

Subject

Pull/Hold Relay and Throttle Solenoid Testing – Kubota Powered Multifunction Power Systems

SYSTEM OR PARTS AFFECTED

- Kubota-powered Multifunction Power Systems

OVERVIEW

The Kubota powered VMAC Multifunction Power System responds to demands for air, generator output, or PTO output by increasing engine speed from 2500-2600 rpm low speed to 3650 rpm second speed when the Multifunction control system sees the demand.

The engine throttle mechanism is actuated mechanically from idle to second speed by a solenoid. This solenoid contains two separate windings: a Pull winding and a Hold winding.

Each winding receives current from a dedicated relay, a Pull relay and a Hold relay.

The Pull relay makes contact momentarily, energizing the Pull winding in the throttle solenoid to pull the throttle into the second-speed position. Once in the second-speed position, the Pull relay will open/deactivate at the same time as the Hold relay closes to send current to the Hold winding, holding the throttle in place for as long as the control system demands it.

When the control system determines that the engine speed should return to idle, the Hold relay opens, the throttle solenoid deactivates, and an internal spring in the throttle mechanism returns the throttle to its idle speed position.

If the Multifunction Power system engine speed does not elevate when it should, or elevates but does not hold as it should, perform the following procedure.

TROUBLESHOOTING

- ☐ Remove the service panel, top panel, and rear panel from the Multifunction. (Figure 1)

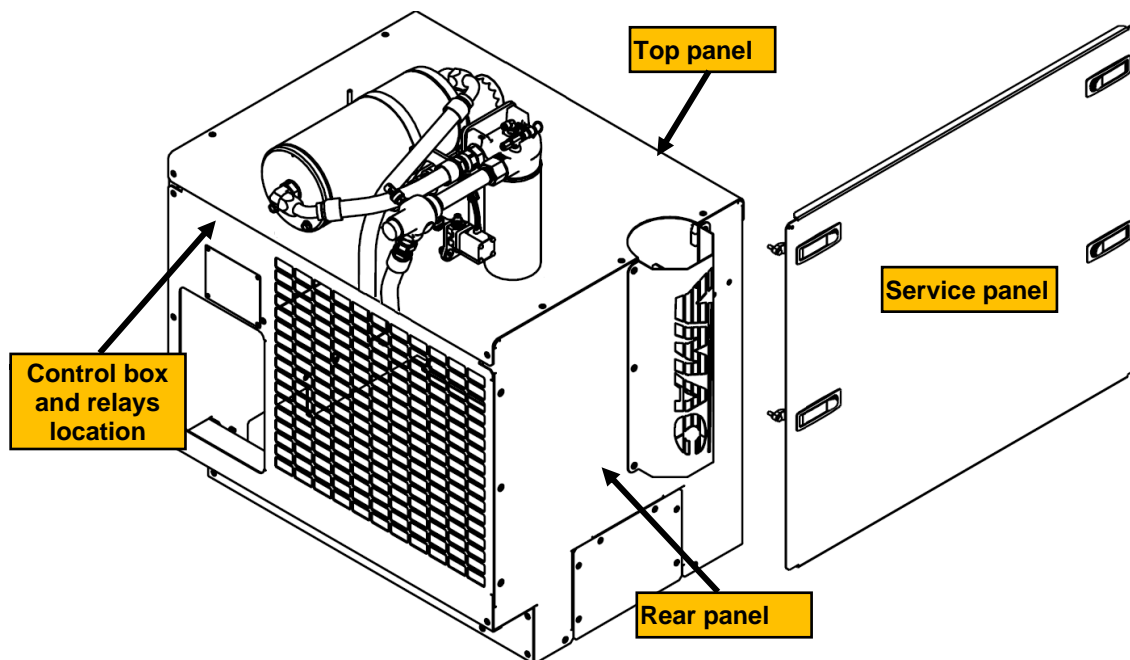


Figure 1 – Panel identification and relay location

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Relay Testing

- ☐ Locate the Pull and Hold Relays, on the control box bracket, at the top of the radiator (Figure 2).
- ☐ Locate the control box relays (x4), to the right of the pull and hold relays, above the control box.

