

PRAG 304L: Electrical Diagnostics for Farm Machinery Lab

Instructor: Dr. Young Chang

Spring 2025

Lab 6: DC Charging System Tests for Tractors

1. Overview

Students will perform several tests on vehicle DC charging system using appropriate tools and specifications. The goal is to determine whether the DC charging system meets operational standards or requires service or replacement.

2. Objectives

- Learn How to Use Tools: Understand and use diagnostic tools for rests.
- Load Testing: Conduct diagnostic tests to evaluate battery health.
- Field Diagnosis: Develop practical skills to diagnose batteries with minimal tools.

3. Materials and Equipment

- Multimeter
- Digital battery tester
- Safety gloves and goggles
- Notebook or digital device for recording results
- Five Kubota RTV X1100C

4. Procedure

Step 1: Safety Preparation

1. Wear safety gloves and goggles.
2. Ensure the workspace is free from flammable materials.
3. Verify that tools are functioning properly.

Step 2: Battery Access

1. The battery of the Kubota RTV can be accessed from the driver side.
 - **Locate the Battery**
 - 1) The battery is on the driver side of Kubota ATV behind a meshed panel.



- 2) This panel must be removed to fully access the battery.

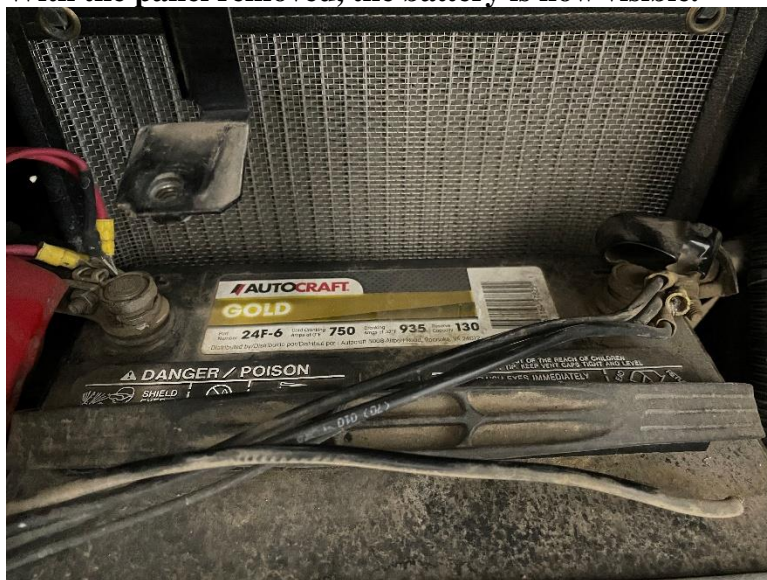
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- Remove two screws on the top of the Panel
- Access the Battery
 - 1) With the panel removed, the battery is now visible.



- 2) Put the panel and two bolts in the RTV bed for reinstallation.

