Technical Manual

ZAXIS30/35/40/50

Vol No.: T1LSE-00

PROVIDE SIGNALS FOR JOBS INVOLVING MULTIPLE NUMBERS OF MACHINES

- For jobs involving multiple numbers of machines, provide signals commonly known by all personnel involved. Also, appoint a signal person to coordinate the job site. Make sure that all personnel obey the signal person's directions.

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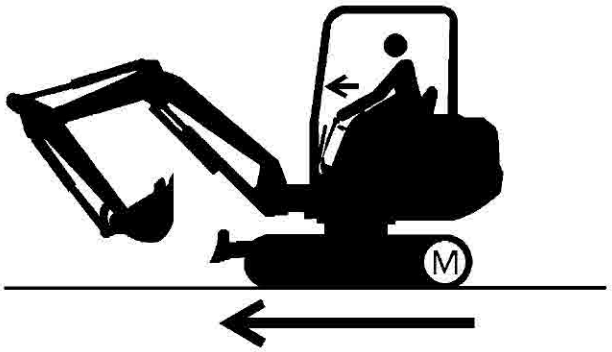
SA-481

CONFIRM DIRECTION OF MACHINE TO BE DRIVEN

- Incorrect travel pedal/lever operation may result in serious injury death.
  - Before driving the machine, confirm the position of the undercarriage in relation to the operator's position. If the travel motors are located in front of the cab, the machine will move in reverse when travel pedals/levers are operated to the front.



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PRACTICE SAFE MAINTENANCE

To avoid accidents:

- Understand service procedures before doing work.
- Keep the work area clean and dry.
- Do not spray water or steam inside cab.
- Never lubricate or service the machine while it is moving.
- Keep hands, feet and clothing away from power-driven parts.

SA-026

Before servicing the machine:

1. Park the machine on a level surface.
2. Lower the bucket to the ground.
3. Run the engine at slow idle speed without load for 5 minutes.
4. Turn the key switch to OFF to stop engine.
5. Relieve the pressure in the hydraulic system by moving the control levers several times.
6. Remove the key from the switch.
7. Attach a “Do Not Operate” tag on the control lever.
8. Pull the pilot control shut-off lever to the LOCK position.
9. Allow the engine to cool.

SA-527

- If a maintenance procedure must be performed with the engine running, do not leave machine unattended.
- If the machine must be raised, maintain a 90 to 110° angle between the boom and arm. Securely support any machine elements that must be raised for service work.
- Never work under a machine raised by the boom.
- Inspect certain parts periodically and repair or replace as necessary. Refer to the section discussing that part in the “MAINTENANCE” chapter of this manual.
- Keep all parts in good condition and properly installed.
- Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.
- Disconnect battery ground cable (–) before making adjustments to electrical systems or before welding on the machine.

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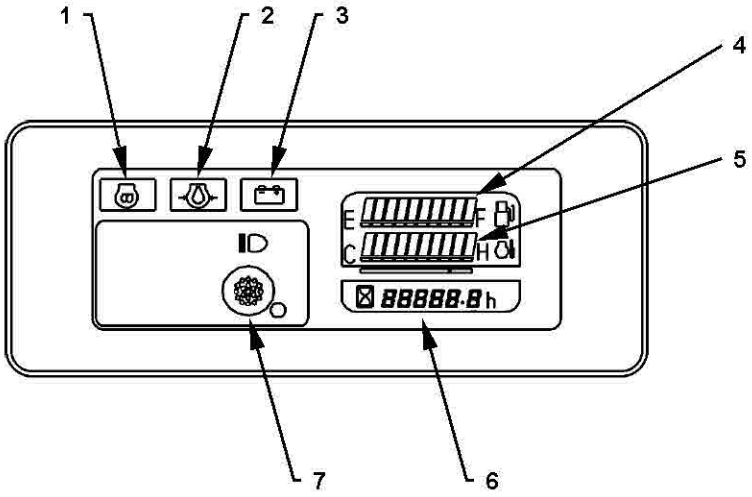
MONITOR AND SWITCHES

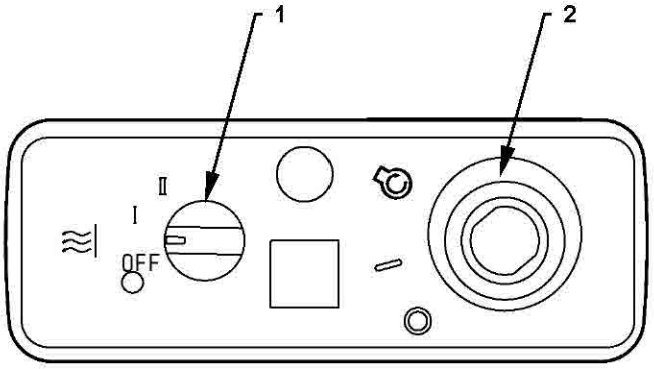
Left Console



M577-01-002

1 - Preheat Indicator
2 - Engine Oil Pressure Indicator
3 - Alternator Indicator
4 - Fuel Gauge (Indicator)
5 - Coolant Temperature Gauge (Indicator)
6 - Hour Meter
7 - Work Light Switch

Right Console



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1 - Heater Switch
2 - Key Switch

ZAXIS30, 35
SWING DEVICE

	ZAXIS30, 35	ZAXIS40, 50
Type	Two-Stage Reduction Planetary Gear	←
Reduction Gear Ratio	15.5	20.615
Weight	32 kg (70.5 lb)	46 kg (101 lb)

SWING MOTOR

Type..... Swash-Plate Type, Fixed Displacement Axial Plunger Motor

SWING VALVE UNIT

	ZAXIS30, 35	ZAXIS40, 50
Type	Non Counterbalance Valve Type	←
Relief Set Pressure	20.6 MPa (210 kgf/cm^2) at 13 L/min	24.5 MPa (250 kgf/cm^2) at 40 L/min

SWING PARKING BRAKE

Type..... Single-Disc-Wet Negative Type
Relief Pressure (Full Stroke)..... Less than 2.9 MPa (Less than 30 kgf/cm^2)

PILOT CIRCUIT

The pressure oil from pilot pump is supplied to the following circuits:

- Operation Circuit
  Controls pressure oil from the pilot pump by pilot valves to move the spools in the control valve.

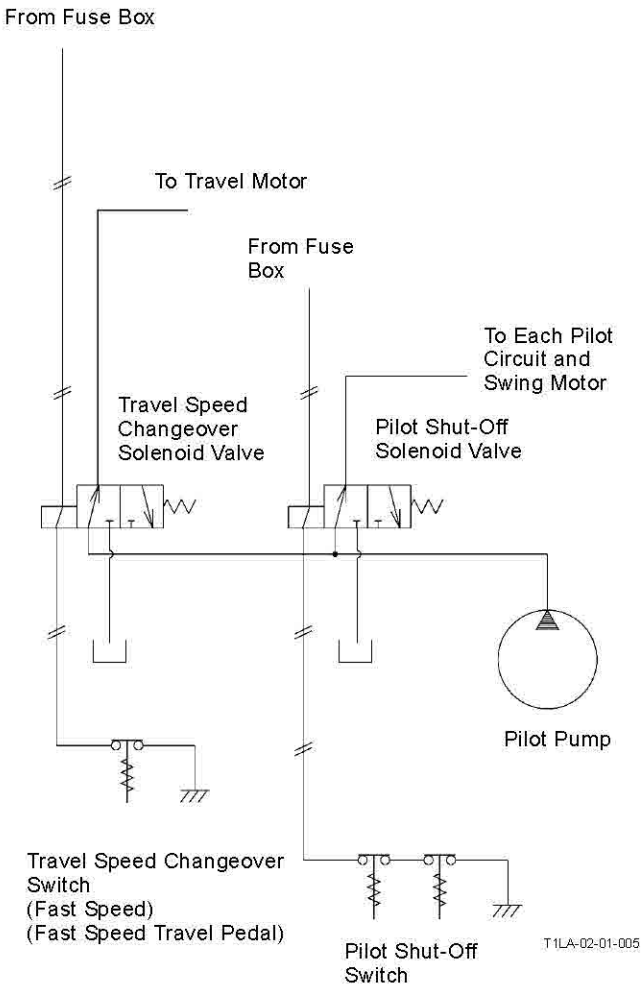
- Valve Control Circuit
  (Refer to Main Circuit in this section and Control Valve group in COMPONENT OPERATION section)
  The flow combiner valve is shifted depending on whether the pilot signal circuit is opened on closed. The boom lowering pilot pressure from the pilot valve shifts the boom anti-drift valve.

