GE
Lighting

2D™Watt-Miser™

DATA SHEET

Applications areas

Biax™ 2D™ compact fluorescent lamps have been available for many years but GE is introducing the next generation of lamps under the name of 2D™Watt-Miser™. These are available in 16, 21, 28 and 38 Watt in a wide choice of colour temperatures, these lamps are a direct replacement to existing 2D fixtures delivering the same life of 15,000 hours in case of 28 and 38 Watt but additional energy saving performance, 2D™Watt-Miser™ lamps give similar lumen as the lamps they are replacing but up to 12% energy saving dependent upon ballast and wattage.
Saving energy cost: 16W lamp runs on 14W*, 21W lamp runs on 19W*, 28W lamp runs on 24W* and 38W runs on 34W*

(*When used with electronic ballast)

Lamp technology

New 2D™Watt-Miser™ lamps are energy saving compact fluorescent tubes formed into a "2D" shape. All types are available with a 4pin cap which permits use with conventional or electronic (high frequency) control gear, dimming and emergency lighting circuits.
The 16-28W types are also available with 2pin cap which contains a starter switch and an EMC (RIS) capacitor.
All lamps use rare earth triphosphors to give high efficacy with good colour rendering properties.
In response to the demand from the market for a lower energy consumption GE has invented the extra energy saving 2D™Watt-Miser™.
These lamps are designed to retrofit, into existing fixtures, provide similar lamps performance but save energy at the same time.

Features

- 16-28W 2D™Watt-Miser™ lamp available in
  2 & 4-pin versions
  2-pin design with internal starter
  4-pin design optimised for high frequency operation and also suitable for emergency lighting
- 21-38W 2D™Watt-Miser™ lamp available only in 4-pin version
  Superior lumen maintenance – over 80% of the initial lumen output at 15000 hours (21W=12,000 hours)
- Excellent colour rendering – CRI Ra 82
- Compatible with existing ballasts and fittings

Application areas

- residential
- domestic
- hotels/motels/restaurants
- utility areas
- task lighting
- emergency lighting

The flat profile makes the 2D™ an ideal choice for building into slim, attractive luminaries. Its two dimensional shape is suitable for both up lighting and downlighting applications, where directional lighting is required. Due to its shallow, broad configuration, it spreads light over a large area without the need for expensive optics.

GE imagination at work

Specification summary

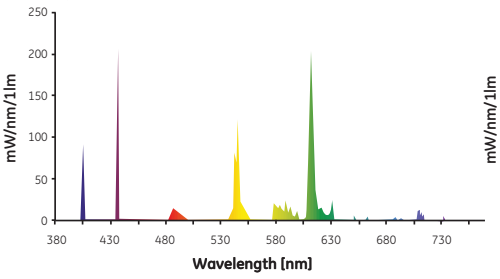
Ordering Information

Rated power [W]	Actual power* [W]	Product Desription	Volts [V]	I [mA]	Cap	Lumen [lm]	Colour temperature [K]	CRI [Ra]	Rated life [h]	Product Code
16	14	F162D/827 GE 20PK	98	195	GR-8	1100	2700	82	12000	**41744**
16	14	F162D/835 GE 20PK	98	195	GR-8	1100	3500	82	12000	**41745**
16	14	F162D/827/4P GE 20PK	80	195	GR-10q	1100	2700	82	12000	**41746**
16	14	F162D/835/4P GE 20PK	80	195	GR-10q	1100	3500	82	12000	**41747**
16	14	F162D/860 GE 20PK	98	195	GR-8	1100	6000	80	12000	**41749**
16	14	F16 2D/827/2P OEMN	98	195	GR-8	1100	2700	82	12000	**41751**
16	14	F16 2D/827/4P OEMN	80	195	GR-10q	1100	2700	82	12000	**41752**
16	14	F16 2D/835/2P OEMN	98	195	GR-8	1100	3500	82	12000	**41753**
16	14	F16 2D/835/4P OEMN	80	195	GR-10q	1100	3500	82	12000	**41754**
16	14	F16W2D/830/4P GE OEM102PK	80	195	GR-10q	1100	3000	82	12000	**41765**
16	14	F16 2D/830/2P GE OEM102PK	98	195	GR-8	1100	3000	82	12000	**45440**
21	19	F212D/827/4P GE 20PK	80	260	GR-10q	1385	2700	82	12000	**41794**
21	19	F212D/835/4P GE 20PK	80	260	GR-10q	1385	3500	82	12000	**41806**
21	19	F212D/860/4P GE 20PK	80	260	GR-10q	1385	6000	80	12000	**41808**
21	19	F212D/835/4P OEMN	80	260	GR-10q	1385	3500	82	12000	**41812**
28	24	F282DT5/827/4P OEM56PK WM	95	260	GR10q	2150	2700	82	15000	**10529**
28	24	F282DT5/835/4P OEM56PK WM	95	260	GR10q	2150	3500	82	15000	**10534**
28	26	F282DT5/827/2P BLISTER20PK WM	108	320	GR8	2150	2700	82	15000	**10546**
28	24	F282DT5/827/4P BLISTER20PK WM	95	260	GR10q	2150	2700	82	15000	**10547**
28	24	F282DT5/840/4P BLISTER20PK WM	95	260	GR10q	2150	4000	82	15000	**10548**
28	24	F282DT5/835/4P BLISTER20PK WM	95	260	GR10q	2150	3500	82	15000	**10567**
28	24	F282DT5/830/4P GE OEM56PK WM	95	260	GR10q	2150	3000	82	15000	**21526**
28	24	F282DT5/840/4P OEM32PK SLVLESS WM	95	260	GR10q	2150	4000	82	15000	**23055**
28	26	F28 2D T5/840/2P GE OEM56PK WM	108	320	GR8	2150	4000	82	15000	**45436**
38	34	F382DT5/827/4P OEM56PK WM	97	355	GR10q	3000	2700	82	15000	**10538**
38	34	F382DT5/835/4P OEM56PK WM	97	355	GR10q	3000	3500	82	15000	**10544**
38	34	F382DT5/827/4P BLISTER20PK WM	97	355	GR10q	3000	2700	82	15000	**10550**
38	34	F382DT5/835/4P BLISTER20PK WM	97	355	GR10q	3000	3500	82	15000	**10566**
38	34	F382DT5/840/4P OEM32PK SLVLESS WM	97	355	GR10q	3000	4000	82	15000	**23056**

