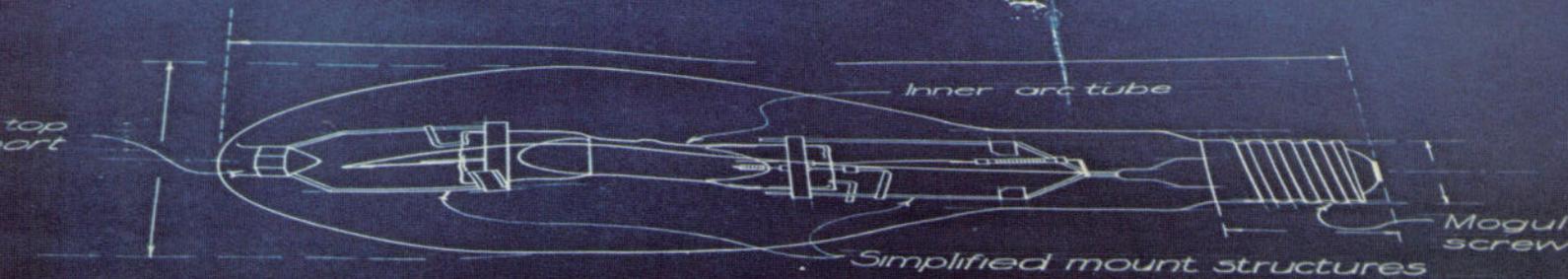
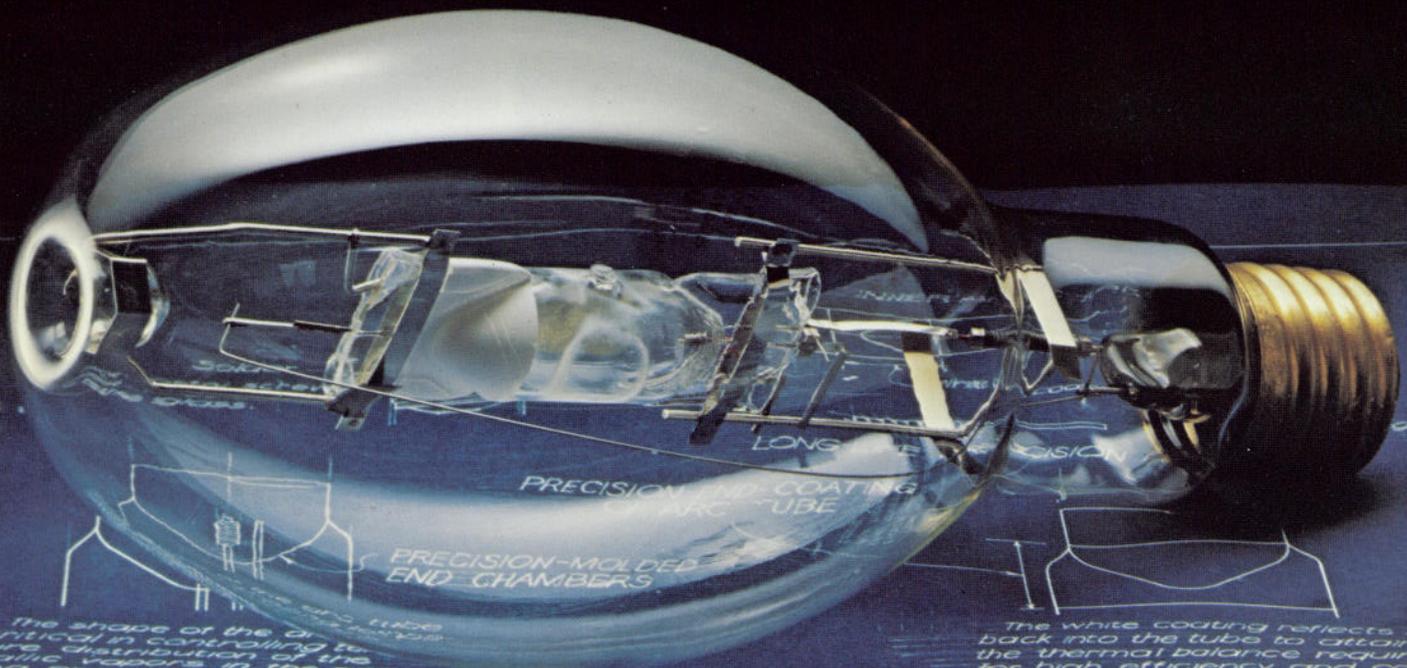


