

Femt* Line Components

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OPTICAL COMPONENTS CLEANING INSTRUCTIONS

See page A.4



FemtoLine Laser Optics

LASER MIRRORS

Laser mirrors for femtosecond applications are designed to have a broad operating wavelength range and linear phase versus frequency characteristics (*group delay dispersion (GDD)*). The coating is a single layer dielectric and has no phase shift over the operating wavelength region.

High reflectivity mirrors always have higher reflection, broader operating region and lower pulse distortion for s-polarization than for p-polarization for the same dielectric coating. If possible use the mirrors with s-polarized beam.

Our standard mirrors are suitable for fundamental Ti:Sapphire and Yb:KGW or KYW lasers and their doubled, tripled or quadrupled frequencies.

SUBSTRATE

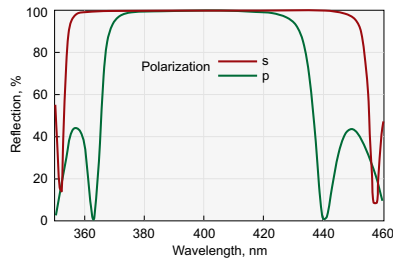
Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	$\lambda/10$ at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	± 0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

COATING

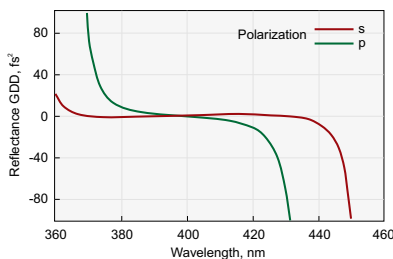
Technology	Electron beam multilayer dielectric or Ion beam sputtering
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coating	Hard dielectric High Reflection $R > 99.5\%$
Angle of Incidence	0 or $45 \pm 3^\circ$
Designed for average polarization	$R = (R_s + R_p) / 2$
Laser Damage Threshold	>100 mJ/cm ² , 50 fsec pulse, 50 Hz, 800 nm typical
Coated Surface Flatness	$\lambda/10$ at 633 nm over clear aperture

Low GDD Ultrafast Mirrors

Substrate material: **BK7 grade A**



HR > 99.5% @ 380-420 nm, AOI = 45°



HRsp @ 380-420 GDD, AOI = 45°

Size: **12.7 × 3 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
380-420	99.7 / 99.5	031-0400-i0	031-0400	57 / 57
500-530	99.7 / 99.5	031-0515-i0	031-0515	56 / 56
760-840	99.7 / 99.5	031-0800-i0	031-0800	61 / 61
1000-1060	99.7 / 99.5	031-1030-i0	031-1030	57 / 57

Size: **12.7 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
380-420	99.7 / 99.5	031-0400T6-i0	031-0400T6	57 / 57
500-530	99.7 / 99.5	031-0515T6-i0	031-0515T6	56 / 56
760-840	99.7 / 99.5	031-0800T6-i0	031-0800T6	61 / 61
1000-1060	99.7 / 99.5	031-1030T6-i0	031-1030T6	57 / 57

Size: **25.4 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
380-420	99.7 / 99.5	032-0400-i0	032-0400	89 / 89
500-530	99.7 / 99.5	032-0515-i0	032-0515	74 / 74
760-840	99.7 / 99.5	032-0800-i0	032-0800	85 / 85
1000-1060	99.7 / 99.5	032-1030-i0	032-1030	75 / 75

Size: **50.8 × 8 mm**

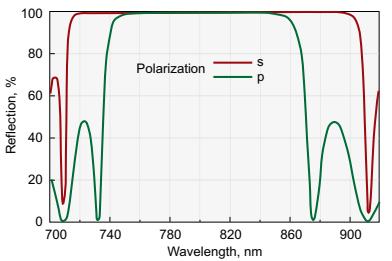
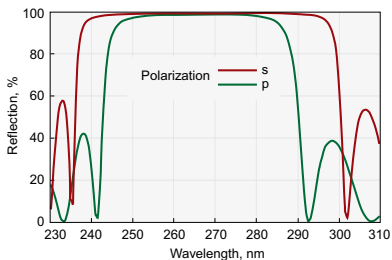
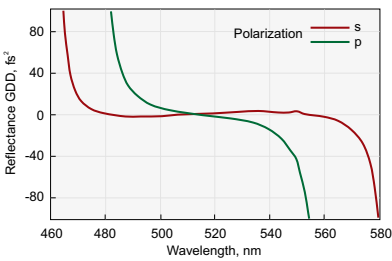
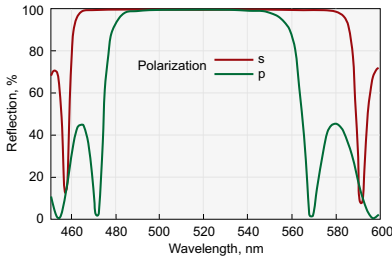
Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
380-420	99.7 / 99.5	035-0400-i0	035-0400	133 / 133
500-530	99.7 / 99.5	035-0515-i0	035-0515	110 / 110
760-840	99.7 / 99.5	035-0800-i0	035-0800	133 / 133
1000-1060	99.7 / 99.5	035-1030-i0	035-1030	110 / 110

Size: 76.2 × 12.7 mm

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR
		AOI=0°	AOI=45°	AOI=0° / AOI=45°
380-420	99.7 / 99.5	037-0400-i0	037-0400	199 / 199
500-530	99.7 / 99.5	037-0515-i0	037-0515	185 / 185
760-840	99.7 / 99.5	037-0800-i0	037-0800	199 / 199
1000-1060	99.7 / 99.5	037-1030-i0	037-1030	185 / 185

Low GDD Ultrafast Mirrors

Substrate material:
UV grade Fused Silica



Size: 12.7 × 3 mm

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR
		AOI=0°	AOI=45°	AOI=0° / AOI=45°
257-275	99.0 / 99.0	041-0266-i0	041-0266	71 / 71
333-353	99.7 / 99.5	041-0343-i0	041-0343	77 / 77
380-420	99.7 / 99.5	041-0400-i0	041-0400	67 / 67
500-530	99.7 / 99.5	041-0515-i0	041-0515	62 / 62
760-840	99.7 / 99.5	041-0800-i0	041-0800	75 / 75
1000-1060	99.7 / 99.5	041-1030-i0	041-1030	62 / 62

Size: 12.7 × 6 mm

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR
		AOI=0°	AOI=45°	AOI=0° / AOI=45°
257-275	99.0 / 99.0	041-0266T6-i0	041-0266T6	71 / 71
333-353	99.7 / 99.5	041-0343T6-i0	041-0343T6	77 / 77
380-420	99.7 / 99.5	041-0400T6-i0	041-0400T6	67 / 67
500-530	99.7 / 99.5	041-0515T6-i0	041-0515T6	62 / 62
760-840	99.7 / 99.5	041-0800T6-i0	041-0800T6	75 / 75
	99.9 / 99.9	041-0800HHRT6-i0	041-0800HHRT6	108 / 108
1000-1060	99.7 / 99.5	041-1030T6-i0	041-1030T6	62 / 62
	99.9 / 99.9	041-1030HHRT6-i0	041-1030HHRT6	75 / 75

Size: 25.4 × 6 mm

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR
		AOI=0°	AOI=45°	AOI=0° / AOI=45°
257-275	99.0 / 99.0	042-0266-i0	042-0266	99 / 99
333-353	99.7 / 99.5	042-0343-i0	042-0343	107 / 107
380-420	99.7 / 99.5	042-0400-i0	042-0400	95 / 95
500-530	99.7 / 99.5	042-0515-i0	042-0515	90 / 90
760-840	99.7 / 99.5	042-0800-i0	042-0800	97 / 97
760-840	99.9 / 99.9	042-0800HHR-i0	042-0800HHR	130 / 130
1000-1060	99.7 / 99.5	042-1030-i0	042-1030	90 / 90
1000-1060	99.9 / 99.9	042-1030HHR-i0	042-1030HHR	105 / 105
1400-1700	99.0 / 99.0	082-1417-i0	082-1417	210 / 210

Size: 50.8 × 8 mm

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR
		AOI=0°	AOI=45°	AOI=0° / AOI=45°
257-275	99.0 / 99.0	045-0266-i0	045-0266	207 / 207
333-353	99.7 / 99.5	045-0343-i0	045-0343	187 / 187
380-420	99.7 / 99.5	045-0400-i0	045-0400	181 / 181
500-530	99.7 / 99.5	045-0515-i0	045-0515	169 / 169
760-840	99.7 / 99.5	045-0800-i0	045-0800	181 / 181
1000-1060	99.7 / 99.5	045-1030-i0	045-1030	169 / 169

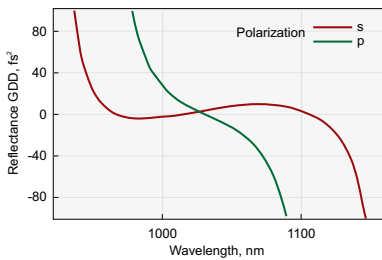
Size: 76.2 × 12.7 mm

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR
		AOI=0°	AOI=45°	AOI=0° / AOI=45°
257-275	99.0 / 99.0	047-0266-i0	047-0266	290 / 290
333-353	99.7 / 99.5	047-0343-i0	047-0343	281 / 281
380-420	99.7 / 99.5	047-0400-i0	047-0400	272 / 272
500-530	99.7 / 99.5	047-0515-i0	047-0515	258 / 258
760-840	99.7 / 99.5	047-0800-i0	047-0800	272 / 272
1000-1060	99.7 / 99.5	047-1030-i0	047-1030	258 / 258

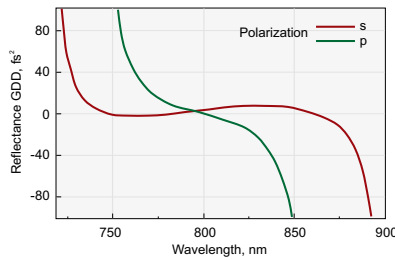
RELATED PRODUCTS

Adapter for Mirror at 45° 840-0115
See page 7.41

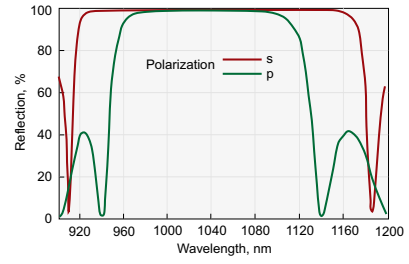
Recommended for high power laser applications operating in UV region.



HRsp@1000-1060 GDD, AOI=45°



HRsp@760-840 GDD, AOI=45°



HR>99.5%@1000-1060 nm, AOI=45°

DUAL BAND MIRRORS

SPECIFICATIONS

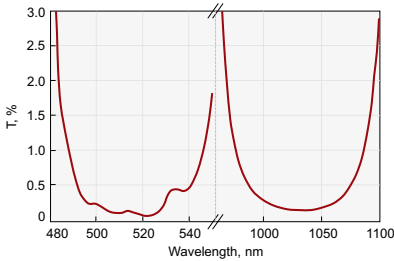
Coating	Hard dielectric High Reflection R>99.5%
Angle of Incidence	0 or 45±3°
Designed for average polarization	$R=(R_s+R_p)/2$
Laser Damage Threshold	>50 mJ/cm², 50 fsec pulse, 800 nm typical

SUBSTRATE

Material	UV grade Fused Silica or BK7 glas
S1 Surface Flatness	$\lambda/10$ at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Dual Band Mirrors

Substrate material: **BK7 grade A**



HR>99.5%@500-530 nm+1000-1060 nm, AOI = 45°

Size: **12.7 × 3 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
390-410+780-820	99.7 / 99.5	051-4080-i0	051-4080	85 / 85
500-530+1000-1060	99.7 / 99.5	051-5103-i0	051-5103	85 / 85

Size: **12.7 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
390-410+780-820	99.7 / 99.5	051-4080T6-i0	051-4080T6	85 / 85
500-530+1000-1060	99.7 / 99.5	051-5103T6-i0	051-5103T6	85 / 85

Size: **25.4 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
390-410+780-820	99.7 / 99.5	052-4080-i0	052-4080	103 / 103
500-530+1000-1060	99.7 / 99.5	052-5103-i0	052-5103	103 / 103

Size: **50.8 × 8 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
390-410+780-820	99.7 / 99.5	055-4080-i0	055-4080	151 / 151
500-530+1000-1060	99.7 / 99.5	055-5103-i0	055-5103	151 / 151

Size: **76.2 × 12.7 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
390-410+780-820	99.7 / 99.5	057-4080-i0	057-4080	227 / 227
500-530+1000-1060	99.7 / 99.5	057-5103-i0	057-5103	227 / 227

Dual Band Mirrors

Substrate material: **UV grade Fused Silica**

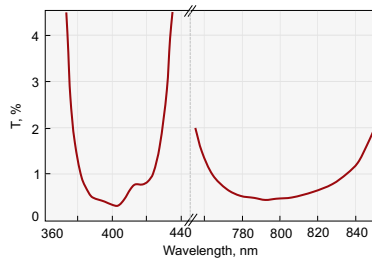
Recommended for high power laser applications operating in UV region.

Size: **12.7 × 3 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
390-410+780-820	99.7 / 99.5	061-4080-i0	061-4080	110 / 110
500-530+1000-1060	99.7 / 99.5	061-5103-i0	061-5103	110 / 110

Size: **12.7 × 6 mm**

Wavelength, nm	R, % (s+p)/2 AOI=0° / AOI=45°	Catalogue number		Price, EUR AOI=0° / AOI=45°
		AOI=0°	AOI=45°	
390-410+780-820	99.7 / 99.5	061-4080T6-i0	061-4080T6	110 / 110
500-530+1000-1060	99.7 / 99.5	061-5103T6-i0	061-5103T6	110 / 110



HR > 99% @ 400 nm + 800 nm, AOI = 45°

Size: 25.4 × 6 mm

Wavelength, nm	R, % (s+p)/2		Catalogue number		Price, EUR
	AOI=0°	AOI=45°	AOI=0°	AOI=45°	AOI=0° / AOI=45°
390-410+780-820	99.7	99.5	062-4080-i0	062-4080	128 / 128
500-530+1000-1060	99.7	99.5	062-5103-i0	062-5103	128 / 128

Size: 50.8 × 8 mm

Wavelength, nm	R, % (s+p)/2		Catalogue number		Price, EUR
	AOI=0°	AOI=45°	AOI=0°	AOI=45°	AOI=0° / AOI=45°
390-410+780-820	99.7	99.5	065-4080-i0	065-4080	214 / 214
500-530+1000-1060	99.7	99.5	065-5103-i0	065-5103	214 / 214

Size: 76.2 × 12.7 mm

Wavelength, nm	R, % (s+p)/2		Catalogue number		Price, EUR
	AOI=0°	AOI=45°	AOI=0°	AOI=45°	AOI=0° / AOI=45°
390-410+780-820	99.7	99.5	067-4080-i0	067-4080	321 / 321
500-530+1000-1060	99.7	99.5	067-5103-i0	067-5103	321 / 321

BROADBAND LOW GDD ULTRAFAST MIRRORS

- High reflectivity and low group delay dispersion in broad region centered at 800 nm
- $R_s > 99\%$ @ 700-930 nm, $|GDD_s| < 30 \text{ fs}^2$ @ 700-930 nm
- $R_p > 99\%$ @ 730-870 nm, $|GDD_p| < 30 \text{ fs}^2$ @ 730-870 nm

SPECIFICATIONS

Coating	Hard Dielectric High Reflection or Ion Beam Sputtering
Angle of Incidence	0 or 45±3°
Designed for average polarization	$R = (R_s + R_p)/2$
Laser Damage Threshold	>50 mJ/cm ² , 50 fsec pulse, 800 nm typical

SUBSTRATE

Material	UV grade Fused Silica or BK7 glas
S1 Surface Flatness	$\lambda/10$ at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	±0.25 mm
Wedge	< 3 min
Chamfer	0.3 mm at 45° typical

Broadband Low GDD Ultrafast Mirrors

Substrate material:
BK7 grade A

Catalogue number	Diameter, mm	Thickness T, mm	Wavelength, nm	R, % (s+p)/2	Price, EUR	
					AOI = 0°	AOI = 45°
071-7288-i0	071-7288	12.7	3.0	720-880	99.0	86 / 86
071-7288T6-i0	071-7288T6	12.7	6.0	720-880	99.0	86 / 86
072-7288-i0	072-7288	25.4	6.0	720-880	99.0	104 / 104
074-7288-i0	074-7288	38.1	8.0	720-880	99.0	195 / 195
075-7288-i0	075-7288	50.8	8.0	720-880	99.0	220 / 220
077-7288-i0	077-7288	76.2	12.7	720-880	99.0	395 / 395
078-7288-i0	078-7288	101.6	15.0	720-880	99.0	540 / 540

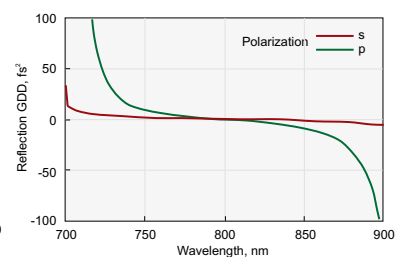
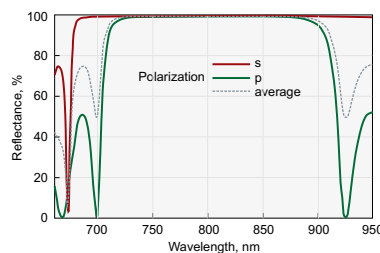
Substrate material:
UV grade Fused Silica

Catalogue number	Diameter, mm	Thickness T, mm	Wavelength, nm	R, % (s+p)/2	Price, EUR	
					AOI = 0°	AOI = 45°
081-7288-i0	081-7288	12.7	3.0	720-880	99.0	111 / 111
081-7288T6-i0	081-7288T6	12.7	6.0	720-880	99.0	111 / 111
082-7288-i0	082-7288	25.4	6.0	720-880	99.0	129 / 129
082-7288HHR-i0	082-7288HHR	25.4	6.0	720-880	99.9 / 99.8	145 / 145
084-7288-i0	084-7288	38.1	8.0	720-880	99.0	225 / 225
085-7288-i0	085-7288	50.8	8.0	720-880	99.0	255 / 255
087-7288-i0	087-7288	76.2	12.7	720-880	99.0	460 / 460
088-7288-i0	088-7288	101.6	15.0	720-880	99.0	612 / 612

RELATED PRODUCTS

Metallic Coated Mirrors
See page 1.24

Kinematic Mirror / Beamsplitter Mounts 840-0056
See page 7.38



HR > 99% @ 720-880nm, AOI=45°

LASER HARMONIC SEPARATORS

- Offered on Ø 0.5 or 1 inch UV FS substrates with surface flatness $\lambda/10$

Harmonic separators are dichroic beamsplitters that reflect one wavelength and transmit others. Reflectance is better than 99.5% for the wavelength of interest and transmittance is at least 90% for the rejected wavelengths. The rear surface of har-

monic separators is antireflection coated. If possible use shorter wavelength for reflection and longer wavelengths for transmission in order to have higher reflection/transmission coefficients.

