

## Medium Pressure Arc UV versus UV LED Curing Technology Comparison Chart

When considering UV LED curing for your flexographic processes it's helpful to compare to traditional medium pressure arc UV curing technologies. The chart below provides general and specific comparisons of UV lamp characteristics and process design considerations for typical narrow web flexo label, tag, and flexible packaging processes. The notes column provides additional relevant details, considerations, and pointers for a process development or design engineer.

|                                   | ARC (medium pressure)                    | UV LED  | Notes   |
|-----------------------------------|--|---|---|
| <b>Technology Characteristics</b> |  |   |   |
| <b>Useful Life (hours)</b>        | 500 - 3,000*                             | 10,000+   | All UV lamps degrade over time, so it's important to understand "useful life", which is the expected operating hours where adequate curing can still be achieved for your process. *Arc lamp life is significantly reduced if the lamp is not kept within a narrow operating temperature range and by the number of on/off cycles. Additive arc lamps have a shorter useful life than mercury arc lamps.  |
| <b>Cooling Needs</b>              | External Fans - complicated and critical | Internal Fans - simple  | Water cooling sometimes used for all types. In general, UV LED systems require about 10 times less cooling than traditional UV systems and dynamic cooling, like that used in Semray UV LED systems, ensures longevity and optimal operation.   |
| <b>Energy Use</b>                 | High                                     | Low   | UV LED curing systems use 30 to 70% less energy than traditional UV curing systems.   |
| <b>Power Class</b>                | 600 W/inch                               | 14 - 22 W/cm <sup>2</sup>   | This is a general indication of the class of curing system, but does not indicate UV energy reaching a substrate. For arc and microwave systems this is actually the input power. For UV LEDs their rating is typically the peak irradiance at the emission window. Since there is no standard for energy density ratings of UV curing systems, users need to run tests or obtain data from individual manufacturers. <a href="#">Technical Paper: Comparing traditional UV to UV LED</a> |
| <b>Wavelength Output</b>          | Broad - short and long; additive lamps   | Narrow, nearly monochromatic; 365, 385, or 395nm                    | Wavelength output needs to be a best match for the chemistry formulation being cured. This is normally available from your chemistry or ink supplier. The longer wavelengths of UV LEDs are ideal for thick inks, opaque whites, dense blacks, laminating adhesives and PSAs, but surface curing for hard coats is challenging.   |
| <b>Lamp Length</b>                | Up to 110 inches                         | Custom array lengths or multiple modular segments to span wide webs | Long arc lamps require rotating at least each week to prevent bowing of the lamp. Modular UV LED curing platforms like Semray enable quick changes to different wavelengths, different press stations, and less costly upgrades as UV LED chip technology advances. <a href="#">Picture: UV segment coming out of the backplane</a>   |
| <b>Dimming</b>                    | 38 - 100%, step or continuous            | 30 - 100% continuous  | Controls typically tied into overall flexo press controls to improve process flexibility and consistency. Power supply technology is advancing rapidly to include smart, self-monitoring dynamic controls like that found in Semray UV LED systems.   |
| <b>Warm-up Time</b>               | ~ 5 min.                                 | 0   | The instant on/off capability of UV LEDs offer a significant advantage over arc lamps resulting in higher line utilization and production rates.  |
| <b>Restrike Time</b>              | long, must use shutters                  | 0   | Unexpected line stops and changeovers between production runs become non-events with UV LED. No worries that a shutter may break.   |