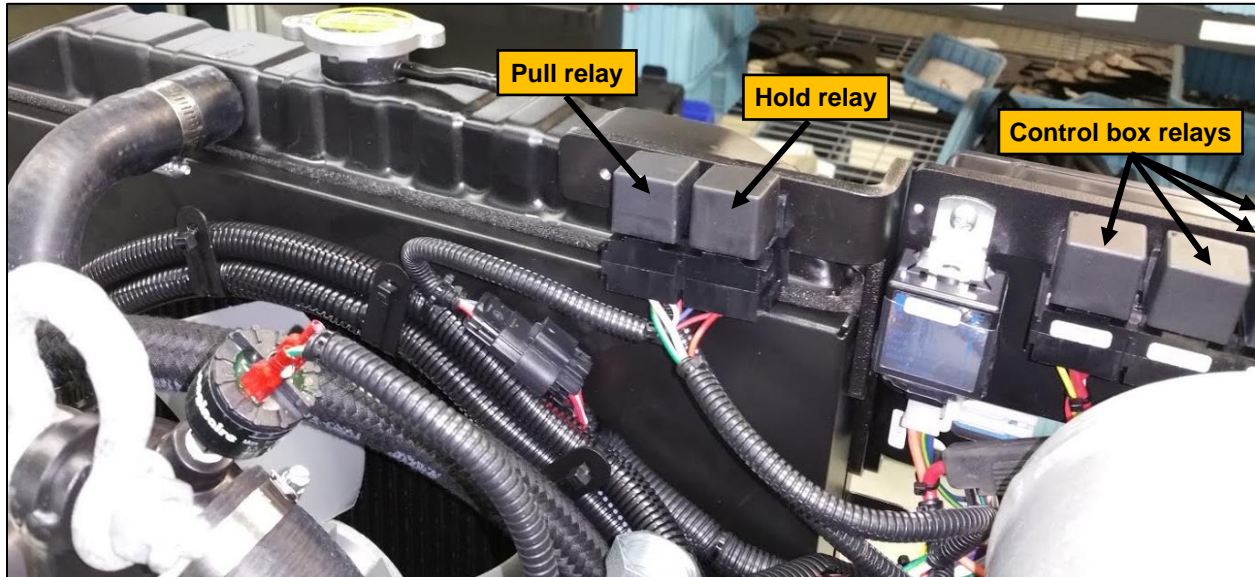


Figure 2 - identifying relays.



To prevent pushing the wires out of the relay socket, use care when removing or installing the relays. Care must also be used when probing the wires to prevent distorting the spade connector which could prevent proper contact with the relay.

Relay test method 1

- ☐ Remove the "Pull" relay from its socket.
- ☐ Remove any oxidation from the contacts.

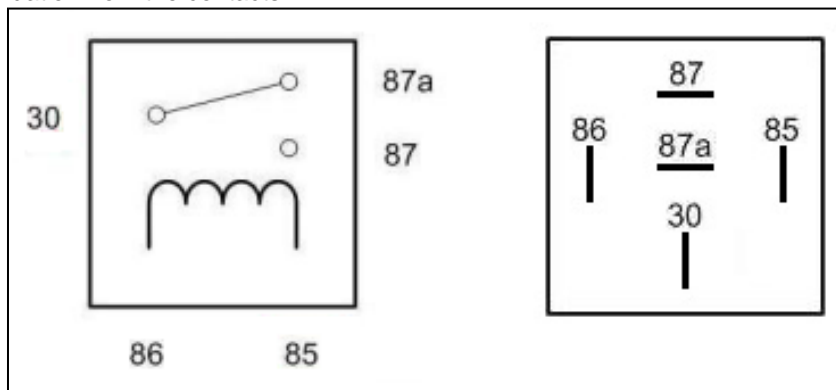


Figure 3-Relay pinout

- ☐ With the multimeter set to Ohms (Ω), measure the resistance between pin 30 and pin 87a of the relay. (Figure 3) The meter should beep or indicate that there is an electrical connection between the pins. A reading of "OL", "NA", or "1" indicates either a bad contact between the meter and the contact on the relay, or that the relay has failed.