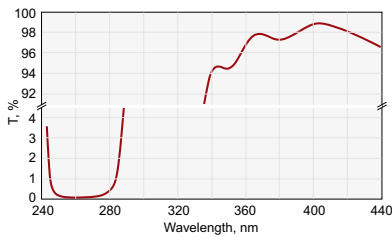
SUBSTRATE

Material	UV grade Fused Silica
S1 Surface Flatness	$\lambda/10$ typical at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	$\lambda/10$ typical at 633 nm
S2 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	± 0.25 mm
Parallelism	< 30 arcsec
Chamfer	0.3 mm at 45° typical

COATING

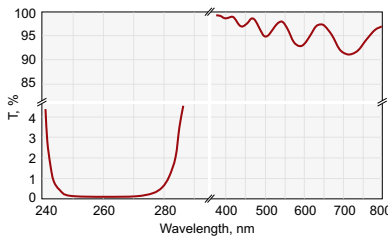
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Coated Surface Flatness	$\lambda/10$ at 633 nm over clear aperture
Back side antireflection coated	AOI 45°, R<0.5% AOI 0°, R<0.25%
Laser Damage Threshold	>100 mJ/cm ² , 50 fsec pulse, 800 nm typical

Reflected wavelength, nm, R > 99.5%	Transmitted wavelength, nm	Transmission, %	AOI	Substrate material	Catalogue number			Price, EUR
					Ø12.7x3 mm	Ø25.4x3 mm	Ø50.8x8 mm	
257-275	780-820	>95	0	UV FS	041-2800	042-2800	045-2800	145 / 175 / 265
257-275	780-820	>95	45	UV FS	041-2805	042-2805	045-2805	145 / 175 / 265
257-275	390-410	>95	0	UV FS	041-2400	042-2400	045-2400	145 / 175 / 265
257-275	390-410	>95	45	UV FS	041-2405	042-2405	045-2405	145 / 175 / 265
257-275	400+800	>90	0	UV FS	041-2480	042-2480	045-2480	165 / 195 / 295
257-275	400+800	>90	45	UV FS	041-2485	042-2485	045-2485	165 / 195 / 295
390-410	780-820	>95	0	UV FS	041-4800	042-4800	045-4800	145 / 175 / 265
390-410	780-820	>95	45	UV FS	041-4805	042-4805	045-4805	145 / 175 / 265
800	400	>93	0	UV FS	041-0840	042-0840	045-0840	140 / 170 / 255
800	400	>93	45	UV FS	041-0845	042-0845	045-0845	140 / 170 / 255
333-353	1000-1060	>95	0	UV FS	041-3130	042-3130	045-3130	135 / 165 / 245
333-353	1000-1060	>95	45	UV FS	041-3135	042-3135	045-3135	135 / 165 / 245
333-353	500-530	>95	0	UV FS	041-3450	042-3450	045-3450	135 / 165 / 245
333-353	500-530	>95	45	UV FS	041-3455	042-3455	045-3455	135 / 165 / 245
333-353	515+1030	>90	0	UV FS	041-3530	042-3530	045-3530	155 / 185 / 275
333-353	515+1030	>90	45	UV FS	041-3535	042-3535	045-3535	155 / 185 / 275
500-530	1000-1060	>95	0	UV FS	041-5130	042-5130	045-5130	135 / 165 / 245
500-530	1000-1060	>95	45	UV FS	041-5135	042-5135	045-5135	135 / 165 / 245
1030	515	>93	0	UV FS	041-6510	042-6510	045-6510	140 / 170 / 255
1030	515	>93	45	UV FS	041-6515	042-6515	045-6515	140 / 170 / 255



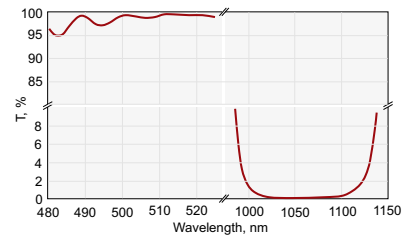
042-2405.

HR>99.5% @ 257-275 nm + HT>95% @ 390-410 nm, AOI=45°



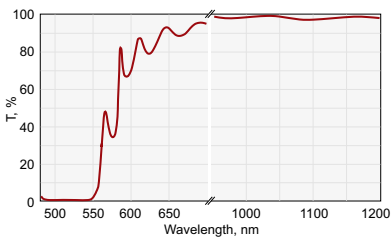
042-2485.

HR>99.5% @ 257-275 nm + HT>90% @ 400+800 nm, AOI=45°



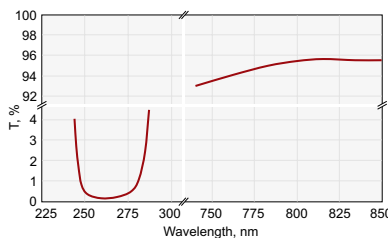
042-6515.

HR>99.5% @ 1030 nm + HT>93% @ 515 nm, AOI=45°



042-5135.

HR>99.5% @ 500-530 nm + HT>95% @ 1000-1060 nm, AOI=45°



042-2805.

HR>99.5% @ 257-275 nm + HT>95% @ 780-820 nm, AOI=45°

RELATED PRODUCTS

Pellin-Broca Prisms. See page 1.51

Adapter for Beamsplitter at 45°
840-0116. See page 7.41

Kinematic Mirror and Beamsplitter
Mount 840-0020. See page 7.33

LASER OUTPUT COUPLERS

• **Low Group Delay Dispersion**

An output coupler is a partially reflecting dielectric mirror used in a laser cavity. It transmits a part of the circulating intracavity power for generating a useful output from the laser.

A low transmission output coupler leads to low laser threshold and possibly to poor laser efficiency if the losses due to output coupling do not dominate other parasitic losses in the laser cavity. The output coupler transmission is often chosen to maximize the output power, although its optimum value may be lower or higher if there are other design purposes (minimizing intracavity intensities or suppressing Q-switching instabilities in a passively mode-locked laser).

The standard substrates are parallel within 30 arcsec. If you need wedged substrates, please, choose from chapter Wedge Prisms (page 1.49).

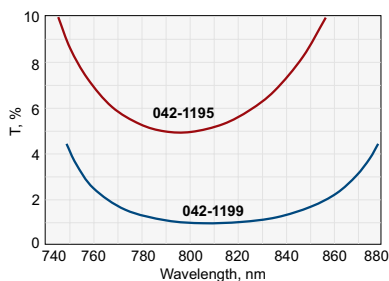
SUBSTRATE

Material	UV grade Fused Silica
S1 Surface Flatness	$\lambda/10$ typical at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	$\lambda/10$ typical at 633 nm
S2 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm -0.12 mm
Thickness Tolerance	± 0.25 mm
Parallelism	30 arcsec
Chamfer	0.3 mm at 45° typical

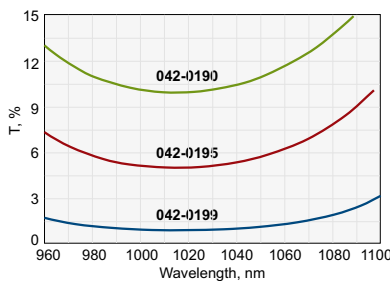
COATING

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0–8°
Parallelism	30 arcsec
Back side antireflection coated	$R < 0.25\%$
Laser Damage Threshold	>100 mJ/cm ² , 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number			Price, EUR
				$\varnothing 12.7 \times 3$ mm	$\varnothing 25.4 \times 6$ mm	$\varnothing 50.8 \times 8$ mm	
1030	50 \pm 3	50 \pm 3	UV FS	041-0150	042-0150	045-0150	105 / 125 / 205
1030	60 \pm 3	40 \pm 3	UV FS	041-0160	042-0160	045-0160	105 / 125 / 205
1030	65 \pm 3	35 \pm 3	UV FS	041-0165	042-0165	045-0165	105 / 125 / 205
1030	70 \pm 3	30 \pm 3	UV FS	041-0170	042-0170	045-0170	105 / 125 / 205
1030	75 \pm 3	25 \pm 3	UV FS	041-0175	042-0175	045-0175	105 / 125 / 205
1030	80 \pm 3	20 \pm 3	UV FS	041-0180	042-0180	045-0180	105 / 125 / 205
1030	85 \pm 3	15 \pm 3	UV FS	041-0185	042-0185	045-0185	105 / 125 / 205
1030	90 \pm 2	10 \pm 2	UV FS	041-0190	042-0190	045-0190	112 / 132 / 220
1030	95 \pm 2	5 \pm 2	UV FS	041-0195	042-0195	045-0195	112 / 132 / 220
1030	97 \pm 1	3 \pm 1	UV FS	041-0197	042-0197	045-0197	119 / 139 / 245
1030	98 \pm 1	2 \pm 1	UV FS	041-0198	042-0198	045-0198	119 / 139 / 245
1030	99.0 \pm 0.5	1.0 \pm 0.5	UV FS	041-0199	042-0199	045-0199	126 / 146 / 255
800	50 \pm 3	50 \pm 3	UV FS	041-1150	042-1150	045-1150	105 / 125 / 205
800	60 \pm 3	40 \pm 3	UV FS	041-1160	042-1160	045-1160	105 / 125 / 205
800	65 \pm 3	35 \pm 3	UV FS	041-1165	042-1165	045-1165	105 / 125 / 205
800	70 \pm 3	30 \pm 3	UV FS	041-1170	042-1170	045-1170	105 / 125 / 205
800	75 \pm 3	25 \pm 3	UV FS	041-1175	042-1175	045-1175	105 / 125 / 205
800	80 \pm 3	20 \pm 3	UV FS	041-1180	042-1180	045-1180	105 / 125 / 205
800	85 \pm 3	15 \pm 3	UV FS	041-1185	042-1185	045-1185	105 / 125 / 205
800	90 \pm 2	10 \pm 2	UV FS	041-1190	042-1190	045-1190	112 / 132 / 220
800	95 \pm 2	5 \pm 2	UV FS	041-1195	042-1195	045-1195	112 / 132 / 220
800	97 \pm 1	3 \pm 1	UV FS	041-1197	042-1197	045-1197	119 / 139 / 245
800	98 \pm 1	2 \pm 1	UV FS	041-1198	042-1198	045-1198	119 / 139 / 245
800	99.0 \pm 0.5	1.0 \pm 0.5	UV FS	041-1199	042-1199	045-1199	126 / 146 / 255



042-1199. PR = 99 \pm 0.5% @ 800 nm, T = 1 \pm 0.5%
042-1195. PR = 95 \pm 2% @ 800 nm, T = 5 \pm 2%



042-0199. PR = 99 \pm 0.5% @ 1030 nm, T = 1 \pm 0.5%
042-0195. PR = 95 \pm 2% @ 1030 nm, T = 5 \pm 2%
042-0190. PR = 90 \pm 2% @ 1030 nm, T = 10 \pm 2%

RELATED PRODUCTS

Uncoated Elliptical Mirrors

See page 1.10

Kinematic Mirror and Beamsplitter Mount 840-0020

See page 7.33



LASER REAR MIRRORS

High reflectivity ($R > 99.8\%$) dielectric coatings with high laser damage threshold are applied on laser rear mirrors. UV FS substrates are recommended for high power laser applications.

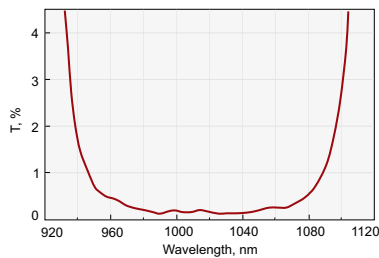
Back side can be AR coated to avoid back reflection from second surface on request.

SUBSTRATE

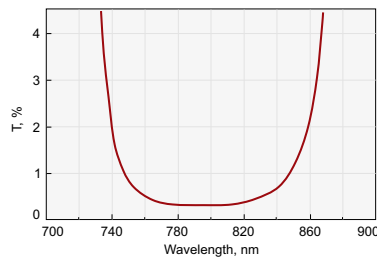
Material	UV grade Fused Silica or BK7 glass
S1 Surface Flatness	$\lambda/10$ at 633 nm
S1 Surface Quality	20–10 scratch & dig (MIL-PRF-13830B)
S2 Surface Quality	Commercial polish
Diameter Tolerance	+0.00 mm-0.12 mm
Thickness Tolerance	± 0.25
Chamfer	0.3 mm at 45° typical

COATING

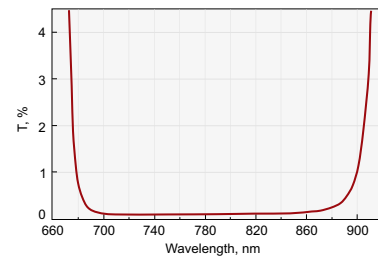
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0–8° (normal)
Coating	Hard dielectric high reflection: $R > 99.7\%$ at 800 nm and 1030 nm $R > 99\%$ at 720 – 880 nm
Laser Damage Threshold	$> 100 \text{ mJ/cm}^2$, 50 fsec pulse, 800 nm typical



HR > 99.7% @ 1030±30 nm, AOI=0°



HR > 99.7% @ 800±20 nm, AOI=0°



HR > 99.0% @ 720–880 nm, AOI=0°

Wavelength, nm	Substrate type	Radius, mm	Substrate material BK7			Substrate material UVFS		
			Catalogue number		Price, EUR	Catalogue number		Price, EUR
			Ø25.4 × 6 mm	Ø50.8 × 10 mm	Ø25.4 / Ø50.8	Ø25.4 × 6 mm	Ø50.8 × 10 mm	Ø25.4 / Ø50.8
1030±30	Plano-plano	∞	032-1030-i0	035-1030-i0 *	75 / 110	042-1030-i0	045-1030-i0 *	90 / 169
1030±30	Plano-concave	-50	012-8005	015-8005	99 / 145	022-8005	025-8005	119 / 209
1030±30	Plano-concave	-100	012-8010	015-8010	99 / 145	022-8010	025-8010	119 / 209
1030±30	Plano-concave	-150	012-8015	015-8015	99 / 145	022-8015	025-8015	119 / 209
1030±30	Plano-concave	-200	012-8020	015-8020	99 / 145	022-8020	025-8020	119 / 209
1030±30	Plano-concave	-250	012-8025	015-8025	99 / 145	022-8025	025-8025	119 / 209
1030±30	Plano-concave	-500	012-8050	015-8050	99 / 145	022-8050	025-8050	119 / 209
1030±30	Plano-concave	-1000	012-8100	015-8100	99 / 145	022-8100	025-8100	119 / 209
1030±30	Plano-concave	-2000	012-8200	015-8200	99 / 145	022-8200	025-8200	119 / 209
1030±30	Plano-concave	-2500	012-8250	015-8250	99 / 145	022-8250	025-8250	119 / 209
1030±30	Plano-concave	-4000	012-8400	015-8400	99 / 145	022-8400	025-8400	119 / 209
1030±30	Plano-concave	-5000	012-8500	015-8500	99 / 145	022-8500	025-8500	119 / 209
1030±30	Plano-convex	+100	012-9010	015-9010	103 / 155	022-9010	025-9010	123 / 219
1030±30	Plano-convex	+200	012-9020	015-9020	103 / 155	022-9020	025-9020	123 / 219
1030±30	Plano-convex	+500	012-9050	015-9050	103 / 155	022-9050	025-9050	123 / 219
1030±30	Plano-convex	+1000	012-9100	015-9100	103 / 155	022-9100	025-9100	123 / 219
1030±30	Plano-convex	+2000	012-9200	015-9200	103 / 155	022-9200	025-9200	123 / 219
1030±30	Plano-convex	+4000	012-9400	015-9400	103 / 155	022-9400	025-9400	123 / 219

* Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.

Wavelength, nm	Substrate type	Radius, mm	Substrate material BK7			Substrate material UVFS		
			Catalogue number		Price, EUR Ø25.4 / Ø50.8	Catalogue number		Price, EUR Ø25.4 / Ø50.8
			Ø25.4 × 6 mm	Ø50.8 × 10 mm		Ø25.4 × 6 mm	Ø50.8 × 10 mm	
800±20	Plano-plano	-∞	032-0800-i0	035-0800-i0 *	85 / 133	042-0800-i0	045-0800-i0 *	97 / 181
800±20	Plano-concave	-50	062-8005	065-8005	99 / 145	082-8005	085-8005	119 / 209
800±20	Plano-concave	-100	062-8010	065-8010	99 / 145	082-8010	085-8010	119 / 209
800±20	Plano-concave	-150	062-8015	065-8015	99 / 145	082-8015	085-8015	119 / 209
800±20	Plano-concave	-200	062-8020	065-8020	99 / 145	082-8020	085-8020	119 / 209
800±20	Plano-concave	-250	062-8025	065-8025	99 / 145	082-8025	085-8025	119 / 209
800±20	Plano-concave	-500	062-8050	065-8050	99 / 145	082-8050	085-8050	119 / 209
800±20	Plano-concave	-1000	062-8100	065-8100	99 / 145	082-8100	085-8100	119 / 209
800±20	Plano-concave	-2000	062-8200	065-8200	99 / 145	082-8200	085-8200	119 / 209
800±20	Plano-concave	-2500	062-8250	065-8250	99 / 145	082-8250	085-8250	119 / 209
800±20	Plano-concave	-4000	062-8400	065-8400	99 / 145	082-8400	085-8400	119 / 209
800±20	Plano-concave	-5000	062-8500	065-8500	99 / 145	082-8500	085-8500	119 / 209
800±20	Plano-convex	+100	062-9010	065-9010	103 / 155	082-9010	085-9010	123 / 219
800±20	Plano-convex	+200	062-9020	065-9020	103 / 155	082-9020	085-9020	123 / 219
800±20	Plano-convex	+500	062-9050	065-9050	103 / 155	082-9050	085-9050	123 / 219
800±20	Plano-convex	+1000	062-9100	065-9100	103 / 155	082-9100	085-9100	123 / 219
800±20	Plano-convex	+2000	062-9200	065-9200	103 / 155	082-9200	085-9200	123 / 219
800±20	Plano-convex	+4000	062-9400	065-9400	103 / 155	082-9400	085-9400	123 / 219

* Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.

Wavelength, nm	Substrate type	Radius, mm	Substrate material BK7			Substrate material UVFS		
			Catalogue number		Price, EUR Ø25.4 / Ø50.8	Catalogue number		Price, EUR Ø25.4 / Ø50.8
			Ø25.4 × 6 mm	Ø50.8 × 10 mm		Ø25.4 × 6 mm	Ø50.8 × 10 mm	
720-880	Plano-plano	∞	072-7288-i0	075-7288-i0 *	104 / 220	082-7288-i0	085-7288-i0 *	129 / 255
720-880	Plano-concave	-50	062-8005B	065-8005B	128 / 245	082-8005B	085-8005B	153 / 280
720-880	Plano-concave	-100	062-8010B	065-8010B	128 / 245	082-8010B	085-8010B	153 / 280
720-880	Plano-concave	-150	062-8015B	065-8015B	128 / 245	082-8015B	085-8015B	153 / 280
720-880	Plano-concave	-200	062-8020B	065-8020B	128 / 245	082-8020B	085-8020B	153 / 280
720-880	Plano-concave	-250	062-8025B	065-8025B	128 / 245	082-8025B	085-8025B	153 / 280
720-880	Plano-concave	-500	062-8050B	065-8050B	128 / 245	082-8050B	085-8050B	153 / 280
720-880	Plano-concave	-1000	062-8100B	065-8100B	128 / 245	082-8100B	085-8100B	153 / 280
720-880	Plano-concave	-2000	062-8200B	065-8200B	128 / 245	082-8200B	085-8200B	153 / 280
720-880	Plano-concave	-2500	062-8250B	065-8250B	128 / 245	082-8250B	085-8250B	153 / 280
720-880	Plano-concave	-3000	062-8300B	065-8300B	128 / 245	082-8300B	085-8300B	153 / 280
720-880	Plano-concave	-4000	062-8400B	065-8400B	128 / 245	082-8400B	085-8400B	153 / 280
720-880	Plano-concave	-5000	062-8500B	065-8500B	128 / 245	082-8500B	085-8500B	153 / 280
720-880	Plano-convex	100	062-9010B	065-9010B	132 / 250	082-9010B	085-9010B	157 / 285
720-880	Plano-convex	200	062-9020B	065-9020B	132 / 250	082-9020B	085-9020B	157 / 285
720-880	Plano-convex	500	062-9050B	065-9050B	132 / 250	082-9050B	085-9050B	157 / 285
720-880	Plano-convex	600	062-9060B	065-9060B	132 / 250	082-9060B	085-9060B	157 / 285
720-880	Plano-convex	1000	062-9100B	065-9100B	132 / 250	082-9100B	085-9100B	157 / 285
720-880	Plano-convex	1500	062-9150B	065-9150B	132 / 250	082-9150B	085-9150B	157 / 285
720-880	Plano-convex	2000	062-9200B	065-9200B	132 / 250	082-9200B	085-9200B	157 / 285
720-880	Plano-convex	4000	062-9400B	065-9400B	132 / 250	082-9400B	085-9400B	157 / 285

* Thickness of plano-plano rear mirrors of Ø50.8 is 8 mm.

