38.18. The red wire on the OCR plug carries **battery voltage**.

- **Behavior**: D.C. battery voltage should show-up on a volt meter when the red probe is touched to this terminal and the black probe is grounded, regardless of the key switch position.
- **Circuitry**: This wire draws power directly from the B terminal on the key switch.
- **Interpretation**: If there is not battery voltage at this terminal, the tractor is probably not function at all. Look for a blown fuse, disconnected battery, disconnected ammeter or some other major fault.

38.19. The purple wire provides a **ground signal** to the RMC module when the key switch is placed in the **REVERSE CAUTION MODE.**

- **Behavior**: There should be continuity to ground at this terminal when the key switch is in the REVERSE CAUTION MODE position.
- **Circuitry**: When the key switch is in the REVERSE CAUTION MODE position, a ground path is established by connecting terminal A2 to terminal L within the key switch. The white wire from the RMC module connects to A2, and a green ground wire connects to L.
- **Interpretation**: If the purple wire fails to reach a ground path when the key switch is in the REVERSE CAUTION MODE position, the RMC module will not arm or operate. Check the key switch for continuity between A2 and L in the REVERSE CAUTION MODE position, confirm that the green wire connecting to the L terminal does have good continuity to ground, and check for any loss of continuity in the purple wire that extends from the key switch to the RMC module, including the molded connector between the two components.
- If the RMC plug test indicates fault with any of the safety switches, the next step is to test the suspect switch.The operation of those switches is described in the following sections.

39. UNDERSTANDING THE PTO SWITCH

39.1. A-COM is in the starter inhibit circuit. It is a normally closed (NC) set of contacts. When the PTO is OFF, and the contacts are closed, power coming from the brake switch (key switch in START, brakes ON) through the orange wire with black trace is passed on to the trigger terminal on the starter solenoid through the orange wire with white trace.

39.2. B-COM is in the safety shut-down circuit. It is a normally opened (NO) set of contacts. A circuit is completed from the M terminal on the key switch through the yellow wire to the Magneto terminal on the RMC module through the yellow wire with black trace when the contacts are closed. This gives the RMC module the ability to turn-off the engine when the PTO is ON.

39.3. In C-Com, power is supplied to the PTO switch from the A1 terminal of the ignition switch through a red wire.when the PTO switch is turned on this completes the circuit to allow power to go to the PTO clutch. It is a normally opened (NO) set of contacts.

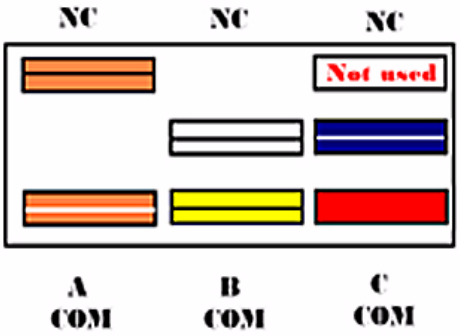


Figure 39.3

NOTE: The top terminals are showing normally closed at rest and the middle terminals are normally open at rest

NOTE: There are three contacts on the right side in the C-COM.For this application the normally opened (NO) contact is used.

