

"CAPAKOR" has offered wide range of high quality, economic efficiency fluorescent lamp starters used in fluorescent lamp lighting systems to start fluorescent lamps operated with conventional electromagnetic ballasts.

Conforming to IEC 60155 "CAPAKOR" reliable fluorescent lamp starter quickly preheats the lamp cathodes to working temperature automatically, after the switch is turned on. So the fluorescent lamp lights immediately and insures satisfactory lamp operation throughout rated life in different environments without blinking problems.

The "CAPAKOR" fluorescent lamp starters have key benefits;

- safe, sure, fast and every time lamp start even in the case of voltage fluctuations.
- high precision made top quality starters with consistent performance more than 10,000 switches and satisfactory operation over a wide temperature range.
- well controlled preheating of the lamp cathodes and adequate striking pulse voltage extend lamp life.
- ultra-violet (UV) stabilised and flame-retardant (UL94V-0) polycarbonate (Makrolon) case:

 - protects the gradual erosion of the plastic, which may occur with normal plastic case, especially when exposed to bright light.
 - avoid burning.

the 2 dents on the top indicate the positions of the 2 pins for easy and fast installation and change-over, even in darkness.

suitable for protection class , provides perfect electrical insulation.

most environmental friendly starter.

in dual lamp circuits, lights both lamps quickly and uniformly.

What is fluorescent lamp starter

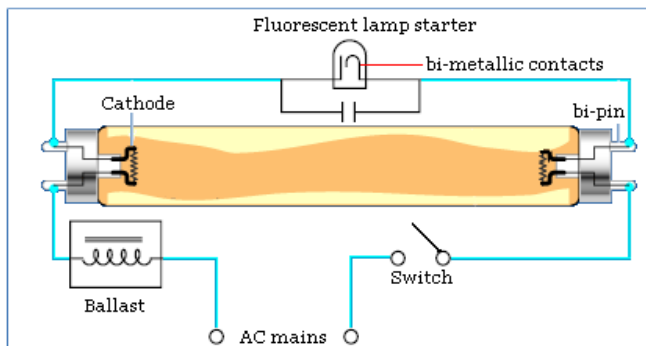
Fluorescent lamp starter is a switch for the purpose of starting the fluorescent lamp that opens the preheating circuit of the lamp and applies the necessary striking high pulse voltage for starting to the both ends of the lamp after the cathode of the lamp has been preheated.

"CAPAKOR" fluorescent lamp starter is a glow discharge type of starter which carries out open and close of the circuit by the glow discharge and thermal response type contacts (normally open contacts, one is a bi-metal strip) automatically.

How do fluorescent lamp starter work?

A fluorescent lamp starter that operates only during the starting period is used with preheat start type lamps to preheat the cathodes automatically after the switch is turned on so the fluorescent lamp lights immediately.

The below fig. illustrates a fluorescent lamp with a fluorescent lamp starter.



When the switch is closed, the AC mains voltage is applied to the circuit.

At first, the lamp does not operate, since there is no electrical connection from one end to the other.

A non-operating fluorescent tube will appear as an open circuit and the current does not flow.

In order to start the lamp, striking high pulse voltage must be applied across the lamp to ionize the gas and "strike the arc" within.

If instantly "cold start" the lamp without the corrected preheat current, the cathode would be progressively damaged, resulting in short lamp life by sputtering electron-emitting material from lamp cathode,

Thus, preheat current is supplied to the cathodes prior to the striking pulse voltage.

If the cathodes are first preheated by the fluorescent lamp starter, to generate a space charge of electrons at each end of the lamp, the strike pulse voltage is considerably reduced and lamp life will not be unduly compromised by the start-up.

The full AC mains voltage appears across the contacts of the fluorescent lamp starter via the ballast and lamp cathodes, since the fluorescent lamp starter is switched electrically in parallel with the lamp.

The fluorescent lamp starter consists of bi-metallic contacts sealed with a small discharge bulb with an argon gas.

When the AC mains voltage which exceeds the fluorescent lamp starter operating voltage is supplied, a glow discharge within the small discharge bulb occurs and a bi-metallic contact is heated, causing the contact to bend and make contact with the other contact and close.

The contacts touch completes the circuit, and the ballast and the lamp cathodes are now series connected across the AC mains, and allowing preheat current to flow between the lamp cathode through the starter and the ballast.

