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THORLABS

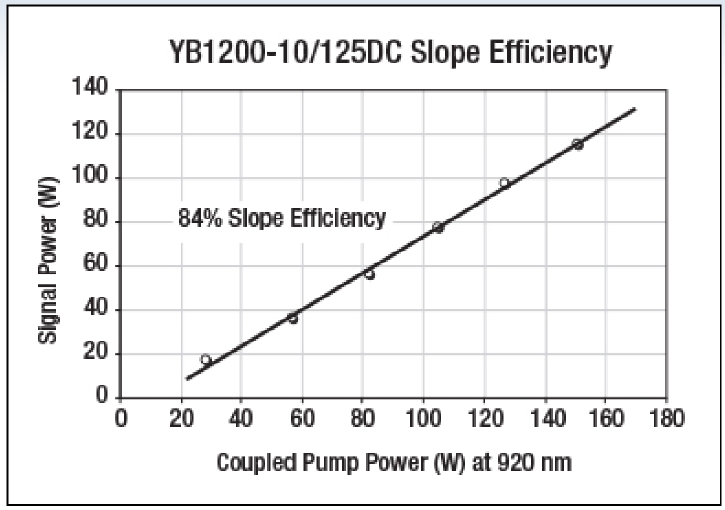
P-40/140DC - January 6, 2015

Item # P-40/140DC was discontinued on January 6, 2015. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

YTTERBIUM-DOPED OPTICAL FIBER

- Ytterbium-Doped Fiber for Fiber Lasers and Amplifiers
- 920 nm Absorption and 1000 - 1100 nm Emission Wavelength Range
- Core- and Cladding-Pumped Versions Available
- Single Mode or Large-Mode-Area Fibers

YB1200-6/125DC



Hide Overview

OVERVIEW

Features

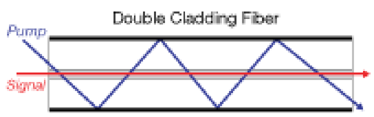
- Ytterbium-Doped Silica Fiber for ~1000 - 1100 nm Fiber Lasers and Amplifiers
- Single Mode and Large-Mode-Area Fibers Available
- Core- and Cladding-Pumped Designs for 1 mW to >100 W Output Power
- Matched LMA Passive Fibers Also Sold Below
- Industry-Standard Active Fiber Geometries with Ø125, Ø250, or Ø400 µm Cladding

Item #	Type	Absorption @ 920 nm	Pump Type	Core Diameter	Cladding Diameter
YB1200-4/125	SM[a]	280 ± 50 dB/m	Core	4.4 ± 0.8 µm MFD	125 ± 2 µm
YB1200-6/125DC	SM[a]	0.6 ± 0.2 dB/m		6.0 ± 0.8 µm MFD	125 ± 2 µm
YB1200-10/125DC	LMA[b]	1.8 ± 0.4 dB/m		10 ± 1 µm	125 ± 2 µm
YB1200-20/400DC	LMA[b]	0.7 ± 0.2 dB/m	Cladding	20 ± 2 µm	400 ± 15 µm
YB1200-25/250DC	LMA[b]	2.5 ± 0.7 dB/m		25 ± 2.5 µm	250 ± 10 µm
YB2000-10/125DC	LMA[b]	2.0 ± 0.4 dB/m		10 ± 1.0 µm	125 ± 2 µm

- Single Mode
- Large Mode Area

Thorlabs offers state-of-the-art ytterbium-doped optical fibers for optical amplifiers, ASE light sources, and high-power pulsed and CW fiber laser applications operating with powers in the milliwatt to 100 W range and emitting in the 1000 - 1100 nm wavelength region. These fibers, manufactured by Liekki Ltd. in Finland, are fabricated using the latest doped fiber production technology: Liekki Direct Nanoparticle Deposition (DND). Lekki DND technology was designed to fulfill the requirements of advanced fiber applications, including short fiber lengths, flat refractive index profiles without core burnout, and large core-to-cladding ratio (large-mode-area double-clad fibers).

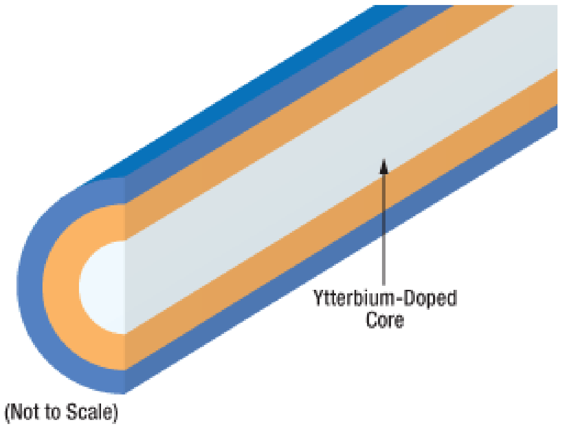
Yb-doped fibers are available with either a core-pumped or cladding-pumped (double clad) design. Core-pumped fibers are excellent for lower-power applications and provide a short active fiber length, telecom-like geometry for easy splicing and handling, and compatibility with low-cost pump diodes and standard passive single mode (SM) fibers.



