GE Consumer & Industrial
Lighting

ConstantColor CMH™

Ceramic Metal Halide Lamps
150W 4000K type
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 LucaloxTM lamp, which minimises the chemical changes inside the lamp through life. When combined with the halide doses used in ArcstreamTM 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.

FEATURES

- Consistent colour over life
- Colour uniformity lamp to lamp
- Energy saving installation
- Dimmable – better color control on electronic ballast
- Operates on either electronic or electro-magnetic ballasts
- Up to 15,000 Hr life
- UV control
- Easy retrofit for High Pressure Sodium lamps

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.

APPLICATION AREAS

- Architectural floodlighting
- Street Lighting
- City Beautification

MESOPIC LIGHTING

Human eye sensitivity curve maximum is different for daylight and - for example – for night driving light levels. The more overlap a light source spectrum have with this curve the higher illumination we interpret.
Research conducted to find an optimal lamp spectrum fit to the human eye sensitivity curve under night roadway illumination levels. That we call mesopic illumination levels. Research shown the lamp developed enhances visibility of objects and decrease reaction time. In the other hand while keeping the same illumination levels it can substitute a higher wattage HPS lamp.

SPECIFICATION SUMMARY[1]

Ordering Information Description	Product code	Wattage	Colour	Format
CMH150/UVC/T/U/842/E40	21514	150	4000K	Tubular

General	Units	
Product code		21514
Nominal wattage	W	150
Bulb format		Tubular
Bulb material		Heat resistant/Hard Glass
Bulb finish		Clear
Arc Gap	mm	10
Bulb designation		T15
Base		E40

Operating Conditions	
Burning Position	Universal
Luminaire characteristics	Enclosed

Electrical Characteristics		Electromagnetic ballast	Electronic ballast	
		Horizontal	Horizontal	Vertical
Lamp power	W	149	145	145
Lamp voltage	V	95	90	90
Lamp Volts Min	V	85	85	85
Lamp Volts Max	V	115	115	115
Lamp current	A	18	16	16
Min. Ignition Voltage	kV	35	N/A[3]	
Max. Ignition Voltage	kV	5	5	
Ballast Required		HPS or MH compatible		
Ballast Impedance at 230V	V/A	99	N/A	
Power Factor Correction Capacitor	µF	20	N/A	

[1] The specification contains data about lamp operated on a typical electromagnetic or on a typical electronic ballast. Actual values may depend on ballast and application.
[2] Optimized for horizontal operation. In vertical orientation best performance achieved by electronic ballast.Note that the lamp voltage inside the luminaire should not deviate by more than 10V from the bare lamp voltage in free air. Thermal protection recommended.
[3] Minimum voltage should be such as lamp should start reliably. Usually 3 kV pulse.

SPECIFICATION SUMMARY

Photometric characteristics	Units	Electro magnetic ballast1	Electronic ballast
Product Code		21514	
100 hour Initial Lumens	lm	14500	14500
Typical Lumens change with burning position - vertical to horizontal	lm	N/A	300
Correlated Colour Temperature V	K	N/A	4450
Correlated Colour Temperature H	K	4100	3850
Chromaticity X Vertical		N/A	0.367
Chromaticity Y Vertical		N/A	0.394
Chromaticity X Horizontal		0.377	0.386
Chromaticity Y Horizontal		0.376	0.378
Colour Rendering Index VBU	Ra	N/A	80
Colour Rendering Index Hor	Ra	89	88
Luminous efficacy Hor	lm/W	97	98