- Travel Speed Changeover Circuit
  (Refer to Travel Device group in COMPONENT OPERATION section)

1. When the travel speed changeover switch is stepped ON, the current from fuse box activates the travel speed changeover solenoid valve.
2. Then, the pressure oil from pilot pump flows into the left and right travel motors.
3. Accordingly the travel speed changeover valve in the travel motor is shifted, allowing the travel motor to rotate at fast speed.

- Swing Parking Brake Release Circuit (Refer to Swing Device group in COMPONENT OPERATION section)

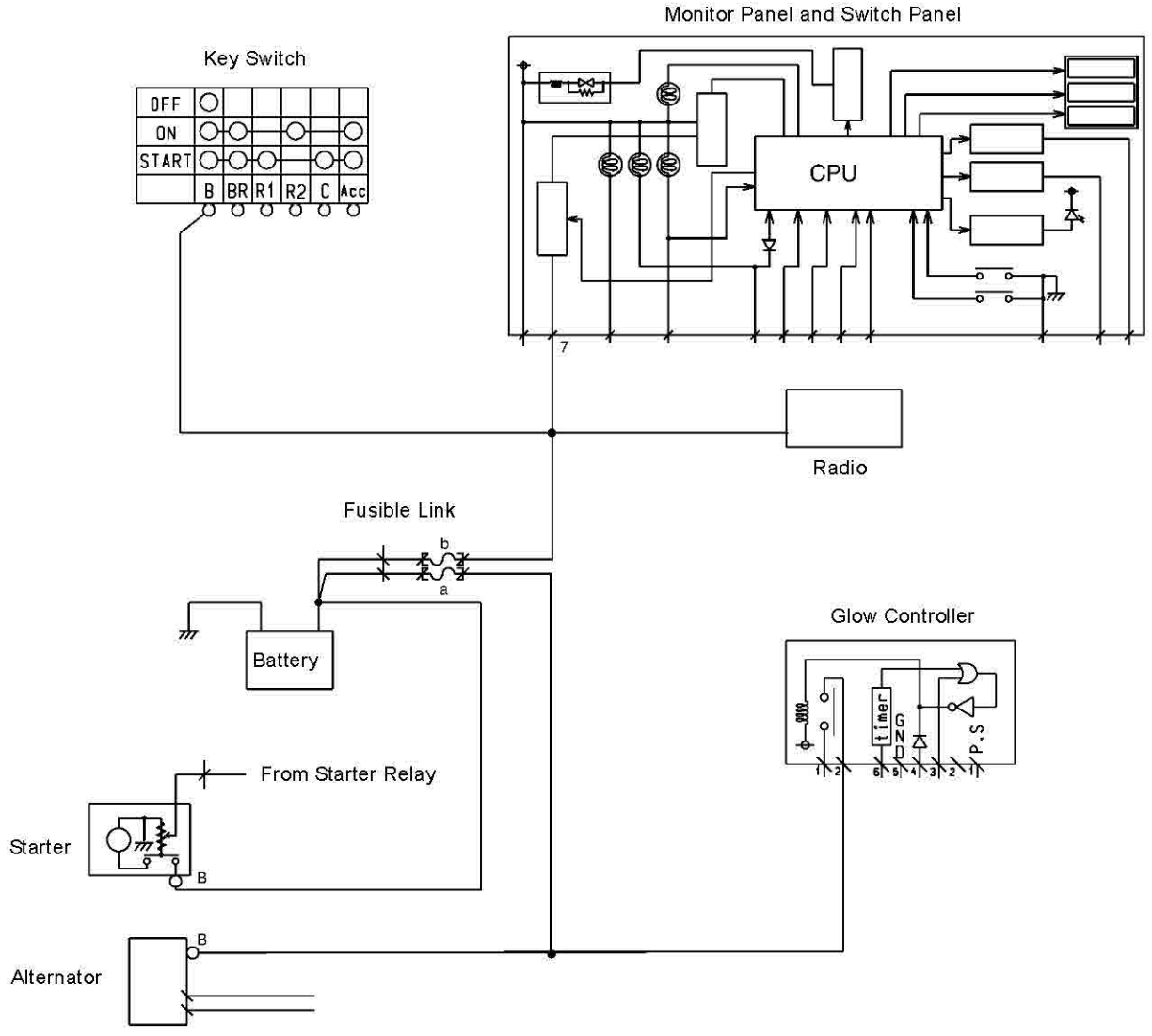
1. When the both pilot shut-off switches are placed to the UNLOCK position (with the pilot shut-off switch ON), the current from fuse box activates the pilot shut-off solenoid valve.
2. Then, the pressure oil from pilot pump flows into each pilot circuit. In addition, the pressure oil releases the swing parking brake at the same time.



POWER CIRCUIT (KEY SWITCH OFF)

The battery negative terminal is grounded to the vehicle frame. When the key is in the OFF position, electrical power from the positive battery terminal is supplied as follows.

- Battery
  - Fusible Link a
    - → Alternator Terminal B
    - → Glow Relay inside Glow Controller (Power Source)
  - Fusible Link b
    - → Key Switch Terminal B
    - → Monitor Panel and Switch Panel Terminal #7
    - → Radio (Optional)
  - Starter Terminal B



