

16—Industrial Buildings and Plant Layout

230- and 250-volt circuits are available in wattages from 100 to 1500. Some types are available in 260, 277, and 300-volt design. High-voltage lamps necessarily have filaments that are less rugged, require more supports and are considerably less efficient than those of equal wattage 120-volt lamps.

- "Infrared" lamps are available in various types and sizes up to 1000 watts. These lamps are used in baking, drying, and heat processing, as well as for therapeutic purposes. They also have fire protection value: a great amount of heat can be exchanged without flame. Such lamps cannot be used in hazardous location applications.

Fluorescent lamps. The fluorescent lamp is an electric discharge source in which light is produced predominantly by the fluorescence of phosphors activated by ultraviolet energy from a low-pressure mercury arc. The lamp requires a ballast to limit the current and in many instances to transform the supply voltage to a suitable level. Lamp performance is influenced by the character of the ballast and luminaire, line voltage, ambient temperature, burning hours per start, and air movement.

Fluorescent lamps vary in efficiency from approximately 30 to 80 lumens per watt, for lamps of standard cool-white color, depending on bulb size and shape. (Lamps range in size from 6 to 96 in. long.) This does not include power losses in the ballast, typically in the order of 20 percent. While most fluorescent lamps are of conventional tubular design, there are some special types such as circular reflectorized, jacketed and panel-shaped.

Fluorescent lamps are available in many different shades of white and in a number of colors. "Standard cool-white" is most popular for industrial lighting because of its cool appearance, even though it is not quite as efficient as "standard warm-white." "Daylight" and "white" are also used considerably for industrial lighting.

Plastic safety sleeves for fluorescent lamp tubes offer excellent protection against lamp breakage in critical areas where such breakage would endanger workers or cause broken glass and phosphor contamination of proc-

esses, foods, and the like.

Since voltage changes affect the performance of fluorescent lamps, voltages at the luminaire should be kept at the specified voltage rating of the ballast. It should be noted that low voltage is as undesirable as high voltage. Low voltage, as well as high voltage, may reduce lamp and ballast life somewhat. Low voltage may also cause instability in the arc and starting difficulty.

Ambient temperature and air movement around the lamp are important factors in the performance of fluorescent lamps. The bulb wall temperature has a substantial effect on the amount of ultraviolet energy generated by the arc. Where fluorescent lamps are to be used in cold temperatures, as in unheated buildings or in refrigerated rooms, special luminaires or special lamps are recommended, otherwise light output may be greatly reduced. The light output of fluorescent lamps also falls off with high-temperature operation, the amount depending on lamp type.

Light output is also a function of the length of time a lamp is burned. When a fluorescent lamp is first lit, its output is abnormally high. During the first 100 hours of burning, this level drops about five percent. For this reason, the published "initial lumens" is the value obtained after 100 hours burning. Thereafter the drop in output is more gradual. The published "mean lumen" value is the approximate average of the output throughout lamp life. Lamp life is affected by the number of hours per start. A minimum number of starts favors lamp life. In general, fluorescent lamps are rated at three hours per start, and have 7 to 18 times the life of incandescent lamps.

Mercury lamps. Mercury lamps are electric discharge sources. The basic difference between mercury and fluorescent lamps is that the operating pressure of the mercury arc is much higher in mercury lamps. Spectral characteristics are different because the higher-pressure arc emits a large portion of its energy as visible light. Mercury lamps produce full light output only when full operating pressure has been reached, which generally is several minutes after starting. Most mercury lamps contain both an inner and outer bulb. The inner commonly is made of quartz while the outer bulb is generally