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The next step requires providing 12 V and ground to the relay.

- ☐ Apply 12 V and ground to pins 85 and 86. The relay should “click” (polarity does not matter for this test).
- ☐ With the multimeter set to Ohms (Ω), measure the resistance between pin 30 and pin 87. The meter should beep or indicate that there is an electrical connection between the pins. A reading of “OL”, “NA”, or “1” indicates either a bad contact between the meter and the contact on the relay, or that the relay has failed.
- ☐ Repeat the above steps with the “Hold” relay.

Relay test method 2

- ☐ Start the engine and allow it to warm up.
- ☐ Temporarily remove one of the relays from above the control box (Figure 2) and plug it in to the “Pull” relay receptacle.
- ☐ Enable one of the accessories (compressor, generator, or PTO) to see if the system goes to high idle.
 - If the system goes to high idle and operates normally, the “Pull” relay is faulty and must be replaced.
 - If the engine briefly elevates rpm but returns to idle, switch off the accessory and remove the “Hold” relay. Temporarily remove one of the relays from above the control box and plug it in to the “Hold” relay receptacle. Switch on the accessory again and observe the result.
 - ☐ If the engine elevates rpm to second speed and operates as normal, the Hold Relay is faulty. Replace it.
- ☐ Re-install or replace any relays “borrowed” from the control box relays, as these are required for normal operation of the engine.

Wire Harness Test

The following procedure tests the wiring harness between the Multifunction control box and the Pull/Hold Relays, including the coils in those relays.

- ☐ Locate the Multifunction control box and relay terminals.
- ☐ Find the blue 32 pin connector at the control box. (Figure 4)

