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DATA SHEET

Ceramic Metal Halide Lamp G8.5 Mini

Single Ended 20W,35W and 70W

Product information

CMH lamps combine HPS technology (providing stability, efficiency & uniformity) and 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 Metal Halide lamps the quality and stability of the dose maintains the colour consistency. Hence the name 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.

Single ended format

Single ended Ceramic Metal Halide lamps are designed to provide symmetrical beam distribution using the axial configuration of the discharge arc. A variety of beam angles are possible and adjustable beam control can be built into the luminaire. This compact lamp shape enables luminaire size to be minimised and the bi-pin lamp base enables easy changing with front access.

Features

- Consistent colour over life
- Good colour uniformity lamp to lamp
- Bright light – in a very compact size
- Excellent colour rendition
- Improved reliability due to 3 part design
- Up to 97 Lumens per Watt (LPW) efficacy
- Up to 18,000 hours life
- UV control
- Colour temperatures 3000K, 4200K

Applications areas

- Retail
- Office
- Hospitality
- Showbiz
- Commercial areas / city beautification / architectural

Specification summary

Description	Wattage	Colour	Product Code
CMH20/TC/UVC/U/830/G8.5 PLUS TU	20	3000K	**93095263**
CMH35/TC/UVC/U/830/G8.5 PLUS TU	35	3000K	**93095264**
CMH35/TC/UVC/U/942/G8.5 TU	35	4200K	**93095366**
CMH70/TC/UVC/U/830/G8.5 PLUS TU	70	3000K	**93095265**
CMH70/TC/UVC/U/942/G8.5 TU	70	4200K	**93095367**

General	Units	20W 3000K	35W 3000K Plus	35W 4200K	70W 3000K Plus	70W 4200K
Product code		**93095263**	**93095264**	**93095366**	**93095265**	**93095367**
Nominal wattage	[W]	20	35	35	70	70
Format		Single ended	Single ended	Single ended	Single ended	Single ended
Bulb type		T4.5	T4.5	T4.5	T4.5	T4.5
Bulb material		UVC Quartz	UVC Quartz	UVC Quartz	UVC Quartz	UVC Quartz
Bulb finish		Clear	Clear	Clear	Clear	Clear
Arc gap	[mm]	3.4	4.7	4.3	6.3	5.5
Base		G8.5	G8.5	G8.5	G8.5	G8.5

Operating conditions	
Burning position	Universal
Luminaire characteristics	Enclosed

Notes:
1) Lamp voltage in the luminaire should not increase by more than 5V when compared to lamp voltage in free air.
2) Ballast protection required, according to IEC61167.

Electrical characteristics *						
Lamp power (rated)	[W]	20	39	39	72	72
Weighted Energy Consumption	[kWh/1000 hrs]	21.78	43.40	44.24	79.20	80.43
Lamp voltage	[V]	90	90	90	85	90
Typical voltage change with burning position – vertical to horizontal	[V]	8	8	8	8	8
Lamp current	[A]	0.226	0.43	0.43	1.01	0.98
Max. ignition voltage	[kV]	5.0	5.0	5.0	5.0	5.0
Min. ignition voltage	[kV]	3.0	3.0	3.0	3.0	3.0
Extinction voltage (% of rated input voltage)	[%]	80 (Max.)	90 (Max.)	90 (Max.)	90 (Max.)	90 (Max.)

* The specification provides typical performance data for 70W operating from a 50Hz mains sinewave supply at rated power, and for 20w & 35w operating on typical electronic ballast. Actual values depend on ballast, supply voltage and application. 20W to be used only with an electronic ballast.

Specification summary

Photometric characteristics		20W 3000K	35W 3000K Plus	35W 4200K	70W 3000K Plus	70W 4200K
Product code		**39858**	**43273**	**26348**	**67698**	**26349**
100 hrs lumens	[lm]	1650	3400	3200	7000	6000
Typical lumen change with burning position – vertical to horizontal	[lm]	100-150	100-150	100-150	100-150	100-150
Correlated colour temperature	[K]	3000	3000	4000	3000	4200
Chromaticity x		0.435	0.435	0.379	0.433	0.372
Chromaticity y		0.400	0.400	0.374	0.402	0.374
Colour rendering index	[Ra]	80+	84+	88+	83+	90+
Luminous efficacy	[lm/W]	83	87	82	97	83
Energy Efficiency Class	[EEC]	A	A+	A	A+	A

1) Photometric characteristics refer to lamp performance after 100hrs burning.
2) 70W data are based on operation from a conventional magnetic ballast. Improved performance can be achieved using an electronic ballast.
3) 35W data are based on operation from an electronic ballast. Lamps can run on conventional ballast with a small reduction in performance.
4) 20W designed for operation only from an electronic ballast.

