GE
Lighting

WORLDWIDE PARTNER

DATA SHEET

ConstantColor™ CMH Open Rated

Tubular and Elliptical
Ceramic Metal Halide Lamps
70W and 150W

Product information

ConstantColor™ CMH lamps combine the HPS technology (providing stability, efficiency & uniformity) and the Metal Halide Technology (providing bright white quality light) to produce highly efficient light sources with good colour rendering and consistent colour performance through life. This is achieved by using the ceramic arc tube material from the Lucalox™ lamp, which minimises the chemical changes inside the lamp through life. When combined with the halide doses used in Arcstream™ Metal Halide lamps then the quality and stability of the dose maintains the colour consistency. Hence the name ConstantColor™ CMH. Metal halide lamps, traditionally made with quartz arc tubes, are prone to colour shift through life and lamp-to-lamp colour variation. Some of the dose, e.g. sodium, (an important component of metal halide lamps), can migrate through quartz to cause colour shift and loss of light through life. The ceramic arc tube resists this material loss, can be manufactured to tighter tolerances and withstands a higher temperature to provide a more constant colour.
The Open Rated lamps have a transparent shroud around the arc tube to dissipate the internal rupture energy in case the arc tube shatters due to any reason. Therefore, no front glass is needed. In case of a fixture without a front glass there is no need for the expensive cleaning to maintain the high illumination level.

Application areas

- Commercial areas /city beautification / architectural
- Street and Pedestrian
- Retail

Features

- Easy retrofit for High Pressure Sodium lamps
- No front glass required
- No ballast thermal protection required
- Excellent colour rendition (CRI: 80+ for 3000K; 90+ for 4200K products)
- Consistent colour over life
- Colour uniformity lamp to lamp
- 15,000 hour life
- Up to 24% higher efficacy than Quartz Metal Halide
- UV control

Tubular format

Conventional lamp shapes with a screw-type base enables existing luminaire designs to use ConstantColor™ CMH lamps with little or no modification to the optical system.

Elliptical format

Conventional lamp shape with a screw-type base enables existing luminaire designs to use ConstantColor™ CMH lamps with little or no modification to the optical system. Coated and clear versions enable close matching to the lamp types previously used.

GE imagination at work

Specification summary[1]

Description	Product Code	Wattage [W]	Colour	Format
CMH150/UVC/O/T/U/830/E40	21516	150	3000K	Tubular
CMH150/UVC/O/T/U/942/E40	21517	150	4200K	Tubular
CMH70/E/UVC/O/U/940/E27/D	43282	70	4000K	Elliptical
CMH150/E/UVC/O/U/942/E27/C	43285	150	4200K	Elliptical
CMH150/E/UVC/O/U/940/E27/D	43286	150	4000K	Elliptical

General	Units	150W 3000K Tubular	150W 4200K Tubular	70W 4000K Elliptical	150W 4200K Elliptical	150W 4000K Elliptical
Product Code		21516	21517	43282	43285	43286
Nominal Wattage	[W]	150	150	70	150	150
Rated Wattage	[W]	146	149	76	148	150
Weighted Energy Consumption	[kWh/1000 hrs]	161.06	163.36	83.98	163.27	164.63
Bulb Material		Heat Resistant/ Hard Glass	Heat Resistant/ Hard Glass	Heat Resistant/ Hard Glass	Heat Resistant/ Hard Glass	Heat Resistant/ Hard Glass
Bulb Finish		Clear	Clear	Diffuse coated	Clear	Diffuse coated
Arc Gap	[mm]	10.9	10	5	10	10
Bulb Designation		T15	T15	ED17	ED17	ED17
Base		E40	E40	E27	E27	E27
Mercury Content	[mg]	10.4	9.0	7.4	9.0	9.0
Ambient Temperature	[°C]	25	25	25	25	25
Operating Conditions						
Burning Position		Universal				
Luminaire Characteristics		Open (without front glass)				

Electrical Characteristics	Units	150W 3000K Tubular		150W 4200K Tubular		70W Elliptical		150W Elliptical	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Lamp Power (Rated)	[W]	150	149	145	145	78	78	155	152
Lamp Voltage	[V]	107	100	90	90	110	101	106	100
Lamp Volts min.	[V]	115	115	85	85	123	114	111	105
Lamp Volts max.	[V]	85	85	115	115	89	80	91	85
Typical Voltage Change with Burning Position – Vertical to Horizontal	[V]	7		12		9		6	
Lamp Current	[A]	1.72	1.78	16	16	0.86	0.94	1.74	1.8
Max. Ignition Voltage	[kV]	5		5		5		5	
Min. Ignition Voltage[2]	[kV]	2.7		2.7		2.7		2.7	
Ballast Required		HPS or MH compatible				HPS with MH ignitor		HPS Compatible	
Ballast Impedance at 230V	[V/A]	106		106		203		106	
Power Factor Correction Capacitor	[µF]	20		20		10-12		20	

[1] The specification contains typical performance data for operation on 50Hz mains sinewave supply at rated power. Actual values may depend on ballast and application. The lamp voltage inside the luminaire should not deviate by more than 5V from the bare lamp voltage in free air. Tubular lamps are optimized for horizontal operation and in vertical orientation the best performance is achieved with electronic ballast.
[2] Minimum voltage should be such that lamp starts reliably. Usually 3kV pulse.

