Southern Lamps Inc.

UV & Specialty Supplies

ULTRAVIOLET LAMP TROUBLESHOOTING GUIDE

ULTRAVIOLET TECHNICAL GLOSSARY

EXCLUSIVE DISTRIBUTOR FOR

ALPHA-CURE

Specialists in UV Technology

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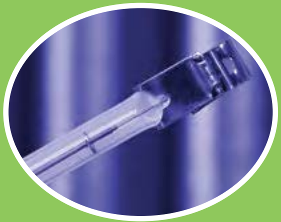

- Medium Pressure
  - > Mercury
- Metal Halide
  - > Gallium
  - > Iron
- Low Pressure, Low Output
- Low Pressure, High Output (Amalgam Lamps)
- Infrared

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OVERVIEW - BAD UV CURING RESULTS

When a UV lamp stops curing within the UV system, it's generally down to a number of common occurrences. These general issues result in decreased output of UV light intensity, primarily due to the deterioration of the lamp and the transparency of the quartz body.

UV radiation can no longer pass through the quartz wall due to devitrification and the deteriorated electrodes are no longer capable of sparking a plasma arc. Longer wavelengths transmit through the quartz body fairly easily, but shorter wavelengths are absorbed in ageing or poorly maintained UV lamps.

DEVITRIFICATION/ CLOUDING

PROBLEM:

The basis of natural "devitrification" occurs when quartz converts back into a crystalline structure which acts as a very poor UV transmitter. This process occurs after surface contamination and is accelerated when the UV lamp becomes too hot. Devitrification appears as many white spots on the surface of the quartz body, which causes a reduction of quartz transparency to UV light.

PREVENTION:

- Ensure the UV lamp is clean before running and is operated in a dust free environment
- Ensure the UV lamp is run at correct volts and amps and that the UV system is properly cooled

MIRROR COATING

MIRROR COATING

PROBLEM:

Over-cooling results in a combination of tungsten from the electrode and mercury condensing onto the inside of the lamp ends giving it a mirror coated effect.

PREVENTION:

- To keep the lamp shoulders hot, Alpha-Cure's UV lamps are coated with heat reflective materials such as gold, platinum, silver & white paint. Contrary to popular belief, white paint is actually the best reflective coating to retain heat within the lamp
- The system could be producing too much cool air that isn't being evenly circulated along the length of the lamp. Remember to keep the lamp shoulder temperature above 600 °C
- If the UV lamp is not running at the correct power for prolonged periods, UV lamp operators should seek professional advice

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BLACK ENDS/ ELECTRODE EROSION

BLACK ENDS

PROBLEM:

Although tungsten has a high melting point, natural "blackening" occurs during the lifetime of a UV lamp. This is due to very high arc temperatures operating between each electrode. During normal operation the electrodes start to erode and the tungsten material starts to sputter, depositing on the inside of the quartz body. When the transparency of a quartz body is compromised, UV output potential is significantly reduced.

PREVENTION:

- To prolong the lives of the UV lamps, Alpha-Cure uses a "special material" coating on the ends of the electrodes
- This process can be avoided by simply not switching the UV lamp on and off in between print runs; the biggest surge of current (increased loading) on the electrode happens at ignition. To avoid this, most UV system manufacturers design a standby mode, which keeps the lamp running at 50% (and increasingly lower than this) even when not in use during the production shift; this avoids switching the lamp on and off (power cycling)

BOWING/
DEFORMATION

BOWING/ DEFORMATION

PROBLEM:

The UV lamp has overheated due to poor air circulation within the UV system. This is more common with longer lamps due to the increased requirement for airflow across a larger surface area. Overheating of the lamp body softens the quartz which starts to sag under gravity, or deforms from pressure differences.

