GUIDE TO HLC™ ADHESIVES

MEDICAL HYBRID LIGHT-CURABLE MATERIALS

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. Our laboratory is fully equipped to deliver mechanical or electrical testing, as well as specialty testing such as flowers of sulfur, salt spray, or thermal shock to ASTM standards. We also offer an extensive inventory of curing equipment, and manual and automated dispensing systems to help you achieve a more efficient, cost-effective manufacturing process.

HLC™ Adhesives

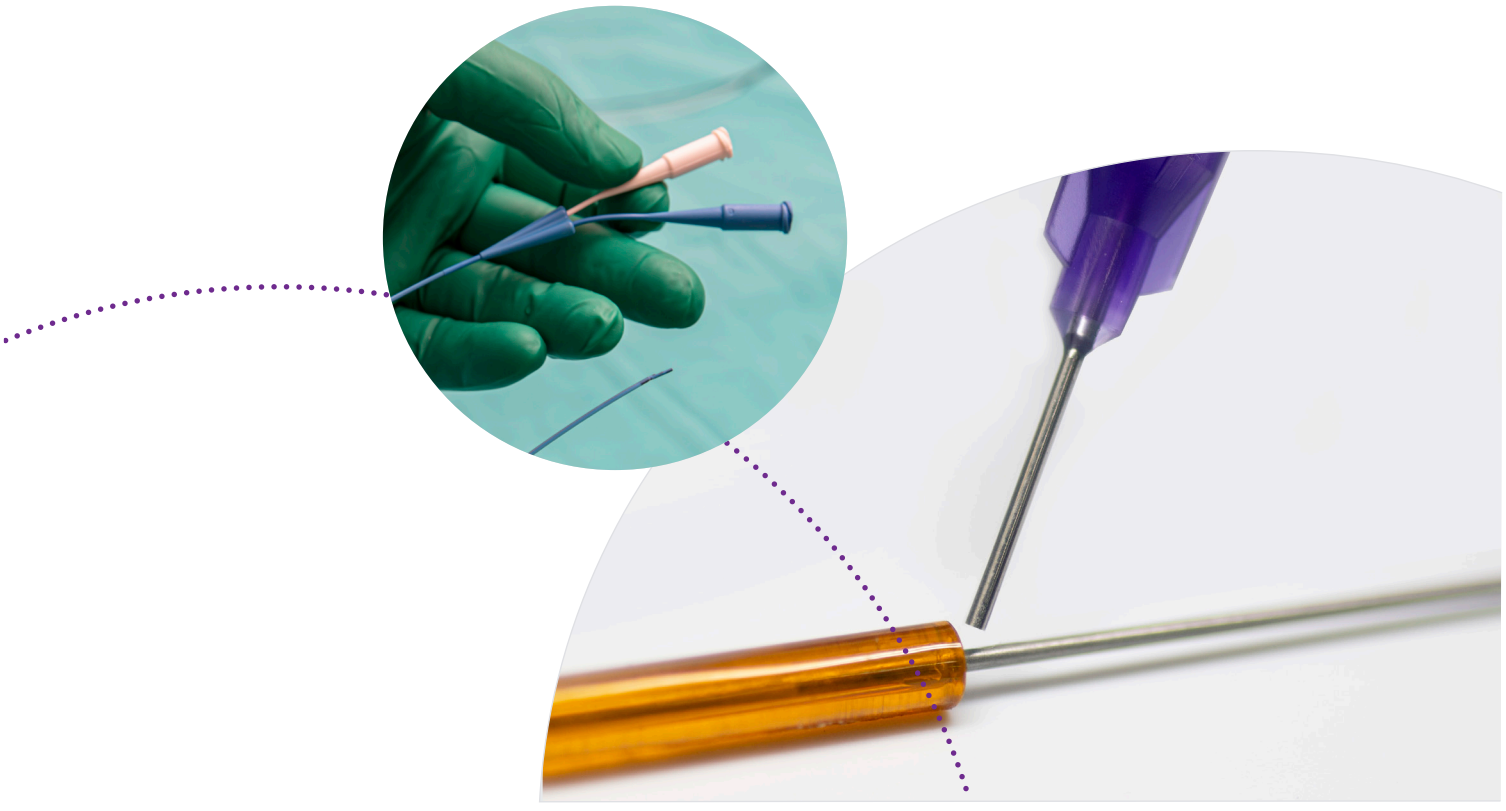
Patented Hybrid Light-Curable Materials with On-Contact Dark Area Cure Capability

Dymax hybrid light-curable technology is a revolutionary new adhesive platform that combines the best attributes of anionic and free radical chemistries into one. HLC adhesives exhibit the exceptional physical and performance properties of Dymax standard light-curable materials and the rapid on-contact cure of anionics. The incorporation of contact curing allows these materials to be used with a larger range of substrates and provides curing in dark areas not reachable by light.

