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## Introduce

CeNing Optics Co., Ltd is a China-based optical company specializing in producing optical components used to control light.

Our commitment is to deliver excellent quality products on time and provide best service.

Our products include prisms, lenses, windows, beamsplitters, waveplates, polarizers, mirrors, filters and related products. We supply all these optical components not only in standard design, but also in customized design.

CeNing Optics has whole production lines from cutting, polishing to coating process. We own two factories; one factory located in Jinan produces flat optics only. The other factory produces spherical optics. We consist of a skilful team included 15 engineers and 175 workers in total.

Our products have been delivered to global market mainly in North America, Europe and Asia. Our customers are from industry, university, government laboratories.

Whatever industry you may be in, we are committed to be a long term and reliable supplier of your company.

### **Prototyping and volume-production**

With our extensive tooling inventory, CeNing Optics can produce prototype in short term with very low tooling cost. We have enough facilities and people to manufacture large quantity products in schedule and on time.

### **Quality assurance**

Every product before shipped out need to pass through inspection to meet customer requirements. Optical metrologies included spectral photometer, goniometer, interferometers ensure the measurement of all specifications.

### **Customized Design**

CeNing Optics is dedicated to manufacture optical components based on individual customer requirements. We can use our capability to create products that meet customer needs. We are willing to take on more specialized projects to make special optical components.

*Meet or exceed your quality needs*

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## CeNing in Fuzhou

International sales office  
Site of Export-Import Operations

- ※ Global Customers Service
- ※ Experienced sales Team
- ※ Fast response, quote and reply in 24 hours



## CeNing in Jinan - Production Base

**ShanDong Ming Shun Optics**  
Flat Optics Factory

Our production base is located in Jinan.  
Whole process: Cutting, grinding, edging, polishing, coating  
Interferometric testing.

Staff: 130 people; Engineers: 10 people;  
Area: More than 2500m<sup>2</sup>



Mr. ZhengGang Yu  
(President, Supervisor)

## Flat Optics Workshop



### Coating Workshop



### Spherical optics factory

Conventional Polishing  
High-Speed Polishing



Inventory of Tools, Radius Templets  
More than 1000 templets

### Spherical Optics Workshop



## Select material for optics

Different optical material have different characteristics, Selecting a proper glass material is very important for optical design. Following factors need be considered when selecting a material.

- ※ Transmission wavelength region
- ※ Index of refraction, abbe number
- ※ Thermal expansion
- ※ Density, Mechanical and chemical characteristics
  
- ※ Cost of material. Some of materials like Fused Silica are much expensive.

Below are basic information of optical glasses that are often used.

Glass name	Index (n <sub>d</sub> )	Abbe (v <sub>d</sub> )	Density (g/cm <sup>3</sup> )	Coefficient of Thermal expansion (10 <sup>-6</sup> /k)	Transparency Range(μm)
N-FK1	1.470	66.82	2.30	8.10	0.32--2.4
N-ZK7	1.508	61.06	2.43	4.55	0.35--2.4
N-BK7	1.517	64.20	2.52	7.10	0.33--2.4
B270	1.523	58.50	2.55	8.20	0.35--2.4
N-SK11	1.564	60.80	3.05	6.50	0.35--2.4
N-BAK4	1.569	56.04	2.83	7.00	0.37--2.4
N-SK12	1.583	59.46	3.28	6.65	0.35--2.4
N-F2	1.620	36.35	2.67	8.40	0.39--2.4
N-LAK22	1.651	55.89	3.73	8.00	0.34--2.4
N-SF2	1.647	33.87	3.86	8.10	0.38--2.4
N-SF5	1.672	32.22	4.09	7.55	0.38--2.4
N-LAF3	1.717	47.89	4.44	8.00	0.38--2.4
N-LAF7	1.749	34.98	4.22	5.40	0.38--2.4
N-SF11	1.785	25.80	5.41	6.20	0.40--2.4
N-LASF44	1.804	46.58	4.72	7.00	0.38--2.4
N-SFL6	1.805	25.39	3.37	9.00	0.39--2.4
N-SF57	1.846	23.80	3.52	9.80	0.40--2.4

Fused silica	1.458	67.70	2.20	0.55	0.19--2.5
Borosilicate	1.474	65.70	2.23	3.25	0.35--2.4
Silicon	1.472	65.70	2.33	3.25	1.2--7.0
CaF <sub>2</sub>	1.434	94.99	3.18	18.85	0.17--7.8
Sapphire	1.768	72.24	3.99	8.4	0.18--4.8
Ge	4.00@10μm			5.7	1.9--16.0
ZnSe	2.40@10μm			7.1	0.63--18.0

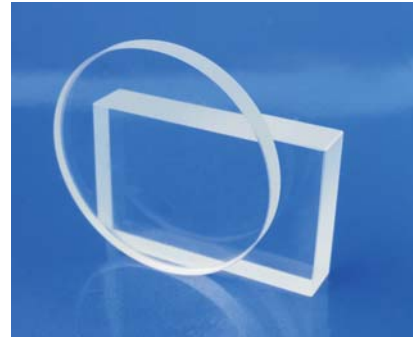
For more information of optical glass, please visit the website of material manufacturers: Schott, or CDGM Glass.

# Windows

Windows are glass with parallel surfaces used to enable optical radiation to pass from one environment to another without allowing environments to mix.

Material, transmission, scattering, wavefront distortion, damage threshold and resistance to certain environments should be considered when selecting windows.

**Materials:** N-BK7  
 UV Fused silica  
 Borofloat, Pyrex  
 CaF<sub>2</sub>, BaF<sub>2</sub>  
 Sapphire  
 Silicon  
 Other optical glasses from Schott, CDGM



## General Specifications

	Low Grade	Standard Grade	High grade
Dimensional tolerance	±0.1mm	±0.05mm	±0.05mm
Surface quality	60-40 S/D	20-10 S/D	10-5 S/D
Parallelism	3 arcmin	1 arcmin	30 arcsec
Flatness	λ/2 @ 633nm	λ/4 @ 633nm	λ/8 @ 633nm
Bevel	Protective bevel	Protective bevel	Protective bevel

## Typical Sizes

### Round Diameter(mm)

φ5.0	φ10.0	φ12.7	φ15.0	φ20.0
φ25.4	φ30.0	φ38.1	φ50.8	φ76.2

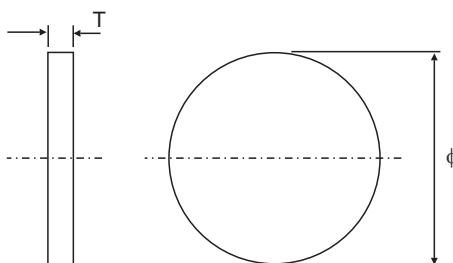
### Square W X H (mm)

5.0x5.0	10.0x10.0	15.0x15.0
20.0x20.0	25.0x25.0	50.0x50.0

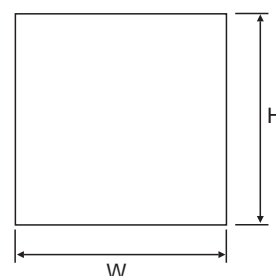
### Thickness(mm)

0.5	1.0	1.5	2.0	3.0
4.0	5.0	6.0	8.0	10.0

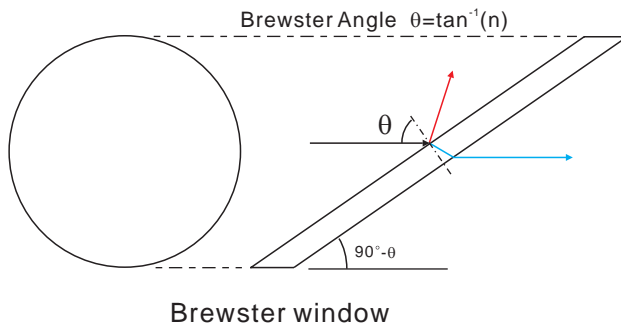
*other sizes and shapes are available.*



Round Shape



Square Shape



### Choose Anti-reflective Coatings

- Single layer MgF<sub>2</sub>
- Multiple layers AR coating
  - R < 0.25 % @ Laser line
  - R < 0.5% @ Broadband Wavelength

### How to order Windows? Example:

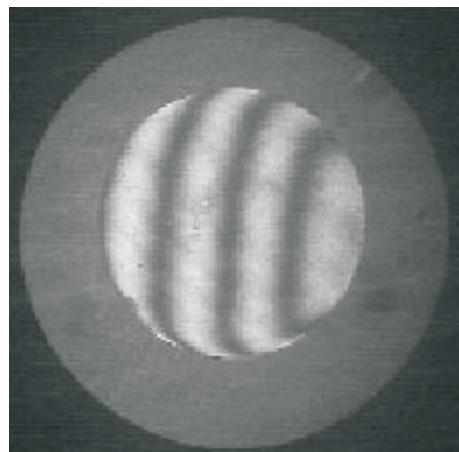
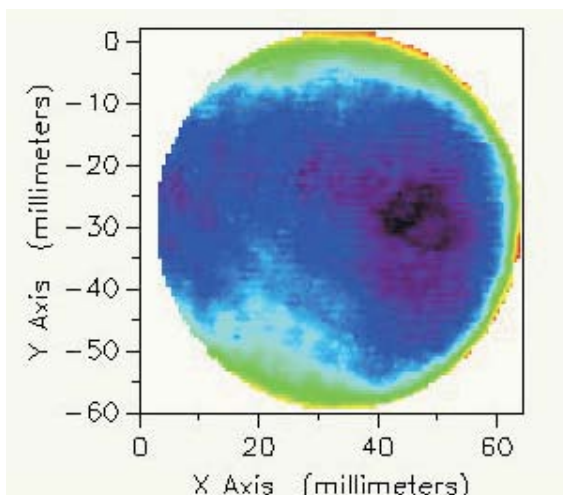
Material: **N-BK7**  
 Size: **dia 12.7 ± 0.1 mm**  
 Thickness: **2 ± 0.1 mm**  
 Parallelism: **± 1'**  
 Polishing quality: **Quality: 20-10 s/d, Flatness: λ/4 @ 633nm**

Coating **AR @ 808nm on both surfaces R < 0.25%, AOI = 0°**

Price on request

Custom Design

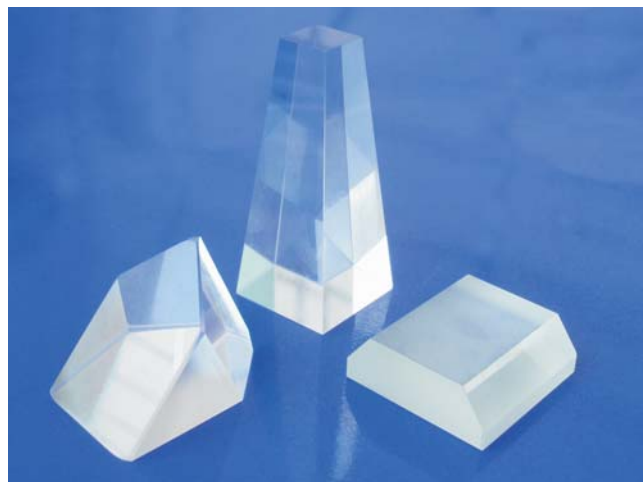
Volume Discount





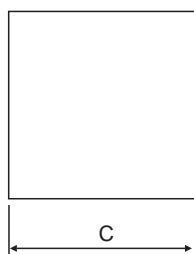
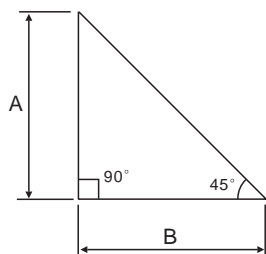
# Prisms

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# Right Angle Prisms

Right angle prisms are most popular of all prisms. Right angle prisms are used to deviate beam through  $90^\circ$ , when beam enters normal to right sides, and as also a retroreflector to deviate beam through  $180^\circ$  when beam enters normal to hypotenuse.



## General Specifications

Dimensional tolerance  
 Surface quality  
 Surface Flatness  
 Angular tolerance  
 Clear aperture  
 Bevel

## Standard Precision

$\pm 0.1\text{mm}$   
 40-20 S/D  
 $\lambda/4 @ 632.8\text{nm}$   
 $\pm 3 \text{ arcmin}$   
 $>85\%$   
 Protective bevel

## High precision

$\pm 0.05\text{mm}$   
 10-5 S/D  
 $\lambda/8 @ 632.8\text{nm}$   
 $\pm 1 \text{ arcmin}$   
 $>85\%$   
 Protective bevel

**Material:** N-BK7, UV Fused Silica, other optical glass

## Typical Sizes

AxBxC(mm)	AxBxC(mm)
1.0x1.0x1.0	15.0x15.0x15.0
2.0x2.0x2.0	18.0x18.0x18.0
3.0x3.0x3.0	20.0x20.0x20.0
5.0x5.0x5.0	25.4x25.4x25.4
10.0x10.0x10.0	38.1x38.1x38.1
12.7x12.7x12.7	50.8x50.8x50.8

## Angular accuracy ( $45^\circ-90^\circ-45^\circ$ )

<15"	<30"	<1'	<2'	<3'
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## Choose Coatings (Please specify which surfaces require coatings)

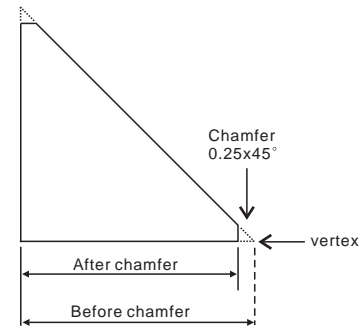
- Single layer  $\text{MgF}_2$
- Anti-reflective coating,  $R < 0.25\%$  @ design wavelength
- High reflective dielectric coating.
- Protected Aluminum

**Prisms Manufacturing capability:**

- Size: 0.5x0.5x0.5mm----150x150x150mm
- Surface quality: up to 10-5 S/D
- Flatness: up to  $\lambda/10$  @633nm
- Angular accuracy: up to  $\pm 5$  arcsec
- Side Perpendicularity: up to  $\pm 30$  arcsec

Unless specified otherwise, any dimension from vertex to surface (or, from one vertex to another vertex) is the dimension BEFORE-Chamfer.

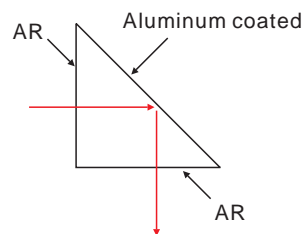
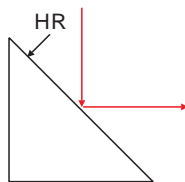
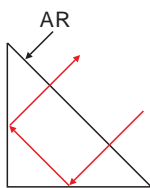
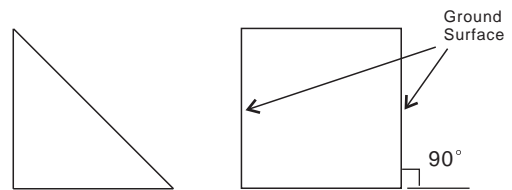
Unchamfered edge is available upon request.



Unless specified otherwise, the tolerance of angle between ground surface and polished surface is

- 10' for size < 3x3x3mm
- 5' for size > 5x5x5mm

Higher accuracy is available upon request



**How to order Right-angle Prisms? Example:**

Material: **N-BK7**  
 Size: **10x10x10±0.05 mm**  
 Angular accuracy: **± 3'**  
 Polishing quality: **Quality: 20-10 s/d, Flatness:  $\lambda/4$ @633nm**  
 Coating: **AR @808nm on two leg surfaces R<0.25%**

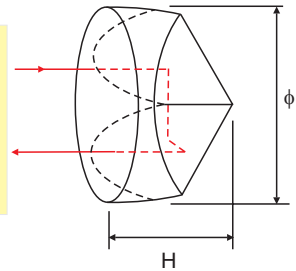
- Price on request
- Custom Design
- Volume Discount

# Corner Retroreflectors

Corner cube retroreflector has three mutually orthogonal reflecting surfaces. The corner cube reflect any light rays back towards their source. The reflection angle  $180^\circ$  is independent of the orientation of the corner cube, making it ideal where precision alignment is difficult.

## General Specifications

Material	N-BK7
Dimensional tolerance	$\pm 0.1\text{mm}$
Surface quality	40-20 S/D
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Bevel	Roof edges un-beveled, chip $< 0.1\text{mm}$ other edge Protective bevel



## Deviation $180^\circ$ accuracy:

$< 3''$	$< 5''$	$< 10''$	$< 15''$	$< 30''$
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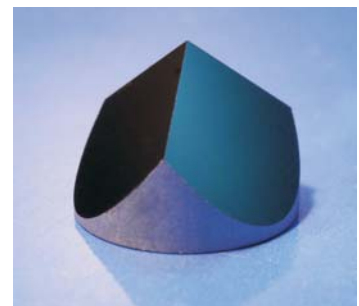
## Choose Coatings:

Reflective surfaces: Protected Silver coating + Black paint  
 Front surface: Anti-reflective coating



## Typical Sizes & deviation:

Diameter	Height	Deviation
$\phi 12.7$	10.2	$180^\circ \pm 5''$
$\phi 15.0$	11.4	$180^\circ \pm 5''$
$\phi 25.4$	19.1	$180^\circ \pm 5''$
$\phi 38.1$	29.2	$180^\circ \pm 5''$
$\phi 50.8$	38.1	$180^\circ \pm 5''$



## How to order Corner Retroreflector? Example:

Material: **N-BK7**  
 Size and tolerance:  **$\phi 12.7 \times 10.2 \pm 0.05\text{ mm}$**   
 Deviation:  **$\pm 5''$**   
 Polishing quality: **Quality: 20-10 s/d, Flatness:  $\lambda/8 @ 633\text{nm}$**   
 Coating: **AR @ 808nm on front surface**  
**Silver + Black paint on reflective surfaces**

Price  
on request

Custom  
Design

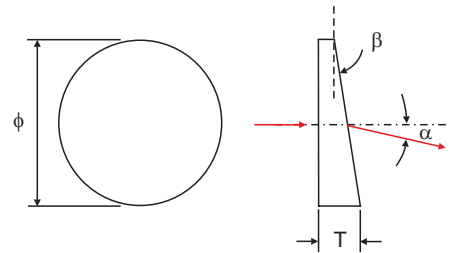
Volume  
Discount

# Wedges

Wedge prism is used individually to deviate a beam through some specified angles. When used in pairs, the wedge prisms can steer a beam anywhere within a circle described by full angle  $4\alpha$ , where is the deviation from a single prism. The beam steering is accomplished by rotating the two wedge prisms independently of each other.

