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GE Lighting

Starcoat™ T5

High Efficiency & High Output ranges
Product Information for Original Equipment Manufacturers

DESCRIPTION

Starcoat™ T5 lamps are triphosphor fluorescent lamps with 16mm outer diameter (5/8 of an inch). These lamps feature "Starcoat Technology" that delivers high quality triphosphor performance.

GE produces two ranges of Starcoat™ T5 lamps with equivalent length in each:
• High Efficiency offering high lumens per watt
• High Output offering improved lumen package

High Efficiency Lamps

The High Efficiency range of Starcoat™ T5 brings lumen efficacy up to 104 lm/W. Combined with an extremely long service life, this range of lamps is ideally suited to commercial and retail application in both direct and combined direct/indirect luminaires.

High Output Lamps

The extremely high surface illuminance of the High Output Starcoat™ T5 range makes these lamps ideal for indirect luminaires.
These are the best suited to uplighting systems or direct lighting in high ceilings applications, such as those in canopies or industrial situations.

For easy recognition of the two ranges the High Efficiency range is brand stamped with silver ink and the High Output range is brand stamped with gold ink.

APPLICATION AREAS

- Retail
- Office
- Schools
- Commercial
- Industrial
- Sports halls

FEATURES

- High efficiency - up to 104 lumens per watt - for ongoing cost savings
- Reduced environmental impact - only 5mg mercury
- Easy fitting of the T5 luminaires into the ceiling module system
- High lumen output - up to 7000 lumens - for improved system efficacy and reduced number of fittings
- Smaller physical dimensions for improved light output control and smaller, more aesthetic fittings
- Peak lumen output at 35°C for optimum light output within fittings
- Less raw material than T8 lamps (38% less glass, less packaging materials)
- Designed for HF-operation: higher lamp efficacy and lower ballast losses than conventional ballasts.

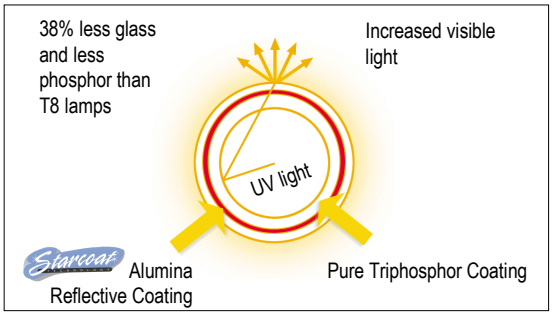
COMPLIANCE WITH IEC STANDARDS

GE Lighting Starcoat™ T5 linear fluorescent lamps comply with IEC 60061, IEC 60081 and IEC 61195.

Starcoat™ T5 linear fluorescent lamps

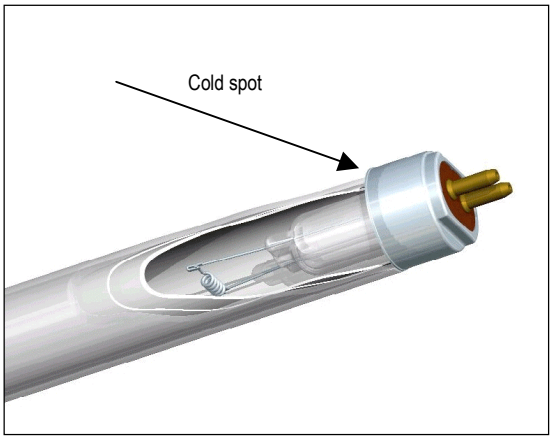
STARCOAT™ TECHNOLOGY

Starcoat™ is a proprietary coating technology that eliminates the need for traditional lower quality halophosphor coating by reflecting the UV-light more effectively. This leaves a pure triphosphor coating for excellent colour rendering and lumen maintenance performance.



LAMP OPERATION

The light output of a low-pressure mercury vapor lamp is determined by the saturated mercury vapour pressure which is determined by the temperature of the liquid mercury deposited somewhere on the inner wall of the lamp. In a stabilized lamp this is the coldest part of the bulb: the “cold chamber” or “cold spot”.
In case of a Starcoat™ T5 linear fluorescent lamp this “cold spot” is situated behind the electrode at the brand stamp end of the lamp. Starcoat™ T5 lamps were designed to reach their maximum luminous flux at an ambient draught-free air temperature of 35°C. As the cold spot is situated near the metal cap, the temperature of the cap can tell how close the Hg vapour pressure is to the optimum : a cap temperature of approx. 43-45°C corresponds to conditions resulting in maximum light output in a stabilized T5 lamp



RECOMMENDATIONS FOR MEASURING STARCOAT™ T5 LAMPS

Proper lamp handling is essential when measuring the stable light output of a Starcoat™ T5 lamp. In order to minimize stabilization time try to handle T5 lamps in vertical position with the “cold spot” at the lowest point as much as possible.

During measurements the luminous flux of the tested lamps should be stabilized. Stable light output is reached when all the liquid mercury is in the cold chamber.

