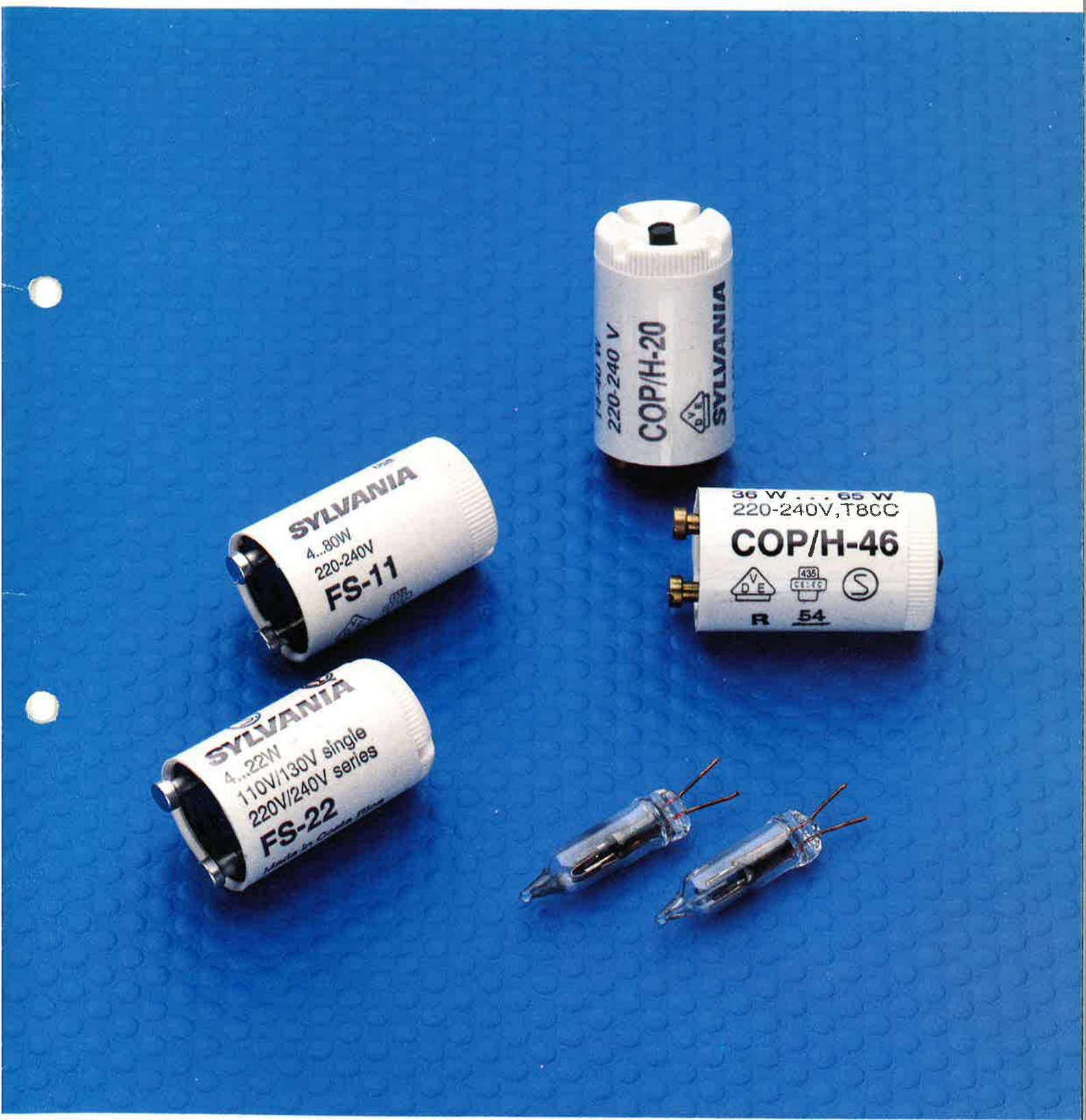
Fluorescent Lamp Starters

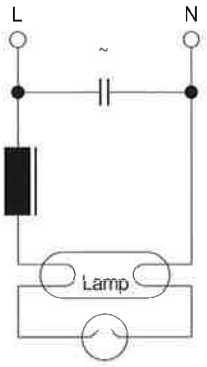
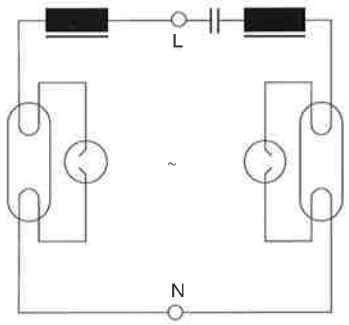
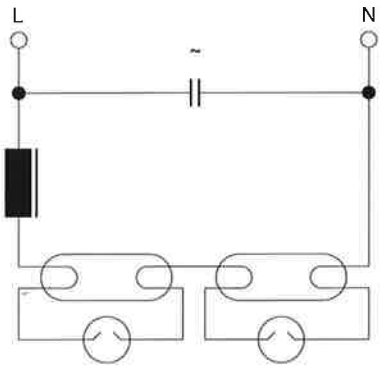


