TCM TECHNICAL MANUAL
Troubleshooting

E820-3

No.M-025-MAE

TCM CORPORATION

No.M-025-MAE

TCM®

TECHNICAL MANUAL
Troubleshooting

WHEEL LOADER

E820-3

TCM CORPORATION

OPERATE ONLY FROM OPERATOR'S SEAT

- Inappropriate engine starting procedures may cause the machine to runaway, possibly resulting in serious injury or death.
  - Start the engine only when seated in the operator's seat.
  - NEVER start the engine while standing on the track or on ground.
  - Do not start engine by shorting across starter terminals.
  - Before starting the engine, confirm that all control levers are in neutral.
  - Before starting the engine, confirm the safety around the machine and sound the horn to alert bystanders.

SA-431

012-E01B-0431

JUMP STARTING

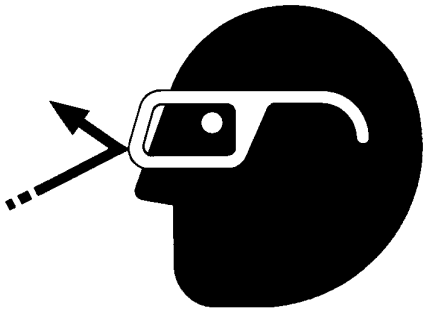
- Battery gas can explode, resulting in serious injury.
  - If the engine must be jump started, be sure to follow the instructions shown in the “OPERATING THE ENGINE” chapter in the operator’s manual.
  - The operator must be in the operator’s seat so that the machine will be under control when the engine starts.
  - Jump starting is a two-person operation.
  - Never use a frozen battery.
  - Failure to follow correct jump starting procedures could result in a battery explosion or a runaway machine.

SA-032

PROTECT AGAINST FLYING DEBRIS

- If flying debris hit eyes or any other part of the body, serious injury may result.
  - Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.
  - Keep bystanders away from the working area before striking any object.

031-E01A-0432



SA-432

PARK MACHINE SAFELY

To avoid accidents:
- Park machine on a firm, level surface.
- Lower bucket to the ground.
- Place the forward/reverse lever (switch) in neutral, and turn the parking brake switch (lever) in the ON (parking brake) position.
- Run engine at low idle speed without load for 5 minutes.
- Turn key switch to OFF to stop engine.
- Remove the key from the key switch.
- Lower the lock lever to the LOCK position.
- Close windows, roof vent, and cab door.
- Lock all access doors and compartments.

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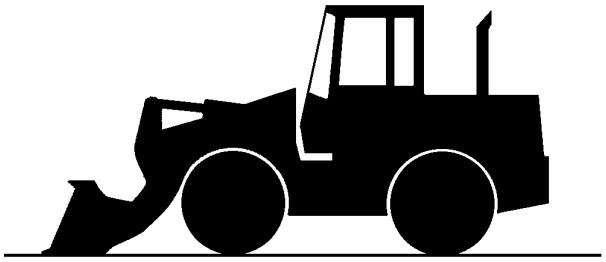
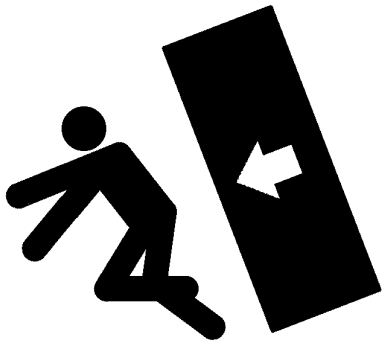


SA-456

STORE ATTACHMENTS SAFELY

- Stored attachments such as buckets, hydraulic hammers, and blades can fall and cause serious injury or death.
  - Securely store attachments and implements to prevent falling. Keep children and bystanders away from storage areas.

504-E01A-0034



SA-034

AVOID HEATING NEAR PRESSURIZED FLUID LINES

- Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders.
  - Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.
  - Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install temporary fireresistant guards to protect hoses or other materials before engaging in welding, soldering, etc..

SA-030

AVOID APPLYING HEAT TO LINES CONTAINING FLAMMABLE FLUIDS

- Do not weld or flame cut pipes or tubes that contain flammable fluids.
- Clean them thoroughly with nonflammable solvent before welding or flame cutting them.

510-E01B-0030

REMOVE PAINT BEFORE WELDING OR HEATING

- Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch. If inhaled, these fumes may cause sickness.
  - Avoid potentially toxic fumes and dust.
  - Do all such work outside or in a well-ventilated area. Dispose of paint and solvent properly.
  - Remove paint before welding or heating:

1. If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
2. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

SA-029

511-E01A-0029

PREPARATION FOR PERFORMANCE TESTS

Observe the following rules in order to carry out performance tests accurately and safely.

THE MACHINE

1. Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

TEST AREA

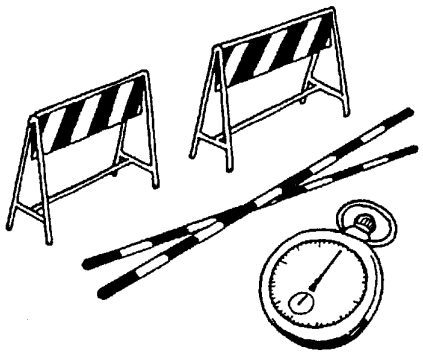
1. Select a hard and flat surface.
2. Secure enough space to allow the machine to run straight more than 200 m (656 ft 2 in), and to operate steering.
3. If required, rope off the test area and provide signboards to keep unauthorized personnel away.

PRECAUTIONS

1. Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.
2. Operate the machine carefully and always give first priority to safety.
3. While testing, always take care to avoid accidents due to landslides or contact with high-voltage power lines. Always confirm that there is sufficient space for full swings.
4. Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

MAKE PRECISE MEASUREMENT

1. Accurately calibrate test instruments in advance to obtain correct data.
2. Carry out tests under the exact test conditions prescribed for each test item.
3. Repeat the same test and confirm that the test data obtained can be produced repeatedly. Use mean values of measurements if necessary.



T105-06-01-003

SERVICE BRAKE CAPACITY

Summary:

1. The overall performance of the service brake is judged.
2. The braking capability of the brake is an item of safety control. Conduct the performance test correctly.

