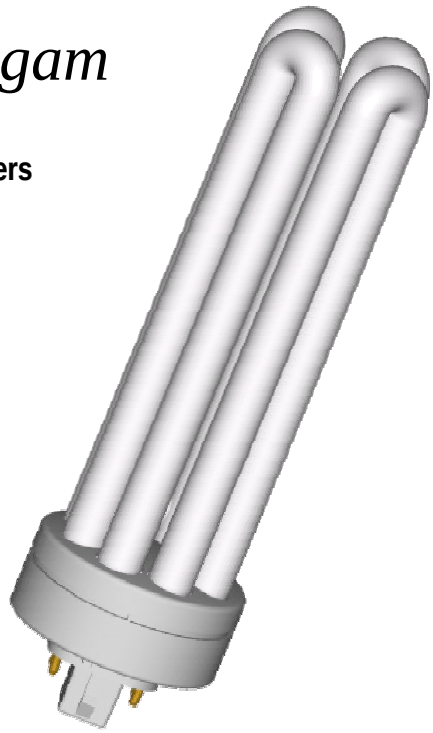
GE Lighting

Biax™ Q/E 70W with amalgam

Biax™ Q/E 70W (F70QBX) Compact Fluorescent Lamps
Product Information for Original Equipment Manufacturers



DESCRIPTION

The Biax™ Q/E 70W, a unique high output compact fluorescent lamp is the result of GE's latest development. This lamp was designed to fulfill our customers' demand to extend our product range towards higher wattages. The ultra compact energy saving Biax™ Q/E lamps with amalgam technology extend the application space of the innovative quadruple tube design. They can be used both in closed luminaires and outdoor applications without significant light loss. Amalgam technology makes the Biax™ Q/E lamps suitable for use in any burning position with the same light output. The Biax™ Q/E 70W lamps with a 4-pin electrical connection and without an internal starter are designed for high-frequency electronic ballasts. .

FEATURES

- Same light output in any burning position
- Reliable starting even in extreme thermal conditions
- Long life — 12 000 hours
- High luminous efficacy — 74 lm/W
- High colour rendering index — R_a = 82
- Available in five colour temperatures — 2700, 3000, 3500, 4000, 5000K.
- 4-pin design for high frequency operation
- Wide operating temperature range
- Built-in End-of-Life protection

APPLICATION AREAS

- Office
- Commercial
- Retail
- School
- Healthcare
- Hotel/Motel
- Restaurant
- Industrial
- Sports halls
- Outdoor

COMPLIANCE WITH IEC STANDARDS

GE Lighting compact fluorescent lamps comply with IEC 60061, IEC 60901 and IEC 61199. Standardization of the F70QBX is progress.

LAMP TECHNOLOGY

The F70QBX is a compact fluorescent lamp with amalgam technology. The amalgam is a mercury alloy, which is an up-to-date replacement for the traditional liquid and pellet-dosed mercury. The amalgam is placed in the lamp and provides the following benefits: more stable light output in every burning position, and a wider optimum operating temperature range (since amalgam gives better mercury vapour control).

The unique quadruple tube design results in a shorter overall length, allowing for use in smaller luminaires. Moreover, the horizontal light distribution is more uniform compared to the triple tube lamps.

In certain circumstances with very low probability, a traditional CFL may smoke and emit s melting plastic-like odour at the end of its life, an incident which is not generally dangerous. It may happen because the lamp voltage is increased, and the ballast still sustains the discharge, thus overheating the lamp. Even though most commercial ballasts are equipped with End-of-Life protection, the F70QBX is designed to eliminate the above-mentioned issue by itself. A small portion of titanium-hydride is placed near the cathode, and in case of critical overheat, the evaporating hydrogen quenches the arc.