Starting and warm-up characteristics*						
Time to start (at 25 °C)	[sec.]	< 2	< 2	< 2	< 2	< 2
Time to start - cold box test at -30 °C	[sec.]	< 15	< 15	< 15	< 15	< 15
Hot restart time	[min.]	< 4	< 7	< 7	15	15
Warm-up time (for 90% lumens)	[min.]	1.2	1.2	3	3	3

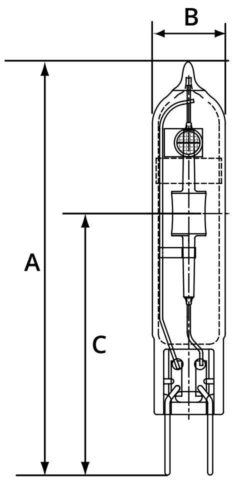
* Typical values (actual values are ballast and ignitor dependent)

Through life performance						
Lumen maintenanceat 40% rated life (mean lumens)	[%]	68	68	78	71	77
Average rated life (electronic ballast)	[h]	12,000	16,500	18,000	15,000	15,000
Average rated life (magnetic ballast)	[h]	N/A	15,000	12,000	15,000	15,000

Maximum operating temperatures*						
Maximum allowed bulb temperature (horizontal orientation, thermocouple attached above burner)	[°C]	500	500	500	550	550
Maximum pinch temperature (vertical base up orientation)	[°C]	300	300	300	300	300

* Temperatures above which lamp performance or reliability is impaired.

Dimensions

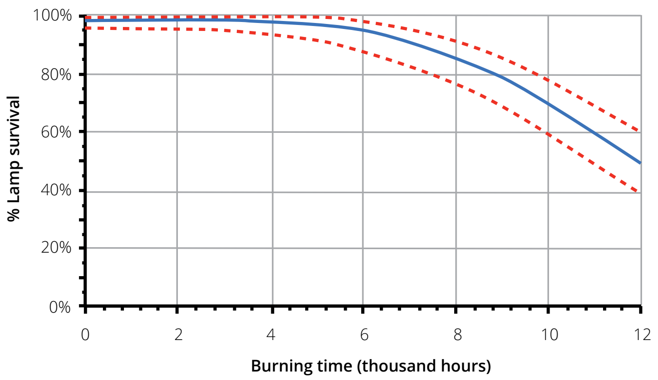


Dimension	A Length (mm)	B Diameter	C LCL nominal (mm)
	85	14,5	52

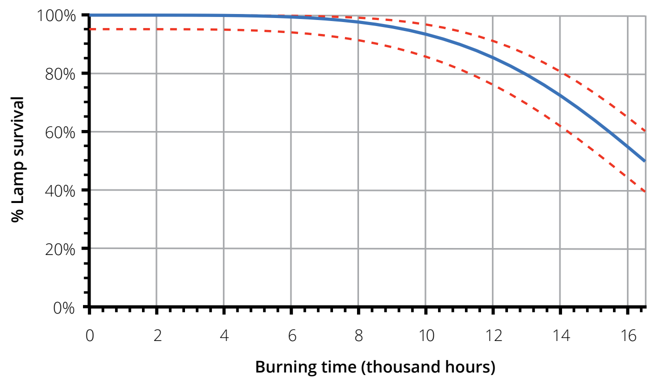
Lamp life

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.

