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Topic 1

The rated CFL life as claimed by manufacturers is based on 3-hour-on/ 20- minutes- off cycle of operation. In actual applications, the CFLs are switched on and off at different rates and under different climatic conditions. Therefore the actual life of CFL is different than the rated or predicted life. If CFLs are started more frequently than the standard 3-hour on/ 20-minute off i.e. **shorter cycles operation**- they will have statistically shorter life than their rated life.

A CFL fails when the emissive coating on its cathodes is exhausted due to evaporation and sputtering. The rate of loss of coating is fairly low and steady during lamp operation. However, during starting the cathode coating is rapidly lost when it is bombarded with mercury ions, which are accelerated due to a high cathode fall voltage. Therefore, the **starting method of a CFL** is one of the important factors affecting CFL life.

Type of Ballasts used in CFLs have effect on the CFL life. In CFLs operated with magnetic ballasts, the preheat-starting circuit probably does the most severe damage to CFL cathodes. It overheats cathodes and it “blinks” while starting. The rapid-start magnetic ballast, which heats the electrodes before starting and then limits the current to CFL is less damaging to the cathodes. Some electronic ballasts with solid state components minimize the damage to CFL. However, instant-start electronic ballasts have greater potential to shorten the life of CFL as compared to rapid-start electronic ballasts, which do not preheat the cathodes.

CFL starting voltage applied between the CFL electrodes is generally two to three times greater than the CFL operating voltage. A starting voltage less than the minimum recommended will cause unreliable starting. A starting voltage greater than the recommended maximum will reduce CFL life.

CFL starting electrode voltage is the voltage supplied by rapid-start ballasts to heat the electrodes before applying starting voltage. If the electrode voltage is high, it can raise the electrode temperature to more than 1000 °C, which will reduce the CFL life due to excessive evaporation of the emissive coating. If the electrode voltage is low, the electrodes may not reach 700 °C, which will again reduce CFL life due to loss of emissive coating due to excessive sputtering.

Preheat time and starting time are also factors affecting CFL life. When the length of time heating the electrode by a rapid start ballasts is long, overheating of electrodes occurs causing reduction in CFL life. Recommended preheat time for the rapid start ballasts is greater than 500 ms.

In instant- start ballasts, the **length of time that the high voltage is applied to the CFL during starting** is an important factor. If the high voltage is applied to the CFL for too long, the CFL life is likely to reduce due to higher sputtering.

Another factor affecting the CFL life is **the glow current** i.e. the current flowing away from the electrodes during the preheat time. High glow current increases the lamp end darkening and reduces CFL life.

Lamp current crest factor (CCF)- the ratio of the peak lamp current to the root mean square(RMS) lamp current- higher than 1.41 indicating distorted wave shape other than sine wave can damage the CFL electrodes due to evaporation and affect the CFL life.

Lamp operating electrode voltage, which is the voltage supplied by the ballast to heat the electrodes during CFL operation has effect on CFL life. Sputtering of the electrode emissive material can occur during CFL operation for some ballasts.

CFL operating current may have an indirect impact on CFL life. When lamp-operating current is reduced, light output of CFL is reduced and resulting in a lower electrode temperature, which may cause electrode sputtering and reduce CFL life.

Another factor affecting CFL is the **lamp ambient temperature** particularly for self-ballasted CFLs. It has only secondary effects on CFL life. But it directly affects ballast life.

Use of CFL in wet condition may result in premature failure as CFLs are not capable of withstanding water- whether actual rain or just water vapour.

CFL failure likely to occur if used with **electronic timers or in vicinity of electronic equipment**.