Technical Manual

SYLVANIA GTE

GTE Starter Quick Reference Selection Chart

Temperature limitations per Data Sheets pages 13/14

Lamp Circuit	Line Voltage	Lamp Rating	Starter Type
Single Lamp Circuit With or without Parallel Compensation 	220-250V	Tubular 4-80W LYNX-L 18-36W CIRCLINE 22-60W	FS-11
	220-240V	Tubular 14-40W LYNX-L 18-36W CIRCLINE 22-40W	COP/H-20
		Tubular 18-65W LYNX-L 18, 36W CIRCLINE 22-40W	COP/H-46
	110-130V	Tubular 4-20W LYNX-L 18W CIRCLINE 22W	FS-22
DUO Circuit (inductive/capacitive) 	220-250V	Tubular 4-80W LYNX-L 18-36W CIRCLINE 22-60W	FS-11
	220-240V	Tubular 14-40W LYNX-L 18-36W CIRCLINE 22-40W	COP/H-20
		Tubular 18-65W LYNX-L 18-36W CIRCLINE 22-60W	COP/H-46
TANDEM Circuit with or without Parallel Compensation 	220-240V	Tubular 4-20W LYNX-L 18W CIRCLINE 22W	FS-22

Sylvania reserves the right to change data and specifications without notice. Data for guidance only.

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SYLVANIA GTE

Starters - How the System works

Phase	Circuit Function	Starter	Lamp
Starting Glow Discharge	Circuit active	Sees line voltage Glow discharge between glowbottle bi-metal contacts Bi-metal contacts heat up and close	Sees line voltage usually no cold-start
Preheat	Preheating current heats up lamp electrodes Choke and electrode resistance determine preheating current*	Glow discharge is short circuited Bi-metal contacts cool down	Electrodes heat to ideally 800°C causing thermionic electron emission and ionisation at Lamp ends
Starting voltage	Interruption of pre-heating current causes induction of high voltage transient (spike) in choke	Bi-metal contacts open Capacitor in starter attenuates and broadens voltage spike	Lamp starting Discharge between lamp electrodes is established
Lamp Operation		Starter/glowbottle sees lamp voltage which is below reclosure voltage Starter remains inactive The capacitor attenuates electronic noise at the electrodes of the lamp.	Normal operation