## General Specifications

Material	N-BK7
Design wavelength	632.8nm, $n=1.51467$
Dimensional tolerance	$\pm 0.1\text{mm}$
Surface quality	60-40
Flatness	$\lambda/4 @ 632.8\text{nm}$
Wedge tolerance	$\pm 1 \text{ arcmin}$
Thickness of thin edge	3.0mm
Bevel	Protective bevel

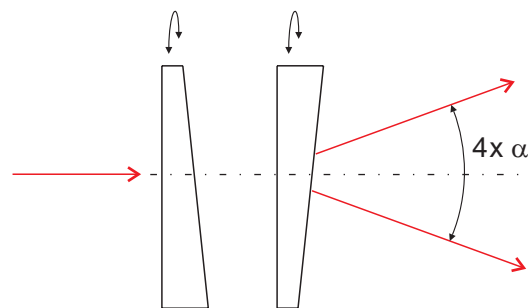


## Typical Sizes

$\phi$ (mm)	Deviation angle( $\alpha$ )	Wedge angle( $\beta$ )	T(mm) Thickest
$\phi 25.4$	$1^\circ$	$1^\circ 57'$	3.86
$\phi 25.4$	$2^\circ$	$3^\circ 53'$	4.72
$\phi 25.4$	$4^\circ$	$7^\circ 41'$	6.43
$\phi 25.4$	$6^\circ$	$11^\circ 21'$	8.11
$\phi 25.4$	$8^\circ$	$14^\circ 51'$	9.74
$\phi 25.4$	$10^\circ$	$18^\circ 08'$	11.33



Square shape is available.



## How to order Wedges? Example:

Material	N-BK7
Size and tolerance	$\phi 15 \times 3.0 \pm 0.1 \text{ mm}$
Angle and accuracy	$7^\circ 41' \pm 3'$
Polishing quality	Quality: 60-40 s/d, Flatness: $\lambda/4 @ 633\text{nm}$
Coating	Single Layer MgF2 @ 550nm

Price on request

Custom Design

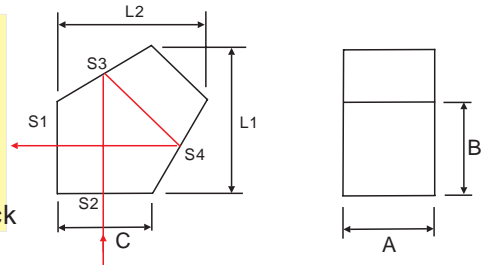
Volume Discount

# Penta Prisms

Penta prisms are used to deviate an incident beam 90° independent of small positional changes of the prism with respect to the beam. The image is neither inverted nor reversed.

## General Specifications

Material	N-BK7
Dimensional tolerance	±0.1mm
Surface quality	60-40 S/D
Flatness	λ/4 @632.8nm
Bevel	Protective bevel
Surfaces S1 & S2	Single layer MgF <sub>2</sub> coating
Surfaces S3 & S4	Aluminized and painted black

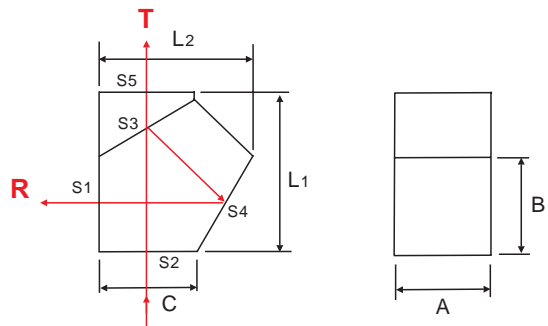


## Deviation 90° accuracy:

<10"	<15"	<30"	< 1'
------	------	------	------

## Typical Size

AxBxC(mm)	L1=L2(mm)
6.0x7.0x7.0	9.90
10.0x10.0x10.0	14.14
15.0x15.0x15.0	21.21
20.0x20.0x20.0	28.28
30.0x30.0x30.0	42.42



## Beamsplitting Penta

Beamsplitter penta prism is a penta prism glued with a wedge on a reflecting surface. It is used to divide an incident beam into two separate beams: Transmission and Reflection. The image is neither inverted nor reversed.

Beamsplitter ratio (R:T)    80%:20% for 630-680nm (±5%)

Angular Deviation:    <3"   <15"   <30"   <1'

### How to order Penta Prisms? Example:

Material: **N-BK7**  
 Size and tolerance: **15x15±0.05 mm**  
 Deviation: **± 15"**  
 Coating: **MgF<sub>2</sub> coating**

Price on request

Custom Design

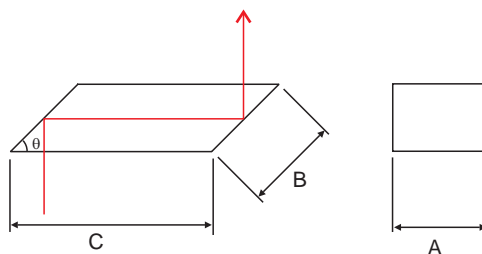
Volume Discount

# Rhomboid Prisms

Rhomboid prism is used to displace a laser beam without changing its direction. The displacement is equal to the length of the prism.

## General Specifications

Material	N-BK7
Dimensional tolerance	$\pm 0.1$ mm
Surface quality	60-40 S/D
Flatness	$\lambda/4 @ 632.8$ nm
Bevel	Protective bevel



Deviation accuracy	<30"	<1'	<3'
(Parallelism of input and output beam)			

## Typical Sizes

AxB(mm)	C(mm)	$\theta$
5.0x5.0	7.1	45°
10.0x10.0	14.2	45°
15.0x15.0	21.2	45°
20.0x20.0	28.3	45°
25.0x25.0	35.4	45°

### How to order Rhomboid prisms? Example:

Material: N-BK7  
 Size: AxB=15.0x15.0, C=21.2mm  $\pm 0.1$  mm  
 Angle and accuracy: 45°  $\pm 1'$   
 Polishing quality: Quality: 60-40 s/d, Flatness:  $\lambda/4 @ 633$  nm  
 Coating: AR @ 1064nm at entrance/exit surfaces

Price on request

Custom Design

Volume Discount

# Dove Prisms

Dove prisms can be used as an image rotator, the output image rotates through twice the angle that the prism rotates through. Dove prism also can be used as a retroreflectors.

## General Specifications

Material	N-BK7
Dimensional tolerance	$\pm 0.1$ mm
Surface quality	60-40 S/D
Flatness	$\lambda/2 @ 632.8$ nm
Bevel	Protective bevel

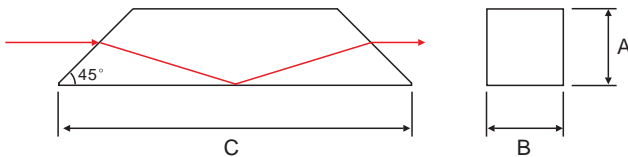


Angular tolerance:

<30"	<1'	<3'
------	-----	-----

## Typical Sizes

AxB(mm)	C(mm)	$\theta$
5.0x5.0	21.1	45°
10.0x10.0	42.3	45°
15.0x15.0	62.4	45°
20.0x20.0	84.5	45°



## How to order Dove prisms? Example:

Material: **N-BK7**  
 Size and tolerance: **15.0x15.0, C=62.4mm  $\pm 0.1$  mm**  
 Angle and accuracy: **45°  $\pm 1'$**   
 Polishing quality: **Quality: 60-40 s/d, Flatness:  $\lambda/2 @ 633$  nm**  
 Coating: **AR @780nm at entrance/exit surfaces**

Price  
on request

Custom  
Design

Volume  
Discount



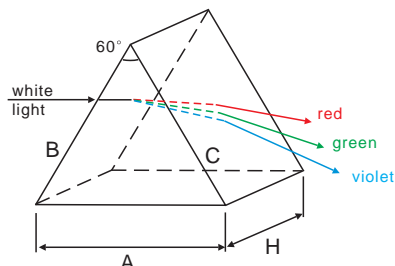
# Equilateral Dispersing Prisms

Equilateral prisms has three equal  $60^\circ$  angles, and are mostly used to disperse the spectrum.

## General Specifications

Material	N-SF11
Dimensional tolerance	$\pm 0.1$ mm
Surface quality	60-40 S/D
Flatness	$\lambda/2 @ 633$ nm
Bevel	Protective bevel

Three Angles:  $\theta = 60^\circ$   
 Angular tolerance: 3'



## Typical Sizes

A=B=C(mm)	H(mm)	$\theta$
15.0	15.0	$60^\circ$
25.4	25.4	$60^\circ$
30.0	30.0	$60^\circ$
38.1	38.1	$60^\circ$
50.8	50.8	$60^\circ$



## How to order equilateral dispersing prisms? Example:

Material: N-SF11  
 Size and tolerance: 15.0x15.0, H=15mm  $\pm 0.1$  mm  
 Angle and accuracy:  $60^\circ \pm 3'$   
 Polishing quality: Quality: 60-40 s/d, Flatness:  $\lambda/2 @ 633$ nm  
 Coating: Single layer MgF2 at three surfaces

Price on request

Custom Design

Volume Discount

# Anamorphic Prisms

The Anamorphic prisms are used in pairs to magnify input beam size along one axis while leaving the other axis unchanged. The elliptical laser diode beams can be transferred into nearly circular beams.

By adjusting the orientation of prisms( $\alpha_1$  and  $\alpha_2$ ), the magnification range from 2x to 6x.

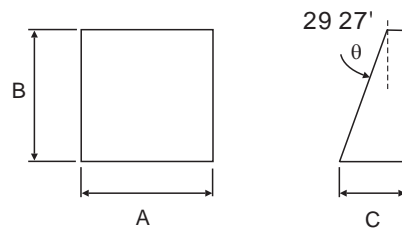
## General Specifications

Material	N-SF11
Dimensional tolerance	$\pm 0.1\text{mm}$
Surface quality	60-40 S/D
Surface flatness	$\lambda/8 @ 632.8\text{nm}$
Bevel	Protective bevel

Typical angle:  $\theta = 29^\circ 27'$   
 Angular tolerance:  $30''$

## Typical Size

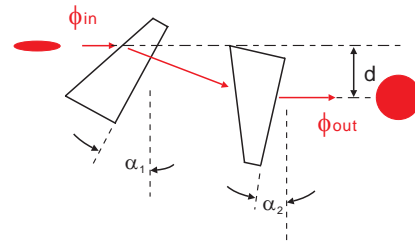
A=B (mm)	C (mm)
12.0 x 12.0	8.5



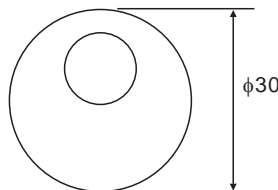
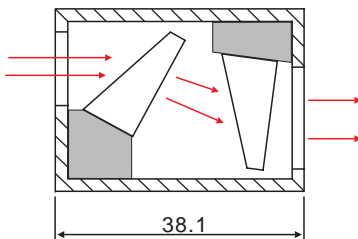
Design wavelength 830nm

Magnification	Prisms position	
	$\alpha_1$	$\alpha_2$
x 2.0	$21.2^\circ$	$6.0^\circ$
x 3.0	$30.4^\circ$	$0.1^\circ$
x 4.0	$35.2^\circ$	$-2.5^\circ$
x 5.0	$38.2^\circ$	$-3.9^\circ$

Displacement(d) depend on the space between two prisms.



## Mounted Anamorphic Prisms



### How to order mounted anamorphic prisms? Example:

Magnification: **x 3**  
 Coating: **Single Layer MgF2 @ 830nm**

Price  
on request

Custom  
Design

Volume  
Discount

## Other prisms

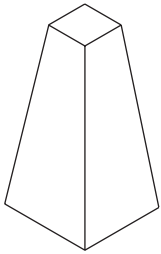
### Capability

Shape:	Any shape
Minimum sizes:	0.5x0.5x0.5mm
Dimensional tolerance:	up to $\pm 0.01$ mm
Flatness:	up to $\lambda/10@632.8$ nm
Surface quality:	up to 10-5 S/D
Angle tolerance:	up to $\pm 3$ arcsec

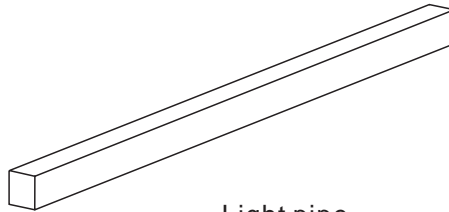
Price  
on request

Custom  
Design

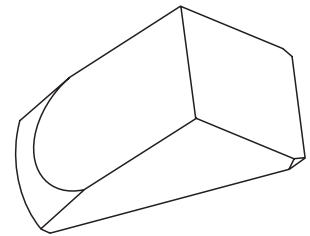
Volume  
Discount



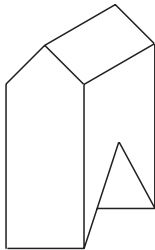
Tapered Light pipe



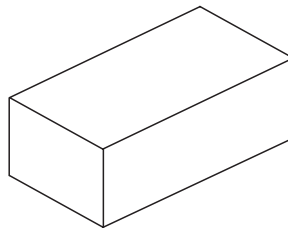
Light pipe



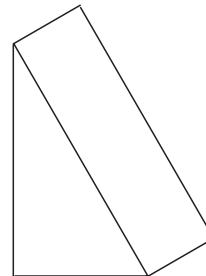
Half Penta



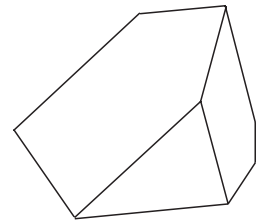
Reversion Prism



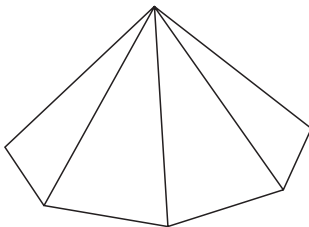
Block



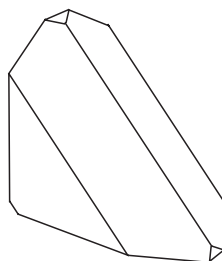
Littrow Prism



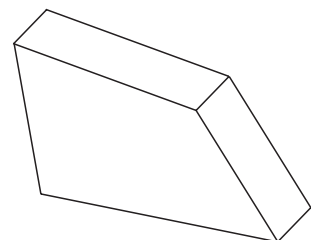
Schmidt Prism



Tapered Prism  
(6- facets)



Amici Prism



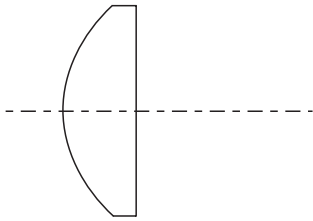
Pellin-Broca

# Lenses

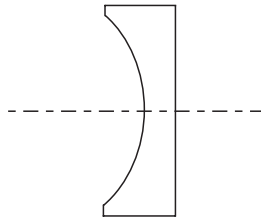
- ※ Singlets-----19
  - Plano-Convex lenses-----20
  - Plano-Concave lenses-----22
  - Double-Convex lenses-----24
  - Double-Concave lenses-----25
  - Convex-Concave lenses-----26
- ※ Cylindrical Lenses-----27
  - Plano-Convex lenses-----27
  - Plano-Concave lenses-----29
- ※ Achromatic lenses (Doublets)-----31
- ※ Rods (light pipes)-----33
- ※ Balls-----33



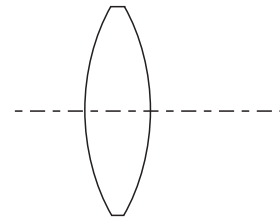
# Singlets



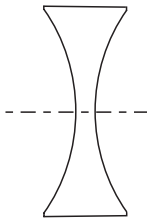
Plano-Convex



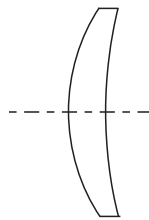
Plano-Concave



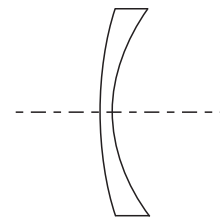
Double-Convex



Double-Concave

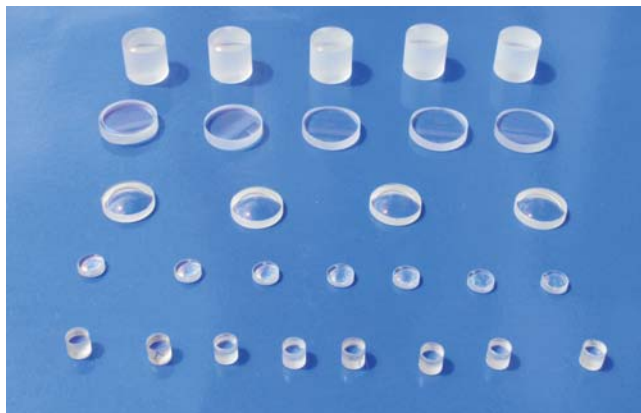


Convex-Concave(+)



Convex-Concave(-)

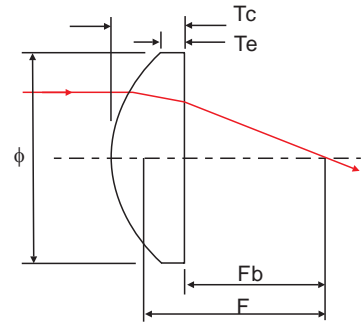
Specifications	Manufacturing Capability
Configuration	See above
Material	Optical glass
Focal length(F)	$\pm 2\text{mm}$ ----- $\pm 3000\text{mm}$
Diameter( $\phi$ )	$\phi 2\text{mm}$ ----- $\phi 200\text{mm}$
Radius(R)	2mm --- --1500mm
Central Thickness( $T_c$ )	0.5mm-----50mm
Edge Thickness( $T_e$ )	0.5mm-----50mm
Surface quality	10-5, 20-10, 40-20, 60-40, 80-50, 120-80s/d
Surface flatness	$N=1$ --10(Power), $\Delta N=0.2$ --2.0(Irreg)
Centration	30" 1', 2', 3', 5'



## Plano-Convex Lenses

### General Specifications

Diameter tolerance	$\pm 0.1\text{mm}$
Focal tolerance	$\pm 2\%$
Surface quality	60-40 S/D
Centration	3 arcmin
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	$>90\%$
Bevel	Protective bevel



