LED Light-Curing Technology

Product Selector Guide

www.led.dymax.com

DYMAX®

Our Technology. Your Advantage.™

Where others only supply products, we are committed to developing a true collaborative partnership, bringing our total process knowledge to our customers' specific application challenges. Because we understand the process as a whole, and not just individual aspects of it, we can offer our customers a solution where chemistry and equipment work seamlessly together with maximum efficiency. Our solutions help our customers lower costs, increase process efficiency, and become more profitable, providing them with a competitive advantage they can't get anywhere else.

About Dymax

Dymax Corporation is an ISO 9001 certified global manufacturer of light-curable adhesives, oligomers, coatings, light-curing equipment, and dispensing systems supplied to the medical device, electronic, appliance, transportation, and alternative energy markets.

Our complete line of dispensing and light-curing systems, which are perfectly matched to our adhesive chemistry, can be configured as stand-alone units or integrated into existing manufacturing assembly lines for fast processing. Both manual and automatic dispensing systems are available to accommodate a variety of applications. Our light-curing system selection includes light-curing spot lamps, flood lamps, conveyor systems, and radiometers for measuring light intensity.

Dymax Corporation, which employs more than 250 people globally, is headquartered in Torrington, CT, with additional facilities in Germany, Ireland, China, Hong Kong, Singapore, and Korea.

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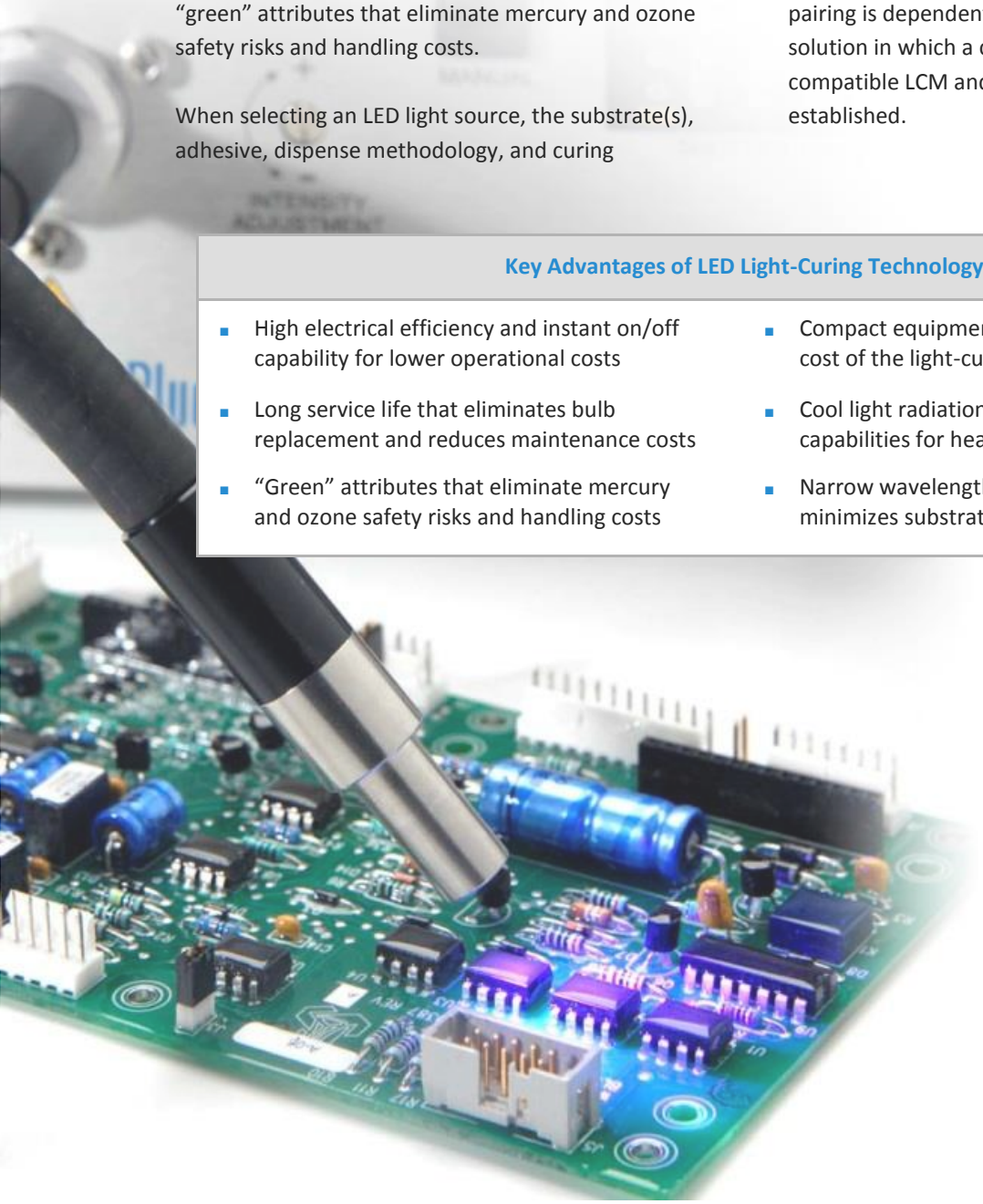
LED Light-Curing Technology

As a relative newcomer to the light-curable materials (LCM) industry, LED-curing lamps continue to evolve as an ideal alternative for the mercury-arc lamps that have been the industry standard for several decades. Conventional mercury-arc lamps are broadband light sources that emit light over a wide range of wavelengths including short wave UV, long wave visible, and even longer wave infrared. LED curing lamps on the other hand, are semiconductor light sources that emit very discrete wavelengths of light energy, resulting in a single, narrow, bell-shaped emission spectrum. LED curing offers many benefits over traditional lamps such as longer useful life, cooler curing, lower operating costs, and "green" attributes that eliminate mercury and ozone safety risks and handling costs.

