TUNGSRAM™

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DATA SHEET

Ceramic Metal Halide Lamp

Double Ended Lamps
35W, 70W and 150W

Product information

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 Metal Halide lamps then 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.

Features

- Consistent colour over life
- 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 LPW efficacy
- 15,000 Hr life
- UV control
- Easy retrofit for Quartz Metal Halide lamps
- 3000K and 4200K colour temperature

Application areas

- Retail
- Office
- City Beautification/Architectural
- Hospitality
- Industrial

Specification summary

Ordering Information	Wattage	Colour	Product Code
Description			
CMH35/TD/UVC/830/RX7s TU	35	3000K	93102197
CMH70/TD/UVC/830/RX7s TU	70	3000K	93102188
CMH70/TD/UVC/942/RX7s TU	70	4200K	93102191
CMH150/TD/UVC/830/RX7s-24 TU	150	3000K	93102189
CMH150/TD/UVC/942/RX7s-24 TU	150	4200K	93102190

General	Unit	35W 3000K	70W 3000K	70W 4200K	150W 3000K	150W 4200K
Product code		**93102197**	**93102188**	**93102191**	**93102189**	**93102190**
Nominal Wattage	[W]	35	70	70	150	150
Format		Double ended				
Bulb type		T6	T6	T6	T7	T7
Bulb diameter	[mm]	20	20	20	24	24
Bulb material		UVC Quartz				
Bulb finish	Clear					
Arc Gap	[mm]	4.65	7.6	7.0	11	10
Base		RX7s	RX7s	RX7s	RX7s-24	RX7s-24

Operating Conditions

Burning position	HOR +/-45°
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]	39	72	72	150	150
Weighted Energy Consumption	[kWh/1000 hrs]	41.99	80.73	79.42	158.73	155.26
Lamp voltage	[V]	90	90	90	96	96
Lamp current	[A]	0.53	0.98	0.98	1.8	1.8
Max. Ignition Voltage		5kV				
Min. Ignition Voltage**		3kV				
Extinction voltage (% of rated input voltage)		90% (Max.)				

* The specification provides typical performance data for lamps operating from a 50Hz mains sinewave supply at rated power. Actual values depend on ballast, supply voltage and application.
** Data related to pulse start ignitor. Resonant start ballast with lower ignition voltage also can be used with the lamp, subject approval by GE.

Specification summary

Photometric characteristics		35W 3000K	35W 3000K	70W 3000K	70W 4200K	150W 3000K	150W 4200K
		Electronic ballast*		Conventional Electromagnetic Ballast			
Product code		93102197	93102197	93102188	93102191	93102189	93102190
100 hrs Lumens	[lm]	3400	3200	7000	6200	14500	12500
Correlated Colour Tempera-ture	[K]	2900	3100	3000	4200	3000	4200
Chromaticity X		0.440	0.430	0.430	0.370	0.430	0.370
Chromaticity Y		0.400	0.400	0.400	0.370	0.400	0.370
Colour Rendering Index	[Ra]	80+	80+	80+	90+	80+	90+
Luminous efficacy	[lm/W]	87	82	97	86	97	83
Energy Efficiency Class	[EEC]	A	A	A+	A+	A+	A+

* Typical low frequency square wave ballast. Rated average lamp lumens are obtained under controlled labora-tory conditions.

Starting characteristics*							
Time to start (at 25 deg. C)	[sec.]	< 2	< 2	< 2	< 2	< 2	< 2
Time to start – Cold box test at – 30°C	[sec.]	< 15	< 15	< 15	< 15	< 15	< 15
Warm-up time (for 90% lumens)	[min.]	2	2	3	3	3	3
Hot restart time	[min.]	15	15	15	15	15	15

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

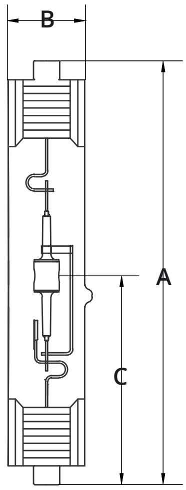
Through life Performance*							
Lumen maintenanceat 40% rated life (mean lumens)	[%]	75	76	75	75	80	80
Average rated life	[h]	15,000	15,000	15,000	15,000	15,000	15,000

* Life data measured in Horizontal position.