### N-BK7 Plano-Convex Lenses

Design wavelength: 546nm,  $n=1.5187$

Item#	$\Phi(\text{mm})$	F(mm)	R(mm)	Tc(mm)	Te(mm)	Fb(mm)
LP01-6-10	$\phi 6.0$	10.0	5.2	2.45	1.5	8.41
LP01-6-15	$\phi 6.0$	15.0	7.79	2.10	1.5	13.65
LP01-6-20	$\phi 6.0$	20.0	10.37	1.95	1.5	18.70
LP01-6-30	$\phi 6.0$	30.0	15.56	1.79	1.5	28.82
LP01-12-20	$\phi 12.7$	20.0	10.37	3.97	1.8	17.39
LP01-12-30	$\phi 12.7$	30.0	15.56	3.16	1.8	27.92
LP01-12-40	$\phi 12.7$	40.0	20.75	2.80	1.8	39.16
LP01-12-50	$\phi 12.7$	50.0	25.94	2.59	1.8	48.30
LP01-12-75	$\phi 12.7$	75.0	38.90	2.32	1.8	73.47
LP01-12-100	$\phi 12.7$	100.0	51.88	2.19	1.8	98.57
LP01-18-30	$\phi 18.0$	30.0	15.56	4.67	1.8	26.92
LP01-18-50	$\phi 18.0$	50.0	25.94	3.41	1.8	47.76
LP01-18-75	$\phi 18.0$	75.0	38.90	2.86	1.8	73.11
LP01-25-50	$\phi 25.4$	50.0	25.94	5.32	2.0	46.51
LP01-25-75	$\phi 25.4$	75.0	38.90	4.13	2.0	72.27
LP01-25-100	$\phi 25.4$	100.0	51.88	3.58	2.0	97.66
LP01-25-150	$\phi 25.4$	150.0	77.80	3.04	2.0	147.98
LP01-25-200	$\phi 25.4$	200.0	103.75	2.78	2.0	198.18
LP01-25-250	$\phi 25.4$	250.0	129.72	2.62	2.0	248.35
LP01-30-50	$\phi 30.0$	50.0	25.94	7.28	2.5	45.21
LP01-30-75	$\phi 30.0$	75.0	38.90	5.51	2.5	71.36
LP01-30-100	$\phi 30.0$	100.0	51.88	4.72	2.5	96.91
LP01-30-200	$\phi 30.0$	200.0	103.75	3.6	2.5	197.75
LP01-38-100	$\phi 38.0$	100.0	51.83	6.6	3.0	95.70
LP01-38-200	$\phi 38.0$	200.0	103.66	4.8	3.0	196.50
LP01-38-300	$\phi 38.0$	300.0	155.60	4.2	3.0	297.23
LP01-50-100	$\phi 50.8$	100.0	51.88	9.65	3.0	93.67
LP01-50-200	$\phi 50.8$	200.0	103.75	6.16	3.0	195.96
LP01-50-300	$\phi 50.8$	300.0	155.60	5.09	3.0	296.62
LP01-50-500	$\phi 50.8$	500.0	259.40	4.25	3.0	497.28

## UV Fused Silica Plano-Convex Lenses

Design wavelength: 546nm, n=1.46008

Item#	Φ(mm)	F(mm)	R(mm)	Tc(mm)	Te(mm)	Fb(mm)
LP02-6-10	φ6.0	10.0	4.6	2.62	1.5	8.2
LP02-6-15	φ6.0	15.0	6.9	2.19	1.5	13.5
LP02-6-20	φ6.0	20.0	9.2	2.01	1.5	18.6
LP02-6-30	φ6.0	30.0	13.8	1.83	1.5	28.7
LP02-12-20	φ12.7	20.0	9.2	4.35	1.8	17.02
LP02-12-30	φ12.7	30.0	13.8	3.35	1.8	27.7
LP02-12-40	φ12.7	40.0	18.4	2.93	1.8	38.00
LP02-12-50	φ12.7	50.0	23.01	2.69	1.8	48.17
LP02-12-75	φ12.7	75.0	34.51	2.39	1.8	73.37
LP02-12-100	φ12.7	100.0	46.03	2.24	1.8	98.51
LP02-18-30	φ18.0	30.0	13.8	5.14	1.8	26.48
LP02-18-50	φ18.0	50.0	23.01	3.64	1.8	48.51
LP02-18-75	φ18.0	75.0	34.51	3.0	1.8	72.97
LP02-25-50	φ25.4	50.0	23.01	5.82	2.0	46.03
LP02-25-75	φ25.4	75.0	34.51	4.42	2.0	71.98
LP02-25-100	φ25.4	100.0	46.03	3.79	2.0	97.45
LP02-25-150	φ25.4	150.0	69.00	3.20	2.0	147.8
LP02-25-200	φ25.4	200.0	92.04	2.88	2.0	198.1
LP02-25-250	φ25.4	250.0	115.08	2.70	2.0	248.3

### Choose Anti-reflective Coatings

- Single layer MgF<sub>2</sub>
- Multiple layers AR coating
  - R<0.25 % @ Laser line
  - R<0.5% @ Broadband Wavelength

### How to order Singlet Lenses? Example:

Material: **N-BK7**  
 Shape: **Plano-convex**  
 Diameter: **φ12.7±0.1mm**  
 Focal, Radius: **F=+30mm, R=15.56mm**  
 Thickness: **Tc=3.0±0.1mm**  
 Surface quality: **60-40 S/D**  
 Flatness: **λ/4 @633nm**  
 Centration: **3'**  
  
 Coating: **AR @430--680nm, R<0.5%, AOI=0°**

Price  
on request

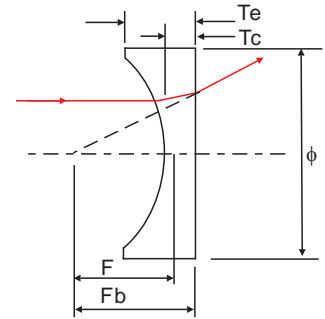
Custom  
Design

Volume  
Discount

## Plano-Concave Lenses

### General Specifications

Diameter tolerance	$\pm 0.1\text{mm}$
Focal tolerance	$\pm 2\%$
Surface quality	60-40 S/D
Centration	3 arcmin
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	$>90\%$
Bevel	Protective bevel



### N-BK7 Plano-Concave Lenses

Design wavelength: 546nm,  $n=1.5187$

Item#	$\Phi(\text{mm})$	F(mm)	R(mm)	T <sub>c</sub> (mm)	T <sub>e</sub> (mm)	F <sub>b</sub> (mm)
LP11-6-10	$\phi 6.0$	-10.0	-5.18	2.0	2.95	-11.30
LP11-6-15	$\phi 6.0$	-15.0	-7.79	2.0	2.60	-16.34
LP11-6-20	$\phi 6.0$	-20.0	-10.37	2.0	2.44	-21.30
LP11-6-30	$\phi 6.0$	-30.0	-15.56	2.0	2.29	-31.32
LP11-12-20	$\phi 12.7$	-20.0	-10.37	2.0	4.17	-21.33
LP11-12-30	$\phi 12.7$	-30.0	-15.56	2.0	3.40	-31.31
LP11-12-40	$\phi 12.7$	-40.0	-20.75	2.0	3.00	-41.32
LP11-12-50	$\phi 12.7$	-50.0	-25.94	2.0	2.79	-51.33
LP11-12-75	$\phi 12.7$	-75.0	-38.90	2.0	2.52	-76.31
LP11-12-100	$\phi 12.7$	-100.0	-51.88	2.0	2.39	-101.33
LP11-18-30	$\phi 18.0$	-30.0	-15.56	2.0	4.86	-31.32
LP11-18-50	$\phi 18.0$	-50.0	-25.94	2.0	3.61	-51.33
LP11-18-75	$\phi 18.0$	-75.0	-38.90	2.0	3.05	-76.30
LP11-25-50	$\phi 25.4$	-50.0	-25.94	2.0	5.32	-51.33
LP11-25-75	$\phi 25.4$	-75.0	-38.90	2.0	4.13	-76.31
LP11-25-100	$\phi 25.4$	-100.0	-51.88	2.0	3.58	-101.33
LP11-25-150	$\phi 25.4$	-150.0	-77.80	2.0	3.04	-151.30
LP11-25-200	$\phi 25.4$	-200.0	-103.75	2.0	2.78	-201.33
LP11-25-250	$\phi 25.4$	-250.0	-129.72	2.0	2.62	-251.39
LP11-30-50	$\phi 30.0$	-50.0	-25.94	2.0	6.77	-51.33
LP11-30-75	$\phi 30.0$	-75.0	-38.90	2.0	5.08	-76.31
LP11-30-100	$\phi 30.0$	-100.0	-51.88	2.0	4.22	-101.34
LP11-30-200	$\phi 30.0$	-200.0	-103.75	2.0	3.09	-201.34
LP11-38-100	$\phi 38.0$	-100.0	-51.88	2.0	5.60	-101.34
LP11-38-200	$\phi 38.0$	-200.0	-103.75	2.0	3.76	-201.34
LP11-38-300	$\phi 38.0$	-300.0	-155.60	2.0	3.16	-301.30
LP11-50-100	$\phi 50.8$	-100.0	-51.88	2.0	8.64	-101.34
LP11-50-200	$\phi 50.8$	-200.0	-103.75	2.0	5.16	-201.34
LP11-50-300	$\phi 50.8$	-300.0	-155.60	2.0	4.00	-301.30
LP11-50-500	$\phi 50.8$	-500.0	-259.40	2.0	3.25	-501.40



## UV Fused Silica Plano-Concave Lenses

Design wavelength: 546nm, n=1.46008

Item#	Φ(mm)	F(mm)	R(mm)	Tc(mm)	Te(mm)	Fb(mm)
LP12-6-10	φ6.0	-10.0	-4.6	2.0	3.1	-11.37
LP12-6-15	φ6.0	-15.0	-6.9	2.0	2.69	-16.37
LP12-6-20	φ6.0	-20.0	-9.2	2.0	2.50	-21.37
LP12-6-30	φ6.0	-30.0	-13.8	2.0	2.33	-31.37
LP12-12-20	φ12.7	-20.0	-9.2	2.0	4.54	-21.37
LP12-12-30	φ12.7	-30.0	-13.8	2.0	3.55	-31.37
LP12-12-40	φ12.7	-40.0	-18.40	2.0	3.13	-41.37
LP12-12-50	φ12.7	-50.0	-23.0	2.0	2.89	-51.37
LP12-12-75	φ12.7	-75.0	-34.5	2.0	2.59	-76.37
LP12-12-100	φ12.7	-100.0	-46.0	2.0	2.44	-101.37
LP12-18-30	φ18.0	-30.0	-13.8	2.0	5.34	-31.37
LP12-18-50	φ18.0	-50.0	-23.0	2.0	3.83	-51.37
LP12-18-75	φ18.0	-75.0	-34.5	2.0	3.20	-76.37
LP12-25-50	φ25.4	-50.0	-23.0	2.0	5.82	-51.37
LP12-25-75	φ25.4	-75.0	-34.5	2.0	4.42	-76.37
LP12-25-100	φ25.4	-100.0	-46.0	2.0	3.79	-101.37
LP12-25-150	φ25.4	-150.0	-69.0	2.0	3.18	-151.37
LP12-25-200	φ25.4	-200.0	-92.0	2.0	2.88	-201.37
LP12-25-250	φ25.4	-250.0	-115.0	2.0	2.70	-251.37

### Choose Anti-reflective Coatings

- Single layer MgF<sub>2</sub>
- Multiple layers AR coating
  - R<0.25 % @ Laser line
  - R<0.5% @ Broadband Wavelength

#### How to order Singlet Lenses? Example:

Material: N-BK7  
 Shape: Plano-concave  
 Diameter: φ12.7±0.1mm  
 Focal, Radius: F=-30mm, R=-15.56mm  
 Thickness: Tc=3.0±0.1mm  
 Surface quality: 60-40 S/D  
 Flatness: λ/4 @633nm  
 Centration: 3'  
  
 Coating: AR @430--680nm, R<0.5%, AOI=0°

Price  
on request

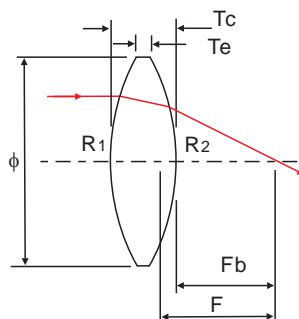
Custom  
Design

Volume  
Discount

## Double-Convex Lenses

### General Specifications

Diameter tolerance	$\pm 0.1$ mm
Focal tolerance	$\pm 2\%$
Surface quality	60-40 S/D
Centration	3 arcmin
Surface flatness	$\lambda/4$ @ 632.8nm
Clear aperture	>90%
Bevel	Protective bevel



### N-BK7 Double-Convex Lenses

Design wavelength: 546nm,  $n=1.5187$

Item#	$\phi$ (mm)	F(mm)	R1(R2)	Tc(mm)	Te(mm)	Fb(mm)
LB01-12-25	$\phi 12.7$	25.0	25.35	3.62	2.0	23.82
LB01-12-30	$\phi 12.7$	30.0	30.55	3.33	2.0	28.89
LB01-12-40	$\phi 12.7$	40.0	41.02	2.99	2.0	39.04
LB01-12-50	$\phi 12.7$	50.0	51.40	2.79	2.0	49.08
LB01-12-75	$\phi 12.7$	75.0	77.45	2.52	2.0	74.24
LB01-12-100	$\phi 12.7$	100.0	103.28	2.39	2.0	99.16
LB01-25-50	$\phi 25.4$	50.0	50.93	5.22	2.0	48.22
LB01-25-75	$\phi 25.4$	75.0	77.09	4.11	2.0	73.63
LB01-25-100	$\phi 25.4$	100.0	103.04	3.57	2.0	98.73
LB01-25-200	$\phi 25.4$	200.0	207.00	2.78	2.0	199.07
LB01-25-250	$\phi 25.4$	250.0	258.90	2.62	2.0	249.17
LB01-25-500	$\phi 25.4$	500.0	518.30	2.31	2.0	499.21

### UV Fused silica Double-Convex Lenses

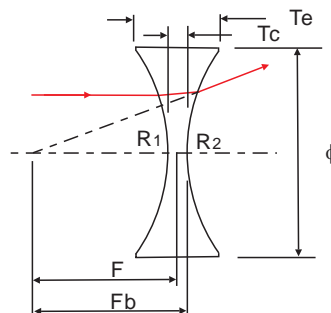
Design wavelength: 546nm,  $n=1.46008$

Item#	$\phi$ (mm)	F(mm)	R1(R2)	Tc(mm)	Te(mm)	Fb(mm)
LB02-12-25	$\phi 12.7$	25.0	22.39	3.84	2.0	23.66
LB02-12-30	$\phi 12.7$	30.0	27.04	3.51	2.0	28.77
LB02-12-40	$\phi 12.7$	40.0	36.31	3.12	2.0	38.92
LB02-12-50	$\phi 12.7$	50.0	45.62	2.9	2.0	49.06
LB02-12-75	$\phi 12.7$	75.0	68.7	2.6	2.0	74.21
LB02-12-100	$\phi 12.7$	100.0	91.6	2.5	2.0	99.11
LB02-25-50	$\phi 25.4$	50.0	45.08	5.65	2.0	48.01
LB02-25-75	$\phi 25.4$	75.0	68.23	4.39	2.0	73.39
LB02-25-100	$\phi 25.4$	100.0	91.6	3.77	2.0	98.69
LB02-25-200	$\phi 25.4$	200.0	183.65	2.88	2.0	199.09
LB02-25-250	$\phi 25.4$	250.0	229.60	2.70	2.0	249.06
LP02-25-500	$\phi 25.4$	500.0	458.8	2.35	2.0	498.30

## Double-Concave Lenses

### General Specifications

Diameter tolerance	$\pm 0.1\text{mm}$
Focal tolerance	$\pm 2\%$
Surface quality	60-40 S/D
Centration	3 arcmin
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	$>90\%$
Bevel	Protective bevel



### N-BK7 Double-Concave Lenses

Design wavelength: 546nm,  $n=1.5187$

Item#	$\Phi(\text{mm})$	F(mm)	$R_1(R_2)$	$T_c(\text{mm})$	$T_e(\text{mm})$	$F_b(\text{mm})$
LB11-12-20	$\phi 12.7$	-20.0	26.30	2.0	3.56	-25.68
LB11-12-30	$\phi 12.7$	-30.0	31.48	2.0	3.29	-30.67
LB11-12-40	$\phi 12.7$	-40.0	41.88	2.0	2.97	-40.70
LB11-12-50	$\phi 12.7$	-50.0	52.24	2.0	2.78	-50.68
LB11-25-50	$\phi 25.4$	-50.0	52.17	2.0	5.1	-50.7
LB11-25-75	$\phi 25.4$	-75.0	78.09	2.0	4.1	-75.7
LB11-25-100	$\phi 25.4$	-100.0	104.00	2.0	3.6	-100.7
LP11-25-150	$\phi 25.4$	-150.0	156.0	2.0	3.0	-151.3
LB11-25-200	$\phi 25.4$	-200.0	207.66	2.0	2.8	-200.7
LB11-25-250	$\phi 25.4$	-250.0	259.49	2.0	2.6	-250.7

### UV Fused silica Double-Concave Lenses

Design wavelength: 546nm,  $n=1.46008$

Item#	$\phi(\text{mm})$	F(mm)	$R_1(R_2)$	$T_c(\text{mm})$	$T_e(\text{mm})$	$F_b(\text{mm})$
LB12-12-20	$\phi 12.7$	-20.0	18.71	2.0	4.22	-20.67
LB12-12-30	$\phi 12.7$	-30.0	27.92	2.0	3.50	-30.7
LB12-12-40	$\phi 12.7$	-40.0	37.12	2.0	3.10	-40.7
LB12-12-50	$\phi 12.7$	-50.0	46.32	2.0	2.87	-50.7
LP12-25-50	$\phi 25.4$	-50.0	46.32	2.0	5.55	-50.7
LB12-25-75	$\phi 25.4$	-75.0	69.32	2.0	4.34	-75.7
LB12-25-100	$\phi 25.4$	-100.0	92.33	2.0	3.75	-100.7
LB12-25-150	$\phi 25.4$	-150.0	138.33	2.0	3.17	-150.7
LP12-25-200	$\phi 25.4$	-200.0	184.32	2.0	2.87	-200.7
LB12-25-250	$\phi 25.4$	-250.0	230.36	2.0	2.70	-250.7

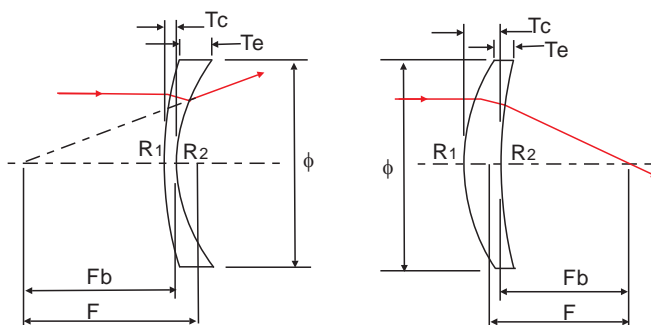
### Choose Anti-reflective Coatings

- Single layer  $\text{MgF}_2$
- Multiple layers AR coating
  - R<0.25 % @ Laser line
  - R<0.5% @ Broadband Wavelength

## Convex-Concave Lenses

### General Specifications

Diameter tolerance	$\pm 0.1\text{mm}$
Focal tolerance	$\pm 2\%$
Surface quality	60-40 S/D
Centration	3 arcmin
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	$>90\%$
Bevel	Protective bevel



Convex-Concave(-)    Convex-Concave(+)