Biax™ Q/E 70W with amalgam

SPECIFICATION SUMMARY

Nominal wattage	W	70
Cap		GX24q-6*
Operation		High frequency
Cathode		Preheated
Burning position		Universal
Available correlated colour temperature range	K	2700, 3000, 3500, 4000

Ordering information				
CCT 2700K	-	Product description: F70QBX/827/A/4P/EOL	-	Product code: 48865
CCT 3000K	-	Product description: F70QBX/830/A/4P/EOL	-	Product code: 48866
CCT 3500K	-	Product description: F70QBX/835/A/4P/EOL	-	Product code: 48867
CCT 4000K	-	Product description: F70QBX/840/A/4P/EOL	-	Product code: 48868
CCT 5000K	-	Product description: F70QBX/850/A/4P/EOL	-	Product code: 93406

Electrical and photometric characteristics		
Rated wattage	W	70
Lamp voltage	V	219
Rated lamp current	A	0.32
Operating frequency	kHz	> 20
Luminous flux at 25 °C, cap up	lm	5200
Luminous flux at 25 °C, cap down	lm	5200
Ambient air temperature range to reach 90% light output		
Vertical, cap up	°C	+5...60
Horizontal, cap down	°C	+25...
Vertical, cap down	°C	+35...
Colour rendering index	R_a	82
Luminous efficacy	lm/W	74
Warm-up time to reach 80% light output	s	140
UV PET	h	650

Lifetime performance		
Lumen maintenance		
at 500 h	%	96
at 1000 h	%	94
at 2000 h	%	90
at 4000 h	%	85
Rated life (2h45min on, 15 min off cycle)	h	12,000
Rapid cycling switches (30 s on, 4.5 min off)	cycles	> 20,000

Starting characteristics		
Preheat current for starting test	A	0.42
Preheat time for starting test	s	2
Starting time	s	< 0.1
Maximum starting voltage at 25°C	V	710

* Standardization is in progress

SPECIFICATION SUMMARY

Cathode characteristics		
Cold resistance	Ω	2.71
Test current (providing Rh/Rc = 4.75)	A	0.31
Resistance of each cathode at test current	Ω	13

Reference ballast characteristics		
Frequency	kHz	20…26
Nominal wattage	W	70
Rated voltage	V	438
Calibration current	A	0.32
Resistance	Ω	685

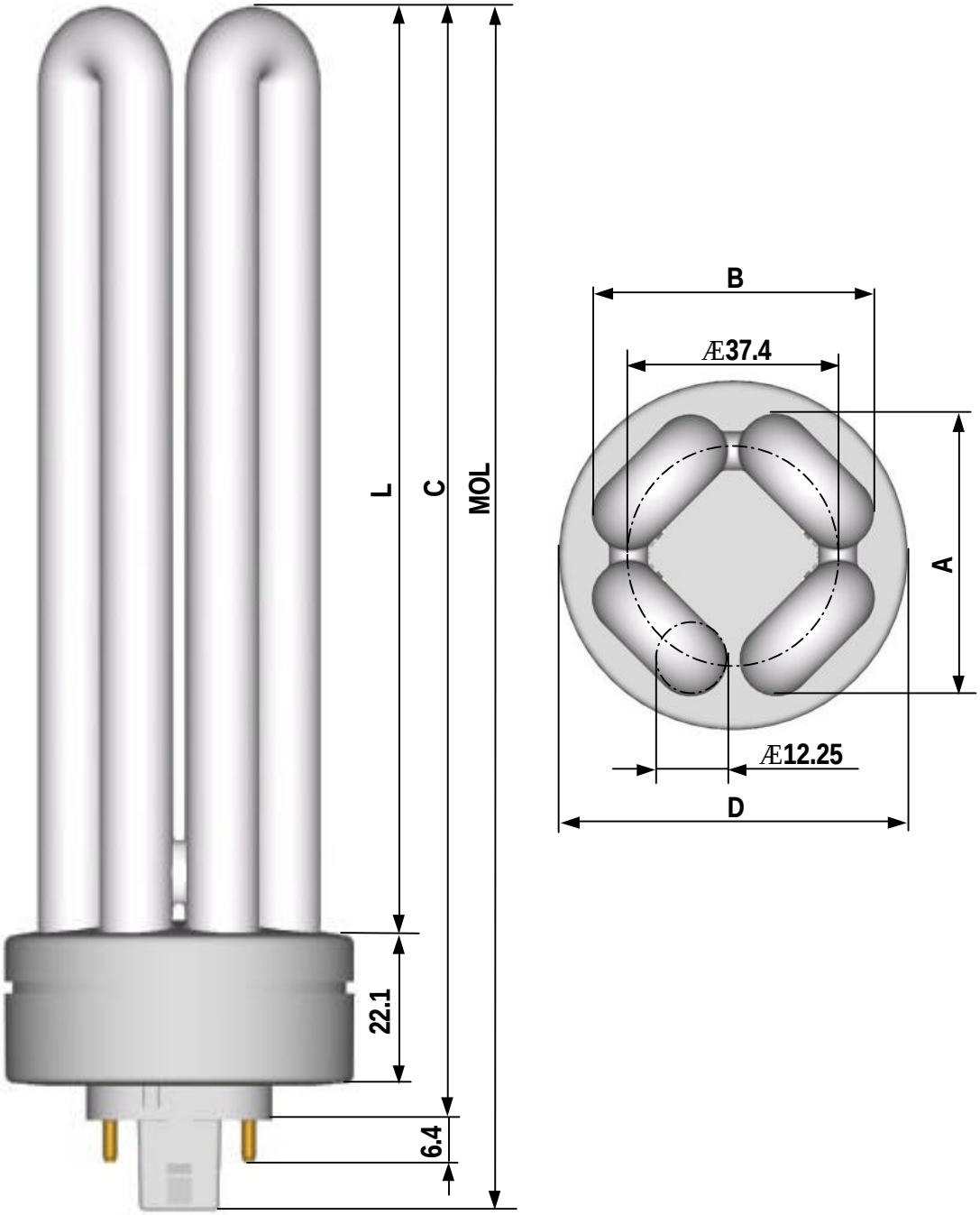
Information for HF ballast design		
Frequency	kHz	> 20
Current in any lead to cathodes	A	< 0.42*
Lamp operating current	A	0.22…0.36

