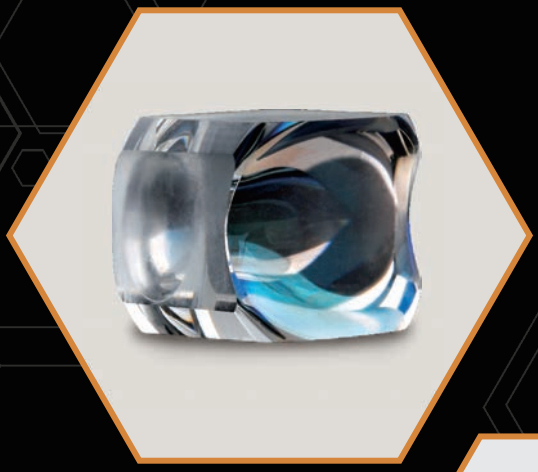
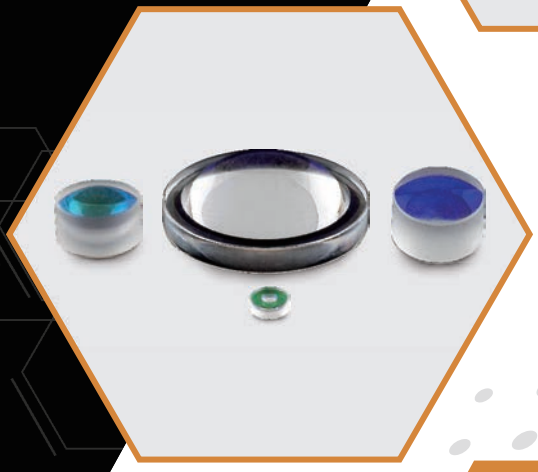
GLOBAL LEADER IN OPTICAL TECHNOLOGY

LightPath® TECHNOLOGIES

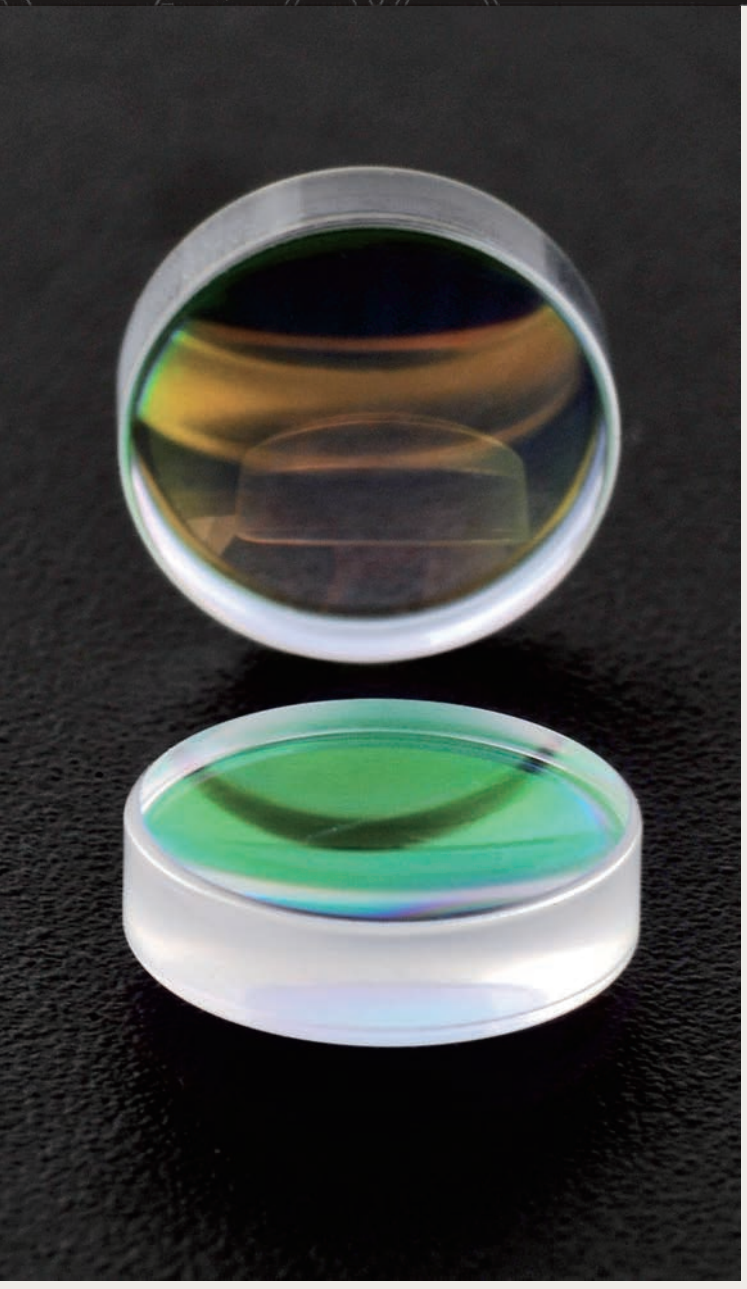


Geltech Molded Aspheric Lenses



www.lightpath.com.cn

ABOUT LIGHTPATH TECHNOLOGIES



LightPath Technologies, Inc. (NASDAQ: LPTH) is a leading global, vertically integrated provider of optics, photonics and infrared solutions for the industrial, commercial, defense, telecommunications, and medical industries. LightPath designs, manufactures, and distributes proprietary optical and infrared components including molded glass aspheric lenses and assemblies, infrared lenses and thermal imaging assemblies, fused fiber collimators, and proprietary Black DiamondTM ("Bd6") chalcogenide-based glass lenses. LightPath also offers custom optical assemblies, including full engineering design support. The Company is headquartered in Orlando, Florida, with manufacturing and sales offices in Latvia and China.

LightPath's wholly-owned subsidiary, ISP Optics Corporation, manufactures a full range of infrared products from high performance MWIR and LWIR lenses and lens assemblies. ISP's infrared lens assembly product line includes athermal lens systems used in cooled and un-cooled thermal imaging cameras. Manufacturing is performed in-house to provide precision optical components including spherical, aspherical and diffractive coated infrared lenses. ISP's optics processes allow it to manufacture its products from all important types of infrared materials and crystals. Manufacturing processes include CNC grinding and CNC polishing, diamond turning, continuous and conventional polishing, optical contacting and advanced coating technologies.

OUR VISION

Grow LightPath Technologies into an optical solution company that is a fully integrated manufacturer and supplier of visible and infrared optical components and sub-systems, based on world class optical manufacturing technology.

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DIODE COLLIMATION

Due to the way that the laser cavity is constructed in edge emitting diode lasers, light is emitted in a diverging, elliptical geometry - so the divergence is typically specified in both the x and y axes separately. The axis with the larger divergence is called the "fast axis" and the axis with the smaller divergence is called the "slow axis".

When selecting a lens to collimate the laser, first consider the numerical aperture of the lens. If the application requires a high amount of the laser light to be coupled through the system, a lens with a high enough NA must be chosen. The NA of a lens is a measure of the maximum amount of divergence that the lens can capture from the laser. Ideally, a lens should be used that has an NA higher than the NA of the laser's fast axis. If not, the laser will "clip" the lens causing some of the light to be wasted. To convert the NA to the divergence angle (and vice-versa), use this formula.

$$NA = n \cdot \sin(\phi)$$

In most cases n = 1 since the NA of the laser is defined in air. Therefore, solving for the equation is simplified to:

$$(\phi) = \sin^{-1}(NA)$$

It is important to note that is the half angle of the divergence cone and is given at the marginal ray (not 1/ e^2 or half width half max). After the minimum NA is determined, next consider what beam diameter is preferred. Although ray-tracing is necessary to precisely determine the beam diameter for a given NA source with a particular lens, it can be approximated with the following formula.

$$\text{Beam Diameter} \cong 2 \cdot EFL \cdot NA$$

Where EFL is the effective focal length of the lens and NA is the numerical aperture of the source (not the NA of the lens).

Remember that most edge emitting diodes are elliptical, so the beam diameter will be different in the x-axis versus the y-axis. Use the formula above to calculate the beam diameter in both axes to determine the shape of the collimated, elliptical beam.

Important Note:

Some laser manufacturers give the NA of the source in different terms, such as half width half max (50% point) or 1/e^2 (87% point). Whatever type of number is entered into the formula for the NA of the source will be the same type of number given for the beam diameter. For example, if the half width half max NA for a laser is used with the above formula, you will get the full width half max beam diameter. There is no simple way to convert from a half max number or a 1/e^2 beam diameter to a full beam diameter for a specific source because it depends on the intensity profile of the source itself. A reasonable approximation, though, for most edge emitting diode lasers is to assume a Gaussian beam profile. Using this beam profile, you can convert the beam diameters as follows:

1. To convert a full width half max beam diameter to a full beam diameter (i.e. 99% power contained), multiply the diameter by 2.576.

2. To convert a 1/e^2 beam diameter to a full beam diameter, (i.e. 99% power contained), multiply the diameter by 1.517.

DID YOU KNOW?

If you don't see the lens you need in our catalog, we can custom build it.

Our engineering team can manufacture at off-the-shelf lens prices that you won't find elsewhere.

FIBER COUPLING

Another common use for aspheric lenses is to couple laser light into optical fibers. Choosing the right lens or lenses to do the coupling is important to maintain high efficiency in the optical system. The guide below is intended to show how best to do this while using offthe-shelf components. This guide assumes that the input laser light has already been collimated (not diverging) and the fiber is multimode (single fiber requires more extensive modeling for optimum coupling efficiency). When selecting a lens to focus light into a fiber, first consider what focal length lens is needed. Let's revisit the formula given previously.

$$\text{Beam Diameter} \cong 2 \cdot \text{EFL} \cdot \text{NA}$$

Solving for EFL it becomes:

$$\text{EFL} \cong \frac{\text{Beam Diameter}}{2 \cdot \text{NA}}$$

Where NA is the numerical aperture of the fiber that is used for the coupling. It is important to note that the EFL value that is calculated above is the minimum EFL needed to couple the light completely into the fiber. Longer EFL lenses can be used, but the spot on the fiber tip will become larger. Therefore, it is best practice to use the shortest EFL lens possible that is larger than the minimum value specified above.