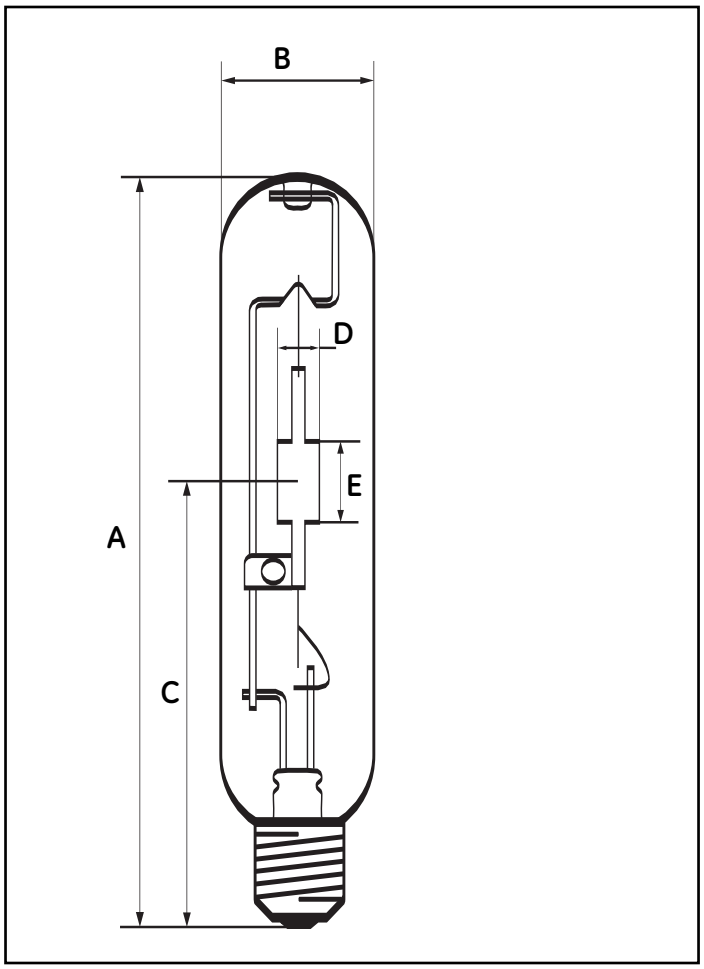
Starting characteristics		
Time to start (at 25 oC)	s	< 10
Time to start - Cold box test at -30°C	s	< 30
Warm-up time (for 90% lumens)	min	3
Hot restart time	min	15

Through life Performance[2]		
Lumen maintenance at 40% rated life (mean lumens)"	lm	11000
Average rated life	h	15,000

Safety requirements		
Maximum allowed bulb temperature under abnormal conditions[3]	deg. C	310 (based on IEC)
Maximum base temperature[3]	deg. C	210 (based on IEC)

[1]The specification contains data about typical performance (50 Hz sine wave at nominal W). Actual values may depend on ballast and application.
[2]Life data measured in Horizontal position.
[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

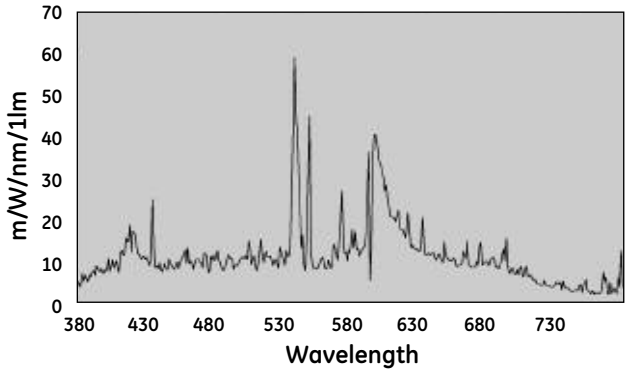


Dimensions Product code		21514
A	mm	207
B	mm	48
C	mm	132
D - Burner height	mm	13.8
E - Burner width	mm	8.8