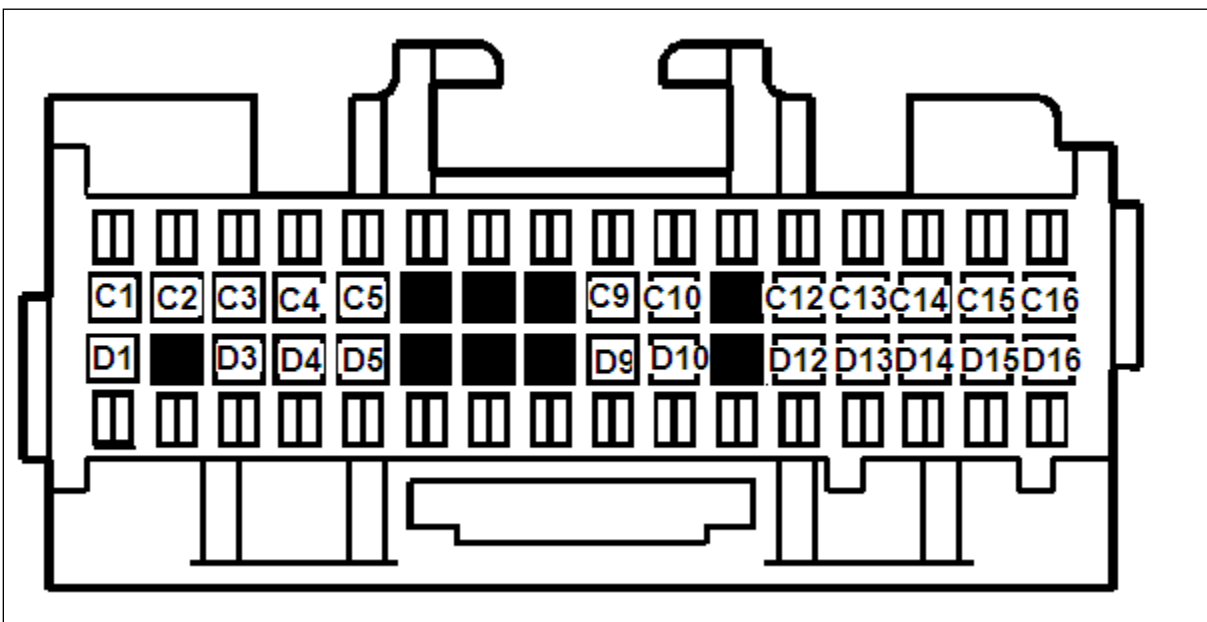


Figure 4- Control box connector.

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- ☐ Unplug the blue 32 pin electrical connector from the Multifunction control box.
- ☐ Using a multimeter, set to Ohms, measure resistance between the following pins. (Table 1)

NOTE This test is polarity specific.

- ☐ Multimeter positive lead to pin D13 and negative lead to pin C13
- ☐ Multimeter positive lead to pin D14 and negative lead to pin C14

Resistance spec is approximately 80 Ohms.

Connector Pin	Wire Colour	Description
C13	Blue	2 Speed Hold to Ground
D13	Red	2 Speed Hold to +12V
C14	White	2 Speed Pull to Ground
D14	Red	2 Speed Pull to +12V

Table 1

Inspecting/Testing the throttle solenoid and harness

Solenoid Bracket and Linkage inspection

If the bracket that the solenoid is attached to becomes bent, the throttle solenoid may not be able to pull through its full range of motion. If the solenoid does not pull fully into second speed position, it may not hold second speed.

If linkage between the solenoid and the Kubota throttle mechanism is worn or damaged, the linkage may come out of alignment, preventing full solenoid motion, and not hold second speed.

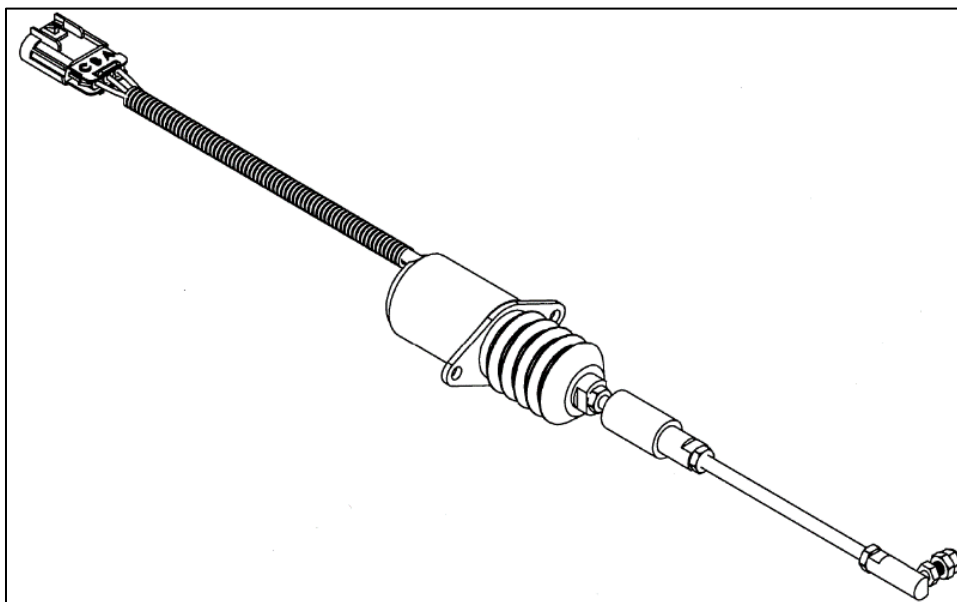


Figure 5 – Throttle solenoid and linkage.