Preparation:

1. Adjust air pressure of the tires evenly in advance. 240 KPa (2.4 kgf/cm^2) at tire size 17.5/65-20-10PR (L-2)
2. On a paved dry ground, prepare a 350 m (1148 ft) straight travel course (a 300 m (984 ft) of acceleration/deceleration zone and a 50 m (164 ft) of measurement road), and set the brake starting point.
3. Empty the bucket, and hold the lift arm at 0.3 to 0.4 m (12 in to 1 ft 4 in) above the ground.
4. Keep hydraulic oil temperature at 50±5 °C (122±9 °F). Warm the axle oil by repeating travel and brake operations.
   Warm up the engine so that the needle of the indicators of the engine coolant temperature gauge rise above the horizontal positions.

Measurement:

CAUTION: Avoid measurement during travel reverse operation for dangers.
(FNR switch: F)

1. Measurement for high-speed mode.
2. Select the pedal, switch, and forward/reverse lever as follows.

High-Low Selector Switch	Parking Brake Switch	Accelerator Pedal	eco Mode Switch
High (2nd gear)	OFF	Full depression	OFF

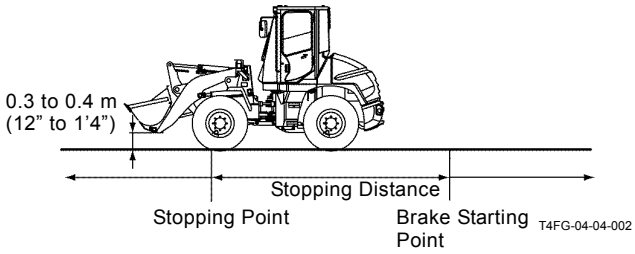
3. Set the forward/reverse lever at the F (Forward) position. From the acceleration zone, travel at the maximum speed 34 km/h (21 mph) by depression the accelerator pedal to the stroke end.
4. Depress the brake pedal at the brake starting point, and completely stop the vehicle. (Right Service Brake Pedal)
5. Measure the distance from the brake starting point to the point where the front tire is contacting.
6. Repeat the measurement three times and calculate the mean values.

Evaluation:

Refer to Operational Performance Standard in T4-2.

Remedy:

Refer to Trouble Shooting in T5.



DIG FUNCTION DRIFT CHECK

Summary:

1. Internal leakage of the lift arm, bucket cylinders and control valves when the buket is loaded with load equivalent to the standard load is judged by the settlement (shrinkage) of the cylinder rod.
2. Measurement is made in the standard front attachment configuration (standard bucket).
3. When measurement is made immediately after the cylinder replacement, conduct air venting of the cylinder before measurement by slowly operating the cylinders to the both stroke ends several times.

Preparation:

1. Load the bucket with weight or sand equivalent to the standard load.
   1440 kg (3170 lb)
2. In the front attachment position, extend the lift arm to the maximum reach, and hold the bucket at an angle of about 5° declined forward from full tilting.

CAUTION: Do not allow any persons to be under the bucket.

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

Measurement:

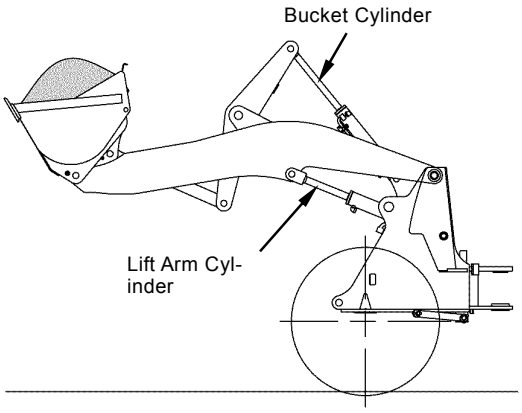
1. Stop the engine.
2. After 15 minutes, measure the shrinkage of the lift arm cylinder and the shrinkage of the bucket cylinder respectively. (Shrinkage dimension=A-B)
3. Repeat the measurement three times and calculate the mean values.

Evaluation:

Refer to Operational Performance Standard in T4-2.

Remedy:

Refer to Trouble Shooting in T5.



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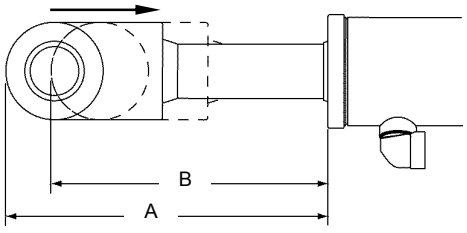


T4FG-04-04-010

OVERLOAD RELIEF PRESSURE

Summary:

1. The circuit pressure should be increased by applying an external force while blocking the return circuit from the control valve. This measuring method is hazardous and the results obtained with this method are unreliable.
2. The oil flow rate used to set the overload relief pressure is far less than that used to set the main relief pressure. Therefore, measuring the overload pressure in the main circuit by increasing the main relief set pressure more than the overload valve set-pressure is not a proper method. In addition, in case a main relief valve designed to leak a small quantity of oil before reliving is used, its pre-leaking start pressure should be increased more than the overload relief valve set pressure. However, the pre-leaking start pressure is not always increased more than the overload relief valve set-pressure as the adjustable upper limit of the main relief valve set-pressure is provided. Accordingly, the overload relief valve assembly should be removed from the machine and checked on a specified test stand at a correct oil flow rate. Some overload relief valves come in contact with the control valve body to block the oil passage. When this type of overload relief valve is checked, the control valve body should be precisely finished as the test unit. Provide one control valve other than that on the machine as a test kit.
3. If the overload relief valve performance should be checked on the machine, however, measure the main relief pressure while releasing each front function respective to the measuring overload relief valve. And, assume that the overload relief valve is functioning correctly if the obtained main relief pressure is within the specified value range. Measure the main pressure of the front functions.

Preparation:

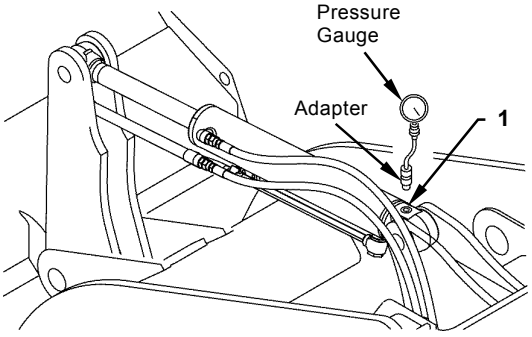
1. Stop the engine.
2. Remove the plug from the pressure check port (1) at the tilt cylinder bottom side. Install an adapter (G1/8), a hose, and a pressure gauge.
   : 5 mm (0.20 in)
3. Start the engine. Check for oil leakage at the pressure gauge connection.
4. Maintain hydraulic oil temperature at 50±5 °C (122±9 °F).