HLC adhesives are ideal for medical assemblies where dark areas are a concern, including bonding applications on catheters, tube sets, diagnostic and therapeutic devices, auto-injectors, and endoscopes.

Key Attributes

- Fast, tack-free cure with UV light - broad spectrum or LED
- Cures with very low intensity (~20 mW/cm^2)
- On-contact dark area cure capability
- Improved physical properties with low to no blooming after proper light cure
- Heat and humidity resistance
- Wicking-grade viscosity available for fast flow into tight-fitting assemblies
- ISO 10993 evaluated per intended use
- Cold ship/storage



Why Choose HLC™ Adhesives?

Dymax hybrid light-curable adhesives are an excellent choice for manufacturers looking to optimize their manufacturing processes. Fast light-cure times increase production rates and reduce labor costs. The incorporation of contact curing into this technology allows one material to be used on a vast range of substrates and bond areas, eliminating the need for multiple chemistries and additional process steps. HLC™ adhesives also benefit from high performance and improved quality, reducing defects and ultimately waste and disposal costs.

- Eliminates the need for multiple chemistries and/or primers
- Increases throughput
- Streamlines process steps
- Eliminates wait time for dark area curing
- Reduces errors and defects

Features	Dymax Light-Curable Material	Dymax HLC Material	Cyanoacrylate
Fast Cure Speeds	✓ Full cure in 1-30 seconds	✓ Light cure in 1-30 seconds; Non-light fixture in 5-75 seconds	Fixture only in 10-60 seconds
Tack-Free Surface Cure	Specific formulas only; Can require high-intensity light cure	✓ Tack free with low intensity light (20 mW/cm^2) <5 seconds	Specific formulas only ; Requires use of activators
Open Time (Time Before Cure Begins)	✓ No cure until exposed to high-intensity light	10-30 seconds	10-30 seconds
Moisture Resistance	✓ Some with excellent moisture resistance	✓ Patented technology to increase moisture resistance	Not designed for high humidity or long-term moisture exposure
Temperature Resistance	✓ Can withstand greater temperature extremes or a broader range of temperatures	✓ Patented technology to increase temperature resistance	Not recommended for ≥225ºF (107ºC)
Opaque Substrate Bonding	Opaque substrates block UV and visible light	✓ Not an issue	✓ Not an issue
Impact Resistance	✓ Grades range from flexible to rigid	✓ Patented technology to reduce brittleness and increase impact resistance	Brittle with little impact resistance
Equipment	Light-curing equipment required	✓ Equipment can be used to improve cure time and reduce crazing but not required for dark areas	✓ No equipment required
Gap Cure	✓ Typically recommended for 0,002"-0,25" (0,05-6,35 mm) with some formulas able to provide even larger gap curing	✓ Can accommodate close gaps or larger bond gaps with light cure	Requires close contact
Blooming	✓ None with proper cure	✓ Low to no blooming after proper cure	Produces white haze around bond line during or after the cure
Stress Cracking	✓ Rarely an issue with proper cure	✓ Rarely an issue with proper cure	Tiny cracks in plastic can occur before or during the cure
Bondable Substrates	✓ Bonds dissimilar substrates	✓ Bonds dissimilar substrates	Does not typically bond dissimilar substrates

Material Specifications & Performance

Product	Features & Applications	Nominal Viscosity, mPas	Durometer Hardness	Modulus of Elasticity, MPa (psi)	Tensile at Break, MPa [psi]	Elongation at Break, %	Linear Shrinkage, %	ISO 10993 Biocompatibilty
HLC-M-1000	• Hybrid light & contact cure adhesive • Low to no blooming with light cure • Wicking grade viscosity • Recommended substrates: ABS, PC, PCTG, PEBA, PETG, PMMA, PS, SAN, SS	3	D80	2.144,3 [311.000]	49 [7.100]	4	0,7	• ISO 10993-4 Hemolysis • ISO 10993-5 Cytotoxicity • ISO 10993-6 Implantation • ISO 10993-11 Systemic Toxicity • ISO 10993-23 Intracutaneous Irritation
HLC-M-1004	• Hybrid light & contact cure adhesive • Limited blooming with light cure • Recommended substrates: ABS, CAP, PC, PEI, PMMA, SAN	1.300	D65	544,7 [79.000]	13,1 [1.900]	150	0,2	