Maximum Operating temperatures*			
Maximum allowed bulb temperature (horizontal orientation, thermocou-ple attached above burner)	[°C]	500	650
Maximum pinch temperature (45° orien-tation, thermocouple attached centrally on top pinch between base and curved portion of outer bulb)	[°C]	280	

* Temperatures above which lamp performance or reliability is impaired.

Dimensions

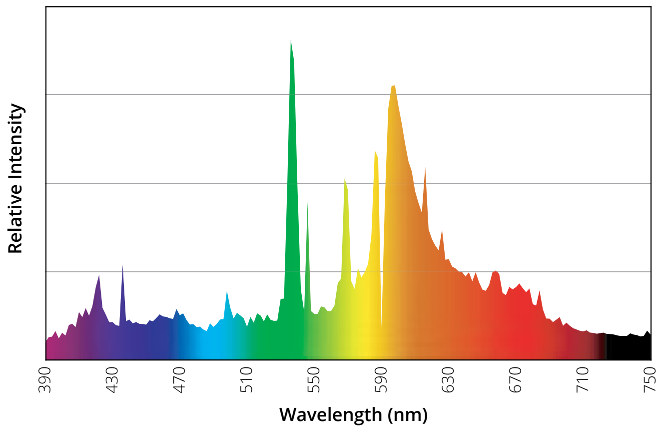


Product code	93102197	93102188	93102191	93102189	93102190
Dimension					
A [mm] max	118	118	118	135.4	135.4
B [mm] nominal	20	20	20	24	24
C [mm] nominal	57	57	57	66	66

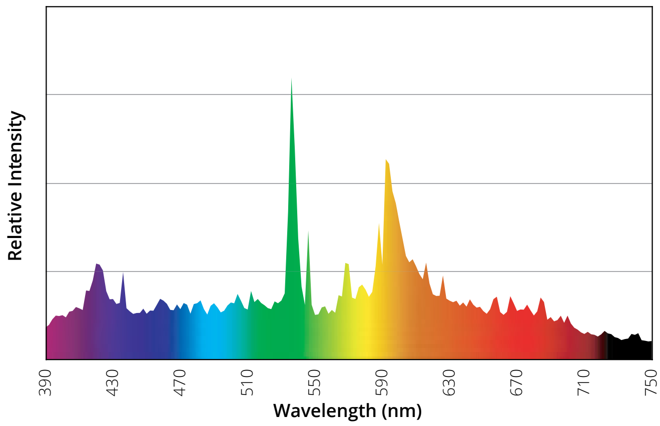
Spectral power distribution

Spectral Power Distribution curves are given in the following diagram.

Spectral Power Distribution 3000K



Spectral Power Distribution 4200K

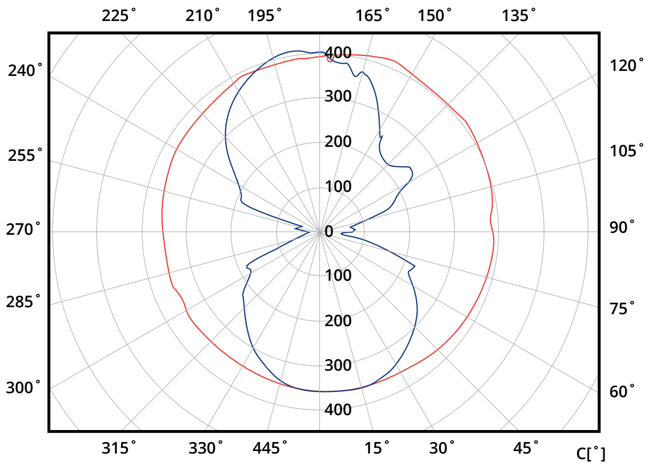


Distribution of luminous intensity

The following diagrams show typical polar light intensity curves of the lamp in horizontal position.