Example: Suppose you wish to focus a collimated beam with a full beam diameter of 2.0mm into a 50 micron multimode fiber.

The fiber NA given by the manufacturer is approximately 0.20. Fiber NA is normally given at the 99% power point (as opposed to $1/e^2$ or half max), we can use the full beam diameter given.

$$\text{EFL} \cong \frac{\text{Beam Diameter}}{2\ \text{NA}} \cong \frac{2.0}{2 \cdot 0.2} \cong 5.0\text{mm}$$

So it is best to look for a lens with an EFL of at least 5.0mm and a clear aperture 2.0mm (in order to capture the full collimated beam). One might consider the 354430 lens for its 5mm EFL (at 1550nm), but its 1.5mm clear aperture will not capture the full collimated beam. A better choice might be the 354550 lens. Its 6.10mm EFL at 1550nm becomes 5.94mm at 660nm. The lens also has a large enough clear aperture (2.2mm) to capture the entire input beam.

CHOOSE FROM A VARIETY OF FORM FACTORS FOR CUSTOM DESIGNS

LightPath's unique molding process allows us to custom manufacture lenses based on specific requirements. We can provide lenses in a number of different form factors from a simple aspheric lens, to a lens array, and even a lens molded into a metal housing. Some of LightPath's lens molding capabilities include:

- Lens Arrays
- Anamorphic Lenses
- Insert Molding (molded into a metal holder)
- Cylindrical Metal Holders
- Square Holders
- T-Holders
- Custom Holders
- Freeform Optics

C-LENS (MOLDED ASPHERIC)

Custom available C-Type Aspheric lenses (collimating rods) are offered as part of the small beam air-gap collimator assembly. These are available as molded lenses having an angled plano surface on one end to prevent back reflections and an aspheric surface on the other. Compared with our standard molded aspheres, these lenses offer the same superior optical performance, however, in a rod form compatible with fiber integration. These lenses offer unprecedented technological advantages for low loss fiber coupling applications such as optical telecommunications, and advanced aerospace communication systems.

NUMERICAL APERTURE

Our molded aspheric lenses are available with numerical apertures ranging from 0.15 up to 0.77. Applications that would use a low numerical aperture include bar code scanners, surveying instruments, and small weapons sights. High numerical aperture applications include data storage and industrial printing.

SHAPES AND SIZES

With lenses available in a multitude of shapes and sizes, up to 23mm in diameter, LightPath will be able to provide you with the perfect lens for your unique application.

DIFFRACTIVE HYBRID LENSES

Combining a refractive aspheric lens with a diffractive feature can achieve sophisticated beam shaping of laser light. Diffractive hybrid lenses can also be used to make a system achromatic over a range of wavelengths. LightPath hybrid lenses can be customized to each application.

DIFFRACTION LIMITED PERFORMANCE

Most LightPath lenses are designed to be diffraction limited, and are measured on a phase shift interferometer.

ASSEMBLIES

By leveraging our broad optical component portfolio, LightPath has been implementing sophisticated integrated optical assemblies. Our in-house engineering staff can design custom assemblies, including complex imaging systems for camera systems, to your exact specifications. Additional services include thermal analysis and athermalization for better performance across a large temperature range.

GLASS DICING AND LENS EDGING

LightPath has the ability to dice lenses and glass to precision shapes and sizes. We can dice optics within a tolerance of ±5µm and hold edge chipping <15µm depending on the condition of glass used. In addition, we can dice lens center lined to edge within microns. We have experience in dicing lens arrays, wafers and custom lens shapes. LightPath uses multi-blade dicing gangs to increase our capacity to dice in higher volumes.

FREEFORM

Freeform optics involve optical designs with at least one freeform surface which has no translational or rotational symmetry about axes normal to the mean plane. LightPath's precision glass molding is a viable process for the cost-effective volume production of freeform optics.

Manufacturing Tolerances	
Parameter	**Typical Tolerance**
Focal Length	± 1%
Center Thickness (CT)	± 0.025mm
Outer Diameter (OD)	± 0.015mm
Wedge (arcmin)	4
Power/Irregularity (fringes)	3/1
Surface Roughness	15nm
Surface Quality (scratch/dig)	40/20
RMS WFE	Diffraction Limited

CUSTOMIZABILITY

LightPath offers the option to design a custom lens to meet your specifications. Our in-house engineering and manufacturing teams will work with you to design a lens to meet your unique needs. LightPath also offers a wide range of custom coatings. Custom coatings include dual band, triple band, and V anti-reflection coatings. LightPath can also provide reflectivity coatings for aspheric mirror applications.

INSERT MOLDING

LightPath's lenses can be molded directly into metallic holders, allowing the lenses to be welded or soldered into the package and eliminating the need to use epoxy. This can be an ideal solution for high volume automated assembly or in applications where strict outgassing requirements preclude the use of epoxy adhesives.

Contact us today for a quote on your custom design.

DID YOU KNOW?

We can blacken the edge of your lens.

HIGH-PERFORMANCE OPTICS FOR A VARIETY OF APPLICATIONS

- Benefit from the quality and performance of all-glass aspheres
- Easily transition from prototype phase to high-volume production
- Customize to fit your application or choose from over 100 standard aspheric designs
- RoHS-compliant, ultra-high quality glass

Aspheric lenses are known for their optimal performance but the expense of fabricating them has inhibited their use. LightPath's glass molding technology has enabled high volume production of aspheric optics while maintaining the highest quality at an affordable price. Because molding is the most consistent and economical way to produce aspheres in large volumes, LightPath has perfected this method to offer the most precise aspheric lens available. LightPath offers standard and custom-made lenses, all designed by our expert optical design engineers.

Geltech Asphere Performance Parameters

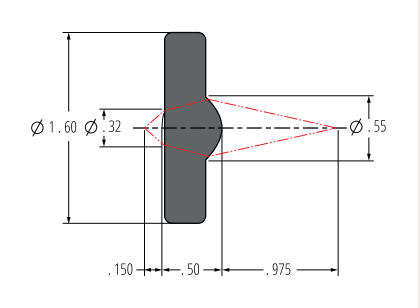
Lens Code	Focal Length (mm)	Numerical Aperture	Outer Diameter (mm)	Working Distance (mm)	Page
355104	0.3	0.65	1.6	0.150 / .975	8
355631	0.39	0.55 / 0.13	1.20 x 1.20	0.284 / 1.902	8
355070	0.43	0.06 / 0.66	1.20 x 1.20	5.00 / 0.270	8
355485	0.55	0.50 / 0.10	1.00	0.30 / 3.030	8
355487	0.55	0.50 / 0.11	1.00	0.276 / 2.940	8
355465	0.55	0.50 / 0.10	1.0 x 1.0	0.250 / 2.874	8
355536	0.60	0.60	1.24	0.22	8
355880	0.70	0.60	2.50	0.33	8
355840	0.75	0.47	3.00	0.43	8
355915	0.80	0.12 / 0.50	1.30	3.931 / 0.669	8
355960	1.00	0.62	1.824	0.24	9
355198	1.05	0.5	1.4	.610	9
355200	1.14	0.43 / 0.124	2.40	4.81	9
355201	1.14	0.124 / 0.430	4.93	1.129 / 4.809	9
354450	1.16	0.30 / 0.30	1.80	1.67 / 1.67	9
357786	1.41	0.502	2.00	1.20	9
356785	1.42	0.62	2.75	0.86	9
354710	1.49	0.53	2.65	1.02	9

Geltech Asphere Performance Parameters

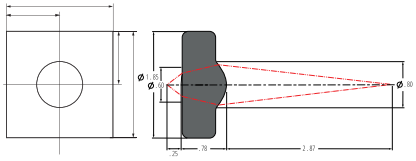
Lens Code	Focal Length (mm)	Numerical Aperture	Outer Diameter (mm)	Working Distance (mm)	Page
355957	1.8	0.4	3.0	1.1	9
355755	1.94	0.15 / 0.15	1.70	3.570 / 3.570	10
355150	2.00	0.5	3.00	1.4	10
355151	2.00	0.504	3.00	1.029	10
355410	2.51	0.20	1.805	1.84	10
355615	2.51	0.201	2.05	1.731	10
355945	2.51	0.317	3.00	1.761	10
356300	2.54	0.66	4.00	1.55	10
355160	2.73	0.55	4.00	2.37	10
355390	2.75	0.55	4.50	2.16	10
355440	2.76	0.52 / 0.26	4.70	7.090 / 2.713	10
355392	2.80	0.6	4.00	1.5	11
355660	2.976	0.52	4.00	1.56	11
354330	3.10	0.7	6.325	1.8	11
355330	3.10	0.77	6.325	1.59	11
353515	3.50	0.4	3.00	2.3	11
355545	3.50	0.38	3.50	2.3	11
355970	3.70	0.21	1.80	3.030	11

Geltech Asphere Performance Parameters					
Lens Code	Focal Length (mm)	Numerical Aperture	Outer Diameter (mm)	Working Distance (mm)	Page
355970	3.70	0.21	1.80	3.030	11
357775	4.00	0.6	6.325	2.4	11
357610	4.00	0.616	6.325	2.691	11
357765	4.00	0.61	6.325	2.37	11
355940	4.02	0.17	3.00	3.37	12
354340	4.03	0.64	6.325	2.68	12
355625	4.13	0.55	5.585	2.2	12
355022	4.47	0.47	5.42	3.08	12
354350	4.50	0.4	4.70	2.2	12
354996	4.50	0.30	3.00	3.46	12
355230	4.50	0.55	6.325	3.08	12
354453	4.60	0.5	6.00	2.7	12
354430	5.00	0.15	2.00	4.37	12
354105	5.50	0.6	7.20	3.7	12
354130	6.00	0.21	3.00	4.90	13
354550	6.10	0.18	2.79	4.87	13
354171	6.20	0.30	4.70	4.10	13
355110	6.20	0.4	7.20	3.5	13
354525	6.70	0.44	6.650	4.9	13
354115	6.80	0.5	9.20	4.3	13