### N-BK7 Convex-Concave Lenses

Item#	Type	$\Phi(\text{mm})$	F(mm)	R1(mm)	R2(mm)	Tc(mm)	Te(mm)	Fb(mm)
LM01-25-100	+	$\phi 25.4$	100.0	33.72	90.0	4.0	2.5	97.5
LM01-25-125	+	$\phi 25.4$	125.0	38.47	90.0	4.0	2.8	121.8
LM01-25-150	+	$\phi 25.4$	150.0	42.52	90.0	4.0	3.0	146.3
LM01-25-175	+	$\phi 25.4$	175.0	46.05	90.0	4.0	3.1	171.2
LM01-25-200	+	$\phi 25.4$	200.0	49.03	90.0	3.5	2.8	197.0
LM01-25-250	+	$\phi 25.4$	250.0	83.96	235.0	3.5	2.9	246.5
LM01-25-300	+	$\phi 25.4$	300.0	94.08	235.0	3.5	3.0	296.3
LM01-25-500	+	$\phi 25.4$	500.0	123.90	235.0	3.5	3.2	495.4
LM01-25-1K	+	$\phi 25.4$	1000.0	278.34	600.0	3.5	3.3	993.7
LM11-25-100	-	$\phi 25.4$	-100.0	90.0	32.59	3.0	4.5	-99.2
LM11-25-125	-	$\phi 25.4$	-125.0	90.0	37.26	3.0	4.2	-123.7
LM11-25-150	-	$\phi 25.4$	-150.0	90.0	41.42	3.0	4.0	-149.5
LM11-25-175	-	$\phi 25.4$	-175.0	90.0	44.86	3.0	3.8	-174.6
LM11-25-200	-	$\phi 25.4$	-200.0	90.0	47.84	3.0	3.7	-199.5
LM11-25-300	-	$\phi 25.4$	-300.0	235.0	93.13	3.0	3.5	-298.3
LM11-25-500	-	$\phi 25.4$	-500.0	235.0	122.6	3.0	3.3	-496.5
LM11-25-600	-	$\phi 25.4$	-600.0	600.0	204.08	3.0	3.2	-596.8

### How to order Singlet Lenses? Example:

Material: **N-BK7**  
 Shape: **Convex-concave**  
 Diameter:  **$\phi 25.4 \pm 0.1\text{mm}$**   
 Focal, Radius:  **$F=+100\text{mm}$ ,  $R1=33.72\text{mm}$ ,  $R2=90.0\text{mm}$**   
 Thickness:  **$Tc=3.0 \pm 0.1\text{mm}$**   
 Surface quality: **60-40 S/D**  
 Flatness:  **$\lambda/4 @ 633\text{nm}$**   
 Centration: **3'**  
 Coating: **AR @ 430--680nm,  $R < 0.5\%$ ,  $AOI = 0^\circ$**

Price  
on request

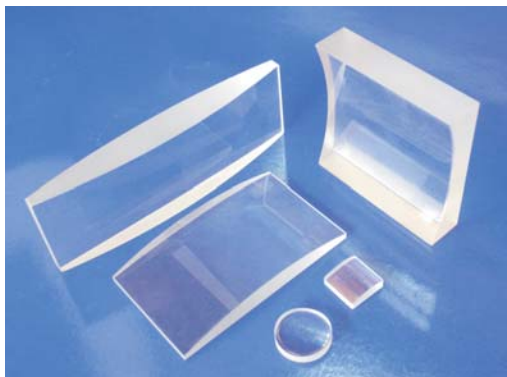
Custom  
Design

Volume  
Discount

# Cylindrical Lenses

## Cylindrical Lenses Capability:

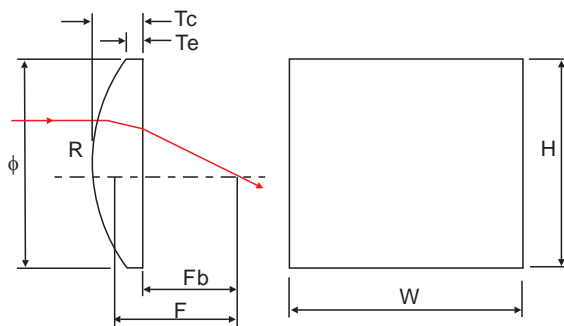
Configuration: Convex, Concave  
 Round:  $\phi 3$ --  $\phi 150$ mm  
 Rectangular: 2x2 --- 150x150mm  
 Radius: 1.5mm --- 3000mm  
 Surface quality: 10-5s/d --- 80-50s/d  
 Centration: 1--5 arcmin  
 Flatness: best Power 1, Irreg: 0.2



## Cylindrical Plano-Convex Lenses (Rectangular)

### General Specifications

Diameter tolerance	$\pm 0.1$ mm
Design wavelength	546.1nm, $n=1.5187$
Focal tolerance	$\pm 2\%$
Surface quality	60-40 S/D
Centration	3 arcmin
Surface flatness	$\lambda/4$ @ 632.8nm
Clear aperture	>90%
Bevel	Protective bevel



Rectangular type

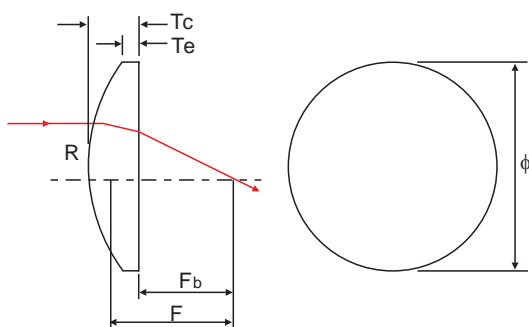
### N-BK7 Cylindrical Plano-Convex Lenses

Item#	WxH(mm)	F(mm)	R(mm)	Te(mm)	Tc(mm)	Fb(mm)
LC01-10x10-12.7	10.0x10.0	12.7	6.54	2.0	4.3	9.8
LC01-10x10-20	10.0x10.0	20.0	10.29	2.0	3.3	17.8
LC01-10x10-25	10.0x10.0	25.0	12.87	2.0	3.0	23.0
LC01-12x10-10	12.0x10.0	10.0	5.2	2.0	5.9	6.17
LC01-12x10-15	12.0x10.0	15.0	7.8	2.0	3.8	12.6
LC01-12x10-20	12.0x10.0	20.0	10.34	2.0	3.3	17.8
LC01-20x10-12.7	20.0x10.0	12.7	6.54	2.0	4.3	9.8
LC01-20x10-20	20.0x10.0	20.0	10.29	2.0	3.3	17.8
LC01-20x10-25	20.0x10.0	25.0	12.87	2.0	3.0	23.0
LC01-20x20-50	20.0x20.0	50.0	25.73	2.0	4.0	47.3
LC01-20x20-75	20.0x20.0	75.0	38.60	2.0	3.3	72.8
LC01-20x20-100	20.0x20.0	100.0	51.47	3.0	4.0	97.3
LC01-20x20-150	20.0x20.0	150.0	77.20	3.0	3.7	147.5

### N-BK7 Cylindrical Plano-Convex Lenses(Rectangular)

Item#	WxH(mm)	F(mm)	R(mm)	Te(mm)	Tc(mm)	Fb(mm)
LC01-20x20-200	20.0x20.0	200.0	102.93	3.0	3.5	197.7
LC01-20x20-250	20.0x20.0	250.0	128.67	3.0	3.4	247.7
LC01-20x20-300	20.0x20.0	300.0	154.40	3.0	3.3	297.8
LC01-20x20-500	20.0x20.0	500.0	257.33	3.0	3.2	497.9
LC01-40x20-50	40.0x20.0	50.0	25.73	2.0	4.0	47.3
LC01-40x20-75	40.0x20.0	75.0	38.60	2.0	3.3	72.8
LC01-40x20-100	40.0x20.0	100.0	51.47	3.0	4.0	97.3
LC01-40x20-150	40.0x20.0	150.0	77.20	3.0	3.7	147.5
LC01-40x20-200	40.0x20.0	200.0	102.93	3.0	3.5	197.7
LC01-20x40-250	40.0x20.0	250.0	128.67	3.0	3.4	247.7
LC01-40x20-300	40.0x20.0	300.0	154.40	3.0	3.3	297.8
LC01-40x20-500	40.0x20.0	500.0	257.33	3.0	3.2	497.9

### Cylindrical Plano-Convex Lenses (Round)



Circular type

#### Choose Anti-reflective Coatings

- Single layer MgF<sub>2</sub>
- Multiple layers AR coating
  - R<0.25 % @ Laser line
  - R<0.5% @ Broadband Wavelength

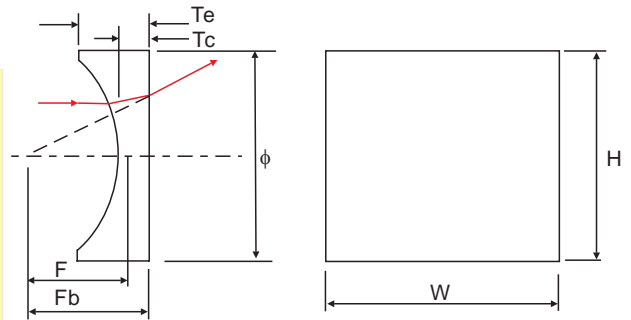
### N-BK7 Cylindrical Plano-Convex Lenses(Round)

Item#	Φ(mm)	F(mm)	R(mm)	Tc(mm)	Te(mm)	Fb(mm)
LC01-φ5-8	φ5.0	8.0	4.13	2.84	2.0	6.14
LC01-φ8-9.2	φ8.0	9.2	4.74	4.20	2.0	6.44
LC01-φ8-10	φ8.0	10.0	5.17	3.9	2.0	7.43
LC01-φ12-12.5	φ12.7	12.5	6.43	7.44	2.0	7.57
LC01-φ12-25	φ12.7	25.0	12.88	3.67	2.0	22.58
LC01-φ12-50	φ12.7	50.0	25.75	2.80	2.0	48.17
LC01-φ25-75	φ25.4	75.0	38.64	4.15	2.0	72.28
LC01-φ25-100	φ25.4	100.0	51.52	4.59	3.0	96.99
LC01-φ25-150	φ25.4	150.0	77.27	4.05	2.0	147.34

## Cylindrical Plano-Concave Lenses (Rectangular)

### General Specifications

Diameter tolerance	$\pm 0.1\text{mm}$
Design wavelength	546.1nm, $n=1.5187$
Focal tolerance	$\pm 2\%$
Surface quality	60-40 S/D
Centration	3 arcmin
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	$>90\%$
Bevel	Protective bevel



### N-BK7 Cylindrical Plano-Concave Lenses

Item#	WxH(mm)	F(mm)	R(mm)	Tc(mm)	Te(mm)	Fb(mm)
LC11-10x10-12.7	10.0x10.0	-12.7	-6.54	2.0	4.3	-14.0
LC11-10x10-20	10.0x10.0	-20.0	-10.29	2.0	3.3	-21..1
LC11-10x10-25	10.0x10.0	-25.0	-12.87	2.0	3.0	-26.3
LC11-20x10-12.7	20.0x10.0	-12.7	-6.54	2.0	4.3	-14.0
LC11-20x10-20	20.0x10.0	-20.0	-10.29	2.0	3.3	-21..1
LC11-20x10-25	20.0x10.0	-25.0	-12.87	2.0	3.0	-26.3
LC11-20x20-50	20.0x20.0	-50.0	-25.73	2.0	4.0	-51.3
LC11-20x20-75	20.0x20.0	-75.0	-38.60	2.0	3.3	-76.3
LC11-20x20-100	20.0x20.0	-100.0	-51.47	3.0	4.0	-102.0
LC11-20x20-150	20.0x20.0	-150.0	-77.20	3.0	3.7	-152.0
LC11-20x20-200	20.0x20.0	-200.0	-102.93	3.0	3.5	-202.0
LC11-20x20-250	20.0x20.0	-250.0	-128.67	3.0	3.4	-252.0
LC11-20x20-300	20.0x20.0	-300.0	-154.40	3.0	3.3	-302.9
LC11-20x20-500	20.0x20.0	-500.0	-257.33	3.0	3.2	-502.0
LC11-40x20-50	40.0x20.0	-50.0	-25.73	2.0	4.0	-51.3
LC11-40x20-75	40.0x20.0	-75.0	-38.60	2.0	3.3	-76.3
LC11-40x20-100	40.0x20.0	-100.0	-51.47	3.0	4.0	-102.0
LC11-40x20-150	40.0x20.0	-150.0	-77.20	3.0	3.7	-152.0
LC11-40x20-200	40.0x20.0	-200.0	-102.93	3.0	3.5	-202.0
LC11-40x20-250	40.0x20.0	-250.0	-128.67	3.0	3.4	-252.0
LC11-40x20-300	40.0x20.0	-300.0	-154.40	3.0	3.3	-302.9
LC11-40x20-500	40.0x20.0	-500.0	-257.33	3.0	3.2	-502.0

### How to order Cylindrical Lenses? Example:

Material: **N-BK7**  
 Shape: **Plano-convex cylinder, Rectangular**  
 Diameter: **12.0x10.0 $\pm$ 0.1mm**  
 Focal, Radius: **F=+30mm, R=15.56mm**  
 Thickness: **Tc=3.0 $\pm$ 0.1mm**  
 Surface quality: **60-40 S/D**  
 Flatness:  **$\lambda/4 @ 633\text{nm}$**   
 Centration: **3'**

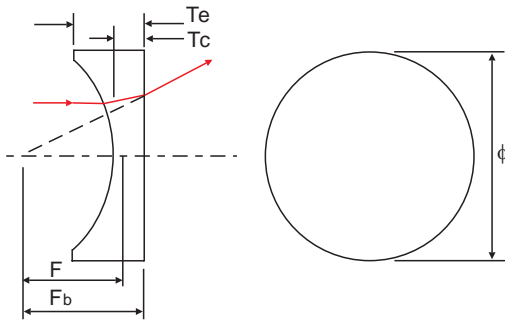
Coating: **AR @980nm, R<0.5%, AOI=0°**

Price  
on request

Custom  
Design

Volume  
Discount

## Cylindrical Plano-Concave Lenses(Round)



### N-BK7 Cylindrical Plano-Concave Lenses

Item#	$\Phi$ (mm)	F(mm)	R(mm)	Tc(mm)	Te(mm)	Fb(mm)
LC11- $\phi$ 5-8	$\phi$ 5.0	-8.0	-4.13	2.0	2.84	-9.34
LC11- $\phi$ 8-9.2	$\phi$ 8.0	-9.2	-4.74	2.0	4.20	-10.53
LC11- $\phi$ 8-10	$\phi$ 8.0	-10.0	-5.16	2.0	3.89	-11.31
LC11- $\phi$ 12-12.5	$\phi$ 12.7	-12.5	-6.43	2.0	7.44	-13.80
LC11- $\phi$ 12-25	$\phi$ 12.7	-25.0	-12.89	2.0	3.67	-26.33
LC11- $\phi$ 12-50	$\phi$ 12.7	-50.0	-25.76	2.0	2.80	-51.33
LC11- $\phi$ 25-75	$\phi$ 25.4	-75.0	-38.64	2.0	4.15	-76.34
LC11- $\phi$ 25-100	$\phi$ 25.4	-100.0	-51.52	3.0	4.59	-102.00
LC11- $\phi$ 25-150	$\phi$ 25.4	-150.0	-77.27	3.0	4.05	-151.99

### Choose Anti-reflective Coatings

- Single layer MgF<sub>2</sub>
- Multiple layers AR coating
  - R<0.25 % @ Laser line
  - R<0.5% @ Broadband Wavelength

### How to order Cylindrical Lenses? Example:

Material: **N-BK7**  
 Shape: **Plano-concave cylinder, Round**  
 Diameter:  **$\phi$ 12.7 $\pm$ 0.1mm**  
 Focal, Radius: **F=-25mm, R=-12.89mm**  
 Thickness: **Tc=3.0 $\pm$ 0.1mm**  
 Surface quality: **60-40 S/D**  
 Flatness:  **$\lambda/4$  @633nm**  
 Centration: **3'**  
  
 Coating: **AR @430--680nm, R<0.5%, AOI=0°**

Price  
on request

Custom  
Design

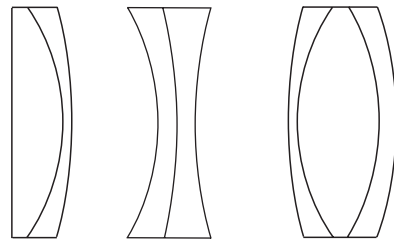
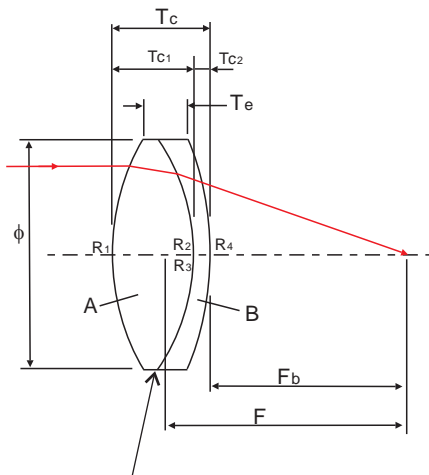
Volume  
Discount



# Achromatic Lenses

Achromatic lenses are lenses consisting of two or more elements, which are usually made of crown and flint glass with differing indices of refraction. One element is positive, the other is negative. Distinct wavelengths can be corrected for chromatic aberration.

Achromatic lenses are nearly free from aspherical aberration and coma. Comparing with singlet lenses, achromatic lenses have far superior optical performance.