SPECTRAL POWER DISTRIBUTION

Spectral Power Distribution curves are given in the following diagram

Spectral Power Distribution 3000 K

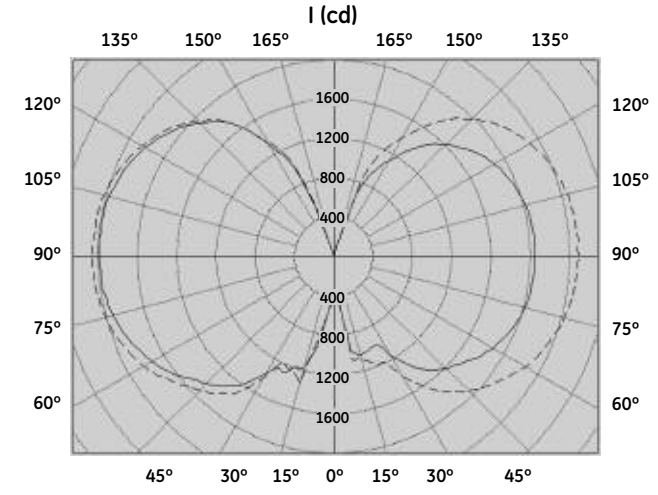


DISTRIBUTION OF LUMINOUS INTENSITY

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

Vertical plane polar intensity curve

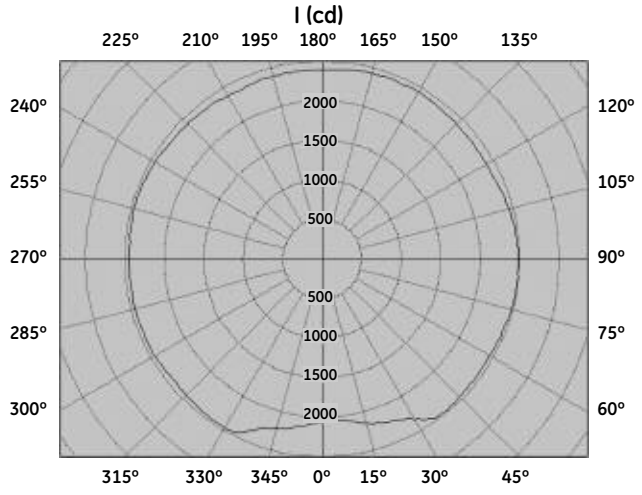
150 W



C180° ——— C270° -------- C0° ——— C90° --------

Horizontal plane polar intensity curve

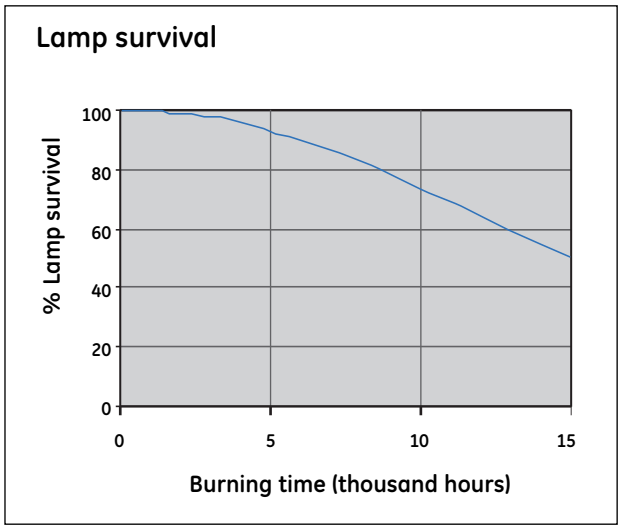
150 W



G90° ———

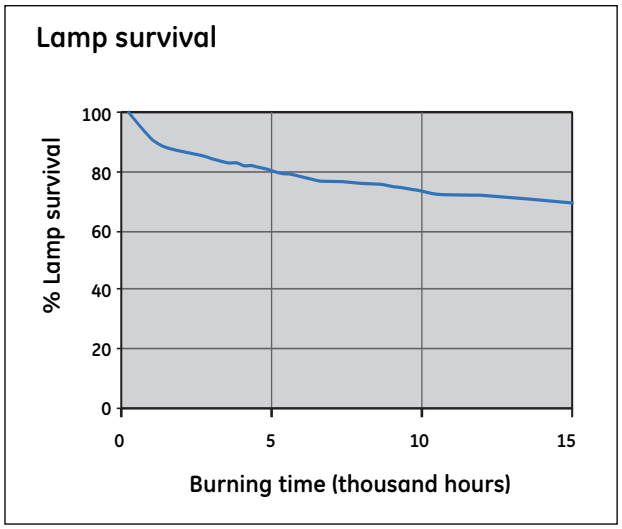
LAMP LIFE

The tables and graphs show the mmortality 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.



