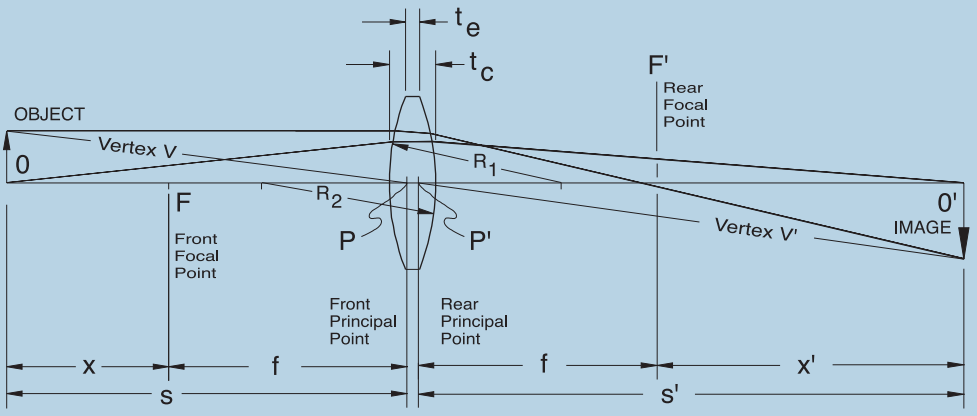
Spherical Lens Parameters



Ø = Lens Diameter

$M = \frac{S'}{S}$ Magnification or Conjugate Ratio

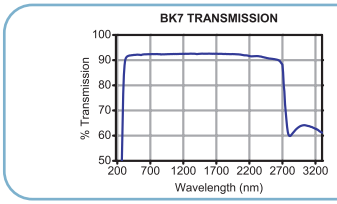
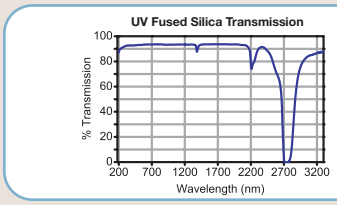
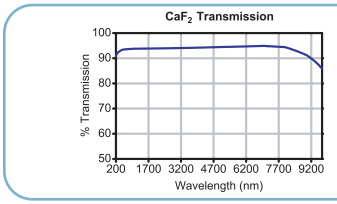
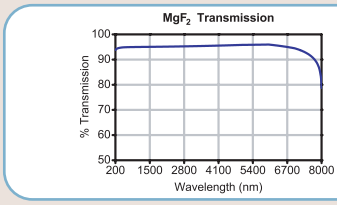
f = EFL (Effective Focal Length)

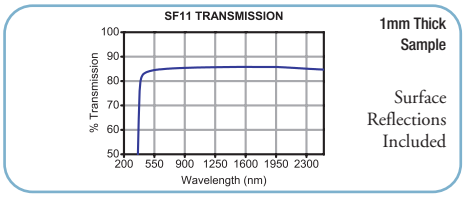
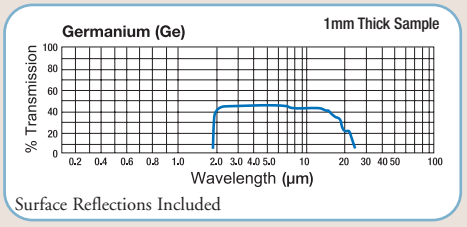
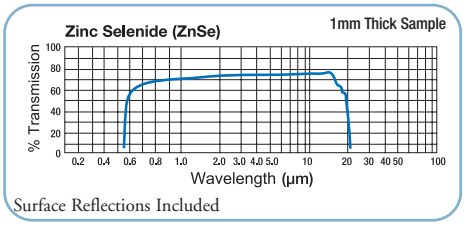
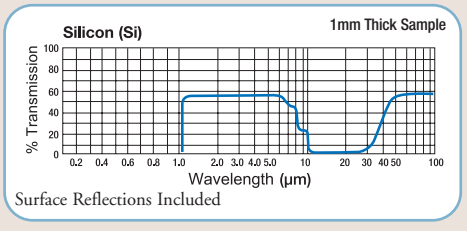
$\frac{1}{f} = \frac{1}{S} + \frac{1}{S'}$ Paraxial Lens Formula (assumes $\sin\theta \approx \theta$)

S = Object Distance, positive for objects to the left of the front principal point P.