Before measuring stable light output Starcoat™ T5 lamps should be seasoned for approx. 100 hours in a vertical position with the cold chamber (stamp side) at the lowest point. If the lamps are switched off for more than 12 hours, they are to be burnt for at least four additional hours with cold chamber down. Placing the lamps into the test system the cold chamber should be kept at the lowest point as much as possible. After placing the lamp within the test system and before measuring the stable luminous flux lamps should be continuously burnt for one hour at 25°C ambient temperature. Stability should be checked by monitoring the luminous flux. The measured luminous flux may be considered stable if relative changes in light output are less than 0.5% over a 5 minute period.

RECOMMENDATIONS FOR BALLAST DESIGN

Starcoat™ T5 lamps have electrodes with emitting material which needs to be heated to sufficiently high temperature.The recommended method of starting a Starcoat™ T5 lamp is to heat the electrodes to proper temperatures prior to applying the open circuit voltage to the required values that will cause an ignition. For further information on ballasts please refer to IEC publications 60929: "A.C. supplied electronic ballasts for tubular fluorescent lamps. Performance requirements."

Emergency Operation

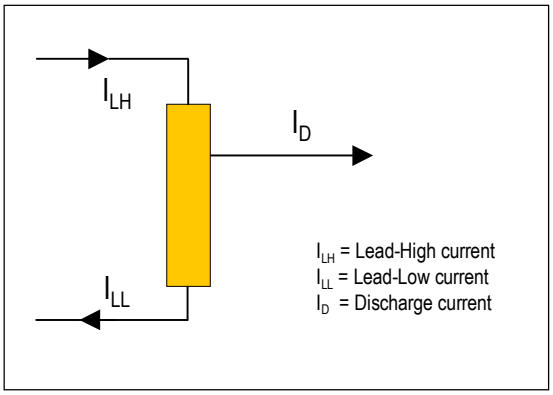
Emergency operation is a very important application for T5. It is recognised that there are technical issues associated with operating long narrow lamps at the low currents associated with emergency operations . However, provided an adequate maintaining voltage is applied , acceptable performance can be obtained. Also, the impact on lamp life can be minimised by applying cathode heating. If the emergency ballast is not applying cathode heating during emergency operation then sputtering of the emitting material might occur due to the low cathode temperature.
GE Lighting is prepared to offer technical advise and assistance to manufacturers of emergency lighting gear.

End of lamp life behavior

The normal end-of-life failure mode for fluorescent lamps is emitter material depletion of one of the electrodes. In most cases the discharge will extinguish and the lamp will not start again. In some cases the ballast is capable of sustaining the arc even if the above mentioned condition occurs. The voltage drop will rise and extra power dissipation will take place in front of the depleted cathodes. This could lead to overheating of the glass near the cathodes, caps and the lampholders. Ballasts should be designed to limit the power or switch-off when detecting this condition. Various cases of voltage rise are possible: if both cathodes are deactivated or broken, the voltage rise would be symmetrical. If only one cathode is broken the voltage will be asymmetric. The ballast should switch off in both cases. If the lamp has intact electrodes but would not start (hard starting) the ballast and the luminaire should control the maximum current in any lead and the maximum cap temperature according to IEC requirements.

Dimming

Dimming is done by reducing the discharge current. As the discharge is lower the power dissipation in the electrodes will decrease which will result in lower temperatures of the electrodes. Additional cathode heating should be applied to the cathodes in order to maintain their temperature. Limits and target setting for the currents will be published later. Below 10% of the discharge current ("deep dimming") the system needs to be tested for lamp life.



Further considerations on system design

If the design of the luminaire allows higher or lower ambient temperature than 35°C the luminous output will be different from the designed maximum light output.

In cases where additional cathode heating is applied by an electronic ballast during lamp operation, power dissipation may substantially increase the temperature of the cold chamber located behind the electrode. This might result in a shift of the peak light output toward temperature ranges below 35°C.

Air movement within the luminairs can also substantially affect the light output of the T5 lamps since it may also change the cold spot temperature.

