TECHNICAL INFORMATION BULLETIN

Subject: Electroluminescent Lamps
Topic: Handling Instructions & Catastrophic Failure

The basic electroluminescent (EL) lamp is best described as a luminous capacitor consisting of a phosphor powder (similar to that on a television screen) sandwiched between two electrically conducting layers (plates). At least one of the plates must be transparent to allow the light to escape. When the EL lamp is placed under an alternating electric field, electrons within the phosphor layer are accelerated to relatively high kinetic energies. These highly energetic electrons impact other electrons as they move back and forth. Electron impact of this type excites the electrons to higher energy states. When these electrons return to their original state, energy is released in the form of emitted visible light. The intensity of the emitted light increases with increasing voltage and frequency.

A typical printed EL lamp is made by screen printing a layer of phosphor powder onto an electrically conductive piece of plastic. On top of the phosphor is printed another layer of conductive material. Finally, the entire area is covered with a plastic sealant which serves the double purpose of keeping moisture out of the EL lamp and keeping the high voltages used to drive the lamp away from anyone touching it. Two connectors are then attached to the lamp; one to each conductive plate. When a sinusoidally alternating voltage of from 120 to 160 volts AC with a frequency of from 700 to 1200 Hertz is applied to the connectors, light will be emitted.

A printed EL lamp can be characterized as a flexible capacitor made up of several very thin plastic layers. It is low in cost, light weight, and highly reliable. In addition, it is quite durable and consumes relatively little power. The light emitted is extremely uniform over the entire lamp area and no heat is generated by the light producing mechanisms. However, a printed EL lamp is also a sensitive instrument and requires moderate handling considerations to keep from being damaged, thereby reducing its lifetime.

An EL lamp's construction consists of 2 electrically conductive plates separated by a very thin dielectric layer. The front plate is extremely thin, allowing it to become transparent. The light emitted from the lamp passes through this layer. The dielectric layer is approximately 1/1000 of an inch thick. It must completely separate the 2 plates. The back plate is a silver filled plastic which is attached to the connectors. Finally, the entire back of the EL lamp is covered with a non-conducting insulation and sealer layer which is also extremely thin.

In all cases, catastrophic failure (failure to light) of an EL lamp occurs when the very thin dialectic layer fails, allowing the 2 plates to short together. When this happens 2 things can occur. The first is, the extremely thin front plate acts as a fuse and burns away the conductive material where the short occurs. It actually creates a nonconductive circle around the point of contact. In this case, you can see a bright spark, then the lamp will relight. Most times the short will not reestablish itself, and the lamp will work normally. This case only occurs when the short is a very small point.

The second case occurs when the short is more than just a very small point. Here the short is so severe that the inverter that drives it turns itself off (this is built into most inverters). Since the inverter is no longer driving the lamp, it no longer lights. In some cases, even a bad short can be burned away by hooking the EL lamp directly to a 110 VAC wall plug through a 100 ohm, 10 watt resistor. This provides much more current than a small inverter, and will burn away the front electrode. WARNING - THIS CIRCUIT CREATES DANGEROUSLY HIGH VOLTAGE! TAKE NECESSARY PRECAUTIONS TO NOT COME IN CONTACT WITH THE WIRES! In the very worst cases, this circuit will cause the lamp to begin to burn and must be disconnected immediately and the lamp discarded!

All EL lamps manufactured by Business Adventures Inc. are tested before they leave the factory. This removes all the lamps that fail due to a manufacturing defect. However, carelessness in the installation of the lamps can lead to additional damage of the dielectric layer and catastrophic failure. Here are the the most common problems we have encountered, and our suggestions to solve them.

1. SMASHING OR COMPRESSION OF THE LAMP

When an EL lamp is installed, it is very easy to compress it between 2 plates. Some of these instances are:

a. when the washer or nut holding a switch in place in a panel catches the lamp under it.

b. when the lamp is caught between the edge of a plate and the housing the plate is being placed in.

c. when an assembly with a lamp is pressed into a tight area and wires from the assembly are pressed against it.

d. when a wood chip, plastic chip, or rough edge on a plastic housing is pressed against the lamp.

e. when parts awaiting assembly are stacked on top of each other.

