

一、灯具电容器的标准体系

灯具电容器的主要标准是由中国国家标准化管理委员会发布的 **GB/T 18489** 和 **GB/T 18504** (等同于由 IEC 34 技术委员会 (灯及其有关附件) 的 **34C** 技术委员会 (气体放电灯附件) 制定的 **IEC 61048** 和 **IEC 61049**)。

UL 810 标准因其广泛适用性, 也是灯具电容器的常用标准之一。

我司主要在上述标准的基础上制定了各个型号交流灯具电容器的企业标准, 以供内部引用。

另外, 灯具电容器的部分标准术语也参考了其它电容器标准中的定义, 不再一一列出。

以上, 构成了灯具电容器的标准体系

灯具电容器的标准体系, 举例如下:

一. The standard system of capacitors for use in tubular fluorescent and other discharge lamp circuits

The main standards are GB/T 18489 & GB/T 18504, published by Standardization administration of the people' s republic of China. These standards are equal to IEC 61048 & IEC 61049, prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment.

The standard UL 810, because of its wide applicability, is also one of the criteria commonly used in lighting capacitors.

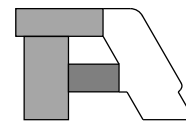
According to the basic requirements of above standards, Faratronic made detailed standards of various lighting capacitor type for internal use.

In additional, some terminologies are also reference to other capacitor standards, which will be not listed below.

The standard system of lamp capacitors is made up of all above standards.

Following please find the corresponding specification lists for lamp capacitors.

标准号(No.)	标准 (Standards)
GB/T 18489 (IEC 61048)	管形荧光灯和其他放电灯线路用电容器 一般要求和安全要求 Capacitors for use in tubular fluorescent and other discharge lamp circuits – General and safety requirements
GB/T 18504 (IEC 61049)	管形荧光灯和其他放电灯线路用电容器 性能要求 Capacitors for use in tubular fluorescent and other discharge lamp circuits – Performance requirements
UL 810	电容器 Capacitors
	详细规范: Detail specification for each type



二、常用的标准术语

1. 额定容量 C_N

设计电容时采用的电容值。

2. 额定电压 U_N

电容器上所标志的正弦波电压的有效值。

3. 额定频率 f_N

设计电容时采用的最高频率。

4. 额定电流 I_N

在额定电压和频率下的交流电流的有效值。

5. 电容器损耗角正切 $\tan\delta$

在额定频率的正弦波电压下，电容器的损耗功率除以电容器的无功功率所得的值。

6. 额定最高温度 t_c

电容器表面最热部分在工作期间不应超过的温度。

7. 额定最低温度

电容器表面任何部分在低于该值时不应给电容器通电的温度。

8. 放电电阻

跨接于电容器接线端子之间的电阻，用来降低储存于电容器内的电荷造成冲击的危险。

(若电容器不包含放电电阻，厂家必须提供绝缘电阻或时间常数等参数。)

9. A 类电容器

无断路装置的自愈式并联电容器。

10. B 类电容器

有断路装置用于串联照明电路中的自愈式电容器或自愈式并联电容。

二、Terminologies

1. Rated capacitance C_N

Capacitance value for which the capacitor has been designed.

2. Rated voltage U_N

r.m.s. value of the sinusoidal voltage, marked on the capacitor

3. Rated frequency f_N

Highest frequency for which the capacitor has been designed.

4. Rated current I_N

r.m.s. value of the alternating current at the rated voltage and frequency.

5. Loss factor of the capacitor $\tan\delta$

Power loss of the capacitor divided by the reactive power of the capacitor at a sinusoidal voltage of rated frequency.

6. Rated maximum temperature t_c

Temperature, in degrees Celsius, which must not be exceeded by the hottest part of the capacitor surface during operation.

7. Rated minimum temperature

Temperature, in degrees celsius, of any part of the surface of the capacitor below which the capacitor must not be energized.

8. Discharge resistor

Resistor connected across the terminals of a capacitor to reduce shock hazard from the charge stored in the capacitor.