Metal Halide GE MULTI-VAPOR® LAMPS

Have the *EDGE*



MULTI VAPOR LAMP

Extraordinary Design from General Electric

GENERAL  ELECTRIC

GE Multi-Vapor lamps—for economical daylight-quality lighting systems

Why do you buy metal halide lamps? To get daylight-quality light at low cost! And to provide you that lighting value, metal halide lamp design must produce a balanced combination of high efficiency (lumens-per-watt), consistency of color, output and wattage, reliability (freedom from early failures), and long life. A design that

assures optimum interaction of the complex physical, chemical and electrical factors of lamp operation.

Multi-Vapor® is the GE trademark for metal halide high-intensity discharge lamps. GE invented and patented them over 13 years ago — and has continued to improve their design and construction features. So today, GE Multi-Vapor lamps give you unsurpassed value in metal halide lamps—for a light source

combining sparkling daylight color with high lumen-per-watt efficiency in relatively large "packages of light," yet permitting good optical control.

In short, GE Multi-Vapor lamps give you the EDGE in providing low-cost daylight-quality light.

Following are the principal areas of excellence in Multi-Vapor lamp performance, related to the GE construction features that make such performance possible.

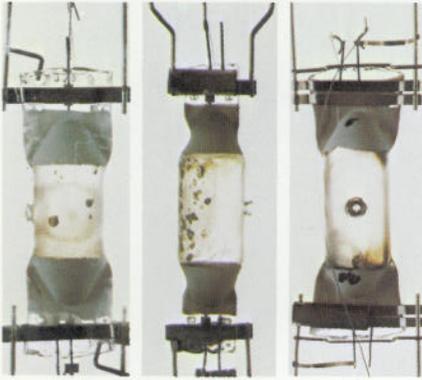
| REASONS FOR GE MULTI-VAPOR EXCELLENCE IN PERFORMANCE. | | | | | | | | | |
|-----------------------------------------------------------------------------|----------------------------------------|------------------------------|-------------------------------------|--------------------------------|-----------|-------------------------|-------------------------------------------------------|------------------------|-----------------------------------|
| Lamp Performance Benefits GE Design as Construction Features Responsible | Initial Color Uniformity Lamp to Lamp | Color Stability Through Life | Resistance to Arc Swirl and Flicker | Wattage Stability Through Life | Long Life | Minimal Early Failures* | High Lumen-per-Watt Efficiency | High Lumen Maintenance | Exclusive Burn-Any-Position Lamps |
| | Precision-Molded Arc Tube End Chambers | | | | | | Total Design Plus Rigid Manufacturing Quality Control | | |
| Precision Scandium/Sodium Dose | | | | | | | | | |
| Precision White End Coatings of Arc Tube | | | | | | | | | |
| Long-Life Electrodes | | | | | | | | | |
| Conservative Arc-Tube Loading | | | | | | | | | |
| High-Sensitivity Bi-Metal Switch | | | | | | | | | |

*Early Failures = lamp failures that occur within the first 20% of rated life.

1. Precision-Molded End Chambers

The shape of the arc tube is critical in controlling temperature distribution of the metallic vapors in the arc during operation, so as to attain color consistency from lamp to lamp, and color stability through life. Particularly important in achieving these results is the shaping of the end chambers of the arc tube.

GE Multi-Vapor arc tube ends are formed by blowing the quartz against a mold during



400-watt metal halide arc tubes in lamps. GE picked at random from production, others are "worst cases" selected from a small group of lamps purchased in the market.

pinching, which results in very consistent shape from lamp to lamp. This process is performed on special equipment designed and built by GE. Other manufacturers appear to be using tube-forming techniques that result in less-precise and less-consistent shapes, as can be seen in the photos.

2. Precision End-Coating of Arc Tube

The white coating on the ends of GE Multi-Vapor arc tubes reflects heat back into the tube to attain the thermal balance required for high efficiency and consistent color from lamp to lamp. GE uses a special high-reflectivity material that stays white throughout life, thereby assuring a more constant arc temperature that helps keep color constant.

