

# Fluorescent Lamps

## **Introduction<sup>1</sup>**

Over the past few years, significant advances have been made in fluorescent lamp technology. In general, fluorescent lamp improvements have been driven by the demand for reduced power consumption and for improved color rendering characteristics. Advances in the phosphors used in fluorescent lamps have significantly improved efficacy and color rendering abilities of these lamps. In many instances, fluorescent lamps are now acceptable in applications that were previously dominated by incandescent lamps, especially in cases where lamp fixtures are designed to accommodate fluorescent lamps.<sup>1</sup>

Energy-saving fluorescent lamps can directly replace standard 40 watt fluorescent lamps. By using an argon-krypton gas mixture (rather than just argon), these lamps are rated at 34 watts per lamp. Although more efficient, these lower wattage lamps produce ten to fifteen percent less light. Energy-saving 32 watt lamps save several watts per lamp with little or no decrease in light output relative to the 34 watt lamp. These lamps also use an argon-krypton gas mixture and are more efficient because the cathode disconnects following start-up. Energy-saving lamps are suitable in instances where a one to two minute restrike time is acceptable.

Standard fluorescent lamps are one-and-a-half inch in diameter and are designated as T-12, for twelve-eighths of an inch. Reduced diameter fluorescent lamps such as T-10 (10/8 or 1-1/4 inch diameter) and T-8 (eight-eighths or 1 inch diameter) can provide improved system efficacy compared to conventional T-12 lamps. Reduced diameter lamps have created new opportunities for efficient luminaire designs that are better suited for focusing the light output from a fluorescent lamp. The smaller interior surface area of the T-10 and T-8 lamps allows the use of more expensive but higher efficiency and higher color rendering phosphors with a smaller increase in lamp cost relative to the T-12 lamps.

Triphosphor lamps of any size provide better color rendition and improved efficacy. Lamp efficacies associated with triphosphors, also called rare earth phosphors, are five to fifteen percent better than those of conventional phosphors. Color rendering is measured on a scale relative to 100, with the highest color rendering most closely resembling the color appearance under a reference light source. Fluorescent lamps are offered in high or moderately high color rendering, with higher color rendering lamps being more expensive than moderately high color rendering lamps.

T-10 lamps are used primarily to directly replace standard, 40-watt, T-12 lamps. They offer higher efficacies, increased light output, and longer life compared to standard lamps. T-10 lamps operate on the same ballast as the T-12 it replaces, drawing slightly less current and offering lower ballast losses. T-10 lamps are generally used in situations where higher lighting levels are required, or in combination with specular reflectors, to boost light output from a delamped fixture.

T-8 lamps can fit in the the same sockets as T-12 lamps; however, they require a different ballast because they operate at a lower current. These lamps, like all fluorescent lamps, can be dimmed using dimmable ballasts and dimmers. T-8 lamps can have efficacies over twelve percent higher than standard T-12 lamps (not including the ballasts) and significantly improve system efficiency. T-8 lamps are often recommended for new installations, including offices, retail stores, commercial and industrial lighting, task lighting, decorative lighting, and other special applications.

## **Operation<sup>2</sup>**

All fluorescent lamps should be used only with auxiliary equipment designed to produce proper values. Specifications for auxiliary equipment are covered by appropriate American National Standards Institute (ANSI) specifications.

## **Ratings<sup>2</sup>**

Design improvements are frequently made in fluorescent lamps which tend to obsolete published ratings after a period of time. Technical bulletins will be issued from time to time if changes in ratings occur prior to the next catalog printing. Ratings published in this catalog are based on laboratory tests conducted by the manufacturer under controlled conditions.

## **Application Recommendations<sup>2</sup>**

**Energy Saver fluorescent lamps are intended for use where lamp ambient temperatures are 60 degrees F or higher. Lamp flickering may occur where lamp ambient temperature is below 60 degrees F or where strong air drafts blow directly on bare bulbs.**

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## RAPID START (No starter required):

**F32T8 Lamps (265ma) and FB031 T-8 U-Shaped Lamps:** F32T8 & FB031 T-8 lamps require operation on 265 ma T8 rapid start ballasts. Use of rapid start T-12 ballasts is not recommended.

**F-30 Lamps:** F-30 Fluorescent lamps are intended for use on two-lamp indoor lead-circuit high power factor rapid start ballasts. Operation on low power factor ballasts, dimming and emergency lighting systems (unless approved by the system manufacturer) or operation on reduced current/reduced light output ballasts is not recommended.

**F-40 Lamps:** F-40 lamps are intended for use on single lamp and two-lamp indoor lead-circuit high power factor rapid start ballasts. Operation on low power factor ballasts, dimming and emergency lighting systems (unless approved by the system manufacturer) or operation on reduced current/reduced light output ballasts is not recommended. Lamp life on single-lamp rapid start ballasts may be reduced .

**32 watt, F-40:** 32 watt, F-40 lamps are not recommended for use with electronic or cathode heat cut-out (HYBRID) ballasts.

**F-40 U-Shaped Lamps:** F-40 lamps are intended for use on single and two-lamp indoor lead circuit, high power factor rapid start ballasts. Operation on low power factor, dimming, emergency lighting, (unless approved by the system manufacturer) reduced current/reduced light output, or cathode heat cut-out (HYBRID) ballasts is not recommended.

**F-96 and F-48 High Output (800 ma) Lamps:** High Output lamps are intended for use on single-lamp and two lamp indoor lead-circuit high power factor rapid start ballasts. Operation on reduced current/reduced light output ballasts is not recommended.

**F-96 and F-48 Very High Output (1500 ma), T-12 Or PG-17 Lamps:** 1500 ma, T-12 lamps are intended for use on two-lamp indoor lead-circuit high power factor rapid start ballasts. Marginal starting may be experienced on single lamp ballasts, particularly with low primary voltage conditions.

**INSTANT START (No Starter Required), F-96 and F-48 Slimline Lamps:** Slimline lamps are intended for use on single-lamp and two-lamp indoor lead-circuit high power factor instant start ballasts. Operation on low power factor, lead-lag or reduced current/reduced light output ballasts is not recommended.

**PREHEAT (FOR USE WITH STARTERS), F40-PH:** F-40-PH lamps are intended for use on two-lamp indoor switch-start high-powered factor ballasts in open type industrial or commercial fixtures.

## Average Life <sup>3</sup>

**Average Life for Various Burning Cycles:** The average life listed for the fluorescent lamps is based on an industry standard of 3 hours per start. What this means is that the average life is estimated by testing large samples of lamps cycling them on and off every three hours. Typically actual burn times are much longer, therefore the following chart shows the effects of longer burn times on T-8 lamps operated on rapid start ballasts and instant start ballasts.

	Hours per Start Hours per Start					
	3	6	10	12	18	Continuous
Rapid Start	20000	24400	27700	28800	31600	37700
Instant Start	15000	21500	26000	28800	31600	37700

<sup>1</sup> Information provided by EPRI

<sup>2</sup> Information provided by GE

<sup>3</sup> Information provided by Osram Sylvania