Starting requirements with cathode preheating			
$E = Q + P \cdot t_s$ (t_s = 0.4…3.0 s)		Min.	Max.
Q	J	0.8	1.4
P	W	1.0	1.75
R_{sub}	Ω	9	
Voltage across each cathode for $E(t)<E_{min}$	V	< 10	
Minimum open circuit voltage (V_{rms}) without starting aid			
$t < t_b$	V	*	
$t > t_b$ at 10 °C	V	810	
$t > t_b$ at -15 °C	V	880	
Substitution resistor for each cathode	Ω	9…27	

Safety requirements		
Maximum allowed cap temperature	°C	140
Maximum preheat current	A	0.55

* Under consideration

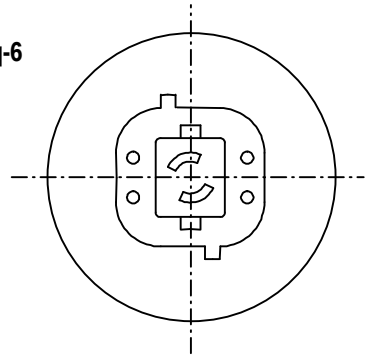
DIMENSIONS



A - according to IEC 60901	mm	max. 51
B - according to IEC 60901	mm	max. 51
C - according to IEC 60901	mm	max. 193.3
L - Lighted length	mm	max. 165.5
D - Plastic shell diameter	mm	max. 58
MOL - Maximum overall length	mm	208