SPECIFICATION SUMMARY
according to EN 60081, IEC 60081 - datasheets

High Efficiency

Specification summary

Lamp Type		14W	21W	28W	35W
General					
Nominal wattage	W	14	21	28	35
Cap			G5		
Operation			High Frequency		
Cathode			Preheated		
Recommended burning position			horizontal		
Available correlated colour temperature range	K		2700, 3000, 3500, 4000, 6500		
Ordering information (40-way bulk pack)					
827 - CCT 2700K		39965	39975	39980	39986
830 - CCT 3000K		39964	39976	39982	39989
835 - CCT 3500K		39961	39977	39983	39990
840 - CCT 4000K		39973	39978	39984	39991
865 - CCT 6500K		90222	39979	39985	39992
Electrical and photometric characteristics at 25°C					
Rated wattage	W	14	20,6	27,9	35,5
Rated lamp voltage	V	86	126	166	205
Rated lamp current	A	0.165	0.165	0.170	0.175
Operating frequency	kHz	> 20	> 20	> 20	> 20
Rated luminous flux	lm	1230	1910	2640	3320
Rated luminous flux for 865	lm	1140	1770	2450	3090
Temperature range (90% light output, horizontal)	°C	+25...45	+25...45	+25...45	+25...45
Colour rendering index	Ra	85	85	85	85
Typical UV PET	h	>100	>100	>100	>100
Typical lamp characteristics at 35°C					
Lamp wattage	W	13.7	20.7	27.8	34.7
Lamp voltage	V	82	123	167	209
Lamp current	A	0.170	0.170	0.170	0.170
Luminous flux	lm	1350	2100	2900	3650
Luminous flux for 865	lm	1250	1950	2700	3400
Luminous efficacy @ 35 °C	lm/W	96	100	104	104
Lifetime performance					
Lumen maintenance (@ 10 000 h)	%	92	92	92	92
Rated life (2h45min on, 15 min off cycle)	h	20,000	20,000	20,000	20,000
Rapid cycling switches (30 s on, 4.5 min off)	cycles	> 20,000	> 20,000	> 20,000	> 20,000
Starting characteristics					
Preheat current for starting test	A	0.210	0.210	0.210	0.210
Preheat time for starting test	s	2	2	2	2
Starting time	s	0.1	0.1	0.1	0.1

SPECIFICATION SUMMARY
according to EN 60081, IEC 60081 - datasheets

High Efficiency

Specification summary

Lamp Type		14W	21W	28W	35W
Cathode characteristics					
Test current (providing Rh/Rc = 4.75)	A	0.160	0.160	0.160	0.160
Resistance of each cathode at test current	Ω	40	40	40	40
Reference ballast characteristics					
Frequency	kHz	20…26	20…26	20…26	20…26
Nominal wattage	W	14	21	28	35
Rated voltage	V	167	246	329	413
Calibration current	A	0.170	0.170	0.170	0.170
Resistance	Ω	500	725	950	1200
Information for HF ballast design					
Frequency	kHz	> 20	> 20	> 20	> 20
Current in any lead to cathodes	A	< 0.220	< 0.220	< 0.220	< 0.220
Lamp operating current	A	0.130…0.205	0.130…0.205	0.130…0.205	0.130…0.205
Starting requirements with cathode preheating					
Emin = Q + P·t_s (t_s = 0.4…3.0 s)					
Q	J	0.9	0.9	0.9	0.9
P	W	0.75	0.75	0.75	0.75
Rsub	Ω	30	30	30	30
Emax = F x Emin		1.75	1.75	1.75	1.75
Voltage across each cathode for E(t)<E_{min}	V	< 10	< 10	< 10	< 10
Open circuit voltage (V_{rms}) across lamp					
t < t_0	V	130	200	240	275
t > t_0 at 10 °C	V	230	340	425	530
t > t_0 at -15 °C	V	275	390	530	700
Substitution resistor for each cathode	Ω	30 …. 90	30 …. 90	30 …. 90	30 …. 90
Luminous flux					
I_{LH}^2+I_{LL}^2 Minimum		A - B x I_d	A - B x I_d	A - B x I_d	A - B x I_d
			under consideration		
I_{LH}^2+I_{LL}^2 Target		G - H x I_d	G - H x I_d	G - H x I_d	G - H x I_d
			under consideration		
Lamp operating current with additional cathode heat	A	0.020 … 0.130	0.020 … 0.130	0.020 … 0.130	0.020 … 0.130
Minimum operating current without additional heat current	A	0.130	0.130	0.130	0.130
Safety requirements					
Maximum allowed cap temperature under abnormal conditions	°C	120	120	120	120
Maximum cap temperature rise	°C	75	75	75	75
Maximum lamp operating current	A	0.205	0.205	0.205	0.205
Dimensions					
A Max - base to base	mm	549.0	849.0	1149.0	1449.0
B Min - pin to base	mm	553.7	853.7	1153.7	1453.7
B Max - pin to base	mm	556.1	856.1	1156.1	1456.1
C Max - pin to pin	mm	563.2	863.2	1163.2	1463.2
D Max - outer diameter	mm	17	17	17	17