PREVENTION:

- Keep lamps below 850 °C
- Adjust airflow and cooling around the lamp and ensure your cooling system is fully functioning
- If possible, rotate the UV lamp by 180° weekly

EXTERNAL CONTAMINATION DAMAGE

EXTERNAL CONTAMINATION

PROBLEM:

External contamination of a UV lamp happens when foreign contaminants such as fingerprints or spray from powders, paper dust and ink, stick onto the outside surface of the quartz body. Sometimes contamination even occurs where the system reflector itself has come into direct contact with the lamp. These contaminants cause devitrification (recrystallisation) on the quartz body, as such UV radiation is no longer able to pass through.

PREVENTION:

- Clean UV lamps frequently using isopropanol wipes
- Always wear gloves when handling lamps and exert caution whilst cleaning and changing them
- Regularly clean the system, filters and reflectors

CAP & SEAL DAMAGE

CAP & SEAL DAMAGE

PROBLEM:

If a UV lamp is exposed to a current overload or excessively high temperatures, the electrical connection can break down. Overcurrent situations are generally due to power supply faults, not a fault in the lamp design itself. The electrical connections at the end of each UV lamp are designed to withstand temperatures of no more than 250 °C. This problem causes electrical arcing between the lamp and the lamp holder, which can result in a hole being burnt through the cap, destroying the lamp and potentially even damaging the UV system.

PREVENTION:

- Ensure the right UV lamp is matched to your power supply and that the power supply is operating correctly
- Keep the ceramic caps and seals below 250 °C
- Ensure the lamp is correctly placed within the lamp head
- Inspect caps for damage before placing into the system

CONTAMINATED AIRFLOW

CONTAMINATED AIRFLOW

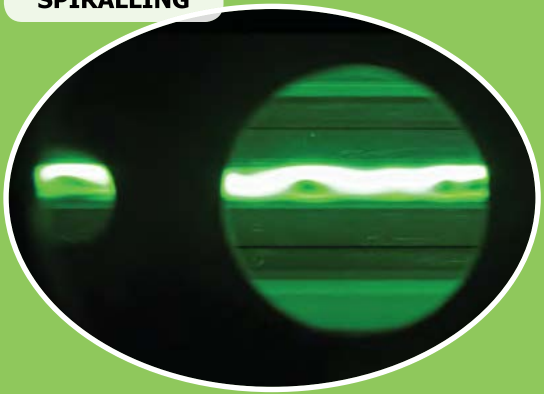
PROBLEM:

In compressed air cooling systems, airflow contamination can occur. This causes spot devitrification, denoted by the alignment of the cooling holes within the UV system reflector.

PREVENTION:

- Ensure compressed air is suitably clean and dry

SPIRALLING



SPIRALLING

PROBLEM:

Spiralling is when the plasma arc is no longer stabilised. The plasma arc spirals out of control, repeatedly hitting the inside surface of the lamp body, softening the quartz. Risk of spiralling is higher when:

- A lamp is run on a constant wattage transformer with secondary series capacitors
- The UV lamp in the system is not a standard mercury lamp but a doped lamp (gallium or iron)
- The lamp operates at a higher voltage
- The lamp is over 1m in length

PREVENTION:

- If this is a common occurrence, consider changing the transformer

LEAKING

LEAKING

PROBLEM:

In the unlikely event the UV lamp doesn't strike out of the box, it is possible that this is due to leaking – which means air is entering into the lamp envelope. The only way to confirm this technical issue is to use a high frequency lamp tester. A constricted purple or blue arc, or no discharge at all, indicates there may be a small leak in the seal, which is unlikely to be visible to the naked eye.

PREVENTION:

- Sadly no prevention, return the lamp to the manufacturer

DIRTY UV REFLECTOR

DIRTY/DISTORTED UV REFLECTORS

PROBLEM:

There are many different types of reflectors installed in various UV systems, from plain aluminium to extrusions, fabrications and dichroic coatings. Around 70 % of UV radiation that hits the substrate is actually reflected UV and loss of reflected radiation causes significant loss of UV curing results. As such, it is imperative that system reflectors are maintained and cleaned regularly. Poorly focused/distorted reflectors are also a very common reason for UV systems failing to cure.

