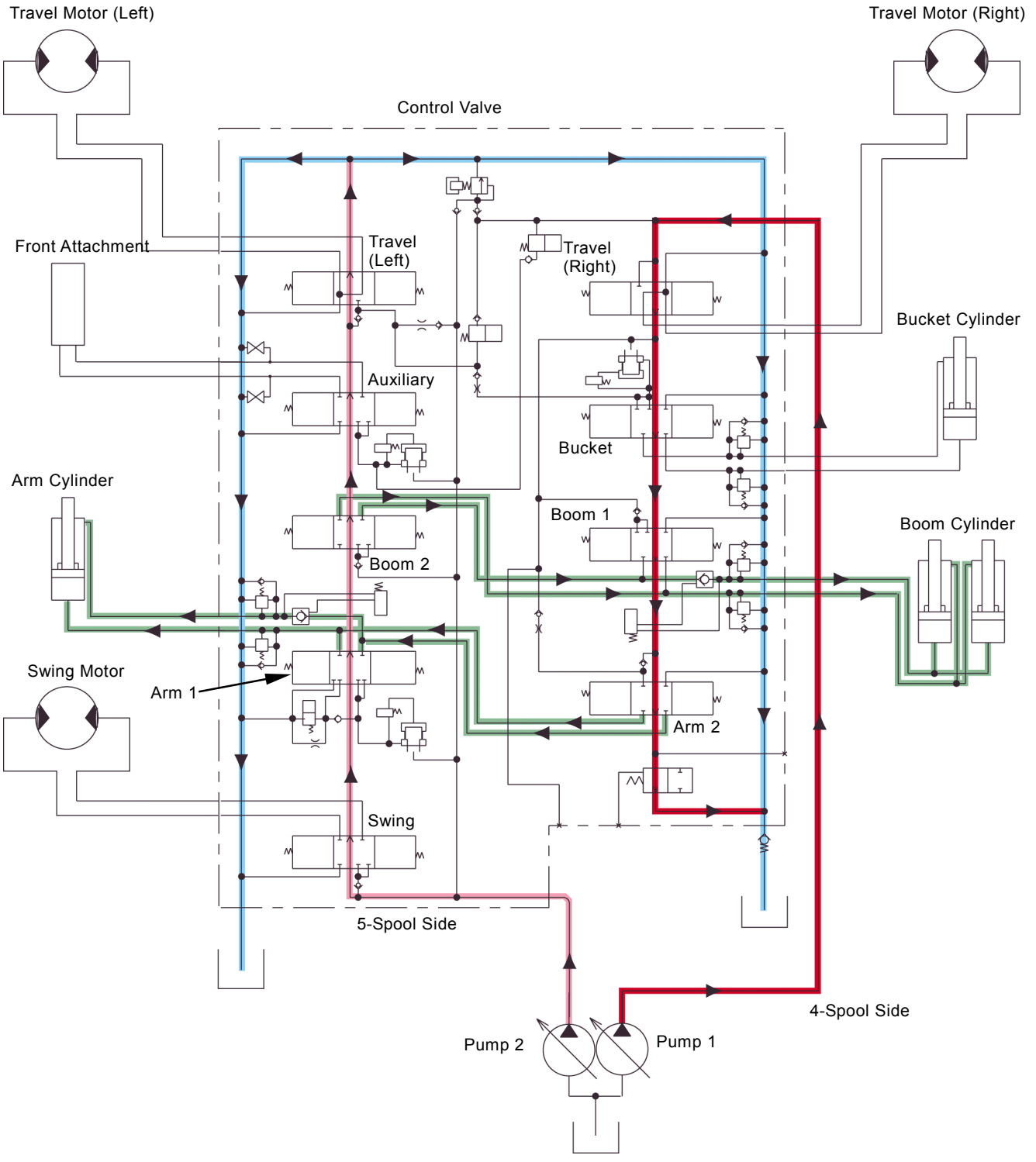
T178-02-01-024

ZX200 class, ZAXIS225USR, 230 class, 270 class,
ZAXIS225US (Serial No.104909 and up)



T178-02-02-012

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
9 - Left Travel Forward
10 - Left Travel Reverse
11 - Right Travel Forward
12 - Right Travel Reverse
13 - Positioning Lower
14 - Positioning Raise


Travel Motor (Left)
Travel Motor (Right)
Control Valve
Front Attachment
Travel (Left)
Travel (Right)
Bucket Cylinder
Auxiliary
Bucket
Arm Cylinder
Boom 1
Boom Cylinder
Boom 2
Swing Motor
Arm 1
Arm 2
Swing
5-Spool Side
4-Spool Side
Pump 2
Pump 1
T178-02-02-001

OUTLINE

The electrical circuit is broadly divided into the main circuit, monitor circuit, and control circuit.

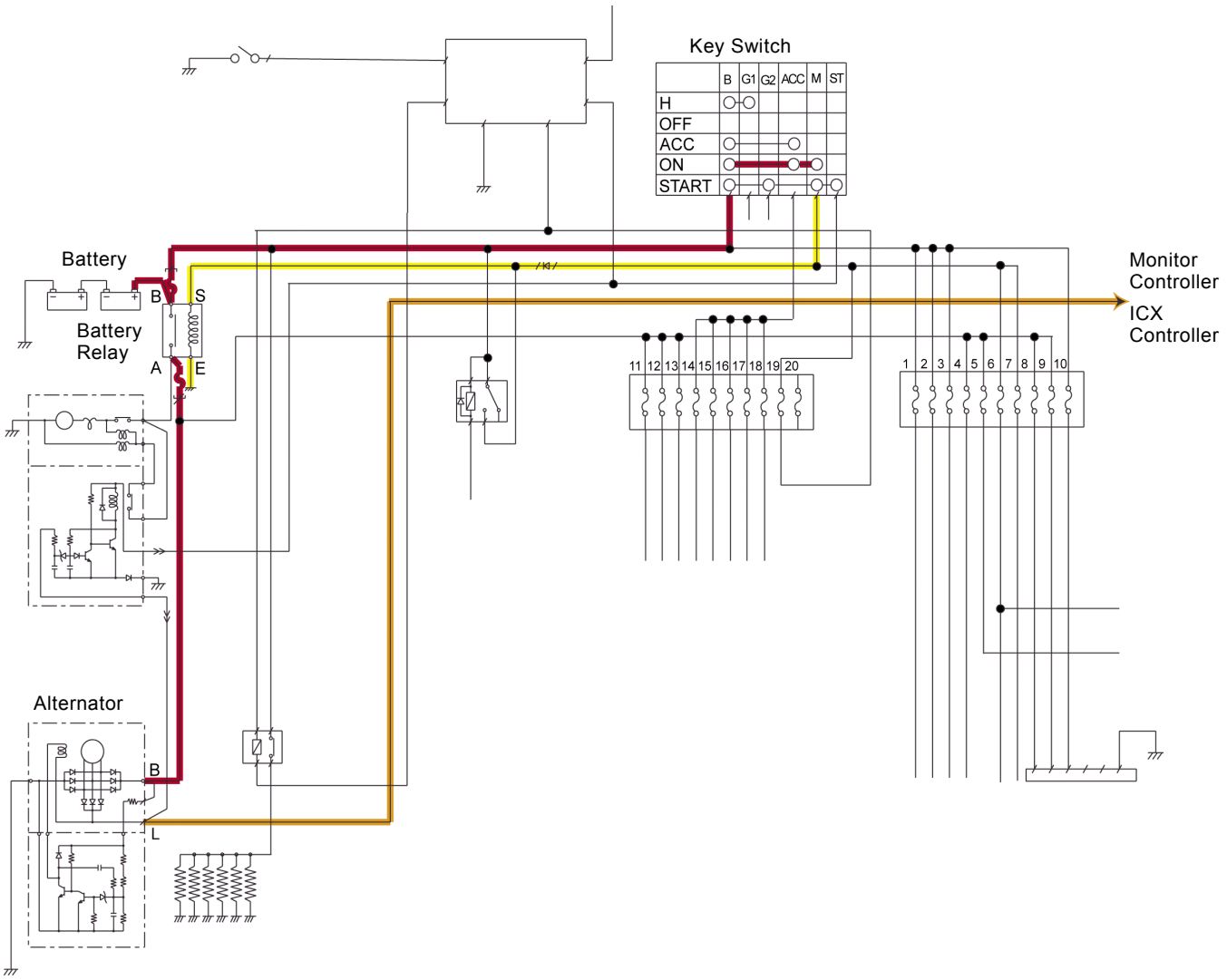
- Main Circuit
  The engine and accessory operation related circuit.