When selecting an LED light source, the substrate(s), adhesive, dispense methodology, and curing approach should all be considered. In order to implement LED curing technology into any application, it is important to determine if these components are all in optimized harmony with one other. As many manufacturers have experienced, simply inserting LED curing into an already existing process is not a guarantee of success. This assumption of interchangeable parts can result in frustrating performance failures that ultimately cost manufacturers' time and money. In order to yield the required performance characteristics from the adhesive, it is essential to match the wavelength of the LED lamp with the absorption spectrum of the LCM photoinitiator in the adhesive. This successful pairing is dependent upon having an optimized solution in which a cohesive combination of compatible LCM and LED curing system is established.



Key Advantages of LED Light-Curing Technology

- High electrical efficiency and instant on/off capability for lower operational costs
- Long service life that eliminates bulb replacement and reduces maintenance costs
- "Green" attributes that eliminate mercury and ozone safety risks and handling costs
- Compact equipment that reduces the size and cost of the light-curing system
- Cool light radiation that extends curing capabilities for heat-sensitive substrates
- Narrow wavelength spectrum emission that minimizes substrate thermal rise

Frequently Asked Questions

Q. What is the difference between a mercury-arc bulb and an LED bulb?

A. Conventional arc lamps are considered broadband light sources because they emit light over a wide range of wavelengths including short wave UV, long wave visible, and even longer wave infrared. LEDs (Light-Emitting Diodes) on the other hand, are semiconductor light sources that emit very discrete wavelengths of light energy. This results in a single, narrow, bell-shaped emission spectrum.

LEDs offer many advantages over mercury-arc bulbs. LEDs cure cooler for better thermal management and offer very stable intensity which translates into more consistent process control. LED light-curing systems start up instantly, provide immediate light energy, and have an expected operating life of 10,000 hours, which results in significantly reduced downtime and lower light replacement costs when compared to conventional lamp systems.

Q. Will bond performance be similar whether you are using an LED or a conventional lamp light source?

A. The direct replacement of an arc lamp spot-curing system with an LED spot-curing system—without evaluation and process adjustment—can result in substandard bond performance. Differences in LED wavelength distribution and intensity necessitates the evaluation (if not formulary modification) of the chemistry and curing-energy dosage. There are some adhesives that provide the flexibility to use both types of light sources without changes to your process. Verification is strongly recommended to ensure successful results.

Q. Do LED adhesives cure best at the 365 nm wavelength peak?

A. Traditional mercury arc lamps indeed emit a high level of energy at the wavelength peak of 365 nm. However, this does not mean that an LED light source with a 365 nm peak will provide the best performance. The reality is that many light-curable chemistries, including acrylated adhesives, use photo initiators that respond best to the narrow, bell-shaped spectral curve.

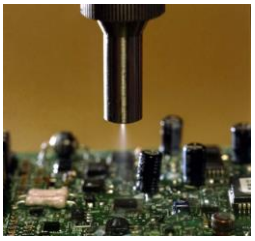
Questions about LED Light-Curing Technology?

Dymax's Application Engineering team is available to answer your questions and assist you in choosing the correct LED light-curable material and equipment for your application. Assistance from our Application Engineers is available by phone, email, or by scheduling a visit to Dymax's Application Engineering laboratory. The lab is fully equipped to perform mechanical testing under a variety of environmental conditions including shear strength, adhesion strength between substrates, compression set, and humidity aging per ASTM standards. The lab also has fully automated and industry-proven XYZ application systems and manual spray or dispense valves to demonstrate conformal coating technology, cure-in-place gaskets, or to provide conceptual test samples for evaluation.

Types of Applications for Dymax Products

Dymax is a major manufacturer of both light-curable materials (LCMs) and light-curing equipment. This focus on light-curing technology, coupled with the synergy produced by designing both the materials and equipment, uniquely positions Dymax as the technical leader in light-curing technology. The primary Dymax products are:

Adhesives	
Application Use	Bonding glass, plastic, metal, and ceramic
Industries	Medical, appliance, aerospace, automotive, solar, alternative energy
Chemistries	Light-curable adhesives, Multi-Cure® adhesives, activator-cured acrylics, 2-part epoxies



Coatings	
Application Use	Protective conformal coatings for electronics; decorative coatings
Industries	Automotive, appliance, solar, electronics
Chemistries	Light-curable adhesives, Multi-Cure® adhesives

Potting Compounds	
Application Use	Component protection
Industries	Appliance, aerospace, automotive, solar, alternative energy
Chemistries	Light-curable adhesives, Multi-Cure® adhesives, moisture-cure adhesives, 2-part epoxies

Masking Materials	
Application Use	Protection during surface treatment and manufacturing processes
Industries	Aerospace, automotive, orthopedic
Chemistries	Light-curable resins, Multi-Cure® resins

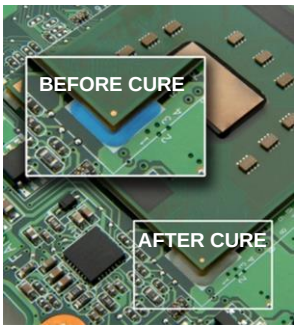
Gaskets	
Application Use	Moisture barrier, vibration resistance, noise reduction
Industries	Appliance, automotive, aerospace, solar, fuel cell, alternative energy
Chemistries	Light-curable resins

Adhesive Technologies

Dymax LED-curable adhesives are available in See-Cure, Ultra-Red™, Multi-Cure®, or Dual-Cure formulations that can assist manufacturers during in-line and Q.C. inspection.