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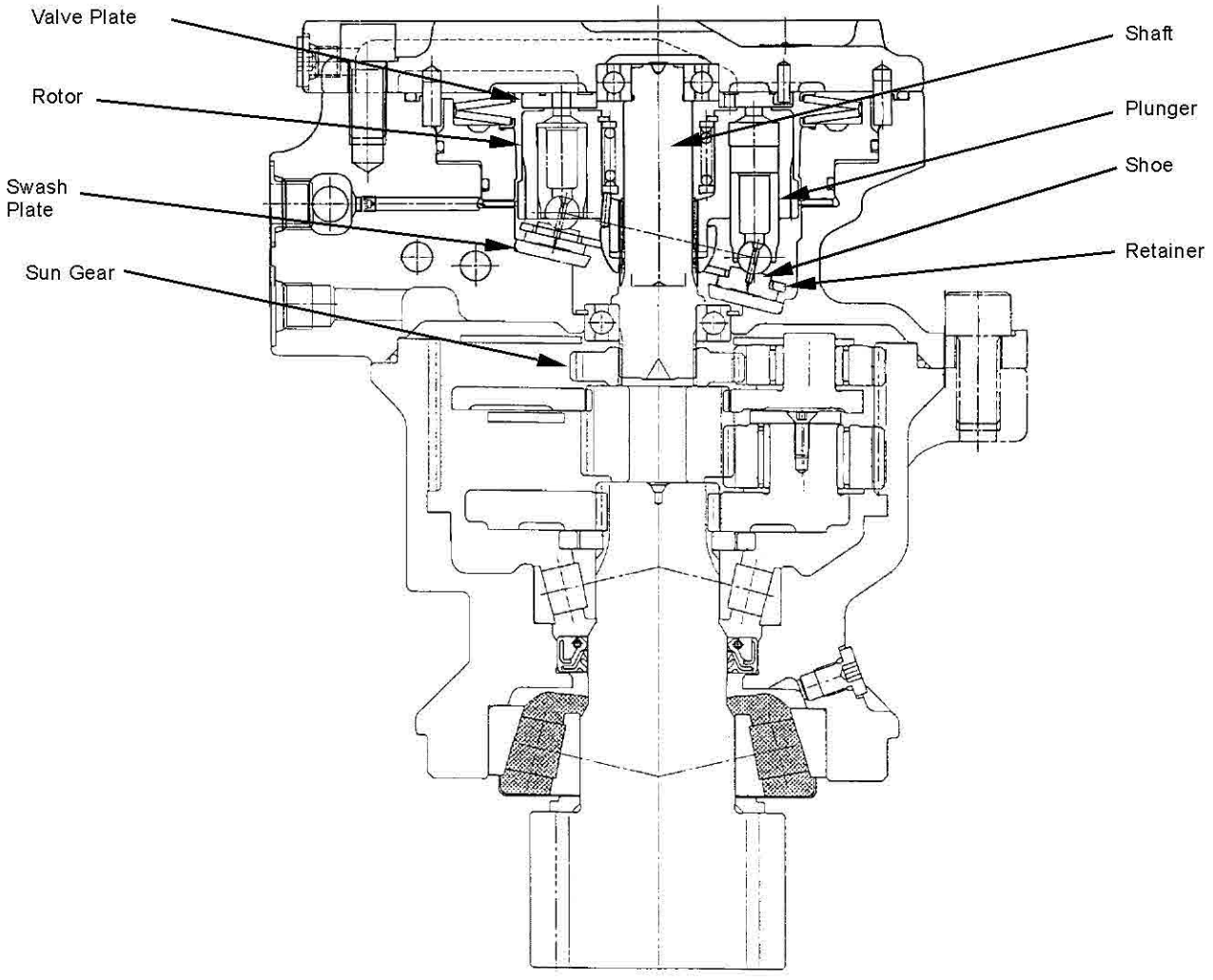
SWING MOTOR

The inner rotor is splined to the shaft, and the plunger is inserted in the rotor.
When the pump supplies pressure oil to the swing motor, plungers are pushed down with pressure oil while sliding along the swash plate, developing turning force. As the shaft is splined to the rotor and sun gear in the swing reduction gear, the rotor torque is transmitted to the swing reduction gear unit.



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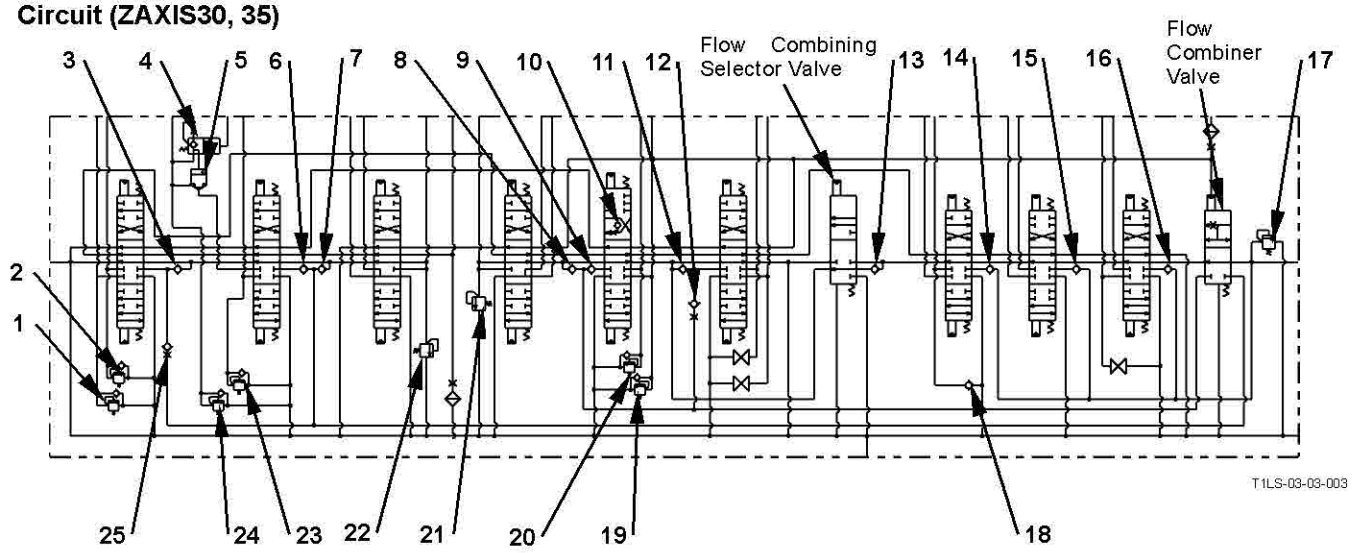
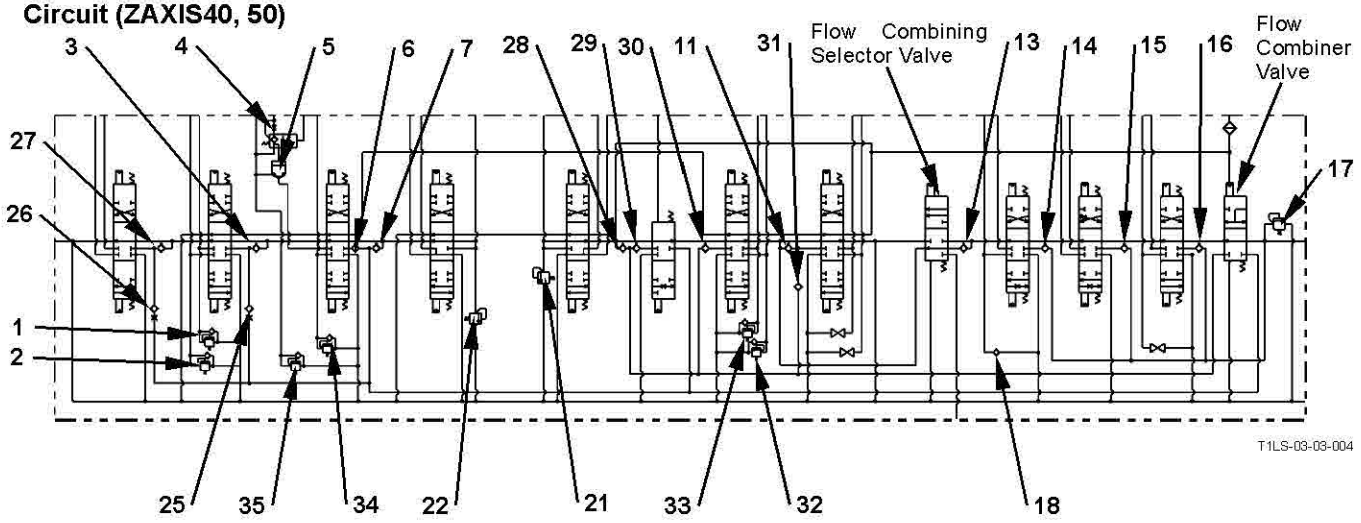
Circuit (ZAXIS30, 35)



Circuit (ZAXIS40, 50)



