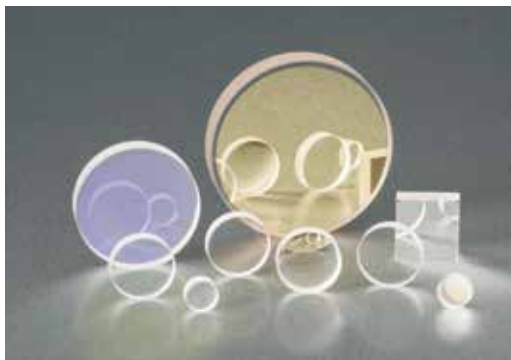


Mirrors



Our mirrors are available in partial or high reflecting configurations, narrow or large bandwidth, and are designed for specific laser technology including, but not limited to: excimer, gas, Nd:YAG, Nd:YLF, laser diode, diode-pumped solid-state; and Ti:Sapphire lasers. With an impressive complement of reflective coatings and substrates, our mirrors can be utilized in the deep UV, all the way up to the infrared with either dielectric or metallic coatings. Our dielectric mirrors are designed for high powered applications utilizing laser grade substrates.

Don't see a mirror configuration that meets your needs? We also offer an extensive range of mirror substrates that can be ordered in production quantities with a CVI specific coating.

SELECTION GUIDE	4
PARTIAL REFLECTORS (OUTPUT COUPLERS)	6
NARROWBAND LASER LINE MIRRORS	8
BROADBAND DIELECTRIC MIRRORS.	17
METAL COATED MIRRORS.	20
UNCOATED MIRROR SUBSTRATES	27

CVI Laser Optics specializes in
prototype to volume production manufacturing!

Give us a call and we will be honored to assist you with your custom needs.

NOTES:

SELECTION GUIDE

PRODUCT TYPE	WAVELENGTHS	REFLECTANCE	OPERATING CONDITIONS	PAGE
Narrowband Partial Reflecting Mirrors				
HIGH ENERGY PARTIAL REFLECTING LASER MIRRORS: PR1	Wavelengths from 190nm to 2100nm	See page 6 Range: 30% to 99%	20 J/cm ² , 20ns, 20Hz at 1064nm, 10 MW/cm ² at 1064nm	6
Narrowband Laser Line Mirrors				
TUNABLE LASER LINE MIRRORS: TLM1	Wavelengths from 190nm to 2100nm	R ≥ 99.0% at 0° R ≥ 98.5% at 45°, P-Pol R ≥ 99.0% at 45°, UNP R ≥ 99.5% at 45°, S-Pol	20 J/cm ² , 20ns, 20Hz at 1064nm, 10 MW/cm ² at 1064nm	8
FIBER LASER MIRRORS: FLM	343, 515, 1030, 1064, 1070, and 1550nm	R ≥ 99.0% at 0° R ≥ 99.0% at 45°, UNP	20 J/cm ² , 20ns, 20Hz at 1064nm, 10 MW/cm ² at 1064nm	14
EXCIMER LASER MIRRORS: ARF	193	R ≥ 97% at 0° R ≥ 96.0% at 45° UNP	1 J/cm ² , 20ns pulse at 193nm	9
Nd:YAG MIRRORS: Y5	213	R ≥ 97.0% at 0° R ≥ 97.0% at 45°, UNP	3 J/cm ² , 8ns pulse at 248nm	12
EXCIMER LASER MIRRORS: KRF	248	R ≥ 99.5% at 0° R ≥ 99.0% at 45°, UNP	3 J/cm ² , 8ns pulse at 248nm	9
Nd:YAG / Nd:YLF LASER MIRRORS: Y4	262-266	R ≥ 99.9% at 0° R ≥ 99.6% at 45°, P-Pol R ≥ 99.8% at 45°, UNP R ≥ 99.9% at 45°, S-Pol	10 J/cm ² , 20ns, 20Hz at 266nm	10
Nd:YAG / Nd:YLF LASER MIRRORS: Y3	349-355	R ≥ 99.9% at 0° R ≥ 99.6% at 45°, P-Pol R ≥ 99.8% at 45°, UNP R ≥ 99.9% at 45°, S-Pol	15 J/cm ² , 20ns, 20Hz at 355nm	10
Nd:YAG / Nd:YLF LASER MIRRORS: Y2	523-532	R ≥ 99.9% at 0° R ≥ 99.6% at 45°, P-Pol R ≥ 99.8% at 45°, UNP R ≥ 99.9% at 45°, S-Pol	20 J/cm ² , 20ns, 20Hz at 532nm	10
Nd:YAG / Nd:YLF LASER MIRRORS: Y1	1047-1064	R ≥ 99.9% at 0° R ≥ 99.6% at 45°, P-Pol R ≥ 99.8% at 45°, UNP R ≥ 99.9% at 45°, S-Pol	25 J/cm ² , 20ns, 20Hz at 1064nm	10
ION BEAM SPUTTERED Nd:YAG LASER MIRRORS: Y1S , Y2S , Y3S , Y4S	266, 355, 532, 1064	R ≥ 99.9% at 0° R ≥ 99.9% at 45°, P-Pol R ≥ 99.9% at 45°, S-Pol	40 J/cm ² , 20ns, 20Hz at 1064nm	13
Dual Band Laser Line Mirrors				
Nd:YAG 1064/532nm DUAL WAVELENGTH MIRRORS: HM	1064/532	R ≥ 99% at 1064 and 532nm	8 J/cm ² , 20ns, 20Hz at 1064nm, 3 J/cm ² , 20ns, 20Hz at 532nm	15
Nd:YAG 1064/633nm DUAL WAVELENGTH MIRRORS: YH	1064/633	R ≥ 99% at 1064nm R ≥ 80% at 633nm	8 J/cm ² , 20ns pulse at 1064nm	16