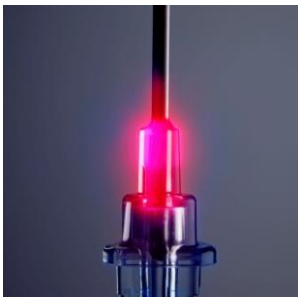
See-Cure Technology

Dymax light-curable adhesives with patented See-Cure technology have built-in cure validation that makes it easy for operators or simple automated inspection equipment to confirm cure without investing in additional specialized equipment. See-Cure technology is an indicator of cure that intentionally transitions the color of the adhesive after it has cured and builds a visible safety factor into the assembly process.



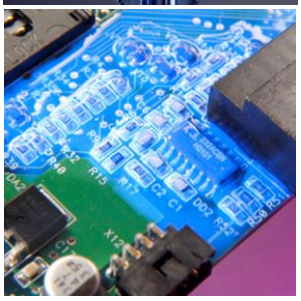
Ultra-Red® Fluorescing Technology

Ultra-Red® fluorescing technology, formulated into Dymax adhesives, enhances bond-line inspection processes and product authentication. The adhesives remain clear until exposed to low-intensity UV light at which point they fluoresce bright red. This is particularly effective while bonding plastics that naturally fluoresce blue, such as PVC and PET. Ultra-Red technology also produces a unique spectral signature that can be used by manufacturers for product authentication.



Encompass™ Technology

Adhesives formulated with Encompass™ technology incorporate Dymax exclusive See-Cure color change and Ultra-Red™ fluorescing technologies into one light-curable product. As a result, manufacturers gain efficiencies from rapid on-demand curing with easy cure confirmation and post-cure bond-line inspection.



Dual-Cure Light/Moisture-Cure Adhesives and Coatings

Dual-Cure adhesives and coatings are formulated to ensure complete cure in applications where shadowed areas are a concern. Previously, areas shadowed from light were managed by selective coating - eliminating the need to cure in shadowed areas - or a secondary heat-cure process. Shadowed areas cure over time with moisture, eliminating the need for that second process step or concerns of component life degradation due to temperature exposure.

Multi-Cure® Light/Activator or Heat-Cure Adhesives

These one-component acrylic adhesives combine the high-speed cure of UV or UV/Visible light with secondary cure mechanisms that enhance polymerization. Secondary cure mechanisms, which include thermal (heat) cure or activator cure, are useful when light can only reach a portion of the bond line, or when tacking a part prior to thermal cure to allow easier handling and transport during the manufacturing process.

LED-Curable Medical Products Selector Guide

Product	Applications	Description	Interfacial Cure Time* Glass-to-Glass, sec	Nominal Viscosity cP (20 rpm)	Durometer Hardness	Tensile at Break, MPa [psi]	Elongation at Break, %
CTH-Series Catheter Adhesives							
204-CTH-F	Catheter Assembly	Flexible; blue fluorescing	0.2	500	D58	17 [2,500]	200
209-CTH	Catheter Assembly	Flexible; blue fluorescing	0.4	300	D70	17 [2,500]	120
210-CTH	Catheter Assembly	Moisture resistant; adhesion to wide variety of plastics	0.2	150	D65	12 [1,800]	18
211-CTH-SC	Catheter Assembly	Adhesion to a wide variety of plastics; formulated with patented See-Cure technology	0.2	450	D70	16 [2,300]	140
212-CTH-UR-SC	Catheter Assembly	Formulated with Encompass™ technology; red fluorescing; blue-to-colorless color change upon cure	0.2	10,000	D62	18 [2,600]	185
215-CTH-UR-SC	Catheter Assembly	Formulated with Encompass™ technology; red fluorescing; blue-to-colorless color change upon cure	0.2	20,000	D53	15.1 [2,200]	360
Needle-Bonding Adhesives							
1161-M	Tube Sets & Fittings; Reservoirs; Needle Bonding	Multipurpose adhesive for plastics, glass, & stainless steel; blue fluorescing	0.2	300	D70	17 [2,500]	120
1180-M	Needle Bonding; Reservoirs; Transducer Assembly; Medical Potting	Multipurpose adhesive for plastics and stainless steel; blue fluorescing	0.2	150	D70	17 [2,400]	90
1401-M-UR	High-Speed Needle Bonding; Tube Assemblies	Tack-free cure at 385 & 405 nm; Ultra-Red™ fluorescing	0.4	2,800	D70	22 [3,300]	200
1402-M	Needle Bonding; Tube Sets; Reservoir Assemblies; Plastic Disposable Items	Curable at 385 & 405 nm; low viscosity for improved wetting; resists yellowing; blue fluorescing	0.2	150	D70	21 [3,200]	160
1403-M	Needle Bonding; Disposable Applications; Medical Device Assembly	Tack-free cure at 385 & 405 nm; blue fluorescing; moisture resistance	0.2	450	D57	17 [2,500]	80
1404-M-UR	Needle Bonding	Curable at 385 & 405 nm; low wicking; Ultra-Red® fluorescing	0.2	6,000	D65	23 [3,400]	150
1405M-T-UR-SC	Needle Bonding; Blood Transfer Device; Winged Infusion Sets; Collection Sets; Safety Sharps Devices	Curable at 385 & 405 nm; Formulated with Encompass™ technology; red fluorescing; blue-to-colorless color change upon cure	3	7,000	D70	23 [3,400]	180

* Interfacial cure times measured with the BlueWave® LED Prime UVA or the BlueWave® LED DX-1000 in spot mode.