The layers of an EL lamp are **extremely** thin! They are damaged by a slight pressure (puncture) that is very short or by a pressure (compression) that exists over a long time. To avoid these problems, do not overtighten screws holding a panel with EL lights in place. Make absolutely sure the lamp is not caught under switches, washers, edges of the panel, etc. Check an installed panel to be sure no wires or other things are pressing against the lamp. Do not glue wire holders, etc. to the back of any lamp. Do not stack uninstalled panels on top of one another. Be careful not to bump an EL lamp against any objects while installing. Remove all burrs from the edges of the plates by sanding or scraping. Never drill through, cut, or otherwise modify the EL lamp package. If the wires attached to the EL lamp protrude back toward the lamp (the usual case) be sure they are pulled up and away from the lamp. Be sure the metal connectors where the wire attaches to the lamp are not being pressed down into the lamp. In general, think of an EL lamp like a glass light bulb. You know that compressing it will break the glass. In the same fashion, compressing an EL will break the thin layers!

2. CHEMICAL ATTACK & OVERHEATING

On the back of an EL lamp is a sealant & insulation layer. It keeps water out of the lamp and provides protection from the high voltages inside. This layer is also thin and can be easily be destroyed by aggressive chemicals or overheating. Once the back layer is destroyed, the chemical usually continues into the lamp and destroys the dielectric layer.

To avoid these problems, do not place any chemicals directly on the lamp. This includes hot melt glues, silicone sealants, solvent based glues, etc. This is especially true at the point where the wires are connected to the lamp. This area cannot be sealed or the wires would not make electrical connection. This point is electrically HOT! Many companies wish to insulate this connection by covering the connectors with a sealant. This will normally destroy the lamp, if not immediately, then over time! To seal the connector, we recommend first covering the connector with a clear, polyester plastic tape (like plastic shipping tape) then covering the tape with a sealant. The tape will ensure the connector is not touched by the sealant. Also, do not use hot melt glues over an EL lamp (like gluing a switch into a panel). If the glue, while hot, touches the lamp, the plastic layers will melt, thereby destroying the lamp! Magic markers, inks, paints, coatings, etc. have solvents in them. If used on the edges or back of an EL lamp, they will dissolve the layers. Again, before using these, cover the lamp with plastic tape. The adhesives on most tapes are not damaging to the lamp.

Some companies have found insulating chemicals that do not damage the lamps. Although we do not recommend them, you are welcome to try to find them. As a rule of thumb, if you are placing a chemical over the lamp, test, test, and test some more to be certain it will not damage it!

3. BENDING & CREASING

A plastic EL lamp will take a 1/4 inch radius bend. Bends beyond this amount (even for an extremely short time) will cause the dielectric layer to crack, leading to failure. To avoid this, do not overbend the tail of a lamp when installing it in a panel. If a lamp has a tail that comes through a panel, rout the hole out very large so the lamp comes through the panel with a smooth bend. A narrow slot forces the lamp tail to make a sharp bend coming through the panel and cracks the layers. Also, when pressing an overlay down onto an EL lamp that comes through a panel, do not press hard at the point where the tail proceeds through the panel. Pressing hard forces the tail down into the edge where the panel ends and the opening begins. If this edge is routed, it is normally a little sharp and pressing on the overlay puts a crease in the lamp at this point.

In addition, when picking up a lamp for installation, never hold or pull it by its tail alone. Always install the tail through any slots first, then gently place the lamp on the panel instead of placing the lamp on the panel then bending the tail tightly to force it into a slot. Never pick up or pull a lamp by the wires attached to it. This will bend the lamp at the point of connection.

4. SOLDERING

If your EL lamp has attached wires you do not need to worry about this one. If, however, your EL lamp has pin connectors, you should not solder wires to the pins. The tremendous heat from soldering melts the layers of the

lamp. Pin connectors require using pin terminals on the wires you attach to the lamp so no soldering is necessary. If you don't want to use pin terminals, then we suggest you order your EL with the prewired connectors.

5. INCORRECTLY MATCHED INVERTERS & INVERTER HEATING

Every EL lamp of a different size has different electrical characteristics. For instance, the larger the lit area, the more current required to light the lamp. Since an EL will not light with DC current, an automotive application requires an inverter to convert the 12 VDC of the vehicle to the 120-160 VAC required for the lamp. Since every lamp is different, the inverter must be matched to the characteristics of the lamp to operate properly (at the right voltage & frequency). A single inverter for any size lamp or combination of lamps is not possible! If any inverter is not matched correctly it may not light consistently or it may overheat. A correctly matched inverter will consistently light the lamp and will be cool or slightly warm to the touch after operating for an extended period. A HOT inverter is matched incorrectly and can be a fire hazard! In addition, always mount the inverter away from the lamp. This way the heat from the inverter operation or the chemicals used to mount it will not effect the lamp.

In conclusion, with moderate handling operations and a general respect for the very thin layers of an EL lamp you will find them to be long lasting, reliable lights for whatever your application is!