Dymax Appliance Application Guide

DYMAX®

About Dymax

Dymax is a world-class, ISO 9001 certified, leading manufacturer of solvent-free, UV/Visible light-curable industrial adhesives and light-curing systems which are supplied to the medical, electronic, appliance, transportation, and alternative energy markets worldwide.

The company was originally founded in January 1980 as the *American Chemical and Engineering Company*. Our first products, a patented line of structural adhesives that combined high bond strength with fast fixturing speed, offered significant productivity improvement to manufacturers of electric motors and were widely used in OEM and manufacturing environments. Eventually, formulations were developed that offered faster processing speeds for a larger segment of the industrial market. This led to the development of ultraviolet light-curable adhesives and compatible UV light-curing equipment.

Today, our product line includes light-curable adhesives and coatings, one- and two-part epoxy resins, cyanoacrylates, activator-cured adhesives, and form-in-place gaskets.

Our complete line of light-curing systems, which are perfectly matched to our adhesives' chemistry, include light-curing spot lamps, flood lamps, conveyor systems, and radiometers for measuring light intensity. Our equipment can be configured as stand-alone units or integrated into existing manufacturing assembly lines for fast processing.

Dymax is headquartered in Torrington, CT, with 240 employees globally, and additional facilities in Germany, China, Hong Kong, and Korea.

Dymax Corporation
318 Industrial Lane
Torrington, CT 06790 USA
Phone: 860.482.1010
Fax: 860.496.0608
E-mail: info@dymax.com
www.dymax.com

Dymax Oligomers & Coatings
318 Industrial Lane
Torrington, CT 06790 USA
Phone: 860.626.7006
Fax: 860.626.7043
E-mail:
oligomers&coatings@dymax.com
www.dymax-oc.com

Dymax Europe GmbH
Kasteler Strasse 45,
Building G 359
65203 Wiesbaden, Germany
Phone: +49 (0) 611.962.7900
Fax: +49 (0) 611.962.9440
E-mail: info_de@dymax.com
www.dymax.de

Dymax Korea LLC
#903, CCMM B/D, 12 Yeoido-Dong,
Youngdungpo-Gu,
Seoul, Korea, 150-869
Phone: 82.2.784.3434
Fax: 82.2.784.5775
E-mail: info@dymax.kr
www.dymax.co.kr

Dymax UV Adhesives & Equipment (Shenzhen) Co. Ltd
Room 617 & 618, South Tower
Cangsong Building, Terra 6th Road
Futian District, Shenzhen, China 518040
Phone: +86.755.83485759
Fax: +86.755.83485760
E-mail: dymaxasia@dymax.com
www.dymax.com.cn

Dymax UV Adhesives & Equipment (Shanghai) Co Ltd
A5 407/401/411 688 Qiuhi Road,
Jinshan District, Shanghai, China 201512
Phone: +86.21.37285759
Fax: +86.21.37285760
E-mail: dymaxasia@dymax.com
www.dymax.com.cn

Dymax Asia (H.K.) Limited
Flat B, 9/F, Yeung Yiu Chung (No. 8) Ind. Bldg.
No. 20 Wang Hoi Road, Kowloon Bay
Kowloon, Hong Kong
Phone: +852.2460.7038
Fax: +852.2460.7017
E-mail: dymaxasia@dymax.com
www.dymax.com.cn

The Dymax Edge – Making You, Our Customer, More Efficient

Dymax offers manufacturers complete solutions to optimize the speed and yields of their assembly process:

- **Light-curable materials** (LCMs) that are environmentally friendly and maximize process throughput.
- **Curing equipment** that is optimized to our LCM formulations for the fastest, most thorough cure.
- **Dispensing systems** that are robotically or manually integrated into the assembly process.
- **Technology consultative services** from the Dymax Applications Engineering and R&D groups that enable selection of the best combination of bonding materials, curing equipment, and process parameters for the most efficient and robust assembly process.

Technical Consulting

The Applications Engineering team is available to you to help choose the best combination of adhesives, coatings, sealants, gaskets, and curing systems, as well as full-system integration, to optimize your manufacturing processes.

The Applications Engineering laboratory 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.

Dymax has a library of 3,000 adhesive formulations already developed to solve manufacturing problems. The Applications Engineering lab is available to engineers who want to visit and work alongside our engineers to evaluate a variety of UV/Visible light-curing spot, flood, and LED lamps, conveyors, and manual and robotic dispensing systems. The lab has fully automated and industry-proven X, Y, Z 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.

