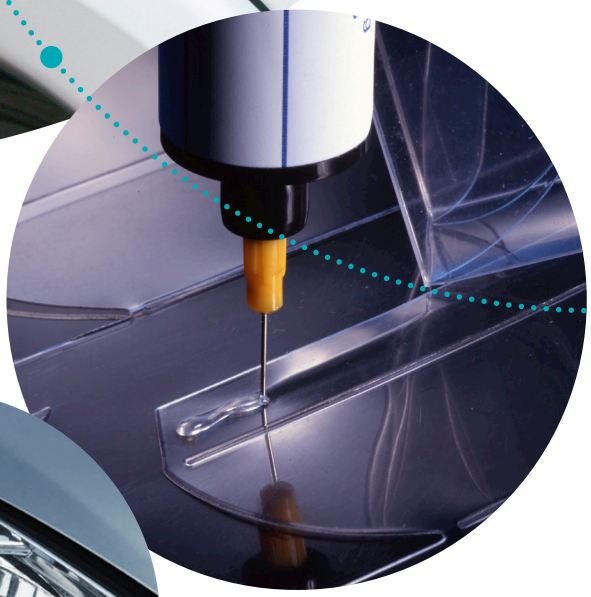


INDUSTRIAL ADHESIVES
PRODUCT SELECTOR GUIDE

DYMAX®

Only Dymax offers expert knowledge of light-cure technology, along with a full array of light-cure products. Dymax is committed to developing a true collaborative partnership — applying our extensive process knowledge to your specific application challenges.

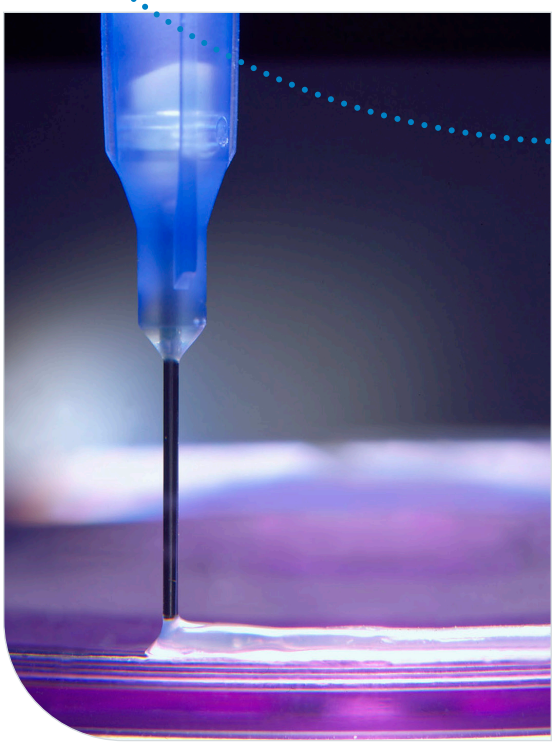
We create custom solutions to ensure that chemistry and equipment work seamlessly together with maximum efficiency. Our application engineering team works side-by-side with our customers, providing assistance with formulation, testing, evaluation, and pre-production trials. We also offer an extensive inventory of curing equipment, manual and automated dispensing systems to help you achieve a more efficient, cost-effective manufacturing process.

About Dymax

Dymax Corporation is an ISO 9001 registered leading manufacturer of light-curable adhesives, coatings, oligomers, light-curing equipment, and fluid dispense systems that work together to optimize assembly processes. Dymax products provide design, research, and manufacturing engineers value-added tools to dramatically improve manufacturing efficiency and lower costs.

Since pioneering light-cure technology over 40 years ago, Dymax has continued to develop innovative ways to co-optimize the assembly process with customer-centric solutions that meet today's application challenges. Dymax owns over 30 patents and has a worldwide network of technical experts who understand manufacturers' demands and assist them with adhesive selection, dispensing options, curing recommendations, component design, and process validation. The result of this collaboration is faster, more reliable processing, less energy consumption, and lower production costs.

The company's headquarters are located in Torrington, CT USA, with additional facilities in the USA, Germany, Ireland, China, Hong Kong, Korea, and Singapore.