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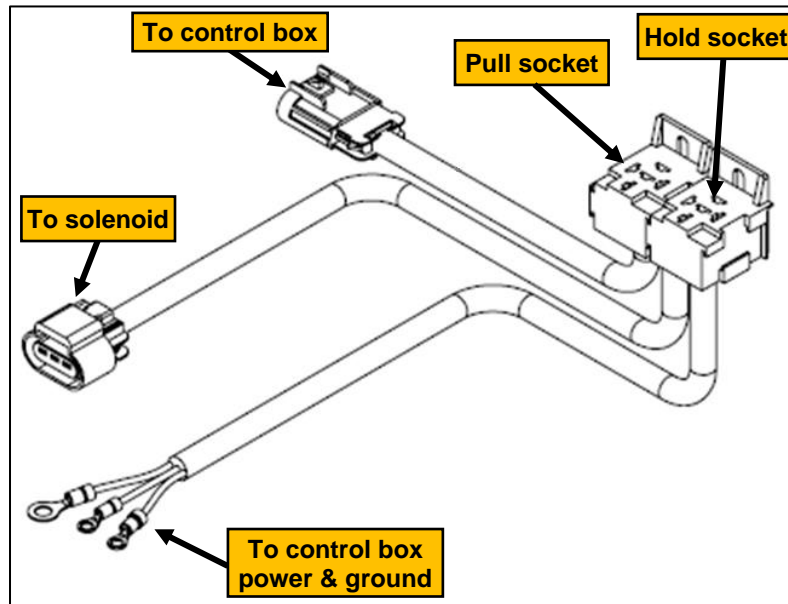


Figure 6 – Pull/Hold relay to throttle solenoid harness.

- ☐ Inspect the harness running between the “Pull” and “Hold” relays and the throttle solenoid; check for broken/frayed wires and ensure the pins are seated in the connectors and making good contact.

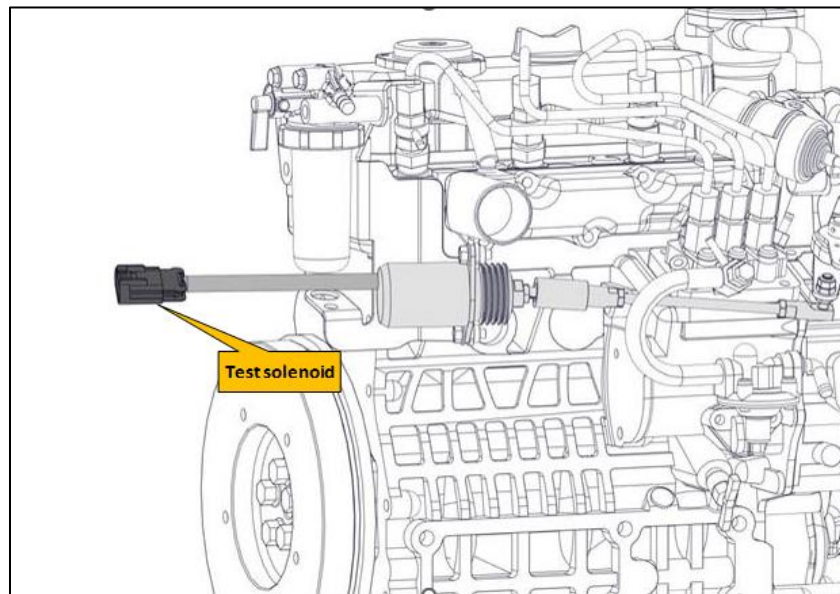


Figure 7– Throttle solenoid.

- ☐ Test the throttle solenoid (Figure 7)
 - With the multimeter set to Ohms (Ω), the measured resistance between the green wire with yellow stripe and red wire should be 11.9 Ohms.
 - With the multimeter set to Ohms (Ω), the measured resistance between the green wire with yellow stripe and white wire should be 0.5 Ohms.

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