This maintained whiteness also results in less light being absorbed, for improved lumen maintenance during life. The coating thickness and area of coverage are precisely controlled by means of a special dipping process, thus enhancing

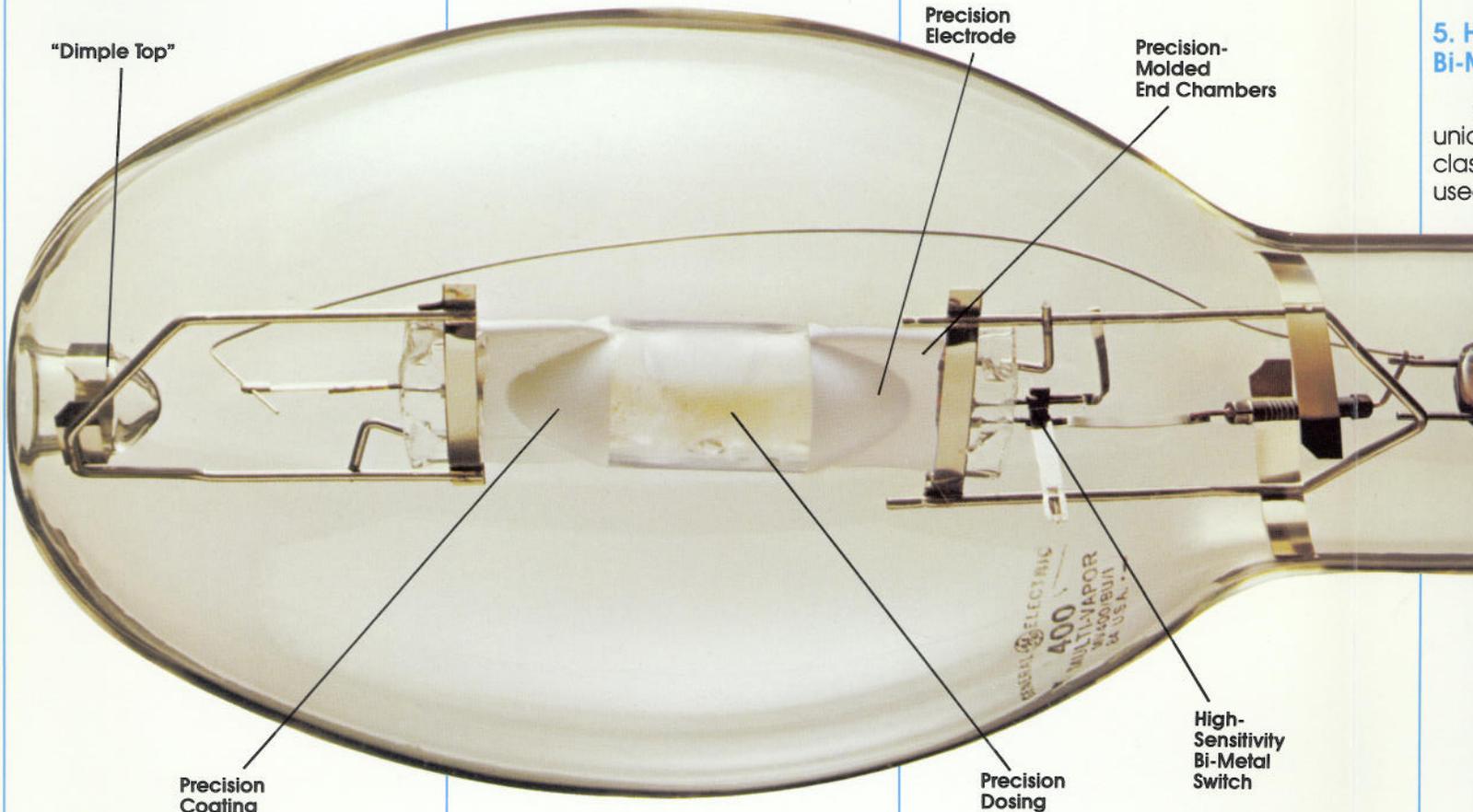
uniformity of color and light output from lamp to lamp. GE coatings also have excellent adhesion properties, with virtually no flake-off during life.