* Other influences are from line voltage variation and in case series capacitors

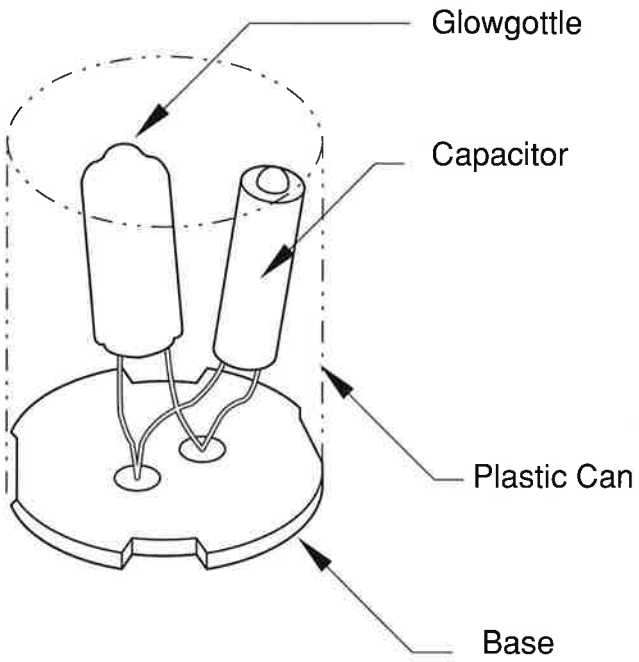
Starting Aids

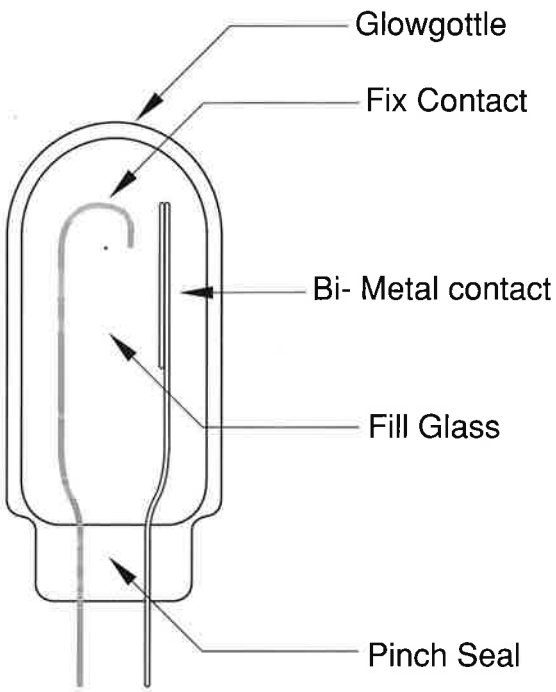
Lamp starting is helped by 2 means

- GTE manufactured lamps are coated with a silicon wax to reduce the required starting voltage (exceptions are metal strip lamps)
- An earthed metal part in parallel with the lamp, not further away than 25 mm, acts as a capacitive starting aid.

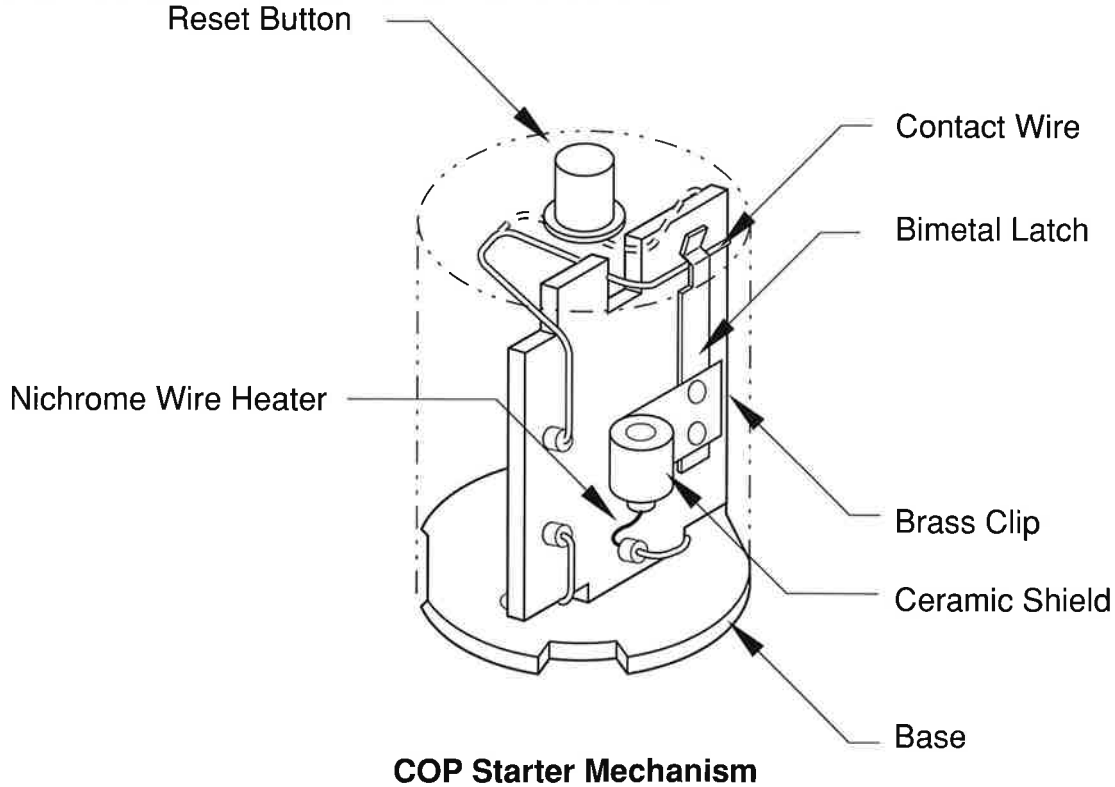
Starter Construction

FS-11 and FS-22





COP Starters
(additional elements to glowbottle and capacitor)



COP Starter Mechanism

COP Safety Starters

The principle advantages of this starter type are

- circuit cut-out at the end of lamp life to avoid disturbing flicker and flashing
- to avoid overheating and a consequent reduction of choke life
- to avoid unnecessary power consumption

COP starters are an ideal choice for installations for which planned maintenance cycles with lamp group replacement are applied.

The Cut-Out Mechanism

This consists of a heating element which is connected in series with the glowbottle, and a bi-metal latch with a spring loaded contact wire.

Each time the preheating current flows, with the glowbottle contacts closed, the heating element heats the bi-metal latch. After a period of unsuccessful starting attempts the contact wire will be released by the bi-metal, and the lamp circuit is deactivated.

Pressing the button of the COP starter when the lamp is changed repositions the contact wire in the bi-metal latch and the starter is ready for a further lamp life.

It is strongly recommended to change the starter with every third lamp change.

Cut-Out Time

In the following is a listing of typical cut-out times for nominal line voltage and at 25°C starter ambient temperature.

