

Using the LM-9000™ Lamp Monitor to maintain UV curing system efficiency



During a recent test performed by a high volume container printer, the LM-9000™ Continuous UV Lamp Monitor was used to analyze the operating performance of two Fusion® F450 UV Curing Systems operating in-line on the company's OMSO® NOVAX M Automatic Container Printer. During a 4-1/2 week span and 188 hours of testing, the printer used the LM-9000™ to simultaneously monitor both lamps and six individual wavelengths within the ultraviolet spectrum.

The first lamp, identified as System 1, was monitored under normal production conditions for approximately two weeks in order to establish the baseline performance of the lamp. During the third week, operators replaced System 1's lamp with a bulb that had accumulated 4700 hours of use. The LM-9000™ showed System 1 had a dramatic drop-off in energy output across the full UV spectrum, but most noticeably in the 365 and 435 range. Upon reinstallation of the original lamp, energy output was restored to levels achieved prior to the lamp replacement. Yet, upon cleaning

System 1's reflector and the bulb, the LM-9000™ noted output returned to levels equivalent to one week after the lamp was initially installed.

Over this same period, a second lamp, identified as System 2, was monitored in the same manner. For this test, rather than replacing the lamp, the printer replaced System 2's reflector with another reflector which had been previously replaced due to yellowed discoloration.

Like System 1, System 2 displayed a gradual fall-off in UV energy during the initial weeks of observation. After introducing the yellowed reflector in the third week, the LM-9000™ showed that output remained surprisingly constant. This revealed that, although yellowed, the reflector had been replaced prematurely. And like System 1, after the reintroduction of the original parts, and following cleaning of the lamp and reflector, output returned to pre-test levels.

Using this hard data, the printer chose to

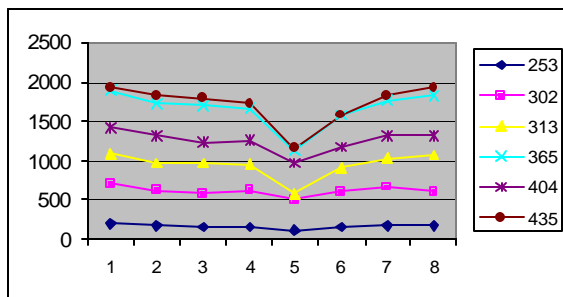
shorten the period between system cleanings from 500 hours to 350 in order to optimize performance. [Note: The LM-9000™ revealed both lamps experienced increasing output over the final week of observation. This indicated that the curing systems's output was also being significantly affected by another operating parameter, possibly temperature or voltage.]

Conclusions

1. The LM-9000 effectively monitored output variations in the performance of two UV curing lamps operating within two Fusion® F450 Curing Systems over a 4-1/2 week period.
2. The LM-9000™ data shows that properly scheduled lamp and reflector cleanings can improve operating efficiency by up to 15% and can prevent costly premature lamp and/or reflector replacement.
3. The LM-9000's continuous monitoring capabilities can effectively reduce operating cost, improve operating efficiencies, and ensure product quality.

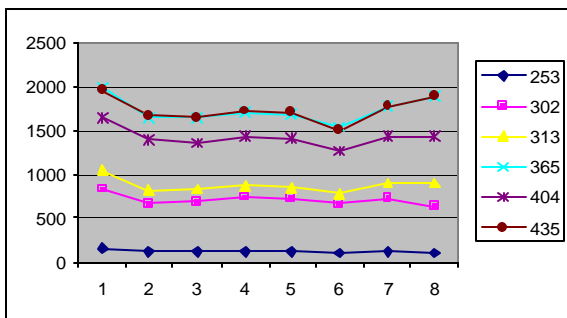
The LM-9000™ Performance Test

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|---------------------------|------------------------------|----------------------------|------------------------------|
| • Type of unit monitored: | Fusion F450 UV Curing System | • No. of hours monitored: | 188 hours |
| • No. of units monitored: | 2 | • No. of charted readings: | 8 |
| • Length of test: | 4-1/2 weeks | • Wavelengths monitored: | 253, 302, 313, 365, 404, 435 |



System 1 - Lamp Replacement Test

1. Original baseline established for new lamp on 10/17
2. Normal operating reading taken on 10/21.
3. Normal operating reading taken on 10/29.
4. Normal operating reading taken after start-up on 11/1.
5. Operating reading taken on 11/1 after bulb with 4700 hours was installed.
6. Operating reading taken on 11/1 after original bulb was reinstalled.
7. Operating reading taken on 11/1 immediately following preventive maintenance (lamp and reflector cleaned).
8. Normal operating reading taken on 11/11.



System 2 - Reflector Replacement

1. Original baseline established for lamp on 10/17.
2. Normal operating reading taken on 10/21.
3. Normal operating reading taken on 10/29.
4. Normal operating reading taken after start-up on 11/1.
5. Operating reading taken on 11/1 after installation of old reflector (originally removed due to discoloration).
6. Operating reading taken on 11/1 after reinstallation of original reflector.
7. Operating reading taken on 11/1 immediately following preventive maintenance (lamp and reflector cleaned).
8. Normal operating reading taken on 11/11.