



# Light-Curing Equipment

## Ultraviolet (UV) Light Safety Guide



The use of any Dymax light-curing source without first reading and understanding the information in this guide can result in injury from exposure to high-intensity UV and visible light energy. To reduce the risk of injury, please read and ensure you understand the information in this user guide before assembling and operating any Dymax light-curing system.

# General Safety Considerations

All users of Dymax light-curing systems should read and understand this user guide before assembling and using the system.

To learn about the safe handling and use of light-curable formulations, obtain and read the Safety Data Sheet for each product. Dymax includes an SDS with each adhesive sold. In addition, fluid product SDS can be requested through our website.

## Safety Symbol Index

The following symbols may be displayed on Dymax light curing systems and documentation. Please see below for their meanings.



Refer to Equipment  
Manual Before Operating  
Equipment



Warning! Use Caution When  
Operating Equipment



Eye Protection Required



Product Contains an  
Electrostatic Sensitive  
Device (ESD) Internally



Complies with All Listed  
European Directives



Warning! UV Emitter Light  
Hazard (Do not look directly  
at light)



WEEE Directive (Waste  
electrical and electronic  
equipment must be  
disposed of or recycled  
at the nearest collection  
facility)



Caution! Hot Surface

# Standard Safety Considerations

Dymax manufactures light source systems which produce ultraviolet and visible light spectra. These systems are designed to maximize operator safety and minimize exposure to light-curing energy. To use one of these units safely, it must be set up and operated in accordance with the instructions in this user guide.

*NOTE: Dymax light-curing products are tested and follow compliance standards with IEC62471.*



**WARNING!** *Looking directly at the high-intensity light emitted by the Dymax curing source can result in eye injury. To prevent eye injury, never look directly at the energy-emitting source and always wear appropriate protective goggles. To avoid accidental exposure, verify the curing energy target prior to activating a curing exposure cycle.*



**WARNING!** *UV energy is emitted from this product. Avoid eye and skin exposure to the unshielded product. Gloves, long sleeve clothing, and goggles should be worn when working near the UV energy source.*



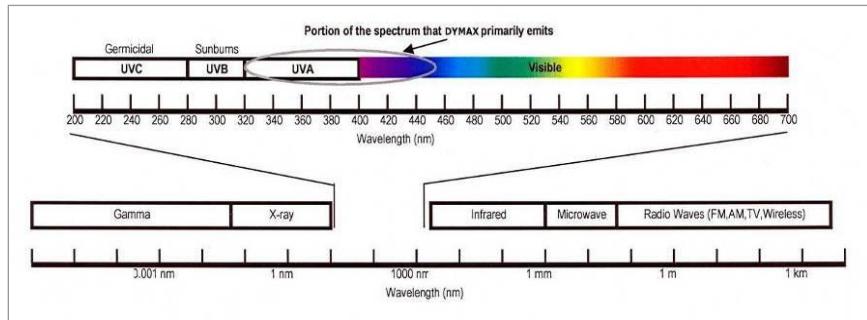
**WARNING!** *Surfaces of light emission optics can be very hot after use. Do not touch the distal (light-emitting) end of any lightguide, lightguide-simulator optic, or the protective glass window of any flood curing system. Touching these surfaces can result in thermal burns. Please allow optic windows to cool for a minimum of 10 minutes before attempting to touch or service them.*

# Dymax UV Light-Curing System Safety Considerations

Operators must understand a few concepts to use Dymax light-curing systems safely: UV exposure, high-temperature surfaces, bright visible light emissions, and ozone (broad spectrum).

## UV Exposure

**Figure 1. UV Spectrum**



Standard Dymax light-curing systems have been designed primarily to emit UVA and Visible energy above 400 nm (Figure 1).