3. Precise Dose of Sodium and Scandium

The deposits noticeable inside the arc tube of an unlighted Multi-Vapor lamp consist principally of sodium and scandium, the elements primarily responsible for the color and efficiency of the lamp. General Electric's proprietary method for putting small but very precisely proportioned



quantities of these materials into the tube makes possible General Electric's superior color consistency from lamp to lamp and excellent uniformity of initial light output.



"Dimple Top"

Precision Electrode

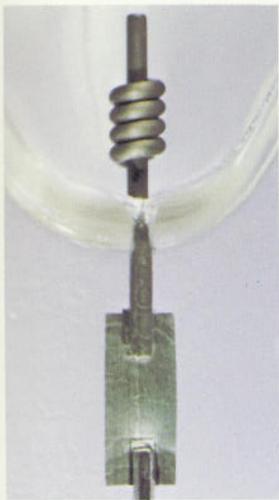
Precision-Molded End Chambers

Precision Coating

Precision Dosing

High-Sensitivity Bi-Metal Switch

4. Long-life Precision Electrodes



GE uses thoriated-tungsten electrodes of an advanced design, and has also carefully selected the chemical ingredients within the arc tube to minimize chemical

attack of the electrodes.

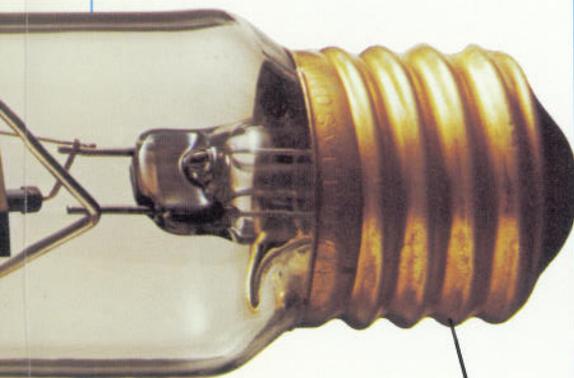
The result is minimal burn-back of electrodes during life, thus retaining a more stable arc length.

This, in turn, results in more constant wattage through life than is typical of Sylvania metal halide lamps.

More-constant wattage is important for two reasons: (1) greater temperature stability, resulting in less color shift, and (2) lower average lamp wattage through life results in lower energy costs (see page 6).

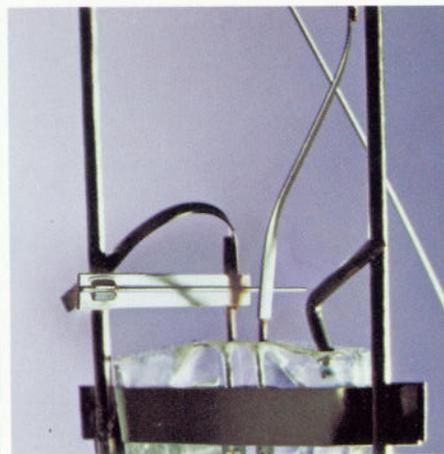
5. High-Sensitivity Bi-Metal Switch

GE Multi-Vapor lamps use a unique configuration of the classic bi-metal switch which is used to "short out" the auxiliary



Mechanical Base

starting electrode from the electrical circuit after the lamp has ignited, so that all the lamp power is used in the main arc stream. The bi-metal switch in most other metal halide lamps is less heat-sensitive than GE's, so that it must be mounted in different positions within the lamp, depending on whether the lamp is for base-up or base-down operation. For example, in Sylvania base-down lamps, the switch is at the end opposite the base, where heat rising from the arc tube can activate it. In Sylvania base-up to horizontal lamps, the switch is near the base, again depending on heat convection (and radiation) to operate it.



The GE bi-metal switch is always mounted near the base end of the arc tube. It is so heat-sensitive that it will operate regardless of the lamp position, thus making possible the exclusive universal-burning-position feature of GE Multi-Vapor lamps.

6. E-Bulb Shape

General Electric's unique dimple-top bulb shape provides a means for supporting the end of the arc tube mount structure securely and precisely centered on the base axis, using a minimum of welded-on parts that could rattle or come loose.