Since the glow discharge within the small discharge bulb has now ceased by the close of the bi-metallic contact, the bi-metallic contacts cool down and re-open, breaking the short circuit.

Because the inductance of the ballast tries to maintain current flow, the sudden interruption of the preheat circuit causes a voltage

slope (striking high pulse voltage) at the instant of the opening of the contacts to trigger which starts the lamp.

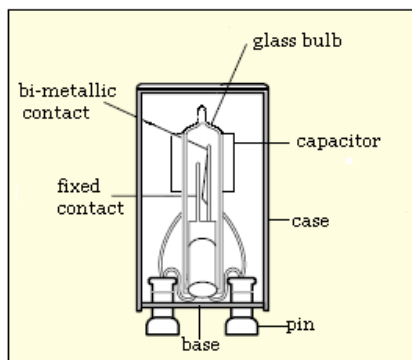
At this point, the lamp will work and the starter consumes no power while the lamp is operating.

If it does not, the fluorescent lamp starter's contacts close again and the cycle repeats.

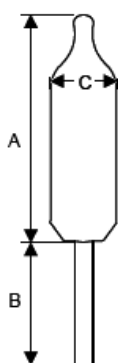
Once the lamp has started, the ballast controls its current and voltage to the correct levels, so that the lamp running current is enough to keep the cathodes hot and emitting electrons.

Since the lamp's running voltage is much lower than the AC mains voltage (less than half AC mains), there is not enough voltage to cause a glow discharge in the fluorescent lamp starter, so it remains open circuit.

The construction of fluorescent lamp starter



Glow bottle



| Dimension | Min.(mm) | Max.(mm) |
|-----------|----------|----------|
| A | 27.5 | 30.0 |
| B | 17mm | |
| C | 7mm | |

Ⓐ The glow bottle is main component of the fluorescent lamp starters, containing an argon gas mixture.

The glow bottle is switched electrically in parallel with the fluorescent lamp, and when the AC mains is supplied, a glow discharge occurs and a bi-metallic contact is heated.

Ⓑ Its purpose are;

to close the circuit conformed by the ballast and lamp cathode for preheat the lamp cathodes.

to open the circuit again after the cathodes have been preheated up sufficiently.

The opening the circuit causing the interruption of the current in the ballast provides a striking pulse voltage across the lamp and start the lamp up.

Ⓒ The glow bottle consist of a glass bulb containing 2 contacts, one of which has a bi-metal attached to it.

This is the critical part of the glow bottle enabling it to act as a switch and allowing current to flow between the cathodes in the fluorescent lamp.

Ⓓ In the preheat compact fluorescent lamps (energy saving lamps) the glow bottle alone serves as a starter.

Case

Ⓐ The glow bottle is mounted in a cylindrical case.

Ⓑ Case making the starter moisture-proof, provides perfect electrical insulation.

Ⓒ The 2 dents on the top indicate the positions of the 2 pins for easy installation and change-over, even in darkness.

Ⓓ Available in;



Plastic case specific shaped with indented top for easy grip and installation ultra-violet (UV) stabilised and flame-retardant (UL94V-0) polycarbonate (Makrolon) case that protect against the gradual erosion and avoid burning.

polypropylene case

Aluminum case specific shaped with indented top for easy grip and installation

Inside surface of the aluminum case is insulated.

Customized printing case on request.

Capacitor


The capacitor is electrically in parallel to the glow bottle and fluorescent lamp.

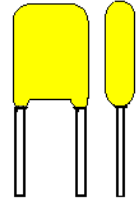
Ⓐ it serves;



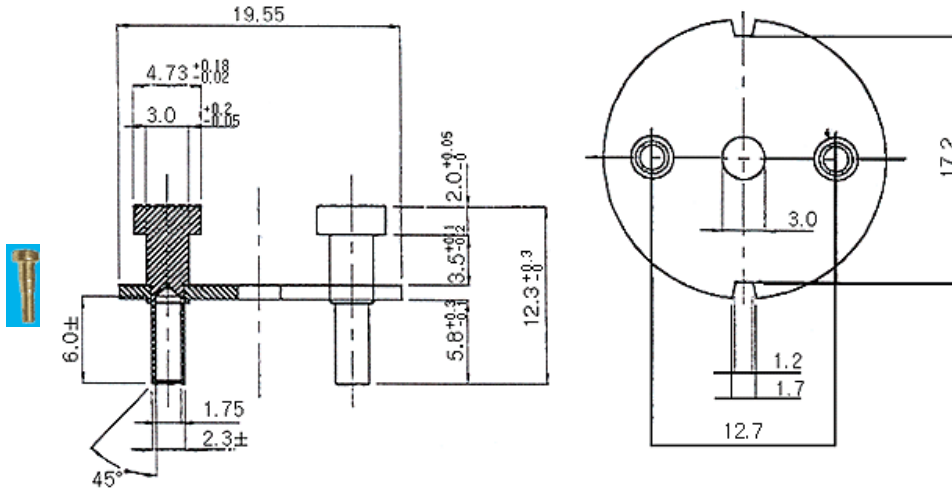
to avoid arcing between glow bottle contacts to ensure a long contact life.
 to attenuate the striking pulse voltage height from the ballast and to widen it as well for more reliable starting.
 to absorb electric noise created by the discharge around the electrodes for reduced radio interference(EMI/RFI).