The cut-out time is influenced by

- line voltage variation
- starter ambient temperature
- lamp type and circuit type (inductive or capacitive) and their preheating current

Approximate Cut-out-time (s)	F 18W		F 36W		F 58W	
	Inductive	Capacitive	Inductive	Capacitive	Inductive	Capacitive
COP/H-20	40	70	30	50	-	-
COP/H-46	90	300	70	190	25	60

Choice of COP Starters

See Starter Selection Chart and Data Sheets.

Starter Materials

The combustible parts of a starter are

- the support disc made of a phenolic resins compound
- the starter can made of polycarbonate
- the capacitor made of metallised polyester film

GTE starters are manufactured to IEC 155 which prescribes flammability tests for the combustible materials used in a starter construction. Severe overheating brought about by abnormal circuit conditions should not result in any risk of fire hazard.

The Capacitor in the Starter

The capacitor is switched electrically in parallel with the glowbottle and therewith also in parallel with the fluorescent lamp.

Its capacitance is specified by IEC Nr. 155 with 0.005 to 0.02 µF.

The capacitor has 3 important functions:

- to avoid arcing between the glowbottle contacts ensuring long contact life, and to avoid radio interference
- to attenuate the starting voltage pulse height from the choke 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).

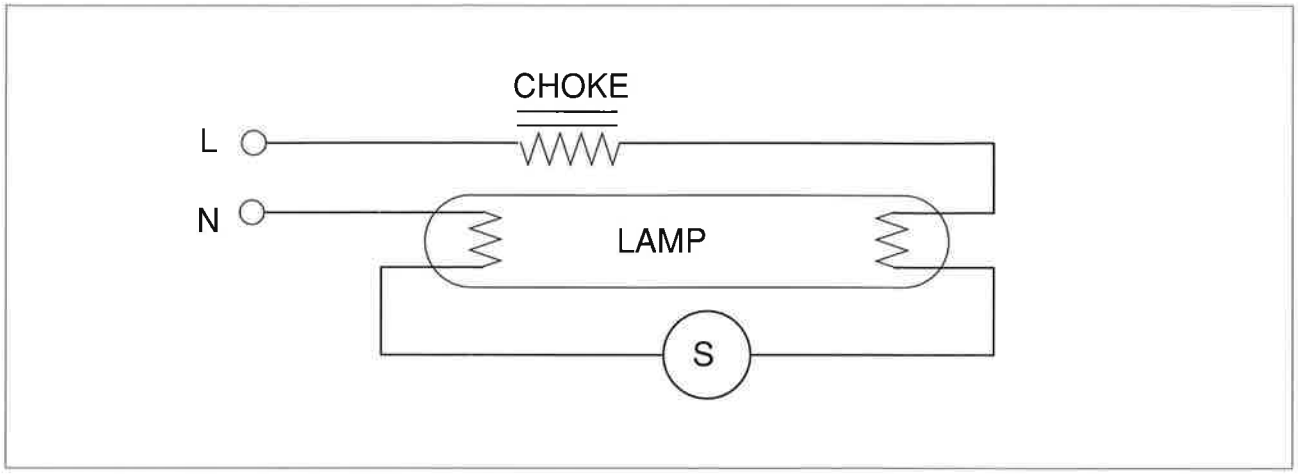
Starter Life, Replacement

The life of glowbottle starters is tested according to IEC standards for 6.000 switchings. - A fluorescent lamp is switched on about 1000 to 4000 times during its life.

To assure proper lamp performance it is therefore recommended to change standard starters like the FS-11 or FS-22 with every lamp change.

Because COP starters are not exposed to endlessly repeated starting attempts at the end of lamp life, COP starters should be replaced with every third lamp.

Glowbottle and Circuit Voltages



The starter, which contains a glowbottle, is switched electrically in parallel with the lamp. This means that

- at the instant the circuit is switched on, the glowbottle is connected to line voltage (e.g. 230V).
- when the lamp has started and is working normally, the glowbottle is connected to lamp voltage (in case of a F 36W lamp, 103V)

The glowbottle is, however, designed for two distinct voltage conditions which assure correct function. The glowbottle must:

- develop a glow discharge and close the contacts at a test line voltage of 180V (IEC) for the FS-11 and COP starter types (103.5V for the FS-22)
- remain inactive after lamp starting at a voltage of 140V or above (non-reclosure voltage by IEC specification) for FS-11 and COP starter types, resp. 70V for the FS-22 type so that the starter will not operate when the lamp is burning.

