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OPTICAL SUBSTRATES

14S Optical Substrates

Various dimensions substrates made from BK7, UVFS, IRFS, CaF_2, ZnSe, Sapphire, MgF_2.
Standard substrates are laser grade polished on both surfaces. These substrates are ideal for beamsplitters, windows, partial reflecting mirrors etc.
Laser components require highly polished substrates as well as high performance coatings. Scattering, laser damage of laser light can occur if the substrate is made of inferior material or if it is inadequately polished. For UV, very high power applications and ultrashort pulses we recommend using UVFS substrates. BK7 substrates are economical solution for laser components used in many applications in laboratory as well as in many devices and instruments.
Standa provides various dielectric and metallic coatings on optical substrates.

FEATURES

- Ideal for beamsplitters, windows, partial reflecting mirrors etc.
- UVFS substrates are recommended for the UV and very high energy applications
- Windows up to 500 mm diameter are available
- Various dielectric coatings can be deposited on substrates

STANDARD SPECIFICATIONS

Material	BK7, UVFS, IRFS, CaF_2, ZnSe, Sapphire, MgF_2
Shape	Round, Rectangular
Surface Quality	20–10 scratch & dig (BK7, UVFS); 40–20 scratch & dig (ZnSe, Sapphire, CaF_2, MgF_2)
Surface Figure	λ/10 – λ/8 per 1 inch diam (BK7, UVFS) λ/2 – λ/4 per 1 inch diam (ZnSe)
Dimension Tolerances	Diameter: +0.0, –0.1 mm Thickness: ±0.1 mm
Coatings	None. Please refer to the *Coating Section*

CODE EXAMPLE FOR ORDERING

14S-1-1-XXX

- Dimensions
- Substrate material
- Coating type (optional)

STANDARD PRODUCTS

Material	Dimensions, mm	Parallelism Error	Ordering Code
BK7	12.7×3	<1 arcmin	**14S-05-1**
	12.5×5	<1 arcmin	**14S-4-1**
	12.7×6	<1 arcmin	**14S-5-1**
	20×40×3	<20 arcsec	**14S-6-1**
	25.4×3	<1 arcmin	**14S-7-1**
	25.4×5	1 deg ± 5 arcmin	**14S-8-1**
	25.4×6	<1 arcmin	**14S-1-1**
	30×6	<1 arcmin	**14S-9-1**
	38.1×5	<1 arcmin	**14S-10-1**
	50.8×8	<1 arcmin	**14S-2-1**
	76.2×8	<1 arcmin	**14S-3-1**
UVFS	12.7×2	<1 arcmin	**14S-11-2**
	12.7×3	<1 arcmin	**14S-05-2**
	12.7×5	<1 arcmin	**14S-4-2**
	12.7×6	<1 arcmin	**14S-5-2**
	20×40×3	<20 arcsec	**14S-6-2**
	20×60×2	<20 arcsec	**14S-14-2**
	25.4×3	<1 arcmin	**14S-7-2**
	25.4×5	<1 arcmin	**14S-8-2**
	25.4×3	1 deg ± 5 arcmin	**14S-16-2**
	30×5	<1 arcmin	**14S-17-2**
	30×30×5	<1 arcmin	**14S-18-2**
	38.1×5	<1 arcmin	**14S-10-2**
	50.8×6	<1 arcmin	**14S-20-2**
	76.2×6	<1 arcmin	**14S-21-2**
IRFS	12.7×6	<1 arcmin	**14S-5-3**
	25.4×3	<1 arcmin	**14S-7-3**
ZnSe	25.4×3	<1 arcmin	**14S-7-4**
CaF_2	25.4×3	<1 arcmin	**14S-7-5**
MgF_2	25.4×3	<1 arcmin	**14S-7-6**
Sapphire	25.4×3	<1 arcmin	**14S-7-7**

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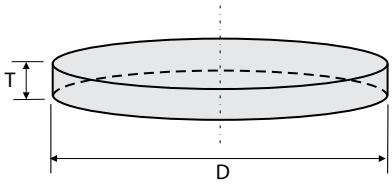
14OF Optical Flats

Optical flats – precisely polished optical grade substrates used for testing and evaluating the surface flatness of other optical components. When an optical flat is placed on another surface and illuminated with monochromatic light, the light waves reflect off both – the bottom surface of the flat and the surface it is resting on. The reflected waves interfere, creating a pattern of interference fringes (Newton's rings), visible as light and dark bands. If the surface of the optical flat is significantly flatter than the surface that is being evaluated, it is correct to interpret the interference pattern directly as a contour map of the surface being evaluated. If the flat is used on the top of the object, and interference pattern viewed through the flat, it is advantageous to have an anti-reflection coating on the top surface of the flat (the surface which does not touch the object being evaluated).
For appropriate AR coating please refer to the *Coatings section*.



STANDARD SPECIFICATIONS

Material	UVFS
Diameter Tolerance	+0.0, –0.12 mm
Thickness Tolerance	±0.2 mm
S1 Surface Flatness	λ/20 @ 633 nm
S2 Surface Flatness	2 λ @ 633 nm
AR Coatings	None. Please refer to the *Coatings Section*

APPLICATIONS

Optical flats are versatile optical components used in many applications, such as:

- inspection of gauge blocks for wear and accuracy,
- as well as the testing of various components including windows, prisms, filters, mirrors, etc.
- They can also be used as extremely flat optical windows for demanding interferometry requirements.

OPTICAL FLATS

Diameter, mm	Thickness, mm	Ordering Code
25.4	8	**14OF-1**
38.1	8	**14OF-1.5**
25	10	**14OF-25**
40	10	**10OF-40**

CODE EXAMPLE FOR ORDERING

14OF-40-XXX

Diameter, mm

Coating type (optional)

RELATED PRODUCTS

- **4OCM-25** – Optical Component Mount

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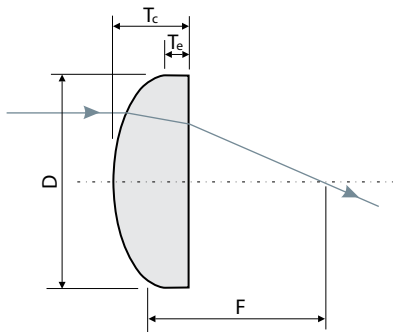
LENSES

14PCX Plano-Convex Lenses



Positive focal length lenses have flat surface on one side and spherical surface on the other. They are used for focusing beams in telescopes, collimators or condenser systems, optical transceivers or other applications. PCX lens up to 500 mm diameter are available. Under customers request lens are anti-reflection coated (please refer to the *Coatings section*).

FEATURES

- Converges incident light
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

STANDARD SPECIFICATIONS

Material	BK7, FS, UVFS, CaF_2, ZnSe, Si, Ge
Diameter Tolerance	+0.0, –0.15 mm
Focal Length Tolerance	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40-20 scratch & dig
Design Wavelength	632.8 nm
AR Coatings	None. Please refer to the *Coatings Section*

BK7 PLANO-CONVEX LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	+20	2.5	**14PCX20-05-1**
12.7	+25	2.5	**14PCX25-05-1**
12.7	+40	2.5	**14PCX40-05-1**
12.7	+50	2.5	**14PCX50-05-1**
12.7	+60	2.5	**14PCX60-05-1**
12.7	+75	2.5	**14PCX75-05-1**
12.7	+100	2.5	**14PCX100-05-1**
12.7	+150	2.5	**14PCX150-05-1**
12.7	+200	2.0	**14PCX200-05-1**
12.7	+250	2.0	**14PCX250-05-1**
12.7	+300	2.0	**14PCX300-05-1**
12.7	+500	2.0	**14PCX500-05-1**
12.7	+1000	2.0	**14PCX1000-05-1**
12.7	+1500	2.0	**14PCX1500-05-1**
25.4	+30	2.3	**14PCX30-1-1**
25.4	+35	2.0	**14PCX35-1-1**
25.4	+40	2.0	**14PCX40-1-1**
25.4	+50	2.0	**14PCX50-1-1**
25.4	+60	2.0	**14PCX60-1-1**
25.4	+75	2.0	**14PCX75-1-1**
25.4	+100	2.0	**14PCX100-1-1**
25.4	+125	2.0	**14PCX125-1-1**
25.4	+150	2.0	**14PCX150-1-1**
25.4	+200	2.0	**14PCX200-1-1**
25.4	+250	2.0	**14PCX250-1-1**
25.4	+300	2.0	**14PCX300-1-1**
25.4	+350	2.5	**14PCX350-1-1**
25.4	+400	2.0	**14PCX400-1-1**

BK7 Plano-Convex Lenses *(continued)*

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
25.4	+450	2.7	**14PCX450-1-1**
25.4	+500	2.0	**14PCX500-1-1**
25.4	+700	2.8	**14PCX700-1-1**
25.4	+750	2.0	**14PCX750-1-1**
25.4	+800	2.8	**14PCX800-1-1**
25.4	+1000	2.5	**14PCX1000-1-1**
25.4	+1200	2.5	**14PCX1200-1-1**
25.4	+1300	2.9	**14PCX1300-1-1**
25.4	+1500	2.5	**14PCX1500-1-1**
25.4	+2000	3.0	**14PCX2000-1-1**
25.4	+2500	3.0	**14PCX2500-1-1**
25.4	+3000	3.0	**14PCX3000-1-1**
25.4	+4000	3.0	**14PCX4000-1-1**
25.4	+5000	3.0	**14PCX5000-1-1**
25.4	+10000	3.0	**14PCX10000-1-1**
38.1	+50	3.0	**14PCX50-1.5-1**
38.1	+75	2.5	**14PCX75-1.5-1**
38.1	+100	2.5	**14PCX100-1.5-1**
38.1	+150	2.5	**14PCX150-1.5-1**
38.1	+200	2.5	**14PCX200-1.5-1**
38.1	+250	2.5	**14PCX250-1.5-1**
38.1	+300	2.7	**14PCX300-1.5-1**
38.1	+400	3.1	**14PCX400-1.5-1**
38.1	+500	3.4	**14PCX500-1.5-1**
38.1	+700	3.5	**14PCX700-1.5-1**
38.1	+1000	3.6	**14PCX1000-1.5-1**
38.1	+5000	3.8	**14PCX5000-1.5-1**

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BK7 Plano-Convex Lenses *(continued)*

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
50.8	+75	3.0	**14PCX75-2-1**
50.8	+100	3.0	**14PCX100-2-1**
50.8	+150	3.0	**14PCX150-2-1**
50.8	+200	3.0	**14PCX200-2-1**
50.8	+250	3.0	**14PCX250-2-1**
50.8	+300	3.0	**14PCX300-2-1**
50.8	+350	3.0	**14PCX350-2-1**
50.8	+400	4.0	**14PCX400-2-1**

UVFS PLANO-CONVEX LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	+20	2.5	**14PCX20-05-2**
12.7	+25	2.5	**14PCX25-05-2**
12.7	+40	2.5	**14PCX40-05-2**
12.7	+50	2.5	**14PCX50-05-2**
12.7	+60	2.5	**14PCX60-05-2**
12.7	+75	2.5	**14PCX75-05-2**
12.7	+100	2.5	**14PCX100-05-2**
12.7	+150	2.5	**14PCX150-05-2**
12.7	+200	2.0	**14PCX200-05-2**
12.7	+250	2.0	**14PCX250-05-2**
12.7	+300	2.0	**14PCX300-05-2**
12.7	+500	2.0	**14PCX500-05-2**
12.7	+1000	2.0	**14PCX1000-05-2**
12.7	+1500	2.0	**14PCX1500-05-2**
25.4	+35	2.0	**14PCX35-1-2**
25.4	+50	2.0	**14PCX50-1-2**
25.4	+60	2.0	**14PCX60-1-2**
25.4	+75	2.0	**14PCX75-1-2**
25.4	+100	2.0	**14PCX100-1-2**
25.4	+125	2.0	**14PCX125-1-2**
25.4	+150	2.0	**14PCX150-1-2**
25.4	+200	2.0	**14PCX200-1-2**
25.4	+250	2.0	**14PCX250-1-2**
25.4	+300	2.0	**14PCX300-1-2**
25.4	+400	2.0	**14PCX400-1-2**
25.4	+500	2.0	**14PCX500-1-2**
25.4	+750	2.0	**14PCX750-1-2**
25.4	+1000	2.5	**14PCX1000-1-2**
25.4	+1200	2.5	**14PCX1200-1-2**
25.4	+1500	2.5	**14PCX1500-1-2**
25.4	+2000	3.0	**14PCX2000-1-2**
25.4	+2500	3.0	**14PCX2500-1-2**
25.4	+3000	3.0	**14PCX3000-1-2**
25.4	+4000	3.0	**14PCX4000-1-2**

ZnSe PLANO-CONVEX LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	+25	3.0	**14PCX25-05-4**
12.7	+30	3.0	**14PCX30-05-4**
12.7	+50	2.5	**14PCX50-05-4**
12.7	+100	2.5	**14PCX100-05-4**
12.7	+200	2.5	**14PCX200-05-4**
12.7	+300	2.5	**14PCX300-05-4**
12.7	+500	2.5	**14PCX500-05-4**
25.4	+100	2.5	**14PCX100-1-4**
25.4	+200	2.5	**14PCX200-1-4**
25.4	+300	2.5	**14PCX300-1-4**
25.4	+500	2.5	**14PCX500-1-4**

BK7 Plano-Convex Lenses *(continued)*

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
50.8	+500	3.0	**14PCX500-2-1**
50.8	+600	4.0	**14PCX600-2-1**
50.8	+800	4.0	**14PCX800-2-1**
50.8	+1000	3.0	**14PCX1000-2-1**
50.8	+2000	3.0	**14PCX2000-2-1**
50.8	+5000	4.9	**14PCX5000-2-1**
50.8	+10000	4.9	**14PCX10000-2-1**

UVFS Plano-Convex Lenses *(continued)*

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
25.4	+5000	3.0	**14PCX5000-1-2**
25.4	+10000	3.0	**14PCX10000-1-2**
38.1	+50	2.5	**14PCX50-1.5-2**
38.1	+75	2.5	**14PCX75-1.5-2**
38.1	+100	2.5	**14PCX100-1.5-2**
38.1	+150	2.5	**14PCX150-1.5-2**
38.1	+200	2.8	**14PCX200-1.5-2**
38.1	+250	2.2	**14PCX250-1.5-2**
38.1	+300	2.5	**14PCX300-1.5-2**
38.1	+400	2.9	**14PCX400-1.5-2**
38.1	+500	3.1	**14PCX500-1.5-2**
38.1	+600	3.2	**14PCX600-1.5-2**
38.1	+1000	3.5	**14PCX1000-1.5-2**
38.1	+1500	3.7	**14PCX1500-1.5-2**
38.1	+5000	3.9	**14PCX5000-1.5-2**
50.8	+75	2.8	**14PCX75-2-2**
50.8	+100	2.0	**14PCX100-2-2**
50.8	+150	2.0	**14PCX150-2-2**
50.8	+200	3.0	**14PCX200-2-2**
50.8	+250	3.3	**14PCX250-2-2**
50.8	+300	3.0	**14PCX300-2-2**
50.8	+350	3.0	**14PCX350-2-2**
50.8	+400	4.3	**14PCX400-2-2**
50.8	+500	3.0	**14PCX500-2-2**
50.8	+600	4.8	**14PCX600-2-2**
50.8	+800	4.8	**14PCX800-2-2**
50.8	+1000	3.0	**14PCX1000-2-2**
50.8	+2000	3.0	**14PCX2000-2-2**
50.8	+2500	5.7	**14PCX2500-2-2**

CaF_2 PLANO-CONVEX LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	+25	2.0	**14PCX25-05-3**
12.7	+50	2.0	**14PCX50-05-3**
12.7	+75	2.0	**14PCX75-05-3**
12.7	+100	2.0	**14PCX100-05-3**
12.7	+150	2.0	**14PCX150-05-3**
12.7	+200	2.0	**14PCX200-05-3**
12.7	+250	2.0	**14PCX250-05-3**
12.7	+500	2.0	**14PCX500-05-3**
25.4	+50	3.0	**14PCX50-1-3**
25.4	+75	3.0	**14PCX75-1-3**
25.4	+100	3.0	**14PCX100-1-3**
25.4	+150	3.0	**14PCX150-1-3**
25.4	+200	3.0	**14PCX200-1-3**
25.4	+250	3.0	**14PCX250-1-3**
25.4	+500	3.0	**14PCX500-1-3**
25.4	+1000	3.0	**14PCX1000-1-3**

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CODE EXAMPLE FOR ORDERING

14PCX100-1-2

Focal length

Diameter
05 – 12.7 mm
1 – 25.4 mm
1.5 – 38.1 mm
2 – 50.8 mm

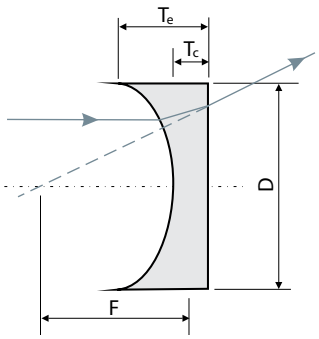
Material
1 – BK7
2 – UVFS
3 – CaF_2
4 – ZnSe

RELATED PRODUCTS

- **4SCML-2 –** Self-Centering Lens/Optics Mount

- **5TLM-1 –** Y-Z Positioner for Lens, Pinholes and Objectives

14PCV Plano-Concave Lenses



These negative focus length lenses have flat surface on one side and spherical surface on the other. They are used to expand beams or to increase focal lengths in optical systems or other similar applications. PCV lens up to 500 mm diameter are available. Under customers request lens are anti-reflection coated (please refer to the *Coatings section*).

FEATURES

- Diverges incident light
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

STANDARD SPECIFICATIONS

Material	BK7, FS, UVFS, CaF_2, ZnSe, Si, Ge
Diameter Tolerance	+0.0, –0.15 mm
Focal Length Tolerance	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design Wavelength	632.8 nm
AR coatings	None. Please refer to the *Coatings Section*

BK7 PLANO-CONCAVE LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	–20	4.0	**14PCV20-05-1**
12.7	–30	3.5	**14PCV30-05-1**
12.7	–50	3.5	**14PCV50-05-1**
12.7	–75	3.5	**14PCV75-05-1**
12.7	–100	3.5	**14PCV100-05-1**
12.7	–125	3.5	**14PCV125-05-1**
12.7	–150	3.5	**14PCV150-05-1**
12.7	–200	3.5	**14PCV200-05-1**
12.7	–250	3.5	**14PCV250-05-1**
12.7	–500	3.5	**14PCV500-05-1**
12.7	–1000	3.5	**14PCV1000-05-1**

BK7 Plano-Concave Lenses *(continued)*

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
25.4	–40	6.0	**14PCV40-1-1**
25.4	–50	5.5	**14PCV50-1-1**
25.4	–75	5.0	**14PCV75-1-1**
25.4	–100	4.0	**14PCV100-1-1**
25.4	–125	4.0	**14PCV125-1-1**
25.4	–150	3.5	**14PCV150-1-1**
25.4	–200	3.5	**14PCV200-1-1**
25.4	–250	3.5	**14PCV250-1-1**
25.4	–300	3.5	**14PCV300-1-1**
25.4	–400	3.5	**14PCV400-1-1**
25.4	–500	3.5	**14PCV500-1-1**

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BK7 Plano-Concave Lenses *(continued)*

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
25.4	–1000	3.5	**14PCV1000-1-1**
25.4	–2000	3.5	**14PCV2000-1-1**
25.4	–3000	3.5	**14PCV3000-1-1**
25.4	–10000	3.5	**14PCV10000-1-1**
38.1	–100	7.0	**14PCV100-1.5-1**
38.1	–150	6.0	**14PCV150-1.5-1**
38.1	–200	6.0	**14PCV200-1.5-1**
38.1	–300	6.0	**14PCV300-1.5-1**
50.8	–500	4.0	**14PCV500-2-1**
50.8	–900	4.0	**14PCV900-2-1**
50.8	–1000	4.0	**14PCV1000-2-1**
50.8	–1200	4.0	**14PCV1200-2-1**
50.8	–1500	4.0	**14PCV1500-2-1**
50.8	–2000	4.0	**14PCV2000-2-1**
50.8	–8000	4.0	**14PCV8000-2-1**

CaF_2 PLANO-CONCAVE LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	–25	4.0	**14PCV25-05-3**
12.7	–50	3.0	**14PCV50-05-3**
12.7	–75	3.0	**14PCV75-05-3**
12.7	–100	3.0	**14PCV100-05-3**
12.7	–150	3.0	**14PCV150-05-3**
12.7	–200	2.0	**14PCV200-05-3**
12.7	–250	2.0	**14PCV250-05-3**
12.7	–500	2.0	**14PCV500-05-3**
25.4	–100	3.0	**14PCV100-1-3**
25.4	–150	4.0	**14PCV150-1-3**
25.4	–200	3.0	**14PCV200-1-3**
25.4	–250	4.0	**14PCV250-1-3**
25.4	–500	3.0	**14PCV500-1-3**
25.4	–1000	3.0	**14PCV1000-1-3**

ZnSe PLANO-CONCAVE LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	–50	3.0	**14PCV50-05-4**
12.7	–100	3.0	**14PCV100-05-4**
12.7	–500	2.5	**14PCV500-05-4**
25.4	–50	3.5	**14PCV50-1-4**
25.4	–100	3.0	**14PCV100-1-4**
25.4	–200	2.5	**14PCV200-1-4**
25.4	–300	2.5	**14PCV300-1-4**

RELATED PRODUCTS AND ACCESSORIES

- **5ZYP-2-B1** – Y-Z Positioner for Lens, Pinholes and Objectives

UVFS PLANO-CONCAVE LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	–20	4.0	**14PCV20-05-2**
12.7	–30	3.5	**14PCV30-05-2**
12.7	–50	3.5	**14PCV50-05-2**
12.7	–75	3.5	**14PCV75-05-2**
12.7	–100	3.5	**14PCV100-05-2**
12.7	–150	3.5	**14PCV150-05-2**
12.7	–200	3.5	**14PCV200-05-2**
12.7	–250	3.5	**14PCV250-05-2**
12.7	–500	3.5	**14PCV500-05-2**
12.7	–1000	3.5	**14PCV1000-05-2**
25.4	–40	6.0	**14PCV40-1-2**
25.4	–50	5.5	**14PCV50-1-2**
25.4	–75	5.0	**14PCV75-1-2**
25.4	–100	4.0	**14PCV100-1-2**
25.4	–150	3.5	**14PCV150-1-2**
25.4	–200	3.5	**14PCV200-1-2**
25.4	–250	3.5	**14PCV250-1-2**
25.4	–300	3.5	**14PCV300-1-2**
25.4	–400	3.5	**14PCV400-1-2**
25.4	–500	3.5	**14PCV500-1-2**
25.4	–1000	3.5	**14PCV1000-1-2**
25.4	–2000	3.5	**14PCV2000-1-2**
25.4	–3000	3.5	**14PCV3000-1-2**
25.4	–10000	3.5	**14PCV10000-1-2**
38.1	–100	7.0	**14PCV100-1.5-2**
38.1	–150	6.0	**14PCV150-1.5-2**
38.1	–200	5.2	**14PCV200-1.5-2**
38.1	–300	5.7	**14PCV300-1.5-2**
50.8	–500	4.0	**14PCV500-2-2**
50.8	–900	4.0	**14PCV900-2-2**
50.8	–1000	4.0	**14PCV1000-2-2**
50.8	–1200	4.0	**14PCV1200-2-2**
50.8	–1500	4.0	**14PCV1500-2-2**
50.8	–2000	4.0	**14PCV2000-2-2**
50.8	–8000	4.0	**14PCV8000-2-2**

CODE EXAMPLE FOR ORDERING

14PCV100-1-1

Focal length

Diameter
05 – 12.7 mm
1 – 25.4 mm
1.5 – 38.1 mm
2 – 50.8 mm

Material
1 – BK7
2 – UVFS
3 – CaF_2
4 – ZnSe

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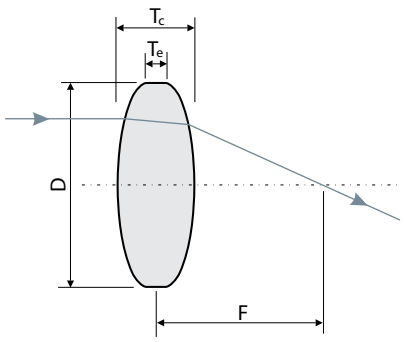
14BCX Double-Convex Lenses



Double convex lenses are symmetrical therefore have equal radius of curvature on both sides. Biconvex lenses are used as magnifiers, objectives, condensing systems. Since both surfaces contribute to the power of biconvex lenses, they have shorter focal length than PCX lenses of equal diameter and surface radius. Lenses can be anti-reflection coated (please refer to the *Coatings section*).

FEATURES

- Converges incident light
- Lower spherical aberrations than for Plano-Convex lenses
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

STANDARD SPECIFICATIONS

Material	BK7, FS, UVFS, CaF_2, ZnSe, Si, Ge
Diameter Tolerance	+0.0, –0.15 mm
Focal Length Tolerance	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design Wavelength	632.8 nm
AR coatings	None. Please refer to the *Coatings Section*

BK7 DOUBLE-CONVEX LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	+12	2.0	**14BCX12-05-1**
12.7	+15	2.0	**14BCX15-05-1**
12.7	+20	2.0	**14BCX20-05-1**
12.7	+60	2.0	**14BCX60-05-1**
12.7	+75	2.0	**14BCX75-05-1**
12.7	+100	1.6	**14BCX100-05-1**
12.7	+125	1.7	**14BCX125-05-1**
12.7	+150	1.7	**14BCX150-05-1**
12.7	+200	1.9	**14BCX200-05-1**
12.7	+250	1.9	**14BCX250-05-1**
12.7	+300	1.9	**14BCX300-05-1**
12.7	+400	1.9	**14BCX400-05-1**
25.4	+25	2.0	**14BCX25-1-1**
25.4	+30	2.0	**14BCX30-1-1**
25.4	+35	2.0	**14BCX35-1-1**
25.4	+40	1.9	**14BCX40-1-1**
25.4	+50	2.0	**14BCX50-1-1**
25.4	+60	1.6	**14BCX60-1-1**
25.4	+75	2.0	**14BCX75-1-1**
25.4	+100	2.5	**14BCX100-1-1**
25.4	+150	3.0	**14BCX150-1-1**
25.4	+200	3.2	**14BCX200-1-1**
25.4	+250	3.4	**14BCX250-1-1**
25.4	+500	3.7	**14BCX500-1-1**
25.4	+700	3.8	**14BCX700-1-1**
25.4	+1000	3.8	**14BCX1000-1-1**
38.1	+50	2.2	**14BCX50-1.5-1**
38.1	+100	2.0	**14BCX100-1.5-1**
38.1	+150	2.6	**14BCX150-1.5-1**
38.1	+200	3.0	**14BCX200-1.5-1**
38.1	+250	3.4	**14BCX250-1.5-1**
38.1	+300	3.7	**14BCX300-1.5-1**
38.1	+400	4.0	**14BCX400-1.5-1**

BK7 Double-Convex Lenses *(continued)*

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
38.1	+500	4.2	**14BCX500-1.5-1**
38.1	+700	4.5	**14BCX700-1.5-1**
38.1	+1000	4.6	**14BCX1000-1.5-1**
50.8	+50	1.5	**14BCX50-2-1**
50.8	+75	2.0	**14BCX75-2-1**
50.8	+100	2.0	**14BCX100-2-1**
50.8	+150	2.0	**14BCX150-2-1**
50.8	+200	2.0	**14BCX200-2-1**
50.8	+300	3.0	**14BCX300-2-1**
50.8	+400	3.6	**14BCX400-2-1**
50.8	+500	4.0	**14BCX500-2-1**
50.8	+750	3.4	**14BCX750-2-1**
50.8	+1000	4.4	**14BCX1000-2-1**
50.8	+1200	4.5	**14BCX1200-2-1**

UVFS DOUBLE-CONVEX LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	+12.7	1.8	**14BCX12.7-05-2**
12.7	+15	2.0	**14BCX15-05-2**
12.7	+20	2.0	**14BCX20-05-2**
12.7	+25	2.0	**14BCX25-05-2**
12.7	+50	2.1	**14BCX50-05-2**
12.7	+75	1.9	**14BCX75-05-2**
12.7	+100	1.9	**14BCX100-05-2**
12.7	+150	1.9	**14BCX150-05-2**
25.4	+25	2.4	**14BCX25-1-2**
25.4	+30	2.0	**14BCX30-1-2**
25.4	+40	2.0	**14BCX40-1-2**
25.4	+50	2.0	**14BCX50-1-2**
25.4	+75	1.7	**14BCX75-1-2**
25.4	+100	2.3	**14BCX100-1-2**

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UVFS Double-Convex Lenses *(continued)*

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
25.4	+150	2.1	**14BCX150-1-2**
25.4	+200	2.2	**14BCX200-1-2**
25.4	+250	2.3	**14BCX250-1-2**
25.4	+300	2.6	**14BCX300-1-2**
25.4	+400	2.7	**14BCX400-1-2**
25.4	+500	2.7	**14BCX500-1-2**
25.4	+750	2.9	**14BCX750-1-2**
25.4	+1000	2.8	**14BCX1000-1-2**
38.1	+50	1.9	**14BCX50-1.5-2**
38.1	+100	1.5	**14BCX100-1.5-2**
38.1	+150	2.1	**14BCX150-1.5-2**
38.1	+200	2.8	**14BCX200-1.5-2**
38.1	+250	2.3	**14BCX250-1.5-2**
38.1	+300	3.5	**14BCX300-1.5-2**
38.1	+400	3.9	**14BCX400-1.5-2**
38.1	+500	4.1	**14BCX500-1.5-2**
38.1	+700	4.4	**14BCX700-1.5-2**
38.1	+1000	4.3	**14BCX1000-1.5-2**
50.8	+50	1.0	**14BCX50-2-2**
50.8	+75	1.1	**14BCX75-2-2**
50.8	+100	2.9	**14BCX100-2-2**
50.8	+150	3.0	**14BCX150-2-2**
50.8	+175	3.0	**14BCX175-2-2**
50.8	+200	3.5	**14BCX200-2-2**
50.8	+250	3.8	**14BCX250-2-2**
50.8	+300	4.0	**14BCX300-2-2**
50.8	+500	4.8	**14BCX500-2-2**
50.8	+1000	5.4	**14BCX1000-2-2**

CODE EXAMPLE FOR ORDERING

14BCX50-1-2

- Focal length
- Diameter
  - 05 – 12.7 mm
  - 1 – 25.4 mm
  - 1.5 – 38.1 mm
  - 2 – 50.8 mm
- Material
  - 1 – BK7
  - 2 – UVFS

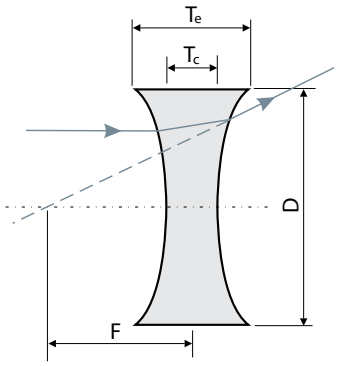
RELATED PRODUCTS

- **4LM13-40** – Self-Centering Lens/Optics Mount

- **4LM149-10** – Universal Adjustable Lens/Optics Mount

14BCV Double-Concave Lenses

Double concave lenses are symmetrical with equal radius of curvature on both sides.
The biconcave lenses are used in optical systems in combination with other lenses. These lenses also work as beam expanders, optical character readers, viewers and projection systems. Lenses can be anti-reflection coated (please refer to the *Coatings Section*).



STANDARD SPECIFICATIONS

Material	BK7, FS, UVFS, CaF_2, ZnSe, Si, Ge
Diameter Tolerance	+0.0, –0.15 mm
Focal Length Tolerance	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design Wavelength	632.8 nm
AR coatings	None. Please refer to the *Coatings Section*

FEATURES

- Diverges incident light
- Lower spherical aberrations than for Plano-Concave lenses
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

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BK7 DOUBLE-CONCAVE LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	–12	5.0	14BCV12-05-1
12.7	–15	5.0	14BCV15-05-1
12.7	–20	4.5	14BCV20-05-1
12.7	–40	3.0	14BCV40-05-1
12.7	–50	3.0	14BCV50-05-1
12.7	–60	3.0	14BCV60-05-1
12.7	–75	3.0	14BCV75-05-1
12.7	–100	3.0	14BCV100-05-1
12.7	–125	2.0	14BCV125-05-1
12.7	–150	2.0	14BCV150-05-1
12.7	–200	2.0	14BCV200-05-1
12.7	–250	2.0	14BCV250-05-1
25.4	–25	8.0	14BCV25-1-1
25.4	–30	8.0	14BCV30-1-1
25.4	–35	7.0	14BCV35-1-1
25.4	–50	7.0	14BCV50-1-1
25.4	–60	5.0	14BCV60-1-1
25.4	–75	4.7	14BCV75-1-1
25.4	–100	4.0	14BCV100-1-1
25.4	–125	4.0	14BCV125-1-1
25.4	–150	4.0	14BCV150-1-1
25.4	–200	3.5	14BCV200-1-1
25.4	–250	3.5	14BCV250-1-1
25.4	–400	3.5	14BCV400-1-1
25.4	–500	3.5	14BCV500-1-1

UVFS DOUBLE-CONCAVE LENSES

Diameter D, mm	Focal Length F, mm	Edge Thickness T_e, mm	Ordering Code
12.7	–12.5	5.8	14BCV12.5-05-2
12.7	–15	5.0	14BCV15-05-2
12.7	–20	5.0	14BCV20-05-2
12.7	–25	4.5	14BCV25-05-2
12.7	–30	2.5	14BCV30-05-2
12.7	–50	3.0	14BCV50-05-2
12.7	–75	3.0	14BCV75-05-2
12.7	–100	3.0	14BCV100-05-2
25.4	–25	9.5	14BCV25-1-2
25.4	–30	8.0	14BCV30-1-2
25.4	–40	8.0	14BCV40-1-2
25.4	–50	7.0	14BCV50-1-2
25.4	–75	5.0	14BCV75-1-2
25.4	–100	4.5	14BCV100-1-2
25.4	–150	4.5	14BCV150-1-2
25.4	–200	3.9	14BCV200-1-2

CODE EXAMPLE FOR ORDERING

14BCV20-05-1

- Focal length
- Diameter
  05 – 12.7 mm
  1 – 25.4 mm
- Material
  1 – BK7
  2 – UVFS

RELATED PRODUCTS

- **4SCML-4** – Self-Centering Lens/Optics Mounts

- **4OCM-25** – Optical Component Mount

14LK Lens Kits

GENERAL LENS SPECIFICATIONS

Material	BK7, UVFS,
Diameter Tolerance	+0.0, –0.5 mm
Focal Length Tolerance	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design Wavelength	632.8 nm

UNCOATED LENS KITS

Optical Lens Kit – irreplaceable tool for your day to day research activities. Ideal for R&D laboratories and Universities lens Kit include research quality spherical one inch diameter lenses of all four basic shapes made from highest grade BK7 or UVFS glass materials. Plano convex and Biconvex Lenses cover focal distance from 25 up to 1000 mm, whereas Plano concave and biconcave shaped lenses from -25 up to 300 mm.
All lenses are organized in compact hardwood box for permanent storage.