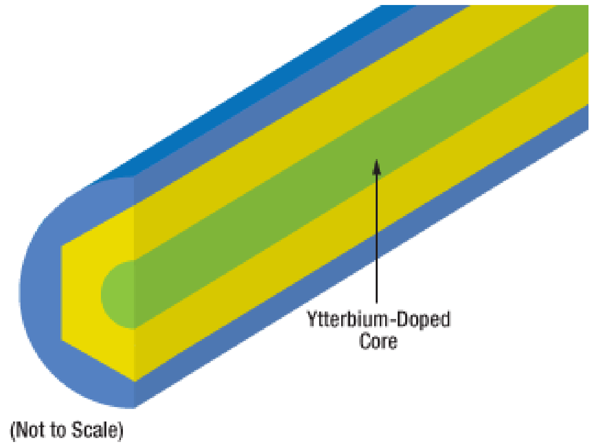
Click for Details

Cladding-pumped, double-clad fibers allow for higher efficiencies and higher output powers compared to their core-pumped active fiber counterparts. Cladding-pumped fibers are double clad, meaning that the fiber's coating acts as a second cladding, allowing the first cladding to function as a waveguide. Double-clad fibers typically have a low-NA single mode or large-mode-area (LMA) core for the emitted light and a high-NA, multimode first cladding for the pump light.

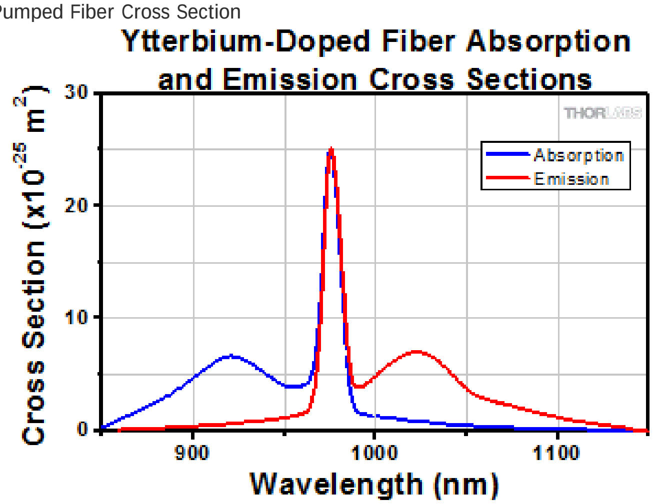
We also offer Polarization-Maintaining Yb-Doped Fibers.



Click for Details
Core-Pumped Fiber Cross Section



Click for Details
Cladding-Pumped Fiber Cross Section



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Active Fibers Selection Guide					
Ytterbium-Doped SM and LMA	Ytterbium-Doped PM	Erbium-Doped SM and LMA	Thulium-Doped SM and LMA	Thulium-Doped PM	Doped Fluoride Fibers for MIR

Hide Specs

SPECS

Core-Pumped Single Mode Fiber

Item#	YB1200-4/125
MFD	4.4 ± 0.8 µm
Peak Core Absorption @ 976 nm (Nominal)	1200 dB/m
Core Absorption @ 920 nm	280 dB/m
Core Numerical Aperture (NA) (Nominal)	0.2

Cladding NA	>0.46
Cut-Off Wavelength	1010 ± 70 nm
Cladding Diameter	125 ± 2 µm
Cladding Geometry	Round
Coating Diameter	245 ± 15 µm
Coating Material	High Index Acrylate
Core Concentricity Error	<0.7 µm
Proof Test	>100 kpsi
Core Index	Proprietary[a]
Cladding Index	Proprietary[a]

- We regret that we cannot provide this proprietary information.