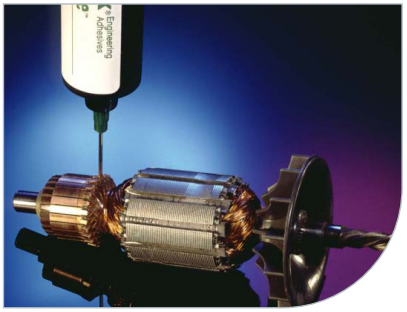
Our Commitment to Greener, Safer Manufacturing

Dymax is committed to green manufacturing that reduces environmental impact, conserves energy, and provides greater worker safety. Over the last 40 years, our light-curable materials and curing equipment have become the industry standard for fast, environmentally conscious assembly. Dymax products are readily replacing technologies that contain hazardous ingredients, produce waste, or require higher amounts of energy to process.

- Eco-friendly, one-component materials
- Materials without solvents and other materials of concern for improved worker and user safety
- Fast curing products and equipment designed for less energy consumption
- Dymax products conform to regulatory standards like RoHS and REACH

Products for Bonding Plastic

Product	Chemistry	Characteristics	Applications	Uncured Appearance
PLASTIC				
3013	UV/Visible	Blue fluorescing; resilient; general purpose; moisture resistant	Bond and joint sealing, plastic window bonding, appliance assembly, plastic assembly	Light Yellow
3069	UV/Visible	Rapid laminating and bonding of flexible and rigid substrates; adhesion to wide variety of plastics	Flexible lamination, plastic housing assembly, appliance assembly, speaker assembly	Colorless
3099	UV/Visible	Strong bonds to PMMA (acrylic), polycarbonate, glass, and other plastics	Display assembly, plastic housing assembly, appliance assembly	Light Yellow
3401	UV/Visible	UV- and LED-curable PC and ABS bonder with secondary moisture cure; blue fluorescing; shadow area performance; moisture and thermal resistance; jetting compatible	Plastic assemblies, appliance assemblies, bonding, sealing, or encapsulating PC or ABS components, automotive applications	Colorless
PLASTIC + METAL/GLASS				
3094-GEL-REV-A	UV/Visible	Adhesion to many plastics including LCP; low shrinkage; low stress bonder; LED curable	CCM assembly, plastic assembly, household appliance assembly	Colorless
3094-T-REV-A	UV/Visible	Adhesion to many plastics including LCP as well as glass and metals; low shrinkage; low stress bonder; LED curable	CCM assembly, plastic assembly, household appliance assembly	Light Yellow
DOME COATINGS				
4-20806	UV/Visible	Non-yellowing; fast curing; clear; low dome profile; flexible and rigid substrate applications; suitable for indoor and some outdoor applications	Dome coating of polycarbonate and PVC nametags	Colorless



Product	Viscosity, cP (20 rpm) Nominal	Durometer Hardness	Tensile at Break, MPA [psi]	Elongation at Break, %	Linear Shrinkage, %	Water Absorption, % (25°C, 24h)
PLASTIC						
3013	150	D70	18 [2,400]	70	0.9	1.6
3069	450	D55	17 [2,400]	175	2.1	1.6
3099	150	D75	19 [2,800]	170	0.4	8.4
3401	150	D55-D75	30 [4,400]	13	0.2	0.7
PLASTIC + METAL/GLASS						
3094-GEL-REV-A	30,000	D67	12.4 [1,800]	200	0.5	22
3094-T-REV-A	11,750	D65	14 [2,000]	184	0.7	6.5
DOME COATINGS						
4-20806	1,750	A80	1.4 [205]	22	1.2	1.2