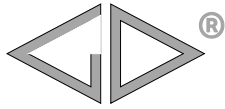
(If the capacitor does not contain discharge resistor, manufacturer must provide Insulation Resistance or Time Constant.)

9. Capacitor of type A

Self-healing parallel capacitor not necessarily including an interrupting device.

10. Capacitor of type B

Self-healing capacitor used in series lighting circuits or a self-healing parallel capacitor, containing interrupter device.



11. 容量温度系数 α

电容器在规定的温度范围内容量随温度的变化率。通常以 20°C 时电容量为参考，用百万分之一每摄氏 (10⁻⁶/°C) 表示。(10⁻⁶/°C = 1ppm/°C)

$$\alpha_i = \frac{C_i - C_0}{C_0(T_i - T_0)}$$

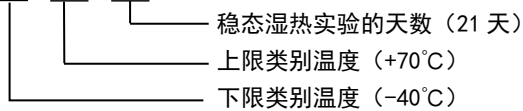
C_i: 电容器在温度 T_i 时容量

C₀: 电容器在 T₀(20±2)°C 时的容量

12. 气候类别

电容器所属的气候类别用斜线分隔的三个数来表示 (IEC 60068-1: 如: 40/70/21)。

40 / 70 / 21



13. 绝缘电阻(IR)/时间常数(t)

绝缘电阻为电容器充电 1 分钟后所加的直流电压和流经电容器的漏电流值的比值，单位为 MΩ。时间常数为绝缘电阻和电容量的乘积，通常以秒表示，公式如下：

$$t[s] = IR[M\Omega] \times C_N[\mu F]$$

一般情况下，绝缘电阻用于描述小容量电容器的绝缘特性，时间常数用于描述大容量 (如: C_N > 0.33μF) 电容器的绝缘特性。

(若电容器包含放电电阻时，通过设备测量出的绝缘电阻值实际上为放电电阻值。)

14. 自愈性(仅对金属化膜电容器)

电容器的电特性在发生局部电介质击穿后迅速而基本地恢复到击穿前的值的过程。

金属化膜的金属镀层是通过真空蒸发的方法将金属沉积在薄膜上，厚度只有几十个纳米，当介质上存在弱点、杂质时，局部电击穿就可能发生，电击穿处的电弧放电所产生的能量足以使电击穿点邻近处的金属镀层蒸发，使击穿点与周围极板隔开，电容器电气性能即可恢复正常。

11. Temperature coefficient of capacitance α

The change rate of capacitance with temperature measured over a specified range of temperature. It is normally expressed in parts per million per Celsius degree (10⁻⁶/°C) and referred to 20°C.

$$\alpha_i = \frac{C_i - C_0}{C_0(T_i - T_0)}$$

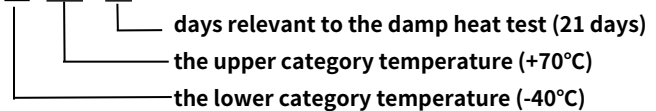
C_i: Capacitance at temperature T_i.

C₀: Capacitance at temperature T₀(20±2)°C.

12. Climatic category

The climatic category which the capacitor belongs to is expressed in three numbers separated by slashes, (IEC 60068-1: example 40/70/21).

40 / 70 / 21



13. Insulation Resistance(IR) / Time Constant (t)

The insulation resistance is the ratio between an applied D.C. voltage and the resulting leakage current after a minute of charge. It is expressed in MΩ. The time constant is expressed in Seconds with the following formula:

$$t[s] = IR[M\Omega] \times C_N[\mu F]$$

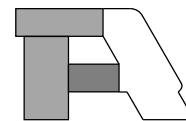
In general, Insulation resistance is used for describing smaller capacitance capacitors' insulation character, Time Constant for describing bigger one's (example: C_N > 0.33μF).

(If the capacitor contains discharge resistor, the value measured by instrument is discharge resistor value.)

14. Self-healing(Only for metallized film capacitor)

Process by which the electrical properties of the capacitor, after a local breakdown of the dielectric, are rapidly and essentially restored to the values before the breakdown.

