Lifter Troubleshooting Guide

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Warning Notice: This document is intended for educational use only! The project described in this document uses extremely high-voltage power-sources, and is intended for readers over 21 years of age who are experienced working with dangerously high-voltages. If you are not a legal adult, or are not proficient working with dangerously high-voltages, do not try to build this project without expert supervision. The author of this document is not responsible for any death, injury, or property damage resulting from or relating to the procedures shown or devices described in this document.

Purpose of this Document: This document provides in-depth information on troubleshooting a prototype Lifter in the event that it does not work correctly during testing.

Problem 1: The Lifter is not moving, and I don't hear a hissing noise.

→ If you don't hear a hissing noise, this means that it is not receiving HV power from the monitor.

- Unplug the monitor and wait for the HV charge to dissipate.
- Check the ground connection to the Lifter and make sure that you have good contact to both the foil skirt and the monitor's silver-threaded chassis ground-wire.
- Lift up the lip of the suction-cup covering the HV electrode and make sure that the crimped end of your corona-wire is hooked snugly around the electrode that goes into the picture-tube.
- Ensure that the enamel coating has been removed from the ends of both the corona-wire and the ground-wire. You can do this by scraping the enamel off with the edge of a hobby-knife.

Problem 2: The Lifter is not moving, and the monitor seems completely dead.

→ Have you tried checking the power-supply to the monitor?

- Check the monitor's 'on/off' switch.
- Check the power-outlet that the monitor is plugged into by testing another appliance in it.
- Check the 'on/off' switch on the power-strip if you are using one.

Problem 3: The Lifter is not moving, and I do hear a hissing noise.

→ The hissing noise (and slight breeze) means that the Lifter is getting HV power from the monitor.

- Unplug the monitor and wait for the HV charge to dissipate.
- Check the ground-wire connectivity to make sure it has a connection back to the monitor.
- Try sliding the entire corona-wire down the vertical balsa-struts a little until it is closer to the foil-skirt. This reduces the distance between the two capacitive elements and increases lifting-power.
- Ensure that you have scraped the enamel off the underside of the corona-wire, facing the foil skirt. This allows better charge-transfer between the wire and the skirt.

Problem 4: The Lifter is moving a little bit, but is not taking off

→ The Lifter either does not have enough power to lift off or the High-Voltage capacitance on the foil-skirt is causing an attraction to the test-surface.

- Leave the monitor is plugged in and the power turned on
- Try gently blowing on the Lifter until it moves – this may jostle the Lifter off the capactive spot that it sits on and it may suddenly lift off without warning.
- While you are wearing electrician's gloves, try using a long, non-conductive piece of plastic to gently lift one edge of the Lifter up from the testing surface.
- Check the HV and ground wires to ensure that they are up off the testing surface. They may also cause static 'cling' to the testing surface.

Problem 5: The Lifter is moving, but has a lot of electrical arcing.

→ The electrical-arcing on your Lifter is preventing enough capacitance to build up to allow

sustainable lift.

- Unplug the monitor and wait for the HV charge to dissipate.
- Try sliding the entire corona-wire up the vertical balsa-struts a little (less than 1 cm at a time) until it is farther away from the foil-skirt. This increases the distance between the two capacitive elements and reduces lifting-power, but it should also reduce electrical arcing and make lift-off possible.
- Ensure that the foil-skirt has been folded over the top of the balsa horizontal-strut and taped with a half-piece of Scotch-tape on the other side. If the foil has not been folded over the top of the horizontal balsa-strut, it will not have proper surface-area capacitance.
- Ensure that there are no sharp edges for ion-leakage on the foil-skirt of the Lifter. Also ensure that there are no sharp edges sticking off the end of the corona-wire. Sharp edges will allow ion-leakage and reduce capacitance.