SELECTION GUIDE

PRODUCT TYPE	WAVELENGTHS	REFLECTANCE	OPERATING CONDITIONS	PAGE
Broadband Mirrors				
TUNABLE BROADBAND MIRRORS: TLM2	Wavelengths from 450nm to 2100nm	R > 99.5% at 0° incidence R > 99.0% at 45° incidence	500 mJ/cm², 20ns, 20Hz at 1064nm	18
MAXBRITETM BROADBAND MIRRORS: MPQ	245 – 390 (UV) 420 – 700 (VIS)	R _{avg} ≥ 98% from 245 – 390nm at 0° - 45° R _{avg} ≥ 98% from 420 – 700nm at 0° - 45°	0.5 J/cm², 10ns at 532nm	19
TI:SAPPHIRE ULTRAFAST MIRRORS: TLMB	740 – 860	R > 99.0% from 740 – 860nm	8 J/cm², 300 ps, 20Hz at 800nm	17
Metal Coated Mirrors				
VACUUM UV ALUMINUM MIRRORS: VUVA	157 – 190	R > 85% at 157nm by design	Low Power Applications	20
DEEP UV ALUMINUM MIRRORS: DUVA	193 – 1200	R > 90% at 193nm R _{avg} ≥ 85% at 400 – 1200nm	Low Power Applications	21
UV ENHANCED ALUMINUM FLAT MIRRORS: PAUV	250 – 600	R _{avg} ≥ 85% (250 – 600nm)	Low Power Applications	22
PROTECTED ALUMINUM FLAT MIRRORS: PAV	400 – 800	R _{avg} ≥ 87% (400 – 800nm)	Low Power Applications	23
ENHANCED ALUMINUM FLAT MIRRORS: EAV	450 – 650	R _{avg} ≥ 92% (450 – 650nm)	Low Power Applications	24
PROTECTED SILVER FLAT MIRRORS: PS	400 – 20,000	R _{avg} ≥ 95% (400nm to 20 µm)	Low Power Applications	25
PROTECTED GOLD FLAT MIRRORS: PG	650 – 20,000	R _{avg} ≥ 95.5% (650 – 1700nm) R _{avg} ≥ 98.0% (2 – 16 µm)	Low Power Applications	26
Uncoated Mirror Substrates				
PRODUCT TYPE	MATERIAL			PAGE
CONVEX SPHERICAL FUSED SILICA MIRROR BLANKS: SMCX-UV	Standard Grade Corning 7980 1-D (Fused Silica)			27
CONCAVE SPHERICAL MIRROR BLANKS: SMCC-C , SMCC-UV	N-BK7 or Standard Grade Corning 7980 1-D (Fused Silica)			28
PLANE ROUND MIRROR BLANKS: PM-C , PM-UV	N-BK7 or Standard Grade Corning 7980 1-D (Fused Silica)			29
PLANE SQUARE MIRROR BLANKS: SQM-C , SQM-UV	N-BK7 or Standard Grade Corning 7980 1-D (Fused Silica)			30
PLANE RECTANGULAR MIRROR BLANKS: RM-UV	Standard Grade Corning 7980 1-D (Fused Silica)			31

HIGH ENERGY PARTIAL REFLECTING LASER MIRRORS: PR1



Specifications

Product Code: PR1

Substrate Material:

 $\lambda \leq 450\text{nm}$: Standard Grade Corning 7980 1-D (Fused Silica) $\lambda > 450\text{nm}$: N-BK7Diameter Tolerance: $\pm 0/-0.25\text{mm}$ Thickness Tolerance: $\pm 0.25\text{mm}$ Wedge: ≤ 5 arc minutes (plano substrates only)Concentricity: $\pm 0.05\text{mm}$ (spherical substrates only)Radius Tolerance: $\pm 0.5\%$ (spherical substrates only)

Chamfer: 0.35mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S2 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

Transmitted Wavefront

Distortion: $< \lambda/10$ p-v at 633nmClear Aperture: $\geq 85\%$ of central diameter

Angle of Incidence: 0°

Adhesion and Durability: Per MIL-C-48497a

S1 Coating: See table on page 7

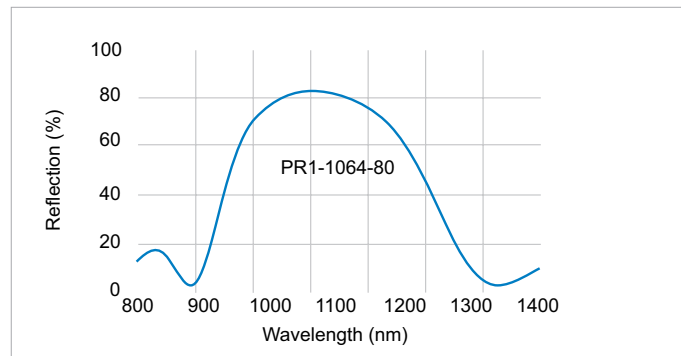
S2 AR Coating: $R \leq 0.25\%$ at center wavelength

Damage Threshold:

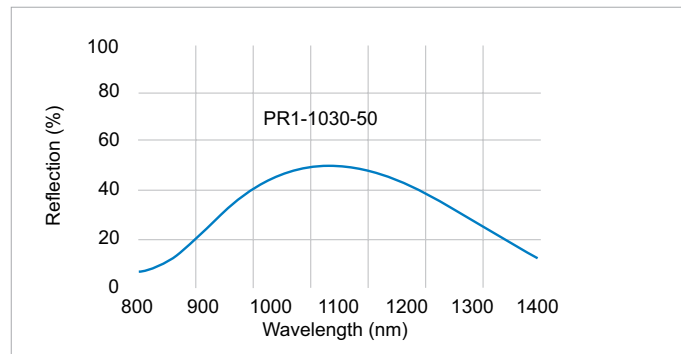
Fused Silica: 20 J/cm², 20ns, 20Hz at 1064nmN-BK7: 10 J/cm², 20ns, 20Hz at 1064nm

Other reflectance values and substrate dimensions available upon request. Standard partial reflectors have an anti-reflection coating on the second surface.

- Custom reflection options from 10% to 99%
- Contact an applications engineer for OEM options



Reflectivity vs wavelength of PR1-1064-80 at 0° incidence angle



Reflectivity vs wavelength of PR1-1030-50 at 0° incidence angle

Visit cvilaseroptics.com for additional traces.