39.4. The **Brake Switch** is mounted to the inside of the frame slightly right of the steering shaft. See Figure 39.4.

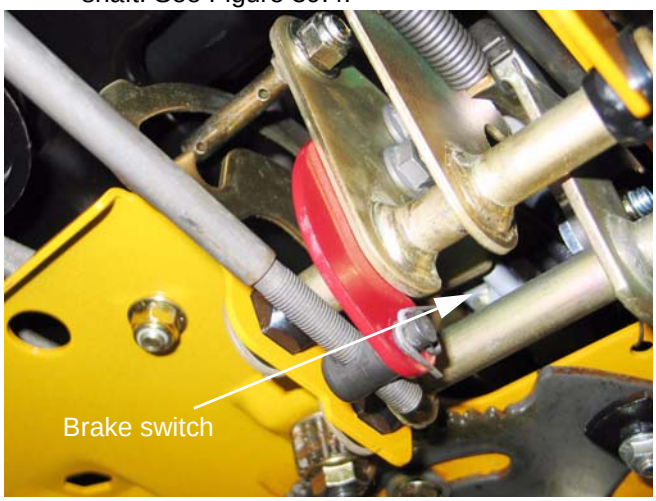


Figure 39.4

- The plunger on the switch is depressed when the clutch / brake pedal is pressed-down, de-clutching the drive belt and applying the brakes. The switch contains two sets of contacts.
- A normally open (NO) set of contacts is in the starter inhibit circuit. When the clutch / brake pedal is depressed, the contacts are closed, power coming from the key switch (key switch in START) through the orange wire is passed on to the PTO switch through the orange wire with black trace.
- A normally closed (NC) set of contacts is in the safety shut-down circuit. A circuit is completed from the M terminal on the key switch, and directly from the magneto primary windings through the pair of yellow wires to the clutch / brake switch through to the yellow wire with black trace when the contacts are closed.
- The yellow wire with black trace leads to one element of the seat switch. If the seat is vacant *and* the pedal is up, the engine will turn-off.

39.5. The **Reverse Safety Switch** is a simple metal contact tang. The gear selector touches it when placed in the reverse position, providing a ground path through the gear sector lever itself. See Figure 39.5.

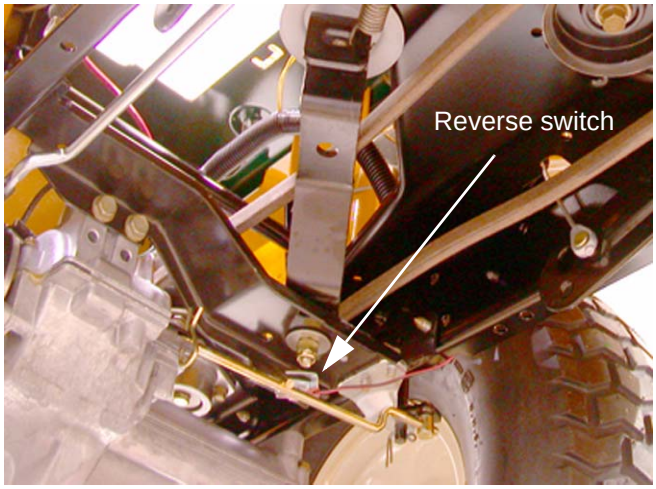


Figure 39.5

39.6. On hydraulic drive units the reverse safety switch is located on the right side just above the brake arm. See Figure 39.6.

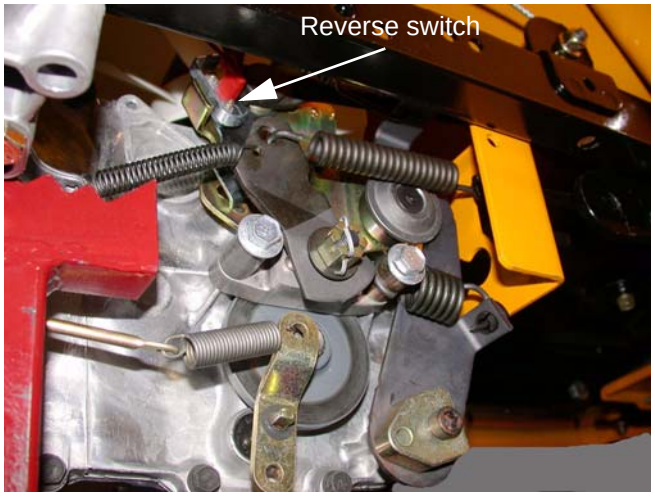


Figure 39.6

39.7. The **Seat Safety Switch** consists of a pair of simple metal contact tangs attached to the seat mounting bracket. See Figure 39.7.

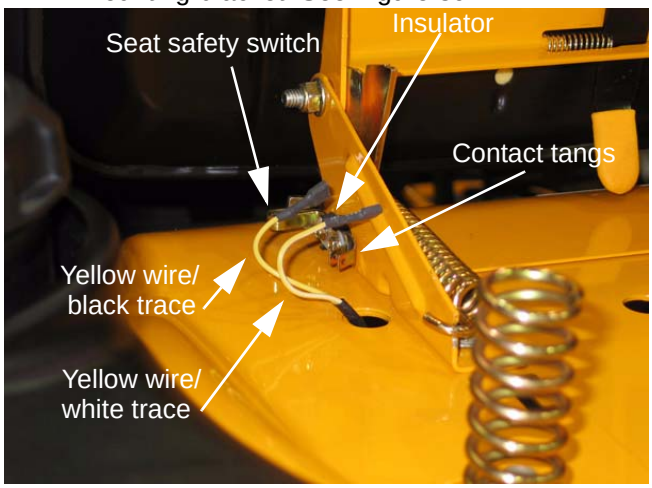


Figure 39.7

- The yellow wire with white trace is connected to the front spade terminal on the seat safety switch. When the seat is vacant, the tab on the seat bracket closes a ground path in series with the PTO switch. If the PTO is ON and the seat is empty, the circuit is completed, shorting-out the primary windings of the magneto, turning-off the engine.