RELATED PRODUCTS

Uncoated Curved Windows

See page 1.8

Kinematic Mirror Mount 840-0010

See page 7.33



Kinematic Mirror and Beamsplitter Mount 840-0020

See page 7.33



LASER BEAMSPLITTERS

Beamsplitter splits average polarized laser beam in two beams separated 90° from each other.

The standard substrate thickness is 3 mm. If you need thinner substrate, please, choose from chapter Precision Thin Round Windows (page 1.11).

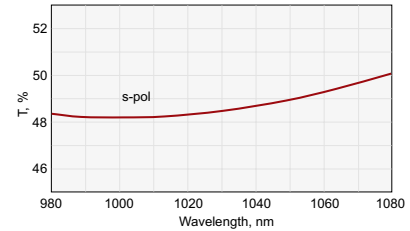
SUBSTRATE

Material	UV FS
S1 Surface Flatness	$\lambda/10$ at 633 nm
S1 Surface Quality	20-10 scratch & dig (MIL-PRF-13830B)
S2 Surface Flatness	$\lambda/10$ at 633 nm
S2 Surface Quality	20-10 scratch & dig (MIL-PRF-13830B)
Diameter Tolerance	+0.00 mm-0.12 mm
Thickness Tolerance	± 0.25
Parallelism	30 arcsec
Chamfer	0.3 mm at 45° typical

COATING

Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	45 \pm 3°
Back side antireflection coated	R<0.5%

Please contact us for wedged beamsplitters or choose wedged substrates from Wedge Prisms (page 1.49)



032-7450S. Rs=50% @ 1030 nm, AOI=45°

Designed for average polarization: $R=(R_s+R_p)/2$ and $T=(T_s+T_p)/2$

Laser Damage Threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number			Price, EUR
				Ø12.7 × 3 mm	Ø25.4 × 3 mm	Ø50.8 × 8 mm	
1030	20±3	80±3	UV FS	031-7420A	032-7420A	035-7420A	105 / 125 / 205
1030	30±3	70±3	UV FS	031-7430A	032-7430A	035-7430A	105 / 125 / 205
1030	50±3	50±3	UV FS	031-7450A	032-7450A	035-7450A	105 / 125 / 205
1030	70±3	30±3	UV FS	031-7470A	032-7470A	035-7470A	105 / 125 / 205
1030	80±3	20±3	UV FS	031-7480A	032-7480A	035-7480A	105 / 125 / 205
515	20±3	80±3	UV FS	031-7520A	032-7520A	035-7520A	103 / 123 / 200
515	30±3	70±3	UV FS	031-7530A	032-7530A	035-7530A	103 / 123 / 200
515	50±3	50±3	UV FS	031-7550A	032-7550A	035-7550A	103 / 123 / 200
515	70±3	30±3	UV FS	031-7570A	032-7570A	035-7570A	103 / 123 / 200
515	80±3	20±3	UV FS	031-7580A	032-7580A	035-7580A	103 / 123 / 200
343	20±3	80±3	UV FS	031-7620A	032-7620A	035-7620A	110 / 140 / 245
343	30±3	70±3	UV FS	031-7630A	032-7630A	035-7630A	110 / 140 / 245
343	50±3	50±3	UV FS	031-7650A	032-7650A	035-7650A	110 / 140 / 245
343	70±3	30±3	UV FS	031-7670A	032-7670A	035-7670A	110 / 140 / 245
343	80±3	20±3	UV FS	031-7680A	032-7680A	035-7680A	110 / 140 / 245
800	20±3	80±3	UV FS	041-7720A	042-7720A	045-7720A	105 / 125 / 205
800	30±3	70±3	UV FS	041-7730A	042-7730A	045-7730A	105 / 125 / 205
800	50±3	50±3	UV FS	041-7750A	042-7750A	045-7750A	105 / 125 / 205
800	70±3	30±3	UV FS	041-7770A	042-7770A	045-7770A	105 / 125 / 205
800	80±3	20±3	UV FS	041-7780A	042-7780A	045-7780A	105 / 125 / 205
400	20±3	80±3	UV FS	041-7820A	042-7820A	045-7820A	103 / 123 / 200
400	30±3	70±3	UV FS	041-7830A	042-7830A	045-7830A	103 / 123 / 200
400	50±3	50±3	UV FS	041-7850A	042-7850A	045-7850A	103 / 123 / 200
400	70±3	30±3	UV FS	041-7870A	042-7870A	045-7870A	103 / 123 / 200
400	80±3	20±3	UV FS	041-7880A	042-7880A	045-7880A	103 / 123 / 200
266	20±3	80±3	UV FS	041-7920A	042-7920FA	045-7920A	115 / 145 / 265
266	30±3	70±3	UV FS	041-7930A	042-7930FA	045-7930A	115 / 145 / 265
266	50±3	50±3	UV FS	041-7950A	042-7950FA	045-7950A	115 / 145 / 265
266	70±3	30±3	UV FS	041-7970A	042-7970FA	045-7970A	115 / 145 / 265
266	80±3	20±3	UV FS	041-7980A	042-7980FA	045-7980A	115 / 145 / 265

Designed for S- polarization. Laser Damage Threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number			Price, EUR Ø12.7 / Ø25.4 / Ø50.8
				Ø12.7 × 3 mm	Ø25.4 × 3 mm	Ø50.8 × 8 mm	
1030	20±3	80±3	UV FS	031-7420S	032-7420S	035-7420S	105 / 125 / 205
1030	30±3	70±3	UV FS	031-7430S	032-7430S	035-7430S	105 / 125 / 205
1030	50±3	50±3	UV FS	031-7450S	032-7450S	035-7450S	105 / 125 / 205
1030	70±3	30±3	UV FS	031-7470S	032-7470S	035-7470S	105 / 125 / 205
1030	80±3	20±3	UV FS	031-7480S	032-7480S	035-7480S	105 / 125 / 205
515	20±3	80±3	UV FS	031-7520S	032-7520S	035-7520S	103 / 123 / 200
515	30±3	70±3	UV FS	031-7530S	032-7530S	035-7530S	103 / 123 / 200
515	50±3	50±3	UV FS	031-7550S	032-7550S	035-7550S	103 / 123 / 200
515	70±3	30±3	UV FS	031-7570S	032-7570S	035-7570S	103 / 123 / 200
515	80±3	20±3	UV FS	031-7580S	032-7580S	035-7580S	103 / 123 / 200
343	20±3	80±3	UV FS	031-7620S	032-7620S	035-7620S	110 / 140 / 245
343	30±3	70±3	UV FS	031-7630S	032-7630S	035-7630S	110 / 140 / 245
343	50±3	50±3	UV FS	031-7650S	032-7650S	035-7650S	110 / 140 / 245
343	70±3	30±3	UV FS	031-7670S	032-7670S	035-7670S	110 / 140 / 245
343	80±3	20±3	UV FS	031-7680S	032-7680S	035-7680S	110 / 140 / 245
800	20±3	80±3	UV FS	041-7720S	042-7720S	045-7720S	105 / 125 / 205
800	30±3	70±3	UV FS	041-7730S	042-7730S	045-7730S	105 / 125 / 205
800	50±3	50±3	UV FS	041-7750S	042-7750S	045-7750S	105 / 125 / 205
800	70±3	30±3	UV FS	041-7770S	042-7770S	045-7770S	105 / 125 / 205
800	80±3	20±3	UV FS	041-7780S	042-7780S	045-7780S	105 / 125 / 205
400	20±3	80±3	UV FS	041-7820S	042-7820S	045-7820S	103 / 123 / 200
400	30±3	70±3	UV FS	041-7830S	042-7830S	045-7830S	103 / 123 / 200
400	50±3	50±3	UV FS	041-7850S	042-7850S	045-7850S	103 / 123 / 200
400	70±3	30±3	UV FS	041-7870S	042-7870S	045-7870S	103 / 123 / 200
400	80±3	20±3	UV FS	041-7880S	042-7880S	045-7880S	103 / 123 / 200
266	20±3	80±3	UV FS	041-7920S	042-7920FS	045-7920S	115 / 145 / 265
266	30±3	70±3	UV FS	041-7930S	042-7930FS	045-7930S	115 / 145 / 265
266	50±3	50±3	UV FS	041-7950S	042-7950FS	045-7950S	115 / 145 / 265
266	70±3	30±3	UV FS	041-7970S	042-7970FS	045-7970S	115 / 145 / 265
266	80±3	20±3	UV FS	041-7980S	042-7980FS	045-7980S	115 / 145 / 265

Designed for P- polarization. Laser Damage Threshold: >100 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number			Price, EUR Ø12.7 / Ø25.4 / Ø50.8
				Ø12.7 × 3 mm	Ø25.4 × 3 mm	Ø50.8 × 8 mm	
1030	20±3	80±3	UV FS	031-7420P	032-7420P	035-7420P	105 / 125 / 205
1030	30±3	70±3	UV FS	031-7430P	032-7430P	035-7430P	105 / 125 / 205
1030	50±3	50±3	UV FS	031-7450P	032-7450P	035-7450P	105 / 125 / 205
1030	70±3	30±3	UV FS	031-7470P	032-7470P	035-7470P	105 / 125 / 205
1030	80±3	20±3	UV FS	031-7480P	032-7480P	035-7480P	105 / 125 / 205
515	20±3	80±3	UV FS	031-7520P	032-7520P	035-7520P	103 / 123 / 200
515	30±3	70±3	UV FS	031-7530P	032-7530P	035-7530P	103 / 123 / 200
515	50±3	50±3	UV FS	031-7550P	032-7550P	035-7550P	103 / 123 / 200
515	70±3	30±3	UV FS	031-7570P	032-7570P	035-7570P	103 / 123 / 200
515	80±3	20±3	UV FS	031-7580P	032-7580P	035-7580P	103 / 123 / 200
343	20±3	80±3	UV FS	031-7620P	032-7620P	035-7620P	110 / 140 / 245
343	30±3	70±3	UV FS	031-7630P	032-7630P	035-7630P	110 / 140 / 245
343	50±3	50±3	UV FS	031-7650P	032-7650P	035-7650P	110 / 140 / 245
343	70±3	30±3	UV FS	031-7670P	032-7670P	035-7670P	110 / 140 / 245
343	80±3	20±3	UV FS	031-7680P	032-7680P	035-7680P	110 / 140 / 245
800	20±3	80±3	UV FS	041-7720P	042-7720P	045-7720P	105 / 125 / 205
800	30±3	70±3	UV FS	041-7730P	042-7730P	045-7730P	105 / 125 / 205
800	50±3	50±3	UV FS	041-7750P	042-7750P	045-7750P	105 / 125 / 205
800	70±3	30±3	UV FS	041-7770P	042-7770P	045-7770P	105 / 125 / 205
800	80±3	20±3	UV FS	041-7780P	042-7780P	045-7780P	105 / 125 / 205
400	20±3	80±3	UV FS	041-7820P	042-7820P	045-7820P	103 / 123 / 200
400	30±3	70±3	UV FS	041-7830P	042-7830P	045-7830P	103 / 123 / 200
400	50±3	50±3	UV FS	041-7850P	042-7850P	045-7850P	103 / 123 / 200
400	70±3	30±3	UV FS	041-7870P	042-7870P	045-7870P	103 / 123 / 200
400	80±3	20±3	UV FS	041-7880P	042-7880P	045-7880P	103 / 123 / 200
266	20±3	80±3	UV FS	041-7920P	042-7920FP	045-7920P	115 / 145 / 265
266	30±3	70±3	UV FS	041-7930P	042-7930FP	045-7930P	115 / 145 / 265
266	50±3	50±3	UV FS	041-7950P	042-7950FP	045-7950P	115 / 145 / 265
266	70±3	30±3	UV FS	041-7970P	042-7970FP	045-7970P	115 / 145 / 265
266	80±3	20±3	UV FS	041-7980P	042-7980FP	045-7980P	115 / 145 / 265

Broadband Laser Beamsplitters

Designed for S- polarization. Laser Damage Threshold: >50 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number		Price, EUR Ø25.4 / Ø50.8
				Ø25.4 × 3 mm	Ø50.8 × 6 mm	
720 – 880	8±1	92±1	UV FS	042-7708SB	045-7708SB	110 / 185
720 – 880	20±5	80±5	UV FS	042-7720SB	045-7720SB	185 / 340
720 – 880	30±5	70±5	UV FS	042-7730SB	045-7730SB	185 / 340
720 – 880	40±5	60±5	UV FS	042-7740SB	045-7740SB	185 / 340
720 – 880	50±5	50±5	UV FS	042-7750SB	045-7750SB	185 / 340
720 – 880	60±5	40±5	UV FS	042-7760SB	045-7760SB	190 / 360
720 – 880	70±5	30±5	UV FS	042-7770SB	045-7770SB	195 / 390
720 – 880	80±5	20±5	UV FS	042-7780SB	045-7780SB	195 / 390
720 – 880	90±3	10±3	UV FS	042-7790SB	045-7790SB	215 / 440
720 – 880	95±2	5±2	UV FS	042-7795SB	045-7795SB	225 / 470

Designed for P- polarization. Laser Damage Threshold: >50 mJ/cm², 50 fsec pulse, 800 nm typical

Wavelength, nm	Reflection, %	Transmission, %	Substrate material	Catalogue number		Price, EUR Ø25.4 / Ø50.8
				Ø25.4 × 3 mm	Ø50.8 × 6 mm	
750 – 850	10±2	90±2	UV FS	042-7710PB	045-7710PB	185 / 340
750 – 850	20±5	80±5	UV FS	042-7720PB	045-7720PB	185 / 340
750 – 850	25±5	75±5	UV FS	042-7725PB	045-7725PB	185 / 340
750 – 850	30±5	70±5	UV FS	042-7730PB	045-7730PB	185 / 340
750 – 850	40±5	60±5	UV FS	042-7740PB	045-7740PB	185 / 340
750 – 850	50±5	50±5	UV FS	042-7750PB	045-7750PB	185 / 340
750 – 850	60±5	40±5	UV FS	042-7760PB	045-7760PB	190 / 360
750 – 850	70±5	30±5	UV FS	042-7770PB	045-7770PB	195 / 390
750 – 850	75±5	25±5	UV FS	042-7775PB	045-7775PB	195 / 390
750 – 850	80±5	20±5	UV FS	042-7780PB	045-7780PB	195 / 390
750 – 850	90±3	10±3	UV FS	042-7790PB	045-7790PB	215 / 440
750 – 850	95±2	5±2	UV FS	042-7795PB	045-7795PB	225 / 470

RELATED PRODUCTS

Uncoated Elliptical Mirrors

See page 1.10

Kinematic Mirror and Beamsplitter Mount 840-0030-02

See page 7.33



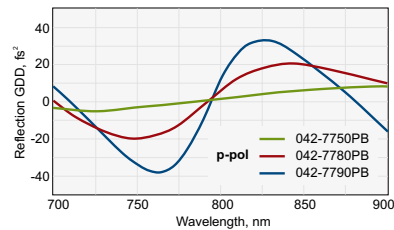
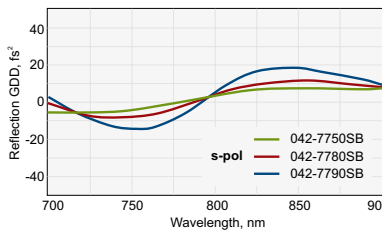
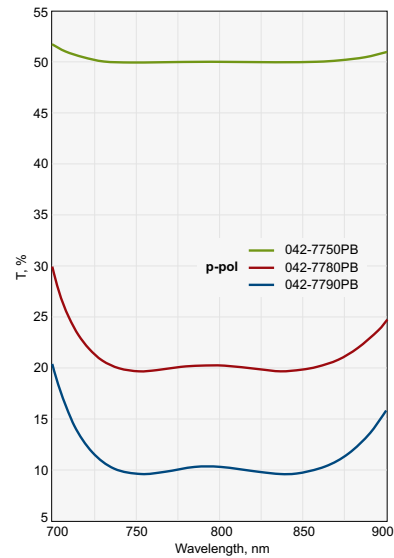
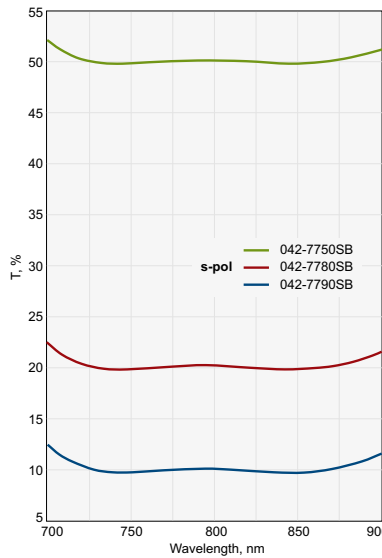
Adapter for Beamsplitter at 45° 840-0116

See page 7.41



Flipping Mirror / Beamsplitter Mount 840-0155

See page 7.45



042-7750SB. Rs=50±5% @ 720-880 nm, AOI=45°
042-7780SB. Rp=80±5% @ 720-880 nm, AOI=45°
042-7790SB. Rp=90±3% @ 720-880 nm, AOI=45°

042-7750PB. Rp=50±5% @ 750-850 nm, AOI=45°
042-7780PB. Rp=80±5% @ 750-850 nm, AOI=45°
042-7790PB. Rp=90±3% @ 750-850 nm, AOI=45°

THIN LENSES

- **Very thin: edge thickness varies from 0.5~1.9 mm**
- **Centre thickness varies from 1~3 mm**
- **Plano-Convex or Plano-Concave type**
- **Uncoated, AR coated @ 333-353 nm, AR coated @ 380-420 nm, AR coated @ 500-530 nm, AR coated @ 515+1030 nm, AR coated @ 760-840 nm, AR coated @ 1000-1060 nm, BBAR @ 700-900 nm, UBBAR @ 350-900 nm**

EKSMA OPTICS introduces Ultrathin Lenses series for femtosecond applications. Femtosecond application often requires Low Group Delay Dispersion optics. Our below given Thin UVFS lenses are ideal in this case.

SPECIFICATIONS

Material	UV FS
Surface quality	40-20 scratch & dig (MIL-PRF-13830B)
Clear aperture	90% of the diameter
Diameter tolerance	+0.00, -0.12 mm
Thickness tolerance	±0.2 mm
Surface irregularity	λ/8 @ 633 nm
Concentricity	3 arcmin
Paraxial focal length	±2% @ 800 nm

Other sizes and focal length are available on request.