LUMEN MAINTENANCE

Lumen maintenance graph shows how the luminous output decreases throughout life. 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. Curves are representing 11 hours per start cycle, less frequent starting will improve lumen maintenance.



END OF LIFE CONDITIONS

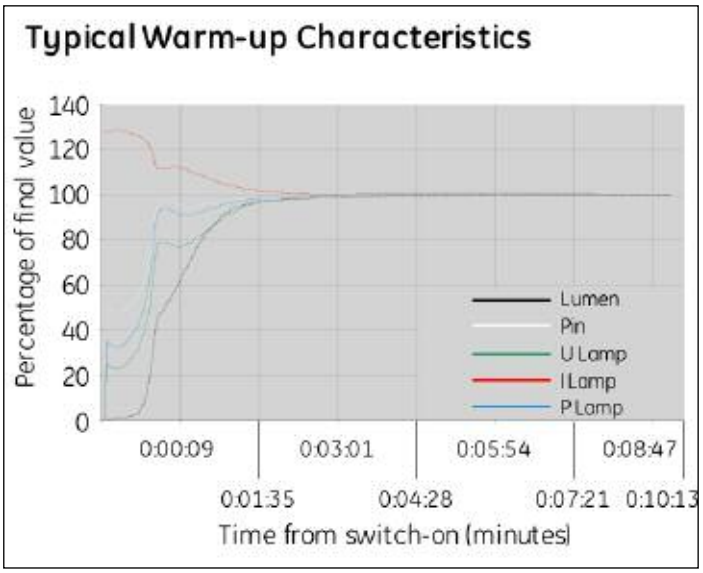
The principal end of life failure mechanism for CMH™ lamps is arc tube leakage into the outer jacket. At the high operating temperatures inside the arc-tube, the corrosive dose material gradually corrodes the arc tube wall and can eventually cause leakage after a long period of time. Arc-tube leakage 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. It is good practice with lamps that are operated virtually continuously to introduce a switching once every 24 hours. Lamps with one electrode failing often will not restart and thus are detected and can be replaced. See Fusing Recommendations.

LUMEN DEPRECIATION

All metal halide lamps experience a reduction in light output and a very slight increase in power consumption through life. (When operated on electronic ballast that phenomenon does not work.) 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.

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.



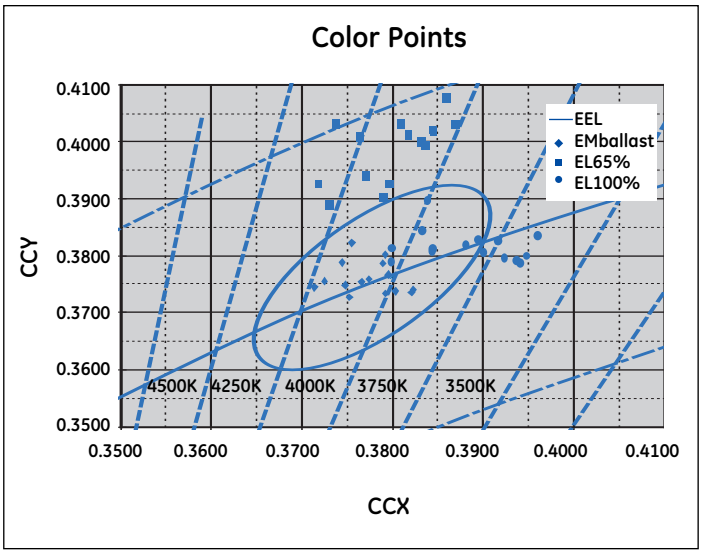
SUPPLY VOLTAGE SENSITIVITY

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

On ballasts specifically designed to operate lamps at reduced power dimming is possible with this product. Dimming to 70% does not affect the lamp performance significantly. Dimming to 50% provides reliable operation. There results may vary on ballast type.