Customized design  
Diameter:  $\phi 3.0$ --- $\phi 100$ mm

Cement: NOA61 from Norland

### Choose Anti-reflective Coatings:

- Single layer MgF<sub>2</sub>
- Multiple layers AR coating
  - R<0.25 % @ Laser line
  - R<0.5% @ Broadband Wavelength



### How to order Achromatic Lenses? Example:

	Element-A:	Element -B	
Materials:	N-BK7	N-SF5	
Diameter:	$\phi 25.4 +0/-0.1$	$\phi 25.4 +0/-0.1$	
Thickness:	$T_{c1}=4.0$	$T_{c2}=1.0+/-0.1$	
Radius:	$R_1=73.28$	$R_2(R_3)=-54.33$	$R_4=-159.96$
Surface quality:	60-40s/d		
Flatness:	$\lambda/4$ @ 633nm		
Centration:	3'		

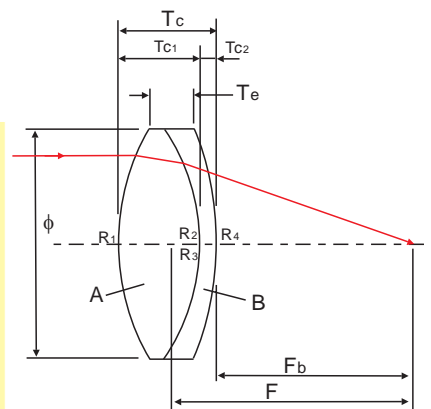
Coating: AR @ 430--680nm, R<0.5%, AOI=0°

- Price on request
- Custom Design
- Volume Discount

## Achromatic Lenses

### Specifications

Materials	See table
Diameter tolerance	±0.1mm
Design wavelength	480.0nm, 546.1nm, 632.8nm
Focal tolerance	±2%
Surface quality	60-40 S/D
Centration	3 arcmin
Surface flatness	λ/4@632.8nm
Clear aperture	>90%
Bevel	Protective bevel



Item#	Φ(mm)	F(mm)	Material		R1(mm)	R2(mm) R3	R4(mm)	Tc	Fb(mm)
			A	B					
LA0-6-10	φ6.0	10.0	SK9	SF15	6.55	-4.05	-23.23	3.6±0.8	7.54
LA0-6-15	φ6.0	15.0	BK7	SF5	8.83	-6.54	-19.77	2.71±1.0	13.06
LA0-6-20	φ6.0	20.0	BK7	SF5	12.36	-8.51	-24.38	2.6±1.0	18.29
LA0-6-25	φ6.0	25.0	BK7	SF5	15.70	-10.66	-29.99	2.3±1.0	23.45
LA0-6-30	φ6.0	30.0	BK7	SF5	18.88	-12.94	-34.68	1.9±1.0	28.69
LA0-8-25	φ8.0	25.0	BK7	SF5	15.60	-10.81	-30.48	2.9±1.0	23.12
LA0-8-30	φ8.0	30.0	BK7	SF5	18.88	-12.88	-36.22	2.7±1.0	28.27
LA0-12-25	φ12.7	25.0	BK7	SF5	15.60	-11.40	-31.05	4.3±1.3	22.25
LA0-12-30	φ12.7	30.0	BK7	SF5	18.53	-13.49	-37.84	4.0±1.3	27.36
LA0-12-40	φ12.7	40.0	BK7	SF5	25.23	-17.54	-48.75	3.4±1.3	37.77
LA0-12-50	φ12.7	50.0	BK7	SF5	31.26	-21.93	-62.37	3.1±1.3	47.99
LA0-12-75	φ12.7	75.0	BK7	SF5	46.77	-32.96	-94.62	2.6±1.3	73.23
LA0-18-40	φ18.0	40.0	BK7	SF5	24.27	-18.35	-53.09	5.4±1.5	36.51
LA0-18-50	φ18.0	50.0	BK7	SF5	31.69	-22.00	-60.57	4.8±1.5	46.98
LA0-18-60	φ18.0	60.0	BK7	SF5	37.84	-26.49	-73.79	4.1±1.5	57.30
LA0-18-80	φ18.0	80.0	BK7	SF5	49.55	-36.81	-165.58	3.4±1.5	77.41
LA0-25-50	φ25.4	50.0	BaF53	SF4	34.59	-24.21	-179.06	7.8±2.0	44.52
LA0-25-60	φ25.4	60.0	BK7	SF5	37.33	-27.16	-75.86	7.0±2.0	55.56
LA0-25-80	φ25.4	80.0	K7	SF1	49.09	-37.93	-95.94	5.5±2.0	76.46
LA0-25-100	φ25.4	100.0	BK3	SF5	60.67	-44.67	-122.18	4.5±2.0	97.05
LA0-25-120	φ25.4	120.0	BK7	SF5	73.28	-54.33	-159.96	4.2±2.0	117.10
LA0-30-100	φ30.0	100.0	BK3	SF5	59.02	-45.29	-127.64	6.8±2.5	95.26
LA0-30-140	φ30.0	140.0	BK3	SF5	84.92	-62.23	170.61	4.9±2.5	136.60

### Choose Anti-reflective Coatings:

- Single layer MgF2
- Multiple layers AR coating

R<0.25% @ Laser line or R<0.5% @ Broadband Wavelength

## Rods (Light Pipe)

### General Specifications

Material	N-BK7
Diameter tolerance	$\pm 0.1\text{mm}$
Surface quality	80-50 S/D
Cylindricity	3 arcmin
Surface flatness	$\lambda/2 @ 632.8\text{nm}$
Clear aperture	$>90\%$



Diameter: available from  $\phi 1.0\text{mm}$  to  $\phi 25\text{mm}$

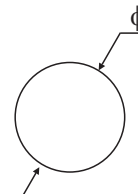
All surfaces (end-faces and cylinder) are polished



## Balls

### General Specifications

Material	N-BK7
Diameter tolerance	$\pm 0.1\text{mm}$
Surface quality	80-50 S/D
Circularity	minimum $1\mu\text{m}$
Surface flatness	$\lambda/2 @ 632.8\text{nm}$
Clear aperture	$>90\%$



Diameter: available from  $\phi 1.0\text{mm}$  to  $\phi 50\text{mm}$

All surfaces polished

Price  
on request

Custom  
Design

Volume  
Discount

# Beamsplitters

- ※ Beamsplitters Cube-----35
- ※ Beamsplitters Plate-----36
- ※ Polarization Beamsplitters-----37
- ※ Non-Polarizing Beamsplitters-----38
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# Beamsplitters (Cube)

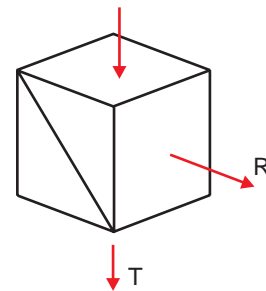
The beamsplitter cubes are constructed by cemented two matched right angle prisms. The hypotenuse is coated with partial dielectric coating.

- ※ Easy to mount, is ideal for beam superposition.
- ※ Less deformation.

Cube Beamsplitters are recommended for use with collimated or nearly collimated beam. Convergent or divergent beam will contribute spherical aberration.

## General Specifications

Material	N-BK7
Dimension tolerance	$\pm 0.1$ mm
Beam deviation	3 arc min
Surface quality	60-40 S/D
Surface flatness	$\lambda/4$ @ 632.8nm
Clear aperture	>90%
Bevel	Protective bevel
Hypotenuse surface	Partial reflective coating
Entrance/Exit surfaces	AR coating



Incident of angle:  $0^\circ \pm 2^\circ$

Reflectance/Transmittance R/T=50/50%  $\pm 5\%$

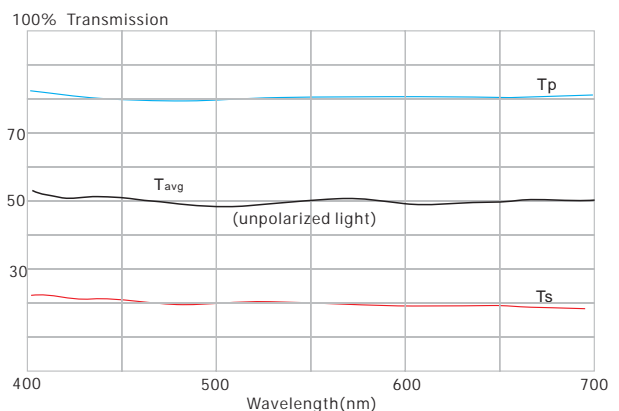
[Other ratio is available](#)

( R,T are the average of S- and P-pol)

## Polarization Sensitive

### Typical Sizes

Size (mm)	Size (mm)
5.0x5.0x5.0	18.0x18.0x18.0
10.0x10.0x10.0	20.0x20.0x20.0
12.7x12.7x12.7	25.4x25.4x25.4
15.0x15.0x15.0	30.0x30.0x30.0



### How to order Beamsplitter cube? Example:

Size: 15.0x15.0x15.0+/-0.1mm  
 Wavelength: 430--680nm  
 Transmittance: T(R)=50%  $\pm 5\%$   
 (Reflectance)

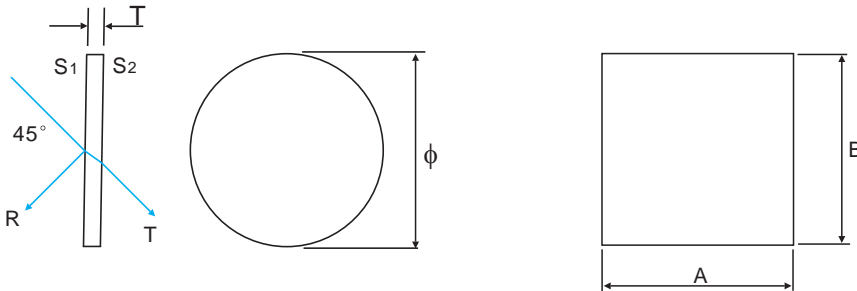
Price  
on request

Custom  
Design

Volume  
Discount

# Beamsplitters (Plate)

Plate Beamsplitters are part-mirrors that reflect part of incident energy and transmit the rest.



## General Specifications

Material	N-BK7
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	3 arc min
Surface quality	60-40 S/D
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	>90%
Bevel	Protective bevel
Front surface	Partial reflective coating
Back surface	AR coating

Transmission curve see Page 35

Incident of angle:  $45^\circ$

Reflectance/Transmittance  $R/T=50/50\% \pm 5\%$  **Other ratio is available**  
 (R,T are the average of S- and P-pol) **Polarization Sensitive**

## Typical Sizes:

Round Shape:

Diameter(mm)
$\phi 5.0, \phi 10.0, \phi 12.7$
$\phi 15.0, \phi 18.0, \phi 20.0$
$\phi 25.4, \phi 38.0$

Square Shape:

A x B(mm)
5.0x5.0, 10.0x10.0
12.7x12.7, 15.0x15.0
20.0x20.0, 25.4x25.4

Thickness
0.5, 1.0, 1.5
2.0, 2.5, 3.0
5.0, 6.3

## How to order Beamsplitter Plate? Example:

Size:  $\phi 15.0 \times 2.0 \pm 0.1\text{mm}$   
 Wavelength: 430--680nm  
 Transmittance:  $T(R)=50\% \pm 5\%$   
 (Reflectance)

Price  
on request

Custom  
Design

Volume  
Discount

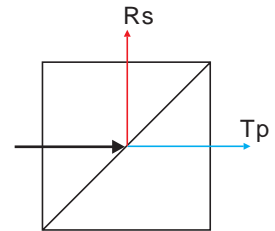
# Polarization Beamsplitters (PBS)

Polarization beamsplitter cubes are constructed by cemented two right angle prisms, the hypotenuse of one prism is coated with polarization dielectric coating.

When used with normal incident, un-polarized light, the incident beam is separated into two polarized beams, p-polarized component is passed straight through, s-polarized component is reflected out at 90deg.

## General Specifications

Material	N-BK7 or N-SF5
Dimensional tolerance	$\pm 0.1\text{mm}$
Beam deviation	3 arc min
Surface quality	60-40 S/D
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	>90%
Bevel	Protective bevel
Hypotenuse	Polarization dielectric coating
Entrance & exit faces	AR coating



Incidence of angle:  $0^\circ \pm 2^\circ$

## Laser line

Transmittance	$T_p > 96\%$ and $T_s < 0.3\%$
Reflectance	$R_p < 4\%$ and $R_s > 99.7\%$

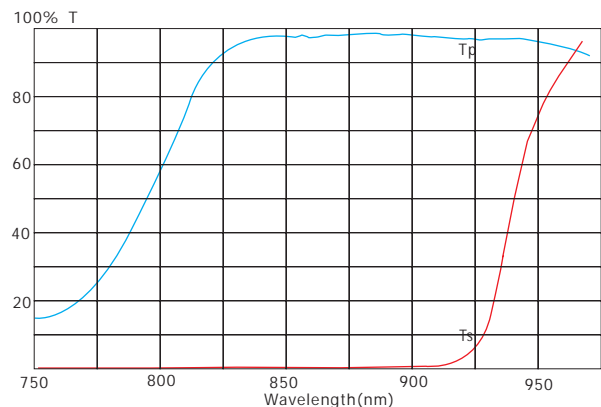
## Broadband wavelength

Transmittance	$T_p > 95\%$ and $T_s < 0.5\%$
Reflectance	$R_p < 5\%$ and $R_s > 99.5\%$



## Typical Sizes

Size (mm)	Size (mm)
5.0x5.0x5.0	18.0x18.0x18.0
10.0x10.0x10.0	20.0x20.0x20.0
12.7x12.7x12.7	25.4x25.4x25.4
15.0x15.0x15.0	30.0x30.0x30.0



## How to order Polarization Beamsplitters? Example:

Size:  $15.0 \times 15.0 \times 15.0 \pm 0.1\text{mm}$   
 Wavelength: 780nm  
 Transmittance:  $T_p > 96\%$   
 Reflectance:  $R_s < 0.3\%$

Price  
on request

Custom  
Design

Volume  
Discount

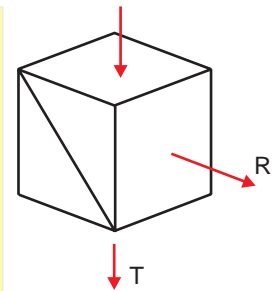
# Non-polarizing Beamsplitters

Non-polarizing beamsplitter cube are constructed by cemented two right angle prisms. The hypotenuse of one prism is coated with hybrid metal dielectric coating, which exhibits moderate absorption with little polarization sensitivity.

The beamsplitters are fairly insensitive to changes in angle of incidence. Performance is relatively flat across a large spectral band.

## General Specifications

Material	N-BK7
Dimension tolerance	$\pm 0.1\text{mm}$
Beam deviation	3 arc min
Surface quality	60-40 S/D
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	>90%
Bevel	Protective bevel
Coating on hypotenuse	Hybrid metallic dielectric coating
Coating on entrance & exit faces	AR coating



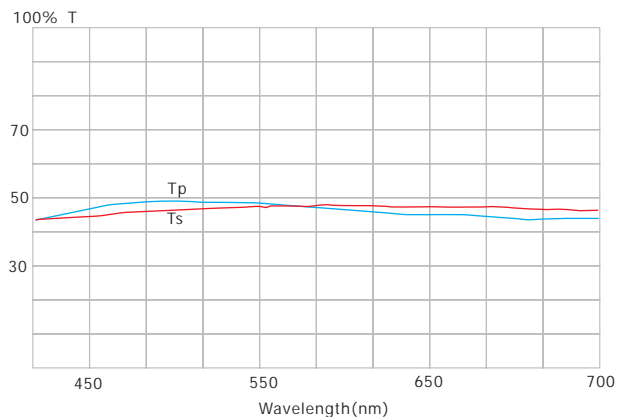
Incidence of angle:  $0^\circ \pm 2^\circ$

Transmittance	R/T=50/50%, $T_p(T_s)=50 \pm 5\%$
Energy absorption	$ T_s - T_p  < 5\%$ , $ R_s - R_p  < 5\%$ <10%

For broadband wavelength and Narrow wavelength

## Typical Sizes

Size (mm)	Size (mm)
5.0x5.0x5.0	18.0x18.0x18.0
10.0x10.0x10.0	20.0x20.0x20.0
12.7x12.7x12.7	25.4x25.4x25.4
15.0x15.0x15.0	30.0x30.0x30.0



## How to order Non-Polarizing Beamsplitters?

## Example:

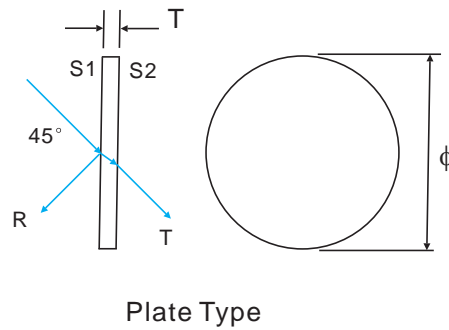
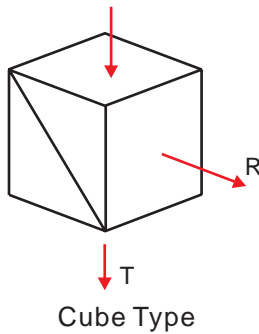
Size: **15.0x15.0x15.0 $\pm 0.1\text{mm}$**   
 Wavelength: **430--680nm**  
 Transmittance:  **$T_p(T_s)=50+/-5\%$**   
 (Reflectance)

- Price on request
- Custom Design
- Volume Discount

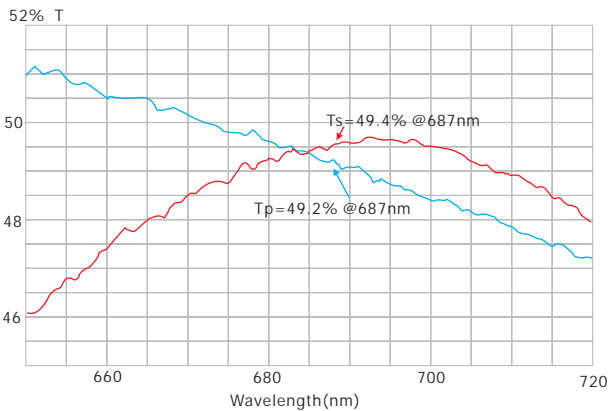


## Non-polarizing Beamsplitters (No energy loss)

- ※ Design by dielectric coating
- ※ Energy loss negligible.
- ※ Transmission of P-pol or S-pol are very close to 50% with +/-2%



### Available only for narrow wavelength



### How to order Non-Polarizing Beamsplitters(No energy loss)? Example:

Size: 15.0x15.0x15.0±0.1mm  
 Wavelength: 687nm  
 Transmittance:  $T_p=50 \pm 2\%$ ;  $T_s=50 \pm 2\%$   
 (Reflectance)

Price  
on request

Custom  
Design

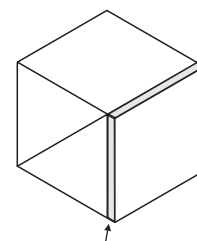
Volume  
Discount

# Polarization Beamsplitters + Waveplate

## General Specifications

Material	N-BK7 or N-SF5
Dimension tolerance	$\pm 0.1$ mm
Beam deviation	3 arc min
Surface quality	60-40 S/D
Surface flatness	$\lambda/4$ @ 632.8nm
Clear aperture	>90%
Bevel	Protective bevel
Hypotenuse	Polarization dielectric coating
Entrance & exit faces	AR coating

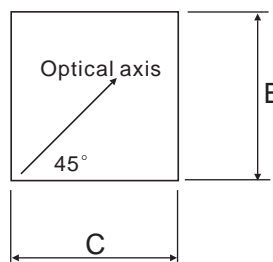
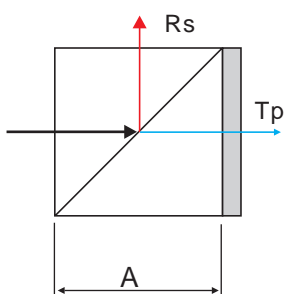
Incidence of angle:  $0^\circ \pm 2^\circ$



$\lambda/4$  Waveplate  
(Glue together)

Transmittance:	$T_p > 96\%$ and $T_s < 0.3\%$
Reflectance:	$R_p < 4\%$ and $R_s > 99.7\%$

Transmission curve see Page 37



## Typical Sizes

AxBxC (mm)	Size (mm)
5.0x5.0x5.0	18.0x18.0x18.0
10.0x10.0x10.0	20.0x20.0x20.0
12.7x12.7x12.7	25.4x25.4x25.4
15.0x15.0x15.0	30.0x30.0x30.0

## Waveplate Size

Zero order, or Multiple order  
Size(BxC): Same as beamsplitter size  
Thickness: 1.0--1.5mm

(Refer to Waveplate Chapter)

## How to order Polarization Beamsplitters+waveplate? Example:

Size: 15.0x15.0x15.0 $\pm$ 0.1mm  
Wavelength: 780nm  
Transmittance:  $T_p > 96\%$   
Reflectance:  $R_s < 0.3\%$   
Waveplate:  $\lambda/4$  @ 780nm

Price  
on request

Volume  
Discount

Custom  
Design

# Displacement Beamsplitters

(Polarization)