1 - Overload Relief Valve (Bucket: Rod Side)
2 - Overload Relief Valve (Bucket: Bottom Side)
3 - Load Check Valve (Bucket Tandem Circuit)
4 - Boom Anti-Drift Valve (Selector Valve)
5 - Boom Anti-Drift Valve (Check Valve)
6 - Load Check Valve (Boom Tandem Circuit)
7 - Load Check Valve (Boom Tandem Circuit)
8 - Load Check Valve (Arm Tandem Circuit)
9 - Load Check Valve (Arm Tandem Circuit)
10 - Arm Regenerative Valve
11 - Load Check Valve (Auxiliary Tandem Circuit)
12 - Check Valve (Orifice) (Auxiliary Parallel Circuit)
13 - Load Check Valve (Main Pump P3 Parallel Circuit)
14 - Load Check Valve (Boom Swing Parallel Circuit)
15 - Load Check Valve (Swing Parallel Circuit)
16 - Load Check Valve (Blade Parallel Circuit)
17 - Main Relief Valve (Main Pump P3)
18 - Make-Up Valve (Boom Swing: Bottom Side)
19 - Overload Relief Valve (Arm: Bottom Side)
20 - Overload Relief Valve (Arm: Rod Side)
21 - Main Relief Valve (Main Pump P2)
22 - Main Relief Valve (Main Pump P1)
23 - Overload Relief Valve (Boom: Rod Side)
24 - Overload Relief Valve (Boom: Bottom Side)
25 - Load Check Valve (Bucket Parallel Circuit)
26 - Load Check Valve (Arm 2 Parallel Circuit)
27 - Load Check Valve (Arm 2 Tandem Circuit)
28 - Load Check Valve (Boom 2 Tandem Circuit)
29 - Load Check Valve (Boom 2 Tandem Circuit)
30 - Load Check Valve (Arm 1 Parallel Circuit)
31 - Load Check Valve (Auxiliary Parallel Circuit)
32 - Overload Relief Valve (Arm 1: Rod Side)
33 - Overload Relief Valve (Arm 1: Bottom Side)
34 - Overload Relief Valve (Boom 1: Rod Side)
35 - Overload Relief Valve (Boom 1: Bottom Side)

Pilot Operation Circuit

The spool operation in control valve is controlled by pressure oil from the pilot valve.

Pilot Signal Circuit

Pilot signal circuits (A) and (B) are connected to the hydraulic oil tank through each spool. During combined operation of the travel and front attachment (boom, arm and bucket), pilot signal circuits (A) and (B) are blocked by the spools so that the pressure in the signal circuits rises. Consequently the flow combiner valve is shifted. During combined operation of the travel and front attachment, the pressure oil from main pump P3 flows into the front attachment spools located after the travel spools so that the combined operation of the travel and front attachment can be operated.

When operating the swing, boom swing and blade, the flow combiner valve is not shifted.

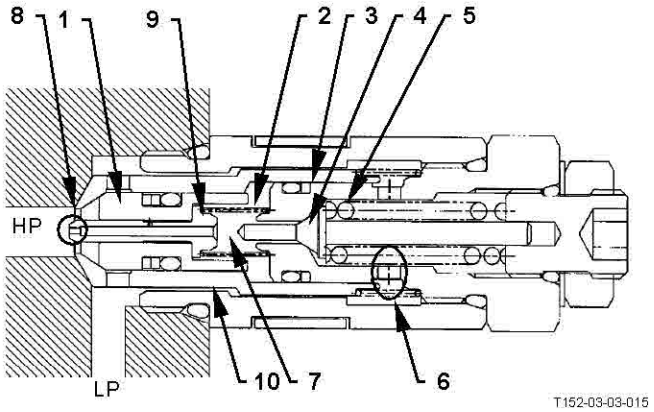
As pressure oil from main pumps P1 and P2 flows to the left travel and the right travel respectively, combined operation of swing, boom swing, blade and travel can be made.

OVERLOAD RELIEF VALVE

The overload relief valve has two functions:
Relief function to prevent the actuator circuit pressure from increasing more than the set-pressure.
Make-up function to prevent the occurrence of cavitation in the circuit.

Relief Operation
When the actuator circuit pressure is increased by external loads, the overload relief valve opens to relieve the pressure oil to the hydraulic oil tank.

1. The oil pressure at port HP acts on pilot poppet (4) via orifice (8) in piston (9).
2. When the oil pressure at port HP increases up to the set-pressure, pilot poppet (4) opens to allow a small quantity of pressure oil to flow into port LP through passage (6) in seat (3).
3. As orifice (8) is provided, a pressure difference is developed between port HP and spring chamber (7). When this pressure difference increases more than spring (5) set-force, piston (9) and main poppet (1) are unseated, allowing the pressure oil to relieve from port HP to port LP.



1 - Main Poppet
2 - Spring
3 - Seat
4 - Pilot Poppet
5 - Spring
6 - Passage
7 - Spring Chamber
8 - Orifice
9 - Piston
10 - Sleeve

- Travel Pilot Valve

Control Lever-In Neutral (Pusher Stroke: A to B)

When the control lever is in neutral, spool (8) blocks the pressure oil in port P completely. The output port is connected to port T through hole (9), so the pressure at output port becomes equal to the hydraulic oil tank pressure.

When the control lever is moved slightly, pusher (2) and spring guides (3), (5) move downward together, compressing spring (4), and return spring (7). At this time, as the pressure under spool (8) (output port) is equal to the hydraulic oil tank pressure, spool (8) moves downward by balance spring (6), while the top of spool is kept with spring guide (5). This state is maintained until clearance (A) of spool (8) becomes zero.

Control Lever-Operated (Pusher Stroke: C to D Metering)

When the control lever is moved further, hole (9) of spool (8) reaches port P. The pressure oil in port P flows into the output port via the passage in spool (8), so the pressure at output port increases.

The pressure at output port acts on the bottom of spool (8), to push spool (8) upward.

If the acting force on spool (8) is smaller than the spring force of balance spring (6), balance spring (6) will not be pressed. As a result, spool (8) will not be pushed up, and the pressure at output port increases continuously.

If the pressure at output port increases further, the force to push up spool (8) increases. When this force becomes larger than the spring force of balance spring (6), spool (8) pushes balance spring (6) and moves upward.

When spool (8) moves upward, hole (9) closes, so the pressure oil does not flow into the output port from port P. Thereby, the pressure at output port stops raising.

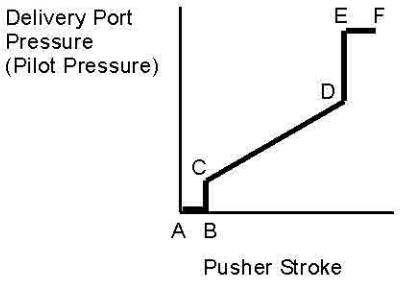
Accordingly, the amount the balance spring (6) is compressed is equal to the amount spool (8) is pressed down, so the balanced pressure between the spring force and the force acting on spool (8) becomes the pressure at output port.

Control Lever-Full Stroke (Pusher Stroke: E to F)

When the control lever is moved to full stroke, pusher (2) compresses spring (4) and return spring (7) more and pusher (2) is moved down.

Thereby, spool (8) is pressed directly by the bottom of pusher (2). As a result, the lower hole (9) of spool (8) does not close even if the pressure at output port rises.

As a result, the pressure at output port becomes equal to the pressure at port P.



OUTPUT DIAGRAM

Counterbalance Valve

- Travel Operation
  When the pressure oil from control valve is supplied to port P1, the pressure oil flows to motor port AM through inside of the spool and opens the check valve. On the other hand, the return oil from motor port BM is blocked by the check valve and the spool.
  Thereby, the pressure at port P1 side increases gradually, so the pressure at port P1 enters into the spring chamber from the orifice, and moves the spool to the right acting on the end surface of spool.
  As a result, the spool notch opens and port BM and port P2 connect, so the travel motor rotates.