The metal coatings of the metallized film, which are vacuum-deposited directly onto the plastic film, have a thickness of only several tens nm. At weak points or impurities in the dielectric, a dielectric breakdown would occur. The energy released by the arc discharge in the breakdown channel is sufficient to totally evaporate the thin metal coating in the vicinity of the channel. The insulated region thus resulting around the former faulty area will cause the capacitor to regain its full operation ability.



三、使用薄膜电容器的注意事项:

1. 工作电压:

薄膜电容器的选用取决于施加的最高电压, 并受施加的电压波形、电流波形、频率、环境温度(电容器表面温度)、电容量等因数的影响。使用前请先检查电容器两端的电压波形、电流波形和频率(在高频场合, 允许电压随着电容器类型的不同而改变, 详细资料请参阅说明书)是否在额定值内。

2. 工作电流

当电容器中通过持续电流时, 热量累积会使电容器整体温度升高。当电容表面温度超出允许的额定最高温度时, 可能会导致电容器短路甚至燃烧。

工作电流被认为是由击穿模式决定的脉冲电流和连续电流(均方根电流)组成, 当使用时, 需确认这两个电流都在允许范围之内。

3. 谐波

谐波指的是电源中相对于 50Hz 或 60Hz 的多次正弦电流和电压波形。谐波主要由电网中的变频器、电子驱动器、焊机和 UPS 等电子设备负载引起。谐波会造成电容器的过电压、过电流:

1) 过电压

过电压会加速聚丙烯介质老化, 缩短电容器寿命。一般来说, 在额定电压之上, 电容器电压每升高 8%, 电容器寿命会减半。同时, 过电压会导致电容器局部放电强度加大, 导致聚丙烯介质介电性能劣化, 甚至突发性的击穿。

2) 过电流

过电流会使电容器损耗功率大幅增加, 引起电容器异常发热, 导致热击穿, 严重缩短电容器寿命。综上所述, 谐波对电容器的危害十分严重, 在电容器的使用过程中, 所采用的电网必须符合国标 GB/T 14549《电能质量 公用电网谐波》的相关规定

4. 各种波形的有效值换算关系

不同的波形有效值按下面的公式计算。

种类(type)	1	2	3	4
波形 (waveform)				
有效值(rms)	$E/\sqrt{2}$	$E/\sqrt{2}$	$E\sqrt{t/(2T)}$	$E/\sqrt{3}$

三、Caution items in using plastic film capacitors

1. Operation voltage

The plastic film capacitor varies in the maximum applicable voltage depending on the applied voltage waveform, current waveform, frequency, ambient temperature (capacitor surface temperature), capacitance value, etc. Be sure to use capacitors within the specified values by checking the voltage waveform, current waveform, and frequency applied to them (In the application of high frequency, the permissible voltage varies with the type of the capacitor. For detail see the specification).

2. Operating Current

When continuous current flows through the capacitor, the temperature of whole capacitor will rise, induced by accumulated heat. If the temperature exceeds admitted rated maximum temperature, it might cause a short circuit or fire. The operating current must be considered by dividing into pulse current and continuous current (rms current) depending on the break down mode, and when using, should make sure the both currents are within the permissible values.

3. Harmonics

Harmonics are sinusoidal voltages and currents with frequencies that are multiples of a 50Hz or 60Hz power supply frequency. Harmonics result from the operation of electrical loads with non-linear voltage current characteristics. They are mainly caused by loads operated with modern electronic devices, such as converters, electrical drives, welding machines and uninterruptible power supplies (UPS). Harmonics may cause overvoltage, overcurrent.

1. Overvoltage

Overvoltage will accelerate aging of polypropylene film, which will reduce capacitor's life.

Generally speaking, overvoltage of 8% cuts life expectancy in half. At the same time, it will enhance local discharge, causing electric property worse, even suddenly broken down.

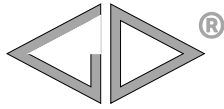
2. Overcurrent

Overcurrent will add loss power, which will bring thundering heat inside capacitor, even hot-breaking down. It will reduce capacitor's life.