- Monitor Circuit
  The electrical circuit group consists of the monitors, sensors, and switches, and displays the machine operation status.

- Control Circuit (Refer to the SYSTEM / Control System group.)
  The control circuit is categorized into the engine, pump, and valve control circuits. Each circuit consists of the actuators such as solenoid valves, MC (main controller), switch boxes, sensors and pressure switches.

CHARGING CIRCUIT (KEY SWITCH: ON)

- After the engine starts and the key switch is released, the key switch moves to the ON position.
- Then, key switch terminal B is connected to terminals ACC and M in the key switch.
- When the alternator starts generating electricity, current flows from alternator terminal B to the batteries via the battery relay, charging the batteries.
- Current from alternator terminal L flows to the monitor controller and the ICX controller, turning the alternator indicator OFF.

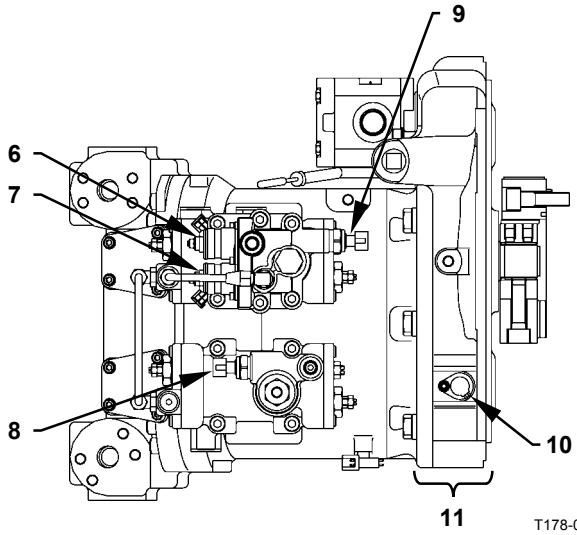


T178-02-03-006

OUTLINE

The pump device consists of transmission (11), main pump[pump 1 (1) and pump 2 (2)] and pilot pump (3). The engine output is transmitted to transmission (11) via coupling (12). After being distributed by the gear train in the transmission, the engine power drives pump 1 (1), pump 2 (2), and pilot pump (3). Both reduction gear ratios of the main pumps and pilot pump are 1:1. The transmission 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. The pilot pump is a gear pump.
Pump delivery pressure sensors (4 and 5), pump control pressure sensors (8 and 9), and N sensor (engine speed sensor) (10) are provided to control pump and valve operations.



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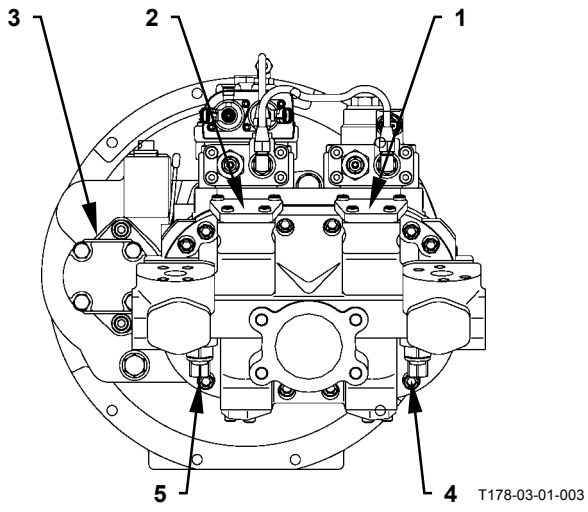

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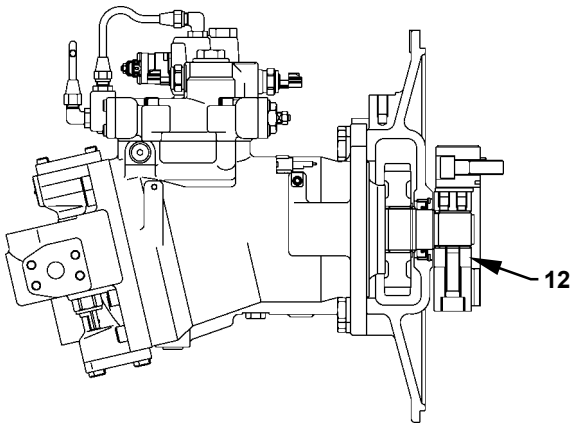
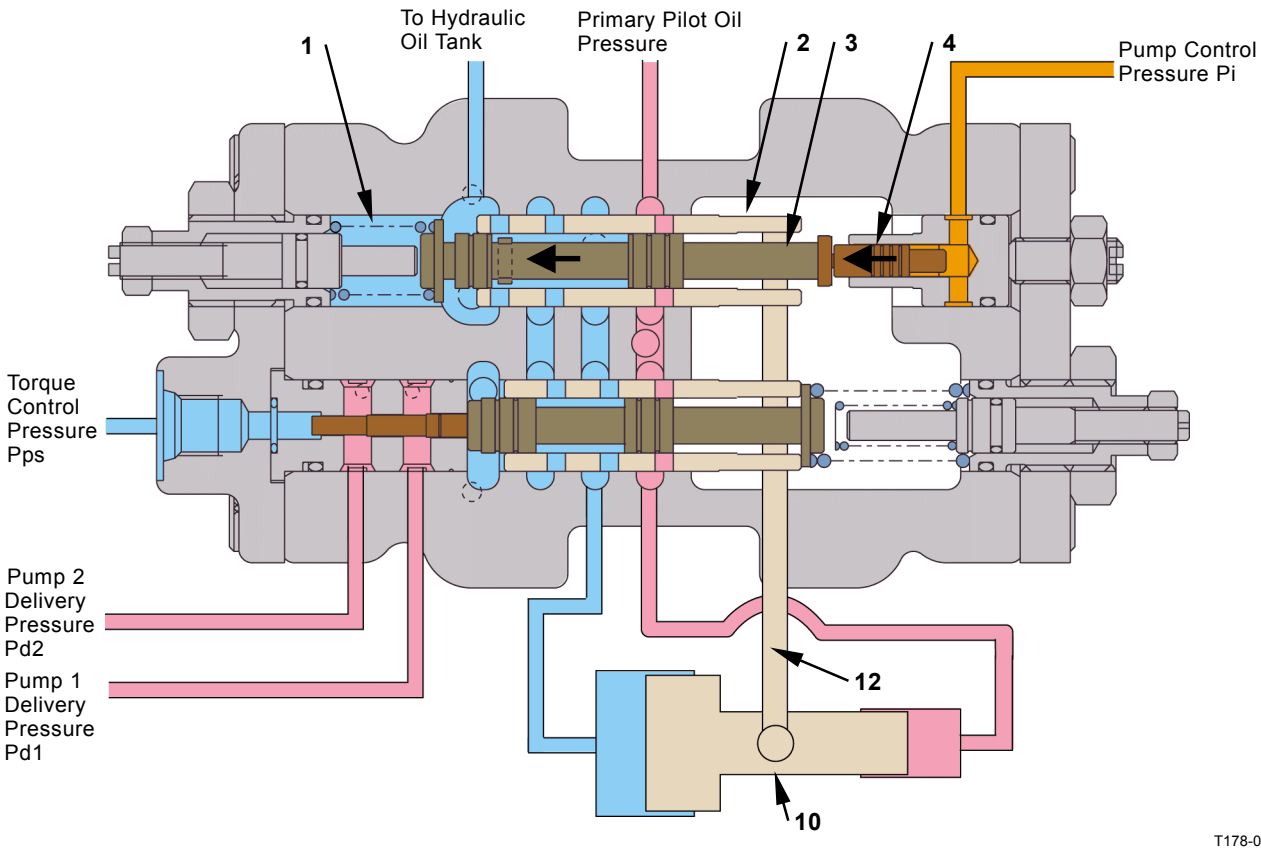