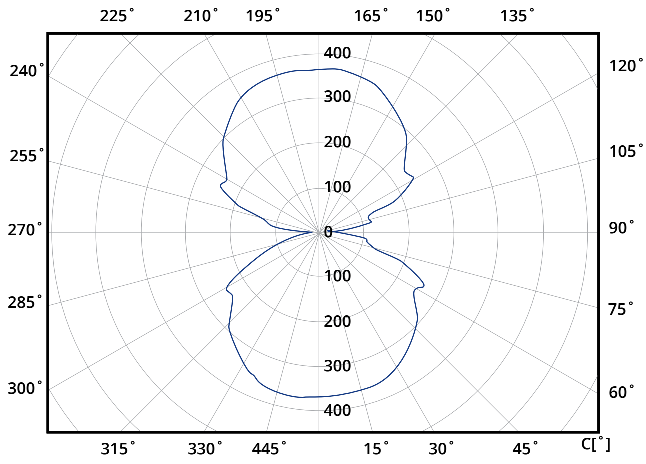
Vertical plane polar intensity curve

Intensity [cd] CMH TD 35W

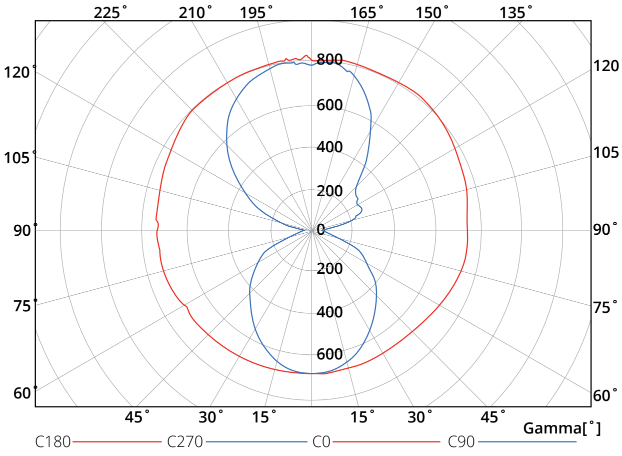


Horizontal plane polar intensity curve

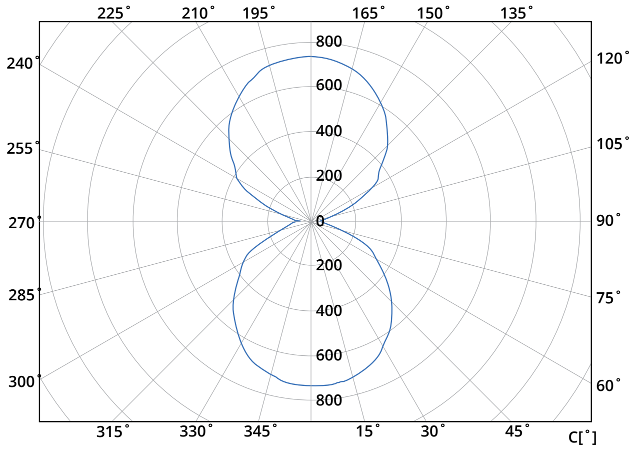
Intensity [cd] CMH TD 35W



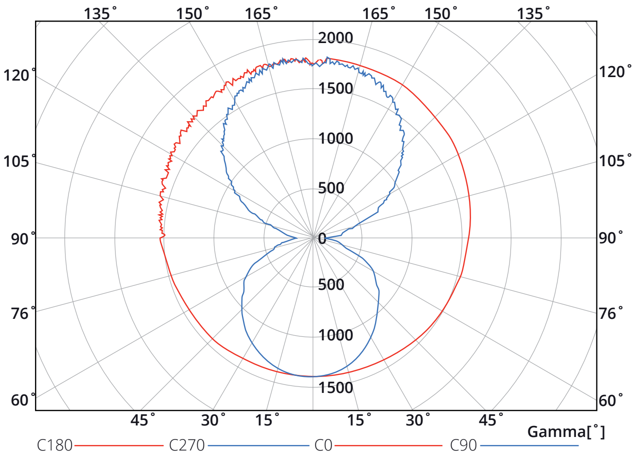
Intensity [cd] CMH TD 70W