SPECIFICATION SUMMARY
according to EN 60081, IEC 60081 - datasheets

High Output

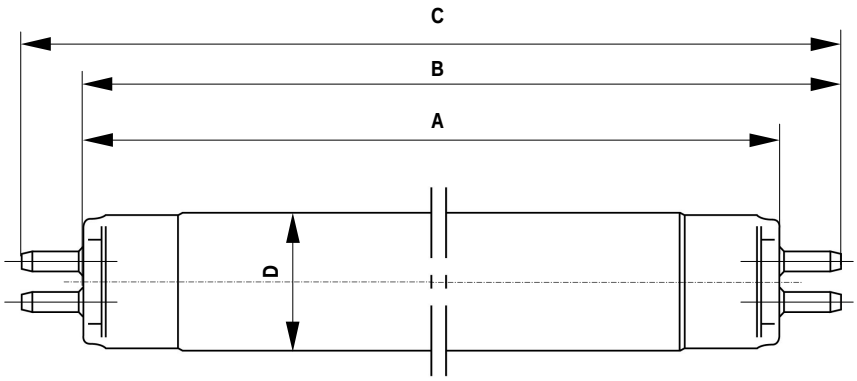
Lamp Type		24W	39W	54W	49W	80W
General						
Nominal wattage	W	24	39	54	49	80
Cap		G5	G5	G5	G5	G5
Operation				High Frequency		
Cathode				Preheated		
Recommended burning position				horizontal		
Available correlated colour temperature range	K			2700, 3000, 3500, 4000, 6500		
Ordering information (40-way bulk pack)						
827 - CCT 2700K		39994	90200	90205	90220	90225
830 - CCT 3000K		39998	90201	90232	90219	90226
835 - CCT 3500K		90196	90202	90206	90221	90227
840 - CCT 4000K		90197	90203	90209	90223	90228
865 - CCT 6500K		90198	90204	90211	90224	90229
Electrical and photometric characteristics at 25°C						
Rated wattage	W	22,5	38	54,1	49,2	79,8
Rated lamp voltage	V	77	118	120	195	152
Rated lamp current	A	0,295	0,325	0,455	0,255	0,530
Operating frequency	kHz	> 20	> 20	> 20	> 20	> 20
Rated luminous flux	lm	1750	3200	4460	4450	6450
Rated luminous flux for 865	lm	1600	2950	4100	4100	5950
Temperature range (90% light output, horizontal)	°C	+25…45	+25…45	+25…45	+25…45	+25…45
Colour rendering index	Ra	85	85	85	85	85
Typical UV PET	h	>100	>100	>100	>100	>100
Typical lamp characteristics at 35°C						
Rated wattage	W	22.5	38	53.8	49.3	80
Lamp voltage	V	75	112	117	191	145
Rated lamp current	A	0.300	0.340	0.460	0.260	0.555
Luminous flux	lm	2000	3500	5000	4900	7000
Luminous flux for 865	lm	1900	3330	4750	4650	6650
Luminous efficacy at 35°C	lm/W	84	90	93	100	88
Lifetime performance						
Lumen maintenance at 10 000h	%	92	92	92	92	92
Rated life (2h45min on, 15 min off cycle)	h	20,000	20,000	20,000	20,000	20,000
Rapid cycling switches (30 s on, 4.5 min off)	cycles	> 20,000	> 20,000	> 20,000	> 20,000	> 20,000
Starting characteristics						
Preheat current for starting test	A	0.440	0.440	0.720	0.330	0.765
Preheat time for starting test	s	2	2	2	2	2
Starting time	s	0.1	0.1	0.1	0.1	0.1

SPECIFICATION SUMMARY
according to EN 60081, IEC 60081 - datasheets

High Output

Lamp Type		24W	39W	54W	49W	80W
Cathode characteristics						
Test current (providing Rh/Rc = 4.75)	A	0.350	0.350	0.500	0.260	0.550
Resistance of each cathode at test current	Ω	12	12	8	16,5	7
Reference ballast characteristics						
Frequency	kHz	20…26	20…26	20…26	20…26	20…26
Nominal wattage	W	24	39	54	49	80
Rated voltage	V	150	224	234	390	290
Calibration current	A	0.300	0.340	0.460	0.255	0.555
Resistance	Ω	250	330	255	765	260
Information for HF ballast design						
Frequency	kHz	> 20	> 20	> 20	> 20	> 20
Current in any lead to cathodes	A	< 0.450	< 0.450	< 0.650	< 0.330	< 0.715
Lamp operating current	A	0.270… 0.435	0.270… 0.435	0.370… 0.625	0.180… 0.295	0.440… 0.670
Starting requirements with cathode preheating						
Emin = Q + P·t_s (t_s = 0.4…3.0 s)						
Q	J	1.5	1.5	2.2	0.8	2.2
P	W	0.9	0.9	1	0.7	1
Rsub	Ω	8	8	4.8	12	4.5
Emax = F x Emin		1.75	1.75	1.75	1.75	1.75
Voltage across each cathode for E(t)<E_{min}	V	< 10	< 10	< 10	< 10	< 10
Open circuit voltage (V_{rms}) across lamp						
t < t_0	V	130	175	240	225	250
t > t_0 at 10 °C	V	280	350	520	450	580
t > t_0 at -15 °C	V	350	390	620	625	750
Substitution resistor for each cathode	Ω	8 …. 24	8 …. 24	4.8 …. 14.4	12 …. 36	4.5 …. 13.5
Luminous flux						
$I_{LH}^2+I_{LL}^2$ Minimum		A - B x I_d	A - B x I_d	A - B x I_d	A - B x I_d	A - B x I_d
				under consideration		
$I_{LH}^2+I_{LL}^2$ Target		G - H x I_d	G - H x I_d	G - H x I_d	G - H x I_d	G - H x I_d
				under consideration		
Lamp operating current with additional cathode heat	A	0.030 … 0.270	0.030 … 0.270	0.050 ..0.370	0.025 … 0.180	0.055 … 0.440
Minimum operating current without additional heat curre	A	0.270	0.270	0.370	0.180	0.440
Safety requirements						
Maximum allowed cap temperature under abnormal co	°C	120	120	120	120	120
Maximum cap temperature rise	°C	75	75	75	75	75
Maximum lamp operating current	A	0.425	0.425	0.625	0.295	0.670
Dimensions						
A Max - base to base	mm	549.0	849.0	1149.0	1449.0	1449.0
B Min - pin to base	mm	553.7	853.7	1153.7	1453.7	1453.7
B Max - pin to base	mm	556.1	856.1	1156.1	1456.1	1456.1
C Max - pin to pin	mm	563.2	863.2	1163.2	1463.2	1463.2
D Max - outer diameter	mm	17	17	17	17	17

