Analysis and Case Study on Electrical Fault of Komatsu Loader

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Abstract: In recent years, as the WA series wheel loaders have been applied more and more widely in the country and greatly reduce the human physical labor, how to improve the use of loader efficiency? Inevitably it is to reduce the loader's faults, especially electrical faults. It is necessary to analyze and diagnose the electrical faults of the loader, continuously improve the reliability and safety of the loader, correctly regulate the operation of construction machinery, and pay attention to maintenance and maintenance.

Keywords: WA series wheel loaders, electrical failure analysis, construction machinery, reliability and safety.

1. Electrical Fault Analysis

1.1 Starter Common Faults
The starter is the heart of the starting system. Other components of the starter system are batteries, electric locks, start buttons, connecting wires, etc. The common faults of the starter are: the starter does not rotate; the starter idles without starting power; the rotation speed is too low or even slightly stop; the starter runs, but the diesel engine does not turn; the starter cannot stop turning; the diesel engine cannot be started and there is impact Sound and so on.

1.2 Failure Analysis of Starter
Starter does not rotate Fault phenomenon:
When starting the diesel engine, the starter cannot turn.
(1) Cause of failure
①The surface of the 1 pole is heavily oxidized and the connection is loose; the battery
is depleted with too much electricity and the long-term charge is insufficient.  
② The contact plate has been severely blamed by electric shock or the solenoid coil or the pull-in coil in the electromagnetic switch has been broken, short-circuited or grounded. The electric shock cannot be closed.
③ Field winding or armature windings open, short circuit or ground fault.
④ The brush can’t touch the commutator.
⑤ Ignition switch failure, bad line or connection error.

(2) Failure Analysis
① Turn on the headlight experiment and click the horn before turning on the start switch. If the lights are dim, the horn sounds hoarse, indicating that the battery is running low or the starting circuit is in poor contact. At this time, check the connection of the battery wires. If looseness occurs, tighten them in time. If the wires are connected properly, the battery power and performance should be checked.
② Now use thick conductors to connect the two terminals of the electromagnetic switch of the starter. If there is a strong spark, the starter will not turn, it means that the internal short circuit of the starter, the mechanical part is too tight or the crankshaft resistance of the diesel engine is too large; if there is no spark if the starter does not turn, it indicates that the starter has an open circuit fault. It must be completely and comprehensively repaired.

Starter idling, low speed phenomenon:
Turn on the starter switch, the starter drives the diesel engine to rotate, but the rotation speed is too low or even stop slightly.
(1) Cause of failure
① Wire bad contact
② Insufficient battery charge, insufficient battery discharge, etc.
③ Starter itself fails
(2) Fault Analysis and Diagnosis
① First turn on the headlights, restart the starter, and observe the light changes. If the light goes out immediately or the filament turns dark red, it indicates that there is a bad connection between the battery headers or insufficient battery storage.
② If the filament maintains its original brightness, it indicates that the main circuit of the starter is in poor contact or open circuit. The firmness of the starter’s ground wire should be checked. Is the brush contact area and the spring force too small? Is the brush dirty? Whether the stator coil is broken or not.

1.3 Charging System Operation Failure Analysis
First of all, it can be analyzed through the ammeter that the charging system is in normal operation. If there is a failure, it should be immediately found and promptly
eliminated.

working principle:
(1) Before the engine is started, the circuit can be grounded through the alternator R terminal and the generator excitation coil, the alternator relay is pulled in, and the battery charging lamp is lit.

Fault phenomenon:
When the generator is running at medium speed, the charge indicator lights up or the ammeter indicates discharge.

cause of issue:
① The connection wires in the charging system may be short-circuited.
② Internal fault of the generator. If there is a fault or short circuit between the stator and three-phase windings; the brush is stuck in the brush holder, making it inaccessible to the slip ring, and the result is that the generator does not generate electricity.

Fault diagnosis:
When this fault occurs, check the following steps.
① First check that the wire connections in the charging system are reliable.
② Second, check whether the belt is loose. The judgment method can be used for the middle point of the thumb pressure transmission belt, and the deflection is about 10mm.
③ Finally determine the fault in the generator or regulator. A conductor can be used to connect the two terminals of the "+" and "F" terminals on the regulator, and then the generator is started to run the motor and observe the display of the ammeter. If the charging is displayed, it means that the generator is operating normally and the fault is on the regulator; if the ammeter still shows discharge, or the charging indicator does not go out, it means that the generator does not generate electricity and it will inevitably fail.

(2) The charging current is too large.

Fault phenomenon:
When the generator is running at a medium speed, the ammeter indicates that a large current is charged, the electrolyte in the battery is consumed too quickly, the bulb is easily burned out, and the generator is easily overheated.

cause of issue:
The regulator is the main reason for the excessive charging current.
① The low-speed contact of the electromagnetic vibrating regulator is sintered; the regulator has a bad ground; the spring has too much elasticity, so that the adjustment voltage is too high.
② In addition, excessive battery loss or internal short circuit can also cause excessive charging current.
Failure analysis:
The diagnosis should first determine whether the battery is internally disconnected. Then disconnect the regulator and short circuit the “+” and “F” terminals of the alternator to allow the alternator to generate electricity and charge the battery.

2. Case Studies

2.1 WA380-3 Machine Without Retrograde File

(1) Failure phenomenon
The machine has only forward gear, medium gear, and no reverse gear.

(2) Actual investigation process
① When the reverse gear is engaged, the input voltage is 26.4V (standard is 20 to 30V), which is normal.
② Ground and frame resistance is zero. This can be used to make a judgment that the reverse solenoid valve circuit is normal.
③ The forward electromagnetic valve circuit is also detected and the measured circuit may be normal.
④ Using emergency manual slide valve, the machine can go backwards, indicating that the directional spool valve is working properly.
⑤ Judging from this may be that the orifice of the emergency manual spool valve is blocked or the solenoid valve spool is stuck in the position of the normally-connected fuel tank.
⑥ Dismantling forward electromagnetic valve check, found that the solenoid valve spool stuck, can not return to close the oil circuit.

(3) Failure Analysis
For this fault, consider from the electrical direction:
① If the direction switch (combination switch) is abnormal, that is, when the direction lever is set to reverse, no power is output from the R terminal (reverse terminal).
② The reverse relay is abnormal. If the coil is open and the coil ground is open, the terminal switch cannot be closed.
③ Open circuit or short circuit to ground from the combination switch R terminal to the reverse solenoid valve.
④ Reverse solenoid valve coil open circuit.
The above failures will cause the reverse solenoid valve to not work properly when the reverse gear is reversed.
3. Conclusion

This article mainly introduces several typical electrical faults and a case study of the loader. Combined with several electrical faults, a variety of angles and methods for analyzing the electrical faults of the loader are provided. From the phenomenon to the cause, the research is gradually deepened. Observe the problem and analyze the problem. Only by finding the root of the problem can we solve the problem as soon as possible. Constantly improve the reliability and safety of loaders and improve work efficiency.

References