- The yellow wire with black trace is connected to the rear spade terminal on the seat safety switch. When the seat is vacant, the tab on the seat bracket closes a ground path in series with the brake switch. If the brake is not applied, and the seat is empty, the circuit is completed, shorting-out the primary windings of the magneto, turning-off the engine.
- The most common problems are likely to be caused by physical damage: a broken insulator between the switch and the seat bracket, an unplugged wire, or a bent tang.

39.8. On the 1000 series tractors the **starter solenoid** is mounted at the left rear corner of the frame. The mounting bracket is visible beneath the left fender, and the solenoid itself is accessibly by removing the battery. See Figure 39.8.

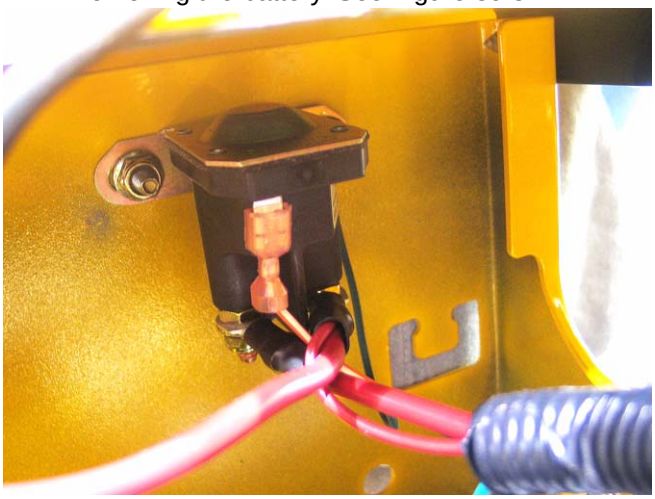


Figure 39.8

- When the proper safety conditions are met, (brake applied, PTO OFF) the orange wire with white trace energizes the windings that magnetize an iron core, pulling the contacts closed between the two heavy posts, connecting battery power to the starter motor.

39.9. The 1500 series tractors use a starter solenoid that is actually part of the starter.

39.10. The starters on the Kohler Command engines have the starter solenoid on the starter. See Figure 39.10.

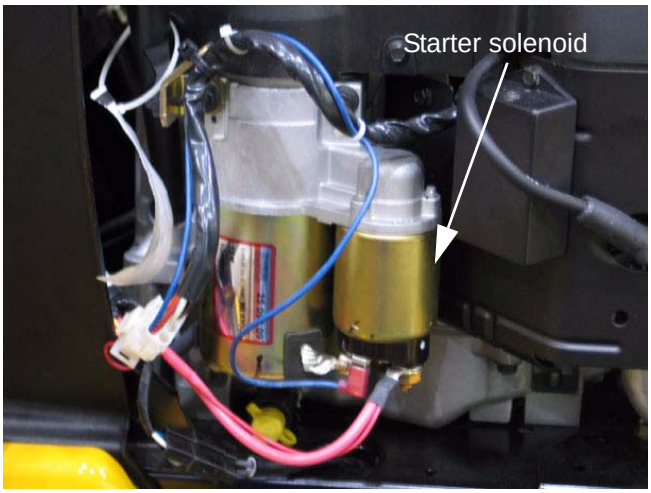


Figure 39.10

39.11. The **lighting circuit** is hot whenever the engine is running. It does not draw from the battery, but runs directly off its own circuit on the alternator. See Figure 39.11.

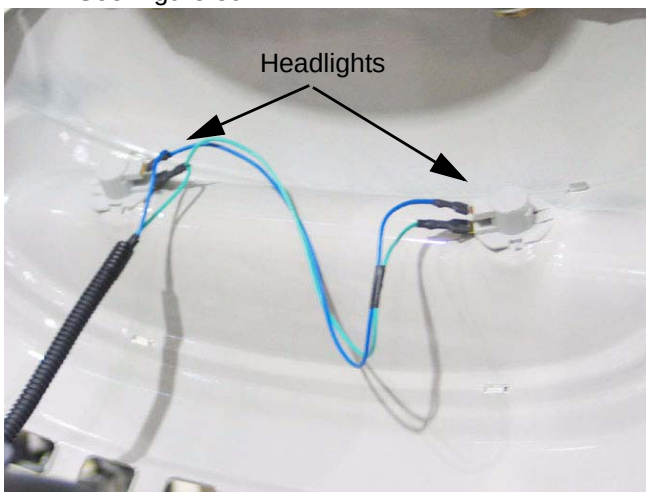


Figure 39.11

- The blue wire carries alternator current, the green wire is a ground.

