SPDI UV Total-Cure 8” to 24" Benchtop UV Curing Conveyor System

INSTRUCTION MANUAL

SKU: 302501

Please read this user manual carefully before using the product

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General UV Curing Information

Lamp Information

The lamp emits large amounts of ultraviolet radiation, which can be extremely harmful to eyes and skin. Great care should be taken to insure that personnel are not exposed to direct or reflected radiation from the lamp. Suitable eye and skin protection must be employed when lamp is in operation.

The lamp generates ozone gas during operation. Operating equipment and work areas should be adequately ventilated to comply with the OSHA regulations for ozone.

The lamp should be handled only when cold and with clean cotton gloves. Alcohol can be used to remove fingerprints and all external foreign matter. Premature devitrivication and dramatic poor lamp performance are directly related to a clean outer surface.

UV Curing Principle

Ultraviolet curing is a photochemical process in which an abundant amount of UV energy is produced by a mercury discharge lamp and focused at monomers through cross-linking or polymerization. The sensitizer present in the monomer absorbs UV radiation at a rapid rate and initials the reaction in the monomer, producing a hard dry surface. The rate or speed of the curing process depends on the following:

(A) Chemical Compound – Each monomer will cure at a different rate, depending upon the composition and amounts of sensitizer, pigment, and chemical additives.

(B) Thickness of Coating – The thickness of a specific coating is not directly proportional to exposure time. The amount of UV energy inside a layer of coating decreases exponentially with depth. If 70% of the UV energy is absorbed in the top .001” of coating, then 70% of the remainder or 7% of the initial amount will be absorbed in the second .001” of coating. Thus, a two-fold increase in thickness requires a ten-fold increase in UV intensity.

(C) Amount of UV per Unit Surface – Normally, the curing speed will increase with the amount of UV energy per unit surface at a nonlinear rate. If a 200 watt per inch mercury lamp was increased to 400 watt, the curing speed would increase ten fold.

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The sensitizer should absorb UV in the range which is not absorbed by the monomer or pigment. The wavelength produced by a medium mercury pressure lamp should coincide with the wavelength absorbed by the sensitizer. The continuous light spectrum produced by these lamps in the 200 to 440 nanometer range propels technology to a plateau of efficiency.

(D) The UV Spectrum – Once the basic concept of radiation has been understood, how ultraviolet radiation fits into the scheme of things, and what UV curing contains, then, one can easily understand the advantages and disadvantages of various light sources. UV curing lamps display the following characteristic in *Figure 1*.