Measurement:

1. Set engine speed at fast idle. Depress the accelerator pedal fully.
2. Operate the lift arm or bucket control lever for the overload relief valve to be measured. Operate the cylinder to the stroke end (extend/retract).
3. Read the pressures on the pressure gauge at this time.
4. Repeat the measurement three times and calculate the mean values.

Evaluation:

In case the pressure of the bucket or lift arm circuit which has been measured is specification of the main relief valve set pressure, this is normal.
Refer to Orerational Performance Standard in T4-2.



T4FG-04-05-010

DIAGNOSING PROCEDURE

These six basic steps are essential for efficient troubleshooting:

1. Study the System
   Study the machine's technical manuals. Know the system and how it works, and what the construction, functions and specifications of the system components are.

2. Ask the operator
   Before inspecting, get the full story of malfunctions from the operator below.

   (a) How is the machine being used? (Find out if the machine is being operated correctly)

   (b) When was the trouble noticed, and what types of work the machine doing at that time?

   (c) What are the details of the trouble? Is the trouble getting worse, or did it appear suddenly for the first time?

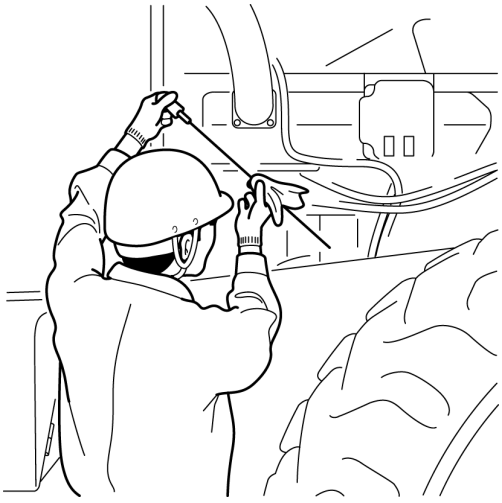
   (d) Did the machine have any other troubles previously? If so, which parts were repaired before?

3. Inspect the machine
   Before starting the troubleshooting procedure, check the machine's daily maintenance points, as shown in the operator's manual.

   Also, check the electrical system, including the batteries, as troubles in the electrical system such as low battery voltage, loose connections and blown fuses will result in malfunction of the controllers, causing total operational failure of the machine.
   If troubleshooting is started without checking for blown fuses, a wrong diagnosis may result, wasting time. Check for blown fuses before troubleshooting. Even if a fuse looks normal by visual inspection, a fine crack is difficult to find. Always use a tester when checking the fuses.

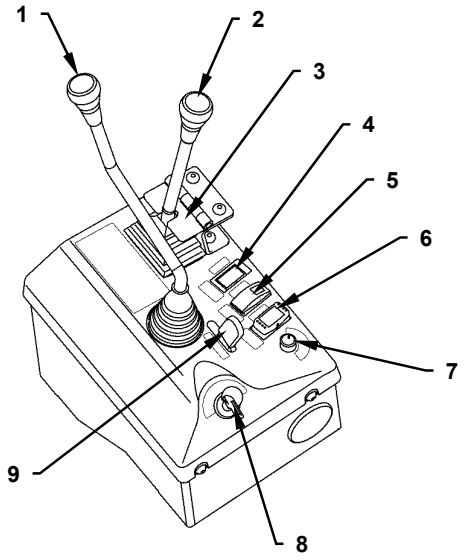
T4GB-05-01-001

T4GB-05-01-002



T4GB-05-01-003

Right Console



M4FG-01-009

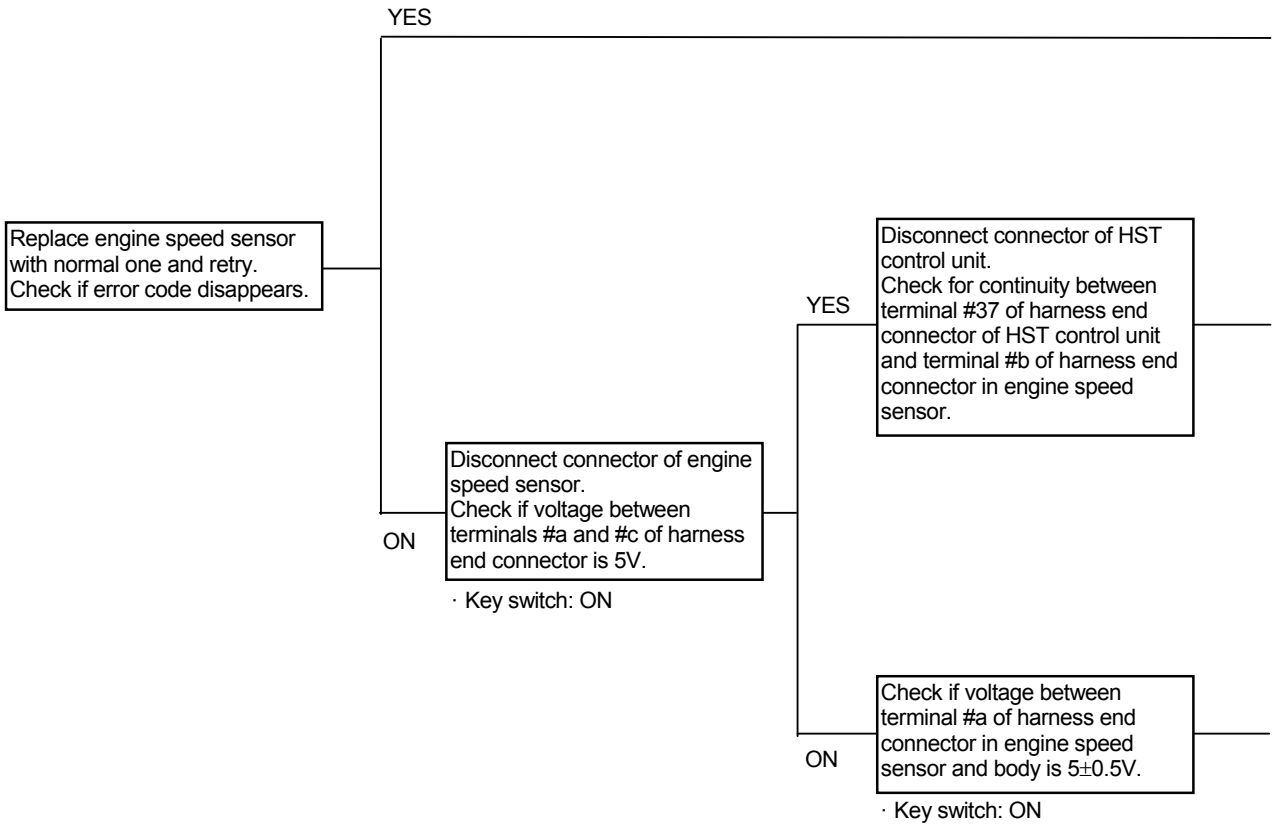
1 - Loader Control Lever
2 - Auxiliary Control Lever (Optional)
3 - Auxiliary Control Lever Lock (Optional)
4 - Auxiliary
5 - Ride Control Switch (Optional)
6 - eco Mode Switch
7 - Heater Switch (Optional)
8 - Key Switch
9 - Loader Control Lever Lock