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4
PRODUCT CODE	CENTER WAVELENGTH (nm)	REFLECTANCE (%)	SIZE CODE/RADII/WEDGE
PR1	800	95	0525

EXAMPLES: PR1-800-95-0525 (FLAT); PR1-800-95-0525-0.10CC (RADII); PR1-800-95-IF-0525-UV (WEDGE)

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

PR1

2. CENTER WAVELENGTH (nm)

532	633	800	1030	1064	1550
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3. REFLECTANCE (%)

30	±5.0	70	±4.0	90	±2.0	98	±1.0
50	±5.0	80	±4.0	95	±1.5	99	±0.5

4. SIZE CODE

	DIAMETER (mm)	THICKNESS (mm)	STANDARD OPTIONS
0525	12.7	6.35	Flat, Radius or Wedge
1025	25.4	6.35	Flat, Radius or Wedge
2037	50.8	9.53	Flat or Wedge

4. RADIUS OF CURVATURE (m)

SIZE CODE	DIAMETER (mm)	RADII OPTIONS (m), CC = concave						
0525	12.7	0.10CC	0.25CC	0.50CC	1.00CC			
1025	25.4	0.10CC	0.25CC	0.50CC	1.00CC	3.00CC	5.00CC	10.00CC

4. WEDGE OPTION (for wedge option omit size and radius of curvature options)

SUBSTRATE PART #	DIAMETER (mm)	THICKNESS (mm)	WEDGE (minutes)	MATERIAL
IF-0525-UV	12.7	6.35	30±5	Fused Silica
IF-1025-UV	25.4	6.35	30±5	Fused Silica
IF-2037-UV	50.8	9.53	30±5	Fused Silica

HIGH POWER TUNABLE LASER LINE MIRRORS: TLM1



Specifications

Product Code: TLM1

Substrate Material:

 $\lambda < 450\text{nm}$: Standard Grade Corning 7980 1-D (Fused Silica) $\lambda > 450\text{nm}$: N-BK7Diameter Tolerance: $\pm 0/-0.25\text{mm}$ Thickness Tolerance: $\pm 0.25\text{mm}$ Wedge: ≤ 5 arc minutes

Chamfer:

 $\emptyset \leq 50.8\text{mm}$: 0.35mm leg width at 45° nominal $\emptyset > 50.8\text{mm}$: 0.85mm leg width at 45° nominal**S1 Surface Figure:** $< \lambda/10$ p-v at 633nm before coating: after coating on select substrates**S1 Surface Quality:** 10-5 scratch-dig per MIL-PRF-13830b (at 100W)**S2 Surface Quality:** Commercial polishConcentricity: $\leq 0.05\text{mm}$ (spherical substrates only)Radius Tolerance: $\pm 0.5\%$ (spherical substrates only)Clear Aperture: $\geq 85\%$ of central diameterAngle of Incidence: 0° or 45° options

Adhesion and Durability: Per MIL-C-48497a

Reflectance:

 $R \geq 99.0\%$ at 0° $R \geq 98.5\%$ at 45° , P-Pol $R \geq 99.0\%$ at 45° , UNP $R \geq 99.5\%$ at 45° , S-Pol

Damage Threshold:

Pulsed:

 20 J/cm^2 , 20ns, 20Hz at 1064nm 0.55 J/cm^2 , 50 fsec, 50Hz at 800nm 5.0 J/cm^2 , 10ns, 20Hz at 532nm 3.0 J/cm^2 , 7ns, 20Hz at 266nmContinuous Wave: 10 MW/cm^2 at 1064nmCenter Wavelength Tolerance: $\pm 3\%$

TYPICAL BANDWIDTH FOR TLM1 MIRRORS

Center wave-length (nm)	R>99% 0°	R>99% 45°S	R> 98% 45°P
200	10*	12*	—
400-405	50	64	31
780	85	109	61
800	88	110	62
1030	99	123	74
1550	124	154	94

* R > 97.0%

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4	STEP-5
PRODUCT CODE	CENTER WAVELENGTH	ANGLE OF INCIDENCE	SIZE CODE	RADII OPTIONS
TLM1	800	0	1025	1.00CC

EXAMPLE: TLM1-800-0-1025-1.00CC

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

TLM1

2. CENTER WAVELENGTH (nm)

200	400-405	780	800	1030	1550
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3. ANGLE OF INCIDENCE in Degrees

0	0 degree (normal incidence)
45	45 degrees

4. FLAT SIZE CODE	Diameter (mm)	Thickness (mm)	Standard Options
0525	12.7	6.35	Flat or Radius
0725	19.1	6.35	Flat Only
1025	25.4	6.35	Flat or Radius
2037	50.8	9.53	Flat Only
3050	76.2	12.7	Flat Only
4050	101.6	12.7	Flat Only

5. RADIUS OF CURVATURE (m)

SIZE CODE	Diameter (mm)	RADII OPTIONS (m), cc = concave		RADII OPTIONS (m), cx = convex
0525	12.7	0.10CC	0.75CC	
		0.25CC	1.00CC	
		0.50CC		
1025	25.4	0.10CC	1.50CC	0.30CX
		0.25CC	2.00CC	0.50CX
		0.50CC	3.00CC	1.00CX
		0.75CC	5.00CC	
		1.00CC	10.00CC	

For Nd:YAG/Nd:YLF wavelengths see page 11

For ArF and KrF wavelengths see page 9

Please see page T-28 for High Reflection Coating Traces.

EXCIMER LASER MIRRORS: ARF, KRF



Specifications

Product Code: **ARF, KRF**

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge: ≤ 5 arc minutes

Chamfer:

Ø ≤ 50.8mm: 0.35mm leg width at 45° nominal

Ø > 50.8mm: 0.85mm leg width at 45° nominal

S1 Surface Figure: < λ/10 p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF 13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: ≥ 85% of central diameter

Adhesion and Durability: Per MIL-C-48497a

Angle of Incidence: 45° only

Reflectance (at 193nm):

R ≥ 96.0% at 45°, UNP

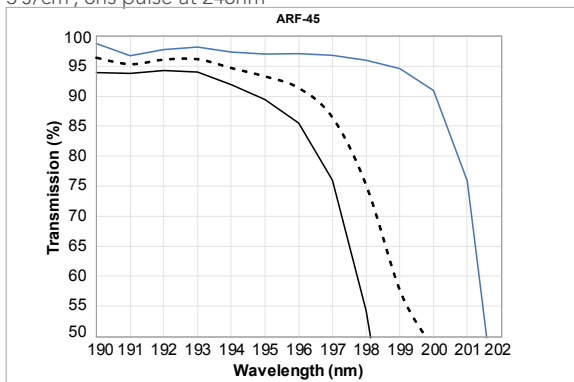
Reflectance (at 248nm):

R > 99.0% at 45°, UNP

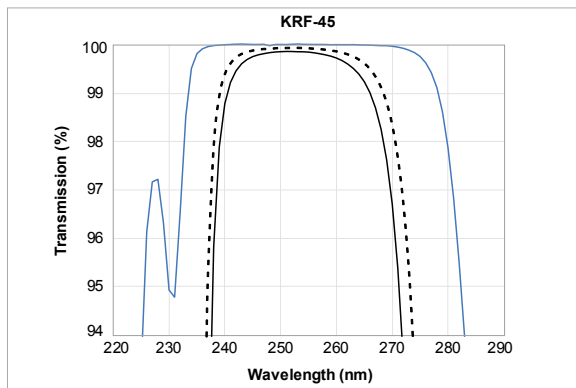
Damage Threshold:

1 J/cm², 20ns pulse at 193nm

3 J/cm², 8ns pulse at 248nm



Reflection vs wavelength of 193nm excimer laser mirror for 0° and 45° designs. Minimum reflectance > 97% at 0°, > 96.0% at 45° UNP, > 94.0% at 45° P-Pol, and > 97.0% at 45° S-Pol



Reflection vs wavelength of 248nm excimer laser mirror for 0° and 45° designs. Minimum reflectance > 99.5% at 0° and > 99.0% at 45° UNP

P-POL: — UNP: - - - S-POL: — 0°: ····

We offer an extensive range of high-quality excimer laser mirrors specifically designed for use with today's high-energy excimer laser applications. Our unique coatings have continued to outperform the industry standards and provide our customers with optics for the most demanding laser environments.

