GE
Lighting

WORLDWIDE PARTNER

DATA SHEET

ConstantColor™ CMH

Ceramic Metal Halide Lamps
250W and 400W types
Product information

Lamp technology

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.

Elliptical and tubular formats

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.
Coated and clear versions enable close matching to the lamp types previously used.

Features

- Consistent colour over life
- Colour uniformity lamp to lamp
- Excellent colour rendition (CRI: 80+)
- Up to 24% higher efficacy than Quartz Metal Halide
- Up to 24,000 Hr life
- UV control
- Easy retrofit for High Pressure Sodium and High Pressure Mercury lamps

Applications areas

- Architectural floodlighting
- Street Lighting
- City Beautification
- Stage/Studio
- High Bay Lighting

GE imagination at work

Specification summary*

Ordering Information

Description	Product Code	Wattage	Colour	Format
CMH250/E/UVC/U/830/E40/D	**10591**	250	3000K	Elliptical
CMH250/TT/UVC/U/830/E40	**10589**	250	3000K	Tubular
KRC250/CMH/830/T/H/E40	**20302**	250	3000K	Tubular
CMH400/E/UVC/U/830/E40/D	**13087**	400	3000K	Elliptical
CMH400/TT/UVC/U/830/E40	**13067**	400	3000K	Tubular

General	Units	250W		400W	
		Tubular	**Elliptical**	**Tubular**	**Elliptical**
Product code		**10589 20302**	**10591**	**13067**	**13087**
Nominal Wattage	W	250	250	400	400
Bulb format		Tubular	Elliptical	Tubular*	Elliptical
Bulb material			**Heat resistant/Hard Glass**		
Bulb finish		Clear	Diffuse	Clear	Diffuse
Arc Gap	mm	25.7	N/A	24.7	N/A
Bulb designation		T15	ED28	ED18	ED37
Base		E40	E40	E40	E40

***Thermal protection required**

Operating Conditions	250W		400W
Product code(s)	**10589 10591**	**20302**	**13067 13087**
Operating position	Universal	Horizontal	Universal
Luminaire characteristics		Enclosed	

Note that the lamp voltage inside the luminaire should not deviate by more than 10V from the bare lamp voltage in free air.

Electrical Characteristics*		250W		400W		
		Horizontal	Vertical	Horizontal	Vertical	Horizontal
Lamp power	W	262	266	220	420	420
Lamp Voltage	V	117	110	110	110	120
Lamp Volts Max	V	125	120	120	125	135
Lamp Volts Min	V	100	100	105	95	105
Lamp current	A	2.7	2.6	2.3	4.2	4.0
Max. Ignition Voltage	kV			5		
Min. Ignition Voltage	kV			3.3		
Conventional Ballast Required		HPS compatible		Hg	HPS compatible	
Ballast Impedance at 230V	V/A	60		71	40.9	
Power Factor Correction Capacitor	mF	35		35	45	

*** The specification contains data about typical performance on a 50 Hz sine wave ballast at rated power. Actual values may depend on ballast and application.**

Specification summary*

General	Units	250W			400W	
		T	EII	T	T	EII
Product code		**10589**	**10591**	**20302**	**13067**	**13087**
100 Initial Lumens	lm	25000	23500	20000	41000	39000
Typical Lumens change with burning position - vertical to horizontal	lm	-500		N/A	0	
Typical voltage change with burning position - vertical to horizontal	V	-7		N/A	+10	
Correlated Colour Temperature V	K	3450			3600*	3600*
Correlated Colour Temperature H	K	2900		3000	3050	3150
Chromaticity X Vertical		0.41	0.40		0.40	
Chromaticity Y Vertical		0.39	0.39		0.40	
Chromaticity X Horizontal		0.43	0.43	0.43	0.43	
Chromaticity Y Horizontal		0.38	0.39	0.39	0.39	
Colour Rendering Index VBU	Ra	81	80		80	80
Colour Rendering Index HOR	Ra	86	85	80	82	80
Luminous efficacy VBU	lm/W	97	90		100	97
Luminous efficacy HOR	lm/W	94	89	92	100	97