COATED LENS KITS

If required, Standa offers lens kits designed to work in a particular wavelength range or at single wavelength. Choosing BK7 lens kit is the most cost-effective way in fulfilling your demands for visible and near infrared applications. Standard kits are broadband anti-reflection coated for visible spectral range (400-700 nm) as well as for Nd:YAG laser fundamental and second harmonics wavelengths (1064 nm and 532 nm respectively).
For femtosecond and/or deep-UV applications we recommend you UVFS lens kits. All UV FS lens kits are offered with anti-reflection coatings either for Nd:YAG laser fundamental or harmonics wavelengths: 1064 nm, or 532 nm, or 355 nm, or 266 nm.

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BK7 LENS KIT

Dia, mm	F, mm	Centre Thickness CT, mm	Edge Thickness ET, mm
Plano-Convex Lenses (16 pcs.)			
25.4	30	8.5	2.3
25.4	40	6.1	2.0
25.4	50	5.0	2.0
25.4	60	4.4	2.0
25.4	75	4.0	2.0
25.4	100	3.5	2.0
25.4	125	3.2	2.0
25.4	150	3.0	2.0
25.4	200	3.0	2.2
25.4	250	3.0	2.4
25.4	300	3.0	2.5
25.4	350	3.0	2.5
25.4	400	3.0	2.5
25.4	500	3.0	2.7
25.4	700	3.0	2.8
25.4	1000	3.0	2.8
Biconvex Lenses (12 pcs)			
25.4	25	9.0	2.1
25.4	30	7.5	2.4
25.4	40	6.0	3.0
25.4	50	6.0	3.0
25.4	60	4.0	1.6
25.4	75	4.0	2.0
25.4	100	4.0	2.5
25.4	150	4.0	3.0
25.4	200	4.0	3.2
25.4	250	4.0	3.4
25.4	500	4.0	3.7
25.4	1000	4.0	3.8
Plano-Concave Lenses (6 pcs.)			
25.4	-50	2.8	6.0
25.4	-75	2.9	5.0
25.4	-100	3.1	4.5
25.4	-150	2.7	3.7
25.4	-200	3.0	3.7
25.4	-300	3.1	3.7
Biconcave Lenses (6 pcs.)			
25.4	-25	4.8	8.3
25.4	-50	4.4	6.0
25.4	-75	3.7	4.7
25.4	-100	3.2	4.0
25.4	-150	3.0	4.0
25.4	-200	2.8	3.5

UVFS LENS KIT

Dia, mm*	F, mm	Centre Thickness CT, mm	Edge Thickness ET, mm
Plano-Convex Lenses (12 pcs.)			
25.4	30	9.75	2.0
25.4	50	6.0	2.3
25.4	75	4.5	2.2
25.4	100	4.0	2.3
25.4	125	4.0	2.4
25.4	150	4.0	2.8
25.4	200	4.0	3.2
25.4	250	4.0	3.3
25.4	300	4.0	3.4
25.4	400	4.0	3.6
25.4	500	4.0	3.6
25.4	1000	4.0	3.8
Biconvex Lenses (12 pcs)			
25.4	25	10.0	2.4
25.4	40	7.1	2.1
25.4	50	6.0	2.5
25.4	75	4.0	1.7
25.4	100	4.0	2.3
25.4	150	3.2	2.1
25.4	200	3.0	2.2
25.4	250	3.0	2.3
25.4	300	3.0	2.6
25.4	400	3.0	2.7
25.4	500	3.0	2.7
25.4	1000	3.0	2.8
Plano-Concave Lenses (6 pcs.)			
25.4	-50	1.9	5.6
25.4	-75	3.1	5.5
25.4	-100	3.0	4.7
25.4	-150	3.1	4.2
25.4	-200	3.1	4.0
25.4	-300	3.4	4.0
Biconcave Lenses (6 pcs.)			
25.4	-25	5.3	9.5
25.4	-50	4.2	6.0
25.4	-75	3.8	5.0
25.4	-100	3.6	4.5
25.4	-150	3.9	4.5
25.4	-200	3.0	3.9

*Diameter tolerance +0.0/-0.5 mm

RELATED PRODUCTS

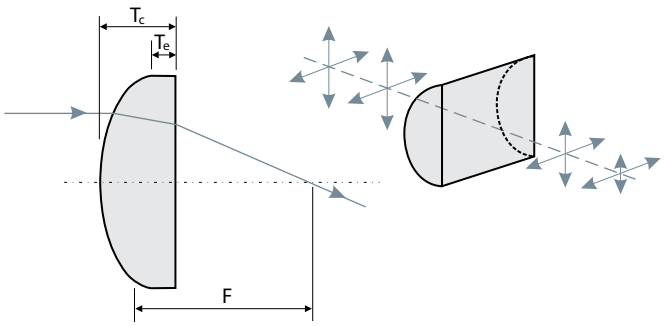
- **4SCML-2 –** Self-Centering Lens/Optics Mount

- **5TLM-1 –** Y-Z Positioner for Lens, Pinholes and Objectives

ORDERING INFORMATION

Material	Coating	Number of Lenses, pc	Ordering Code
BK7	uncoated	40	**14LK-1-1**
UVFS	uncoated	36	**14LK-1-2**
BK7	AR @ 1064 nm	40	**14LK-1-1-AR15**
BK7	AR @ 400-700 nm	40	**14LK-1-1-BBAR1**
BK7	AR @ 532 nm	40	**14LK-1-1-AR6**
UVFS	AR @ 1064 nm	36	**14LK-1-2-AR15**
UVFS	AR @ 1030 nm	36	**14LK-1-2-AR14**
UVFS	AR @ 700-900 nm	36	**14LK-1-2-BBAR3**
UVFS	AR @ 760-840 nm	36	**14LK-1-2-BBAR4**
UVFS	AR @ 532 nm	36	**14LK-1-2-AR6**
UVFS	AR @ 515 nm	36	**14LK-1-2-AR5**
UVFS	AR @ 350-900 nm	36	**14LK-1-2-BBAR9**
UVFS	AR @ 355 nm	36	**14LK-1-2-AR2**
UVFS	AR @ 343 nm	36	**14LK-1-2-AR19**
UVFS	AR @ 266 nm	36	**14LK-1-2-AR1**
UVFS	AR @ 210-400 nm	36	**14LK-1-2-BBAR10**

14PCL Positive Cylindrical Lenses



Cylindrical lenses with positive focal length condense light in one dimension only. They are used to focus light to a thin line for effective harmonic generation in nonlinear crystals, in laser scanners, spectroscopy, dye lasers, acousto-optics or other applications. They are also irreplaceable for circularization of diode laser outputs, energy collection for linear detectors or for coupling to a slit input.

FEATURES

- Rectangular and Round shape are available
- Focus light in one dimension only
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

STANDARD SPECIFICATIONS

Material	BK7, FS, UVFS, CaF_2, ZnSe
Diameter Tolerance	+0.0, –0.15 mm
Focal Length Tolerance	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design Wavelength	632.8 nm
AR coatings	None. Please refer to the *Coatings Section*

BK7 POSITIVE CYLINDRICAL LENSES

Size, mm	Focal length F, mm	Ordering Code
10×10	+50	**14PCL50-1-1**
	+100	**14PCL100-1-1**
	+175	**14PCL175-1-1**
	+200	**14PCL200-1-1**
	+500	**14PCL500-1-1**
	+1000	**14PCL1000-1-1**
20×20	+50	**14PCL50-2-1**
	+100	**14PCL100-2-1**
	+175	**14PCL175-2-1**
	+200	**14PCL200-2-1**
	+500	**14PCL500-2-1**
	+1000	**14PCL1000-2-1**
	+2000	**14PCL2000-2-1**
25×25	+50	**14PCL50-4-1**
	+75	**14PCL75-4-1**
	+100	**14PCL100-4-1**
	+150	**14PCL150-4-1**
	+200	**14PCL200-4-1**
	+300	**14PCL300-4-1**
	+500	**14PCL500-4-1**
	+1000	**14PCL1000-4-1**
	+1500	**14PCL1500-4-1**
25×50	+50	**14PCL50-5-1**
	+75	**14PCL75-5-1**
	+100	**14PCL100-5-1**
	+150	**14PCL150-5-1**
	+200	**14PCL200-5-1**
	+300	**14PCL300-5-1**
	+500	**14PCL500-5-1**
	+1000	**14PCL1000-5-1**
	+1500	**14PCL1500-5-1**
30×30	+200	**14PCL200-3-1**
	+500	**14PCL500-3-1**
	+1000	**14PCL1000-3-1**
	+3000	**14PCL3000-3-1**

UVFS POSITIVE CYLINDRICAL LENSES

Size, mm	Focal length F, mm	Ordering Code
10×10	+50	**14PCL50-1-2**
	+100	**14PCL100-1-2**
	+175	**14PCL175-1-2**
	+200	**14PCL200-1-2**
	+500	**14PCL500-1-2**
	+1000	**14PCL1000-1-2**
20×20	+50	**14PCL50-2-2**
	+100	**14PCL100-2-2**
	+175	**14PCL175-2-2**
	+200	**14PCL200-2-2**
	+500	**14PCL500-2-2**
	+1000	**14PCL1000-2-2**
	+2000	**14PCL2000-2-2**
25×25	+50	**14PCL50-4-2**
	+75	**14PCL75-4-2**
	+100	**14PCL100-4-2**
	+150	**14PCL150-4-2**
	+200	**14PCL200-4-2**
	+300	**14PCL300-4-2**
	+500	**14PCL500-4-2**
	+1000	**14PCL1000-4-2**
	+1500	**14PCL1500-4-2**
25×50	+50	**14PCL50-5-2**
	+75	**14PCL75-5-2**
	+100	**14PCL100-5-2**
	+150	**14PCL150-5-2**
	+200	**14PCL200-5-2**
	+300	**14PCL300-5-2**
	+500	**14PCL500-5-2**
	+1000	**14PCL1000-5-2**
	+1500	**14PCL1500-5-2**
30×30	+200	**14PCL200-3-2**
	+500	**14PCL500-3-2**
	+1000	**14PCL1000-3-2**
	+3000	**14PCL3000-3-2**

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CODE EXAMPLE FOR ORDERING

14PCL100-2-1

Focal length

Dimensions
1 – 10×10 mm
2 – 20×20 mm
3 – 30×30 mm
4 – 25×25 mm
5 – 25×50 mm

Material
1 – BK7
2 – UVFS

RELATED PRODUCTS

- **4PH132** – Universal Plate Holder
- **5OM37-20** – Two Angular Fine Adjustment Mounts

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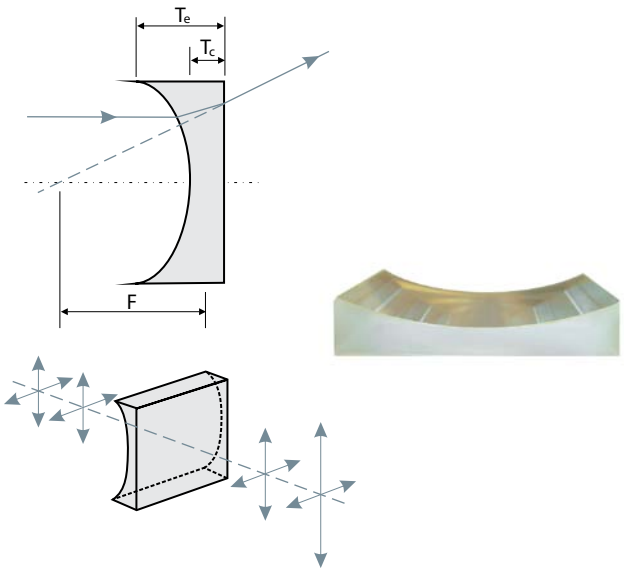
14NCL Negative Cylindrical Lenses

Cylindrical lens with negative focal length expand light in one dimension only. They are used in laser scanners, spectroscopy, dye lasers, acousto-optics, optical processors or other applications. They are also irreplaceable for circularization of diode laser outputs. Lenses can be anti-reflection coated (please refer to the *Coatings Section*).



STANDARD SPECIFICATIONS

Material	BK7, FS, UVFS, CaF_2, ZnSe
Diameter Tolerance	+0.0, –0.15 mm
Thickness Tolerance	±1.0 mm
Focal Length Tolerance	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design Wavelength	632.8 nm
AR coatings	None. Please refer to the *Coatings Section*

CODE EXAMPLE FOR ORDERING

14NCL100-2-1

Focal length

Dimensions
1 – 10×10 mm
2 – 20×20 mm
3 – 30×30 mm
4 – 25×25 mm
5 – 25×50 mm

Material
1 – BK7
2 – UVFS

FEATURES

- Rectangular and Round shape are available
- Diverges light in one dimension only
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

BK7 NEGATIVE CYLINDRICAL LENSES

Size, mm	Focal length F, mm	Ordering Code
10×10	–50	**14NCL50-1-1**
	–100	**14NCL100-1-1**
	–180	**14NCL180-1-1**
	–200	**14NCL200-1-1**
	–400	**14NCL400-1-1**
	–500	**14NCL500-1-1**
	–600	**14NCL600-1-1**
	–1000	**14NCL1000-1-1**
20×20	–50	**14NCL50-2-1**
	–100	**14NCL100-2-1**
	–150	**14NCL150-2-1**
	–200	**14NCL200-2-1**
	–500	**14NCL500-2-1**
	–1000	**14NCL1000-2-1**
	–2000	**14NCL2000-2-1**
25×25	–50	**14NCL50-4-1**
	–75	**14NCL75-4-1**
	–100	**14NCL100-4-1**
	–150	**14NCL150-4-1**
	–200	**14NCL200-4-1**
	–300	**14NCL300-4-1**
	–500	**14NCL500-4-1**
25×50	–50	**14NCL50-5-1**
	–75	**14NCL75-5-1**
	–100	**14NCL100-5-1**
	–150	**14NCL150-5-1**
	–200	**14NCL200-5-1**
	–300	**14NCL300-5-1**
	–500	**14NCL500-5-1**
30×30	–200	**14NCL200-3-1**
	–500	**14NCL500-3-1**
	–1000	**14NCL1000-3-1**
	–3000	**14NCL3000-3-1**

UVFS NEGATIVE CYLINDRICAL LENSES

Size, mm	Focal length F, mm	Ordering Code
10×10	–50	**14NCL50-1-2**
	–100	**14NCL100-1-2**
	–175	**14NCL175-1-2**
	–200	**14NCL200-1-2**
	–500	**14NCL500-1-2**
	–1000	**14NCL1000-1-2**
20×20	–50	**14NCL50-2-2**
	–100	**14NCL100-2-2**
	–175	**14NCL175-2-2**
	–200	**14NCL200-2-2**
	–500	**14NCL500-2-2**
	–1000	**14NCL1000-2-2**
	–2000	**14NCL2000-2-2**
25×25	–50	**14NCL50-4-2**
	–75	**14NCL75-4-2**
	–100	**14NCL100-4-2**
	–150	**14NCL150-4-2**
	–200	**14NCL200-4-2**
	–300	**14NCL300-4-2**
	–500	**14NCL500-4-2**
25×50	–50	**14NCL50-5-2**
	–75	**14NCL75-5-2**
	–100	**14NCL100-5-2**
	–150	**14NCL150-5-2**
	–200	**14NCL200-5-2**
	–300	**14NCL300-5-2**
	–500	**14NCL500-5-2**
30×30	–200	**14NCL200-3-2**
	–500	**14NCL500-3-2**
	–1000	**14NCL1000-3-2**
	–3000	**14NCL3000-3-2**

RELATED PRODUCTS

- **4H29** – Push Holder

- **4LM42** – Adjustable Radius Optics Mounts

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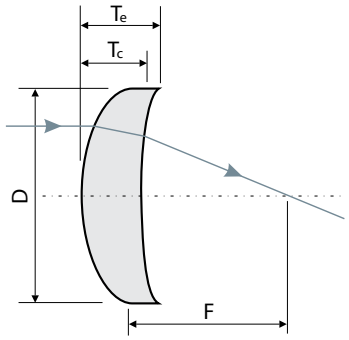
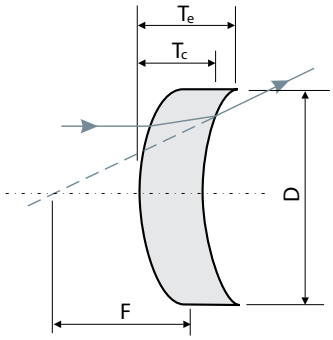
14MSL Meniscus Lenses

Positive and negative focal length lenses have different radii on both sides. Meniscus lenses are used in applications where distortion of the beam has to be reduced. They are used on focusing beams in telescopes, collimators or condenser systems, optical transceivers or other devices. Standa provides lens with anti-reflection coating (please refer to the *Coatings Section*).





FEATURES

- Used in applications to reduce beam distortion
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coating Section*

STANDARD SPECIFICATIONS

Material	BK7, FS, UVFS, CaF_2, ZnSe
Diameter Tolerance	+0.0, –0.15 mm
Focal Length Tolerance	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design wavelength	633 nm
AR coatings	None. Please refer to the *Coatings Section*

BK7 MENISCUS LENSES

Diameter, mm	ROC_1, mm	ROC_2, mm	Ordering Code
25.4	+50	–50	**14MSL-1-50/50-1**
	+100	–100	**14MSL-1-100/100-1**
	+150	–150	**14MSL-1-150/150-1**
	+200	–200	**14MSL-1-200/200-1**
	+250	–250	**14MSL-1-250/250-1**
	+300	–300	**14MSL-1-300/300-1**

UVFS MENISCUS LENSES

Diameter, mm	ROC_1, mm	ROC_2, mm	Ordering Code
25.4	+50	–50	**14MSL-1-50/50-2**
	+100	–100	**14MSL-1-100/100-2**
	+150	–150	**14MSL-1-150/150-2**
	+200	–200	**14MSL-1-200/200-2**
	+250	–250	**14MSL-1-250/250-2**
	+300	–300	**14MSL-1-300/300-2**

RELATED PRODUCTS

- **4SCML-2** – Self-Centering Lens/Optics Mount

CODE EXAMPLE FOR ORDERING

14MSL-1-50/50-1

- Diameter: 1 – 25.4 mm
- ROC_1
- ROC_2
- Material: 1 – BK7, 2 – UVFS

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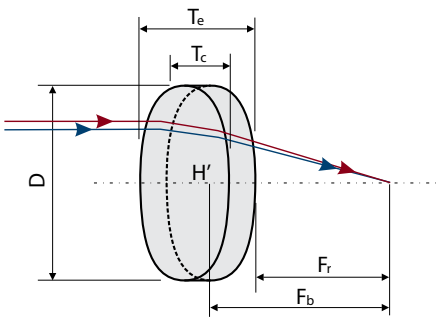
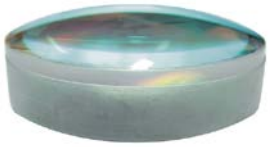
14AD Unmounted Achromatic Doublet Lenses





Compound lens system forms an image free from chromatic aberration. Cemented achromatic lenses significantly reduce coma and chromatic aberration. Best used to replace single components where performance must be improved.

FEATURES

- Used in applications to reduce beam distortion
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

STANDARD SPECIFICATIONS

Material	All type of material are available to design the optimal achromats
Dimensions Tolerance	+0.0, –0.15 mm
Focal Length	±3%
Centration	<3 arc minutes
Clear Aperture	>90%
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	60–40 scratch & dig
Design Wavelength	632.8 nm
AR Coatings	VIS or NIR

NIR COATED ACHROMATIC DOUBLET LENSES

Optimal Wavelength Range, nm	Diameter D, mm	Focal Length F, mm	Ordering Code
700-1050	12.7	+30	14ADP-05-30-BBAR5
	12.7	+50	14ADP-05-50-BBAR5
	12.7	+75	14ADP-05-75-BBAR5
	25.4	+100	14ADP-1-100-BBAR5
	25.4	+125	14ADP-1-125-BBAR5
	25.4	+150	14ADP-1-150-BBAR5
	25.4	+200	14ADP-1-200-BBAR5
	25.4	+250	14ADP-1-250-BBAR5
	25.4	+300	14ADP-1-300-BBAR5
700-1050	12.7	–50	14ADN-05-50-BBAR5
	12.7	–75	14ADN-05-75-BBAR5
	12.7	–100	14ADN-05-100-BBAR5
	25.4	–150	14ADN-1-150-BBAR5
	25.4	–200	14ADN-1-200-BBAR5
	25.4	–250	14ADN-1-250-BBAR5

VIS COATED ACHROMATIC DOUBLET LENSES

Optimal Wavelength Range, nm	Diameter D, mm	Focal Length F, mm	Ordering Code
400-700	12.7	+30	14ADP-05-30-BBAR1
	12.7	+50	14ADP-05-50-BBAR1
	12.7	+75	14ADP-05-75-BBAR1
	25.4	+100	14ADP-1-100-BBAR1
	25.4	+125	14ADP-1-125-BBAR1
	25.4	+150	14ADP-1-150-BBAR1
	25.4	+200	14ADP-1-200-BBAR1
	25.4	+250	14ADP-1-250-BBAR1
	25.4	+300	14ADP-1-300-BBAR1
400-700	12.7	–50	14ADN-05-50-BBAR1
	12.7	–75	14ADN-05-75-BBAR1
	12.7	–100	14ADN-05-100-BBAR1
	25.4	–150	14ADN-1-150-BBAR1
	25.4	–200	14ADN-1-200-BBAR1
	25.4	–250	14ADN-1-250-BBAR1

RELATED PRODUCTS AND ACCESSORIES

- **4SCML-12** – Self-Centering Lens/Optics Mounts

CODE EXAMPLE FOR ORDERING

14ALP-1-150-BBAR1

- P – positive lens, N – negative lens
- Diameter: 05 – 12.7 mm, 1 – 25.4 mm
- Focal length
- Coating type

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14ATL Mounted Achromatic Triplet Lenses

Standa mounted achromatic triplet is three-lens system commonly used in fluorescence and spectroscopy research applications. Air-spaced computer optimized triplet design is a cost effective and convenient way for correcting all primary aberrations.
All our assemblies are mounted in robust aluminium housing, which allows easy handling and integration into optical setup.

Special options include:
- mounting threads
- triplets of greater apertures
- AR coatings.

Please contact us for pricing.

STANDARD SPECIFICATIONS

Diameter Tolerance	+0.00, –0.10 mm
Focal Length Tolerance	±1%
Clear Aperture	>90% of Diameter
Centration	≤3 arcmin
Surface Quality	60–40 scratch/dig
Wavefront Distortion	λ/4 @ 632.8 nm
Coatings	BBAR @ 400–700 nm, AR @ 1064 nm, AR @ 532 nm
Housing Material	Black anodized aluminium
Mounting Thread	Optional

FEATURES

- Air-Spaced three lens design for infinite conjugate ratios
- AR coatings available upon request
- Provides minimal chromatic and spherical aberrations
- Custom size triplets available upon request

MOUNTED ACHROMATIC TRIPLET LENSES

f/l, mm	CA,mm	Housing D, mm	Housing t, mm	Ordering code
56	35	41	33	**14ATL56-35**
77	35	41	33	**14ATL77-35**
90	35	41	33	**14ATL90-35**
99.6	27	36(41)	28	**14ATL99.6-27**
127	27	36(41)	28	**14ATL127-27**
144.9	27	36(41)	28	**14ATL144.9-27**
15.5	15	25	15.5	**14ATL15.5-15**

RELATED PRODUCTS AND ACCESSORIES

- **5KOM5-1** – Five Axis Kinematic Optical Mount

CODE EXAMPLE FOR ORDERING

14ATL56-35

Focal length f/l, mm

Clear aperture CA, mm

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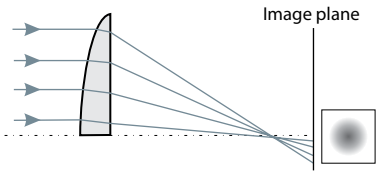
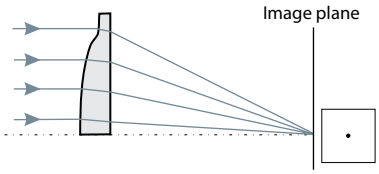
14ASL Aspherical Lenses





Aspherical lenses are effective in the elimination of not only spherical aberration, but also other forms of aberration generated by lenses. Standa provides computer calculations and designing of aspherical lenses without spherical aberrations as well as low cost production of aspherical lenses made of Fused Silica, BK7 glass or other material upon your request. Our long time experience in production of aspherical elements lead to the development of low-cost, high image quality and high performance products.

Aspherical lens is produced by exactly cutting away some part of a spherical surface. A standard spherical lens has the undesirable property (called spherical aberration) of causing a stronger diffraction of light rays the further it is from the optical axis of the lens. The spherical aberration causes a loss of image sharpness.

Properly designed aspherical lenses fully compensate spherical aberrations. Aspherical lenses are effective in the elimination of not only spherical aberration, but also other forms of aberration generated by lenses. Aspherical lenses are also used to compensate for distortion aberration.

FEATURES

- Used in applications to reduce beam distortion
- Other dimensions are available in small and mass production quantities
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*
- Molded aspheric lenses are also available

STANDARD SPECIFICATIONS

Dimensions Tolerance	+0.0, –0.15 mm
Centration	<3 arc minutes
Chamfer	0.25 mm @ 45°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	60–40 scratch & dig
Design Wavelength	632.8 nm
AR coatings	BBAR coated. Please refer to the *Coatings Section* for details

ASPHERICAL LENSES

Diameter, mm	Effective Focal Length, mm	NA	Wavelength Range, nm	Ordering Code
6.33	4.00	0.60	400–700	**14ASL-2-1-BBAR1**
4.70	4.51	0.55	400–700	**14ASL-1-2-BBAR1**
7.20	6.24	0.40	400–700	**14ASL-4-3-BBAR1**
9.94	8.00	0.50	400–700	**14ASL-5-4-BBAR1**
7.20	11.00	0.25	400–700	**14ASL-4-5-BBAR1**
6.50	15.29	0.16	400–700	**14ASL-3-6-BBAR1**
6.50	18.40	0.15	400–700	**14ASL-3-7-BBAR1**
6.33	4.00	0.60	600–1050	**14ASL-2-1-BBAR4**
4.70	4.50	0.42	600–1050	**14ASL-1-2-BBAR4**
7.20	6.24	0.40	600–1050	**14ASL-4-3-BBAR4**
9.94	8.00	0.50	600–1050	**14ASL-5-4-BBAR4**
7.20	11.00	0.25	600–1050	**14ASL-4-5-BBAR4**
6.50	15.29	0.16	600–1050	**14ASL-3-6-BBAR4**
6.50	18.40	0.15	600–1050	**14ASL-3-7-BBAR4**

RELATED PRODUCTS

- **4OCM-25** – Optical Component Mount

CODE EXAMPLE FOR ORDERING

14ASL-1-1-BBAR1

Diameter
1 – 4.70 mm
2 – 6.33 mm
3 – 6.50 mm
4 – 7.20 mm
5 – 9.94 mm

Efective Focal Length
1 – 4.00 mm
2 – 4.50 mm
3 – 6.24 mm
4 – 8.00 mm
5 – 11.00 mm
6 – 15.29 mm
7 – 18.40 mm

Coating type

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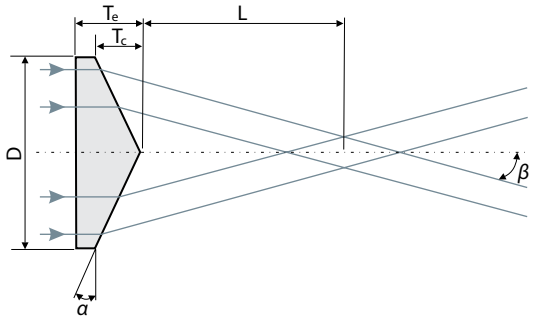
14APX Plano-Convex Axicons



FEATURES

- Produces a line image along the axis from a point light source or non diffractive Bessel beam
- Available diameter up to 50 mm
- Plano Convex, Plano Concave and Double Convex available
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

Plano-convex axicons are conical lenses which are used for variety of applications. When followed by a basic spherical lens, axicons can focus laser light to a ring shape with annular focus. This feature can be used in hole drilling, microscopy and medical applications. Another interesting feature of axicons is a possibility to transform Gaussian beam into non-diffractive Bessel beam in the near field. Bessel beams can be used in atom or molecule guiding applications.
Standa offers two types of plano-convex axicons: regular and precision type. Regular axicons will create annularly shaped beam whereas precision axicons will also transform Gaussian beam into a Bessel beam. You can choose accordingly, depending to your specific application.

STANDARD SPECIFICATIONS

Material	BK7, UVFS
Diameter Tolerance	+0.0, −0.15 mm
Thickness Tolerance	±0.1 mm
Edge Thickness	3.5 mm. Available down to 2 mm
Apex Angle	90 – 179.98°
Clear Aperture	>90%
Apex angle Tolerance	±0.5°. Available down to ±0.02°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design Wavelength	632.8 nm
AR Coatings	None. Please refer to the Coatings Section

CODE EXAMPLE FOR ORDERING

14APX-1-90-1-P

- Diameter: 1 – 25.4 mm
- Apex Angle
- Material: 1 – BK7, 2 – UVFS
- Type: none – regular, P – precision

RELATED PRODUCTS AND ACCESSORIES

- **4SCML-2** – Self-Centering Lens/Optics Mount

- **5KOM4-1** – Four Axis Kinematic Optical Mount

BK7 PLANO-CONVEX AXICONS

Diameter D, mm	Apex Angle α, deg	Ordering Code
25.4	90	**14APX-1-90-1**
25.4	130	**14APX-1-130-1**
25.4	140	**14APX-1-140-1**
25.4	160	**14APX-1-160-1**
25.4	170	**14APX-1-170-1**
25.4	175	**14APX-1-175-1**
25.4	176	**14APX-1-176-1**
25.4	178	**14APX-1-178-1**
25.4	179	**14APX-1-179-1**

UVFS PLANO-CONVEX AXICONS

Diameter D, mm	Apex Angle α, deg	Ordering Code
25.4	90	**14APX-1-90-2**
25.4	130	**14APX-1-130-2**
25.4	140	**14APX-1-140-2**
25.4	160	**14APX-1-160-2**
25.4	170	**14APX-1-170-2**
25.4	175	**14APX-1-175-2**
25.4	176	**14APX-1-176-2**
25.4	178	**14APX-1-178-2**
25.4	179	**14APX-1-179-2**

UVFS PLANO-CONVEX PRECISION AXICONS

Diameter D, mm	Apex Angle α, deg	Ordering Code
25.4	130	**14APX-1-130-2-P**
25.4	140	**14APX-1-140-2-P**
25.4	160	**14APX-1-160-2-P**
25.4	170	**14APX-1-170-2-P**
25.4	176	**14APX-1-176-2-P**
25.4	178	**14APX-1-178-2-P**
25.4	179	**14APX-1-179-2-P**

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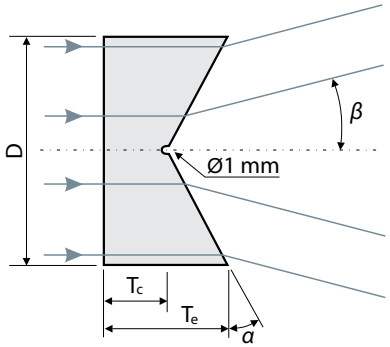
14APC Plano-Concave Axicons



Standa is able to offer and Plano-Concave Axicons of various dimensions and Apex angles. Plano-concave axicons are made of a plano surface in combination with a concave conical surface. They are made of optically transparent or filter materials with polished opposite sides, grounded edges and chamfers. Concave axicon produces a ring shaped image along the axis from a point light source (e.g. Gaussian laser beam). Due to specifics in fabrication process, a hole in the center of concave surface is needed. Diameter of the hole is typically 1 mm. Different coatings can be applied on the polished surfaces of axicons. When coated with HR coating, concave conical surface can be used as a conical mirror in some specific applications.

FEATURES

- Produces a line image along the axis from a point light source or non diffractive Bessel beam
- Available diameter up to 50 mm
- Plano Convex, Plano Concave and Double Convex available
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

STANDARD SPECIFICATIONS

Material	BK7, UVFS
Diameter Tolerance	+0.0, –0.15 mm
Thickness Tolerance	±0.1 mm
Apex Angle	90 – 179.98°
Clear Aperture	>90%
Apex Angle Tolerance	±0.5°. Available down to ±0.02°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40-20 scratch & dig
Design Wavelength	632.8 nm
AR Coatings	None. Please refer to the *Coatings Section*

BK7 PLANO-CONCAVE AXICONS

Diameter D, mm	Apex Angle α, deg	Ordering Code
25.4	90	**14APC-1-90-1**
25.4	130	**14APC-1-130-1**
25.4	140	**14APC-1-140-1**
25.4	160	**14APC-1-160-1**
25.4	170	**14APC-1-170-1**
25.4	175	**14APC-1-175-1**
25.4	176	**14APC-1-176-1**
25.4	178	**14APC-1-178-1**
25.4	179	**14APC-1-179-1**

UVFS PLANO-CONCAVE AXICONS

Diameter D, mm	Apex Angle α, deg	Ordering Code
25.4	90	**14APC-1-90-2**
25.4	130	**14APC-1-130-2**
25.4	140	**14APC-1-140-2**
25.4	160	**14APC-1-160-2**
25.4	170	**14APC-1-170-2**
25.4	175	**14APC-1-175-2**
25.4	176	**14APC-1-176-2**
25.4	178	**14APC-1-178-2**
25.4	179	**14APC-1-179-2**

RELATED PRODUCTS AND ACCESSORIES

- **5TLM-1** – Y-Z Positioner for Lens, Pinholes and Objectives

- **4OCM-25** – Optical Component Mount

CODE EXAMPLE FOR ORDERING

14APC-1-90-1

Diameter
1 – 25.4 mm

Apex Angle

Material
1 – BK7
2 – UVFS

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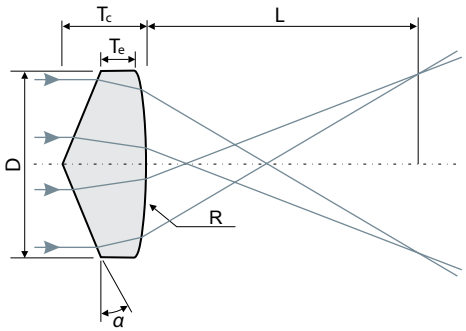
14ABX Double Convex Axicons

Standa is able to offer and Double Convex Axicons of various dimensions and Apex angles. Double convex axicons stand for optical components with a convex conical surface in combination with a convex spherical surface. Such combination focuses laser light into a ring shaped beam with annular focus. Different combinations of focal length and apex angles are available.



