



# HL Light Fiber Products

## Product Description

3M™ HL (High Luminance) Light Fiber is a low-voltage, extremely brilliant and uniform fiber-optic illumination system for creating distinctive and decorative, long-run, architectural accents. The HL light fiber is flexible and resistant to fatigue, elongation and vibration and can be used indoors and outdoors. Use it with high-performance illuminators, which may include a color wheel.

## How HL Light Fiber Works

The core material of the HL light fiber is a fully-cured polymethacrylate that is wrapped with a translucent plastic outer layer, or cladding, which has a lower refractive index than the core. Light entering the fiber is transported down the length of the fiber by total internal reflection (TIR). As light strikes the interface between the core and cladding, it scatters and is reflected out of the core along the perimeter, causing the fiber to illuminate. The fiber can appear visually uniform for 65 to 100 feet (20 to 30 meters (65 to 100 feet) when illuminated from both ends. The large core plastic optical fibers are capable of transporting visible light in wavelength range of 400-720 nm. Useful length and uniformity of illumination depends on the illuminator used.

## Recommended Types of Graphics and End Uses

Examples of end uses

- Theaters
- Museums
- Indirect cove lighting
- Retail centers
- Building interiors and exteriors
- Amusement parks
- Restaurants
- Hotels

## Physical Characteristics

These are typical values for unprocessed product; processing may change the values. Contact your 3M representative for a custom specification.

Characteristic	LF70HL	LF120HL
Useful visible light range	400 to 720 nm	
Indoor/Outdoor use	Suitable for interior or exterior applications	
Material - Core Material - Cladding	Flexible, fully cured polymethacrylate, T <sub>g</sub> near 40°F (0°C)	
Available Length	656 feet (200 meter) roll	
Thickness		
Core only Nominal Dia.	0.291 in (7.4 mm)	0.496 in (12.6 mm)
With Cladding OD (+0.4/-0.6)	0.315 in (8.0 mm)	0.531 in (13.5 mm)
Operating Temperature	32° to +140°F (0° to 60°C)	-4° to +140°F (-20° to +60°C)
Maximum Fiber Temperature	122° F (50° C)	
Numerical Aperture for Illuminator	0.65	
Light Transmission	11% per meter loss in 0.47 inch (12 mm) fiber (0.5 dB/m), Source NA = 0.5	
Bending Radius	8 times fiber diameter Approx 4 inches (101.6 mm)	
Connecting with the light source	Secure a minimum fiber bending radius of 12 inch within 1 yard (300 mm within 1m) of the light source device and connecting section.	

## Planning the Installation

### Access for Future Fiber Replacement

Always plan to allow the easiest access possible for in case fiber placement is needed at some time.

### Environmental Extremes

When installing the fiber in excessively high temperature or relative humidity, such as underwater, underground or inside conduit pipe into which water may seep, use installation materials that protect against damage. Refer to the separate Instruction Bulletin LF-2, *Fiber Installation Method for Extreme Relative Humidity or Inside Conduit Piping Environments*.

The light fiber must be routed through a protective pipe, such as PF tubing, if installed underground to prevent the risk of water damage. Ensure that all tubing is properly sealed.

### Environments over 104°F (40°C)

For installation outside or in other environments where the temperature may rise to over 104°F (40°C), attach the fiber using a saddle-shaped attachment jig with a pitch of less than 12 inches (300 mm). This prevents the fiber from stretching due to the heat. Also refer to *Fixtures*, later in this Bulletin.

### Installation in Cold Environments

The fiber tends to harden and resist bending when exposed to low temperatures. Always warm the fiber if installation is performed at temperatures less than 40°F (4.4°C), by acclimating it in normal indoor temperature for at least three hours.

### Normal Operating Temperature

−4° to 140°F (−20° to 60°C)

## Bends and Curvatures

### Radius Bends

A bend radius of 12R (300R) or higher is recommended. Make sure that there are no cuts or joints in the piping. Cuts will cause the fiber to break, and joints are not recommended or warranted.

### Curvature Radius

The minimum fiber curvature radius is 8 inches (200 mm).

After the installation is complete, recheck it entirely and reinstall if necessary to ensure a minimum radius of no less than 8 inches (200 mm).

## Protect the Light Fiber from Damage

Handle the light fiber carefully while preparing to install it and during installation. Scratches, scuffs or nicks in the outer casing will show as defects in the fiber when illuminated.

Protect the fiber from damage during installation. Damage to the cladding can affect the normal illumination, optical performance and durability, and may cause the fiber to overheat. Avoid anything that could cause physical deformation of the cladding, including bending the fiber, dropping or hitting it with a hard, sharp or heavy object, dragging it across surfaces, contact by setscrews used in mounting.

### Unwind All Light Fiber Before Installation

Unwind the entire length of light fiber before installing it.