Thin Plano-Convex Lenses, Ø12.7 mm

Uncoated lenses. Material – UVFS. Diameter D = Ø12.7 mm

Catalogue number	Centre Thickness CT, mm	Edge Thickness ET, mm	Focal Length, mm @ 800 nm	Radius, mm	Price, EUR
110-1106ET	2.5	1.0	30	13.6	60
110-1108ET	1.8	0.7	40	18.1	60
110-1109ET	1.9	1.0	50	22.7	60
110-1111ET	1.8	1.2	75	34.0	60
110-1115ET	1.5	0.9	100	45.3	60
110-1117ET	1.4	1.0	125	56.7	60
110-1119ET	1.5	1.2	150	68.0	60
110-1121ET	1.2	1.0	175	79.3	60
110-1123ET	1.2	1.0	200	90.7	60
110-1126ET	1.1	1.0	250	113.3	60
110-1129ET	1.1	1.0	300	136.0	60
110-1133ET	1.1	1.0	400	181.3	60
110-1135ET	1.1	1.0	450	204.0	60
110-1137ET	1.1	1.0	500	226.7	60

Thin Plano-Convex Lenses, Ø25.4 mm

Uncoated lenses. Material – UVFS. Diameter D = Ø25.4 mm

Catalogue number	Centre Thickness CT, mm	Edge Thickness ET, mm	Focal Length, mm @ 800 nm	Radius, mm	Price, EUR
110-1205ET	4.9	1.0	50	22.7	80
110-1209ET	3	0.5	75	34.0	80
110-1211ET	2.5	0.7	100	45.3	80
110-1216ET	2	0.6	125	56.7	80
110-1217ET	2	0.8	150	68.0	80
110-1219ET	2	1.1	200	90.7	80
110-1223ET	2	1.4	300	136.0	80
110-1225ET	2	1.5	350	158.7	80
110-1227ET	2	1.6	400	181.3	80
110-1231ET	2	1.6	450	204.0	80
110-1233ET	2	1.6	500	226.7	80
110-1245ET	1.5	1.3	1000	453.3	80
110-1255ET	1.4	1.3	1500	680.0	80
110-1265ET	1.4	1.3	2000	906.6	80

Thin Plano-Convex Lenses, Ø50.8 mm

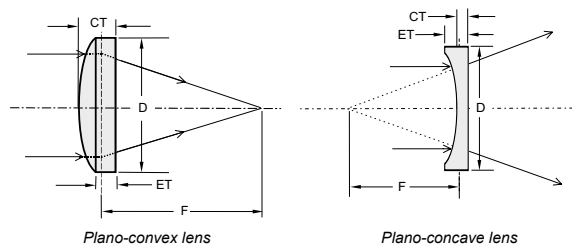
Uncoated lenses. Material – UVFS. Diameter D = Ø50.8 mm

Catalogue number	Centre Thickness CT, mm	Edge Thickness ET, mm	Focal Length, mm @ 800 nm	Radius, mm	Price, EUR
110-1505ET	14	2.5	75	34.0	180
110-1509ET	10.3	2.5	100	45.3	180
110-1511ET	7.4	2.5	150	68.0	180
110-1515ET	6.1	2.5	200	90.7	180
110-1519ET	4.9	2.5	300	136.0	180
110-1523ET	4.3	2.5	400	181.3	180
110-1527ET	3.9	2.5	500	226.7	180
110-1545ET	3.2	2.5	1000	453.3	180
110-1550ET	3	2.5	1500	680.0	180
110-1555ET	2.9	2.5	2000	906.6	180
110-1566ET	2.7	2.5	3000	1360.0	180
110-1568ET	2.7	2.5	4000	1813.3	180
110-1567ET	2.6	2.5	5000	2266.6	180
110-1570ET	2.6	2.5	6000	2719.9	180

Thin Plano-Concave Lenses, Ø12.7 mm

Uncoated lenses. Material – UVFS. Diameter D = Ø12.7 mm

Catalogue number	Centre Thickness CT, mm	Edge Thickness ET, mm	Focal Length, mm @ 800 nm	Radius, mm	Price, EUR
112-1104ET	1	3.5	-20	-9.1	60
112-1106ET	1	2.5	-30	-13.6	60
112-1108ET	1	2.1	-40	-18.1	60
112-1109ET	1	1.9	-50	-22.7	60
112-1110ET	1	1.7	-60	-27.2	60
112-1112ET	1	1.5	-75	-34.0	60
112-1113ET	1	1.5	-80	-36.3	60
112-1115ET	1	1.4	-100	-45.3	60
112-1117ET	1	1.3	-125	-56.7	60
112-1119ET	1	1.2	-150	-68.0	60



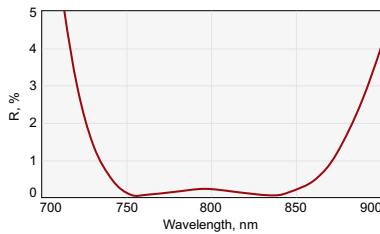
Available Standard Coatings for Thin Lenses

SPECIFICATIONS

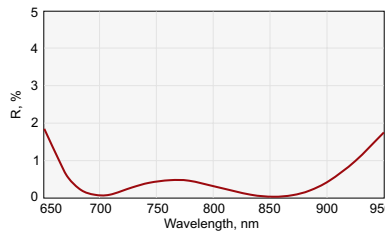
Technology	Electron beam multilayer dielectric
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0°
Coated Surface Flatness	$\lambda/10$ at 633 nm over clear aperture

Available Coatings

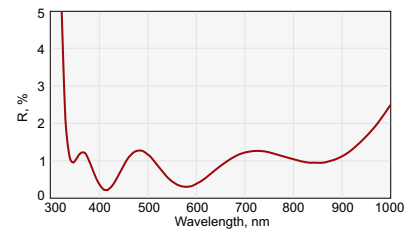
Coating suffix	Wavelength	Reflection per surface	Laser Damage Threshold	Price per unit to be added, EUR/pc.
AR	760 – 840 nm	R<0.5%	100 mJ/cm ²	29
BBAR	700 – 900 nm	R<0.5%	50 mJ/cm ²	50
UBBAR	350 – 900 nm	R<1.5%	50 mJ/cm ²	60
AR1030	1000 – 1060 nm	R<0.3%	100 mJ/cm ²	29
AR515	500 – 530 nm	R<0.4%	100 mJ/cm ²	29
AR400	380 – 420 nm	R<0.5%	100 mJ/cm ²	29
AR343	333 – 353 nm	R<0.5%	100 mJ/cm ²	29
ARD	515 + 1030 nm	R<0.5%	100 mJ/cm ²	35



Reflectivity @ 760-840 nm



Reflectivity @ 700-900 nm



Reflectivity @ 350-900 nm

Available IBS Coatings for Thin Lenses

SPECIFICATIONS

Technology	Ion Beam Sputtering (IBS)
Adhesion and Durability	Per MIL-C-675A. Insoluble in lab solvents
Clear Aperture	Exceeds central 85% of diameter
Angle of Incidence	0°
Coated Surface Flatness	$\lambda/10$ at 633 nm over clear aperture

Available Coatings

Coating suffix	Wavelength	Reflection per surface	Laser Damage Threshold	Price per unit to be added, EUR/pc.
AR800HT	760 – 840 nm	R<0.1%	100 mJ/cm ²	105
ARB800HT	700 – 900 nm	R<0.1%	100 mJ/cm ²	115
AR400HT	380 – 420 nm	R<0.2%	50 mJ/cm ²	105
ARD800HT	400 + 800 nm	R<0.2%	50 mJ/cm ²	115
AR1030HT	1000 – 1060 nm	R<0.1%	100 mJ/cm ²	105
AR515HT	500 – 530 nm	R<0.1%	50 mJ/cm ²	105
AR343HT	333 – 353 nm	R<0.2%	25 mJ/cm ²	135
ARD1030HT	515 + 1030 nm	R<0.1%	50 mJ/cm ²	115

Ordering of Coated Thin Lenses

Please choose the coating and add its suffix to the lens code.

Example:

UVFS Thin Plano-Convex Lens, focal length 75 mm, coated AR / AR @ 760-840 nm
 Code: **110-1209ET + AR**, Price: 80 + 29 EUR= 109 EUR/pc.



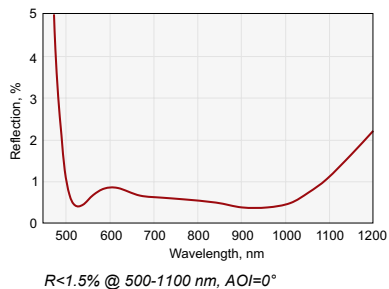
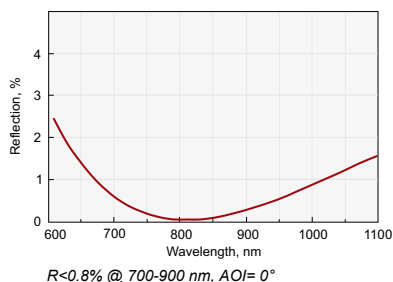
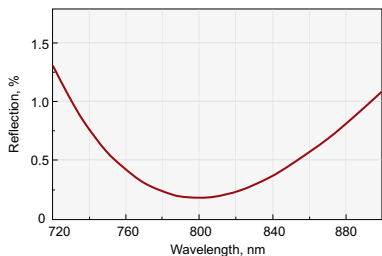
AR COATED LENS KITS



Large Lenses Kit

Lens kits contain different types (plano-convex, biconvex, plano-concave, biconcave) of Ø25.4 mm lenses with various focal lengths. Kits are packed into foam lined plastic the new plastic boxes for safe handling and storage.

Large lens kit consists of 40 lenses and small lens kit consists of 15 lenses made of UVFS. Kits are available with laser line and broadband multilayer anti-reflection coatings.



Large UV FS Lenses Kit (40 pcs.)

Code	Coating	Price, EUR
140-1240-AR210-400	BBAR @ 210–400 nm, R<2%	3490
140-1240-AR350-900	BBAR @ 350–900 nm, R<1.5%	3290
140-1240-AR760-840	BBAR @ 760–840 nm, R<0.4%	3040
140-1240-AR700-900	BBAR @ 700–900 nm, R<0.8%	3210
140-1240-AR650-1100	BBAR @ 650–1100 nm, R<1%	3310
140-1240-AR266	AR @ 266 nm, R<0.4%	3130
140-1240-AR1030	AR @ 1030 nm, R<0.25%	2930
140-1240-AR515	AR @ 515 nm, R<0.25%	2930
140-1240-AR343	AR @ 343 nm, R<0.3%	3030
140-1240-AR258	AR @ 258 nm, R<0.4%	3130

Large UV FS Lens Kit

Code	Type	Dia, mm	F, mm	Code	Type	Dia, mm	F, mm
110-1203E	pl/cx	25.4	30	111-1218E	bi/cx	25.4	100
110-1205E	pl/cx	25.4	50	111-1222E	bi/cx	25.4	150
110-1209E	pl/cx	25.4	75	111-1226E	bi/cx	25.4	200
110-1210E	pl/cx	25.4	80	111-1230E	bi/cx	25.4	250
110-1211E	pl/cx	25.4	100	111-1234E	bi/cx	25.4	300
110-1216E	pl/cx	25.4	125	111-1238E	bi/cx	25.4	400
110-1217E	pl/cx	25.4	150	111-1240E	bi/cx	25.4	500
110-1219E	pl/cx	25.4	200	111-1260E	bi/cx	25.4	1000
110-1221E	pl/cx	25.4	250	112-1205E	pl/cv	25.4	-50
110-1223E	pl/cx	25.4	300	112-1209E	pl/cv	25.4	-75
110-1225E	pl/cx	25.4	350	112-1211E	pl/cv	25.4	-100
110-1227E	pl/cx	25.4	400	112-1217E	pl/cv	25.4	-150
110-1233E	pl/cx	25.4	500	112-1219E	pl/cv	25.4	-200
110-1235E	pl/cx	25.4	600	112-1223E	pl/cv	25.4	-300
110-1239E	pl/cx	25.4	750	114-1204E	bi/cv	25.4	-25
110-1245E	pl/cx	25.4	1000	114-1208E	bi/cv	25.4	-50
111-1204E	bi/cx	25.4	25	114-1212E	bi/cv	25.4	-75
111-1207E	bi/cx	25.4	40	114-1216E	bi/cv	25.4	-100
111-1210E	bi/cx	25.4	50	114-1220E	bi/cv	25.4	-150
111-1214E	bi/cx	25.4	75	114-1224E	bi/cv	25.4	-200

Small UV FS Lenses Kit (15 pcs.)

Code	Coating	Price, EUR
140-1215-AR210-400	BBAR @ 210–400 nm, R<2%	1830
140-1215-AR350-900	BBAR @ 350–900 nm, R<1.5%	1660
140-1215-AR760-840	BBAR @ 760–840 nm, R<0.4%	1530
140-1215-AR700-900	BBAR @ 700–900 nm, R<0.8%	1610
140-1215-AR650-1100	BBAR @ 650–1100 nm, R<1%	1670
140-1215-AR266	AR @ 266 nm, R<0.4%	1380
140-1215-AR1030	AR @ 1030 nm, R<0.25%	1320
140-1215-AR515	AR @ 515 nm, R<0.25%	1320
140-1215-AR343	AR @ 343 nm, R<0.3%	1350
140-1215-AR258	AR @ 258 nm, R<0.4%	1380

Small UV FS Lens Kit

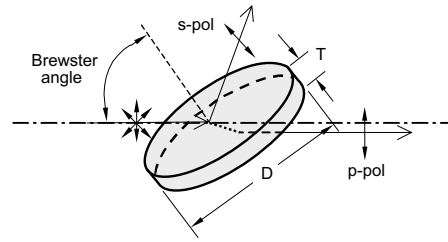
Code	Type	Dia, mm	F, mm	Code	Type	Dia, mm	F, mm
110-1203E	pl/cx	25.4	30	110-1233E	pl/cx	25.4	500
110-1205E	pl/cx	25.4	50	110-1245E	pl/cx	25.4	1000
110-1209E	pl/cx	25.4	75	112-1205E	pl/cv	25.4	-50
110-1211E	pl/cx	25.4	100	112-1209E	pl/cv	25.4	-75
110-1216E	pl/cx	25.4	125	112-1211E	pl/cv	25.4	-100
110-1217E	pl/cx	25.4	150	112-1215E	pl/cv	25.4	-125
110-1219E	pl/cx	25.4	200	112-1217E	pl/cv	25.4	-150
110-1223E	pl/cx	25.4	300				

THIN FILM POLARIZERS (56° Angle of Incidence)

Thin film polarizers separate s- and p- polarization components. Due to their high laser damage threshold, thin film polarizers can be used as an alternative to Glan-Taylor laser polarizing prisms or cube polarizing beamsplitters.

Femtoline thin film laser polarizers are designed for use in high energy lasers. They can be used for Yb:KYW/KGW or Ti:Sapphire laser fundamental wavelengths or their harmonics, as well as intracavity Q-switch hold-off polarizers.

The most efficient way to use these polarizers is at Brewster's angle – $56 \pm 2^\circ$.



SPECIFICATIONS

Material	BK7, UV FS
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	$\lambda/10 @ 633 \text{ nm}$
Angle of incidence (AOI)	$56 \pm 2^\circ$
Laser damage threshold	$>100 \text{ mJ/cm}^2$, 50 fsec pulse, 800 nm typical

Thin Film Polarizers with High Extinction Ratio

Round Polarizers. Material – UV FS. $T_p > 98\%$, $T_s < 0.1\%$. Extinction ratio for transmitted light $T_p/T_s: >1000:1$

Catalogue number	Diameter D , mm	Thickness T , mm	Wavelength, nm	Price, EUR
420-1242HE	25.4	3	343	218
420-1244HE	25.4	3	515	185
420-1256HE	25.4	3	800	185
420-1248HE	25.4	3	1030	216

Rectangular Polarizers. Material – UV FS. $T_p > 98\%$, $T_s < 0.1\%$. Extinction ratio for transmitted light $T_p/T_s: >1000:1$

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T , mm	Wavelength, nm	Price, EUR
420-1478HE	20	15	6	1030	165
420-1578HE	30	20	6	1030	220

High Transmission Thin Film Polarizers

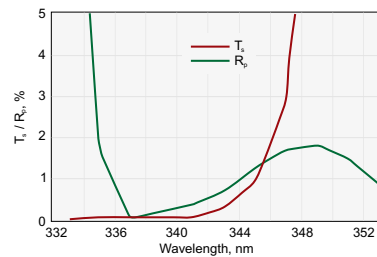
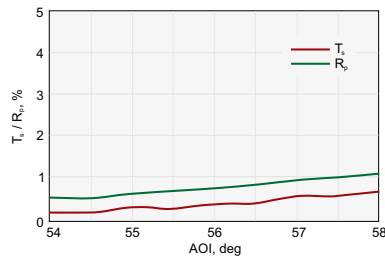
Round Polarizers. Material – UV FS. $R_s / T_p > 99.5 / 99.0\%$. Extinction ratio for transmitted light $T_p/T_s > 200:1$

Catalogue number	Diameter D , mm	Thickness T , mm	Wavelength, nm	Price, EUR
420-1242HT	25.4	3.0	343	237
420-1244HT	25.4	3.0	515	200
420-1256HT	25.4	3.0	800	200
420-1248HT	25.4	3.0	1030	234

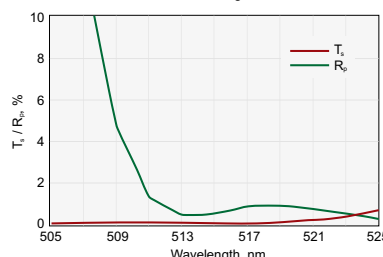
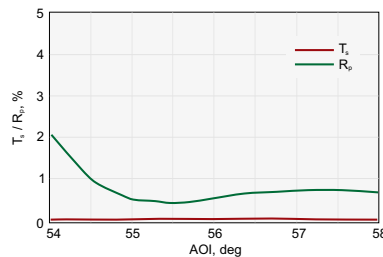
Ultra High Transmission Thin Film Polarizers

Round Polarizers. Material – UV FS. $T_s < 0.2\%$, $R_p < 0.2\%$. Extinction ratio for transmitted light $T_p/T_s > 200:1$

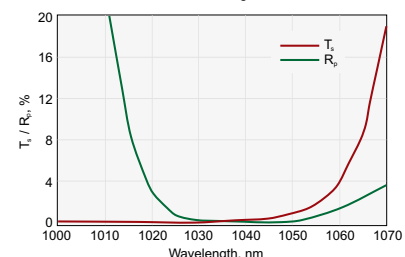
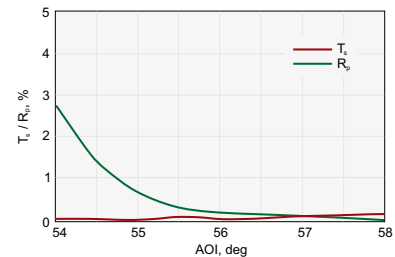
Catalogue number	Diameter D , mm	Thickness T , mm	Wavelength, nm	Price, EUR
420-1256UHT	25.4	3.0	800	260
420-1248UHT	25.4	3.0	1030	304



420-1242HT.
High Transmission @ 343 nm,
 $R_s/T_p > 99.5/99.0\%$, AOI=56°

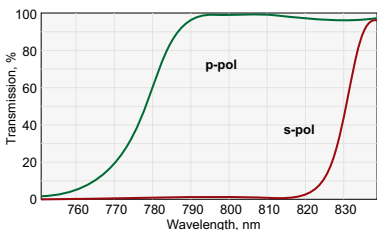


420-1244HT.
High Transmission @ 515 nm,
 $R_s/T_p > 99.5/99.0\%$, AOI=56°

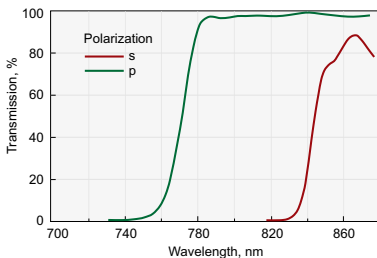


420-1248HT.
High Transmission @ 1030 nm,
 $R_s/T_p > 99.5/99.0\%$, AOI=56°

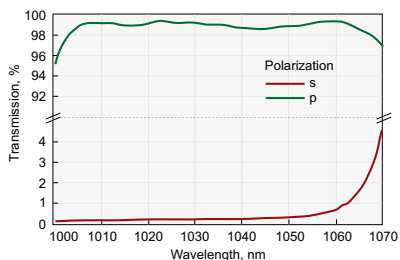
Standard Thin Film Polarizers



420-0126E.
Transmission @ 800 nm,
Rs/Tp > 99.5/95.0 %, AOI=56°



420-0266E.
Transmission @ 780-820 nm,
Rs/Tp > 99.5/95.0 %, AOI=56°



420-0268E.
Transmission @ 1010-1050 nm,
Rs/Tp > 99.5/95.0 %, AOI=56°

Please contact us if you need thin film laser polarizers of other wavelengths or other types of substrates.