STANDARD SPECIFICATIONS

Material	BK7, UVFS
Diameter Tolerance	+0.0, –0.15 mm
Thickness Tolerance	±0.1 mm
Edge Thickness	9 mm
Apex Angle	90 – 179.98°
Clear Aperture	>90%
Apex Angle Tolerance	±0.5°. Available down to ±0.02°
Surface Figure	λ/4 @ 632.8 nm
Surface Quality	40–20 scratch & dig
Design Wavelength	632.8 nm
Available Focal Length	20–10000 mm
Radius Tolerance	±3%
AR Coatings	None. Please refer to the *Coatings Section*

FEATURES

- Produces a line image along the axis from a point light source or non diffractive Bessel beam
- Available diameter up to 50 mm
- Plano Convex, Plano Concave and Double Convex available
- Various AR coatings are available for all these lenses. Please refer to the *Coatings Section*

BK7 DOUBLE CONVEX AXICONS

Diameter D, mm	Focal length range of the spherical face L, mm	Apex Angle α, deg	Ordering Code
25.4	50–2000	90	**14ABX-1-90-1**
25.4	50–2000	130	**14ABX-1-130-1**
25.4	50–2000	140	**14ABX-1-140-1**
25.4	50–2000	160	**14ABX-1-160-1**
25.4	50–2000	170	**14ABX-1-170-1**
25.4	50–2000	175	**14ABX-1-175-1**
25.4	50–2000	176	**14ABX-1-176-1**
25.4	50–2000	178	**14ABX-1-178-1**
25.4	50–2000	179	**14ABX-1-179-1**

UVFS DOUBLE CONVEX AXICONS

Diameter D, mm	Focal length range of the spherical face L, mm	Apex Angle α, deg	Ordering Code
25.4	50–2000	90	**14ABX-1-90-2**
25.4	50–2000	130	**14ABX-1-130-2**
25.4	50–2000	140	**14ABX-1-140-2**
25.4	50–2000	160	**14ABX-1-160-2**
25.4	50–2000	170	**14ABX-1-170-2**
25.4	50–2000	175	**14ABX-1-175-2**
25.4	50–2000	176	**14ABX-1-176-2**
25.4	50–2000	178	**14ABX-1-178-2**
25.4	50–2000	179	**14ABX-1-179-2**

CODE EXAMPLE FOR ORDERING

14ABX-1-90-1

- Diameter: 1 – 25.4 mm
- Apex Angle
- Material: 1 – BK7, 2 – UVFS

RELATED PRODUCTS AND ACCESSORIES

- **5KOM5-1** – Five Axis Kinematic Optical Mount

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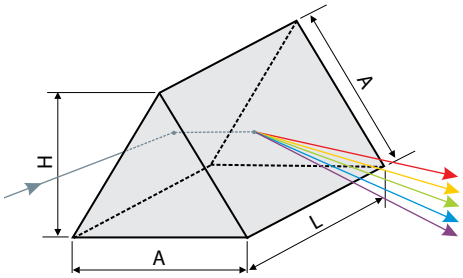
PRISMS

14DP Dispersing Prisms



Dispersing prisms are used for wavelength separation applications. A light ray is twice refracted passing through the prism. Deviation is a function of refractive index, and hence wavelength.

STANDARD SPECIFICATIONS

Material	BK7, UVFS, IRFS
Dimension Tolerances	+0.0, –0.2 mm
Surface Quality	40-20 scratch & dig
Flatness	λ/4 @ 632.8 nm
Angle Tolerance	±2 arcmin
Design Wavelength	780 nm
Coatings	None. Please refer to *Coatings Section*

FEATURES

- Separates light by wavelength
- Various dielectric coatings can be deposited upon request

DISPERSING PRISMS

Material	Dimensions A × L, mm	Coating	Ordering Code
BK7	12.5 × 12.5	Uncoated	**14DP-1-1**
	25 × 25	Uncoated	**14DP-2-1**
UVFS	12.5 × 12.5	Uncoated	**14DP-1-2**
	25 × 25	Uncoated	**14DP-2-2**

RELATED PRODUCTS AND ACCESSORIES

- **5OM37-20** – Two Angular Fine Adjustment Mounts

- **5PM131** – Prism/Optics Mount

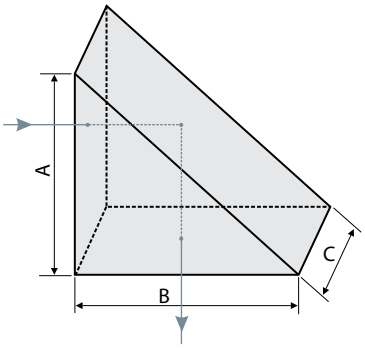
CODE EXAMPLE FOR ORDERING

14DP-1-1

Dimensions (A×L)
1 – 12.5×12.5 mm
2 – 25×25 mm

Material
1 – BK7
2 – UVFS

14RAP Right-Angle Prisms



These prisms are used to direct beams at 90 degrees by using hypotenuse face in total internal reflection (TIR). Right angle prisms are often preferable to an inclined mirror in applications involving severe acoustic or inertial loads, because they are easier to mount, and deform much less than mirror in response to external mechanical stress. As long as acceptance angle limitations for TIR from the roof faces are not exceeded, the right angle prisms can serve as a retro reflector, turning beams back to the original direction.

FEATURES

- Can work as internal or external reflectors or as retro-reflectors
- Various dielectric coatings can be deposited upon request

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RIGHT-ANGLE PRISMS

Material	Dimensions A × B × C, mm	Angle tolerance	Ordering Code
BK7	12.5 × 12.5 × 12.5	General type	**14RAP-1-0-1**
		Precision type	**14RAP-1-1-1**
	20.0 × 20.0 × 20.0	General type	**14RAP-2-0-1**
		Precision type	**14RAP-2-1-1**
	25.0 × 25.0 × 25.0	General type	**14RAP-3-0-1**
		Precision type	**14RAP-3-1-1**
UVFS	12.5 × 12.5 × 12.5	General type	**14RAP-1-0-2**
		Precision type	**14RAP-1-1-2**
	20.0 × 20.0 × 20.0	General type	**14RAP-2-0-2**
		Precision type	**14RAP-2-1-2**
	25.0 × 25.0 × 25.0	General type	**14RAP-3-0-2**
		Precision type	**14RAP-3-1-2**

CODE EXAMPLE FOR ORDERING

14RAP-1-0-1

Dimensions (A×B×C)
1 – 12.5×12.5×12.5 mm
2 – 20×20×20 mm
3 – 25×25×25 mm

Material
1 – BK7
2 – UVFS

Angle Tolerance
0 – General Type
1 – Precision Type

STANDARD SPECIFICATIONS

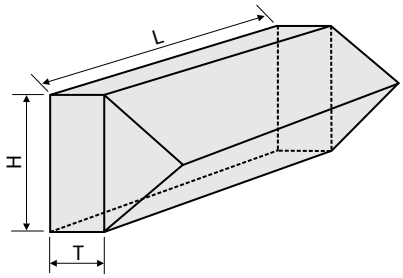
Material	BK7, IRFS, UVFS
Dimension Tolerances	+0.0, –0,2 mm
Surface Quality	40-20 scratch & dig
Clear Aperture	80% of the face size
Flatness	λ/4 @ 632.8 nm
90° Angle Tolerance	±2 arcmin (general type) ±5 arcsec (precision type)
Pyramidal Tolerance	±1 arcmin (general type) ±30 arcsec (precision type)
Coatings	None. Please refer to *Coatings Section*

RELATED PRODUCTS

- **5OM37-50** – Two Angular Fine Adjustment Mounts
- **5PM57** – Prism/Optics Mount

14RPR Right-Angle Prisms – Retroreflectors

Right-angle prisms - retroreflectors are often preferable to an inclined mirror in applications involving severe acoustic or inertial loads, because they are easier to mount, and deform much less than mirror in response to external mechanical stress. As long as acceptance angle limitations for TIR from the roof faces are not exceeded, the right angle prisms are working as a retro reflector, turning beams back to the original direction.



STANDARD SPECIFICATIONS

Material	BK7
Dimension Tolerances	+0.0, –0.2 mm
Surface Quality	40-20 scratch & dig
Clear Aperture	80% of the face size
Flatness	λ/4 @ 632.8 nm
90° Angle Tolerance	±2 arcmin (general type)
Coatings	None. Please refer to the *Coatings Section*

FEATURES

- Working as internal or external reflectors or as retro-reflectors
- Various dielectric coatings can be deposited upon request

BK7 RIGHT-ANGLE PRISMS – RETROREFLECTORS

Dimensions L × H × T, mm	Ordering Code
16 × 10 × 5	**14RPR-1-1**
18 × 8 × 4	**14RPR-2-1**
22 × 16 × 8	**14RPR-3-1**
25 × 10 × 4	**14RPR-4-1**
35 × 10 × 5	**14RPR-5-1**

CODE EXAMPLE FOR ORDERING

14RPR-1-1

Dimensions (L×H×T)
1 – 16 × 10 × 5 mm
2 – 18 × 8 × 4 mm
3 – 22 × 16 × 8 mm
4 – 25 × 10 × 4 mm
5 – 35 × 10 × 5 mm

Material
1 – BK7

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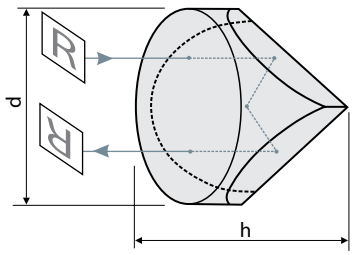
14CCR Corner Cube Retroreflectors



BK7 or UVFS Corner cube retroreflectors designed to deviate incident light by 180 degrees independently of an angle of incidence. These prisms have 3 mirror surfaces making angles of 90 deg to each other, juxtaposed to form the corner of a cube with the entrance face perpendicular to cube diagonal. All beams, despite of incident direction, are reflected back to the original direction. Corner cubes are used in high precision applications or with lasers over very long distances.

FEATURES

- Incident light deviates by 180 degrees independently of the angle of incidence
- Mainly used in high precision applications or with lasers over very long distances
- Various dielectric coatings can be deposited upon request

STANDARD SPECIFICATIONS

Material	BK7, UVFS
Dimension Tolerances	+0.0, –0.2 mm
Surface Quality	40-20 scratch & dig
Flatness	λ/10 @ 632.8 nm
Beam Deviation	180° ± 30 arcsec
Angular Deviation	±5 arcsec

CORNER CUBE RETROREFLECTORS

Material	Dimensions d × h, mm	Coating	Ordering Code
BK7	25.4 × 19.0	Uncoated	**14CCR-1-1**
	38.1 × 28.5	Uncoated	**14CCR-2-1**
UVFS	25.4 × 19.0	Uncoated	**14CCR-1-2**

CODE EXAMPLE FOR ORDERING

14CCR-1-1

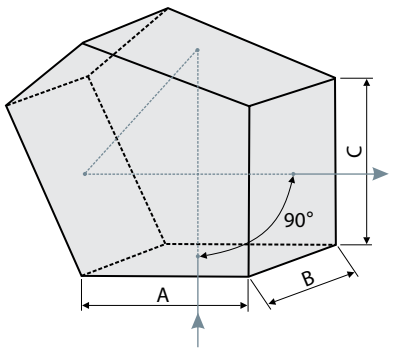
Dimensions (d×h)
1 – 25.4×19.0 mm
2 – 38.1×28.5 mm

Material
1 – BK7
2 – UVFS

RELATED PRODUCTS AND ACCESSORIES

- **5OM37-20** – Two Angular Fine Adjustment Mounts

14PP Penta Prisms



Penta prism's function is to deviate the direction of the light beam by 90 degrees. Penta prism will neither invert nor reverse the image. Penta prisms are extremely useful in alignment systems as they define a right angle very precisely and independently of angle of incidence. Rays entering one face emerge from the adjacent face at precisely 90 deg after they have undergone two reflections inside the prism for a total of 270 deg. The penta prism acts as a turning mirror which is insensitive to alignment.

FEATURES

- High precision
- Various dielectric coatings can be deposited upon request
- Custom size available

STANDARD SPECIFICATIONS

Material	BK7
Dimension Tolerances	+0.0, –0.2 mm
Surface Flatness	<λ/4 @ 632.8 nm
Surface Quality	40-20 scratch & dig
90° Deviation Tolerance	< 30 arcsec (down to 5 arcsec available!)

BK7 PENTA PRISMS

Dimensions A x B, mm	Coating	Ordering Code
7.0 x 7.0	Uncoated	**14PP-1**
12.7 x 12.7	Uncoated	**14PP-2**
25.4 x 25.4	Uncoated	**14PP-3**

CODE EXAMPLE FOR ORDERING

14PP-1

Dimensions (A×B)
1 – 7.0×7.0 mm
2 – 12.7×12.7 mm
3 – 25.4×25.4 mm

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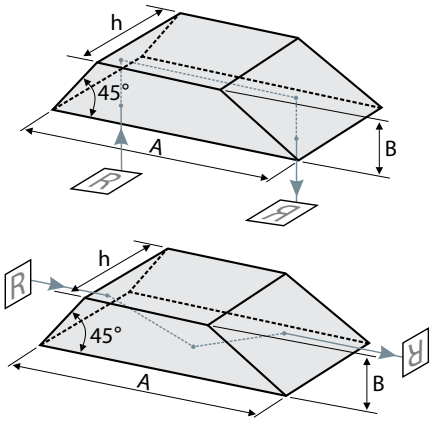
14DOP Dove Prisms

Dove prism is a type of reflective prism which is used to invert an image. Dove prisms are shaped from a truncated right-angle prism. A beam of light entering one of the sloped faces of the prism undergoes total internal reflection from the inside of the longest (bottom) face and emerges from the opposite sloped face. Images passing through the prism are flipped, and because only one reflection takes place, the image's handedness is changed to the opposite sense. Dove prisms have an interesting property that when they are rotated along their longitudinal axis, the transmitted image rotates at twice the rate of the prism. It is very important that the application must be used with parallel or collimated beam and the large square reflective surface should be kept very clean. Another application is used as a retroreflector. For this application it performs as a right-angle prism.



STANDARD SPECIFICATIONS

Material	BK7, UVFS
Dimension Tolerances	+0.0, –0.2 mm
Angle Tolerance	<3 arcmin
Surface Flatness	<λ/2 @ 632.8 nm
Surface Quality	60-40 scratch & dig
Dimension Tolerance	±0.2 mm
Clear Aperture	>80%

FEATURES

- Ideal for Image rotation
- Various dielectric coatings available upon request

DOVE PRISMS

Material	Dimensions A × B × h, mm	Coating	Ordering Code
BK7	21.1 × 5.0 × 5.0	Uncoated	**14DOP-1-1**
	42.3 × 10.0 × 10.0	Uncoated	**14DOP-2-1**
UVFS	21.1 × 5.0 × 5.0	Uncoated	**14DOP-1-2**

CODE EXAMPLE FOR ORDERING

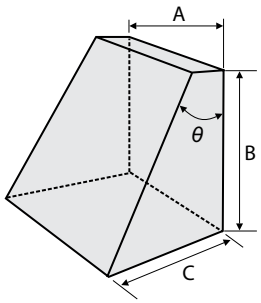
14DOP-1-1

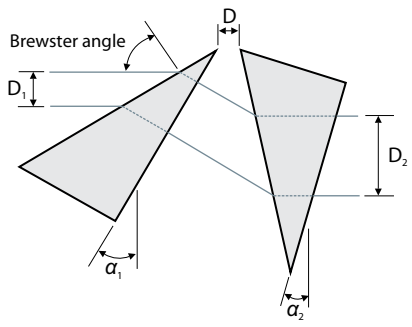
Dimensions (A×B×h)
1 – 21.1×5.0×5.0 mm
2 – 42.3×10.0×10.0 mm

Material
1 – BK7
2 – UVFS

14AP Anamorphic Prisms

Anamorphic prisms are used to change the dimension of a beam in one axis, the effect being analogous to that of a cylindrical lens. These two prisms can expand or contract the beam in one direction without any changes in the other direction. By adjusting the angles among the incident beam and two prisms, the shape of the beam can be changed. It is very easy to turn elliptical beam into circular beam. If beam shaping is required, a system using a pair of anamorphic prisms has several significant benefits.





FEATURES

- A pair of prisms can be designed into a much more compact package than a telescope using cylindrical optics
- The ability of adjusting the position of the prisms allows the user to compensate for variations from one light source to another
- The prisms are more cost effective than cylindrical lenses of comparable quality
- Mount for anamorphic prisms is available upon request

CODE EXAMPLE FOR ORDERING

14AP-1-1

Dimensions (A×B×C)
1 – 12.0×12.0×8.5 mm

Coating
0 – Uncoated
1 – MgF_2 single layer

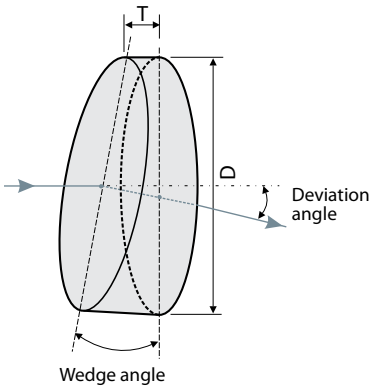
STANDARD SPECIFICATIONS

Material	SF11
Dimension Tolerances	+0.0, –0.2 mm
Surface Flatness	<λ/8 @ 632.8 nm
Surface Quality	60-40 scratch & dig
Theta Angle	29°27' ± 3"
Clear Aperture	> 85% in central circular dimension
Coating	MgF_2 single layer on perpendicular surface

SF11 ANAMORPHIC PRISMS

Dimensions A x B x C, mm	Coating	Ordering Code
12.0 x 12.0 x 8.5	Uncoated	**14AP-1-0**
	MgF_2 single layer on perpendicular surface	**14AP-1-1**

14WP Wedge Prisms



Wedge prism is an optical element with plane-inclined surfaces; usually the faces are inclined toward one another at very small angles. It diverts light toward its thicker portion. By selecting the appropriate wedge it is simple to create a precise beam deviation without affecting other beam parameters. If two wedges are used together with the sloping surfaces in close proximity it is possible to produce a continuous variation of beam deviation by counter – rotating the wedges.

FEATURES

- Ideal for beam steering

STANDARD SPECIFICATIONS

Material	BK7, UVFS
Dimensions D × T, mm	25.4 × 3
Dimension Tolerances	+0.0, –0.2 mm
Wedge Angle	0.5°, 1°, 3°
Surface Quality	40-20 scratch & dig
Clear Aperture	90% of the diameter
Wedge Tolerance	±3 arcmin
Flatness	λ/4 @ 632.8 nm
Bevel	0.25 mm × 45 deg

CODE EXAMPLE FOR ORDERING

14WP-1-1-1

Dimensions (D×T)
1 – 25.4×3.0 mm

Wedge Angle
05 – 0.5°
1 – 1°
3 – 3°

Material
1 – BK7
2 – UVFS

WEDGE PRISMS

Material	Dimensions D × T, mm	Wedge angle, deg	Coating	Ordering Code
BK7	25.4 × 3	0.5	Uncoated	**14WP-1-05-1**
		1	Uncoated	**14WP-1-1-1**
		2	Uncoated	**14WP-1-2-1**
		3	Uncoated	**14WP-1-3-1**
		5	Uncoated	**14WP-1-5-1**
UFVS	25.4 × 3	0.5	Uncoated	**14WP-1-05-2**
		1	Uncoated	**14WP-1-1-2**
		2	Uncoated	**14WP-1-2-2**
		3	Uncoated	**14WP-1-3-2**
		5	Uncoated	**14WP-1-5-2**

RELATED PRODUCTS AND ACCESSORIES

- **5KVDOM-1** – Kinematic Vertical Drive Optical Mount

- **5MBM24-1-3** – Kinematic Mirror/ Beamsplitter Mount

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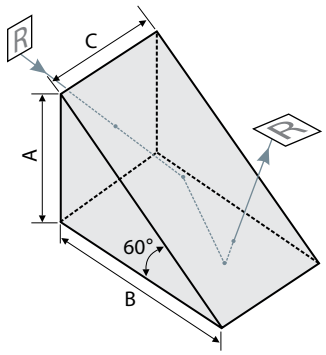
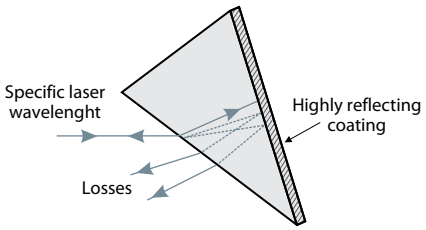
14LP Littrow Prisms

Littrow prisms usually are 30 – 60 – 90 deg prisms. The uncoated Littrow prism can disperse white light into its spectrum; the coated Littrow prism diverts the beam at a 60 deg angle without inverting or reversing the image. Littrow prisms can also be used as retro-reflecting Brewster prisms, as shown in the picture. They are positioned so that beam which enters front side of prism suffers Brewster angle and falls normal to the flat surface and is reflected back along the same path. They are useful in laser cavities where the wavelength of the return beam can be selected by tilting the prism slightly. In this way the gain of the cavity can be tuned to a specific laser line.





STANDARD SPECIFICATIONS

Material	BK7
Dimension Tolerances	+0.0, –0.2 mm
Surface Flatness	<λ/4 @ 632.8 nm
Angle Tolerance	+/- 10 arcmin
Bevel	0.4 mm × 45 deg
Surface Quality	40-20 scratch & dig

BK7 LITTROW PRISMS

Dimensions A × B × C, mm	Coating	Ordering Code
12.70 × 21.90 × 12.70	Uncoated	**14LP-1-0**
	Al+SiO_2 coated	**14LP-1-1**
22.00 × 37.90 × 22.00	Uncoated	**14LP-2-0**
	Al+SiO_2 coated	**14LP-2-1**

FEATURES

- Uncoated prisms can be used to disperse the light into spectrum
- Aluminium coated (B face) prisms diverts the beam at a 60 deg angle without inverting or reverting the image

CODE EXAMPLE FOR ORDERING

14LP-1-0

Dimensions (A×B×C)
1 – 12.7×12.9×12.7 mm
2 – 22.0×37.9×22.0 mm

Coating
0 – Uncoated
1 – Al+SiO_2 coated

RELATED PRODUCTS AND ACCESSORIES

- **5PM131** – Prism/Optics Mount

- **5PMF57** – Universal Prism/ Optics Mount

- **6PT169** – Three Angle Prism/ Beamsplitter Table

- **6PT110** – Tilt/Rotation Stage

- **5OM37-50** – Two Angular Fine Adjustment Mounts

- **7FA3** – Roll & Pitch Tilt Platform

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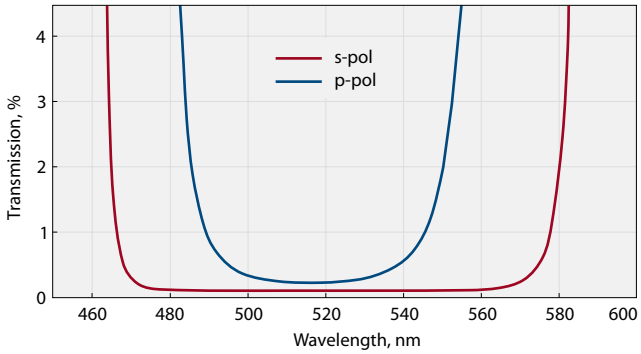
DIELECTRIC COATED OPTICS

14DM-HR HR Laser Line Mirrors

HR Laser Line mirrors (HR) provide an optimized performance at certain wavelength and certain angle of incidence (AOI). These multilayer coating stacks helps to achieve the highest possible reflectivity at specific laser line wavelengths at normal or 45 degrees incidence. Laser line HR coatings are used for external beam manipulation applications where even slight losses may be intolerable. Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques.
High reflectivity dielectric coatings in the range of 0.19 - 20 µm are available.

FEATURES

- Provide an optimised performance at certain wavelength and certain angle of incidence (AOI)
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- HR Laser Line coatings (HR) highly reflect wavelength range of <10% of the central wavelength (CWL). For instance, HR@800nm will reflect wavelength range of 760-840 nm
- If your application needs to reflect wider wavelength range please refer to – *Broad Band HR wavelength coatings,* page 72
- Our standard substrates can be coated with this type of coatings!



Measured transmission curve of the standard Coating Code **HR5**

STANDARD SPECIFICATIONS

Substrate Dimension Tolerance	+0.0, –0.1 mm
Substrate Wavefront Distortion	<λ/8 (<λ/4 for curved surfaces)
Substrate Surface Quality	20-10 S-D (40-20 S-D for curved surfaces)
Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Measured Reflectivity	R>99.5% @ 0°, R_s>99.8% and R_p>99.3% @ 45°
Laser Damage Threshold	>5-7 J/cm² for 10 ns pulses @ 1064 nm

HR LASER LINE MIRRORS

Wavelength, nm	Reflectivity (average), %	Substrate material	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
			Ø12.7 mm		Ø25.4 mm	
266	>99.0	UVFS	**14DM-05-HR1-0-2**	**14DM-05-HR1-45-2**	**14DM-1-HR1-0-2**	**14DM-1-HR1-45-2**
343-355	>99.5	UVFS	**14DM-05-HR2-0-2**	**14DM-05-HR2-45-2**	**14DM-1-HR2-0-2**	**14DM-1-HR2-45-2**
400	>99.5	UVFS	**14DM-05-HR3-0-2**	**14DM-05-HR3-45-2**	**14DM-1-HR3-0-2**	**14DM-1-HR3-45-2**
473-488	>99.5	BK7	**14DM-05-HR4-0-1**	**14DM-05-HR4-45-1**	**14DM-1-HR4-0-1**	**14DM-1-HR4-45-1**
515	>99.5	UVFS	**14DM-05-HR5-0-2**	**14DM-05-HR5-45-2**	**14DM-1-HR5-0-2**	**14DM-1-HR5-45-2**
527-532	>99.5	BK7	**14DM-05-HR6-0-1**	**14DM-05-HR6-45-1**	**14DM-1-HR6-0-1**	**14DM-1-HR6-45-1**
589	>99.5	BK7	**14DM-05-HR7-0-1**	**14DM-05-HR7-45-1**	**14DM-1-HR7-0-1**	**14DM-1-HR7-45-1**
633	>99.5	BK7	**14DM-05-HR8-0-1**	**14DM-05-HR8-45-1**	**14DM-1-HR8-0-1**	**14DM-1-HR8-45-1**
780	>99.5	UVFS	**14DM-05-HR9-0-2**	**14DM-05-HR9-45-2**	**14DM-1-HR9-0-2**	**14DM-1-HR9-45-2**
800	>99.5	UVFS	**14DM-05-HR10-0-2**	**14DM-05-HR10-45-2**	**14DM-1-HR10-0-2**	**14DM-1-HR10-45-2**
852	>99.5	BK7	**14DM-05-HR11-0-1**	**14DM-05-HR11-45-1**	**14DM-1-HR11-0-1**	**14DM-1-HR11-45-1**
946	>99.5	BK7	**14DM-05-HR12-0-1**	**14DM-05-HR12-45-1**	**14DM-1-HR12-0-1**	**14DM-1-HR12-45-1**
980	>99.5	BK7	**14DM-05-HR13-0-1**	**14DM-05-HR13-45-1**	**14DM-1-HR13-0-1**	**14DM-1-HR13-45-1**

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Wavelength, nm	Reflectivity (average), %	Substrate material	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
			Ø12.7 mm		Ø25.4 mm	
1030	>99.5	UVFS	**14DM-05-HR14-0-2**	**14DM-05-HR14-45-2**	**14DM-1-HR14-0-2**	**14DM-1-HR14-45-2**
1047-1064	>99.5	BK7	**14DM-05-HR15-0-1**	**14DM-05-HR15-45-1**	**14DM-1-HR15-0-1**	**14DM-1-HR15-45-1**
1122	>99.5	BK7	**14DM-05-HR16-0-1**	**14DM-05-HR16-45-1**	**14DM-1-HR16-0-1**	**14DM-1-HR16-45-1**
1319	>99.5	BK7	**14DM-05-HR17-0-1**	**14DM-05-HR17-45-1**	**14DM-1-HR17-0-1**	**14DM-1-HR17-45-1**
1550	>99.5	BK7	**14DM-05-HR18-0-1**	**14DM-05-HR18-45-1**	**14DM-1-HR18-0-1**	**14DM-1-HR18-45-1**

PLEASE NOTE: thickness of UVFS Ø12.7 mm is 2 mm; thickness of BK7 Ø12.7 mm is 3 mm
thickness of UVFS Ø25.4 mm is 5 mm; thickness of BK7 Ø25.4 mm is 6 mm

OPTICAL SUBSTRATES
LENSES
PRISMS
DIELECTRIC COATED OPTICS
METALLIC COATED OPTICS
FILTERS
OFF-AXIS MIRRORS
VARIABLE REFLECTIVITY MIRRORS
NON POLARIZING BEAMSPLITTER CUBES
POLARIZING OPTICS
ADAPTIVE OPTICAL SYSTEMS
COATINGS SECTION

RELATED PRODUCTS AND ACCESSORIES

- **5F21-1** – Flipping Mirror/ Beamsplitter Mount
- **5KVDOM-1** – Kinematic Vertical Drive Optical Mount
- **5MBM24-2-2SQ** – Kinematic Mirror/ Beamsplitter Mount



CODE EXAMPLE FOR ORDERING

14DM-1-HR1-0-1

Diameter
05 – 12.7 mm
1 – 25.4 mm

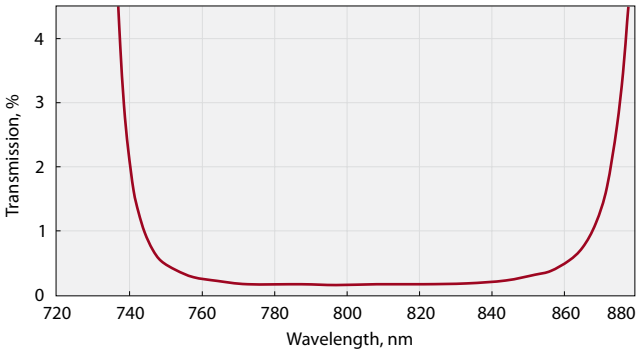
Coating type
see *HR Laser Line coatings*, page 71

Material
1 – BK7
2 – UVFS

Angle of Incidence, deg

14DM-BBHR HR Broad Band Mirrors

HR Broad Band mirrors (BBHR) provide an optimized performance at broad wavelength range. These multilayer coatings offer high reflectivity for broad spectrum. Therefore, it is the ideal for a wide range of multi-wavelength laser or white light applications. Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques.
High reflectivity dielectric coatings in the range of 0.19 - 20 µm are available.



Measured transmission curve of the standard Coating Code **BBHR3**

FEATURES

- Provide an optimised performance over broad wavelength range
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- If your application do not require such wide wavelength range to be reflected please refer to – *Laser Line HR wavelength coatings*, page 71
- Any other our standard substrate can be coated with this type of coatings!

STANDARD SPECIFICATIONS

Substrate Dimension Tolerance	+0.0, –0.1 mm
Substrate Wavefront Distortion	<λ/8 (<λ/4 for curved surfaces)
Substrate Surface Quality	20-10 S-D (40-20 S-D for curved surfaces)
Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Measured Reflectivity	R>99% @ 0°, R_{ave}>99% @ 45°
Laser Damage Threshold	>2-3 J/cm² for 10 ns pulses @ 1064 nm

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HR BROAD BAND MIRRORS

Wavelength range, nm	Reflectivity (average), %	Substrate material	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
			Ø12.7 × 3 mm		Ø25.4 × 6 mm	
400-700	>99.0	BK7	**14DM-05-BBHR1-0-1**	**14DM-05-BBHR1-45-1**	**14DM-1-BBHR1-0-1**	**14DM-1-BBHR1-45-1**
700-950	>99.0	BK7	**14DM-05-BBHR2-0-1**	**14DM-05-BBHR2-45-1**	**14DM-1-BBHR2-0-1**	**14DM-1-BBHR2-45-1**
750-850	>99.0	BK7	**14DM-05-BBHR3-0-1**	**14DM-05-BBHR3-45-1**	**14DM-1-BBHR3-0-1**	**14DM-1-BBHR3-45-1**
750-1000	>99.0	BK7	**14DM-05-BBHR4-0-1**	**14DM-05-BBHR4-45-1**	**14DM-1-BBHR4-0-1**	**14DM-1-BBHR4-45-1**
900-1200	>99.0	BK7	**14DM-05-BBHR5-0-1**	**14DM-05-BBHR5-45-1**	**14DM-1-BBHR5-0-1**	**14DM-1-BBHR5-45-1**

CODE EXAMPLE FOR ORDERING

14DM-1-BBHR1-0-1

- Diameter: 05 – 12.7 mm; 1 – 25.4 mm
- Angle of Incidence, deg
- Coating type: see *HR Broad Band coatings*, page 72
- Material: 1 – BK7

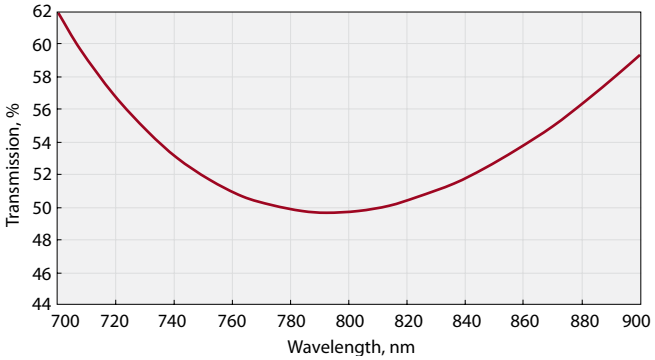
RELATED PRODUCTS AND ACCESSORIES

- **5F23-05** – Miniature Flipping Mirror/ Beamsplitter Mounts

- **5MBM23-05-3SH** – Miniature Kinematic Mirror/Beamsplitter Mount

14DM-PR Partial Reflecting Mirrors

Partial reflecting mirrors (PR) provide required percentage reflection/transmission at a specific angle of incidence for both single and broad band wavelengths. These coatings serves usually for the efficient beam splitting as well as output coupling in high power laser cavities.