Problem 6: The Lifter is lifting off, but when arcing occurs it suddenly drops or loses height.
→ Sudden drops in lift-height may accompany large electrical arcs between the foil and the corona-wire. This is due to a rapid reduction in capacitance on the corona-wire and foil-skirt of the Lifter, which in turn reduces thrust.

- See problem 5 for details on troubleshooting this.

Problem 7: The Lifter is lifting off and 'bouncing' the tether – thrust is not stable.
→ If the Lifter is bouncing at the end of the tether, or rapidly swaying back and forth, it is due to irregularities in thrust versus positioning.

- Unplug the monitor and wait for the HV charge to dissipate.
- Check each of the tethering threads and make sure that they are all the same length when fully extended.
- Check the each of the tethering threads to make sure that they are a reasonable length (8 to 14 inches).
- Check the HV and ground-wires to make sure that they aren't "snagging" on something during liftoff. You may try taping the HV and ground wires to a nonconductive surface about 10 inches from the top of the testing surface. (NOTE: Make sure that these wires do not cross, or else they will short out your power-supply).
- Make sure that all three corners of the Lifter are about the same weight. Note that the corners with wires attached will weigh a little more, but should not be noticeably heavier.

Problem 8: Arcing is occurring between the ground-wire and the HV wire.
→ Electrical arcing between the ground-wire and the high-voltage wire occurs because the wires are too close. This does not include arcing that occurs on the Lifter itself, which is covered under problem 5.

- Immediately unplug the monitor and wait for the HV charge to dissipate.
- Move the ground and HV wires further apart from each other to prevent future arcing.
- Note that electrical arcs between these two wires can cause permanent damage to your computer-monitor power source.

Problem 9: Arcing is occurring between the HV-wire and the monitor's picture-tube.
→ Electrical arcing between the HV-wire and the picture tube occurs because the HV wire is too close to the glass-portion of the tube.

- Immediately unplug the monitor and wait for the HV charge to dissipate.
- Lift up gently on the HV wire so that it is bent at a 90 degree angle from the lip of the suction cup. In other words, after it leaves it suction cup, the HV wire should be angled directly away

from the picture tube. This should prevent arcing between the monitor's picture-tube and the HV wire.

- Ensure that you do not lift up on the HV wire with enough force to pull it away from the HV electrode on the interior of the suction-cup. You can tell if this has occurred if the Lifter hisses less than normal when turned on.
- Note that electrical arcs between the HV-wire and the picture-tube can cause permanent damage to your computer-monitor power source.

Problem 10: The Lifter lifts off and immediately shorts the HV and ground wires.

→ Electrical shorts between the HV and ground wires can occur when the position of these wires changes when the Lifter lifts off from the test surface.

- Immediately unplug the monitor and wait for the HV charge to dissipate.
- Reposition the HV and ground wires so that they are less likely to touch and cause an electrical short during liftoff. Taping the wires in place about 10 inches from the testing surface can also reduce the movement of these wires during liftoff.

Problem 11: The Lifter lifts off and immediately pulls to one side

→ The Lifter may pull to one side when it lifts off, meaning that instead of moving 'up' in a reasonably straight manner from the testing surface, it takes off and flies in a particular direction. This occurs because of weight instability or thrust instability, and is usually due to weight imparted on the corners of the Lifter from incorrectly position HV and ground wires.

- Unplug the monitor and wait for the HV charge to dissipate.
- Try shortening or lengthening the tethering-threads to position the Lifter where it should be at maximum height.
- Try shortening all three tethering threads to a reasonable length by reducing them by approximately 2 inches.
- Ensure that the HV and ground wires are suspended up from the testing surface so that they do not add excess weight to the corners of the Lifter.
- Ensure that the aluminum foil skirt is reasonably straight and uncrumpled around the entire frame of the Lifter, and is cut to the same height all the way around the frame.
- Ensure that the corona-wire maintains the same distance from the foil skirt around the entire frame of the Lifter, and is pulled reasonably tight between vertical balsa struts.