Cap

GX24q-6



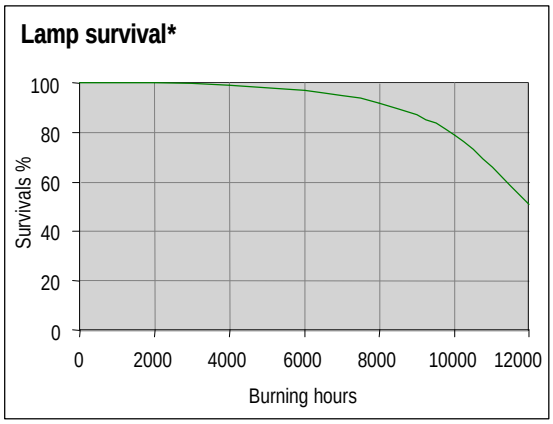
LAMP LIFE AND LUMEN MAINTENANCE

Cathodes of a fluorescent lamp lose their electron-emissivity during life due to the evaporation of emission mixture. When the deterioration reaches a certain level, the cathode breaks. Typical lifetime characteristics are based on GE Lighting's measurements according to the relevant IEC standards. The declared lamp life is the median life, which is when 50% of the lamps from a large sample batch would have failed. Real lifetime figures may depend on actual application. For instance improper cathode preheat, too high operating current, or too low operating current without additional cathode heating reduces the expected life.

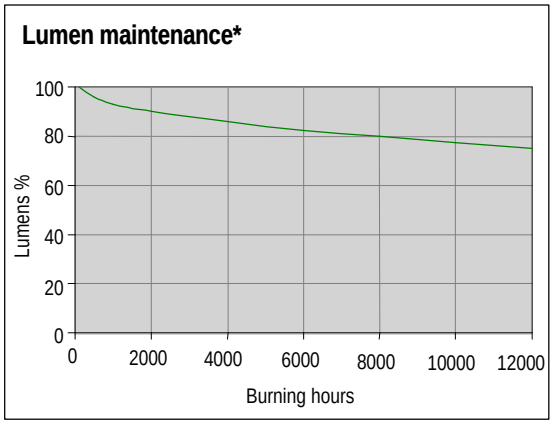
The lumen maintenance graph shows how the luminous output decreases throughout life. The main causes of the light depreciation are the deterioration of phosphor coating and the lamp blackening due to the deposition of evaporated emission mixture on the glass tube. These effects are unavoidable. The lumen maintenance curve presented here for 57W Biax™ Q/E lamp is based on lumen readings under laboratory conditions.

Test conditions:
- Photometric sphere
- Vertical, cap up burning position
- Switching cycle: 165 minutes On – 15 minutes Off
- High frequency operation
- 25ºC ambient temperature

Burning hours	Survival %*
2000	100
4000	99
6000	97
8000	92
1000	79
12000	51



Burning hours	Lumen %*
500	96
1000	93
2000	90
4000	85
8000	80
12000	75



* Preliminary data

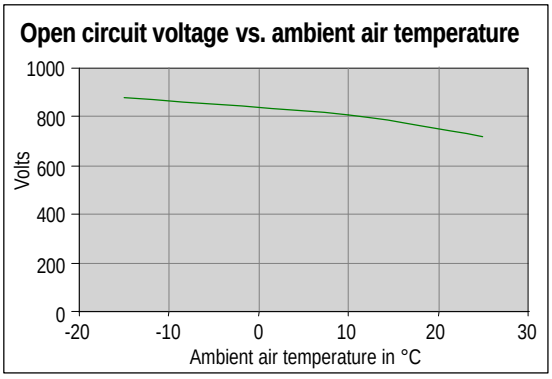
LAMP STARTING

Required open circuit voltage

The following curve shows how the maximum open circuit voltage depends on the ambient air temperature. The graph below is based on GE Lighting's measurements under controlled test conditions. Real starting voltage figures depend on the applied electronic ballast. Appropriate preheating of cathodes is necessary to reach low starting voltage and long lamp life.

Test conditions:
- vertical, cap up lamp position
- thermal chamber providing ±2°C accuracy
- 2 s current controlled preheat
- preheat current: 420 mA
- voltage ramp-up until ignition