T178-03-01-002

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



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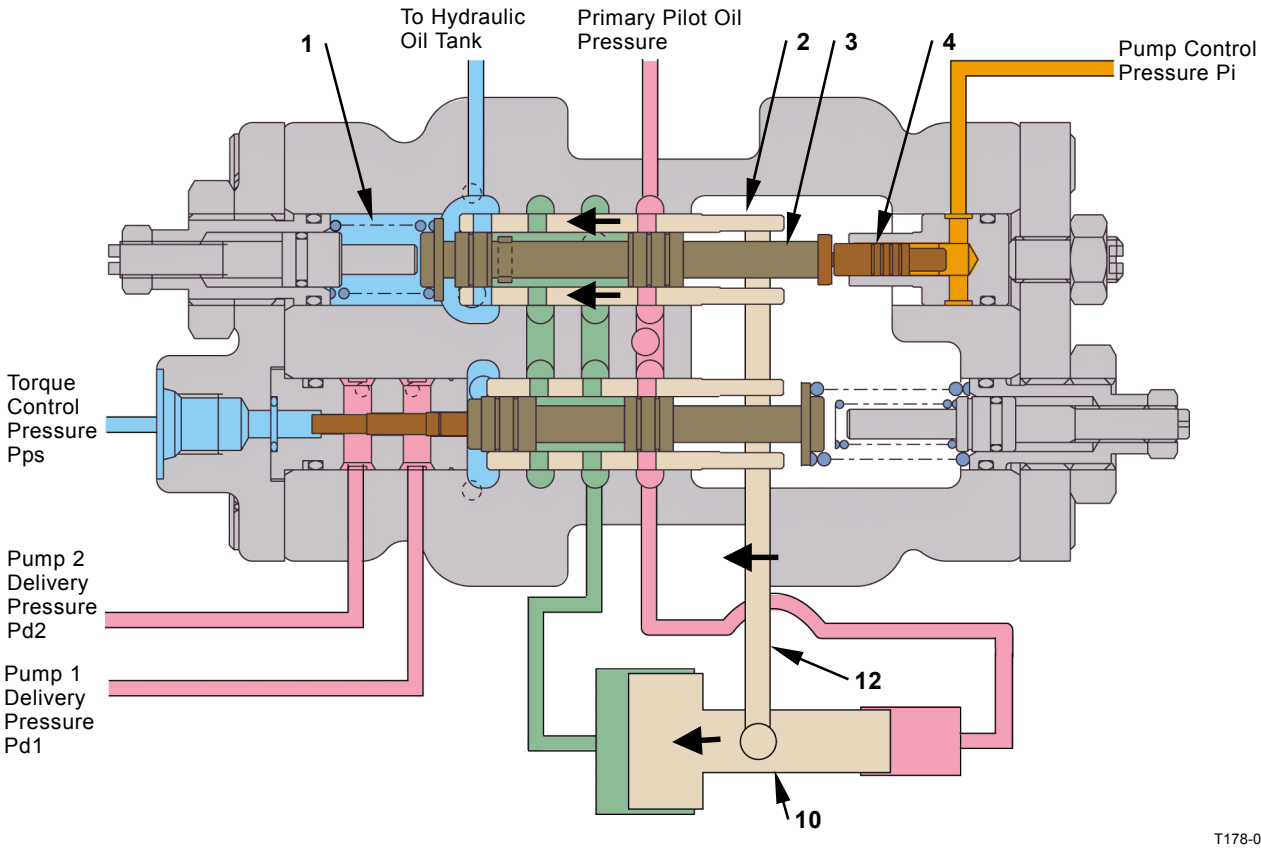

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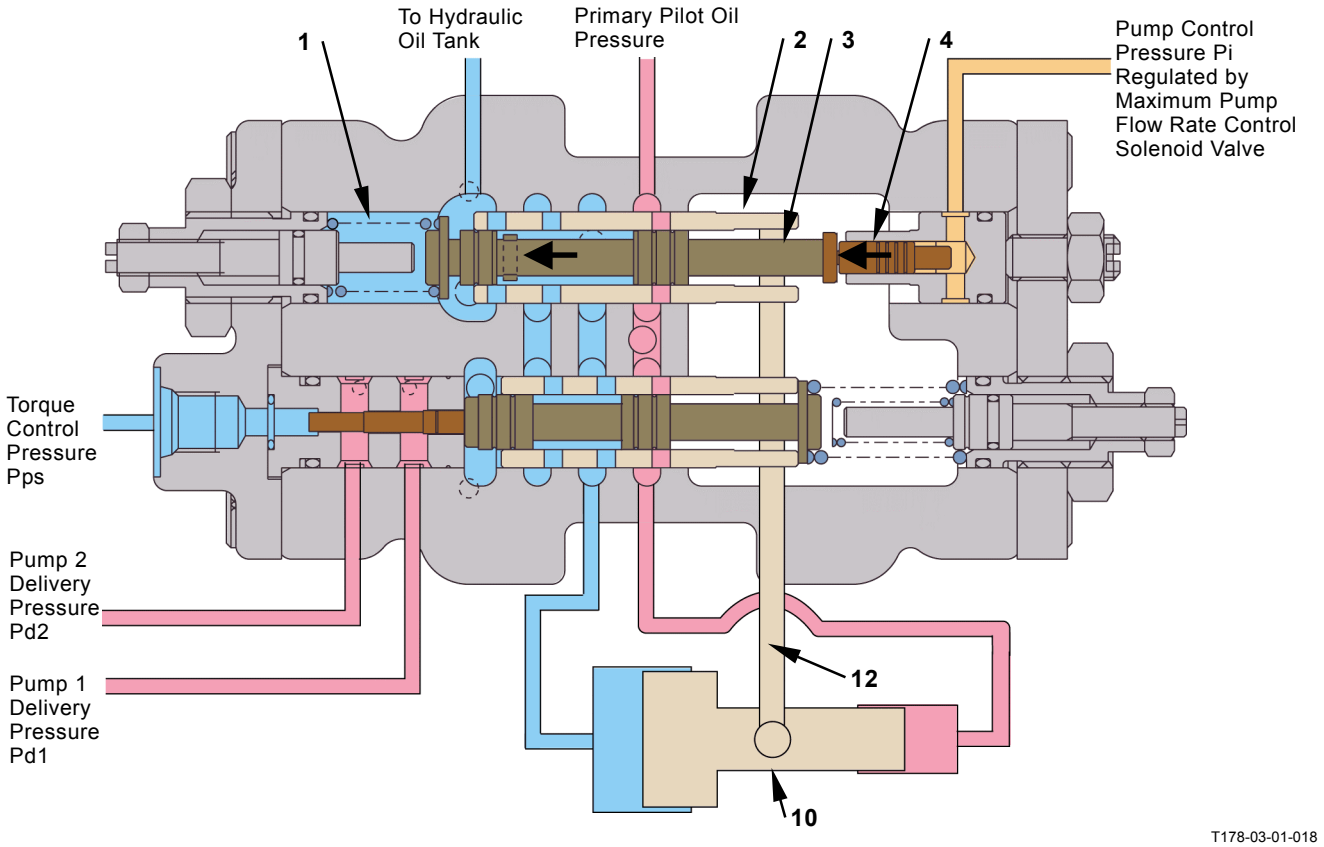