HST CONTROL UNIT ERROR CODE LIST

Error Code	Trouble	Cause	Influenced Control
1-1	Abnormal start-up condition	The supplied voltage to the HST control unit is reduced. (10 V or less) The supplied voltage to the HST control unit is raised. (17 V or more) Failure is diagnosed only when the HST control unit starts.	HST pump control HST motor control
2-1	Abnormal HST motor displacement angle control output	Faulty harness. Faulty proportional solenoid valve.	HST motor control
2-2	Abnormal HST pump displacement angle control output	Faulty harness. Faulty proportional solenoid valve.	HST pump control
2-3	Abnormal parking brake control output	Faulty harness. Faulty relay.	Emergency parking brake
2-4	Abnormal overrunning buzzer	Open circuit in harness of overrunning buzzer output. Faulty overrunning buzzer.	Buzzer control when overrunning
3-1	Abnormal speed sensor	The detected value is 60 km/h (37 mph) or more. Emergency stop of the detected value (The signal is stopped over 15 km/h (9 mph) or more when the HST brake is depressed at 50 % or less in the operable range.)	HST motor control (100 % output)
3-2	Abnormal engine speed sensor	The following abnormal values are detected. • Less than 300 min^{-1} when machine speed is 5 km/h (3 mph) or more. • 0 min^{-1} when terminal L of the alternator is 12 V. • Engine speed is beyond 5000 min^{-1}.	HST pump control (40 % output)
3-3	Abnormal brake pedal angle sensor low voltage	The sensor input voltage to the HST control unit is 0.25 or less.	HST pump control (50 % output)
3-4	Abnormal brake pedal angle sensor high voltage	The sensor input voltage to the HST control unit is 4.75 or more.	HST pump control (50 % output)
3-5	Abnormal forward/reverse lever	The following conditions are detected. • The forward and the reverse signals are detected at the same time. • Detected machine speed is below in sequence. 3 km/h (2 mph) with engine speed at 1500 min^{-1} or more without inputting the forward and the reverse signal. → 0 km/h (0 mph)→ 3 km/h (2 mph) with engine speed at 1500 min^{-1} or more.	Control selecting forward and reverse travel operation
4-1	Abnormal low voltage	The supplied voltage to the HST control unit is 10 V or less.	Normal operation
4-2	Abnormal high voltage	The supplied voltage to the HST control unit is 17 V or more.	Normal operation

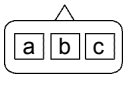
HST CONTORL UNIT ERROR CODE 3-2

Error Code	Trouble	Cause	Influenced Control
3-2	Abnormal engine speed sensor	The following abnormal values are detected. • Less than 300 min^{-1} when machine speed is 5 km/h (3 mph) or more. • 0 min^{-1} when terminal L of the alternator is 12 V. • Engine speed is beyond 5000 min^{-1}.	HST pump control (40 % output)



Connector (Harness end of connector viewed from the open end side)

Engine Speed Sensor Connector



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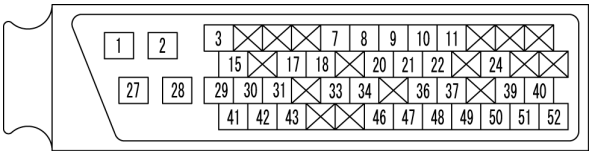
HST Control Unit Connector



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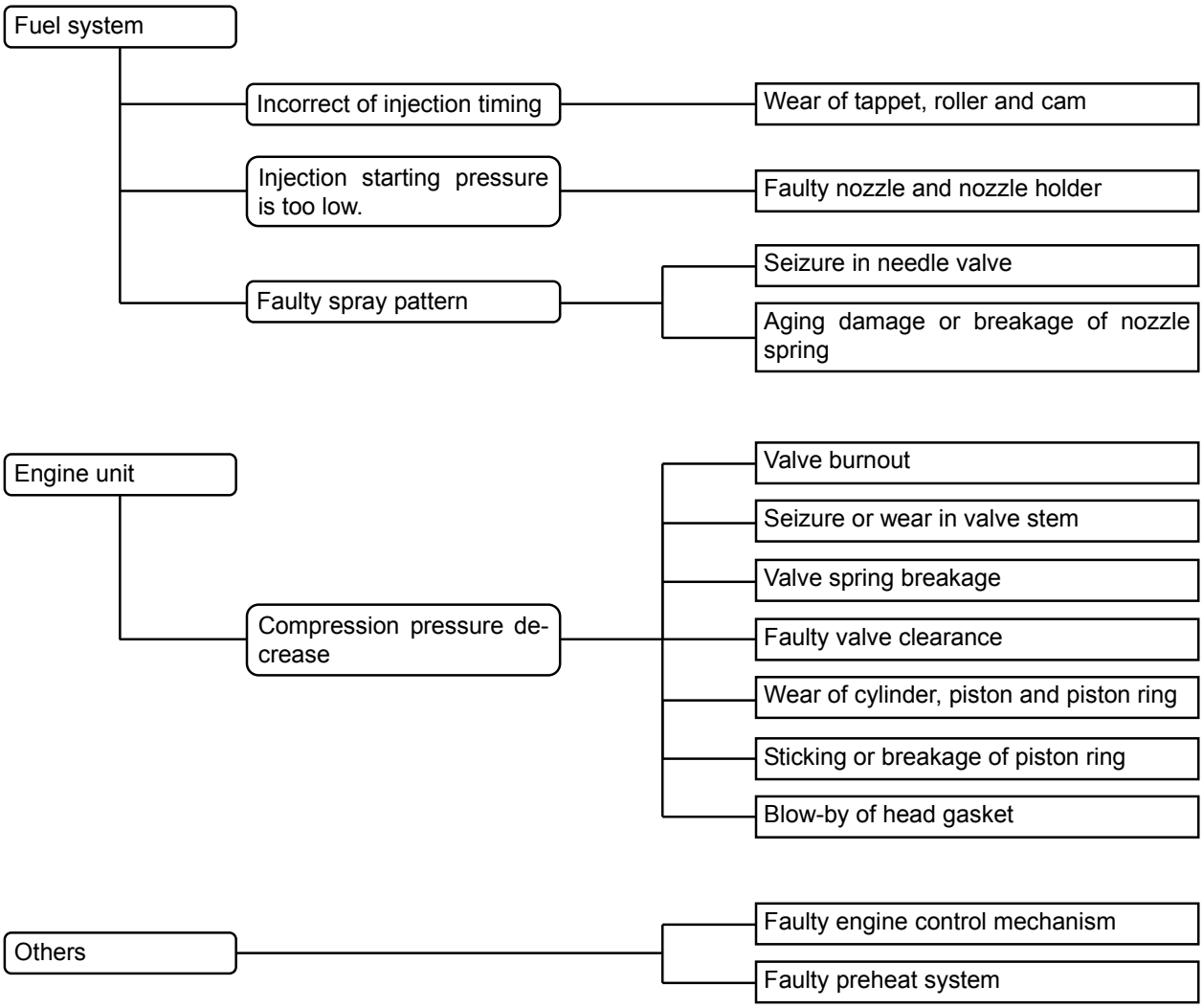
Trouble symptoms	2. Hard to start engine