* 3300K at 1000hrs & beyond

Starting characteristics*

Time to start (at 25 deg. C)	s	<10						
Time to start - Cold box test at -30˚C	s	<30						
Warm-up time (for 90% lumens)	min.	5	5	5	4	4	4	4
Starting current - Min	A	2.7		2.1	4.2		4.2	
Starting current - Max	A	4.5		4.5	7.5		7.5	
Pulse Peak Voltage - Min	kV	3.3						
Pulse Peak Voltage - Max	kV	5						
Pulse Width @ 90% of min pulse peak voltage	µs	2						
Pulse Reptition Rate @ 60-90˚ or 240-270˚	µs	1 per cycle min.						
Hot restart time	min.	15						

* Typical values (actual values will be ballast dependent)

Through life Performance

Lumen maintenance at 40% rated life (mean lumens)	lm	20000	18800	17000		31300	29800
Average rated life	h		24000		20000		

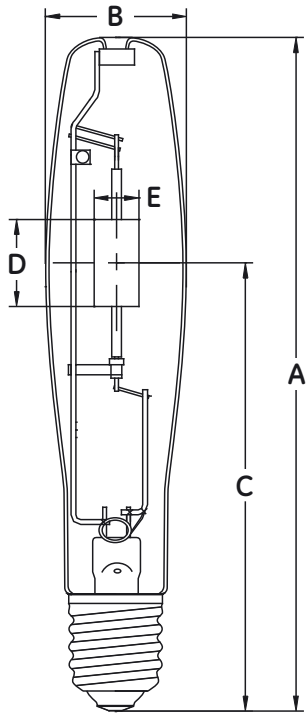
Safety requirements

Maximum allowed bulb temperature under abnormal conditions* **	deg. C	400
Maximum base temperature* **	deg. C	250

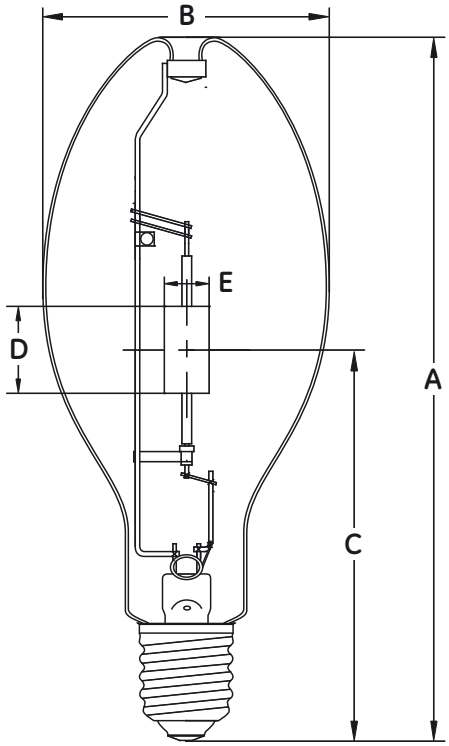
*** For a bare lamp running at 1.25 x normal operating power to simulate the most unfavourable conditions of high line voltage and low ballast impedance in a fixture environment.

Dimension

Tubular



Elliptical



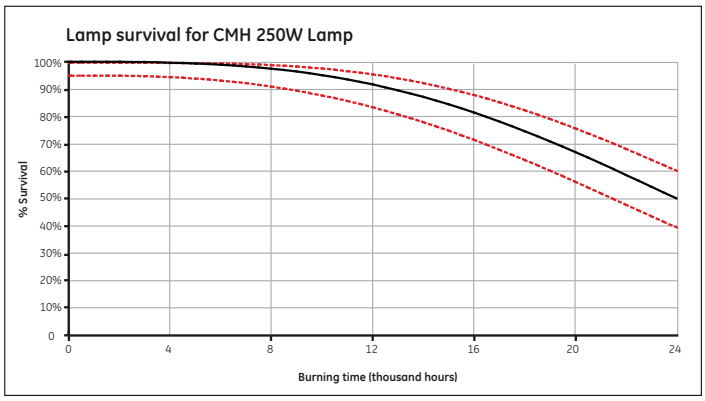
Note: The elliptical product drawing is made transparent for illustration only. In real life the arc-tube cannot be seen, due to the coated outer bulb.