Measured transmission curve for PR coating code **PR6.50**

FEATURES

- Efficient beam splitting as well as output coupling in high power laser cavities
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- Various wavelengths and Reflectivity values are available
- Any other our standard substrate can be coated with this type of coatings

STANDARD SPECIFICATIONS

Substrate Dimension Tolerance	+0.0, –0.1 mm
Substrate Wavefront Distortion	<λ/8 (<λ/4 for curved surfaces)
Substrate Surface Quality	20-10 S-D (40-20 S-D for curved surfaces)
Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Laser Damage Threshold	>5-6 J/cm² for 10 ns pulses @ 1064 nm

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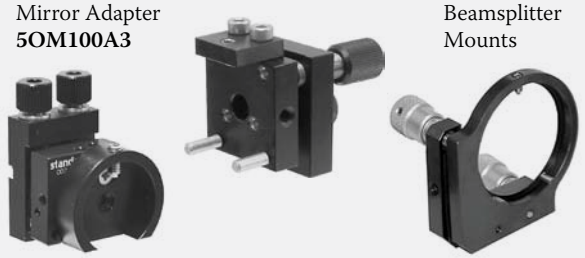
PARTIAL REFLECTING MIRRORS

Wavelength, nm	Substrate material	Reflectivity (average), %	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
			Ø12.7 mm		Ø25.4 mm	
266	UVFS	10±3	**14DM-05-PR1.10-0-2**	**14DM-05-PR1.10-45-2**	**14DM-1-PR1.10-0-2**	**14DM-1-PR1.10-45-2**
		50±2	**14DM-05-PR1.50-0-2**	**14DM-05-PR1.50-45-2**	**14DM-1-PR1.50-0-2**	**14DM-1-PR1.50-45-2**
		90±1	**14DM-05-PR1.90-0-2**	**14DM-05-PR1.90-45-2**	**14DM-1-PR1.90-0-2**	**14DM-1-PR1.90-45-2**
355	UVFS	10±3	**14DM-05-PR2.10-0-2**	**14DM-05-PR2.10-45-2**	**14DM-1-PR2.10-0-2**	**14DM-1-PR2.10-45-2**
		50±2	**14DM-05-PR2.50-0-2**	**14DM-05-PR2.50-45-2**	**14DM-1-PR2.50-0-2**	**14DM-1-PR2.50-45-2**
		90±1	**14DM-05-PR2.90-0-2**	**14DM-05-PR2.90-45-2**	**14DM-1-PR2.90-0-2**	**14DM-1-PR2.90-45-2**
400	UVFS	10±3	**14DM-05-PR3.10-0-2**	**14DM-05-PR3.10-45-2**	**14DM-1-PR3.10-0-2**	**14DM-1-PR3.10-45-2**
		50±2	**14DM-05-PR3.50-0-2**	**14DM-05-PR3.50-45-2**	**14DM-1-PR3.50-0-2**	**14DM-1-PR3.50-45-2**
		90±1	**14DM-05-PR3.90-0-2**	**14DM-05-PR3.90-45-2**	**14DM-1-PR3.90-0-2**	**14DM-1-PR3.90-45-2**
515-532	BK7	10±3	**14DM-05-PR4.10-0-1**	**14DM-05-PR4.10-45-1**	**14DM-1-PR4.10-0-1**	**14DM-1-PR4.10-45-1**
		50±2	**14DM-05-PR4.50-0-1**	**14DM-05-PR4.50-45-1**	**14DM-1-PR4.50-0-1**	**14DM-1-PR4.50-45-1**
		90±1	**14DM-05-PR4.90-0-1**	**14DM-05-PR4.90-45-1**	**14DM-1-PR4.90-0-1**	**14DM-1-PR4.90-45-1**
633	BK7	10±3	**14DM-05-PR5.10-0-1**	**14DM-05-PR5.10-45-1**	**14DM-1-PR5.10-0-1**	**14DM-1-PR5.10-45-1**
		50±2	**14DM-05-PR5.50-0-1**	**14DM-05-PR5.50-45-1**	**14DM-1-PR5.50-0-1**	**14DM-1-PR5.50-45-1**
		90±1	**14DM-05-PR5.90-0-1**	**14DM-05-PR5.90-45-1**	**14DM-1-PR5.90-0-1**	**14DM-1-PR5.90-45-1**
750-850	UVFS	10±3	**14DM-05-PR6.10-0-2**	**14DM-05-PR6.10-45-2**	**14DM-1-PR6.10-0-2**	**14DM-1-PR6.10-45-2**
		50±2	**14DM-05-PR6.50-0-2**	**14DM-05-PR6.50-45-2**	**14DM-1-PR6.50-0-2**	**14DM-1-PR6.50-45-2**
		90±1	**14DM-05-PR6.90-0-2**	**14DM-05-PR6.90-45-2**	**14DM-1-PR6.90-0-2**	**14DM-1-PR6.90-45-2**
946	BK7	10±3	**14DM-05-PR7.10-0-1**	**14DM-05-PR7.10-45-1**	**14DM-1-PR7.10-0-1**	**14DM-1-PR7.10-45-1**
		50±2	**14DM-05-PR7.50-0-1**	**14DM-05-PR7.50-45-1**	**14DM-1-PR7.50-0-1**	**14DM-1-PR7.50-45-1**
		90±1	**14DM-05-PR7.90-0-1**	**14DM-05-PR7.90-45-1**	**14DM-1-PR7.90-0-1**	**14DM-1-PR7.90-45-1**
1020-1100	BK7	10±3	**14DM-05-PR8.10-0-1**	**14DM-05-PR8.10-45-1**	**14DM-1-PR8.10-0-1**	**14DM-1-PR8.10-45-1**
		50±2	**14DM-05-PR8.50-0-1**	**14DM-05-PR8.50-45-1**	**14DM-1-PR8.50-0-1**	**14DM-1-PR8.50-45-1**
		90±1	**14DM-05-PR8.90-0-1**	**14DM-05-PR8.90-45-1**	**14DM-1-PR8.90-0-1**	**14DM-1-PR8.90-45-1**
1122	BK7	10±3	**14DM-05-PR9.10-0-1**	**14DM-05-PR9.10-45-1**	**14DM-1-PR9.10-0-1**	**14DM-1-PR9.10-45-1**
		50±2	**14DM-05-PR9.50-0-1**	**14DM-05-PR9.50-45-1**	**14DM-1-PR9.50-0-1**	**14DM-1-PR9.50-45-1**
		90±1	**14DM-05-PR9.90-0-1**	**14DM-05-PR9.90-45-1**	**14DM-1-PR9.90-0-1**	**14DM-1-PR9.90-45-1**
1319	BK7	10±3	**14DM-05-PR10.10-0-1**	**14DM-05-PR10.10-45-1**	**14DM-1-PR10.10-0-1**	**14DM-1-PR10.10-45-1**
		50±2	**14DM-05-PR10.50-0-1**	**14DM-05-PR10.50-45-1**	**14DM-1-PR10.50-0-1**	**14DM-1-PR10.50-45-1**
		90±1	**14DM-05-PR10.90-0-1**	**14DM-05-PR10.90-45-1**	**14DM-1-PR10.90-0-1**	**14DM-1-PR10.90-45-1**
1550	BK7	10±3	**14DM-05-PR11.10-0-1**	**14DM-05-PR11.10-45-1**	**14DM-1-PR11.10-0-1**	**14DM-1-PR11.10-45-1**
		50±2	**14DM-05-PR11.50-0-1**	**14DM-05-PR11.50-45-1**	**14DM-1-PR11.50-0-1**	**14DM-1-PR11.50-45-1**
		90±1	**14DM-05-PR11.90-0-1**	**14DM-05-PR11.90-45-1**	**14DM-1-PR11.90-0-1**	**14DM-1-PR11.90-45-1**

PLEASE NOTE: thickness of UVFS Ø12.7 mm is 2 mm; thickness of BK7 Ø12.7 mm is 3 mm
thickness of UVFS Ø25.4 mm is 5 mm; thickness of BK7 Ø25.4 mm is 6 mm

RELATED PRODUCTS AND ACCESSORIES

- **5OM10T** – Small Optical Mount of Side Drive with Mirror Adapter **5OM100A3**
- **5M111-0** – Mirror/Optics Mount
- **5BM57-2** – Stable Steel Mirror/ Beamsplitter Mounts



CODE EXAMPLE FOR ORDERING

14DM-1-PR1.10-0-1

Diameter
05 – 12.7 mm
1 – 25.4 mm

Angle of Incidence, deg

Coating type
see *Partial reflecting coatings*, page 72

Material
1 – BK7
2 – UVFS

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14DM-WS Wavelength Separators

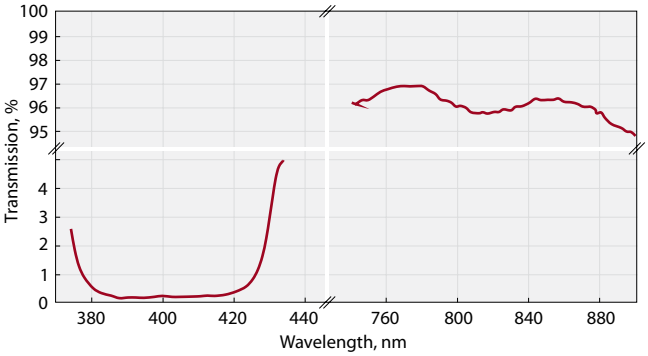
FEATURES

- Used to separate the spectral regions or specified wavelengths
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques

Wavelength separators are used to separate the spectral regions or specified wavelengths (harmonic components) of the multi-frequency laser systems by selective spectral reflection, transmission and absorption.
These multilayer dielectric coatings coatings separates various harmonic components separate the various harmonic components of frequency doubled laser systems by selective spectral reflection and transmission. In all cases one wavelength is reflected while the others are transmitted.

STANDARD SPECIFICATIONS

Substrate Dimension Tolerance	+0.0, −0.1 mm
Substrate Wavefront Distortion	<λ/8 (<λ/4 for curved surfaces)
Substrate Surface Quality	20-10 S-D (40-20 S-D for curved surfaces)
Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Laser Damage Threshold	>5 J/cm² for 10 ns pulses @ 1064 nm



Measured transmission curve for wavelength separator coating code **WS4**

WAVELENGTH SEPARATORS

Reflected Wavelength, nm	Transmitted Wavelength, nm	Material	Size	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
R>99% @ 266	T>90% @ 355+532+1064	UVFS	Ø12.7×2 mm	**14DM-05-WS1-0-2**	**14DM-05-WS1-45-2**
			Ø25.4×5 mm	**14DM-1-WS1-0-2**	**14DM-1-WS1-45-2**
R>99.5% @ 343	T>95% @ 515+1030	UVFS	Ø12.7×2 mm	**14DM-05-WS2-0-2**	**14DM-05-WS2-45-2**
			Ø25.4×5 mm	**14DM-1-WS2-0-2**	**14DM-1-WS2-45-2**
R>99.5% @ 355	T>95% @ 532+1064	BK7	Ø12.7×3 mm	**14DM-05-WS3-0-1**	**14DM-05-WS3-45-1**
			Ø25.4×6 mm	**14DM-1-WS3-0-1**	**14DM-1-WS3-45-1**
R>99.5% @ 400	T>95% @ 800	UVFS	Ø12.7×2 mm	**14DM-05-WS4-0-2**	**14DM-05-WS4-45-2**
			Ø25.4×5 mm	**14DM-1-WS4-0-2**	**14DM-1-WS4-45-2**
R>99.5% @ 515	T>95% @ 1030	UVFS	Ø12.7×2 mm	**14DM-05-WS5-0-2**	**14DM-05-WS5-45-2**
			Ø25.4×5 mm	**14DM-1-WS5-0-2**	**14DM-1-WS5-45-2**
R>99.5% @ 515	T>90% @ 630-1300 (AOI=0°), T>85% @ 630-1300 (AOI=45°)	UVFS	Ø12.7×2 mm	**14DM-05-WS6-0-2**	**14DM-05-WS6-45-2**
			Ø25.4×5 mm	**14DM-1-WS6-0-2**	**14DM-1-WS6-45-2**
R>99.5% @ 532	T>90% @ 266	UVFS	Ø12.7×2 mm	**14DM-05-WS7-0-2**	**14DM-05-WS7-45-2**
			Ø25.4×5 mm	**14DM-1-WS7-0-2**	**14DM-1-WS7-45-2**
R>99.5% @ 532	T>95% @ 1064	BK7	Ø12.7×3 mm	**14DM-05-WS8-0-1**	**14DM-05-WS8-45-1**
			Ø25.4×6 mm	**14DM-1-WS8-0-1**	**14DM-1-WS8-45-1**
R>99.5% @ (532+1064)	T>90%@ 355	UVFS	Ø12.7×2 mm	**14DM-05-WS9-0-2**	**14DM-05-WS9-45-2**
			Ø25.4×5 mm	**14DM-1-WS9-0-2**	**14DM-1-WS9-45-2**
R>99.5% @ (532+1064)	T>95% @ 808	BK7	Ø12.7×3 mm	**14DM-05-WS10-0-1**	**14DM-05-WS10-45-1**
			Ø25.4×6 mm	**14DM-1-WS10-0-1**	**14DM-1-WS10-45-1**
R>99.5% @ (750-850)	T>95% @ 532	UVFS	Ø12.7×2 mm	**14DM-05-WS11-0-2**	**14DM-05-WS11-45-2**
			Ø25.4×5 mm	**14DM-1-WS11-0-2**	**14DM-1-WS11-45-2**
R>99.5% @ 800	T>95% @ 400	UVFS	Ø12.7×2 mm	**14DM-05-WS12-0-2**	**14DM-05-WS12-45-2**
			Ø25.4×5 mm	**14DM-1-WS12-0-2**	**14DM-1-WS12-45-2**
R>99.5% @ 800	T>95% @ 1100-1600	UVFS	Ø12.7×2 mm	**14DM-05-WS13-0-2**	**14DM-05-WS13-45-2**
			Ø25.4×5 mm	**14DM-1-WS13-0-2**	**14DM-1-WS13-45-2**
R>99.5% @ 1030	T>95% @ 515	UVFS	Ø12.7×2 mm	**14DM-05-WS14-0-2**	**14DM-05-WS14-45-2**
			Ø25.4×5 mm	**14DM-1-WS14-0-2**	**14DM-1-WS14-45-2**
R>99.5% @ 1030	T>95% @ 940	BK7	Ø12.7×3 mm	**14DM-05-WS15-0-1**	**14DM-05-WS15-45-1**
			Ø25.4×6 mm	**14DM-1-WS15-0-1**	**14DM-1-WS15-45-1**
R>99.5% @ 1020-1200	T>95% @ 970-980	UVFS	Ø12.7×2 mm	**14DM-05-WS16-0-2**	**14DM-05-WS16-45-2**
			Ø25.4×5 mm	**14DM-1-WS16-0-2**	**14DM-1-WS16-45-2**
R>99.5% @ 1064	T>95% @ 355	UVFS	Ø12.7×2 mm	**14DM-05-WS17-0-2**	**14DM-05-WS17-45-2**
			Ø25.4×5 mm	**14DM-1-WS17-0-2**	**14DM-1-WS17-45-2**

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Reflected Wavelength, nm	Transmitted Wavelength, nm	Material	Size	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
R>99.5% @ 1064	T>95% @ 532	BK7	Ø12.7×3 mm	**14DM-05-WS18-0-1**	**14DM-05-WS18-45-1**
			Ø25.4×6 mm	**14DM-1-WS18-0-1**	**14DM-1-WS18-45-1**
R>99.5% @ 1064	T>95% @ 400-700	BK7	Ø12.7×3 mm	**14DM-05-WS19-0-1**	**14DM-05-WS19-45-1**
			Ø25.4×6 mm	**14DM-1-WS19-0-1**	**14DM-1-WS19-45-1**
R>99.5% @ 1064	T>95% @ 808	BK7	Ø12.7×3 mm	**14DM-05-WS20-0-1**	**14DM-05-WS20-45-1**
			Ø25.4×6 mm	**14DM-1-WS20-0-1**	**14DM-1-WS20-45-1**

CODE EXAMPLE FOR ORDERING

14DM-1-WS1-0-1

Diameter
05 – Ø12.7 mm
1 – Ø25.4 mm

Coating type
see *Wavelength Separating Coatings*, page 73

Material
1 – BK7
2 – UVFS

Angle of Incidence, deg

RELATED PRODUCTS

- **5APH79T-1** – Kinematic Double Optical Mount of Side Drive with Adjustable Polarizer Holder

OPTICAL SUBSTRATES
LENSES
PRISMS
DIELECTRIC COATED OPTICS
METALLIC COATED OPTICS
FILTERS
OFF-AXIS MIRRORS
VARIABLE REFLECTIVITY MIRRORS
NON POLARIZING BEAMSPLITTER CUBES
POLARIZING OPTICS
ADAPTIVE OPTICAL SYSTEMS
COATINGS SECTION

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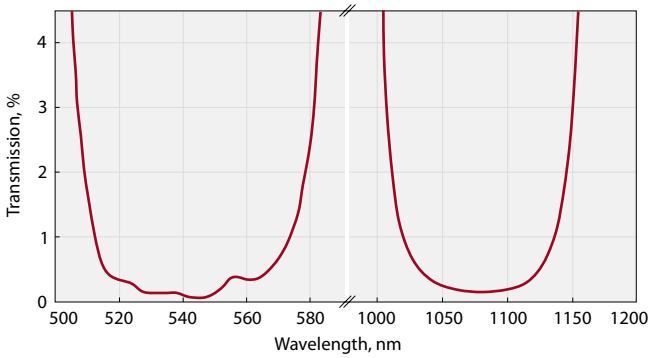
14DM-DHR Dual Laser Line Reflecting Mirrors

Dual Laser Line reflecting mirrors (DHR) provide an optimized performance at two certain wavelengths and certain angle of incidence (AOI).
These multilayer coating stacks helps to achieve the highest possible reflectivity at two specific laser line wavelengths at normal or 45 degrees incidence. Laser line high reflectivity coatings are intended for external beam manipulation applications where even slight losses may be intolerable.



Measured transmission curve
for dual wavelength HR coating code **DHR9**

FEATURES

- The coatings are designed to achieve the highest possible reflectivity at two specific laser line wavelengths at normal or 45 degrees incidence
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- Any other standard substrate can be coated with this type of coatings!

STANDARD SPECIFICATIONS

Substrate Dimension Tolerance	+0.0, −0.1 mm
Substrate Wavefront Distortion	<λ/8 (<λ/4 for curved surfaces)
Substrate Surface Quality	20-10 S-D (40-20 S-D for curved faces)
Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Measured Reflectivity	R>99.5% @ 0°, R_s>99.3% and R_p>98.5% @ 45°
Laser Damage Threshold	>3-5 J/cm² for 10 ns pulses @ 1064 nm

DUAL LASER LINE REFLECTING MIRRORS

Wavelength, nm	Substrate material	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
		Ø12.7 mm		Ø25.4 mm	
266+532	UVFS	**14DM-05-DHR1-0-2**	**14DM-05-DHR1-45-2**	**14DM-1-DHR1-0-2**	**14DM-1-DHR1-45-2**
343+1030	UVFS	**14DM-05-DHR2-0-2**	**14DM-05-DHR2-45-2**	**14DM-1-DHR2-0-2**	**14DM-1-DHR2-45-2**
355+532	UVFS	**14DM-05-DHR3-0-2**	**14DM-05-DHR3-45-2**	**14DM-1-DHR3-0-2**	**14DM-1-DHR3-45-2**
355+1064	UVFS	**14DM-05-DHR4-0-2**	**14DM-05-DHR4-45-2**	**14DM-1-DHR4-0-2**	**14DM-1-DHR4-45-2**
399+556	BK7	**14DM-05-DHR5-0-1**	**14DM-05-DHR5-45-1**	**14DM-1-DHR5-0-1**	**14DM-1-DHR5-45-1**
400+800	BK7	**14DM-05-DHR6-0-1**	**14DM-05-DHR6-45-1**	**14DM-1-DHR6-0-1**	**14DM-1-DHR6-45-1**
426+852	BK7	**14DM-05-DHR7-0-1**	**14DM-05-DHR7-45-1**	**14DM-1-DHR7-0-1**	**14DM-1-DHR7-45-1**
515+1030	BK7	**14DM-05-DHR8-0-1**	**14DM-05-DHR8-45-1**	**14DM-1-DHR8-0-1**	**14DM-1-DHR8-45-1**
532+1064	BK7	**14DM-05-DHR9-0-1**	**14DM-05-DHR9-45-1**	**14DM-1-DHR9-0-1**	**14DM-1-DHR9-45-1**
1064+1319	BK7	**14DM-05-DHR10-0-1**	**14DM-05-DHR10-45-1**	**14DM-1-DHR10-0-1**	**14DM-1-DHR10-45-1**

PLEASE NOTE: thickness of UVFS Ø12.7 mm is 2 mm; thickness of BK7 Ø12.7 mm is 3 mm
thickness of UVFS Ø25.4 mm is 5 mm; thickness of BK7 Ø25.4 mm is 6 mm

CODE EXAMPLE FOR ORDERING

14DM-1-DHR1-0-1

- Diameter: 05 – 12.7 mm; 1 – 25.4 mm
- Angle of Incidence, deg
- Coating type see *Dual Laser Line reflecting coatings*, page 74
- Material: 1 – BK7; 2 – UVFS

RELATED PRODUCTS AND ACCESSORIES

- **5BM69T-1** – Kinematic Optical Mount of Side Drive

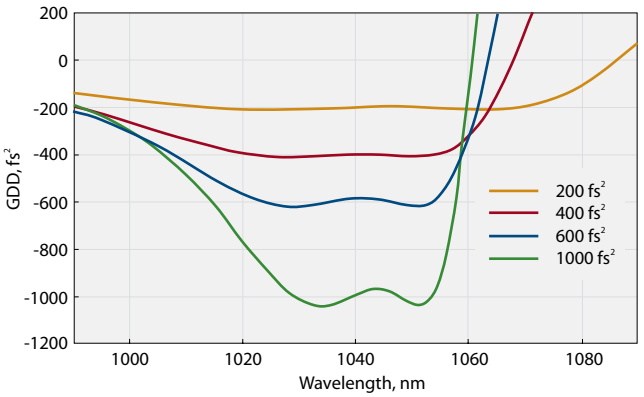
- **5BM131** – Beamsplitter/ Mirror Mount

14DM-GTI Gires-Tournois Interferometer Mirrors

FEATURES

- Reflectivity up to 99.9%
- Central wavelength tolerance up to 1%
- GDD values ranges from 100 fs² to 1500 fs² for Yb:KGW, Yb:YAG laser type coatings
- GDD – Group Delay Dispersion

Gires–Tournois interferometer (GTI) is an optical standing-wave resonator designed for generating chromatic dispersion. GTI mirrors are used mainly for pulse compression in Yb:YAG, Yb:KGW femtosecond lasers, but can be optimized for other wavelengths, for example Ti:Sapphire laser system. Compared to prism or grating pulse compression systems GTI thin film mirrors exhibits lower losses and sensitivity to mechanical misalignment errors, thus enabling higher output power and stability of laser system.



Measured GDD curves

STANDARD SPECIFICATIONS

Material	Fused Silica
Substrate Dimension Tolerance	+0.0, –0.1 mm
Substrate Wavefront Distortion	<λ/8
Surface Quality	20-10 S-D
Clear Aperture	>90%
Measured Reflectivity	R_{sp} > 99.8% @ 1010 nm – 1080 nm, AOI=0°–10° R_{sp} > 99.8% @ 700 nm – 900 nm, AOI=0°–10°
Laser Damage Threshold	>5-7 J/cm² for 10 ns pulses @ 1064 nm
Coating Adhesion and Durability	Per MIL-C-675A

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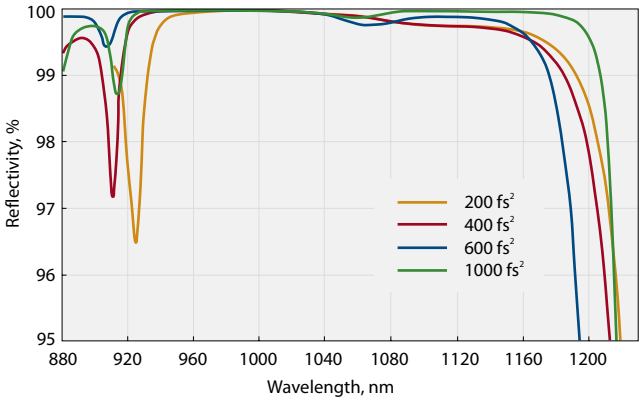
GIRES-TOURNOIS INTERFEROMETER MIRRORS (GTI)

Wavelength, nm	Average GDD, fs²	AOI	Ordering Code	
			Ø12.7×5 mm	Ø25.4×5 mm
780 – 820	-150	0° – 10°	**14DM-05-GTI1-0-150**	**14DM-1-GTI1-0-150**
780 – 820	-250	0° – 10°	**14DM-05-GTI1-0-250**	**14DM-1-GTI1-0-250**
780 – 820	-400	0° – 10°	**14DM-05-GTI1-0-400**	**14DM-1-GTI1-0-400**
1010 – 1080	-200	0° – 10°	**14DM-05-GTI2-0-200**	**14DM-1-GTI2-0-200**
1010 – 1080	-400	0° – 10°	**14DM-05-GTI2-0-400**	**14DM-1-GTI2-0-400**
1010 – 1080	-600	0° – 10°	**14DM-05-GTI2-0-600**	**14DM-1-GTI2-0-600**
1010 – 1080	-1000	0° – 10°	**14DM-05-GTI2-0-1000**	**14DM-1-GTI2-0-1000**
1200 – 1370	-150	0° – 10°	**14DM-05-GTI3-0-150**	**14DM-1-GTI3-0-150**
1530 – 1570	-200	0° – 10°	**14DM-05-GTI4-0-200**	**14DM-1-GTI4-0-200**
1530 – 1570	-300	0° – 10°	**14DM-05-GTI4-0-300**	**14DM-1-GTI4-0-300**
1530 – 1570	-400	0° – 10°	**14DM-05-GTI4-0-400**	**14DM-1-GTI4-0-400**



HR>99.8% @ 700-900 nm, GDD @ 780-820 nm, AOI=0°

CODE EXAMPLE FOR ORDERING

14DM-1-GTI2-0-200

- Diameter: 05 – 12.7 mm; 1 – 25.4 mm
- Coating type
- Angle of Incidence, deg
- Average GDD, fs²

14DM-AR AR Coated Windows

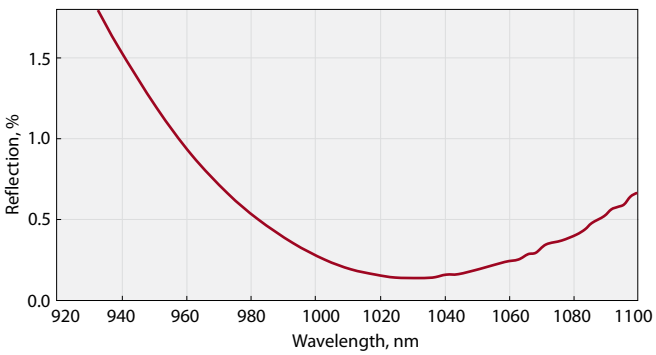
FEATURES

- Designed to reduce reflectivity of a optical component to near-zero for specific wavelength
- Laser Line Anti-Reflection Coatings in range 0.19 µm - 10.6 µm are available
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques

Anti-reflecting coatings (AR) are designed to reduce reflectivity of a component to near-zero for specific wavelength.

STANDARD SPECIFICATIONS

Substrate Dimension Tolerance	+0.0, –0.1 mm
Substrate Wavefront Distortion	<λ/8
Substrate Surface Quality	20-10 S-D (40-20 S-D for curved surfaces)
Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Measured Residual Reflectivity	R<0.2% @ 0° AOI, R<0.4% @ 45° AOI
Laser Damage Threshold	>8 J/cm² for 10 ns pulses @ 1064 nm



Measured residual back reflection curve for AR coating code **AR14**

BK7 AR COATED WINDOWS

Wavelength, nm	Ordering Code for AOI = 0° (residual reflectivity <0.2%)	Ordering Code for AOI = 45° (residual reflectivity <0.35%)	Ordering Code for AOI = 0° (residual reflectivity <0.2%)	Ordering Code for AOI = 45° (residual reflectivity <0.35%)
	Ø12.7×3 mm		Ø25.4×6 mm	
473-488	**14DM-05-AR4-0-1**	**14DM-05-AR4-45-1**	**14DM-1-AR4-0-1**	**14DM-1-AR4-45-1**
515	**14DM-05-AR5-0-1**	**14DM-05-AR5-45-1**	**14DM-1-AR5-0-1**	**14DM-1-AR5-45-1**
527-532	**14DM-05-AR6-0-1**	**14DM-05-AR6-45-1**	**14DM-1-AR6-0-1**	**14DM-1-AR6-45-1**
589	**14DM-05-AR7-0-1**	**14DM-05-AR7-45-1**	**14DM-1-AR7-0-1**	**14DM-1-AR7-45-1**
633	**14DM-05-AR8-0-1**	**14DM-05-AR8-45-1**	**14DM-1-AR8-0-1**	**14DM-1-AR8-45-1**
780	**14DM-05-AR9-0-1**	**14DM-05-AR9-45-1**	**14DM-1-AR9-0-1**	**14DM-1-AR9-45-1**
800	**14DM-05-AR10-0-1**	**14DM-05-AR10-45-1**	**14DM-1-AR10-0-1**	**14DM-1-AR10-45-1**
852	**14DM-05-AR11-0-1**	**14DM-05-AR11-45-1**	**14DM-1-AR11-0-1**	**14DM-1-AR11-45-1**
946	**14DM-05-AR12-0-1**	**14DM-05-AR12-45-1**	**14DM-1-AR12-0-1**	**14DM-1-AR12-45-1**
980	**14DM-05-AR13-0-1**	**14DM-05-AR13-45-1**	**14DM-1-AR13-0-1**	**14DM-1-AR13-45-1**
1030	**14DM-05-AR14-0-1**	**14DM-05-AR14-45-1**	**14DM-1-AR14-0-1**	**14DM-1-AR14-45-1**
1047-1064	**14DM-05-AR15-0-1**	**14DM-05-AR15-45-1**	**14DM-1-AR15-0-1**	**14DM-1-AR15-45-1**
1122	**14DM-05-AR16-0-1**	**14DM-05-AR16-45-1**	**14DM-1-AR16-0-1**	**14DM-1-AR16-45-1**
1319	**14DM-05-AR17-0-1**	**14DM-05-AR17-45-1**	**14DM-1-AR17-0-1**	**14DM-1-AR17-45-1**
1550	**14DM-05-AR18-0-1**	**14DM-05-AR18-45-1**	**14DM-1-AR18-0-1**	**14DM-1-AR18-45-1**

UVFS AR COATED WINDOWS

Wavelength, nm	Ordering Code for AOI = 0° (residual reflectivity <0.2%)	Ordering Code for AOI = 45° (residual reflectivity <0.35%)	Ordering Code for AOI = 0° (residual reflectivity <0.2%)	Ordering Code for AOI = 45° (residual reflectivity <0.35%)
	Ø12.7×2mm		Ø25.4×5mm	
266	**14DM-05-AR1-0-2**	**14DM-05-AR1-45-2**	**14DM-1-AR1-0-2**	**14DM-1-AR1-45-2**
343-355	**14DM-05-AR2-0-2**	**14DM-05-AR2-45-2**	**14DM-1-AR2-0-2**	**14DM-1-AR2-45-2**
400	**14DM-05-AR3-0-2**	**14DM-05-AR3-45-2**	**14DM-1-AR3-0-2**	**14DM-1-AR3-45-2**
473-488	**14DM-05-AR4-0-2**	**14DM-05-AR4-45-2**	**14DM-1-AR4-0-2**	**14DM-1-AR4-45-2**
515	**14DM-05-AR5-0-2**	**14DM-05-AR5-45-2**	**14DM-1-AR5-0-2**	**14DM-1-AR5-45-2**
527-532	**14DM-05-AR6-0-2**	**14DM-05-AR6-45-2**	**14DM-1-AR6-0-2**	**14DM-1-AR6-45-2**
589	**14DM-05-AR7-0-2**	**14DM-05-AR7-45-2**	**14DM-1-AR7-0-2**	**14DM-1-AR7-45-2**
633	**14DM-05-AR8-0-2**	**14DM-05-AR8-45-2**	**14DM-1-AR8-0-2**	**14DM-1-AR8-45-2**
780	**14DM-05-AR9-0-2**	**14DM-05-AR9-45-2**	**14DM-1-AR9-0-2**	**14DM-1-AR9-45-2**
800	**14DM-05-AR10-0-2**	**14DM-05-AR10-45-2**	**14DM-1-AR10-0-2**	**14DM-1-AR10-45-2**
852	**14DM-05-AR11-0-2**	**14DM-05-AR11-45-2**	**14DM-1-AR11-0-2**	**14DM-1-AR11-45-2**
946	**14DM-05-AR12-0-2**	**14DM-05-AR12-45-2**	**14DM-1-AR12-0-2**	**14DM-1-AR12-45-2**
980	**14DM-05-AR13-0-2**	**14DM-05-AR13-45-2**	**14DM-1-AR13-0-2**	**14DM-1-AR13-45-2**
1030	**14DM-05-AR14-0-2**	**14DM-05-AR14-45-2**	**14DM-1-AR14-0-2**	**14DM-1-AR14-45-2**
1047-1064	**14DM-05-AR15-0-2**	**14DM-05-AR15-45-2**	**14DM-1-AR15-0-2**	**14DM-1-AR15-45-2**
1122	**14DM-05-AR16-0-2**	**14DM-05-AR16-45-2**	**14DM-1-AR16-0-2**	**14DM-1-AR16-45-2**
1319	**14DM-05-AR17-0-2**	**14DM-05-AR17-45-2**	**14DM-1-AR17-0-2**	**14DM-1-AR17-45-2**
1550	**14DM-05-AR18-0-2**	**14DM-05-AR18-45-2**	**14DM-1-AR18-0-2**	**14DM-1-AR18-45-2**

CODE EXAMPLE FOR ORDERING

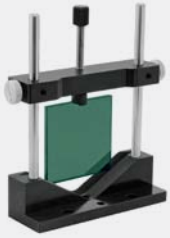
14DM-1-AR1-0-1

- Diameter: 05 – 12.7 mm; 1 – 25.4 mm
- Material: 1 – BK7; 2 – UVFS
- Coating type: see *Laser Line AR coatings*, page 74
- Angle of Incidence, deg

RELATED PRODUCTS

- **4FH56** – Multiple Filter Holder

- **4H89** – Adjustable Height V-Mount



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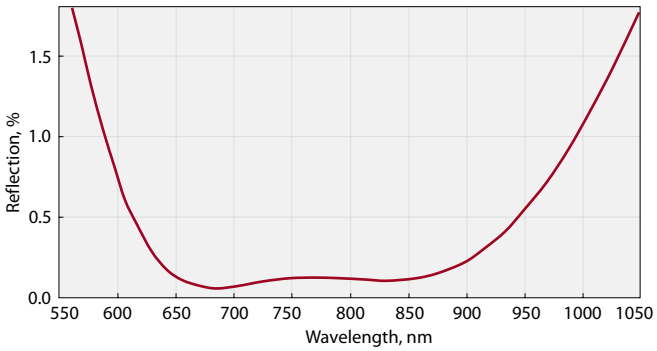
14DM-BBAR Broad Band AR Coated Windows

Broad Band AR coatings designed to reduce the reflectivity of a component to near-zero for Broad band wavelength range.
We supply standard Broad Band AR coatings in the range 0.19–10.6 µm. These multilayer broadband anti-reflective coating coating increases transmission of optical element for broad spectrum. Therefore, it is the ideal for a wide range of multi-wavelength laser and white light applications. The wavelength range and reflectivity of the coating depends on the angle of the incident beam.

