Customer Troubleshooting Instructions

STATOR TEST

Just sending through some tests that you can perform on your stator to ensure it is operating correctly. For all of these tests please disconnect the 4-pin deutsch connector nearest the E-box with 3 yellow and 1 black wire. You will be performing the tests on the loom that runs to the front cover, not the e-box.

Resistances (Set multimeter to Ohms - Ω)
Each yellow wire to black wire: Multimeter should show OL for open loop or infinite resistance
Yellow wire to yellow wire: 1.2 Ohms

Note: The following tests require a redundant ground to be installed between the e-box and the battery ground or engine block.

AC Voltages (Set multimeter to ACV) while cranking/turning over ski (plugs removed from cylinder and resting on cylinder head with spark plug caps connected)
Yellow wire (red probe) to black wire (black probe): 3V AC
Yellow wire to yellow wire: 7.5V AC

AC Voltages (Set multimeter to ACV) while engine is running and idling
Yellow wire (red probe) to black wire (black probe): 18.8V AC
Yellow to yellow: 37.7V AC

FUSE POPPING

Below are steps to check which component is popping fuses.

Fuse Popping Component Identification Steps:

1. Open the e-box and identify the 12V loom (red wire with three bullet connections and incorporates the fuse holder)
2. Disconnect all the components from the 12 loom (Regulator, CDI, Bilge)
3. Ensure the Stator loom is connected to the E box and front cover
4. Ensure battery is connected
5. Disconnect Start Stop Switch (plug external to the e-box)
6. Put in new 15 amp fuse
7. Plug back in Start stop switch, nothing else
8. Check if the fuse has popped. If popped then please double check step 2 was completed. The fuse popping at this step indicates a failure in the Start Stop Switch which is very uncommon. If not popped then continue the process.
9. Unplug start stop switch
10. Plug in CDI red wire to 12V loom.
11. Check if the fuse has popped. If popped this indicates the CDI has entered a short circuit fail state. If not popped then continue the process.
12. Plug in the bilge brown wire to the 12V loom (note, do not unplug CDI)
13. Check if the fuse has popped. If popped then it's a bilge pump issue. If not popped then continue the process.
14. Unplug both CDI and Bilge and plug in Regulator 7. If popped it is a stator/regulator issue.If not popped then continue the process.
15. Plug in the start/stop switch (no bilge or CDI, but regulator connected) and turn over ski for approximately 5-10 seconds.
16. Check if the fuse has popped.
17. If the fuse has not popped at this point then we will need to identify the specific scenario that is causing the fuse to pop. We can discuss this over the phone.

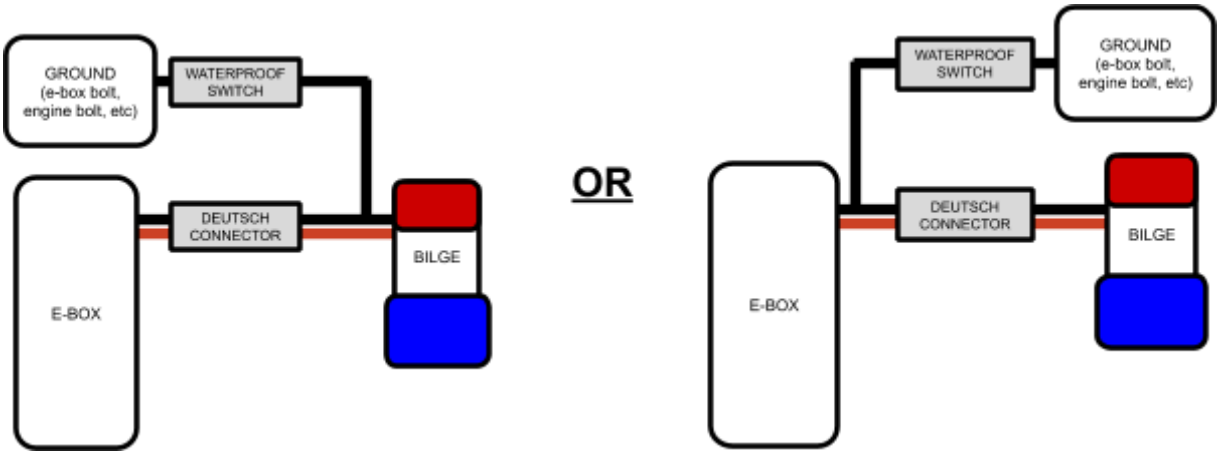
BILGE not running

Please measure the following voltages and resistances:

- Voltage between brown wire coming from e-box that would normally connect to the bilge and the e-box itself (GND)
    - This should show the same as battery voltage
- Continuity between the black wire coming from e-box that would normally connect to the bilge and the e-box itself (GND)
    - Please use the multimeter setting that creates an audible tone when there is continuity
    - The multimeter should beep intermittently with the same rhythm that the bilge would usually exhibit.