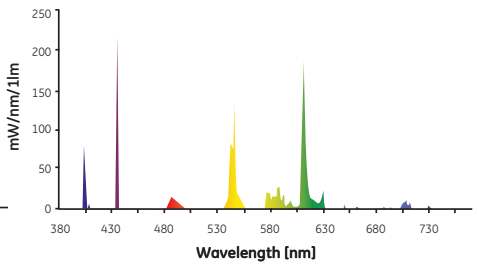
*** please see details page 4**

CCT (K)	x	y	CRI
2700	0.463	0.420	82
3000	0.440	0.402	82
3500	0.415	0.402	82
4000	0.380	0.377	82
6000	0.316	0.336	82

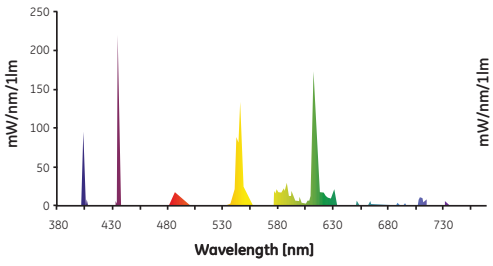
Spectral Power Distribution 2700K



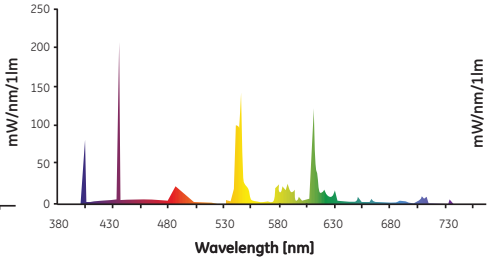
Spectral Power Distribution 3000K



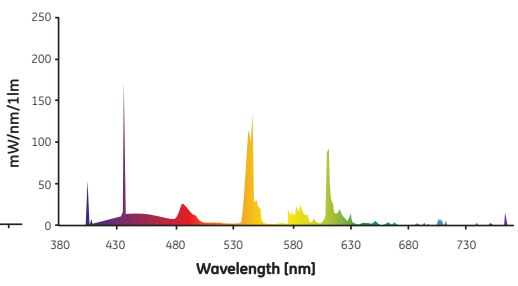
Spectral Power Distribution 3500K



Spectral Power Distribution 4000K



Spectral Power Distribution 6000K



Lamp dimension

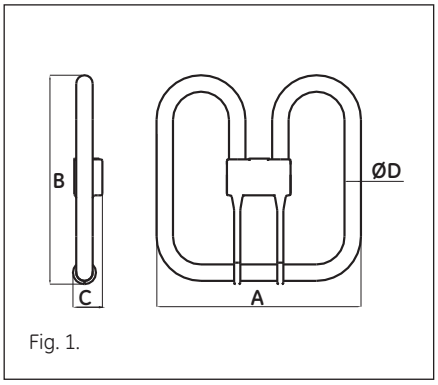
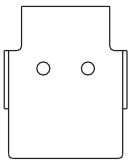


Fig. 1.