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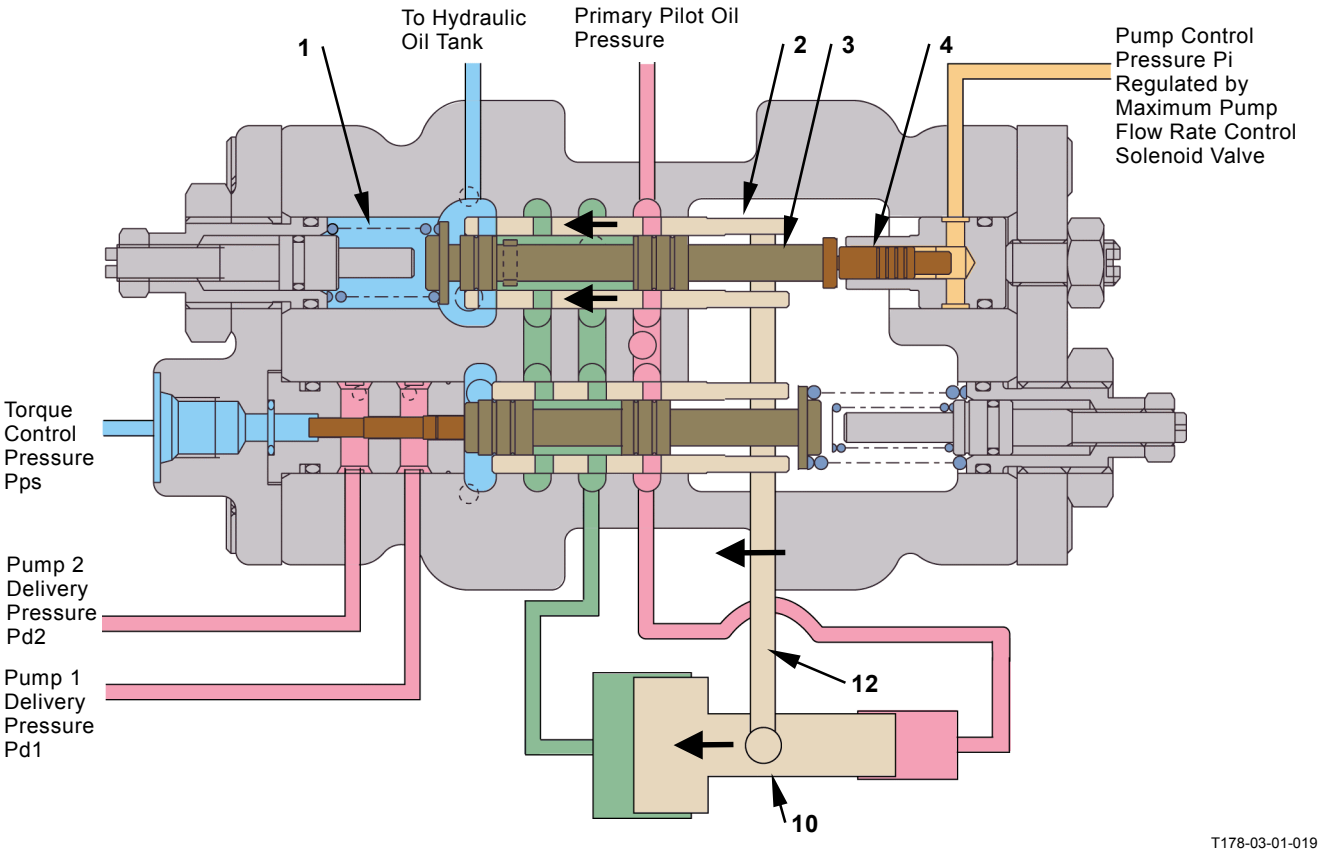
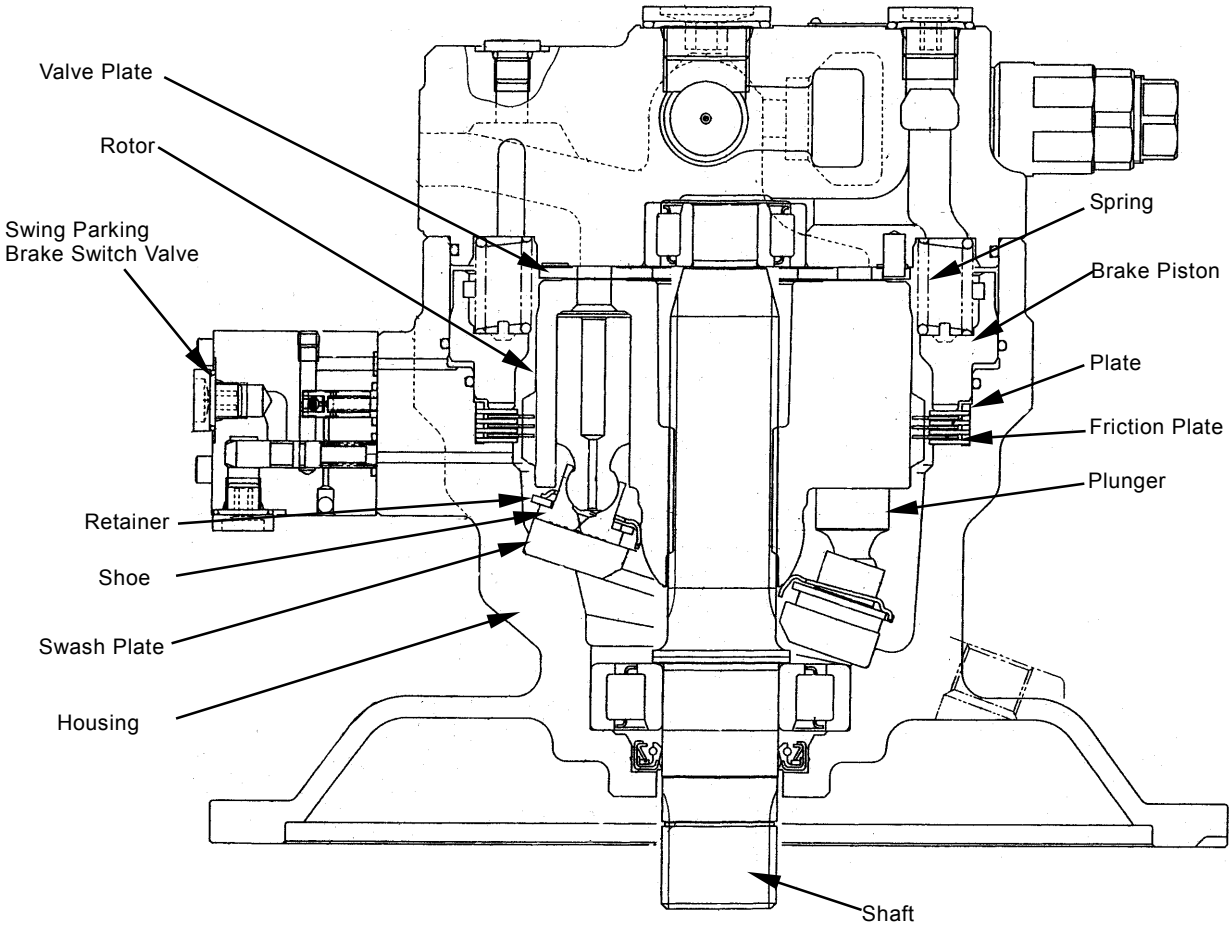