FEATURES

- These coatings are designed to increase the transmission over a broad spectrum
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- Broad Band Anti-Reflection Coatings in the range 0.19–10.6 µm are available



Measured residual back reflection curve for BBAR coating code **BBAR4**

STANDARD SPECIFICATIONS

Substrate Dimension Tolerance	+0.0, –0.1 mm
Substrate Wavefront Distortion	<λ/8
Substrate Surface Quality	20-10 S-D (40-20 S-D for curved surfaces)
Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Laser Damage Threshold	>4-5 J/cm² for 10 ns pulses @ 1064 nm

BK7 AR COATED WINDOWS

Wavelength, nm	Residual Reflectivity @ 0° AOI, %	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
		Ø12.7×3 mm		Ø25.4×6 mm	
400-700	<1.0	**14DM-05-BBAR1-0-1**	**14DM-05-BBAR1-45-1**	**14DM-1-BBAR1-0-1**	**14DM-1-BBAR1-45-1**
600-1050	<0.8	**14DM-05-BBAR2-0-1**	**14DM-05-BBAR2-45-1**	**14DM-1-BBAR2-0-1**	**14DM-1-BBAR2-45-1**
700-950	<0.4	**14DM-05-BBAR3-0-1**	**14DM-05-BBAR3-45-1**	**14DM-1-BBAR3-0-1**	**14DM-1-BBAR3-45-1**
750-850	<0.3	**14DM-05-BBAR4-0-1**	**14DM-05-BBAR4-45-1**	**14DM-1-BBAR4-0-1**	**14DM-1-BBAR4-45-1**
750-1000	<0.5	**14DM-05-BBAR5-0-1**	**14DM-05-BBAR5-45-1**	**14DM-1-BBAR5-0-1**	**14DM-1-BBAR5-45-1**
900-1200	<0.6	**14DM-05-BBAR6-0-1**	**14DM-05-BBAR6-45-1**	**14DM-1-BBAR6-0-1**	**14DM-1-BBAR6-45-1**
1200-1500	<0.6	**14DM-05-BBAR7-0-1**	**14DM-05-BBAR7-45-1**	**14DM-1-BBAR7-0-1**	**14DM-1-BBAR7-45-1**
1500-1900	<0.7	**14DM-05-BBAR8-0-1**	**14DM-05-BBAR8-45-1**	**14DM-1-BBAR8-0-1**	**14DM-1-BBAR8-45-1**

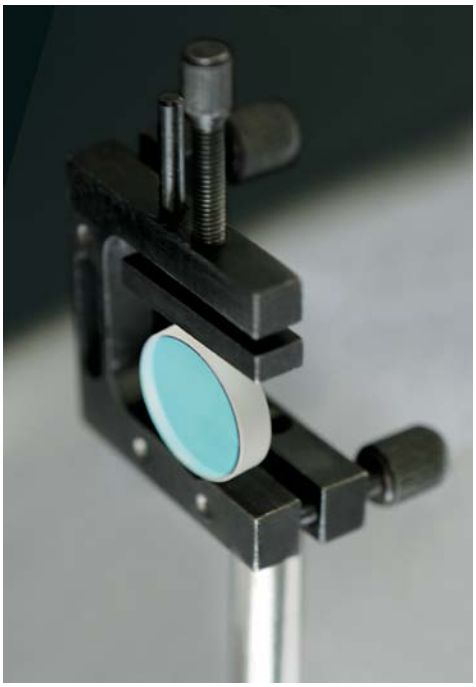
CODE EXAMPLE FOR ORDERING

14DM-1-BBAR1-0-1

- Diameter: 05 – 12.7 mm; 1 – 25.4 mm
- Angle of Incidence, deg
- Coating type: see *Broad Band AR coatings*, page 75
- Material: 1 – BK7

RELATED PRODUCTS

- **4PH132** – Universal Plate Holder



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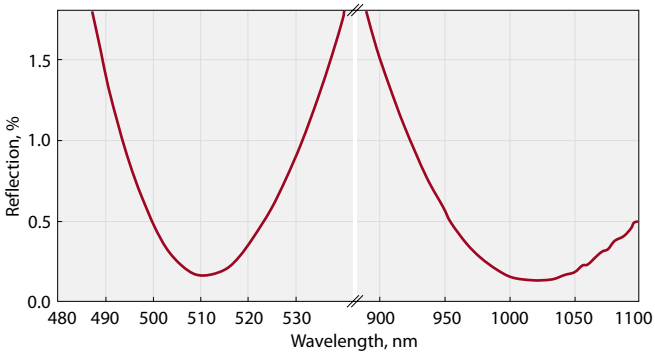
14DM-DAR Dual AR Coated Windows

Dual AR coated windows designed to reduce the reflectivity of a component to near-zero for two certain wavelengths.
Usually these windows are used in multi-frequency laser output systems (e.g. frequency doubling).
This type of coating provides very high transmission at two different wavelength. Typical wavelengths and reflection curves of an AR coating suitable for the standard laser system output at 1064 nm and 532 nm are shown below.



The measured residual back reflection curve for DAR coating code **DAR9**

FEATURES

- These coatings are designed to increase the transmission over a broad spectrum
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- Broad Band Anti-Reflection Coatings in the range 0.19–10.6 µm are available

STANDARD SPECIFICATIONS

Substrate Dimension Tolerance	+0.0, –0.1 mm
Substrate Wavefront Distortion	<λ/8
Substrate Surface Quality	20-10 S-D (40-20 S-D for curved surfaces)
Coating Adhesion and Durability	Per MIL-C-675A
Residual Reflectivity	<0.5%
Clear Aperture	>90% of diameter
Laser Damage Threshold	>4-5 J/cm² for 10 ns pulses @1064 nm

DUAL AR COATED WINDOWS

Wavelength, nm	Substrate material	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°	Ordering Code for AOI = 0°	Ordering Code for AOI = 45°
		Ø12.7×3 mm		Ø25.4×6 mm	
266+532	UVFS	**14DM-05-DAR1-0-2**	**14DM-05-DAR1-45-2**	**14DM-1-DAR1-0-2**	**14DM-1-DAR1-45-2**
343+1030	UVFS	**14DM-05-DAR2-0-2**	**14DM-05-DAR2-45-2**	**14DM-1-DAR2-0-2**	**14DM-1-DAR2-45-2**
355+532	UVFS	**14DM-05-DAR3-0-2**	**14DM-05-DAR3-45-2**	**14DM-1-DAR3-0-2**	**14DM-1-DAR3-45-2**
355+1064	UVFS	**14DM-05-DAR4-0-2**	**14DM-05-DAR4-45-2**	**14DM-1-DAR4-0-2**	**14DM-1-DAR4-45-2**
399+556	BK7	**14DM-05-DAR5-0-1**	**14DM-05-DAR5-45-1**	**14DM-1-DAR5-0-1**	**14DM-1-DAR5-45-1**
400+800	BK7	**14DM-05-DAR6-0-1**	**14DM-05-DAR6-45-1**	**14DM-1-DAR6-0-1**	**14DM-1-DAR6-45-1**
426+852	BK7	**14DM-05-DAR7-0-1**	**14DM-05-DAR7-45-1**	**14DM-1-DAR7-0-1**	**14DM-1-DAR7-45-1**
515+1030	BK7	**14DM-05-DAR8-0-1**	**14DM-05-DAR8-45-1**	**14DM-1-DAR8-0-1**	**14DM-1-DAR8-45-1**
532+1064	BK7	**14DM-05-DAR9-0-1**	**14DM-05-DAR9-45-1**	**14DM-1-DAR9-0-1**	**14DM-1-DAR9-45-1**
1064+1319	BK7	**14DM-05-DAR10-0-1**	**14DM-05-DAR10-45-1**	**14DM-1-DAR10-0-1**	**14DM-1-DAR10-45-1**

RELATED PRODUCTS

- **4H29** – Push Holder

CODE EXAMPLE FOR ORDERING

14DM-1-DAR1-0-1

Diameter
05 – 12.7 mm
1 – 25.4 mm

Angle of Incidence, deg

Material
1 – BK7
2 – UVFS

Coating type see *Dual AR coatings*, page 76

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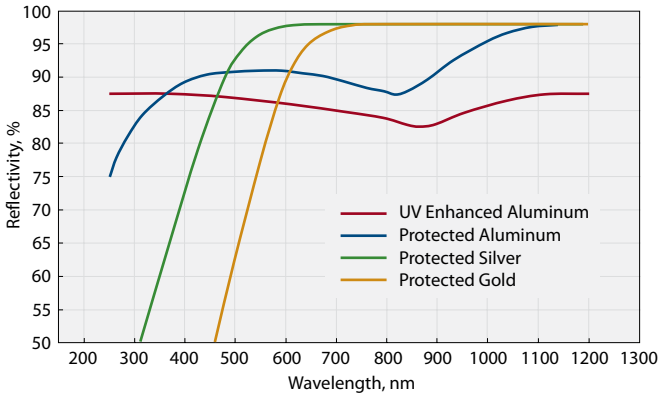
METALLIC COATED OPTICS

14EAM • 14AM • 14SM • 14GM Metallic Coated Optics

Metallic coatings can be used at any angle of incidence because they have extremely broadband reflectance.
We offer Gold, Silver and Aluminium high reflection coatings formed by vacuum deposition. All metallic reflectors can be over-coated with dielectric film of MgF_2 or SiO_2 in order to prevent oxidation of the metallic surface and provide abrasion resistance.



FEATURES

- Protected Gold provides excellent, broadband infrared high reflectance
- Protected Silver provides higher reflectance than aluminium throughout the visible and near IR
- Protected Aluminium is economical solution for VIS applications
- UV enhanced Aluminium provides good reflectance over a wide range and are mainly used in UV applications

STANDARD SPECIFICATIONS

Substrate Material	BK7, UVFS for UV enhanced mirrors
Substrate Dimension Tolerance	+0.0, –0.1 mm
Surface Quality (after coating)	40-20 scratch & dig
Surface Flatness (after coating)	λ/4
Clear Aperture	>90% of diameter
Laser Damage Threshold	>0.3 J/cm² for 10 ns pulses @ 1064 nm (for Gold and Silver)

CODE EXAMPLE FOR ORDERING

14SM-2-200

Coating type, see page 76
EAM – UV enhanced Aluminium
AM – Protected Aluminium
SM – Protected Silver
GM – Protected Gold

Diameter
05 – Ø12.7 mm
1 – Ø25.4 mm
2 – Ø50.8 mm
3 – Ø76.2 mm

Radius of curvature, mm (optional)

RELATED PRODUCTS

- **5BM121T** – Beamsplitters/ Optics Mount

- **5OM10T** – Small Optical Mount of Side Drive

- **5OM122T** – Mirror Mounts/ Tilt Platforms of Side Drive

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METALLIC COATED OPTICS

Coating type	Dimensions, mm	Type	Ordering Code
UV enhanced Aluminium R>87% @ 250-350 nm	Ø12.7×6	FLAT/FLAT	**14EAM-05**
	Ø25.4	FLAT/FLAT	**14EAM-1**
		Plano-Concave, ROC=-50 mm	**14EAM-1-50**
		Plano-Concave, ROC=-100 mm	**14EAM-1-100**
		Plano-Concave, ROC=-200 mm	**14EAM-1-200**
		Plano-Concave, ROC=-500 mm	**14EAM-1-500**
		Plano-Concave, ROC=-1000 mm	**14EAM-1-1000**
	Ø50.8×6	FLAT/FLAT	**14EAM-2**
	Ø76.2×6	FLAT/FLAT	**14EAM-3**
Protected Aluminium R>85% @ 350 nm – IR	Ø12.7×6	FLAT/FLAT	**14AM-05**
	Ø25.4	FLAT/FLAT	**14AM-1**
		Plano-Concave, ROC=-50 mm	**14AM-1-50**
		Plano-Concave, ROC=-100 mm	**14AM-1-100**
		Plano-Concave, ROC=-200 mm	**14AM-1-200**
		Plano-Concave, ROC=-500 mm	**14AM-1-500**
		Plano-Concave, ROC=-1000 mm	**14AM-1-1000**
	Ø50.8×8	FLAT/FLAT	**14AM-2**
	Ø76.2×12.7	FLAT/FLAT	**14AM-3**
Protected Silver R>96% @ 400 nm – IR	Ø12.7×6	FLAT/FLAT	**14SM-05**
	Ø25.4	FLAT/FLAT	**14SM-1**
		Plano-Concave, ROC=-50 mm	**14SM-1-50**
		Plano-Concave, ROC=-100 mm	**14SM-1-100**
		Plano-Concave, ROC=-200 mm	**14SM-1-200**
		Plano-Concave, ROC=-500 mm	**14SM-1-500**
		Plano-Concave, ROC=-1000 mm	**14SM-1-1000**
	Ø50.8×8	FLAT/FLAT	**14SM-2**
	Ø76.2×12.7	FLAT/FLAT	**14SM-3**
Protected Gold R>98% @ 900 nm – IR	Ø12.7×6	FLAT/FLAT	**14GM-05**
	Ø25.4	FLAT/FLAT	**14GM-1**
		Plano-Concave, ROC=-50 mm	**14GM-1-50**
		Plano-Concave, ROC=-100 mm	**14GM-1-100**
		Plano-Concave, ROC=-200 mm	**14GM-1-200**
		Plano-Concave, ROC=-500 mm	**14GM-1-500**
		Plano-Concave, ROC=-1000 mm	**14GM-1-1000**
	Ø50.8×8	FLAT/FLAT	**14GM-2**
	Ø76.2×12.7	FLAT/FLAT	**14GM-3**

RELATED PRODUCTS

- **5BM141** – Mirror Optical Mount

- **5MBM24-1-3** – Kinematic Mirror/ Beamsplitter Mount

- **5GM25T-1** – True Gimbal Mount

- **5BM57-2** – Stable Steel Mirror/Beamsplitter Mounts

- **5F21-1** – Flipping Mirror/ Beamsplitter Mount

- **5KVDOM-1** – Kinematic Vertical Drive Optical Mount

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FILTERS

14CGF Color Glass Filters

Standa provides color glass filters for laser pulse attenuation, filtering, etc.
Due to its selective absorption in visible wavelength range, color glass filter will exhibit various color depending the glass type. Color glass filter provides an economical filter for various applications.
Optical glass filters are widely used in safety glasses, industrial measurement, environment protection and many others.

STANDARD SPECIFICATIONS

Material	Schott glass or equivalent
Diameter Tolerance	+0.0, –0.2 mm
Clear Aperture	90%
Surface Quality	60-40 scratch & dig
Surface Flatness	λ @ 632.8 nm
Parallelism	<3 arcmin
Uncoated, Unmounted	

FEATURES

- Color glass filter provides an economical filter for many various applications
- For your convenience, we have selected 45 pcs of the color and neutral glass filters for various applications in the laboratory! Filters are assembled in safe and compact wooden box

COLOR GLASS FILTERS

Material	Ordering Code		
	Ø12.7×3 mm	Ø25.4×3 mm	50.8×50.8×3 mm
GG Series: Yellow glass			
GG10	**14CGF-GG10-1**	**14CGF-GG10-2**	**14CGF-GG10-3**
GG375	**14CGF-GG375-1**	**14CGF-GG375-2**	**14CGF-GG375-3**
GG400	**14CGF-GG400-1**	**14CGF-GG400-2**	**14CGF-GG400-3**
GG420	**14CGF-GG420-1**	**14CGF-GG420-2**	**14CGF-GG420-3**
GG455	**14CGF-GG455-1**	**14CGF-GG455-2**	**14CGF-GG455-3**
GG475	**14CGF-GG475-1**	**14CGF-GG475-2**	**14CGF-GG475-3**
GG495	**14CGF-GG495-1**	**14CGF-GG495-2**	**14CGF-GG495-3**
OG Series: Orange glass			
OG515	**14CGF-OG515-1**	**14CGF-OG515-2**	**14CGF-OG515-3**
OG530	**14CGF-OG530-1**	**14CGF-OG530-2**	**14CGF-OG530-3**
OG550	**14CGF-OG550-1**	**14CGF-OG550-2**	**14CGF-OG550-3**
OG570	**14CGF-OG570-1**	**14CGF-OG570-2**	**14CGF-OG570-3**
OG590	**14CGF-OG590-1**	**14CGF-OG590-2**	**14CGF-OG590-3**
RG Series: Red and black glass, IR transmitting			
RG6	**14CGF-RG6-1**	**14CGF-RG6-2**	**14CGF-RG6-3**
RG7	**14CGF-RG7-1**	**14CGF-RG7-2**	**14CGF-RG7-3**
RG610	**14CGF-RG610-1**	**14CGF-RG610-2**	**14CGF-RG610-3**
RG630	**14CGF-RG630-1**	**14CGF-RG630-2**	**14CGF-RG630-3**
RG645	**14CGF-RG645-1**	**14CGF-RG645-2**	**14CGF-RG645-3**
RG665	**14CGF-RG665-1**	**14CGF-RG665-2**	**14CGF-RG665-3**
RG695	**14CGF-RG695-1**	**14CGF-RG695-2**	**14CGF-RG695-3**
RG715	**14CGF-RG715-1**	**14CGF-RG715-2**	**14CGF-RG715-3**
RG780	**14CGF-RG780-1**	**14CGF-RG780-2**	**14CGF-RG780-3**
RG830	**14CGF-RG830-1**	**14CGF-RG830-2**	**14CGF-RG830-3**
RG850	**14CGF-RG850-1**	**14CGF-RG850-2**	**14CGF-RG850-3**

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Material	Ordering Code		
	Ø12.7×3 mm	Ø25.4×3 mm	50.8×50.8×3 mm
UG Series: Black blue glasses, ultraviolet transmitting			
UG1	**14CGF-UG1-1**	**14CGF-UG1-2**	**14CGF-UG1-3**
UG5	**14CGF-UG5-1**	**14CGF-UG5-2**	**14CGF-UG5-3**
UG11	**14CGF-UG11-1**	**14CGF-UG11-2**	**14CGF-UG11-3**
KG Series: Colorless glass with high transmission in the visible and absorption in the IR range			
KG1	**14CGF-KG1-1**	**14CGF-KG1-2**	**14CGF-KG1-3**
KG2	**14CGF-KG2-1**	**14CGF-KG2-2**	**14CGF-KG2-3**
KG3	**14CGF-KG3-1**	**14CGF-KG3-2**	**14CGF-KG3-3**
VG Series: Green glass			
VG5	**14CGF-VG5-1**	**14CGF-VG5-2**	**14CGF-VG5-3**
VG8	**14CGF-VG8-1**	**14CGF-VG8-2**	**14CGF-VG8-3**
VG10	**14CGF-VG10-1**	**14CGF-VG10-2**	**14CGF-VG10-3**
BG Series: Blue, blue-green and multi-band glass			
BG3	**14CGF-BG3-1**	**14CGF-BG3-2**	**14CGF-BG3-3**
BG7	**14CGF-BG7-1**	**14CGF-BG7-2**	**14CGF-BG7-3**
BG12	**14CGF-BG12-1**	**14CGF-BG12-2**	**14CGF-BG12-3**
BG20	**14CGF-BG20-1**	**14CGF-BG20-2**	**14CGF-BG20-3**
BG25	**14CGF-BG25-1**	**14CGF-BG25-2**	**14CGF-BG25-3**
BG38	**14CGF-BG38-1**	**14CGF-BG38-2**	**14CGF-BG38-3**
Color and neutral filter set consisting of 45 mounted filters (Ø25.4 mm, CA18 mm)			
Universal Filter Set (45 pcs)		**14UFS-1-S45**	
Color Glass Filter Set consisting of 95 unmounted filters (40×40 mm)			
Color Glass Filter Set (95 pcs)		**14CGF**	

Universal Filter Set **14UFS-1-S45**

Color Glass Filter Set **14CGF**

RELATED PRODUCTS AND ACCESSORIES

- **4PH132-3** – Universal Plate Holder

- **4OFH-10** – Multiple Filters Holder

- **5OM37-50TPF-9S7C** – Two Angular Fine Adjustment Mount

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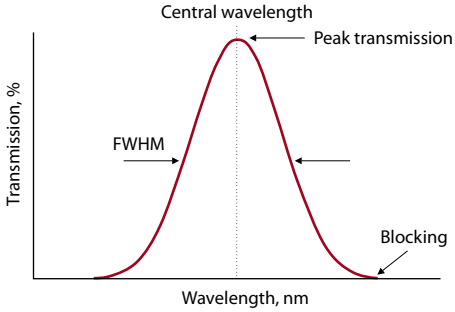
14IF Interference Filters

Standa supplies high quality standard and custom-made interference filters within the spectral range from 250 nm to 5000 nm. We also offer biomedical bandpass filters, which are specially designed for biomedical instrumentation, including chemistry analyzers and microplate readers. These bandpass filters include standard or custom matched filters. Fluorescence filters, which we can supply includes such features as steep slopes, deep blocking (up to OD 6), minimal spectral crosstalk, high transmission and environmental durability.



FEATURES

- In general interference filters are used as wavelength selectors in astrophysics, clinical chemistry, material analysis, quality control, and in general purpose laboratory colorimeters and other applications

STANDARD SPECIFICATIONS

Bandwidth Tolerance	±20% maximal
Blocking	<0.01%
Mount Diameter	25.4 mm
Clear Aperture	>18 mm
Temperature Limits	-50 °C to 80 °C

VIS NARROW BANDPASS INTERFERENCE FILTERS

Central wavelength, nm	Bandwidth (FWHM), nm	Peak Transmittance, %	Ordering Code
405	10	35	**14IF35-405-10**
415	10	40	**14IF40-415-10**
450	10	50	**14IF50-450-10**
488	3	50	**14IF50-488-3**
505	10	50	**14IF50-505-10**
510	10	50	**14IF50-510-10**
515	10	50	**14IF50-515-10**
532	10	50	**14IF50-532-10**
546	10	50	**14IF50-546-10**
550	10	50	**14IF50-550-10**
570	10	50	**14IF50-570-10**
590	10	50	**14IF50-590-10**
600	10	50	**14IF50-600-10**
620	10	50	**14IF50-620-10**
633	11	50	**14IF50-633-11**
650	11	50	**14IF50-650-11**
670	11	50	**14IF50-670-11**
690	11	50	**14IF50-690-11**

CODE EXAMPLE FOR ORDERING

14IF35-352-12

- 14IF: Peak Transmittance
- 35: Central Wavelength
- 352: Bandwidth

UV BANDPASS INTERFERENCE FILTERS

Central wavelength, nm	Bandwidth (FWHM), nm	Peak Transmittance, %	Ordering Code
228	12	10	**14IF10-228-12**
232	12	10	**14IF10-232-12**
239	12	10	**14IF10-239-12**
254	12	12	**14IF12-254-12**
265	12	12	**14IF12-265-12**
280	12	12	**14IF12-280-12**
289	12	12	**14IF12-289-12**
297	12	12	**14IF12-297-12**
312	12	15	**14IF15-312-12**
326	12	15	**14IF15-326-12**
334	12	15	**14IF15-334-12**
340	11	40	**14IF40-340-11**
352	12	35	**14IF35-352-12**
365	12	35	**14IF35-365-12**
380	12	35	**14IF35-380-12**

NIR NARROW BANDPASS INTERFERENCE FILTERS

Central wavelength, nm	Bandwidth (FWHM), nm	Peak Transmittance, %	Ordering Code
766	11	45	**14IF45-766-11**
780	11	45	**14IF45-780-11**
795	11	45	**14IF45-795-11**
830	12	45	**14IF45-830-12**
850	12	45	**14IF45-850-12**
880	12	45	**14IF45-880-12**
905	12	45	**14IF45-905-12**
940	13	45	**14IF45-940-13**
1060	10	45	**14IF45-1060-10**
1064	10	45	**14IF45-1064-10**
1152	11	45	**14IF45-766-11**
1310	12	45	**14IF45-1310-12**
1320	12	45	**14IF45-1320-12**
1523	10	45	**14IF45-1523-10**
1550	10	45	**14IF45-1550-10**

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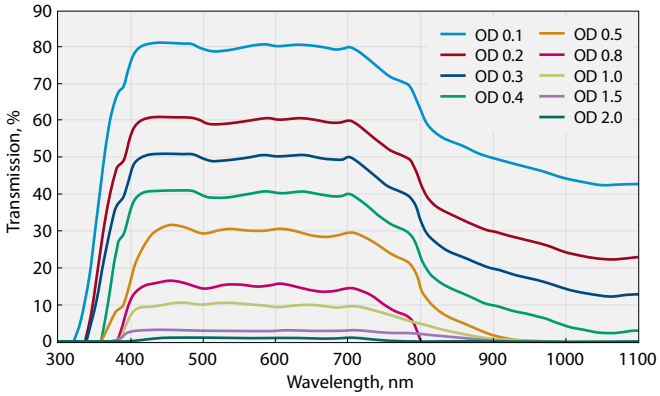
14NDF Neutral Density Absorption Type Filters

Neutral density filters are ideal for overall light reduction in cases of extreme light intensity. Neutral density laser radiation filters with custom transmittance, dimensions and shape. Neutral density absorption type filters decrease intensity of light without altering relative spectral distribution of the energy. Attenuation is accomplished by using an absorbing type glass.



FEATURES

- Neutral Density filter is an economical solution to attenuate the light
- For your convenience, we have selected 11 pcs of the neutral glass filters for various applications in the laboratory! Filters are assembled in safe and compact wooden box

STANDARD SPECIFICATIONS

Material	Neutral density glass
Diameter Tolerance	+0.0, −0.2 mm
Clear Aperture	90%
Surface Quality	60-40 scratch & dig
Surface Flatness	λ @ 632.8 nm
Parallelism	<3 arcmin
Designed for VIS range (400-700 nm)	
Uncoated, Unmounted	

Neutral density filter set **14NFS-1-S11**

Color and neutral density filter set consisting of 45 mounted filters (Ø25.4 mm, CA18 mm)	
Universal Filter Set (45 pcs)	**14UFS-1-S45**

Neutral density filter set consisting of 11 mounted filters (Ø25.4 mm, CA18 mm)	
Neutral density filter set (11 pcs)	**14NFS-1-S11**

NEUTRAL DENSITY ABSORPTION TYPE FILTERS

Optical density	Average Transmission in VIS	Ordering Code		
		Ø12.7 mm	Ø25.4 mm	50.8×50.8 mm
0.1	80%	**14NDF-80-1**	**14NDF-80-2**	**14NDF-80-3**
0.2	60%	**14NDF-60-1**	**14NDF-60-2**	**14NDF-60-3**
0.3	50%	**14NDF-50-1**	**14NDF-50-2**	**14NDF-50-3**
0.4	40%	**14NDF-40-1**	**14NDF-40-2**	**14NDF-40-3**
0.5	30%	**14NDF-30-1**	**14NDF-30-2**	**14NDF-30-3**
0.8	15%	**14NDF-15-1**	**14NDF-25-2**	**14NDF-35-3**
1.0	10%	**14NDF-10-1**	**14NDF-20-2**	**14NDF-30-3**
1.5	3%	**14NDF-3-1**	**14NDF-3-2**	**14NDF-3-3**
2.0	1%	**14NDF-1-1**	**14NDF-1-2**	**14NDF-1-3**
3.0	0.1%	**14NDF-01-1**	**14NDF-01-2**	**14NDF-01-3**

RELATED PRODUCTS

- **10WA168** & **10CWA168** – Variable Wheel Attenuators

CODE EXAMPLE FOR ORDERING

14NDF-80-1

Transmittance, %

Size
1 – Ø12.7 mm
2 – Ø25.4 mm
3 – 50.8×50.78 mm

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14CNDF Circular Variable Neutral Density Filters

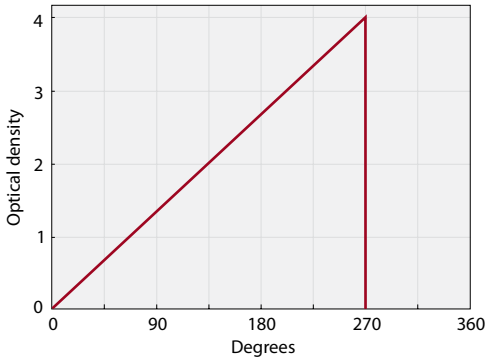
Circular ND filters provide continuously variable, linear attenuation of light by rotating the filter around its center. Transmitted intensity varies as a function of the optical density range. The filter can be used for white light as well as for lasers. A large finite aperture can be attenuated by counter rotating two filters in series. Sizes are available from 25 mm to over 100 mm in diameter.

STANDARD SPECIFICATIONS

Material	B-270 optical crown; UV grade Fused Silica
Outside Diameter	25 mm; 50 mm; 100 mm
Inside Diameter	8.3 mm
Design Wavelength	400-700 nm
Operating Wavelength Range	380-2000 nm (B-270); 250-2500 nm (UV grade Fused silica)
Coated Area	0 to 270°
Parallelism	±3 arcmin

FEATURES

- Circular Variable Neutral Density filter is an economical solution to attenuate the light



CIRCULAR VARIABLE NEUTRAL DENSITY FILTERS

Optical density range	Average Transmission in VIS	Substrate material	Operating range	Ordering Code		
				Ø25 mm	Ø50 mm	Ø100 mm
0.04 to 1.0	90% to 10%	B-270 optical crown	380-2000 nm	**14CNDF-25-90/10-1**	**14CNDF-50-90/10-1**	**14CNDF-100-90/10-1**
0.04 to 2.0	90% to 1%	B-270 optical crown	380-2000 nm	**14CNDF-25-90/1-1**	**14CNDF-50-90/1-1**	**14CNDF-100-90/1-1**
0.04 to 3.0	90% to 0,1%	B-270 optical crown	380-2000 nm	**14CNDF-25-90/01-1**	**14CNDF-50-90/01-1**	**14CNDF-100-90/01-1**
0.04 to 1.0	90% to 10%	UV grade Fused silica	250-2500 nm	**14CNDF-25-90/10-2**	**14CNDF-50-90/10-2**	**14CNDF-100-90/10-2**
0.04 to 2.0	90% to 1%	UV grade Fused silica	250-2500 nm	**14CNDF-25-90/1-2**	**14CNDF-50-90/1-2**	**14CNDF-100-90/1-2**
0.04 to 3.0	90% to 0,1%	UV grade Fused silica	250-2500 nm	**14CNDF-25-90/01-2**	**14CNDF-50-90/01-2**	**14CNDF-100-90/01-2**

- *Rectangular shape variable neutral density filters available. Please request us for more information.*

CODE EXAMPLE FOR ORDERING

14CNDF-25-90/1-1

- Diameter, mm
- Transmission Range
- Material
  1 – B-270 optical crown
  2 – UV grade Fused silica

RELATED PRODUCTS

- **4CFH-8** – CNDF Filter Holder

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14OAP Off-Axis Parabolic Mirrors

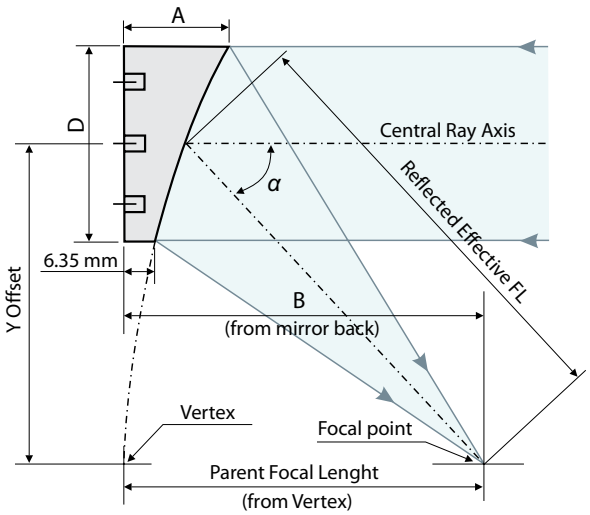
FEATURES

- Aluminium Substrate Mirrors
- Available in 30°, 60°, or 90° Off-Axis
- Mounting Plates Also Available

Standa`s basic reflecting type off-axis mirrors with parabolic surface contours for off-axis beam focussing performance. Unlike regular parabolic mirrors, OAP mirrors direct and focus incident collimated beam to a point or point source to infinity. This allows unrestricted access to the focal point.
Typical applications for OAP mirrors include Schlieren and MTF systems where OAP is used as collimators. For easy mounting the aluminium mirror base already has M4 or M6 threaded holes.

STANDARD SPECIFICATIONS

Material	Aluminium
Diameter Tolerance	+0.0, –0.4 mm
Focal Length Tolerance	±1%
Surface Figure	1/4λ - 1λ RMS (depends on size)
Surface Roughness	< 100-175 Å RMS
Coating	Protected Aluminium or Protected Gold



CODE EXAMPLE FOR ORDERING

14OAP-1-50-60-AL

- Diameter: 1 – Ø25.4 mm; 2 – Ø50.8 mm
- Reflected Effective Focal Length, mm
- Angle, deg
- Coating type: AL – Protected Aluminium; GM – Protected Gold

OFF-AXIS PARABOLIC MIRRORS

Diameter D, mm	Parent Focal Lenght, mm	Reflected Effective FL, mm	Angle α, deg	Y Offset Axis, mm	Coating	Ordering Code
25.4	12.7	25	90	25.4	Protected Gold	**14OAP-1-25-90-GM**
25.4	38.1	50	60	44.0	Protected Gold	**14OAP-1-50-60-GM**
25.4	50.8	100	90	101.6	Protected Gold	**14OAP-1-100-90-GM**
25.4	76.2	150	90	152.4	Protected Gold	**14OAP-1-150-90-GM**
25.4	101.6	200	90	203.2	Protected Gold	**14OAP-1-200-90-GM**
50.8	50.8	50	30	27.2	Protected Gold	**14OAP-2-50-30-GM**
50.8	25.4	50	90	50.8	Protected Gold	**14OAP-2-50-90-GM**
50.8	76.2	150	90	152.4	Protected Gold	**14OAP-2-150-90-GM**
25.4	25.4	25	30	13.6	Protected Aluminium	**14OAP-1-25-30-AL**
25.4	12.7	25	90	25.4	Protected Aluminium	**14OAP-1-25-90-AL**
25.4	25.4	35	60	29.3	Protected Aluminium	**14OAP-1-35-60-AL**
25.4	50.8	50	30	27.2	Protected Aluminium	**14OAP-1-50-30-AL**
25.4	38.1	50	60	44.0	Protected Aluminium	**14OAP-1-50-60-AL**
25.4	25.4	50	90	50.8	Protected Aluminium	**14OAP-1-50-90-AL**
25.4	50.8	70	60	58.6	Protected Aluminium	**14OAP-1-70-60-AL**
25.4	50.8	100	90	101.6	Protected Aluminium	**14OAP-1-100-90-AL**
25.4	101.6	200	90	203.2	Protected Aluminium	**14OAP-1-200-90-AL**
50.8	50.8	50	30	27.2	Protected Aluminium	**14OAP-2-50-30-AL**
50.8	25.4	50	90	50.8	Protected Aluminium	**14OAP-2-50-90-AL**
50.8	101.6	100	30	54.5	Protected Aluminium	**14OAP-2-100-30-AL**
50.8	76.2	100	60	88.0	Protected Aluminium	**14OAP-2-100-60-AL**
50.8	50.8	100	90	101.6	Protected Aluminium	**14OAP-2-100-90-AL**
50.8	95.2	200	90	190.5	Protected Aluminium	**14OAP-2-200-90-AL**

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SYNCHROTRON RADIATION and Extra-UV MIRRORS

Synchrotron radiation is a high-performance instrument for many kinds of science and industry applications these days. Due to extremely small wavelengths and ultra-high vacuum chambers Synchrotron Radiation equipment brings the research scale to atomic level, therefore the requirements for optical components are very high.

It is agreed that the quality of grazing incident optics is defined by surface figure error. This term describes the maximum (PV) or average (RMS) deviation of the actual form from the ideal surface. Since the quality of the focus for grazing incident optics is primarily determined by slope distribution on the surface, it is more convenient to use the RMS Slope error to specify the surface form accuracy. Typical slope error values range from 0.5 arcsec/rms (for flat surfaces) up to 1 arcsec/rms (aspherical surfaces).

FEATURES

- Shape accuracy up to λ / 100 @ 632.8 nm
- Individual certification including interferograms and topographich maps for each mirror
- Surface micro-roughness as low as 0.4 nm, rms
- Plane, Spherical, Cylindrical, Toroidal, Ellipsoidal, Paraboloid, Hyperboloid, Free Form available

TYPICAL SURFACE GEOMETRY OF SYNCHROTRON MIRRORS:

- Flat – best slope error is reached.
- Sphere, Cylinder – very good slope error.
- Toroids, elliptic/parabolic cylinder, elliptical toroid – good slope error.
- Ellipsoid (rotary), paraboloid, hyperboloid, Free-form Surface – good slope error.