Photometric Characteristics	Units	150W 3000K Tubular		150W 4200K Tubular		70W Elliptical Coated		150W Elliptical Coated		150W Elliptical Clear	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Product Code		21516		21517		43282		43286		43285	
100 hour Initial Lumens	[lm]	14,500	14,000	13,200	12,800	5,850	5,900	12,300	12,300	13,200	13,200
Rated Lumen	[lm]	–	14,260	–	12,970	–	5,650	–	10,780	–	12,700
Correlated Colour Temperature	[K]	2,900	3,000	3,800	4,200	3,700	3,750	3,750	4,050	3,850	4,150
Chromaticity X		0.444	0.436	0.383	0.371	0.389	0.390	0.387	0.378	0.384	0.373
Chromaticity Y		0.406	0.402	0.364	0.386	0.380	0.380	0.37	0.375	0.37	0.371
Colour Rendering Index	[Ra]	83	82	95	95	95	95	95	94	95	94
Luminous Efficacy	[lm/W]	97	95	86.4	86.1	75	75.5	79	81	85	87
Rated Lamp Efficacy	[lm/W]	–	97	–	87	–	74	–	72	–	86
Energy Efficiency Class	[EEC]	A+	A+	A	A	A	A	A	A	A	A

Specification summary

Starting Characteristics		
Time to Start (at 25°C)	[s]	< 10
Time to Start – Cold Box Test at -30°C	[s]	< 30
Warm-up Time (for 90% lumens)	[min]	3
Pulse Peak Voltage – Min.	[kV]	2.7
Pulse Peak Voltage – Max.	[kV]	5
Pulse Width @ 90% of Min Pulse Peak Voltage	[µs]	2
Pulse Reptition Rate @ 60 - 900 or 240 -2700		Min. 1 above specified pulse in each half period
Hot restart time	[min]	15

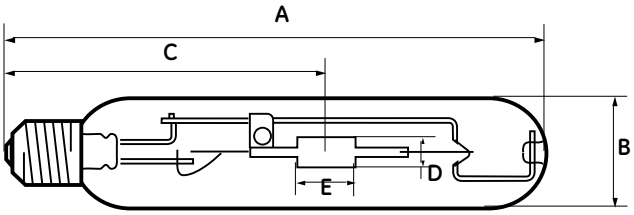
Through Life Performance[2]		150W 3000K Tubular		150W 4200K Tubular		70W Elliptical Coated	150W Elliptical Coated	150W Elliptical Clear
		Horizontal	Vertical	Horizontal	Vertical			
Lumen Maintenance at 40% Rated Life (mean lumens)	[lm]	11,600	11,200	10,560	10,240	4,425	9,200	9,900
Average Rated Life	[h]	15,000	15,000	15,000	15,000	15,000	15,000	15,000

[2] Tubular life data measured in Horizontal position. Elliptical life data measured in Vertical base up position.

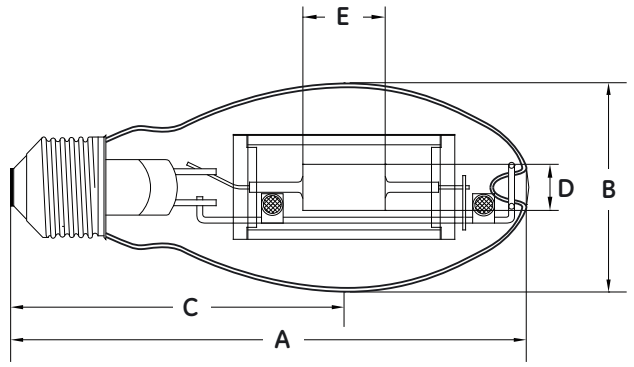
Safety Requirements		
Maximum Allowed Bulb Temperature Under Abnormal Conditions[3]	[°C]	310 (based on IEC)
Maximum Base Temperature[3]	[°C]	210 (based on IEC)

[3] For a bare lamp running at 1.25 x normal operating power to simulate the most unfavourable conditions of high line voltage and low ballast impedance in a fixture environment.

Dimensions



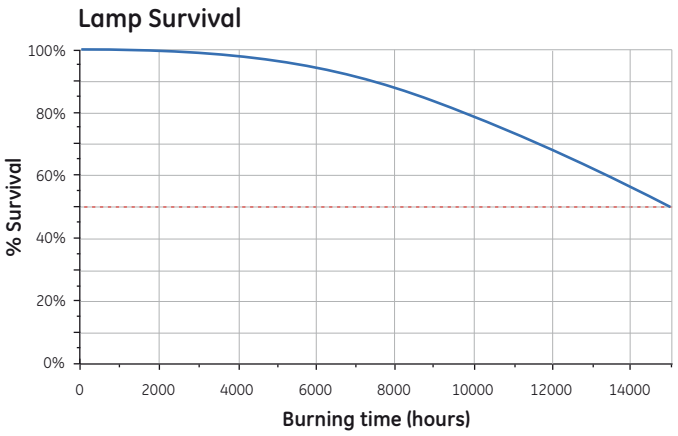
Dimensions		
A	[mm]	207
B	[mm]	48
C	[mm]	132
D – burner height	[mm]	12.0
E – burner width	[mm]	21.2



