Electric Sign Repair

Introduction
1. Safety and precaution
2. What to do if you are grabbed by the high voltage
3. How neon channel letters are wired
4. The force field around the neon glass
5. Signs using PK housings
6. Types of transformers
7. Types of Installations
8. The Timer
9. How to prevent future problems with a customer
10. Schematic drawings, and more technical information

Troubleshooting a Channel Letter Sign
1. Evaluation of the sign
2. Where to start checking the sign
3. The Channel Letter
4. The symptoms, the possible cause
5. How To Check a non GFI Transformer
6. How to check a GFI transformer
7. How to check the neon
8. How to prolong the life of a neon sign
9. PK housings and Age of neon
Electric Sign Repair

Introduction

The sign repair business has always been for sign companies the source of the fast cash flow, and that is because most of the time you are done with the job in one or two days and sometimes even at the first visit to the sign. So it's a fast way of making money and it's also a job that not many people are into. But that's not all, in some cases you get other types of repairs from the owner of the sign but related mostly to illumination, like office fluorescent lighting, or outdoor lighting.

The sign maintenance business can also include, installation of timers or photocells. Many signs are on 24 hours a day and the owner sometimes doesn't know, his sign is wasting power because during the day it doesn't need to be on and also it's shortening the life of the neon and transformers.

So overall it's a good business to get into and you don't need a very big investment, a truck some ladders and basic tools and you're in business.

This is perfect for people that already have experience with electricity and for electricians.

You will find in this website all the information you need to start repairing electric neon illuminated signs.
Electric Sign Repair

Safety and Precautions

The Voltage Detector

• A very practical way of detecting if you are in front of a live wire, the difference between detecting a low voltage (120vac or 220vac) is that you have to almost touch the voltage detector to the wire to see if it's hot. But with neon high voltage it starts beeping even a foot away from hot wires or neon. First tool I put in my shirt pocket is this little handy device and of course I test it on my 120 vac outlet first to check if the batteries are good. And I would set it to beep, so it would start beeping if I got close to a hot live gto wire, transformer or neon.

The Timer

• Check to see if there's a timer, most of the time if there's a timer it will not be correctly set and you may have turned it off manually but the clock is turning and suddenly it will turn on, check the clock or loosen the screws so it will not trip the switch.

Uninstalling a Sign illuminated with Neon

• Many stores have closed and somebody has to take the signs down, so if you are hired to take down a signs it's very important that you take down the transformers also, disconnect the transformers and insulate the ac wires that used to go to the transformers.

There's a case I knew where a property manager hired a handyman to take down a sign, and he did take it down and hauled it away, only thing is he forgot or didn't know that he had to take down the transformers also, so the transformers were left with the wires hanging. And they were the old type of transformer that didn't have a GFI, so as soon as the timer kicked in, the transformers started to work, only problem that there was no neon to light up, so the high voltage sparks started to look for ground and they found ground but the sparks get very hot so it started a fire and eventually the whole building went up in fire. They were looking for the guy that took the signs down.

• If you have worked with regular electricity you already know the precautions you have to have, the only difference with the electricity coming out of the transformers (high voltage) is that;
Electric Sign Repair

1. You don't have to touch the wires to get zapped, the spark will jump to a distance of 1 to 2 inches, if the power is being dissipated or used by the sign and the circuit is closed then there will be no jumping spark, the problem starts when there is a broken neon and the electricity is looking to complete the circuit and it finds you a good conductor then it will jump to you, if you are closer than 1 to 2 inches.

• Never work on a sign that you have not killed the power to, some shopping center signs are not turned on and off at the store, they are connected to a network in which they are controlled sometimes thousands of miles away by the corporate owners of the shopping center. In those cases there has to be a switch on the sign itself for maintenance purposes.

What to do if you are grabbed by the high voltage

I once, by accident of course, grabbed the two wires of a 15000 transformer while it was on, my hands were grabbing the wire and I couldn't let go because of the electric current, so what I did was just walk backwards until the wires were stretched and the wires slipped from my hand. That is the only way of getting free from that situation, by pulling yourself away from the transformer until you have pulled enough that the wire slips from your hand. The other thing I could have done is bend over put my feet over both wires and straighten myself pullin

g the wires out of my hands.

I have never heard of anybody dying of electrocution from the output of a neon transformer, only very scared people, and an embarrassing situation.

Cannot say the same thing of the low voltage 120 vac
Electric Sign Repair

How Neon Channel Letters are wired

You will find this configuration to be the most common, so that is why if one letter is broken or died of natural causes, then there is an interruption of the flow of electricity and the sign will not work properly.

There is another configuration that you could encounter as described in the second photo in which the transformer has a midpoint connection.

Each transformer has a limited amount of neon glass that it can light up, depending on the output voltage and the diameter of the glass.