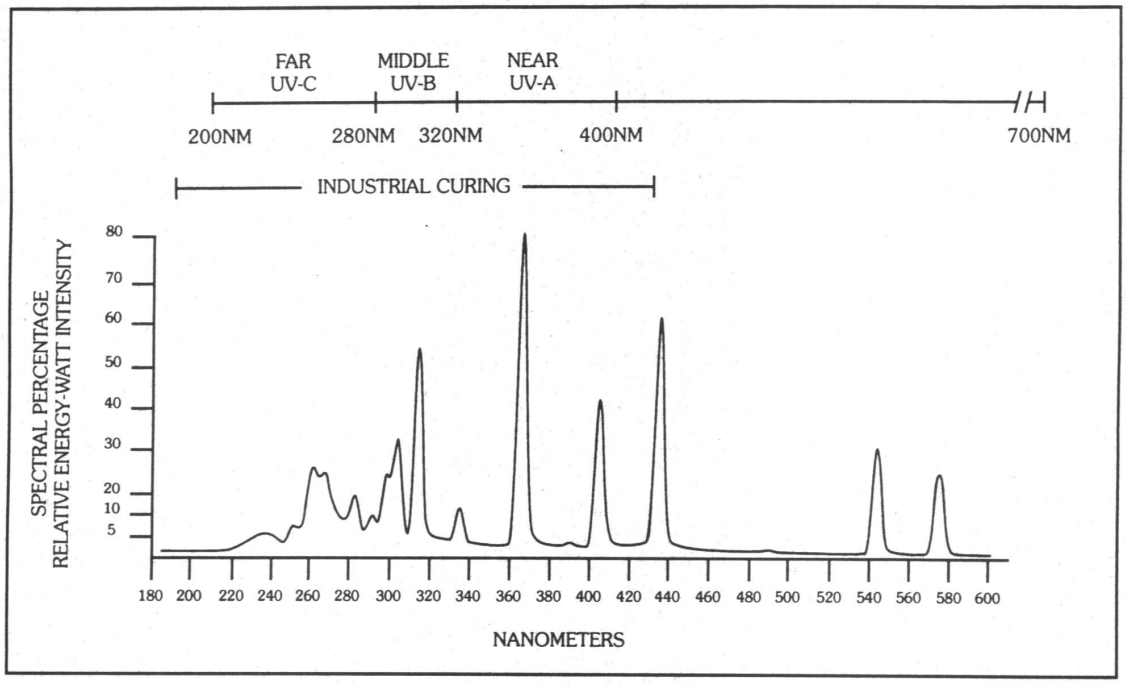

Figure 1

The far ultraviolet lies between 200nm and 300nm and is classified as Germicidal or UV-C. The middle ultraviolet lies between 280nm and 320nm is called Erythmea (suntan) or UV-B. The near ultraviolet lies between the 320nm and 400nm and is commonly called Black Light (long ultraviolet) or UV-A.

(E) Advantages of UV Curing

(1) A drastic reduction in “air pollution” becomes possible with the monomer system of excitation. No solvent need be evaporated and expelled into the atmosphere.

(2) The fast and rapid curing rate UV lamps.

(3) Huge savings in plant space, labor costs, and the highest quality in improved appearance cannot be overlooked.

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UV Safety

Ultraviolet Safety

The spectra available for ultraviolet curing and drying is quite varied. Coatings, inks, and adhesives may be composed of formulations that require strong UV intensity of various wavelengths. Longwave ultraviolet radiation (320-420 nanometers) is considered most practical.

Shielding is absolutely mandatory. Medium pressure UV lamps radiate harmful UV radiation that can cause serious burns to skin and eyes.

While thermal burns are felt immediately, UV burns are not felt for several hours. Short exposure to lamp radiations can cause severe burning of skin and eyes. UV burn of the eyes affects the cornea that takes several days to heal. UV burn is identical to 'Welder's Burn' and will feel like sand in the eyes that cannot be washed out. The discomfort is transitory. Extreme caution must be taken – high power UV radiation can cause blindness.

Exposure to UV radiations, of only limited time, will evoke erythema on normal skin. Such erythema is transitory and will not produce blistering, nor tanning, as only a small amount of radiation penetrates the Malpighian layer. Extreme caution must be taken – high power UV radiation can cause severe burns to the skin.

Shielding material can be of cloth, glass, plastic, wood, or metal. As infrared energy is generated along with intense visible light, fireproof as well as opaque material that does not degenerate under UV radiation must be utilized.

Direct light from the UV processor should not be visible to the operator nor other personnel. Bounce (reflected) light should be minimized and avoided. Total shielding with openings minimized for product entrance and egress from the UV processor should be incorporated into processor design. Reflective surfaces coated with black UV absorbing paint reduce reflected UV radiations. Protective clothing and safety spectacles should be worn if optimum shielding cannot be attained.

Thermal Safety

Infrared energy, an inherent product of the arc utilized to create UV energy in UV processors, can cause overheating of processor components when adequate safeguards are not incorporated into the UV processor design and application.

Cooled heat sinks should provide protection to the press, conveyor, and other process components in or near the UV processor. The cooling system should be carefully designed and properly maintained. In air-cooled systems, filters must be

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properly cleaned or replaced on a maintenance schedule related to powder, dust, and dirt conditions where the UV processor is operating.

Halon type fire extinguishers are to be used in the event of fire. CO_2 fire extinguishers with dry chemical or water are **NOT** recommended.

If a fire occurs, all residue of damaged substrate should be removed from curing area. Soot and ash must be cleaned from lamps and reflectors before re-start.

Investigation to determine the malfunction causing the fire is most important. Correction must be made to eliminate re-occurrence.

UV processor electrical systems should be serviced only by qualified electricians.

Ozone Safety

Triatomic oxygen or ozone (O_3) is the only by-product of the UV lamp. It is formed by oxygen being exposed to 185nm wavelengths of UV energy.

