

THE QUARTZ MERCURY ARC

BY WILLIAM T. ANDERSON JR. PhD.

The electric arc reaches its peak of attainment in the quartz mercury arc. The visible and ultraviolet radiations are all emitted by the ionized mercury vapor, a condition which permits attainment of the highest arc efficiency.

The natural efficiency of the quartz mercury arc in converting electrical energy into ultraviolet light is enhanced by a predominance of ultraviolet in the light emitted by ionized mercury. Considering the range of light wave lengths transmitted by the quartz, namely, from 1,850 A.U. in the short ultraviolet to 40,000 A.U. in the long infra-red, 28 percent of the emitted energy is in the ultraviolet, an amount greater than that obtainable by any other arc or light source.

The luminous efficiency of the quartz mercury arc is about 5 candle power per watt of input as compared to 3 candle power per watt for the impregnated flame carbon arc, and 1 candle power per watt for the solid core non-impregnated carbon arc. The quartz mercury arc is, therefore, a very efficient source of visible light.

Because of the high efficiency and predominance of ultraviolet in its spectrum, the quartz mercury arc produces an intensity of ultraviolet radiation which can be equalled by other artificial light sources only by the expenditure of four or more times the electrical energy. With regard to power consumption, the quartz mercury arc is the most economical artificial light source known.

In practice, the mercury arc must be enclosed in an evacuated envelope of quartz which can transmit the ultraviolet radiations and can withstand the temperature changes to which it must submit. Glass does not transmit ultraviolet nor can it withstand the temperatures encountered in the arc tube. Thus fused quartz serves in a dual role, and is indispensable to the existence of the arc.

Quartz mercury arcs slowly deteriorate with use, though the deterioration does not materially affect the spectrum of the lamp. An old burner which has been properly cleaned and is not blackened because of a poor vacuum gives the same spectrum as a new lamp. The decrease in the light produced is almost entirely due to changes in the quartz.

The arc itself produces as much light as formerly, but the quartz envelope has decreased in transparency and will not let as much of the light pass out. The resulting decrease in intensity affects both the short and long ultraviolet and the visible portions of the spectrum in a nearly equal measure.

The greatest rate of decrease in the intensity of a new lamp occurs during its first few hours of operation. Since all lamps are given several hours of operating tests in the laboratory prior to stocking and shipment, the initial drop in intensity has occurred prior to shipment. The subsequent decrease in intensity is very much slower.

Deterioration may be hastened by outside causes, such as improper operation, handling, and cleansing. These factors may produce changes which affect greatly the spectral energy distribution, so that the relative intensity of various portions of the spectrum vary with age. It is especially important that only pure liquids which leave no residue on evaporation be employed in washing burners. Many a good burner has been completely ruined through failure to observe this precaution.

The properly aged quartz mercury arc lamp exceeds other light sources of like current consumption in the intensity of its ultraviolet radiation. Indeed, the great majority of the energy measurements which have been made and reported in the literature have employed partially aged quartz mercury lamps.

The operation of the quartz mercury arc is extremely simple. With the exception of occasional washing of the burner, no adjustments of any kind are required. A large number of lamps have been in operation five years and more, without the burner having been once removed from its mounting. The quartz mercury arc is a convenient light source.

Since the arc is completely enclosed, there are no fumes or sparks. While there is excessive heat, many quartz mercury arcs are operated unattended overnight in chemical laboratories without anxiety on the part of their owners. The quartz mercury arc is a carefree light source*.

***Note:** When quartz lamps are inserted in water cooled wells, danger can exist if the cooling source is lost; hence a safety cut-off system should be employed especially if operated unattended.



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