TRAVEL SYSTEM TROUBLESHOOTING

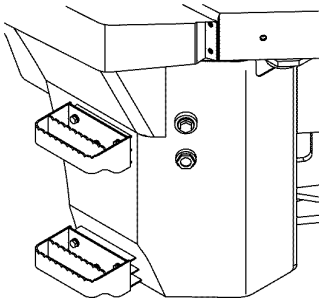
Trouble symptoms	A-1. The vehicle does not travel at all (traveling is impossible forward and reverse)

(1) Oil shortage in the hydraulic oil tank

Check for the hydraulic oil level.

1. Keep the machine horizontally.
2. Lower the bucket or the attachment onto the ground horizontally.
3. Stop the engine. Check that the oil level of dipstick is between the upper limit mark and the lower limit mark.

- Hydraulic oil amount is short. → Repair oil leak area and add oil.
- Hydraulic oil amount is normal.



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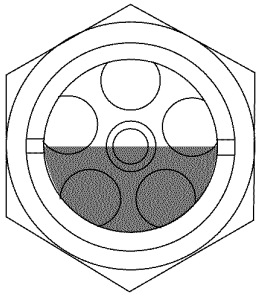


M4EJ-07D-002

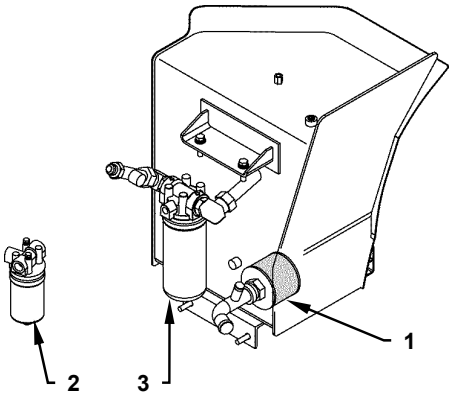
(2) Clogged suction strainer

Remove suction strainer (1) in the hydraulic oil tank. Check for restrictions.

- With restriction
- No restriction

Check HST filter element (2) and hydraulic oil filter element (3). Check for the foreign particles, which cause suction strainer (1) restrictions.

- Cleaning of suction strainer
- Repair of hydraulic cylinders and hose (Metal fragments included copper powder)
- Repair of hydraulic pump (Nylon and rubber pieces)



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Trouble symptoms	A-4. Travel at engine low idle speed.

(1) Engine low idle speed is too high.

↓

Measure the engine low idle speed.

1. Measure the engine low idle speed according to Engine Performance Test / Engine speed.
2. As for specification, refer to Operational Performance Standard.

↓

Out of Specification

1. The adjustment of accelerator linkage is faulty. Even if the accelerator pedal is returned, the pedal does not get in contact with the low idle stopper in the governor.
2. Foreign objects get caught in the accelerator pedal and the accelerator pedal is not returned completely.
3. Rust and stuck of accelerator linkage.

Within Specification

Faulty bleeding air from HST circuit.

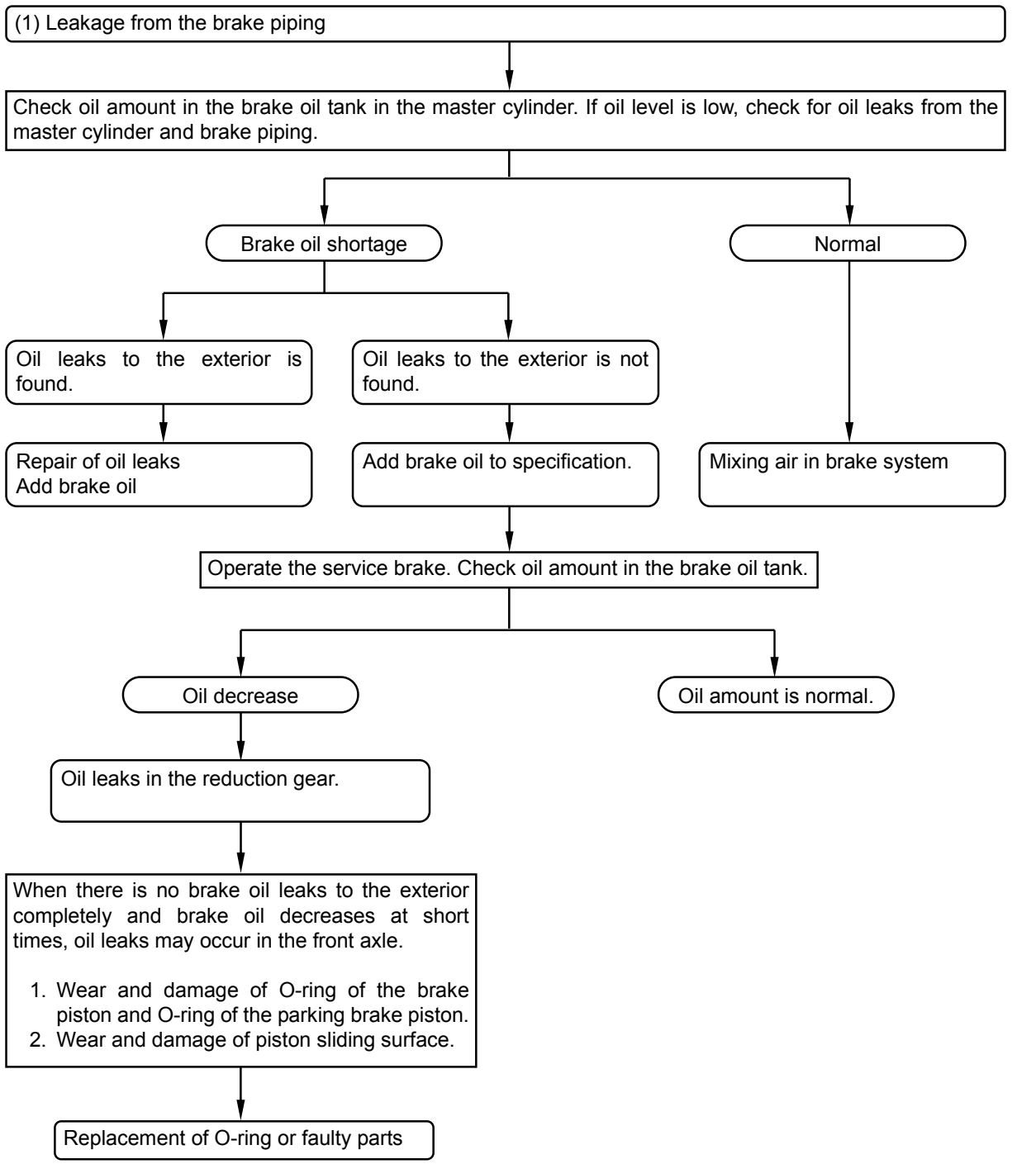
(2) Faulty bleeding air from HST circuit