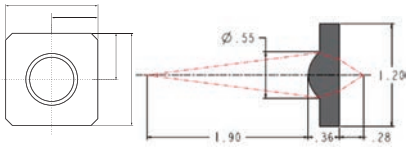
Geltech Asphere Performance Parameters					
Lens Code	Focal Length (mm)	Numerical Aperture	Outer Diameter (mm)	Working Distance (mm)	Page
355375	7.50	0.3	6.51	5.8	13
354240	8.00	0.5	9.936	5.9	13
354060	9.60	0.30	6.325	8.13	13
354306	9.90	0.3	6.335	8.4	13
354125	10.00	0.5	11.00	7.8	14
355561	10.00	0.6	15.00	7.0	14
354220	11.00	0.3	7.20	7.9	14
354061	11.00	0.24	6.325	9.56	14
354062	11.00	0.24	6.00	9.66	14
354064	11.00	0.2	6.00	9.3	14
355397	11.00	0.3	7.20	10.0	14
354058	12.00	0.22	6.325	10.57	14
354057	13.00	0.20	6.325	11.58	14
354560	13.86	0.18	6.325	12.11	14
354059	14.00	0.19	6.325	12.63	15
354120	15.04	0.15	4.985	13.19	15
354260	15.29	0.16	6.50	13.98	15
354280	18.40	0.15	6.50	17.11	15
354850	22.00	0.13	6.325	20.41	15



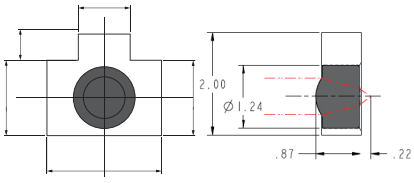
355104	
Design Wavelength	1300
Focal Length	0.3
Numerical Aperture	0.65
Clear Aperture	0.29/0.48



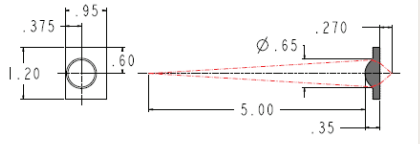
355465	
Design Wavelength	1310
Focal Length	0.55
Numerical Aperture	0.50/0.10
Clear Aperture	0.40/0.70



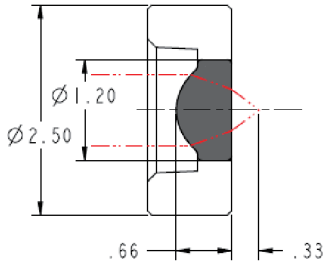
355631	
Design Wavelength	1310
Focal Length	0.39
Numerical Aperture	0.55/0.13
Clear Aperture	0.37/0.53



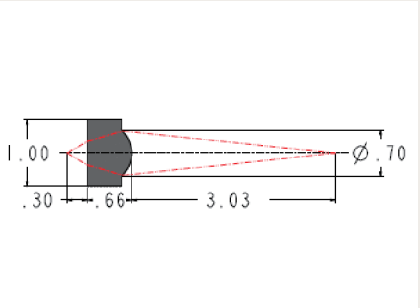
355536	
Design Wavelength	1310
Focal Length	0.60
Numerical Aperture	0.60
Clear Aperture	0.72/0.35



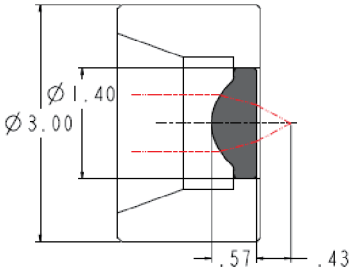
355070	
Design Wavelength	1550
Focal Length	0.43
Numerical Aperture	0.06/0.66
Clear Aperture	0.62/0.47



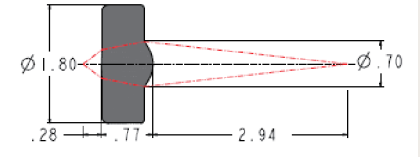
355880	
Design Wavelength	1550
Focal Length	0.70
Numerical Aperture	0.60
Clear Aperture	0.84/0.49



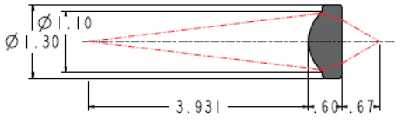
355485	
Design Wavelength	1550
Focal Length	0.55
Numerical Aperture	0.50/0.10
Clear Aperture	0.35/0.66



355840	
Design Wavelength	940
Focal Length	0.75
Numerical Aperture	0.47
Clear Aperture	0.71/0.46



355487	
Design Wavelength	1500
Focal Length	0.55
Numerical Aperture	0.50/0.11
Clear Aperture	0.35/0.68



355915	
Design Wavelength	1550
Focal Length	0.80
Numerical Aperture	0.12/0.50
Clear Aperture	1.00/0.77

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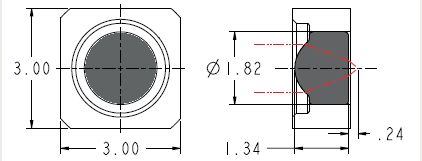
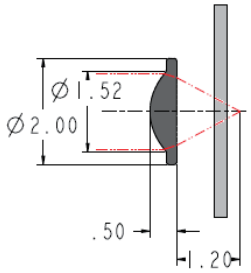
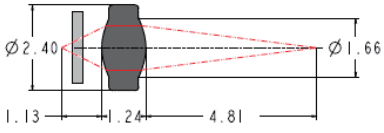


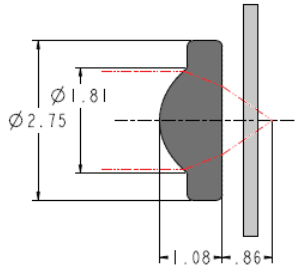
355960	
Design Wavelength	1500
Focal Length	1.00
Numerical Aperture	0.62
Clear Aperture	1.20/0.39



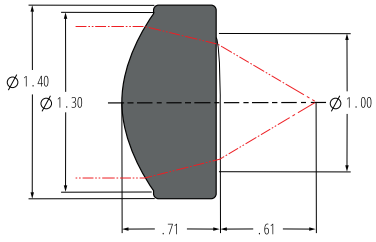
357786	
Design Wavelength	488
Focal Length	1.41
Numerical Aperture	0.502
Clear Aperture	1.42/1.28



355200	
Design Wavelength	1300
Focal Length	1.14
Numerical Aperture	0.43/0.124
Clear Aperture	1.24/1.24



356785	
Design Wavelength	488
Focal Length	1.42
Numerical Aperture	0.62
Clear Aperture	1.70/1.18



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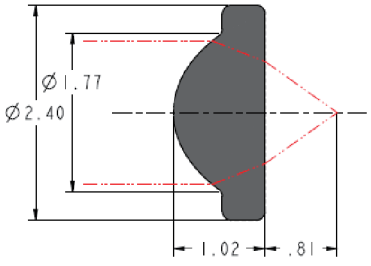
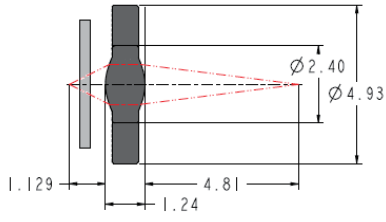
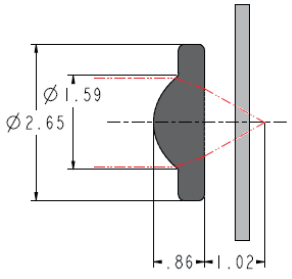
Design Wavelength	1550
Focal Length	1.05
Numerical Aperture	0.5
Clear Aperture	1.10/0.84



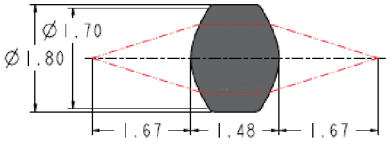
354140	
Design Wavelength	780
Focal Length	1.45
Numerical Aperture	0.58
Clear Aperture	1.60/1.14



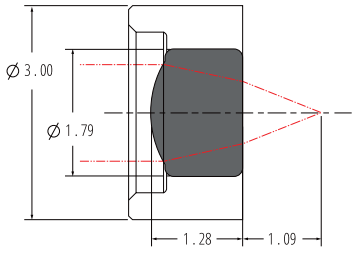
355201	
Design Wavelength	1300
Focal Length	1.14
Numerical Aperture	0.124
Clear Aperture	1.24/1.24



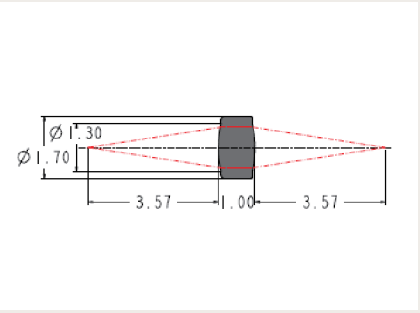
354710	
Design Wavelength	1550
Focal Length	1.49
Numerical Aperture	0.53
Clear Aperture	1.50/1.15



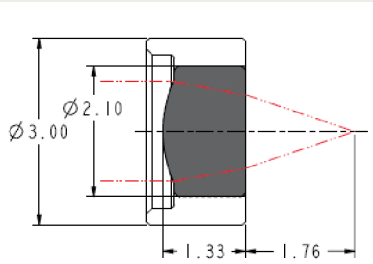
354450	
Design Wavelength	980
Focal Length	1.16
Numerical Aperture	0.30
Clear Aperture	1.14/1.14



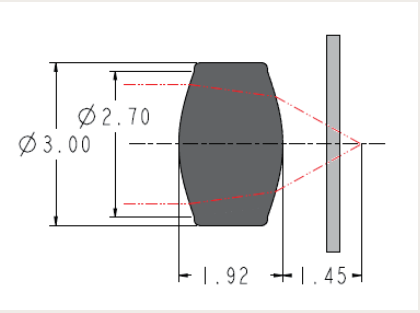
355957	
Design Wavelength	1550
Focal Length	1.8
Numerical Aperture	0.4
Clear Aperture	1.35/0.87



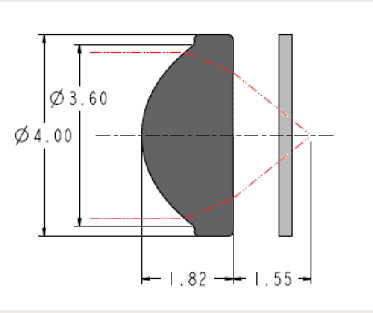
355755	
Design Wavelength	1577
Focal Length	1.94
Numerical Aperture	0.15/0.15
Clear Aperture	1.10/1.10



