



AL'S CO UV

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• UV CURING EQUIPMENT

• UV LAMPS & REFLECTORS

• UV EQUIPMENT SERVICE

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SAFETY-MEDIUM PRESSURE LINEAR LAMPS

CAUTION

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

Ultraviolet Safety

The spectra available for ultraviolet curing and drying are quite varied. Coatings, inks and adhesives may be composed of formulations that require strong UV intensity of various wavelengths. Long-wave 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 radiation can cause severe burning to skin and eyes. Even a minor ultraviolet burn to the eyes affecting the cornea can cause permanent eye damage. Taking days to heal, a UV burn which is identical to 'Welder's Burn' feels like sand in the eyes that cannot be washed out. Extreme caution must be taken - high power UV radiation can cause permanent blindness.

Exposure to UV radiation, of only limited time, will evoke erythema on normal skin. Such erythema is transitory and will not produce blistering, or 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.

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. Shielding material can be of cloth, glass, plastic, wood or metal. 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 radiation. 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 properly cleaned or replaced on a maintenance schedule related to powder, dust, and dirt conditions where the UV processor is operating.

Shielding design must allow for thermal expansion. Any exposed heated surfaces of the processor or related equipment should have guards to prevent contact by personnel.

Safety circuits are necessary to shut down lamps if the press stops with paper or other substrate under the UV processor. Low power switches are incorporated into web press systems so that energy is reduced automatically when the web is slowed or stopped. Regular inspection is required to ensure time limits and related circuits have not been altered or by-passed.

Halon #1211 fire extinguishers are to be used in event of fire. Damage to press and lamps will be minimized. CO2 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 reoccurrence.

Lamps in excess of ninety (90) inches arc length should have quartz supports incorporated into the irradiator design to relieve the strain on the lamp ends. The supports will also help prevent lamp bowing, which can cause excessive heat to the substrate causing a possible fire.

High voltage and currents energize UV lamps in UV processors. Transformers and capacitors (stabilizers) designed to provide lamp starting voltages, and to limit current subsequently, provide a uniform output of energy. UV processors have stabilizers with starting voltages from 400V to 6000V, operating voltages from 50V to 2800V, and currents from 3.0 Amperes to 30.0 Amperes. Arc length of the lamp dictates the particular factors for its operational design.

A short circuit in the stabilizer (secondary) lamp circuit will not reflect in the primary line circuit. No fuses will blow or circuit breakers trip. Such a short circuit will continue to arc until an 'insulation' space is burned into the equipment at arc point. As the starting current of lamps equals the secondary short circuit current, no fusing of the secondary circuit can be made.

High voltage/high temperature wire is utilized in UV processor circuits. Lamp wiring should be in separate conduit - not with control or power wiring. All wires must be kept from the lamp radiation area to negate infrared/UV degradation of wire insulation.

Electrical interlocks should be provided on the processor and its control cabinets. Regular maintenance inspection should be made to ensure these are not defeated in use. Closed and locked junction boxes must be provided and should remain closed and locked when the UV processor is in operation.

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

Ozone Safety

Triatomic oxygen or ozone (O₃) is the only by-product of the UV lamp. It is formed by oxygen being exposed to wavelengths lower than 210 nm of UV energy.

Ozone formation can be eliminated by using ozone-free quartz lamps. Certain dioxides are added to the quartz of these lamps, which absorb the ozone producing wavelengths.

Ozone-free and pure fused quartz lamps are interchangeable. Ozone-free lamp usage may affect cure speeds if ink or coating formulation is designed to utilize the absorbed wavelengths.

A nitrogen atmosphere in a processor also eliminates ozone production by eliminating oxygen. Lower power lamps may be used in a nitrogen atmosphere however the cost of nitrogen will probably offset any operating cost savings attained.

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.

Neither a nitrogen atmosphere nor ozone-free lamps eliminate the cooling system required by lamps and related UV processor components.

Ink And Coating Safety

Handling of ink, coating materials and wash-up chemicals requires procedures that should be issued by the related manufacturers of these products. Procedures should be followed by users. Shut down of the UV processor is mandatory when washing up the press and cleaning of blankets or plates. Alcohol and other flammable solvents should never be used near hot lamps. A severe flash fire could result (possibly fatal to pressmen) causing damage to the press.

System manufacturers should provide solutions to any ink misting problems. Misting ink can be drawn into the UV processor and deposited as dust on lamps. UV output decreases, along with overheating of the equipment, and electrical arcing at lamp fittings will eventually occur. Slower curing speeds and higher operating costs will occur. Exterior contamination of lamp surface also voids lamp warranty.

UV Lamp Handling

Fused quartz (Silicon dioxide SiO₂), with a high melting point and excellent UV transmissivity is used in the fabrication of UV processor lamps. A 22 x 25 millimeter diameter tube with wall thickness of 1.5 mm used with tungsten electrodes sealed into each end is typical. Lamps are manufactured from 1" to 200" arc length. Since quartz is very fragile, special cushioned packaging is utilized for safe transportation.

Upon receipt of lamp package, the carton should be examined for damage incurred in shipping. Delivering carrier employee should sign off any apparent damages at time of receipt.

The carton should be opened fully so lamp can be lifted out of 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 press 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- to 8500C will form permanent etching (devitrification) on the quartz surface decreasing UV energy transmission. A contaminated lamp eventually will overheat causing premature failure that will not be covered under warranty.

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.

As the UV processor is an optical system, all types of dust, powder, grease, smoke and misting ink must be cleaned from lamp and reflectors especially if other operations, such as running a press, with powder, are in the same area. Electrical fittings must also be cleaned to prevent arcing between fitting and lamp ends.

Dirty reflectors will reduce cure rates and increase temperature. 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 1¹ ounces to 1 gallon makes a good cleaning solution. After cleaning, rinse with clear distilled water and wipe or polish with a clean cloth. The advised method of cleaning is to check with the irradiator manufacturer for their recommended cleaning procedure. Grease or ink on lamp or reflectors will require washing with a solvent, then 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.

UV Lamp Disposal

Medium pressure quartz lamps contain mercury that is considered a hazardous waste. Do not discard these lamps in the trash at the end of their useful life. Disposal must be in accordance with local, state and federal regulations. Contact your local hazardous waste management authority for proper recycling / disposal information.