Storage & Use Considerations

Storage between 2-8°C (35-46°F) is required. Storage below or above these temperatures can adversely affect product properties and shelf life. Once opened, maintaining storage between 10°C (50°F) and 21°C (70°F) in a low humidity, dark environment is recommended as this product may polymerize upon prolonged exposure to ambient and artificial light as well as moisture.

Unopened material should be allowed to reach room temperature before use. This may take approximately 20-60 minutes depending on the package size being used. The container should remain closed and sealed when not directly in use. Once opened, returning the material to refrigeration is not recommended. Once material has been removed from the original container, it may be contaminated and should not be returned to the original container.

Applying HLC Materials

Surface Preparation

For best adhesion, all bond surfaces should be clean and free from grease, mold release, or other contaminants prior to dispensing the adhesives. If your surfaces need to be cleaned, wipe them with acetone or Isopropyl Alcohol (IPA) to remove oils, grease, or contaminants.

Dispensing

Always utilize appropriate PPE (personal protective equipment) when working with any adhesive, including nitrile gloves, safety glasses, and ventilation.

Because this product cures with exposure to UV and visible light as well as moisture, exposure to light (ambient and artificial) and moisture should be kept to a minimum before curing. Dispensing components including needles and fluid lines should be 100% light blocking, not just UV blocking. Use of nitrogen or dry compressed air is recommended to eliminate moisture in dispensing lines.

Fluid paths must be evaluated for component compatibility. Known compatible and incompatible materials are listed in the table below. We recommend using polypropylene, polyethylene, PTFE, or PTFE-lining for all wetted parts in direct contact with the liquid adhesive in the dispensing equipment. Passivated stainless steel can be used in place of any metal parts that are in direct contact with liquid adhesive.

✓ Known Compatible Materials	X Known Incompatible Materials	
HDPE - High Density Polyethylene	Acetals	Mild Steel
HDPP - High Density Polypropylene	Aluminum	N-Butyl "O" Rings
Fluorinated Ethylene Propylene (FEP) Coated Gaskets	Brass	Non-Passivated Stainless Steel
Passivated Stainless Steel	Bronze	Nylon
PTFE – Polytetrafluoroethylene	Cast Iron	Polycarbonate
	Copper	Polyurethane
	Glass	PVC
	Hard Chrome	Silicone
	Magnetic Stainless Steel	Zinc

If dispensing equipment needs to be cleaned or purged, fresh acetone or a similar aprotic solvent should be used.

✓ Polar Aprotic Solvents	X Polar Protic Solvents
Acetone	Acetic Acid
Butyl Acetate	Ammonia
Dimethyl Sulfoxide (DMSO)	Ethanol
Ethyl Acetate	Formic Acid
Hydroxymethylfurfural (HMF)	Hydrogen Fluoride
Methyl Ethyl Ketone (MEK)	Isopropyl Alcohol (IPA)
N,N-dimethylformamide (DMF)	Methanol
Propylene Glycol Monomethyl Ether Acetate (PM Acetate)	Water

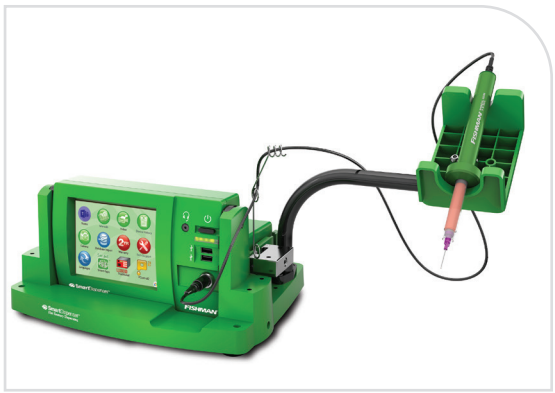
Available Dispensing Systems

Dispensing Systems for 30cc Syringes

Dymax offers the SmartDispenser® and SmartDispenser® MINI from Fishman® Corporation as air-free dispensing options for our HLC™ adhesives packaged in 30cc syringes. Each eliminates the need for unstable compressed air for dispensing fluids, replacing it with a mechanical drive system that can be accurately controlled by algorithms. With this unique ability, operators simply key in numeric dispense programs as opposed to relying on hit-or-miss calculations that come when using air-driven dispensers. This assures high repeatability and exact performance from validation to production, and from workstation to workstation and facility to facility. With the first greatly reducing the time and cost of validating equipment.