CAPS/Connection Caps:

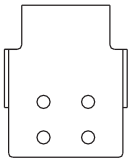
16-28W

2pin
GR-8



16-21-28-38W

4pin
GR-10q



Dimensions (mm)	A	B	C	D	Fig.no
16W	138	141	27.2	13	2
21W	138	141	27.2	13	2
28W	202	204	28.6	16	1
38W	202	204	28.6	16	1

General information	16W 2pin	16W 4pin	21W 4pin	28W 2pin	28W 4pin	38W 4pin
Nominal wattage (HF) [W]	14	14	19	26,6	24,1	34
Cap	GR-8	GR-10q	GR-10q	GR-8	GR-10q	GR-10q
Burning position					see pages-8	
Lifetime performance	**16W 2pin**	**16W 4pin**	**21W 4pin**	**28W 2pin**	**28W 4pin**	**38W 4pin**
Rated median life [h]	**12000**	**12000**	**12000**	**15000**	**15000**	**15000**
Average survival rate						
@ 5000 h	99%	99%	99%	99%	99%	99%
@ 10000 h	79%	79%	83%	92%	92%	92%
@ 15000 h	51%	51%	51%	51%	51%	51%
Average lumen maintenance						
@ 5000 h	85%	85%	82%	90%	90%	90%
@ 10000 h	75%	75%	75%	86%	86%	86%
@ 15000 h	70%	70%	68%	83%	83%	83%
Photometric data	**16W 2pin**	**16W 4pin**	**21W 4pin**	**28W 2pin**	**28W 4pin**	**38W 4pin**
Initial luminous flux [Lm]	**1100**	**1100**	**1250**	**2150**	**2150**	**3000**
Colour rendering index [Ra]	82	82	82	82	82	82
UV PET [h]	>2000	>2000	>2000	>2000	>2000	>2000
Run up time [s]	20	20	20	30	30	40
Operation with standard ballast	**16W 2pin**	**16W 4pin**	**21W 4pin**	**28W 2pin**	**28W 4pin**	**38W 4pin**
Lamp wattage [W]	**14,84**	**14,84**	**19.61**	**26,6**	**26,6**	**37,4**
Lamp current [mA]	210	210	270	320	320	430
Lamp voltage [V]	90	90	88	108	108	110
Recommended starter	–	GE 155/400	GE 155/500	–	GE 155/400	GE 155/400
Operation with electronic (HF) ballast	**16W 2pin**	**16W 4pin**	**21W 4pin**	**28W 2pin**	**28W 4pin**	**38W 4pin**
Lamp wattage [W]		14.05	18.76		**24,1**	**34**
Lamp current [mA]		180	240		260	355
Lamp voltage [V]		80	80		95	97
Max. current in any lead to cathodes [mA]		220	270		380	590
Operating current range [mA]		110...195	155...255		**215 – 350**	**340 – 550**
Dimming						
I_D [mA]		15...110	20...155		27 – 215	40 – 340
X [A2]		0.033	0.055		**0.13**	**0.32**
Y [A]		0.25	0.33		0.50	0.78
Min. ballast OCV @ 10°C [V]		550	550		550	550
Cathode resistance @ test current [Ohms]		13.5	6.5		17.5	9
Max. cathode voltage during preheat [V (rms)]		11	11		11	11
R_h/R_c cathode resistance ratio		4.25...6.5	4.25...6.5		4.25 – 6.5	4.25 – 6.5

Lamp life

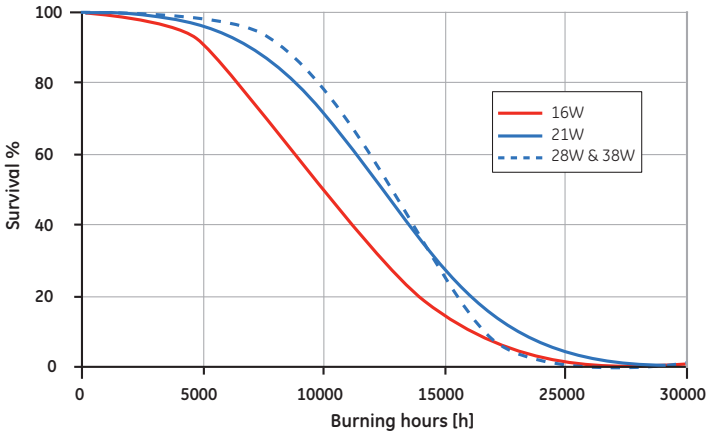
Cathodes of a fluorescent lamp lose their electronemisivity during life due to the evaporation of emission mixture. When the deterioration reaches a certain level, the cathode breaks. Typical lifetime characteristics are based on GE Lighting's measurements according to the relevant IEC standards. The 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.