Dimensions		70W	150W
A	[mm]	133+/-4 (144 max.)	133+/-4 (144 max.)
B	[mm]	55 (57 max.)	55 (57 max.)
C	[mm]	86	86
D – burner height	[mm]	8.8	12
E – burner width	[mm]	13.8	21.2

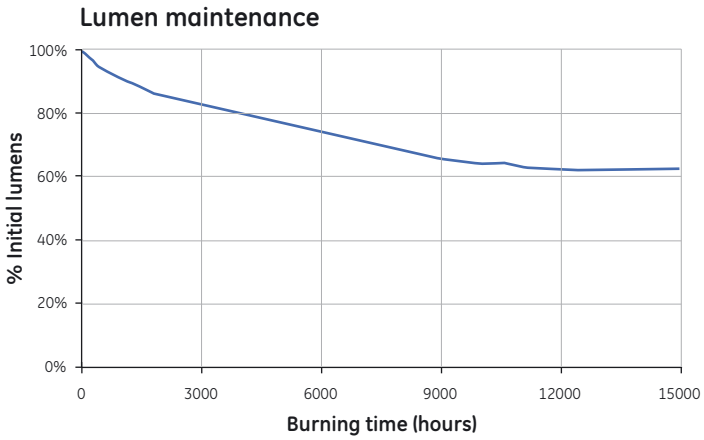
Lamp life

Life survival graphs are shown for statistically representative batches of lamps operated under controlled nominal conditions with an 11 hours per start switching cycle. The declared lamp life is the median life, which is when 50% of the lamps from a large sample batch would have failed. Lamp life in service will be affected by a number of parameters, such as supply voltage variation, switching cycle, operating position, mechanical vibration, luminaire design and control gear. The information is intended to be a practical guide for comparison with other lamp types. The determination of lamp replacement schedules will depend upon the acceptable reduction in illuminance and the relative costs of spot and group replacement.



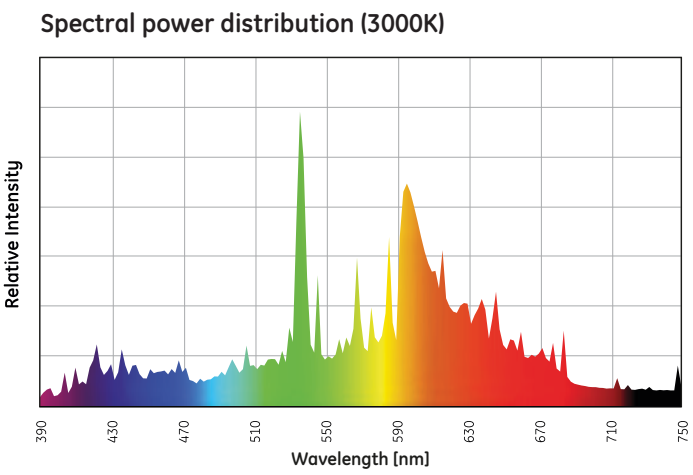
Lumen maintenance

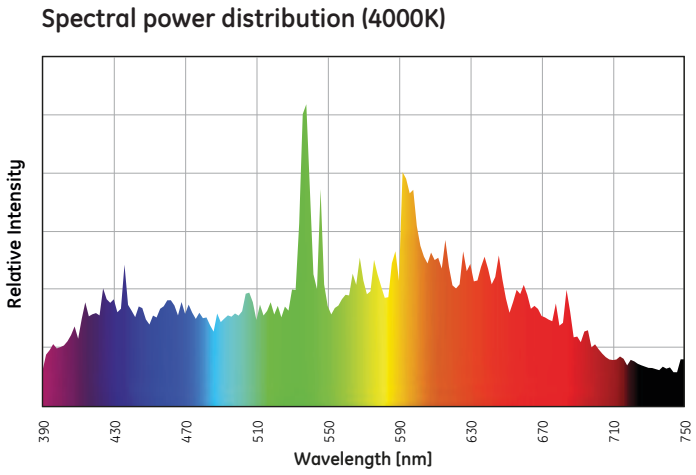
The lumen maintenance graph shows light output performance through life for statistically representative batches of lamps operated under controlled conditions with an 11 hours per start switching cycle. A common characteristic for all metal halide lamps is a reduction in light output and a slight increase in power consumption through life. Consequently there is an economic life at which lamp efficacy falls to a level when lamps should be replaced to restore design illumination levels. In areas where multiple of lamps are installed, consideration should be given to a group lamp replacement programme to maintain uniform illumination levels. Curves represent operating conditions for an 11 hours per start switching cycle, but less frequent switching will improve lumen maintenance.



Spectral power distribution

Spectral power distribution curves are given in the following diagrams.