Do not allow the fiber to twist or kink as it is being unwound, which may affect normal illumination performance.

### Illuminate and Inspect Light Fiber Before Installation

Supply power to the light fiber and inspect it for scratching and uneven illumination conditions before installing it. Such problems that are reported after the light fiber has been installed are not covered by the 3M warranty.

## Mounting Details

### Mounting/Retention System

Design or use a mounting or fiber retention system that prevents damage to the light fiber. Read the section above, *Protect the Light Fiber from Damage*, for additional details.

### **3M™ High Performance Channel Mounting System**

This system has a specially designed profile for mounting 3M light fiber and 1 inch (25.4 mm) and 2 inches (50.8 mm) mounting brackets. The brackets are fastened to the mounting surface with either #6 screws or 3M™ VHB™ 4941 tape. Snap the channel over the brackets and place the light fiber into the channel.



### **Feeding Light Fiber Through Piping**

Use minimal tension when feeding the fiber through a piping. Excessive tension elongates the fiber, which may affect normal illumination performance.

### **Pressure on Light Fiber**

Do not apply excessive pressure to the fiber surface during installation. Strong pressure on the fiber core may cause a change in shape, which could lead to uneven illumination.

### **Cutting Light Fiber**

To cut the light fiber, work in typical room temperature, use a sharp PVC pipe cutter and cut the light fiber slowly to avoid chipping of the fiber core.

### **Cutting and Polishing**

3M light fiber can be cut to fit the specific dimensions of your application. However cutting the fiber can leave a dull, slightly reflective surface on the end of the optical fiber. If not properly installed this reflective surface can be a source of heat that may cause the fiber to fail prematurely. A clean cut or well polished end decreases the chance of heat build up and may increase the light output by up to 10%.

For specific instruction on cutting and polishing 3M HL light fiber, refer to Instruction Bulletin: *Procedure for Cutting and Polishing 3M™ Light Fiber*.

This procedure is designed to help produce a polished end for 3M HL Light Fiber; this method can be used in the field with a standard drill. It can also be used for 3M Standard Side Light and End Light Fibers.

### **Connection Faces**

Connection faces (interface between the bare fiber and the illuminator) should be free of dust and staining, otherwise light emission may be reduced, fiber may deteriorate, etc.

## **Illuminators**

### **Guidelines for Selecting Illuminators**

An illuminator is an integral part of a light fiber system. You must consider several factors to design a successful system. This section provides some guidelines but is not all inclusive. Always consult with a lighting designer.

- **Suitable Illuminators.** LEDs; Halogen; HID; Ambient Light
- **Color Temperature.** Different lamps in the illuminator create different hues of white light. The actual color temperature of the lamp varies with the manufacturer, the wattage, etc. Remember that cultural influences affect how light is perceived.
  - Halogen lamps generally give off a yellow or warm appearance that can be desirable for interior lighting applications such as down-lights and display case lighting. Typical wattage is 45-150w. Lamp life is usually less than 1000 hours.
  - Metal halide type lamps appear more blue or cool and are used when high brightness is needed. Typical wattage is 100 to 400w. Lamp life, which varies with wattage, is usually above 2000 hours.

- **White or Colored Light.**
  - White-only illuminators are generally less expensive than illuminators that are equipped with a color wheel. A common usage is display case lighting.
  - A single colored light filter is available. However, more commonly a constant-speed drive motor will rotate a color wheel through the light beam before it enters the fiber. The number and choice of colors varies by manufacturer.
  - Some illuminators use computer control systems so that multiple illuminators can be sequenced. Frequently, DX control protocol is used.
- **Effect of Ambient Light.** The darker or dimmer the area in which the light fiber is installed, the brighter it will appear. If the ambient light level is high, a higher amount of light (lumens) must be launched into the fiber to make the fiber look bright compared to the background light level.
- **Brightness and Spotlighting.** These characteristics are influenced both by the illuminator and the fiber's optical properties.
  - Neon-type lighting effects. Use an illuminator that launches more light into the fiber. Illuminator design affects the visual uniformity of long, side light fiber runs.
  - Spotlighting effects. The amount of light required on the target surface that must exit the fiber end.
- **Light Dimmers.**
  - Halogen lamps usually can be electronically dimmed.
  - Metal halide lights require using a dowsler to mechanically block a specified amount of light. In this case the power consumption is not reduced and the blocked light is dissipated as heat.
- **Fiber Runs per Illuminator.** Many illuminators can feed light into more than one fiber at a time. This generally affects the brightness of the individual fiber or, in the case of end-light, the amount of usable light at the end of the fiber runs. There may be some variation between the fibers as well.

The overall system cost of illuminators and fiber depends on the desired lighting effect. Single fiber type installations usually provide the best visual results when neon-like brightness is desired.

## Safety

Local building codes may require the illuminators to be listed with an independent test lab, such as UL, CUL or ETL. You must ensure that the illuminator can be used safely in the installation environment.