	SmartDispenser® MINI	SmartDispenser®
Dispensing Valve	Volumetric positive displacement	Volumetric positive displacement
Activation	Foot pedal (dry contact); finger switch; PLC — terminal block	Foot pedal (dry contact); finger switch; PLC — terminal block
Features	• Handheld benchtop dispenser with 30cc syringe • Can be integrated with automation platform • Algorithmic Control™ for optimum precision • Air-free dispensing for greater control and accuracy • Dependable numeric programming • Lightweight, ergonomically designed pencil gun for operator comfort • Delivers SmartDispenser® performance in a streamlined offering	• Handheld benchtop dispenser with 30cc syringe • Can be integrated with automation platform • AlgorithmicControl™ for optimum precision • AirFree® Technology for greater control and accuracy • Dependable numeric programming • Automatically collects and records valuable production data • Nearly two dozen free system enhancements available that increase productivity, eliminate human error and boost security • Built-in SQL database • Networking capabilities • Large, easy-to-read touchscreen
System Part Number	T41401	T41048
Accessories & Spare Parts	T41406 Fishman® Stand Kit	T41050 Fishman® Dispensing Mount & Stand Kit

SmartDispenser® MINI System
(shown with stand kit)



SmartDispenser® System

Curing HLC™ Adhesives

HLC™ adhesives feature on-contact cure capability for dark areas not reachable by light as well as rapid, low-intensity curing with UV or visible light. Using a combination of both cure types will allow the adhesive to achieve its best performance. The material is compatible with all wavelengths, but has been optimized for 405 nm LED cures, achieving excellent strength at that wavelength.

Curing with Contact

Cure rate is dependent upon many variables including substrate cleanliness, porosity, and required depth of cure. The cure times reported are based on lab results and are intended for reference only. Testing was performed using a 250 mm^2 (0,39 in^2) bond area and represents the time required for the bond to support a 3kg (6,6 lb) weight for 10 seconds at 22°C/50% R.H.

Substrates	Non-UV Fixture Time	
	HLC-M-1000	
ABS - ABS	5-15s	30-45s
Aluminum - Aluminum	10-20s	25-40s
PC - PC	60-70s	105-120s
PMMA - PMMA	25-35s	140-155s
PVC - PVC	25-35s	160-175s
Stainless Steel - Stainless Steel	65-75s	200-215s
Cold Rolled Steel - Cold Rolled Steel	55-65s	225-240s

Curing with Light

Cure rate is dependent upon many variables including lamp intensity, distance from the light source, and required depth of cure. The cure times reported are based on lab results and are intended for reference only. Testing was performed using a 0,127 mm (0,005") thickness and measured based on the time to achieve a tack-free surface.

Dymax Curing System (intensity)	Tack-Free Time[A]	
	HLC-M-1000	
5000-EC (200 mW/cm^2)[B]	1,0s	1,0s
BlueWave® MX-250 RediCure® 365 nm (255 mW/cm^2)[C]	0,4s	0,5s
BlueWave® MX-250 PrimeCure® 385 nm (355 mW/cm^2) [C]	0,4s	0,5s
BlueWave® MX-250 VisiCure® 405 nm (375 mW/cm^2) [C]	0,4s	0,5s
BlueWave® 200 (10 W/cm^2) [B]	0,2s	0,5s
BlueWave® MX-150 RediCure® 365 nm (10 W/cm^2) [C]	0,2s	0,5s
BlueWave® MX-150 PrimeCure® 385 nm (15 W/cm^2) [C]	0,2s	0,5s
BlueWave® MX-150 VisiCure® 405 nm (15 W/cm^2) [C]	0,2s	0,5s

A Tack-free times/belt speeds are based on a 0,127 mm thickness coating when cured with the noted Dymax cure systems.
B Intensity was measured over the UVA range (320-395 nm) using a Dymax ACCU-CAL™ 50 Radiometer.
C Intensity was measured over the UVA/Visible range (350-450 nm) using a Dymax ACCU-CAL™ 50-LED Radiometer.