PREVENTION:

- In most circumstances, cleaning your system reflectors regularly with isopropanol wipes will ensure good UV reflection
- If 100 % certain your UV reflector is not coated or polish-finished such as dichroic reflectors, you can use an abrasive rubber block to gently remove the dirt
- If UV reflectors are beyond cleaning or are misshapen, they must be replaced immediately

UV LIGHT BELOW FULL INTENSITY

UV LIGHT BELOW FULL INTENSITY

PROBLEM:

If UV light falls below full intensity, the UV lamp will not reach the necessary levels required for the curing of inks, adhesives and varnishes and similarly with other processes such as the disinfection of air, water or surface treatment.

Many of the UV lamp troubleshooting issues mentioned within this technical guide will cause UV light intensity to fall below full intensity

PREVENTION:

- To ascertain if the UV lamp is not producing full intensity UV light, perform a simple test with UV test strips available from your supplier

TRIPPING OUT

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UV LAMP TRIPPING OUT

PROBLEM:

Lamps operate at high voltages, if they are too close to any metal work or humidity is high, an earth fault can occur as the arc jumps to ground. Most control systems will instantly trip out.

PREVENTION:

- Ensure the lamp is correctly positioned
- Check UV reflectors are not distorted or too close to the lamp body

INKS & COATINGS

INKS, COATINGS & ADHESIVES - POORLY FORMULATED

PROBLEM:

UV curable inks, coatings and adhesives when not properly mixed, can lead to unequally distributed photoinitiators which can negatively affect the curing results.

PREVENTION:

- Ensure all UV inks, coatings and adhesives are mixed thoroughly before application so that the photoinitiator is uniformly dispersed

NEW UV LAMPS

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HOW TO ENHANCE THE LIFETIME OF A UV LAMP

PROBLEM:

Natural degradation of UV output occurs during the lifetime of a lamp, but there is no significant natural loss of UV output under 1,000 operating hours. Apart from ensuring a UV lamp is purchased from a top quality manufacturer, the lifetime of a lamp is very much dependent on the environment in which it is used.

PREVENTION:

- A consistent maintenance programme and the right operating environment can dramatically increase the lifetime of UV lamps. Under ideal operating conditions, customers have reported gaining an additional 4,000 - 6,000 operating hours by simply following a rigorous UV lamp and system maintenance program
- UV lamps should be replaced after 1000 - 1500 hours depending on the application and industry. Some industries such as cosmetics and pharmaceuticals religiously change lamps every 1000 hours, as they cannot risk loss of UV intensity. To measure loss of UV intensity use UV sensitive labels, test strips, or in more detail using instruments such as UV power maps

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A comprehensive list of UV industry related terms and their definitions.

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CONFORMAL COATING:

A protective non-conductive dielectric layer that is applied onto the printed circuit board assembly, to protect the electronic assembly from damage due to contamination, salt spray, moisture, fungus, dust and corrosion caused by harsh or extreme environments.

DEVITRIFICATION:

Crystallisation of a formerly non-crystalline (amorphous) glass reduces its ability to transmit a range of electromagnetic radiation (e.g. UV).

DICHROIC:

Describes materials with the property to selectively reflect or transmit a particular wavelength range. Dichroic UV reflectors that reflect shorter wavelength radiation such as infrared, are called "cold mirrors", while those that reflect longer are called "hot mirrors".

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DIELECTRIC:

An electrical insulator that can be polarised by an applied electric field.

DIELECTRIC STRENGTH:

The maximum electric field a material can withstand intrinsically before it breaks down and becomes a conductor of electricity.

DISCHARGE TUBE / UV LAMP:

A lamp envelope containing electrodes, a starting gas that is ionised by an electric field and other additives. The atoms are excited to high energies and emit a UV photon as they return to their ground state.