↓

1. When the machine travels with the forward/reverse lever set in the Neutral position, perform the check of hydraulic oil. (Especially pay attention to viscosity)
2. After the engine starts, when the machine travels with the forward/reverse lever set in the Neutral position for a moment, bleed air from HST circuit.
   Cause of trapping air is replacement of hydraulic oil filter or element, repair of motor or residual air when replacing HST piping or hose. If any cause cannot be found, as air may be sucked from the loosened part of HST piping and hose, check and retighten the hose and piping

BRAKE SYSTEM TROUBLESHOOTING

Trouble symptoms	B-1. Brake control force decreases



Trouble symptoms	C-1. Steering operation is impossible or heavy

(3) Faulty steering valve (sticking or wear of spool and sleeve)

↓

Measure the operating force of steering wheel.

1. Park the machine on a level paved road with traveling position. Release the parking brake.
2. Hydraulic oil temperature is kept at operating temperature (40 to 60 °C (104 to 140 °F)).
3. The bucket must be empty.
4. Measure the operating (rotational) force of steering wheel at engine low idle speed and fast idle speed in this condition. At the same time, check for the unevenness (sticking) of operating (rotational) force.

As for specification, refer to Operational Performance Standard.

↓

Measure the slip amount of steering wheel.

1. Turn the steering wheel to the right or left and get in contact with the frame stopper completely (stroke end).
2. In addition, turning the steering wheel from this condition, the wheels rotate while slipping due to the internal leaks of steering valve.
   Measure the revolutions of steering wheel per 1 minute.

Specification

Specification on a new machine: 3.5 rev/min

When the slip amount of steering wheel reaches to 1.5 times or more, repair is required as the internal leaks becomes excessive.

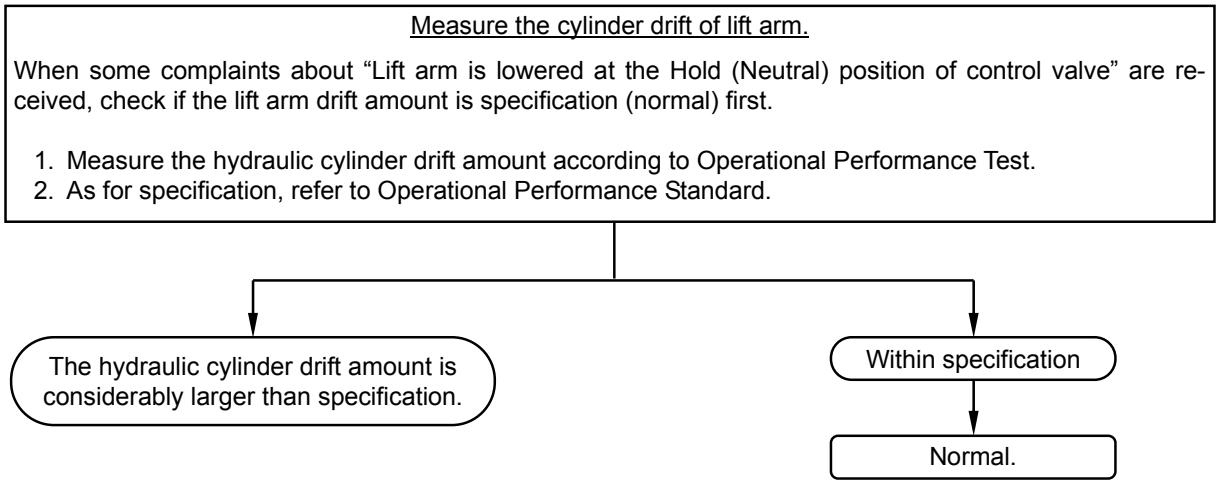
↓

Out of Specification

↓

Repair or replacement of steering valve

Trouble symptoms	D-2. Cylinder drift of lift arm is large at the neutral position of control lever.



Trouble symptoms	D-6. Bucket operation (tilt back) time is long or operation force is insufficient.

(5) All of measurement values in paragraph 1 to paragraph 3 of Measurement of Overload Relief Valve Hydraulic Pressure are the same and lower than the main relief valve specification. In addition, measurement value in paragraph 2 is specification.

