



LIGHT-CURABLE MATERIALS
FOR WEARABLE MEDICAL
DEVICE ASSEMBLY



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 Our Products

Since pioneering light-cure technology over 40 years ago, Dymax has continued to develop innovative ways to optimize medical device assembly. We understand the demands of the medical device market and are ready to assist you with every step of the product development process including adhesive selection, dispensing options, curing recommendations, biocompatibility testing, component design, and process validation. We are continually developing new technologies to help you build safer, higher quality products that increase your manufacturing efficiency, and deliver the best possible outcomes.



MD® Adhesives

Dymax MD® adhesives are specially formulated for disposable medical device assembly and used in a variety of applications.*

- Optimize assembly speeds enabling faster processing, greater output, and in-line inspection of bond lines
- Solvent free and RoHS compliant
- Many meet ISO 10993 biocompatibility and/or USP Class VI standards.

*MD® adhesives are intended for use in short-term (<29 days) or single-use disposable-device applications only. Dymax does not authorize their use in long-term implant applications. In all cases, it's the user's responsibility to determine and validate the suitability of these adhesives in the intended medical device.

Compatible sterilization methods include gamma irradiation and ethylene oxide. Sterilization by autoclaving may be limited to certain applications. It remains the user's obligation to ascertain the effect of sterilization on the cured adhesive.

2000-MW Series Adhesives

Dymax 2000-MW series adhesives are uniquely designed for the assembly of wearable medical devices where materials of concern and proximity to skin matter.

- Formulated without:
 - IBOA, a known skin irritant
 - TPO, a material of concern
- Pass ISO 10993-5 for cytotoxicity
- Grades available that pass ISO 10993-10 for sensitization and irritation
- Cure within seconds upon exposure to
 - Broad-spectrum light
 - UV LED light
- Provide strong bonds and dependable performance against moisture and thermal shock
- Some products fluoresce under black light for easy bond-line inspection

Recommended Products

| Product | Features | Cure Mechanism | Nominal Viscosity, cP | Durometer Hardness | Water Absorption, % (25° C, 24h) | Tensile at Break, MPa [psi] | Modulus of Elasticity, MPa [psi] | 10993-5 Cytotoxicity | 10993-10 Irritation | 10993-10 Sensitization | Formulated Without IB0A | Formulated Without TPO |
|---------------|---|---|-----------------------|--------------------|----------------------------------|-----------------------------|----------------------------------|----------------------|---------------------|------------------------|-------------------------|------------------------|
| 2022-MW | Ideal for general bonding, encapsulation, and coating; low water absorption | UV broad spectrum; UV LED 365 nm | 750 | D60 | 0.5 | 18.6 [2,700] | 668.8 [97,000] | • | • | • | • | • |
| 2101-MW-UR | Ideal for general bonding of medical wearables; adhesion to a variety of substrates including PC, PVC, TPU; Ultra-Red® fluorescing | UV broad spectrum; UV LED 405 nm | 5,500 | D77 | 2.1 | 24.8 [3,600] | 1,020.4 [148,000] | • | • | • | • | • |
| 2103-MW-UR | Ideal for general bonding; moisture resistant; adhesion to a variety of substrates including PC, PVC, TPU; Ultra-Red® fluorescing | UV broad spectrum; UV LED 405 nm | 5,500 | D70 | 0.1 | 13.8 [2,000] | 448.2 [65,000] | • | • | • | • | • |
| 1172-M-UR | Ideal for general bonding; low water absorption; Ultra-Red® fluorescing | UV broad spectrum; UV LED 385 nm | 1,100 | A70 | 1.0 | 4.1 [600] | 8.8 [1,270] | • | | | | |
| 1405M-T-UR-SC | Ideal for general bonding, encapsulation, and coating; Encompass® technology - See-Cure color change technology with Ultra-Red® fluorescing | UV broad spectrum; UV LED 385 & 405 nm | 7,000 | D70 | 3.1 | 23 [3,400] | 379 [55,000] | • | | | | |
| 1901-M | Ideal for encapsulation and coating; low water absorption; flame retardant (meets UL 94 V-0); repairable; suitable for both flexible and rigid substrates | UV broad spectrum; UV LED 385 nm; Heat cure | 3,000 | A67 | 1.5 | 2 [290] | 3 [480] | • | | | | |