Products for Bonding Glass and Metal

Product	Chemistry	Characteristics	Applications	Uncured Appearance
GLASS				
429	UV	LED curable; optically clear structural adhesive for large areas; high impact; resistant to yellowing and thermal shock	Glass-to-metal bonding, potting critical components, large-area bonding	Colorless to Light Yellow
429-GEL				
429-T	UV	LED curable; optically clear structural adhesive for large areas; high impact; resistant to yellowing and thermal shock	Glass-to-metal bonding, potting critical components, large-area bonding	Colorless to Light Yellow
431	UV/Visible	LED curable; high-temperature and moisture-resistant glass-to-metal bonder; low shrinkage	Glass-to-glass assembly, glass-to-metal assembly, appliance and lighting sub-assemblies, furniture	Colorless
431-T				
4-20418	UV/Visible	Low-stress plastic and glass bonder; rapid bonding and laminating to glass, metal, and many plastics	Glass, plastic, and metal bonding and laminating	Colorless
4-20418-GEL				
METAL + GLASS + PLASTIC				
6-621	UV/Visible, Heat, Activator	LED curable; adhesive for phenolic and filled plastics, glass, and metal; hard, clear bonds	Metal-to-glass bonding, coil winding, potting	Colorless
6-621-GEL-F				Colorless
6-621-T				Colorless
6-621-VT				Colorless
6-630	UV/Visible, Heat, Activator	LED curable; flexible; high temperature and moisture resistant; high adhesion to glass and metal; clear bonds	Glass fixtures and furniture, consumer packaging, structural glass assemblies, potting, automotive latches	Colorless
6-630-T				
7501-T-UR-SC	UV/Visible	Encompass® technology; visual cure confirmation; Ultra-Red® fluorescing; optimized for 405 nm cure	Sealing critical automotive components and assemblies	Blue
METAL				
846-GEL	Activator	Low-volatility, high-strength structural adhesive; bonds dissimilar substrates; tough durable bonds; good thermal shock characteristics; use with 501-E or 535-A activators	Metal frame bonding, metal-to-stone assembly, loudspeaker hardware assembly, D.C. motor assembly, magnet bonding	Translucent Straw
ACTIVATORS				
501-E-REV-A	N/A	Activator for fast, reliable structural bonding; fixtures in 15-20 seconds; no solvent flash-off time; no VOCs and ODCs	Use with Dymax 600 & 800 series adhesives for increasing bond strength to metal, ceramic, & glass	Yellow to Amber
535-E-REV-A	N/A	Activator for fast, reliable structural bonding; environmentally safe; excellent degreasing and wetting properties; long pre-applied open times available	Use with Dymax 600 & 800 series adhesives for increasing bond strength to metal, glass, & thermoset plastics	Amber to Brown

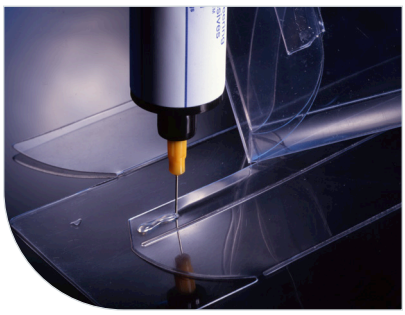
Product	Viscosity, cP (20 rpm) Nominal	Durometer Hardness	Tensile at Break, MPa [psi]	Elongation at Break, %	Linear Shrinkage, %	Water Absorption, % (25°C, 24h)
GLASS						
429	2,500	D60	21.6 [3,140]	120	0.79	1.1
429-GEL	20,000	D60	20.7 [3,000]	120	TBD	1.2
429-T	5,000	D60	20.7 [3,000]	120	TBD	1.2
431	500	D70	27 [3,900]	61	0.78	1.5
431-T	6,000	D70	24 [3,500]	86	0.5	3.4
4-20418	450	D60	20.6 [3,000]	200	0.4	4.4
4-20418-GEL	35,000	D60	11.4 [1,650]	130	TBD	4.1
METAL + GLASS + PLASTIC						
6-621	800	D80	26 [3,700]	19	0.3	1.5
6-621-GEL-F	27,000	D80	5.7 [3,700]	35	0.2	1.4
6-621-T	3,700	D80	23 [3,300]	45	1.0	1.4
6-621-VT	14,500	D80	22.9 [3,320]	25	1.0	1.3
6-630	500	D70	22.4 [3,250]	93	0.5	4.4
6-630-T	6,000	D70	28.2 [4,100]	130	0.5	1.5
7501-T-UR-SC	6,500	D70	17.9 [2,600]	125	1.9	2.6
METAL						
846-GEL	29,000	NA	19 [2,800]	NA	NA	NA
ACTIVATORS						
501-E-REV-A	N/A	NA	NA	NA	NA	NA
535-E-REV-A	N/A	NA	NA	NA	NA	NA

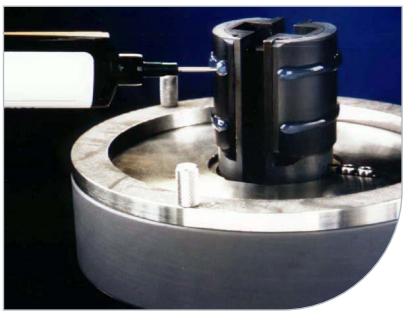
Substrate Bonding Guide - Plastic Bonders