DIMENSIONS



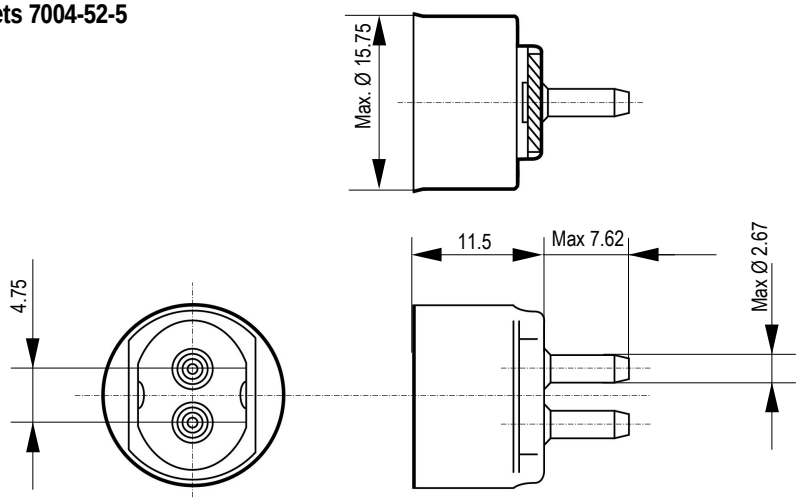
Dimensions		14W	21W	28W	35W
A - Max (base to base)	mm	549.0	849.0	1149.0	1449.0
B - Min (base to pin)	mm	553.7	853.7	1153.7	1453.7
B - Max (base to pin)	mm	556.1	856.1	1156.1	1456.1
C - Max (pin to pin)	mm	563.2	863.2	1163.2	1463.2
D - Max (outer diameter)	mm	17.0	17.0	17.0	17.0

Dimensions		24W	39W	54W	49W & 80W
A - Max (base to base)	mm	549.0	849.0	1149.0	1449.0
B - Min (base to pin)	mm	553.7	853.7	1153.7	1453.7
B - Max (base to pin)	mm	556.1	856.1	1156.1	1456.1
C - Max (pin to pin)	mm	563.2	863.2	1163.2	1463.2
D - Max (outer diameter)	mm	17.0	17.0	17.0	17.0

According to IEC 60081

Cap - G5

IEC 60081 Datasheets 7004-52-5



Dimensions measured on finished lamps

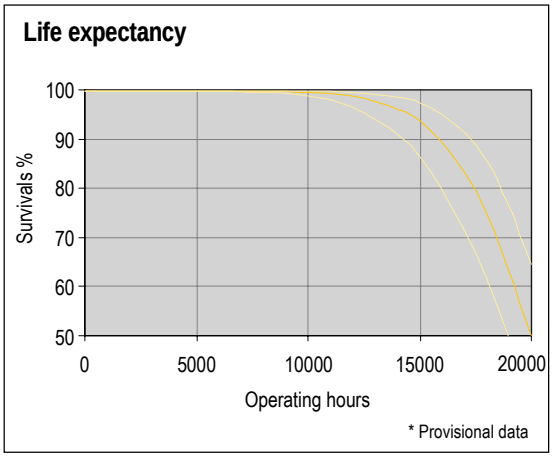
LAMP LIFE AND LUMEN MAINTENANCE

Cathodes of a fluorescent lamp lose their electron-emissivity during life due to various degradation processes like evaporation and sputtering. When the deterioration reaches a certain level, the cathode fails. Typical lifetime characteristics given below are based on GE Lighting's measurements according to the relevant IEC standards. The declared lamp life is the median life defined by the time when 50% of the lamps from a large sample batch would have failed. Real lifetime figures may depend on the actual application. For instance improper cathode preheat, too high operating current, or too low operating current without additional cathode heating might reduce the expected life.

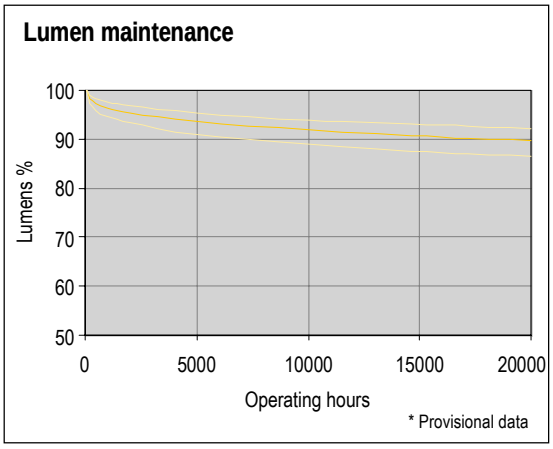
The lumen maintenance graph below shows the luminous output decreasing throughout life. The main causes of the light depreciation are deterioration of phosphor coating and lamp blackening due to the deposition of evaporated emission mixture on the glass tube. These effects are unavoidable with present technology. The lumen maintenance curve presented here for Starcoat™ T5 lamps is based on lumen readings under laboratory conditions.