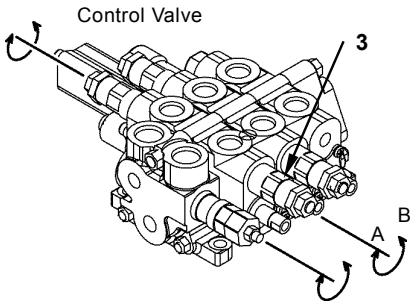
↓

Faulty or faulty adjustment of overload valve (3)

<Adjustment Methods>
(1) According to paragraph 3 of Measurement of Overload Relief Valve Hydraulic Pressure, hydraulic pressure of overload relief valve (3) can be measured by using an oil pressure gauge.
(2) Loosen lock nut (6) of overload relief valve (3)
(3) While reading the needle of oil pressure gauge, turn adjusting screw * by using a hexagonal wrench so that the needle indicates specification.
A: Tightening (clockwise) → Oil pressure increases
B: Loosening (counterclockwise) → Oil pressure decreases

Specification: Refer to Operational Performance Standard

NOTE: As the relief sensitivity is exceedingly sensitive, do not loosen quickly.
- *Hold adjusting screw (7) by using a hexagonal wrench and secure by using lock nut (6)*
- *Measure the overload relief pressure again and confirm that set pressure is specification.*
- *Adjust the main relief valve set pressure to specification.*



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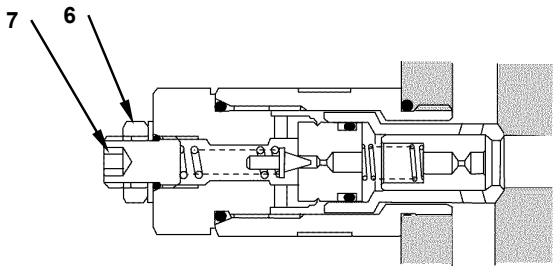


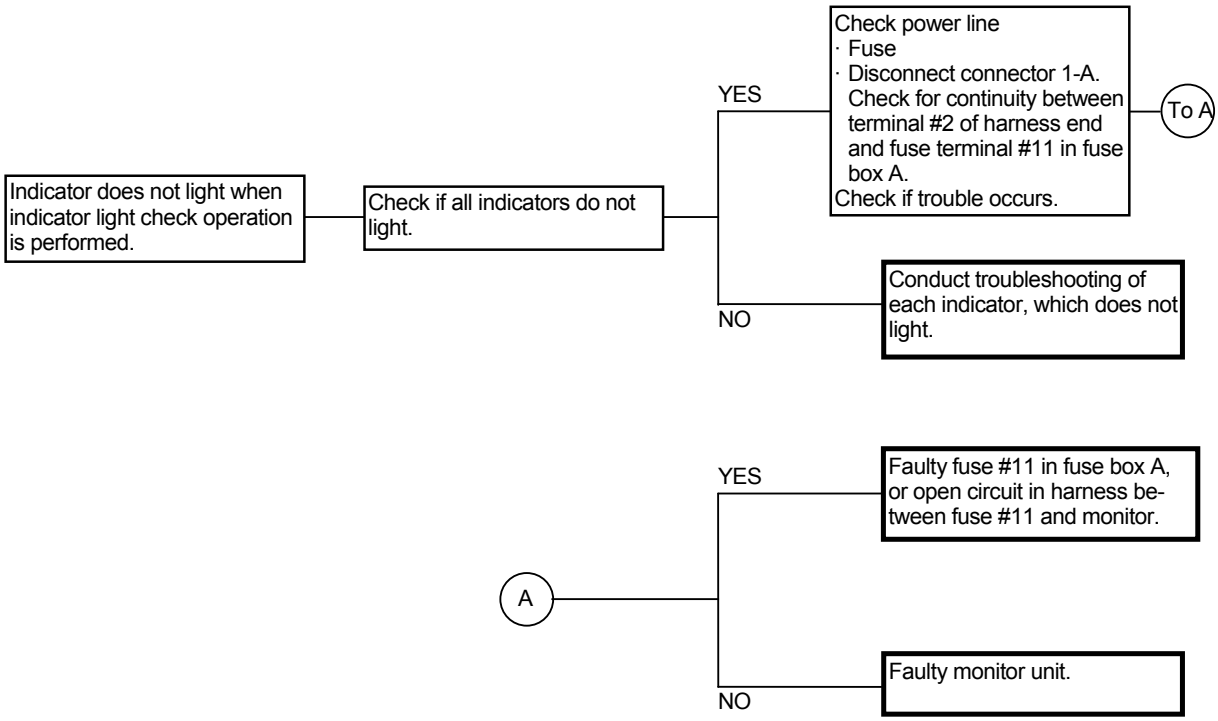
T4FG-03-02-013

(6) When measurement values in paragraph 2 of Measurement of Overload Relief Valve Hydraulic Pressure is higher than specification, refer to paragraph 4 and adjust overload relief valve (2)

(7) When measurement values in paragraph 3 of Measurement of Overload Relief Valve Hydraulic Pressure is higher than specification, refer to paragraph 5 and adjust overload relief valve (3)

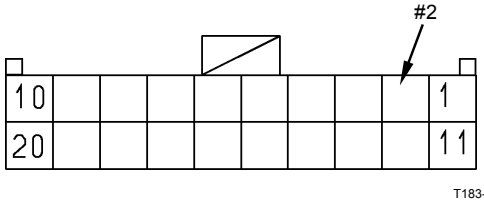
MALFUNCTION OF INDICATOR LIGHT CHECK SYSTEM

- Check the wiring connections first.



Connector (Harness end of connector viewed from the open end side)