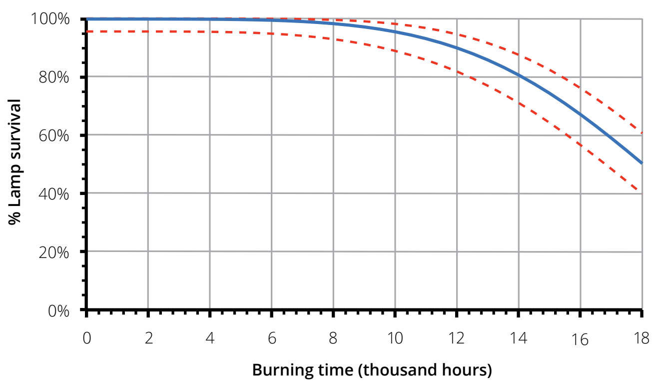
CMH G8.5 20W 3000K



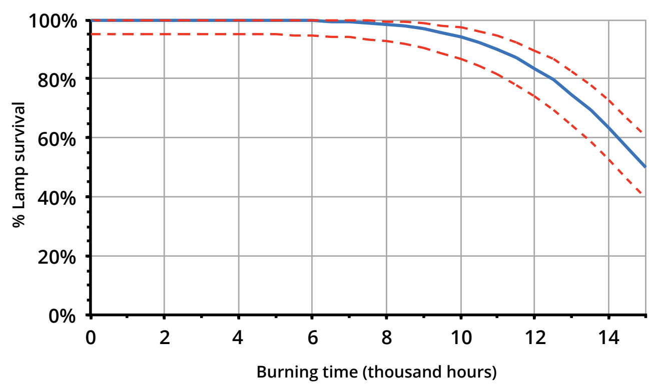
CMH G8.5 35W 3000K



CMH G8.5 35W 4200K



CMH G8.5 70W 3000K and 4200K

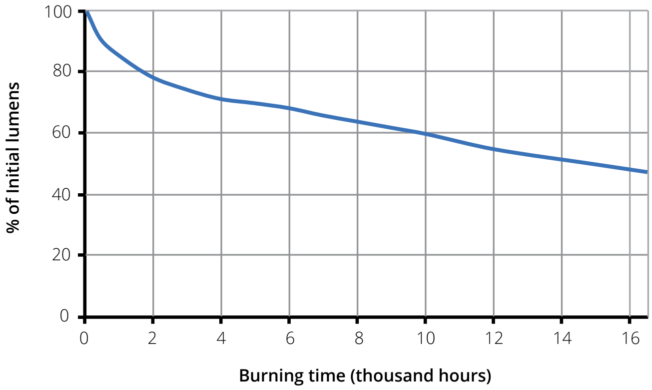


Lumen maintenance

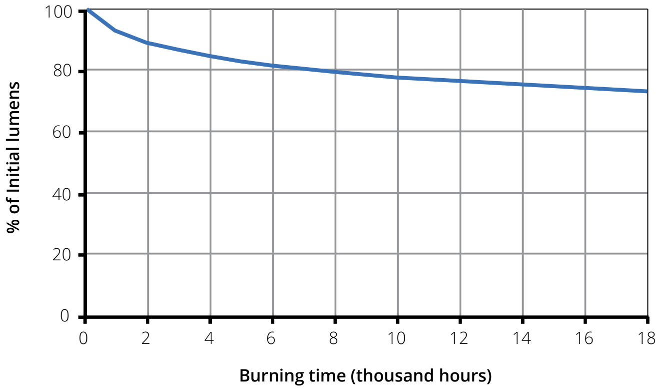
Lumen maintenance graphs show light output performance through life for statistically representative batches of lamps operated under controlled nominal conditions with an 11 hours per start switching cycle. A common characteristic for all metal halide lamps is a reduction in light output and a slight 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 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.

Note: The representative curves are shown for vertical base-up lamp orientation unless otherwise specified. Lumen maintenance performance is significantly improved in horizontal burning position.