- Descending Operation
  When the machine travels down a slope, the travel motors are forcibly driven by the machine weight, so that the motor draws oil like a pump.
  The pressure oil in port P1 is drawn into the travel motor, so the pressure at port P1 decreases.
  Thereby, the spool returns to the left, and the return oil from port BM to port P2 is restricted, so the oil pressure brake is activated.
  When the return oil from port BM is restricted, the pressure at port P1 increases again and moves the spool to the right, so the motor rotates.

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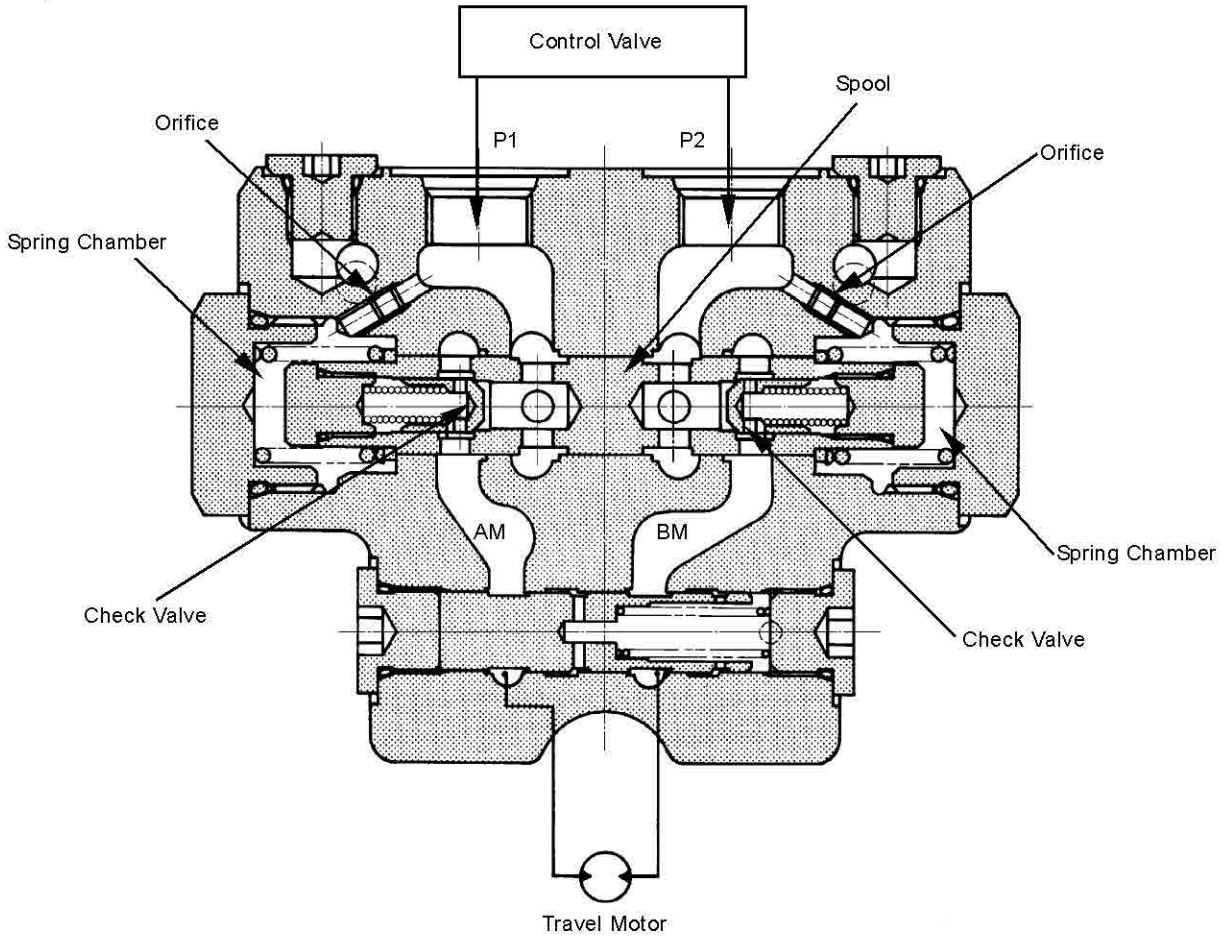

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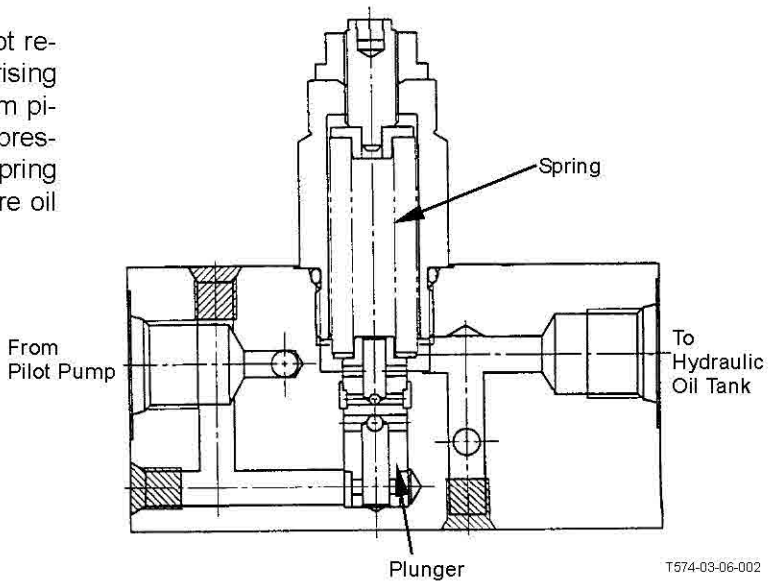
PILOT RELIEF VALVE

The pilot circuit of 2-unit solenoid valve has a pilot relief valve, preventing the circuit pressure from rising more than the set pressure. The pressure oil from pilot pump always acts on the plunger. When this pressure increases more than the set pressure (by spring force), the plunger is moved, allowing the pressure oil to be relieved through the passage in the plunger.



Item	ZAXIS30	ZAXIS35	Remarks
CONTROL LEVER/PEDAL STROKE mm			Refer to T4-4-19
Boom Lever	100±10	←	
Arm Lever	100±10	←	
Bucket Lever	90±10	←	
Swing Lever	90±10	←	
Travel Lever	135±10	←	
Blade Lever	115±10	←	
Fuel Lever	125±10	←	
Boom Swing Pedal	18±5	←	
BOOM RAISE/SWING (Bucket Empty)			
Height mm	2400 or more	←	Refer to T4-4-20
Time sec	2.0±0.3	←	
PRIMARY PILOT PRESSURE MPa (kgf/cm^2)	4.4±0.5 (45±5)	←	Refer to T4-5-1
SECONDARY PILOT PRESSURE MPa (kgf/cm^2)	4.4±0.5 (45±5)	←	Refer to T4-5-2
MAIN RELIEF VALVE, RELIEF SET PRESSURE(P1, P2) MPa (kgf/cm^2)	21.6±1.0 (220±10)	←	Measure at machine, Refer to T4-5-4
MAIN RELIEF VALVE, RELIEF SET PRESSURE(P3)	21.6±1.0 (220±10)	←	
Swing	19.4±1.0 (198±10)	←	
OVERLOAD RELIEF VALVE, RELIEF SET PRESSURE MPa (kgf/cm^2)			Measure at bench, Refer to T4-5-6
Boom, Arm, Bucket	23.5(240)	←	
Swing	16.7(170)	←	When back pressure is 1.5 MPa (15 kgf/cm^2)
SWING MOTOR DRAINAGE L/min			Refer to T4-5-8
at constant speed	(0.5 or less)	←	
TRAVEL MOTOR DRAINAGE L/min			Refer to T4-5-10
at constant speed (Fast/Slow)	(0.3 or less/ 0.2 or less)	←	