Test conditions:

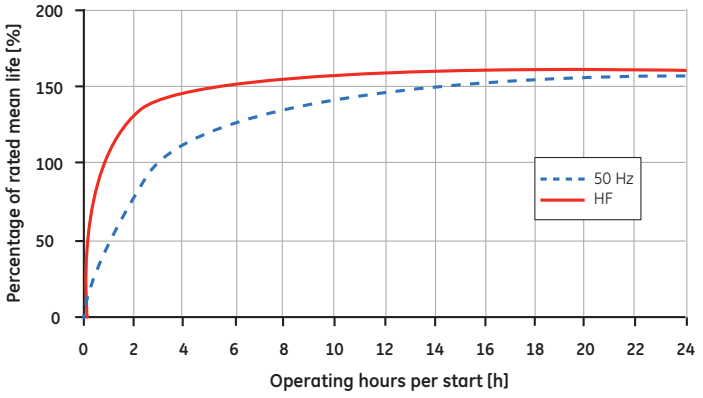
- Horizontal burning position
- Switching cycle: 165 minutes On – 15 minutes Off
- 50Hz line frequency operation
- 25°C ambient temperature

Presented median life of 2D™Watt-Miser™ lamps is tested on a standard switching cycle of 3 hours (2.75 hours on, 0.25 hours off). The impact on life of alternative switching cycles is shown in the graph "Life versus Frequency of Switching". For very frequent switching applications it is possible to minimise the adverse effect of short on periods with the use of a suitable electronic starter. For lamps with an integral starter switch (2pin), the switch is designed to give approximately 20,000 starts which may be of more relevance than rated lamp life in a frequently switched situation.
To achieve claimed life for high frequency operation a preheated start is recommended.

Lamp life 2D 16W, 21W, 28W, 38W



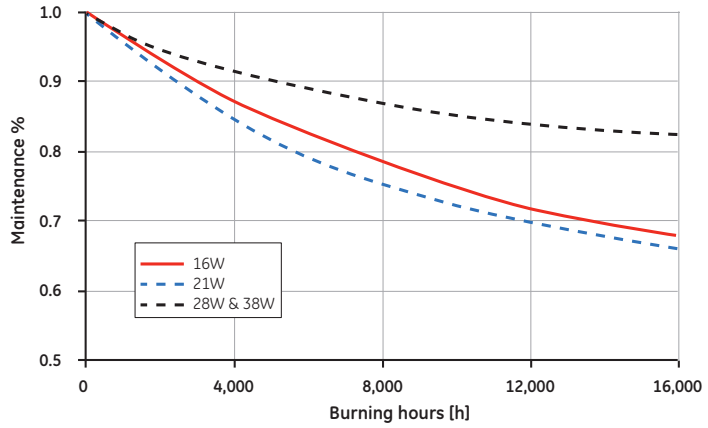
Life versus frequency of switching



Lumen maintenance

The lumen maintenance graph shows how the light output decreases throughout life. The main causes of the light depreciation are the deterioration of phosphor coating and end blackening due to the deposition of evaporated emission mixture on the glass tube. These effects are normal and unavoidable. The lumen maintenance curve given below for 2D™Watt-Miser™ lamps is based on lumen readings under laboratory conditions.

Lumen Maintenance



Test conditions:

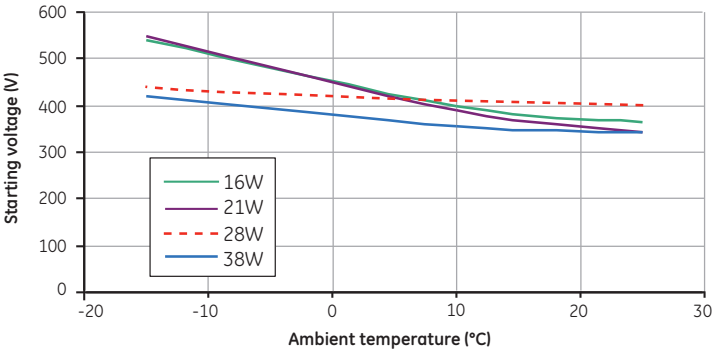
- Photometric sphere
- Horizontal burning position
- Switching cycle: 165 minutes On – 15 minutes Off
- 50Hz line frequency operation
- 25°C ambient temperature

	16W 2pin, 16W 4pin	21W 4pin	28W 2pin, 28W 4pin	38W 4pin
Average lumen maintenance				
@ 5000 h	85%	82%	90%	90%
@ 10000 h	75%	72%	86%	86%
@ 12000 h	70%	68%		
@ 15000 h			83%	83%

Lamp starting

The graph Starting Voltage Vs Ambient Temperature shows electronic ballast open circuit voltage required for starting as a function of ambient air temperature. Data is based on measurements carried out by GE Lighting under controlled test conditions. Actual lamp starting voltage figures depend on the overall characteristics of electronic ballast. Appropriate preheating of cathodes is necessary in order to achieve low starting voltage and long lamp life.