	ABS	CAP	COPE	EP	HDPE/LDPE	PA	PC	PCTG	PEBA	PET	PETG	PI	PMMA	PP	PS	PSU	PU	PVC	SB	SAN	TPU	AL	Brass	Ceramic	Copper	Cold Rolled Steel	FR-4	Glass	SS
PLASTIC																													
3013	•	•	•				•			❍		•	•		•		•	•		❍	•								•
3069	•		•				•		•	•	•		❍		•		•	•											
3099	•						•	•			•		•		❍		❍	•	•	•								•	
3401	•						•	•					•				•	•		•	•		•				•	•	
PLASTIC + METAL/GLASS																													
3094-GEL-REV-A	•					•	•	•		•	•	❍	•		•		•	•		•								•	•
3094-T-REV-A	•					•	•	•		•	•	❍	•		•		❍	•		•									
DOME COATINGS*																													
4-20806	•						•						•									•				•		•	•

- • Recommended adhesive
- ❍ Limited applications
- **ST** Requires surface treatment (e.g., plasma, corona treatment, etc.)

*Substrate adhesion for dome coatings is application dependent.





Substrate Bonding Guide - Glass and Metal Bonders

	AL	Brass	Ceramic	Copper	Cold Rolled Steel	FR-4	Glass	SS	ABS	CAP	EP	HDPE/LDPE	PA	PC	PCTG	PEBA	PEEK	PEI	PET	PETG	Phenolic Plastic	PI	PMMA	PP	PPO	PS	PU	PVC	SAN	TPU
GLASS																														
429	❍				❍		●	❍	●					❍									❍					●		
429-GEL	❍				❍		●	❍	●					❍									❍					●		
429-T	❍				❍		●	❍	●					❍									❍					●		
431	●	●	●	●		●	●	●	●	●			●	●	●	●	●		●	●		●						●	●	
431-T	●		●	●			●	●					●	●					●				●			●	●			
4-20418	●	●			●		●		●	●		ST	●	●	●		●	●	●	●		●	●	ST	●	●		●	●	●
4-20418-GEL							●		●						●					●			●			●	●	●	●	
METAL + GLASS + PLASTIC																														
6-621	●		●	●	●		●	●	●		●		●	❍				❍	❍		●	❍					❍	❍		
6-621-GEL-F	●		●	●	●		●	●	●		●		●	❍				❍	❍		●	❍					❍	❍		
6-621-T	●		●	●	●		●	●	●		●		●	❍				❍	❍		●	❍					❍	❍		
6-621-VT	●		●	●	●		●	●	●		●		●	❍				❍	❍		●	❍					❍	❍		
6-630	●		●				●	●	●				●									●				●		●		
6-630-T	●						●	●	●								●	●										●		
7501-T-UR-SC								●	●					●	●			●	●				●			●	●	●	●	●
METAL																														
846-GEL	●	●		●	●	●	●	●	●															ST						

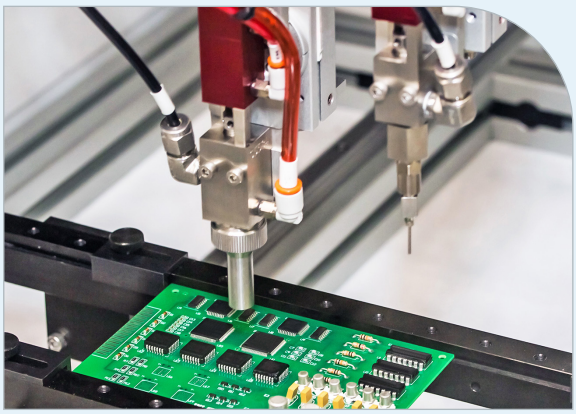
- ● Recommended adhesive
- ❍ Limited applications
- **ST** Requires surface treatment (e.g., plasma, corona treatment, etc.)

Dispensing & Curing Equipment

Dymax designs, manufactures, and sells a range of light-curing spot lamps, flood lamps, conveyor systems, and dispensing equipment, as well as radiometers and other equipment accessories. These systems work with Dymax light-curable adhesives to gain process efficiencies by targeting rapid surface curing, depth of cure, and speed of cure, all while delivering light in a quick and economical way. Dymax equipment is ideal for industrial bonding, coating, encapsulating, potting, and sealing applications. Manufacturers can easily integrate these curing systems into existing assembly lines or use them as stand-alone, bench-top curing systems. CE marked equipment is available.