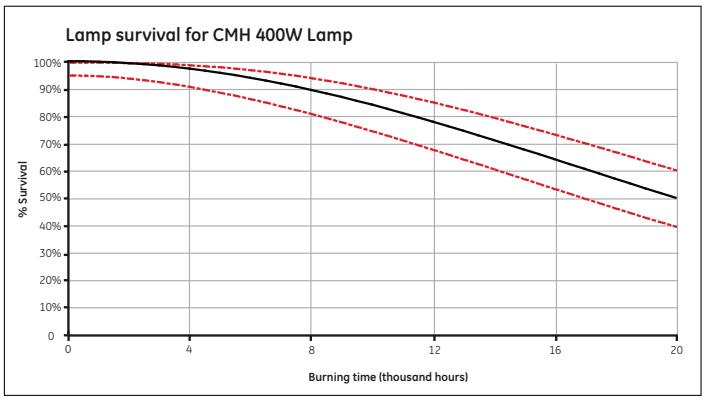
Dimensions		250W		400W	
		Tubular	Elliptical	Tubular	Elliptical
Product code		**10589/20302**	**10591**	**13067/92951**	**13087/92952**
A	**mm**	251	251	270	280
B	**mm**	48	91	59	122
C	**mm**	153.5	133.5	175	155
D - Burner height	**mm**	25.5	25.5	34.4/42.5	425
E - Burner width	**mm**	14.4	14.4	18.7/21.5	18.7/21.5

Lamp life

The graphs below show the mortality curves of statistically representative batches of lamps operated under controlled conditions of 11 hours per start. 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.

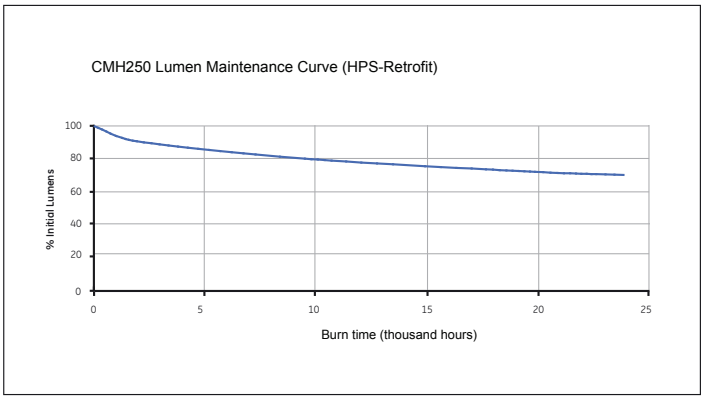
Note: The representative curves are for both Vertical Base Up and Horizontal burn position.

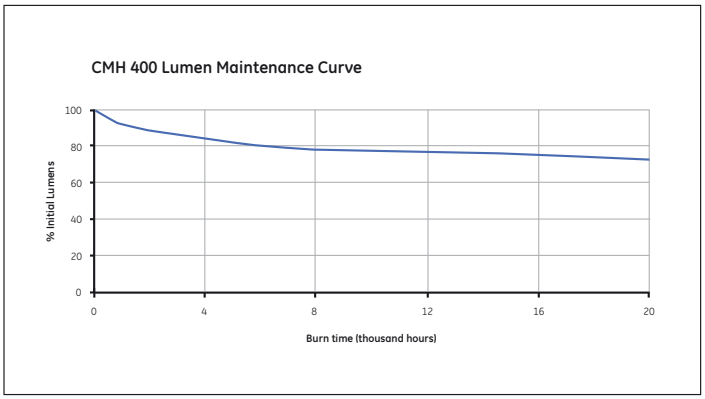


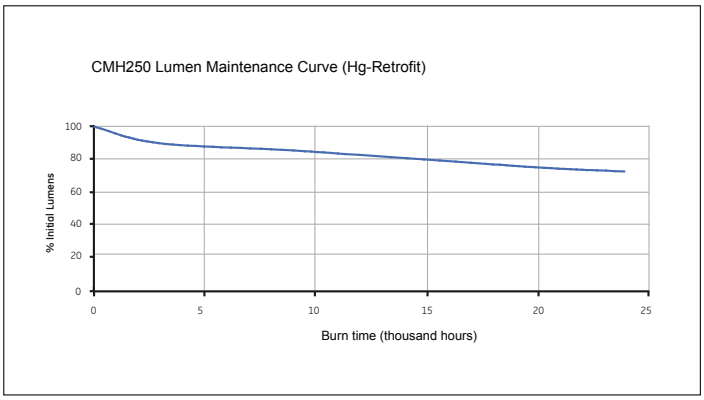


Lumen maintenance

The lumen maintenance graphs show 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. Where a quantity of lamps are installed within an area, 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.