Starting voltage vs. ambient temperature



Test conditions:

- Horizontal lamp position
- Thermal chamber providing ±2°C accuracy
- 2s current controlled preheat
- Sufficient preheat current
- Voltage ramp-up until ignition

Ambient temperature	Starting voltage Veff			
[°C]	16W	21W	28W	38W
-15	540	550	440	420
+10	400	390	410	355
+25	365	345	400	345

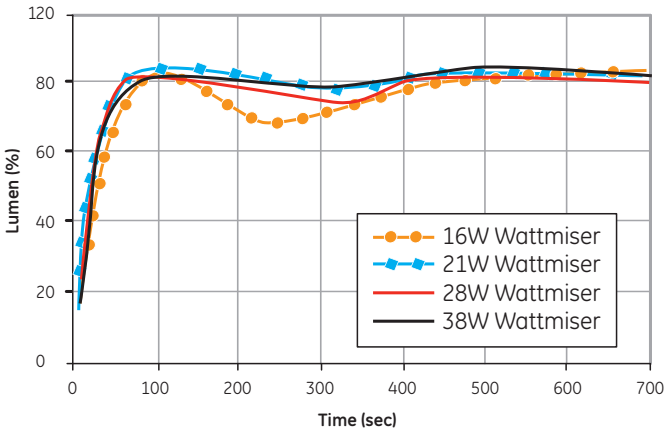
Minimum Starting Temperature

Lamp starting at low ambient temperatures can be successfully achieved, however light output during initial warm-up will be considerably reduced, but will gradually increase as lamp temperature rises. Use of an electronic starter or electronic ballast is recommended for lower ambient temperature applications. Satisfactory starting at lower ambient temperatures requires a close proximity earth (ground) plate.
Use of an electromagnetic ballast and glow starter is not recommended for applications below -10°C

Run-Up Time

When a fluorescent tube is switched on light output rises during the first few minutes until the optimum temperature is reached, but then falls if the temperature continues to rise.

Run-up time



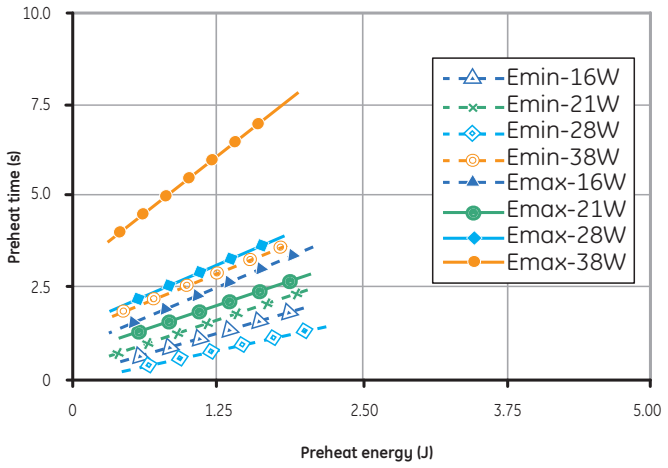
Preheating requirements

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
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.

Preheat energy vs time



	Minimum energy			Maximum energy		
Description	Q	P	Rsub	Q	P	Rsub
16W	0.57	0.64	42.0	1.14	1.28	56.0
21W	0.40	0.58	18.0	0.80	1.16	27.0
28W	0.70	1.10	11.5	1.40	2.20	17.5
38W	1.50	1.21	6.5	3.00	2.42	8.5

Influence of ambient temperature

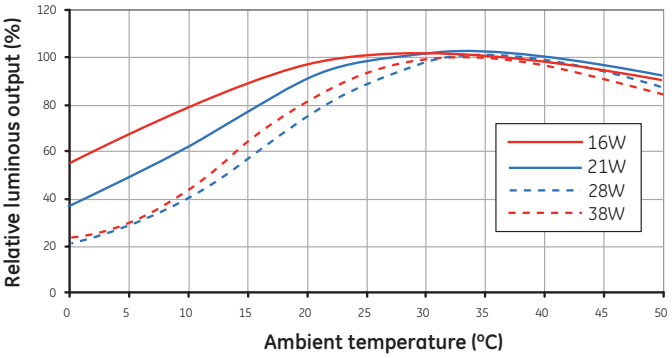
Lamp performance

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 lamp. The burning position, air flow, and radiated heat have an effect on these conditions. The curve shows the relative luminous output as function of the ambient temperature in horizontal burning positions. Tests were performed in draught-free air under thermally controlled conditions.