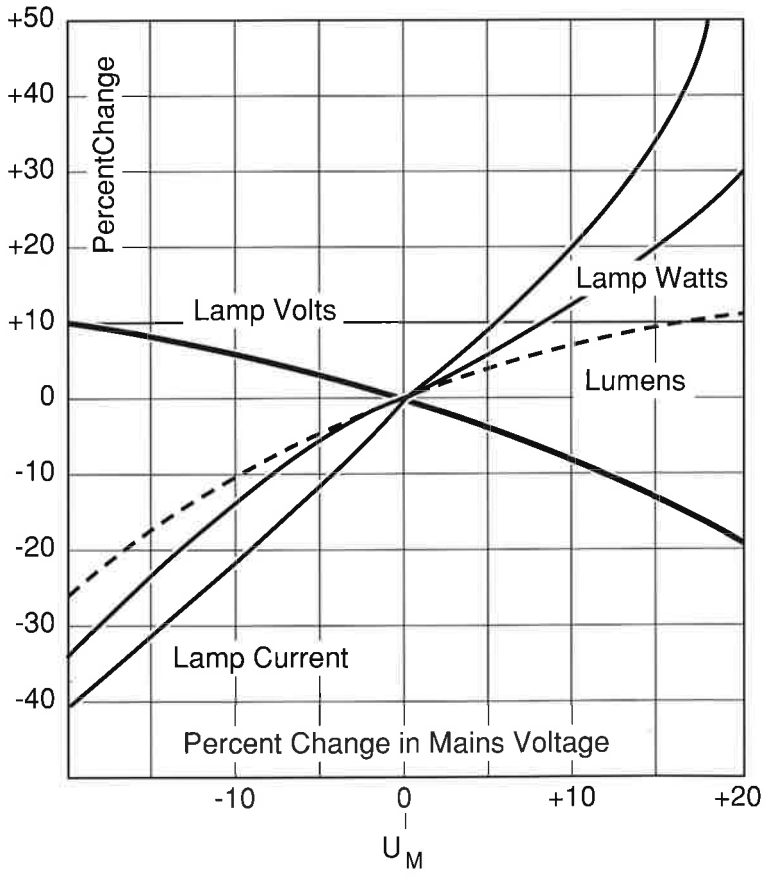
Line Voltage

Variations in line voltage may come from the average supply voltage available to a building, the variations during a 24h period, and voltage drops particularly at the end of long supply lines.

The line voltage has first of all an influence on sustaining the starting mechanism in the lamp. The higher the voltage the better for this purpose.

Secondly we see from the diagram that the lamp current and thus the preheating current are affected.

The higher the preheating current, the more positive the electrode preheating, and the higher the voltage spike from the choke when the starter contacts open.



Circuit Conditions

- **Preheat Current Values**

  In inductive circuits the preheating current is about 50% higher than the normal lamp current. - In capacitive (overcompensated) circuits the preheating current is about equal to the normal lamp current. This means in the latter case that the electrodes are less well preheated and also the voltage spike is lower.

- **Starting Time**

  Capacitive circuits always start slower than inductive ones. A combination of low line voltage and capacitive circuits may lead to longer starting time.

- **Repeated Starting Attempts**

  Another uncontrollable condition is the starter contact opening instant, relative to the current wave curve. If the preheating current at this instant is high, the starting conditions are good. If the preheating current at this instant is low or even zero, then the voltage spike may be too low to start the lamp and the glowbottle function will be repeated for another starting attempt.

  For a starter in good condition, therefore, two or three attempts to start is not abnormal. Repeated attempts to start without striking the lamp indicates an end of life lamp, or starter, or both.

Influences on Starting Behaviour

See Starters - How the system works page 2 for the starting mechanism.

The speed and quality of lamp starting is influenced by various factors:

The Lamp

The lamp age plays a role as well as the condition of the electrodes and their emitter material, the gas fill pressure, and the type of gas mix. Furthermore the lamp diameter, the lamp length, and the lamp conditioning (see silicon coating) all affect starting performance.