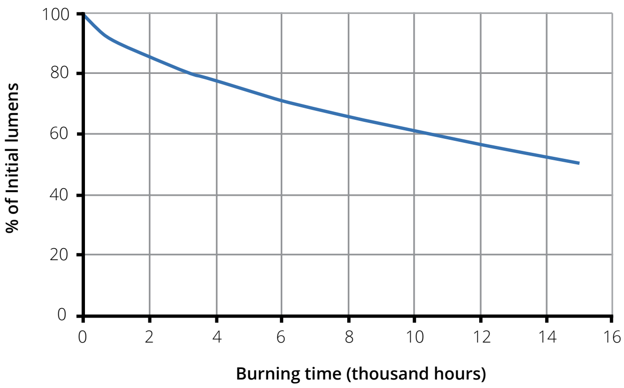
Lumen maintenance CMH G8.5 35W 3000K



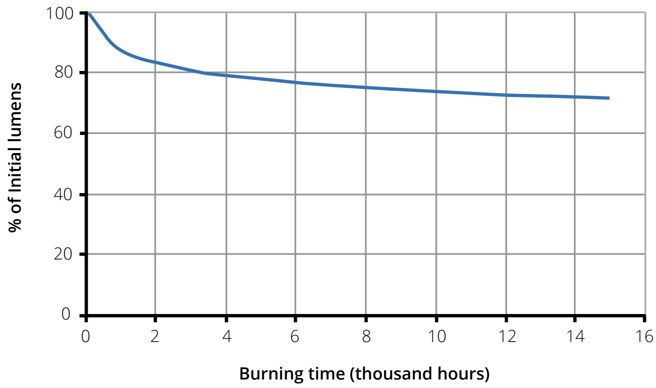
Lumen maintenance CMH G8.5 35W 4200K



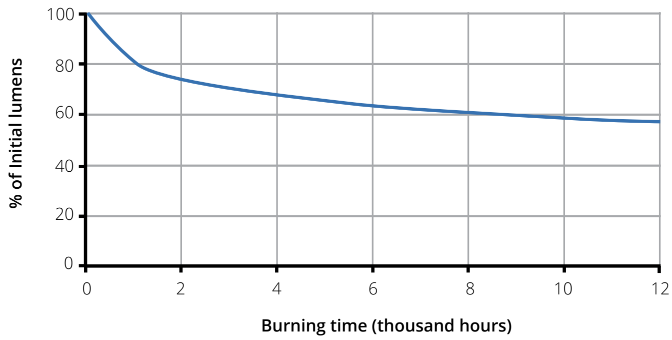
Lumen maintenance CMH G8.5 70W 3000K



Lumen maintenance CMH G8.5 70W 4200K



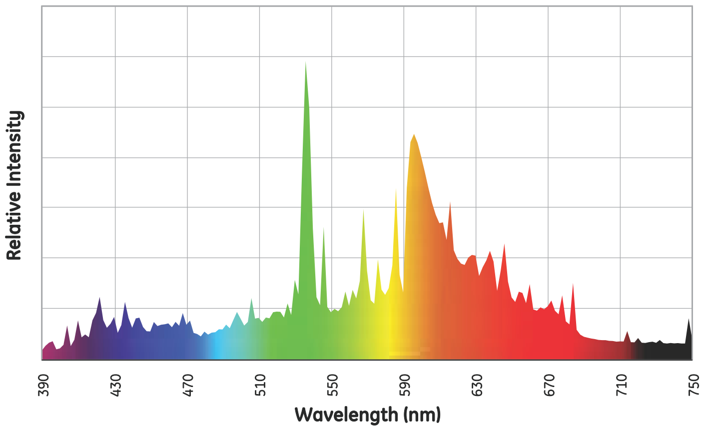
Lumen maintenance CMH G8.5 20W 3000K



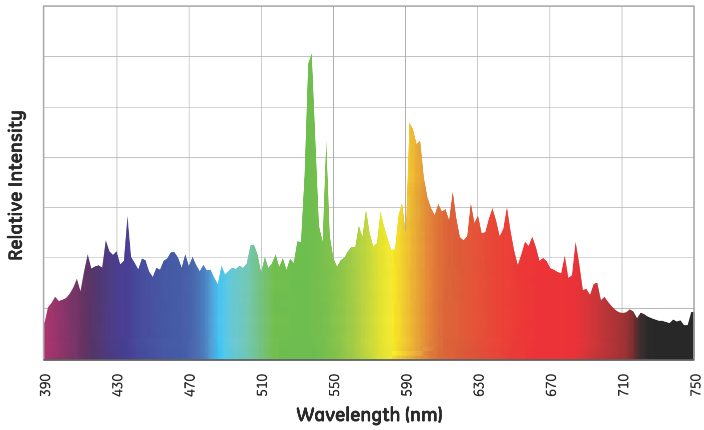
Spectral power distribution

Spectral power distribution curves are given in the following diagrams

Spectral power distribution 3000K



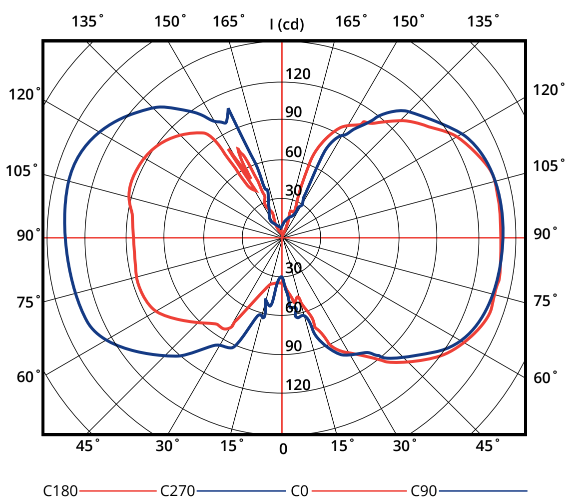
Spectral power distribution 4200K



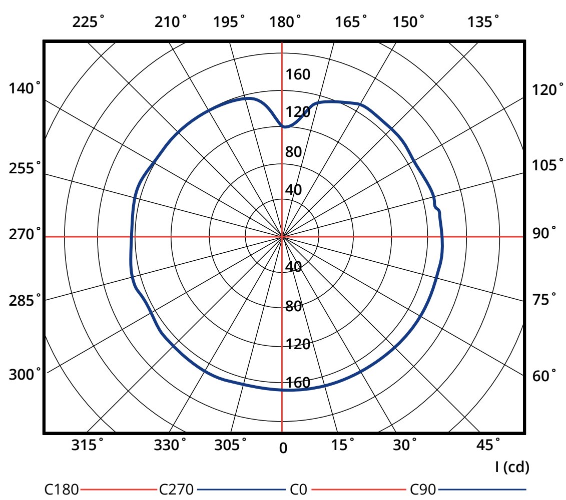