Test conditions:

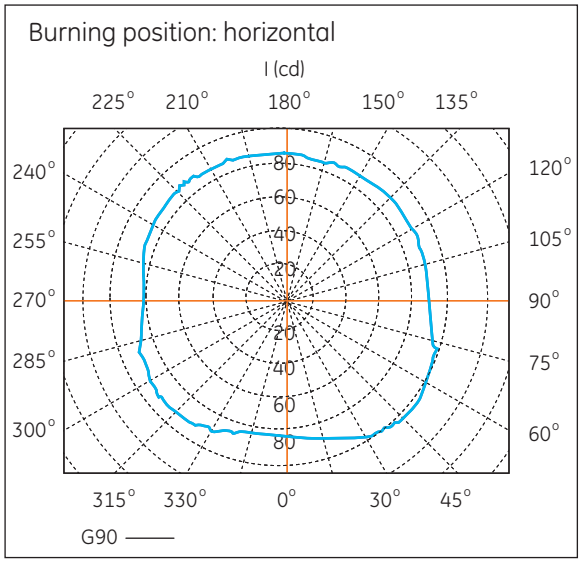
- Thermal chamber with ±2°C accuracy
- Draught-free air

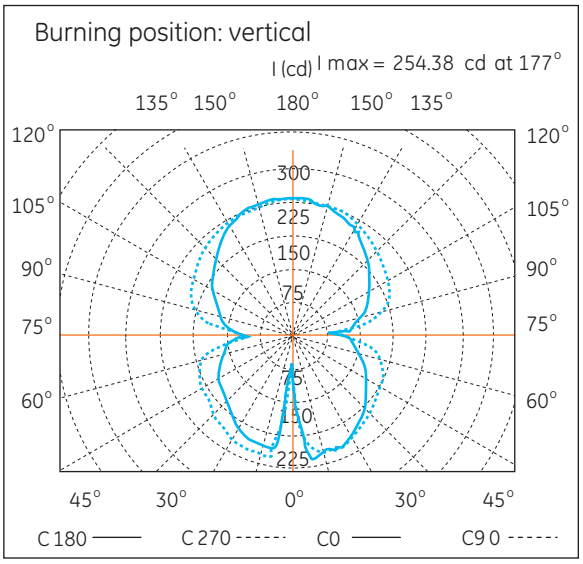
Luminous flux vs. ambient temperature



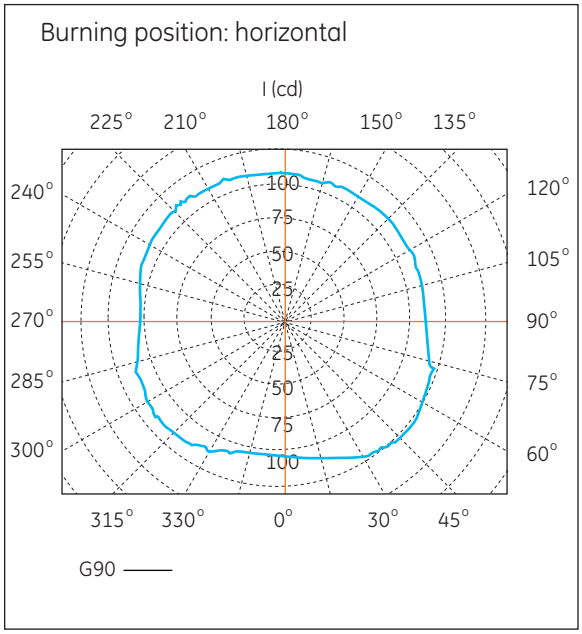
Luminous intensity distribution

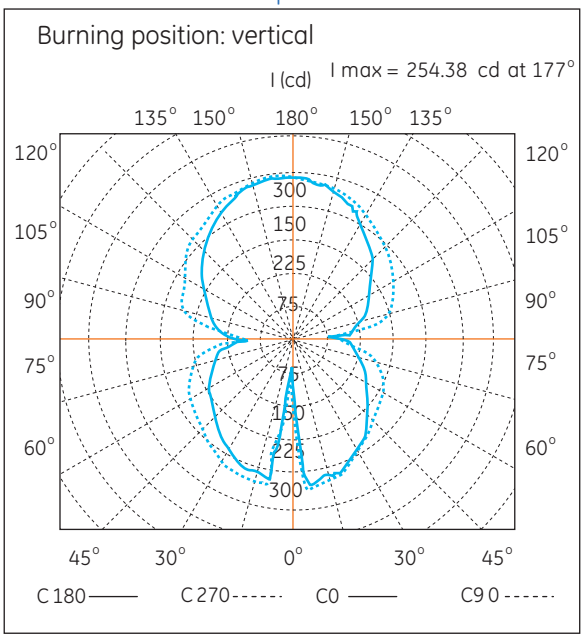
The following diagrams show the polar light intensity distribution of the 2D™Watt-Miser™ 28-38W lamp.