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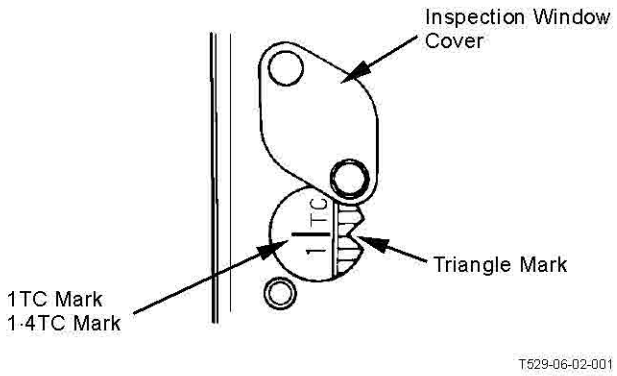
Summary:

1. Perform the measurement when the engine is cold.
2. Before removing the head cover, clean the area around the head cover to prevent the entry of dust into the engine.

Preparation:

1. Remove the head cover.
2. Locate the top dead center (TDC) in the compression stroke. Align "1·4TC Mark" on flywheel with "Triangle Mark".
   In this position, cylinder No.1 is at the top dead center in the compression stroke.



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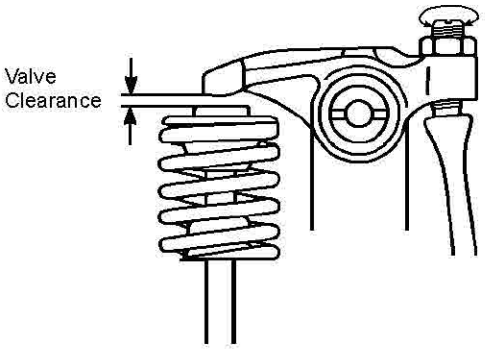
NOTE: The flywheel can be easily turned after the glow plugs are removed.

Measurement:

1. Measure the valve clearance between the rocker arm and the valve.
2. When the measurement is started from cylinder No.1, measure the clearances of the valves marked (O) in the table below.

Cylinder No.	1		2		3		4	
Valve	I	E	I	E	I	E	I	E
Cylinder No.1 at top dead center	O	O	O			O		
Cylinder No.4 at top dead center				×	×		×	×

3. Turn flywheel 360°, then measure the valve clearances marked (×) in the above table.



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Evaluation:

Refer to T4-2 Standard.

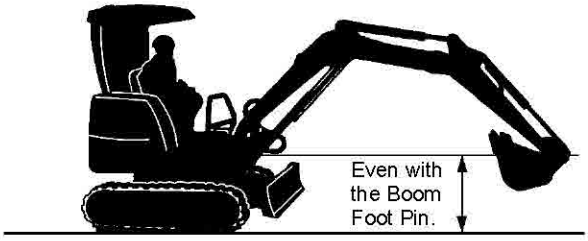
Adjustment:

If the measured value is not within specification, loosen the lock nut and adjust valve clearance by turning the adjusting screw, then tighten lock nut while holding the adjusting screw.

SWING SPEED

Summary:
Measure the time required to swing three complete turns to check the total swing drive system (between the main pump and swing motor).

Preparation:
1. Check the lubrication of swing gear and swing bearing.
2. Place the machine on level, solid ground with ample space for swinging. Do not conduct this test on slopes.
3. With the arm rolled out and bucket rolled in, hold the bucket so that the height of arm top pin is even with the boom foot pin. The bucket must be empty.
4. Maintain the hydraulic oil temperature at 50±5 °C (122±9 °F)



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CAUTION: Before starting the measurement, make sure that there are no person or obstacles within the swing area.

Measurement:
1. Run engine at fast idle speed. Operate swing control lever fully.
2. Measure the time required to swing 3 turns in one direction.
3. Operate swing control lever fully in the opposite direction and measure the time required for 3 turns.
4. Repeat steps (2) and (3) three times each and calculate the average values.

Evaluation
Refer to T4-2 Operational Performance Standard.

Remedy:
Refer to T5-2 "Troubleshooting A".

CONTROL LEVER OPERATING FORCE

Summary:

Use a spring scale to measure the maximum force needed to move each control lever and pedal.
Measure the operating force at the center of each lever grip.

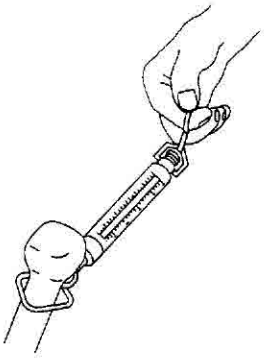
Preparation:

1. Maintain the hydraulic oil temperature at 50±5 °C (122±9 °F).

CAUTION: Before the measurement, make sure there are no personnel or obstacles within the swing area.

Measurement:

1. Start the engine.
2. Measure the maximum operating force with each boom raise, arm, bucket, swing lever, full stroke.
3. Measure the maximum operating force with the boom lower lever full stroke until the fully raised boom comes in contact with the ground.
4. Lower the bucket to the ground to raise one track off the ground. Operate the travel lever to full stroke and measure the maximum operating force.
   When finished, lower the track and then jack up the other track.
5. Repeat each measurement three times and calculate the mean values.



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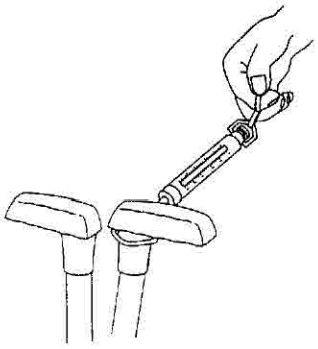

T107-06-03-004

Evaluation:

Refer to T4-2 Operational Performance Standard.

Overload Relief Valve Adjustment

NOTE: Pressure of overload relief valve shall be adjusted with test device in principle.

1. Loosen the lock nut on the overload relief valve.
   : 17 mm
2. Turn adjusting screw to adjust the setting pressure.
   : 6 mm
3. Tighten lock nut.
   : 17 mm
   : 28 to 31 N·m
   (2.9 to 3.2 kgf·m, 21 to 23 lbf·ft)
4. After completing the adjustment, recheck the set pressure.

NOTE: Standard change in pressure.