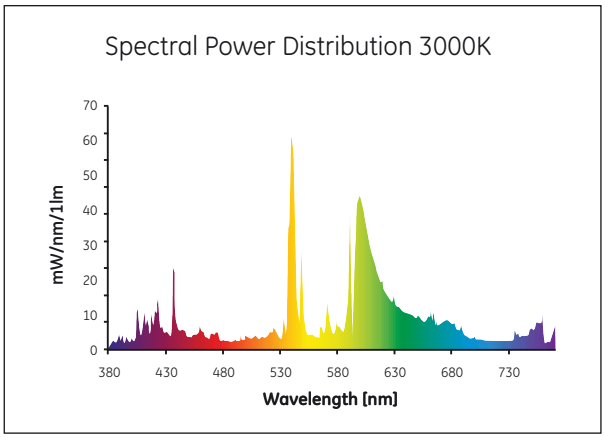






Spectral power distribution

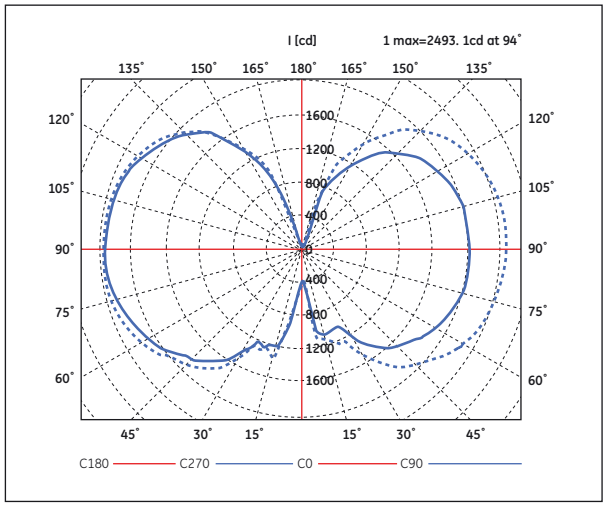
Spectral Power Distribution curves are given in the following diagram



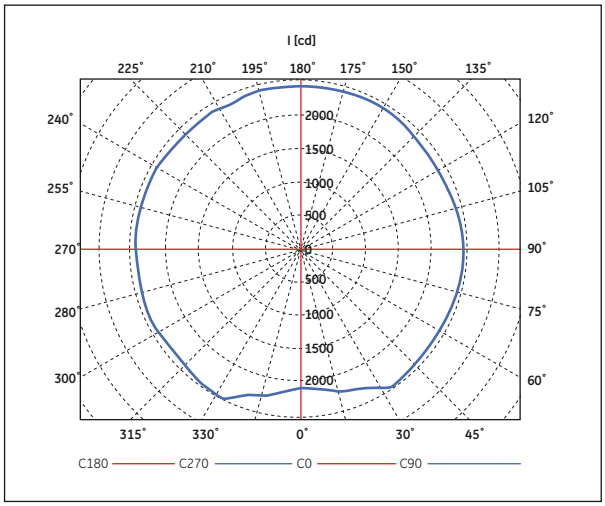
Distribution of luminous intensity

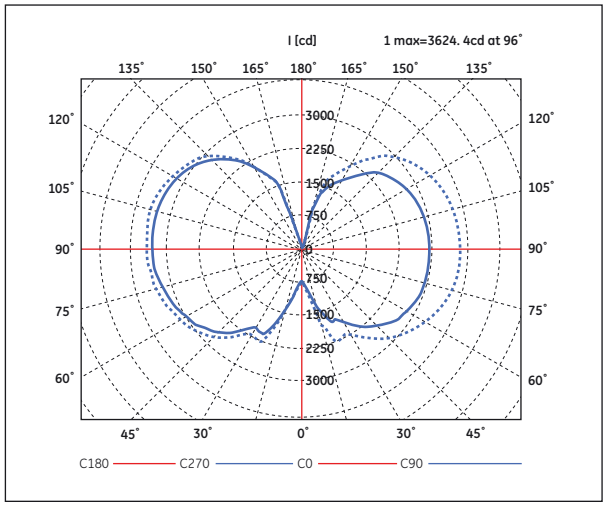
The following diagrams show the polar light intensity curves of the lamp in vertical base-up position