Adhesion Chart for LED-Curable Medical Products

● = Recommended adhesive ○ = Limited applications
ST = Surface treatment required in addition to adhesive (plasma, corona, UV, chemical, etc.)

Bonds These Substrates	LED-Curable Medical Products													
	204-CTH-F	209-CTH	210-CTH	211-CTH-SC	212-CTH-UR-SC	215-CTH-UR-SC	1161-M	1180-M	1201-M-SC	1401-M-UR	1402-M	1403-M	1404-M-UR	1405M-T-UR-SC
Plastic														
ABS	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CAP			●	●	●		●							
COPE														
EVA														
PA		○	○	●	●	●	○	●	○	●	●	●	●	
PC	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PCTG						●	●							●
PEBA	○	○				●			●					
PEI						●								●
PET	○	●				○	●	●	●					
PETG						○		●						●
PI	●	○				○	○	○						
PMMA	○	●				●	●	●	○	●	●	●	●	●
PP							○	○		ST	ST	ST	ST	
PS	●	●	●		●	○	●	●		●	●	●	●	●
PSU						●								●
PU	●	○			○	●	○	○	●	●	●	●	●	●
PVC	●	○	●	●	●	●	○	●	●					●
SAN			●	●		○	●							●
TPU			○	●		●								●
Other (metals, ceramics, glass)														
AL						●								
CRS														
CU														
FR-4			○	●										
GL							●	●		●				
NiTi		●		○										
PL					●									
SS		○			●		●	●		●	●	●	●	●

LED-Curable Medical Products Selector Guide

Product	Applications	Description	Interfacial Cure Time* Glass-to-Glass, sec	Nominal Viscosity cP (20 rpm)	Durometer Hardness	Tensile at Break, MPa [psi]	Elongation at Break, %
Multipurpose Medical Adhesives							
1120-M-UR	Tube Sets; Reservoirs; Pumps; Port Fittings; Drug Delivery Devices	Adhesion to a variety of plastics; moisture resistant; Ultra-Red™ fluorescing	0.2	300	D70	19 [2,800]	30
1128A-M	Needle Bonding; Metal Bonding; Heat Exchanger Assembly	Multipurpose adhesive for plastics, glass, and metals with secondary heat cure; blue fluorescing; impact resistant	3	600	D80	30 [4,300]	13
1162-M	Needle Bonding;	Multipurpose adhesive for metals and plastics; high pull-strength to PP hubs with annular rings molded in; blue fluorescing	0.2	200	D75	15 [2,100]	140
1163-M	Needle Bonding; Reservoirs; Tube Sets & Fittings	Multipurpose adhesive for plastics and stainless steel; blue fluorescing; moisture resistant	0.2	5,000	D50	12 [1,800]	125
1165-M	Tube Sets & Fittings; Gaskets	Flexible; bonds to plasticized plastics; blue fluorescing	0.2	10,000	A55	3.8 [550]	250
1168-M	Tube Sets & Fittings; Metal to Plastic; Plastic Assembly	Flexible; low shrinkage; blue fluorescing moisture resistant;	0.2	300	D55	9 [1,300]	230
1187-M	Tube Sets; Reservoirs; Pumps; Port Fittings; Water Carboys; Disposable Devices; Drug Delivery Devices	Moisture resistant; flexible; blue fluorescing	0.2	450	D55	17 [2,400]	170
1201-M-SC	Tube Sets; Reservoirs; Catheter Assembly	Flexible plastic bonding adhesive; formulated with See-Cure technology	0.2	600	D60	14 [2,000]	170
Micro Circuit Coatings							
1901-M	Sealing; Moisture Barrier; Coating of Medical Micro Circuits	Secondary heat cure; flame retardant; repairable; solvent free; suitable for both flexible and rigid substrates	0.1	3,000	A67	2 [290]	45

* Interfacial cure times measured with the BlueWave® LED Prime UVA or the BlueWave® LED DX-1000 in spot mode.




Adhesion Chart for LED-Curable Medical Products

● = Recommended adhesive ○ = Limited applications
ST = Surface treatment required in addition to adhesive (plasma, corona, UV, chemical, etc.)

Bonds These Substrates	LED-Curable Medical Products								
	1120-M-UR	1128A-M	1162-M	1163-M	1165-M	1168-M	1187-M	1201-M-SC	1901-M
Plastic									
ABS	●	●	●	●	●	●	●	●	
CAP	●								●
COPE							●		
EVA					●				
PA		●				●		○	
PC	●		●	●	●	●	●	●	
PCTG									
PEBA		●				●	●	●	
PEI		●							
PET			●		○	●	●	●	
PETG				●					
PI					○	●			
PMMA				●	○	●	○	○	
PP			ST	ST					
PS		●	●		○	●	●		●
PSU		○							
PU		●		●	●	●	●	●	
PVC	●		●	●	●	●	●	●	
SAN	●	●							
TPU									●
Other (metals, ceramics, glass)									
AL		●	●						○
CER									○
CRS		●							
CU		●							
FR-4									●
GL		●	●						○
NiTi									
SS		●	●	●		●			