RELATED PRODUCTS

Glan Laser Polarizing, Wollaston Prisms

See page 1.61

Adapters for Polarizer at 56° 840-0117, 840-0118

See page 7.43



Variable Attenuators for Linearly Polarized Laser Beam 990-0070

See page 5.25



Round Polarizers. Material – BK7. $R_s / T_p > 99.5 / 95.0\%$.
Extinction ratio for transmitted light $T_p/T_s > 200:1$

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-0114E	12.7	3.0	515	108
420-0126E	12.7	3.0	800	108
420-0136E	12.7	3.0	780-820	160
420-0118E	12.7	3.0	1030	115
420-0138E	12.7	3.0	1010-1050	160
420-0244E	25.4	3.0	515	128
420-0256E	25.4	3.0	800	128
420-0266E	25.4	3.0	780-820	189
420-0248E	25.4	3.0	1030	155
420-0268E	25.4	3.0	1010-1050	189
420-0514E	50.8	6.0	515	206
420-0506E	50.8	6.0	800	215
420-0526E	50.8	6.0	780-820	309
420-0518E	50.8	6.0	1030	255
420-0528E	50.8	6.0	1010-1050	335

Rectangular Polarizers. Material – BK7. $R_s / T_p > 99.5 / 95.0\%$.
Extinction ratio for transmitted light $T_p/T_s > 200:1$

Catalogue number	Rectangular dimensions Length, mm Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-0274	28.6 14.3	3.0	515	142
420-0286	28.6 14.3	3.0	800	142
420-0296	28.6 14.3	3.0	780-820	220
420-0278	28.6 14.3	3.0	1030	170
420-0298	28.6 14.3	3.0	1010-1050	220

Round Polarizers. Material – UV FS. $R_s / T_p > 99.5 / 95.0\%$.
Extinction ratio for transmitted light $T_p/T_s > 200:1$

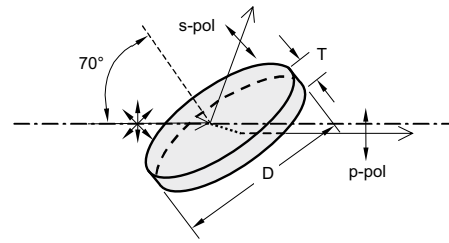
Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1112E	12.7	3.0	343	164
420-1123E	12.7	3.0	400	131
420-1114E	12.7	3.0	515	131
420-1126E	12.7	3.0	800	131
420-1136E	12.7	3.0	780-820	196
420-1118E	12.7	3.0	1030	145
420-1138E	12.7	3.0	1010-1050	196
420-1242E	25.4	3.0	343	182
420-1253E	25.4	3.0	400	154
420-1244E	25.4	3.0	515	154
420-1256E	25.4	3.0	800	154
420-1266E	25.4	3.0	780-820	231
420-1248E	25.4	3.0	1030	180
420-1268E	25.4	3.0	1010-1050	231
420-1512E	50.8	6.0	343	325
420-1503E	50.8	6.0	400	295
420-1514E	50.8	6.0	515	295
420-1506E	50.8	6.0	800	305
420-1526E	50.8	6.0	780-820	404
420-1518E	50.8	6.0	1030	315
420-1528E	50.8	6.0	1010-1050	404

Rectangular Polarizers. Material – UV FS. $R_s / T_p > 99.5 / 95.0\%$.
Extinction ratio for transmitted light $T_p/T_s > 200:1$

Catalogue number	Rectangular dimensions Length, mm Width, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1272	28.6 14.3	3.0	343	255
420-1283	28.6 14.3	3.0	400	215
420-1274	28.6 14.3	3.0	515	215
420-1286	28.6 14.3	3.0	800	215
420-1296	28.6 14.3	3.0	780-820	315
420-1278	28.6 14.3	3.0	1030	225
420-1298	28.6 14.3	3.0	1010-1050	315

THIN FILM POLARIZERS (70° Angle of Incidence)

Broadband thin film polarizers separate the s- and p-polarization components in broad region at 70° angle of incidence (AOI). These polarizers are designed to be used in high energy laser systems, typically as extracavity attenuators for femtosecond lasers. Polarizers are made from UV fused silica and feature a high laser damage threshold – up to 50 mJ/cm².



SPECIFICATIONS

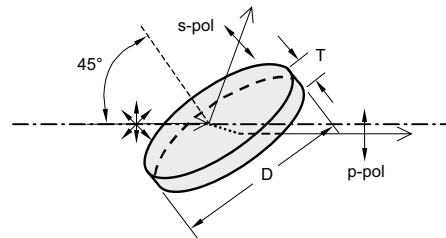
Substrate material	UV FS
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	$\lambda/10$ @ 633 nm
Clear aperture	>90% of diameter
Angle of incidence (AOI)	70 ± 2°
Parallelism	<30 arcsec

Rectangular Polarizers. Material – UV FS. $R_s / T_p > 99.5 / 95.0\%$.
Extinction ratio for transmitted light $T_p/T_s > 200:1$

Catalogue number	Rectangular dimensions Length, mm	Width, mm	Thickness T, mm	Centre wavelength, nm	Operating wavelength region, nm	Price, EUR
420-1696BBi70	60.0	20.0	4.0	800	750 – 850	435
420-1698BBi70	60.0	20.0	4.0	1030	980 – 1080	435

THIN FILM POLARIZERS (45° Angle of Incidence)

These thin film polarizers separate or combine the s- and p-polarization components at 45° angle of incidence. They are designed for use in high energy lasers. Polarizers are made from UV FS and feature high laser damage threshold reaching 10 J/cm² at 1064 nm.



SPECIFICATIONS

Substrate material	UV FS
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Transmitted wavefront distortion	$\lambda/10$ @ 633 nm
Clear aperture	>90% of diameter
Angle of incidence (AOI)	45 ± 2°
Parallelism	<30 arcsec

TF Polarizers with High Extinction Ratio

Round Polarizers. Material – UV FS. $T_p > 98\%$, $T_s < 0.1\%$.
Extinction ratio for transmitted light $T_p/T_s > 1000:1$

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242i45HE	25.4	3	343	328
420-1244i45HE	25.4	3	515	295
420-1248i45HE	25.4	3	1030	315
420-1512i45HE	50.8	6	343	640
420-1514i45HE	50.8	6	515	555
420-1518i45HE	50.8	6	1030	620

Standard Thin Film Polarizers

Round Polarizers. Material – UV FS. $R_s / T_p > 99.5 / 95.0\%$.
Extinction ratio for transmitted light $T_p/T_s > 200:1$

Catalogue number	Diameter D, mm	Thickness T, mm	Wavelength, nm	Price, EUR
420-1242i45	25.4	3	343	238
420-1244i45	25.4	3	515	200
420-1248i45	25.4	3	1030	225
420-1512i45	50.8	6	343	455
420-1514i45	50.8	6	515	395
420-1518i45	50.8	6	1030	440

QUARTZ RETARDATION WAVEPLATES

Quartz Retardation Plates are made of material enabling linear birefringence. These plates are made of high quality optical grade crystalline quartz, featuring high damage threshold. Retardation

plates rotate polarization's direction ($\lambda/2$) or convert linear into circular polarization or vice versa ($\lambda/4$). Quartz retardation plates are supplied mounted and AR coated.

ZERO ORDER OPTICALLY CONTACTED WAVEPLATES

- Easily aligned
- Temperature insensitive
- Moderately insensitive to wavelength

Zero order plates are comprised of two different plates cut parallel to their optical axis. This construction makes plates less dependent on temperature. The plates are polished to different thicknesses enabling one to achieve required retardation difference. These component plates have orthogonal optic axis directions, so that the roles of the ordinary and extraordinary rays are interchanged in passing from one plate to another. The thickness of the plate determines the phase shift between the ordinary and extraordinary beams for any specific wavelength.



SPECIFICATIONS

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	$\lambda/10$ @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	> 10 mJ/cm ² , 50 fsec pulse, 800 nm typical

Ø12.7 mm waveplates, clear aperture Ø11 mm, unmounted

Center wavelength, nm	AR coating range, nm	Retardation $\lambda/2$		Retardation $\lambda/4$	
		Catalogue no.	Price, EUR	Catalogue no.	Price, EUR
1030	1000-1060	460-4208D12	165	460-4408D12	165
800	760-840	460-4215D12	165	460-4415D12	165
780	740-820	460-4220D12	165	460-4420D12	165
515	500-530	460-4232D12	165	460-4432D12	165
400	380-420	460-4235D12	165	460-4435D12	165
343	333-353	460-4241D12	175	460-4441D12	175
266	257-275	460-4245D12	185	460-4445D12	185
257	250-265	460-4246D12	185	460-4446D12	185

RELATED PRODUCTS

Achromatic Air-Spaced Waveplates

See page 1.66

Polarizer Holder
840-0180

See page 7.48



High Precision Rotation
Polarizer, Waveplate
Mount 840-0186

See page 7.49



Ø20 mm waveplates, clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Center wavelength, nm	AR coating range, nm	Retardation $\lambda/2$		Retardation $\lambda/4$	
		Catalogue no.	Price, EUR	Catalogue no.	Price, EUR
1030	1000-1060	460-4208	245	460-4408	245
800	760-840	460-4215	245	460-4415	245
780	740-820	460-4220	245	460-4420	245
515	500-530	460-4232	245	460-4432	245
400	380-420	460-4235	245	460-4435	245
343	333-353	460-4241	270	460-4441	270
266	257-275	460-4245	280	460-4445	280
257	250-265	460-4246	280	460-4446	280

ZERO ORDER AIR-SPACED WAVEPLATES

- For high power laser applications



SPECIFICATIONS

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Wavefront distortion	$\lambda/10$ @ 633 nm
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	100 mJ/cm ² , 50 fsec pulse, 800 nm typical

HOUSING ACCESSORIES

Polarizer Holder
840-0180

See page 7.48



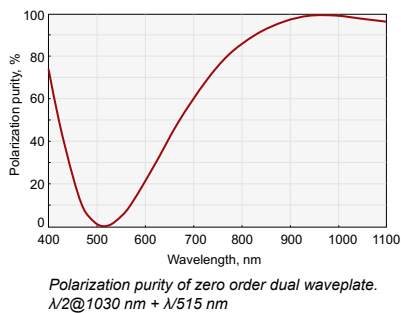
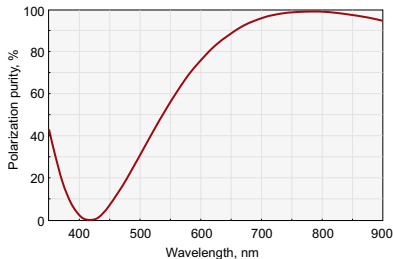
Center wavelength, nm	AR coating range, nm	Retardation $\lambda/2$		Retardation $\lambda/4$	
		Catalogue no.	Price, EUR	Catalogue no.	Price, EUR
1030	1000-1060	464-4208	310	464-4408	310
800	760-840	464-4215	310	464-4415	310
780	740-820	464-4220	310	464-4420	310
515	500-530	464-4232	310	464-4432	310
400	380-420	464-4235	310	464-4435	310
343	333-353	464-4241	335	464-4441	335
266	257-275	464-4245	345	464-4445	345
257	250-265	464-4246	345	464-4446	345

ZERO ORDER DUAL WAVELENGTH WAVEPLATES

When optical axis is turned by 45 degrees to input polarization, the waveplate rotates polarization of Ti:Sapphire laser fundamental (800 nm) by 90 degrees and the polarization of Ti:Sapphire second harmonic (400 nm) remains the same.

SPECIFICATIONS

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0/-0.12 mm
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	$\lambda/10$ @ 633 nm
Parallelism	<10 arcsec
AR coating	R<0.5%



Code	Description	AR coated	Laser Damage Threshold	Application	Price, EUR
465-4211	optically contacted $\lambda/2@800\text{ nm} + \lambda@400\text{ nm}$	800+400 nm	>10 mJ/cm ² , 50 fsec pulse, 800 nm typical	Ti: Sapphire	345
466-4211	air-spaced $\lambda/2@800\text{ nm} + \lambda@400\text{ nm}$	800+400 nm	100 mJ/cm ² , 50 fsec pulse, 800 nm typical	Ti: Sapphire	410
465-4212	optically contacted $\lambda/2@1030\text{ nm} + \lambda@515\text{ nm}$	1030+515 nm	>10 mJ/cm ² , 50 fsec pulse, 1030 nm typical	Yb: KGW/KYW	345
466-4212	air-spaced $\lambda/2@1030\text{ nm} + \lambda@515\text{ nm}$	1030+515 nm	100 mJ/cm ² , 50 fsec pulse, 1030 nm typical	Yb: KGW/KYW	410

HOUSING ACCESSORIES

Polarizer Holder
840-0180

See page 7.48



LOW ORDER WAVEPLATES

- Thinner than multiple order

Low order plates are less temperature sensitive and temperature dependent than multiple order plates. These plates are suitable for high and low power applications.

SPECIFICATIONS

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	$\lambda/10$ @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	100 mJ/cm ² , 50 fsec pulse, 800 nm typical

Ø12.7 mm waveplates, clear aperture Ø11 mm, unmounted

Wavelength, nm	Retardation $\lambda/2$		Retardation $\lambda/4$	
	Catalogue no.	Price, EUR	Catalogue no.	Price, EUR
1030	461-4208D12	105	461-4408D12	105
800	461-4215D12	105	461-4415D12	105
780	461-4220D12	105	461-4420D12	105
515	461-4232D12	105	461-4432D12	105

RELATED PRODUCTS

Low Order Plates of other wavelengths

See page 1.67

High Precision Rotation Polarizer, Waveplate Mount 840-0186

See page 7.49



Ø20 mm waveplates, clear aperture Ø17 mm, mounted into Ø25.4 mm ring holder

Wavelength, nm	Retardation $\lambda/2$		Retardation $\lambda/4$	
	Catalogue no.	Price, EUR	Catalogue no.	Price, EUR
1030	461-4208	160	461-4408	160
800	461-4215	160	461-4415	160
780	461-4220	160	461-4420	160
515	461-4232	160	461-4432	160
400	461-4235	160	461-4435	160
343	461-4241	192	461-4441	192

MULTIPLE ORDER DUAL WAVELENGTH WAVEPLATES

SPECIFICATIONS

Material	Single crystal quartz
Optical axis	normal to facet on circumference of retarder
Wavefront distortion	$\lambda/10$ @ 633 nm
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Nominal thickness of waveplate	0.2-1.2 mm
Laser damage threshold	>100 mJ/cm ² , 50 fsec pulse, 800 nm typical

RELATED PRODUCTS

Dual Wavelength Plates of other wavelengths

See page 1.69

High Precision Rotation Polarizer, Waveplate Mount 840-0186

See page 7.49

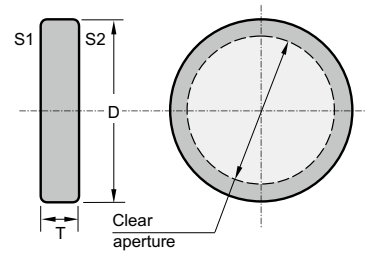


Retardation and Wavelength	Catalogue number	Price, EUR
λ @ 800 nm + $\lambda/2$ @ 400 nm	463-4121	215
λ @ 800 nm + $\lambda/4$ @ 400 nm	463-4141	215
$\lambda/2$ @ 800 nm + λ @ 400 nm	463-4211	215
$\lambda/2$ @ 800 nm + $\lambda/2$ @ 400 nm	463-4221	215
$\lambda/2$ @ 800 nm + $\lambda/4$ @ 400 nm	463-4241	215
$\lambda/4$ @ 800 nm + λ @ 400 nm	463-4411	215
$\lambda/4$ @ 800 nm + $\lambda/2$ @ 400 nm	463-4421	215
$\lambda/4$ @ 800 nm + $\lambda/4$ @ 400 nm	463-4441	215

POLARIZATION PLANE ROTATORS

- Made of crystalline quartz
- Intended to rotate a beam polarization plane strictly to an appropriate angle using circular birefringent effect

Compared to a waveplate, a rotator has an intrinsic advantage, being independent of rotation around its own optical axis. It needs no adjustment, only to be installed normal to incident radiation. A polarization plane rotator is normally used for the specific wavelength. It is only slightly dependent on ambient temperature.



SPECIFICATIONS

Material	Single crystal quartz
Optical axis	Normal to faces S1, S2 of rotator
Clear aperture	Ø17 mm
Ring mount outer diameter	25.4 +0.0/-0.12 mm
Surface quality	20-10 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	$\lambda/10$ @ 633 nm
Parallelism	< 10 arcsec
AR coating	R < 0.5%
Laser damage threshold	100 mJ/cm ² , 50 fsec pulse, 800 nm typical

Polarization plane rotators for any wavelength from 200 to 2300 nm are available.

Catalogue number	Center wavelength, nm	Rotation angle of polarization plane, deg	AR coating range, nm	Price, EUR
470-4904	1030	45	1000-1060	215
470-4909	1030	90	1000-1060	215
470-4804	800	45	760-840	195
470-4809	800	90	760-840	195
470-4784	780	45	740-820	195
470-4789	780	90	740-820	195
470-4514	515	45	500-530	195
470-4519	515	90	500-530	195
470-4044	400	45	380-420	195
470-4049	400	90	380-420	195
470-4344	343	45	333-353	195
470-4349	343	90	333-353	195
470-4264	266	45	257-275	245
470-4269	266	90	257-275	245
470-4254	257	45	250-265	245
470-4259	257	90	250-265	245

RELATED PRODUCTS

Polarization plane rotators of other wavelengths
See page 1.70

Kinematic Mirror and Beamsplitter Mount 840-0020
See page 7.33



Kinematic Positioning Mount 840-0193
See page 7.51



GROUP VELOCITY DELAY COMPENSATION PLATES

Compensation plates are made of calcite. Plates are available with different orientation for different Group Velocity Delay compensation – starting from tens of femtosecond up to tens of picosecond delay compensation.

Standard GVD compensation plates are adjusted for required compensation by angular tuning changing the angle of incidence. Suggested AOI is -5 to +5 deg, however they also can operate at larger AOI.

Standard plates are made of 16x14 mm aperture, clear aperture Ø12 mm and mounted in to 1" ring holder. The optical axis is at special orientation – non parallel to faces of plate.

AR coatings for custom wavelengths are also available. Standard GVP compensation plates have clear aperture Ø12 mm. However, on special requests clear apertures up to 20 mm diameter can be produced.