## General Specifications

Material	N-BK7 or N-SF5
Dimension tolerance	$\pm 0.1\text{mm}$
Beam deviation	3 arc min
Surface quality	60-40 S/D
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Clear aperture	>90%
Bevel	Protective bevel
Hypotenuse	Polarization dielectric coating
Entrance & exit faces	AR coating

Incidence of angle:  $0^\circ \pm 2^\circ$

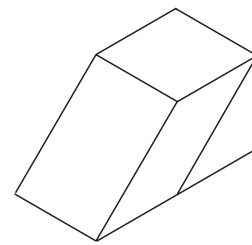
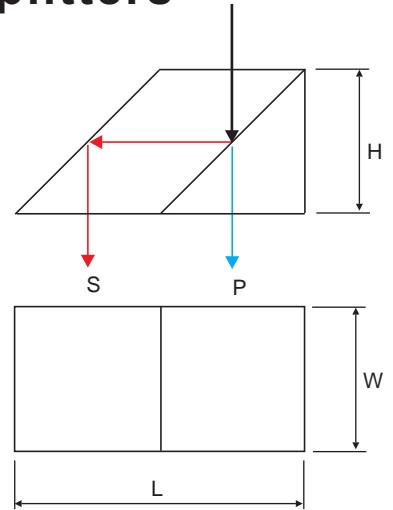
## Laser line

Transmittance	$T_p > 96\%$ and $T_s < 0.3\%$
Reflectance	$R_p < 4\%$ and $R_s > 99.7\%$

Transmission curve see Page 37

## Broadband wavelength

Transmittance	$T_p > 95\%$ and $T_s < 0.5\%$
Reflectance	$R_p < 5\%$ and $R_s > 99.5\%$



## Typical Sizes

WxHxL (mm)	WxHxL (mm)
5.0x5.0x10.0	18.0x18.0x30.0
10.0x10.0x20.0	20.0x20.0x40.0
12.7x12.7x25.4	25.4x25.4x50.8
15.0x15.0x30.0	30.0x30.0x60.0

## How to order Displacement Polarization Beamsplitters? Example:

Size: 15.0x15.0x30.0mm  
 Wavelength: 780nm  
 Transmittance:  $T_p > 96\%$   
 Reflectance:  $R_s < 0.3\%$

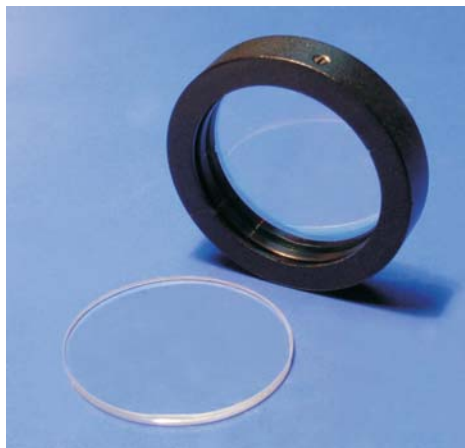
Price  
on request

Volume  
Discount

Custom  
Design

# Waveplates

- ※ Zero order Waveplates-----43
- ※ Multiple order Waveplates-----44
- ※ True Zero order Waveplates-----45
- ※ Dual wavelength Waveplates-----46
- ※ Polarization Rotators -----47
- ※ Holders for Waveplates-----47



# Zero order Waveplates

Zero order waveplates are constructed of two multiple order waveplates with their axes crossed. Thus the effect of the first plate is cancelled by the second, except for the residual difference between them.

Zero order waveplates are much less susceptible to wavelength changes, can be up to 2% above or below the design wavelength with little effect on retardation. The waveplates should be considered for more critical application.

## General Specifications

Material	Quartz
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	2 arc sec
Surface quality	20-10 S/D
Wavefront distortion	$\lambda/8 @ 632.8\text{nm}$
Retardation tolerance	$\lambda/300$
Clear aperture	>90%
Coating on both sides	$R < 0.25\% @ \text{design wavelength}$

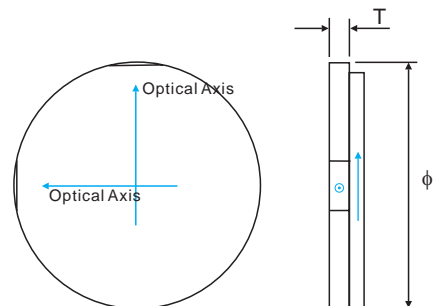
## Typical Diameters

$\phi 5.0$	$\phi 10.0$	$\phi 12.7$	$\phi 15.0$
$\phi 20.0$	$\phi 25.4$	$\phi 30.0$	$\phi 38.1$

Thickness: around 1.0--1.5mm

Retardation Available:  $\lambda/2$ ,  $\lambda/4$   
 $1\lambda$ ,  $\lambda/8$

Mounted Waveplates are available.



Cemented or Optically contact

## How to order zero order waveplate? Example:

Type	Size	Wavelength	Retardation	Coating
Zero order	$\phi 25.4\text{mm}$	800nm	$\lambda/2$	AR

Price on request

Custom Design

Volume Discount

# Multiple Order Waveplates

Multiple order waveplates are made from a single crystalline plate, which are designed to give a retardance of several full waves, plus the desired fraction. Multiple order waveplates are more susceptible to change in wavelength and they should not be used more than several nanometers outside of design wavelength.

## General Specifications

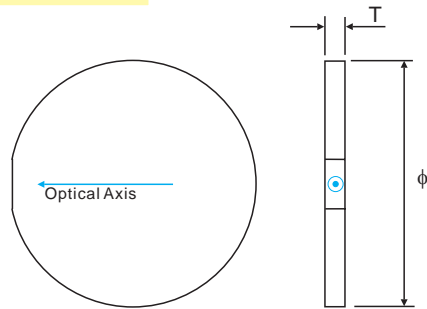
Material	Quartz
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	1 arc sec
Surface quality	20-10 S/D
Wavefront distortion	$\lambda/8 @ 632.8\text{nm}$
Retardation tolerance	$\lambda/300$
Clear aperture	>90%
Coating on both sides	$R < 0.25\% @ \text{design wavelength}$

## Typical Diameters

$\phi 5.0$	$\phi 10.0$	$\phi 12.7$	$\phi 15.0$
$\phi 20.0$	$\phi 25.4$	$\phi 30.0$	$\phi 38.1$

Thickness: around 0.5mm

Retardation Available:  $\lambda/2$ ,  $\lambda/4$   
 $1\lambda$ ,  $\lambda/8$



Mounted Waveplates are available.



## How to order multiple order waveplate? Example:

Type	Size	Wavelength	Retardation	Coating
Multiple order	$\phi 25.4\text{mm}$	800nm	$\lambda/2$	AR

Price on request

Custom Design

Volume Discount

# True Zero Order Waveplates

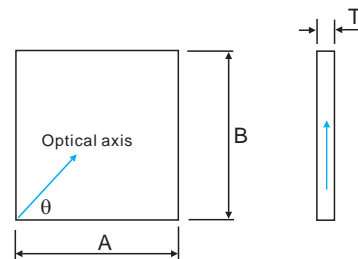
True order waveplate is designed for wavelength range 1300-- 1700nm for telecom application. These waveplates provide best possible angle, temperature and wavelength performance. The thickness of these waveplates are very thin (approx 100 $\mu$ m).

## General Specifications

Material	Quartz
Dimension tolerance	$\pm 0.1$ mm
Parallelism	1 arc sec
Surface quality	20-10 S/D
Wavefront distortion	$\lambda/8$ @632.8nm
Retardation tolerance	$\lambda/300$
Clear aperture	>90%
Coating on both sides	$R < 0.25\%$ @ design wavelength

## Typical Sizes

Square	Round	Thickness
1.0x1.0	$\phi 1.0$	0.03--0.10
2.0x2.0	$\phi 2.0$	0.03--0.10
3.0x3.0	$\phi 3.0$	0.03--0.10
5.0x5.0	$\phi 5.0$	0.03--0.10



Retardation Available:  $\lambda/2$ ,  $\lambda/4$   
 $1\lambda$ ,  $\lambda/8$

typical  $\theta = 22.5^\circ$ ,  $45^\circ$

### How to order true zero order waveplate? Example:

Type	Size	Wavelength	Retardation	Coating
True zero order	2x2mm	1550nm	$\lambda/2$	AR

Price  
on request

Custom  
Design

Volume  
Discount

# Dual Wavelength Waveplates

Dual wavelength waveplates are multiple order waveplate that provide a specific retardance at two different wavelengths. Its application is separation of different wavelengths with a polarization beamsplitter by rotating the polarization of one wavelength by 90°, and leaving the other unchanged.

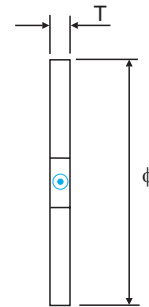
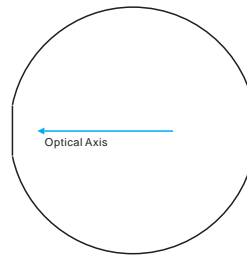
## General Specifications

Material	Quartz
Dimension tolerance	±0.1mm
Parallelism	1 arc sec
Surface quality	20-10 S/D
Wavefront distortion	λ/8@632.8nm
Retardation tolerance	λ/300
Clear aperture	>90%
Coating on both sides	R<0.25% @ design wavelength

## Typical Diameters

φ5.0	φ10.0	φ12.7	φ15.0
φ20.0	φ25.4	φ30.0	φ38.1

Thickness: depend on the wavelength



Retardation Available: λ/2, λ/4  
1λ, λ/8

Mounted Waveplates are available.

## How to order dual wavelength waveplate? Example:

Type	Size	Wavelength-1 Retardation	Wavelength-2 Retardation	Coating
Dual wavelength	φ25.4mm	532nm-λ/2	1064nm-1λ	AR

Price  
on request

Custom  
Design

Volume  
Discount



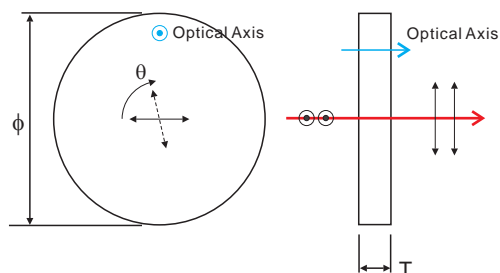
# Polarization Rotators

Crystal quartz plate with optical axis perpendicular to surfaces can rotate the plane of polarization of an input beam of light. The rotation angle at a particular wavelength is a function of thickness of crystal quartz.

With particular thickness the quartz plates can rotate the plane of polarization of incident linearly polarized single wavelength of light by 45 or 90 degrees.

## General Specifications

Material	Quartz
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	10 arc sec
Surface quality	20-10 S/D
Wavefront	$\lambda/4@632.8\text{nm}$
Rotate tolerance	$<5$ arcmin
Clear aperture	$>90\%$
Coating on both sides	AR coating



## How to order polarization rotator? Example:

Type	Size	Wavelength	Rotate Angle	Coating
Rotator	$\phi 25.4\text{mm}$	1064nm	$90^\circ$	AR

Price on request

Custom Design

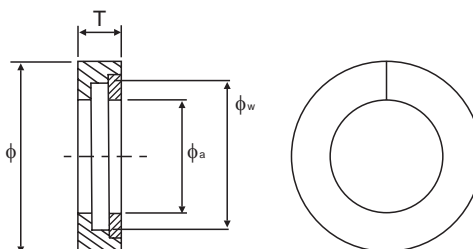
Volume Discount

# Holders For Waveplates

The holders are designed to mount waveplates.

## Specifications

Material: Black anodized aluminum  
Dimension tolerance:  $\pm 0.1\text{mm}$



Item#	Holder $\phi$ (mm)	Holder T (mm)	Waveplate $\phi_w$ (mm)	Clear aperture $\phi_a$ (mm)
WH-01	$\phi 25.4$	6.0	10.0	8.0
WH-02	$\phi 25.4$	6.0	12.7	10.5
WH-03	$\phi 25.4$	6.0	15.0	13.5
WH-04	$\phi 30.0$	6.0	20.0	18.0
WH-05	$\phi 30.0$	6.0	25.4	23.0



## Polarizers

※ Glan-Taylor Polarizers-----	49
※ Glan-Taylor Polarizers(With exiting Holes)-----	50
※ Glan-Thompson Polarizers-----	51
※ Glan-Thompson Polarizers(Beamsplitting)-----	52
※ Wollaston Polarizers -----	53
※ Rochon Polarizers-----	54



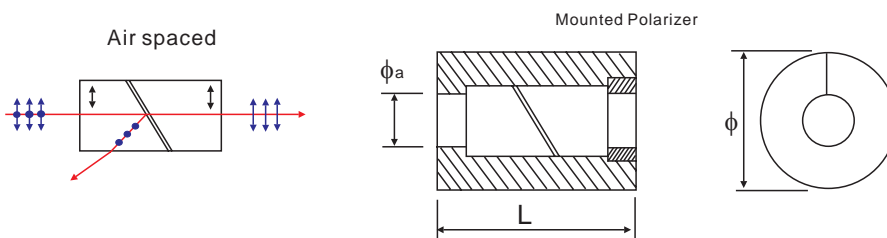
# Glan Taylor Polarizers

Polarizer is a device that produces linearly polarized light from other states of polarization. Glan Taylor polarizer consists two calcite prisms which are separated by an air space. Glan Taylor polarizer will divide an entering unpolarized beam into two rays, one is the extraordinary ray that is transmitted through the other side, another is the ordinary ray that is totally internally reflected and absorbed.

## General Specifications

Material	Calcite	$\alpha$ -BBO
Wavelength	350-2300nm	190-3500nm
Extinction ratio	$5 \times 10^5 : 1$	$1 \times 10^6 : 1$
Angle field	$7.7^\circ$	$6^\circ$
Beam deviation	3 arcmin	3 arcmin
Dimension tolerance	$\pm 0.1\text{mm}$	$\pm 0.1\text{mm}$
Surface quality	20-10 S/D	20-10 S/D
Clear aperture	>90%	>90%
Coating on both sides	Single layer $\text{MgF}_2$ coating	

Item#	Material	Clear aperture $\phi_a$ (mm)	Holder $\phi$ (mm)	Length (mm)	Application Wavelength
PZ1-C06	Calcite	6.0	15.0	15.0	350-2300nm
PZ1-C08	Calcite	8.0	25.4	17.0	
PZ1-C10	Calcite	10.0	25.4	19.0	
PZ1-C15	Calcite	15.0	30.0	23.0	
PZ1-B06	$\alpha$ -BBO	6.0	15.0	15.0	200--300nm 300--700nm 700-3000nm
PZ1-B08	$\alpha$ -BBO	8.0	25.4	17.0	
PZ1-B10	$\alpha$ -BBO	10.0	25.4	19.0	
PZ1-B15	$\alpha$ -BBO	15.0	25.4	23.0	
PZ1-Y08	YVO4	8.0	25.4	15.0	500-4000nm
PZ1-Y10	YVO4	10.0	25.4	17.0	



How to order Polarizers? Example:

Item# + Application Wavelength

Price  
on request

Volume  
Discount

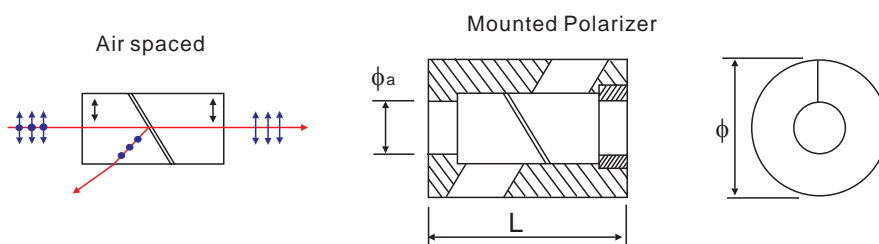
## Glan Talor Polarizers -- with exiting holes (Glan Laser Polarizers)

Also called Glan laser polarizers, the polarizers are specially designed for high energy application. The side of housing are drilled two holes. The ordinary ray is reflected through an angle and exits the polarizers through one of the holes.

### General Specifications

Material	Calcite	$\alpha$ -BBO
Wavelength	350-2300nm	190-3500nm
Extinction ratio	$5 \times 10^5 : 1$	$1 \times 10^6 : 1$
Angle field	$7.7^\circ$	$6^\circ$
Beam deviation	3 arcmin	3 arcmin
Dimension tolerance	$\pm 0.1$ mm	$\pm 0.1$ mm
Surface quality	20-10 S/D	20-10 S/D
Clear aperture	$>90\%$	$>90\%$
Coating on both sides	Single layer $MgF_2$ coating	

Item#	Material	Clear aperture $\phi_a$ (mm)	Holder $\phi$ (mm)	Length (mm)	Application Wavelength
PZ2-C06	Calcite	6.0	15.0	21.0	350-2300nm
PZ2-C08	Calcite	8.0	25.4	24.5	
PZ2-C10	Calcite	10.0	25.4	26.2	
PZ2-C15	Calcite	15.0	30.0	33.3	
PZ2-B06	$\alpha$ -BBO	6.0	15.0	29.0	200--300nm 300--700nm 700-3000nm
PZ2-B08	$\alpha$ -BBO	8.0	25.4	31.0	
PZ2-B10	$\alpha$ -BBO	10.0	25.4	31.0	
PZ2-B15	$\alpha$ -BBO	15.0	25.4	38.0	
PZ2-Y08	YVO4	8.0	25.4	20.0	500-4000nm
PZ2-Y10	YVO4	10.0	25.4	23.0	



How to order Polarizers? Example:

**Item# + Application Wavelength**

Price  
on request

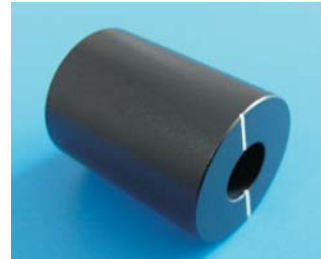
Volume  
Discount

# Glan Thompson Polarizers

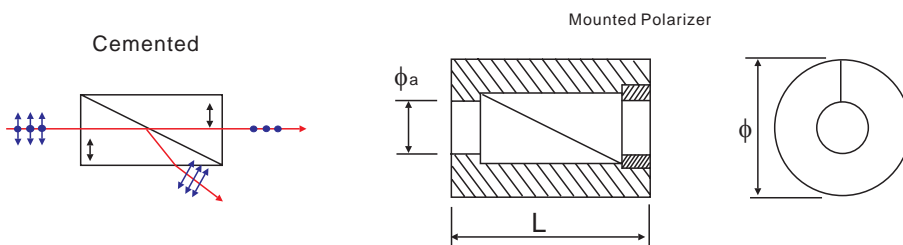
Glan Thompson polarizer consists two same calcite prisms which are cemented together. The extraordinary ray is transmitted, while ordinary ray is deflected and absorbed. Glan Thompson Polarizers are ideal choices for applications requiring a large field of view and high extinction ratio.