Problem 12: The Corona-Wire 'flutters' during liftoff and causes thrust-problems.

→ The Corona wire may flutter during liftoff due to electrostatic forces.

- Unplug the monitor and wait for the HV charge to dissipate.
- Try straightening the corona-wire by hand until it is lined-up reasonably straight above the foil-skirt.
- Try removing the corona-wire from the Lifter and re-wrapping it with a new piece of 30-gauge magnet wire stretched firmly between posts. (Remember that the posts are balsa and cannot take much stress. Also, remember to remove the enamel-coating from the bottom of the corona-wire as well as the tip that connects to the HV suction-cup electrode on the monitor.)

Problem 13: The Foil-Skirt 'flutters' during liftoff and causes thrust-problems.

→ A reasonable amount of aluminum-skirt flutter may occur during testing due to electrostatic forces, however, an excessive amount may cause thrust problems.

- Unplug the monitor and wait for the HV charge to dissipate.
- Try straightening the corona-wire by hand until it is lined-up reasonably straight above the foil-skirt.
- Try using small dabs of super-glue to hold the bottom of the skirt in place on the bottom of the

vertical balsa support-struts. Be aware that weight is critical and super-glue may add too much weight if it is used excessively.

Problem 14: The Lifter hisses, but just will not lift off

→ If you've gone through this entire troubleshooting document and still not found out what the problem is, it could be that your Lifter is just too heavy. Some ways to correct weight problems include:

- Shaving excess balsa from the frame.
- Trimming aluminum foil off the Lifter (trim even strips around the bottom to remove foil)
- Supporting the HV and ground wires off the test-surface to reduce wire-weight.
- Ensuring that you used 30-gauge magnet wire (red enamel coated, about a hair's width across).
- Using a higher-voltage power-supply
- Shortening the overall length of the HV and ground wires to reduce electrical resistance.
- Ensuring that you've used balsa-wood and not bass-wood to construct the Lifter (bass-wood looks almost identical, but has a smoother consistency and more almond-like color and texture).
- Ensuring that you haven't used 'heavy-duty' aluminum foil for the foil skirt.

Author's Note: General Troubleshooting Guidelines

→ Here are some extra thoughts on troubleshooting that don't really fit well in any of the above categories but may assist you during testing.

- There are two factors that enable the Beifeld-Brown effect to cause thrust and lift.
    - First, there needs to be a capacitance between the corona-wire and the foil-skirt. If there are sharp edges, or if these elements are just too close, then too much charge transfer will occur and capacitance will be lost. This is the main reason why the foil is folded over the top of the horizontal balsa-support struts – to reduce sharp edges and increase capacitance. This is also why there are several centimeters of distance between the corona-wire and the foil-skirt. This also reduces charge-transfer and increases capacitance.
    - Second, charge transfer between the corona-wire and the foil-skirt needs to occur for the Biefeld-Brown effect to work properly. If the corona-wire is too heavily shielded due to the wire's enamel coating charge transfer will not occur. Similarly, if the distance between the corona-wire and the foil skirt is too great, charge transfer will not occur. Please note that charge transfer seems to be only required when the device is tested in an atmosphere, because the Lifter design has been successfully tested in a vacuum environment.
- Make sure that your Lifter weighs as little as possible. The required weight appears to be about 2.6 grams maximum, although that is not set in stone – it depends on construction, leakage current, etc…The prototypes constructed by the author weighed so little that the author could barely tell when he was holding them – the wires seemed to outweigh the prototype itself.
- The Lifter prototype requires time and a little finesse to make it work. The author spent nearly 2 weeks building prototypes before he built his first working model. It only takes him about 20 minutes to build a working model at this point.
- The Lifter has a real tendency to cause attraction to the test-surface. This is 'static-cling' from the capacitive charge on the foil-skirt to the testing surface. You can reduce this by putting something underneath the Lifter (the author uses a plastic-straw) to prop it up from the surface during testing.