Basically I am expecting one of these tests to fail as the bilge needs continuous 12V power and then it is cycled on and off through a MOSFET connecting the black wire to ground.

Worst case scenario you can connect a switch between the black wire coming from the bilge (either side of deutsch connector) and ground. This switch when closed will override the auto-bilge and hold the bilge in the on state. The auto-bilge will then control the bilge once again when the switch is opened. This will not work if there is an issue with the constant 12V power supplied to the bilge.



CDI POWER

Outlined below are the instructions to check that an unresponsive CDI is receiving both constant 12V power and a 12V start signal when the start button is pressed. It will not take long (5-15 minutes) unless several problems are present.

You will require a multimeter along with a 4mm hex key to remove the e-box lid and a 3mm hex key to remove the CDI from the e-box.

CDI Power and Turn On Signals Test:

1. Remove CDI from e-box as we will be checking signals in the now exposed CDI connector
2. Set multimeter to volts (autorange or 20V setting is fine)
3. Connect jet ski 12V battery.
4. Connect the stator loom (3 yellow wires and one black wire) to the front cover of the engine and to the e-box
5. Connect the black multimeter probe to the e-box (threaded holes to retain lid work well)
6. Connect the red multimeter probe to the starter relay terminal nearest the lid of the e-box (that connects to the battery) and verify that battery voltage is present.
    - If no voltage is observed then the ebox is not getting either power or ground or the multimeter has a problem (verify multimeter by checking voltage directly across battery terminals)
7. Connect black multimeter probe to the GREEN/YELLOW wire terminal in CDI connector
8. Connect red multimeter probe to the RED wire terminal in CDI connector
9. Verify that battery voltage is shown on the multimeter. If no voltage is observed, skip to **"12V Loom Troubleshooting Steps"** below.
10. Keep the black multimeter probe connected to the GREEN/YELLOW wire terminal
11. Connect the red multimeter probe to the YELLOW wire terminal.
12. When pressing the START BUTTON, verify that battery voltage is shown on the multimeter. If it shows battery voltage then the CDI is receiving both signals it requires to operate and the CDI has likely failed. If no voltage is observed, skip to **"Start Signal Loom Troubleshooting Steps"** below.

12V Loom Troubleshooting Steps:

The CDI requires battery voltage (approx. 12.6-13.5V) to be present across the RED wire and GREEN/YELLOW wire in the CDI connector to work. At some point between the starter relay and the RED wire terminal in the CDI connector there is a problem.

For this test the black multimeter probe can be grounded anywhere on the e-box. The red probe is then connected to each of the points of interest.

1. Does the ski turn over (or the starter relay engage) when the start button is pressed? If yes, please skip to step 4.
2. Confirm that 12V is present on the starter relay terminal nearest the lid of the e-box.
    - If there is no voltage, then either:
        - The battery is likely not connected
        - The stator loom (3 yellow wires and one black wire) is not connected to the front cover of the engine and to the e-box.
        - There is a major fault in either the cable connecting the battery to the starter relay or the ground cable from the starter motor to the battery.
3. Follow the RED wire from the starter relay terminal nearest the lid of the e-box to the fuse holder. Confirm that 12V is present on both sides of the fuse.
    - If there is no voltage on the starter relay side of the fuse, there is likely an issue with the bullet connection between the starter relay and the fuse holder. See "**Checking and Repairing Bullet Connections**" below.
    - If there is no voltage on the other side of the fuse, either the fuse has failed or the fuse holder is not contacting the terminals of the fuse (squeezing it with pliers gently should fix this).
4. Moving along the RED wire on the side of the fuse away from the starter relay there are three bullet connections. Disconnect the bullet connection that provides power to the CDI (connected to the RED wire into the CDI connector that was tested earlier). Verify that 12V is present on the female bullet connection (not the CDI side that has been disconnected).
    - If no voltage is present then there is likely an issue within the female bullet crimp but first we need to verify that the 12V loom supplying the female bullet connection has 12V present.
    - Confirm the loom has 12V power by either:
        - Confirm that the engine turns over (or the starter relay engages) when the start button is pressed.
        - Disconnect the other two bullet connections (one goes to the bilge and the other to the regulator) and confirm that 12V is present on either of these female bullet terminals.
    - If no voltage is present, please go back to step 2 with the aim of identifying the point of discontinuity.
    - If there is 12V on the loom, see "**Checking and Repairing Bullet Connections**" below.
5. If 12V is observed on the female bullet terminal then one or both of the issues below are present:

    - The male bullet crimp on the RED wire that leads to the CDI connector is not conducting. See "**Checking and Repairing Bullet Connections**" below.
    - In the CDI connector the RED wire terminal crimp has failed. See **"Removing CDI Connector Terminals"** below.
6. If all connections are verified between the starter relay and the RED wire into the CDI connector then 12V should now be present at the connector.

