

GE ConstantColor® CMH® Ceramic Metal Halide Lamp Color Performance and Dimming

New approaches to Metal Halide lamp design, materials and processes have recently led to the introduction of GE's ConstantColor® CMH® family of Ceramic Metal Halide lamps which are significantly different in performance when compared to standard Quartz Metal Halide (QMH) lamps.

The need to provide energy savings by operating metal halide lamps on dimming systems has typically resulted in less than desirable color performance with QMH lamps. The new CMH® lamp technology has significantly improved the lamp lumen maintenance, Color Rendering Index (CRI) and minimized color variability initially and throughout life for full wattage and reduced wattage operation. These new CMH® lamps have very minimal color variation lamp-to-lamp and imperceptible color shift, while providing improved lumen maintenance never before seen with standard QMH lamps.

Lumen Maintenance

The term "Lumen Maintenance" describes the lumen output of a lamp at its initial rated value (beginning after 100 hours of burn in time) and then throughout life. Manufacturer's catalogs typically provide both "Initial lamp lumens" measured after 100 hours burn time and "Mean lumens" measured at 40% of rated life. Lamp mean lumens are often expressed by stating the lamp's percentage of initial lumens. QMH lamps have mean lumens of approximately 65 percent of initial lumens, PulseArc™ QMH lamps have mean lumens of approximately 75 percent of initial lumens while CMH® lamps have mean lumens of approximately 85 percent of initial lumens. These lumen maintenance values assume that the lamps are operated on standard magnetic type ballasts. With the advent of new "electronic ballast technology", preliminary data suggests that lumen maintenance for both QMH and CMH® lamps can be improved by as much as 10 points, bringing the lumen maintenance of CMH® lamps similar to that of Fluorescent lamps. However, these systems will require much future testing before conclusive results are established.

Beyond mean lumen ratings very little or no reference is typically made to the lumen output as the lamp progresses toward its end-of-life lumen output. This last point can make a big difference as to the total lumen performance throughout life when comparing different metal halide lamp technologies. Lamps that have a higher percentage of initial lumens at end-of-life provide more useable lumens over a longer period of time and can provide more benefits to end-users when selecting one system over another.

Lamp Color Spread

Color spread or color consistency for QMH lamps describes the range of color variation (in Kelvin temperature) that can be seen by an individual. Normal color spread for QMH lamps is expressed in steps of an industry recognized 10 step Color Oval, whereby each step represents approximately 100 degrees Kelvin. QMH lamps can have a normal range of 10 steps spread or approximately +/- 500 degrees Kelvin, with color variation being greater than this during the initial 100 hours of burn in time.

Much tighter color spread is achieved with CMH® lamps, which have as little as +/- 75 Kelvin spread for some G12 and Double Ended types, to a maximum of +/- 150 Kelvin for other ceramic metal halide types.

Lamp Color Shift

Color shift for standard QMH lamps describes how color temperature changes as lamps age throughout life and can be as much as 300 Kelvin shift from initial color temperature. Standard QMH lamps shift to a warmer looking, lower color temperature, while the GE lamp descriptions with prefix MXR shifts to a cooler looking, higher color temperature as they age. When replacing an individual older lamp with a new one, color shift may introduce a wider total color spread into an installation than when the initial set of lamps was installed.

GE's CMH® family of lamps has imperceptible color shift as they age and appear similar to each other regardless if they are new or old. This means that when a replacement lamp is installed it will have nearly the same color appearance of the older population lamps. Minimizing color spread and color shift by using CMH® lamps is a desirable feature when considering aesthetically pleasing color for critical applications.

Color Rendering Index (CRI)

CRI is an international system used to rate a lamp's ability to render object colors. The higher the CRI (based a 0-100 scale), the better colors appear. It is common practice that for different task conditions CRI is chosen which best suits the task requirements and can be considered as follows:

<u>Task Importance</u>	<u>Recommended CRI</u>
Unimportant	<20
Important	>70
Critical	>85

QMH lamps have a typical CRI rating of 65-70 and are considered to be a good choice for Important task conditions. However, CMH® lamps have a higher CRI rating of 85 for most types and >90CRI for SPXX types, making them very desirable for Critical task applications.

Throughout lamp life, both QMH and CMH® CRI maintenance stays fairly constant or may even increase a few points, but nothing very significant.

Dimming Effect on Metal Halide Color Performance

Conserving energy on metal halide systems is achieved by operating the lamp at lower wattage. Approved metal halide dimming systems are currently available which limit lamp dimming to no less than 50% of rated full wattage in order to preserve the lamp life rating. While saving energy is the practical outcome of dimming, the affect on color performance can be of great importance when choosing QMH versus CMH® lamps for specific task applications.

When QMH lamps are dimmed to 50% of full rated wattage, color temperature shifts to a cooler looking, higher Kelvin temperature. Likewise, CRI drops from approximately 65 CRI to approximately 45 CRI, making the lamp unappealing for Important color applications.

On the other hand, when CMH® lamps are dimmed to 50% of rated wattage, color temperature again shifts to a cooler looking, higher Kelvin temperature, but CRI is less affected and only drops to approximately 65 CRI, which is what standard QMH lamps are at

full wattage. This makes CMH® lamps more appealing for Important to Critical color applications.

When selecting metal halide lamps, users must take into account many variables in order to maximize the required value of the lighting system. While lamp life and lumens are often the most obvious parameters to consider, lamp color performance can be of equal or more importance depending on the application. New GE ConstantColor® CMH® lamps provide the best Multi Vapor® lumen maintenance, minimal color spread and shift, and the highest CRI for the most challenging application requirements.

For information regarding GE ConstantColor® CMH® lamps, contact your local GE Sales Representative or www.gelighting.com for help with all your lighting needs.

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6-4-04

CMH Vs QMH
Color Control Rev6-4-04