Ozone can be effectively eliminated in the processing area by exhausting air of the cooling system of the UV processor to outside the building. Such exhausting has no danger as the hot gas is very unstable and breaks down to oxygen rapidly in ducting. The lamps contained in this system use doped quartz which inhibits the production of Ozone

UV Lamp Handling

Fused quartz (Silicon di-oxide, SiO_2) with a high melting point and excellent UV transmissivity is used in fabrication of UV processor lamps. A 22 x 25 mm diameter tube with wall thickness of 1.0 to 1.5 mm used with tungsten electrodes sealed into each end is typical. Lamps are manufactured from 1” to 180: arc length. Quartz is very fragile and special cushioned packaging is utilized for safe transportation.

Upon receiving new lamps the carton should be opened fully so the lamp can be lifted out of the packaging with no twisting or pulling. Unpacking should take place in an area large enough to eliminate the possibility of inadvertently striking lamp against walls, pillars, pipes, beams, or machinery.

Lamp must be wiped with alcohol before placing in service. Bare skin contact with the quartz envelope must be avoided. Compounds from the skin when heated on lamps operating at 600^o to 850^o C will form permanent etching (devitrification) on the quartz surface, decreasing UV energy transmission. A contaminated lamp eventually will overheat causing premature failure.

UV Processor Maintenance

Lamps and reflectors must be clean at the time of installation and maintained so the UV energy generated can reach the ink or coating.

Since the UV processor is an optical system, all types of dust, powder, grease, smoke, and coatings must be cleaned from the lamp and reflectors. Electrical fittings must also be kept clean to prevent arcing between fitting and lamp ends.

Dirty reflectors will reduce cure rates and increase temperature. The reflectors return approximately 50-60% of lamp energy. Overheating from a dirty condition can cause warping, possibly reducing electrical spacing, and cause a short of the arc to ground.

A mild detergent and distilled water mixed at a ratio of 1¼ ounces to 1 gallon makes a good cleaning solution. After cleaning, rinse with clear distilled water and wipe or polish with a clean cloth.

Grease or ink on the lamp or reflectors will require washing with a solvent rather than cleaning with a detergent solution. Clean alcohol or ammonia and distilled water can also be used for cleaning. The use of steel wool, emery paper, or abrasive powders is not recommended for cleaning lamps or reflectors.

CAUTION

Ultraviolet lamps emit radiation, which is harmful to eyes and skin. Great care should be taken to ensure that personnel are not exposed to direct or reflected light.

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SYSTEM OVERVIEW

SPDI UV Total-Cure 8” to 24" Benchtop UV Curing Conveyor System is comprised of the *conveyor system as a single unit.*

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Setup

The system is normally shipped with the lamps installed.

NOTE: When handling the lamp keep free of fingerprints or dirt on the quartz which could cause damage when the lamp heats up.

Always make sure the power is disconnected before changing lamp or reflector.

1. Remove the top front panel and ensure the bulbs are secure and not damaged.

2. *Attach necessary ventilation to the blower atop of the machine.*

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OPERATING INSTRUCTIONS

TURNING THE SYSTEM ON

1. Connect the power to a rated breaker via the power cable attached to the unit. (Seek professional installation.) If you turn on power and the system does not power up, swap any 2 of the power wires to fix phase.

2. Turn Power switch to ON

3. Blower Speed is set by default. It does not need to be adjusted (Default is Max)

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LAMP Start

1. Ensure the system is on and readings are nominal.
2. Push LAMP 1 Start to ignite lamp 1
3. Push LAMP 2 Start to ignite lamp 2
4. The blower will automatically start once temp set point is reached.
5. Place desired item on conveyor to begin exposure.
6. Conveyor speed is adjustable using speed controller pot.

POWERING DOWN THE SYSTEM

1. Push Lamp 1 Stop
2. Push Lamp 2 Stop
3. Allow 10 mins for the lamps to adequately cool, once blower shuts off it is safe to turn main power off.
4. Select Power switch from ON to OFF position

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REPLACING THE LAMP

- Remove the upper front and rear panel
- Disconnect lamp wires from terminal block
- Carefully remove lamp from lamp clips
- Install new lamp into lamp clips
- Hookup lamp wires to terminal block
- Replace the upper front and rear panels

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