The smaller the diameter of the glass the more voltage it will need, and also any neon that is filled with neon gas will need more voltage than the neon glass filled with Argon.

So if the sign has a lot of letters you will probably see more than one transformer, but the wiring is the same, each transformer will light up a group of letters.
Electric Sign Repair

The Force Field around the neon Glass

The glass on a neon sign has an electric field running on the outside of the glass as it does on the inside. The outside electric field is not very powerful but it can give you a small shock. That is why the glass has to be at least an inch and a half away from any metal part, because that electricity will create a small spark that will heat up and eventually pock a hole on the glass and the gas will escape making the neon section useless.
Electric Sign Repair

Types of Transformers

Self Enclosed Transformer
The box is designed for the flexible conduit to connect directly to it.

Regular Outdoor Neon Transformer
This transformer needs a metal box to enclose it.

Metal box for the regular neon transformer
Electric Sign Repair

Channel Letter Transformer

Some large channel letters have a transformer like this one in each letter.

Housing Transformers

This transformer are also installed in large channel letters and the...
Electric Sign Repair

Types Of Installations

This is one of the most common installations

The Raceway Installation

The transformer and all the wires and connections between the letters are contained in the metal box behind the letters, the only wires going thru the wall are these low voltage 120vac.
Electric Sign Repair

The Timer

This timer is one of the best timers in existence, and the reason is that it has been tested for many years and it's made to last, something that is not very common these days. It's 100% mechanical/electric and still made with a metal body. There are other more modern ones that are electronic and made with plastic, and more expensive than this ones. But so fragile that if you drop them they will probably break.

The yellow disk is what turns as time goes by and the middle metal arrow pointing down stays fixed and it is the indicator of the current time.

To put the timer on time you pull the yellow disk towards you and turn it until the fixed middle arrow is pointing to the correct time of day, then you pull back the yellow disk again to its position. To set the ON/OFF switch you unscrew the small screws on the metal objects on the side of the yellow circle to
**Electric Sign Repair**

move them as needed pointing them to the hour when you want to turn on the sign and turn off.

You have to tighten the screws with pliers because if you just tighten them with your hand they will move a soon as the hit the switch, so they have to be tighten with pliers.

There is a manual on /off switch that will help you override the timer.

---

**How to prevent future problems with a customer**

You have to make aware to the customer exactly what you did to the sign, if you just replaced one neon letter, you have to specify in the invoice which letter was replaced and you have to specify the condition of the rest of the sign if you saw that it was in bad shape, that way you are informing what you are responsible for and what you are not responsible for, because if you do not indicate in writing in the invoice, the client could make you responsible for the whole sign. So if the sign has 3 transformers and you just replaced one, you have to indicate that the transformer you replaced is illuminating the XYZ letters and not the whole sign, so next time your client calls and it's another bad transformer they will know it's not the same one. Same situation with the letters you have to specify in the invoice in writing which letters you replaced within new neon, that way you have proof that the next time it's not the same letters failing.

---

**Schematic Drawings, and more Technical Information**
Evaluation of The Sign

Not all signs are created equal. The reason is that some signs are installed in an incorrect way, and I am talking about wires everywhere, no metal conduits, no grounding, transformer exposed. So this is why I evaluate the sign before I decide to go ahead with the repair, and the reason is that if I see a badly installed sign I will not go ahead with the repair, specially if it has one of the old transformers with no GFI (ground fault interrupter), because the probabilities of something going wrong after the repair is high just because of the badly wired sign, but maybe the client will accept an upgrade of the signs wiring then it's possible to work on the sign.

Another situation is an old sign that has a lot of problems, including very old neon that looks like it's at the end of it's life, where you know that some neon will not survive 6 more months, then you have to tell the client before hand that you will repair the bad neon section but that more neon sections will fail in the near future and that it's a good idea to replace all the neon, that way you prevent future problems with your customer. If the client refuses to do that and just wants to replace the one bad neon letter then you have to put a note on the invoice as proof that you advise your client of what could happen and also put on the invoice what letter you replaced, because what could happen is that in the future when the sign fails again you are covered, you can only warranty for the letter you replaced not the whole sign.
Electric Sign Repair

Where to start Checking the Sign

There are two types of signs you will encounter

• The ones where you will be able to talk to the owner and you will get a decision straight from him/her. and payment when finished
• The ones where there is no owner, the sign is managed by a corporate company on the east coast or somewhere in the world and you will be facing maybe payments 30, 60 or 90 days after you finished the job. If you have enough money in the bank to wait that much for payment then it’s ok, but if you are not rich and need money flowing fast through your business then you better stay away from those big corporate jobs. It all really depends on your ability to survive without that payment coming in anytime soon.

