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| Station | | Task | |
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| Running 903 | | | |
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**

# Charging System

## TASK OBJECTIVE

At the completion of this task, the technician will be able to properly check the output of the charging system of a three phase charging system. In addition he will be able to demonstrate the correct procedure to troubleshoot the charging system using a multi-meter. Further skills will be demonstrated by demonstrating how to check the amperage output. He will also be able to demonstrate how to check for amperage draw.

**INTRODUCCION**

If a complaint of a battery going dead comes in, it is probably a charging system malfunction. Or the person could be leaving the DESS lanyard on the boat causing an excessive draw. Don’t forget to check the battery itself. Then proceed with testing the charging system.

Find and disconnect the generator coil’s output leads from the vehicle’s wiring harness. Set your multi-meter to the Ohms function and select the appropriate range (as per the resistance specification provided in the shop manual). Connect the ohmmeter leads to the generator coil’s output wires. Compare the ohmmeter reading to the specification. If the reading is not within the specified range, replace the coil.

Next, you will want to make sure that the generator coil winding is not shorted to ground. Perform this test by connecting one ohmmeter lead to one of the generator output wires and touching the other ohmmeter lead to ground. If the generator is accessible, you can touch the ohmmeter lead to the generator rotor or backing plate, as shown below. If the generator is not accessible, touch the lead to any part of the engine or chassis that is grounded.

The results of this test should indicate infinite resistance. In other words, there should be no continuity between the coil windings and ground. If there is a measurable resistance, the winding is shorted to ground and must be replaced.

Even if the foregoing resistance test indicates normal resistance through the generator coil winding, that does not necessarily mean that the coil’s actual voltage output is sufficient. In order to confirm that the coil actually is producing current, you will need to perform an AC output voltage test.

If the stator winding AC voltage output tests indicate that the stator assembly is functioning normally, the only remaining test to be performed is a DC output voltage output test of the rectifier/regulator.

To perform a rectifier/regulator DC output voltage test. Set your multi-meter to the DC volts function and select the appropriate range, as per the voltage output range specification provided in the vehicle’s shop manual (usually 0~20 VDC range). Connect the positive (+) voltmeter lead to the regulator/rectifier output wire and the negative (-) voltmeter lead an engine or chassis ground. Start the engine and bring the engine’s RPM up to the test speed specified in the manual. Compare the voltage reading to the specification. If the reading is not within the specified range, replace the rectifier/regulator.

Loose or corroded circuit connections are likely the single most common cause of AC generator system malfunctions. Always begin your troubleshooting with a thorough inspection of all circuit connections. Don’t forget the ground connections. Remember that ground connections are part of the circuit.

Also check the amp output. An inductive ammeter is usually recommended for measuring current flow beyond 10 amps. An inductive ammeter, for example, measures current flow through a circuit without actually having to be connected to the circuit. As the name implies, an inductive ammeter measures current flow indirectly by sampling the magnetic field produced by current flowing through a circuit.

**Why a 3 phase system should be checked at the voltage regulator with the voltage regulator disconnected.**

Note: The test specification for this example stator is 45-85 volts ac @ 5000 RPM.

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If testing with the 4 pin magneto adapter with the voltage regulator connected the readings will be lower than the specification in the shop manual. As shown in this illustration they will be around 17 volts ac if the system is functioning normally. This is misleading to the technician as the specification says 45-85 vac.

When testing with the voltage regulator disconnected the voltage will be within specification when tested either at the voltage regulator connector or at the 4 pin magneto harness.

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When testing with an open wire in the harness as illustrated above, the readings will be within specification at the magneto adapter. However, show out of specification at the voltage regulator connector.

As illustrated here, if the stator has the open, the specification will be out of spec when tested either at the regulator or the 4 pin magneto adapter. If tested first at the voltage regulator connector and the test fails, then test at the 4 pin magneto adapter to eliminate the wiring from the stator to the voltage regulator.

This is where the diagnosis begins. You need to apply a logical method of diagnosis. For example, first check the schematic and check the wire colors and locations of the terminals and components. Visually check for disconnected connectors or backed out terminals. Ensure there is enough grip on the terminal. Ensure the wires are in the correct positions in the connector. Ohm the component first from the MPEM or ECM connector, then at the component. Then verify the continuity of the wires from the component to the ECM. Remember diagnosis is a process of eliminating what is good to determine what is bad.