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DOPED LAMP:

Also known in the industry as a metal halide lamp, it contains an additive, such as gallium or iron, to alter the spectral output in order to cure different types of inks, coatings and adhesives.

ELECTRIC ARC:

An electric current involving an ionised gas, such as argon, leading to the formation of a plasma arc.

ELECTRIC FIELD:

In simple cases, the electric field between two points is the voltage between those points divided by the distance between them.

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ELECTRICAL BALLAST:

A device to prevent excess current into a lamp that can also assist in lamp ignition.

ELECTROMAGNETIC SPECTRUM / RADIATION:

The entire range of all possible electromagnetic radiation. This includes gamma rays, X-rays, ultraviolet, visible light, infrared, microwaves and radio waves.

GROUND STATE:

The lowest energy state of an electron.

ULTRAVIOLET TECHNICAL GLOSSARY

HALOGEN:

Chemical elements in Group XVII of the periodic table, including fluorine, chlorine, bromine, iodine and astatine.

INFRARED (IR):

The band of the electromagnetic spectrum ranging between 700 nm to 1 mm.

ISOPROPYL ALCOHOL (ISOPROPANOL):

A colourless and relatively non-toxic alcohol. It evaporates quickly and can dissolve various oils, so is useful for cleaning quartz cooling tubes, UV reflectors and UV lamp bodies.

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METAL HALIDE:

A chemical compound involving a metal and a halogen.

MOLYBDENUM:

A silvery metal with the chemical symbol Mo and atomic number 42.
It has the sixth-highest melting point of any element. It is frequently used for making steel alloys as well as in the seal for UV lamps due to its relatively low thermal expansion and high electrical conductivity.

NANOMETRE (nm):

A term used within the industry to measure specific wavelengths of the electromagnetic radiation spectrum, equal to one billionth of a metre:

1 millimetre = 1000th of a metre

1 micrometre = 1000th of a millimetre

1 nanometre = 1000th of a micrometre

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NOBLE GASES:

Chemical elements in Group XVIII of the periodic table with similar properties such as being odourless, colourless and of low reactivity. This includes helium, neon, argon, krypton, xenon and radon.

PHOTOINITIATOR:

A compound that undergoes chemical reaction(s) when subjected to electromagnetic radiation.

PHOTOPOLYMERISATION:

A process of reacting monomer molecules together in a chemical reaction to form polymer chains or three-dimensional networks.

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QUARTZ:

A glass-like material made of silicon dioxide (SiO_2) with various different forms. It has low thermal expansion and a very high melting point of around 1665 °C. The 'fused quartz' form transmits UV very effectively.

SPECTRAL ENHANCEMENT:

Moving the electromagnetic radiation output of the UV lamp, by doping with certain additives. This may include increasing the intensity of the radiation, or shifting the range of wavelengths of the radiation.

TRANSFORMER:

An electrical device used to step-up or step-down the voltage of alternating currents.

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TUNGSTEN:

Is a chemical element with the chemical symbol W and atomic number 74. Tungsten and its alloys are used in numerous applications such as light bulb filaments, and it is used to make UV lamp electrodes owing to having the highest boiling point of any metal.

TUNGSTEN ELECTRODES:

Conductor through which electricity enters a UV lamp and are the two points at which the plasma arc forms.

UV COATING:

Refers to treatment of a substrate with UV radiation to cure the surface or protect the underlying material from harmful effects.

ULTRAVIOLET TECHNICAL GLOSSARY

UV CURING:

A photochemical reaction (photopolymerisation), when specialised coatings are cured after exposure to UV light instead of relying on heat and time to evaporate carriers like in solvent-based coatings.

WAVELENGTH:

A property of electromagnetic radiation – by altering the wavelength you can cure or disinfect various types of substrates.

WEEE:

The Waste Electrical and Electronic Equipment Directive (WEEE Directive) is the European Community directive 2002/96/EC on waste electrical and electronic equipment (WEEE).

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