Distribution of luminous intensity

The following diagrams show typical polar light intensity curves for the lamp in vertical base-up orientation.

Vertical plane polar intensity curve Imax=170.13 cd at 100°



Horizontal plane polar intensity curve Imax=170.13 cd at 100°

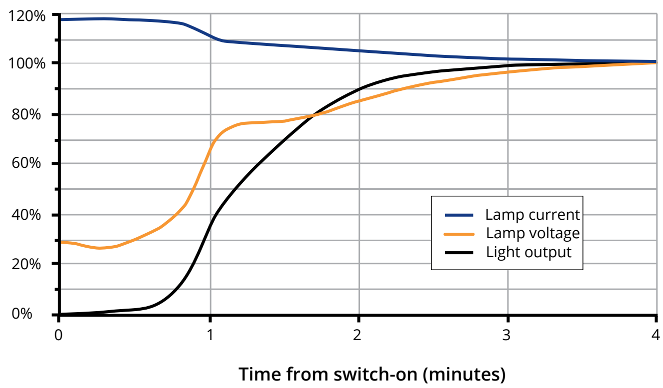


Warm-up characteristics

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.

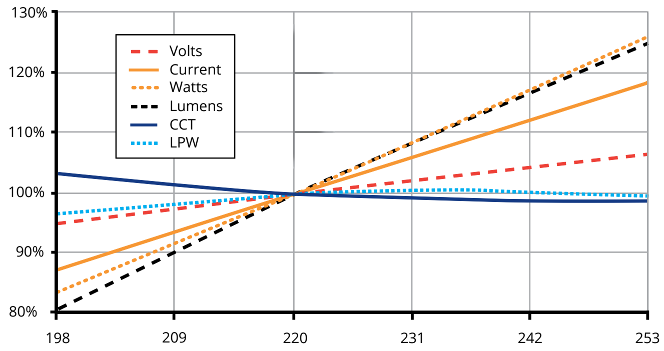
Typical warm-up characteristics



Supply voltage sensitivity

Supply line voltage to conventional magnetic ballast control gear should be as close to the rated nominal value 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.