Cladding-Pumped, Double-Clad SM and LMA Fibers

Item #	YB1200-6/125DC	YB1200-10/125DC	YB1200-20/400DC	YB1200-25/250DC	YB2000-10/125DC
MFD	6.0 ± 0.8 µm	-	-	-	-
Peak Cladding Absorption @ 976 nm (Nominal)	2.6 dB/m	6.9 dB/m	3.0 dB/m	10.8 dB/m	-
Cladding Absorption @ 920 nm	0.6 ± 0.2 dB/m	1.8 ± 0.4 dB/m	0.7 ± 0.2 dB/m	2.5 ± 0.7 dB/m	2.0 ± 0.4 dB/m
Core Numerical Aperture (NA)	0.15 ± 0.01	0.08 ± 0.01	0.07 ± 0.005	0.07 ± 0.01	0.12 ± 0.02
Cladding NA	>0.46	>0.46	>0.46	>0.46	>0.46
Core Diameter	-	10 ± 1 µm	20 ± 2 µm	25 ± 2.5 µm	10 ± 1.0 µm
Cladding Diameter[a]	125 ± 2 µm	125 ± 2 µm	400 ± 15 µm	250 ± 10 µm	125 ± 2 µm
Cladding Geometry	Octagonal	Octagonal	Octagonal	Octagonal	Octagonal
Coating (Second Cladding) Diameter	245 ± 15 µm	245 ± 15 µm	520 ± 15 µm	350 ± 15 µm	245 ± 15 µm
Coating Material	Low Index Acrylate	Low Index Acrylate	Low Index Acrylate	Low Index Acrylate	Low Index Acrylate
Core Concentricity Error	<1.0 µm	<1.5 µm	<1.5 µm	<1.5 µm	<1.5 µm
Proof Test	>100 kpsi	>100 kpsi	>50 kpsi	>100 kpsi	>100 kpsi
Core Index	Proprietary[b]				
Cladding Index	Proprietary[b]				

- Octagonal cladding measured flat to flat.
- We regret that we cannot provide this proprietary information.

Matched Passive LMA Fibers

Item #	P-10/125DC	P-20/390DC	P-40/140DC
Matching Active Fiber	YB1200-10/125DC	YB1200-20/400DC	ER60-40/140DC[a]
Core Numerical Aperture (NA)	0.08 ± 0.01	0.07 ± 0.01	0.07 ± 0.005
Cladding NA	>0.46	>0.46	>0.46
Core Diameter	10 ± 1 µm	20 ± 2 µm	25 ± 2.5 µm
Cladding Diameter	125 ± 2 µm	400 ± 8 µm	250 ± 5 µm
Cladding Geometry	Round	Round	Round
Coating (Second Cladding) Diameter	245 ± 15 µm	500 ± 15 µm	350 ± 15 µm
Coating Material	Low Index Acrylate	Low Index Acrylate	Low Index Acrylate
Proof Test	>100 kpsi	>50 kpsi	>10 kpsi
Core Index	Proprietary[b]		
Cladding Index	Proprietary[b]		

- ER60-40/140DC is an erbium-doped fiber available as a special order. Contact Technical Support to order.
- We regret that we cannot provide this proprietary information.

Hide Publications

PUBLICATIONS

Active Optical Fiber Publications and Further Reading

As an emerging field of research, many advancements in doped fiber laser and amplifier construction are being made. The following publications contain information that may be helpful in the construction of fiber lasers and amplifiers.

2012

Bryce Samson, George Oulundsen, Adrian Carter, and Steven R. Bowman, "OPTICAL FIBER FABRICATION: Holmium-doped silica fiber designs extend fiber lasers beyond 2 µm," Laser Focus World, August 1, 2012

2011

Jianwu Ding, Bryce Samson, Adrian Carter, Chiachi Wang, Kanishka Tankala, "A Monolithic Thulium Doped Single Mode Fiber Laser with 1.5ns Pulsewidth and 8kW Peak Power," Proc. SPIE 7914, Fiber Lasers VIII: Technology, Systems, and Applications, 79140X (February 10, 2011); doi:10.1117/12.876867

2010

Timothy S. McComb, Pankaj Kadwani, R. Andrew Sims, Lawrence Shah, Christina C. C. Willis, Gavin Frith, Vikas Sudesh, Bryce Samson, Martin Richardson, "Amplification of Picosecond Pulses Generated in a Carbon Nanotube Modelocked Thulium Fiber Laser," in *Lasers, Sources and Related Photonic Devices*, OSA Technical Digest Series (CD) (Optical Society of America, 2010), paper AMB10.