► Contact an applications engineer for OEM options

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3
PRODUCT CODE	SIZE CODE	ANGLE OF INCIDENCE
ARF	1537	45
EXAMPLE: ARF-1537-45		

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE	LASER TYPE	WAVELENGTH (nm)
ARF	ArF Solid State Excimer Laser	193
KRF	KrF Solid State Excimer Laser	248

2. SIZE CODE	DIAMETER (mm)	THICKNESS (mm)
1025	25.4	6.35
1537	38.1	9.53
2037	50.0	9.53
3050	76.2	12.7

3. ANGLE OF INCIDENCE in Degrees	
45	45 degrees

HIGH POWER Nd:YAG / Nd:YLF LASER MIRRORS: Y1, Y2, Y3, Y4



Specifications

Product Code: Y1, Y2, Y3, Y4

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge: ≤ 5 arc minutes (flat substrates only)

Chamfer:

Ø ≤ 50.8mm: 0.35mm leg width at 45° nominal

Ø > 50.8mm: 0.85mm leg width at 45° nominal

Concentricity: ±0.05mm (spherical substrates only)

Radius Tolerance: ±0.5% (spherical substrates only)

S1 Surface Figure: < λ/10 p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: ≥ 85% of central diameter

Angle of Incidence: 0° or 45° options

Reflectance:

R ≥ 99.9% at 0°

R ≥ 99.6% at 45°, P-Pol

R ≥ 99.8% at 45°, UNP

R ≥ 99.9% at 45°, S-Pol

Adhesion and Durability: Per MIL-C-675c and MIL-C-48497a

Damage Threshold:

Pulsed:

25 J/cm², 20ns, 20Hz at 1064nm

20 J/cm², 20ns, 20Hz at 532nm

15 J/cm², 20ns, 20Hz at 355nm

10 J/cm², 20ns, 20Hz at 266nm

cw: 10 MW/cm² at 1064nm

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4
PRODUCT CODE	SIZE CODE	ANGLE OF INCIDENCE	RADII OPTIONS
Y1	1025	0	1.00CC
EXAMPLE: Y1-1025-0-1.00CC			

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE	LASER TYPE	WAVELENGTH (nm)
Y1	Nd:YAG / Nd:YLF	1047-1064
Y2	Nd:YAG / Nd:YLF second harmonic	523-532
Y3	Nd:YAG / Nd:YLF third harmonic	349-355
Y4	Nd:YAG / Nd:YLF fourth harmonic	262-266

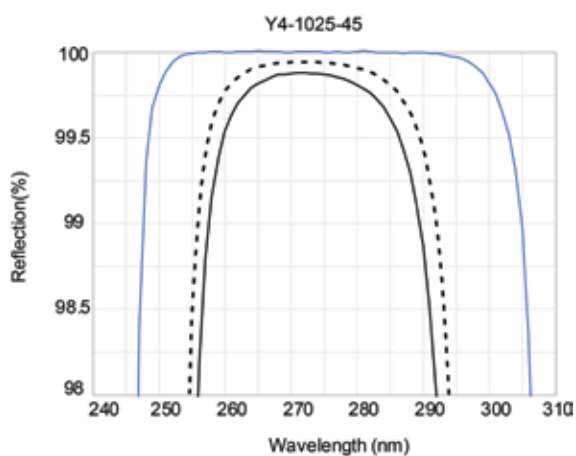
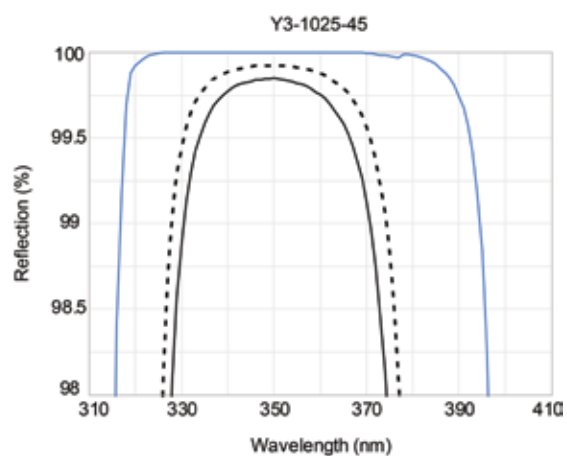
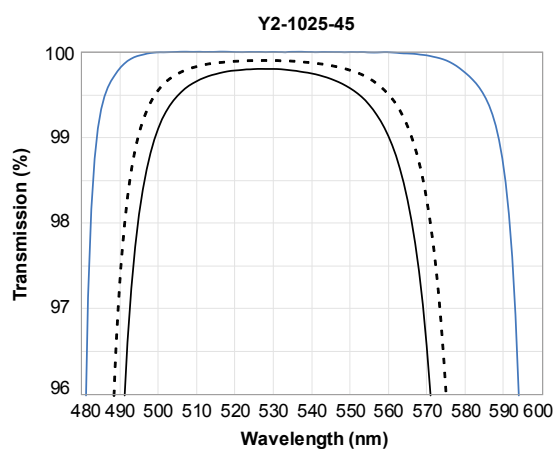
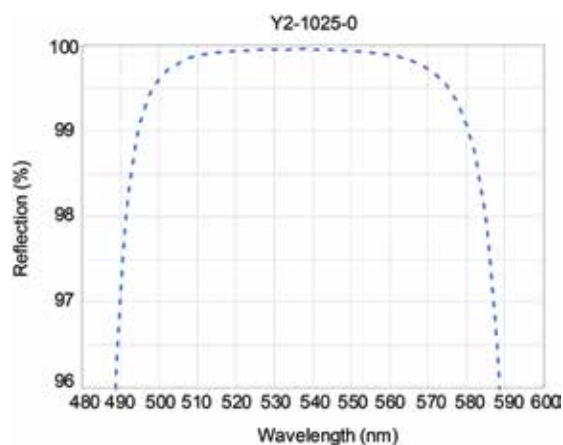
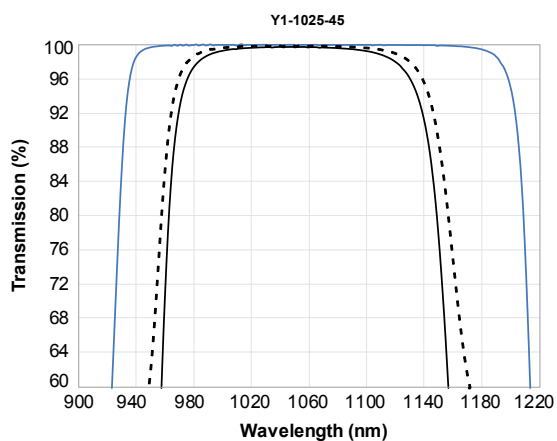
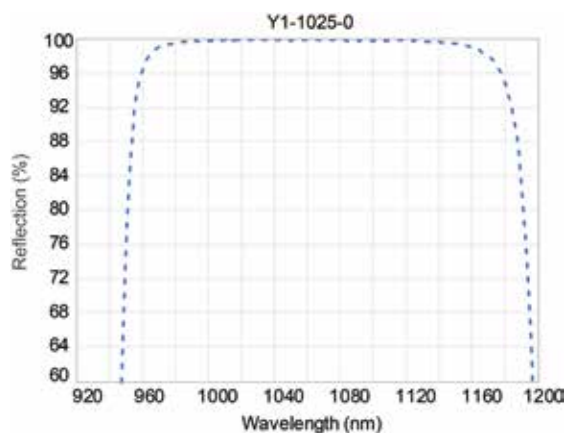
2. SIZE CODE	DIAMETER (mm)	THICKNESS (mm)
0525	12.7	6.35
1025	25.4	6.35
1537	38.1	9.53
2037	50.8	9.53
3050	76.2	12.7
4050	101.6	12.7