## General Specifications

Material	Calcite
Extinction ratio	$5 \times 10^5 : 1$
Angle field	14-16°
Beam deviation	3 arcmin
Dimension tolerance	$\pm 0.1$ mm
Surface quality	20-10 S/D
Clear aperture	>90%
Coating on both sides	Single layer MgF <sub>2</sub> coating



Item#	Material	Clear aperture $\phi_a$ (mm)	Holder $\phi$ (mm)	Length (mm)	Application Wavelength
PZ3-C06	Calcite	6.0	15.0	22.0	350-2300nm
PZ3-C08	Calcite	8.0	25.4	28.0	
PZ3-C10	Calcite	10.0	25.4	33.0	
PZ3-C12	Calcite	12.0	25.4	39.0	



How to order Polarizers? Example:

Item# + Application Wavelength

Price  
on request

Volume  
Discount

# Glan Thompson Polarizers (Beamsplitting)

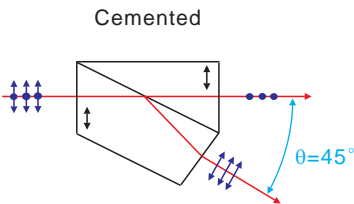
The polarizing beamsplitter is Glan Thompson polarizer that permit the reflected beam output from exit-surface.

The extraordinary ray is straight transmitted, the ordinary ray deviated by  $45^\circ$  is always normal to exit surface, and doesn't change angle with wavelength.

### General Specifications

Material	Calcite
Extinction ratio (Ts)	$10^5 : 1$
Extinction ratio (Tp)	$5 \times 10^5 : 1$
Angle field	$14-16^\circ$
Deviation angle	$\theta=45^\circ$
Coating on both sides	Single layer $MgF_2$ coating

Item#	Material	Clear aperture $\phi a$ (mm)	Application Wavelength
PZ3B-C06	Calcite	6.0	350-2300nm
PZ3B-C08	Calcite	8.0	
PZ3B-C10	Calcite	10.0	
PZ3B-C12	Calcite	12.0	



Mount is customized.

How to order Polarizers? Example:

**Item# + Application Wavelength**

Price  
on request

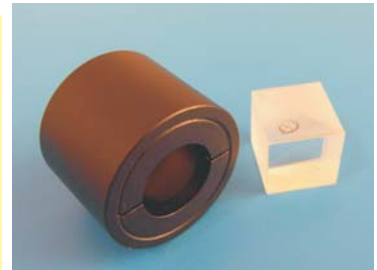
Volume  
Discount

# Wollaston Polarizers

Wollaston polarizers can separate an incident beam into two rays: extraordinary and ordinary ray with a deviation angle which is dependent on wavelength. Both rays are transmitted through the other surface.

## General Specifications

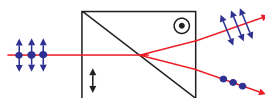
Material	Calcite, $\alpha$ -BBO, YVO4
Extinction ratio	$10^5 : 1$
Angle field	$15^\circ$ (Calcite)
Beam deviation	3 arcmin
Dimension tolerance	$\pm 0.1\text{mm}$
Surface quality	20-10 S/D
Clear aperture	$>90\%$
Coating on both sides	Single layer $\text{MgF}_2$ coating



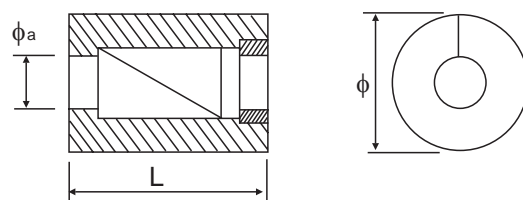
Typical separation angle: 10--20deg, Calcite

Item#	Material	Clear aperture $\phi_a$ (mm)	Holder $\phi$ (mm)	Length (mm)	Application Wavelength
PZ4-C08	Calcite	8.0	25.4	17.0	350-2300nm
PZ4-C10	Calcite	10.0	25.4	19.0	
PZ4-C15	Calcite	15.0	30.0	23.0	
PZ4-B08	$\alpha$ -BBO	8.0	25.4	17.0	190--3500nm
PZ4-B10	$\alpha$ -BBO	10.0	25.4	19.0	
PZ4-Y08	YVO4	8.0	25.4	17.0	500-4000nm
PZ4-Y10	YVO4	10.0	25.4	19.0	

Cemented



Mounted Polarizer



How to order Polarizers? Example:

**Item# + Application Wavelength**

Price  
on request

Volume  
Discount

# Rochon Polarizers

Rochon polarizers separate incident beam into ordinary ray and extraordinary ray like wollaston polarizer, but extraordinary ray is straight transmitted through, while ordinary is transmitted with a deviation angle.

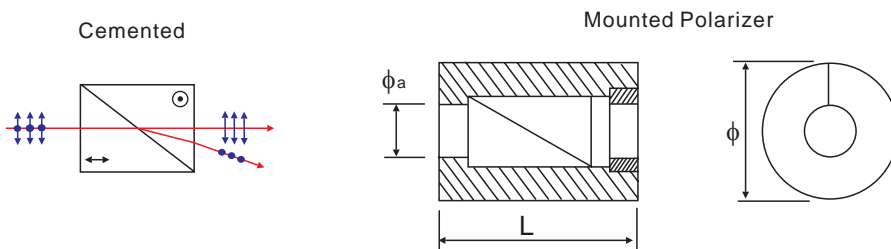
## General Specifications

Material	$\alpha$ -BBO, YVO4
Extinction ratio	$5 \times 10^5 : 1$
Angle field	$> 6.9^\circ$
Beam deviation	3 arcmin
Dimension tolerance	$\pm 0.1 \text{ mm}$
Surface quality	20-10 S/D
Clear aperture	$> 90\%$
Coating on both sides	Single layer $\text{MgF}_2$ coating



Typical separation angle:  $8^\circ$  @ 1064nm,  $\alpha$ -BBO

Item#	Material	Clear aperture $\phi_a$ (mm)	Holder $\phi$ (mm)	Length (mm)	Application Wavelength
PZ5-B08	$\alpha$ -BBO	8.0	25.4	17.0	190-3500nm
PZ5-B10	$\alpha$ -BBO	10.0	25.4	19.0	
PZ5-B15	$\alpha$ -BBO	15.0	30.0	23.0	
PZ5-Y08	YVO4	8.0	25.4	17.0	400-4000nm
PZ5-Y10	YVO4	10.0	25.4	23.0	



How to order Polarizers? Example:

Item# + Application Wavelength

Price  
on request

Volume  
Discount



## Mirrors

- ※ Metallic Coating Mirrors(Al, Ag, Au)-----56
- ※ High energy reflective Mirrors-----58
- ※ Dichroic Mirrors-----59



# Metallic Coated Mirrors

- Protected Aluminum
- VIS Enhanced Aluminum
- UV Enhanced Aluminum
- Protected Silver
- Protected Gold

**Substrate Materials:** N-BK7, UV Fused silica, Pyrex  
Other optical glasses from Schott, CDGM

## General Specifications

Dimensional tolerance	$\pm 0.1\text{mm}$
Surface quality	60-40 S/D
Flatness	$\lambda/4$ @ 633nm
Bevel	Protective bevel
One surface	Polished and Metallic coating
The other surface	Fine ground

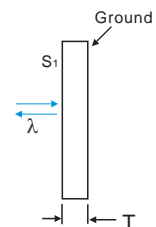
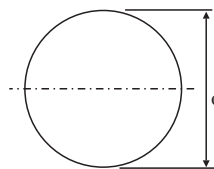
## Typical Sizes

Diameter(mm)

$\phi 5.0$	$\phi 10.0$	$\phi 12.7$	$\phi 15.0$	$\phi 20.0$
$\phi 25.4$	$\phi 30.0$	$\phi 38.1$	$\phi 50.8$	$\phi 76.2$

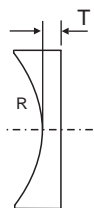
Thickness(mm)

0.5	1.0	1.5	2.0	3.0
4.0	5.0	6.0	8.0	10.0

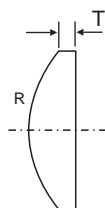


*other sizes and shapes are available.*

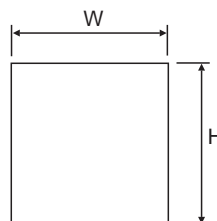
## Other Shapes



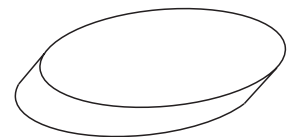
Plano-Concave



Plano-Convex



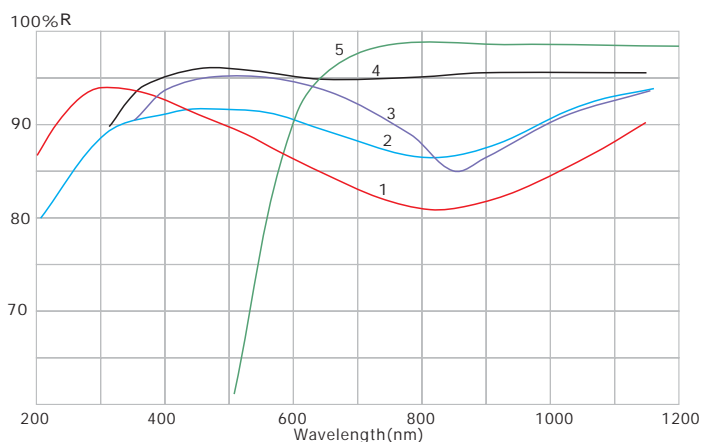
Rectangular



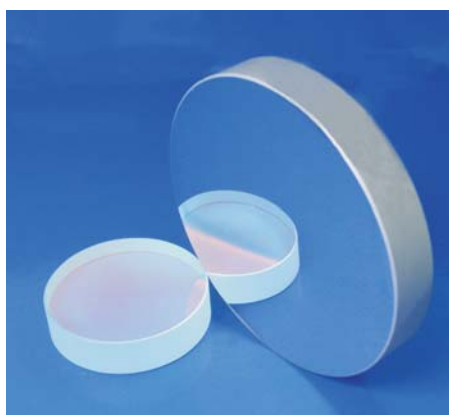
Elliptical Shape

*See "Lenses-Chapter" for the size of Plano-Concave or Plano-convex shape*

Coating Types	Reflectivity
Protected Aluminum	Ravg > 87% from 400nm to 800nm
VIS Enhanced Aluminum	Ravg > 93% from 450nm to 750nm
UV Enhanced Aluminum	Ravg > 86% from 250nm to 400 nm
Protected Silver	Ravg > 95% from 400nm to 20μm
Protected Gold	Ravg > 98% from 650nm to 16μm



1. UV Enhanced AL
2. Protected AL
3. VIS Enhanced AL
4. Protected Silver
5. Protected Gold



Metallic reflective coatings are delicate and require care during cleaning. Clean and dry pressurized gas can be used to blow off loose particles, then clean, deionized water, a mild detergent can be used. Gentle cleaning with a swab is recommended

**How to order mirrors? Example:**

Substrate: **N-BK7, φ25.4x 5.0mm**  
 Coating: **Protected Aluminum**

Price on request

Custom Design

Volume Discount

# Mirrors

(High energy reflective dielectric)

**Substrate Materials:** N-BK7, UV Fused silica

## General Specifications

Dimensional tolerance  
Surface quality  
Flatness  
Parallelism  
Bevel

## Commercial Grade

$\pm 0.1\text{mm}$   
60-40 S/D  
 $\lambda/4$  @ 633nm  
3'  
Protective bevel

## Laser Grade

$\pm 0.1\text{mm}$   
10-5 S/D  
 $\lambda/8$  @ 633nm  
1'  
Protective bevel

## Coating

One surface(S1)  
The other surface  
Angle of incident

HR @ wavelength  
None  
 $0^\circ$  or  $45^\circ$

## Example

HR @ 1064nm, R>99.8% AOI= $0^\circ$

## Typical Sizes

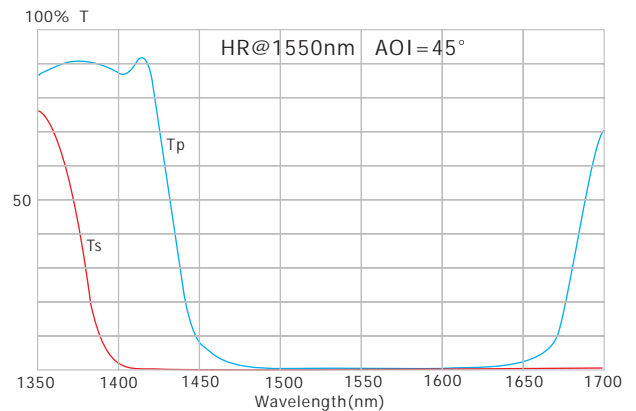
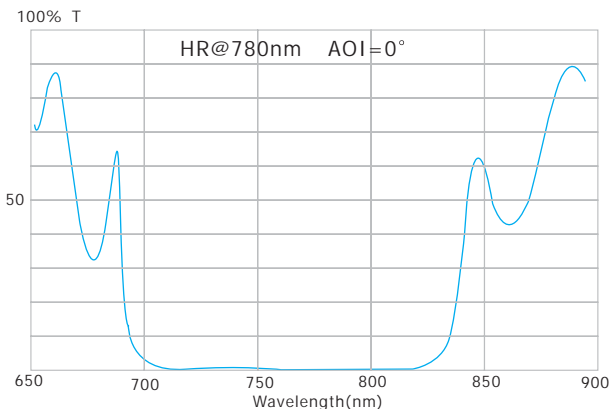
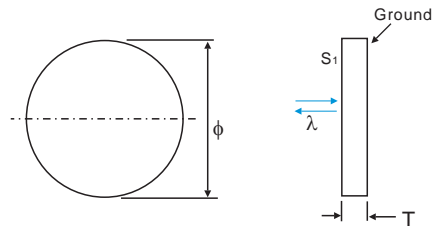
Diameter(mm)

$\phi 5.0$	$\phi 10.0$	$\phi 12.7$	$\phi 15.0$	$\phi 20.0$
$\phi 25.4$	$\phi 30.0$	$\phi 38.1$	$\phi 50.8$	$\phi 76.2$

Thickness(mm)

0.5	1.0	1.5	2.0	3.0
4.0	5.0	6.0	8.0	10.0

*other sizes and shapes are available.*



## How to order mirrors? Example:

Substrate: N-BK7,  $\phi 25.4 \times 5.0\text{mm}$

Coating: HR R>99.8% @ 1064nm, AOI= $0^\circ$

Price  
on request

Custom  
Design

Volume  
Discount

# Dichroic Mirrors

**Substrate Materials:** N-BK7, UV Fused silica

## General Specifications

Dimensional tolerance  
Surface quality  
Flatness  
Parallelism  
Bevel

## Commercial Grade

±0.1mm  
60-40 S/D  
 $\lambda/4$  @ 633nm  
3'  
Protective bevel

## Laser Grade

±0.1mm  
10-5 S/D  
 $\lambda/8$  @ 633nm  
1'  
Protective bevel

## Coating

One surface(S1)  
The other surface(S2)  
Angle of incident

HR @wavelength-1 + HT @wavelength-2  
AR @wavelength-2  
0° or 45°

## Example

HR @1064nm, R>99.8% + HT @532nm, T>97% AOI=0°

## Typical Sizes

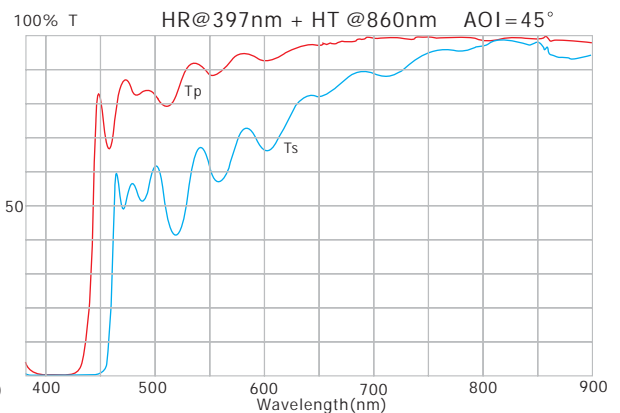
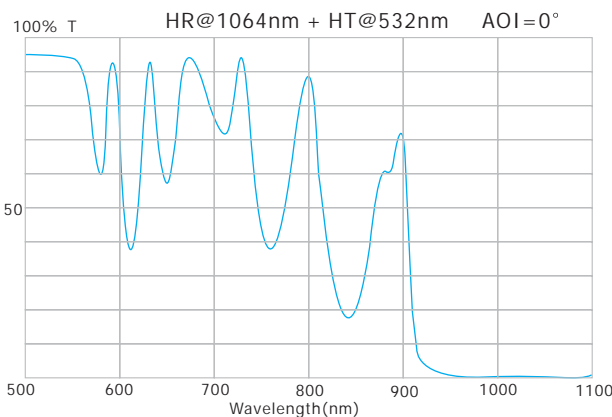
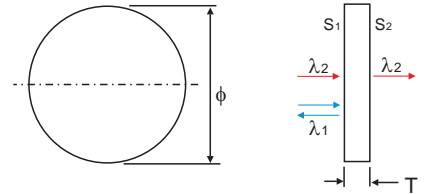
Diameter(mm)

φ5.0	φ10.0	φ12.7	φ15.0	φ20.0
φ25.4	φ30.0	φ38.1	φ50.8	φ76.2

Thickness(mm)

0.5	1.0	1.5	2.0	3.0
4.0	5.0	6.0	8.0	10.0

*other sizes and shapes are available.*



## How to order Dichroic Mirrors? Example:

Substrate: N-BK7, φ25.4x 3.0mm

Coating: HR R>99.8% @1064nm; HT@532nm T>95% AOI=0°

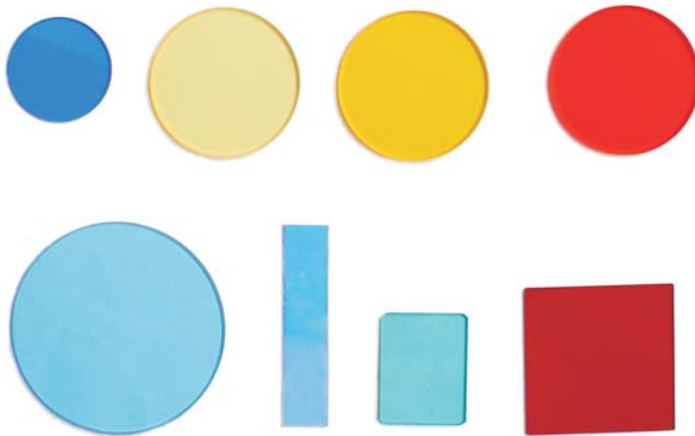
Price  
on request

Custom  
Design

Volume  
Discount

# Filters

- ※ Colored glass Filters-----61
- ※ Bandpass Filters-----62



# Colored Glass Filters

CeNing Optics provide a variety of colored glass filters covering the UV, visible and near-infrared wavelength regions. These filters serve as bandpass, broadband, or long-wave pass filters.