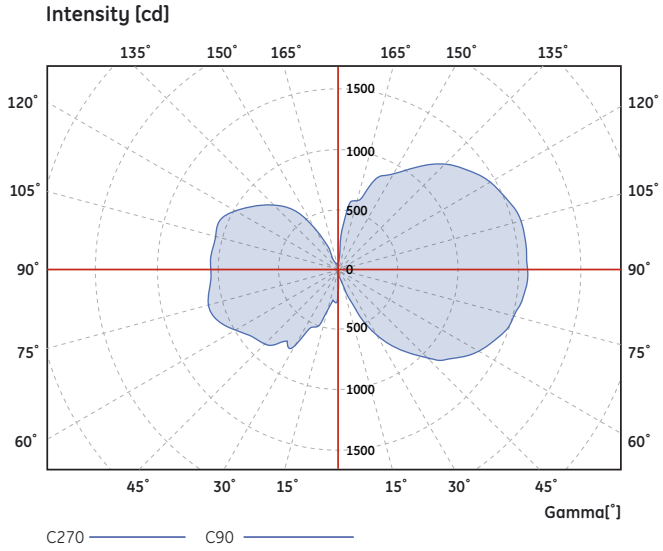




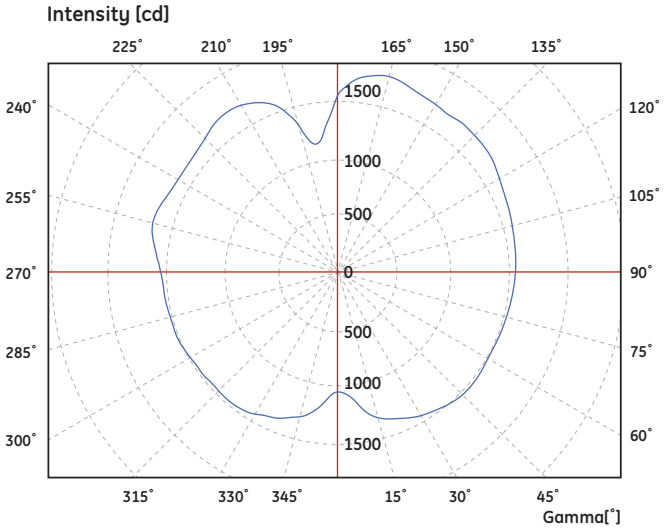
Distribution of luminous intensity

The following diagrams show typical polar light intensity curves of the lamp

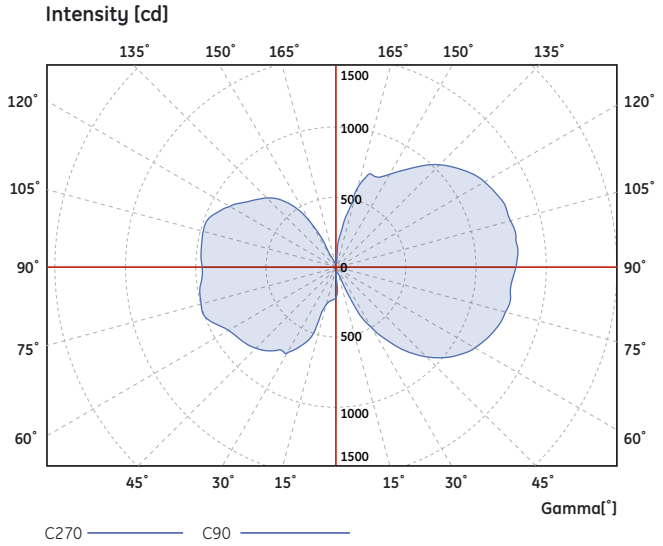
Vertical plane polar intensity curve – 150W Tubular 3000K



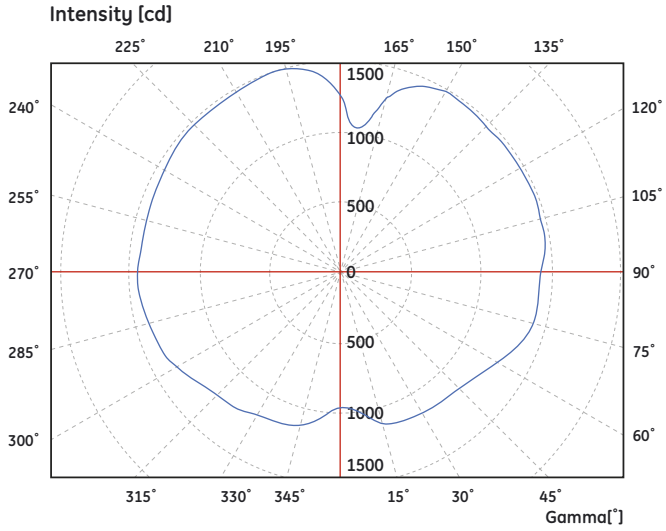
Horizontal plane polar intensity curve – 150W Tubular 3000K



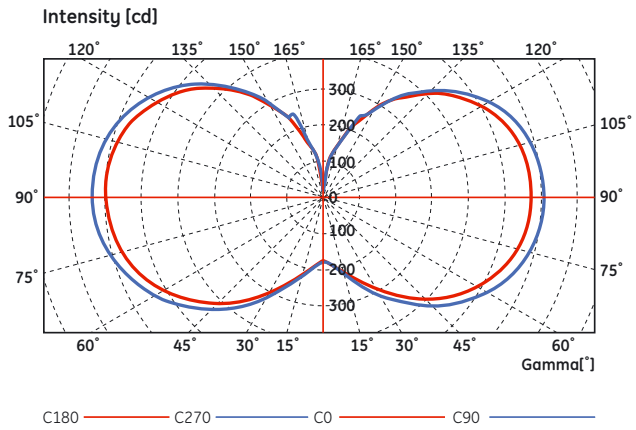
Vertical plane polar intensity curve – 150W Tubular 4200K