39.12. The 20A fuse is located near the RMC module / key switch assembly, under the dash panel. See Figure 39.12.

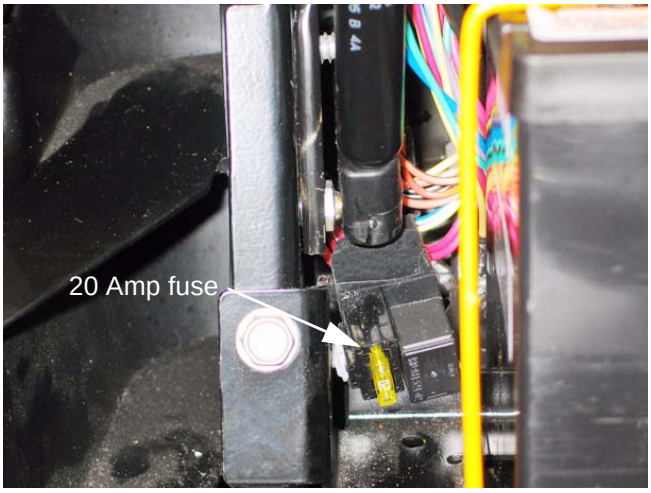


Figure 39.12

- The solid red wire feeds the fuse with power picked-up from the battery cable connection to the “hot” post of the starter solenoid.
- The red wire with white trace carries fused power to the B terminal on the key switch.

  NOTE: On units with an auxiliary power point a second red wire with white trace will supply a 5 amp service to the power point.

  CAUTION: DO NOT PUT A CIGERETTE LIGHTER IN THIS POWER POINT. This will cause the fuse to blow and can seriously damage the harness.

- A failed fuse will disable most of the tractor’s electrical system.
- Remember that a failed fuse has done it’s job of protecting the rest of the circuit from an overload. If a fuse blows, figure-out why and correct the core problem before returning the tractor to service.

39.13. Refer to the engine manufacturer’s specifications to test the engine and charging systems.

39.14. **Ground issues**: It is relatively easy to track where power is on the positive side of the system. The negative side is frequently neglected, though it may account for just as many electrical problems as the positive side.

39.15. Most technicians’ first instinct when testing ground paths is to set the multi meter to the Ohms scale (Ω) and look for continuity using resistance as a measurement. This method does give a rough idea if the circuit is complete or not.

39.16. Resistance is not the most definitive scale for identifying circuits that are complete, but have reduced current carrying capacity because of bad connections, physical damage, or corrosion.

39.17. As a point of illustration, a short length of 12 or 14 gauge stranded wire can be stripped at the ends to facilitate an Ohm reading. See Figure 39.17.

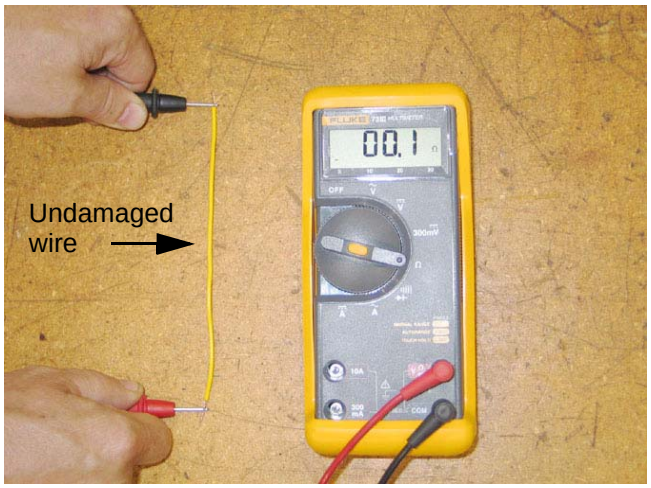


Figure 39.17

39.18. For comparison, strip away insulation at the middle of the wire, and snip strands until only a few remain. Repeat the Ohm reading. There will not be a substantial change. See Figure 39.18.

