Anatomy of a Strobe

Imagine you are walking down the street on a stormy day. Overhead, a massive thunderhead looms dark and foreboding. The air itself seems electrified -- static energy fills the air, built to a frenzy by the movement of things thrashed about in the wind. Suddenly up ahead, the sky is riped apart by a blinding flash, as lightening streaks its way from clouds to earth below your feet.

You have just experienced something of what it is like to be inside a strobe tube as it flashes.

Understanding the workings of a strobe is easier when you are familiar with its basic components.

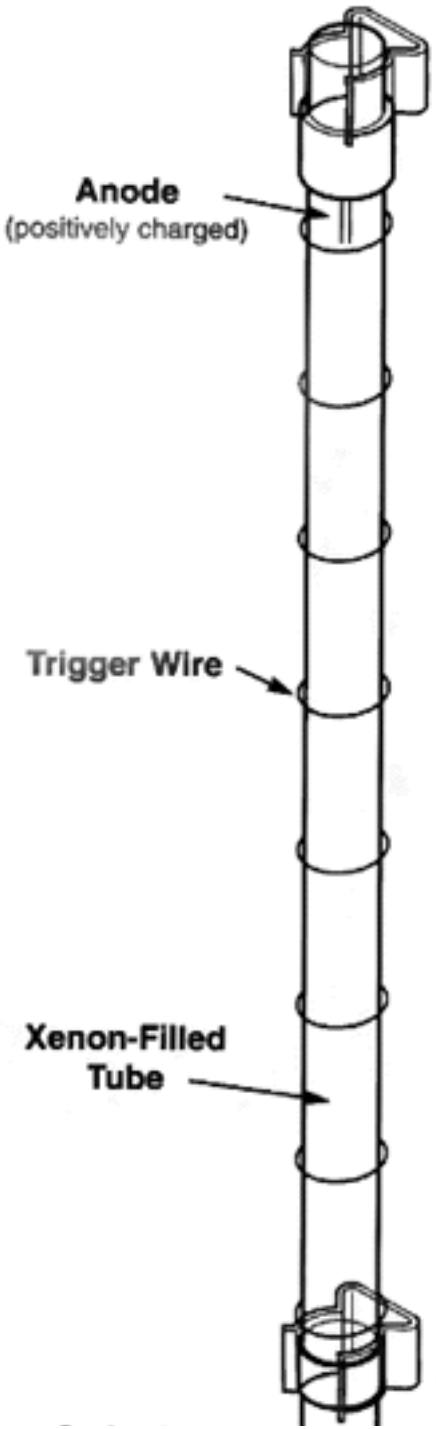
FLASH TUBE, which consists of:

Anode -Functions like the earth, drawing the current when it runs through the atmosphere of the strobe tube. The anode is made of pure tungsten.

Cathode -This negatively charged component functions like the cloud in the previous illustration, releasing an electron charge that races through the ionized xenon gas within the strobe tube, in an attempt to reach the positively charged anode. The cathode is typically made of tungsten as well; better strobe tubes have their cathodes impregnated with a small amount of barium or other electron-rich metal; this compound provides a more efficient flash, and helps prolong lamp life.

Xenon-filled Tube -Usually considered an inert gas, much like our own atmosphere, the xenon gas used in a strobe is unique in two ways. First, it very efficiently converts electrical energy into radiant energy (light), and second, the radiant energy that it emits is nearly the same color as daylight.

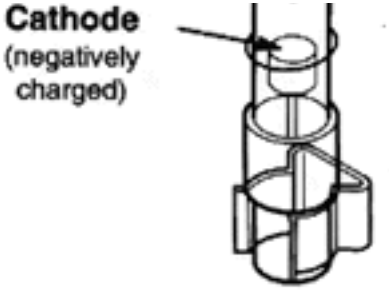
Trigger Wire -The trigger wire, or ignition electrode, is typically wrapped around the xenon-filled tube (on some strobe tubes, conductive paint is used in lieu of a wire.) When a small amount of extremely high voltage/low current energy is passed through the trigger wire, the energy ionizes the xenon gas within the tube, making it conductive enough to support the flash 1hat momentarily follows.



FLASH CAPACITOR -Acts as a holding bin for energy until sufficient voltage "is collected to generate an overflow, or flash.

Now, with an understanding of these components, it is possible to explain how the strobe works. Power is supplied to the flash capacitor in a steady stream. A great deal of high-amperage current must be collected

before a strobe flash can occur. The capacitor functions like a bucket, collecting incoming energy until it is at "capacity". As this condition approaches, a small amount of energy is released to the trigger wire, which is wound tightly around the strobe tube. This small amount of high-voltage current is sufficient to ionize the Xenon gas within the tube; the normally-inert gas, like the earth's atmosphere in the electrical storm, is now able to conduct electricity. At this precise moment, the capacitor reaches its limit, and flash-point is reached. The entire voltage within the capacitor flows through the ionized Xenon; as the current moves from cathode to anode, the gas within the sealed tube goes through a heating phase as the current level rises, followed immediately by a current decay phase. During the current decay phase, the electrical energy becomes radiant energy --and the Xenon gas emits light.



The entire heating and decay cycle occurs in a matter of milliseconds (I millisecond = 1/1000 of a second).

WHAT TO LOOK FOR IN A STROBE WARNING LIGHT

Now that you understand the basics of a strobe light, we'll complicate the issue. Strobe warning lights offer you a super-bright white light that flashes a signal without the maintenance headache of moving parts. When superior materials are used, the strobe can have up to 10,000 hour lamp life.

Cathode should feature an electron-rich metal alloy.
Strobe tubes do not bum out; theoretically, they can last indefinitely. Eventually, the tungsten material from the cathode "sputters", or builds up on the inside walls of the tube, causing it to darken and diminishing its light output. Barium or other electron-rich material used in the cathode means less "tungsten sputter". Additionally, both the anode and cathode should be "baked"; this process also helps to decrease the sputter.

Tube shape should position the maximum amount of light output in the focal point of the lens.
A bent or coiled shape in the strobe tube allows sufficient arc-length for an efficient flash, while ensuring that the bulk of the flash occurs in the focal point of the warning light's lens.

Timing circuit regulates flash rate.
Having a separate timing circuit means the flash rate remains constant regardless of power flow.

Care should be taken to protect the components against environmental moisture.
Potting the strobe tube and conformal coating the surface mounted components protect the strobe components against shorts and corrosion due to dampness in the environment.

REMEMBER. ..when it comes to safety signaling, you do not want to settle for just a "basic" strobe light - people's lives may depend on the visibility of your signal. Be sure to ask your signal provider if the strobe tube and mechanism they are using meets with these safety considerations.

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