G. Frith, A. Carter, B. Samson, J. Faroni, K Farley, K Tankala and G. E. Town, "Mitigation of photodegradation in 790nm-pumped Tm-doped fibers," *Proc. SPIE* 7580, Fiber Lasers VII: Technology, Systems, and Applications, 75800A (February 17, 2010); doi:10.1117/12.846230

Thomas Ehrenreich, Ryan Laveille, Imtiaz Majid, and Kanishka Tankala, Glen Rines, Peter Moulton "1-kW All-Glass Tm:fiber Laser," SPIE Photonics West 2010: LASE Presentation, Session 16: Late-Breaking News, January 29, 2010

2009

Gavin Frith, Adrian Carter, Bryce Samson, and Graham Town, "Design considerations for short-wavelength operation of 790-nm-pumped Tm-doped fibers," Appl. Opt. **48**, 5072-5075 (2009)

S.D. Jackson, "The spectroscopic and energy transfer characteristics of the rare earth ions used fr silicate glass fibre lasers operating in the shortwave infrared," Laser & Photon. Rev., 3: 466–482. doi: 10.1002/lpor.200810058

Peter F. Moulton, Glen A. Rines, Evgueni V. Slobodtchikov, Kevin F. Wall, Gavin Frith, Bryce Samson, and Adrian L.G. Carter, "Tm-Doped Fiber Lasers: Fundamentals and Power Scaling," IEEE Journal of Selected Topics in quantum Electronics, Vol. 15, No. 1, Jan/Feb 2009

2006

Alexander Hemming, Shayne Bennetts, Nikita Simakov , John Haub, Adrian Carter, "Development of resonantly cladding-pumped holmium-doped fibre lasers," *Proc. SPIE* 8237, Fiber Lasers IX: Technology, Systems, and Applications, 82371J (February 9, 2012); doi:10.1117/12.909458

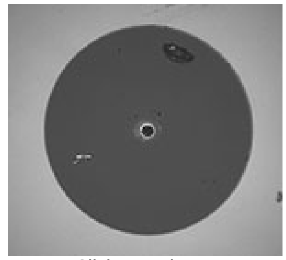
W. Torruellas, Y. Chen, B. McIntosh, J. Farroni, K. Tankala, S. Webster, D. Hagan, M. J. Soileau, M. Messerly, J. Dawson, "High peak power Ytterbium doped fiber amplifiers," *Proc. SPIE* 6102, Fiber Lasers III: Technology, Systems, and Applications, 61020N (February 23, 2006); doi:10.1117/12.646571

Hide Damage Threshold

DAMAGE THRESHOLD

Laser Induced Damage in Optical Fibers

The following tutorial details damage mechanisms in unterminated (bare) and terminated optical fibers, including damage mechanisms at both the air-to-glass interface and within the glass of the optical fiber. Please note that while general rules and scaling relations can be defined, absolute damage thresholds in optical fibers are extremely application dependent and user specific. This tutorial should only be used as a guide to estimate the damage threshold of an optical fiber in a given application. Additionally, all calculations below only apply if all cleaning and use recommendations listed in the last section of this tutorial have been followed. For further discussion about an optical fiber's power handling abilities within a specific application, contact Thorlabs' Tech Support.


Click to Enlarge
Damaged Fiber End


Click to Enlarge
Undamaged Fiber End

Damage at the Free Space-to-Fiber Interface

There are several potential damage mechanisms that can occur at the free space-to-fiber interface when coupling light into a fiber. These come into play whether the fiber is used bare or terminated in a connector.

Unterminated (Bare) Fiber

Damage mechanisms in bare optical fiber can be modeled similarly to bulk optics, and industry-standard damage thresholds for UV Fused Silica substrates can be applied to silica-based fiber (refer to the table to the right). The surface areas and beam diameters involved at the air-to-glass interface are extremely small compared to bulk optics, especially with single mode (SM) fiber, resulting in very small damage thresholds.

Silica Optical Fiber Maximum Power Densities		
Type	Theoretical Damage Threshold	Practical Safe Value
CW (Average Power)	1 MW/cm^2	250 kW/cm^2
10 ns Pulsed (Peak Power)	5 GW/cm^2	1 GW/cm^2

The effective area for SM fiber is defined by the mode field diameter (MFD), which is the effective cross-sectional area through which light propagates in the fiber. A free-space beam of light must be focused down to a spot of roughly 80% of this diameter to be coupled into the fiber with good efficiency. MFD increases roughly linearly with wavelength, which yields a roughly quadratic increase in damage threshold with wavelength. Additionally, a beam coupled into SM fiber typically has a Gaussian-like profile, resulting in a higher power density at the center of the beam compared with the edges, so a safety margin must be built into the calculated damage threshold value if the calculations assume a uniform density.

Multimode (MM) fiber's effective area is defined by the core diameter, which is typically far larger than the MFD in SM fiber. Kilowatts of power can be typically coupled into multimode fiber without damage, due to the larger core size and the resulting reduced power density.

It is typically uncommon to use single mode fibers for pulsed applications with high per-pulse powers because the beam needs to be focused down to a very small area for coupling, resulting in a very high power density. It is also uncommon to use SM fiber with ultraviolet light because the MFD becomes extremely small; thus, power handling becomes very low, and coupling becomes very difficult.