Low Intensity Tack-Free Cure

HLC-M-1000 also has the unique ability to cure tack free with low intensity. The cure times reported below are based on lab results and are intended for reference only. Testing was performed using a 5 mil / 0,125 mm (0,005") thickness.

Wavelength	@ 20 mW/cm²	@ 100 mW/cm²
Broad Spectrum	1 sec	1 sec
365 nm LED	1 sec	0,4 sec
385 nm LED	1 sec	0,4 sec
405 nm LED	1 sec	0,4 sec

Recommended Curing Systems

Dymax light-curing systems are perfectly matched to our adhesives' chemistry. We offer a complete line of UV broad-spectrum and UV LED light-curing equipment including spot, flood, and conveyor systems, as well as radiometers for measuring light intensity. Our equipment can be configured as stand-alone units or integrated into existing manufacturing assembly lines for fast processing. Visit the dymax.com website for a complete listing of our equipment.

BlueWave® MX-Series LED Curing Systems

BlueWave MX-Series curing systems feature all the benefits of LED-curing technology in smaller, more versatile units. These systems are uniquely designed to offer higher, more consistent curing intensity than traditional spot or flood curing systems.

- Compact, easy-to-use control interface
- Flood, spot, and line pattern models
- 365, 385, and 405 nm wavelength emitters
- Can be easily mounted into automated lines or used as bench-top units.

BlueWave® QX4 LED Spot Lamp

The BlueWave QX4 high-intensity spot-curing system is comprised of a controller and up to four LED heads. LED heads can be controlled through the system's variable mode, a feature that allows each head to be individually programmed for intensity and cycle times.

- 365, 385, and 405 nm wavelength LED heads with three different size focusing lens available.
- Activated by touchscreen, foot pedal, or through an I/O interface connection, allowing it to be easily incorporated into automated systems.

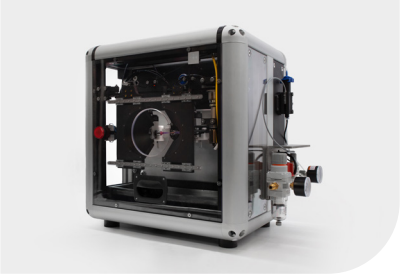
BlueWave® FX-1250 LED Flood Lamps

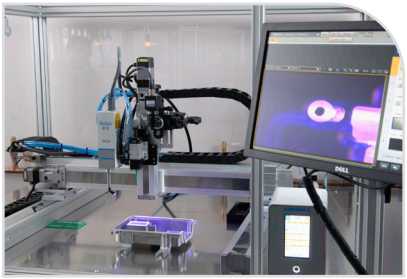
The BlueWave FX-1250 delivers true, high-irradiance LED light for better speed, depth, and fullness of cure. It is comprised of a controller and up to two LED emitters. The system combines intensities of over 2 W/cm^2 with a 12,7 cm x 12,7 cm (5″ x 5″) curing area and high uniformity for exceptional cure performance.

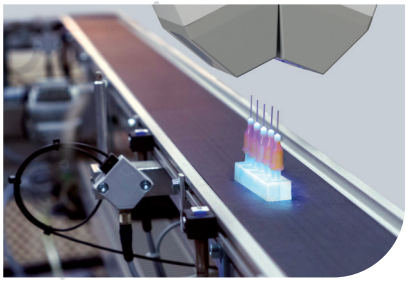
- 365, 385, and 405 nm wavelength emitters
- Easy-to-use controller interface with 7″ touch screen
- Can be activated, controlled, and remotely monitored by PLC for automated lines
- Controller stores programs and parameters for repeatable processes and continuously monitors the health of the system

System Integration Services

Our Systems Integration Team works with manufacturers across various industries that are looking for automated and robotic dispensing and curing solutions for all size processes, from bench-top assemblies to standalone stations or sub-assemblies within larger production lines. They work with manufacturers to fully understand their manufacturing goals and to provide individualized solutions suitable for each application and budget. Our system integrations team draws upon Dymax technology but also collaborates with industry leading automation organizations.







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 with no added solvents for improved worker safety

Fast curing products and LED equipment designed for less energy consumption

Dymax meets global statutory and regulatory requirements

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