MANUFACTURING TECHNIQUES

There are two techniques for SR Mirrors: Direct Manufacturing and Replication by negative master form. The direct manufacturing process generally includes the following steps:

1. Grinding the pre-manufacturing substrates and optical surface geometry.
2. Etching to reduce stress and sub-surface damages.
3. Lapping to set a good thermal contact at the side faces and to optimize the optical

surface for next steps.

4. Several levels of polishing to correct and smoothen the surface shape.

For achieving the desired quality a very close interaction between metrology and polishing is required. Depending on the mirror type, geometry and required accuracy, fine correction of residual errors is performed by:

- Conventional polishing. for Plane & Spherical mirrors, rms-Roughness: 2 nm ; 0.5 nm with Magnetorheological finishing.
- Computer controlled fine-correction polishing – tool for figuring aspherical surfaces. Slope errors 0.5-1 arcsec.
- Ion Beam Figuring – highest precision tool for figuring optical surfaces of any form (slope errors <0.1 arcsec)
- Metal Mirrors can also be performed by Diamond Turning methods and Replication Technique.

TEST DOCUMENTATION

A complete report including all data of performed measurements as described before is established for each optical piece. Test documents are delivered together with optical pieces.

TYPICAL MIRRORS SUBSTRATE MATERIALS

For low SR flux:

- Zerodur®, Astrositall® (Sitall CO-115M)
- Fused Silica
- ULE™
- Glasses (Pyrex, BK7, …)

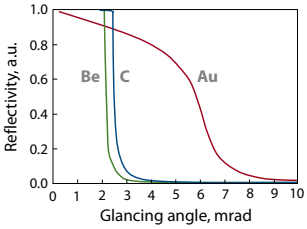
For high SR flux:

- Silicon (single crystal)
- Silicon Carbide (CVD)
- Cu with electroless Ni layer
- Al with electroless Ni layer

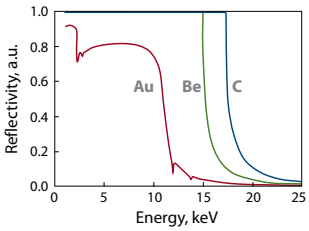
COATINGS

Commonly used coating materials: Au, Pt, Rh, Ni, Pd, Al, Si, C, Ru, SiO_2, Al/MgF_2. In some cases (e.g. Ru) a thin Cr binding layer (0.4 nm) is necessary for reducing stress and also for keeping the micro roughness performance. Standa offers the "Special EUV HR" (EUV) for wavelengths < 50 nm. Nominal Reflection for different metallic coatings at AOI = 75 degree for EUV mirrors (Theoretical, for nonpolarized):

Platinum	Gold Standard EUV (Au_40 nm / Cr_binder)	Nickel
R~ 55 – 58 % @ 200 nm – 65 nm	R ~ 55 – 58 % @ 200 nm – 65 nm	R~ 60 – 68 % @ 200 nm – 120 nm
R~ 60 – 69 % @ 65 nm – 27 nm	R ~ 55 – 65 % @ 65 nm – 25 nm	R~ 56 – 60 % @ 120 nm – 40 nm
R~ 55 – 60 % @ 27 nm – 22 nm		R~ 60 – 70 % @ 41 nm – 30 nm
R ~ 60 – 65 % @ 22 nm – 12 nm	R~ 61 – 70 % @ 25 nm – 15 nm	R~ 30 – 60 % @ 30 nm – 20 nm
R ~ 50 – 55 % @ 12 nm – 10 nm	R~ 70 – 71 % @ 15 nm – 9 nm	R ~ 30 – 40 % @ 20 nm – 16 nm



Reflectivity of Au, Be and C at 12398 eV



Bandpath of Au, Be and C

Reflectivity at 1 Angstrom and energy bandpath at the critical angle for Au, Be and C coatings acting as a high energy cut-off.

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PACKAGING

Each item is packaged in its own protective container. The container is the membrane box, and is designed to prevent dust, contamination and contact of any part of clear aperture. The packaging of each optic will clearly identify its serial number.

PACKING AND DELIVERY

Packing for shipment will insure that each optic is insulated from severe shock and rough handling. Each optic will be delivered with its own documents: optical test report and conformance certificates.

14OAP-HP Precision Off-Axis Parabolic XUV Mirrors

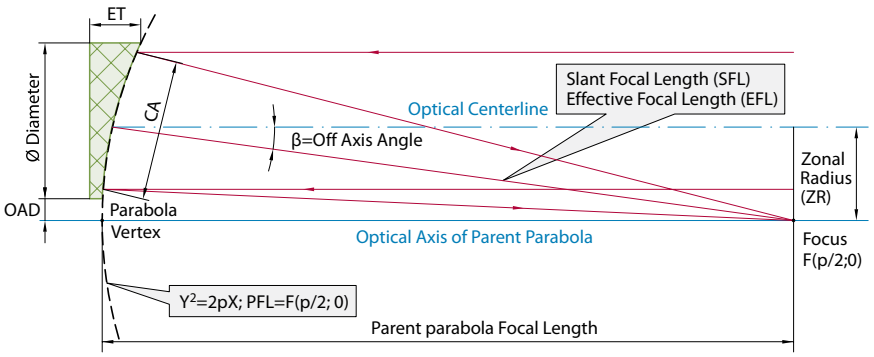
FEATURES

- Reflecting and grazing incidence type mirrors
- Dimensions up to 1200 mm
- Typical surface accuracy is λ/15 at 633 nm P-V (λ/70 RMS)

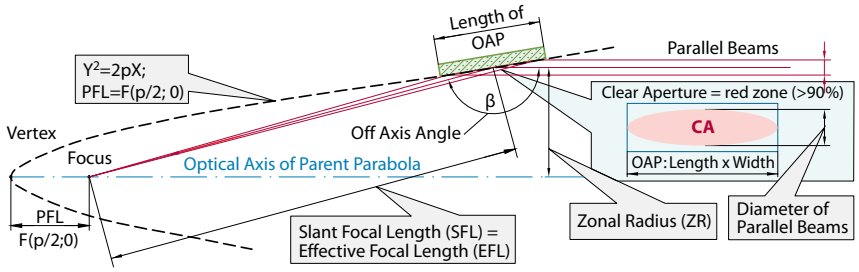
Parabolic mirrors are most common type of aspherical mirrors used in optical systems and devices. They are free from spherical aberrations, and therefore focus the beam to a point or point source to infinity.

OAP PARAMETER DESCRIPTION:

- Parent focal length (PFL) is the focal length of the parent paraboloid $Y^2=2pX$ for YX coordinates.
- Slant Focal Length (SFL) is the distance between OAP mechanical center and parabola focus F(p/2;0). This parameter is commonly known as Reflected Effective Focal Length (EFL).
- Optical Centerline is the line parallel to parent parabola optical axis and coming through the mechanical center of OAP.
- Zonal Radius (ZR) is the distance between parent parabola optical axis and optical centerline of the OAP. Often are used Off Axis Angle -β.
- Off-axis Distance (OAD) is the distance from parent parabola optical axis to inner edge of OAP. This value may be calculated from ZR and vice versa.



Principal scheme of reflective type OAP mirror (0°<β <160°)



Principal scheme of grazing incidence type OAP mirror (165°<β<180°)

All above parameters are not independent. For example longer focal length influences better surface accuracy and on opposite site – longer zonal radius makes for lower SA.

Specifications	Standard	Enhanced
Material	Zerodur®, Astrositall®, FS, ULETM , Si, Cu, Al, Pyrex, BK7	
Wavelength range, nm	9 – 200	
Dimensions, mm	up to 500	up to 1200
Clear Aperture (CA)	<90%	up to 100%
Focal length tolerances	± 0.5%	± 0.01%
Micro-roughness, nm (RMS)	~ 2	≤ 0.4
Slope Error, arcsec (RMS)	1 – longitudinal 4 – transverse	0.3 – longitudinal 0.8 – transverse
Shape accuracy @ 632.8 nm	≤ λ / 30	λ / 100

Exact parameters are subject of each particular inquiry. Please contact us for a quote.

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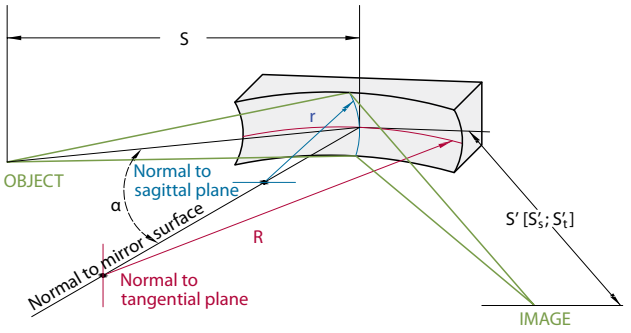
14TM Toroidal Mirrors

Toroidal mirrors are focusing devices having two different radii whose axes are oriented perpendicularly. They are utilized in instances where a beam must be focused and folded. Rather than using both a spherical mirror and a plane mirror for this purpose, both functions may be combined in one element. Toroidal mirrors also correct for the astigmatism that result when a spherical mirror is used off axis.



Principal scheme of Toroidal mirror

FEATURES

- Often used in monochromators based on Czerny-Turner optical scheme

α – the angle of incidence (to Normal); one half the included angle of the incident and reflected rays;
S – Object conjugate distance; ***S'*** – Image conjugate distance;
S'_s – for the sagittal plane; S'_t – for the tangential plane;
r – the Radius whose axis of revolution is oriented in the sagittal plane; also called the cylinder curve.
R – the Radius whose axis of revolution is in the tangential plane; also called the base curve.

$$1/S + 1/S'_s = 2\cos\alpha / r = 1 / f_{sag};$$
$$1/S + 1/S'_t = 2/R\cos\alpha = 1 / f_{tan};$$
$$r/R = \cos 2\alpha;$$
$$f_{tan} = f_{sag}, \text{ if } \cos\alpha = \sqrt{r/R}$$

Specifications	Standard	Enhanced
Material	Zerodur®, Astrositall®, FS, ULETM , Si, Cu, Al, Pyrex, BK7	
Wavelength range	9–200 nm	
Dimensions, mm	up to 500 mm	up to 2000 mm
Clear Aperture (CA)	<90%	up to 100%
Focal length tolerances	± 0.5%	± 0.01%
Micro-roughness, nm (RMS)	~ 2	≤ 0.4
Slope Error, arcsec (RMS)	1 – longitudinal ; 4 – transverse	0.3 – longitudinal; 0.8 – transverse
Shape accuracy @ 632.8 nm	≤ λ / 30	λ / 100

Exact parameters are subject of each particular inquiry. Please contact us for a quote.

RELATED PRODUCTS AND ACCESSORIES

- **6TP116** – Multi-Axis Tilt Platform

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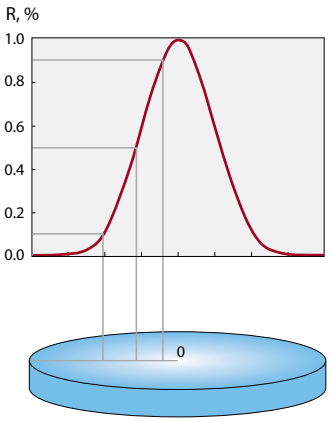
VARIABLE REFLECTIVITY MIRRORS

14VRM Variable Reflectivity Mirrors

In order to have better beam quality, i.e. in non-stable resonators, variable reflection mirrors – variable reflectivity mirrors can be used. High intensity of the laser beam requires use of components with a high damage threshold. Dielectric coatings are best suited to meet these requirements. Standa offers variable reflectivity mirrors with dielectric coating, designed at wavelengths in a range from 266 to 2500 nm.

FEATURES

- Improves beam shape and quality
- Variable/locally defined reflection
- Highest available central reflection value R_r (max) – 50%
- Custom design (substrate shape, wedge, AR coating) available



$$R_r = R_0 \times \exp\left[-2\left(\frac{r}{w_m}\right)^k\right]$$

Function of reflection.
Expression:
r - radius (variable), mm
R_r - Reflection (mean), %
R_0 - Reflection (center), %
w_m - coating $1/e^2$-radius, mm
k - order

Exact parameters are subject of each particular inquiry. Please contact us for a quote.

STANDARD SPECIFICATIONS

Material	UVFS
Types	Plano/Plano, PCV, PCX
Diameter Tolerance	+0.0, –0.15 mm
Thickness Tolerance	±0.1 mm
Flatness	λ/10
Surface Quality	20-10 scratch & dig
Parallelism error (PL/PL)	<10 arcsec
Clear Aperture	>90%
Coating Damage Threshold	>10 J/cm² for 10 ns pulses @ 1064 nm

RELATED PRODUCTS AND ACCESSORIES

- **5VDOM-1** – Kinematic Vertical Drive Optical Mounts

- **5MBM24-1-3** – Kinematic Mirror/ Beamsplitter Mount

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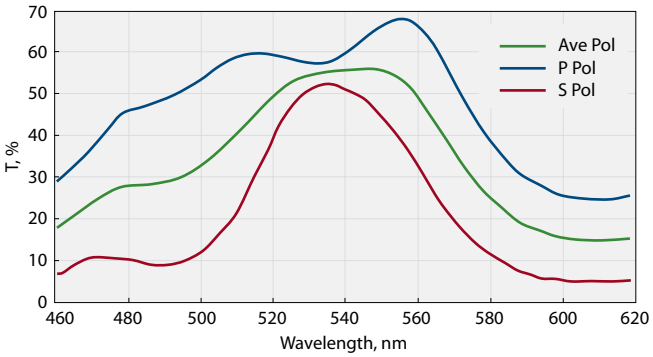
NON POLARIZING BEAMSPLITTER CUBES

14NBC Non Polarizing Beamsplitter Cubes

50/50 split ratio non-polarizing beamsplitter cubes are available in Standa! Cubes are constructed by cementing two precision right angle prisms together with metallic-dielectric coating on the hypotenuse surface. Absorption loss due to coating is around 10%, moreover these cubes do not affect polarization of the incident beam!
Cubes of different sizes, other splitting ratio or wavelength range are available upon request. Please contact us for pricing.



Typical performace of NBC cube designed for 532 nm wavelength

FEATURES

- All faces are Anti-reflection coated
- Low polarization dependance (R_s–R_p < 5%)
- Cubes of greater sizes available upon request

STANDARD SPECIFICATIONS

Material	BK7 grade A, optical glass
Dimension Tolerance	±0.1 mm
Flatness	λ/8 @ 632.8 nm per 25 mm
Surface Quality	40-20 scratches and dig
Angle Tolerance	±2 arcmin
Beamsplitting Ratio	$T_p = T_s = 45 \pm 5\%$ $R_p = R_s = 45 \pm 5\%$
Clear Aperture	90%
Bevel	0.3 mm × 45°
Coating Type	Hybrid
Transmittance	45 ± 5%
Absorption	<10%
Polarization	<6%

CODE EXAMPLE FOR ORDERING

14NBC-10-50/50-650-900

- 14NBC-10: Cube size, mm
- 50/50: Splitting ratio
- 650-900: Wavelength, nm

NON POLARIZING BEAMSPLITTER CUBES

Dimensions, mm	Wavelength range, nm	Ordering code
5×5×5	450–700	**14NBC-5-50/50-450-700**
	700–1000	**14NBC-5-50/50-700-1000**
	1000–1300	**14NBC-5-50/50-1000-1300**
	1300–1600	**14NBC-5-50/50-1300-1600**
10×10×10	450–700	**14NBC-10-50/50-450-700**
	700–1000	**14NBC-10-50/50-700-1000**
	1000–1300	**14NBC-10-50/50-1000-1300**
	1300–1600	**14NBC-10-50/50-1300-1600**
12.7×12.7×12.7	450–700	**14NBC-12.7-50/50-450-700**
	700–1000	**14NBC-12.7-50/50-700-1000**
	1000–1300	**14NBC-12.7-50/50-1000-1300**
	1300–1600	**14NBC-12.7-50/50-1300-1600**
20×20×20	450v700	**14NBC-20-50/50-450-700**
	700–1000	**14NBC-20-50/50-700-1000**
	1000–1300	**14NBC-20-50/50-1000-1300**
	1300–1600	**14NBC-20-50/50-1300-1600**
25.4×25.4×25.4	450–700	**14NBC-25.4-50/50-450-700**
	700–1000	**14NBC-25.4-50/50-700-1000**
	1000–1300	**14NBC-25.4-50/50-1000-1300**
	1300–1600	**14NBC-25.4-50/50-1300-1600**

RELATED PRODUCTS

- **5MO111** – Mirror/ Optics Mount

- **10AFP3-1** – Variable Attenuator/ Beamsplitter

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POLARIZING OPTICS

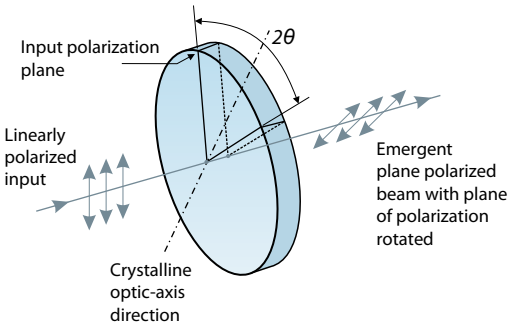
Waveplates – Brief Overview

FEATURES

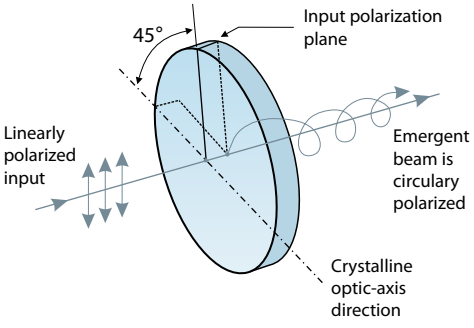
- Waveplates for any wavelength in 240-9000 nm range
- Air-spaced ZO waveplates for high energy applications
- Waveplates for many wavelengths are available from STOCK!!
- Custom design waveplate assemblies are available on request!

Standa is offering wide range of Zero Order (ZO), Low order (LO) half (λ/2) or quarter (λ/4) waveplates for UV, VIS, NIR and IR (for any wavelength in 240-9000 nm range)
Waveplates are made from materials which exhibit birefringence. The velocity of the extraordinary and ordinary rays through the birefringent material varies inversely with their refractive indices. This difference in velocities gives a rise to phase difference when two beams recombine. At any specific wavelength the phase difference is governed by the thickness of the retarder - waveplate.
Half (λ/2) Waveplate. A linearly polarized beam incident on a half wave crystal quartz waveplate emerges as a linearly polarized beam but rotated such that its angle to the optical axis is twice that of the incident beam. Therefore, half-waveplates can be used as continuously adjustable polarization rotators. Half-waveplates are used to rotate the plane of polarization, electro-optic modulation and as a variable ratio beamsplitter when used in conjunction with a polarization cube.
Quarter (λ/4) Waveplate – thin-film compensator. If the angle between the electric field vector of the incident linearly polarized beam and the retarder principal plane of the quarter-waveplate is 45°, the emergent beam is circularly polarized. When a quarter waveplate is double passed, i.e. by mirror reflection, it acts as a half waveplates and rotates the plane of polarization to a certain angle. Quarter waveplate are used in creating circular polarization from linear or linear polarization from circular, ellipsometry, optical pumping, suppressing unwanted reflection and optical isolation.

Zero Order (ZO) waveplates are generally preferred since they are least sensitive to variations in wavelength, angle of incidence and temperature. To suit different applications, air spaced or optically contacted (see drawings on next page) Zero Order compensated phase retardation plates are available from Standa.
The air-spaced construction enables to use the waveplate for the high power laser applications. The damage threshold is more than 500 MW/cm².



Performance of Half (λ/2) Waveplate



Performance of Quarter (λ/4) Waveplate

RELATED PRODUCTS

- **5PH50** – Polarizer Holder

- **5PHH50-1** – Polarizer Holder

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14WPZO • 14WPLO Crystalline Quartz Waveplates

Standa is offering wide range of Zero Order (ZO), Low Order (LO) waveplates for UV, VIS, NIR range (for any wavelength in 240-2600 nm range). All our waveplates are made from excellent quality laser grade Crystalline quartz material.
ZO waveplate is constructed by two quartz plates with their fast axis crossed. The difference in thickness between the two plates determines the retardance. ZO waveplates offer a substantially lower dependence on temperature, angle and wavelength change than conventional monolithic LO waveplates.
To suit different applications, air-spaced or optically contacted ZO compensated phase retardation waveplates are available.
The air-spaced construction enables to use the waveplate for the high power laser applications. The damage threshold is more than 500 MW/cm².

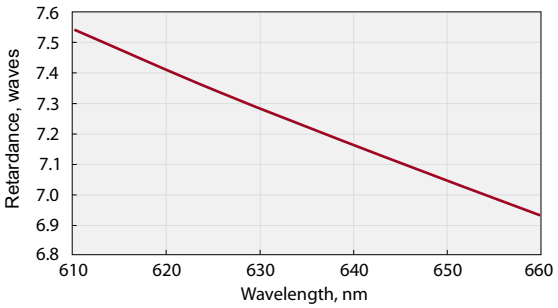
FEATURES

- Waveplates are made from excellent quality laser grade Crystalline quartz material.
- We specialize in Air-spaced Zero-order Waveplates
- Dual wavelength waveplates are also available
- All waveplates are AR coated and mounted by default

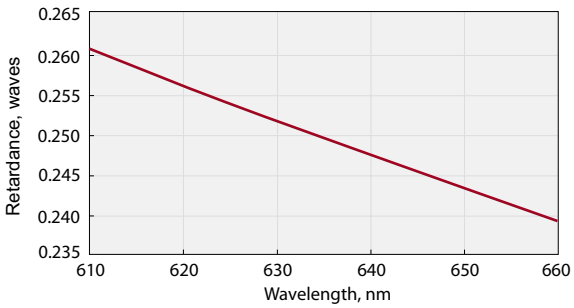
STANDARD SPECIFICATIONS

Material	Crystalline Quartz
AR Coatings	R < 0.2% at each surface
Retardation Tolerance	λ/500 @ 20 °C
Wavefront Distortion	λ/8 @ 633 nm
Surface Quality	20-10 scratch & dig
Surface Flatness	λ/10 @ 632.8 nm
Parallelism Error	< 1 arcsec
Laser Damage Threshold	5 J/cm² 10 ns pulsed @ 1064 nm typical
Mounting	Mounted in 25.4 mm black anodized metal mount

RETARDATION VS. WAVELENGTH FOR ZO AND LO CRYSTALLINE QUARTZ WAVEPLATES

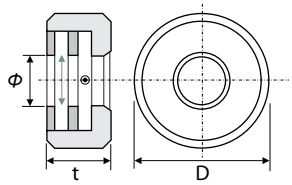


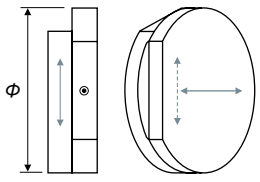
7.25 waves LO waveplate @ 633 nm

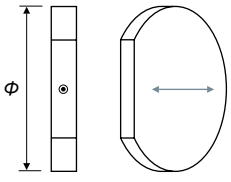


0.25 waves ZO waveplate @ 633 nm

DRAWING AND SELECTION GUIDE







ZO air-spaced	ZO optically contacted	LO waveplate
Broad wavelength dependence		Good for single wavelength use
Low Temperature dependence		Sensitive to Temperature changes
More expensive than LO waveplates		Low cost
High damage threshold (>500 MW/cm²)	Higher transmission due to optical contact	

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ZO CRYSTALLINE QUARTZ WAVEPLATES

Air-spaced, clear aperture **12.7 mm**
Mounted in 25.4 mm metal mount

Wavelength, nm	Ordering Code	
	λ/2 Retardation	λ/4 Retardation
266	14WPZO.2-266-12.7	14WPZO.4-266-12.7
343	14WPZO.2-343-12.7	14WPZO.4-343-12.7
355	14WPZO.2-355-12.7	14WPZO.4-355-12.7
400	14WPZO.2-400-12.7	14WPZO.4-400-12.7
473	14WPZO.2-473-12.7	14WPZO.4-473-12.7
515	14WPZO.2-515-12.7	14WPZO.4-515-12.7
532	14WPZO.2-532-12.7	14WPZO.4-532-12.7
589	14WPZO.2-589-12.7	14WPZO.4-589-12.7
633	14WPZO.2-633-12.7	14WPZO.4-633-12.7
780	14WPZO.2-780-12.7	14WPZO.4-780-12.7
800	14WPZO.2-800-12.7	14WPZO.4-800-12.7
852	14WPZO.2-852-12.7	14WPZO.4-852-12.7
940	14WPZO.2-940-12.7	14WPZO.4-940-12.7
980	14WPZO.2-980-12.7	14WPZO.4-980-12.7
1030	14WPZO.2-1030-12.7	14WPZO.4-1030-12.7
1064	14WPZO.2-1064-12.7	14WPZO.4-1064-12.7
1122	14WPZO.2-1122-12.7	14WPZO.4-1122-12.7
1319	14WPZO.2-1319-12.7	14WPZO.4-1319-12.7
1550	14WPZO.2-1550-12.7	14WPZO.4-1550-12.7

ZO CRYSTALLINE QUARTZ WAVEPLATES

Air-spaced, clear aperture **15 mm**
Mounted in 25.4 mm metal mount

Wavelength, nm	Ordering Code	
	λ/2 Retardation	λ/4 Retardation
266	14WPZO.2-266-15	14WPZO.4-266-15
343	14WPZO.2-343-15	14WPZO.4-343-15
355	14WPZO.2-355-15	14WPZO.4-355-15
400	14WPZO.2-400-15	14WPZO.4-400-15
473	14WPZO.2-473-15	14WPZO.4-473-15
515	14WPZO.2-515-15	14WPZO.4-515-15
532	14WPZO.2-532-15	14WPZO.4-532-15
589	14WPZO.2-589-15	14WPZO.4-589-15
633	14WPZO.2-633-15	14WPZO.4-633-15
780	14WPZO.2-780-15	14WPZO.4-780-15
800	14WPZO.2-800-15	14WPZO.4-800-15
852	14WPZO.2-852-15	14WPZO.4-852-15
940	14WPZO.2-940-15	14WPZO.4-940-15
980	14WPZO.2-980-15	14WPZO.4-980-15
1030	14WPZO.2-1030-15	14WPZO.4-1030-15
1064	14WPZO.2-1064-15	14WPZO.4-1064-15
1122	14WPZO.2-1122-15	14WPZO.4-1122-15
1319	14WPZO.2-1319-15	14WPZO.4-1319-15
1550	14WPZO.2-1550-15	14WPZO.4-1550-15

ZO CRYSTALLINE QUARTZ WAVEPLATES

Air-spaced, clear aperture **20 mm**
Mounted in 25.4 mm metal mount

Wavelength, nm	Ordering Code	
	λ/2 Retardation	λ/4 Retardation
266	14WPZO.2-266-20	14WPZO.4-266-20
343	14WPZO.2-343-20	14WPZO.4-343-20
355	14WPZO.2-355-20	14WPZO.4-355-20
400	14WPZO.2-400-20	14WPZO.4-400-20
473	14WPZO.2-473-20	14WPZO.4-473-20
515	14WPZO.2-515-20	14WPZO.4-515-20
532	14WPZO.2-532-20	14WPZO.4-532-20
589	14WPZO.2-589-20	14WPZO.4-589-20
633	14WPZO.2-633-20	14WPZO.4-633-20
780	14WPZO.2-780-20	14WPZO.4-780-20
800	14WPZO.2-800-20	14WPZO.4-800-20
852	14WPZO.2-852-20	14WPZO.4-852-20
940	14WPZO.2-940-20	14WPZO.4-940-20
980	14WPZO.2-980-20	14WPZO.4-980-20
1030	14WPZO.2-1030-20	14WPZO.4-1030-20
1064	14WPZO.2-1064-20	14WPZO.4-1064-20
1122	14WPZO.2-1122-20	14WPZO.4-1122-20
1319	14WPZO.2-1319-20	14WPZO.4-1319-20
1550	14WPZO.2-1550-20	14WPZO.4-1550-20

LO CRYSTALLINE QUARTZ WAVEPLATES

Clear aperture **>18 mm**.
Mounted in 25.4 mm metal mount

Wavelength, nm	Ordering Code	
	λ/2 Retardation	λ/4 Retardation
266	14WPLO.2-266-18	14WPLO.4-266-18
343	14WPLO.2-343-18	14WPLO.4-343-18
355	14WPLO.2-355-18	14WPLO.4-355-18
400	14WPLO.2-400-18	14WPLO.4-400-18
473	14WPLO.2-473-18	14WPLO.4-473-18
515	14WPLO.2-515-18	14WPLO.4-515-18
532	14WPLO.2-532-18	14WPLO.4-532-18
589	14WPLO.2-589-18	14WPLO.4-589-18
633	14WPLO.2-633-18	14WPLO.4-633-18
780	14WPLO.2-780-18	14WPLO.4-780-18
800	14WPLO.2-800-18	14WPLO.4-800-18
852	14WPLO.2-852-18	14WPLO.4-852-18
940	14WPLO.2-940-18	14WPLO.4-940-18
980	14WPLO.2-980-18	14WPLO.4-980-18
1030	14WPLO.2-1030-18	14WPLO.4-1030-18
1064	14WPLO.2-1064-18	14WPLO.4-1064-18
1122	14WPLO.2-1122-18	14WPLO.4-1122-18
1319	14WPLO.2-1319-18	14WPLO.4-1319-18
1550	14WPLO.2-1550-18	14WPLO.4-1550-18

RELATED PRODUCTS

- **7R150-1** – Rotation Stage

- **10APF3-1** – Variable Attenuator/ Beamsplitter

CODE EXAMPLE FOR ORDERING

14WPZO.2-800-18

- Waveplate type: ZO – Zero order, LO – Low order
- Retardation: 2 – λ/2, 4 – λ/4
- Wavelength, nm
- Clear aperture

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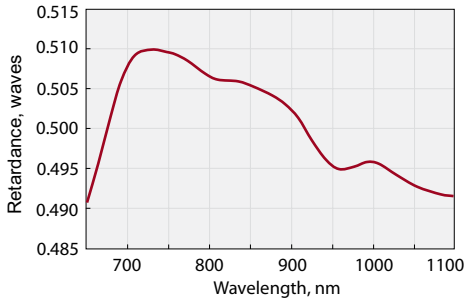
14WPA Achromatic (Broadband) Waveplates

Achromatic waveplate (AWP) is a pair of crystal quartz and magnesium fluoride plates.
Because of difference in dispersion in these uniaxial positive crystals it is possible to calculate thickness of each plate so that birefringent phase shift in assembly changes very slowly over certain wavelength range. This is a way to obtain achromatic zero order waveplates. Such AWPs are necessary for various devices and may replace a number of ordinary quartz waveplates operating at single wavelength only. We can offer series of achromatic waveplates with phase shifts shown in graphs below.

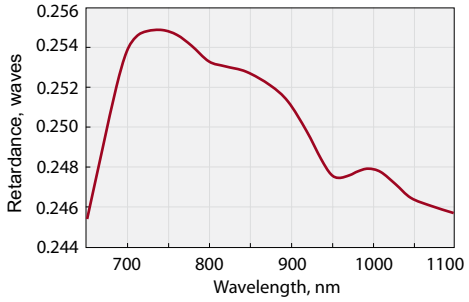
FEATURES

- Operates over Broad Bandwidth wavelength range
- We specialize in Air-spaced Achromatic Waveplates
- All waveplates are BBAR coated and mounted by default
- Custom design waveplates are available in small and mass production quantities

TYPICAL RETARDATION CURVES FOR 650–1100 nm ACHROMATIC WAVEPLATES



Retardation for **14WPA.2-700-1000-10**

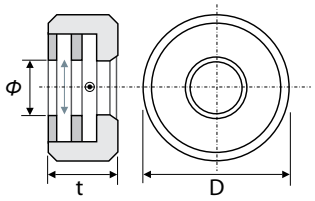


Retardation for **14WPA.4-700-1000-10**

STANDARD SPECIFICATIONS

Material	Quartz + MgF_2
Dimension Tolerance	+0.0, -0.2 mm
Retardation Tolerance	λ/100
Clear Aperture	>90% central area
Wavefront Distortion	λ/4 @ 632.8 nm
Surface Quality	40-20 scratch & dig
Parallelism Error	<30 arcsec
Laser Damage Threshold	5 J/cm² 10 ns pulsed @ 1064 nm typical
AR Coatings	BBAR coated by default
Mounting	Mounted in 25.4 mm black anodized metal mount

DRAWING OF ACHROMATIC WAVEPLATES



ACHROMATIC WAVEPLATES

Wavelength, nm	Ordering Code	
	λ/2 Retardation	λ/4 Retardation
Clear Aperture 10 mm		
450-680	**14WPA.2-450-680-10**	**14WPA.4-450-680-10**
700-1000	**14WPA.2-700-1000-10**	**14WPA.4-700-1000-10**
950-1300	**14WPA.2-950-1300-10**	**14WPA.4-950-1300-10**
1200-1650	**14WPA.2-1200-1650-10**	**14WPA.4-1200-1650-10**
Clear Aperture 12.7 mm		
450-680	**14WPA.2-450-680-12.7**	**14WPA.4-450-680-12.7**
700-1000	**14WPA.2-700-1000-12.7**	**14WPA.4-700-1000-12.7**
950-1300	**14WPA.2-950-1300-12.7**	**14WPA.4-950-1300-12.7**
1200-1650	**14WPA.2-1200-1650-12.7**	**14WPA.4-1200-1650-12.7**
Clear Aperture 15 mm		
450-680	**14WPA.2-450-680-15**	**14WPA.4-450-680-15**
700-1000	**14WPA.2-700-1000-15**	**14WPA.4-700-1000-15**
950-1300	**14WPA.2-950-1300-15**	**14WPA.4-950-1300-15**
1200-1650	**14WPA.2-1200-1650-15**	**14WPA.4-1200-1650-15**

CODE EXAMPLE FOR ORDERING

14WPA.2-450-680-15

Retardation	Wavelength range, nm	Clear aperture
2 – λ/2 4 – λ/4		

RELATED PRODUCTS AND ACCESSORIES

- **5PH50** – Polarizer Holder

- **5APH59T-1** – Adjustable Polarizer Mount

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14WPIR Mid-IR Waveplates

FEATURES

- ZO waveplates for mid-IR applications (2 800 – 9 000 nm)
- Custom size available

Zero order half waveplates and quarter waveplates from cadmium thiogallate ($CdGa_2S_4$) with clear aperture from 10 mm up to 18 mm for the range 2.8 – 9.0 microns are now available.
Dielectric AR coatings for the mid-IR range are also available in order to enhance the performance of the waveplates. Characteristic plates thickness is 0.5 – 0.9 mm. Generally, the waveplates are mounted into the metal holder for easier handling and adjustment.