An additional benefit evident in the phosphor-coated E-bulb lamps is that the entire top of the bulb is coated. No clear area need be left at the top of the bulb to contain the mount support "bumpers," as is done in other lamps. Thus, the whole bulb provides color-improved light.

In base-up operations, there is no stray light from the arc tube to cast color shadows or patterns on the floor, as with other brands of phosphor-coated lamps.

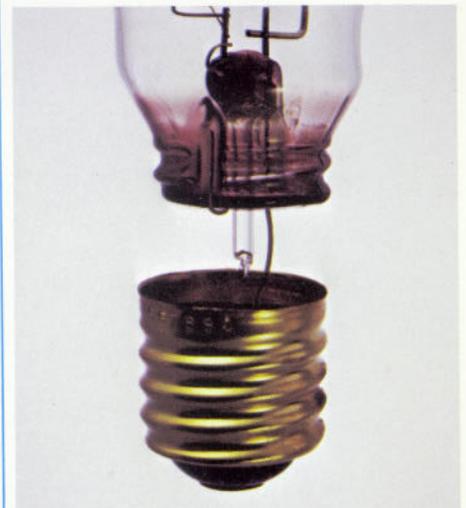


7. Precision Electrostatic Phosphor Coating

Advanced techniques developed by GE for applying the phosphor coating on "-/C" lamps provide precise control of the thickness and uniformity of phosphor deposits. This control is another factor in General Electric's high light output and excellent color uniformity lamp-to-lamp and throughout life.

8. Mechanical Basing

The mogul screw base of 175- and 250-watt GE Multi-Vapor lamps is precisely and securely attached to the bulb by means of



the solder-lock mechanical basing system. During the process of sealing off the bottom of the glass outer bulb, a series of screw threads are pressed into the glass. The metal base shell is screwed onto these threads, and solder is flowed into a "keyway" in the glass adjacent to the top of the base, simultaneously locking the base in place and attaching an electrical lead to the base.

General Electric believes "solder-lock" to be an extremely

durable and secure basing system. Some other lamps (Westinghouse) still use cement to attach the base.

GE 400- and 1000-watt Multi-Vapor lamps currently use the time-tested and very effective conventional "mechanical base" system, which we believe also to be more durable and secure than bases that are cemented on.

Multi-Vapor Lamps Give You the Performance/Economy Edge

You've seen the features inherent in the Extraordinary Design of General Electric Multi-Vapor lamps. Now, here are the ways in which GE Multi-Vapor lamps have the EDGE in performance and economy over other lamps in the market.

Superior Color Uniformity—Initially and Throughout Life

In this chromaticity chart* (fig. A) are shown the "color points" of several common light sources including GE 1000-watt clear Multi-Vapor (MV1000/U). Other Multi-Vapor wattages, and phosphor-coated lamps, have slightly different color points.

Metal halide lamps, which contain several light-emitting elements, each providing different colors of light, have a tendency to vary somewhat in color from lamp to lamp. The range of color variation is represented on the chromaticity chart by a "color tolerance oval".

The expanded section of the color chart B shows 6-step and 9-step ovals. One step represents a just-noticeable difference in color. Individual GE MV1000/U lamps may fall anywhere within the smaller 6-step oval, indicating a maximum color variation of 6 just-noticeable steps in their initial color. Sylvania 1000-watt metal arc lamps have about 50% greater color variation (9 steps) according to the tolerance oval published by Sylvania.** This means the GE lamps are much more uniform in initial color. GE lamps of other wattages, both clear and phosphor-coated, are also held within the smaller 6-step oval.

All metal halide lamps tend to shift color somewhat during life. GE Multi-Vapor lamps are much more stable and uniform in color throughout life, not only because they are more uniform initially, but also because GE long-life electrodes (page 4) result in more constant wattage.

GE color consistency, initially and through life, will give your installation a much more pleasing, uniform appearance.

*International Standard C.I.E. Chromaticity Diagram — the standard "color map" for indicating the color appearance of light sources.

