Lightguides and Accessories

Lightguides

Dymax lightguides transmit curing energy from an energy source mounted inside of a spot-curing system to the curing area. They are the most economical means for delivering energy to cure adhesives and coatings. Our lightguides are available in various lengths, diameters and in single or multi-pole configurations.

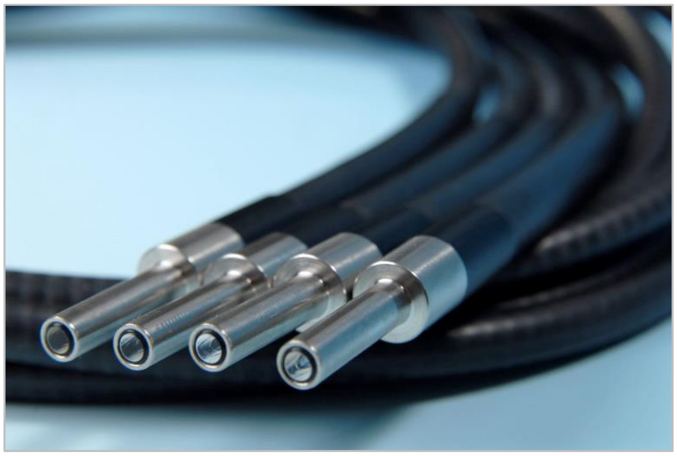


Figure 1. Multi-Pole Liquid Lightgudie

Liquid Filled vs. Quartz-Fiber Lightguides

We offer two types of lightguides, liquid filled or quartz-fiber. Liquid lightguides are made with a proprietary, non-toxic saline based solution core. They typically cost about 50-80% less than a quartz-fiber lightguide and in the single-pole configuration, transmit 35-50% more intensity than a quartz-fiber lightguide across all system types. They are not suitable for transmitting UVB or UVC spectral energy or in high temperature environments, however. For those applications Extended-Range liquid lightguides are more suitable. Multi-pole configurations also require active balancing when used.

Quartz-fiber lightguides are manufactured using a randomized or non-coherent bundle of quartz fibers. Because of the spectral transmission characteristics of these fibers, they are better suited for transmitting/delivering shorter wavelength energy sometimes necessary to overcome O^2 inhibition/surface tack associated with some formulations. The lower numerical aperture value of a quartz-fiber lightguide makes it less efficient than liquid guides in capturing the energy from the emitting angle of LED systems (resulting in lower intensity transmitted). When a multi-pole configuration is used, active balancing is not required.

Comparing Liguid-Filled vs. Quartz Fiber Optic Lightguides

There are pros and cons to both liquid and fiber lightguides. Liquid lightguides are lower in cost and transmit more intensity than fiber lightguides. Fiber lightguides don't require active balancing in multi-pole configurations and are better suited for curing units without a cool blue filter.

Liquid Lightguides

- Proprietary non-toxic saline-based core solution
- ~50-80% reduced cost vs. fiber optic
- Requires routine balancing in multi-pole configurations
- Not applicable for transmitting shorter wavelength (UVB/C) energy
- Single pole liquid filled guides transmit 35-50% more intensity than fiber optic across all system types.

Quartz-Fiber Lightguides

- Bundle of randomized quartz-fibers
- Does not require leg-to-leg output balancing in multipole configurations
- Better suited for unfiltered UVB/UVC/IR intensity
- The lower numerical aperture of the fiber guides makes them less efficient than liquid guides in capturing the energy from the emitting angle of conventional lamped or LED systems (resulting in lower energy transmission levels)

Lightguide Connector Types - D and Wolf Styles

We offer lightguides with two different style entrance fitting configurations. Most current Dymax spot lamps use a “D”-style connector. Our new BlueWave MX-150 system is the only exception. This system uses a Wolf-style connector, which is more optimized for this system’s optic module. Our previous generations of lamps (PC-3, PC-3 Ultra, and 3010-EC) also used the Wolf-style connector.