Vertical plane polar intensity curve

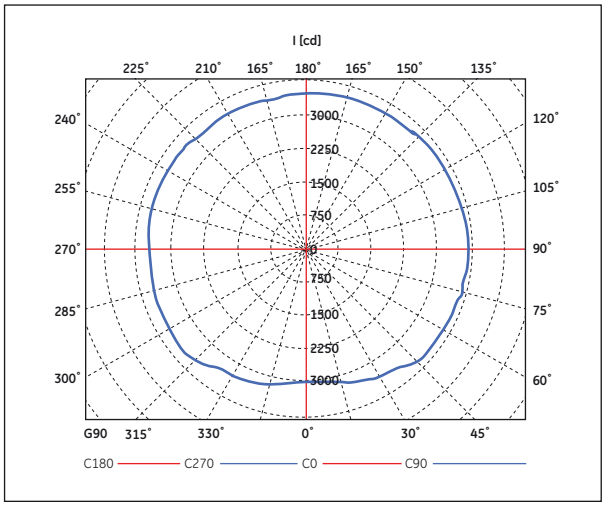


250W





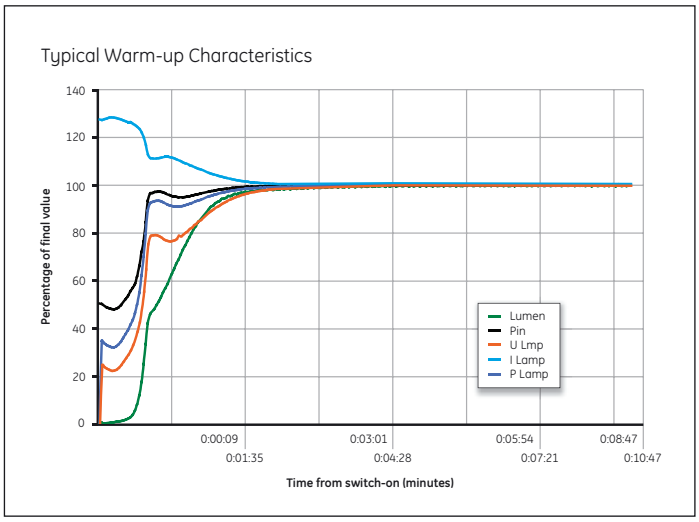
400W



Horizontal plane polar intensity curve

Warm-up characteristics

During the warm-up period immediately after starting, lamp temperature increases rapidly and mercury and the metal halides evaporate within the arc-tube. The lamp current and voltage will stabilise in less than 4 minutes. During this period the light output will increase from zero and the colour will approach the correct visual effect as each metallic element becomes vaporised.



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 200-250V.

Dimming

The dimming of metal halide lamps is not normally recommended. Changes in lamp power alter the thermal characteristics of the lamp and will result 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 250W 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. High operating temperature inside the arc tube causes metal halide dose material to gradually corrode through the ceramic arc tube wall, eventually resulting at normal end-of-life in leakage of the filling gas and dose. Arc tube leakage into the outer jacket can be observed by a sudden and significant lumen drop and a perceptible colour change (usually towards green). The above situation is often accompanied by the so-called rectification phenomena. This occurs where a discharge is established between two mount-frame parts of different material and/or mass, causing asymmetry in the electrical characteristic of the resulting discharge current. Rectification can lead to overheating of the ballast, therefore conventional magnetic ballasts must conform to requirements of the IEC60662 and IEC62035 lamp standards by incorporating protection to maintain safety and prevent damage. It is good practice when lamps are operated continuously 24 hours per day, 7 days per week to introduce switching once every 24 hours. Lamps with one electrode failing often will not restart and can therefore be easily detected and replaced.

Lumen depreciation

All metal halide lamps experience a reduction in light output and a very slight increase in power consumption through life. Consequently there is an economic life when the efficacy of the lamp falls to a level at which is better to replace the lamp and restore the illumination. Where a number of lamps are used within the same area it may be well worth considering a group lamp replacement programme to ensure uniform output from all the 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.
The use of UV control material together with an optically neutral front glass cover 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. Luminaires should not be used if the front glass is broken or missing. It is recommended that a safety interlock switch is incorporated into the luminaire to prevent operation when the luminaire is opened.

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.

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 below.

Lamp type		**250W**	**400W**
UV-PET Performance µW / (cm²) / 500LUX			
UV C	220-280nm	0.0001	0.0002
UV B	280-315nm	0.0000	0.0017
UV A	315-400nm	0.0007	0.0018
UVC/UVB		6.0615	0.0999
UVB/UVA		0.0341	0.9406
E_{eff}		0.0008	0.0037
PET (h)±10%		1898	238
Risk Group	IESNA RP-27.3-96	Exempt	Exempt

Information on luminaire design

Ballasts

ConstantColor™ CMH 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 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 lamps operate above atmospheric pressure, therefore a very small risk exists that the lamp may shatter when the end of life is reached. Though this failure mode is unlikely, containment of shattered particles is required as prescribed by IEC 62035.