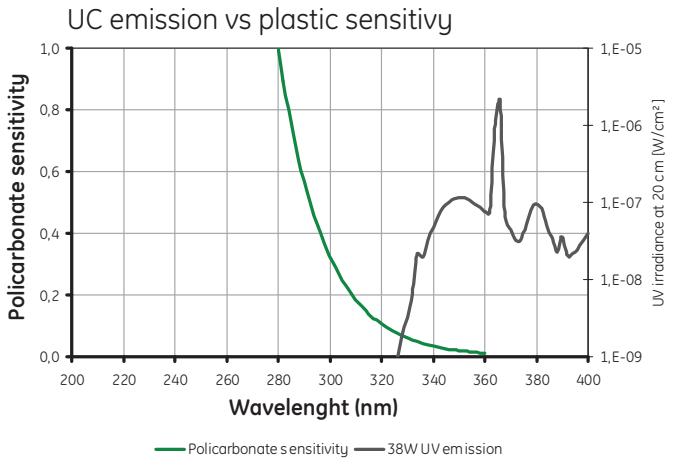
The following diagrams show the polar light intensity distribution of the 2D™Watt-Miser™ 38W lamps.





Tha shape of polar light intensity distribution of the other 2D™Watt-Miser™ lamps follow the above examples due to the similar lamp shape

Ultraviolet spectral distribution graph



The UV output of 2D™Watt-Miser™ lamps is minimised by using special glass for the body tube. This glass able to cut totally UV C and almost totally UV B so that specially suitable for any application where Polycarbonate fittings are applied. Since Polycarbonate material has some sensitivity in the UV A range, some discoloration can be seen after a long time period. (15 000-20 000 hours).

Ballast compability

Control Gear - Mains Frequency (standard gear)

Watt	Volt	Manufacturer	Catagogue Code
16	230	Tridonic. Atco	EC16 B27 230/50
16	230	Helvar	L16D/230
16	230	Helvar	L16DL/230
16	230	ERC	MEC92 16W
16	230	ERC	MEC75/NANO 16W
16	240	Tridonic. Atco	EC16 B27 240/50
16	240	Helvar	L16D/240
16	240	Helvar	L16DL/240
16	240	Vossloh-Schwabe	L16113
16	240	ERC	MEC92 16W
16	240	ERC	MEC75/NANO 16W
21	230	Helvar	L21TL-100
21	230	Vossloh-Schwabe	L21.314
21	230	Tridonic. Atco	EC21 B501K 230/50
21	240	Tridonic. Atco	EC21 B502K 230/50
28	230	ERC	MEC04-LB/28W
28	230	Helvar	L18TL2
28	230	Helvar	L18TLB2
28	230	Tridonic. Atco	EC18B501K
28	230	Tridonic. Atco	EC18LC501K
28	230	Vossloh-Schwabe	LN18.708
28	240	ERC	MECO4-LB/28W
28	240	Helvar	L18TL2
28	240	Helvar	L18TLB2
28	240	Tridonic. Atco	EC18B502K
28	240	Tridonic. Atco	EC18LC502K
28	240	Vossloh-Schwabe	LN18.507
38	230	ERC	MEC04-LB/36-40W
38	230	Helvar	L36TL2
38	230	Helvar	L36TLB2
38	230	Tridonic. Atco	EC36B501K
38	230	Tridonic. Atco	EC36TLB501K
38	230	Vossloh-Schwabe	LN36.511
38	240	ERC	MEC04-LB/36-40W
38	240	Helvar	L36TL2
38	240	Helvar	L36TLB2
38	240	Tridonic. Atco	EC36B502K
38	240	Tridonic. Atco	EC36TLB502K
38	240	Vossloh-Schwabe	LN36.505

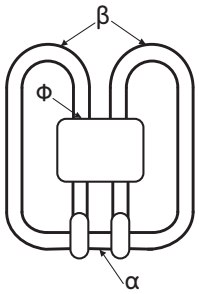
Control Gear - High Frequency (electronic gear)