**GTE Sylvania Engineering Bulletin O-344, High Intensity Discharge Lamps, Metalarc Lamps (10/77).

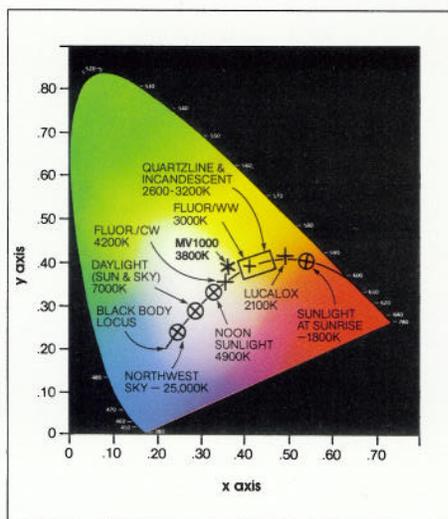


FIG. A
C.I.E. Chromaticity Diagram

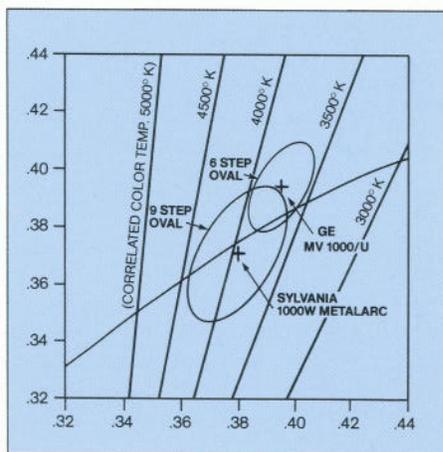
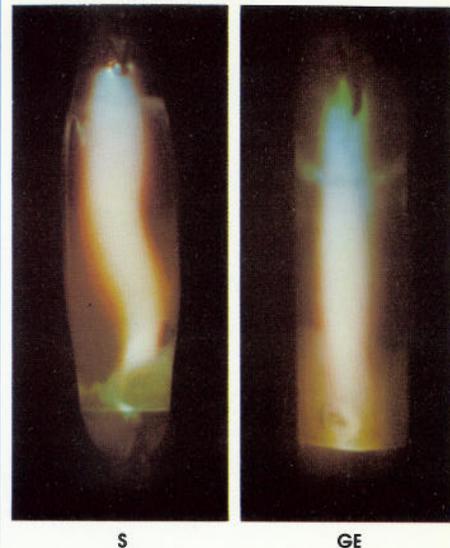


FIG. B

Resistance to Arc Swirl and Flicker

GE Multi-Vapor arc tubes are conservatively designed in terms of watt-loading per unit of surface area, and tube walls are straight and parallel. This design approach,

combined with General Electric's precision scandium/sodium arc tube dosing, results in highly stable operation of the arc.



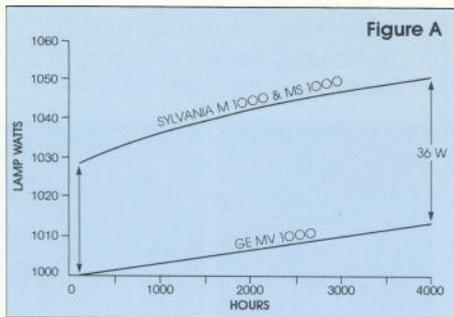
In contrast, the higher-loaded, contoured-side arc tubes in some other lamps exhibit a tendency for the arc to wander around the lower electrode or to swirl or "snake" across the arc gap. For example, in connection with their MS1000 lamp, Sylvania states** that the arc is "slightly less stable than the arc in a straight-walled tube and there may be an almost imperceptible shifting or wandering effect." General Electric's observations of such lamps indicate that the effect is often quite noticeable, resulting in measurable fluctuations in light output and bursts of strong color as the arc wanders within the tube. A photo of the effect is shown here. GE Multi-Vapor lamps are virtually free from such distracting effects.