Example Calculation

For SM400 single mode fiber operating at 400 nm with CW light, the mode field diameter (MFD) is approximately Ø3 µm. For good coupling efficiency, 80% of the MFD is typically filled with light. This yields an effective diameter of Ø2.4 µm and an effective area of 4.52 µm^2:

$$\text{Area} = \pi r^2 = \pi(\text{MFD}/2)^2 = \pi \cdot 1.2^2\ \mu m^2 = 4.52\ \mu m^2$$

This can be extrapolated to a damage threshold of 11.3 mW. We recommend using the "practical value" maximum power density from the table above to account for a Gaussian power distribution, possible coupling misalignment, and contaminants or imperfections on the fiber end face:

$$250\ \text{kW/cm}^2 = 2.5\ \text{mW}/\mu m^2$$

$$4.25\ \mu m^2 \cdot 2.5\ \text{mW}/\mu m^2 = 11.3\ \text{mW}$$

Terminated Fiber

Optical fiber that is terminated in a connector has additional power handling considerations. Fiber is typically terminated by being epoxied into a ceramic or steel ferrule, which forms the interfacing surface of the connector. When light is coupled into the fiber, light that does not enter the core and propagate down the fiber is scattered into the outer layers of the fiber, inside the ferrule.

The scattered light propagates into the epoxy that holds the fiber in the ferrule. If the light is intense enough, it can melt the epoxy, causing it to run onto the face of the connector and into the beam path. The epoxy can be burned off, leaving residue on the end of the fiber, which reduces coupling efficiency and increases scattering, causing further damage. The lack of epoxy between the fiber and ferrule can also cause the fiber to be decentered, which reduces the coupling efficiency and further increases scattering and damage.

The power handling of terminated optical fiber scales with wavelength for two reasons. First, the higher per photon energy of short-wavelength light leads to a greater likelihood of scattering, which increases the optical power incident on the epoxy near the end of the connector. Second, shorter-wavelength light is inherently more difficult to couple into SM fiber due to the smaller MFD, as discussed above. The greater likelihood of light not entering the fiber's core again increases the chance of damaging scattering effects. This second effect is not as common with MM fibers because their larger core sizes allow easier coupling in general, including with short-wavelength light.

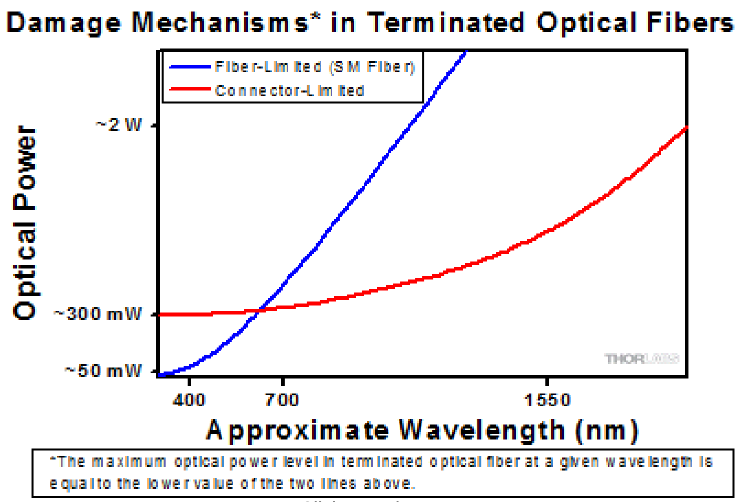
Fiber connectors can be constructed to have an epoxy-free air gap between the optical fiber and ferrule near the fiber end face. This design feature, commonly used with multimode fiber, allows some of the connector-related damage mechanisms to be avoided. Our high-power multimode fiber patch cables use connectors with this design feature.

Combined Damage Thresholds

As a general guideline, for short-wavelength light at around 400 nm, scattering within connectors typically limits the power handling of optical fiber to about 300 mW. Note that this limit is higher than the limit set by the optical power density at the fiber tip. However, power handing limitations due to connector effects do not diminish as rapidly with wavelength when compared to power density effects. Thus, a terminated fiber's power handling is "connector-limited" at wavelengths above approximately 600 nm and is "fiber-limited" at lower wavelengths.

The graph to the right shows the power handling limitations imposed by the fiber itself and a surrounding connector. The total power handling of a terminated fiber at a given wavelength is limited by the lower of the two limitations at that wavelength. The fiber-limited (blue) line is for SM fibers. An equivalent line for multimode fiber would be far above the SM line on the Y-axis. For terminated multimode fibers, the connector-limited (red) line always determines the damage threshold.