T178-03-01-019

ZX270 class



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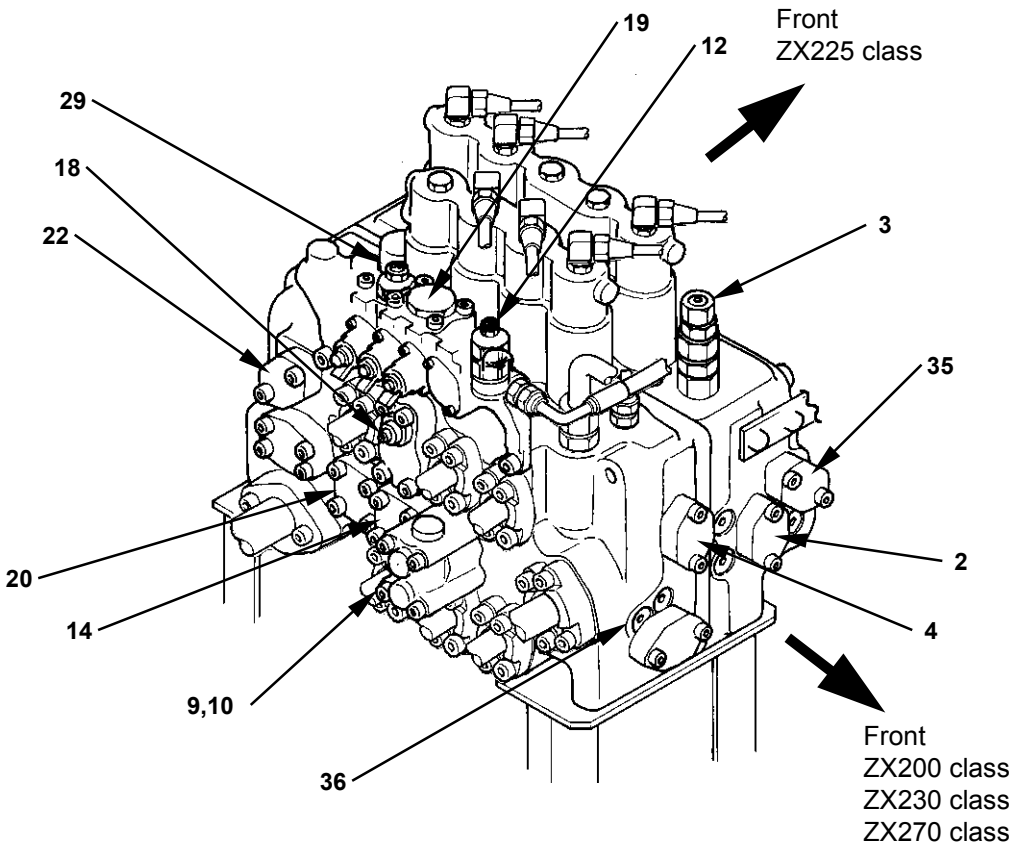
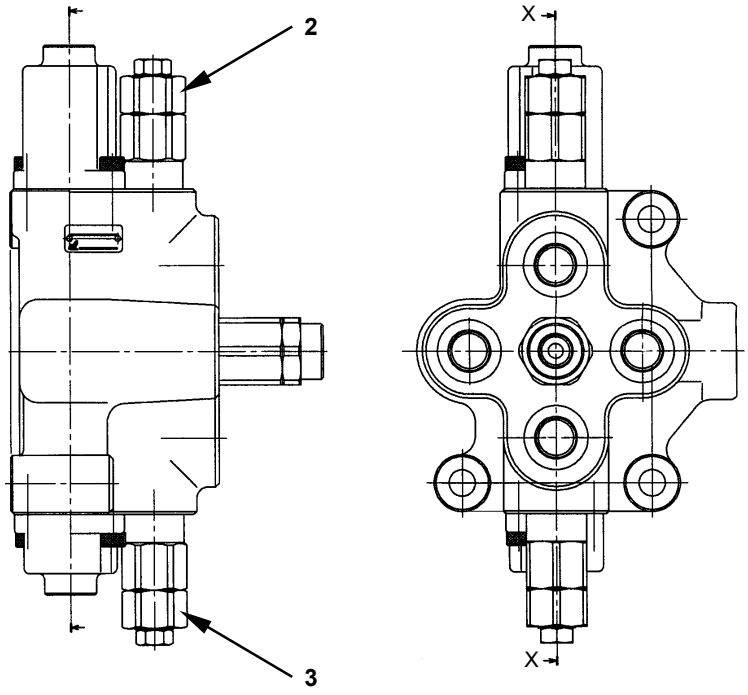


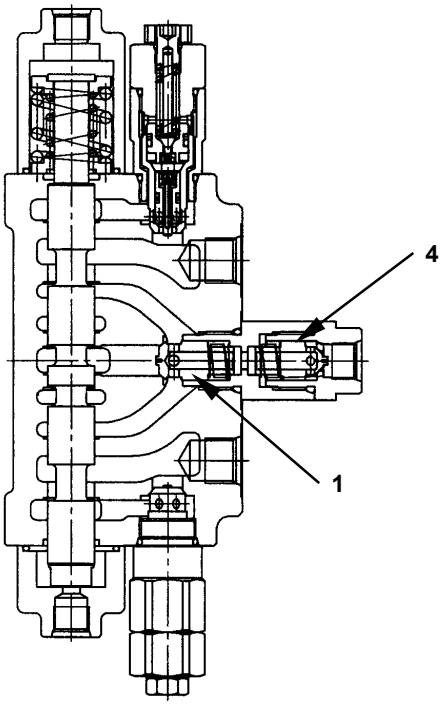
1 - Load Check Valve (Travel Parallel Circuit)
2 - Check Valve (Main Relief Circuit)
3 - Main Relief Valve
4 - Check Valve (Main Relief Circuit)
5 - Check Valve (Flow Combiner Valve Circuit)
6 - Flow Combiner Valve
7 - Auxiliary Flow Combiner Valve
8 - Check Valve (Aux. Flow Combiner Valve Circuit)
9 - Bucket Flow Rate Control Valve (Switch Valve)
10 - Bucket Flow Rate Control Valve (Poppet Valve)
11 - Bucket Regenerative Valve
12 - Overload Relief Valve (Bucket: Rod Side)
13 - Overload Relief Valve (Bucket: Bottom Side)
14 - Load Check Valve (Boom 1 Parallel Circuit)
15 - Boom Regenerative Valve
16 - Overload Relief Valve (Boom: Bottom Side)
17 - Overload Relief Valve (Boom: Rod Side)
18 - Boom Anti-Drift Valve (Check Valve)
19 - Boom Anti-Drift Valve (Switch Valve)
20 - Load Check Valve (Arm Tandem Circuit)
21 - Check Valve (Orifice) (4-Spool Side Parallel Circuit)
22 - Bypass Shut-Out Valve
23 - Arm Flow Rate Control Valve (Poppet Valve)
24 - Arm Flow Rate Control Valve (Switch Valve)
25 - Load Check Valve (Swing Circuit)
26 - Check Valve (Arm Regenerative Circuit)
27 - Arm Regenerative Valve
28 - Overload Relief Valve (Arm: Bottom Side)
29 - Overload Relief Valve (Arm: Rod Side)
30 - Arm Anti-Drift Valve (Check Valve)
31 - Arm Anti-Drift Valve (Switch Valve)
32 - Load Check Valve (Boom 2 Parallel Circuit)
33 - Auxiliary Flow Rate Control Valve (Switch Valve)
34 - Auxiliary Flow Rate Control Valve (Poppet Valve)
35 - Load Check Valve (Travel Tandem Circuit)
36 - Load Check Valve (Orifice) (Bucket)

Positioning Control Valve
(2-Piece Boom Only)