CMH Lamp performance as a function of supply voltage on a 220V Reference Ballast



Dimming

In certain cases, dimming may be acceptable, subject to further testing. Contact your Tungsram 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

When CMH lamps are operated from a conventional magnetic ballast there will be 50Hz line frequency light output flicker typically of 1.5%, in common with all other discharge lamps. Noticeably lower flicker levels occur when lamps are operated horizontally.

Flicker levels of 1.5% do not normally cause concern to the end user, but use of electronic control gear should be considered where visual comfort and performance is critical. Suitable electronic ballasts for CMH typically provide square wave operation in the range 70-400Hz, eliminating perceptible flicker.

Lamp 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 color 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 IEC61167 lamp standard by incorporating protection to maintain safety and prevent damage.

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 extinguishes 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 internal components. The use of a 'timed' or 'cut-out' ignitor is not a specific requirement for 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 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.

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 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		20W 3000K	35W 3000K	35W 4200K	70W 3000K	70W 4200K
UV-PET performance						
UV-C[1]	220-280nm	0.036	0.029	0.020	0.038	0.011
UV-B[1]	280-315nm	0.049	0.037	0.040	0.042	0.009
UV-A[1]	315-400nm	10.170	8.740	13.870	7.170	9.800
UVC/UVB		10.720	0.772	0.509	0.906	1.321
UVB/UVA		0.005	0.004	0.003	0.06	0.0099
E_{eff}[2]		1.04	0.84	0.68	1.02	0.28
PET (h)		16	20	26	17	64
Risk group	IESNA RP-27.3-96	Exempt	Exempt	Exempt	Exempt	Exempt

[1] μW/ (cm2) / 500 Lux
[2] mW / klm

Information on luminaire design

Ballasts

CMH operate from the same type of ballast as conventional quartz technology metal halide lamps of the same nominal power. IEC 61167 MH lamp standard and IEC62035 HID lamp safety standard specify use of ballast thermal protection or equivalent protection device in the circuit. This safety device will protect the ballast and fixture from overheating damage at lamp end-of-life should rectification occur due to electrode imbalance or arc tube failure. The IEC61167 requirement applies to both ceramic and quartz arc tube metal halide lamps of the UV-A, UV-B and UV-C spectral ranges as well as material temperatures when designing luminaires. CMH G8.5 lamps are compatible with a list of approved ballasts; contact your Tungsram representative for more information.

Stray magnetic field from 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.

Electronic ballast operation

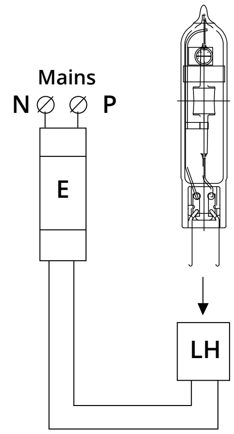
CMH lamps have optimum performance on electronic gear.*
This provides many advantages:

- Flicker free light output
- Well controlled electronic ignition process
- Simple wiring for fixtures due to elimination of ignitor and PFC capacitor
- Reduces fixture weight
- Automatic sensing of failed lamps and shutdown
- Lower overall system power consumption

* For details of approved electronic ballasts for CMH lamps please consult your GE representative. CMH 20W is designed only for operation on electronic gear.

Circuit diagram
electronic ballast

LH = Lamp holder
E = Electronic Gear



Containment requirement

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 lamps 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

A range of Tungsram electronic ballasts have been introduced to complement the Ceramic Metal Halide lamps. Power controlled electronic ballasts suitable for operation of Ceramic Metal Halide lamps are available from various gear manufacturers.

Advantages are:

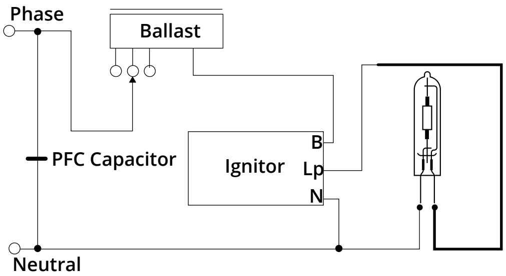
- Good regulation against supply voltage variation
- Improved lamp colour consistency
- Elimination of lamp flicker
- Reduced weight of control gear
- Reduced electrical power losses
- Ballast noise reduced/eliminated
- Single piece compact unit
- Reduced wiring complexity in the luminaire

For selecting proper ballast for CMH lamps please see separate CMH ballasts data sheet.