SC See-Cure (Patented Color-Change Technology)

UR Ultra-Red® (Patented Fluorescing Technology)

T Thick

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

Substrate Bonding Guide

| Product | ABS acrylonitrile-butadiene-styrene | CAP cellulose acetate propionate | COC/COP cyclo olefin copolymer | PA polyamide | PC polycarbonate | PCIG poly(cyclohexylene dimethylene terephthalate)glycol | PEBA polyether block amide | PEEK polyetheretherketone | PEI polyetherimide | PET poly(ethylene terephthalate) | PETG poly(ethylene terephthalate)glycol | PI polyimide | PMMA poly(methyl methacrylate) | PPO poly(phenylene oxide) | PS polystyrene | PSU polysulfone | PU polyurethane | PVC poly(vinyl chloride) | SAN styrene-acrylonitrile | TPU thermoplastic polyurethane | CER ceramic | GL glass: borosilicate, quartz, mica | FR4 glass-reinforced epoxy resin laminate | AL aluminum | BR brass | CRS cold rolled steel | CU copper | Ni-Plated SS | SS stainless steel | PCB printed circuit board |
|---------------|-------------------------------------|----------------------------------|--------------------------------|--------------|------------------|--|----------------------------|---------------------------|--------------------|----------------------------------|---|--------------|--------------------------------|---------------------------|----------------|-----------------|-----------------|--------------------------|---------------------------|--------------------------------|-------------|--------------------------------------|---|-------------|----------|-----------------------|-----------|--------------|--------------------|---------------------------|
| 2022-MW | ● | ○ | | | ● | ● | | | | | | ○ | ● | ● | ○ | | | | ● | ○ | | ● | | ● | ● | | | | ● | |
| 2101-MW-UR | ● | | | | ● | ● | | | ○ | | ● | | | | ○ | | | | ● | ● | | ○ | ○ | | | | | | | |
| 2103-MW-UR | ● | | | | ● | | ○ | | | | | | | | ● | | | ● | | ● | | | | | | | | | ● | |
| 1172-M-UR | ● | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ○ | ● | | ● | ● | ○ | ● | ● | ● | ● | ○ | ● | | | | | | ● | |
| 1405M-T-UR-SC | ● | | | ○ | ● | ● | | ● | ● | ● | ● | ○ | ● | ● | ● | ● | ● | ● | ● | ● | | | ○ | | | | | | ● | ● |
| 1901-M | ● | | | ○ | | | | | | | ○ | | | | ● | | | ○ | | ● | | | | | | | | | ● | |

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

Individual Product Data Sheets (PDS) list complete test data, with copies of test reports available upon request.

Application Areas



Continuous Glucose Monitor (CGM)



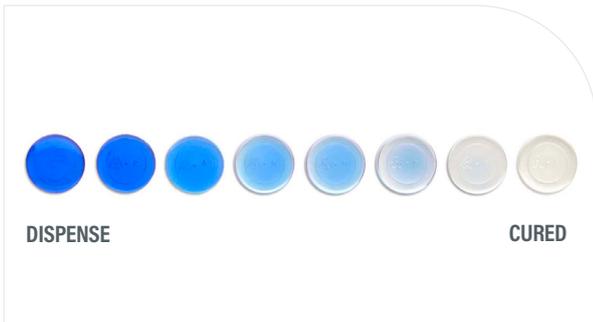
- 1. Electronics Encapsulation
- 2. Needle-to-Hub Bonding
- 3. Edgebond
- 4. Battery Reinforcement
- 5. Wire and Flex Tacking
- 6. Assembly Bonding

Applicable Devices

- Medical smart monitoring devices
- Patient monitoring devices
- Large volume injectors
- Vital sign monitoring devices
- Hearing aids
- Continuous glucose monitors
- Diabetes care devices
- Pain management devices
- Sleep monitoring devices

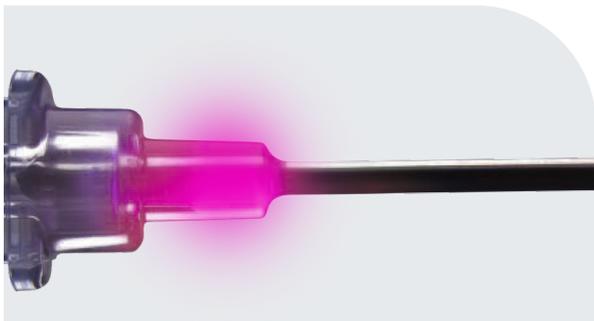
Adhesive Technologies

As an innovator in the adhesive and coating industries, Dymax strives to create new technologies that help manufacturers increase process efficiency, productivity, and throughput while decreasing costs and inventory. Through the years, our dedication to innovation has resulted in over 30 patents and numerous awards for our innovative technologies and service.