Lightguide Lengths

The standard length for lightguides is 1 meter, but various other lengths are also available in 0.5 meter increments. Length does not have an effect upon transmission for fiber lightguides. However, liguid lightguide transmissions attenuate approximately 12% per each meter in length.

Lightguide Intensity

The UV and visible light emitted from a lightguide diverges. As a result, intensity decreases and curing area increases with distance from the end of the lightguide. Figures 2 and 3 show typical intensity rates at various distances. The divergents angle is 30.8 degrees.

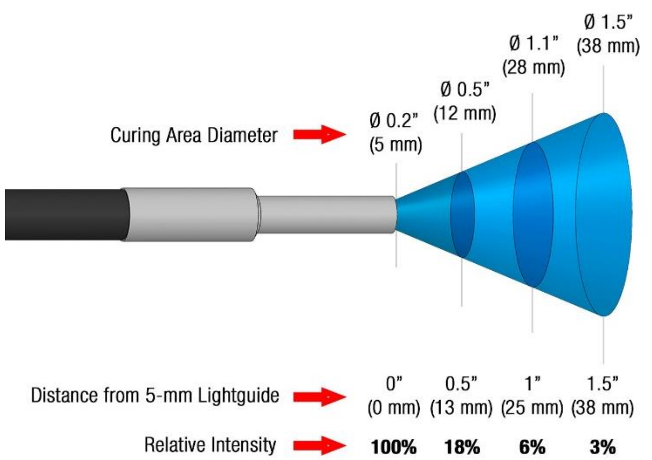


Figure 2. Curing Area/Intensity vs. Distance Using a 5-mm Lightguide

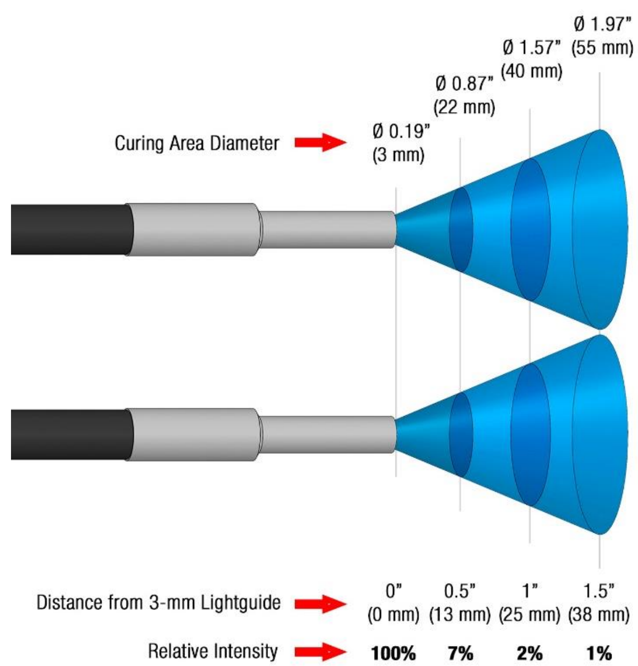


Figure 3. Curing Area/Intensity vs. Distance Using a 2-Pole, 3-mm Lightguide

The intensity output of UV bulbs gradually decreases with usage. This degradation cannot be avoided, but it can be reduced through proper unit setup, operation, maintainence, and process control. Table 1 gives the starting intensity and intensity after 2,000 hours of use of a BlueWave® 200 spot lamp outfitted with various lightguides. You will notice the decrease in intensity as hours increase. It is very important to monitor your process as lamp hours increase to ensure you are still curing with the correct intensity for your application. Incorrect cure intensities could lead to incomplete cures.