How to Use this Guide

Dymax offers different adhesive systems to fit various applications found in appliances, household electronics, handheld tools, or various subcomponents throughout the appliance industry. Designed for the rapid and reliable assembly of your most difficult applications, Dymax has the chemical expertise to solve your adhesive challenges.

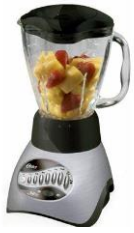
This guide provides an overview of typical assembly applications by appliance type and subassembly with product recommendations for your evaluation and testing. Dymax recommends that each product be tested in your application to evaluate that the performance of the adhesive, coating, gasket, or maskant meets your specific assembly requirement. Full product data information is available on the Dymax website www.dymax.com.

Appliance Industry Applications

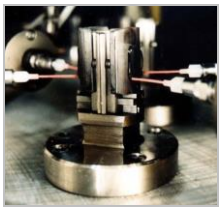
Products listed in **BOLD** font are Dymax's *Leading Edge Products* and are readily available. Please contact Applications Engineering to discuss the full details of your application, dispensing, and curing options.

Applications	Application Area	Application Description	Product
 Refrigerators and Freezers	Cabinet	▪ Bonding mounting bracket	**6-621** **6-625-SV01-REV-A** **846-GEL** **w/501-E Activator** ER1100 Epoxy
	Shelves	▪ Bonding plastic edging to glass shelves	**3025** **3099** **3220-SC** **3225-T-SC**
	Panels	▪ Bonding panels ▪ Replacing welds on stainless steel cabinets and panels	**846-GEL** **w/501-E Activator**
	Displays	▪ Bonding and sealing LCD, touchscreen, or other displays to internal hardware and external panels ▪ Wire tacking	**3099** **6-621** **9481-E** **9-911-REV-A** 3021
	Circuit Boards	▪ Conformal coating of circuit boards	**984-LVUF** **987** **9481-E** **9-20557**
	Potting	▪ Potting thermocouples, terminal switches, wire harnesses	**6-621**
	Doors	▪ Sealing door bracket to cover	**9481-E**
	Decoration	▪ Bonding corporate logos/name tags	**RX50** CA-301
	Gaskets	▪ Form-In-Place Gaskets	**GA-103** **GA-142**
 Electric/Gas Ranges	Control Panel	▪ Bonding stainless steel backsplash ▪ Bonding stainless steel clips	**6-621**
	Displays	▪ Bonding touchscreen controls and displays to stainless steel or powder-coated metal frame	**429** **6-621** **9481-E**
	Stove Tops	▪ Bonding/sealing metal clips to glass tops ▪ Form-In-Place Gaskets	**429** **6-621** **GA-103** **GA-142**
	Circuit Boards	▪ Conformal coating of circuit boards	**984-LVUF** **987** **9481-E** **9-20557**
	Electrical	▪ Wire tacking ▪ Conformal coating	**9-911-REV-A** **984-LVUF**

Applications	Application Area	Application Description	Product
 Clothes Washers and Dryers	Control Panel	▪ Display mounting and sealing ▪ Sealing push-button controls ▪ LED bonding and fixturing	**3025** **3099** **3225-T-SC**
	Control Panel	▪ Touchscreen positioning and fixturing	**3025** **3099** **4-20418** **3225-T-SC**
	Circuitry	▪ Potting of isolated chips and circuits	**9001E V3.1**
	Circuit Boards	▪ Conformal coating of circuit boards	**984-LVUF** **987** **9481-E** **9-20557**
	Panels and Frame	▪ FIP gaskets for vibration isolation and reduction	**GA-103** **GA-120**
	Panels	▪ Bonding panels ▪ Replacing welds on stainless steel cabinets and panels	**846-GEL** **w/501-E Activator**
	Handles	▪ Bonding metal, plastic, or glass	**429** **4-20418** **6-621**
	Door	▪ Bonding door seal	**RX50** CA-301
	Door	▪ Bonding outer window into housing	**3025** **4-20418** **3225-T-SC**
	Motor	▪ Bonding windings on commutator	**6-621**
	Motor	▪ Bonding magnets	**846-GEL** **w/501-E Activator**
	Decoration	▪ Bonding corporate logos/name tags	**RX50** CA-301
	Decoration	▪ Dome coating name tags	**4-20508** **4-20638**
	Process Aid	▪ Removable masking during polishing and finishing steps	**726-SC** **728-G**
 Microwave Ovens	Control Panel	▪ Display mounting and sealing ▪ Touchscreen positioning and fixturing ▪ Sealing push-button controls ▪ LED bonding and fixturing	**3025** **3099** **3225-T-SC**
	Circuitry	▪ Potting of isolated chips and circuits	**9001E V3.1**
	Door	▪ Bonding door seal	**RX50** CA-301
	Door	▪ Bonding outer window into housing	**3025** **3225-T-SC** **4-20418**
	Circuit Boards	▪ Conformal coating of circuit boards	**984-LVUF** **987** **9481-E** **9-20557**