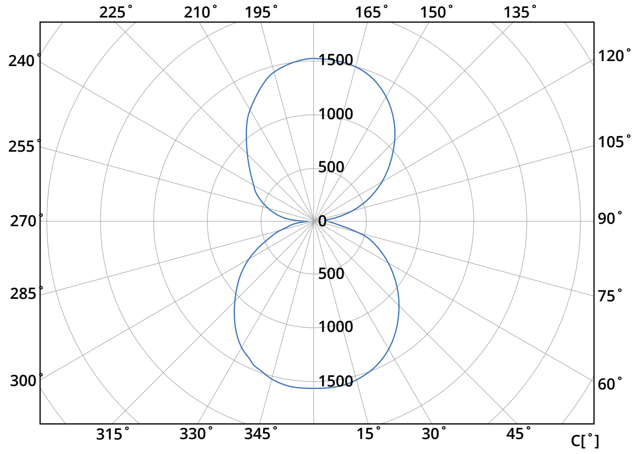
Intensity [cd] CMH TD 70W



Intensity [cd] CMH TD 150W



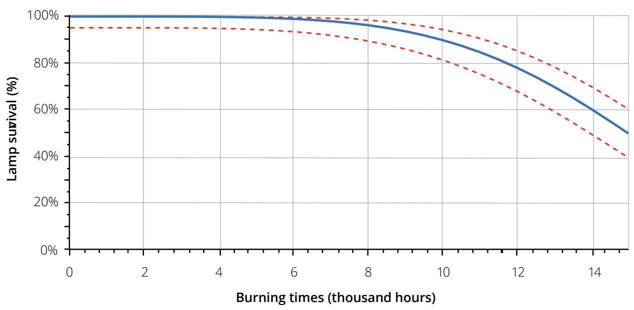
Intensity [cd] CMH TD 150W



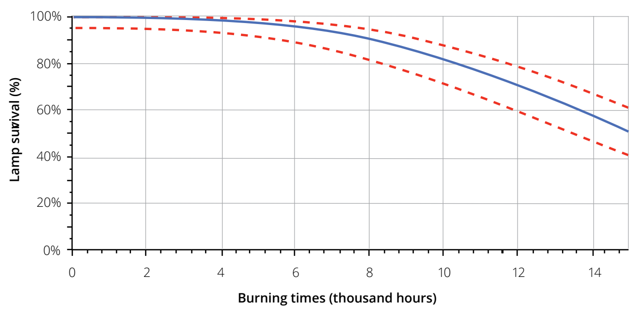
Lamp life

The graphs show the mortality curve and Lumen maintenance curve 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.