3. ANGLE OF INCIDENCE	in Degrees
0	0 degrees (normal incidence)
45	45 degrees

4. RADIUS OF CURVATURE (m)				
SIZE CODE	Diameter (mm)	RADII OPTIONS (m), cc = concave		RADII OPTIONS (m), cx = convex
0525	12.7	0.10CC	0.75CC	
		0.25CC	1.00CC	
		0.50CC		
1025	25.4	0.10CC	1.50CC	0.30CX
		0.25CC	2.00CC	0.50CX
		0.50CC	3.00CC	1.00CX
		0.75CC	5.00CC	
		1.00CC	10.00CC	

USABLE BANDWIDTH (R_{avg} ≥ 99.0%):

Y1	1020 - 1100nm
Y2	510 - 560nm
Y3	340 - 370nm
Y4	255 - 275nm



* Traces based on actual performance; not theoretical

P-POL: — UNP: - - - S-POL: — 0°: - - -

HIGH POWER Nd:YAG LASER MIRROR: Y5



Specifications

Product Code: **Y5****Substrate Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm**Thickness Tolerance:** ±0.25mm**Wedge:** ≤ 5 arc minutes**Chamfer:** 0.35mm leg width at 45° nominal**S1 Surface Figure:** < $\lambda/10$ p-v at 633nm before coating; after coating on select substrates**S1 Surface Quality:** 10-5 scratch-dig per MIL-PRF-13830b (at 100W)**S2 Surface Quality:** Commercial polish**Clear Aperture:** ≥ 85% of central diameter**Angle of Incidence:** 0° or 45° options**Reflectance:**

R ≥ 97.0% at 0°

R ≥ 95.0% at 45°, P-Pol

R ≥ 97.0% at 45°, UNP

R ≥ 98.5% at 45°, S-Pol

Adhesion and Durability: Per MIL-C-48497a**Damage Threshold:****Pulsed:**3 J/cm², 8ns, at 248nm

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3
PRODUCT CODE	SIZE CODE	ANGLE OF INCIDENCE
Y5	1025	45

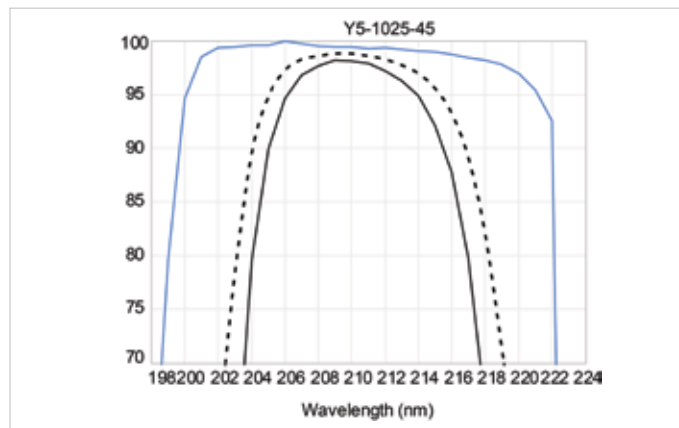
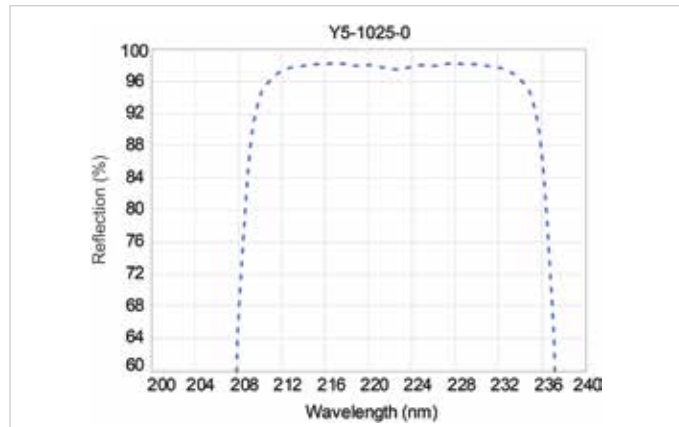
EXAMPLE: Y5-1025-45

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE	LASER TYPE	WAVELENGTH (nm)
Y5	Nd:YAG fifth harmonic	213