See-Cure Technology Confirm Adhesive Placement & Cure

- Material transitions color when cure is complete
- Provides critical safety feature for manufacturing processes
- Simple visual confirmation of cure, no special equipment needed



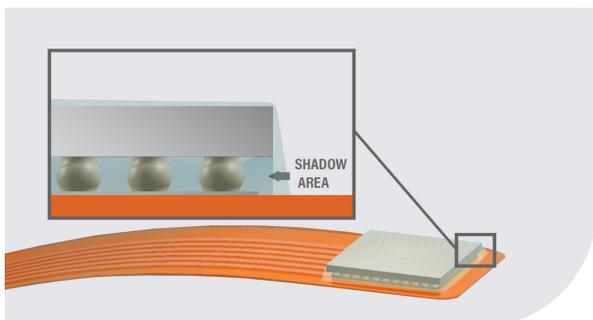
Ultra-Red® Technology Enhance Bond-Line Inspection

- Fluoresces bright red when exposed to low-intensity black light so bond lines can be easily inspected
- Produces a unique energy peak exclusive to Dymax so products can be marked and positively identified



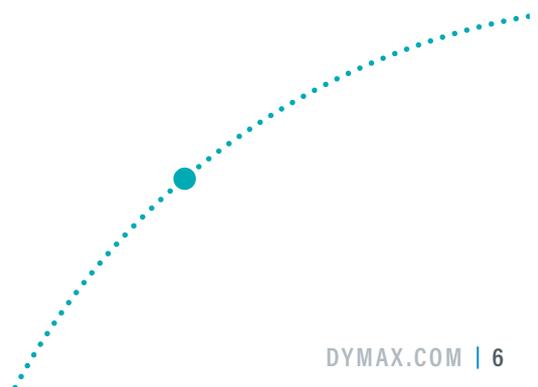
Encompass® Technology Enhance Bond-Line Inspection & Confirm Cure

- Ultra-Red® and See-Cure technologies incorporated into one product
- Manufacturers gain efficiencies from rapid curing with easy cure confirmation and post-cure bond-line inspection



Multi-Cure Technology Eliminate Uncured Material in Shadow Areas

- Cures with light but features secondary heat cure for material that flows into shadow areas.



Dispensing & Light-Curing Equipment

Dymax dispensing and light-curing systems are perfectly matched to our adhesives' chemistry. Our field-proven dispense solutions are designed to fit many adhesive dispensing applications and include various automatic and manual dispense systems, spray valves, and related components for seamless integration into your assembly process. We also offer a complete line of conventional and 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.



Dymax Dispensing Systems

- Pneumatic dispense and spray systems
- Available with suck back control for crisp shutoff even with stringy/tacky materials
- Valves with disposable fluid paths available for contaminate-free dispensing

BlueWave® MX-150 LED Spot-Curing System

- Emitter design for set up flexibility and consistent intensity
- LED curing emitters in 365, 385, and 405 nm
- PLC interface for easy integration into fully automated lines

BlueWave® AX-550 LED Flood-Curing System

- Compact, all-in-one design
- 5" x 5" curing area with up to 800 mW/cm² initial intensity
- Available in 365, 385, and 405 nm

UVCS Conveyor Systems

- Left, right, and top curing capability with 6"- or 12"-width cure area
- Available in a wide range of configurations with UV broad-spectrum or LED flood lamps