LED-Curable Industrial Products Selector Guide

Product	Applications	Description	Interfacial Cure Time* Glass-to-Glass, sec	Nominal Viscosity cP (20 rpm)	Durometer Hardness	Tensile at Break, MPa [psi]	Elongation at Break, %
Plastic Bonding Adhesives							
3030	Plastic Housing Assembly; Display Assembly; Appliance Assembly	Rapid cure; strong bonds to a wide variety of plastics	0.2	300	D65	11 [4,600]	41
3031	Plastic Housing Assembly; Display Assembly; Appliance Assembly	Rapid cure; high adhesion to a wide variety of plastics	0.2	125	D65	10 [1,500]	47
3069-GEL	Plastic Housing Assembly; Speaker Assembly; Appliance Assembly; Flexible Lamination	Rapid cure; flexible; adhesion to a wide variety of plastics	0.2	25,000	D55	17 [2,400]	175
3094	Sign Assembly; Plastic Assembly; Household Appliance Assembly	Rapid cure; low shrinkage and stress plastic bonder	0.2	1,000	D62	14 [2,100]	170
3130-UR	Appliance Bonding & Assembly; Plastic Housing Applications; Display Applications	Moisture resistant; strong bonds to a variety of plastics; ; ultra-fast cure Ultra-Red™ fluorescing	0.2	300	D70	19 [2,800]	30
3227-SC	Plastic Assembly; Plastic Lamination; Appliance Assembly; Sealing Plastic Components	PVC- and PET-bonding adhesive; low viscosity; formulated with patented See-Cure technology; dry environments	0.2	110	D70	14 [2,100]	80
3401	Plastic Assembly; Appliance Assembly; Bonding, Encapsulating, or Sealing PC & ABS Components	Light/Moisture-cure PC and ABS plastic bonder; blue fluorescing; shadowed area performance; moisture and thermal resistance	0.1	150	D55-D75	30 [4,400]	13
Glass Bonding Adhesives							
429	Metal-to-Glass Bonding; Potting Critical Components; Large-Area Bonding	Optically clear structural bonder for glass and plastic; high impact; UV resistant; resistant to yellowing and thermal shock	4	2,500	D60	21.6 [3,140]	120
431	Glass Assembly; Glass-to-Metal Assembly	High-temperature resistant; moisture resistant; high adhesion to glass and metal	0.6	500	D70	27 [3,900]	61
431-T			3.8	6,000		24 [3,500]	86
Structural Bonding Adhesives							
6-621	Metal-to-Glass Bonding; Coil Winding; Potting	Adhesive for phenolic and filled plastics, glass, and metal; activator cure; secondary heat cure; hard, clear bonds	0.4	800	D80	28 [4,000]	20
6-630	Glass Fixtures & Furniture; Automotive Latches; Potting; Structural Glass Assemblies; Consumer Packaging	High adhesion to glass & metal; clear bonds; secondary heat cure; activator cure; flexible; high-temperature and moisture resistant	TBD	500	D70	22.4 [3,250]	93
6-630-T			TBD	6,000		28.2 [4,100]	130
***SpeedMask*® Resins for Surface Protection**							
726-SC	Plating; Decorative Etching & Anodizing; Powder Coating; Part Handling; Air Plasma Spray; Grit Blasting	Surface treatment and protection mask; moderate adhesion; fast curing; easy peel-off after exposure to heat; formulated with patented See-Cure (blue to pink) technology	N/A	45,000	D40	6.8 [980]	160
728-G	Plating; Anodizing; Aggressive Grit Blasting; Shot Peening; Machining	Surface treatment and protection mask; high adhesion; fast curing; easy peel off after hot-water soak; highly visible green color; thixotropic gel; sprayable	N/A	25,000	D55	19 [2,700]	230

* Interfacial cure times measured with the BlueWave® LED Prime UVA or the BlueWave® LED DX-1000 in spot mode.

Adhesion Chart for LED-Curable Industrial Products

● = Recommended adhesive ○ = Limited applications
ST = Surface treatment required in addition to adhesive (plasma, corona, UV, chemical, etc.)

Bonds These Substrates	LED-Curable Industrial Products													
	3030	3031	3069-GEL	3094	3130-UR	3227-SC	429	431	431-T	6-621	6-630	6-630-T	726-SC	728-G
Plastic														
ABS	●	●	●	○	●	●	●	●		●	●	●		
CAP	●	●			●			●						
COPE			●											
PA	●	●		○				●	●	●	●			
PC	●	●	●	●	●	●	○	●	●	○				
PC/PCTG				○										
PCTG				○				●						
PEBA			●					●						
PEEK								●				●		
PEI										○		●		
PET			●	○		●		●	●	○				
PETG			●	○				●						
Phenolic										●				
PI	●			○				●		○	●			
PMMA			○	●			○		●					
PS	●		●	●					●		●			
PSU				○								●		
PU	●		●	●		●			●	○				
PVC	●	●	●	○	●	●	●	●		○	●	●		
SAN	●	●		●	●			●						
TPU		●												
Other (metals, ceramics, glass)														
AL							○	●	●	●	●	●	●	●
BR								●						
CER								●	●	●	●			
CO													●	
CRS							○			●				
CU								●	●	●				
FR-4		●						●		●				
GL				○			●	●	●	●	●	●	●	●
Nickel Alloys													●	●
SS				○			○	●	●	●	●	●	●	●
Steel													●	●
TI													●	●

