

with relatively lower efficiency since light output and life have an inverse relationship. It is important that incandescent lamps conform to the supply voltage, because the change of only a few volts will seriously affect both life and light output.

- Inside-frosted and "white-coated" lamps provide diffusion and thereby reduce high filament brightnesses. Light outputs are approximately equal to those of clear lamps, however, the effective source sizes are increased, which may affect luminaire distribution. Many incandescent lamps are available in colors, or in tints of colors. For instance, the daylight incandescent lamp has a bluish glass bulb that reduces the percentage of red light and gives a color closer to that of daylight. Daylight incandescent lamps are roughly 65 percent as efficient as other comparable types.

- Reflectorized (R and PAR) lamps having self-contained reflectors are manufactured in a number of bulb types in sizes from 30 to 1500 watts, furnishing various distributions of light. PAR lamps are a special form of reflectorized lamps with pressed glass construction, more accurate beam control, and greater resistance to breakage. While efficiencies of reflectorized lamps are lower than for other incandescent lamps, it must be remembered that the bulb also acts to direct the light and that the overall utilizations approach those of conventional lamps in luminaires. Because of economic factors, reflectorized lamps are commonly designed to provide approximately 2000 hours service life. This is equivalent to twice the life of most other incandescent lamps. Reflectorized lamps provide better maintained illumination than other types not only because the sealed-in reflecting surfaces are protected from airborne dust and dirt, but also because dirt and dust do not tend to adhere to the bulb face (in base-up burning position). When used for general light applications, suitable housings should be furnished to protect the lamps against mechanical damage and to provide adequate shielding of the bright light source.

- "Rough service" and "vibration service" lamps are special types that find considerable application in industry. Rough service lamps

(in sizes from 25 to 500 watts) are made with extra filament supports to withstand mechanical shocks. One of the principal applications is for use on extension cords. Vibration service lamps (in sizes from 25 to 150 watts) are made with a flexible filament support for use where vibration would cause early failure of general-service lamps. Vibration and shock frequently accompany each other, sometimes only experiment will determine the better lamp for the purpose. Lower-voltage lamps, generally operated from transformers, are much more resistant to both shock and vibration than standard-voltage types. Shock- and vibration-absorbing socket mounts, utilizing a coiled spring or other flexible material to dampen vibration, have been employed where general-service lamps are used under conditions of severe vibration.

- "Extended-service" lamps are designed to produce approximately two to three times the normal rated life. Available for both regular and high voltage circuits in almost all wattage ratings, they are recommended for use where the cost of lamp replacement is high and cost of power is low. Otherwise their reduced efficacy makes it more economical to use a lamp of standard design.

- "Thermal shock resistant" or "special-service" lamps are available in various wattages and bulb shapes. They are recommended for use in applications where moisture may fall on the hot bulb.

- Quartz-iodine lamps employing iodine to keep the tubular envelope free from blackening have extremely good lumen maintenance in the order of 97 percent over a life of 2000 hours or more. These lamps are made in a variety of sizes from less than 50 watts to 1500 watts. The small linear shape of the lamps enables the luminaire to provide excellent beam control in the plane perpendicular to the lamp axis. Quartz incandescent lamps resist thermal shock.

- "Standard-voltage general-lighting" lamps are designed for use on nominal 120-volt circuits. Lamps designed for 115, 125, and 130 volts are available.

- "High-voltage general-lighting" lamps for