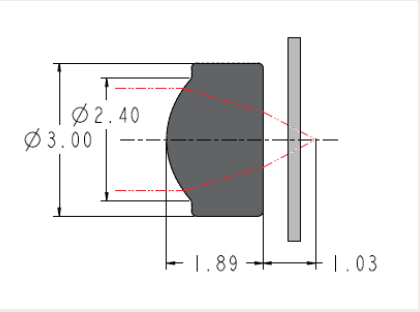
355945	
Design Wavelength	1550
Focal Length	2.51
Numerical Aperture	0.317
Clear Aperture	1.60/1.18



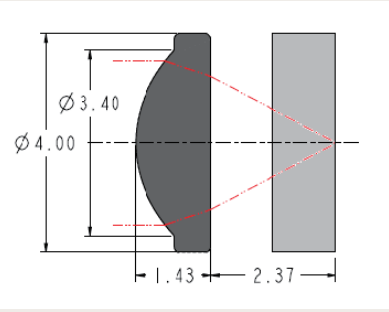
355150	
Design Wavelength	780
Focal Length	2.00
Numerical Aperture	0.5
Clear Aperture	2.20/2.20



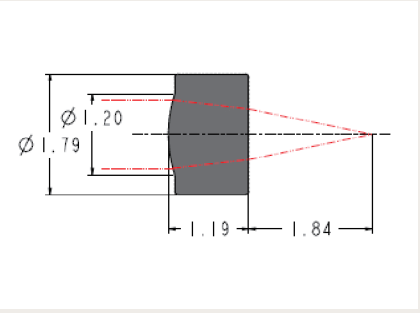
356300	
Design Wavelength	405
Focal Length	2.54
Numerical Aperture	0.66
Clear Aperture	3.30/2.50



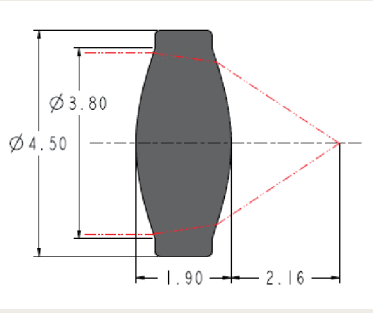
355151	
Design Wavelength	780
Focal Length	2.00
Numerical Aperture	0.504
Clear Aperture	2.00/1.09



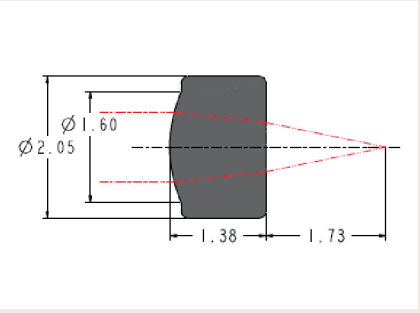
355160	
Design Wavelength	780
Focal Length	2.73
Numerical Aperture	0.55
Clear Aperture	3.00/2.44



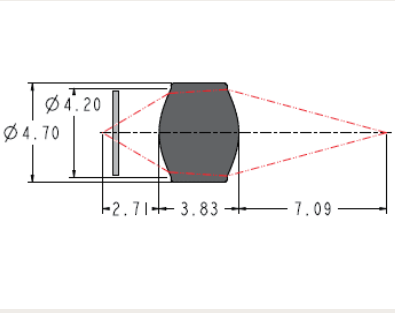
355410	
Design Wavelength	1550
Focal Length	2.51
Numerical Aperture	0.20
Clear Aperture	1.01/0.75



355390	
Design Wavelength	830
Focal Length	2.75
Numerical Aperture	0.55
Clear Aperture	3.60/3.24



355615	
Design Wavelength	1550
Focal Length	2.51
Numerical Aperture	0.201
Clear Aperture	1.01/0.71



355440	
Design Wavelength	980
Focal Length	2.76
Numerical Aperture	0.52/0.26
Clear Aperture	4.12/4.12

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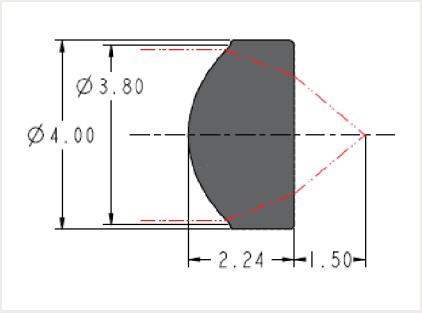
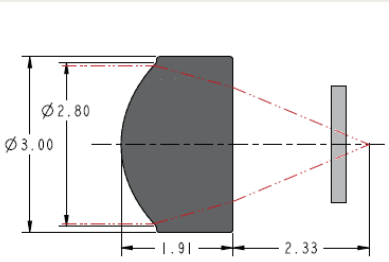
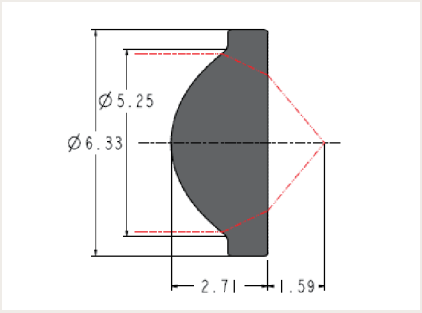


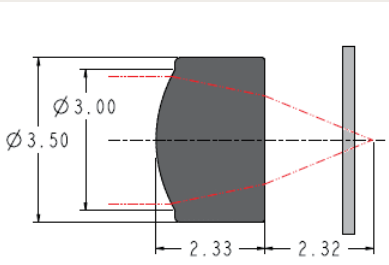
355392	
Design Wavelength	830
Focal Length	2.80
Numerical Aperture	0.6
Clear Aperture	3.60/2.50



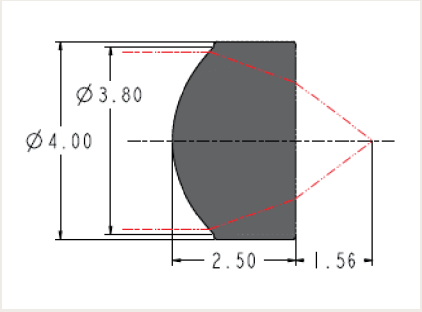
353515	
Design Wavelength	515
Focal Length	3.50
Numerical Aperture	0.4
Clear Aperture	2.70/1.95



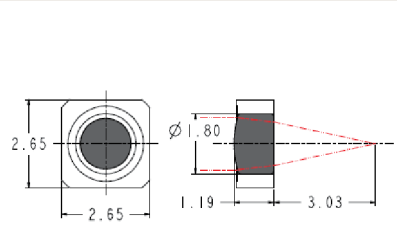
355330	
Design Wavelength	830
Focal Length	3.10
Numerical Aperture	0.77
Clear Aperture	5.00/3.79



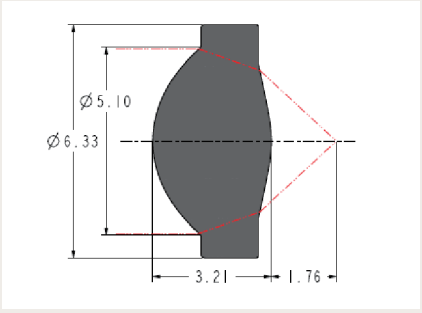
355545	
Design Wavelength	515
Focal Length	3.50
Numerical Aperture	0.38
Clear Aperture	2.71/1.88



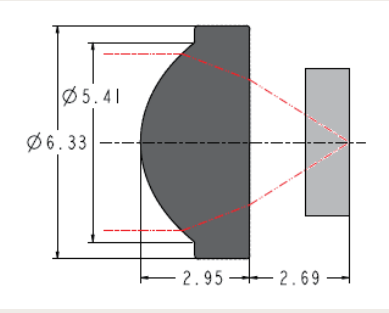
355660	
Design Wavelength	1550
Focal Length	2.976
Numerical Aperture	0.52
Clear Aperture	3.60/2.35



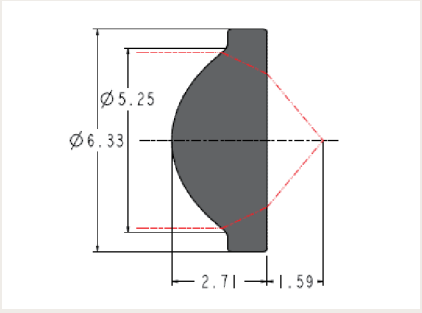
355970	
Design Wavelength	1550
Focal Length	3.70
Numerical Aperture	0.21
Clear Aperture	1.56/1.30



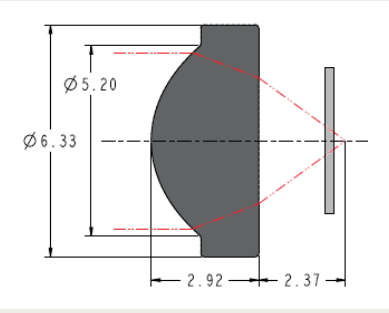
354330	
Design Wavelength	830
Focal Length	3.10
Numerical Aperture	0.7
Clear Aperture	5.00/3.84



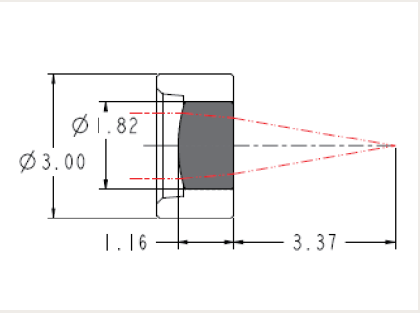
357610	
Design Wavelength	410
Focal Length	4.00
Numerical Aperture	0.616
Clear Aperture	4.80/3.39



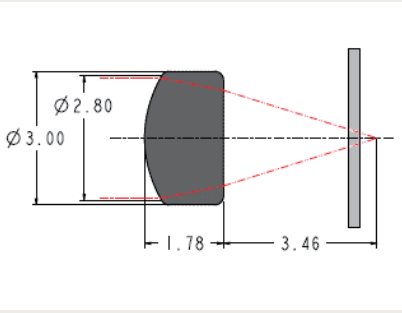
355330	
Design Wavelength	830
Focal Length	3.10
Numerical Aperture	0.77
Clear Aperture	5.00/3.61