CODE EXAMPLE FOR ORDERING

14WPIR.2-3000-10

- Retardation: 2 – λ/2; 4 – λ/4
- Wavelength, nm
- Clear aperture

STANDARD SPECIFICATIONS

Material	Cadmium thiogallate ($CdGa_2S_4$)
Characteristic Thickness	0.5 - 0.9 mm
Clear Aperture	10 mm
Surface Flatness	<λ/8
Wedge Angle Between Faces	1.5-2.0 arcmin
Transparency Range	0.47 - 9.5 microns
Birefringence (n_o-n_e)	~0.005 at IR
Refractive Index	n_o ~2.3
Thermal Conductivity	~3 W/(m×K)
Damage Threshold	~0.6 - 0.8 J/cm² at 20 ns pulses
Diameter of the Metal Holder	25.4 mm
AR Coatings	AR coated by default

ZO mid-IR WAVEPLATES (clear aperture >10 mm)

Wavelength, nm	Ordering Code	
	λ/2 Retardation	λ/4 Retardation
2940	**14WPIR.2-2940-10**	**14WPIR.4-2940-10**
3000	**14WPIR.2-3000-10**	**14WPIR.4-3000-10**
3500	**14WPIR.2-3500-10**	**14WPIR.4-3500-10**
4000	**14WPIR.2-4000-10**	**14WPIR.4-4000-10**
4500	**14WPIR.2-4500-10**	**14WPIR.4-4500-10**
5000	**14WPIR.2-5000-10**	**14WPIR.4-5000-10**
5500	**14WPIR.2-5500-10**	**14WPIR.4-5500-10**
6000	**14WPIR.2-6000-10**	**14WPIR.4-6000-10**
6500	**14WPIR.2-6500-10**	**14WPIR.4-6500-10**
7000	**14WPIR.2-7000-10**	**14WPIR.4-7000-10**
7500	**14WPIR.2-7500-10**	**14WPIR.4-7500-10**
8000	**14WPIR.2-8000-10**	**14WPIR.4-8000-10**
9000	**14WPIR.2-9000-10**	**14WPIR.4-9000-10**

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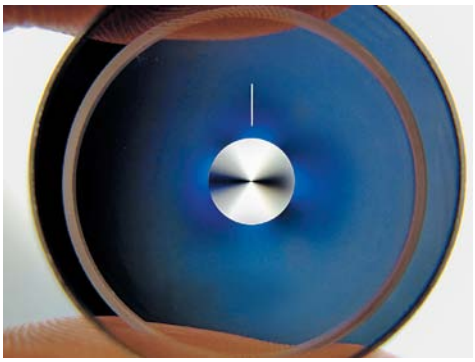
14WPS S-waveplate (Radial Polarization Converter)

S-waveplate is a super-structured waveplate which converts linear polarization to radial or azimuthal polarization. Radial polarization enables focusing laser beam into a smaller spot size. Radial and azimuth polarizations allow achieving the same machining properties in all directions. It is also applicable in optical tweezers and microscopy.
Primary applications for such radial polarizers are in laser machining, microscopy and optical tweezers as well as Raman spectroscopy systems. Unique features of this converter are that it is made in the volume of monolithic fused silica (UVFS) window, therefore resistant against high power laser radiation; AR coatings might be applied; and a single element is used both for polarization conversion to radial/azimuthal and generation of optical vortices.



FEATURES

- Converts linear polarization to radial or azimuth
- Can be used to create an optical vortex
- High damage threshold
- Nearly 100% efficiency in polarization conversion for dedicated wavelengths
- 50-90% transmission (AR coatings applicable)
- No glued components – more resistant to heat

S-WAVEPLATE (RADIAL POLARIZATION CONVERTED)

Wavelength, nm	Transmission (uncoated)	Ordering code
Clear Aperture = 2 mm		
488 ± 15	>40%	**14WPS-40-488-2**
515 ± 20	>45%	**14WPS-45-515-2**
632 ± 20	>50%	**14WPS-50-632-2**
800 ± 25	>55%	**14WPS-55-800-2**
1030 ± 35	>65%	**14WPS-65-1030-2**
1550 ± 40	>75%	**14WPS-75-1550-2**
Clear Aperture = 4 mm		
488 ± 15	>40%	**14WPS-40-488-4**
515 ± 20	>45%	**14WPS-45-515-4**
632 ± 20	>50%	**14WPS-50-632-4**
800 ± 25	>55%	**14WPS-55-800-4**
1030 ± 35	>65%	**14WPS-65-1030-4**
1550 ± 40	>75%	**14WPS-75-1550-4**
Clear Aperture = 6 mm		
488 ± 15	>40%	**14WPS-40-488-6**
515 ± 20	>45%	**14WPS-45-515-6**
632 ± 20	>50%	**14WPS-50-632-6**
800 ± 25	>55%	**14WPS-55-800-6**
1030 ± 35	>65%	**14WPS-65-1030-6**
1550 ± 40	>75%	**14WPS-75-1550-6**
Clear Aperture = 8 mm		
488 ± 15	>40%	**14WPS-40-488-8**
515 ± 20	>45%	**14WPS-45-515-8**
632 ± 20	>50%	**14WPS-50-632-8**
800 ± 25	>55%	**14WPS-55-800-8**
1030 ± 35	>65%	**14WPS-65-1030-8**
1550 ± 40	>75%	**14WPS-75-1550-8**
Clear Aperture = 10mm		
488 ± 15	>40%	**14WPS-40-488-10**
515 ± 20	>45%	**14WPS-45-515-10**
632 ± 20	>50%	**14WPS-50-632-10**
800 ± 25	>55%	**14WPS-55-800-10**
1030 ± 35	>65%	**14WPS-65-1030-10**
1550 ± 40	>75%	**14WPS-75-1550-10**

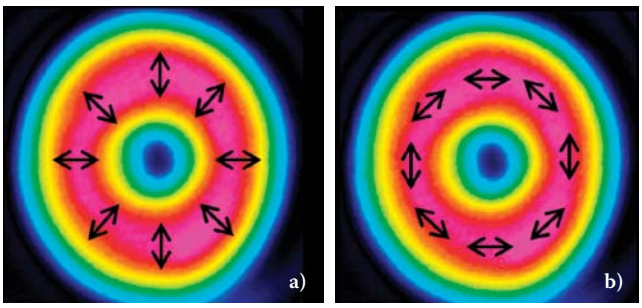
BENEFITS FOR LASER MICRO-MACHINING

- Helps achieving smaller spot size
- Ensures the same machining properties in all directions*
- Complex trajectories are made featuring the same track width**
- Ensures the same cutting speed in all directions
- Increases cutting speed

* *When processing materials with linearly polarized light, features are bigger in width, when machining is performed in the direction perpendicular to polarization of the beam and vice versa.*
** *This is useful for example in fabrication of microfluidics, whereas later chemical etching retains the same characteristics through all the channel.*

BENEFITS FOR USE IN OPTICAL TWEEZERS

- Increases trapping force
- Might trap particles with lower refractive index comparing to surroundings



Radial polarization beam λ= 1030 nm intensity distribution with electromagnetic field direction shown a) radial, b) azimuth

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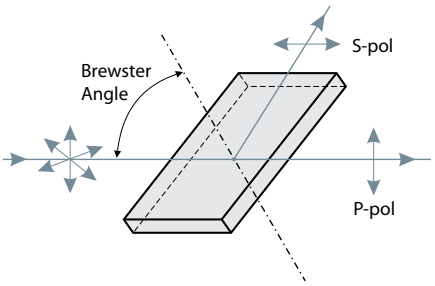
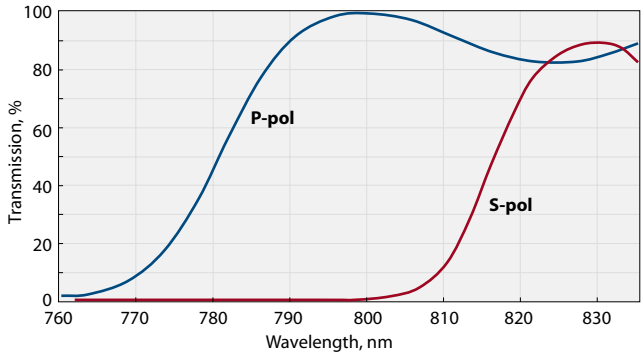
14PBT Brewster Thin Film Polarizers

FEATURES

- Efficiently separates the s- and p- polarization components
- Optimised for popular laser wavelengths
- Brewster Thin Film polarizers with dimensions up to 200×150 mm are available
- Standard Brewster Thin Film Polarizers available from stock

Brewster Thin Film polarizers are used for high energy applications. They have high damage threshold reaching 10 J/cm² @ 1064 nm 8 ns. Brewster polarizers are used as an alternative to Glan-Taylor laser polarizing prisms or cube polarizing beamsplitters. Typically, BK7 or UVFS dielectric coated Brewster Thin film polarizers separate the s- and p-polarization components of high energy laser beams and are intended for intra and extra cavity usage. Typical polarization ratio T_p/T_s is 200:1 and it is achieved at 56° AOI (Brewster angle). For optimal transmission Brewster Thin Film Polarizer should be mounted in an appropriate holder for angular adjustment.





STANDARD SPECIFICATIONS

Material	BK7, UVFS
Diameter Tolerance	+0.0, -0.12 mm
Thickness Tolerance	±0.2 mm
Clear Aperture	>90%
Surface Quality	20-10 scratch & dig
Surface Flatness	λ/10 @ 632.8 nm
Parallelism	<30 arcsec
Extinction Ratio T_p/T_s	>200:1
Typical Transmission	T_p>95%
Typical Reflection	R_s>99.5%
Laser Damage Threshold	5 J/cm² 10 ns pulses @ 1064 nm typical

CODE EXAMPLE FOR ORDERING

14PBT-1-266-1

Size
1 – Ø25.4×3 mm
2 – Ø50.8×6 mm
3 – Ø50.8×8 mm
4 – 20×40×5 mm

Material
1 – BK7
2 – UVFS

Wavelength, nm

BREWSTER THIN FILM POLARIZERS

Wavelength, nm	Substrate Material	Dimensions, mm	Ordering Code
266	UVFS	Ø25.4×3	**14PBT-1-266-2**
		Ø50.8×6	**14PBT-2-266-2**
		20×40×5	**14PBT-4-266-2**
343	UVFS	Ø25.4×3	**14PBT-1-343-2**
		Ø50.8×6	**14PBT-2-343-2**
		20×40×5	**14PBT-4-343-2**
355	UVFS	Ø25.4×3	**14PBT-1-355-2**
		Ø50.8×6	**14PBT-2-355-2**
		20×40×5	**14PBT-4-355-2**
400	UVFS	Ø25.4×3	**14PBT-1-400-2**
		Ø50.8×6	**14PBT-2-400-2**
		20×40×5	**14PBT-4-400-2**
515	UVFS	Ø25.4×3	**14PBT-1-515-2**
		Ø50.8×6	**14PBT-2-515-2**
		20×40×5	**14PBT-4-515-2**
532	BK7	Ø25.4×3	**14PBT-1-532-1**
		Ø50.8×8	**14PBT-3-532-1**
		20×40×5	**14PBT-4-532-1**
780	UVFS	Ø25.4×3	**14PBT-1-780-2**
		Ø50.8×6	**14PBT-2-780-2**
		20×40×5	**14PBT-4-780-2**
780-820 (centered @ 800 nm)	UVFS	Ø25.4×3	**14PBT-1-780/820-2**
		Ø50.8×6	**14PBT-2-780/820-2**
		20×40×5	**14PBT-4-780/820-2**
795-805 (centered @ 800 nm)	UVFS	Ø25.4×3	**14PBT-1-795/805-2**
		Ø50.8×6	**14PBT-2-795/805-2**
		20×40×5	**14PBT-4-795/805-2**
940	BK7	Ø25.4×3	**14PBT-1-940-1**
		Ø50.8×8	**14PBT-3-940-1**
		20×40×5	**14PBT-4-940-1**
980	BK7	Ø25.4×3	**14PBT-1-980-1**
		Ø50.8×8	**14PBT-3-980-1**
		20×40×5	**14PBT-4-980-1**
1020-1040 (centered @ 1030 nm)	UVFS	Ø25.4×3	**14PBT-1-1020/1040-2**
		Ø50.8×6	**14PBT-2-1020/1040-2**
		20×40×5	**14PBT-4-1020/1040-2**
1064	BK7	Ø25.4×3	**14PBT-1-1064-1**
		Ø50.8×8	**14PBT-3-1064-1**
		20×40×5	**14PBT-4-1064-1**
1550	BK7	Ø25.4×3	**14PBT-1-1550-1**
		Ø50.8×8	**14PBT-3-1550-1**
		20×40×5	**14PBT-4-1550-1**

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14PUF Broadband (Ultrafast) Thin Film Polarizers

Broadband (Ultrafast) Thin Film Polarizers are used for femtosecond lasers.

PLEASE NOTE: The optimal working angle is AOI=72° (±2°).

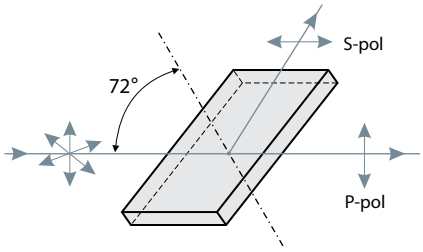
We are offering 4 types of Broadband (Ultrafast) Thin film polarizers. Polarizers work by transmitting p polarization and reflecting s polarization.

TRANSMISSION POLARIZERS – have polarizing coatings on both sides of polarizer. They can be optimized for highest transmission of p polarization T_p > 94% or best contrast of polarizations T_p:T_s>20:1.

REFLECTION POLARIZERS – have polarizing coating on the input face while the output face is AR coated for both s and p polarizations. They can be optimized for highest reflection of s polarization R_s > 98% or best contrast of polarizations R_s:R_p>60:1. Moreover AR coated side of polarizer can have wedge to minimize ghosting. Standard thin film polarizers are designed for optimum performance in the 750-850 nm or 980-1090 nm. Design of custom wavelength range is also available.

FEATURES

- Ideal for Femtosecond laser applications due to the low GVD
- Works over Broad wavelength range
- Separates the s- and p- polarization components
- Standard Thin Film Polarizers are available from stock



STANDARD SPECIFICATIONS

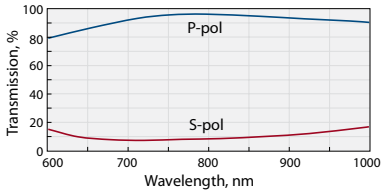
Substrate Material	UVFS
Diameter tolerance	+0.0, -0.12 mm
Thickness tolerance	±0.2 mm
Clear aperture	>90%
Surface quality	20-10 scratch & dig
Surface flatness	λ/6 @ 632.8 nm
Angle of incidence	72°
Parallelism	<30 arcsec
Laser damage threshold	5 J/cm² 10 ns pulses @ 1064 nm typical

TRANSMISSION OPTIMIZED Broadband (Ultrafast) Thin Film Polarizers

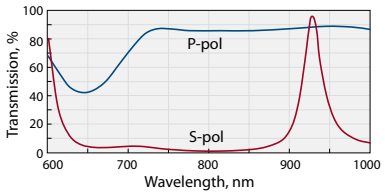
Wavelength, nm	Extinction ratio T_p/T_s	Transmission, %	Dimensions, mm	Ordering Code
750-850 (centered @ 800 nm) Contrast optimized	>20:1	T_p > 85% T_s < 4%	Ø25.4×3	**14PUF-800-1-T2**
			20×60×2	**14PUF-800-2-T2**
			50×160×3	**14PUF-800-3-T2**
750-850 (centered @ 800 nm) T_p optimized	>9:1	T_p > 94% T_s < 10%	Ø25.4×3	**14PUF-800-1-T1**
			20×60×2	**14PUF-800-2-T1**
			50×160×3	**14PUF-800-3-T1**
980-1090 (centered @ 1030 nm) Contrast optimized	>20:1	T_p > 85% T_s < 4%	Ø25.4×3	**14PUF-1030-1-T2**
			20×60×2	**14PUF-1030-2-T2**
			50×160×3	**14PUF-1030-3-T2**
980-1090 (centered @ 1030 nm) T_p optimized	>9:1	T_p > 94% T_s < 10%	Ø25.4×3	**14PUF-1030-1-T1**
			20×60×2	**14PUF-1030-2-T1**
			50×160×3	**14PUF-1030-3-T1**

REFLECTION OPTIMIZED Broadband (Ultrafast) Thin Film Polarizers

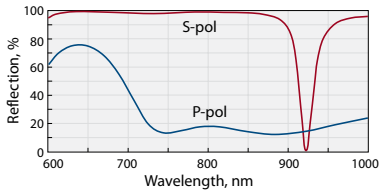
Wavelength, nm	Extinction ratio R_s/R_p	Reflection, %	Dimensions, mm	Ordering Code
750-850 (centered @ 800 nm) R_s optimized	>5:1	R_s > 98% R_p < 20%	Ø25.4×3	**14PUF-800-1-R1**
			20×60×5	**14PUF-800-2-R1**
			50×160×8	**14PUF-800-3-R1**
750-850 (centered @ 800 nm) Contrast optimized	>60:1	R_s > 85% R_p < 1%	Ø25.4×3	**14PUF-800-1-R2**
			20×60×5	**14PUF-800-2-R2**
			50×160×8	**14PUF-800-3-R2**
980-1090 (centered @ 1030 nm) R_s optimized	>5:1	R_s > 98% R_p < 20%	Ø25.4×3	**14PUF-1030-1-R1**
			20×60×5	**14PUF-1030-2-R1**
			50×160×8	**14PUF-1030-3-R1**
980-1090 (centered @ 1030 nm) Contrast optimized	>60:1	R_s > 85% R_p < 1%	Ø25.4×3	**14PUF-1030-1-R2**
			20×60×5	**14PUF-1030-2-R2**
			50×160×8	**14PUF-1030-3-R2**



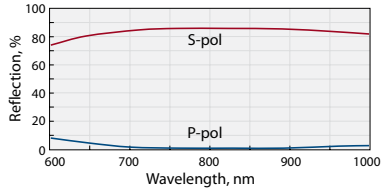
Optimization T1 @ 800 nm



Optimization T2 @ 800 nm



Optimization R1 @ 800 nm



Optimization R2 @ 800 nm

CODE EXAMPLE FOR ORDERING

14PUF-800-1-T2

Wavelength
800 – 750-850 nm (centered at 800 nm)
1030 – 980-1090 nm (centered at 1030 nm)

Size
1 – Ø25.4×3 mm
2 – 20×60×2 (5) mm
3 – 50×160×3 (8) mm

Optimization Type
T1 – Transmission and T_p optimized
T2 – Transmission and contrast optimized
R1 – Reflection and R_s optimized
R2 – Reflection and contrast optimized

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14PBC Polarizing Beamsplitter Cubes

Polarizing cubes for specified wavelength (250-2200 nm) AR coated on four input and output working surfaces. Polarizing Beamsplitter Cube split randomly polarized beams into two orthogonal, linearly polarized components: S polarized light is reflected at a 90° angle while P-polarized light is transmitted.

Polarizing Cubes for Medium Power Applications

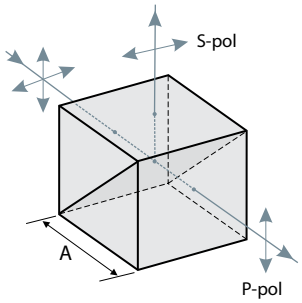
Each beamsplitter consists of a pair of high precision tolerance right angle prisms cemented together with a dielectric coating on hypotenuse of one of the prisms. Typical damage threshold of these cubes is >0.3 J/cm² @ 1064 nm 10 ns at 20 Hz.

Polarizing Cubes for High Power Applications

Optically contacted polarizing beamsplitter cubes used for high power applications can withstand energy fluencies up to 10 J/cm² @ 1064 nm 10 ns at 20 Hz.

FEATURES

- Optimised for popular laser wavelengths
- Dual wavelength Polarizing cubes are also available
- All Cubes are AR coated
- Standard Polarizing cubes are available from stock
- High Extinction ration (> 3000:1) cubes available upon request



STANDARD SPECIFICATIONS

Dimension Tolerance	±0.2mm
Flatness	λ/4 @ 632.8 nm per 25 mm
Surface Quality	60/40 scratches and dig
Extinction Ratio	>100:1
Beam Deviation	<3 arc minutes
Principal Transmittance	T_p>95% and T_s<1% (T_{pavg}>95% between 450-680 nm)
Principal Reflectance	R_s>99% and R_p<5%
Coatings	Polarization splitting coating on hypotenuse face, AR-coatings (R<0.25%) on all input and output face
Laser Damage Threshold (10 ns pulses)	>0.3 J/cm² for cemented cubes >10 J/cm² for optically contacted cubes

MEDIUM POWER CUBES

Wavelength, nm	Side Dimensions, mm	Ordering Code
355	12.7	**14PBC-355-12.7**
	15	**14PBC-355-15**
	20	**14PBC-355-20**
	25.4	**14PBC-355-25.4**
400	12.7	**14PBC-400-12.7**
	15	**14PBC-400-15**
	20	**14PBC-400-20**
	25.4	**14PBC-400-25.4**
488	12.7	**14PBC-488-12.7**
	15	**14PBC-488-15**
	20	**14PBC-488-20**
	25.4	**14PBC-488-25.4**
450-680	12.7	**14PBC-450-680-12.7**
	15	**14PBC-450-680-15**
	20	**14PBC-450-680-20**
	25.4	**14PBC-450-680-25.4**
532	12.7	**14PBC-532-12.7**
	15	**14PBC-532-15**
	20	**14PBC-532-20**
	25.4	**14PBC-532-25.4**
633	12.7	**14PBC-633-12.7**
	15	**14PBC-633-15**
	20	**14PBC-633-20**
	25.4	**14PBC-633-25.4**

MEDIUM POWER CUBES *(continued)*

Wavelength, nm	Side Dimensions, mm	Ordering Code
650-850	12.7	**14PBC-650-850-12.7**
	15	**14PBC-650-850-15**
	20	**14PBC-650-850-20**
	25.4	**14PBC-650-850-25.4**
850	12.7	**14PBC-850-12.7**
	15	**14PBC-850-15**
	20	**14PBC-850-20**
	25.4	**14PBC-850-25.4**
980	12.7	**14PBC-980-12.7**
	15	**14PBC-980-15**
	20	**14PBC-980-20**
	25.4	**14PBC-980-25.4**
900-1200	12.7	**14PBC-900-1200-12.7**
	15	**14PBC-900-1200-15**
	20	**14PBC-900-1200-20**
	25.4	**14PBC-900-1200-25.4**
1064	12.7	**14PBC-1064-12.7**
	15	**14PBC-1064-15**
	20	**14PBC-1064-20**
	25.4	**14PBC-1064-25.4**
1310	12.7	**14PBC-1310-12.7**
	15	**14PBC-1310-15**
	20	**14PBC-1310-20**
	25.4	**14PBC-1310-25.4**

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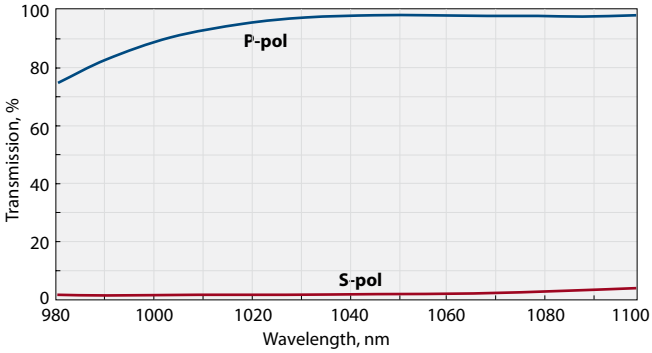
MEDIUM POWER CUBES *(continued)*

Wavelength, nm	Side Dimensions, mm	Ordering Code
1550	12.7	**14PBC-1550-12.7**
	15	**14PBC-1550-15**
	20	**14PBC-1550-20**
	25.4	**14PBC-1550-25.4**
1250-1570	12.7	**14PBC-1250-1570-12.7**
	15	**14PBC-1250-1570-15**
	20	**14PBC-1250-1570-20**
	25.4	**14PBC-1250-1570-25.4**
1500-1610	12.7	**14PBC-1500-1610-12.7**
	15	**14PBC-1500-1610-15**
	20	**14PBC-1500-1610-20**
	25.4	**14PBC-1500-1610-25.4**



HIGH POWER CUBES

Wavelength, nm	Side Dimensions, nm	Ordering Code
345-365 (centered at 355 nm)	12.7	**14PBCH-355-12.7**
510-550 (centered at 532 nm)	12.7	**14PBCH-532-12.7**
1020-1090 (centered at 1064 nm)	12.7	**14PBCH-1064-12.7**
1510-1580 (centered at 1550 nm)	12.7	**14PBCH-1550-12.7**

RELATED PRODUCTS

- **5MO111** – Mirror/Optics Mount

CODE EXAMPLE FOR ORDERING

14PBC-800-10

Cube Type
PBC – for medium power applications
PBCH – for high power applications

Wavelength, nm

Cube side dimensions, mm

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14FR Fresnel Rhomb Retarders (Achromatic)

14FR with a protective cap

Standa manufactures Fresnel Rhombs and mounts for them. 14FR is a combination of a rhomb with a mount (see drawings). Fresnel Rhombs are made of BK7 crown glass or UV grade fused silica. A Single Fresnel Rhomb produces a phase shift of 90° (λ/4) due to total internal reflections at two surfaces. A Double Fresnel Rhomb produces a phase shift of 180° (λ/2) between the components of light polarized perpendicular and parallel to the plane of incidence. It consists of two optically contacted (or air spaced) single Fresnel λ/4 Rhombs. The retardation varies only slightly over a relatively wide range of wavelengths. Fresnel Rhombs mounts are cylindrical in shape. The end faces of a Fresnel retarder are adjusted orthogonally to the axis of rotation. The clear aperture of the mount is 10 mm.

There are several ways to mount the 14FR Fresnel rhomb retarder:

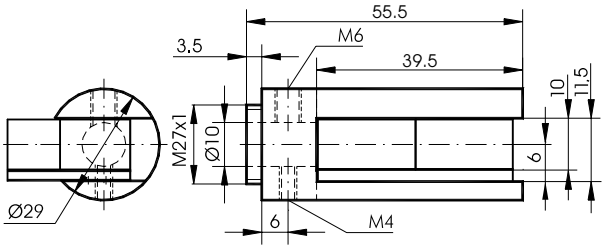
– on any adjustable unit (e.g. a stage) by the M6 and M4 tapped holes;
– to our Polarizer Holder as 5PH50, 5PH51 or other compatible unit using the M27×1 thread.

STANDARD SPECIFICATIONS

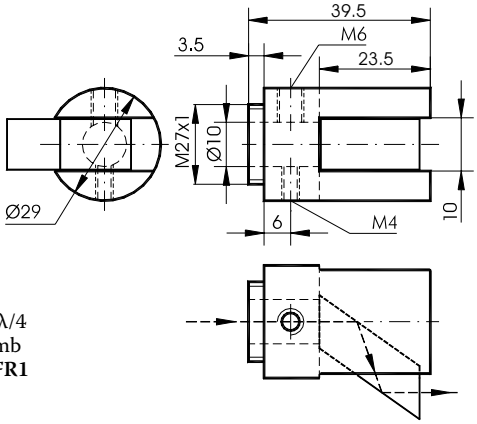
Material	BK7 or UVFS
Beam deviation	≤ 10arcsec
Coating	AR coating
Available wavelength ranges:	
UV	260–400 nm
VIS	400–700 nm
NIR1	700–1300 nm
NIR2	1300–1600 nm

FRESNEL RHOMB RETARDERS

Ordering Code	Retardation	Wavelength range, nm
14FR1-UV-M27	single (λ/4)	260–400
14FR2-UV-M27	double (λ/2)	260–400
14FR1-VIS-M27	single (λ/4)	400–700
14FR2-VIS-M27	double (λ/2)	400–700
14FR1-NIR1-M27	single (λ/4)	700–1300
14FR2-NIR1-M27	double (λ/2)	700–1300
14FR1-NIR2-M27	single (λ/4)	1300–1600
14FR2-NIR2-M27	double (λ/2)	1300–1600



Achromatic λ/2 Fresnel Rhomb Retarder **14FR2**



Achromatic λ/4 Fresnel Rhomb Retarder **14FR1**

CODE EXAMPLE FOR ORDERING

14FR1-UV-M27

Retardation
1 – single (λ/4)
2 – double (λ/2)

Mounting thread

Wavelength range
UV – 260–400 nm
VIS – 400–700 nm
NIR1 – 700–1300 nm
NIR2 – 1300–1600 nm

RELATED PRODUCTS AND ACCESSORIES

- **5PH50** – Polarizer Holder

- **5APH59T-1** – Adjustable Polarizer Mount

- **7R129** – Polarizer Holder

- **10BC68-1** – Beam Splitter Cube

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14GLS High Power Glan Polarizing Prisms

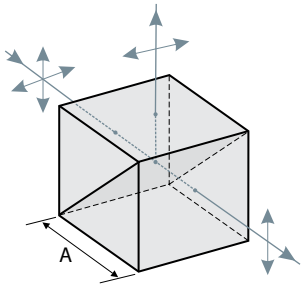
High Power Glan Polarizing Prisms produces linear polarized light from unpolarized input and is made of a higher grade calcite. The prism has two escape windows to allow the rejected beams to escape. Its entrance and exit faces are polished using deep grinding and polishing technique to minimize scatter from surface.

STANDARD SPECIFICATIONS

Material Grade	Calcite Grade "Unique"
Wavelength Range	220–2300 nm. Transmittance in UV–VIS range depends on material quality
Size	10×10, 12×12, 14×14, 16×16, 19×19 mm
Beam Deviation	< 1 arcmin
Full Angle Field	8° (asymmetrical)
Extinction Ratio	0.5×10^{-5}
Surface Quality	Entrance and exit faces: 40–20 scratch and dig
Escape Windows	80–50 scratch and dig
Surface Flatness	Entrance and exit faces: λ/4 @ 633 nm
Escape Windows	λ @ 633 nm
Max. Power Handling	200 MW/cm², pulsed
Housing	Black anodized aluminium with two exit ports for the rejected beams

FEATURES

- Broadband high power polarizers for visible or near IR wavelengths
- Air-spaced
- Close to Brewster's Angle Cutting
- High Polarization Purity
- Short Length
- Double escape windows for intracavity use
- Prisms from **α-BBO** or **YVO_4** are available upon request



CODE EXAMPLE FOR ORDERING

14GLS-10-UV-HP

Side size, mm | High power

CALCITE HIGH POWER GLAN POLARIZING PRISMS

Calcite Grade	Side size A, mm	Ordering Code
Unique	10	**14GLS-10-UV-HP**
	12	**14GLS-12-UV-HP**
	14	**14GLS-14-UV-HP**
	16	**14GLS-16-UV-HP**
	19	**14GLS-19-UV-HP**

14GP Glan Taylor Polarizing Prisms

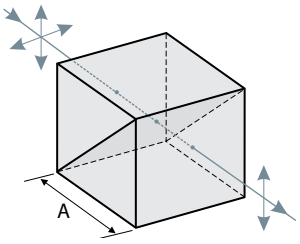
The device produces linear polarized light from unpolarized input. Glan Taylor prism consists of two prisms separated by air gap. Transmitted extraordinary beam is used. Rejected ordinary beam is absorbed by black glass plates cemented to prisms.

STANDARD SPECIFICATIONS

Material Grade	Calcite grade "First"
Wavelength Range	UV quality : 220–2300 nm
	VIS quality : 350–2300 nm
	IR quality : 600–2300 nm
Size	10×10, 12×12, 14×14, 16×16, 19×19 mm
Beam Deviation	< 1 arcmin
Length to Aperture Ratio	0.85
Full Angle Field	8° (asymmetrical)
Extinction Ratio	1.0×10^{-5}
Surface Quality	60–40 scratch and dig
Surface Flatness	λ/4 @ 633 nm
Max. Power Handling	2 W/cm², CW
Housing	Black anodized Aluminium Housing

FEATURES

- Air-spaced, medium power polarizers for visible or near IR wavelengths
- Rejected beam absorbed internally
- $<10^{-5}$ extinction ratio
- Close to Brewster's Angle Cutting
- High Polarization Purity
- Short Length
- Prisms from **α-BBO** or **YVO_4** are available upon request
- Prisms with size greater than **19 mm** are available on special request



GLAN TAYLOR POLARIZING PRISMS

Wavelength range, nm	Side size A, mm	Ordering Code
220–2300	10	**14GP-10-UV**
	12	**14GP-12-UV**
	14	**14GP-14-UV**
	16	**14GP-16-UV**
	19	**14GP-19-UV**
350–2300	10	**14GP-10-VIS**
	12	**14GP-12-VIS**
	14	**14GP-14-VIS**
	16	**14GP-16-VIS**
	19	**14GP-19-VIS**
600–2300	10	**14GP-10-IR**
	12	**14GP-12-IR**
	14	**14GP-14-IR**
	16	**14GP-16-IR**
	19	**14GP-19-IR**

CODE EXAMPLE FOR ORDERING

14GP-10-VIS

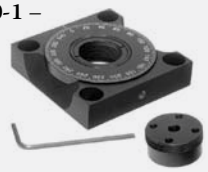
Side size, mm

Wavelength range
UV – 220-2300 nm
VIS – 350-2300 nm
IR – 600-2300 nm

RELATED PRODUCTS

- **8MRU-1** – Universal Motorized Rotation Stage

- **5PHH50-1** – Polarizer Holder

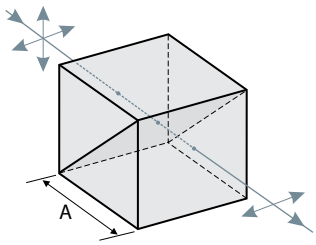


14GT Glan Thompson Polarizing Prisms

FEATURES

- Broadband low power polarizers for UV, visible or near IR wavelengths
- Large Acceptance Angle
- High Polarization Purity
- Prisms from **α-BBO** or **YVO_4** are available upon request
- Prisms with size greater than **10 mm** are available on special request

Glan Thompson prism is birefringent polarization element which consists of two calcite prisms cemented together.
Because of cement it has higher transmission than Glan Taylor type due to reduced reflection losses at the hypotenuse interface but limited useful UV spectral range. Transmitted extraordinary beam is used. Side faces are black painted to absorb rejected ordinary beam.



STANDARD SPECIFICATIONS

Material Grade	VIS quality grade calcite
Wavelength Range	350–2300 nm
Size	10×10 mm
Beam Deviation	< 1 arcmin
Length to Aperture Ratio	2.5
Full Angle Field	14° – 16° (asymmetrical)
Extinction Ratio	1.0×10^{-5}
Surface Quality	60–40 scratch and dig
Surface Flatness	λ/4 @ 633 nm
Max. Power Handling	1 W/cm², CW
Housing	Black anodized aluminium housing

GLAN THOMPSON POLARIZING PRISM

Wavelength range, nm	Side size A, mm	Ordering Code
350–2300	10	**14GT-10-VIS**

RELATED PRODUCTS

- **5PH50** – Polarizer Holder

- **8MR151-1** – Motorized Rotation Stage

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14WLP Wollaston Polarizing Prisms

Wollaston prism is an optical device that separates unpolarized light into two orthogonal, linearly polarized outgoing beams.
The device consists of two birefringent prisms cemented. Wollaston polarizers deviate the two emerging beams by nearly equal amount in opposite directions.