**GTE Sylvania Engineering Bulletin O-344, High Intensity Discharge Lamps, Metalarc Lamps (10/77).

Minimum Wattage Rise Through Life

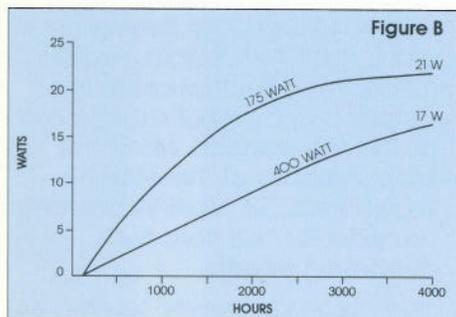
The long-life electrode construction of GE Multi-Vapor lamps, plus their precise dose of a carefully designed sodium/scandium mixture, results in a very low rate of wattage rise through life on commercial metal halide ballasts — as compared to Sylvania lamps.***

***According to GE tests.

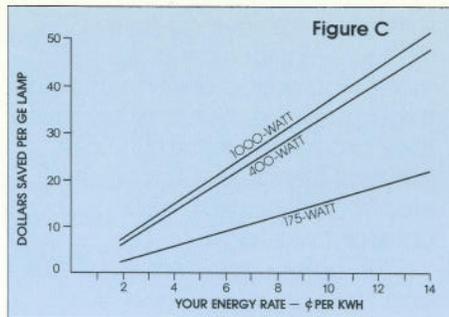


Wattage rise during life — typical lamps on typical commercial halide ballasts.

Figure A shows wattage rise over the first 4000 hours of life for GE vs Sylvania 1000-watt lamps, operated on typical commercial metal halide ballasts. Because of lamp design differences, the Sylvania lamp starts about 28 watts higher than GE. During life, Sylvania wattage increases faster. The 36 watts difference at 4000 hours can be taken as a conservative estimate of the average difference during the 10,000 hour rated life of the two lamps. At 4¢ per kwh, the GE lamp will save you at least \$14.40 in energy cost per lamp over Sylvania's (36 watts x 10,000 hours/1000 x \$0.04/kwh = \$14.40). A significant savings. You can find your savings at your energy rates in figure C.



Additional wattage increase of Sylvania metal halide lamps beyond GE Multi-Vapor wattage rise during life — typical lamps on typical metal halide ballasts.



Dollars saved per lamp (because of lower GE Multi-Vapor wattage rise through life vs. Sylvania).

Wattage-rise differences exist for other standard wattage metal halide lamps on typical commercial metal halide ballasts (see figure B). Again assuming the 4000-hour watt-difference to represent the average difference through rated lamp life, the GE 400-watt Multi-Vapor will save you at least \$13.60 during its 20,000-hour life (4¢/kwh). Similarly, the GE 175-watt lamp will reduce your energy cost at least \$6.30 per lamp during its 7500-hour life. Again, your savings at your energy rates are indicated in Figure C. General Electric Multi-Vapor lamps will hold down your energy costs, during lamp life, to a very significant degree.

Minimal Early Failures

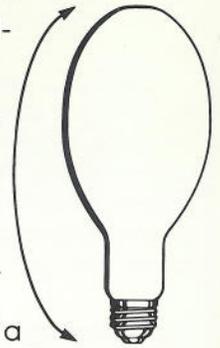
The excellence of General Electric's present Multi-Vapor lamp designs, plus careful quality control during manufacture have resulted in an excellent record of lamp reliability, assuring fewer early failures.

For example, GE 250W, 400W and 1000W Multi-Vapor lamps average less than four failures per 100 lamps during the first 20% of rated life!

A low, early failure rate saves lamp-changing labor costs in new installations.

Universal Burning Position

GE offers Multi-Vapor lamps — in all wattages — that are capable of starting and operating in any burning position, thanks to the unique high-sensitivity bi-metal switch and use of a white reflective coating on both ends of the arc tube. This universal burning feature, a GE exclusive, eliminates the possibility of operating a lamp in the wrong position, which could lead to very short lamp life. One lamp type does the job of two competitive listings, thus simplifying ordering and stocking. You can specify the GE “-/U” lamps regardless of whether your fixtures call for base-up, base-down or horizontal-operating lamps.



Certified Performance

General Electric certifies that GE Multi-Vapor lamps will meet their published ratings of average life, initial and maintained lumens. If any 400-watt lamp fails within 4000 hours of use at 10 hours or more per start, in approved systems, a new lamp will be furnished at no charge (2000 hours for 175-, 250- and 1000-watt lamps, 750 hours for 1500-watt lamps at 5 hours or more per start).

Statements herein are based on information available to GE as of July 1, 1979.

GENERAL  ELECTRIC