Dispensing Systems

Dymax has developed high quality, field-proven dispense systems to fit many types of adhesive and fluid dispensing applications. These systems include various automated and manual dispensing valves, spray valves and guns, and related components for seamless integration into assembly processes. The systems provide accurate, consistent dispense for a range of low- to high-viscosity fluids. Dispensing systems with adjustable suck back control to facilitate clean, crisp shutoff and dispensing valves that offer contaminate-free dispensing are available.



UV-Curing Spot Lamps

Spot-curing systems emit very high- intensity UV/Visible light and are ideal for quickly curing small areas (5 mm diameter) – typically within a 0.5 - 5 second cure time. They use high-pressure mercury vapor bulbs that produce light energy in the 300 to 450 nm range and can be equipped with single- or multi-pole lightguides or rod lenses for a variety of curing options.

Light-Emitting Diode (LED) Curing Equipment – Spot and Flood Lamps

LED spot and flood lamps generate UV and visible curing light using an array of surface-mounted LEDs instead of traditional metal halide or mercury bulbs. These lamps emit over 15,000 mW/cm^2 of UV light (centered at 385 nm) and offer cooler cures compared to traditional bulb-style lamp systems. They emit light over a narrow spectrum at a discreet wavelength and extend maintenance intervals due to the 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.

UV-Curing Flood Lamps

UV light-curing flood-lamp systems are ideal for area curing of large parts or simultaneously curing many small parts. They use moderate- to high-intensity multi-spectrum UV/Visible light for curing areas larger than 12.7 mm in diameter. With intensities ranging from 75-225 mW/cm^2, Dymax flood lamps are capable of curing most UV light-curable adhesives, sealants, and coatings, tack free in 30 seconds or less.

UV-Curing Conveyors

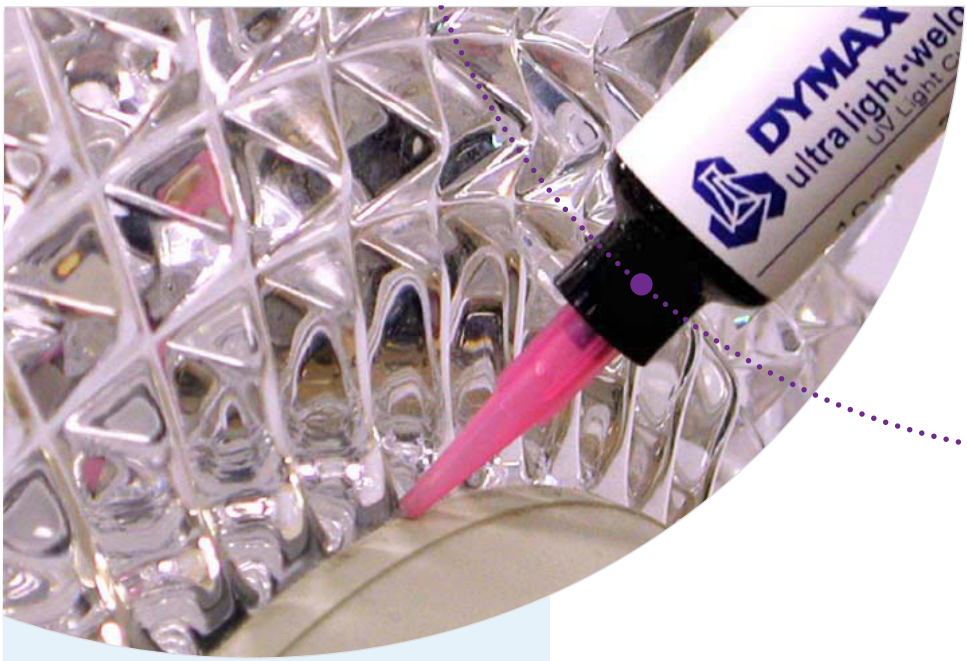
Light-curing conveyor systems consist of a moving belt that passes through a curing tunnel with multi-spectrum flood or focused-beam curing lamps mounted from above or on each side. Dymax conveyor systems, ideal for curing large parts, offer consistent line speed, adjustable lamp height and belt width, and high intensity for fast, safe curing of adhesives, coatings, potting materials, and gaskets. They can be outfitted with standard metal halide (longwave UV), mercury (shortwave UV), or visible bulbs.