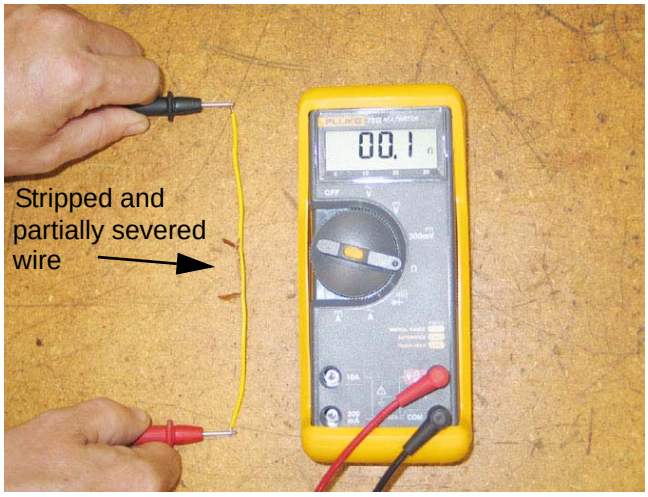


Figure 39.18

- While the actual resistance did not change, the ability of the whittled-down length of wire to carry current is vastly reduced.
- Similar effects occur when a terminal is not firmly crimped, a connection is loose, insulated by paint or corrosion, or the wire is chafed, cut, or corroded.

39.19. A more effective way to identify this reduced current carrying capacity is to look for “voltage drop”.

39.20. Voltage drop tests are useful on both the positive or the negative side of the system. We will concentrate on the negative side to begin with. See Figure 39.20.

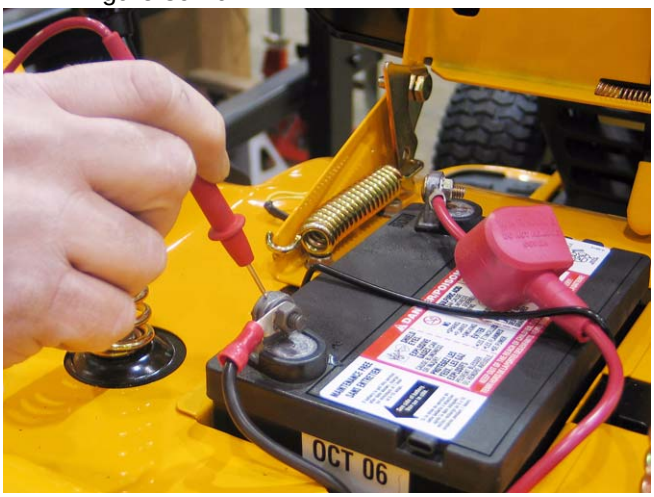


Figure 39.20

- Ultimately, any negative current should find its way back to the negative post of the battery.
- To check ground-side voltage drop: set-up a multi meter to measure 12V DC.
- Make a good electrical connection between the black (-) probe and the negative post on the battery.
- Make a good electrical connection between the red (+) probe and the suspect point of ground.
- Power-up the circuit in question.
- The voltage that shows-up on the meter is the power that is not following the intended path back to the negative battery post.
- Voltage drop on a good circuit should be less than 0.1 volts. A voltage drop reading on the meter of greater than 0.2 volts indicates a fairly substantial problem that demands attention.

39.21. As an example, if the starter solenoid does not engage properly, check for voltage drop between the ground point for the starter solenoid and the negative post on the battery. See Figure 39.21.

Figure 39.21

39.22. With the starter engaged, this machine exhibited a voltage-drop reading beyond 0.30 volts, indicating a poor ground connection.

39.23. A similar ground-side test on a tractor with a slow-cranking starter motor can be conducted between the engine block and the negative battery post. See Figure 39.23.

Figure 39.23

39.24. With the starter engaged, this machine exhibited a voltage-drop reading beyond 0.30 volts, indicating a poor ground connection.

39.25. Individually, these readings should lead a technician to inspect the connection between the solenoid and the ground path (e.g. mounting hardware, green wire with eyelet beneath head of solenoid mounting bolt), or the engine and the frame (e.g. loose or rusty engine mounting bolts).

39.26. If both of these readings were found on the same tractor, a common point in the system would be the primary suspect (e.g. poor connection between negative battery cable and frame).