The diagram to the right illustrates the colour coordinates in horizontal operation on a typical electromagnetic ballast (blue), on a typical electronic ballast (red) and on a typical electromagnetic ballast dimmed to 65% power (green). The 6 mpcd ellipse is indicated on the figure.



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.

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		**150W**
UV-PET Performance	µW / (cm²) / 500LUX	
UV C	220-280nm	0.0000
UV B	280-315nm	0.0000
UV A	315-400nm	5.7029
UVC/UVB		0.0000
UVB/UVA		0.0000
E_{eff}		0.0004
PET (h)±10%		1898
Risk Group	IESNA RP-27.3-96	Exempt

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
- 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.

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

CAUTION

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

Always follow the supplied lamp operation and handling instructions.

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

When designing a luminaire one should take into account that fixture layout (the position and distance of lamp and ballast) could influence lamp performance as well.
Conventional ballasts generally have stray magnetic fields around them, and if a lamp is placed within this field it can lead to “bowing” of the arc in the discharge tube. Since ceramic arctube is much more rigid, than quartz arc tubes, this bowing can lead to arc tube rupture and cause the lamp to fail early.
Therefore in fixtures where the ballast is placed near the lamp the use of magnetic shielding is suggested. Another possibility is to use electronic ballasts, that eliminate the need for ignitors, simplify wiring and have smaller stray field.

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 61167.

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 .

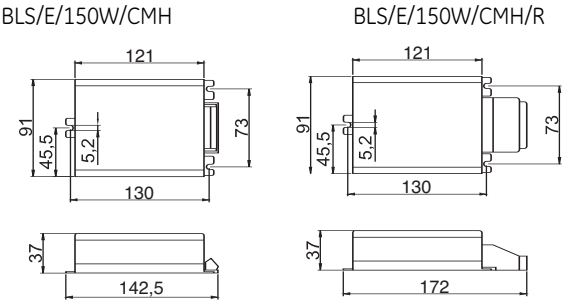
CONTROL GEAR AND ACCESSORIES

Electronic Ballasts

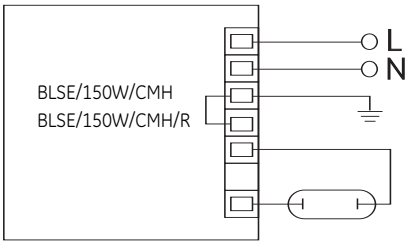
A range of GE electronic ballasts have been introduced to complement the ConstantColor™ Ceramic Metal Halide lamps. Power controlled electronic ballasts suitable for operation of Ceramic Metal Halide lamps are available from various gear manufacturers.
Advantages are:

- 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

Electronic Ballasts



Circuitry



FEATURES

- Integral version with open terminals for embodiment into luminaire
- Remote version with terminal cover and cable strain relief for location outside the luminaire
- 50,000 hours service life under the specified conditions
- Reduced power consumption compared to electromagnetic circuits
- Reduced component count and simplified wiring compared to electromagnetic circuits
- Rapid and controlled power run-up
- Lamp life maximised by square-wave current and constant lamp power
- Excellent lamp colour stability throughout life
- Automatic lamp failure shut-down
- Timed restart after mains voltage interruption
- Immune to mains voltage variations

STANDARDS

The ballasts 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

Operating Characteristics		
Mains Voltage	V	220...240
Mains Current	A	0.69
Mains Frequency	Hz	50...60
Power Factor		> 0.95
Allowed Mains Voltage Range	V	198...264
Ignition Voltage*	kV	< 2.5
Lamp Operating Frequency	Hz	150
Max Cable Capacitance	pF	3000
Max Lamp Distance**	m	25
Ambient Temperature Range	°C	-20...+50
Maximum Case Temperature	°C	80
Thermal Cut-off on PCB	°C	110

* If a hot lamp or no lamp is detected the ballast will attempt to start the lamp after one minute, if not successful further attempts are made up to a maximum of 4 times in 5 minute cycles, then if not successful the ballast will shut-down. The ballast is reset automatically by a supply interruption.