Radiometers

A radiometer is a device that measures the intensity and/or dose associated with light of specified wavelengths. UV light is, by definition, not visible and so a radiometer is required to determine UV intensity. Dymax radiometers measure intensity and dose of UV spot lamps, flood lamps, and conveyors in the UVA (320-395 nm) range. Measuring light intensity and/or dose is useful for maintaining a controlled, "worker friendly" light-curing process and measuring the transmission of light through the substrate.

Accessories

A variety of accessories is available for use with Dymax light-curing equipment including single- and multi-pole lightguides for spot-curing lamps, as well as shields, stands, and shutters for mounting or modifying flood-curing lamps.



Types of Applications

Dymax is a leading manufacturer of both light-curable materials 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. Dymax provides solutions across a range of markets.

Adhesives

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

Coatings

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

Potting Compounds

Application Use	Component protection
Industries	Appliance, aerospace, automotive, alternative energy, electronics
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, orthopaedic implants, electronics
Chemistries	Light-curable resins, Multi-Cure® resins

Gaskets

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

Innovative Technologies

Patented See-Cure Technology

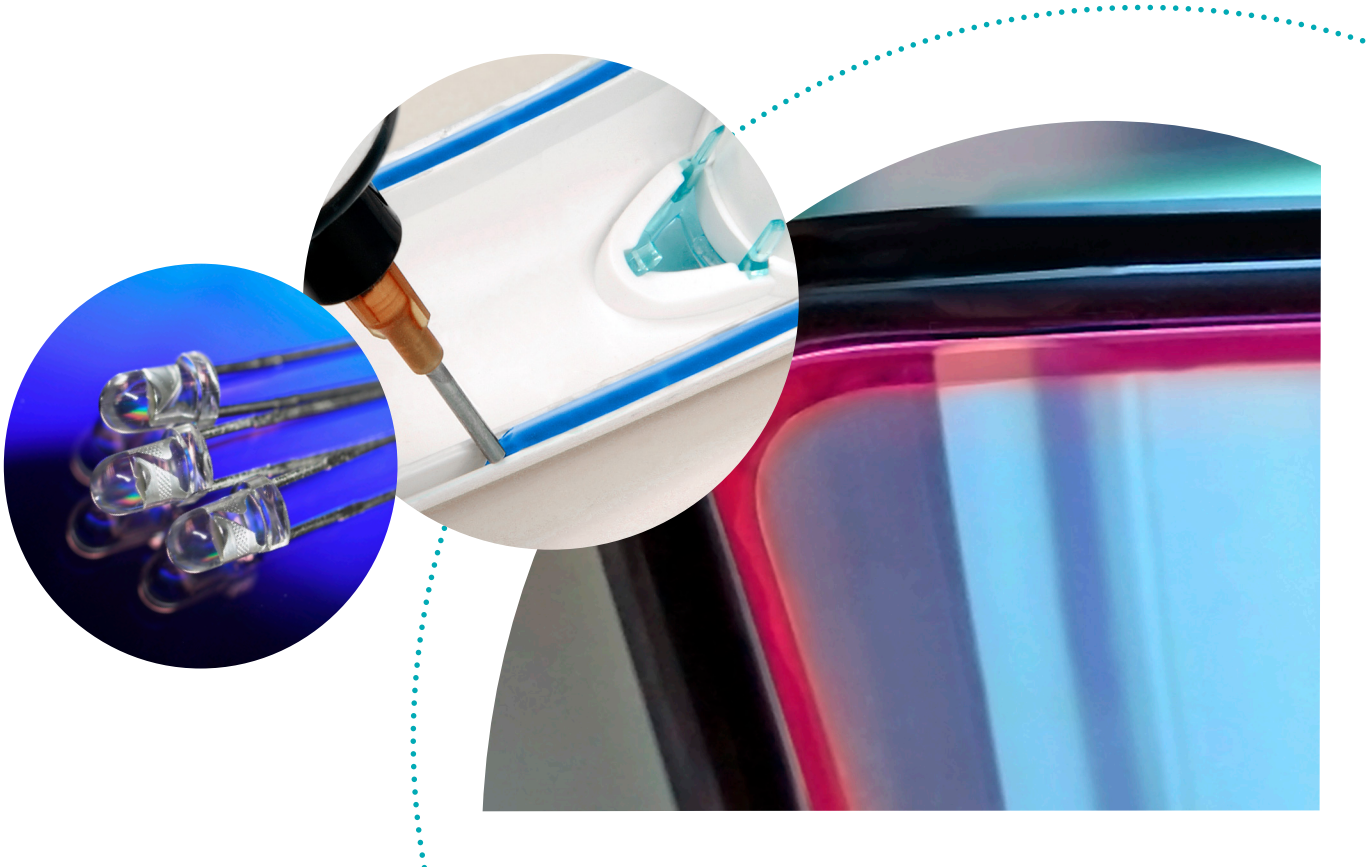
Dymax adhesives formulated with patented See-Cure technology answer the two most asked questions in an adhesive bonding application: Have I dispensed a sufficient amount of adhesive onto my substrate? Has the adhesive cured completely? Uncured See-Cure adhesives are bright blue in color. This makes them easy to see after dispensing onto the substrate. During the light-curing process, the blue color transitions to colorless, indicating that sufficient energy was received by the adhesive to complete the curing process. This visual cure indicator may initially be used to qualify a process and then to ensure that the process remains within the qualified parameters.