S' = Image Distance, positive for images to the right of the rear rear principal point P'

Transmission of Various Materials

GLASS	DESCRIPTION	TRANSMISSION	
BK7	BK7 is a high-quality optical glass commonly used to make lenses intended for laboratory use. It has excellent mechanical and optical properties as well as good transmission in the visible and IR.	350nm to 2.0µm	 1mm Thick Sample Surface Reflections Included
UV Fused Silica	UV fused silica is an excellent material for the transmission of UV light. It is durable and has good mechanical properties $T_{external} \geq 80\%/cm$ @ 185nm $T_{internal} \geq 88\%/cm$ @ 185nm	185nm to 2.1µm	 1mm Thick Sample Surface Reflections Included
CaF_2	Calcium fluoride provides great transmission from the UV to the IR. Synthetic CaF_2 is used to improve deep UV transmission and to increase the damage threshold.	180nm to 8.0µm	 1mm Thick Sample Surface Reflections Included
MgF_2	Magnesium fluoride, an extremely rugged and durable material, is transparent over an extensive range of wavelengths from the UV to the IR.	200nm to 6.0µm	 1mm Thick Sample Surface Reflections Included

GLASS	DESCRIPTION	TRANSMISSION	
SF11	This glass provides excellent chemical resistance and has a high refractive index, which allows for the same amount of refraction with less curvature. It is useful for constructing optics that would be extremely difficult to make from BK7.	420nm to 2.3µm	
Ge	The transmission characteristics of germanium in the IR region of the spectrum make it an ideal choice for imaging 2.0 - 16µm light. Ge plano-convex lenses are particularly well suited for more biomedical and military imaging applications.	2.0µm to 16µm	
ZnSe	With a transmission range from 600nm - 16µm, zinc selenide plano-convex lenses are ideal for IR applications. Due to the low absorption coefficient, these lenses are also particularly well suited for high-power CO_2 laser applications. In contrast to Ge and Si, which also transmit in this spectral range, ZnSe transmits some visible light, thereby allowing for visual alignment of the optic.	600nm to 16µm	
Si	Silicon plano-convex lenses are an ideal choice for applications from 1.2 - 8µm and are particularly well suited for imaging, biomedical, and military applications.	1200nm to 8.0 µm	

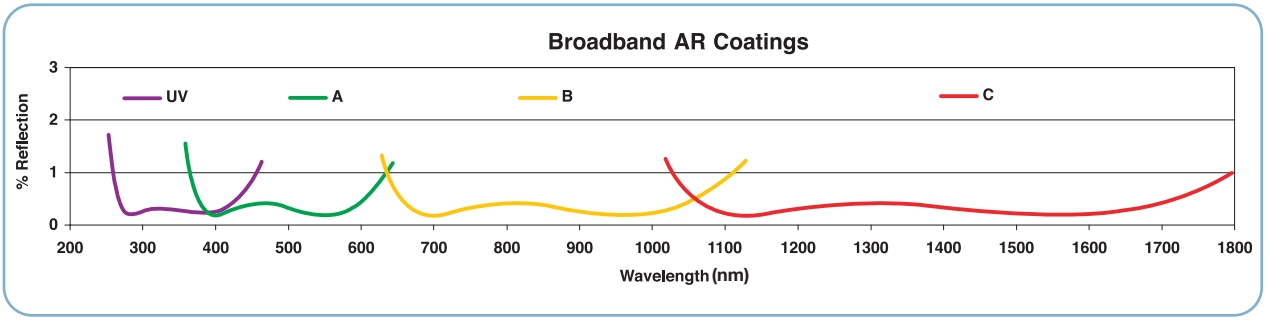
Spherical Singlet Anti-Reflection Coatings