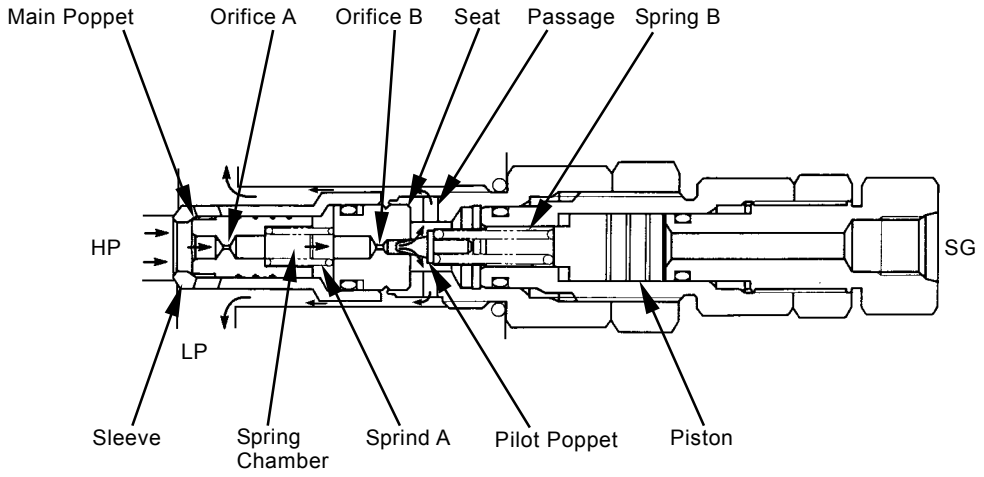
T198-03-03-002

Section X-X



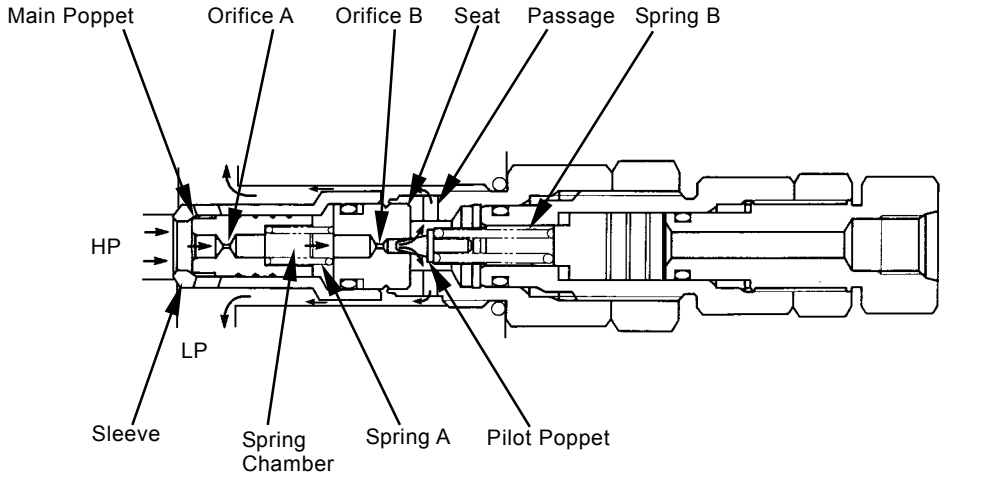
T198-03-03-003

During Normal Operation:



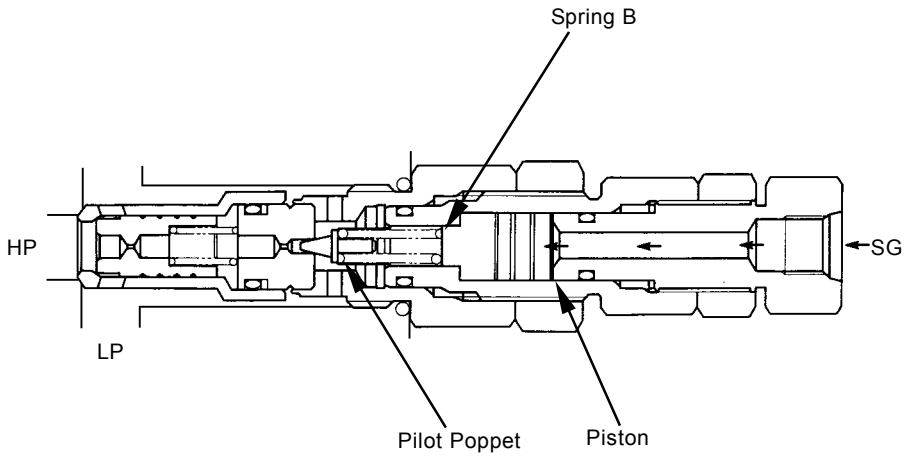
T157-02-05-003

During Relief Operation:



T157-02-05-003

During Set-Pressure Increase Operation:



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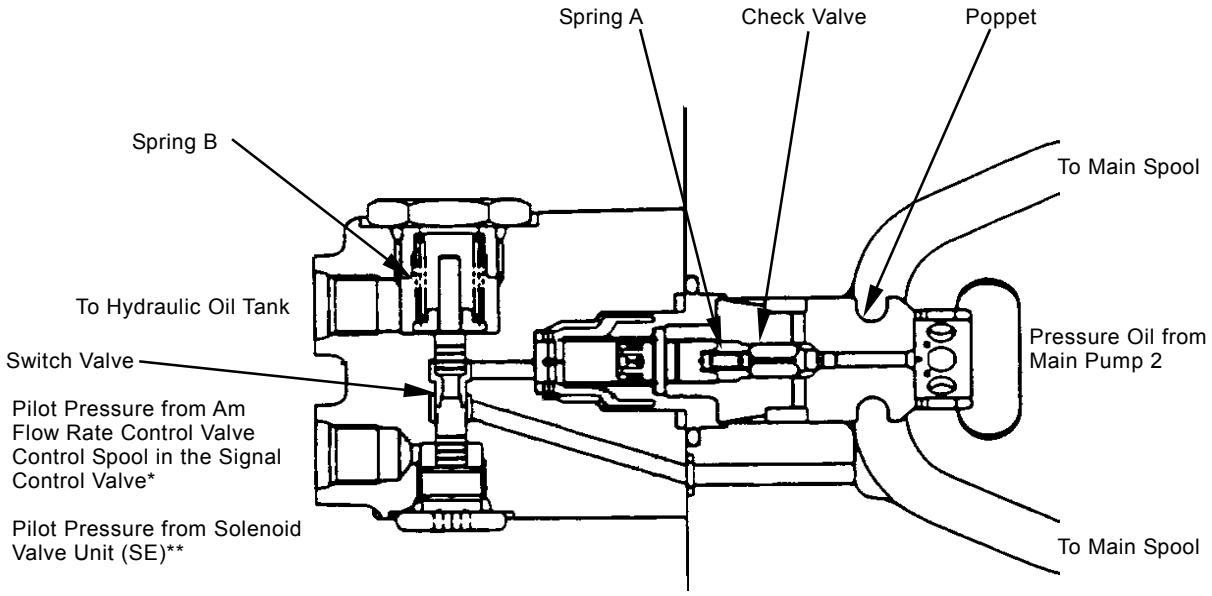
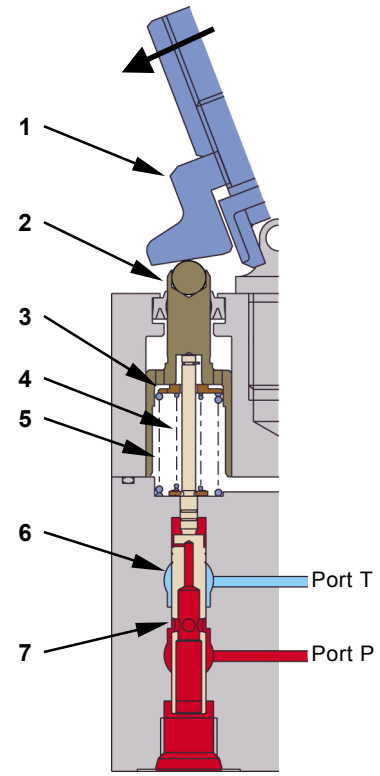