Watt	Manufacturer	Catalogue Code	Dimmable	Emergency	Comment
16	TRIDONIC	PC 1/10/13 TCD PRO	x		
16	TRIDONIC	PC 1x5-16W BASIC			
16	TRIDONIC	PCA 1/18 ECO			
21	TRIDONIC	PC PRO 18 FSQ b101			
21	OSRAM	QT-ECO x1x18-24/220-240L			High TDH%, low power factor ballast
21	HELVAR	EL 1/2x18-42TC		x	
28	HÜCO	BL-HP 1x28W TC-DD HC DIM	x		
28	HÜCO	BL 1x28W TC-DD HMC			High TDH%, low power factor ballast
28	VOSSLOH	ELXc 128.869			
28	OSRAM	QUICKTRONIC QT-M1x26-42			
28	TRIDONIC	PC 1x28DD PRO			
28	TRIDONIC	PC 1x28-33 HO DD COMBO		x	
28	HELVAR	EL 162x18-42TC			
38	HÜCO	BL-HP1x38W TC-DD HC DIM	x		
38	HÜCO	BL-HP 1x38W TC-DD HC			
38	TRIDONIC	PC 1x38W DD PRO			
38	TRIDONIC	PC 1x38-34 DD COMBO		x	
38	OSRAM	QUICKTRONIC QT-M 1x26-42			
38	VOSSLOH	ELXc 142.835			
38	ERC	Mectronic SQU			

Operating notes

2 pin 2D™Watt-Miser™ lamps are unsuitable for use in dimming circuits or from an electronic ballast and should not be used for these applications. The 4pin 2D™Watt-Miser™ lamps can be operated from electronic control gear and dimmed using appropriate control gear. The 2D™Watt-Miser™ lamps can be operated in any position except where leg "a" is higher than bends b in case of 38W types. This limitation is necessary to ensure that region Ø of cap is kept as cool as possible.

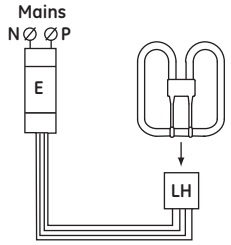
Operating position



Circuit diagrams

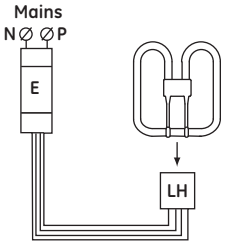
2-pin, electromagnetic ballast (single lamp)

LH= Lamp Holder
E = Electronic Gear



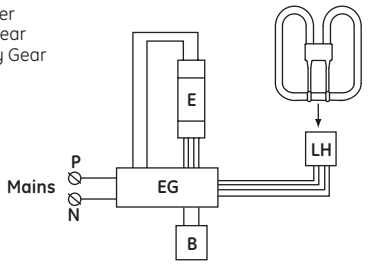
4-pin, electronic ballast (single lamp)

LH= Lamp Holder
E = Electronic Gear



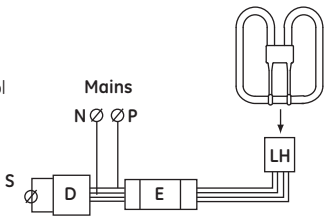
4-pin, automatically switched emergency lighting

LH= Lamp Holder
E = Electronic Gear
EG= Emergency Gear
B= Battery



4-pin, electronic dimming ballast

LH= Lamp Holder
E = Electronic Gear
D= Dimmer
S= Sensor or control



Additional notes

All 2D™Watt-Miser™ lamps have a long tip-off tube which acts as a cool spot into which the liquid mercury reservoir (required by all fluorescent lamps) migrates during early lamp operation. In relation to circuit or fittings design or ballast evaluation, tests should be conducted with lamps aged to a minimum of 500 hours with care being taken to keep the mercury in this "cool spot". In practice this means either the lamp should be left undisturbed in the ageing position or if the lamp is moved avoid mechanical shock. The 2D "loops" should be kept above the straight lamp region (90° bends). This procedure is recommended to ensure that liquid mercury is fully retained in the cool spot tip-off tube.

4 pin lamps can be operated directly from 220/250V 50/60Hz mains supplies using an electromagnetic ballast and external glow or electronic starter. Recommended GE glow starters are 155/500 and 155/400. 2D™Watt-Miser™ 16, 21, 28 and 38W lamps operate flicker-free only with GE 155/400 starters. For supply voltages above or below the range 220/250V, a transformer or other suitable means of adjusting the supply voltage is necessary. Operation from an electronic ballast maximises lamp photometric and survival performance.

2D™Watt-Miser™ lamps are standardised internationally through the International Electrotechnical Commission (IEC). For lamp performance the relevant data sheets in IEC 60901 (EN 60901) apply and for lamp safety the relevant clauses in IEC 61199 apply. Watt-Miser™, Biax™ and 2D™ are registered protected trademarks. Unapproved use of trademarks are illegal.

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