Test conditions:
- Photometric sphere
- Horizontal burning position
- Switching cycle: 165 minutes On – 15 minutes Off
- High frequency operation
- 25°C ambient temperature

Burning hours	Survival %
4000	99
8000	99
12000	98
16000	89
20000	50



Burning hours	Lumen %
500	97
1000	96
2000	95
5000	93
10000	91
20000	89



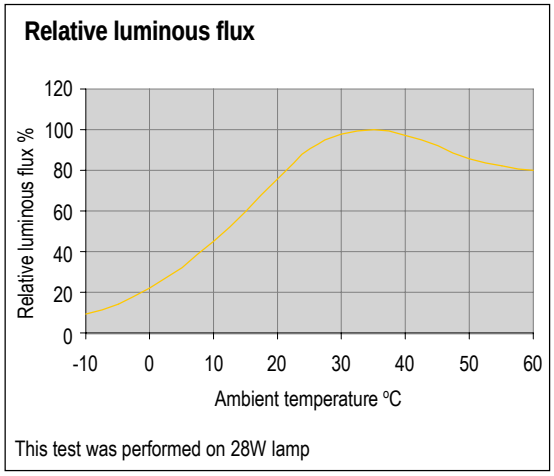
INFLUENCE OF AMBIENT TEMPERATURE

Lamp performance

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 affected by the thermal conditions around the glass tube. These latter are determined by factors such as the burning position, air flow, radiating heat sources , etc. The temperature when the maximum lamp light output occurs under reference conditions is 35°C. T5 lamps and commercial ballasts with an electrode heating cut-off have a maximum luminous flux close to 35°C. The diagram below shows the typical behavior of the relative luminous output of a long T5 lamp at horizontal burning position at different ambient still air temperatures.

Test conditions:
- thermal chamber with ±2°C accuracy
- draught-free air
- commercial ballasts

T_{amb} (°C)	Relative luminous flux (%) Horizontal burning position
-10	9
-5	14
0	22
5	32
10	45
15	60
20	76
25	91
30	98
35	100
40	97
45	92
50	86
55	82
60	80



The fall-off rate of the luminous flux - i.e. the ratio of the luminous flux measured at 35°C and 25°C ambient temperature, respectively - may vary in the range between 1.05 and 1.25 depending on lamp type and electronic gear type used.

Starcoat™ T5 lamps can be ignited from - 20°C to +60°C ambient temperature.

INFLUENCE OF AMBIENT TEMPERATURE

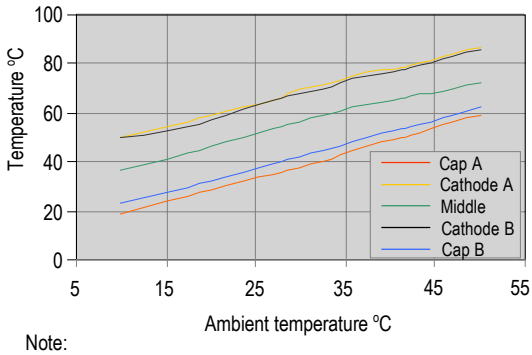
Lamp temperatures

The following chart shows the lamp temperatures at five locations : tube wall near the cathodes, tube wall at the middle of the tube and both caps. Cap temperature was measured according to IEC.

Test conditions:
- thermal chamber with ±2°C accuracy
- draught-free air
- commercial ballast

Ambient Temperature (°C)	Cap A (°C)	Cathode A (°C)	Middle (°C)	Cathode B (°C)	Cap B (°C)
10.0	18.5	50.3	36.4	49.8	23.4
15.0	24.0	54.5	40.7	52.8	27.5
20.0	28.4	59.0	46.2	57.5	32.3
27.0	35.0	65.5	53.5	65.0	39.0
29.7	37.7	69.2	56.3	67.6	41.6
32.4	40.6	71.7	58.8	69.9	44.4
34.5	43.0	73.5	60.8	72.1	46.6
37.5	46.2	76.5	63.3	74.8	49.7
40.2	49.0	78.0	65.2	77.0	52.3
42.2	51.1	79.8	66.7	78.9	54.5
46.9	55.9	83.6	70.0	82.7	59.2
50.1	59.3	86.3	72.4	85.5	62.6