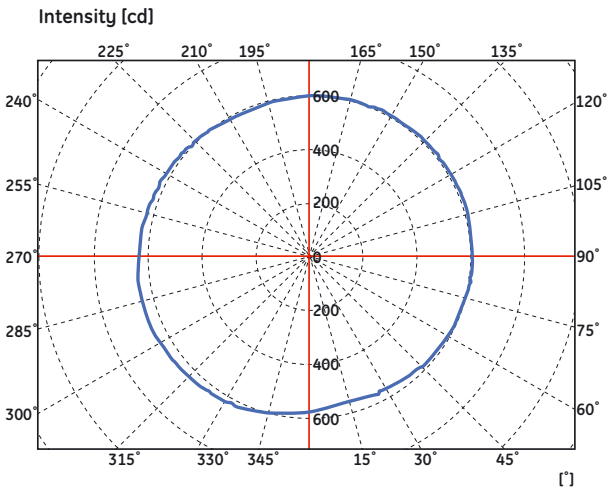
Horizontal plane polar intensity curve – 150W Tubular 4200K



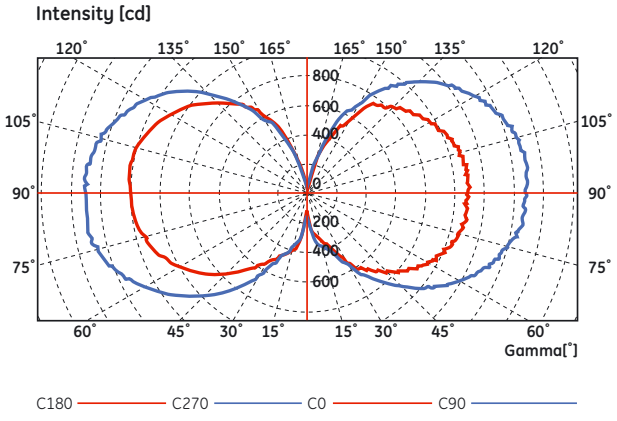
Vertical plane polar intensity curve - 70W/D Elliptical



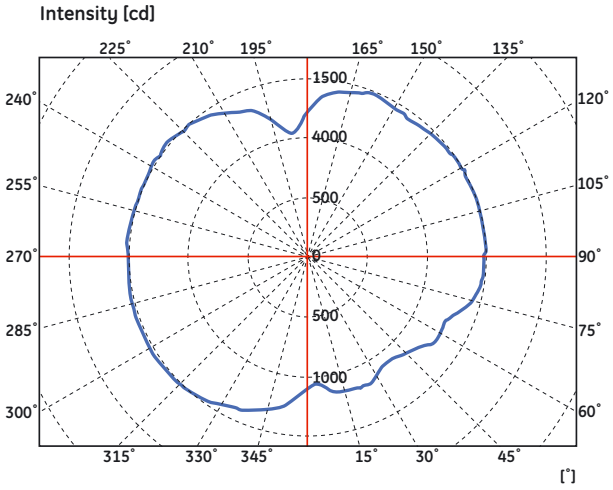
Horizontal plane polar intensity curve – 70W/D Elliptical



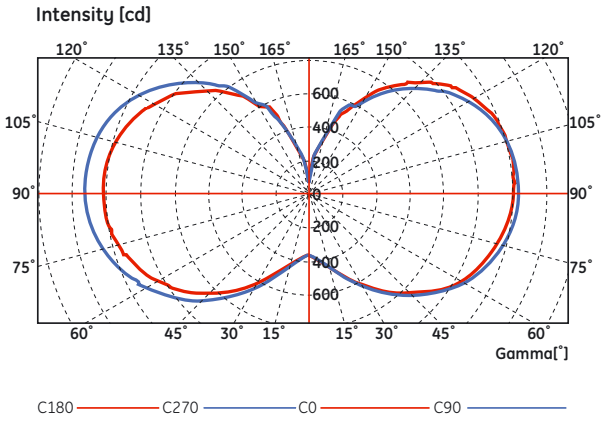
Vertical plane polar intensity curve – 150W/C Elliptical



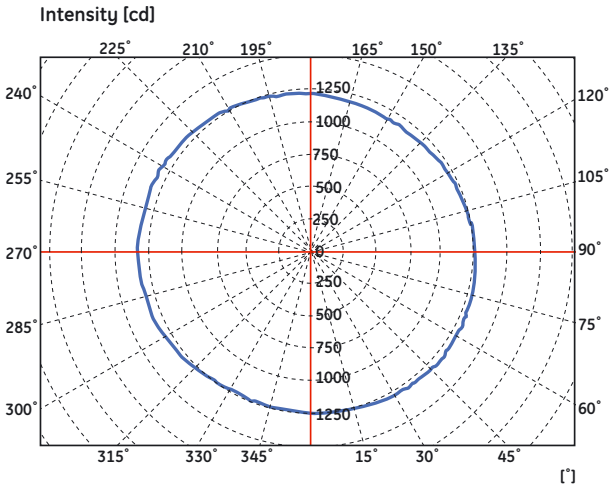
Horizontal plane polar intensity curve – 150W/C Elliptical