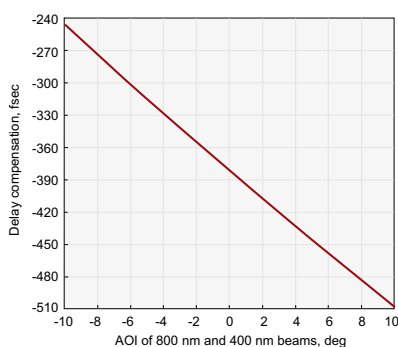
SPECIFICATIONS

Material	Natural Calcite
Clear aperture	Ø12 mm
Ring mount outer diameter	25.4 +0.0 / -0.12 mm
Surface quality	40-20 scratch & dig (MIL-PRF-13830B)
Wavefront distortion	λ/4@ 633 nm
Parallelism	<3 arc min
AR coating	R<0.5% 760-840 nm and R<1% at 380-420 nm

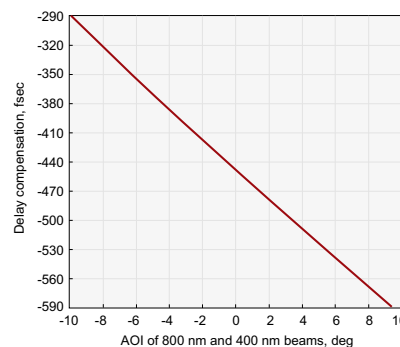
Standard Calcite plates for delay compensation between 800 nm ("o" polarization) and 400 nm ("e" polarization) pulses

Code	Delay compensation range*	Coatings	Price, EUR
225-2113	310 – 450 fsec	BBAR @ 800+400 nm	470
225-2114	370 – 520 fsec	BBAR @ 800+400 nm	470
225-2111	410 – 580 fsec	BBAR @ 800+400 nm	470
225-2115	440 – 630 fsec	BBAR @ 800+400 nm	470

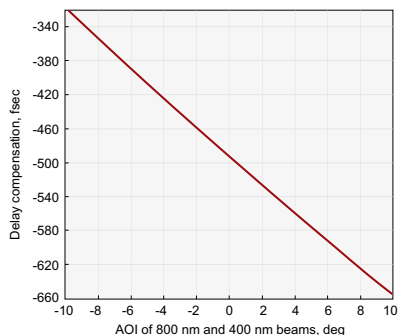
*GVD compensation range at Angle Of Incidence from -5° to +5°.



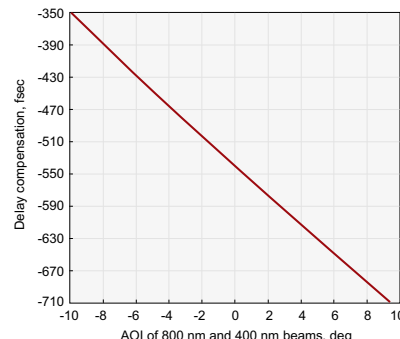
225-2113.



225-2114.



225-2111.



225-2115.

Group velocity delay between 800 nm and 400 nm pulses in compensation plates at different angle of incidence. 400 nm pulse („e" pol) is faster than 800 nm pulse („o" pol).

RELATED PRODUCTS

Thin BBO Crystals for SHG and THG of Ti:Sapphire laser wavelengths

See pages 5.31

Femtokits for THG of Femtosecond Ti:Sapphire Lasers

See page 5.34



Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26



CRYSTAL WINDOWS FOR WHITE LIGHT (CONTINUUM) GENERATION




The interaction of intense laser pulses with transparent media (the crystals with cubic structure are more effective) can result in vast spectral broadening, ranging from the infrared to the ultraviolet spectral region. This continuum or white-light generation is a well-established phenomenon. Femto-

second laser induced white light has been the source of ultrashort coherent radiation for numerous applications: time-resolved broadband pump-probe spectroscopy, optical pulse compression, and optical parametric amplification.

SPECIFICATIONS

Material	undoped YAG, orientation [111]
Clear aperture	>90% of diameter
Diameter tolerance	+0.00 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface quality	20-10 scratch & dig
Transmitted wavefront distortion	$\lambda/4 - \lambda/10$ @ 633 nm
Parallelism	<30 arcsec
Coating	uncoated

Standard YAG windows

Catalogue number	Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Price, EUR
555-7121	YAG	12.7	1.0	$\lambda/4$	185
555-7122	YAG	12.7	2.0	$\lambda/4$	185
555-7123	YAG	12.7	3.0	$\lambda/10$	195
555-7124	YAG	12.7	4.0	$\lambda/10$	195
555-7126	YAG	12.7	6.0	$\lambda/10$	215
555-7128	YAG	12.7	8.0	$\lambda/10$	230
555-7251	YAG	25.4	1.0	$\lambda/4$	225
555-7252	YAG	25.4	2.0	$\lambda/4$	225
555-7253	YAG	25.4	3.0	$\lambda/10$	245
555-7254	YAG	25.4	4.0	$\lambda/10$	245

SPECIFICATIONS

Material	sapphire, orientation c-cut [111]
Clear aperture	>90% of diameter
Diameter tolerance	+0.00 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface quality	60-40 scratch & dig
Transmitted wavefront distortion	<1 λ @ 633 nm
Parallelism	<3 arcmin
Coating	uncoated

Standard Sapphire windows

Catalogue number	Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Price, EUR
550-7120	Sapphire	12.7	0.5	1 λ	26
550-7121	Sapphire	12.7	1.0	1 λ	25
550-7122	Sapphire	12.7	2.0	1 λ	25
550-7123	Sapphire	12.7	3.0	1 λ	25
550-7124	Sapphire	12.7	4.0	1 λ	27
550-7125	Sapphire	12.7	5.0	1 λ	29
550-7126	Sapphire	12.7	6.0	1 λ	30
550-7128	Sapphire	12.7	8.0	1 λ	50
550-7200	Sapphire	20.0	0.5	1 λ	35
550-7201	Sapphire	20.0	1.0	1 λ	35
550-7215	Sapphire	20.0	1.5	1 λ	35
550-7202	Sapphire	20.0	2.0	1 λ	35
550-7250	Sapphire	25.4	0.5	1 λ	45
550-7251	Sapphire	25.4	1.0	1 λ	45
550-7252	Sapphire	25.4	2.0	1 λ	45
550-7253	Sapphire	25.4	3.0	1 λ	45
550-7254	Sapphire	25.4	4.0	1 λ	45
550-7255	Sapphire	25.4	5.0	1 λ	50
550-7256	Sapphire	25.4	6.0	1 λ	70
550-7258	Sapphire	25.4	8.0	1 λ	80

SPECIFICATIONS

Material	single crystal CaF ₂ , orientation [001]
Clear aperture	>90% of diameter
Diameter tolerance	+0.00 / -0.13 mm
Thickness tolerance	±0.2 mm
Surface quality	40-20 scratch & dig
Transmitted wavefront distortion	$\lambda/4 - \lambda/10$ @ 633 nm
Parallelism	<1 arcmin
Coating	uncoated

Standard CaF₂ windows

Catalogue number	Material	Diameter, mm	Thickness, mm	Transmitted wavefront distortion	Price, EUR
531-5123	CaF ₂	12.7	3.0	$\lambda/6$	120
531-5124	CaF ₂	12.7	4.0	$\lambda/8$	140
531-5251	CaF ₂	25.4	1.0	$\lambda/4$	160
531-5252	CaF ₂	25.4	2.0	$\lambda/4$	160
531-5253	CaF ₂	25.4	3.0	$\lambda/4$	160
531-5254	CaF ₂	25.4	4.0	$\lambda/10$	180
531-5255	CaF ₂	25.4	5.0	$\lambda/10$	180

VARIABLE ATTENUATOR FOR FEMTOSECOND LINEARLY POLARIZED LASER BEAM 990-0070

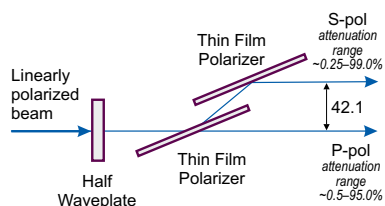


Note: Movable base 820-0090, Rod Holder 820-0050-02 and standard rod should be ordered separately.

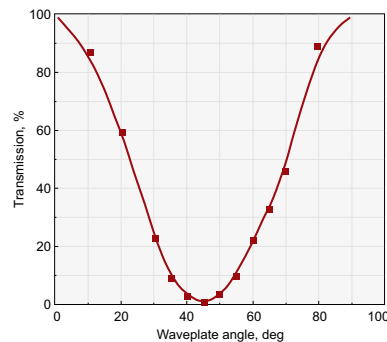
- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~ 0.5 mm
- High Optical damage threshold
- Weight – 0.35 kg

This variable attenuator/beamsplitter consists of special design opto-mechanical Adapter and precision opto-mechanical Holder 840-0197. Two Thin Film Brewster type polarizers, which reflect s-polarized light while transmitting p-polarized light, are housed into Adapter. Quartz Half Waveplates are housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio,



can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by $\pm 2^\circ$ and to get the maximum polarization contrast.



SPECIFICATIONS

Aperture diameter	17 mm
Damage threshold	>10 mJ/cm ² , 50 fs pulse at 800 nm, typical >100 mJ/cm ² , 50 fs pulse at 800 nm, typical for high power laser applications
Time dispersion	t<4 fs for 100 fs Ti:Sapphire laser pulses
Polarization Contrast (after 1st polarizer)	>1:200
Polarization Contrast (after 2nd polarizer)	>1:500

For High Power Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0070-257	257	945
990-0070-266	266	945
990-0070-343	343	840
990-0070-400	400	740
990-0070-400B	390-410	890
990-0070-515	515	740
990-0070-515B	505-525	890
990-0070-800	800	740
990-0070-800B	780-820	890
990-0070-1030	1030	740
990-0070-1030B	1010-1050	890

Catalogue number	Wavelength, nm	Price, EUR
990-0070-257H	257	1020
990-0070-266H	266	1020
990-0070-343H	343	915
990-0070-400H	400	815
990-0070-400HB	390-410	965
990-0070-515H	515	815
990-0070-515HB	505-525	965
990-0070-800H	800	815
990-0070-800HB	780-820	965
990-0070-1030H	1030	815
990-0070-1030HB	1010-1050	965

Zero order optically contacted half waveplate is housed in rotating holder for high power femtosecond applications (Laser damage threshold: >10 mJ/cm², 50 fs pulse at 800 nm, typical).

Zero Order Air-Spaced half waveplate is housed in rotating holder for high power femtosecond applications (Laser damage threshold: >100 mJ/cm², 50 fs pulse at 800 nm, typical).

RELATED PRODUCTS

Femtoline Zero Order Optically Contacted/Air-Spaced Plates
See page 5.19

Femtoline Thin Film Laser Polarizers
See page 5.16

Neutral Density Filters
See page 1.14

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0070M
See page 6.14



Beam dumps 990-0800, 990-0820
See page 6.21



BROADBAND VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0070HBBi70



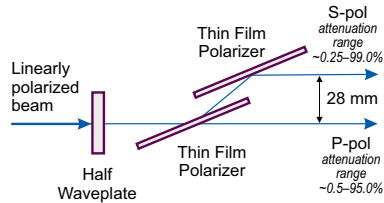
990-0070-800HBBi70



990-0070-800HBBi70M

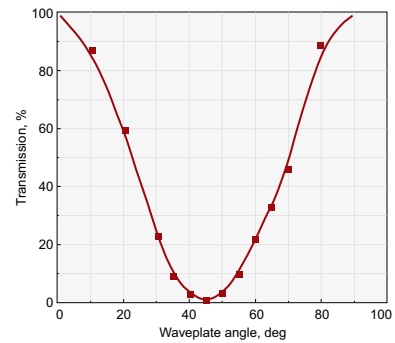
- Divides laser beam into two parallel beams of manually adjustable intensity ratio
- Large dynamic range
- Transmitted beam shift ~ 2.6 mm
- High optical damage threshold

This variable attenuator/beamsplitter consists of a special design opto-mechanical adapter and a precision opto-mechanical holder 840-0197. Two thin film polarizers, operating at AOI=70° and reflecting s-polarized light while transmitting p-polarized light, are housed into the adapter. A quartz zero order air-spaced half waveplate is housed into the rotating holder 840-0197. The intensity ratio of outgoing two parallel beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of the exit beam or outgoing beams intensity ratio can be controlled over a wide dynamic range.



P-polarized beam is transmitted straightly with a 2.6 mm shift and s-polarized beam (after 2 reflections) is parallel to the outgoing p-polarized beam, just separated by 28 mm.

The 840-0197 holder allows to adjust angle of incidence of the thin film polarizers by ±2° and to achieve the maximum polarization contrast.



SPECIFICATIONS

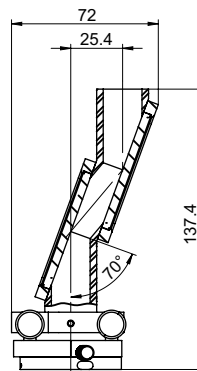
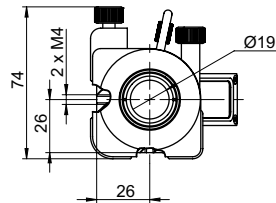
Aperture diameter	12 mm
Operating bandwidth	100 nm
Damage threshold	50 mJ/cm ² pulsed at 800 nm, 50 fsec, 50 Hz
Polarization contrast (after 1st polarizer)	>1:200
Polarization contrast (after 2nd polarizer)	>1:500

Manual attenuators

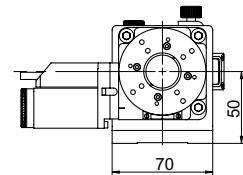
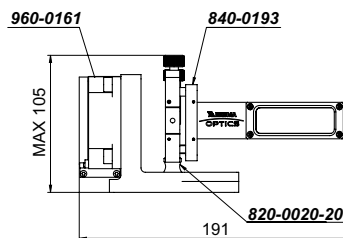
Catalogue number	Wavelength, nm	Price, EUR
990-0070-800HBBi70	750-850	1270
990-0070-1030HBBi70	980-1080	1270

Motorized attenuators

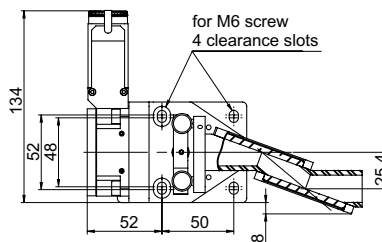
Catalogue number	Wavelength, nm	Price, EUR
990-0070-800HBBi70M	750-850	2050
990-0070-1030HBBi70M	980-1080	2050



990-0070-800HBBi70



990-0070-800HBBi70M



RELATED PRODUCTS

Neutral Density Filters
See page 1.14

Femtoline Zero Order Optically Contacted / Air-Spaced Plates
See page 5.19

Femtoline Thin Film Laser Polarizers
See page 5.16

VARIABLE ATTENUATOR FOR FEMTOSECOND LINEARLY POLARIZED LASER BEAM 990-0071

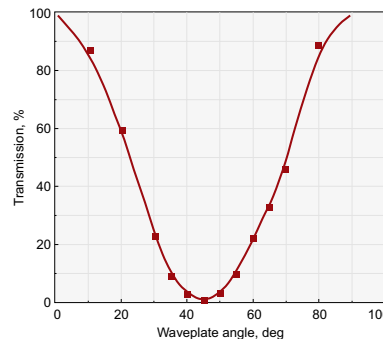
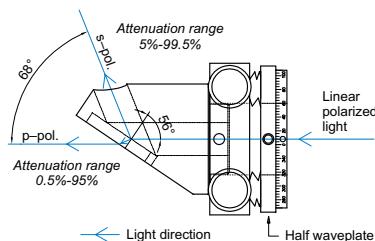


Note: Solid Base Height Extender 820-0210 and Standard Rod 820-0020-20 should be ordered separately

This variable attenuator/beamsplitter consists of special design opto-mechanical adapter for polarizer at 56° 840-0117A or 840-0118A and precision opto-mechanical holder 840-0197. Thin Film Brewster type polarizer, which reflect s-polarized light at 56° while transmitting p-polarized light, is housed into adapter for polarizer at 56°. Quartz Half Waveplates are housed in rotating holder 840-0197.

The intensity ratio of those two beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of

either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place. The holder 840-0197 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizer by $\pm 2^\circ$ and to get the maximum polarization contrast.



- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Transmitted beam shift ~0.5 mm
- High Optical damage threshold
- Weight – 0.25 kg

SPECIFICATIONS

Aperture diameter	10 mm
Damage threshold	>10 mJ/cm ² , 50 fs pulse at 800 nm, typical
for high power laser applications	>100 mJ/cm ² , 50 fs pulse, 800 nm typical
Time dispersion	t<4 fs for 100 fs Ti:Sapphire laser pulses
Polarization Contrast	>1:200

For High Power Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0071-257	257	625
990-0071-266	266	625
990-0071-343	343	600
990-0071-400	400	550
990-0071-400B	390-410	650
990-0071-515	515	550
990-0071-515B	505-525	650
990-0071-800	800	550
990-0071-800B	780-820	650
990-0071-1030	1030	550
990-0071-1030B	1010-1050	650

Catalogue number	Wavelength, nm	Price, EUR
990-0071-257H	257	690
990-0071-266H	266	690
990-0071-343H	343	665
990-0071-400H	400	615
990-0071-400HB	390-410	715
990-0071-515H	515	615
990-0071-515HB	505-525	715
990-0071-800H	800	615
990-0071-800HB	780-820	715
990-0071-1030H	1030	615
990-0071-1030HB	1010-1050	715

Zero order optically contacted half waveplate is housed in rotating holder 840-0197 (laser damage threshold: >10 mJ/cm², 50 fs pulse at 800 nm, typical).

Zero Order Air-Spaced half waveplate is housed in rotating holder 840-0197 (laser damage threshold: >100 mJ/cm², 50 fs pulse at 800 nm, typical).

RELATED PRODUCTS

Neutral Density Filters

See page 1.14

Femtoline Zero Order Optically Contacted / Air-Spaced Plates

See page 5.19

Femtoline Thin Film Laser Polarizers

See page 5.16

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0071M

See page 6.17



VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0072

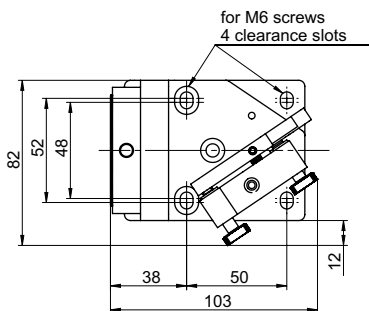
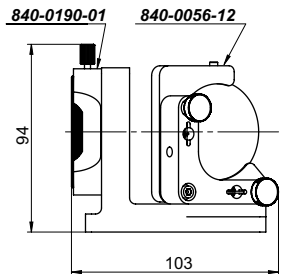
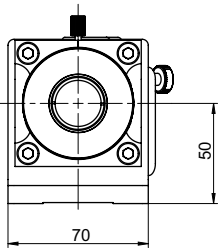
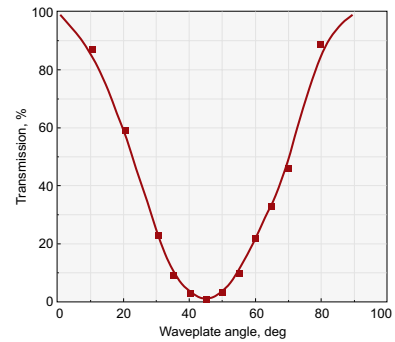


- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Transmitted beam shift ~1 mm
- High optical damage threshold
- Motorized version 990-0072M available online

This variable attenuator/beamsplitter consists of Polarizer Holder 840-0190-01 and Kinematic Mirror/Beamsplitter Mount 840-0056-12. UVFS Thin Film Brewster type polarizer diameter 50.8 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-12. A quartz Zero Order (optically contacted) Half Waveplate diameter 25.4 mm (for femtosecond applications) or Zero Order Air-Spaced Half Waveplate (for high power applications) is housed in rotating polarizer holder 840-0190-01 and placed in the incident linearly polarized laser beam.

The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-12 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by $\pm 4.5^\circ$ and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 78-88mm. Other height can be offered as custom changing the standard rods and rod holders into higher.