2. SIZE CODE	DIAMETER (mm)	THICKNESS (mm)
0525	12.7	6.35
1025	25.4	6.35
2037	50.8	9.53

3. ANGLE OF INCIDENCE in Degrees	
0	Normal incidence
45	45 degrees



P-POL: — UNP: - - - S-POL: — 0°: ·····

ION BEAM SPUTTERED Nd: YAG LASER MIRRORS: Y1S, Y2S, Y3S, Y4S



Specifications

Product Code: **Y1S, Y2S, Y3S, Y4S**

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25 mm

Thickness Tolerance: ±0.25 mm

Wedge: ≤ 5 arc min

Chamfer: 0.35 mm leg width at 45° typical

S1 Surface Figure: < $\lambda/10$ p-v at 633 nm before coating

S1 Surface Quality: 10-5 scratch and dig per MIL-PRF 13830b

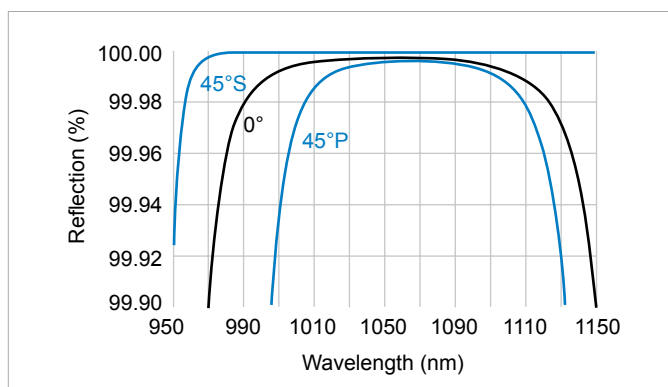
S2 Surface Quality: Commercial polish

Clear Aperture: ≥ 85% of central diameter

Angle of Incidence: 0° or 45° options

Adhesion and Durability: Per MIL-PRF-13830b

- ▶ High reflectivity and laser damage threshold
- ▶ Minimal coating shift; high environmental stability
- ▶ Ideal for high-power Nd:YAG and fiber laser applications



Reflectivity vs wavelength of Y1S low loss Nd:YAG laser mirror at 45° and 0° incidence angle design

ION BEAM SPUTTERED ND:YAG LASER MIRRORS

Wavelength (nm)	Reflectivity	Incidence Angle	Damage Threshold	Ø (mm)	t (mm)	PART NUMBER
1064	≥ 99.9% at 0°	0°	40 J/cm ² @ 1064nm	25.4	6.35	Y1S-1025-0
1064	≥ 99.9% at 45° (both S & P)	45°	40 J/cm ² @ 1064nm	25.4	6.35	Y1S-1025-45
532	≥ 99.9% at 0°	0°	8 J/cm ² @ 532nm	25.4	6.35	Y2S-1025-0
532	≥ 99.9% at 45° (both S & P)	45°	8 J/cm ² @ 532nm	25.4	6.35	Y2S-1025-45
355	≥ 99.9% at 0°	0°	3 J/cm ² @ 355nm	25.4	6.35	Y3S-1025-0
355	≥ 99.9% at 45° (both S & P)	45°	3 J/cm ² @ 355nm	25.4	6.35	Y3S-1025-45
266	≥ 99.9% at 0°	0°	2 J/cm ² @ 266nm	25.4	6.35	Y4S-1025-0
266	≥ 99.9% at 45° (both S & P)	45°	2 J/cm ² @ 266nm	25.4	6.35	Y4S-1025-45

FIBER LASER MIRRORS: FLM



Specifications

Product Code: FLM

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ± 0.25 mmWedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

Adhesion and Durability: Per MIL-C-48497a

Angle of Incidence: 0° or 45° options

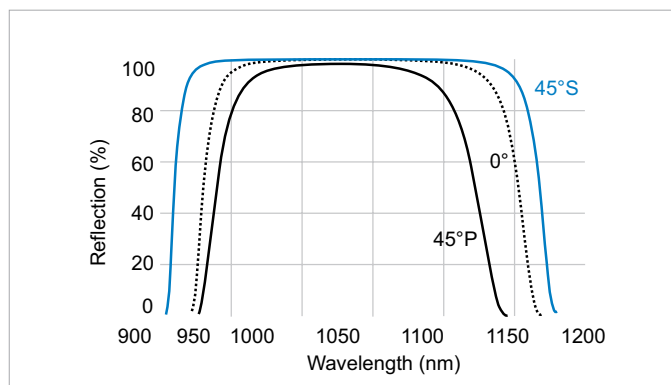
Reflectance:

 $R \geq 99.0\%$ at 0° $R \geq 98.5\%$ at 45°, P-Pol $R \geq 99.0\%$ at 45°, UNP $R \geq 99.5\%$ at 45°, S-Pol

Damage Threshold:

Pulsed: 20 J/cm², 20ns, 20Hz at 1064nmcw: 10 MW/cm² at 1064nm

- Applications include: laser marking, precision micromachining, optical tweezers, and Diode-Pumped Solid-State lasers
- Other center wavelengths and substrate dimensions are available for OEM applications



Reflectivity vs wavelength of FLM fiber laser mirror at 1030nm for 0° and 45° designs

Visit cvilaseroptics.com for additional traces

FIBER LASER MIRRORS

Wavelength (nm)	Incidence Angle	Ø (mm)	t (mm)	PART NUMBER
343	45	25.4	6.35	FLM-343-1025-45
515	45	25.4	6.35	FLM-515-1025-45
1030	45	12.7	6.35	FLM-1030-0525-45
1030	0	25.4	6.35	FLM-1030-1025-0
1030	45	25.4	6.35	FLM-1030-1025-45
1030	0	50.8	6.35	FLM-1030-2037-0
1030	45	50.8	6.35	FLM-1030-2037-45
1064	0	12.7	6.35	FLM-1064-0525-0
1064	45	12.7	6.35	FLM-1064-0525-45
1064	0	25.4	6.35	FLM-1064-1025-0
1064	45	25.4	6.35	FLM-1064-1025-45
1064	0	50.8	6.35	FLM-1064-2037-0
1064	45	50.8	6.35	FLM-1064-2037-45
1070	45	12.7	6.35	FLM-1070-0525-45
1070	0	25.4	6.35	FLM-1070-1025-0
1070	45	25.4	6.35	FLM-1070-1025-45
1070	0	50.8	6.35	FLM-1070-2037-0
1070	45	50.8	6.35	FLM-1070-2037-45
1550	0	25.4	6.35	FLM-1550-1025-0
1550	45	25.4	6.35	FLM-1550-1025-45

Nd:YAG 1064/532nm DUAL WAVELENGTH MIRRORS: [HM](#)



HM dielectric wavelength mirrors are designed for high reflectivity and durability at both Nd:YAG and doubled Nd:YAG wavelengths at either 0° or 45°.