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 the ignitor manufacturer for details of specific ignitor types. A typical circuit diagram is shown:

Typical superimposed ignitor circuit



Suitable ignitors

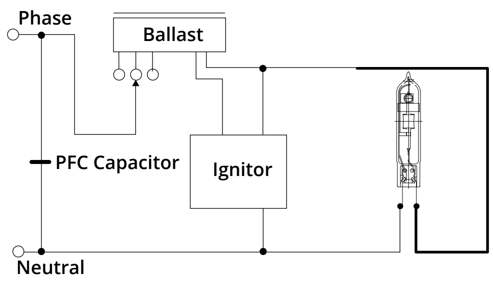
Suitable high-energy (superimposed) ignitors recommended control gear manufacturers are listed below. Check with suppliers for their current range of ignitors. Lamp re-starting under warm lamp conditions can take up to 15 minutes. Suitable ignitors to achieve a warm restart of less than 15 minutes include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

Maker	Products				
APF	SP23				
BAG Turgi	NI 150 SE	NI 150 SE-TM20	MZN 150 SE-C	NI 400 LE/3.5 A	NI 400 LE/3.5 A-TM20
ERC	AZ A 1.8	AZ P 1.8	AZ P 1.8 T3	AZ P 1.8 T3	AZ P 3.0 T3
Helvar	L-150	LSI-150T20			
Magnetek/May & Christe	ZG 0.5	ZG 2.0	ZG 2.0D	ZG 4.5D	
Parry/Parmer	PAV400	PCX400	PXE100		
Philips	SU20S				
Thorn	G53459	G53498	G53476	G53504.TB	
Tridonic	ZRM 1.8-ES/B	ZRM 2.5-ES/B	ZRM 4.5-ES/B	ZRM 6-ES/B	ZRM 2.5-ES/B
Vossloh-Schwabe	Z 150	Z 150 K	Z 150 K A10	Z 150 K A10	Z 250

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 CMH lamps under all conditions.

Typical impulser 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 CMH lamps but it is a good optional safety feature worth considering to prolong ignitor component life. The timed on-period must be adequate to allow lamps to cool and restart as described below. 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 less than 5 minutes are not suitable for CMH lamps.

Hot re-strike

All ratings re-strike within 15 minutes following a short interruption in the supply. Actual re-strike time is determined by the ignitor type, pulse voltage and cooling rate of the lamp. Instant hot re-strike is only possible using a suitable very high voltage ignitor and a double ended lamp. Tungsram Lighting should be consulted when considering use of an instant hot re-striking system.

Warm re-starting

The combined characteristics of ceramic arc tube material and vacuum outer jacket result in 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 a conventional magnetic ballast may allow higher than the normal current to flow. At switch-on the short duration surge current drawn by the power factor correction capacitor can be high. In order to prevent nuisance fuse failure at initial switch-on, the fuse rating must take these transient conditions into account. A separate technical data sheet providing additional explanation and information for the fusing of High Intensity Discharge lighting circuits is available from Tungsram.

Fusing of individual fixtures is recommended, in order to provide added protection for end-of-life conditions when lamp rectification can also occur.

Number of lamps	1	2	3	4	5	6
35W Fuse Rating (A)	4	4	4	4	4	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 supply before changing lamp
• Strong magnetic fields may impair lamp performance and in the worst case could lead to lamp shattering.

Use in enclosed fixtures to avoid the following:

• Risk of fire
• A damaged lamp emits UV radiation which may cause eye/skin injury, remove and dispose of broken lamp
• Unexpected lamp shattering may cause injury, fire or proprty damage, use in luminaire with front cover made of glass

Caution

• Risk of burn, allow lamp to cool before handling
• Lamp may shatter and cause injury if broken
• Arc tube fill gas contains Kr-85

Always follow the supplied lamp operation and handling instructions.