SPECIFICATIONS

Clear Aperture diameter	22 mm
Damage threshold	>10 mJ/cm ² , 50 fs pulse at 800 nm, typical >100 mJ/cm ² , 50 fs pulse at 800 nm, typical for high power applications
Polarization Contrast	>1:200
Transmitted beam shift	~ 1 mm
Weight	0.45 kg

For High Power Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0072-266	266	950
990-0072-343	343	895
990-0072-400	400	865
990-0072-515	515	865
990-0072-800	800	880
990-0072-800B	780-820	980
990-0072-1030	1030	890
990-0072-1030B	1010-1050	980

Catalogue number	Wavelength, nm	Price, EUR
990-0072-266H	266	1085
990-0072-343H	343	1030
990-0072-400H	400	1000
990-0072-515H	515	1000
990-0072-800H	800	1015
990-0072-800HB	780-820	1115
990-0072-1030H	1030	1025
990-0072-1030HB	1010-1050	1115

A quartz Zero Order (optically contacted) Half Waveplate $\varnothing 25.4$ mm is housed in rotating holder 840-0190-01.

A quartz Zero Order Air-Spaced Half Waveplate clear aperture $\varnothing 22$ mm is housed in rotating holder 840-0190-01.

RELATED PRODUCTS

Neutral Density Filters
See page 1.14

Femtoline Thin Film Laser Polarizers
See page 5.16

Femtoline Zero Order Optically Contacted / Air-Spaced Plates
See page 5.19

Motorized Variable Attenuator for Linearly Polarized Laser Beam 990-0072M

For more information visit www.eksmaoptics.com

VARIABLE ATTENUATOR FOR FEMTOSECOND LASER PULSES 990-0073

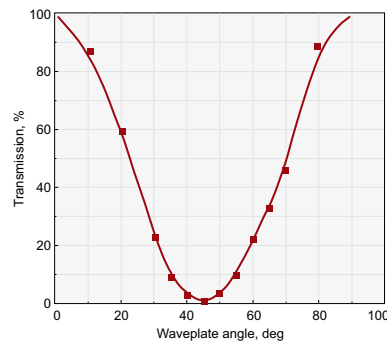


- Divides laser beam into two beams of manually adjustable intensity ratio separated by 68° angle
- Large dynamic range
- Transmitted beam shift ~1.4 mm
- High optical damage threshold

This variable attenuator/beamsplitter consists of Polarizer Holder 840-0180-A2 and Kinematic Mirror/Beamsplitter Mount 840-0056-13. UVFS Thin Film Brewster type polarizer Ø76.2 mm, which reflect s-polarized light while transmitting p-polarized light, is housed into Beamsplitter Mount 840-0056-13. A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm or Zero Order Air-Spaced Half Waveplate Ø40 mm is housed in rotating polarizer holder 840-0180-A2 and placed in the incident linearly polarized laser beam.

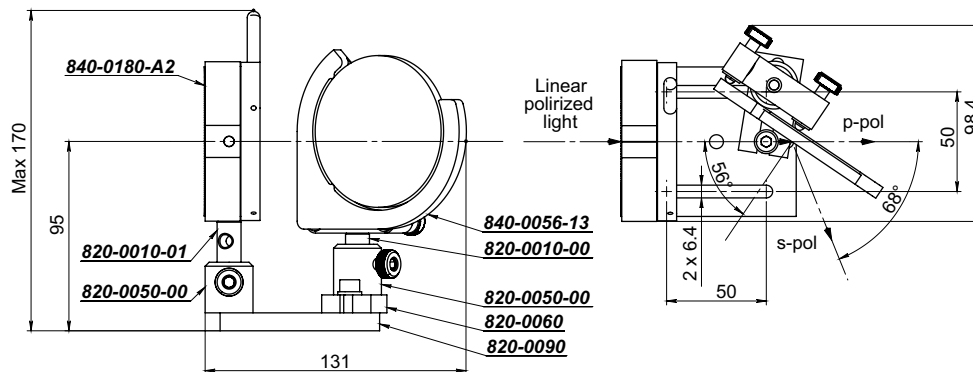
The intensity ratio of those two separated and different polarized beams may be continuously varied without alteration of other beam parameters by rotating the waveplate. The intensity of either exit beam, or their intensity ratio, can be controlled over a wide dynamic range. P-polarization could be selected for maximum transmission, or high-purity s-polarization could be reflected when maximum attenuation of the transmitted beam takes place.

The holder 840-0056-13 allows to adjust Angle Of Incidence of the Thin Film Brewster type polarizers by ±4.5° and to get the maximum extinction contrast. The mounts are on rods, rod holders and Movable Base 820-0090. The optical axis height from the table top can be adjusted in the range 92-98 mm. Other height can be offered as custom changing the standard rods and rod holders into higher.



SPECIFICATIONS

Clear Aperture diameter	36 mm
Damage threshold	>10 mJ/cm ² , 50 fs pulse at 800 nm, typical
for high power applications	>100 mJ/cm ² , 50 fs pulse at 800 nm, typical
Polarization Contrast	>1:200
Transmitted beam shift	~ 1.4 mm
Weight	0.6 kg



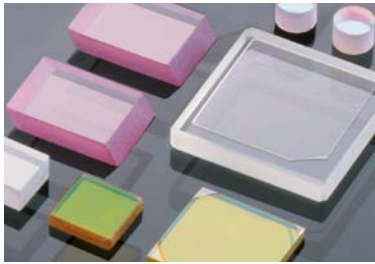
For High Power Laser Applications

Catalogue number	Wavelength, nm	Price, EUR
990-0073-266	266	1690
990-0073-343	343	1560
990-0073-400	400	1540
990-0073-515	515	1540
990-0073-800	800	1560
990-0073-800B	780-820	1790
990-0073-1030	1030	1615
990-0073-1030B	1010-1050	1850

A quartz Zero Order (optically contacted) Half Waveplate Ø40 mm is housed in rotating holder 840-0180-A2.

Catalogue number	Wavelength, nm	Price, EUR
990-0073-266H	266	1790
990-0073-343H	343	1660
990-0073-400H	400	1640
990-0073-515H	515	1640
990-0073-800H	800	1660
990-0073-800HB	780-820	1890
990-0073-1030H	1030	1715
990-0073-1030HB	1010-1050	1950

A quartz Zero Order Air-Spaced Half Waveplate Ø40 mm is housed in rotating holder 840-0180-A2.

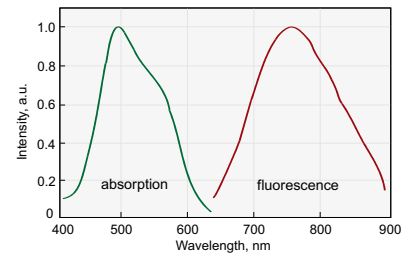


FemtoLine Laser Crystals

Ti:SAPPHIRE (Titanium Doped Sapphire – $Ti:Al_2O_3$) LASER LINE AND HARMONICS



Ti:Sapphire laser crystal is used as a gain medium for tunable lasers and femtosecond solid-state lasers. Lasers based on Ti:Sapphire crystal are mainly used to generate ultrashort – femtosecond pulses. The lasing band of Ti:Sapphire is 660-1050 nm, while common pump wavelength is frequency doubled Nd:YAG laser line at 532 nm or Argon Ion laser lines at 490-514 nm. The peak of emission in Ti:Sapphire is at 790-800 nm wavelength.



MATERIAL PHYSICAL AND LASER PROPERTIES

Chemical formula	$Ti^{3+}:Al_2O_3$
Crystal structure	Hexagonal
Lattice constants	$a=4.748, c=12.957$
Density	3.98 g/cm^3
Mohs hardness	9
Thermal conductivity	$0.11 \text{ cal}/(^{\circ}\text{C}\times\text{sec}\times\text{cm})$
Specific heat	0.10 cal/g
Melting point	2050°C
Laser action	4-Level Vibronic
Fluorescence lifetime	$3.2 \mu\text{sec}$ ($T=300\text{K}$)
Tuning range	660–1050 nm
Absorption range	400–600 nm
Emission peak	795 nm
Absorption peak	488 nm
Refractive index	1.76 @ 800 nm

STANDARD PRODUCT SPECIFICATIONS

Orientation	optical axis C normal to rod axis
Ti_2O_3 concentration	0.03–0.25 wt %
Figure of Merit	> 150
Size	up to 15 mm dia and up to 30 mm length
End configurations	flat/flat or Brewster/Brewster
End flatness	$\lambda/10$ @ 633 nm
Parallelism	10 arcsec
Surface finishing	10-5 scratch & dig
Wavefront distortion	$\lambda/4$ inch

Note: To inquire or order a finished Ti:Sa laser rod, please provide detailed specifications. Dopant concentration, size of crystal and end configuration are essential specifications.

Frequency Conversion of Ti:Sapphire laser wavelengths

Frequency doubling and tripling allow access to the green, blue and ultraviolet spectral regions. While the frequency conversion by Optical Parametric Generation offers wide tuning range in the near-infrared spectral region, it is often sufficient to tune the Ti:sapphire wavelength for tuning the OPO, rather

than tuning the OPO itself, e.g. by actively affecting the phase-matching conditions. Further wavelength extension to mid infrared range is possible by Difference Frequency Generation employing signal and idler wavelength pulses obtained from OPO.

Crystals selection for Ti:Sapphire laser frequency conversion

Thin BBO crystals for SHG @ 800 nm	→	350 – 450 nm range
Thin BBO crystals for THG @ 800 nm	→	230 – 300 nm range
Thin BBO crystals for OPG/OPA @ pump 800 nm	→	1050 – 2300 nm range
Thin BBO crystals for OPG/OPA @ pump 400 nm	→	480 – 2300 nm range
AgGaS ₂ crystals for DFG	→	2500-12000 nm range

THIN BBO CRYSTALS FOR SHG AND THG OF Ti:SAPPHIRE LASER WAVELENGTH



Free Standing BBO Crystals

The crystals down to 100 μm can be supplied as free standing crystals not attached to the support. However, ring mounts are highly recommended for safe handling of these thin crystals. Minimum aperture of free standing BBO is 5×5 mm, maximum aperture is 22×22 mm. The tolerance is ±50 μm for crystals of thickness down to 300 μm and ±20 μm for crystals of thickness down to 100 μm.

Optically contacted crystals

BBO crystals less than 100 μm thickness can be supplied optically contacted on UV Fused Silica substrate sizes 10×10×1 mm

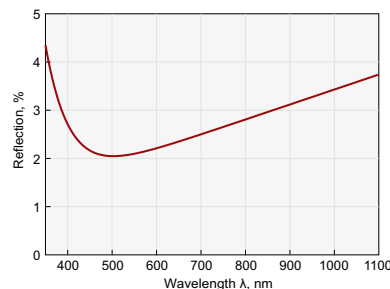
or 12×12×2 mm. Other sizes of substrates are also available on request. Minimum aperture of optically contacted BBO is 5×5 mm, maximum aperture is 10×10 mm. The tolerance of crystal thickness is +10/-5 microns.

Protective Coatings for BBO crystals

P-protective coating – is a single or two layer antireflection coating made at specified wavelength range. Typical reflection values are R<2% in the mid range, R<4% at the edges. P coating is highly recommended for ultrashort pulse applications and features low dispersion and very high laser damage threshold.

STANDARD SPECIFICATIONS OF ULTRATHIN BBO CRYSTALS

Flatness	λ/8 @ 633 nm
Parallelism	< 20 arcsec
Perpendicularity	< 5 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Surface quality	10-5 scratch & dig (MIL-PRF-13830B)
Clear aperture	>90% of full aperture
Laser damage threshold	>200 GW/cm ² , 133 fsec pulse, 800 nm typical, 50 Hz



Typical P-coating for BBO SHG@800 nm application

EKSMA OPTICS recommends the following thickness BBO crystals depending on application and fundamental wavelength pulse duration, assuming it is spectrum limited Gaussian pulse.

Application	Pulse duration, fs	Thickness, mm
Type 1, SHG @ 800 nm Θ=29.2°, φ=90°	10	0.05
	20	0.1
	50	0.2
	100	0.5
	200	1
Type 1, THG @ 800 nm Θ=44,3°, φ=90°	10	0.01
	20	0.02
	50	0.05
	100	0.1
	200	0.2

BBO for SHG @ 800 nm

BBO crystal, Thickness = 0.05 mm*

Code	Aperture, mm	UV FS support size, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-600H	6×6	10×10×2	29.2	90	P/P@400-800 nm	948
BBO-800H	8×8	10×10×2	29.2	90	P/P@400-800 nm	990
BBO-1000H	10×10	12×12×2	29.2	90	P/P@400-800 nm	1110

* All BBO crystals of thickness less than 100 μ m are optically contacted onto UV FS support.
All crystals are mounted into open ring holders.

SHG BBO crystals, Thickness = 0.1 mm

Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-601H	6×6	29.2	90	P/P@400-800 nm	505
BBO-801H	8×8	29.2	90	P/P@400-800 nm	710
BBO-1001H	10×10	29.2	90	P/P@400-800 nm	800
BBO-1201H	12×12	29.2	90	P/P@400-800 nm	1295
BBO-1501H	15×15	29.2	90	P/P@400-800 nm	2040
BBO-2001H	20×20	29.2	90	P/P@400-800 nm	3785
BBO-2201H	22×22	29.2	90	P/P@400-800 nm	5155

SHG BBO crystal, Thickness = 0.2 mm

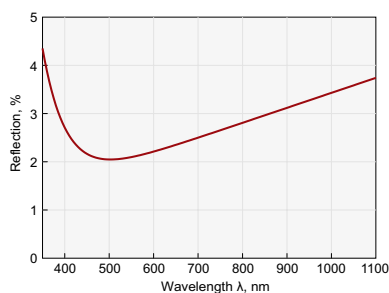
Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-602H	6×6	29.2	90	P/P@400-800 nm	505
BBO-802H	8×8	29.2	90	P/P@400-800 nm	710
BBO-1002H	10×10	29.2	90	P/P@400-800 nm	790
BBO-1202H	12×12	29.2	90	P/P@400-800 nm	1285
BBO-1502H	15×15	29.2	90	P/P@400-800 nm	2020
BBO-2002H	20×20	29.2	90	P/P@400-800 nm	3725
BBO-2202H	22×22	29.2	90	P/P@400-800 nm	5150

SHG BBO crystal, Thickness = 0.5 mm

Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-603H	6×6	29.2	90	P/P@400-800 nm	440
BBO-803H	8×8	29.2	90	P/P@400-800 nm	665
BBO-1003H	10×10	29.2	90	P/P@400-800 nm	760
BBO-1203H	12×12	29.2	90	P/P@400-800 nm	1265
BBO-1503H	15×15	29.2	90	P/P@400-800 nm	1980
BBO-2003H	20×20	29.2	90	P/P@400-800 nm	3720
BBO-2203H	22×22	29.2	90	P/P@400-800 nm	5150

SHG BBO crystal, Thickness = 1 mm

Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-604H	6×6	29.2	90	P/P@400-800 nm	390
BBO-804H	8×8	29.2	90	P/P@400-800 nm	615
BBO-1004H	10×10	29.2	90	P/P@400-800 nm	765
BBO-1204H	12×12	29.2	90	P/P@400-800 nm	1150
BBO-1504H	15×15	29.2	90	P/P@400-800 nm	1860
BBO-2004H	20×20	29.2	90	P/P@400-800 nm	3575
BBO-2204H	22×22	29.2	90	P/P@400-800 nm	4580



P-protective coating curve of Type 1
($\theta=29.2^\circ$, $\varphi=90^\circ$) BBO crystal used for SHG@800 nm

SHG BBO crystal, Thickness = 2 mm

Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-605H	6×6	29.2	90	P/P@400-800 nm	360
BBO-805H	8×8	29.2	90	P/P@400-800 nm	620
BBO-1005H	10×10	29.2	90	P/P@400-800 nm	830
BBO-1205H	12×12	29.2	90	P/P@400-800 nm	1200
BBO-1505H	15×15	29.2	90	P/P@400-800 nm	1910
BBO-2005H	20×20	29.2	90	P/P@400-800 nm	3625
BBO-2205H	22×22	29.2	90	P/P@400-800 nm	4630

HOUSING ACCESSORIES

Ring Holders
for Nonlinear Crystals

See page 2.25



Positioning Mount
840-0199 for
Nonlinear Crystal
Housing

See page 2.26



BBO for THG @ 800 nm

BBO crystal, Thickness = 0.01 mm, optically contacted

Code	Aperture, mm	UV FS support size, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-606H	6×6	10×10×2	44.3	90	P/P@400-800/266	1020
BBO-806H	8×8	10×10×2	44.3	90	P/P@400-800/266	1060
BBO-1006H	10×10	12×12×2	44.3	90	P/P@400-800/266	1175

BBO crystal, Thickness = 0.02 mm, optically contacted

Code	Aperture, mm	UV FS support size, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-607H	6×6	10×10×2	44.3	90	P/P@400-800/266	1020
BBO-807H	8×8	10×10×2	44.3	90	P/P@400-800/266	1060
BBO-1007H	10×10	12×12×2	44.3	90	P/P@400-800/266	1175

BBO crystal, Thickness = 0.05 mm, optically contacted

Code	Aperture, mm	UV FS support size, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-608H	6×6	10×10×2	44.3	90	P/P@400-800/266	948
BBO-808H	8×8	10×10×2	44.3	90	P/P@400-800/266	990
BBO-1008H	10×10	12×12×2	44.3	90	P/P@400-800/266	1110

THG BBO crystal, Thickness = 0.1 mm

Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-609H	6×6	44.3	90	P/P@400-800/266	505
BBO-809H	8×8	44.3	90	P/P@400-800/266	710
BBO-1009H	10×10	44.3	90	P/P@400-800/266	800
BBO-1209H	12×12	44.3	90	P/P@400-800/266	1330
BBO-1509H	15×15	44.3	90	P/P@400-800/266	2140
BBO-2009H	20×20	44.3	90	P/P@400-800/266	3925
BBO-2209H	22×22	44.3	90	P/P@400-800/266	5355

THG BBO crystal, Thickness = 0.2 mm

Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-610H	6×6	44.3	90	P/P@400-800/266	505
BBO-810H	8×8	44.3	90	P/P@400-800/266	710
BBO-1010H	10×10	44.3	90	P/P@400-800/266	790
BBO-1210H	12×12	44.3	90	P/P@400-800/266	1285
BBO-1510H	15×15	44.3	90	P/P@400-800/266	2020
BBO-2010H	20×20	44.3	90	P/P@400-800/266	3915
BBO-2210H	22×22	44.3	90	P/P@400-800/266	5310

THG BBO crystal, Thickness = 0.5 mm

Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-611H	6×6	44.3	90	P/P@400-800/266	440
BBO-811H	8×8	44.3	90	P/P@400-800/266	665
BBO-1011H	10×10	44.3	90	P/P@400-800/266	760
BBO-1211H	12×12	44.3	90	P/P@400-800/266	1265
BBO-1511H	15×15	44.3	90	P/P@400-800/266	1980
BBO-2011H	20×20	44.3	90	P/P@400-800/266	3900
BBO-2211H	22×22	44.3	90	P/P@400-800/266	5300

THG BBO crystal, Thickness = 1 mm

Code	Aperture, mm	θ , deg	φ , deg	Coating	Price, EUR
BBO-612H	6×6	44.3	90	P/P@400-800/266	390
BBO-812H	8×8	44.3	90	P/P@400-800/266	625
BBO-1012H	10×10	44.3	90	P/P@400-800/266	785
BBO-1212H	12×12	44.3	90	P/P@400-800/266	1210
BBO-1512H	15×15	44.3	90	P/P@400-800/266	1920
BBO-2012H	20×20	44.3	90	P/P@400-800/266	3860
BBO-2212H	22×22	44.3	90	P/P@400-800/266	4960

RELATED PRODUCTS

Zero Order Dual Wavelength Plates

See page 5.20

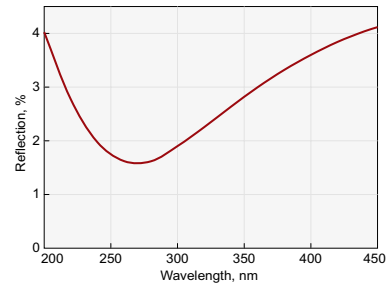
Ring Holders for Nonlinear Crystals

See page 2.25



Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26



P-protective coating curve of Type 1 ($\theta=44.3^\circ$, $\varphi=90^\circ$) BBO crystal's exit face used for THG@800 nm

FEMTOKITS FOR THIRD HARMONIC GENERATION OF FEMTOSECOND Ti:Sapphire LASER

Kits consist of set of components required for efficient third harmonic generation of femtosecond Ti:Sapphire laser. The schemes of the third harmonic generation in basic and extended Femtokits are presented below.