Screw Turns		1/4	1/2	3/4	1
Change in Relief Pressure	MPa	7.1	14.2	21.3	28.4
	(kgf/cm^2)	(72)	(145)	(217)	(290)
	(psi)	(1030)	(2060)	(3100)	(4130)

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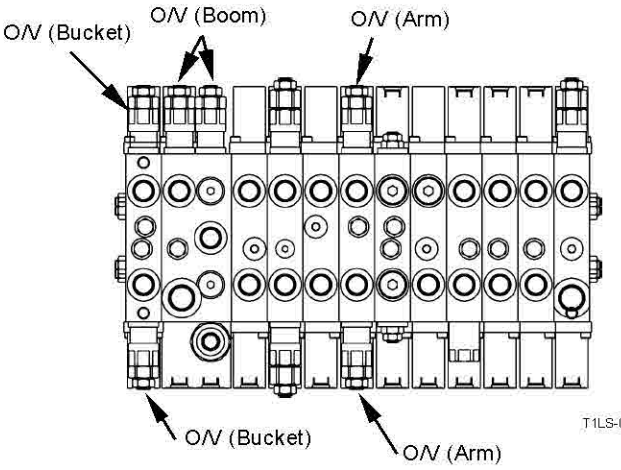

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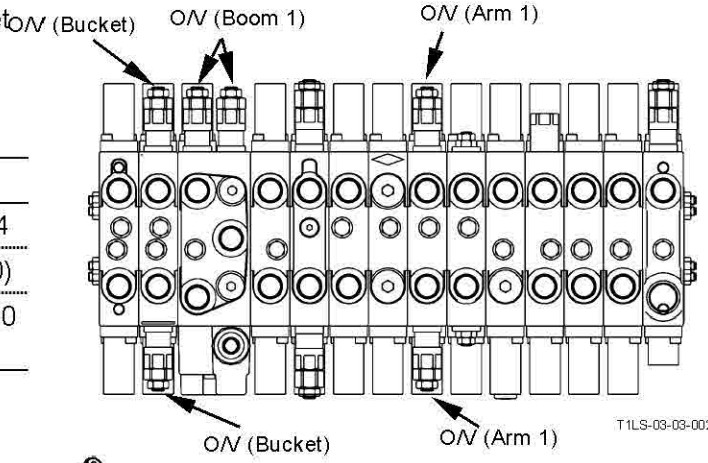

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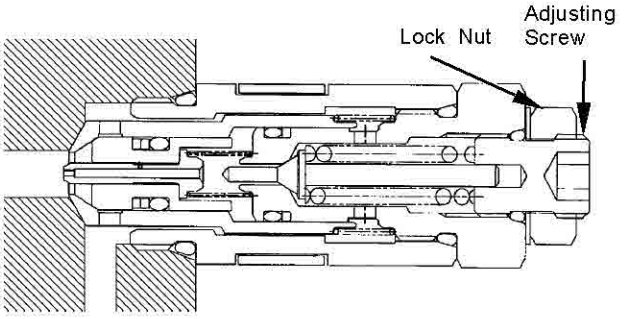
NOTE: O/V: Overload Relief Valve



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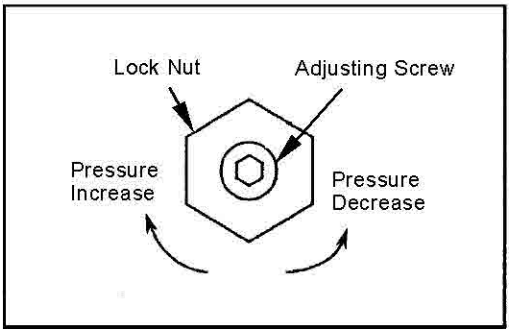


T505-06-04-007

INTRODUCTION

Troubleshooting charts shown in this section indicate the orderly procedures for inspecting and finding out the cause(s) of problems in the machine.

This section is comprised of three groups: Troubleshooting A (diagnosis of machine by symptom), Troubleshooting B (diagnosis of monitor) and Electric System Check.

- Troubleshooting A (diagnosis of machine by symptom)
  This procedure is used when operating the diagnosis by the symptom.

  Example: Starter does not rotate.

- Troubleshooting B (diagnosis of monitor)
  This procedure is used when there are malfunction on components regarding monitor, such as gauges or indicators.

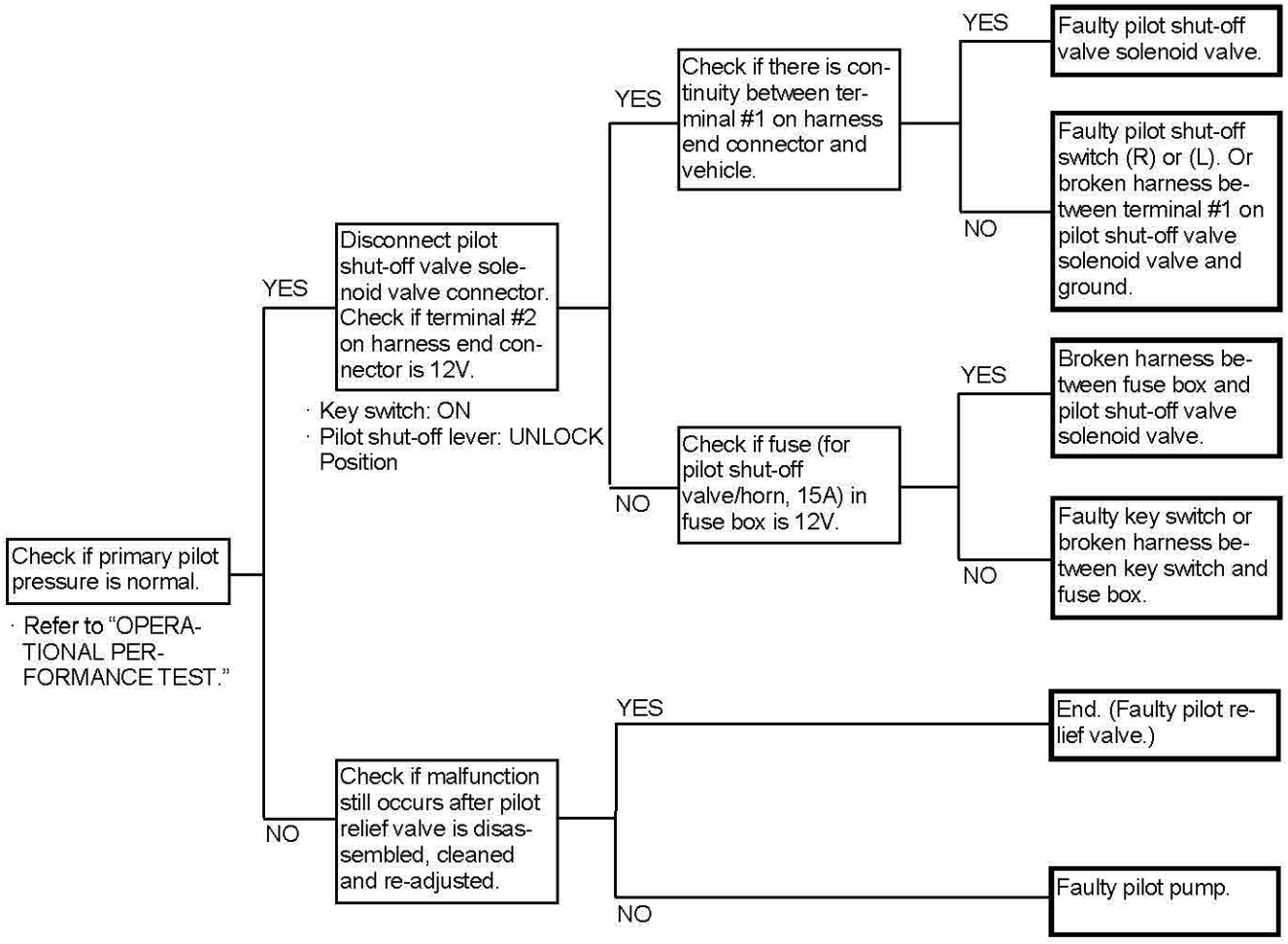
  Example: Fuel gauge does not operate.

- Electric System Check
  This procedure is used when the information on precaution for electric system inspection or inspection method is needed.

  Example: Fuse inspection.

All actuators do not work.

- As the main circuit consists of 3 systems (3 main relief valves are located), the possibility of failure in all main relief valve is small.