LED-Curable Electronic Products Selector Guide

Product	Applications	Description	Interfacial Cure Time* Glass-to-Glass, sec	Nominal Viscosity cP (20 rpm)	Durometer Hardness	Tensile at Break, MPa [psi]	Elongation at Break, %	Halogen Free?
Wire-Tacking Adhesives								
9-911-REV-A	Wire Tacking; Bond Jumper Wires; PCB Repair	High bond strength to PCB components; secondary heat cure; solvent resistant; high viscosity for optimal coverage or wires; compatible with Dymax conformal coatings; blue fluorescing	1	36,000	D80	28 [4,000]	18	HF
Conformal Coatings								
984-LVUF	Conformal Coating	Ultra-brilliant blue fluorescing; rapid room-temperature cure; secondary heat cure; UL 746 94V0 flame class; MIL-I-46058C listed; IPC-CC-830-B approved	N/A	150	D80	41 [6,000]	5	HF
Encapsulants								
9001-E-V3.0	Chip-On-Board; Chip-On-Flex; Chip-On-Glass; Bare-Die Encapsulation; Wire Bonding	Moisture and thermal resistance; good ionic and electrical properties; environmentally resistant	1	400	D45	5 [750]	150	HF
9001-E-V3.1			0.8	4,500				
9001-E-V3.5			1	17,000				
Ruggedizing Adhesives								
9422-SC	Reinforcing Fine Pitch or Leadless Components on PCB; Shock Absorption; Underfill Replacement	Formulated with patented See-Cure technology; no VOCs; reduces stress on board components; highly thixotropic for minimal movement after dispense; rapid cure; adhesion to various PCB substrates	0.2	38,000	D50	16 [2,300]	170	HF
9422-T-SC			0.2	8,000	D50	16 [2,300]	170	HF

* Interfacial cure times measured with the BlueWave® LED Prime UVA or the BlueWave® LED DX-1000 in spot mode.

Adhesion Chart for LED-Curable Electronic Products

● = Recommended adhesive ○ = Limited applications
ST = Surface treatment required in addition to adhesive (plasma, corona, UV, chemical, etc.)

Bonds These Substrates	LED-Curable Electronic Products						
	9-911- REV-A	984-LVUF	9001-E-V3.0	9001-E-V3.1	9001-E-V3.5	9422-SC	9422-T-SC
Plastic							
ABS			●	●	●		
CAP							
EVA							
PA							
PBT							
PC			●	●	●		
PC/ABS			●	●	●		
PC/PCTG			●	●	●		
PCTG							
PE							
PEI			●	●	●		
PET							
PETG							
PI			●	●	●		
PMMA							
PP							
PS			●	●	●		
PSU							
PU							
PVC							
SAN							
TPU			●	●	●		
Other (metals, ceramics, glass)							
AL			●	●	●		
BRASS							
CER	○	●	●	●	●	○	○
CO							
FLEX		○					
GL							
LEAD FRAME	●	●	●	●	●	●	●
NICKEL ALLOYS							
PCB	●	●	●	●	●	●	●
SI	○	●				●	●
SS							
STEEL							
TI							

Curing and Dispensing Equipment

Because of their unique design, Dymax LED curing systems achieve uniform frequency and intensity output for consistent cures that facilitate better process control, increased manufacturing throughput, and lower operating costs. Dymax BlueWave® LED systems offer significant advantages over conventional lamp-curing systems including:

- Cooler curing temperatures
- Lower intensity degradation over time
- More consistent cure results
- Longer life
- No bulbs to change
- Lower energy consumption

Spot Lamps

Spot lamps provide a variety of methods to deliver light to a very precise location. They can be used manually by an operator or incorporated into a high-speed automated assembly line. Spot lamps are ideal for fast, deep curing of adhesives, potting materials, and gaskets.

LED spot lamps generate UV-curing light using an array of surface-mounted LEDs instead of traditional metal halide or mercury bulbs. LED curing units emit over 15,000 mW/cm^2 of UV light. These units offer cooler cures compared to traditional bulb-style lamp systems. They emit light over a narrow spectrum at a discreet wavelength and offer longer periods between maintenance due to longevity of the LED array. There are no bulbs to change and no warm-up; just cool cures and constant intensity for thousands of hours.

Available LED Spot Lamps:

BlueWave® LED Prime UVA – Cures in the UVA light range (385 nm)
BlueWave® LED VisiCure® – Cures in the visible light range (405 nm)
BlueWave® QX4™ – LED heads for cures at 365, 385, or 405 nm

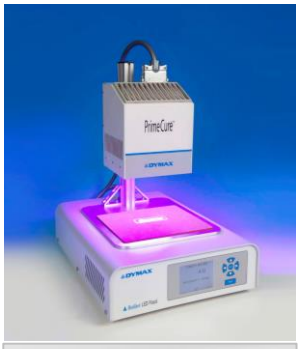
Flexible Spot/Flood Lamp Systems

The BlueWave® LED DX-1000 system is a unique and flexible LED light-curing system that can be configured to operate as either a small-area flood or spot-cure system. In flood mode, up to 1 W/cm^2 can be delivered over a 1" x 1" [2.5 cm x 2.5 cm] area. In spot mode, a single- or multi-pole lightguide can be installed into an optional adapter to deliver up to 15 W/cm^2 in a high-intensity spot. This spot/flood curing system provides all the benefits of Dymax's advanced LED-curing technology in a system that can adapt to meet changing business needs.

