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Partial capacitor failure in HID lamp ballasts: an insidious problem

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Supplemental lighting is responsible for a large portion of the power consumption in growth chambers and greenhouses. Lights not functioning at peak efficiency reduce growth and increase electric consumption. HID lights that appear to be working normally can have a significant reduction in light output without being visually apparent. Over the past two years we have had about 5% of our HPS ballasts with a 60 to 80% reduction in light output caused by partially failed capacitors. This partial failure is not always immediately apparent and the lights continue to function at reduced efficiency for extended periods of time.

HID lights with a partially failed capacitor are characterized by having a lower light output, a lower power factor (VA/W), and a lower efficiency of light output per watt of electric energy used. A light with a capacitor that has lost half of its capacity (down from 26 to 13 microfarads) can be detected visually because the light output is less than half of a normally functioning fixture. The most rigorous test is to measure the output with a quantum sensor or pyranometer, coupled with measurement of the power factor of the fixture. This can be measured with a Kill-a-Watt meter. It cannot be measured with a standard volt-ohm meter.



A direct test of capacitor function can only be accomplished by disassembling the ballast housing to access the capacitor, and using a dedicated capacitance meter. Meters are widely available, starting around \$30. The partially failed capacitors do not show the typical symptoms of failure (budging and oil leakage), but they test at only about 50% capacity (see photo).

An indirect test is to measure the power factor of the light without disassembling the lamp. The power factor of a well functioning light with a new lamp installed is in the range of 0.97 – 0.98. A functioning light with an ageing bulb will have a power factor in the lower 0.90 – 0.94 range, while the lights we have found with capacitors measuring $\frac{1}{2}$ of their rated capacitance have a power factor in the range of 0.70.