In a word, harmonics are seriously harmful. Therefore, when use capacitor, applied supply net must accord with GB/T 14549: Quality of electric energy supply, harmonics in public supply network or other IEC standards.

4. Calculation of rms in various waveforms

In each waveform, calculate the rms value in the following formula.



种类(type)	5	6	7	8
波形 (waveform)				
有效值(rms)	$E\sqrt{t/(3T)}$	E	$E\sqrt{t/T}$	$\sqrt{\frac{t}{2T}(E_1^2 + E_2^2 + E_3^2 + E_4^2)}$

5. 因薄膜振动产生的嗡嗡声

电容器的嗡嗡声是由于电容器薄膜受到两电极间库仑力的作用，产生的振动而发出的声音。施加的电压和频率波形失真越严重，所产生的嗡嗡声越大。但这种嗡嗡声对电容器不会产生任何破坏作用。

6. 工作温度

当电容器处于高温环境下工作时，加上自身发热，电容器的整体温度会快速上升，其介电性能会逐渐下降。当电容器表面温度超过额定最高温度时，电容器的介电稳定性平衡被打破，最后发生电容失效。

因此，需要确保电容器工作时，表面温度不要超过允许的额定最高温度。

7. 高湿环境

如果长时间使用在高湿环境下，电容器可能会吸收潮气、电极被氧化，导致电容器损坏。在 AC 条件下使用，高湿环境将会加剧电晕的影响，从而引起电容量下降、损耗增加。

8. 贮存条件

8.1 电容器不能贮存在腐蚀性的空气环境中，特别是存在氯化物、硫化物、酸、碱、盐、有机溶剂或类似物质时。

8.2 产品不能暴露在高温和高湿状态，必须保存在以下环境中：（在不拆开原包装的基础上）

温度：-40°C 到 35°C

湿度：年平均值不超过 70%RH

全年任意 30 天不超过 80%RH

贮存时间：不超过 12 个月（从产品包装或产品本体上的日期算起）

四、绿色产品

RoHS 符合性

在此产品目录中的法拉公司的产品均符合 RoHS 指令和《电子信息产品污染控制管理办法》的要求。

5. Buzzing noise

Any buzzing noise produced by capacitor is caused by the vibration of the film due to the coulomb force that is generated between the electrodes with opposite poles. If the wave-form with a high distortion rate or frequency is applied across the capacitor, the buzzing noise will become louder. But the buzzing noise is of no damage to capacitor.

6. Operating temperature

When capacitor works in high-temperature, considering the heat power from capacitor, the whole temperature of capacitor will rise quickly, and capacitor's dielectrical property will get worse. When capacitor surface temperature exceeds admitted rated maximum temperature, the dielectric stability of the capacitor may lose the balance, which will cause fail.

So, make sure the capacitor surface temperature does not exceed admitted value.

6. Humid ambient

If used for a long time in a humid ambient, the capacitor might absorb humidity and oxidise the electrodes causing breakage of the capacitor. If case of AC application, high humidity would increase the corona effect. This phenomenon causes a drop of capacitance and an increase of capacitor losses.

8. Storage conditions

7.1 Capacitors may not be stored in corrosive atmospheres, particularly not when chlorides, sulfides, acids, lye, salts, organic solvents or similar substances are present.

7.2 It shouldn't be located in particularly high temperature and high humidity, it must submit to the following conditions (unchanging primal package):

Temperature: -40°C to 35°C

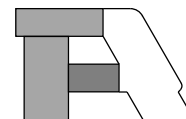
Humidity: Average per year ≤ 70%RH; For 30 full days randomly distributed throughout the year ≤ 80%RH

Storage time: ≤ 24 months (from the date marked on the capacitor's body or the label glued to the package)

四、Green Products

RoHS Compliance

Faratronic products in the catalogue are RoHS Compliant.