Applications	Application Area	Application Description	Product
 Air Conditioners/HVAC	Control Panel	▪ Touchscreen positioning and fixturing ▪ Sealing push-button controls	**3025** **3099** **3225-T-SC**
	Control Panel	▪ LED bonding and fixturing	**3025** **3099**
	Circuitry	▪ Potting of isolated chips and circuits	**9001E V3.1**
	Electrical	▪ Wire tacking ▪ Conformal coating	**984-LVUF** **9-911-REV-A**
	Panels and Frame	▪ FIP gaskets for vibration isolation and reduction	**GA-103** **GA-120** **GA-142**
 Irons	Housing	▪ Bonding plastic clips, hermetically sealing water canister	**3025** **3099** **3225-T-SC** CA-301
	Electrical	▪ Wire tacking ▪ Conformal coatings	**984-LVUF** **9-911-REV-A**
	Control Panel	▪ LED bonding and fixturing ▪ Sealing push-button controls	**3025** **3099** **3225-T-SC**
	Circuitry	▪ Potting of isolated chips and circuits	**9001E V3.1**
 Blenders	Electrical	▪ Wire tacking ▪ Conformal coating	**984-LVUF** **9-911-REV-A**
	Control Panel	▪ LED bonding and fixturing ▪ Sealing push-button controls	**3025** **3069** **3099** **3225-T-SC**
	Circuitry	▪ Potting of isolated chips and circuits	**9001E V3.1**
 Vacuum Cleaners	Housing	▪ Bonding plastic clips, hermetically sealing canister	**3025** **3069** **3099** CA-301
	Electrical	▪ Wire tacking ▪ Conformal coating	**984-LVUF** **9-911-REV-A**
	Circuitry	▪ Potting of isolated chips and circuits	**9001E V3.1**
	Control Panel	▪ LED bonding and fixturing ▪ Sealing push-button controls	**3025** **3069** **3099** **3225-T-SC**

Applications	Application Area	Application Description	Product
 Power Tools	Circuitry	▪ Potting of isolated chips and circuits	**9001E V3.1**
	Control Panel	▪ LED bonding and fixturing	**3025** **3069** **3099** **3225-T-SC**
	Electrical	▪ Wire tacking ▪ Conformal coating	**984-LVUF** **9-911-Rev-A**
	Laser/Levels	▪ Bonding and alignment of lasers or levels into the housing	**3025** **3069** **3099** **3225-T-SC**
	Body	▪ Bonding grips, components, battery	**MR290** CA-301
	Body	▪ FIP gaskets for vibration isolation and reduction	**GA-103** **GA-120** **GA-142**
	Motor	▪ Bonding windings on commutator	600 Series
	Motor	▪ Bonding magnets	**846-GEL** **w/501-E Activator**
 Saws and Cutting Tools	Circuitry	▪ Potting of isolated chips and circuits	**9001E V3.1**
	Control Panel	▪ LED bonding and fixturing	**3025** **3069** **3099** **3225-T-SC**
	Electrical	▪ Wire tacking ▪ Conformal coating	**984-LVUF** **9-911-REV-A**
	Laser/Levels	▪ Bonding and alignment of lasers or levels into the housing	**3025** **3069** **3099** **3225-T-SC**
	Body	▪ Bonding grips, components, battery, housing	**MR290** CA-301
	Body	▪ FIP gaskets for vibration isolation and reduction	**GA-103** **GA-112** **GA-120** **GA-142**
	Motor	▪ Bonding windings on commutator	**6-621** **6-625-SV01-REV-A**
	Motor	▪ Bonding magnets	**846-GEL** **w/501-E Activator**
 Laser Levels, Tape Measures, and Alignment Devices	Laser/Levels	▪ Bonding and alignment of lasers or levels into the housing	**3025** **3069** **3099** **3225-T-SC**
	Windows	▪ Bonding outer window into housing	**3025** **3069** **3099** **3225-T-SC** **429**
	Body	▪ Bonding grips, components, battery, housing	**MR290** CA-301