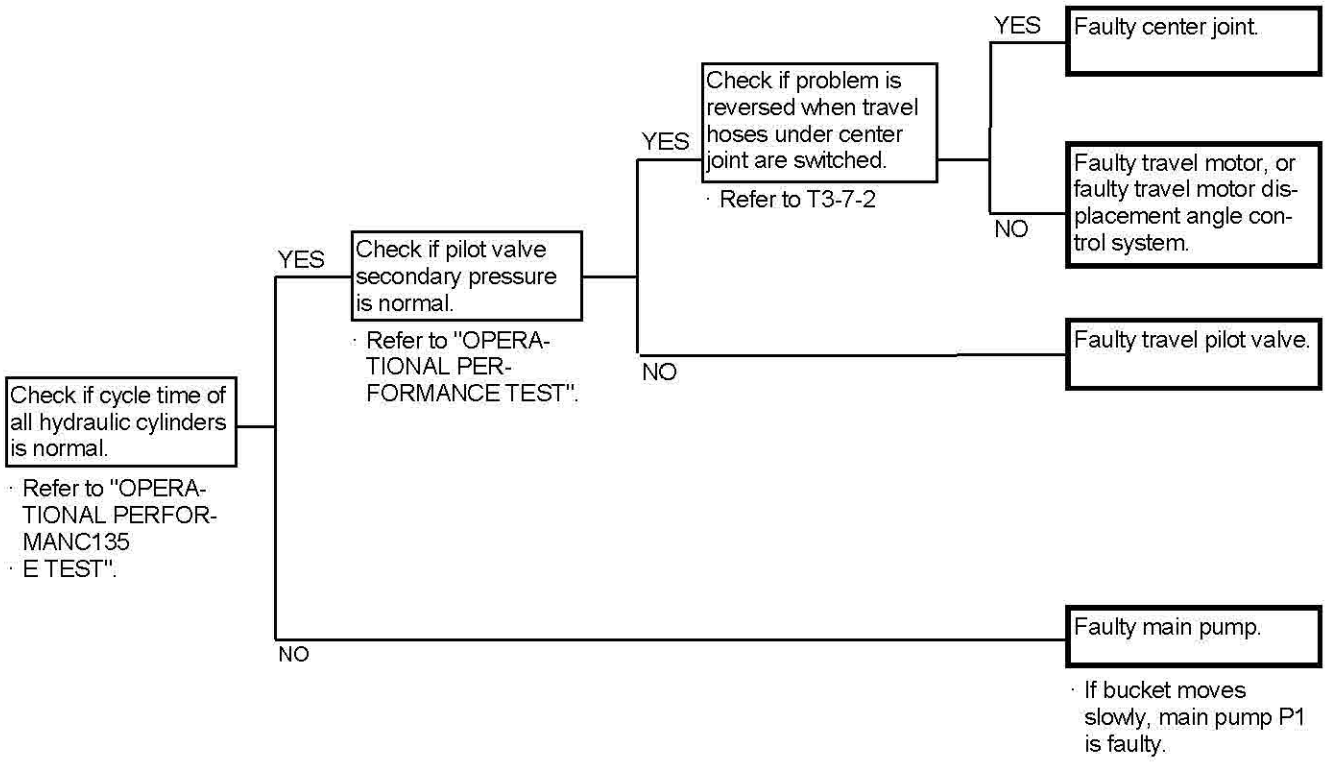
Connector

Pilot Shut-Off Switch

Pilot Shut-Off Valve Solenoid Valve

The excavator mistracks.

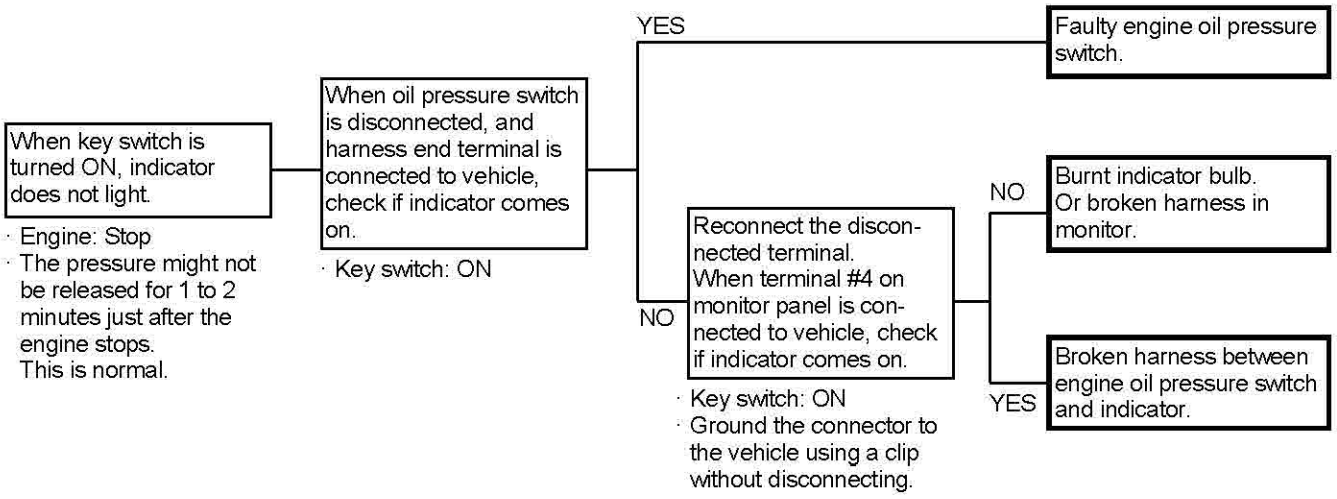
NOTE: If the machine mistracks to the right (only the right travel moves slowly, has no power or does not move), the main relief valve on main pump P2 circuit may be faulty.
If the machine mistracks to the left (only the left travel moves slowly, has no power or does not move), the main relief valve on main pump P1 circuit may be faulty.

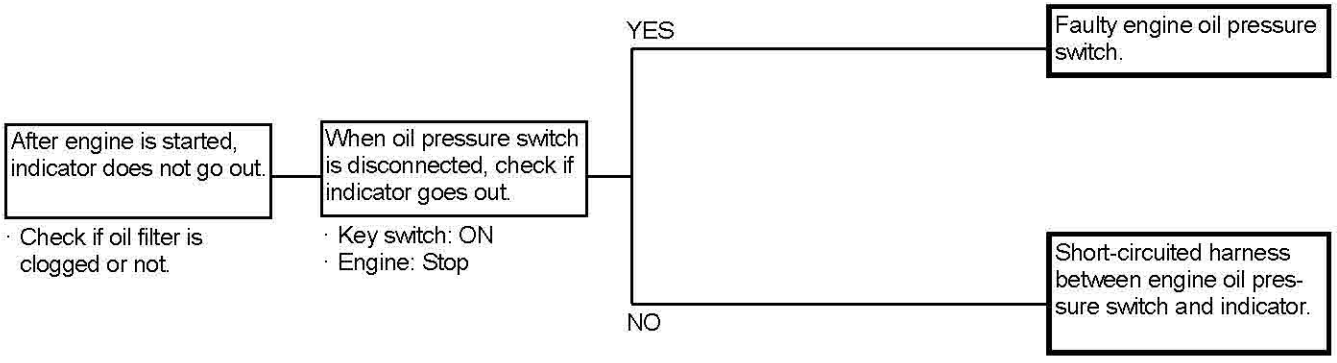


MALFUNCTION OF ENGINE OIL PRESSURE INDICATOR

NOTE: The indicator comes on when engine oil pressure is below 49 kpa (0.5 kgf/cm^2)

- Be sure to inspect connection prior to trouble shooting.





Connector

Monitor Panel