** Typical value if cable capacitance is below the specified limit

General Information

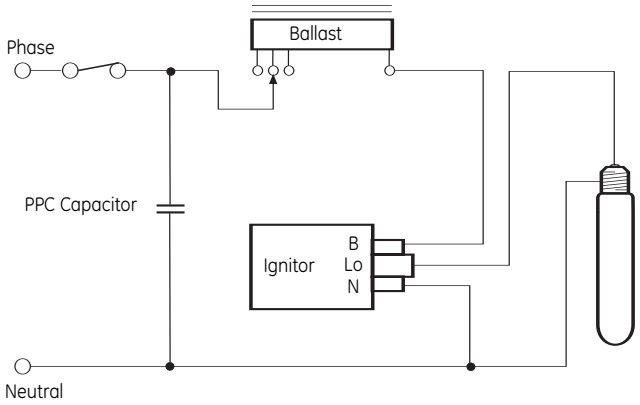
Watts	Volts	Description	Mounting	Weight	Pack Qty	Product Code
150	220-240	BLS/E/150W/CMH	Integral	430 g	12	13050
150	220-240	BLS/E/150W/CMH/R	Remote	445 g	12	13053

CONTROL GEAR AND ACCESSORIES

Superimposed Ignitors

In most installations Ceramic Metal Halide lamps are operated on conventional ballast using superimposed ignitors. These ignitors generate starting pulses independently from the ballast and they need to be placed close to the lamp (usually within the luminaire). Typical circuit diagram is displayed below:
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.

Typical superimposed ignitor circuit



Suitable Ignitors

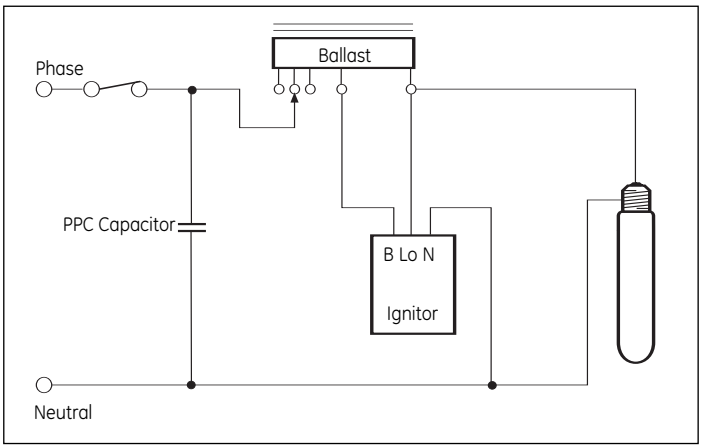
Suitable high-energy (superimposed) ignitors are listed below recommended by gear manufacturers. Check with your supplier for their current range of ignitors. Lamp re-starting under warm lamp conditions can take up to 15 minutes. Suitable ignitors with a warm restart of less than 15 minutes include the following, with the list not being 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 MK A20

Impulser Ignitors

Impulser type ignitors use the ballast windings as a pulse transformer and can only be used with a matched ballast. Always check with the ballast and ignitor supplier that the circuit components are compatible. Ignitors must be capable of generating a pulse voltage and pulse width greater than the minimum specified for ConstantColor™ CMH lamps.

Typical superimposed 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.

CONTROL GEAR AND ACCESSORIES

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
150W Fuse Rating (A)	4	6	10	10	16	16

WARM RE-STARTING

Because of the ceramic materials and the vacuum jacket ConstantColor CMH™ lamps loose their heat slowly. It is possible with low energy (impulser) ignitors to reach the required breakdown voltage, but not sustain a thermionic discharge. Under these conditions the lamp can remain 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 ignitor from the list given in the superimposed ignitor section.

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