Single-ended lamp should only be used in a suitable enclosed luminaire with front cover glass capable of containing the fragments of a lamp should it shatter.

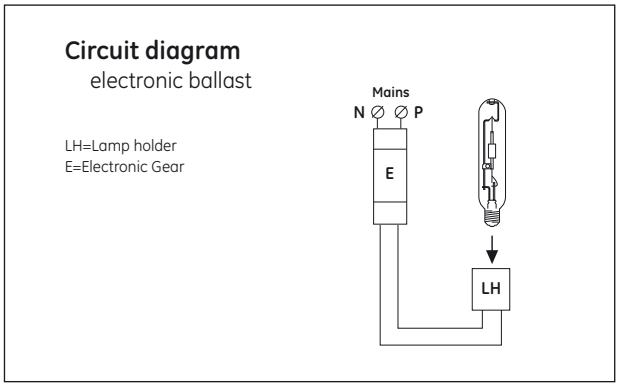
Control gear and accessories

Electronic ballasts

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

Their advantages are:

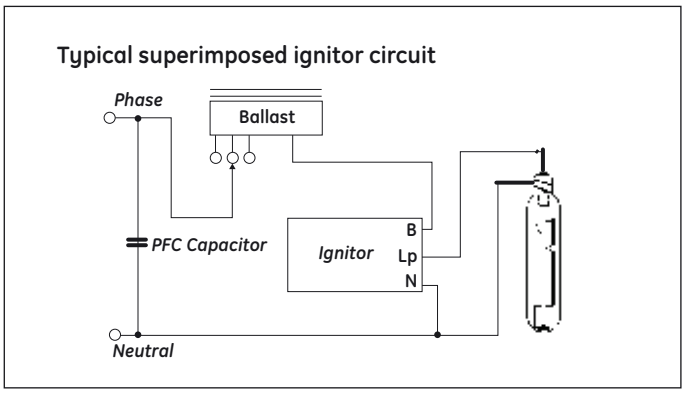
- Supply voltage regulation
- Greater lamp colour consistency
- Reduced noise
- Elimination of lamp flicker when ballast frequency is higher than 70 Hz
- Lightweight
- Lower electrical losses
- Single piece compact unit
- Reduced wiring in luminaire



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

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. Typical circuit diagram is shown:



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.

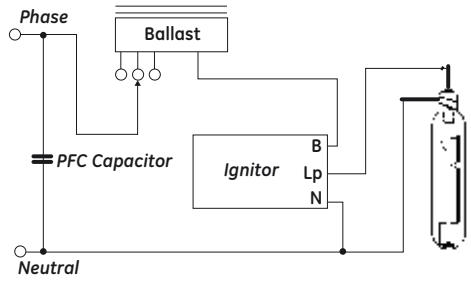
Suitable ignitors with a warm restart of less than 15 minutes include the following, with the list not being exhaustive:

Maker	Products				
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 M A20

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 superimposed ignitor circuit



Other ignitor related considerations

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. GE Lighting should be consulted when considering use of an instant hot re-striking system.

Warm Re-starting

ined 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.

HBC or MCB (type 3 or 4) fuse ratings for single and multiple lamp installations

Number of Lamps	1	2	3	4	5	6
250W Fuse Rating (A)	10	16	16	20	20	20
400W Fuse Rating (A)	16	20	20	25	25	32

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, and in the worst case could lead to lamp rupture
- Use in suitable enclosed luminaire with front cover glass capable of containing the fragments of a lamp should it shatter, to avoid risk of fire
- A damaged lamp emits UV radiation which may cause eye/skin injury
- Unexpected lamp rupture may cause injury, fire, or property damage

IEC 60662 (HPS 1997) 9.4 - Possible conditions at end of lamp life

- A risk exists that at the end of life a number of lamps exhibit a rectifying effect
  This can lead to ballast, transformer or starting device overloading. Suitable protective measures should be taken to ensure that safety is maintained under this condition

Caution

- Risk of burn when handling hot lamp
- Lamp may shatter and cause injury if broken
- Arc tube filling gas contain Kr-85

Always follow the supplied lamp operation and handling instructions.