COLD CATHODE FLUORESCENT LAMPS (CCFL's)
A HISTORY AND OVERVIEW

By John H Kahl
Engineering Manager

ABSTRACT

An understanding of the history and development of a technology can be a tremendous aid in properly utilizing it for a given application. A brief history and overview is given for the CCFL (Cold Cathode Fluorescent Lamp), also referred to as SMFL (Sub-Miniature Fluorescent Lamp). A description of CCFL electrical discharge lighting devices with typical construction and function is given.

HISTORY

The CCFL (Cold Cathode Fluorescent Lamp), also referred to as SMFL (Sub-Miniature Fluorescent Lamp), is a light source classified as an electronic component. The CCFL is closely related to the "neon" sign lamps first introduced in 1910 by Georges Claude in Paris, France. Neon signs gained in popularity during the 1920's and 1930's they are still a significant part of advertising and accent lighting. The technology pioneered with these early gas discharge lights gave way to the innovation of the architectural (hot cathode) fluorescent tubes introduced commercially in the 1940's.

Lighting devices using electrical discharge technology were pursued shortly after the famed Edison patent #223,898 filed in 1879 for the carbon-filament incandescent lamp. Around the year 1895, the 'Moore' tubes containing carbon dioxide and nitrogen gas with a cold cathode construction were demonstrated as light sources. The earliest recorded demonstration of electrical discharge lighting occurred during 1810 at the Royal Institution in London by Sir Humphrey Davey. Light was produced by an open-air arc between two carbon rods, this type of technology was cultivated and improved throughout the rest of the 1800's and into the next century.

DESCRIPTION

The CCFL in simplest terms is a gas-discharge light source, which produces its output from a stimulated phosphor coating inside the glass lamp envelope. A CCFL can be described as a

TO OBTAIN INFORMATION OR TECHNICAL ASSISTANCE

FOR CATALOGS, DATA SHEETS, APPLICATIONS INFORMATION SHEETS, PRICE AND AVAILABILITY, PLEASE CONTACT THE JKL SALES DEPARTMENT. FOR GENERAL TECHNICAL ASSISTANCE OR HELP WITH A SPECIFIC APPLICATION, PLEASE CONTACT THE JKL ENGINEERING DEPARTMENT. BOTH MAY BE REACHED AT ANY OF THE NUMBERS AT THE BOTTOM OF THIS SHEET, OR BY MAIL AT:

JKL COMPONENTS CORPORATION
13343 PAXTON STREET
PACOIMA, CA. 91331-2376

DESCRIPTION (cont.)

transducer converting electrical energy into light energy. The technology of miniature CCFL's and associated electronics advanced tremendously with the advent of the laptop computer for which the CCFL is typically the light source for the LCD display.

Cold cathode refers to the type of electrode in the lamp ends. Cold cathode electrodes do not rely on additional means of thermonic emission besides that created by the electrical discharge through the tube. In contrast, the architectural type of hot cathode fluorescent lamp has an electrode in the form of a filament, which is heated from current passing through it, producing enhanced emissions from the lamp. Essential advantages of cold cathode lamps are their ability for miniaturization because of the simplified electrode, reduced complexity of the drive electronics, increased durability, and improved lamp life.

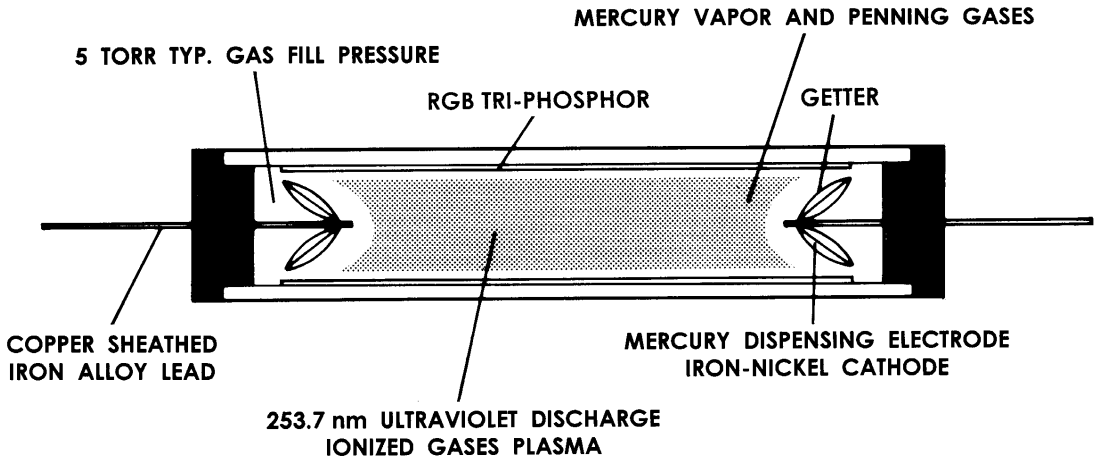

Figure 1

CONSTRUCTION AND FUNCTION

The typical CCFL is a hollow glass cylinder coated inside with a phosphor material composed of rare earth elements and sealed with a gettered electrode at both ends. The lamps normally contain 2-10 milligrams of mercury along with a mixture of gases, such as argon and neon. Ultraviolet energy at 253.7nm is produced by ionization of the mercury and penning gas mixture by the application of high voltage to the electrodes. The ultraviolet energy from the mercury discharge stimulates the phosphor coating, producing light output. Lamp phosphor is typically composed of rare earth elements such as zinc silicate and various types of halophosphates, increasing the wavelength of the 253.7nm energy to the visible light region, in relation to Stokes' Law as applied to luminescence.

CONSTRUCTION AND FUNCTION (cont.)

The visible light portion of the electromagnetic spectrum is referred to as the photopic region, which is energy in the 380nm to 780nm range.

The most widely used white light CCFL lamp phosphors have been compounded for good color rendering when used as an LCD display backlight. These phosphors are referred to as RGB, being composed of Red-Green-Blue fluorescent compounds mixed in the appropriate ratio. With a lamp utilizing RGB phosphors, the ability exists to alter the ratio of the components, hence changing the characteristics of the lamp's color temperature (perceived warmth or coolness of light). Light output from a particular phosphor is described in degrees Kelvin with a typical RGB phosphor for CCFL being 5600, which approximates daylight. A cooler color, hence higher degrees Kelvin, is perceived as a bluer light.

REFERENCE READING

1) Cayless, MA.; Marsden, AM. 'Lamps and Lighting' Baltimore, MD: Edward Arnold, 3rd edition 1983.

2) Derganc, C. 'Thomas Edison and his electric lighting system'. IEEE spectrum, February 1979. Pp. 50-59.

3) Fitt, B.; Thornley, J. 'Lighting Technology'. Oxford, UK: Butterworth-Heinemann, 1997. Pp. 27-46, 75-104.

4) Rabusin, E. Dr. 'Getters for Lamps'. Milan, Italy: SAES Getters S.p.A., 2nd edition 1982. Pp. 31-39.

5) Williams, J. 'The Art and Science of Analog Circuit Design'. Boston, MA: Butterworth-Heinemann, 1995. Pp. 139-193.

INFORMATION ACCURACY

Information furnished herein by JKL Components Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. JKL Components Corporation makes no representation that the interconnection of its devices, as described herein, will not infringe on existing patent rights.

LIFE SUPPORT POLICY

JKL COMPONENTS CORPORATION'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF JKL COMPONENTS CORPORATION.
As used herein:

a. *Life support devices or systems are devices or systems which (1) are intended for surgical implant into the body, or (2) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user.*

b. *A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.*