Ultra-Red® Fluorescing Technology

Patented Ultra-Red® fluorescing technology enhances adhesive bond-line inspection processes and product authentication. Adhesives formulated with Ultra-Red technology remain clear until exposed to low-intensity UV light, at which point they fluoresce bright red. This feature is particularly helpful when bonding plastics that naturally fluoresce blue, such as PVC and PET. Since Ultra-Red technology produces a unique spectral signature, manufacturers can also use it for product authentication.

LED Light-Curing Technology

Dymax manufactures a variety of LED light-curable adhesives and compatible LED UV and visible curing lamps. LED-curable adhesives range from fast to ultra-fast cure speeds to accommodate specific industrial, medical device, and electronic assembly needs. Dymax BlueWave® LED curing systems offer significant advantages over conventional lamp-curing systems including cooler curing temperatures, lower intensity degradation over time, more consistent cure results, lower energy consumption, and reduced costs.



Reference Tables

Viscosity

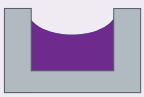
When choosing a viscosity, consideration should be given to how the adhesive must flow (or not flow) on the part after the adhesive is applied. Part geometry, process design, and assembly speed and method should all be considered when selecting viscosity. Viscosity is a material's resistance to flow.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

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

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



LV Low Viscosity
Newtonian

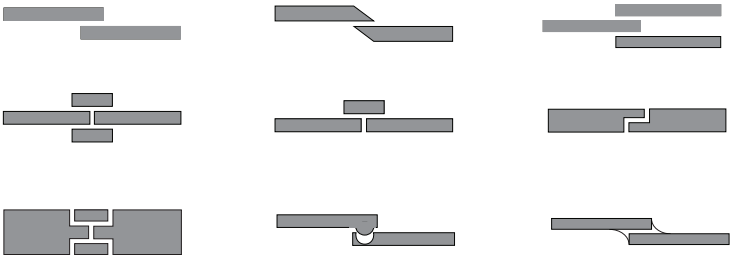
T Viscosity
Slightly Thixotropic

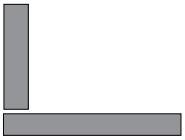
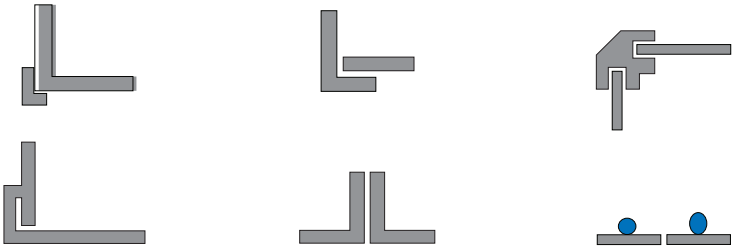
VT Viscosity
Thixotropic

GEL Viscosity
Highly Thixotropic

Dots

Volume of a dot is 1/2 the volume of a sphere V=.2618D^3						
	·	•	•	●	●	●
Volume (ul)	0.10	0.51	0.05	0.01	00.0	25.0
Volume (mL)	0.0001	0.00050	0.0010	0.0050	0.0100	0.025
Diameter (mm)	0.73	1.241	0.56	2.673	0.37	4.57
Diameter (in)	0.0290	0.0490	0.0610	0.1030	0.1330	0.180

Avoid butt joints: cleavage or asymmetric-type forces can result in part failure	Suggested alternatives: (Recommended bond gaps: 0.002" - 0.006" [0.05 -0.15 mm])
	 Tongue in Groove Fillet Smoothing

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])
	

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 SG008EU 14 Dec 2022