五、客户订购指南

请尽量提供以下信息

1. 应用场合：如整流器
2. 额定电容量及允许偏差
3. 电压：主要包括额定电压、工作电压、谐波电压等
4. 电流：包括最大电流、工作电流、谐波电流等
5. 频率：包括额定频率，工作频率，谐波频率等
6. 工作场所：如广场、超市等
7. 工作环境：如温度范围、湿度、海拔等
8. 产品尺寸：如直径、高度、引线长度等
9. 端子类型：如引线式、插片式等
10. 安全要求：如阻燃、防爆等
12. 预期寿命：在给定的工作条件下的预期寿命
12. 安装方式：如底部螺栓、中部卡圈、安装耳等
13. 其它

六、产品编码说明 Part number system

■ 15 位产品代码如下：

The 15 digits part number is formed as follow:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C	6	2												

第 1~3 位 型号代码

第 4~5 位 额定电压(参见 table 1)

第 6~8 位 标称容量

$$105=10 \times 10^5 \text{pF}=1.0\mu\text{F}$$

第 9 位 容量偏差

$$H = \pm 3\%, J = \pm 5\%, K = \pm 10\%$$

第 10~15 位 内部特征码

五、Guide for customer ordering

Please provide following information as possible as you can

- 1.Application or circuit diagram: for example, ballast.
- 2.Rated capacitance and tolerance
- 3.Voltage: mainly including rated voltage, working voltage , harmonic voltage etc
- 4.Current: including maximum current, working current, harmonic current etc
- 5.Frequency: including rated frequency , working frequency, harmonic frequency etc
- 6.Working location: for example, square, supermarket etc
- 7.Working environment: for example, temperature range, humidity, altitude etc
- 8.Dimensions: for example, diameter, height , length of terminals etc
9. Terminal form: for example, wires, tab, etc
10. Safety: for example, flame resistance, anti-explosion etc
11. Expected lifetime: under given working conditions
- 12.Fixed style: for example, bottom-stud, middle-clip, mounting ears etc
- 13 Others

Digit 1 to 3 Series code

Digit 4 to 5 Rated voltage(refer to table 1)

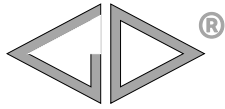
Digit 6 to 8 Rated capacitance value

$$105=10 \times 10^5 \text{pF}=1.0\mu\text{F}$$

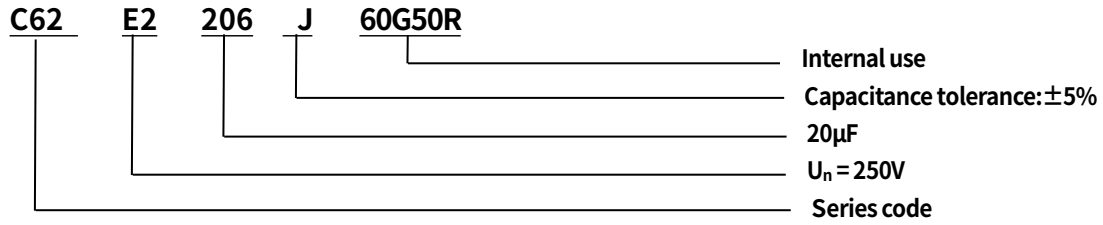
Digit 9 Capacitance tolerance

$$H = \pm 3\%, J = \pm 5\%, K = \pm 10\%$$

Digit 10 to 15 Internal use



■ 例如 for example



■ Table 1 额定电压代码 Rated voltage code

	A	B	C	D	E	F	G	H	J	K	L	M	N
1			16	20	25			50	63	80	132		
2	100	125	160	200	250	315	400	500	630	800	120		
3													
4											180		
5											150		
	P	Q	R	S	T	U	V	W	X	Y			
1	240	300	330	440	540	600	700	850	900				
2	275	305	350	450	520	690	760	875					
3	280	310	320	480	550	660	750						
4	220		345	430	560	620							
5	230			460		650							
6			375		525		780						
7				410	580								
8						680							

说明：1. 字母加数字表示交流，数字加字母表示直流，例如 A2 表示 100Vac, 2A 表示 100Vdc。

Letter and then number indicate AC, but number and then Letter indicate DC, for example ,2A indicate 100Vdc, A2 indicate 100Vac.

2. 表 1 中仅列出了 1 000V 以下的电压。Only show the voltage below 1 000 V in Table 1.