Please note that the values in this graph are rough guidelines detailing estimates of power levels where damage is very unlikely with proper handling and alignment procedures. It is worth noting that optical fibers are frequently used at power levels above those described here. However, damage is likely in these applications. The optical fiber should be considered a consumable lab supply if used at power levels above those recommended by Thorlabs.



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Damage Within Optical Fibers

In addition to damage mechanisms at the air-to-glass interface, optical fibers also display power handling limitations due to damage mechanisms within the optical fiber itself. Two categories of damage within the fiber are damage from bend losses and damage from photodarkening.

Bend Losses

Bend losses occur when a fiber is bent to a point where light traveling in the core is incident on the core/cladding interface at an angle higher than the critical angle, making total internal reflection impossible.Under these circumstances, light escapes the fiber, often in one localized area. The light escaping the fiber typically has a high power density, which can cause burns to the fiber as well as any surrounding furcation tubing.

A special category of optical fiber, called double-clad fiber, can reduce the risk of bend-loss damage by allowing the fiber's cladding (2nd layer) to also function as a waveguide in addition to the core. By making the critical angle of the cladding/coating interface higher than the critical angle of the core/clad interface, light that escapes the core is loosely confined within the cladding. It will then leak out over a distance of centimeters or meters instead of at one localized spot within the fiber, minimizing damage. Thorlabs manufactures and sells 0.22 NA double-clad multimode fiber, which boasts very high, megawatt range power handling.

Photodarkening

A second damage mechanism within optical fiber, called photodarkening or solarization, typically occurs over time in fibers used with ultraviolet or short-wavelength visible light. The pure silica core of standard multimode optical fiber can transmit ultraviolet light, but the attenuation at these short wavelengths increases with the time exposed to the light. The mechanism that causes photodarkening is largely unknown, but several strategies have been developed to combat it. Fibers with a very low hydroxyl ion (OH) content have been found to resist photodarkening. Other dopants, including fluorine, can also reduce photodarkening.

Germanium-doped silica, which is commonly used for the core of single mode fiber for red or IR wavelengths, can experience photodarkening with blue visible light. Thus, pure silica core single mode fibers are typically used with short wavelength visible light. Single mode fibers are typically not used with UV light due to the small MFD at these wavelengths, which makes coupling extremely difficult.

Even with the above strategies in place, all fibers eventually experience photodarkening when used with UV light, and thus, fibers used with these wavelengths should be considered consumables.

Tips for Maximizing an Optical Fiber's Power Handling Capability

With a clear understanding of the power-limiting mechanisms of an optical fiber, strategies can be implemented to increase a fiber's power handling capability and reduce the risk of damage in a given application. All of the calculations above only apply if the following strategies are implemented.

One of the most important aspects of a fiber's power-handling capability is the quality of the end face. The end face should be clean and clear of dirt and other contaminants that can cause scattering of coupled light. Additionally, if working with bare fiber, the end of the fiber should have a good quality cleave, and any splices should be of good quality to prevent scattering at interfaces.

The alignment process for coupling light into optical fiber is also important to avoid damage to the fiber. During alignment, before optimum coupling is achieved, light may be easily focused onto parts of the fiber other than the core. If a high power beam is focused on the cladding or other parts of the fiber, scattering can occur, causing damage.

Additionally, terminated fibers should not be plugged in or unplugged while the light source is on, again so that focused beams of light are not incident on fragile parts of the connector, possibly causing damage.

Bend losses, discussed above, can cause localized burning in an optical fiber when a large amount of light escapes the fiber in a small area. Fibers carrying large amounts of light should be secured to a steady surface along their entire length to avoid being disturbed or bent.

Additionally, choosing an appropriate optical fiber for a given application can help to avoid damage. Large-mode-area fibers are a good alternative to standard single mode fibers in high-power applications. They provide good beam quality with a larger MFD, thereby decreasing power densities. Standard single mode fibers are also not generally used for ultraviolet applications or high-peak-power pulsed applications due to the high spatial power densities these applications present.

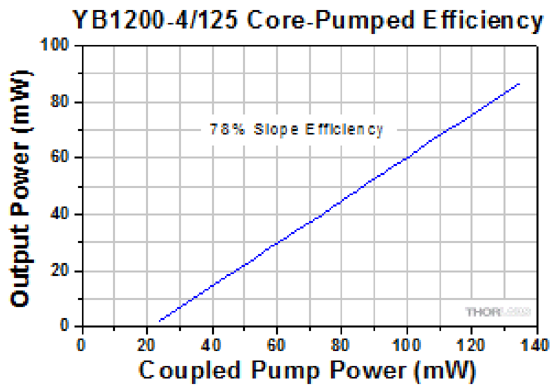
Hide Core-Pumped SM Yb-Doped Fiber, Single Clad

Core-Pumped SM Yb-Doped Fiber, Single Clad

- Core-Pumped Design
- Telecom-Type Fiber Geometry for Easy Handling, Splicing, and Connectorization
- Good Spliceability to HI1060-Type Passive SM Fibers

Applications

- Low Noise, Low Power Preamplifiers
- ASE Sources
- CW and Pulsed Lasers and Amplifiers



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Liekki YB1200-4/125 is a highly doped ytterbium fiber for low noise, low nonlinearity preamplifiers and lasers. It is a single-clad fiber for core-pumped applications. This fiber is ideal for use as a preamplifier in a fiber amplifier chain with double cladding fiber acting as a power amplifier.