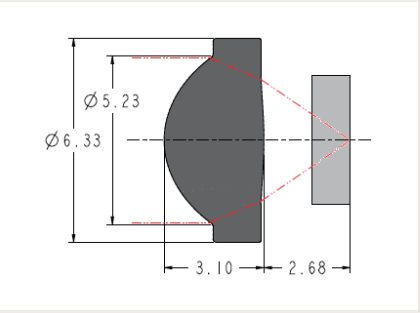
357765	
Design Wavelength	488
Focal Length	4.00
Numerical Aperture	0.61
Clear Aperture	4.80/3.43



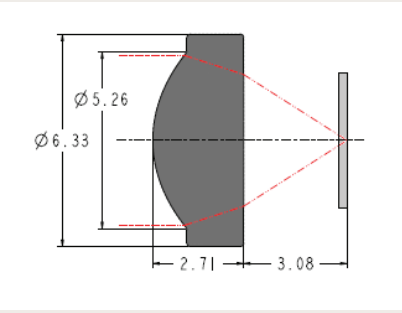
355940	
Design Wavelength	1550
Focal Length	4.02
Numerical Aperture	0.17
Clear Aperture	1.37/1.16



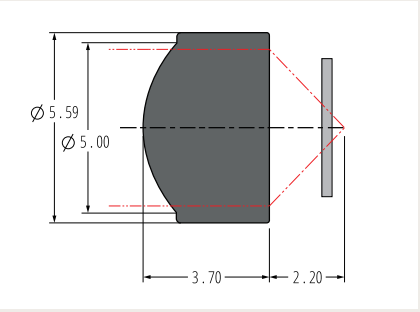
354996	
Design Wavelength	634
Focal Length	4.50
Numerical Aperture	0.30
Clear Aperture	2.70/2.15



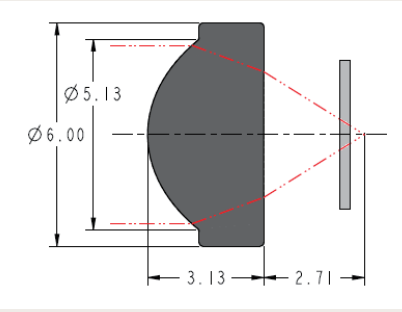
354340	
Design Wavelength	685
Focal Length	4.03
Numerical Aperture	0.64
Clear Aperture	5.10/3.77



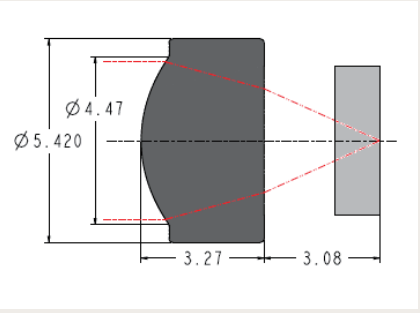
355230	
Design Wavelength	780
Focal Length	4.50
Numerical Aperture	0.55
Clear Aperture	5.07/3.93



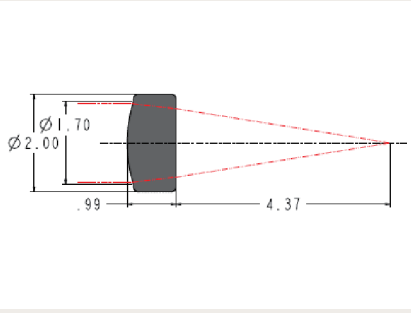
355625	
Design Wavelength	447
Focal Length	4.13
Numerical Aperture	0.55
Clear Aperture	4.60/4.60



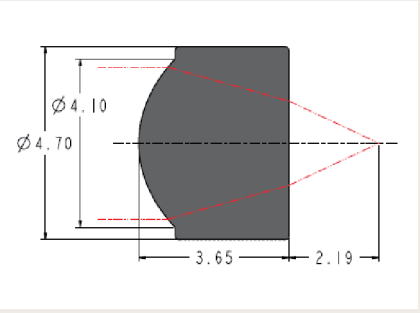
354453	
Design Wavelength	655
Focal Length	4.60
Numerical Aperture	0.5
Clear Aperture	4.80/3.38



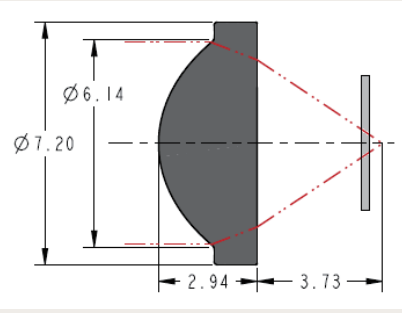
355022	
Design Wavelength	780
Focal Length	4.47
Numerical Aperture	0.47
Clear Aperture	4.20/2.77



354430	
Design Wavelength	1550
Focal Length	5.00
Numerical Aperture	0.15
Clear Aperture	1.60/1.40



354350	
Design Wavelength	980
Focal Length	4.50
Numerical Aperture	0.4
Clear Aperture	3.70/2.05



354105	
Design Wavelength	633
Focal Length	5.50
Numerical Aperture	0.6
Clear Aperture	6.00/4.96

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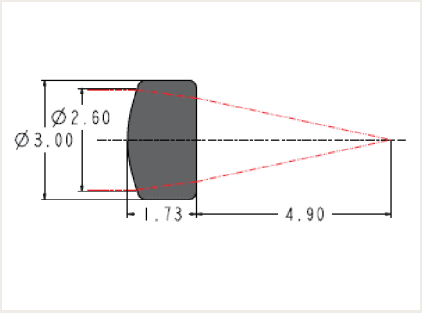
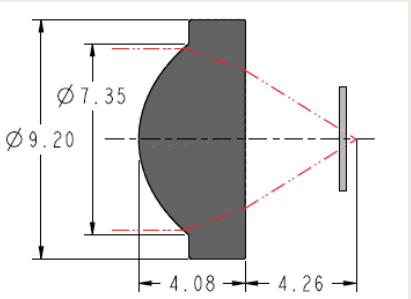
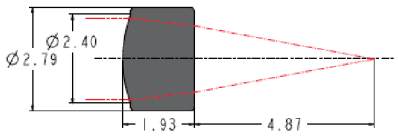


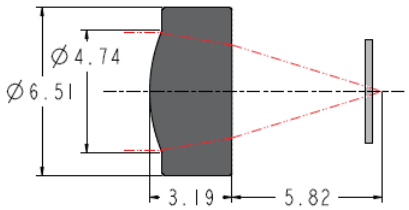
354130	
Design Wavelength	1550
Focal Length	6.00
Numerical Aperture	0.21
Clear Aperture	2.50/2.10



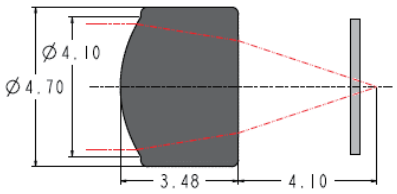
354115	
Design Wavelength	633
Focal Length	6.80
Numerical Aperture	0.5
Clear Aperture	7.00/5.30



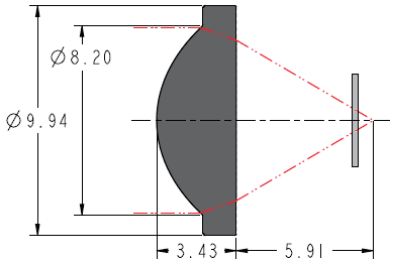
354550	
Design Wavelength	1550
Focal Length	6.10
Numerical Aperture	0.18
Clear Aperture	2.20/1.79



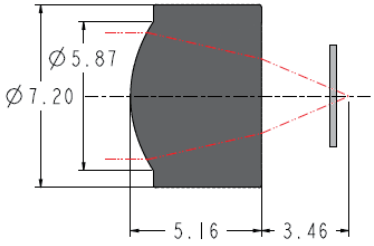
355375	
Design Wavelength	780
Focal Length	7.50
Numerical Aperture	0.3
Clear Aperture	4.54/3.61



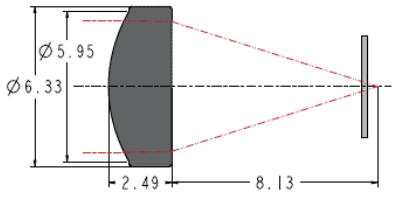
354171	
Design Wavelength	633
Focal Length	6.20
Numerical Aperture	0.30
Clear Aperture	3.70/2.72



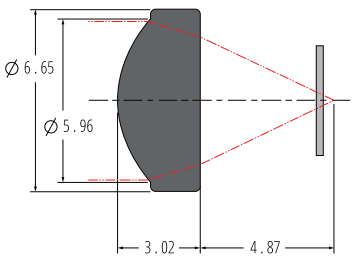
354240	
Design Wavelength	780
Focal Length	8.00
Numerical Aperture	0.5
Clear Aperture	8.00/6.94



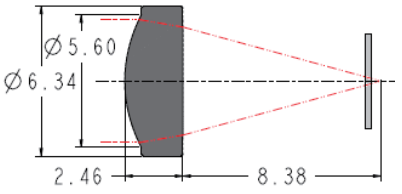
355110	
Design Wavelength	780
Focal Length	6.20
Numerical Aperture	0.4
Clear Aperture	5.00/2.93



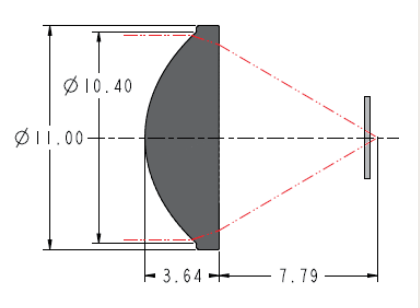
354060	
Design Wavelength	633
Focal Length	9.60
Numerical Aperture	0.30
Clear Aperture	5.20/5.13



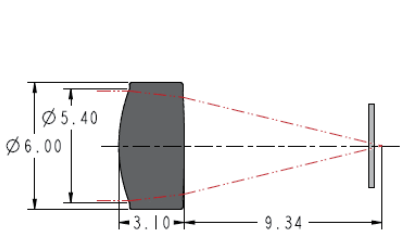
354525	
Design Wavelength	515
Focal Length	6.70
Numerical Aperture	0.44
Clear Aperture	5.75/4.66