39.27. Applying this principle to the positive side of the system: See Figure 39.27.

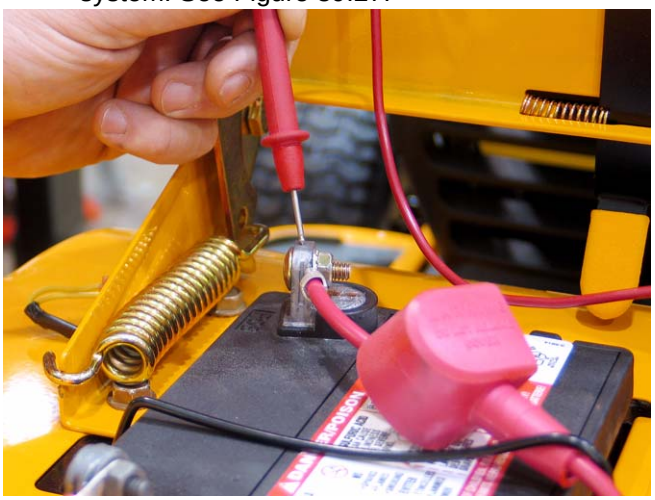


Figure 39.27

- Ultimately, any positive current should find its way from the positive post of the battery to its destination through the wiring harness.
- To check hot-side voltage drop: set-up a multi meter to measure 12V DC.
- Make a good electrical connection between the red (+) probe and the positive post on the battery.
- Make a good electrical connection between the black (-) probe and the suspect point of the circuit.
- Power-up the circuit in question.
- The voltage that shows-up on the meter is the power that is not following the intended path back to the negative battery post.
- Voltage drop on a good circuit should be less than 0.1 volts. A voltage drop reading on the meter of greater than 0.2 volts indicates a fairly substantial problem that demands attention.

39.28. As an example, if the tractor had a slow-turning starter, the ground-side voltage drop measured below 0.1 volts, and there was not a parasitic load on the engine (e.g. PTO clutch that is not fully disengaged), it would be logical for the technician to check voltage drop to the starter. See Figure 39.28.

Figure 39.28

39.29. With the starter motor engaged, the voltage drop reading here is nearly 0.6 volts, indicating a serious problem in the heavy-gauge circuit between the starter and the battery.

39.30. Checking voltage-drop at various points along the circuit can help pin-point the problem.

- Check voltage-drop at the output lug on the starter solenoid:
  If there is a significant difference, the problem lies between the lug on the solenoid and the lug on the starter.
  If there is little change, the problem lies further up-stream.
- Check voltage drop at the input lug on the solenoid:
  If there is significant difference between the reading here and the reading at the output lug (greater than 0.10 volt), then the contacts inside the solenoid may be burned.
  If there is little change, the problem lies further up-stream, between the battery and the solenoid.
- Results may be cross-checked by testing voltage drop across the two posts of the starter solenoid while cranking the starter motor.

39.31. This test may also be applied to the light gauge circuits on the tractor.

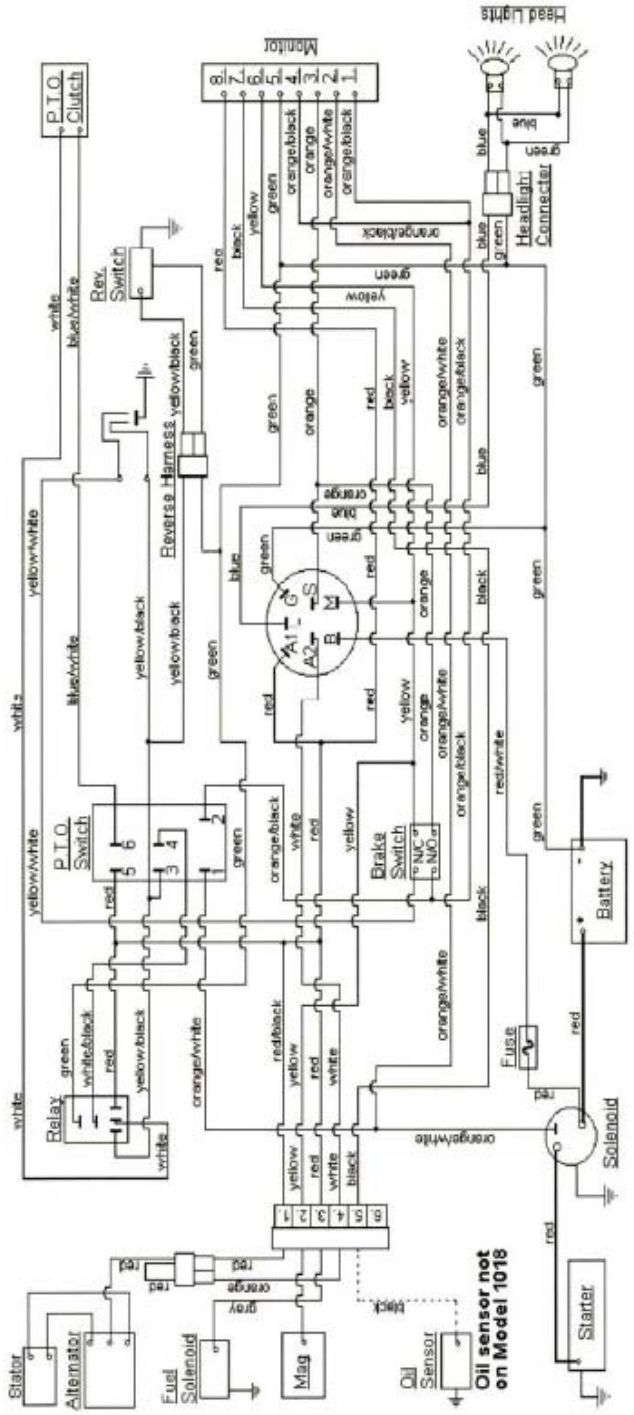
39.32. Switches may be bench tested using an Ohm meter. Generally speaking, safety switches will have less than 0.2 Ω through the contacts.