**PROCEDURES**

####  Place the switches on the switch box in the following positions.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| A | X | X | X | X | X | X | X | X |
| B |  |  |  |  |  |  |  |  |

**Remember do not run the engine over 5000 rpm for the purposes of this training.**

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| 1. What is the stator continuity static specification? | | | | | | | | | | | | | |
| 1. What is the stator insulation static specification? | | | | | | | | | | | | | |
| 1. What is the Amperage dynamic specification? | | | | | | | | | | | | | |
| 1. What is the Voltage output dynamic specification? | | | | | | | | | | | | | |
| 1. Visually inspect all wires and connections. Do they pass a visual? | | YES | | | |  | NO | | | |  | |  |
| 1. Check the amperage output to the battery using the Amp clamp. | | | | | | | | | | | | | |
| 1. Record the charging amperage. | | | | | | | | | | | | | |
| 1. Is the vessel charging? | YES | |  | | NO | | | |  | | |  | |
| 1. Check charging voltage at the battery and record voltage. | | | | | | | | | | | | | |
| 1. Perform static continuity ohms test of the stator as per the shop manual.   Leg 1 \_\_\_\_\_\_\_\_ Leg 2 \_\_\_\_\_\_\_ Leg 3 \_\_\_\_\_\_\_ | | | | | | | | | | | | | |
| 1. Are the readings to specification? | YES | |  | NO | | | |  | |  | | | |
| 1. Perform static insulation ohms test of the stator.   Leg 1 \_\_\_\_\_\_\_\_ Leg 2 \_\_\_\_\_\_\_ Leg 3 \_\_\_\_\_\_\_ | | | | | | | | | | | | | |
| 1. Are the readings to specification? | YES | |  | NO | | | |  | |  | | | |
| 1. Perform dynamic voltage test of the stator.   Leg 1 \_\_\_\_\_\_\_\_ Leg 2 \_\_\_\_\_\_\_ Leg 3 \_\_\_\_\_\_\_ | | | | | | | | | | | | | |
| 1. Are the readings to specification? | YES | |  | NO | | | |  | |  | | | |

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|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| A |  | X | X | X | X | X | X | X |
| B | X |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- |
| 1. **Reconnect the voltage regulator.** | | | | | |
| 1. Check the amperage output to the battery using the Amp clamp. | | | | | |
| 1. Record the charging amperage. | | | | | |
| 1. Is the vessel charging? | YES |  | NO |  |  |
| 1. Check the charging voltage at the battery and record the voltage. | | | | | |
| 1. **Disconnect the voltage regulator.** | | | | | |
| 1. Perform dynamic voltage test of the stator at the voltage regulator connector from the stator and record the results.   Leg 1 \_\_\_\_\_\_\_\_ Leg 2 \_\_\_\_\_\_\_ Leg 3 \_\_\_\_\_\_\_ (Legs = Yellow wires) | | | | | |
| 1. Are the readings to specification? | YES |  | NO |  |  |
| 1. Perform static ohms test of the stator at the regulator connector and record the results.   Leg 1 \_\_\_\_\_\_\_\_ Leg 2 \_\_\_\_\_\_\_ Leg 3 \_\_\_\_\_\_\_ (Legs = Yellow wires) | | | | | |
| 1. Are the readings to specification? | YES |  | NO |  |  |
| 1. What have you determined to be at fault with this charging system?   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | | | |

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|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| A | X | X | X | X | X | X | X | X |
| B |  |  |  |  |  |  |  |  |

**Clear any codes, clean up work station and disconnect BUDS.**

**QUESTIONS**

1. What have you learned from this task?

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2. List possible causes of battery failure.

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3. How many amps does the vehicle draw, when not running?

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4. How many AMPS does the vehicle charge with when operating normally?

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5. Explain why the readings at the regulator connector still showed one half of the voltage of the stator, even though the wire to the stator was open.

**Instructor sign off-- Go \_\_\_\_\_\_\_\_\_\_**