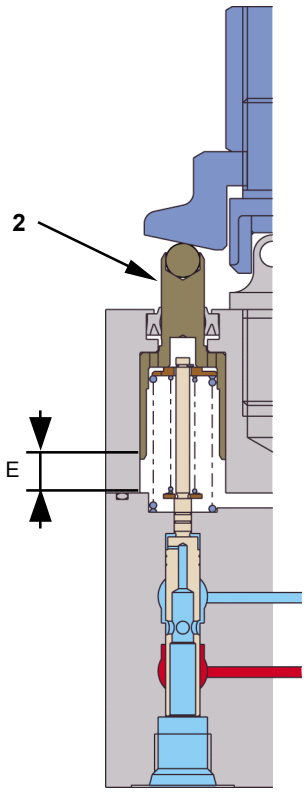
*NOTE: *Serial No.104679 and Up (ZX200 class and 225 class)*
Serial No.010327 and Up (ZX230 class)
Serial No.020043 and Up (ZX270 class)

*NOTE: **Up to Serial No.104678*
(ZX200 class and 225 class)
Up to Serial No.010326 (ZXS230 class)
Up to Serial No.020042 (ZX270 class)

Front Attachment / Swing Pilot Valve

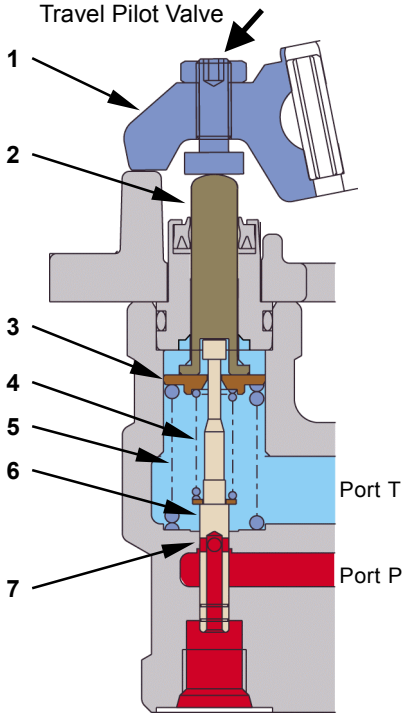


T178-03-04-010

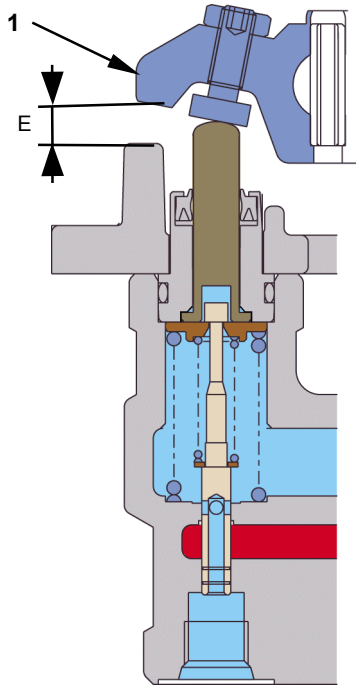


T178-03-04-005

Travel Pilot Valve

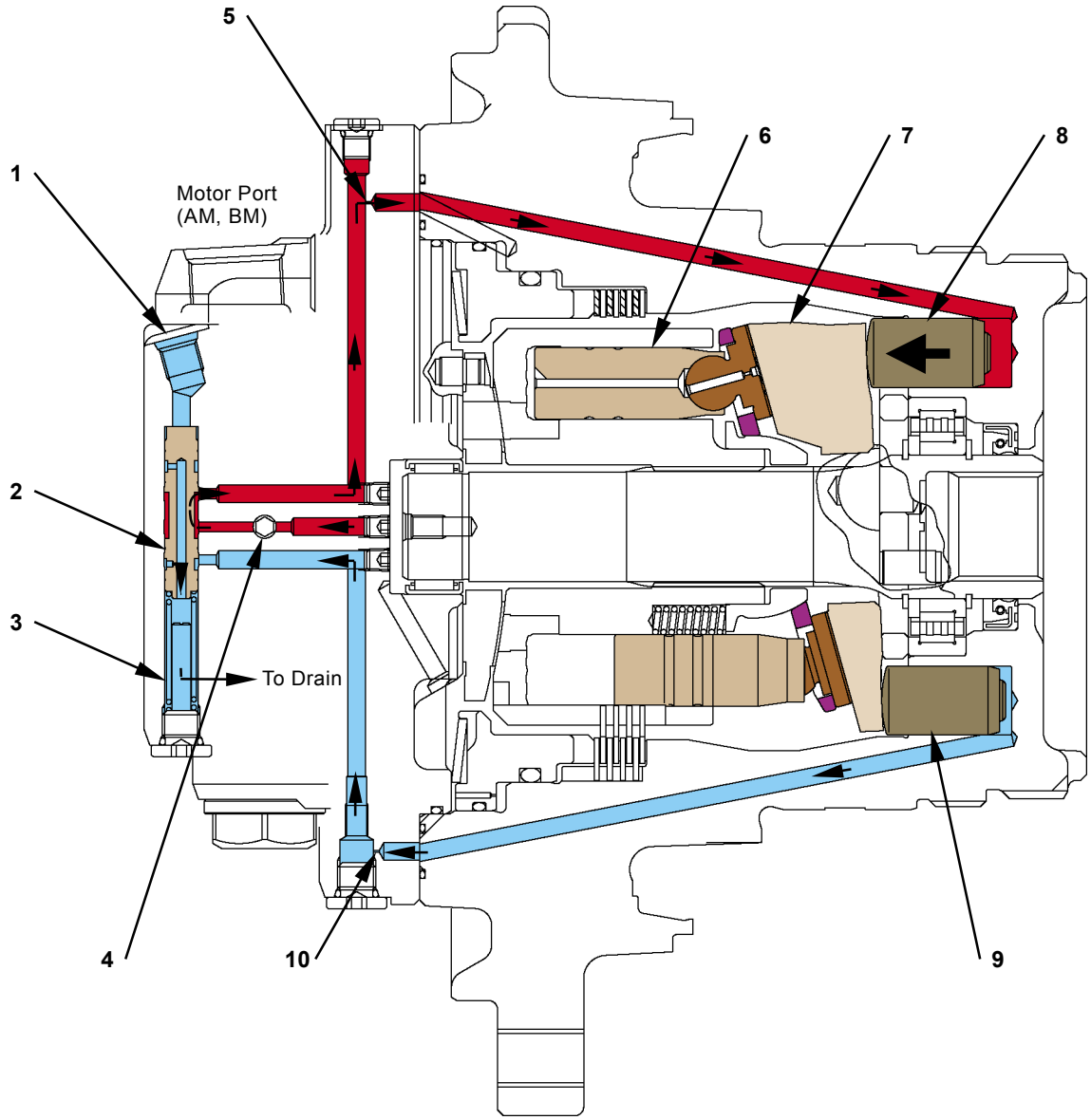


T178-03-04-014



T178-03-04-006

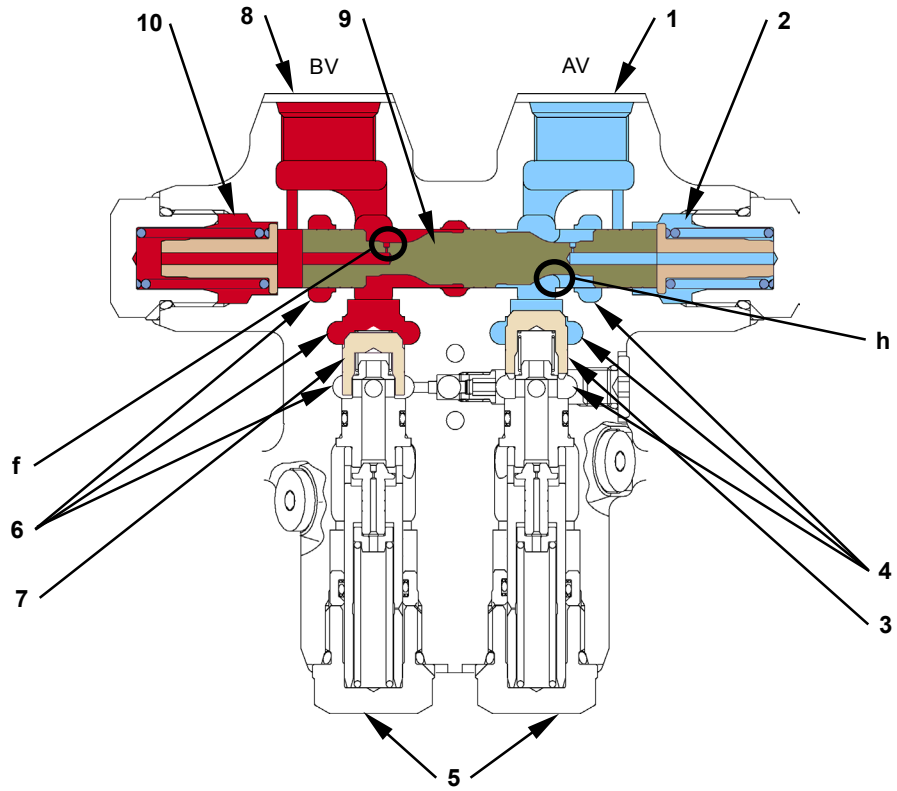
1 - Cam
2 - Pusher
3 - Spring Guide
4 - Balance Spring
5 - Return Spring
6 - Spool
7 - Hole