Available DX-1000 Models:

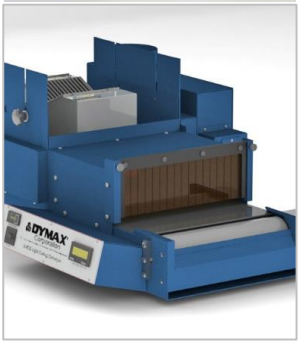
BlueWave® LED DX-1000 – Cures in the UVA light range (385 nm)
BlueWave® LED DX-1000 VisiCure® – Cures in the visible light range (405 nm)

BlueWave® LED Flood Lamp Curing Systems



The BlueWave® LED flood curing system offers greater intensity and uniformity, contributing to faster and more repeatable cure times. The unit features instant on/off capability so there are no mechanical shutter components, no warm-up time requirements, faster exposure cycles, and lower maintenance costs. The system is available with three different wavelength arrays (365, 385, and 405 nm) so users can fully optimize the curing process between their light-curable material and curing equipment. The BlueWave® LED Flood has a 5" x 5" (12.7 cm x 12.7 cm) active area for curing larger parts. It is ideal for manufacturers looking to complement their “green” initiatives because it is CE marked, RoHS compliant, and offers user-friendly operation.

LED Conveyor Systems



Dymax conveyor systems use high-intensity light sources for fast curing of LED-curable materials. UVCS bench-top conveyors can be outfitted with one of three different wavelength LED flood arrays (365 nm, 385 nm, or 405 nm) and if two arrays are used, they can be mounted side-by-side or front-to-back for additional curing flexibility. All UVCS conveyors have adjustable belt speeds of 1 to 32 fpm, and adjustable lamp-to-belt distance to address a variety of application requirements. When combined, the UVCS conveyors’ consistent intensity, fast curing, and adjustable line speeds create an optimized light-curing process that enables high throughput.

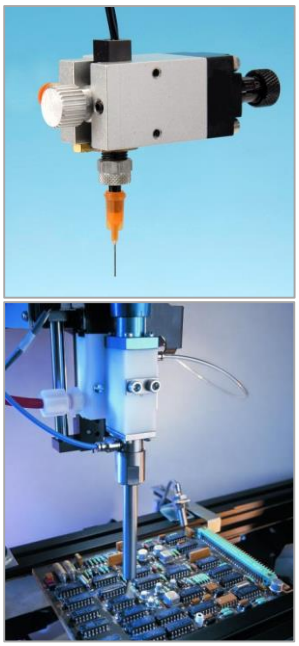
ACCU-CAL™ Radiometers for LED Curing Systems

Measurement of the lamp intensity and dosage is critical to the successful implementation of light-curing technology. Dymax radiometers allow operators to monitor and document the light-curing process. A low UV/Visible measurement signals an operator to replace the bulb, reflector, or lightguide. Radiometers can also be used to confirm that operators are properly shielded from UV/Visible light exposure. Degradation of curing bulbs, lightguides, and reflectors can decrease intensity, resulting in incomplete cures. LED radiometers are optimized to measure spectral output in the 350-450 nm range.

Available ACCU-CAL™ Radiometer Models:

ACCU-CAL™ 50-LED & ACCU-CAL™ 160 LED

Dispensing Systems



Dymax has developed high-quality, field-proven dispense systems to fit many dispensing applications. These systems include various automatic and manual dispense systems, spray valves, and related components for seamless integration into your assembly process. Dymax engineers will work with you to create the best dispensing solution for your application.

Photo courtesy of Asymtek

Reference Tables

Tables on the next two pages are useful for additional information about the Dymax adhesives in this guide.

Viscosity

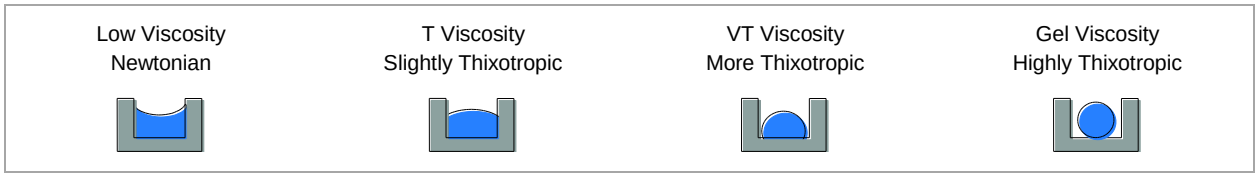
In choosing a viscosity – a material's resistance to flow – consideration should be given to how the adhesive must flow (or not flow) on the part after the adhesive is applied. Low-viscosity adhesives flow more readily than high-viscosity adhesives. Thixotropic gels flow very slowly and are recommended when adhesive flow must be minimized after dispensing onto a part. Part geometry, process design, and assembly speed and method should all be considered when selecting a viscosity.

Dymax adhesives are available in a variety of viscosities. The identifiers appear as suffixes on product names:

- VLV = Very Low Viscosity
- LV = Low Viscosity
- T = Thick
- VT = Very Thick
- GEL = Gel

Standard viscosity products do not have a suffix.

Typical Centipoise (cP/mPa)	Typical Reference Liquids at 20°C
1	Water
10	Kerosene
110	SAE 10 Oil
200	Maple Syrup
440	SAE 30 Oil
1,100	Castor Oil
3,000	Honey
10,000	Molasses
18,000	Chocolate Syrup
65,000	Vaseline
100,000	Sour Cream
200,000	Peanut Butter
1,500,000	Shortening



Volume

Dots:
Volume of a dot is ½ the volume of a sphere V = .2618d^3

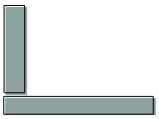
Volume (µL)	0.1	0.5	1	5	10	25
Volume (mL)	0.0001	0.0005	0.001	0.005	0.010	0.025
Diameter (mm)	0.73	1.24	1.56	2.67	3.37	4.57
Diameter (in)	0.029	0.049	0.061	0.103	0.133	0.180

Importance of Joint Design

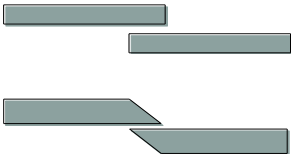
Adhesives are chosen according to the needs of the application and joint design.