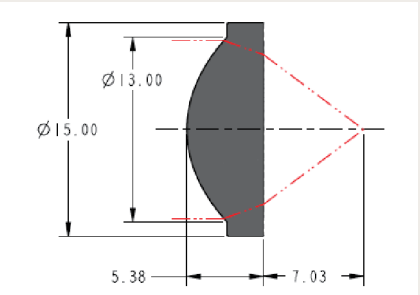
354306	
Design Wavelength	650
Focal Length	9.90
Numerical Aperture	0.3
Clear Aperture	5.20/4.57



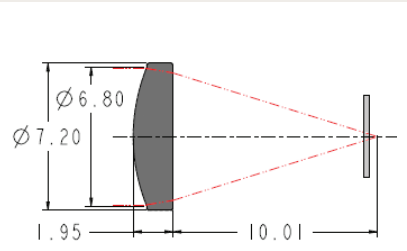
354125	
Design Wavelength	633
Focal Length	10.00
Numerical Aperture	0.5
Clear Aperture	10.00/9.12



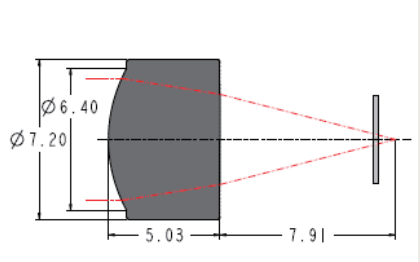
354064	
Design Wavelength	633
Focal Length	11.00
Numerical Aperture	0.2
Clear Aperture	5.20/4.59



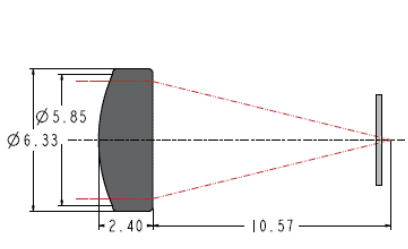
355561	
Design Wavelength	850
Focal Length	10.00
Numerical Aperture	0.6
Clear Aperture	12.50/10.53



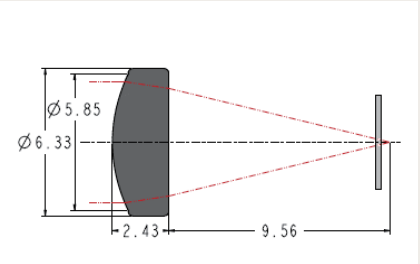
355397	
Design Wavelength	670
Focal Length	11.00
Numerical Aperture	0.3
Clear Aperture	6.68/6.24



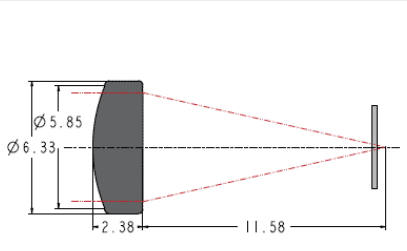
354220	
Design Wavelength	633
Focal Length	11.00
Numerical Aperture	0.3
Clear Aperture	5.50/4.07



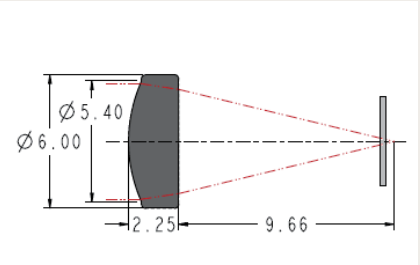
354058	
Design Wavelength	633
Focal Length	12.00
Numerical Aperture	0.22
Clear Aperture	5.20/5.20



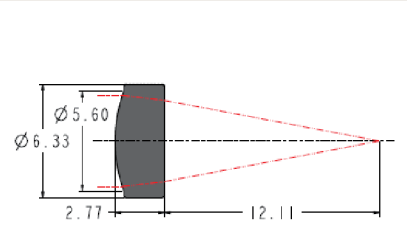
354061	
Design Wavelength	633
Focal Length	11.00
Numerical Aperture	0.24
Clear Aperture	5.20/4.63



354057	
Design Wavelength	633
Focal Length	13.00
Numerical Aperture	0.20
Clear Aperture	5.20/5.20

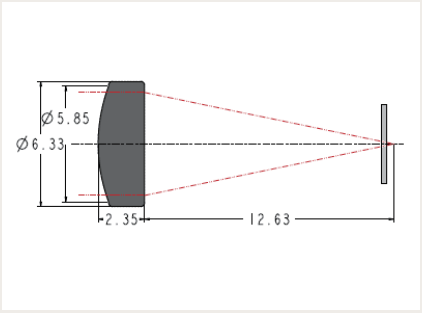


354062	
Design Wavelength	633
Focal Length	11.00
Numerical Aperture	0.24
Clear Aperture	5.20/4.68

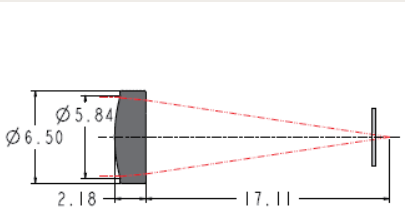


354560	
Design Wavelength	650
Focal Length	13.86
Numerical Aperture	0.18
Clear Aperture	5.10/4.54

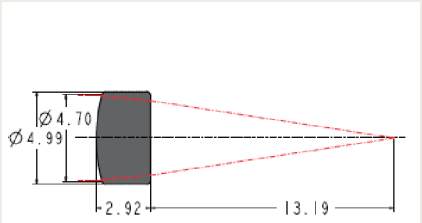
+86-511-88881568



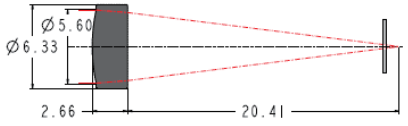
354059	
Design Wavelength	633
Focal Length	14.00
Numerical Aperture	0.19
Clear Aperture	5.20/5.20



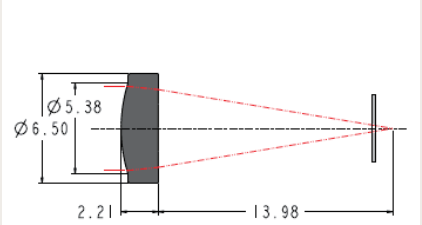
354280	
Design Wavelength	780
Focal Length	18.40
Numerical Aperture	0.15
Clear Aperture	5.50/5.15



354120	
Design Wavelength	670
Focal Length	15.04
Numerical Aperture	0.15
Clear Aperture	4.50/4.00



354850	
Design Wavelength	670
Focal Length	22.00
Numerical Aperture	0.13
Clear Aperture	5.50/5.13



354260	
Design Wavelength	780
Focal Length	15.29
Numerical Aperture	.016
Clear Aperture	5.00/4.61

DID YOU KNOW?

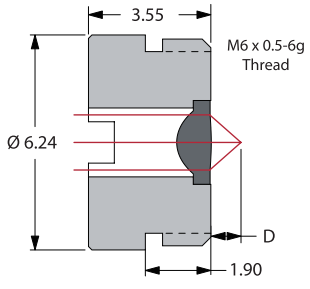
If you don't see the lens you need in our catalog, our engineering team will customize a solution for you.

MOLDED ASPHERIC LENSES MOUNTED FOR EASY ASSEMBLY

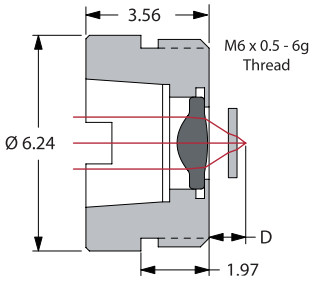
Part Number*	Holder Type	EFL (mm)	NA
357775Y-00-MT	MT9	4.02	0.6
357765Y-00-MT	MT9	4.00	0.61
357610Y-00-MT	MT9	4.00	0.62
355397Y-00-MT	MT9	11.00	0.3
355375Y-00-MT	MT9	7.50	0.3
355330Y-00-MT	MT9	3.10	0.77
355230Y-00-MT	MT9	4.51	0.55
355110Y-00-MT	MT9	6.24	0.4
354850Y-00-MT	MT9	22.00	0.13
354560Y-00-MT	MT9	13.86	0.18
354453Y-00-MT	MT9	4.6	0.55
354340Y-00-MT	MT9	4.03	0.64
354306Y-00-MT	MT9	9.85	0.27
354280Y-00-MT	MT9	18.4	0.15
354260Y-00-MT	MT9	15.29	0.16
354220Y-00-MT	MT9	11.00	0.25
354105Y-00-MT	MT9	5.50	0.56
354064Y-00-MT	MT9	11.00	0.24
354062Y-00-MT	MT9	11.00	0.24
354061Y-00-MT	MT9	11.00	0.24
354060Y-00-MT	MT9	9.60	0.27
354059Y-00-MT	MT9	14.00	0.19
354058Y-00-MT	MT9	12.00	0.22
354057Y-00-MT	MT9	13.00	0.2
354525Y-00-MT	MT9	6.69	0.45
356300Y-00-MT	MT8	2.54	0.66
355660Y-00-MT	MT8	2.97	0.6
355440Y-00-MT	MT8	2.76	0.52
355392Y-00-MT	MT8	2.75	0.64
355390Y-00-MT	MT8	2.75	0.68
355160Y-00-MT	MT8	2.73	0.55
355022Y-00-MT	MT8	4.47	0.47
354350Y-00-MT	MT8	4.50	0.43
357786Y-00-MT	MT6B	1.41	0.5
356785Y-00-MT	MT6B	1.42	0.62
355200Y-00-MT	MT6B	1.14	0.43
355151Y-00-MT	MT6B	2.00	0.5
355150Y-00-MT	MT6B	2.00	0.51
354996Y-00-MT	MT6B	4.50	0.3
354710Y-00-MT	MT6B	1.49	0.53
354550Y-00-MT	MT6B	6.10	0.18
354430Y-00-MT	MT6B	5.00	0.15
353515Y-00-MT	MT6B	3.52	0.4
354140Y-00-MT	MT6A	1.45	0.58
354115Y-00-MT	MT12	6.75	0.54
354240Y-00-MT	MT12	8.00	0.5

- Cost-effective solution for mounting Geltech aspheres
- Easy to handle assembly
- Durable stainless steel housing
- Threaded extension for easy mounting

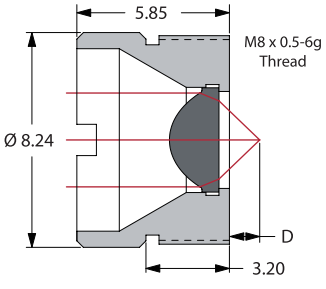
Lens Holder MT6A



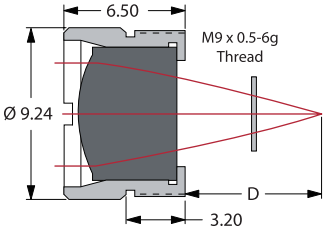
Lens Holder MT6B



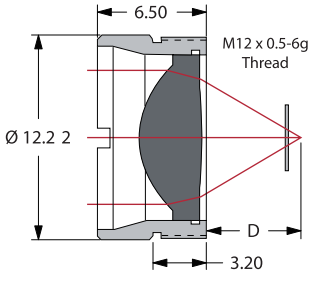
Lens Holder MT8



Lens Holder MT9



Lens Holder MT12



DID YOU KNOW?