T_{amb} (°C)	OCV (V_{rms})
-15	880
10	810
25	710



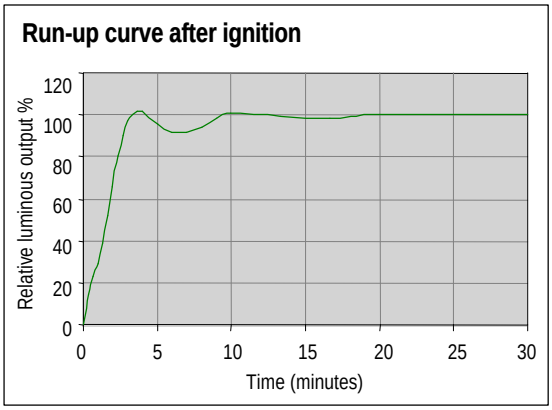
Warm-up

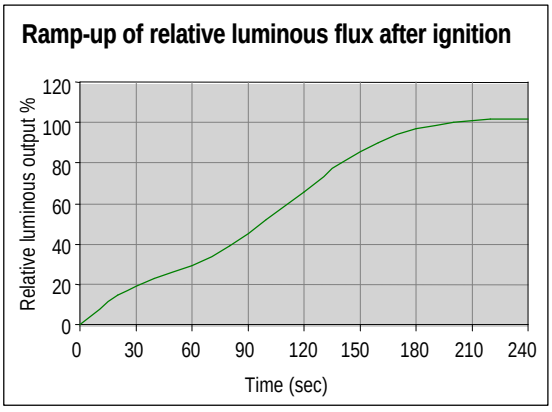
The following curves show the relative light output as the function of time. By definition, warm-up time indicates that time when the luminous output of a lamp reaches the 80% of its steady-state value. The second curve shows the initial ramp-up.

Test conditions:
- 25°C ambient temperature
- base up burning position
- high frequency operation at 320 mA

Time (min)	Lm%
1	29
2	66
4	102
6	92
8	94
10	101
20	100
30	100
60	100

Time (s)	Lm%
20	15
40	23
60	29
80	39
100	52
120	66
140	80
160	90
180	97
200	100
220	102
240	96





INFLUENCE OF AMBIENT TEMPERATURE

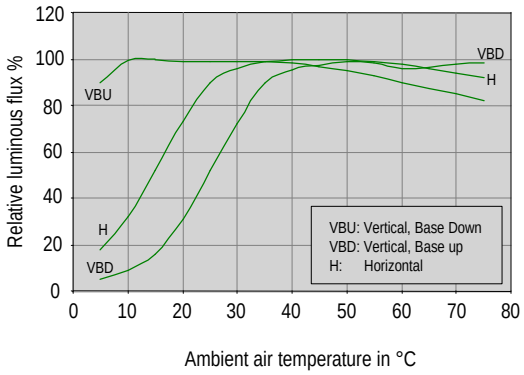
Lamp performance

The lamp performance parameters, such as luminous output, lamp voltage and power depend on the mercury vapour pressure in the discharge tube. The mercury vapour pressure is a function of the thermal conditions around the glass tubes and the amalgam. The burning position, air flow, and radiated heat sources have an effect on these conditions. The first curve shows the relative luminous output as function of the ambient temperature in three lamp burning positions: cap up, horizontal, and cap down. Tests were performed in draught-free air under thermally controlled conditions. The second chart shows the effect of the ambient air temperature on the lamp performance parameters in cap up burning position. These relative parameters are: luminous flux (Φ), lamp voltage (U), lamp current (I) and lamp power (P).

Test conditions:
- thermal chamber with ±2°C accuracy
- draught-free air
- Hüco TC-TEL 1x70W ballast

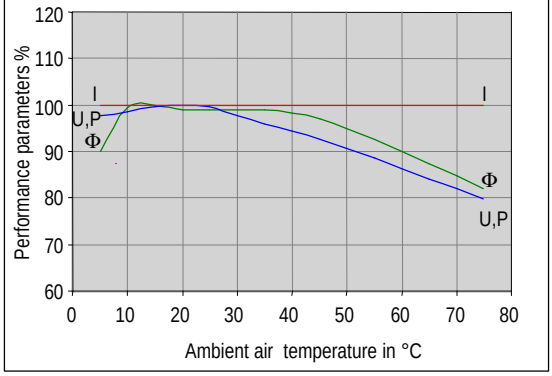
T_{amb}	Relative luminous flux (%)		
(°C)	Cap up	Hor.	Cap down
0	76	10	4
10	100	32	9
20	99	73	31
30	99	96	72
40	98	100	96
50	95	100	100
60	90	98	96
70	85	94	98