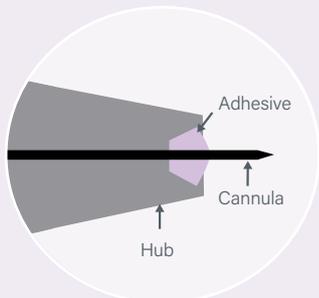
Radiometers

- Provides accurate measurement of system lamp intensity and dosage
- UV broad-spectrum and LED compatible radiometers
- Wand and puck style radiometers available for spot, flood, and conveyor systems

Reference Tables

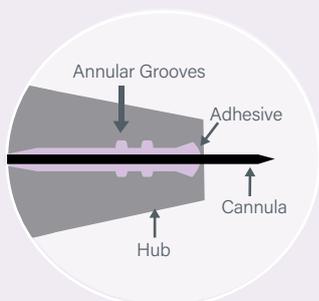
Joint Design

An adhesive should be chosen according to the needs of the application and joint design.



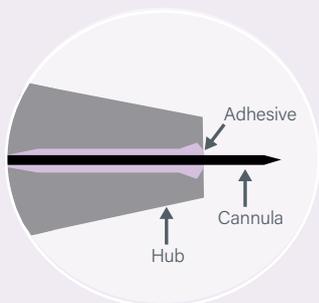
Well Configuration

A hub that is flared at the distal end is described as a “well” configuration. Filling the well with adhesive secures the needle in place. In many cases the hubs are opaque but can be cured from above so UV light is not required to pass through the plastic. In the “well” design, adhesion to both the hub substrate and cannula are of critical importance. The well in this configuration is usually large enough to permit using mid-range viscosities.



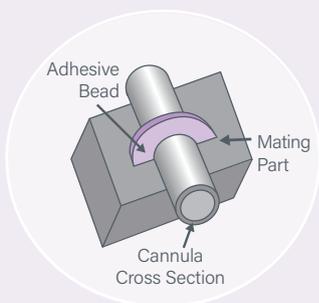
Mechanical Lock

A hub can be molded with annular grooves in its inside diameter. The annular rings are typically 0.005” to 0.008” (0.127-0.2 mm) deep per side subject to molding limitations. This allows the cured adhesive to form a mechanical lock, substantially increasing pullout strength. Adhesives will form a structural bond with the stainless steel cannula and lock in place with the added groove feature. With this design, a low- to medium-viscosity adhesive is used to wick between the stainless steel cannula and hub forming a mechanical lock.



Cylindrical Hub

The close-fitting cannula-to-hub design is commonly encountered in medical disposable syringes. A cylindrical hub that is closely fit to the cannula requires a low-wicking-grade-viscosity adhesive. It is also critical to choose an adhesive that has superior bond strength to both substrates. Recommended gap: 0.002”-0.004” (0.05-0.1 mm) per side.



Bridge Bonding

The cannula can be attached to the mating part by bridge bonding, which entails placing an adhesive bead over the top of the cannula. This design overcomes the problem of getting light into a shadowed area for the purpose of curing the adhesive.

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 VT = Very Thick

LV = Low Viscosity GEL = Gel

T = Thick

Standard viscosity products do not have a suffix.

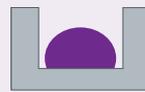
| Typical Centipoise (cP/MPas) | Typical Reference Liquids at 20°C |
|------------------------------|-----------------------------------|
| 1 | Water |
| 10 | Kerosene |
| 110 | SAE 10 Oil |
| 200 | Maple Syrup |
| 440 | SAE 30 Oil |
| 1,100 | Castor Oil |
| 3,000 | Honey |
| 10,000 | Molasses |
| 18,000 | 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

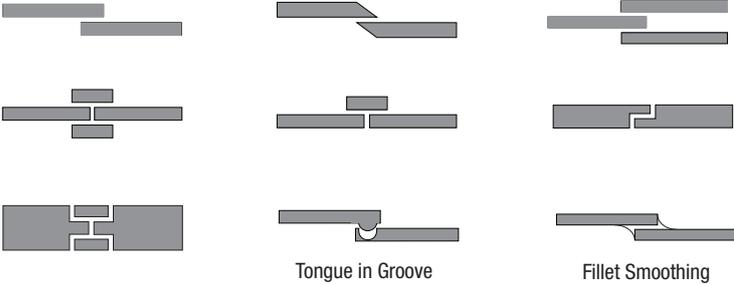
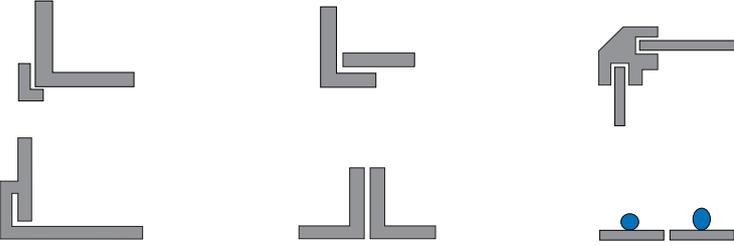