⑧ Specification

| | |
|---|---|
|  RoHS Compliant | GENERAL ① Style:Radial epoxy dipped design. ② Winding:Inductively wound from polyester film dielectric & Aluminum foil electrode. ③ Termination:Pb-free tinned leads are electrically,directly welded to the Aluminum foil(inserted tab). ④ Coating:multi-dip, epoxy resin. ⑤ Operating temperature:-40~+105 (*+85 ~+105 :Derate the voltage) ⑥ Applicable standard:IEC60155,JIS C 7603 |
| | ELECTRICAL ① Capacitance:0.0060uF ② Tolerance:+10%~5% ③ Dissipation factor: 0.8% (@20 ,1KHz) ④ Insulation resistance: 30,000M (@20 ,applied 500VDC between leads for 1min.) ⑤ Working voltage:400VAC ⑥ Withstand voltage:1,500Vrms/60Hz For 1min. between leads. |



Bi-pin base



⑨ Pin

available in; Brass pin.



Aluminum pin



⑩ Base

bakelite plate available in;

by flammability rating

ANSI NEMA Grade FR-1:Flame resistance(UL flammability 94V-0)

ANSI NEMA Grade XP

by case

for aluminum case



for plastic case ① with dia.19.6mm



② with dia.19.8mm



Applications

"CAPAKOR" fluorescent lamp starter and glow bottles can be used in

- Preheat fluorescent lamp
- Compact fluorescent lamp
- Low-wattage Sodium lamp
- UV enhancer units
- Bug lights

Ordering/part number information.

| | | | | | |
|----|---|----|----|--|---|
| FS | U | PC | BR | | 2 |
|----|---|----|----|--|---|



Symbol expressing fluorescent lamp starter

Symbol expressing class of fluorescent lamp starter

Symbol expressing type of case:

PC:ultra-violet(UV) stabilised and flame-retardant(UL94V-0)

PP:Polypropylene case

AL:Aluminum case

Symbol expressing type of pin

BR:Brass pin.

AL:Aluminum pin

Symbol expressing flammability rating of base

FR:ANSI NEMA Grade FR-1:Flame resistance(UL flammability 94V-0)

No code for not flame resistance

Symbol expressing type of base by case assembled

1:for aluminum case

2:for plastic case with dia.19.6mm

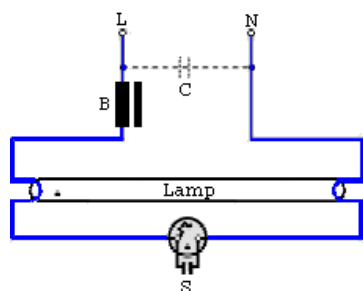
3:for plastic case with dia.19.8mm

Circuit diagram for the operation of fluorescent lamp

Single lamp

The most widely used circuit using a ballast and a glow starter which effects lamp cathode preheating. It is simple wiring,economical and 1 of the most efficient ways of operating a fluorescent lamp.

ⒶLag(Inductive)circuit



L,N:AC mains

B:Ballast

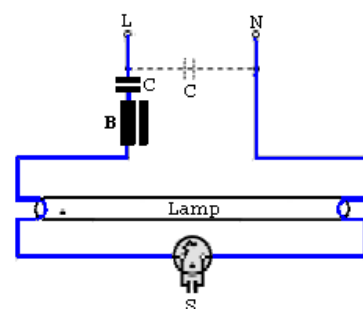
C:Compensation capacitor(if required)

S:Starter

A magnetic ballast having a lagging lamp current with respect to the AC main voltage.