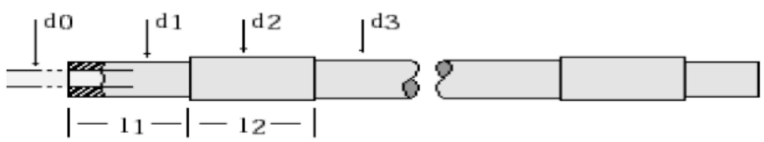
Part Number	Lightguide Description *(all noted are liquid filled)*		Minimum Initial Intensity[1] (W/cm^2)	Typical Intensity at 2,000 Hours[1] (W/cm^2)
5720	Single pole	5 mm x 1 Meter	17.0	8.0
5721	Single pole	5 mm x 1.5 Meters	16.0	7.5
5722	Single pole	8 mm x 1 Meter	13.0	6.5
38476	Two pole	3 mm x 1 Meter	10.5	5.2
38477	Three pole	3 mm x 1 Meter	9.0	4.5
38478	Four pole	3 mm x 1 Meter	7.4	3.7

[1] As measured with a Dymax ACCU-CAL™ 50 Radiometer (320-395 nm).

Table 1. Curing Intensities

Fixturing Lightguides

When fixturing lightguides, if a clamping mechanism is used to hold the lightguide, too much force can damage the lightguide (Figure 9). Only plastic-tipped set screws should be used to help reduce the chance of damage. d1 and d2 as shown in Table 2 are the appropriate retention points to use when mounting lightguides into fixtures.



OUTPUT APERTURE	TYPE		d0	d1	l1	d2	l2	d3
3 mm	LIQUID		3	5	20	9	24	7
	FIBER	single pole	3	6.9	20	10	24	8.4
		multi pole	2.5	4.9	20	9	20	8.4
5 mm	LIQUID		5	7	20	10	24	9.5
	FIBER		5	9.9	20	15	40	12.3
8 mm	LIQUID		8	10	20	15	40	12.5

Table 2. Diameters of Lightguides Output End

Be aware that excessive and repeated bending can also damage lightguides. The minimum bend radii for liquid lightguide diameters are as follows:

Active Core Diameter	Minimum Bend Radius	
	Liquid	Fiber
3	40	60
5	60	70
8	100	100

Table 3. Minimum Bend Radii

Fixturing Multi-Pole Lightguides

3-mm is the standard diameter for each pole a of multi-pole lightguide. Liquid-filled lightguides require “active balancing”, where the lightguide is rotated until it is balanced, and then it is locked in place with the set screw on the entrance fitting of BlueWave® units. Fiber optic, multi-pole lightguides do not require “active balancing”.

Using Lightguides with Dymax’s “Cool Blue” Filter

Dymax conventional broad-sepctrum spot-curing systems use a proprietary “Cool Blue” filter that reduces transmission levels of energy in the UVB, UVC, and IR portion of the spectrum. These frequencies are partially responsible for transmission degradation of liquid filled lightguide so the “Cool Blue” filter results in lower lightguide temperatures and longer liquid-filled lightguide life. Without a “Cool Blue” filter, standard liquid-filled lightguide intensity transmission would degrade significantly faster, and depending on application requirements, may need to be replace more often. Lightguide degradation is a perceived weakness of the spot-cure unit market, but with Dymax’s unique design, it has been significantly reduced.

If the filter is removed, only fiber-optic or Extended-Range lightguides should be used, as they can better withstand the UVB/UVC exposure

Lightguide Maintenance

Cleaning & Protection

Because lightguides are a critical component of the curing process, it is important that they are maintained properly to ensure optimum performance and consistent curing results. Lightguides should be periodically cleaned to remove foreign matter and deposits caused by outgassing. Cleaning the lightguide ensures that the maximum curing energy transmission is achieved. A thin film of contamination can reduce transmission by over 50% and eventually lead to burning of the guide optics (Figure 5). Contamination can come from a variety of sources, including the condensation of curing “smoke” (outgassing) while curing. It is always best practice to use a fan during cure to help keep lightguides clean.