T178-03-05-004

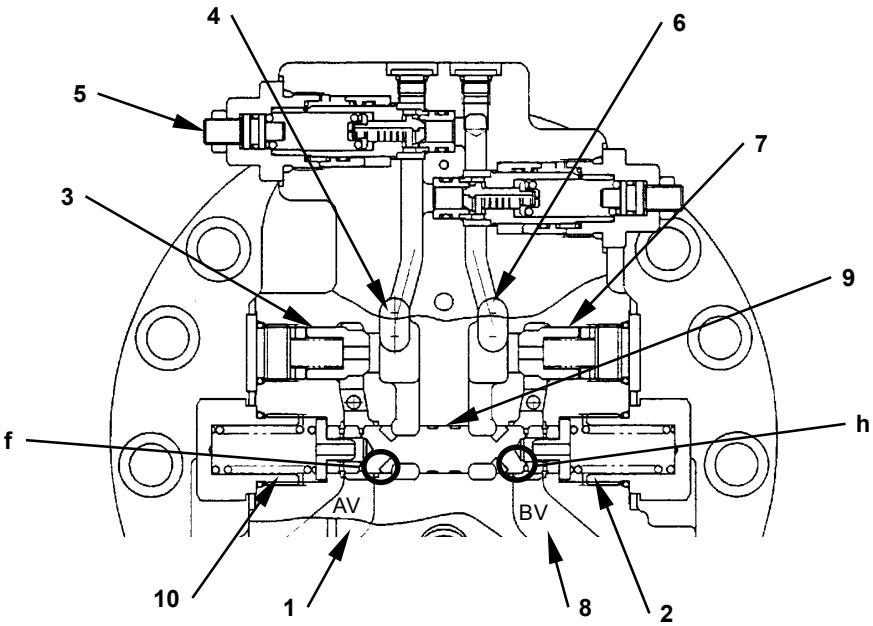
1 - Pilot Port
2 - Spool
3 - Spring
4 - Piston Operating Shuttle Valve
5 - Slow-Speed Orifice
6 - Plunger
7 - Swash Plate
8 - Slow-Speed Piston
9 - Fast-Speed Piston
10 - Fast-Speed Orifice

ZX200 class, 225 class, 230 class



T178-03-05-006

ZX270 class

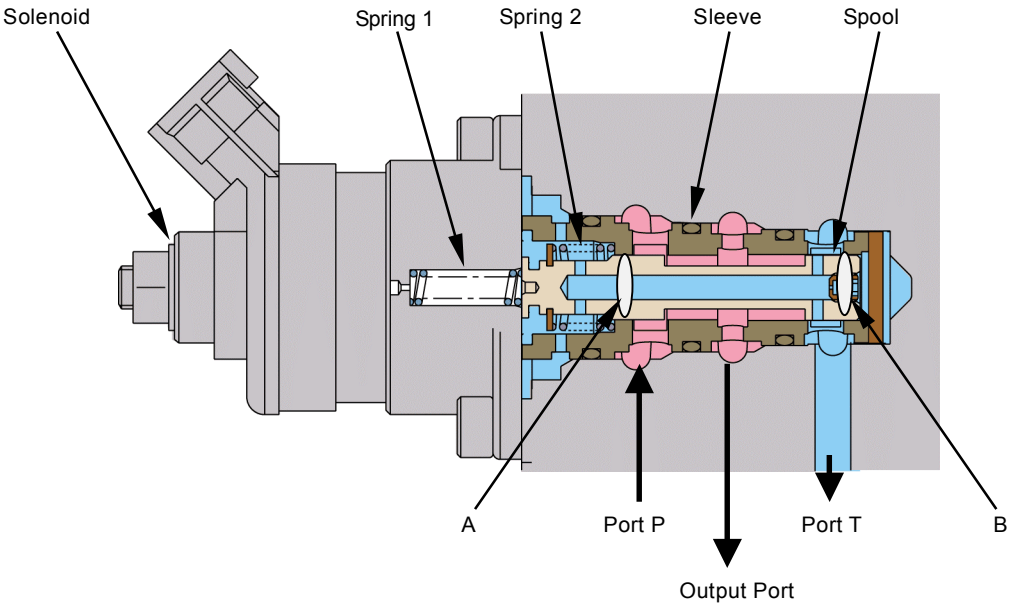


T140-03-02-005

1 - Port AV
2 - Chamber A
3 - Check Valve AC
4 - Motor Port AM
5 - Overload Relief Valve
6 - Motor Port BM
7 - Check Valve BC
8 - Port BV
9 - Spool (Counterbalance Valve)
10 - Chamber B

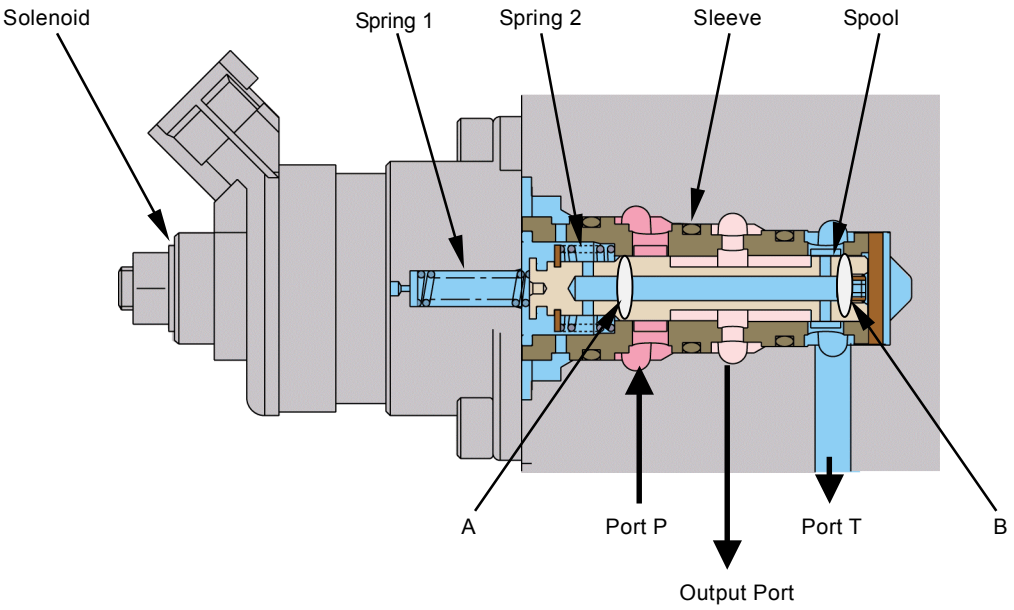
(Blank)

When Neutral:



T176-03-01-030

When in Operation:



T176-03-01-031

NOTE: The theory of operation of this solenoid valve is similar to that of the solenoid valve to control the pump. Refer to T3-1-23 also for the illustration.