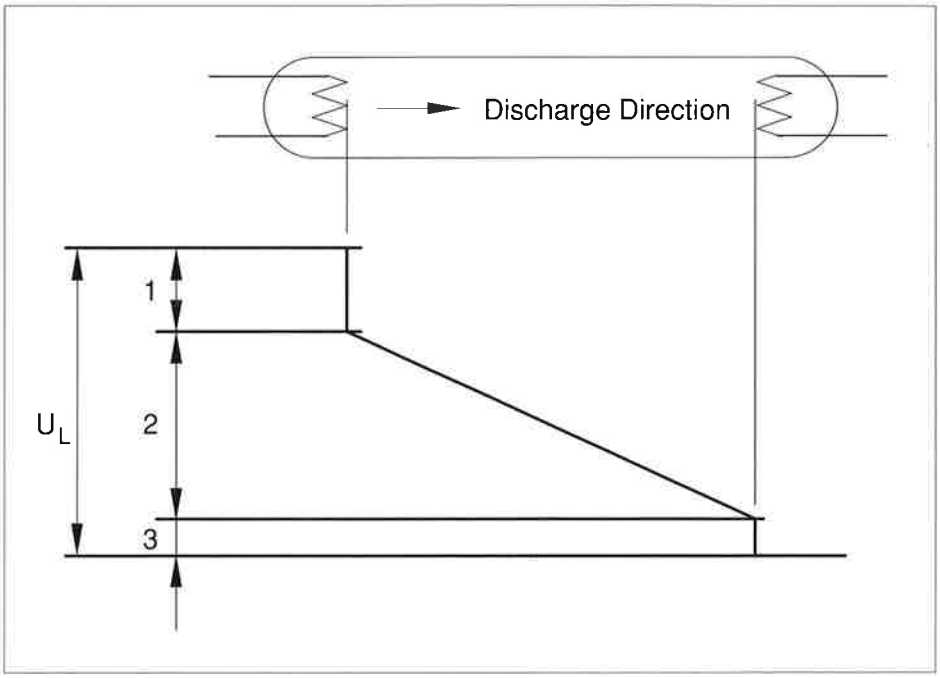
Environmental Conditions

The ambient temperature of the lamp and the resulting internal mercury vapour pressure is important. During operation the lamp wall temperature is about 15-20°C higher than the lamp ambient air temperature.

Good starting conditions are for lamp wall temperatures from 10 to 50°C.

Air humidity plays a role with respect to the electrical surface resistance of the lamp tube. The conditioning with a silicon wax helps to reduce the negative influence (higher starting voltage) of humidity.

Cathode Fall



U_L Lamp Voltage

1 Cathode Fall

2 Discharge Column Voltage

3 Anode Fall

At the instant of a discharge current flowing in the indicated direction we can measure the 3 voltage drops 1, 2 and 3 which together make up the lamp voltage.

The cathode fall 1 is the voltage required for electron emission from the electrode. It will depend on the condition of the electrode and its emitter material impregnation.

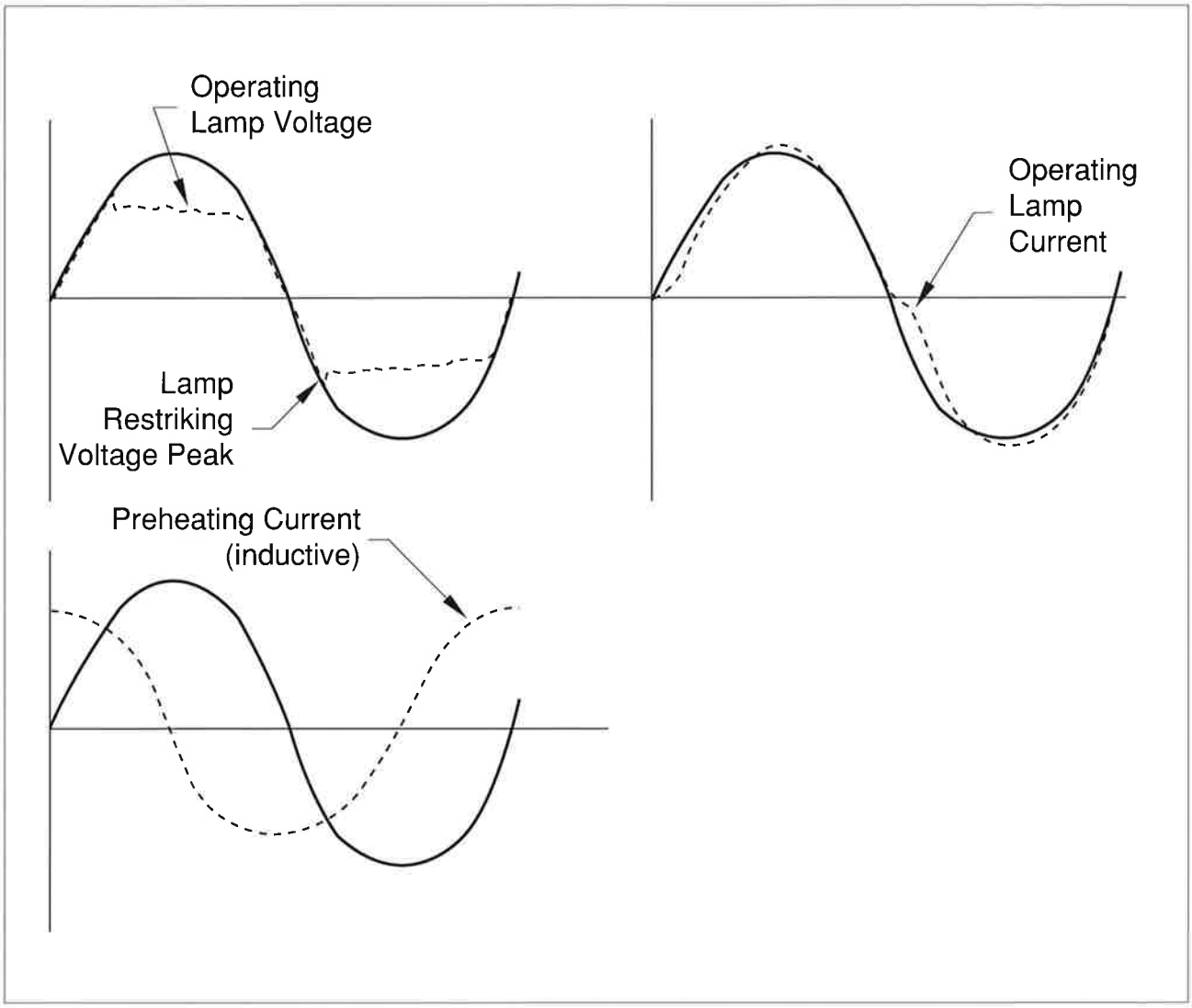
Towards the end of life the cathode fall will increase to the extent that the total lamp voltage will be high enough to pass the glowbottle non-reclosure voltage.