Applications	Application Area	Application Description	Product
Sub Assemblies			
 Magnet Bonding	Speaker Assembly	▪ Magnet-to-housing bonding	**6-621 OR 846-GEL w/501-E Activator**
 Motor Assembly	Motor and Magnet Assembly	▪ DC motor magnet-to-can bonding ▪ Bearing mount assembly ▪ Flange bonding ▪ Magnet-to-flywheel bonding	**6-621 OR 846-GEL w/501-E Activator**
 Magnet-to-Can Assembly	Motor and Magnet Assembly	▪ DC motor magnet-to-can bonding ▪ Bearing mount assembly ▪ Flange bonding ▪ Magnet-to-flywheel bonding	**6-621 OR 846-GEL w/501-E Activator**
 Commutater Windings	Motor and Magnet Assembly	▪ Commutator-to-shaft sealing	**6-621 OR 846-GEL w/501-E Activator**
 	Motor and Magnet Assembly	▪ Commutator-to-shaft sealing ▪ Tab sealing ▪ Amature wire unitizing ▪ DC motor magnet-to-can bonding ▪ Bearing mount assembly ▪ Flange bonding ▪ Magnet-to-flywheel bonding ▪ Chokes, ferrite cores, and transformer bonding	**6-621 OR 846-GEL w/501-E Activator**

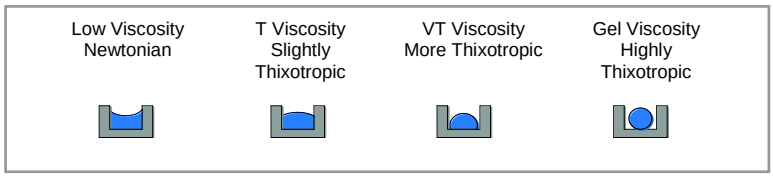
Applications	Application Area	Application Description	Product
	Dome Coatings	▪ Logos, emblems, decorative coatings	**4-20508** **4-20564** **4-20577** **4-20638**
	LED	▪ LED potting, encapsulation, and alignment	**3025** **3069** **3099** **3225-T-SC**
	Circuit Boards	▪ Conformal coating of circuit boards	**984-LVUF** **987** **9481-E** **9-20557**
	Wire Tacking	▪ Ruggedizing circuit boards by tacking wires	**9422-SC** **9-911-REV-A** 9-20474-GEL
	Potting & Encapsulation	▪ Potting and ruggedizing assemblies ▪ Protection from environments	**921-T** **9001E V3 Series**
	Gasket Replacement	▪ Form-In-Place gaskets	**GA-105** **GA-108** **GA-112** **GA-140** **GA-142**

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, 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 a 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: 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	Caster 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

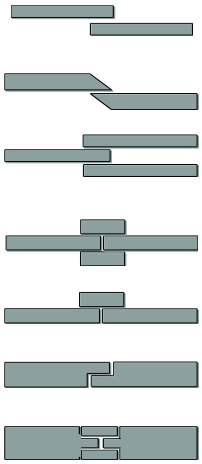
Importance of Joint Design

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

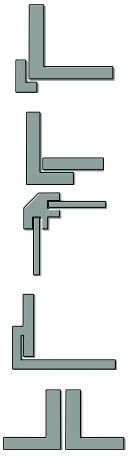
Avoid corner butt joints: cleavage-type forces can result in part failure

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



Tongue in Groove

Fillet Smoothing



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

Reference Tables

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

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.

LIT282 9/27/2011

Dymax Corporation
860.482.1010
info@dymax.com
www.dymax.com

Dymax Oligomers &Coatings
860.626.7006
oligomers&coatings@dymax.com
www.dymax-oc.com

Dymax Europe GmbH
+49 (0) 611.962.7900
info_de@dymax.com
www.dymax.de

Dymax UV Adhesives & Equipment (Shenzhen) Co Ltd
+86.755.83485759
dymaxasia@dymax.com
www.dymax.com.cn

Dymax UV Adhesives & Equipment (Shanghai) Co Ltd
+86.21.37285759
dymaxasia@dymax.com
www.dymax.com.cn

Dymax Asia (H.K.) Limited
+852.2460.7038
dymaxasia@dymax.com
www.dymax.com.cn

Dymax Korea LLC
82.2.784.3434
info@dymax.kr
www.dymax.co.kr