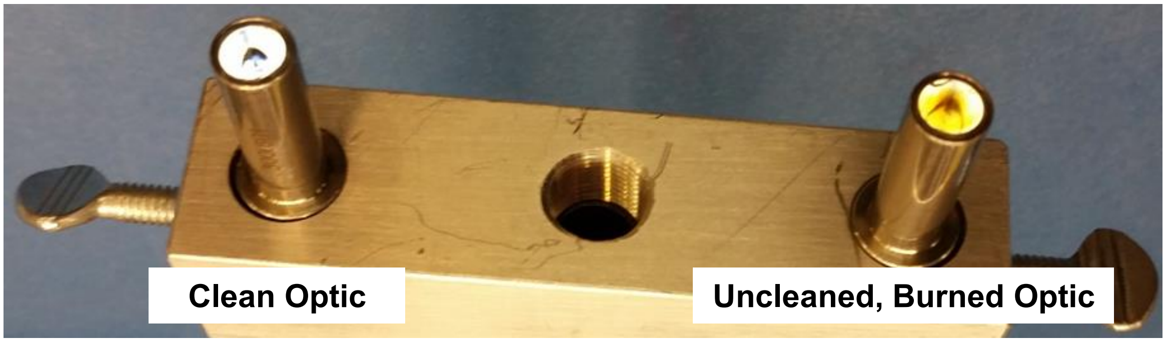


Figure 4. Damaged, Burned Lens

To clean liquid lightguides, the end can be wiped with a solvent-soaked rag. This method is not ideal and will only help a small amount. ***Please note that lightguides should never be soaked in solvent.*** Alternatively, Dymax recommends scraping adhesive and other residue from their light-emitting end. This can be done using a new, unused plastic or metal razor blade. When using this method, it is important to take care not to scratch or damage the light-emitting end of the lightguide as this can reduce light transmission to a lower level than the original adhesive residue did. ***Quartz-fiber lightguides should never be cleaned using a razor.*** For more details about cleaning lightguides, please see the instructions available in INST001.

In addition to periodic cleaning of your lightguide, Dymax also recommends the use of two accessories to keep your lightguide in top condition: a lightguide end protector (PN 40539) and the end-of-wand heat-reducing filter* (PN 35301). Both accessories protect the lightguide by reducing heat and glare. Unfortunately each also attenuates the intensity, resulting in shorter useable lamp life. The end-of-wand heat-reducing Filter attenuates the intensity by approximately 30%, while the lighguide end protector attenuates light intensity by only 12%.

**Please note that this lightguide filter is not compatible with the BlueWave® 200 spot lamp.*

Figure 5. Lightguide End Protector (Side View)

Figure 6. End-of-Wand Heat-Reducing Filter (Left) & Lightguide End Protector (Right)

Damaged Lightguides

Damaged lightguides cannot be repaired, only replaced. Damage can be caused by uncleaned lenses, over-flexing, over-tightening in a clamp, cutting, etc.

Figure 7. Deformed Lightguide

Figure 8. Damaged Lightguide Caused by Over Tightening

Lightguide Accessories

Lightguide Simulator

To ensure optimum lightguide performance, Dymax recommends using a lightguide simulator (PN 38408) to monitor the curing process. A lightguide simulator can be used to accurately measure the direct light intensity from the system's energy source. When testing, intensity levels should be measured at the light-emitting end of the lightguide and then compared to a measurement taken with the Lightguide Simulator. Subtracting the lightguide intensity measurement (from the light-emitting end) from the lightguide simulator's intensity measurement permits calculation of the percentage of lightguide degradation. If intensity appears to be low, the most common cause is a contaminated lightguide tip.

Figure 9. Lightguide Simulator

Angled Terminators

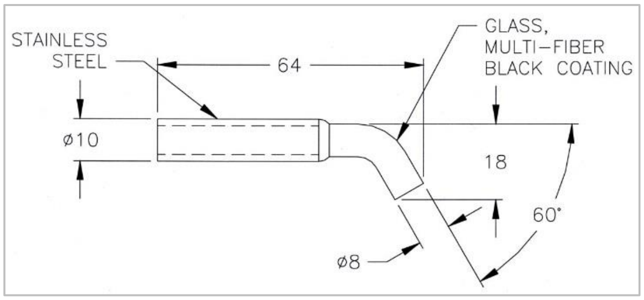
Angled terminators can be attached to 3, 5 and 8mm liquid lightguide. They provide significant value when delivering curing energy to hard to reach and semi-hidden bond lines. They can also enhance worker safety for handheld applications by blocking UV energy below 340 nm. Angled terminators are available angled at 60 or 90 degrees.