Basic Femtokit FK Series

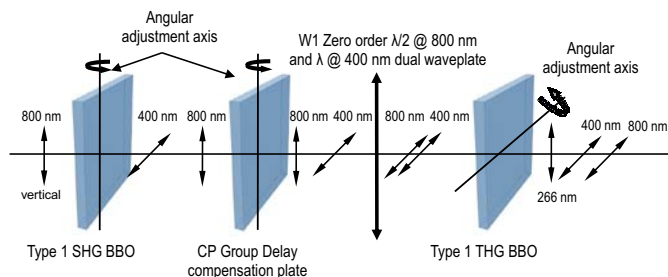


Mounted Femtokit FK Series

Basic Femtokit FK series includes:

- ▶ Type 1 SHG BBO crystal with 6×6 mm aperture, P-coated @ 400-800 nm,
- ▶ Type 1 THG BBO crystal with 6×6 mm aperture, P-coated @ 400-800/266 nm,
- ▶ Calcite plate for group velocity delay compensation CP, AR coated @ 800+400 nm,
- ▶ Zero order dual waveplate W1, optically contacted, AR coated @ 800+400 nm,
- ▶ All above four components are mounted in to 1 inch ring holders for convenient handling.

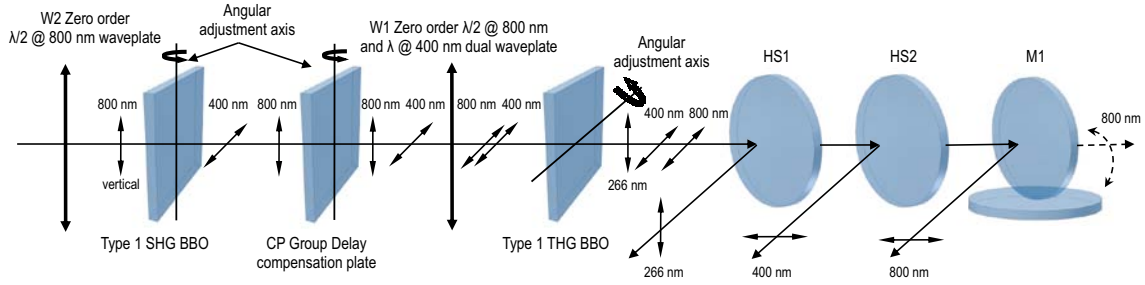
The thickness of SHG BBO crystal, THG BBO crystal and group delay compensation plate is different in each kit and is optimal for certain pulse duration of fundamental harmonic to avoid harmonic pulses broadening.



Fundamental pulse duration	Basic FemtoKit FK Series		Basic Mounted FemtoKit FK Series	
	Code	Price, EUR	Code	Price, EUR
150 – 250 fsec	FK-800-200	1710	FK-800-200-M	2658
120 – 150 fsec	FK-800-130	1760	FK-800-130-M	2708
70 – 120 fsec	FK-800-100	1760	FK-800-100-M	2708
30 – 70 fsec	FK-800-050	2268	FK-800-050-M	3216
15 – 30 fsec	FK-800-020	2340	FK-800-020-M	3288

Non-standard kits with larger apertures of BBO crystals and thicknesses optimal for other pulse durations are available on request.

Extended FemtoKit FKE Series



Extended FemtoKit FKE series includes:

- ▶ All components from basic kit,
- ▶ Additional zero order waveplate W2, optically contacted, AR coated @ 800 nm,
- ▶ Harmonic Separator HS1 HR @ 266 nm and HT @ 800+400 nm at AOI=45 deg,
- ▶ Harmonic Separator HS2 HR @ 400 nm and HT @ 800 nm at AOI=45 deg,
- ▶ Laser mirror M1, HR at 800 nm at AOI=45 deg.

Fundamental pulse duration	Extended FemtoKit FKE Series		Extended Mounted FemtoKit FKE Series	
	Code	Price, EUR	Code	Price, EUR
150 – 250 fsec	FKE-800-200	2402	FKE-800-200-M	4122
120 – 150 fsec	FKE-800-130	2452	FKE-800-130-M	4172
70 – 120 fsec	FKE-800-100	2452	FKE-800-100-M	4172
30 – 70 fsec	FKE-800-050	2960	FKE-800-050-M	4680
15 – 30 fsec	FKE-800-020	3032	FKE-800-020-M	4752

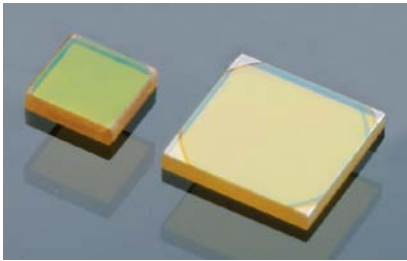
Non-standard kits with larger apertures of BBO crystals and thicknesses optimal for other pulse durations are available on request.

Up to 50% SHG conversion efficiency which was achieved in 0.5 mm SHG BBO crystal with Ti:Sapphire Super Spitfire laser operating at 1 kHz, 130 fs, 20-100 μJ @ 800 nm and effective beam diameter 0.9 mm. THG efficiency was reached up to 8% from fundamental using **FKE-800-100 FemtoKit**.



Extended Mounted FemtoKit FKE Series

THIN AgGaS₂ CRYSTALS FOR DFG → 2.5-1.3 μm



STANDARD SPECIFICATIONS

Flatness	λ/6 @ 633 nm
Parallelism	< 20 arcsec
Perpendicularity	< 10 arcmin
Angle tolerance	< 30 arcmin
Aperture tolerance	± 0.1 mm
Surface quality	10-5 scratch & dig (MIL-PRF-13830B)
Clear aperture	>90% of full aperture

BBAR Coatings for AgGaS₂ crystals

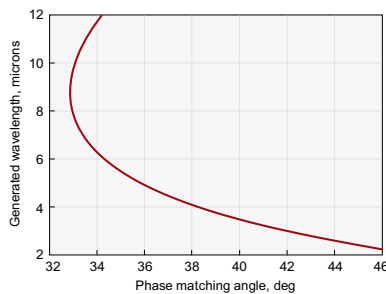
BBAR coating – is multilayer dielectric antireflection coating made at specified wavelength range. Standard coating is designed to reduce reflection losses at input side at 1.1-2.6 micron range and output side at 2.6-11 micron range

Typical reflection values are R<0.5% in the mid range, and up to reflection values of uncoated crystal at the edges of given ranges.

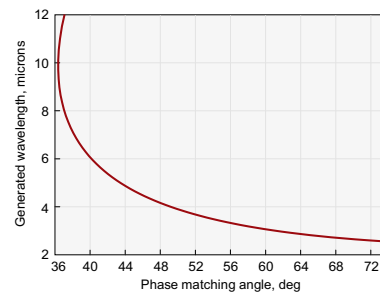
BBAR coating is designed to minimise dispersion of ultrashort pulses and also features high damage threshold.

AgGaS ₂	Size, mm			Orientation		Coating	Application	Price, EUR
	W	H	L	θ	φ			
AGS-401H	5	5	1	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 μm	DFG @ 1.2-2.4 μm → 2.4-11 μm	835
AGS-402H	6	6	2	50	0	BBAR/BBAR @ 1.1-2.6 / 2.6-11 μm	DFG @ 1.2-2.4 μm → 2.4-11 μm	1345
AGS-403H	5	5	0.4	34	45	BBAR/BBAR @ 3-6 / 1.5-3 μm	SHG @ 3-6 μm, Type 1	995
AGS-404H	5	5	0.4	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 μm	DFG @ 1.2-2.4 μm → 2.4-11 μm	995
AGS-801H	8	8	0.4	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 μm	DFG @ 1.2-2.4 μm → 2.4-11 μm	2340
AGS-802H	8	8	1	39	45	BBAR/BBAR @ 1.1-2.6 / 2.6-11 μm	DFG @ 1.2-2.4 μm → 2.4-11 μm	2140

Crystals are mounted into open ring holders (see page 2.25).



Type 1 DFG (e-o=e) in AGS. DFG of signal and idler generated in BBO pumped at 800 nm



Type 2 DFG (e-o=e) in AGS. DFG of signal and idler generated in BBO pumped at 800 nm

HOUSING ACCESSORIES

Ring Holders for Nonlinear Crystals

See page 2.25



Positioning Mount 840-0199 for Nonlinear Crystal Housing

See page 2.26



Yb:KGW AND Yb:KYW CRYSTALS LASER LINES AND HARMONICS



- High absorption coefficient at 981 nm
- High stimulated emission cross section
- Low laser threshold
- Extremely low quantum defect $\lambda_{pump} / \lambda_{se}$
- Broad polarized output at 1023–1060 nm
- High slope efficiency with diode pumping (~ 60%)
- High Yb doping concentration

Yb:KGW and Yb:KYW crystals have broad emission bandwidths and are used as lasing materials to generate ultrashort (~100-200 fs) high power pulses. Direct pump of Yb:KGW/KYW crystals with laser diodes operating at 981 nm supports compact laser systems. Yb:KGW/KYW laser generates pulses at 1023-1060 nm wavelength range.

Also Yb:KGW and Yb:KYW can be used as ultrashort pulse amplifiers.

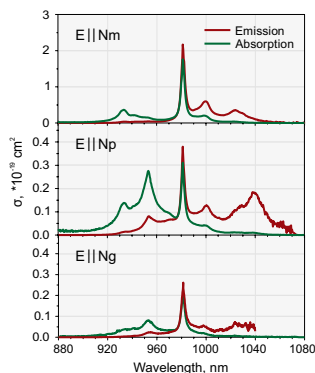
We believe that Yb:KGW and Yb:KYW are some of the best materials for high power thin disk lasers generating femtosecond pulses.

CUSTOM MANUFACTURING CAPABILITIES

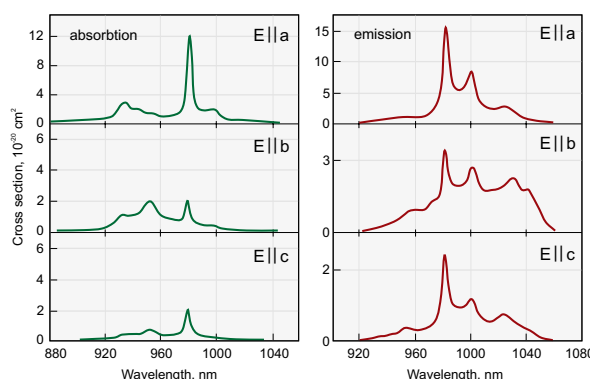
- Various shapes (slabs, rods, cubes, disks)
- Different dopant levels
- Diversified coatings
- Attractive prices for introductory quantities to OEMs

PROPERTIES OF Yb:KGW AND Yb:KYW

Name	Yb:KGW	Yb:KYW
Yb ³⁺ concentration	0.5–5%	0.5–100%
Crystal structure	monoclinic	monoclinic
Point group	C2/c	C2/c
Lattice parameters	a=8.095 Å, b=10.43 Å, c=7.588 Å, β=94.43°	a=8.05 Å, b=10.35 Å, c=7.54 Å, β=94°
Thermal expansion	α _a =4×10 ⁻⁶ /°C, α _b =3.6×10 ⁻⁶ /°C, α _c =8.5×10 ⁻⁶ /°C	—
Thermal conductivity	K _a =2.6 W/mK, K _b =3.8 W/mK, K _c =3.4 W/mK	—
Density	7.27 g/cm ³	6.61 g/cm ³
Mohs' hardness	4–5	4–5
Melting temperature	1075 °C	—
Transmission range	0.35–5.5 μm	0.35–5.5 μm
Refractive indices (λ=1.06 μm)	n _y =2.037, n _p =1.986, n _m =2.033	—
Thermo-optic coefficients @ 1064 nm	∂n _p /∂T= -15.7×10 ⁻⁶ K ⁻¹ ∂n _m /∂T= -11.8×10 ⁻⁶ K ⁻¹ ∂n _y /∂T= -17.3×10 ⁻⁶ K ⁻¹	For 20% Yb:KYW ∂n _p /∂T= -13.08×10 ⁻⁶ K ⁻¹ ∂n _m /∂T= -7.61×10 ⁻⁶ K ⁻¹ ∂n _y /∂T= -11.83×10 ⁻⁶ K ⁻¹
Laser wavelength	1023–1060 nm	1025–1058 nm
Fluorescence lifetime	0.3 ms	0.3 ms
Stimulated emission cross section (E a)	2.6×10 ⁻²⁰ cm ²	3×10 ⁻²⁰ cm ²
Absorption peak and bandwidth	α _a =26 cm ⁻¹ , λ=981 nm, Δλ=3.7 nm	α _a =40 cm ⁻¹ , λ=981 nm, Δλ=3.5 nm
Absorption cross section	1.2×10 ⁻¹⁹ cm ²	1.33×10 ⁻¹⁹ cm ²
Lasing threshold	35 mW	70 mW
Stark levels energy (in cm ⁻¹) of the ² F _{5/2} manifolds of Yb ³⁺ @ 77K	10682, 10471, 10188	10695, 10476, 10187
Stark levels energy (in cm ⁻¹) of the ² F _{7/2} manifolds of Yb ³⁺ @ 77K	535, 385, 163, 0	568, 407, 169, 0



Absorption and stimulated emission cross sections of Yb:KYW



Absorption and emission spectrae of Yb(5%):KGW

BBO AND LBO CRYSTALS FOR Yb:KGW/KYW FREQUENCY CONVERSION

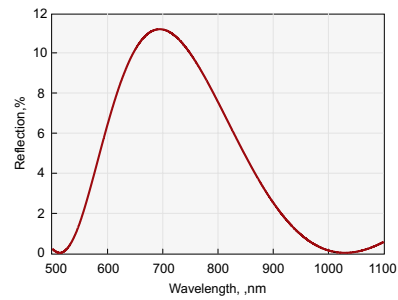
EKSMA OPTICS recommends the following thickness BBO and LBO crystals for Yb:KGW/KYW frequency conversion depending on fundamental wavelength pulse duration, assuming it is spectrum limited Gaussian pulse.

BBO crystals

Pulse duration	BBO SHG @ 1030 nm	BBO THG @ 1030 nm	BBO 4HG @ 1030 nm
50 fs	0.5 mm	0.15 mm	0.1 mm
100 fs	1 mm	0.25 mm	0.15 mm
150 fs	1.5 mm	0.4 mm	0.2 mm
200 fs	2 mm	0.55 mm	0.3 mm

LBO crystals

Pulse duration	LBO SHG @ 1030 nm
50 fs	0.5 mm
100 fs	1 mm
150 fs	1.5 mm
200 fs	2 mm



Typical AR@1030+515 nm coating for LBO or BBO SHG@1030 nm application

NOTE
LBO crystals can be supplied with Clear Aperture up to 50 mm diameter.

LBO for SHG @ 1030 nm

SHG LBO crystals, Type 1, Thickness = 0.9 mm

Code	Aperture, mm	θ , deg	ϕ , deg	Coating	Price, EUR
LBO-601H	6×6	90	13.8	AR/AR@515+1030 nm	515
LBO-801H	8×8	90	13.8	AR/AR@515+1030 nm	620
LBO-1001H	10×10	90	13.8	AR/AR@515+1030 nm	650

SHG LBO crystals, Type 1, Thickness = 1.9 mm

Code	Aperture, mm	θ , deg	ϕ , deg	Coating	Price, EUR
LBO-602H	6×6	90	13.8	AR/AR@515+1030 nm	460
LBO-802H	8×8	90	13.8	AR/AR@515+1030 nm	610
LBO-1002H	10×10	90	13.8	AR/AR@515+1030 nm	815

SHG LBO crystals, Type 1, Thickness = 2.8 mm

Code	Aperture, mm	θ , deg	ϕ , deg	Coating	Price, EUR
LBO-603H	6×6	90	13.8	AR/AR@515+1030 nm	545
LBO-803H	8×8	90	13.8	AR/AR@515+1030 nm	790
LBO-1003H	10×10	90	13.8	AR/AR@515+1030 nm	1035

SHG LBO crystals, Type 1, Thickness = 3.7 mm

Code	Aperture, mm	θ , deg	ϕ , deg	Coating	Price, EUR
LBO-604H	6×6	90	13.8	AR/AR@515+1030 nm	465
LBO-804H	8×8	90	13.8	AR/AR@515+1030 nm	660
LBO-1004H	10×10	90	13.8	AR/AR@515+1030 nm	895

BBO for SHG @ 1030 nm

SHG BBO crystals, Type 1, Thickness = 0.5 mm

Code	Aperture, mm	θ , deg	ϕ , deg	Coating	Price, EUR
BBO-651H	6×6	23.4	90	AR/AR@515+1030 nm	495
BBO-851H	8×8	23.4	90	AR/AR@515+1030 nm	640
BBO-1051H	10×10	23.4	90	AR/AR@515+1030 nm	760

SHG BBO crystals, Type 1, Thickness = 1 mm

Code	Aperture, mm	θ , deg	ϕ , deg	Coating	Price, EUR
BBO-652H	6×6	23.4	90	AR/AR@515+1030 nm	430
BBO-852H	8×8	23.4	90	AR/AR@515+1030 nm	560
BBO-1052H	10×10	23.4	90	AR/AR@515+1030 nm	785

SHG BBO crystals, Type 1, Thickness = 1.5 mm

Code	Aperture, mm	θ , deg	ϕ , deg	Coating	Price, EUR
BBO-653H	6×6	23.4	90	AR/AR@515+1030 nm	475
BBO-853H	8×8	23.4	90	AR/AR@515+1030 nm	600
BBO-1053H	10×10	23.4	90	AR/AR@515+1030 nm	795

SHG BBO crystals, Type 1, Thickness = 2 mm

Code	Aperture, mm	θ , deg	ϕ , deg	Coating	Price, EUR
BBO-654H	6×6	23.4	90	AR/AR@515+1030 nm	480
BBO-854H	8×8	23.4	90	AR/AR@515+1030 nm	630
BBO-1054H	10×10	23.4	90	AR/AR@515+1030 nm	835

BBO for THG @ 1030 nm

Code	Aperture, mm	Thickness, mm	θ , deg	ϕ , deg	Coating	Price, EUR
BBO-631H	6×6	0.15	32.5	90	AR/AR@1030+515/343 nm	725
BBO-632H	6×6	0.25	32.5	90	AR/AR@1030+515/343 nm	665
BBO-633H	6×6	0.4	32.5	90	AR/AR@1030+515/343 nm	605
BBO-634H	6×6	0.55	32.5	90	AR/AR@1030+515/343 nm	540

BBO for 4HG @ 1030 nm

Code	Aperture, mm	Thickness, mm	θ , deg	ϕ , deg	Coating	Price, EUR
BBO-641H	6×6	0.1	50	90	P/P@515/257 nm	600
BBO-642H	6×6	0.15	50	90	P/P@515/257 nm	570
BBO-643H	6×6	0.2	50	90	P/P@515/257 nm	550
BBO-644H	6×6	0.3	50	90	P/P@515/257 nm	535