Start Signal Loom Troubleshooting Steps:

The CDI requires battery voltage (approx. 12.6-13.5V) to be present across the YELLOW wire and GREEN/YELLOW wire in the CDI connector when the START BUTTON is pressed to work. At some point between the 12V loom and the YELLOW wire terminal in the CDI connector there is a problem.

For this test the black multimeter probe can be grounded anywhere on the e-box. The red probe is then connected to each of the points of interest.

1. Does the ski turn over (or the starter relay engage) when the start button is pressed? If yes, please skip to step 6.
2. Disconnect the start/stop switch and confirm that the RED wire from the e-box to the start/stop switch connector shows 12V.
    - If not, go to 12V Loom Troubleshooting Steps above and then return to here.
3. Reconnect the start/stop switch
4. Disconnect the bullet connection between the YELLOW wire from the starter relay and the YELLOW start signal loom.
5. Confirm that 12V is present on the female bullet terminal connected to the YELLOW start signal loom when the START BUTTON is pressed.
    - If no voltage is observed then there is an issue with either the female bullet crimp or the start/stop switch. Carefully cut the heatshrink and slide back the female bullet insulation to expose the crimp. If there is a fault this is best to fix with a replacement female bullet terminal but can be fixed with solder if you don't have any new bullet terminals. If this does not resolve the issue there is likely an issue with the start/stop switch, however, this is uncommon.
    - If voltage is observed and the starter relay does not engage (engine does not turn over), confirm battery voltage is above 12.6V and charge battery if needed. If the battery is charged then there is an issue either with the male crimp on the starter relay side of the bullet connection or an issue where this wire connects to the starter relay.
6. The starter relay engaging confirms there is 12V at the female bullet connector that connects the YELLOW start signal loom to the starter relay, the fact that this is not reaching the CDI connector means there is one of two possible issues:

    - Within the female bullet connection the YELLOW wire that leads to the CDI connector is isolated from the female bullet terminal that we have confirmed is getting 12V.
    - In the CDI connector the YELLOW wire terminal crimp has failed. See **"Removing CDI Connector Terminals"** below.
7. If all connections are verified between the RED wire of the start/stop switch connector and the YELLOW wire into the CDI connector then 12V should now be present at the connector when the start button is pressed.

Checking and Repairing Bullet Connections:

1. Carefully cut the heatshrink (not necessary for male bullet terminals) and slide back the bullet insulation to expose the crimp.
2. Inspect the crimp for anything preventing the core of the wire to contact the metal of the bullet terminal.
3. If there is a fault this is best to fix with a replacement bullet terminal (with the option of adding a dab of solder) but in a pinch the original bullet terminal can be fixed with solder if you don't have any new bullet terminals (attempting to recrimp used bullet terminals is not recommended).

Removing CDI Connector Terminals:

1. Disconnect the CDI.
2. Remove yellow retaining clip from front of connector.
3. On top of each terminal there is a small black plastic tab that holds the terminal in place. Lift this tab gently and the terminal will be able to slide out the back of the connector. If the wire has been pulled out of the crimp then removed the rubber insulation that may be left behind in the back of the connector and the terminal should be able to fall out.
4. Inspect the crimp for anything preventing the core of the wire to contact the metal of the terminal. Problems can be fixed either with solder or replacement terminals.

CDI LIGHTS DESCRIPTION

Below is a description of each CDI light and what it represents. Keep in mind each light only indicates an engine mode when the stop button has been pressed three times and all three lights flash three times in succession representing engine mode selection.

- Green light: Flashes when CDI is on but engine is not running, solid green when engine is running
  - Represents beginner mode only during mode selection
- Amber light: Illuminates when a kill input signal is being received by CDI (either from stop button or lanyard removed)
  - Represents intermediate mode only during mode selection
- Red light: Illuminates when a valid pick-up signal is received when cranking, turns off if pick-up signal is not received for approximately 3 seconds
  - Represents beast mode only during mode selection

CDI LIGHTS

- Diagnostic procedures and testing specs for the CDI module
    - CDI module provides some basic debugging via the LEDs on the surface that are visible through the e-box lid
    - Green light: Flashes when CDI is on but engine is not running, solid green when engine is running, represents beginner mode during mode selection (engaged by 3 presses of stop button)
    - Amber light: Illuminates when a kill input signal is being received by CDI (either from stop button or lanyard removed), represents intermediate mode during mode selection
    - Red light: Illuminates when a valid pick-up signal is received when cranking (<1200 RPM), turns off if no pick-up signal is received for 3 seconds, represents beast mode during mode selection
    - No lights illuminating means that either the CDI is off (start button turns on CDI) or power is not reaching the CDI (battery disconnected, stator loom carrying ground is disconnected, fuse has blown)

AMBER LIGHT BLINKING

The amber light blinking represents that invalid kill input is being received by the CDI and therefore this is the frst problem we will tackle.