Relative luminous flux vs. Ambient air temperature



T_{amb}	F	U	I	P
(°C)	%	%	%	%
0	76	97	100	97
10	100	99	100	99
20	99	100	100	100
30	99	98	100	98
40	98	94	100	94
50	95	91	100	91
60	90	86	100	86
70	85	82	100	82

Performance parameters
in cap up burning position



INFLUENCE OF AMBIENT TEMPERATURE

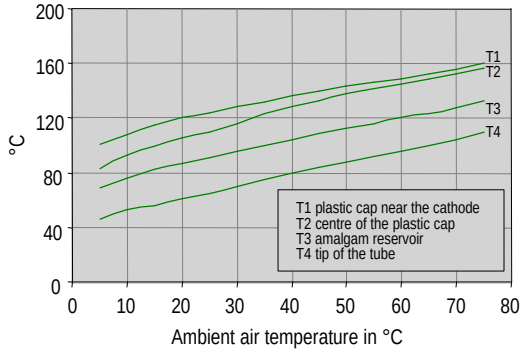
Lamp temperatures

The following charts show the lamp temperatures in two burning positions at four spots: plastic cap near the cathode, centre of the plastic cap, amalgam reservoir, and tip of the tube.

Test conditions:
- thermal chamber with ±2°C accuracy
- draught-free air
- Hüco TC-TEL 1x70W ballast

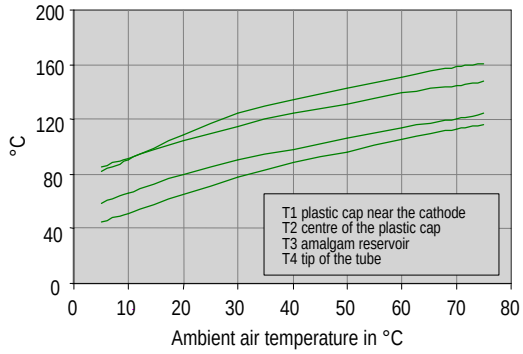
T_{amb} (°C)	Temperature (°C)			
	cap near the cathode	centre of the plastic cap	amalgam reservoir	tip of the tube
0	93	71	60	39
10	108	93	76	53
20	120	105	87	61
30	128	116	96	70
40	136	128	104	80
50	143	138	112	88
60	149	145	120	96
70	156	152	127	104

Spot temperatures vs. Ambient air temperature
in cap up burning position



T_{amb} (°C)	Temperature (°C)			
	cap near the cathode	centre of the plastic cap	amalgam reservoir	tip of the tube
0	80	75	39	53
10	91	90	51	66
20	104	108	65	80
30	115	124	78	90
40	124	134	88	98
50	131	143	96	106
60	139	151	105	114
70	145	158	113	120

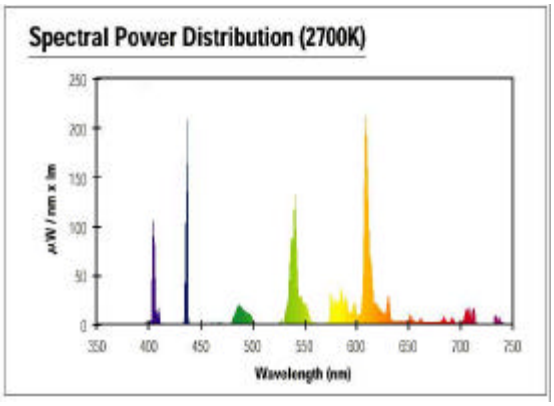
Spot temperatures vs. Ambient air temperature
in horizontal burning position