GEL Viscosity
Highly Thixotropic

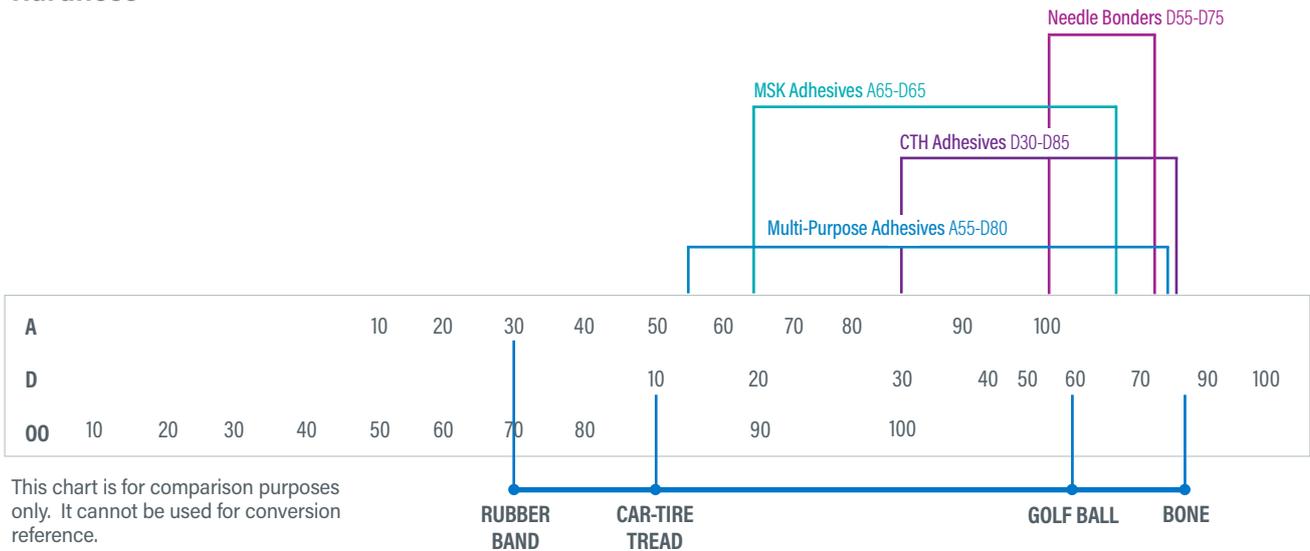
Dots

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 |

| | |
|---|--|
| <p>Avoid butt joints: cleavage or asymmetric-type forces can result in part failure</p> | <p>Suggested alternatives: (Recommended bond gaps: 0.002" - 0.006" [0.05 -0.15 mm])</p> |
|  |  <p style="text-align: center;">Tongue in Groove Fillet Smoothing</p> |
| <p>Avoid corner butt joints: Cleavage-type forces can result in part failure</p> | <p>Suggested alternatives: (Recommended bond gaps: 0.002" - 0.006" [0.05 -0.15 mm])</p> |
|  |  |

Hardness



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 |

*Based on 8-hour shifts.

Estimating Usage

| Bond-Line Gap or Coating Thickness | 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" (.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) |



www.dymax.com

Americas
USA | +1.860.482.1010 | info@dymax.com

Europe
Germany | +49 611.962.7900 | info_de@dymax.com
Ireland | +353 21.237.3016 | info_ie@dymax.com

Asia
Singapore | +65.67522887 | info_ap@dymax.com
Shenzhen | +86.755.83485759 | info@hanarey.com
Hong Kong | +852.2460.7038 | dymaxasia@dymax.com
Korea | +82.31.608.3434 | info_kr@dymax.com

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SG025DA 3/17/2023