Potential hazards include premature lamp failure, electrical shock, fire and burns. The amount of space available for installing the illuminator, as well as the ventilation requirements of the illuminator are also factors to consider.

## Storage of Light Fiber

- Light fiber is typically shipped in 200 meter rolls inside of a hexagonal box approximately 43 inches x 43 inches x 12 inches.
- Store unused light fiber in the original packing case.
- Do not store the packing case on end--lay flat for storage.
- Do not store exposed light fiber indirect sunlight or in areas of high humidity.

## Cleaning

Handle the fiber carefully. The outer cladding can be cleaned with mild soap and water. Do not immerse the bare fiber in liquids.

## 3M Related Literature

Before starting any job, be sure you have the most current Product and Instruction Bulletins.

The information in 3M Product and Instruction Bulletins is subject to change. Current Bulletins are available at [3Mgraphics.com](http://3Mgraphics.com). The following applicable Bulletins provide information and processes you need to properly make the graphics described in this Bulletin. Additional Bulletins may be needed as indicated in the 3M Related Literature section of other 3M components you use.

Subject	Type	Bulletin No.
3M™ High Performance Channel System	PB-IB	LF-5
Cutting and Polishing 3M™ Light Fiber	IB	LF-6
Fiber Installation for Extreme Relative Humidity or Inside Conduit Piping Environments	IB	LF-2

## 3M™ Light Fiber Ten Year Limited Warranty

3M warrants that its 3M™ Light Fiber products shall, for a period of Ten (10) years from date of purchase, be free from any defects in materials and manufacture which may lead to failure of the fiber to transmit light along the originally installed fiber length, excluding such failure due to any abuse or misuse conditions detailed below. 3M™ HL High Luminance Light Fiber products should NOT be used in high humidity (90%+) or underwater for periods of time exceeding two years. All products must be purchased directly from 3M or 3M's Authorized Light Fiber Distributors/Installers. During the warranty period, if any Light Fiber products fails to perform as described above, 3M's entire liability and purchaser's exclusive remedy will be the repair or replacement of such defective fiber and/or a refund of original purchase price, all at 3M's sole discretion, based upon the following schedule:

Years 1 to 5: 100%; Year 6: 60%; Year 7: 40%; Year 8: 20%; Year 9: 10%; Year 10: 5%

Thus, during the first five years, repair, replacement or refund shall be 100% covered by 3M, year 6 will be 60% covered by 3M with 40% the responsibility of purchaser, etc. as indicated above. If not otherwise covered by 3M's warranty obligations set forth above, 3M reserves the right to charge for the remaining portion of all light fiber product and labor required to perform required repairs or replacement. This warranty is given only to the original purchaser of the 3M™ Light Fiber products and may not be assigned or otherwise transferred to any other party.

### Warranty Conditions

This warranty only covers the 3M™ Light Fiber Product itself and related 3M™ Light Fiber accessories. It does not cover illuminators other light sources or any other parts of the installation. It is Purchaser's obligation to retain documentation that indicates date of purchase. This warranty will be void if Light Fiber products are (1) not used, installed and/or maintained as specified or recommended by 3M, (2) exposed to temperatures exceeding 140 degrees F (60 degrees C), (3) damaged due to any mishandling or abnormal abuse such as stretching, pulling, kinking, breaking, crimping, cutting, scratching, natural disasters or other acts of God (4) damaged due to exposure of the inner core to liquids or moisture, or used in high humidity (85%+) conditions such as a steam bath, saunas, spas or underwater locations (5) damaged via use of illuminators which do not protect the intercore optical fiber from UV or infrared rays or temperatures above 60 degree C, (6) modified or altered in anyway by anyone other than 3M or 3M's Authorized Light Fiber Distributor/Installer; or (7) are not made available to 3M or its authorized representatives for inspection when a warranty claim is made.

### Warranty Service

To obtain warranty service, call 3M Light Management Solutions or send a warranty service notice letter to 3M Light Management Solutions detailing fiber failure and include documentation showing your original purchase date. At 3M's sole option, purchaser shall allow representatives of 3M access to conduct reasonable inspection/testing, shall return defective fiber to 3M and/or provide other appropriate documentation of the failure as reasonably requested by 3M. No incidental, consequential or other damages (including, but not limited to, costs of dismantling, shipping, reinstalling or other related costs) will be paid under any circumstances.

THIS WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTY OF MERCHANTABILITY, THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR OF PERFORMANCE, CUSTOM OR USAGE OF

TRADE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's application. 3M SHALL NOT UNDER ANY CIRCUMSTANCES BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, REVENUE OR BUSINESS). This exclusion applies regardless of whether such damages are sought based on breach of warranty, breach of contract, negligence, strict liability in tort, or any other legal theory.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE OR PROVINCE TO PROVINCE.



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