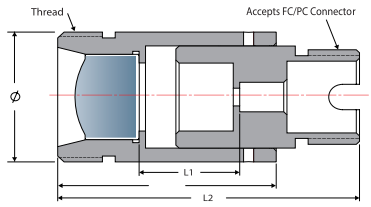
There are a variety of custom coatings available.

* "Y" in the Part Number, is a placeholder for the coating type that the customer selects.

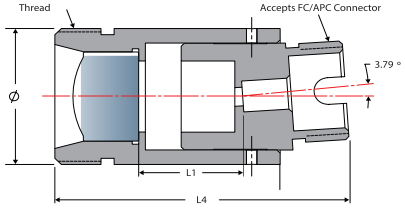
MOLDED ASPHERIC LENSES PRE-ALIGNED FOR USE WITH FIBER PATCH CORDS

LightPath's connectorized collimators are available with FC/PC, FC/APC, or SMA fiber optic connectors. Each collimator is individually aligned and tested for the specified wavelength, and will offer excellent performance throughout the entire range of their AR coatings. Standard design assemblies are available for our most popular lens types, but any asphere in our catalog can be mounted into a custom assembly of your choice. Please contact LightPath sales for more information.

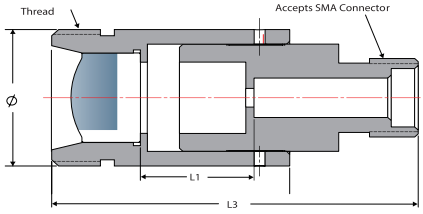
FC/PC Connectors



FC/APC Connectors



SMA Connectors



For all Connectorized Collimators, Pointing Accuracy = 0.5° and Waist Position = Infinity
Connectorized Collimators can also be ordered as an unaligned kit for custom wavelength alignment

Part Number	Wavelength (nm)	Beam ø (mm)*	AR Coating	Thread ø	ø (mm)
355110 - (FCPC/FCAPC/SMA) - 543	543	1.2	A	M11 x 0.5-6g	11
355110 - (FCPC/FCAPC/SMA) - 633	633	1.2	B	M11 x 0.5-6g	11
355110 - (FCPC/FCAPC/SMA) - 780	780	1.2	B	M11 x 0.5-6g	11
355110 - (FCPC/FCAPC/SMA) - 1064	1064	1.4	C	M11 x 0.5-6g	11
355110 - (FCPC/FCAPC/SMA) - 1310	1310	1.1	C	M11 x 0.5-6g	11
355110 - (FCPC/FCAPC/SMA) - 1550	1550	1.2	C	M11 x 0.5-6g	11
355110 - (FCPC/FCAPC/SMA) - Y - KIT			A, B, or C	M11 x 0.5-6g	11
354220 - (FCPC/FCAPC/SMA) - 543	543	2.2	A	M11 x 0.5-6g	11
354220 - (FCPC/FCAPC/SMA) - 633	633	2.1	B	M11 x 0.5-6g	11
354220 - (FCPC/FCAPC/SMA) - 780	780	2.2	B	M11 x 0.5-6g	11
354220 - (FCPC/FCAPC/SMA) - 1064	1064	2.4	C	M11 x 0.5-6g	11
354220 - (FCPC/FCAPC/SMA) - 1310	1310	2.0	C	M11 x 0.5-6g	11
354220 - (FCPC/FCAPC/SMA) - 1550	1550	2.1	C	M11 x 0.5-6g	11
354220 - (FCPC/FCAPC/SMA) - Y - KIT			A, B, or C	M11 x 0.5-6g	11
355230 - (FCPC/FCAPC/SMA) - 543	543	0.9	A	M11 x 0.5-6g	11
355230 - (FCPC/FCAPC/SMA) - 633	633	0.8	B	M11 x 0.5-6g	11
355230 - (FCPC/FCAPC/SMA) - 780	780	0.9	B	M11 x 0.5-6g	11
355230 - (FCPC/FCAPC/SMA) - 1064	1064	1.0	C	M11 x 0.5-6g	11
355230 - (FCPC/FCAPC/SMA) - 1310	1310	0.8	C	M11 x 0.5-6g	11
355230 - (FCPC/FCAPC/SMA) - 1550	1550	0.9	C	M11 x 0.5-6g	11
355230 - (FCPC/FCAPC/SMA) - Y KIT			A, B, or C	M11 x 0.5-6g	11
354240 - (FCPC/FCAPC/SMA) - 543	543	1.6	A	M12 x 0.5-6g	12
354240 - (FCPC/FCAPC/SMA) - 633	633	1.5	B	M12 x 0.5-6g	12
354240 - (FCPC/FCAPC/SMA) - 780	780	1.6	B	M12 x 0.5-6g	12
354240 - (FCPC/FCAPC/SMA) - 1064	1064	1.8	C	M12 x 0.5-6g	12
354240 - (FCPC/FCAPC/SMA) - 1310	1310	1.5	C	M12 x 0.5-6g	12
354240 - (FCPC/FCAPC/SMA) - 1550	1550	1.5	C	M12 x 0.5-6g	12
354240 - (FCPC/FCAPC/SMA) - Y - KIT			A, B, or C	M12 x 0.5-6g	12
354260 - (FCPC/FCAPC/SMA) - 543	543	3.0	A	M11 x 0.5-6g	11
354260 - (FCPC/FCAPC/SMA) - 633	633	2.8	B	M11 x 0.5-6g	11
354260 - (FCPC/FCAPC/SMA) - 780	780	3.1	B	M11 x 0.5-6g	11
354260 - (FCPC/FCAPC/SMA) - 1064	1064	3.3	C	M11 x 0.5-6g	11
354260 - (FCPC/FCAPC/SMA) - 1310	1310	2.8	C	M11 x 0.5-6g	11
354260 - (FCPC/FCAPC/SMA) - 1550	1550	2.9	C	M11 x 0.5-6g	11
354260 - (FCPC/FCAPC/SMA) - Y - KIT			A, B, or C	M11 x 0.5-6g	11
357775 - (FCPC/FCAPC/SMA) - 405	405	0.7	UVA	M11 x 0.5-6g	11
357775 - (FCPC/FCAPC/SMA) - Y - KIT			UVA	M11 x 0.5-6g	11

FUSED FIBER COLLIMATORS

- Laser Fusion™ of fiber optics with cladding up to 550μm in diameter
- Micro-optic lenses from 0.7mm diameter and up
- Huge selection of diverse and specialized optical fibers
- Standard to Customized AR coatings
- The assemblies can be customized with a variety of cable and connector types
- From C-lens to a full portfolio of Precision Molded Aspheric and Specialty glasses (Polished Silica Aspheric, Rad-Hard glasses recommended for High Power laser systems and Harsh environments are available upon request)

LightPath Fusion™ Collimators and fiber optic assemblies utilize proprietary fiber fusion technology that allows collimators to be used at higher powers for pairing, targeting, or pigtailing applications. The lens is laser fused directly to the optical fiber, eliminating any interface causing unwanted signal distortion, photo-degradation and space shifting issues with temperature and service life. Recognized by commercial and scientific industry leaders for offering unmatched stability against other technologies in various environmental conditions, as well as perfectly suited for extremely small packages.

Technical Data

Wavelengths	400 to 1550
Fiber Types *	Single Mode | Multimode | polarization maintain | LMA
Fiber	Acrylate coating | Polyimide coating
Cable Diameters *	250um；900um；3mm
Cable Types	Buffer Coating | Hytrel | PTFE | PVC+Kevlar | Armour
Connector	FC/APC；FC/PC；SC/PC；Pigtail
Beam Diameters	0.2 to 12.5mm(single Mode)
Polarization Ratio	>100:1(Pigtails)
Connector key Alignment	Slow and Fast Axis
Coupling Efficiency	>70%
Pointing Accuracy	<1.0°standard | <0.5°premium(Based on Design)
Power Handing	>10W Small Beams & Large Beams | 100W Premium Designs
Return Loss	≤60dB (Typical)
Anti-Reflective Coatings *	400 to 1550; Reflective ≤ 0.5% (See standard options)
Storage Temperature	-40 to +85°C

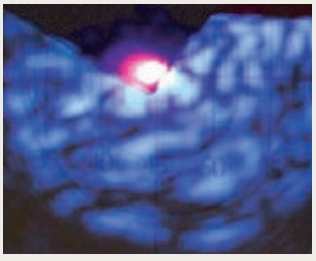
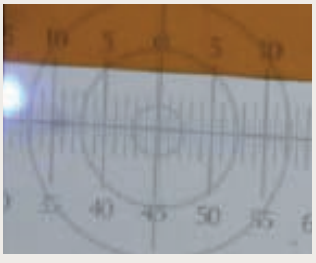
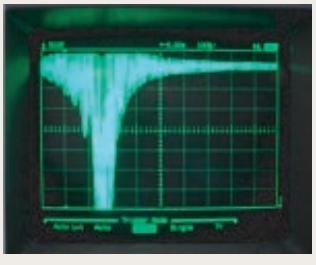
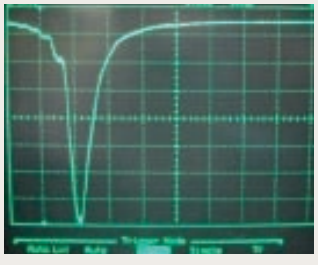
*** Costom available upon request**

INDUSTRY CHALLENGES

Most commercial low-cost collimator technologies rely on integrated packages that consist of multi-components with several interfaces or airgaps, angled surfaces, and numerous attached structures that will degrade the beam quality and pointing, especially at the 405nm operating wavelength. In addition to these factors, we must not forget the increase in relative noise of the overall system

LIGHTPATH FUSION ADVANTAGE

With LightPath Laser Fusion and sophisticated assembly processes, the fiber optic assembly puts an end to any glass-to-air interface and simplify component layout. This eliminates surface effects and damages caused by 405nm laser irradiation that is generally experienced by unprotected fibers operating just few milliwatts of continuous power transmission. In addition,the design stabilizes movement toward the target and delivers high laser quality, essential for smooth signal transmission. Therefore, the time and speed of the photons are very well preserved, and it is possible to check the security of the transmitted key.