LampSurvival CMH TD 35W 3000K



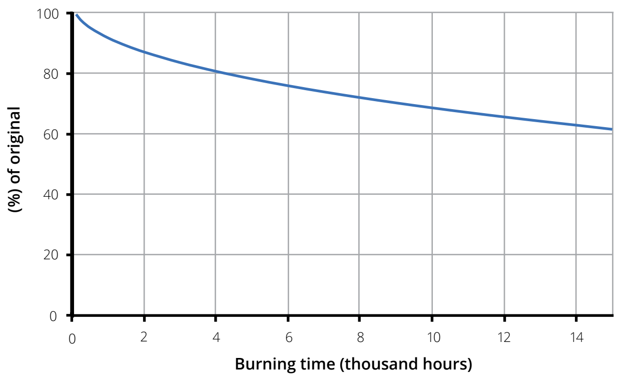
LampSurvival CMH TD 70W & CMH TD 150W



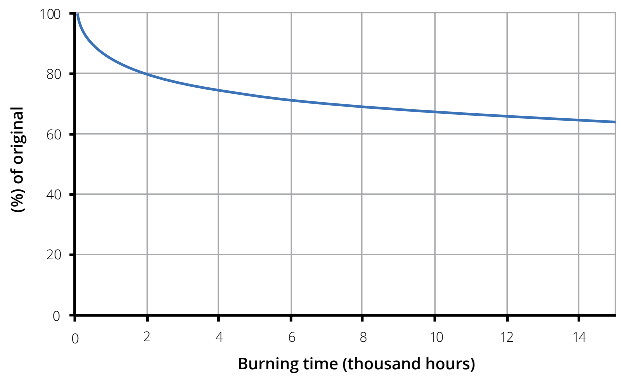
Lumen maintenance

Lumen maintenance graphs show light output performance through life for statistically representative batches of lamps operated under controlled nominal conditions with a 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 given to a group lamp replacement programme to maintain uniform illumination levels. Curves represent operating conditions for a 11 hours per start switching cycle, but less frequent switching will improve lumen maintenance.

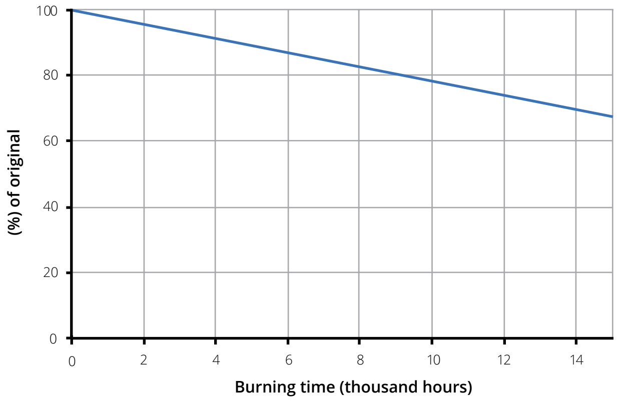
Lumen Maintenance for CMH35/TD 3000



Lumen Maintenance for CMH70/TD

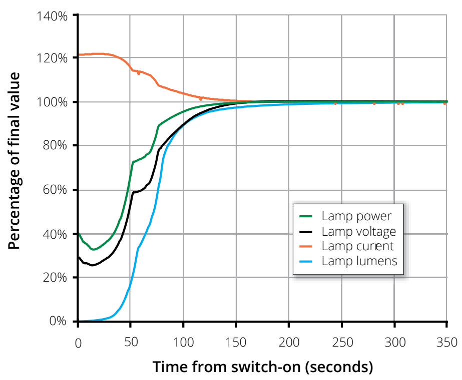


Lumen Maintenance for 150/TD

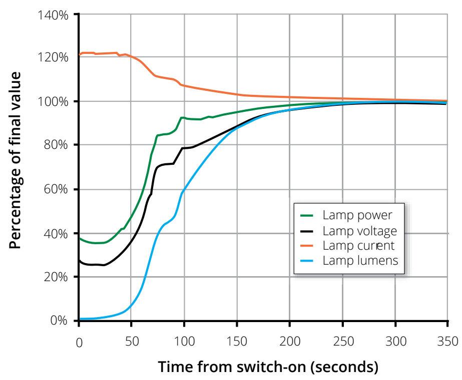


During the warm-up period immediately after starting, lamp temperature increases rapidly and mercury and the metal halides evaporate within the arc-tube. The lamp current and voltage will stabilise in less than 4 minutes. During this period the light output will increase from zero and the colour will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