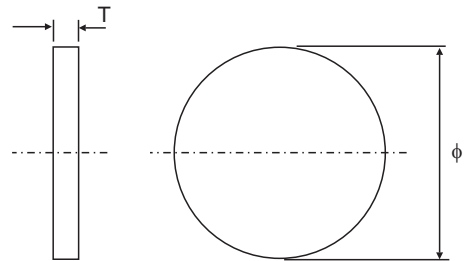
## General Specifications

Material	Schott , Hoya colored glass or equivalent
Dimension tolerance	$\pm 0.15\text{mm}$
Parallelism	3 arcmin
Surface flatness	$\lambda/2$ per 25mm
Surface quality	60-40 S/D
Clear aperture	>85%
Chamfers	0.25x45deg

## Typical Sizes

Diameter(mm)				
$\phi 5.0$	$\phi 10.0$	$\phi 12.7$	$\phi 15.0$	$\phi 20.0$
$\phi 25.4$	$\phi 30.0$	$\phi 38.1$	$\phi 50.8$	$\phi 76.2$

Thickness(mm)				
0.5	1.0	1.5	2.0	3.0
4.0	5.0			



*other sizes and shapes are available.*

## Part of Colored Glass (Schott):

WG230	GG495	RG715	BG25	KG2
WG280	GG515	RG780	VG9	KG3
WG295	GG530	RG830	VG11	BG20
WG320	GG550	UG11	VB8	FG6
WG345	GG570	UG1	VB10	BG34
WG360	GG590	UG5	VG5	FG3
WG400	RG610	BG3	VG6	FG18
WG420	RG630	BG14	GG19	NG1
WG455	RG645	BG38	GG10	NG9
GG475	RG665	BG7	RG60	NG3
GG495	RG695	BG12	RG7	NG11

## How to order colored glass filters? Example:

Material	KG1
Size	dia 12.7 $\pm 0.1$ mm
Thickness	2 $\pm 0.1$ mm
Parallelsim	$\pm 3'$
Polishing quality	Quality: 60-40 s/d, Flatness: $\lambda/2 @ 633\text{nm}$
Coating	Single layer MgF2

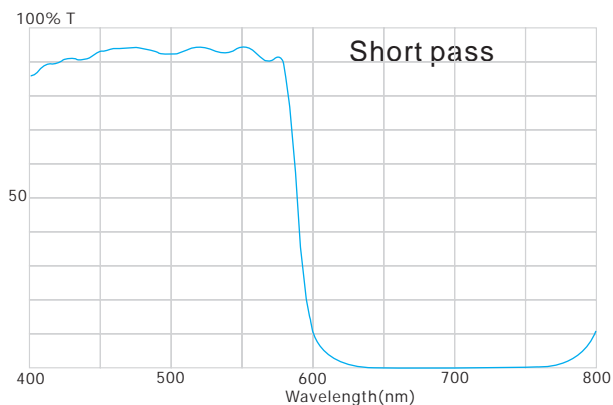
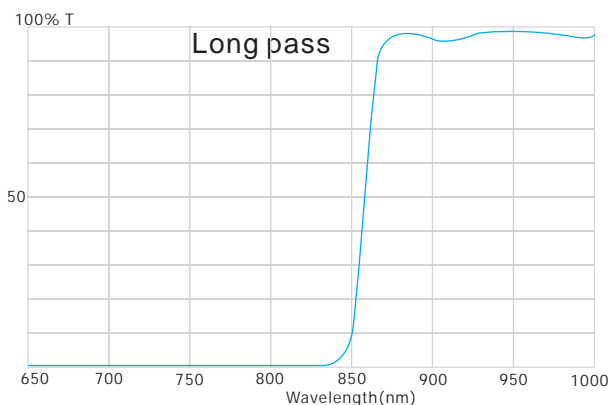
Price  
on request

Custom  
Design

Volume  
Discount

# Bandpass Filters

Band pass filter plate are divided into short-pass and long-pass filters according to whether they transmit below or above the transition wavelength. The transition wavelength or cut-on/off wavelength is the wavelength at which the transmission is 50% of its peak value.



## General Specifications

Material	BK7, Fused silica
Dimension tolerance	$\pm 0.1\text{mm}$
Parallelism	3 arcmin
Flatness	$\lambda/4$ @ 633nm
Surface quality	60-40 S/D

## Coating

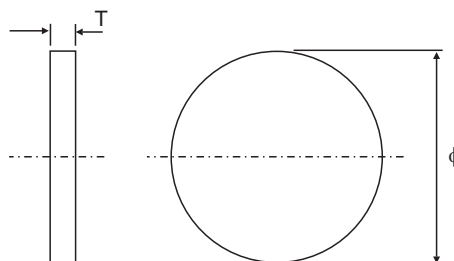
One surface(S1)	HR @ wavelength-1 + HT @ wavelength-2
The other surface(S2)	
Angle of incident	

## Typical Sizes

Diameter(mm)				
$\phi 5.0$	$\phi 10.0$	$\phi 12.7$	$\phi 15.0$	$\phi 20.0$
$\phi 25.4$	$\phi 30.0$	$\phi 38.1$	$\phi 50.8$	$\phi 76.2$

Thickness(mm)				
0.5	1.0	1.5	2.0	3.0
4.0	5.0			



*other sizes and shapes are available.*

## How to order bandpass filters? Example:

Substrate: **BK7,  $\phi 20 \times 2.0\text{mm}$**   
 Coating:  **$T > 80\%$  @  $400\text{--}500\text{nm}$  AOI= $0\text{--}8^\circ$   
 $T = 50\%$  @  $590 \pm 15\text{nm}$   
 $T < 1\%$  @  $640\text{--}740\text{nm}$**

- Price on request
- Custom Design
- Volume Discount



# Crystals

※ BBO-----	64
※ Nd:YAG-----	66
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※ CaF <sub>2</sub> -----	68

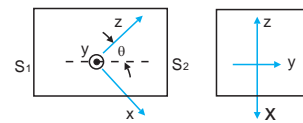
# BBO

BBO is an outstanding crystal for many applications in nonlinear optics and electro-optics. BBO is a colorless trigonal uniaxial crystal with low hygroscopic susceptibility. Its transparency range is from  $0.19\mu\text{m}$  to  $3.5\mu\text{m}$ .

BBO is an efficient nonlinear crystal for second, third, fourth and fifth harmonic generators of Nd: Laser, dye lasers and ultrafast Ti:Sapphire lasers. It has also excellent performance in optical parametric amplifier, oscillators, etc.

## BBO typical orientations:

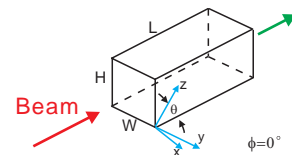
$\theta \neq 0^\circ$ ,  $\phi = 0^\circ$ , For Type I phase matching application.  
 $\theta \neq 0^\circ$ ,  $\phi = 30^\circ$ , For Type II phase matching application.  
 Brewster cut,  $\theta \neq 0^\circ$ ,  $\phi = 0^\circ$ , or  $30^\circ$ , no coating on S1&S2.  
 Z-cut, gold coated on X-faces, for Q-switch application.



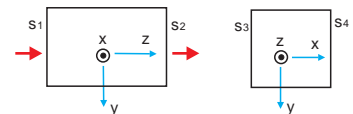
## Phase matching angle: $\theta$ and $\phi$

$\theta$  and  $\phi$  are depended on different applications of frequency conversion.

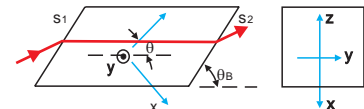
If you're not sure to calculate the phase matching angles, please contact us for assistance.



z-cut



Brewster angle cut



## General Specifications

Dimensional tolerance	$\pm 0.1\text{mm}$
Thickness tolerance	$\pm 0.02\text{mm}$
Angle tolerance	$< 0.5^\circ$
Surface flatness	$\lambda/8 @ 632.8\text{nm}$
Wavefront distortion	$\lambda/8 @ 632.8\text{nm}$
Surface quality	10-5S/D
Parallelism	$< 20 \text{ arcsec}$
Perpendicularity	$< 5 \text{ arcmin}$
Clear aperture	$> 85\%$

## Typical Sizes

Aperture: 5x5mm, 6x6mm, 7x7mm, 10x10mm

Thickness: 0.1mm, 0.2mm, 0.5mm, 1.0mm, 2.0mm, 3.0mm, 5.0mm

## Coating

Protective coating is required to prevent polished surfaces from fogging. Anti-reflective coating should be considered if low reflectivity is required.

Price  
on request

Volume  
Discount

Custom  
Design

### Ultra Thin BBO Plate

The minimum thickness of BBO we can polish is 0.005mm, the ultra thin BBO is used for frequency conversion of ultra fast laser with femtosecond pulse width.

For frequency conversion of ultrafast lasers such as Ti:sapphire and Dye laser with femtosecond pulse width.

The main concern is fs pulse broadening induced by group velocity mismatching(GVM) or group velocity dispersion. The suggested thickness of BBO crystals is less than pulse width divides.

### BBO Optical properties

Transparence range	189—3500nm
Second harmonic generation range	410—2400nm
Type I phase matching plane	X-Z plane, $\phi=0^\circ$
Type II phase matching plane	$\phi=30^\circ$
Refractive indices	$n_e=1.5425$ , $n_o=1.6551$ @ 1064nm $n_e=1.5555$ , $n_o=1.6749$ @ 532nm $n_e=1.6146$ , $n_o=1.7571$ @ 266nm
Therm-optic coefficients	$dn_e/dT=-9.3 \times 10^{-6}/^\circ\text{C}$ $dn_o/dT=-16.6 \times 10^{-6}/^\circ\text{C}$
NLO coefficients	$d_{11}=5.8 \times d_{36}$ (KDP) $d_{31}=0.05 \times d_{11}$ $d_{22}<0.05 \times d_{11}$
Half wave voltage	48Kv @ 1064nm
Damage threshold	5GW/cm <sup>2</sup> , 10ns, 1064nm
Sellmeier equations	$n_o^2(\lambda)=2.7359+0.01878/(\lambda^2-0.01822)-0.01354\lambda^2$ $n_e^2(\lambda)=2.3757+0.01224/(\lambda^2-0.01667)-0.01516\lambda^2$

### BBO Physical properties:

Crystal structure	Trigonal, space group $R_{3c}$
Cell parameters	A=B=12.532 Å, C=12.717Å, Z=6
Melting point	1095°C
Transition temperature	925°C
Mohs hardness	4.5
Optical coefficient	<0.1%/cm @ 1064nm
Density	3.85g/cm <sup>3</sup>
Hygroscopic susceptibility	Low
Resistivity	>10 <sup>11</sup> ohm-cm
Thermal expansion coefficients	$\perp$ C, $4 \times 10^{-6}/\text{K}$ ; //C, $36 \times 10^{-6}/\text{K}$
Thermal conductivity	$\perp$ C, 1.2w/m/k; //C, 1.6w/m/k

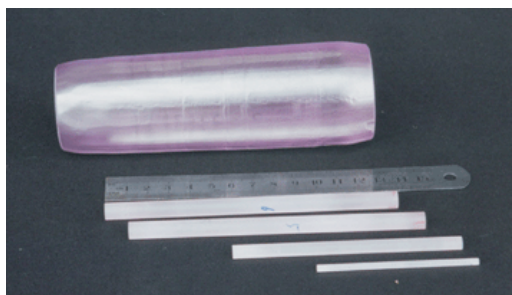
## Nd:YAG

Nd:YAG (neodymium-doped yttrium aluminium garnet;  $\text{Nd:Y}_3\text{Al}_5\text{O}_{12}$ ) is a crystal that is used as a lasing medium for solid-state lasers. The dopant, triply ionized neodymium, typically replaces yttrium in the crystal structure of the yttrium aluminium garnet, since they are of

Nd:YAG rod is an excellent laser crystal for high energy application, it has a high thermal conductivity, and good optical quality.

### General Specifications

Nd dopant	1.1%
Dimension tolerance	$\pm 0.1$ mm
Angle tolerance	$< 0.5^\circ$
Surface flatness	$\lambda/8 @ 632.8\text{nm}$
Wavefront distortion	$\lambda/8 @ 632.8\text{nm}$
Surface quality	10-5 S/D
Parallelism	$< 20$ arcsec
Perpendicularity	$< 5$ arcmin
Clear aperture	$> 85\%$



### Nd:YAG optical and physical properties.

Crystal structure	Cubic
Lattice parameters	$A=B=C=12.01\text{\AA}$
Density	$4.56\text{g/cm}^3$
Melting point	$1970^\circ\text{C}$
Mohs hardness	8.5
Density	$4.64\text{g/cm}^3$
Thermal expansion coefficient	$7.8 \times 10^{-6}/^\circ\text{C}$ [111]
Thermal conductivity	$14\text{w/m/k}$ @ $20^\circ\text{C}$
Refractive index	1.82
Lasing wavelength	1064nm
Stimulated emission cross-section	$2.8 \times 10^{-19}\text{cm}^2$ @ 1064nm
Relaxation time of terminal	30ns
Spontaneous fluorescent	$230\mu\text{s}$ 1 atomic %Nd
Radiative lifetime	$550\mu\text{s}$
Loss coefficient	$0.003\text{ cm}^{-1}$ @ 1064nm
Absorption band at pump wavelength	1nm
Pump wavelength	807.5nm
Polarized emission	unpolarized

Price  
on request

Volume  
Discount

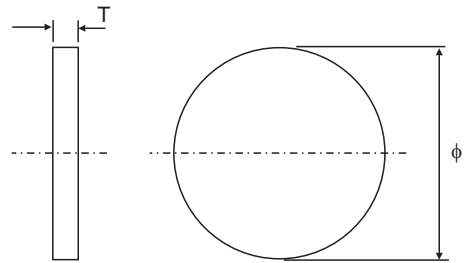
Custom  
Design

# Un-doped YAG

Undoped YAG crystal is an excellent material for UV-IR optical windows, particularly for high temperature and high energy density applications. The mechanical and chemical stability is comparable to sapphire, but YAG is unique with non-birefringence and available with higher optical homogeneity and surface quality.

## General Specifications

Dimension tolerance	$\pm 0.1\text{mm}$
Surface flatness	$\lambda/4 @ 632.8\text{nm}$
Surface quality	20-10 S/D
Parallelism	1 arcmin
Clear aperture	>90%
Bevel	Protective bevel



## Typical Sizes

### Diameter(mm)

$\phi 5.0$	$\phi 10.0$	$\phi 12.7$	$\phi 15.0$	$\phi 20.0$
$\phi 25.4$	$\phi 30.0$	$\phi 38.1$	$\phi 50.8$	

### Thickness(mm)

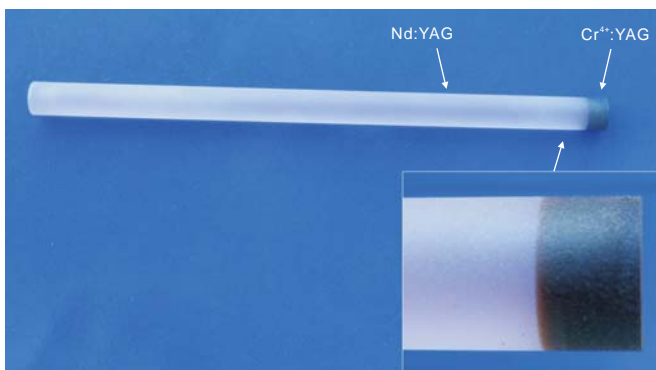
0.5	1.0	1.5	2.0	3.0
4.0	5.0			

*other sizes and shapes are available.*

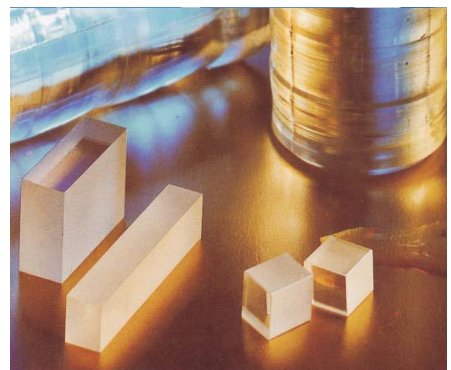
Price  
on request

Volume  
Discount

Custom  
Design



Compound of Nd:YAG+Cr<sup>4+</sup>:YAG



# CaF<sub>2</sub>

Calcium fluoride is commonly used as a window material for both infrared and ultraviolet wavelengths, since it is transparent in these regions (about 0.15μm to 9μm) and exhibits extremely weak birefringence. Furthermore the material is fairly inert chemically so that these windows are not attacked. Nevertheless, at wavelengths as low as 157 nm, which are interesting to semiconductor manufacturers, the birefringence of calcium fluoride exceeds tolerable limits.

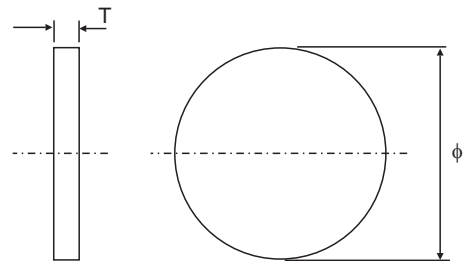
Fluorides are toxic to humans, however CaF<sub>2</sub> is considered relatively harmless due to its extreme insolubility

We provide artificially-crystallized calcium fluoride components available in IR grade and UV Grade. The cost of UV grade is much expensive than IR grade.

Transparence range:	0.13—11.3μm
Index:	1.50 @ 193nm, 1.42 @ 1μm, 1.42 @ 2.6 μm
Knoop hardness:	170kg/mm <sup>2</sup>
Density:	3.18 g/cm <sup>3</sup>
Melting Point:	1360°C
Young's Modulus:	75.8 GPa
Dielectric Constant	6.76x10 <sup>6</sup> Hz
Thermal Expansion	18.85 x10 <sup>-6</sup> /°C
Thermal Conductivity	9.71 w/m/K

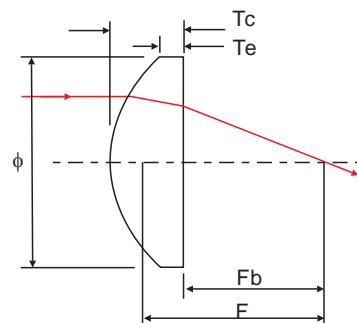
### General specifications

Surface quality	60-40 S/D
Parallelism	3 arcmin
Flatness	λ/2 @ 633nm
Bevel	Protective bevel



### Typical sizes

Diameter	Thickness
φ5.0	1.0
φ10.0	1.0
φ12.7	2.0
φ15.0	2.0
φ20.0	2.0
φ25.4	3.0
φ38.1	3.0



Price on request    Volume Discount    Custom Design

#### Inquiry

No standard prices are listed in the catalog. Please send us your requirements to us by email, fax, phone for inquiry.

#### Quote

We will quote within 24 hours of receipt of your complete specifications. The price we quote are in US\$ or EURO.

#### Order

We accept orders by fax, email. We will send you an order confirmation in two days after receiving order.

#### Delivery

Delivery time is depended on the specifications and quantity. Unless advance instruction from customer, all of shipments are made via Express. We work with major carriers. Please let me know your preferred means of shipping.

#### Payment

We accept payment two methods: wire transfer, and cheque. The payment term is 30 days.

### How to contact us?

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