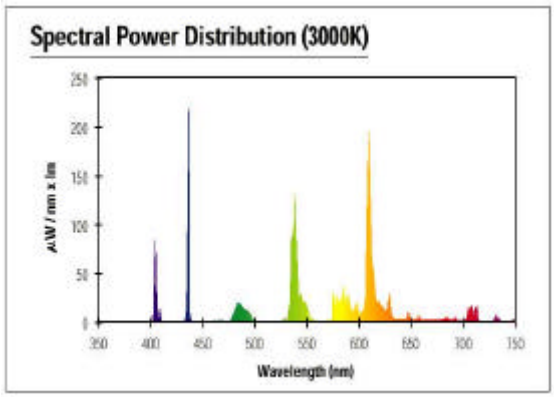


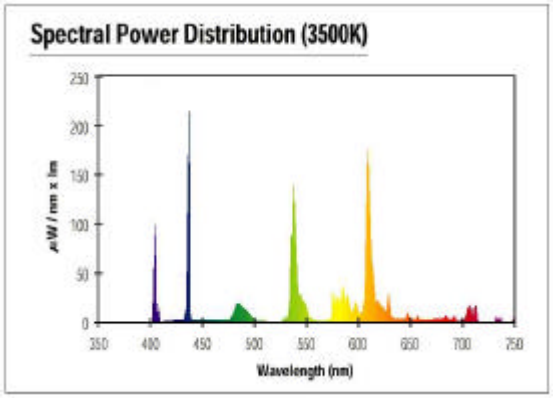
LAMP COLOUR

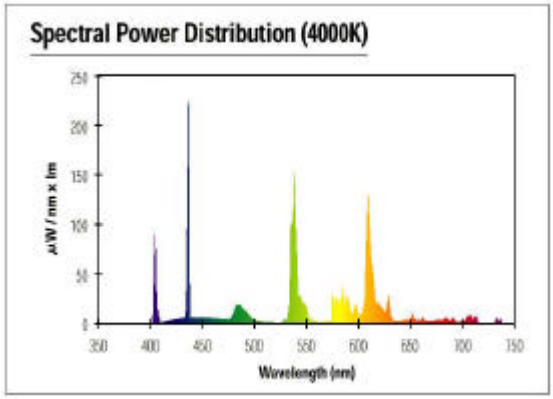
Spectral Power Distribution

Spectral Power Distribution curves are given in the following diagrams.







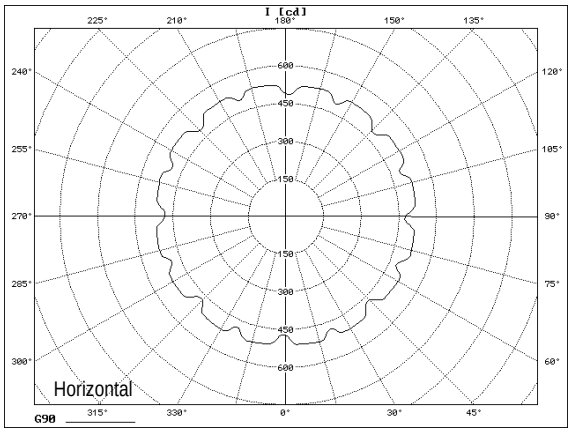


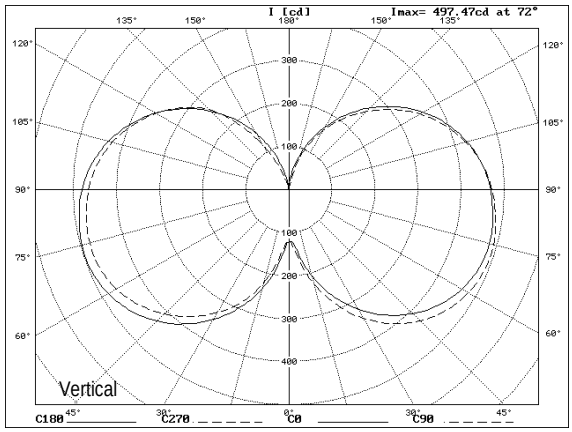
Colour specification according to CIE 1931

CCT (K)	x	y	CRI
2700	0.455	0.410	82
3000	0.440	0.403	82
3500	0.413	0.393	82
4000	0.376	0.387	82
5000	0.346	0.359	82

LUMINOUS INTENSITY DISTRIBUTION

The following diagrams show the polar light intensity distribution of the lamp in cap up position.