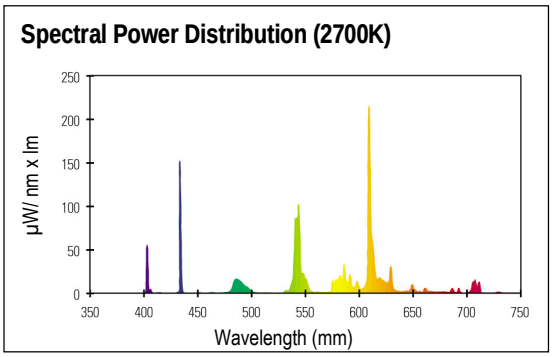
Spot temperatures

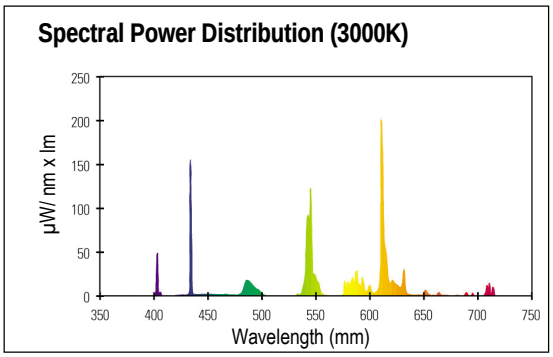


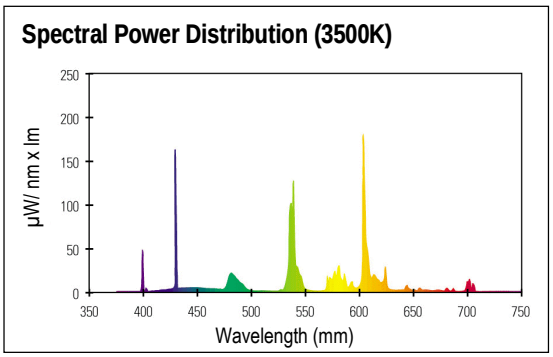
Note:
A - long mount (printed) side
B - short mount side
This test was performed on 28W lamp

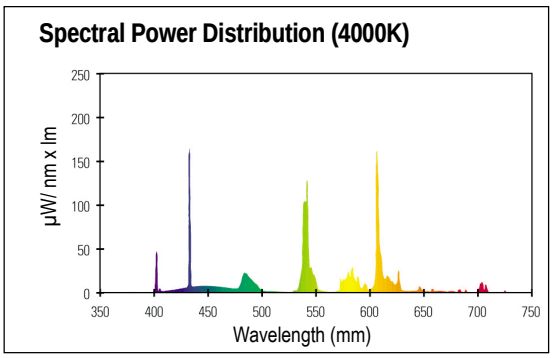
Spectral Power Distribution

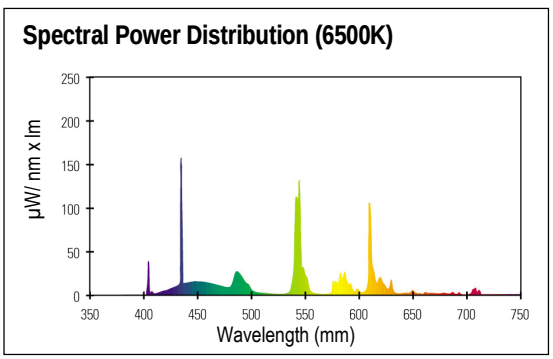
Spectral power distribution curves are given in the following diagrams.











Colour specification according to CIE 1931

CCT (K)	X	Y	CRI
2700	0.463	0.420	85
3000	0.440	0.403	85
3500	0.409	0.394	85
4000	0.380	0.380	85
6500	0.313	0.337	85

PREHEATING REQUIREMENTS

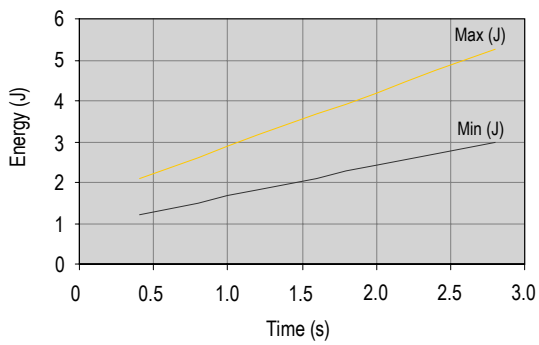
Suitable preheating of cathodes prior to ignition is essential for long lamp life. The preheating requirement can be given by the following formula:

$E = Q + P \cdot t$ E is the energy dissipated on a suitably chosen substitution resistor R_{sub}

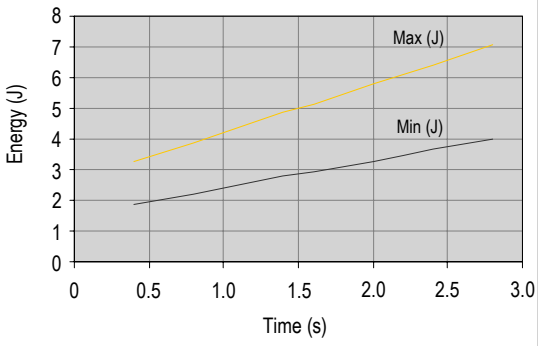
Q represents the necessary thermal energy to raise the cathode temperature. While P describes the heat loss of the cathode. During longer preheating the cathode loses more heat to its surrounding. Parameters for the current controlled and the voltage controlled modes, can be derived from the formula.