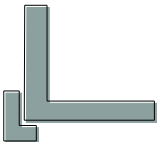
Avoid butt joints: cleavage or asymmetric-type forces can result in part failure

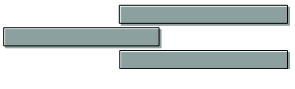
Avoid corner butt joints: cleavage-type forces can result in part failure

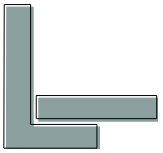


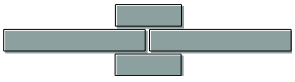
Suggested alternatives (recommended bond gaps: 0.002" – 0.006" [0.05 – 0.15 mm])

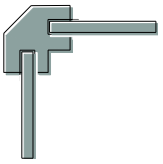


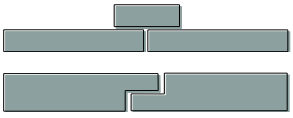


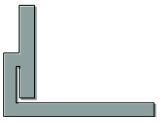












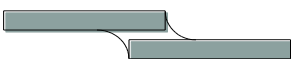
Tongue in Groove

Form-In-Place/Cure-In-Place Gaskets

Ideal Size: 1 mm: 1 mm or 1-mm diameter

Ideal 1:1 Width:Height Non-Ideal: 1:>1.5

Fillet Smoothing



Production Throughput Planner

1 Piece Every…	Minute	Hour	Day (8 Hours)	Week (40 Hours)	Month (21 Days)	Year (50 Weeks)
0.5 second	120	7,200	57,600	288,000	1,209,600	14,400,000
1 second	60	3,600	28,800	144,000	604,800	7,200,000
5 seconds	12	720	5,760	28,800	120,960	1,440,000
10 seconds	6	360	2,880	14,400	60,480	720,000
30 seconds	2	120	960	4,800	20,160	240,000
1 minute	1	60	480	2,400	10,080	120,000
5 minutes	-	12	96	480	2,016	24,000
10 minutes	-	6	48	240	1,008	12,000
30 minutes	-	2	16	80	336	4,000
1 hour	-	1	8	40	168	2,000

Estimating Usage

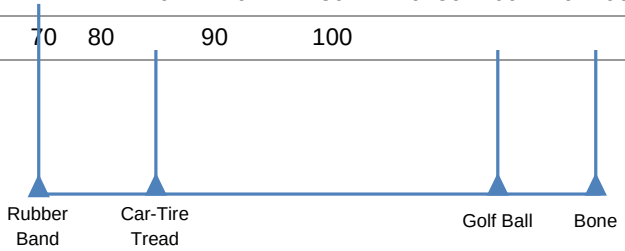
Thickness of the Bond-Line Gap or Coating	Theoretical Area Covered by 1 Liter of Adhesive or Coating
0.002" (51 µm)	30,500 in^2 (212 ft^2) (19.7 m^2)
0.005" (127 µm)	12,200 in^2 (84.7 ft^2) (7.88 m^2)
0.010" (254 µm)	6,100 in^2 (42.4 ft^2) (3.94 m^2)
0.015" (381 µm)	4,070 in^2 (28.3 ft^2) (2.63 m^2)

Bead Size	Theoretical Usage (Length per Liter)
1/32" (0.79 mm)	66,300 in (1,684 m)
1/16" (1.6 mm)	16,600 in (422 m)
3/32" (2.4 mm)	7,400 in (188 m)
1/8" (3.2 mm)	4,100 in (104 m)
3/16" (4.8 mm)	1,900 in (48 m)
1/4" (6.4 mm)	1,000 in (25.4 m)

Hardness Chart

A	10 20 30 40 50 60 70 80 90 100
D	10 20 30 40 50 60 70 90 100
OO	10 20 30 40 50 60 70 80 90 100

This chart is for comparison purposes only.
It cannot be used for conversion reference.



Substrate Abbreviation Chart

Substrate Abbreviation and Polymer Name	
Plastic Substrates	
ABS acrylonitrile-butadiene-styrene	**PSU** polysulfone
CAP cellulose acetate propionate	**PU** polyurethane
COPE copolyester thermoplastic elastomer	**PVC** poly(vinyl chloride)
EVA ethylene vinyl acetate	**SAN** styrene-acrylonitrile
PA polyamide	**TPU** thermoplastic polyurethane
PBT polybutylene terephthalate	**Metal, Glass, Ceramic, & Other Substrates**
PC polycarbonate	**AL** aluminum
PC/ABS Blend of PC and ABS	**BR** brass
PC/PCTG Blend of PC and PCTG	**CER** ceramic
PCTG poly(cyclohexylene dimethylene terephthalate)glycol	**CO** cobalt
PE polyethylene	**CU** copper
PEBA polyether block amide	**FR-4** epoxy fiberglass, FR-4 circuit board
PEEK polyetheretherketone	**GL** glass
PEI polyetherimide	Lead Frame
PET poly(ethylene terephthalate)	Nickel Alloys
PETG poly(ethylene terephthalate)glycol	**NiTi** nickel titanium, nitinol
PI polyimide	**PCB** printed circuit board
PMMA poly(methyl methacrylate)	**SI** Silicone
PP polypropylene	**SS** stainless steel
PPO poly(phenylene oxide)	Steel
PS polystyrene	**TI** titanium

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