This fiber's telecom-like geometry makes it compatible with low-cost pump diodes, standard single mode passive fibers, and standard telecom connectors and splicing techniques.

Item #	Cladding Geometry	Absorption @ 920 nm	Mode Field Diameter	Cladding Diameter	Coating Diameter	Core NA	Cut-Off Wavelength	Core Index	Cladding Index
YB1200-4/125	Round	280 dB/m	4.4 µm @ 1060 nm	125 ± 2 µm	245 ± 15 µm	0.2	1010 ± 70 nm	Proprietary[a]	Proprietary[a]

- We regret that we cannot provide this proprietary information.

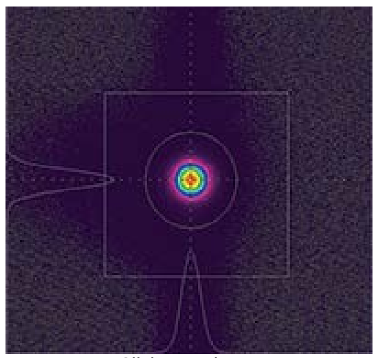
Part Number	Description	Price	Availability

YB1200-4/125	**Ytterbium Doped Single Mode Fiber, 4.4 µm MFD**	**$99.96 Per Meter Volume Pricing Available**	**Today**

Hide Cladding-Pumped SM and LMA Yb-Doped Fibers, Double Clad

Cladding-Pumped SM and LMA Yb-Doped Fibers, Double Clad

- Cladding-Pumped Design
- Single Mode (SM) or Large-Mode-Area (LMA) Operation
- High Pump Absorption with Low Photodarkening
- High Slope Efficiency (75 - 84%)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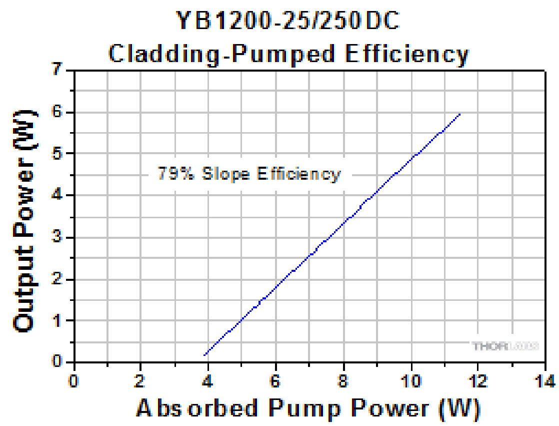
YB1200-20/400DC Typical Beam Quality



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See the Table Below for Each Fiber's Slope Efficiency Graph

Applications

- High Average Power Pulsed Amplifiers
- Medium and High-Power Pulsed and CW Lasers
- Materials Processing
- Lidar
- Rangefinding

These Yb-doped double-clad fibers are ideal for medium- and high-power applications up to 20 W, including fiber power amplifiers. Highly efficient operation allows typical slope efficiencies of 75% to 84%. Matching passive fibers for select LMA versions are sold below.

Key Features	
YB1200-6/125DC	Telecom-like geometry for compatibility with standard components such as gratings and combiners
YB1200-10/125DC	High cladding absorption and a single mode core are ideal for fiber-based power amplifiers
YB1200-20/400DC	Ø400 µm cladding for compatibility with industry-standard high-power pump lasers and delivery fibers
YB1200-25/250DC	High cladding absorption and high efficiency for high average power pulsed fiber amplifiers
YB2000-10/125DC	High doping concentration for photodarkening resistance

