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White Paper:

Pulse Start HID Systems and Proper System Maintenance

Metal Halide Systems

Metal halide lighting systems have been utilized for decades as an efficient source of white light in many applications, from parking and street lighting, to warehouse and production facility lighting. The primary advantages of MH systems over other light sources are that they are very efficient and have a long operating life. Another positive aspect of the technology is that their operation is relatively unaffected by ambient air temperature, which allows them to be utilized in environments where other light sources simply cannot survive. The traditional probe start (switch start) metal halide systems were derived from mercury vapor lamps, which were the original high intensity discharge system and are known for producing a blue/green light. Compared to mercury vapor systems, metal halide has far superior color rendering (60+ CRI metal halide vs. 20s CRI for mercury vapor) and they are much more efficient. Objects look better and appear brighter under metal halide than they do mercury vapor.

The recent push for increased energy efficiency has led to legislation that advocates the utilization of an updated version of the metal halide technology – pulse start metal halide systems. Efficiency mandates for new 150W to 500W metal halide luminaires are impossible for traditional probe start metal halide ballasts to achieve so pulse start metal halide ballasts have been deemed the efficient replacement.

A traditional **Probe Start Metal Halide** system contains a ballast - which often includes a capacitor - and a lamp. Inside the lamp is an arc tube made of quartz or ceramic, which is where the light is generated. The arc tube contains two main electrodes as well as a starter electrode at one of the arc tube's ends. When power is applied to a lamp/ballast system, the ballast converts the incoming electricity to the specific voltage that is required to operate the lamp and a small arc forms between the starter electrode and one of the main electrodes. This vaporizes the mercury in the lamp and increases the temperature and pressure within the arc tube. The main arc strikes once the temperature and pressure are sufficiently elevated. This excites the mercury and metal halide salts within the arc tube and produces light.

Similar to High Pressure Sodium HID system ballasts, **Pulse Start Metal Halide** ballasts include an ignitor. When power is applied to a pulse start metal halide system, the ballast converts the incoming electricity to the specific voltage that is required to operate the lamp. The ignitor, which is about the same size as a capacitor, sends high voltage pulses of electricity to the lamp that starts the arc within the quartz arc tube. This device provides a faster lamp startup and allows different arc tube designs, but also requires that the socket used be *pulse rated* to take the high voltage starting pulse. The requirement for a pulse rated socket should be considered when retrofitting probe start metal halide systems. Pulse start metal halide systems provide numerous advantages over probe start systems.

Pulse start systems have shorter start up and restrike times than probe start systems. Perhaps even more advantageous, pulse start technology increases the efficacy – lumens per watt – of the lamp. This increase in efficacy frequently allows a lower wattage lamp to be used in place of a higher wattage lamp, which saves energy. For example, a 150W lamp may replace an existing 175W probe start lamp. This is the primary reason that pulse start systems have been deemed superior to the probe start systems they are replacing.

Differences between Probe Start and Pulse Start System Maintenance

When a probe start metal halide system's lamp reaches the end-of-life and it has not been re-lamped prior to this point (as is suggested by the manufacturer), the lamp typically displays symptoms such as an inability to strike the main arc within the arc tube. Consequently, the lamp doesn't achieve significant brightness and occasionally there is a slight blue glow from the lamp (which is the arc between the starter electrode and one of the main electrodes). In a probe start system, delaying a lamp replacement does not damage the ballast so it is a relatively common practice to wait until several lamps have failed before replacing them.

This maintenance practice has very detrimental and expensive effects to a pulse start system. Unlike a probe start lamp, when a pulse start lamp cannot strike the main arc, the starter continues to provide high voltage pulses to the lamp. These pulses can exceed 4000V and will continue as the ballast repeatedly attempts to start the lamp. Even though the lamp has failed, the igniter continues to operate and sends 4000V pulses through the wiring and ballast. This initially does not cause damage to the ballast, but after an extended period of time with a non-functional lamp in the socket, the pulses will eventually wear the ballast and ignitor down.

While similar in operation, a high pressure sodium system does not have this issue, as the lamp is prone to cycle at the end of life, rather than with a metal halide lamp simply not igniting. This cycling will still wear down the ignitor and ballast, but since the lamp does begin to start and will warm up for a period of time before extinguishing and setting off the ignitor again, the impact on ballast and ignitor life is not as significant. For this reason, the issue is not often seen in high pressure sodium applications, despite the similarity in lamp starting technique.

Pulse start system maintenance is very important. Improper maintenance and replacement of lamps can cause major damage to the ballast. Without proper maintenance, a simple lamp replacement can easily become an expensive and time consuming lamp ***and*** ballast replacement. It is often good maintenance practice to schedule full re-lamping prior to the lamp's average rated life. Lamp systems should be regularly monitored and failing lamps should be immediately replaced in order to prevent damage to the ballast.

Summary

Pulse start metal halide systems offer numerous benefits to the user including long life and significant energy savings. They are designed differently than older probe start metal halide systems so they require a maintenance strategy that will fully maximize the system. When a pulse start metal halide system is properly maintained, it will provide efficient, high quality light for a long time.

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