Lamp Type	Q (J)	P (W)	Rsub (Ω)
14W	0.9	0.75	30.0
21W	0.9	0.75	30.0
28W	0.9	0.75	30.0
35W	0.9	0.75	30.0
24W	1.5	0.9	8.0
39W	1.5	0.9	8.0
54W	2.2	1.0	4.8
49W	0.8	0.7	12.0
80W	2.2	1.0	4.5

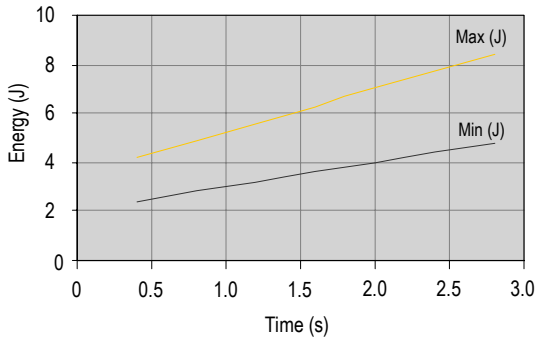
Preheat energy - 14W, 21W, 28W & 35W



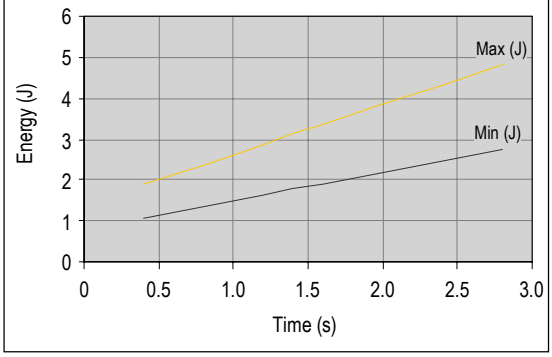
Preheat energy - 24W & 39W



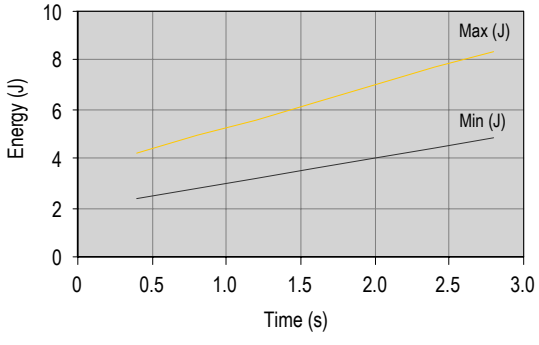
Preheat energy - 54W



Preheat energy - 49W



Preheat energy - 80W



220-240V 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.

Lamp Type	Manufacturers			
	Tridonic	Helvar	Vossloh	Atlas
1x14W	PC 1/14 T5 PRO	EL 1x14 HF T5	ELXc114.460	GM135 HE
	PC 1x35/28/21/14 T5			
2x14W		EL 2x14 HF T5	ELXc214.461	GM214 HE
3x14W		EL 3x14 HF T5		
4x14W		EL 4x14 HF T5		
1x21W	PC 1x35/28/21/14 T5	EL 1x21 HF T5	ELXc121.462	GM135 HE
2x21W		EL 2x21 HF T5	ELXc221.463	
1x28W	PCA 1/28 T5 EXCEL	EL 1x28 HF T5	ELXc128.464	GM135 HE
	PC 1x35/28/21/14 T5			
2x28W	PCA 2/28 T5 EXCEL	EL 2x28 HF T5	ELXc228.465	GM235 HE
1x35W	PC 1x35/28/21/14 T5	EL 1x35 HF T5	ELXc135.466	GM135 HE
2x35W		EL 2x35 HF T5	ELXc235.467	GM235 HE
1x24W	PC 1x24 T5 PRO			GM124 HO
2x24W				GM224 HO
1x39W	PC 1x39 T5 PRO			
2x39W			ELXc239.483	
1x54W	PC 1x54 T5 PRO			
2x54W				
1x49W	PC 1x49 T5 PRO	EL 1x49 HF T5		
2x49W				
1x80W				

Lamp Type	Manufacturers			
	Magnetek	Clalight	Philips	Osram
1x14W	BBT-114-135 W1	CLT/1UN1435/T5		
2x14W		CLT/2UN1428/T5	HF-P 214 TL5	
3x14W				
4x14W				
1x21W	BBT-114-135 W1	CLT/1UN1435/T5		
2x21W			HF-P 221 TL5	
1x28W	BBT-114-135 W1	CLT/1UN1435/T5	HF-P 128 TL5	QT-FH 1x28
2x28W				
1x35W	BBT-114-135 W1	CLT/1UN1435/T5		QT-FH 1x35
2x35W				
1x24W				
2x24W				QT-FQ 2x24
1x39W			HF-R 1x39 TL5	
2x39W			HF-P 2x39 TL5	QT-FQ 2x39
1x54W			HF-R 1x54 TL5	QT-FQ 1x54
2x54W			HF-P 2x54 TL5	
1x49W				
2x49W			HF-P 2x49 TL5	
1x80W				

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