Beam Quality degradation 405nm			**Excellent Beam Quality 405nm**
Off target pointing			**Suitable target pointing**
High signal noise dB			**Smooth signal quality**

OPTIMUM PERFORMANCE WITH OPTIMUM LENSES

Lens Code	Glass Type	Refractive Index, n_d	Abbé Number, ν_d	CTE	dn/dT	Equivalent Glasses	RoHS ✓ Compliance
352xxx	ECO-550	1.603	50.02	11.62 x 10^{-6}/°C	2.39 x 10^{-6}/°C	N/A	✓
353xxx	H-FK61	1.495	81.20	13.8 x 10^{-6}/°C	-6.6 x 10^{-6}/°C	Hoya-FCD1 & Ohara S-FPL51	✓
354xxx	D-ZK3	1.586	60.71	7.6 x 10^{-6}/°C	3.2 x 10^{-6}/°C	Hoya M-BACD5N & Ohara L-BAL35	✓
355xxx	D-ZLaF52La	1.806	40.79	6.9 x 10^{-6}/°C	6.5 x 10^{-6}/°C	Ohara L-LAH53, Hoya M-NBFD130, Sumita K-VC89	✓
356xxx	L-LAL12	1.674	55.00	6.9 x 10^{-6}/°C	6.5 x 10^{-6}/°C	CDGM D-Lak5	✓
357xxx	D-LaK6	1.690	52.65	6.9 x 10^{-6}/°C	6.5 x 10^{-6}/°C	Hoya M-LAC130 & Ohara L-LAL13	✓

D-ZLaF52La → 355xxx Series of Lenses

This glass has a higher index of refraction than ECO-550 and is best suited for those applications that require a higher numerical aperture and need to maintain RoHS compliance.

D-ZK3 → 354xxx Series of Lenses

This glass is best suited for those applications that require a low cost glass for higher volume manufacturing.

ECO-550 → 352xxx Series of Lenses

ECO-550 is an environmentally friendly alternative to conventional moldable glasses.

D-LaK6 →357xxx Series of Lenses

These glasses have been selected for their outstanding UV & Blue transmission properties.

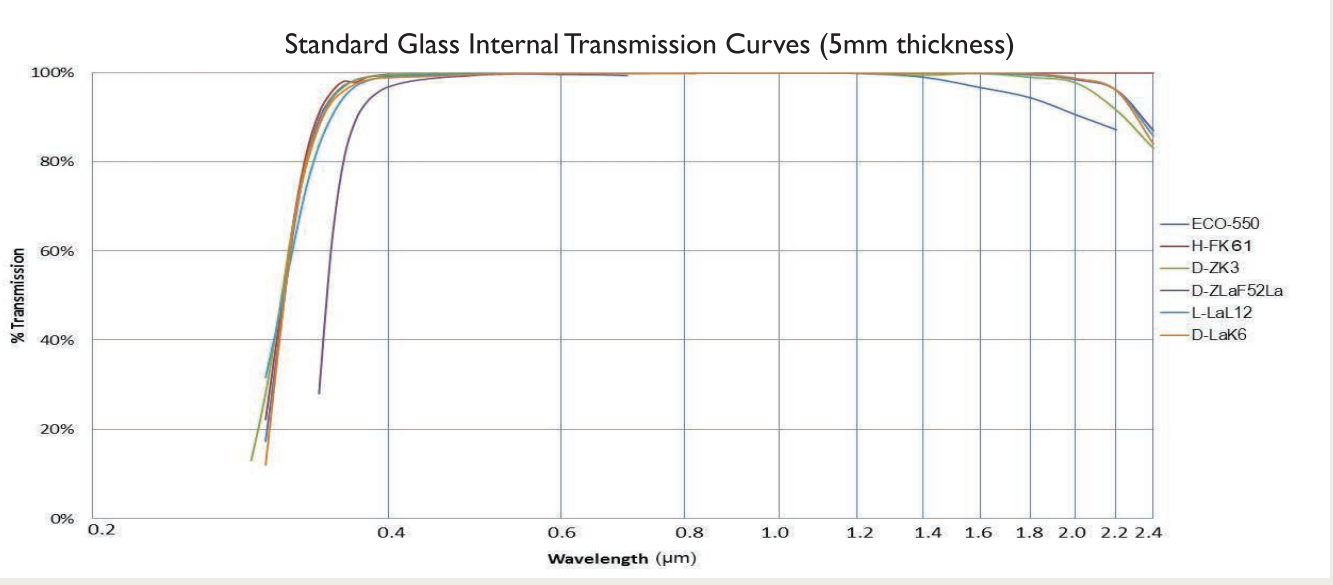
H-FK61 → 353xxx Series of Lenses

These glasses have been selected for their outstanding UV & Green transmission properties.

L-LAL12 → 356xxx Series of Lenses

SPECIALTY GLASS TYPES

There are well over 200 available moldable glass types. LightPath focuses on a select few types in order to provide our customers the fastest lead times at the lowest cost. Our standard selections meet most of our customers' needs but sometimes that special application requires a unique glass. LightPath can provide these glasses, starting with material qualification.



+86-511-88881568

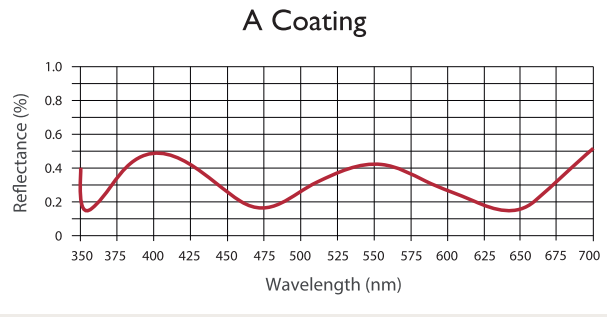
STANDARD ANTI-REFLECTIVE COATINGS

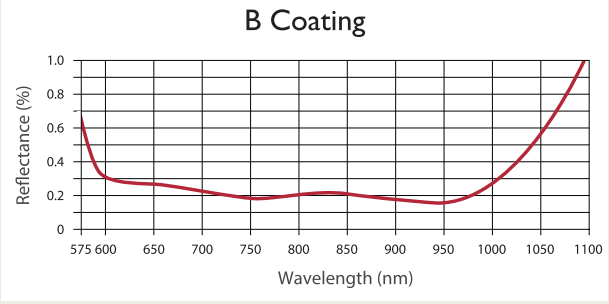
LightPath offers a variety of multilayer broadband coatings to reduce the back reflection from a nominal 6% for uncoated lenses. The choice of which AR coating is appropriate depends on the type of glass the lens is made from and the wavelength at which the lens will be used.

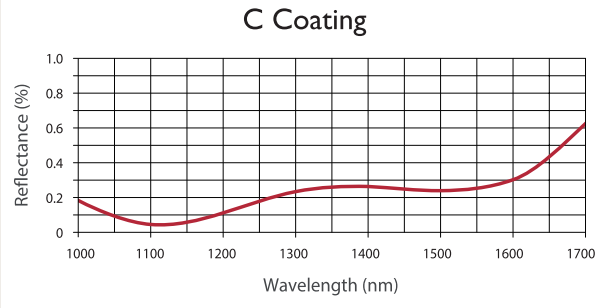
Standard Coatings*			
Lens Series	**Coating**	**λ Range (nm)**	**Reflectance**
352xxx, 353xxx, 354xxx, 355xxx	MLBB-A	350 - 700	$R_{avg} \leq 0.50\%$
352xxx, 354xxx, 355xxx	MLBB-B	600 - 1050	$R_{max} < 1.00\%$
352xxx, 354xxx, 355xxx	MLBB-C	1050 - 1600	$R_{max} < 1.00\%$
355xxx	MLBB-Q	1300 - 1700	$R_{max} < 0.25\%$
356xxx, 357xxx	UVA	350 - 500	$R_{max} < 1.00\%$

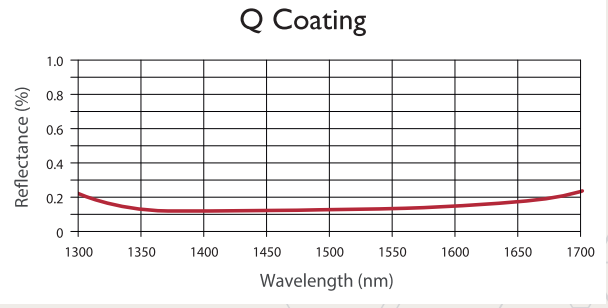
* LightPath's rigorous qualification process ensures all standard coatings will pass the abrasion and adhesion resistance requirements of ISO+9211-4-196.

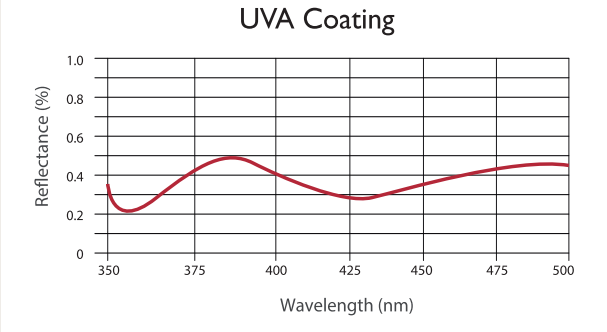
Typical Coating Curves











支持客户定制化 更多信息请联系我们

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