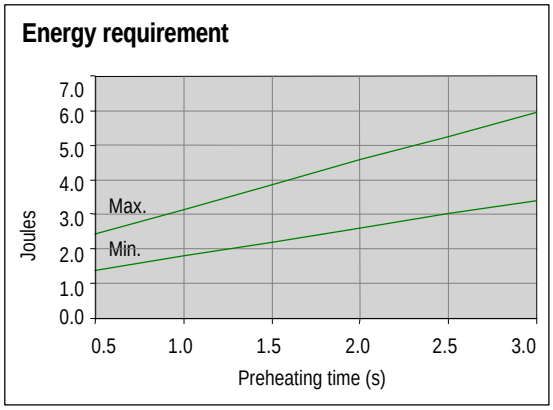
PREHEATING REQUIREMENTS

Suitable preheating of cathodes prior to ignition is essential for long lamp life. The preheating requirement can be given by the following formula:

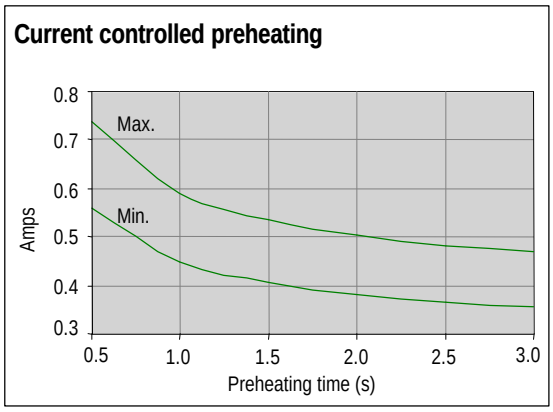
$E = Q + P \cdot t$ This energy is measured on a substitution resistor ($R_{sub} = 9\Omega$)

Q stands for the necessary thermal energy. P represents the power loss due to the heat transmission from the cathode. The longer the preheating, the more the power loss. The two basic preheating modes, the current controlled and the voltage controlled modes, can be derived from the formula.

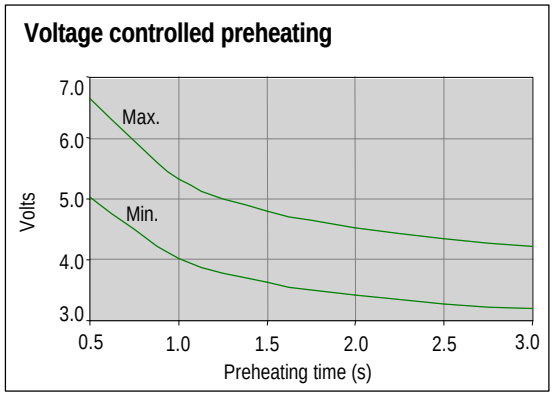
Preheating time	Energy (J)	
	Min.	Max
0.5	1.40	2.45
1.0	1.80	3.15
1.5	2.20	3.85
2.0	2.60	4.55
2.5	3.00	5.25
3.0	3.40	5.95
Q (J)	0.80	1.40
P (W)	1.00	1.75



Preheating time	Preheating current (A)	
	Min.	Max
0.5	0.558	0.738
1.0	0.447	0.592
1.5	0.404	0.534
2.0	0.380	0.503
2.5	0.365	0.483
3.0	0.355	0.469



Preheating time	Preheating voltage (V)	
	Min.	Max
0.5	5.0	6.6
1.0	4.0	5.3
1.5	3.6	4.8
2.0	3.5	4.5
2.5	3.3	4.3
3.0	3.2	4.2



ELECTRONIC BALLASTS

230V electronic ballasts approved by GE Lighting

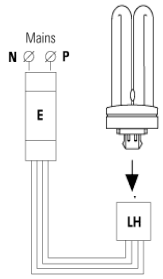
The list given below is not considered to be comprehensive, but merely indicates the ballasts tested by GE Lighting. Ballasts produced by other reputable control gear manufacturers meeting the relevant IEC standards would also be considered as suitable.

Manufacturers	Single lamp option
Hüco	TC-TEL 1x70W
Tridonic	PC PRO 70 FSM b101

CIRCUIT DIAGRAM

4-pin, electronic ballast (single lamp)

LH = Lamp Holder
E = Electronic Gear



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