



Aromat Corporation-Lighting Division

AID013

*Metal Halide Lamp Dimming
Overview*

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Metal Halide Dimming Overview

Background:

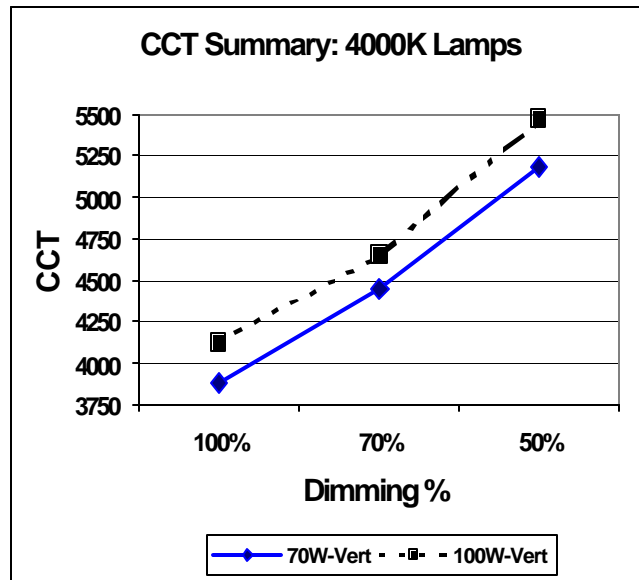
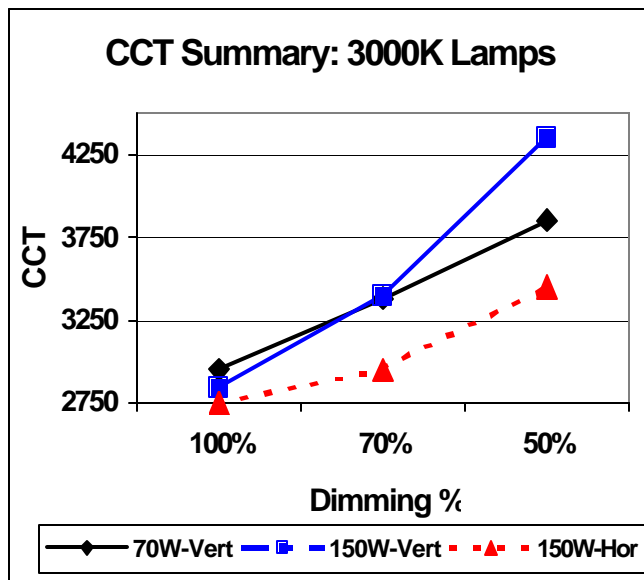
There has been significant activity in the retail lighting channel to convert track spot lighting from old style halogen incandescent lamps to new technology fixtures with the superior system benefits of electronically - driven, ceramic arc tube metal halide lamps. These exciting new benefits include:

- Up to 5 times longer lamp life
- Fixture to fixture color uniformity
- Constant lumens vs. line voltage
- Up to 51% reduced energy consumption: 39W MH vs. 90W HIR lamp
- Reduced wiring costs (twice as many fixtures per branch circuit)
- Proven reliability of Aromat electronic ballasts

Due to the wide use of incandescent lamp dimming systems and the bi-level HID systems, it is only natural that the question of dimming metal halide lamps in retail fixtures would arise. To respond to this question, the following commercially available ceramic arc tube lamps were tested at 100%, 70% and 50% power levels:

- 70W Ceramic MH 3000°K & 4000°K
- 100W Ceramic MH 3000°K
- 150W Ceramic MH 3000°K

Results:



Conclusions:

Dimming of the new ceramic arc tube metal halide lamps can indeed save energy; however, dimming is not acceptable for "color-critical" retail merchandising applications due to the following characteristics:

- Up to 19% CCT shift at 70% power; up to 53% CCT shift at 50% power
- Dimming creates a color shift away from the black body locus resulting in greenish hue
- Wide variations in CCT shift between vertical & horizontal burn ing positions under dimming modes
- Significant reduction in CRI, (-26.8% at 50% power)
- Reduction in lamp efficacy (-15.3 % at 50% power)

Discussion:

The poor performance characteristics of metal halide lamps when operated with reduced power are not unexpected as the superior white color of metal halide lamps over other HID sources is highly dependent on maintaining the proper arc tube temperature. Various halide salt compositions are basically added to a mercury-based lamp to obtain the superior color temperatures and enhanced CRI levels of MH lamps. These halides must be operated at a specific minimum temperature to fully vaporize and provide the intended design benefits.

Dimming the metal halide lamp reduces the power to the lamp, which reduces the arc tube temperature. As the arc tube temperature decreases, less halides are vaporized and at 50% power the MH lamp is basically operating as only a mercury lamp resulting in the significant color shifts and reductions of CRI and LPW.

In contrast to incandescent dimming in which the lamp color gets “warmer” as its dimmed, the MH lamp can only change to a “cooler” temperature if its power is simply reduced; becoming a greenish or bluish color (depending upon the lamp chemistry) of a mercury lamp discharge. This is unacceptable as it is totally opposite of the typical incandescent dimming experience and expectation for retail or ambience mood lighting.

It is the opinion of many lighting designers that metal halide dimming would be a nice feature for various lighting applications; however, *the color must remain essentially constant*. Simply reducing the lamp power by limiting the lamp current does not achieve constant color. Perhaps future MH lamps and electronic ballast system developments can achieve this objective.

Reference Materials:

1. “Dimming of Ceramic Metal Halide Lamps”, 8th International Light Source Symposium; Sept 1998; Rob A.J. Keijser, Philips Lighting B.V.
2. “Properties of High Intensity Discharge Lamps Operating on Reduced Power Lighting Systems”; Summer 1993-Journal of the Illuminating Engineering Society; D. Smith and H. Zhu: Sylvania Lighting Division.