Most of our standard optics are available with high-performance, multilayer AR coatings, which minimize surface reflections within the specified wavelength ranges. These coatings are designed for angles of incidence between 0° and 30° (0.5 NA). For optics intended to be used at large angles, consider using a custom coating optimized at a 45° of incidence; these coatings are effective from 25° to 52°. The plot shown below indicates the performance of the standard coatings in this family as a function of wavelength for a single surface. Broadband coatings have a typical absorption of 0.25% that is not shown in the reflectivity plots.

- R < 0.5% Average Over Band at 0° Incidence
- Less Angular Sensitivity within Angular Range
- Frequently Run Coatings are Listed Below

Normal Incidence Broadband Multilayer Anti-Reflective Coating

COATING CODE	WAVELENGTH RANGE	DESIGN ANGLE OF INCIDENCE	USEFUL ANGLE OF INCIDENCE
-UV	290-370nm	0°	0 to 30°
-A	350-650nm	0°	0 to 30°
-B	650-1050nm	0°	0 to 30°
-C	1050-1620nm	0°	0 to 30°



CaF_2 Vacuum UV: Plano-Convex Lenses

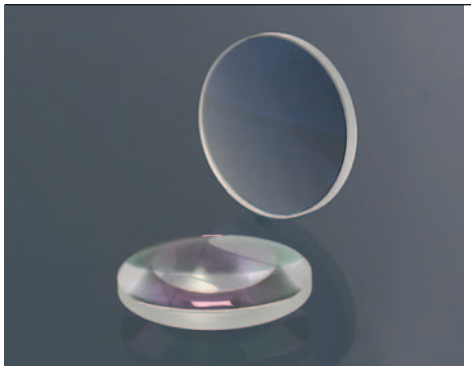
Specifications

- **Material:** Vacuum Grade CaF_2
- **Wavelength Range:** 180nm to 8.0µm Uncoated
- **Dia. Tolerance:** +0.00/-0.10mm
- **Focal Length Tolerance:** ±1% @ 248nm
- **Scratch-Dig:** 40-20
- **Centration:** 3arcmin
- **Clear Aperture:** 90% of Dia.
- **Design Wavelength:** 588nm (n = 1.43388)
- **Coating:** None

Plano-Convex Lenses: Material CaF_2

ITEM #	DIA (mm)	f (mm)	PRICE $	PRICE £	PRICE €	PRICE RMB	R (mm)	t_c (mm)	t_e[1] (mm)	f_b (mm)	SUGGESTED MOUNT[2]
LA5315	12.7	20.0	$ 98.00	£ 61.70	€ 91,10	¥ 935.90	8.7	4.3	1.5	17.0	LMR05
LA5183	12.7	50.0	$ 100.00	£ 63.00	€ 93,00	¥ 955.00	21.7	2.5	1.5	48.3	
LA5458	12.7	80.0	$ 90.00	£ 56.70	€ 83,70	¥ 859.50	34.7	2.1	1.5	78.5	
LA5370	25.4	40.0	$ 145.00	£ 91.40	€ 134,90	¥ 1,384.80	17.4	7.5	2.0	34.8	LMR1
LA5763	25.4	50.0	$ 155.00	£ 97.70	€ 144,20	¥ 1,480.30	21.7	6.1	2.0	45.7	
LA5042	25.4	75.0	$ 185.00	£ 116.60	€ 172,10	¥ 1,766.80	32.5	4.6	2.0	71.8	
LA5817	25.4	100.0	$ 92.00	£ 58.00	€ 85,60	¥ 878.60	43.4	3.9	2.0	97.3	
LA5012	25.4	150.0	$ 102.00	£ 64.30	€ 94,90	¥ 974.10	65.1	3.3	2.0	147.7	
LA5714	25.4	200.0	$ 103.00	£ 64.90	€ 95,80	¥ 983.70	86.8	2.9	2.0	198.0	
LA5255	25.4	250.0	$ 123.00	£ 77.50	€ 114,40	¥ 1,174.70	108.5	2.7	2.0	248.1	
LA5464	25.4	500.0	$ 97.00	£ 61.10	€ 90,20	¥ 926.40	216.9	2.4	2.0	498.3	
LA5956	25.4	750.0	$ 102.00	£ 64.30	€ 94,90	¥ 974.10	325.4	2.2	2.0	748.4	
LA5835	25.4	1000.0	$ 100.00	£ 63.00	€ 93,00	¥ 955.00	433.9	2.2	2.0	998.5	