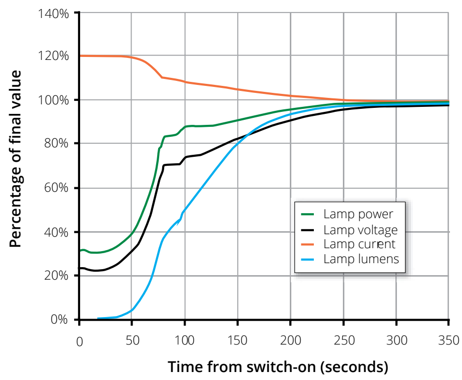
Typical warm-up characteristics for CMH TD 35W



Typical warm-up characteristics for CMH TD 70W



Typical warm-up characteristics for CMH TD 150W



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.

Dimming

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

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 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		35W 3000K	70w 3000K	70w 4200K	150w 3000K	150w 4200K
UV-PET Performance						
UV-C[1]	220-280nm	0.016	0.007	0.027	0.006	0.004
UV-B[1]	280-315nm	0.009	0.005	0.012	0.003	0.002
UV-A[1]	315-400nm	8.07	5.61	13.35	6.01	8.16
UVC/UVB		1.909	1.646	2.193	1.843	2.089
UVB/UVA		0.0011	0.0008	0.0009	0.0005	0.0003
E_{eff}[2]		0.358	0.189	0.548	0.150	0.111
PET (h)		48	91	31	115	158
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 lamps 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 TD lamps are compatible with a list of approved ballasts; contact yourTungsram for more information.

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

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.

Double - 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

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.

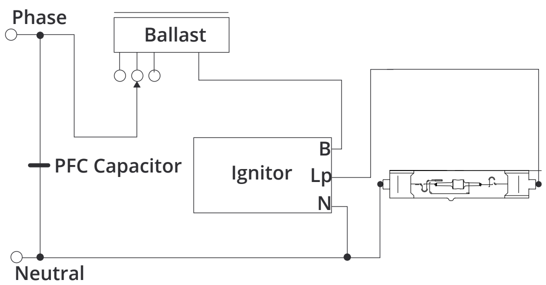
Advantages are:

- Good regulation against supply voltage variation
- Improved lamp colour consistency
- Elimination of lamp flicker
- Reduced weight of control gear

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

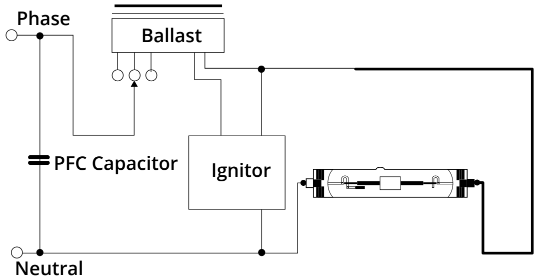
Suitable high-energy (superimposed) ignitors recommended by control gear manufacturers are listed below. Check with suppliers for their current range of ignitors. Lamp re-starting under warm lamp conditions can take up to 15 minutes. Suitable ignitors to achieve a warm restart of less than 15 minutes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

Maker		Products	
APF	SP23		
BAG Turgi	NI 150 SE-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 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 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 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. 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 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 Lighting. Fusing of individual fixtures is recommended, in order to provide added protection for end-of-life conditions when lamp 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
35W Fuse Rating (A)	4	4	4	4	4	4
70W Fuse Rating (A)	4	4	4	6	6	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, and in the worst case could lead to lamp rupture

Use in enclosed fixtures to avoid the following:

- Risk of fire.
- Use in enclosed luminaire with front cover made of glass capable of containing the fragments of a lamp should it shatter
- A damaged lamp emits UV radiation which may cause eye/skin injury
- Unexpected lamp rupture may cause injury, fire, or property damage
- Turn power off if glass bulb is broken. Remove and dispose of lamp

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.