Item #	Cladding Geometry	Absorption @ 920 nm	Core Diameter	Cladding Diameter[a]	Coating (Second Cladding) Diameter	Core NA	Cladding NA	Slope Efficiency Plot	Core Index	Cladding Index
YB1200-6/125DC		0.6 ± 0.2 dB/m	6.0 ± 0.8 µm MFD	125 ± 2 µm	245 ± 15 µm	0.15 ± 0.01				
YB1200-10/125DC		1.8 ± 0.4 dB/m	10 ± 1 µm	125 ± 2 µm	245 ± 15 µm	0.08 ± 0.01				
YB1200-20/400C	Octagonal	0.7 ± 0.2 dB/m	20 ± 2 µm	400 ± 15 µm	500 ± 15 µm	0.07 ± 0.005	>0.46		Proprietary[b]	Proprietary[b]
YB1200-25/250DC		2.5 ± 0.7 dB/m	25 ± 2.5 µm	250 ± 10 µm	350 ± 15 µm	0.07 ± 0.01				
YB2000-		2.0 ± 0.4				0.12 ±				

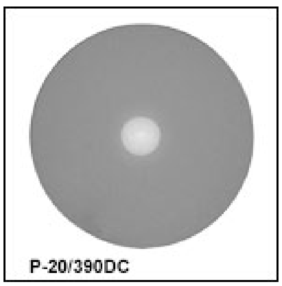
10/125DC		dB/m	10 ± 1.0 µm	125 ± 2 µm	245 ± 15 µm	0.02		-		

- Octagonal cladding measured flat to flat.
- We regret that we cannot provide this proprietary information.

Part Number	Description	Price	Availability
YB1200-6/125DC	**Ytterbium-Doped Single Mode Double Clad Fiber, 6 µm MFD**	**$91.80** **Per Meter** **Volume Pricing Available**	**Today**
YB1200-10/125DC	**Ytterbium-Doped LMA Double Clad Fiber, 10 µm Core Diameter**	**$168.30** **Per Meter** **Volume Pricing Available**	**Today**
YB1200-20/400DC	**Ytterbium-Doped LMA Double Clad Fiber, 20 µm Core Diameter**	**$259.08** **Per Meter** **Volume Pricing Available**	**Today**
YB1200-25/250DC	**Ytterbium-Doped LMA Double Clad Fiber, 25 µm Core Diameter**	**$351.90** **Per Meter** **Volume Pricing Available**	**Today**
YB2000-10/125DC	**Highly Ytterbium-Doped LMA Double Clad Fiber, 10 µm Core Diameter**	**$293.76** **Per Meter** **Volume Pricing Available**	**Today**

Hide Matched Large-Mode-Area Passive Fibers

Matched Large-Mode-Area Passive Fibers



- Optimized for Coupling to Active Doped Fibers
- Core and Cladding Ranges from 10 to 40 µm and 125 to 390 µm, Respectively
- Core and Cladding NA of 0.07 to 0.09 and >0.46, Respectively

These passive large-mode-area (LMA) fibers are matched for ideal splicing with the double clad, LMA active fibers sold above. Their core diameters and numerical apertures are chosen to match that of their active counterparts to maintain excellent beam quality throughout fiber laser or amplifier systems. The outer cladding diameter is designed to "round" the shaped active fibers so as to achieve low pump coupling loss from passive to active fibers.

These large-mode-area passive fibers are coated with low-index fluoroacrylate for pumping active fibers. High-index acrylate-coated fibers are available by special request; please contact Technical Support for details.

Item #	Compatible Active Fiber	Cladding Geometry	Core Diameter	Cladding Diameter	Coating (Second Cladding) Diameter	Core NA	Cladding NA	Proof Test	Core Index	Cladding Index
P-10/125DC	YB1200-10/125DC	Round	10 ± 1 µm	125 ± 2 µm	245 ± 15 µm	0.08 ± 0.01	>0.46	>100 kpsi	Proprietary[a]	Proprietary[a]
P-20/390DC	YB1200-20/400DC		20 ± 2 µm	390 ± 8 µm	500 ± 15 µm	0.07 ± 0.01	>0.46	>50 kpsi		
P-40/140DC	ER60-40/140DC[b]		40 ± 4 µm	140 ± 3 µm	245 ± 15 µm	0.09 ± 0.01	>0.46	>100 kpsi		

- We regret that we cannot provide this proprietary information.
- ER60-40/140DC is an erbium-doped fiber available as a special order. Contact Technical Support to order.

Part Number	Description	Price	Availability
P-10/125DC	**Passive Double Clad Fiber, 10 µm Core, Matched to YB1200-10/125DC(-PM)**	**$10.91** **Per Meter** **Volume Pricing Available**	**Today**

P-20/390DC	**Passive Double Clad Fiber, 20 µm Core, Matched to YB1200-20/400DC**	**$55.59** **Per Meter** **Volume Pricing Available**	**Today**
P-40/140DC	**Passive Double Clad Fiber, 40 µm Core, Matched to ER60-40/140DC**	**$66.00** **Per Meter** **Volume Pricing Available**	**Today**

Visit the *Ytterbium-Doped Optical Fiber* page for pricing and availability information:
http://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=336