Step 3: Alternator Access

1. Open the driver's side door.
2. Locate the switch and put on position.

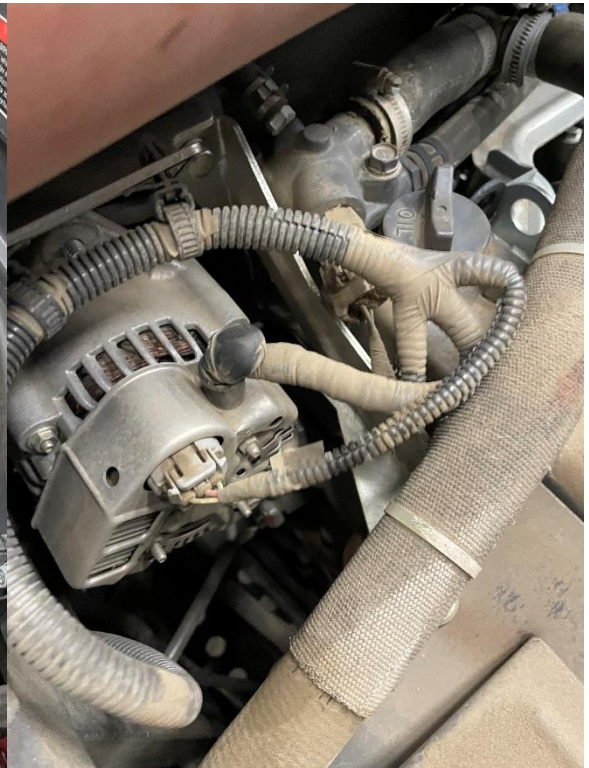
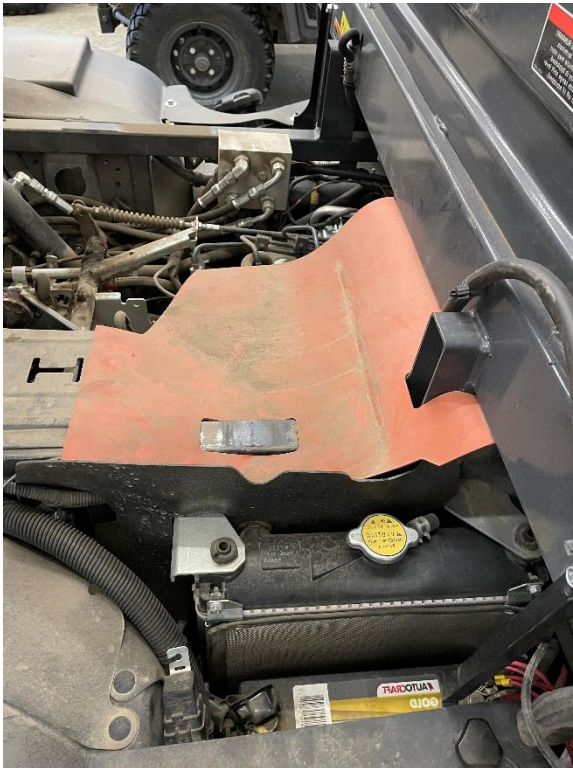
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3. Open the bed using the lever in front of the switch.
4. Find the red cover and locate the alternator behind.



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Step 4 (TEST1): Battery Inspection using a battery tester

1. Visually inspect the battery for physical damage, corrosion, or leaks.
2. Record the battery's specifications (e.g., nominal voltage, Ah, Type, CCA).
3. Connect the digital battery tester to the battery terminals.
4. Select Battery on the screen.
5. Select In-Vehicle.
6. Select Standard Test.
7. Select correct Battery Type.
8. Select Input Standard as CCA (Cold Cranking Ampere).
9. Set CCA according to battery label.
10. Select after charging as it was fully charged before this lab.
11. Record SOH, Voltage, CCA, and Power.

Step 5 (TEST2): Alternator Test with a Multimeter

1. Connect a multimeter to the battery.
2. Turn on the multimeter to DC less than 20V.
3. Press MAX/MIN button.
4. Turn on the engine.
5. Read MAX and MIN value by pushing MAX.MIN button.



6. Record these values in the sheet and do your diagnosis.

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Step 6 (TEST3): Alternator Test with a Multimeter

1. Measure Voltage at Fully Charged Battery Terminals (V1) at Idle

2. Is $V1 > 14.7\text{ V}$? **Too HIGH V**

- Yes → Test alternator **OUTPUT** and check **RECTIFIER** and **VOLTAGE REGULATOR**.
- No → Proceed to Step 2.

3. Is $V1 < 13.8\text{ V}$?

- No → No further action required; voltage is within **acceptable range**.
- Yes → Measure voltage (V2) at the alternator B+ (output terminal) and alternator case.
 - Does V2 fall between 12.6 V and 13.7 V? **Too LOW V**
 - Yes → Replace the alternator. **ALTERNATOR PROBLEM**
 - No, if $V2 > 13.8\text{ V}$ → Perform a voltage drop test. **WIRE PROBLEM**

5. Evaluation Criteria

1. Accuracy in using diagnostic tools.
2. Ability to interpret test results against specifications.
3. Proper documentation of findings and recommendations.