- $R > 99.0\%$ at 1064nm and 532nm
- Incidence angles other than 0° and 45° may be specified
- Other substrate dimensions are available for OEM capabilities

Specifications

Product Code: [HM](#)

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: $\pm 0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

Angle of Incidence: 0° or 45° options

Adhesion and Durability: Per MIL-C-48497a

Reflectance:

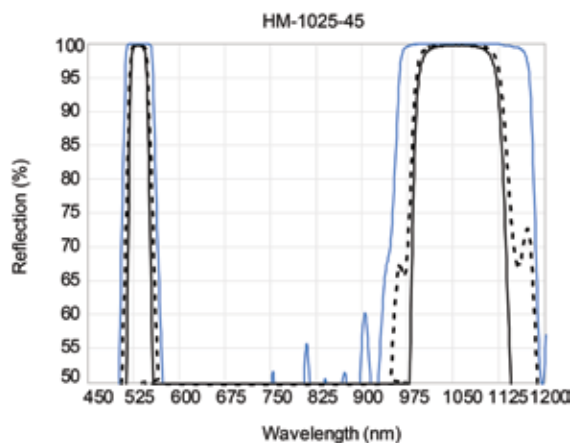
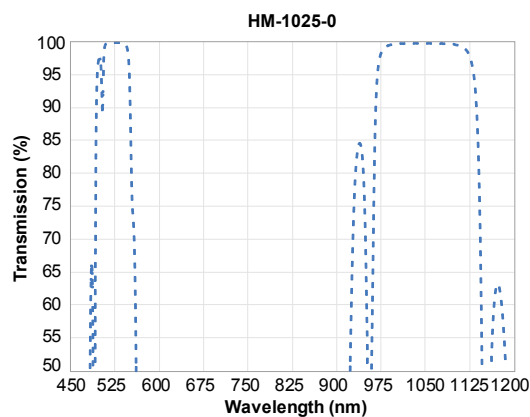
$R \geq 99.0\%$ at 0° at 1064nm and 532nm

$R \geq 98.5\%$ at 45°, P-Pol at 1064nm and 532nm

Damage Threshold:

8 J/cm², 20ns, 20Hz at 1064nm

3 J/cm², 10ns, 20Hz at 532nm



P-POL: — UNP: - - - S-POL: — 0°: ····

Nd:YAG 1064/532nm DUAL WAVELENGTH MIRRORS

Wavelength (nm)	Incidence Angle	Ø (mm)	t (mm)	PART NUMBER
1064/532	0°	12.7	6.35	HM-0525-0
1064/532	45°	12.7	6.35	HM-0525-45
1064/532	0°	25.4	6.35	HM-1025-0
1064/532	45°	25.4	6.35	HM-1025-45
1064/532	0°	50.8	9.5	HM-2037-0
1064/532	45°	50.8	9.5	HM-2037-45

Nd:YAG 1064/633nm DUAL WAVELENGTH MIRRORS: YH



Specifications

Product Code: YH

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: $\pm 0/-0.25$ mmThickness Tolerance: ± 0.25 mmWedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

Angle of Incidence: 45° only

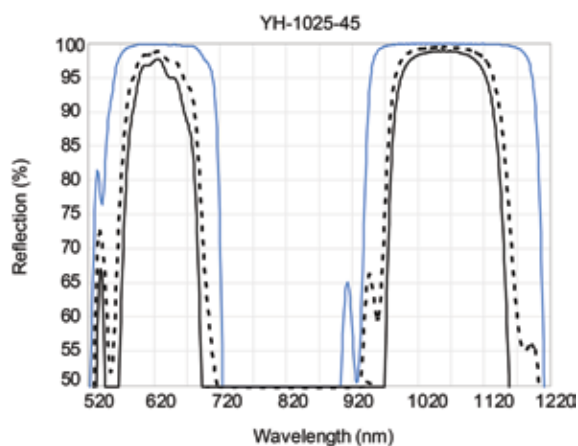
Adhesion and Durability: Per MIL-C-48497a

Reflectance:

 $R \geq 99\%$ at 1064nm, $R \geq 80\%$ at 633nm, at 45° UNPDamage Threshold: >8 J/cm², 20ns, 20Hz at 1064nm

YH dielectric wavelength mirrors are designed for high reflectivity and durability at both Nd:YAG and HeNe wavelengths at either 0° or 45°.

- $R > 99\%$ at 1064nm and $R > 80\%$ at 633nm
- Alignment mirror for Nd:YAG using HeNe laser
- Contact an applications engineer for OEM options



P-POL: — UNP: - - - - S-POL: — 0°: ·····

ND:YAG 1064/633nm DUAL WAVELENGTH MIRROR

Wavelength (nm)	Incidence Angle	Ø (mm)	t (mm)	PART NUMBER
1064/633	45°	25.4	6.35	YH-1025-45
1064/633	45°	50.8	9.5	YH-2037-45

HIGH POWER TI:SAPPHIRE ULTRAFAST MIRRORS: TLMB



Product Code: **TLMB**

Substrate Material: N-BK7

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ± 0.25 mm

Wedge: ≤ 5 arc minutes

Chamfer:

$\varnothing \leq 50.8$ mm: 0.35mm leg width at 45° nominal

$\varnothing > 50.8$ mm: 0.85mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm
(after coating)

S1 Surface Quality: 10-5 scratch-dig
per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

Angle of Incidence: 0° or 45° options

Center Wavelength: 800nm

Reflectance: $R > 99.0\%$ from 740 – 860nm for 0° or 45° UNP

Adhesion and Durability: Per MIL-C-48497a,
Insoluble in lab solvents.

Damage Threshold:

Pulsed: 0.46 J/cm², 50 fsec, 50Hz at 800nm

These mirrors are available upon special request for all Ti:Sapphire laser-related center wavelengths.