Figure 10. Angled Terminators

Size	60 degree	90 degree	Approximate Loss
3 mm	PN 39029	PN 39030	35%
5 mm	PN 38042	PN 38049	30%
8 mm	PN 39334	PN 39333	35%

Table 4. Loss from Lightguide Terminators

Terminators are fiber optic assemblies, therefore the ends cannot be cleans with a razor blade. Razor blades can cause fracturing of the fiber ends and loss of transmission capability. Clean Terminators at the beginning of each shift with an IPA wide – Do not soak terminators in any solvents. Replace any suspect terminators as needed to maintain process integritity.



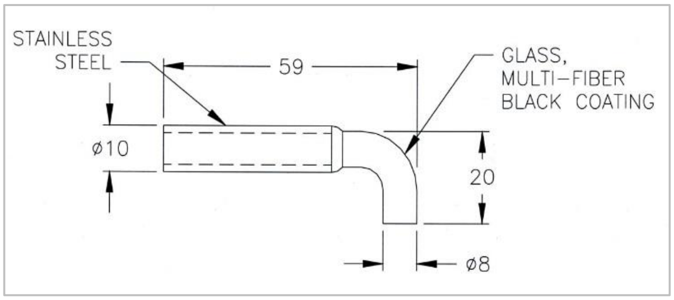


Figure 12. Angled Terminator PN 38049

Figure 11. Angled Terminator PN 38042

Rod Lenses

Rod lenses alter the energy emitted from a light guide to deliver it over larger curing areas We have a selection of rod lenses that are compatible with 8, 5, and 3-mm lightguides. Available rod lenses include:

- PN 38698 – 2.75" - 5" Rod Lens (A)
- PN 38699 – 0.75" - 2" Rod Lens (B)
- PN 41148 – 5 mm Rod Lens (C)
- PN 41256 – 3 mm Rod Lens (C)

Figure 13. Rod Lens

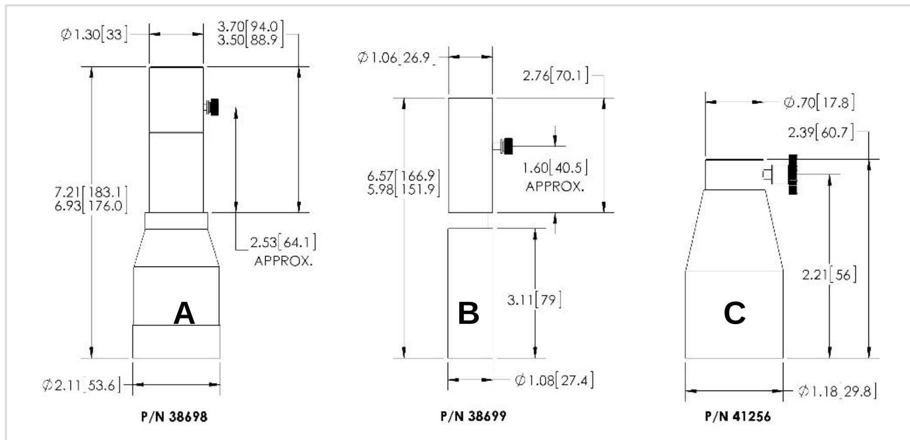


Figure 14. Rod Lens Dimensions

As an example, 5mm Rod Lens PN 41148 focuses and has peak intensity at a distance of 40 to 50mm. In the 10-20mm range the lens has good uniformity, but lower intensity. Dymax is generating additional output data on each of these Rod Lenses

For applications that require positioning of light delivery optics such as the Rod Lenses, accessory stands are available.

Part Numbers:

38680 - Rod Lens Stand Only

38931 - Clamp Only

38968 - Rod Lens Stand & Clamp

Figure 15. BlueWave® 200 with Rod Lens and Stand

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