6. Post-Lab Discussion

- Discuss challenges faced during field diagnosis with limited tools.
- Compare results with peers to identify discrepancies and potential errors.

7. Data Recording Template

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#1 Test		Measured Value	Specification	Y/N	Pass/Fail
TEST1: Battery Test using a battery tester	SOH		50%		
	Voltage		12 V		
	CCA		200 CCA		
	Power		50%		
TEST2: Load Test using a multimeter	MAX V		14.7		
	MIN V		9.6		
TEST3: Alternator Test using a Multimeter	STEP1: V1 (Battery)		V1 > 14.7 V	Y	Check alternator output, rectifier, voltage regulator
				N	Proceed Step 2:
	STEP2:		V1 < 13.8 V	N	Normal
				Y	Measure V2
	V2 (alternator)		12.6 < V2 < 13.7	Y	Replace alternator
				N	Perform a voltage drop test

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#2 Test		Measured Value	Specification	Y/N	Pass/Fail
TEST1: Battery Test using a battery tester	SOH		50%		
	Voltage		12 V		
	CCA		200 CCA		
	Power		50%		
TEST2: Load Test using a multimeter	MAX V		14.7		
	MIN V		9.6		
TEST3: Alternator Test using a Multimeter	STEP1: V1 (Battery)		V1 > 14.7 V	Y	Check alternator output, rectifier, voltage regulator
				N	Proceed Step 2:
	STEP2:		V1 < 13.8 V	N	Normal
				Y	Measure V2
	V2 (alternator)		12.6 < V2 < 13.7	Y	Replace alternator
				N	Perform a voltage drop test

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#3 Test		Measured Value	Specification	Y/N	Pass/Fail
TEST1: Battery Test using a battery tester	SOH		50%		
	Voltage		12 V		
	CCA		200 CCA		
	Power		50%		
TEST2: Load Test using a multimeter	MAX V		14.7		
	MIN V		9.6		
TEST3: Alternator Test using a Multimeter	STEP1: V1 (Battery)		V1 > 14.7 V	Y	Check alternator output, rectifier, voltage regulator
				N	Proceed Step 2:
	STEP2:		V1 < 13.8 V	N	Normal
				Y	Measure V2
	V2 (alternator)		12.6 < V2 < 13.7	Y	Replace alternator
				N	Perform a voltage drop test

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#4 Test		Measured Value	Specification	Y/N	Pass/Fail
TEST1: Battery Test using a battery tester	SOH		50%		
	Voltage		12 V		
	CCA		200 CCA		
	Power		50%		
TEST2: Load Test using a multimeter	MAX V		14.7		
	MIN V		9.6		
TEST3: Alternator Test using a Multimeter	STEP1: V1 (Battery)		V1 > 14.7 V	Y	Check alternator output, rectifier, voltage regulator
				N	Proceed Step 2:
	STEP2:		V1 < 13.8 V	N	Normal
				Y	Measure V2
	V2 (alternator)		12.6 < V2 < 13.7	Y	Replace alternator
				N	Perform a voltage drop test

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#5 Test		Measured Value	Specification	Y/N	Pass/Fail
TEST1: Battery Test using a battery tester	SOH		50%		
	Voltage		12 V		
	CCA		200 CCA		
	Power		50%		
TEST2: Load Test using a multimeter	MAX V		14.7		
	MIN V		9.6		
TEST3: Alternator Test using a Multimeter	STEP1: V1 (Battery)		V1 > 14.7 V	Y	Check alternator output, rectifier, voltage regulator
				N	Proceed Step 2:
	STEP2:		V1 < 13.8 V	N	Normal
				Y	Measure V2
	V2 (alternator)		12.6 < V2 < 13.7	Y	Replace alternator
				N	Perform a voltage drop test