- UVA energy is generally considered the safest of the three UV ranges: UVA, UVB, and UVC.
- Although OSHA does not currently regulate UV-light exposure in the workplace, the American Conference of Governmental Industrial Hygienists (ACGIH) does recommend threshold limit values (TLVs) for ultraviolet light.
- The strictest interpretation of the TLV (over the UVA range) for workers' eyes and skin allows continuous exposure up to  $1 \text{ mW/cm}^2$  (intensity). Unless you are placing bare hands into the curing area, it is unusual to reach or exceed these limits.
- $1 \text{ mW/cm}^2$  is approximately  $1/3^{\text{rd}}$  the energy on a cloudless summer day which may exceed  $3 \text{ mW/cm}^2$  of UVA energy, and includes the more dangerous UVB energy (primarily responsible for sun tans, sun burns, and skin cancer).
- Light energy decreases abruptly in intensity as the distance from the source increases. Measurements should be made to ascertain true exposure levels when not directly in line with a UV source.

# Protecting Operators

Use of light-curing technology can be a regulation compliant, "worker-friendly" manufacturing process when the proper safety equipment and operator training is utilized. There are two ways to protect operators from UV and visible energy exposure: shield the operator and/or shield the source.

## Shield the Operator

**UV-Blocking Eye Protection** – UV-blocking safety glasses are the minimum recommended protection when operating Dymax UV light-curing systems.

**UV-Blocking and Visible Tinted Eye Protection** – UV-blocking eye protection with tinting is recommended when operating UV light-curing systems that the illuminated target surface is directly viewed by the operator. Tinting can reduce the eye fatigue caused by bright visible energy.

**UV-Blocking Skin Protection** – Opaque, UV-blocking clothing, gloves, and full-face shields are recommended when skin may potentially be exposed to nearby UV light.

**Safety Interlocks** – Dymax equipment is designed to interface with customer supplied interlock circuits that can be used to turn off or inhibit UV sources when an interlock circuit is triggered. This will prevent accidental exposure.

## Shield the Source of UV

Any substrate that blocks UV light can be used as a shield to protect workers. The following materials can be used to create simple shielding structures:

**Rigid Plastic Film** – Transparent or translucent/UV-blocking plastics (typically polycarbonate or acrylic) are commonly used to create shielding where some level of transparency is also desired.

**Flexible Film** – Translucent UV-blocking, flexible urethane films can be used to quickly create workstation shielding. This UV-blocking, flexible urethane film is available from Dymax, call for assistance.

## Checking the Workstation

The human eye cannot detect UVA light, only the visible portion of the spectrum. A radiometer should be used to measure stray UV light to confirm the safety of a UV light-curing process. A workstation that exposes an operator to more than 1 mW/cm<sup>2</sup> of UVA continuously should be redesigned.

## High-Temperature Surfaces

Surfaces exposed to high-intensity curing energy may rise in temperature. The intensity, distance, exposure time, cooling fans, and composition of the surface can all affect the rise in surface temperature. In some cases, exposed surfaces can reach temperatures capable of producing a burn or causing damage to a substrate. In these cases, operators should try to maintain a cooler surface temperature, or they should have the appropriate protection/training to avoid injury from the heat.

## Bright Visible Light

The bright visible energy emitted by curing systems can cause eyestrain if proper eye protection or shielding is not used. The use of tinted UV blocking eye protection and/or opaque/tinted shielding can be utilized to reduce eyestrain and address this concern.

## Ozone

Standard Dymax lamps (UVA type) generate an insignificant amount of UVC light energy at or below 200nm and therefore produce very minimal amounts of ozone through reaction with air. Ozone must be concentrated at higher amounts than that produced by standard lamps to cause discomfort.

## Mercury (Hg)

Dymax broad spectrum UV curing equipment uses mercury-based arc lamps. Disposal of used bulbs must be done in accordance with state and local regulations. Mercury bulbs are classified as universal waste by the Environmental Protection Agency and are regulated.

Mercury contamination can occur if a lamp breaks. The debris should be carefully cleaned up as broken glass can cause injury and exposure to mercury may cause health hazards. Mercury spill kits are available commercially and may be used to absorb any liberated mercury. When there is concern about the proper handling of mercury, always consult with an industrial hygienist on the proper handling of mercury contamination.

## Closing

Using Dymax light-curing systems in your process requires adherence to the guidelines established in this document to help prevent accidental exposure of operators. Periodic auditing of workstations is suggested to ensure constant capability of all safeguards daily.

Dymax offers several light blocking devices, eye glasses, and materials for use in constructing a safe work area. Contact Dymax customer service for assistance. Contact information may be found at the back of this guide.

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SAF001 1/06/2023