1) Edge thickness given before 0.2mm @ 45° typical chamfer
2) See the Lens Mount Section, Starting on Page 153.



Magnesium Fluoride: Plano-Convex Lenses

With a transmission window from 200nm to 6µm, Vacuum Grade UV MgF_2 is an ideal material for many biological and military imaging applications. Magnesium Fluoride is extremely durable in comparison to other materials that are transparent from the UV to the IR. The C-axis of the MgF_2 crystalline structure is oriented to minimize birefringence.

- Average Transmission >90% from 200nm to 6µm

Specifications

- **Material:** Vacuum Grade UV MgF_2
- **Wavelength Range:** 200nm to 6µm Uncoated
- **Dia. Tolerance:** +0.00/-0.10mm
- **Center Thickness Tolerance:** ±0.2mm
- **Focal Length Tolerance:** ±2% @ 633nm
- **Scratch-Dig:** 40-20
- **Centration:** 3arcmin
- **Clear Aperture:** 90% of Dia.
- **Alignment to C-Axis:** <20arcmin
- **Coating:** None

Plano-Convex Lenses: Material MgF_2

ITEM #	DIA (mm)	FOCAL LENGTH (mm) 200nm	486nm	633nm	2.0µm	PRICE $	PRICE £	PRICE €	PRICE RMB	R (mm)	t_c (mm)	t_e[1] (mm)	f_b (mm)	SUGGESTED MOUNT[2]
LA6002	25.4	44.6	49.6	50	51.2	$ 333.00	£ 209.80	€ 309,70	¥ 3,180.20	18.9	6.9	2.0	45.0	LMR1
LA6003	25.4	53.3	59.4	60	61.4	$ 307.00	£ 193.40	€ 285,50	¥ 2,931.90	22.6	6.0	2.1	55.5	
LA6004	25.4	66.8	74.4	75	76.9	$ 291.00	£ 183.30	€ 270,60	¥ 2,779.10	28.3	5.0	2.0	71.4	
LA6005	25.4	89.3	99.4	100	102.8	$ 270.00	£ 170.10	€ 251,10	¥ 2,578.50	37.8	4.3	2.1	97.1	
LA6006	25.4	133.7	148.7	150	153.7	$ 250.00	£ 157.50	€ 232,50	¥ 2,387.50	56.6	3.2	1.8	147.7	
LA6007	25.4	178.2	198.3	200	205.0	$ 239.00	£ 150.60	€ 222,30	¥ 2,282.50	75.4	3.2	2.1	197.7	
LA6008	25.4	222.8	247.9	250	256.2	$ 229.00	£ 144.30	€ 213,00	¥ 2,187.00	94.3	2.8	1.9	248.0	
LA6009	25.4	445.5	495.8	500	512.5	$ 218.00	£ 137.30	€ 202,70	¥ 2,081.90	188.5	2.6	2.2	498.1	
LA6010	25.4	891.1	991.6	1000	1024.9	$ 213.00	£ 134.20	€ 198,10	¥ 2,034.20	377.0	2.4	2.2	998.3	

1) Edge thickness given before 0.2mm @ 45° typical chamfer.
2) See the Lens Mount Section, Starting on Page 153.