Vertical plane polar intensity curve – 150W/D Elliptical



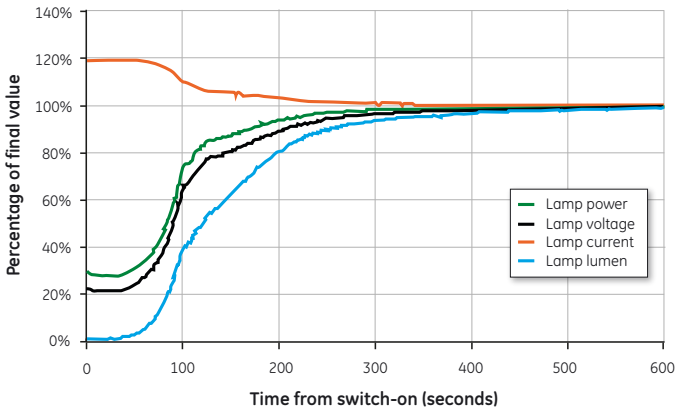
Horizontal plane polar intensity curve – 150W/D Elliptical



Warm-up characteristics

During the warm-up period immediately after starting, lamp temperature increases, rapidly evaporating mercury and metal halide dose in the arc-tube. Lamp electrical characteristics and light output stabilise in less than 4 minutes. During this period light output increases from zero to full output and colour approaches the final visual effect as each metallic element becomes vaporised.

Typical warm-up characteristics



Supply voltage sensitivity

The line supply voltage applied to the control gear should be as close to rated nominal as possible. Lamps will start and operate at 10% below rated supply voltage but this should not be considered as a normal operating condition. In order to maximise lamp survival, lumen maintenance and colour uniformity, supply voltage and rated ballast voltage should be within ±3%. Supply variations of ±5% are permissible for short periods only. Where supply voltage variation is likely to occur the use of electronic control gear should be considered as this type of equipment is normally designed to function correctly for a voltage range of 200-240V.

Dimming

In certain cases, dimming may be acceptable, subject to further testing. Contact your local GE representative for more information. Large changes in lamp power alter the thermal characteristics of the lamp resulting in lamp colour shift and possible reduction in lamp survival.

Flicker

With conventional ballasts there will be a line frequency (50 Hz) flicker from ConstantColor™ CMH lamps as with all other discharge lamps. For example a 150W single-ended lamp has a flicker value of approximately < 0.5 %. Normally this is not of concern, but, where visual comfort and performance is critical, the use of electronic control gear should be considered.

End of life conditions

The principal end of life failure mechanism for CMH lamps is arc tube leakage into the outer jacket. At the high operating temperatures inside the arc tube, the corrosive dose material can eventually cause leakage after a long period of time. Arc tube leakage into the outer jacket can be noticed by a sudden significant lumen drop and a perceptible color change (the color usually turns green). IEC 60662 and IEC 62035 warn that there is a risk that at the end of lamp life a number of lamps may exhibit a rectifying effect. Thermally protected ballasts or ballasts resistant to rectification are recommended by GE Lighting.

See fusing recommendations.

End of life cycling

A condition can exist at end-of-life whereby lamp voltage rises to a value exceeding the voltage supplied by the control gear. In such a case the lamp extinguished and on cooling restarts when the required ignition voltage falls to the actual pulse voltage provided by the ignitor. During subsequent warm-up the lamp voltage will again increase, causing extinction. This condition is known as end-of-life cycling. Normally cycling is an indication that lamp end-of-life has been reached, but it can also occur when lamps are operated above their recommended temperature. Lamp voltage at 100 hours life should not increase by more than 5V when operating in the luminaire, when compared to the same lamp operating in free-air. A good luminaire design will limit lamp voltage rise to 3V.

It is good practice to replace lamps that have reached end-of-life as soon as possible after failure, to minimise electrical and thermal stress on ignitor components. The use of a ‘timed’ or ‘cut-out’ ignitor is not a specific requirement for ConstantColor™ CMH lamps, but is worth considering as a good optional safety feature which also prolongs the life of ignitor internal components, lamp holder contact surfaces, and fixture wiring.

The operating period of a timed/cut-out ignitor must be adequate to allow lamps to cool and restart. A period of 10 to 15 minutes continuous or intermittent operation is recommended before the ignitor automatically switches off. Timed/cut-out ignitors, specifically offered for High-Pressure Sodium lamps, where the period of operation is less than 5 minutes, are not suitable for ConstantColor™ CMH lamps.

UV and damage to sensitive materials

The wall of the bulb, which is produced with specially developed 'UV Control' material, absorbs potentially harmful high energy UV radiation emitted by the ceramic arc tube. This technology allows the lamp to significantly reduce the risk of discolouration or fading of products. When illuminating light-sensitive materials or at high light levels, additional UV filtration is recommended. These luminaries are allowed to be used without front glass.