If the sign is local and it’s only a matter of a few miles to get to the sign i always like to check the sign at night, this evaluation of the sign at night will save me a lot of work in the day when i go to actually fix it. 80% of the time i can tell just by looking at the sign at night;

1. What type of light it is, Neon or LED
2. What is wrong with the sign
3. If it’s the transformer, the neon or an LED or the timer.
4. I take a photo for later reference
5. Check the page The symptoms-the possible cause for detailed information.

Once i have checked the sign at night to see which letters are ok and which are not i tell the owner that i will come back the next day to repair his sign.

Go to the page "The symptoms-the possible cause" for the different possible problems you could encounter and the solution.
Electric Sign Repair

The Channel Letter

The Symptoms and possible cause

Here is a list of probable problems and how to proceed

If possible and practical i start by checking the sign at night to see what the sign does , if it's flickering , one side dark ,the middle dark, it's completely dark, etc . by looking at the sign i can tell if it's neon or LED , and what type of transformer it has , and 80% of the time i know what's wrong with it . Like i said if it's possible i start by doing the night evaluation , if not then i start by asking the owner what he saw , what's wrong with the sign , most of the time they tell me what i want to know . Then i know where to begin.

1. The sign is flickering and only one side of the sign is dimly lit and the other is completely dark.
   First, if it's flickering it means it has an old type transformer with no GFI , so there are two main possibilities here ,
   One is that one side of the transformer went dead ,and the other is that there is a short on the transformer GTO wire leading to the last letter of the circuit.

2. The sign is flickering on both sides but totally dark in the middle
   this one is an easy fix , you go for the neon letter where the dark spot is , there may be one or two bad sections in the middle of the sign, you will have to replace them with new ones.

3. The sign is completely dark no signs of life at all
   First check if there is a timer , if there is one make sure the small screws that turn ON and turn OFF the sign are properly fastened , and check if the timer is on or off, if off turn it on , sometimes that is all the problem.
   If the sign still does not light up then there is a possibility it has a GFI transformer and it tripped because of a short , you will have to go to the transformer to check the transformer , check first the input (120 vac) and then check the output .
   If everything is good then you may have a short on both output GTO wires going to the sign , you may have to replace the GTO wire .

4. It's been raining a lot and you get a call the next day when it stops raining because a sign is not lighting up
   You tell your customer that you will be there to check the sign in about 2 days , considering it will not rain again . The reason for the two days is to let the sign dry out , because it is very possible that it has a GFI
Electric Sign Repair

transformer and there was a temporary short caused by the rain but once the rain stops there is no short anymore, so you just reset the transformer and the sign lights up again. You have to check the first and last letters to see if there are wires too close to the metal that could be the cause of the short, most of the time you can see a little spark residual where the short happened. Most of the time the shorts happen on the GTO wires coming from the transformer and going to the first letter and the last letters on the that circuit in a sign. Shorts also happen when a neon letter dies of natural causes (Old age) and the electricity starts to look for the nearest ground and starts to ground itself to the metal part of the letter.

5. If you want to test a suspicious Neon letter or section to see if it's the one to blame for the sign not working correctly, you use a jumper wire and connect it to the two electrodes on the letter and then turn on the sign, if it's a bad neon then the rest of the sign will light up.

6. The finger test

If you touch the neon glass and run it down the glass and you feel a tingling sensation that means the neon is good, a bad neon will not conduct electricity and you will not feel an tingling sensation on your fingers.

9. Most of the time you have to use all your senses while checking a sign.
The smell of burning tar is indicative of a bad transformer
The smell of burned rubber is indicative of either electrode boots burned or GTO wire burned.

So when possible check the sign at night, because it will tell you what to do the next day when you go fix the sign. It really saves you a lot of time.
Electric Sign Repair

How to check a GFI Neon Transformer

On the videos you will see a method of checking if a transformer is working properly. This method is widely used by many sign maintenance people and has been for many years. And the reason is because it's fast and easy. You will get to know, on this website the most practical and fastest way to diagnose a neon illuminated sign. Not only by what I have been thought, but by what other very experienced sign maintenance people have told me. You learn from other peoples tips and trick as you go.

Link to Video

All neon has a limited life span, it's probably the only light source with the longest life span. If the neon was made correctly it can easily live for more than 15 years, I have seen neon still lighted up that has been installed for 50 years and still going. The neon that I have seen live the longest is the neon that is not ON 24/7 but that it has a timer or a photocell, you can shorten the life of neon and the transformer by having it on always, but you can make it last to its fullest by installing a timer and having it off in the day, it was never intended to be on during the day. The transformer gets hot when in use and the electrodes get warm, and anything that gets warm or hot is in a sense cooking. It's parts in a very slow way being transformed (that is what cooking is) until it comes a time when due to the slow cooking it looses its properties and stops working. So to prolong the life of a neon sign put a timer or photo cell.

PK Housings and The Age Of Neon

Link to video