STANDARD SPECIFICATIONS

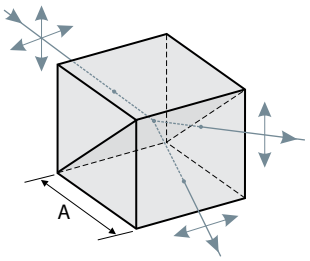
Material Grade	VIS quality grade "First" calcite
Wavelength Range	350–2300 nm
Size	10×10, 14×14, 19×19 mm
Deviation	10°, 20°
Extinction Ratio	1×10^{-5}
Surface Quality	60–40 scratch and dig
Surface Flatness	λ/4 @ 633 nm
Max. Power Handling	1 W/cm², CW
Housing	Black Anodized Aluminium

WOLLASTON POLARIZING PRISMS

Wavelength range, nm	Side size A, mm	Deviation, deg	Ordering Code
350–2300	10	20	**14WLP-10-20**
	14	20	**14WLP-14-20**
	19	20	**14WLP-19-20**

FEATURES

- Wide Wavelength Range
- Low Power Application
- Broadband 10^5 : 1 extinction ratio
- Prism with size **>19 mm** is available on special request



CODE EXAMPLE FOR ORDERING

14WLP-10-10

Side size, mm — Deviation, deg

14BDP Beam Displacers

The device produces two parallel orthogonally polarized beams from unpolarized input.
The displacement between ordinary and extraordinary beams can be found by approximate formula d = 0.1 × L

STANDARD SPECIFICATIONS

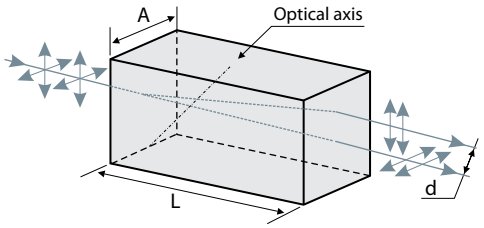
Material	Calcite, grade “First”
Wavelength Range	220–2300 nm. Transmittance in UV–VIS range depends on material quality. Available in UV, VIS and IR quality
Size A	from 5×5 to 20×20 mm
Length L	from 5 to 20 mm
Tolerance Size A	+0.0/-0.1 mm
Length L	±0.1 mm
Ordinary Beam Deviation	< 3 arcmin
Surface Quality	60–40 scratch and dig
Surface Flatness	λ/4 @ 633 nm
Max. Power Handling	200 MW/cm², pulsed
Housing	Available on request

BEAM DISPLACERS

Beam displacement, mm	Side size A, mm	Ordering Code
1	5	**14BDP-5-1**
2	5	**14BDP-5-2**
3	5	**14BDP-5-3**
1	8	**14BDP-8-1**
2	8	**14BDP-8-2**
3	8	**14BDP-8-3**

FEATURES

- Split a beam into two orthogonally polarized divergent beams
- Made from the finest optical grade natural calcite
- Beam Displacers with side size >20 mm are available on special request
- Beam Displacers can be made from crystal quartz and rutile as well
- Beam Displacers made from YVO_4 available on request



CODE EXAMPLE FOR ORDERING

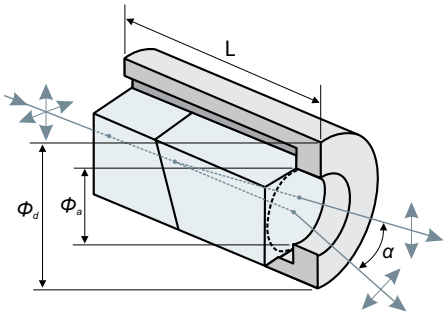
14BDP-5-1

Side size, mm — Beam displacement, mm

14RHP Rochon Polarizing Prisms

FEATURES

- Wide Wavelength Range
- High Extinction Ratio
- High UV Transmission
- Large Field Angle



The device produces linear polarized light from unpolarized input. Alternative for other type of Glan type polarizers.

STANDARD SPECIFICATIONS

Material	Quartz or YVO_4
Wavelength Range	Quartz: 200-2300 nm YVO_4: 500-4000 nm
Extinction Ratio	Quartz: $<5\times10^{-4}$ YVO_4: $<5\times10^{-5}$
Surface Quality	20-10 scratch and dig
Beam Deviation	< 3 arcmin
Wavefront Distortion	λ/4 @ 632.8 nm
Damage Threshold	>100 MW/cm²
Coating	Single Layer MgF_2
Mount	Black Anodized Aluminium

QUARTZ ROCHON POLARIZING PRISMS

Wavelength, nm	Extinction ratio	Angular Field, deg	C.A. Øa, mm	O.D. Ød, mm	L±0.1, mm	Ordering Code
200-2300	$<5\times10^{-4}$	1.0 @ 980 nm	8.0	25.4	26.0	**14RHP-8-1**
			10.0	25.4	28.0	**14RHP-10-1**
			12.7	25.4	33.0	**14RHP-12.7-1**
			15.0	30.0	38.0	**14RHP-15-1**
			20.0	38.0	48.0	**14RHP-20-1**

YVO_4 ROCHON POLARIZING PRISMS

Wavelength, nm	Extinction ratio	Angular Field, deg	C.A. Øa, mm	O.D. Ød, mm	L±0.1, mm	Ordering Code
500-4000	$<5\times10^{-5}$	6.0 @ 1550 nm	8.0	25.4	17.0	**14RHP-8-2**
			10.0	25.4	19.0	**14RHP-10-2**
			12.7	25.4	21.0	**14RHP-12.7-2**
			15.0	30.0	23.0	**14RHP-15-2**
			20.0	38.0	29.0	**14RHP-20-2**

RELATED PRODUCTS

- **10APF3-1CVAF** – Variable Attenuator for Femtosecond Laser Pulses

CODE EXAMPLE FOR ORDERING

14RHP-8-1

Aperture CA, mm

Material:
1 – Quartz (200–2300 nm)
2 – YVO_4 (500–4000 nm)

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ADAPTIVE OPTICAL SYSTEMS

Introduction

Standa Ltd. offers flexible modular adaptive optical systems with 19 to 109 control channels with mirror apertures from 15 mm up to 50 mm. Deformable mirrors can be coated with bare metals such as Aluminum and Gold and with 99.0% HR coatings at 1060 nm, 98% broadband metal/dielectric coatings for 550-1000 nm spectral range, centered at 800 nm, protected aluminum coatings optimized from 266 nm to 350 nm range and other types of coatings if required.
The systems offered by Standa Ltd. use *Piezoelectric Deformable Mirrors* and *Micromachined Membrane Deformable Mirrors*. Wavefront sensor and feedback controller are used as a wavefront control system. Deformable mirrors can be driven with 20 or 40-ch HV amplifier modules that can be combined to any number of channels. Below is a short overview of the standard AO systems that are offered.

14PDM Piezoelectric Deformable Mirrors

Standa offers affordable piezoelectric deformable mirrors with clear aperture of 30 mm and 50 mm. The full surface stroke is 6 µm standard with maximum stroke between the adjacent actuators in the range from 1 µm to 3 µm. The mirror is controlled by HV amplifer(s) and interfaced to a PC using 8-bit PCI or 12-bit USB controller(s). The full-amplitude mechanical response of the mirror is faster than 150 microseconds, but usually the response time is limited to 1 ms by the control electronics. The surface can be coated with a broad range of HR metal and multilayer dielectric coatings. PDM`s easily integrates with Standa wavefront sensors into a complete closed-loop adaptive optical system running with frame frequency of 15 to 100 Hz. Applications include dynamic correction of optical aberrations in laser, astronomical and imaging systems.

14MMDM Micromachined Membrane Deformable Mirrors

FEATURES

- MMDM are small and light, especially compared to continuous faceplate piezoelectric mirrors
- Negligible power consumption
- High optical quality, better than 400 nm rms over the whole aperture
- Very smooth surface: the scattering is negligible
- Large correction range – up to 25 µm in total wavefront deformation
- These mirrors can be coated with metal and metal-dielectric coatings: to be used in lasers at power levels of up to 600 W CW
- Zero hysteresis
- Negligible parameter drift

Micromachined membrane deformable mirrors with apertures in the range of 10 to 50 mm represent a high-quality affordable solution for fast dynamic correction of low-order optical aberrations such as defocus, astigmatism, coma, etc in lasers, telescopes, ophthalmology, displays and general imaging optics.

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14LDM Linear Deformable Mirrors

Membrane and piezoelectric deformable mirrors for ultrafast pulse control. These mirrors are usually used in a stretcher for selective control of the delays of chosen spectral components.

LINEAR PDM FOR PULSE COMPRESSION

The linear piezoelectric deformable mirror for femtosecond pulse shaping has 10×50 mm active area, controlled by two rows of 10 actuators each. The actuator pitch is 5 mm. The maximum surface deflection is 6 um, the profile difference between the adjacent actuators can reach 3um. The initial figure is slightly spherical. The mirror can be custom coated with low-dispersion dielectrics and metal-dielectric coatings. The mirror can be supplied with a complete set of control electronics, including 20-ch 400 V amplifier unit and a 20 (40)-ch USB DAC unit (or a 24-ch 8-bit PCI DAC card) for interfacing to a PC. Full technical description can be downloaded from our website www.standa.lt .

LINEAR MMDM FOR PULSE COMPRESSION

The linear membrane DM represents an attractive alternative to LC wavefront correctors for femtosecond pulse compression and precise control and optimization of the temporal/spectral pulse parameters. They feature very low dispersion, negligible power consumption, high optical quality which is usually better than 2 fringes over the whole aperture, fast response and large correction range. These mirrors can be coated with high-reflective dielectric coatings to be used in lasers at power levels of up to 500W CW. Negligible hysteresis. The linear MMDM are available with 19 and 38 (2×19) actuator structures, with 11×39 mm membrane.

Electronics

Our standard adaptive optical systems are based on Windows OS, high-voltage amplifiers and digital-to-analog converters (DAC) serving as interface between a PC and an amplifier. A number of interfaces and amplifiers are available, that allow to control high-voltage deformable mirrors with up to 2 kHz frequency, voltage up to 400 V with a precision of 8 (PCI), 12 (USB), or 16 (Ethernet) bits.

PCI boards allow to control up to 24 channels with a single board, the number of boards per PC is practically unlimited. The refresh time is better than 1 microsecond per ch annel, all channels of the board can be controlled independently in any order.

A single USB DAC or Ethernet DAC module allows controlling 40 channels with refresh frequency of 1 or 2 kHz and precision of 12 or 16 bits. These modules can be used in parallel to control 80, 120... etc. channels with refresh frequency of up to 2 kHz.

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14MMDM-15-17 Deformable Mirror with Integrated Tip-Tilt Stage

Standard micro machined deformable mirror with 15-mm clear aperture, 17 actuators and integrated tip-tilt stage has been specially designed for correction of low-order aberrrations.
The deformable mirror has the actuator geometry optimized for the correction of the low-order aberrations, with 12 actuators located outside of the working aperture of 10 mm, and is mounted on a piezoelectric tip-tilt stage. This allows to avoid the double use of the pupil-conjugated plane and to build compact and simple adaptive optical systems.
The mirror has tip and tilt range of 24 μm at 10 mm aperture and 8.8 μm defocus range in the reflected wavefront.

STANDARD SPECIFICATIONS

Aperture shape	approximately circular
Mirror coating	Al or Au
Aperture dimensions	15 mm diameter
Number of electrodes	17
Control voltages Vc	0 . . . 235 V
Initial RMS deviation from plane	less than 0.2 μm
Main initial aberration	1.5 fringes at 630 nm
Maximum deflection of the mirror center	9.4 μm

FEATURES

- Fabricated using silicon bulk micromachining technology
- Built-in piezoelectric Tilt-Tip Stage
- Different coatings available upon request

CODE EXAMPLE FOR ORDERING

14MMDM-15-17

Aperture diameter, mm

Number of channels

14MMDM-15-37 37-channel Micromachined Deformable Mirror System

This is probably the most popular deformable mirror ever made. In production since 1997, hundreds of these devices are used by scientists and engineers in all kinds of adaptive optics project, including laser beam control, real time atmospheric correction, ophthalmology, intracavity laser control, communications, holographic memory, optical fiber switching, etc.
Properties of these mirrors are described in numerous scientific publications. Available with Al and gold coatings as standard, custom orders for protected silver and multilayer laser coatings available. The deflection range measured in the center of the membrane is about 25 fringes at 633 nm. In addition to standard silicon nitride-based mirrors, we produce mirrors with thicker polysilicon membrane, featuring higher reliability and snap-on protection.

STANDARD SPECIFICATIONS

Aperture shape	approximately circular
Mirror coating	Al
Aperture dimensions	15 mm diameter
Number of electrodes	37
Control voltages Vc	0 . . . 260 V
Initial RMS deviation from plane	less than 0.45 μm
Main initial aberration	1.5 fringes at 630 nm
Maximum deflection of the mirror center	9.0 μm

FEATURES

- Perfect for correction of low-order optical aberrations
- 37 channels
- Customized mirrors available upon request

CODE EXAMPLE FOR ORDERING

14MMDM-15-37

Aperture diameter, mm

Number of channels

COATINGS SECTION

Dielectric Coatings

Coatings consist of layers with different refractive indices. There are three major techniques used for dielectric coating: **electron-beam deposition (E-beam), ion-assisted electron-beam (IAD)** and **ion beam sputtering (IBS)**. All of these processes are quite similar in their principle. They consist in evaporating some coating material on the substrate. The difference lies in the deposition energy.

Because of low energies involved when using electron-beam deposition, thin film material contains bubbles and micropores, like a sponge. These will eventually fill with water, which will change the refractive index of the coating and thus the properties of the optics. (This is known as *environmental shifting*). The presence of water also lowers the damage threshold of the optics: when submitted to an intense light, the water will tend to vaporize and scrap off bits of the coating. Finally, even in the absence of water, inhomogeneities of coating layers lower the theoretical damage threshold. The positive points about this technology is that it is cheap, widespread and very versatile. The coating itself is also slightly flexible, which makes the optic more resistant to mechanical stress. Some of the major optics manufacturer only have access to that type of coating at the moment and outsource IBS-coated optics.

Ion-assisted electron-beam is an intermediate technique, between ion-beam sputtering and e-beam. So are its results.

Ion beam sputtering involves energies 100 times higher than e-beams. As a result the molecules of the coating layers form covalent bound when deposited. The result is free from bubbles or pores, more homogenous, more durable, have higher damage threshold and is more repeatable and controllable. They also show lower scattering and absorption properties, and overall higher specifications (more broadband, steeper transitions when needed, better spectral stability...). This is high precision coating, and the surface roughness can be controlled at better than 1 Å RMS (!), that is <λ/5000. Of course, this comes at a higher cost (atom-by-atom removal is very slow), and even worse, it is limited in the types of coatings it can handle: most of the UV coatings for instance involve fluorides which dissociate when sputtered. In this case, e-beam is the only option.

RELATED PRODUCTS AND ACCESSORIES

- **10BE02** – Beam Expander

- **10BE03** – Beam Expander

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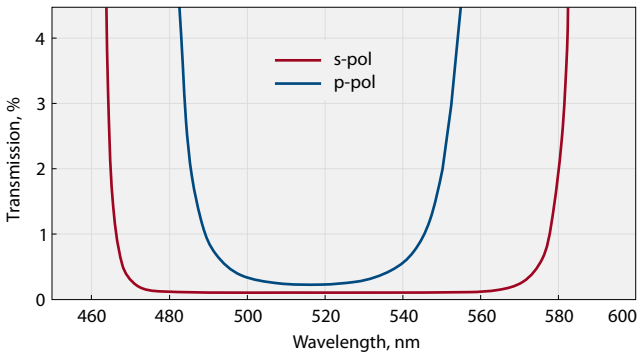
HR HR Laser Line Coatings

HR Laser Line coatings provide an optimized performance at certain wavelength and certain angle of incidence (AOI). These multilayer coating stacks helps to achieve the highest possible reflectivity at specific laser line wavelengths at normal or 45 degrees incidence. HR Laser Line coatings are used for external beam manipulation applications where even slight losses may be intolerable. Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques.
High reflectivity dielectric coatings in the range of 0.19 – 20 μm are available.



Measured transmission curve of the standard Coating Code **HR5**

FEATURES

- Provide an optimized performance at certain wavelength and certain angle of incidence (AOI)
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- HR Laser Line coatings highly reflect wavelength range of <10% of the central wavelength (CWL). For instance, HR @ 800 nm will reflect wavelength range of 760 – 840 nm
- For wider wavelength range please refer to HR Broad Band wavelength (BBHR) coatings

HR LASER LINE COATINGS

Wavelength, nm	Reflectivity (average), %	Coating Code
266	>99.0	**HR1**
343 – 355	>99.5	**HR2**
400	>99.5	**HR3**
473 – 488	>99.5	**HR4**
515	>99.5	**HR5**
527 – 532	>99.5	**HR6**
589	>99.5	**HR7**
633	>99.5	**HR8**
780	>99.5	**HR9**
800	>99.5	**HR10**
852	>99.5	**HR11**
946	>99.5	**HR12**
980	>99.5	**HR13**
1030	>99.5	**HR14**
1047 – 1064	>99.5	**HR15**
1122	>99.5	**HR16**
1319	>99.5	**HR17**
1550	>99.5	**HR18**

STANDARD SPECIFICATIONS

Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Measured Reflectivity	R>99.5% @ 0°; R_s>99.8% and R_p>99.3% @ 45°
Laser Damage Threshold	>5–7 J/cm² for 10 ns pulses @ 1064 nm

RELATED PRODUCTS

- **10BE01** – Beam Expander/ Collimator

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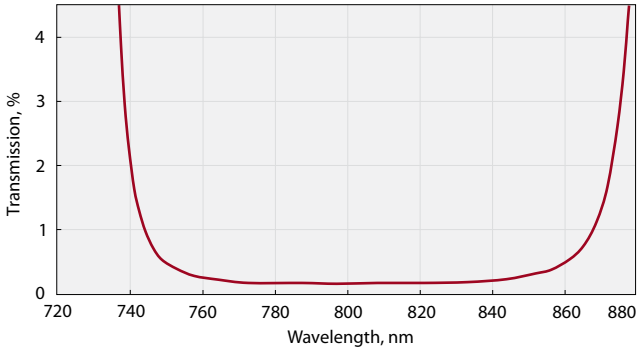
BBHR HR Broad Band Coatings

FEATURES

- Provide an optimized performance over broad wavelength range
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques

HR Broad Band coatings provide an optimized performance at broad wavelength range. These multilayer coatings offer high reflectivity for broad spectrum. Therefore, it is the ideal for a wide range of multi-wavelength laser or white light applications. Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques.
High reflectivity dielectric coatings in the range of 0.19 – 20 µm are available.



Measured transmission curve of the standard Coating Code **BBHR3**

STANDARD SPECIFICATIONS

Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Measured Reflectivity	R>99.5% @ 0°; R_{ave}>99% @ 45°
Laser Damage Threshold	>2–3 J/cm² for 10 ns pulses @ 1064 nm

RELATED PRODUCTS

- **12HP02** – Fiber Collimator

HR BROAD BAND COATINGS

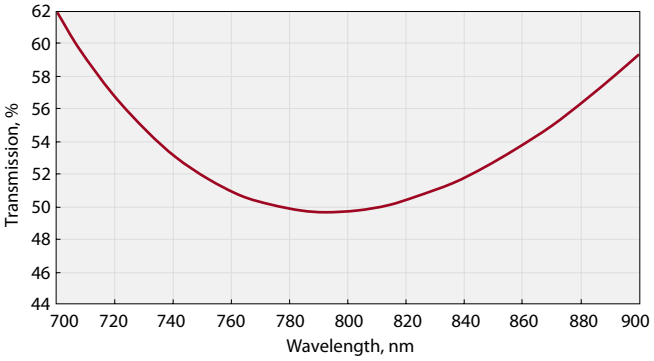
Wavelength range, nm	Reflectivity (average), %	Coating Code
400-700	>99.0	**BBHR1**
700-950	>99.0	**BBHR2**
750-850	>99.0	**BBHR3**
750-1000	>99.0	**BBHR4**
900-1200	>99.0	**BBHR5**

PR Partial Reflecting Coatings

FEATURES

- Efficient beam splitting as well as output coupling in high power laser cavities
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques

Partial reflecting coatings provide required percentage reflection/transmission at a specific angle of incidence both for both single and broad band wavelengths. These coatings serves usually for the efficient beam splitting as well as output coupling in high power laser cavities.



Measured transmission curve for PR coating code **PR6.50**

STANDARD SPECIFICATIONS

Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Laser Damage Threshold	>5–6 J/cm² for 10 ns pulses @ 1064 nm

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PARTIAL REFLECTING COATINGS

Wavelength, nm	Reflectivity (average), %	Coating Code
266	10±3	**PR1.10**
	50±2	**PR1.50**
	90±1	**PR1.90**
355	10±3	**PR2.10**
	50±2	**PR2.50**
	90±1	**PR2.90**
400	10±3	**PR3.10**
	50±2	**PR3.50**
	90±1	**PR3.90**
515 – 532	10±3	**PR4.10**
	50±2	**PR4.50**
	90±1	**PR4.90**
633	10±3	**PR5.10**
	50±2	**PR5.50**
	90±1	**PR5.90**
750 – 850	10±3	**PR6.10**
	50±2	**PR6.50**
	90±1	**PR6.90**

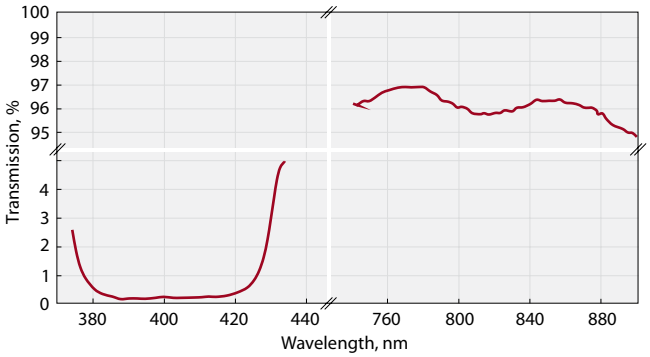
Wavelength, nm	Reflectivity (average), %	Coating Code
946	10±3	**PR7.10**
	50±2	**PR7.50**
	90±1	**PR7.90**
1020 – 1100	10±3	**PR8.10**
	50±2	**PR8.50**
	90±1	**PR8.90**
1122	10±3	**PR9.10**
	50±2	**PR9.50**
	90±1	**PR9.90**
1319	10±3	**PR10.10**
	50±2	**PR10.50**
	90±1	**PR10.90**
1550	10±3	**PR11.10**
	50±2	**PR11.50**
	90±1	**PR11.90**

WS Wavelength Separating Coatings

Wavelength separating coatings are used to separate the spectral regions or specified wavelengths (e.g. harmonic components) of the multi-frequency laser systems by selective spectral reflection, transmission and absorption.
These multilayer dielectric coatings are used to separate the various harmonic components of frequency doubled laser systems by selective spectral reflection and transmission. In all cases one wavelength is reflected while the others are transmitted.

FEATURES

- Used to separate the spectral regions or specified wavelengths
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques



Measured transmission curve for wavelength separator coating code **WS4**

STANDARD SPECIFICATIONS

Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Laser Damage Threshold	>5 J/cm² for 10 ns pulses @ 1064 nm

WAVELENGTH SEPARATING COATINGS

Reflected Wavelength, nm	Transmitted Wavelength, nm	Coating Code
R>99% @ 266	T>90% @ 355+532+1064	**WS1**
R>99.5% @ 343	T>95% @ 515+1030	**WS2**
R>99.5% @ 355	T>95% @ 532+1064	**WS3**
R>99.5% @ 400	T>95% @ 800	**WS4**
R>99.5% @ 515	T>95% @ 1030	**WS5**
R>99.5% @ 515	T>85% @ 630 – 1300, AOI=0° T>90% @ 630 – 1300, AOI=45°	**WS6**
R>99.5% @ 532	T>90% @ 266	**WS7**
R>99.5% @ 532	T>95% @ 1064	**WS8**
R>99.5% @ 532+1064	T>90% @ 355	**WS9**
R>99.5% @ 532+1064	T>95% @ 808	**WS10**

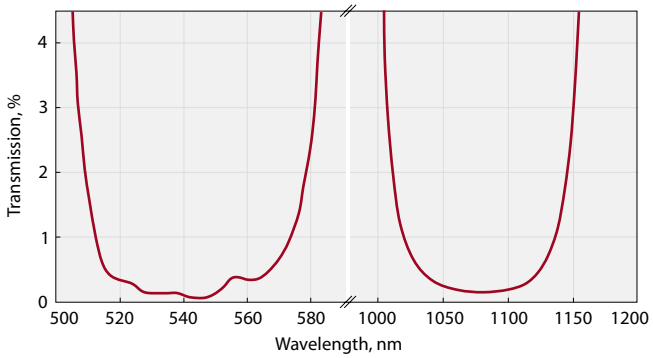
Reflected Wavelength, nm	Transmitted Wavelength, nm	Coating Code
R>99.5% @ 750 – 850	T>95% @ 532	**WS11**
R>99.5% @ 800	T>95% @ 400	**WS12**
R>99.5% @ 800	T>95% @ 1100 – 1600	**WS13**
R>99.5% @ 1030	T>95% @ 515	**WS14**
R>99.5% @ 1030	T>95% @940	**WS15**
R>99.5% @ 1030	T>95% @ 976	**WS16**
R>99.5% @ 1064	T>95% @ 355	**WS17**
R>99.5% @ 1064	T>95% @ 532	**WS18**
R>99.5% @ 1064	T>95% @ 400 – 700	**WS19**
R>99.5% @1064	T>95% @ 808	**WS20**

DHR Dual Laser Line Reflecting Coatings

FEATURES

- The coatings are designed to achieve the highest possible reflectivity at two specific laser line wavelengths at normal or 45 degrees incidence
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques

Dual Laser Line reflecting coatings provide an optimized performance at two certain wavelengths and certain angle of incidence (AOI).
These multilayer coating stacks helps to achieve the highest possible reflectivity at two specific laser line wavelengths at normal or 45 degrees incidence. Laser line high reflectivity coatings are intended for external beam manipulation applications where even slight losses may be intolerable.



Measured transmission curve
for dual wavelength HR coating code **DHR9**

STANDARD SPECIFICATIONS

Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Measured Reflectivity	R>99.5% @ 0° R_s>99.3% and R_p>98.5% @ 45°
Laser Damage Threshold	>3–5 J/cm² for 10 ns pulses @ 1064 nm

DUAL LASER LINE REFLECTING COATINGS

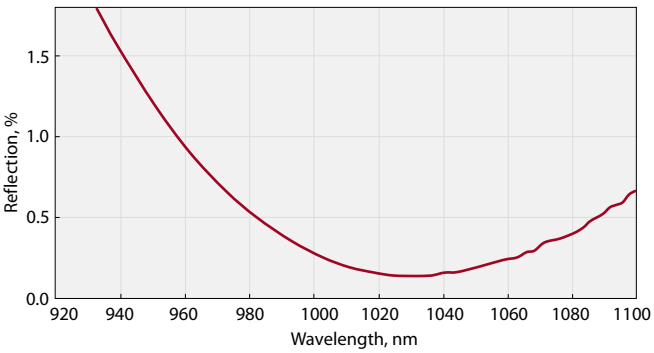
Wavelength, nm	Reflectivity at normal incidence, %	Coating Code
266+532	>99.0	**DHR1**
343+1030	>99.5	**DHR2**
355+532	>99.5	**DHR3**
355+1064	>99.5	**DHR4**
399+556	>99.5	**DHR5**
400+800	>99.5	**DHR6**
426+852	>99.5	**DHR7**
515+1030	>99.5	**DHR8**
532+1064	>99.5	**DHR9**
1064+1319	>99.5	**DHR10**

AR Laser Line Anti-Reflection Coatings

FEATURES

- Designed to reduce the reflectivity of a component to near-zero for specific wavelength
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- Laser Line Anti-Reflection Coatings in the range 0.19 – 10.6 µm are available

AR coatings designed to reduce the reflectivity of a component to near-zero for specific wavelength.
We supply standard Laser Line Anti-Reflection Coatings in the range 0.19 – 10.6 µm.



Measured residual back reflection curve for AR coating code **AR14**

STANDARD SPECIFICATIONS

Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Measured Residual Reflectivity	R<0.2% @ 0° AOI R<0.4% @ 45° AOI
Laser Damage Threshold	>8 J/cm² for 10 ns pulses @ 1064 nm

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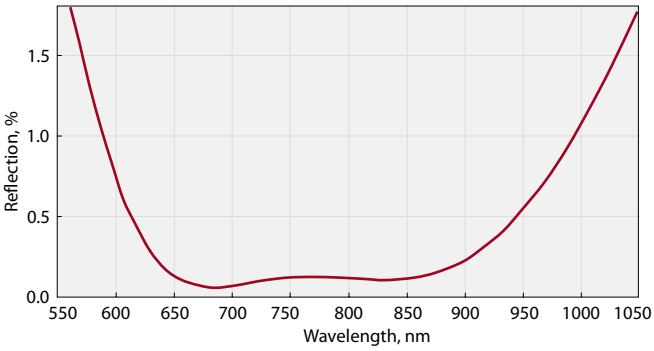
LASER LINE AR COATINGS

Wavelength, nm	Residual Reflectivity, %	Coating Code
266	<0.5	**AR1**
343 – 355	<0.25	**AR2**
400	<0.2	**AR3**
473 – 488	<0.2	**AR4**
515	<0.2	**AR5**
527 – 532	<0.2	**AR6**
589	<0.2	**AR7**
633	<0.2	**AR8**
780	<0.2	**AR9**

Wavelength, nm	Residual Reflectivity, %	Coating Code
800	<0.2	**AR10**
852	<0.2	**AR11**
946	<0.2	**AR12**
980	<0.2	**AR13**
1030	<0.2	**AR14**
1047 – 1064	<0.2	**AR15**
1122	<0.2	**AR16**
1319	<0.2	**AR17**
1550	<0.2	**AR18**

BBAR Broad Band Anti-Reflection Coatings

Broad Band AR coatings designed to reduce the reflectivity of a component to near-zero for Broad band wavelength range.
We suplly standard Broad Band AR coatings in the range 0.19 – 10.6 μm. These multilayer broadband anti-reflective coating can higher transmission access a broad spectrum. Therefore, it is the ideal for a wide range of multi-wavelength laser and white light applications. Please notified that the wavelength range and reflectivity of the coating changes according to the angle of the incident beam.



Measured residual back reflection curve for BBAR coating code **BBAR4**

FEATURES

- These coatings are designed to increase the transmission over a broad spectrum
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques
- Broad Band Anti-Reflection Coatings in the range 0.19 – 10.6 μm are available

STANDARD SPECIFICATIONS

Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Laser Damage Threshold	>4–5 J/cm² for 10 ns pulses @ 1064 nm

BROAD BAND AR COATINGS

Wavelength range, nm	Residual average Reflectivity @ 0° AOI, %	Coating Code
400 – 700	<1.0	**BBAR1**
600 – 1050	<0.8	**BBAR2**
700 – 950	<0.4	**BBAR3**
750 – 850	<0.3	**BBAR4**
750 – 1000	<0.5	**BBAR5**
900 – 1200	<0.6	**BBAR6**
1200 – 1500	<0.6	**BBAR7**
1500 – 1900	<0.7	**BBAR8**

RELATED PRODUCTS

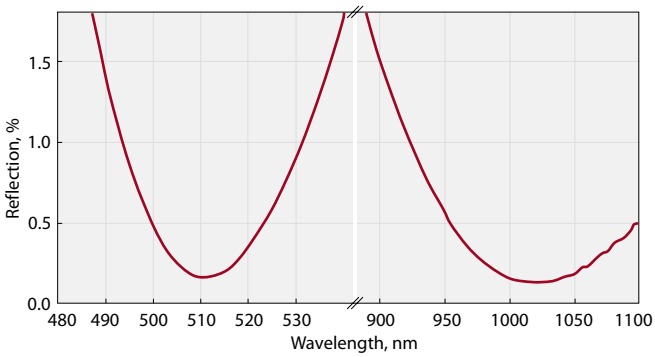
- **10BE01-5X(ZYΘ)** – Beam Expander/ Collimator

DAR Dual Anti-Reflection Coatings

FEATURES

- Frequently used in multi-frequency laser output systems (e.g. frequency doubling)
- Coatings are provided by Ion Beam Sputtering (IBS) or Electron beam evaporation with/without Ion assistance coating techniques

Dual AR coatings designed to reduce the reflectivity of a component to near-zero for two certain wavelengths. Usually these coatings are used in multi-frequency laser output systems (e.g. frequency doubling).
This coating provides very high transmission at two different wavelengths. Typical wavelengths and reflection curves of an AR coating suitable for the prevalent laser system output at 1064 nm and 532 nm are shown below.



The measured residual back reflection curve for DAR coating code **DAR9**

STANDARD SPECIFICATIONS

Coating Adhesion and Durability	Per MIL-C-675A
Clear Aperture	>90% of diameter
Laser Damage Threshold	>6 J/cm² for 10 ns pulses @ 1064 nm

DUAL AR COATINGS

Wavelength, nm	Residual average Reflectivity @ 0° AOI, %	Coating Code
266+532	<0.5	**DAR1**
343+1030	<0.3	**DAR2**
355+532	<0.3	**DAR3**
355+1064	<0.3	**DAR4**
399+556	<0.3	**DAR5**

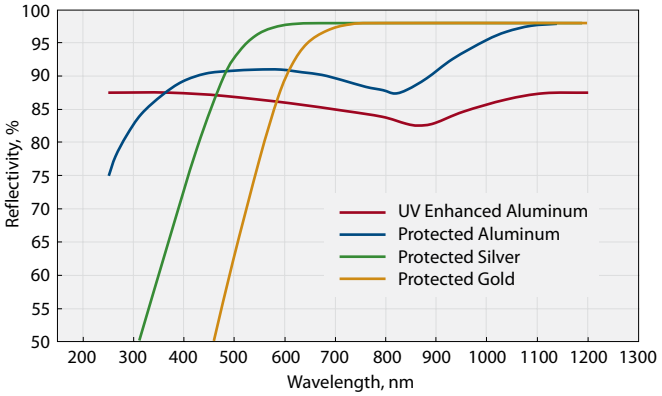
Wavelength, nm	Residual average Reflectivity @ 0° AOI, %	Coating Code
400+800	<0.3	**DAR6**
426+852	<0.3	**DAR7**
515+1030	<0.25	**DAR8**
532+1064	<0.25	**DAR9**
1064+1319	<0.3	**DAR10**

AL • SM • GM Metallic Coatings

FEATURES

- Protected Gold provides excellent, broadband infrared high reflectance
- Protected Silver provides higher reflectance than aluminium throughout the visible and near IR
- Protected Aluminium is economical solution for VIS applications
- UV enhanced Aluminium provides good reflectance over a wide range and are mainly used in UV applications

Metallic coatings are convenient in that they are extremely broadband and can be used at any angle of incidence. We offer Gold, Silver and Aluminium high reflection coatings formed by vacuum deposition. All metallic reflectors can be over-coated with dielectric film of MgF_2 or SiO_2 in order to prevent oxidation of the metallic surface and provide abrasion resistance.



STANDARD SPECIFICATIONS

Clear Aperture	>90% of diameter
Laser Damage Threshold	>0.3 J/cm² for 10 ns pulses @ 1064 nm (for Gold and Silver)

METALLIC COATINGS

Coating type	Reflectivity, %	Coating Code
UV enhanced Aluminium	>87% @ 250 – 350	**EAL**
Protected Aluminium	>85% @ 350 – IR	**AL**
Protected Silver	>96% @ 400 – IR	**SM**
Protected Gold	>98% @ 900 – IR	**GM**

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