The glowbottle and its starting mechanism is activated and the lamp starts cycling.

Usually the electrode wear leads to a situation in which one electrode is still operational at the end of lamp life while the other is deactivated. This leads to a component of DC current in the lamp circuit and consequently to high choke temperatures (shorter choke life).

COP starters will cut out positively under such conditions and will protect the circuit.

Lamp Voltage and Current



The above diagrams show that the wave forms for lamp operating voltage and current are not sinusoidal. The preheating current has an essentially sinusoidal wave form.

While line voltage and preheating current can be measured with a standard VOLT/AMP meter, lamp voltage and current must be measured with a TRUE-RMS meter with a crest factor capability of min. 2.5. (Vpk / VRms)

Trouble Shooting-Check List

Symptom	Possible Cause	Remedy
No function after switch on	Starter defect	Change starter
	Lamp electrode(s) defect	Change lamp
	Starter or lamp badly inserted	Insert correctly
	Bad contact in starter or lamp holder	Change starter and/or lamp holder
	Wiring defect or loose contacts, corroded contacts	Check wiring, tighten connections
	COP starter cut out not reset	Press in button on COP starter
	No line voltage on luminaire	Check fuses, switch, phase and neutral conductors
No starting	Starter contacts welded	Change starter
Lamp ends continuously glowing	Wiring mistake in luminaire (especially 2 lamp circuits)	Check wiring
No starting	Deactivated lamp or leaker	Change lamp, if no improvement change starter
Continuous starting attempts, repeated incandescent glow at lamp ends	End of life starter	
Lamp starts but extinguishes again, repeated	Lamp at end of life	Change lamp
	Unfavourable combination of a lamp with high re-ignition spike and starter with low non-reclosure voltage on a circuit with low line voltage.	Change lamp and/or starter

Symptom	Possible Cause	Remedy
Lamp takes a long time to start. Weak incandescent glow at lamp ends during preheating	Unfavourable combination of capacitive circuits on low line voltage.	If possible change to inductive circuits with parallel compensation.
Tandem circuit, repeated unsuccessful starting attempts.	Wrong starter. FS-11 or COP starter COP starters are not suitable for tandem circuits.	Change to FS-22 starter.
Lamp starts with a flash, no further function at all.	Wiring mistake in luminaire Choke short-circuited	Check wiring Change choke
COP starter cuts out after few starting attempts	Wrong COP starter	Change to COP/H-46 Consult selection chart.
COP starter cuts out when restarting circuit after short switch-off.	Too high internal luminaire temperature Wrong COP starter	Check data sheet for temperature limitation Change to COP/H-46
COP starter does not cut out	Wrong COP starter Too low ambient temperature for starter	Change to COP/H-20 See data sheets for temperature limitation

Glowbottle Switches

The GB 22 and GB 56U glowbottle switches are available from GTE Lighting in Europe for particular applications, as for example for the production of fluorescent hand lamps.

IEC Standards

Glowbottle starters are made to IEC specification Nr. 155 or EN 60155.

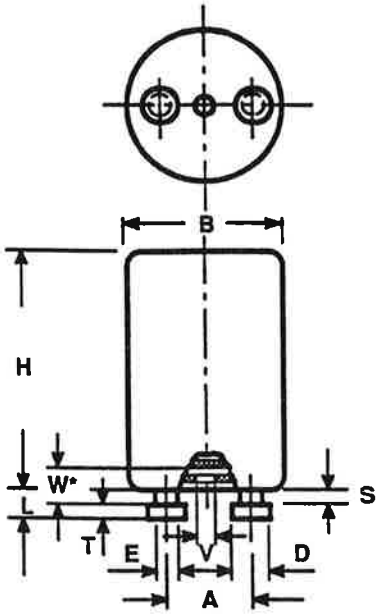
Reference is also made to

- IEC 81, Fluorescent Lamps and to
- IEC 82, Ballasts for Fluorescent Lamps

FLUORESCENT STARTER

FS–11, FS–22

OUTLINE:



Dimension	min.	max.
A	12,5	12,9
B	–	21,5
D	4,7	5,0
E	2,8	3,2
H	33,0	36,0
L	–	4,3
S	1,7	–
T	1,9	2,2
V	2,7	–
W*	4,2	–

*) distance valid for dimension V

Dimensions in mm

APPLICATION DATA:

Starter–Type	Rated–Voltage	Lamp–Wattage	Type	Operating–Mode	Ambient–temp. (°C)
FS–11	220–250 V	4, 6, 8, 13 W	T5	Single	– 20 to + 80
		14, 15, 16, 18, 25, 30 W 36, 38, 58 W	T8	Single	
		20, 40, 65, 80 W	T12	Single	
		22, 32, 40, 60 W	Circline	Single	
		18, 24, 36 W	Lynx–L	Single	
FS–22	110–130 V (Single) 220–240 V (Tandem)	4, 6, 8, 13 W	T5	Single/Tandem	– 20 to + 80
		14, 15, 18 W	T8	Single/Tandem	
		20 W	T12	Single/Tandem	
		22 W	Circline	Single/Tandem	
		18 W	Lynx–L	Single/Tandem	

TEST HOUSE APPROVALS:

FS–11 : VDE, CEBEC, DEMKO, SEMKO, NEMCO, IMQ, KEMA
FS–22 : VDE, CEBEC, SEMKO, IMQ, UL

APPLICATION: For further data refer to EN 60155 (1989)

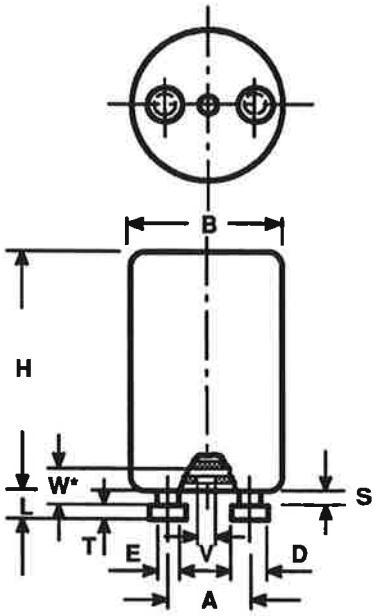
ATTENTION: The product must be used with suitable operating equipment and in accordance with the specified data.

Issued by : ERLANGEN Date : 01.10.82 Revision date: 19.07.90	DATA SHEET	Specification Nbr : 4392C Supersedes : 4392B 07.05.90 Page 1 of 1

FLUORESCENT SAFETY STARTER

COP/H–20, COP/H–46

OUTLINE:



Dimension	min.	max.
A	12,5	12,9
B	–	21,5
D	4,7	5,0
E	2,8	3,2
H	33,0	36,0
L	–	4,3
S	1,7	–
T	1,9	2,2
V	2,7	–
W*	4,2	–

*) distance valid for dimension V

Dimensions in mm

APPLICATION DATA:

Starter–Type	Rated–Voltage	Lamp–Wattage	Type	Operating–Mode	Ambient–temp. (°C)
COP/H–20	220–240 V	14, 15, 18, 25, 30, 36 W	T8	Single, Lead, Lag	– 20 to + 80
		20, 40 W	T12	Single, Lead, Lag	
		22, 32, 40 W	Circline	Single, Lead, Lag	
		18, 24, 36 W	Lynx–L	Single, Lead, Lag	
COP/H–46	220–240 V	58 W	T8	Single, Lead, Lag	– 20 to + 80
		65 W	T12	Single, Lead, Lag	
		60 W	Circline	Single, Lead, Lag	
		36, 38 W	T8	Single, Lag	– 20 to + 80
		40, 42 W	T12	Single, Lag	
		32, 40 W	Circline	Single, Lag	
		36, 38 W	T8	Single, Lead	+ 5 to + 80
		40, 42 W	T12	Single, Lead	
		32, 40 W	Circline	Single, Lead	
		18, 25, 30 W	T8	Single, Lag	+ 5 to + 80
		20 W	T12	Single, Lag	
		22 W	Circline	Single, Lag	
		18, 36 W	Lynx–L	Single, Lag	

TEST HOUSE APPROVALS:

COP/H–20 : VDE
COP/H–46 : VDE, CEBEC

APPLICATION: For further data refer to EN 60155 (1989)

ATTENTION: The product must be used with suitable operating equipment and in accordance with the specified data.

Issued by : ERLANGEN Date : 18.07.89 Revision date: new	**DATA SHEET**	Specification Nbr : 5055 Supersedes : – Page 1 of 1

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