We have had customers report this issue and it has been found to be water in the start/stop switch connection to the e-box (4 p-pin deutsch connector with yellow/brown, red, black and white wires). The steps below should determine whether this is contributing to the issues.

1. Disconnect start/stop switch and inspect for presence of water or dielectric grease (these connections are supposed to be packed out with dielectric grease). If water is present please blow it out with air gun and repack with dielectric grease.
2. Reconnect start/stop switch
3. Attempt to start ski, observe for presence of orange light blinking.
4. If orange light is still blinking then please continue with following steps, if not then pleae observe whether red light before engine cuts out is still present. If the engine still cuts out skip to steps below regarding red light/cut out issue.
5. Disconnect start/stop switch once again.
6. Disconnect pickup
7. With a piece of wire jump a connection between the yellow and red wires in the start/stop switch connector (please take care not to short any other wires). The engine will turn over, please observe for orange light blinking. If still blinking then there may be water present in back of deutsch connector or the CDI may be faulty.

8. You can attempt to start the engine by reconnecting the pickup and jumping the wires but keep in mind that to kill the engine you will either need to set idle RPM low enough to cut out, reconnect the start/stop switch while its running. or jumping the white and black wires in the start/stop switch connector.

RED LIGHT ILLUMINATES BEFORE ENGINE DIES

The red light illuminating followed by the engine cutting out may suggest a problem with the CDI. The two most common causes for the engine to cut out unexpectedly are either faulty ground or faulty connections between the ignition coil and the spark plugs.

1. Please run redundant/spare grounds both from e-box to engine block and from e-box to ground terminal on battery.
2. Remove spark plug caps, trim ends of leads and strip back to reveal ~1/4" of copper. Reinsert lead into spark plugs cap and screw in until firm connection is made and plug cap resists gentle pull test.
3. Attempt to run the ski. If the ski runs without hassle then remove each redundant ground and run the ski again.
4. If the ski cuts out with the redundant ground removed then a faulty ground is likely the cause. These redundant grounds can be left on the unit in whichever locations you prefer. If the customer would like to avoid having two connections to their battery then the wire to the battery can instead by run to the ground connection on the starter motor which is hard wired to the negative terminal of the battery.

START/STOP SWITCH ISSUES

Most likely there is water in his start/stop switch connection causing a false kill signal illustrated by orange light illuminating intermittently. He'll need to disconnect the start/stop connection and blow it out, reconnect and try again.

If this doesn't work he should disconnect the start/stop switch again and then jump the yellow and red wire terminals (making sure not to touch the white of black wire terminals) and observe for spark/orange light turning on. If spark present and no orange light illuminating then disassemble each deutsch connection checking for presence of water/corrosion. Pack the internals of each deutsch with dielectric grease then some in where the connecters join too. Reconnect and check for spark using the start button rather than jumping connection.

SPARK LEADS TROUBLESHOOTING

First test is resistance from spark plug cap to spark plug cap, should get ~16-17kOhms.

Next test is pull test on connection between spark lead and spark plug cap on both leads. Connection should be firm and resist coming apart. If the lead comes out with relative ease then need to:

- Strip back the spark lead (~5-10mm)
- Spread exposed copper cores to extremeties of lead
- Push lead firmly into spark plug cap
- Tighten by rotating spark plug cap until the lead wants to rotate with the cap
- Remeasure resistance between spark plug caps and confirm it measures ~16-17kOhms

IGNITION COIL TESTING

- Diagnostic procedures and testing specs for the ignition coil
    - Primary Resistance: 100-200 mOhms (may not register on multimeter, make sure to compare to probe resistance)
    - Secondary Resistance (spark plug caps removed): 7.2-7.6 kOhms
    - Secondary Resistance (spark plug caps installed): 16.7- 17.2 kOhms
    - Multimeter (AC Volts) on ignition coil primary while connected and sparking: AC 0.24-0.27V
    - Multimeter (DC Volts) on ignition coil primary with orage wire disconnected: DC -400V (and should decrease over time)

PICKUP Open-Loop (OL) Resistance Reading

Having seen the video you sent that showed no continuity (OL resistance) across the pickup I need you to:

1. Remove the battery
2. Remove the battery box
3. Lift the fuel tank out (optional)
4. Remove the front cover
    1. Once bolts are removed can use a flat head screwdriver in small pocket machined into seam to wedge apart as it sits on dowels
5. Remove flywheel
6. Inspect pickup for broken wires