Although PET determines limits of human exposure to lamp UV, the risk of fading of mechanise due to UV can be quantified by a damage factor and a risk of fading. The risk of fading is simply the numerical product of the illuminance, exposure time and damage factor due to the light source.

Lamp type		Tubular 150W	Elliptical 70W Diffuse	Elliptical 150W Clear
UV-PET Performance				
UV C[1]	220-280nm	0.0001	0.0013	0.0011
UV B[1]	280-315nm	0.0005	0.0081	0.0044
UV A[1]	315-400nm	6.8735	13.6649	13.4772
UVC/UVB		0.1371	0.1641	0.2445
UVB/UVA		0.0001	0.0006	0.0003
E_{eff}[2]		0.0155	0.0428	0.0348
PET (h)±10%		1075	389	483
Risk Group	IESNA RP-27.3-96	Exempt	Exempt	Exempt

[1] µW / (cm²) / 500 Lux
[2] mW / klm

Finally the selection of luminaire materials should take into consideration the UV emission. Current UV reduction types on the market are optimised for UV safety of human eye and skin exposure. However, luminaire materials may have different wavelength dependent response functions. Designers must take account of emission in each of the UV-A, UV-B and UV-C spectral ranges as well as material temperatures when designing luminaires.

Typical values for UV-A, UV-B and UV-C range radiation can be found in the table above.

Information on luminaire design

Ballasts

ConstantColor™ CMH lamps in this datasheet are designed to operate from the same ballast impedance as conventional High Pressure Sodium systems. The use of thermal protection or ballast protection is good practice for these lamps. This safety device will protect the circuit at end of lamp life should partial rectification occur due to electrode imbalance or arc tube failure. This requirement applies to both ceramic and quartz arc tube metal halide lamps as well as high performance High Pressure Sodium Lamps.

Stray magnetic field of conventional ballast

At the design stage for fixtures incorporating the control gear, careful consideration should be given to the physical layout of the lamp and ballast. The relative positions and distance between lamp and ballast can adversely affect lamp performance and drastically reduce lamp life survival.

Conventional magnetic ballasts can produce a stray magnetic field and if the lamp is placed within this field, "bowing" of the arc in the discharge tube can occur. Since ceramic is a very rigid material severe arc bowing can cause high thermal stress leading to cracking or rupture of the arc-tube resulting in failure of the lamp early in life.

Such bowing of the arc can also affect the quartz arc-tube in conventional metal halide lamps, but cracking or rupture failure is less likely since quartz softens at the resulting higher wall temperature causing the arc-tube to become swollen. Excessive swelling of a quartz arc-tube can however also result in cracking or rupture failure.

In fixtures where the ballast is necessarily placed close to the lamp, use of magnetic shielding is essential. Another solution is to use an electronic ballast, which eliminates the need for an ignitor, simplifies wiring, reduces the risk of stray magnetic field and eliminates light output flicker.

Containment requirement

ConstantColor™ CMH Open Rated Tubular lamps may be used in open fixtures.

Control gear and accessories

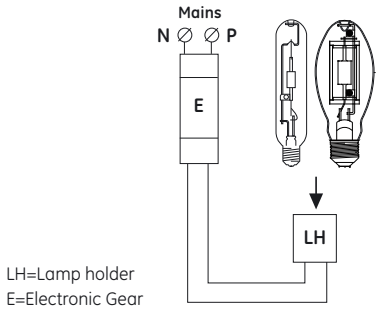
Electronic ballasts

New power controlled electronic ballasts are made by various gear manufacturers for Ceramic Metal Halide lamps.

Their advantages are:

- Supply voltage regulation
- Greater lamp colour consistency
- Reduced noise
- Elimination of lamp flicker when ballast frequency is higher than 70Hz
- Lightweight
- Lower electrical losses
- Single piece compact unit
- Reduced wiring in luminaire

Electronic ballast circuit diagram



Note: GE Lighting is glad to test electronic gears for compatibility. For specific requests please contact your local representative or visit www.gelighting.com.

Standards

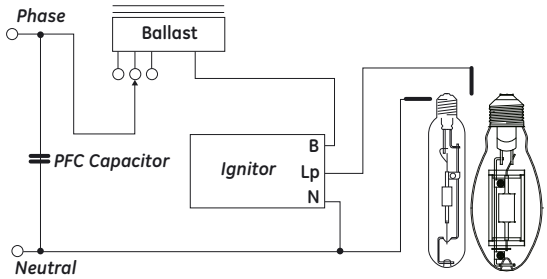
The ballasts should comply with the relevant parts of the following standards:

- RFI suppression EN 55015
- Harmonics EN 61000-3-2
- Immunity EN 61547
- Safety EN 60926/EN 60928/EN 61347
- Performance EN 60927/EN 60929

Superimposed ignitors

In many installations Ceramic Metal Halide lamps are operated from a conventional magnetic ballast in conjunction with a superimposed ignitor. These ignitors generate starting pulses independently from the ballast and should be placed close to the lamp, preferably within the luminaire. Wiring between ignitor and lamp should have a maximum capacitance to earth of 100pF (length equivalent to less than 1 metre) – contact ignitor manufacturer for details of specific ignitor types. A typical circuit diagram is shown:

Typical superimposed ignitor circuit



Suitable ignitors

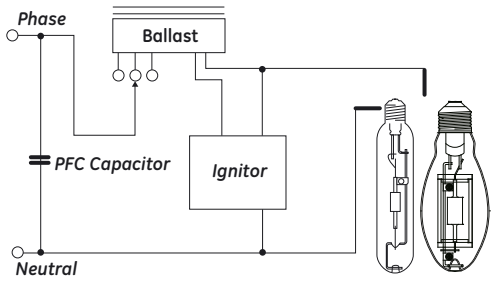
Suitable high-energy (superimposed) ignitors are listed below recommended by gear manufacturers. Check with your supplier for their current range of ignitors. Lamp re-starting under warm lamp conditions can take up to 15 minutes. Suitable ignitors with a warm restart of less than 15 minutes include the following, with the list not being fully inclusive:

	Products				
Open Rated Tubular					
BAG Turgi	NI 400/LE	NI 400 LE/3.5A	NI 400 LE/3.5A-TM20		
ERC	640006	640106	640216	640155	640305
Helvar	L-250	LSI-400			
Tridonic	ZRM 6-ES/B	ZRM 8-ES/D	ZRM 4.5-ES/B	ZRM 6-ES/B	ZRM 2.5-ES/D
Vossloh-Schwabe	Z 400	Z 400 S	Z 400 M	Z 400 M A20	Z 400 MK A20
Open Rated Elliptical					
APF	SP23				
BAG Turgi	NI 150 SE-CM	NI 400 LE 4K	NI 400 LE 4K-TM20		
ERC	ASP 1.8	ASP 1.8 T22	ASP 3.0		
Helvar	L-150	LSI-150T20			
Optima	ZG 4.5 D				
Parmar	PAE400255				
Philips	SU20S	SU20T20S			
Thorn	G53459	G53455			
Tridonic	ZRM 1.8-ES/B	ZRM 2.5-ES/D	ZRM 4.5-ES/B		
Vossloh-Schwabe	Z 250	Z 250 K D20			

Impulser ignitors

Impulser type ignitors use the ballast winding as a pulse transformer and can only be used with a matched ballast. Always check with the ballast and ignitor supplier that components are compatible. Longer cable lengths between ballast & ignitor and the lamp are possible due to the lower pulse frequency generated, giving greater flexibility for remote control gear applications. Ignitor pulse characteristics at the lamp must however comply with specified minimum values for ConstantColor™ CMH lamps under all conditions.

Typical impulser ignitor circuit



Timed or cut-out ignitors

The use of a 'timed' or 'cut-out' ignitor is not a specific requirement for ConstantColor™ CMH lamps but it is a good optional safety feature worth considering to protect the ignitor from overheating and to prolong its life. If used, the timed period must be adequate to allow lamps to cool and restart as described in the previous section. A period of 10-15 minutes continuous or intermittent operation is recommended before the ignitor automatically switches off. Timed ignitors specifically offered for High-Pressure Sodium lamps where the period of operation is only about 5 minutes are not suitable for ConstantColor™ CMH lamps.

Hot re-strike

All ratings re-strike within 15 minutes following a short interruption in the supply. Hot re-strike may be achieved using a suitable ignitor. Actual re-strike time is determined by the ignitor type, pulse voltage and cooling rate of the lamp.

Warm re-starting

The combined characteristics of ceramic arc tube material and vacuum outer jacket result in ConstantColor™ CMH lamps cooling relatively slowly. It is possible with low energy ignitors to reach the required breakdown voltage but not create a full thermionic discharge. Under these conditions the lamp can remain very warm and be prevented from cooling to a temperature at which the arc can be re-established. To avoid this, turn off the power supply for approximately fifteen minutes or change to a suitable high energy ignitor from the list given in the superimposed ignitor section.

Fusing recommendations

For a very short period immediately after switch-on, all discharge lamps can act as a partial rectifier and the ballast may allow higher than the normal current to flow. In order to prevent nuisance fuse failure the fuse ratings must take account of this. See relevant information on national installation requirements for High Intensity Discharge lighting circuits. Single fusing is recommended which gives added protection for the end-of-life condition when partial rectification can also occur.

Number of lamps	1	2	3	4	5	6
70W fuse rating (A)	4	4	4	6	10	10
150W fuse rating (A)	4	6	10	10	16	16

Safety warnings

The use of these products requires awareness of the following safety issues:

Warning

- Risk of electric shock - isolate from power before changing lamp.
- Strong magnetic fields may impair lamp performance.
- Do not use where directly exposed to water or outdoors without an enclosed fixture
- Keep combustible materials away from lamp
- A damaged lamp emits UV radiation which may cause eye/skin injury.
- Unexpected lamp rupture may cause injury, fire, or property damage.
- Use only properly rated ballast & supply voltage.
- Do not use beyond rated life.

Caution

- Allow lamp to cool before handling.
- Do not turn on lamp until fully installed.
- Lamp may shatter and cause injury if broken.
- Do not use lamp if outer glass is scratched or broken.
- Arc tube fill gas contain Kr - 85.
- Dispose of lamps according to local regulations.

Always follow the lamp operation and handling instructions supplied.