39.33. On MTD switches:

- Normally Closed contacts are identified by the letters “NC” stamped on the spades that connect to those contacts.
- Paired spades (going to the same set of contacts) are next to each-other flat-to-flat (not edge to edge).
- It is good to test switch contacts in both modes: open and closed, confirming that each set of contacts is neither shorted nor faulted. See Figure 39.33.

Figure 39.33

D17.

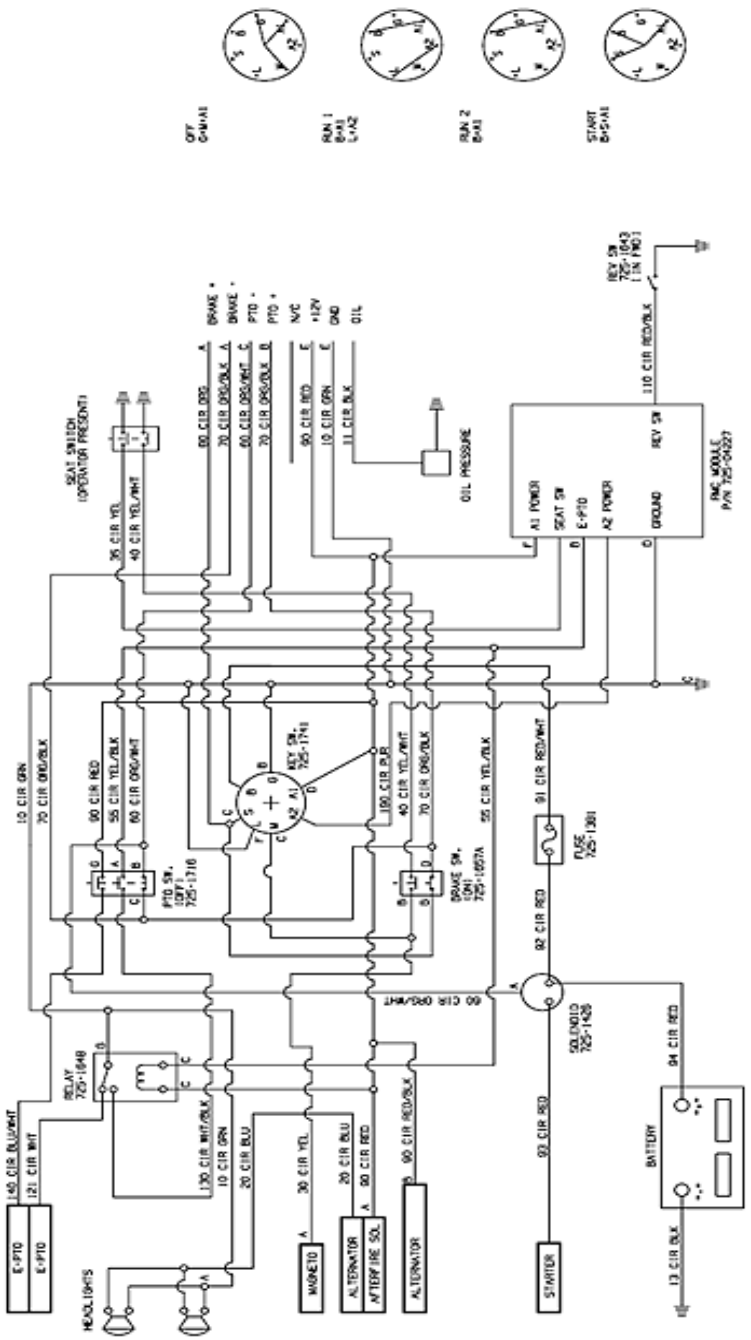


DASH MONITOR

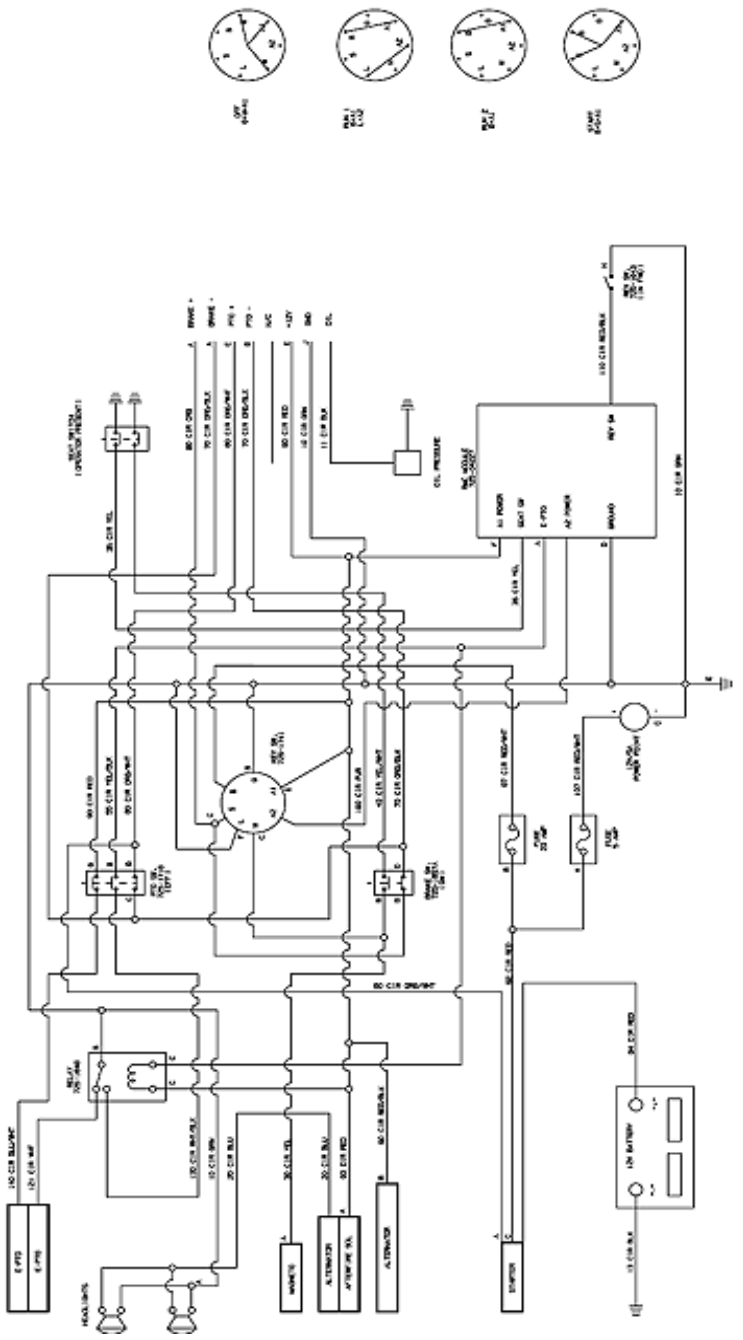
1:	F.T.O. +	5:	GROUND
2:	F.T.O. -	6:	NC CONNECTION
3:	ERAKE +	7:	LOW OIL
4:	ERAKE -	8:	HCUR METER

KEY SWITCH

OFF	M+G+A1
RUN w/LIGHTS	B+A1 / L+A2
RUN	B+A1
START	B+S+A1



RMC wiring schematic drawing



RMC schematic drawing with starter solniod in the starter