Monitor Unit
Connector 1-A



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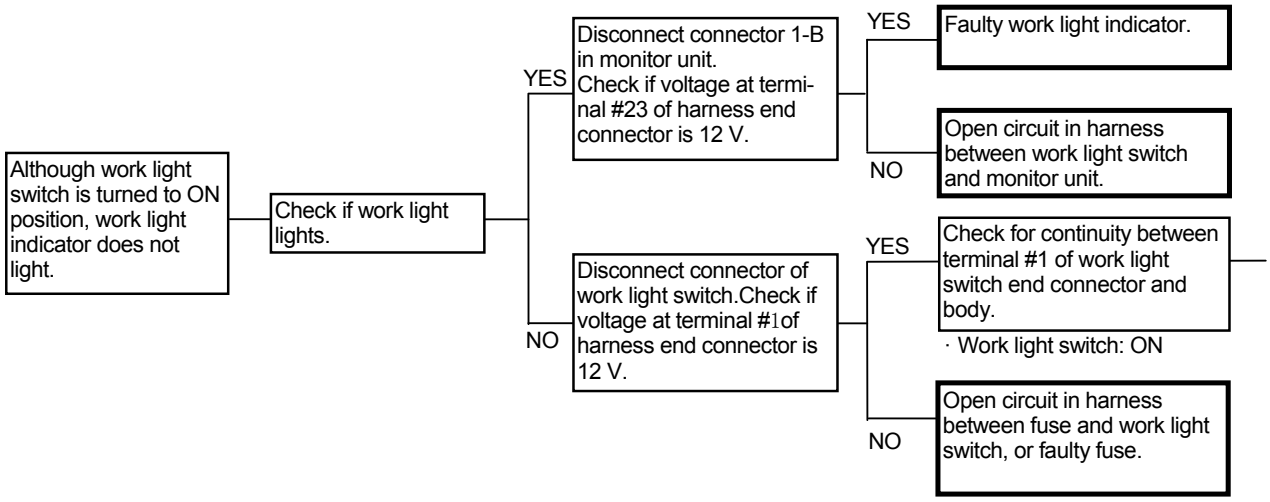
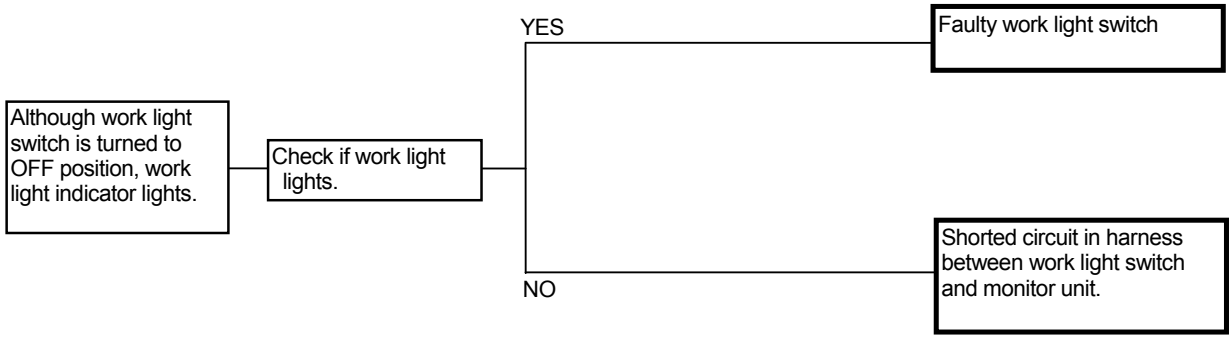
MALFUNCTION OF WORK LIGHT INDICATOR

- Check if the working light switch and headlight switch are in the ON position.
- If the clearance light indicator also does not light, the common circuit for clearance light indicator and working light indicator may be faulty. Refer to MALFUNCTION OF CLEARANCE LIGHT INDICATOR.
- Check the wiring connections first.

NOTE: Front work light is optional.





MALFUNCTION OF SERVICE INDICATOR

- When the following troubles occur, the service indicator lights in order to announce the trouble to the operator, stop the machine and maintain the machine.
- Although the machine is maintained and if the service indicator does not go out, other indicator on monitor must light. Refer to the pages corresponding to the indicator in this group or conduct the remedy according to Troubleshooting A.
- Although there is no trouble and if the service indicator does not go out, the logic circuit in monitor unit may be faulty.

(When the abnormal value is detected, the service indicator lights;)

- Faulty generation of the alternator
- Lighting the engine warning indicator
- Lighting the HST warning indicator

NOTE: When the parking brake is applied with the engine running and the forward/reverse lever is set in neutral position, the parking brake indicator and the service indicator light. This is normal.

MALFUNCTION OF MONITOR DISPLAY

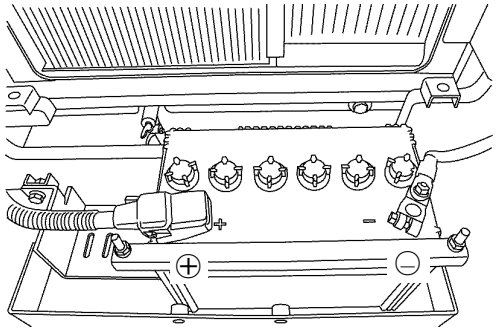
- The data on monitor display is displayed after the signal directly input from the sensors is proceeded in the logic circuit of the monitor unit. Therefore, check if the sensors corresponding to the trouble are normal.

Description			Cause of Trouble
Data on liquid crystal display	Neutral indicator		The sensor system detecting the related signal is faulty. (As for the machine, some trouble must occur. Refer to Troubleshooting A and conduct the remedy.).
	Forward/reverse indicator		
	Driving mode indicator		
	Speed meter		
	Ride control indicator		Refer to T5-3-33.
Data on data display	Odometer	Displayed on normal mode	The sensor system detecting the related signal is faulty. (As for the machine, some trouble must occur. Refer to Troubleshooting A and conduct the remedy.) As for these troubles, the liquid crystal display in monitor unit may be faulty or the logic circuit may be faulty.
	Hour meter	Displayed on normal mode	The alternator is faulty, the harness between terminal L in the alternator and terminal #14 of connector 1-A in monitor unit is faulty, or the clock circuit in monitor unit is faulty.

FUSIBLE LINK INSPECTION

Inspection

1. Open the engine hood. Remove the cover from the battery box at the center of the counterweight. Disconnect the negative cable from the battery.
2. Two fusible links (100 A) are located in the left front of the engine room when the front attachment is set forward.
3. Visually inspect the fusible link.
4. Connect the negative cable to the battery.



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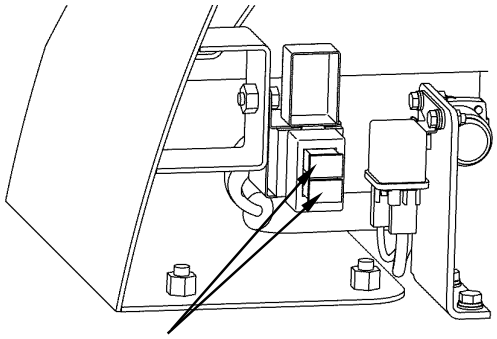
Replacement

1. Check that the negative cable of the battery in the battery box at the center of the counterweight has been disconnected.
2. Two fusible links (100 A) are located in the left front of the body when the front attachment is set forward.
3. Remove and replace the fusible link.
4. Connect the negative cable to the battery.



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THE ATTACHED DIAGRAM LIST

(The following diagrams are attached to this manual.)

1. E820-3 REAR HARNESS 1
   E820-3 REAR HARNESS 2

2. E820-3 REAR HARNESS 3
   E820-3 FRONT HARNESS

3. E820-3 MAIN HARNESS

4. E820-3 ELECTRICAL CIRCUIT DIAGRAM 1
   E820-3 ELECTRICAL CIRCUIT DIAGRAM 2 (Cab)

5. E820-3 HYDRAULIC CIRCUIT DIAGRAM