Current limiting is primarily inductive; holds lamp power reasonably constant with respect to lamp voltage variations.

ⒷLead(Capacitive)circuit



L,N:AC mains

B:Ballast

C:Compensation capacitor(if required)

S:Starter

A magnetic ballast having a leading lamp current with respect to the AC mains voltage.

Current limiting is accomplished by means of an inductor as well as a capacitor connected in series with the lamp.

ⒸIn inductive circuit,the lamp preheating current is about 50% higher than the normal lamp current.

In capacitive circuit,the lamp preheating current is about equal to the normal lamp current.

This means in the latter case the cathodes are less well preheated and also the striking pulse voltage is lower.

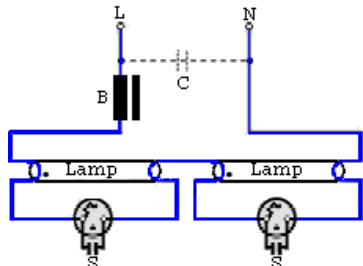
Thus,capacitive circuits always start slower than the inductive circuits.

A combination of low AC mains voltage and capacitive circuits may lead to longer starting time.

2 Lamps

2 Lamp circuits are either series connections or lead-lag design.

ⒶSeries connection for 2 lamps.



L,N:AC mains

B:Ballast

C:Compensation capacitor(if required)

S:Starter

The series connection for 2 lamps is not possible where AC mains voltage is 100~130VAC because this is not sufficient to sustain the discharge where 2 lamps are in series,thus,special dual lamp ballasts are required.

However,where the AC mains voltage is 200~250VAC,series connection is possible and common.

The series connection for 2 lamps is possible, if the lamp operating voltage is less than $\frac{1}{4}$ of the AC mains voltage. Series connections are possible with only FS2 starter on 200~250VAC Mains for most lamps up to 20W, (FL-4W,6W,8W,15W,16W,18W,20W,22W,33W and CFL-5W,7W,9W), for example, FS2 for 2x 18/20W. Also, for single lamp circuit on 100~130VAC mains is possible.

2 fluorescent lamps are run in series on 1 ballast but with individual starters operating per lamp. The lamp starting in sequence, if 1 lamp becomes inoperative, the other lamp will not fully light or light at all. Prolonged start times, especially at low voltage, can be shortened by rotating 1 of starters through 180° .

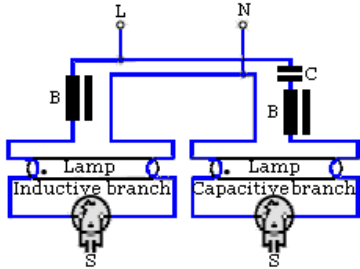
③ Lead-lag circuit

A common circuit combination for 2 lamp with high power factor series capacitor.

Each lamp operates on its own independent circuit, thus, if 1 lamp becomes inoperative, the other lamp will still light.

1 lamp has the normal ballast in series (lag section), and 0.5 lagging power factor. The second lamp operates from a ballast and capacitor in series (lead section), with a 0.5 leading power-factor.

This provides the combined circuits have a high power factor above 0.9, in addition to the 2 lamps operate sufficiently out of phase to cut in half the 60-cycle flicker of the lamps that is annoying in some uses.

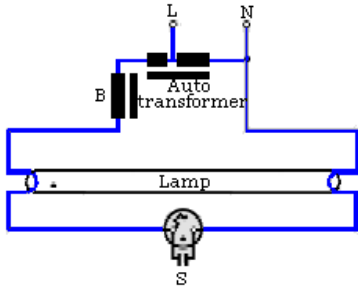


L,N:AC mains
 B:Ballast
 S:Starter
 C:Series capacitor

Auto-transformer circuit

Auto-transformer ballast combination is used where the min. lamp starting voltage cannot be achieved due to the AC mains voltage being too low.

The ballast will transform the input voltage to the required level.



L,N:AC mains
 B:Ballast
 S:Starter

Electrical protection(EN 60.598)

Class :An earthed electrical requirements i.e. functional insulation in all parts and earth termination.

Class :A double insulated electrical requirements i.e. complete insulation in all parts without earth termination. In the event of an electrical fault, no dangerous voltage can reach touchable metal parts.

Class :A luminaire in which protection against electric shock relies on supply at safety extra-low voltage and in which voltages higher than those of safety extra-low voltage are not generated.