|                                      |                                    |  |  |
|--------------------------------------|------------------------------------|--|--|
| <b>Mercury</b>                       | Yes                                | No   | UV LED offers a safer work environment, more sustainable production process.   |
| <b>Ozone</b>                         | Yes                                | No   | Short wavelength UV energy generates ozone. Since UV LED does not emit short wavelengths, there is no ozone - you get a safer work environment and more sustainable production process.  |
| <b>Weight</b>                        | Heavy                              | Light  | UV LED units weigh much less, but also the mounting and UV light shielding weighs significantly less making it easier to move to different press stations as needed.   |
| <b>Form Factor</b>                   | Large, Bulky                       | Compact  | UV LED is so compact that it is easy to retrofit onto existing flexo presses and even use in combination with existing arc lamps. With UV LED there are no bulky cooling/exhaust ducts and external fans.  |
| <b>Optical Output Strategies</b>     | Internal Parabolic Reflectors      | Various Micro-optics or External Means to Collect Stray Energy | UV LEDs do not use reflectors internally since the energy is all forward facing. Some UV LEDs incorporate external mirrors, glass rods, etc. or internal micro-optics as a means to better control and enhance the output onto the substrate.<br><a href="#">Heraeus UV LED micro-optics</a>   |
| <b>Process Design Considerations</b> |                                    |  |  |
| <b>Working Distance</b>              | 2.1 inches                         | 5mm to 20mm  | Distance from the face of a UV curing system to the substrate surface. UV energy reaching the substrate drops significantly the larger the working distance, even more so with UV LED systems which emit energy from the emission window at high angles. Semray uses micro-optics to focus the energy enabling larger working distances with less drop in UV energy onto the substrate. This results in reduced contamination of the emission window, thus a more consistent flexo process with increased uptime.  |
| <b>Uniformity Across Wide Web</b>    | OK                                 | Best   | As an arc lamp ages the lamp ends darken impacting the uniformity of UV energy output across its length, i.e. the width of your flexo press. UV LEDs at close distances have poor uniformity, but increasing working distance to improve uniformity decreases energy density on the substrate. Semray uses micro-optics which enables larger working distances which significantly improves uniformity, while maintaining high energy density, especially alongside Semray's self-monitoring sensors which dynamically adjust the LEDs to maintain consistent energy output. <a href="#">Chart: Uniformity of UV LED</a> |
| <b>Consistent &amp; Reliable</b>     | Good                               | Best   | UV LED curing offers significantly more consistent UV energy and wavelength output and high process reliability, compared to mercury arc lamps whose output and wavelength changes cause inconsistent curing, especially for additive lamp processes like laminating and PSAs.   |
| <b>Maintenance Costs</b>             | Highest                            | Lowest   | The savings here can be significant, not only in maintenance labor and consumable parts, but other <a href="#">operating costs</a> that are lower with UV LED curing. Semray's on-board diagnostics and <a href="#">modular platform</a> enable quick troubleshooting and even less maintenance downtime.  |
| <b>First Cost</b>                    | Lowest                             | Highest  | First cost of the UV LED system is typically higher, but installed facilities costs for things like blowers, ducting, and light shielding is significantly less. First cost should be weighed against Total Cost of Ownership (see below), print production rates and resulting increased revenues.  |
| <b>Total Cost of Ownership</b>       | Highest                            | Lowest   | UV LED TCO is lowest based on lower maintenance, energy, consumable parts costs and upgrading. UV LED technology advances rapidly, so TCO depends on a less costly and easily upgradeable platform. Semray's modular plug & play platform enables easy and less costly upgrades and flexibility to move to different press stations. <a href="#">Picture: Plug &amp; Play Segment</a>  |
| <b>Heat Sensitive Substrates</b>     | Good                               | Best   | UV curing is considered a "cooler" process than thermal drying/curing processes. UV LED curing enables curing of heat sensitive substrates not possible with traditional UV curing. As a result, it may be possible now to UV cure new products, expanding flexo press capabilities into new markets.  |
| <b>Chemistry Availability</b>        | Mature, many available chemistries | Many available inks, some OPVs and PSAs                        | UV LED inks are readily available from most flexo ink suppliers (including low migration food packaging inks), and OPVs and PSAs are available and becoming more prevalent.  |

**Start learning more now by clicking the following:**

**[6 Ways UV LED Curing Improves UV Flexo Label Converting Processes](#)**

– Improving label converting processes is an ongoing challenge given how hard it is to keep up with the latest technologies. If you already have medium pressure arc lamp UV curing on flexo presses, this article will help you learn about the benefits of retrofitting existing presses with UV LED curing technology.

**[Optimizing Flexo Label Production: Upgrading Traditional UV with UV LED Curing](#)**

– Upgrading traditional UV curing equipment on flexographic presses to UV LED curing technology offers significant process benefits for label and tag production. But it's prudent to learn what the options are and how each can optimize your label production processes before selecting a UV LED curing system provider.

**[Guide to Retrofitting a UV Flexo Press for Productivity Advantage: UV LED Equipment Features to Consider](#)**

– Considering an upgrade to UV LED curing technology on your flexo press can be daunting. This guide helps you navigate the UV LED curing equipment features that will deliver higher press productivity.