

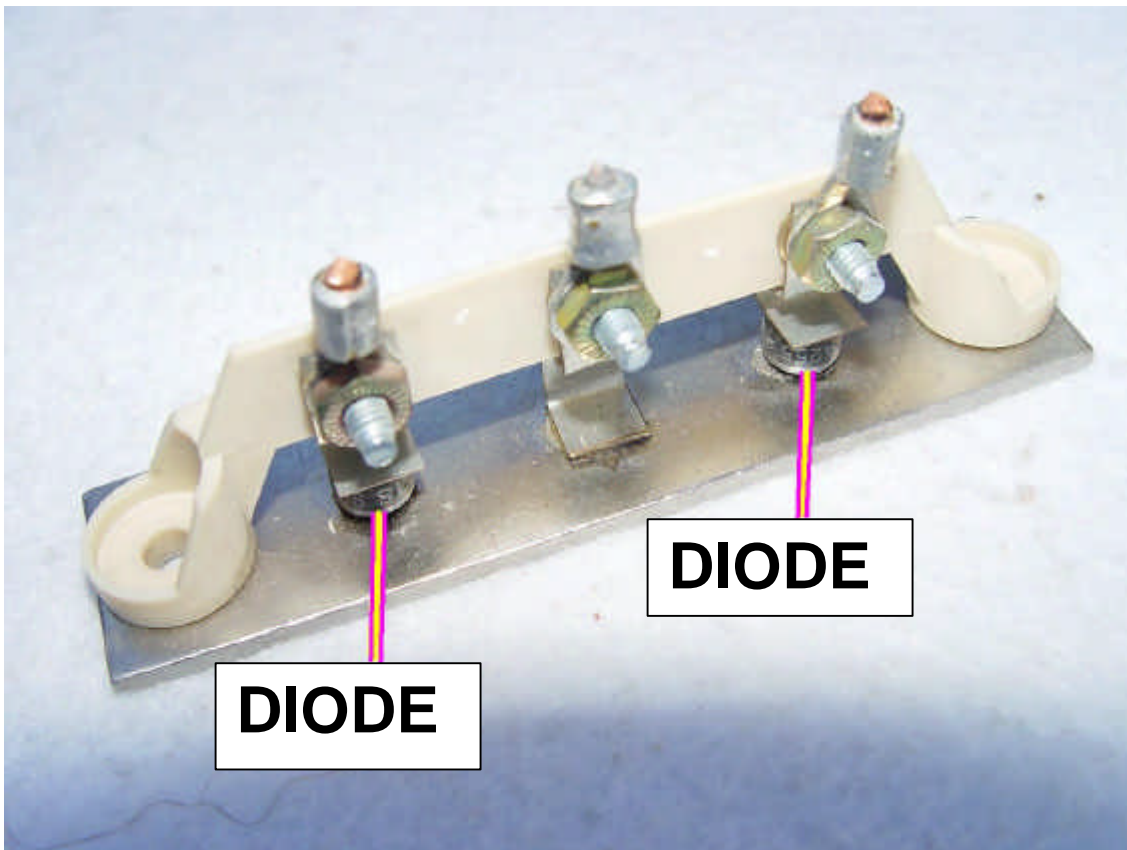
## Diodes

### What is a Diode?

A diode is an electrical “one-way” check valve that allows current to flow in one direction only. Diodes convert the sine wave input of incoming alternating current (AC) into the direct current output (DC) needed to charge batteries.

### What does a Diode look like?

Diodes vary in shape and size, but are always mounted to a “heat sink” to dissipate the heat created by current flowing through them. The illustration below is a typical diode/heat sink configuration. The diode and heat sink configuration in your charger may differ from the illustration below, but should look similar to this. The two transformer output wires attach to the outside leads and send AC current to the diodes. The diodes then “rectify” this AC current and send DC current through the middle lead out to the battery positive (+) wire.



### Why does a diode fail?

Below are some common causes of diode failure.

Voltage Transients – Voltage transients, also referred to as voltage spikes, are the most common cause of diode failures. Most transients originate from the AC line but can also enter the charger from the DC side. Lightning and large inductive loads, such as motors turning on, can cause AC transients. Using equipment while the charger is in operation

can produce transients on the DC side, which is a fairly common practice with scissor lifts.

Reversed polarity of the DC connection - In most DC battery systems the negative (-) wire is black and the positive (+) wire is white (or sometimes red in OEM applications). A mistake we see often is that people familiar with wiring AC circuits, but not DC, assume that the "hot" wire is black and wire the DC system based on their experience. The usual result is that both legs of the fuse blow. This stress may also cause one or both of the diodes to fail.

Before replacing the batteries or the male or female DC plug, or before you make any changes at all in the wiring of the battery pack, please ensure that you mark the connections and draw an accurate sketch of the circuitry. If you don't have a wiring diagram for your application, now is the time to obtain one from the manufacturer. If your machine is used, has been modified, or has an unknown history, make every effort to obtain an accurate wiring diagram.

### **Symptoms of a failed diode**

A charger ammeter that only deflects to 10 to 20% of the charger's rated output when first turned on, regardless of the battery system voltage, most likely has a failed diode. Most diodes fail in the shorted mode, which will cause one of the fuse links to blow. However, a diode that fails in an open mode will not cause the fuse to blow. The length of the charge cycle for a Lestronic charger with an automatic timer depends on several factors, including depth of discharge, battery size, and charger size. While we cannot give you an exact time the charger should run, if you notice a significant increase in charging time and the charger does not turn off, a failed diode may be present. The majority of our calls that involve excessive charger run times are caused by battery problems. Since the charger is trying to increase the voltage to a specific level before turning off, any weaknesses in the batteries or an extremely low charge rate may cause the charger to run longer than normal.

So you are aware, following is a list of conditions that may also cause extended charger run times:

- a) The batteries sat idle for over a month without being charged (Batteries that have sat idle for extended periods may not accept a charge or cause the charger to shut off in a short period of time due to crystallized sulfation),
- b) The batteries are new and are being charged for the first time,
- c) The batteries are in a cool environment of 50° F or less,
- d) The batteries have been excessively discharged to the point that the machine is completely dead and has to be pushed to a wall outlet to be charged,

### **How do I test a diode?**

Note meter settings (reading Ohms) in the picture below, the connections to the diode (red lead) and heat sink assembly (black lead), and the actual meter reading (146.7 Ohms). This check indicates some measurable resistance value, that is, we do not read ZERO or INFINITY.



In the next picture, we show the leads reversed (Red – Heat Sink and Black to Diode). The meter reading in the picture shows “00.0” but is actually reading INFINITY. On this particular model of multi-meter, the display flashes 00.0 indicating an open circuit. Because the diode is designed as a one-way electrical “check valve,” this process of checking indicates the diode is GOOD.

NOTE: Don't forget to check the other diode in the same manner!



In the case of a bad diode, you will have one of two situations. First, if the meter indicates ZERO (as it will if the probes are touched together) both ways, the diode has shorted. Or, second, the meter indicates INFINITY (as it will if the meter probes are not touched together) both ways, meaning the diode is open.