- Designed for Pulse Lengths > 30 fs
- Broadband design with ultralow group velocity dispersion (GVD)
- High reflectivity: 740 – 860nm for 0° or 45° Unpolarized

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4
PRODUCT CODE	WAVELENGTH	ANGLE OF INCIDENCE	SIZE CODE
TLMB	800	45	1025

EXAMPLE: TLMB-800-45-1025

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

TLMB

2. WAVELENGTH (nm)

800

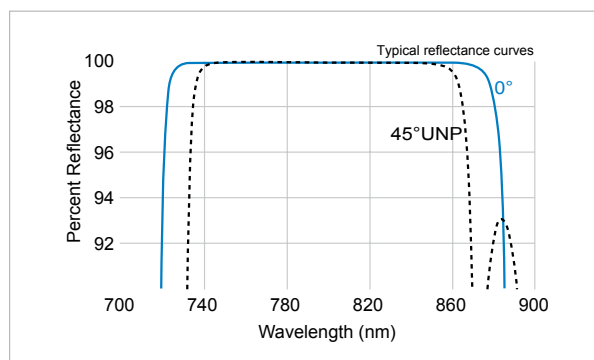
3. ANGLE OF INCIDENCE in Degrees

0	0 degrees (normal incidence)
45	45 degrees

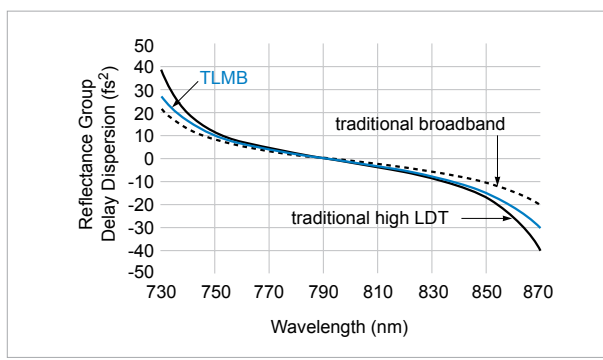
4. SIZE CODE

	DIAMETER (mm)	THICKNESS (mm)
2506M	25.0	6.0
1025	25.4	6.35
5010M*	50.0	10.0
2037	50.8	9.53
3050*	76.2	12.7
4050*	101.6	12.7

* Only available at 45° AOI



TLMB-800 Ti:Sapphire broadband mirror showing 0° and 45° angle of incidence designs



A comparison of group delay dispersion vs wavelength of traditional broadband, traditional high laser damage threshold, and the CVI Laser Optics TLMB ultrafast mirror

TUNABLE BROADBAND MIRRORS: TLM2



Specifications

Product Code: **TLM2**

Substrate Material: N-BK7

Diameter Tolerance: $\pm 0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: $\leq 0.05\text{mm}$ (spherical substrates only)

Radius Tolerance: $\pm 0.5\%$ (spherical substrates only)

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Adhesion and Durability: Per MIL-C-48497a

Clear Aperture: $\geq 85\%$ of central diameter

Center Wavelength: 800nm, or 1030nm

Reflectance: Please refer to the typical bandwidth tables

Angle of Incidence: 45° only

Damage Threshold:

Pulsed:

0.28 J/cm², 50 fsec, 50Hz at 800nm

0.50 J/cm², 20ns, 20Hz at 1064nm

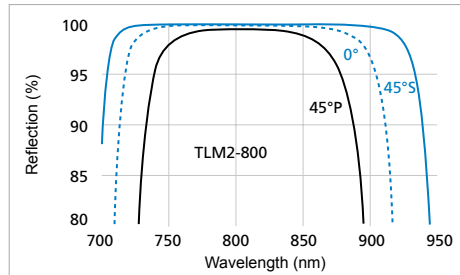
Center Wavelength Tolerance: $\pm 3\%$

Designed for Pulse Lengths: > 30 fs

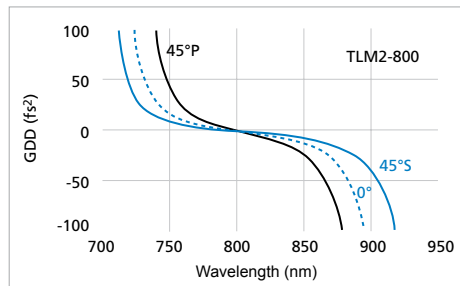
TYPICAL BANDWIDTH FOR TLM2 MIRRORS

Center Wave-length (nm)	R > 99% 0°	R > 99.5% S	R > 99% 45° P
800	156	197	76
1030	180	230	80

The TLM2 mirrors are specially designed to achieve high reflectivity and low dispersion for cw oscillators and low-fluence pulses. These mirrors can be coated for any angle of incidence from 0° to 60° and any center wavelength between 450nm and 2100nm for OEM applications. For 45° tuning mirror applications involving very short pulses or very broad bandwidths. Using s - polarization minimizes pulse distortion and maximizes average reflectivity.



Reflectivity vs wavelength of TLM2-800 broadband laser mirror showing 0° and 45° angle of incidence designs



Group delay dispersion vs wavelength of TLM2-800 broadband laser mirror showing 0° and 45° angle of incidence designs

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4
PRODUCT CODE	WAVELENGTH	ANGLE OF INCIDENCE	SIZE CODE
TLM2	800	45	1025

EXAMPLE: TLM2-800-45-1025

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

TLM2

2. WAVELENGTH (nm)

800

1030

3. ANGLE OF INCIDENCE in Degrees

45

45 degrees

4. SIZE CODE

0525

DIAMETER (mm)

12.7

THICKNESS (mm)

6.35

1025

25.4

6.35

FLAT MIRRORS WITH MAXBRITE™ BROADBAND COATINGS: MPQ



Specifications

Product Code: **MPQ**

Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.15mm

Thickness Tolerance: ±0.25mm

Parallelism: ≤ 3 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

S1 Surface Flatness: < $\lambda/4$ p-v at 633nm before coating

S1 Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

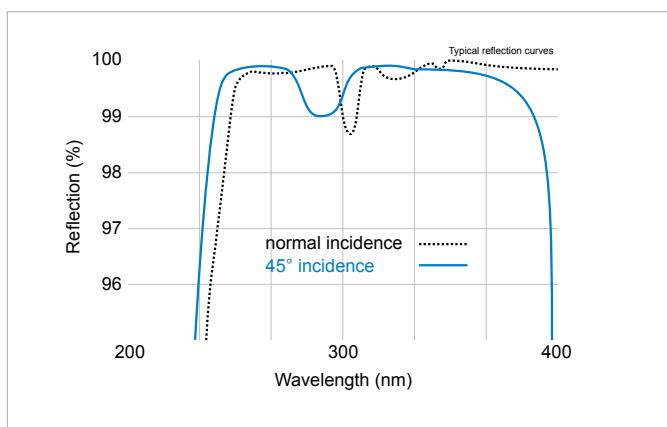
Clear Aperture: ≥ 90% of edge dimension or diameter

Average Reflectance: ≥ 98% at 0° – 45° UNP

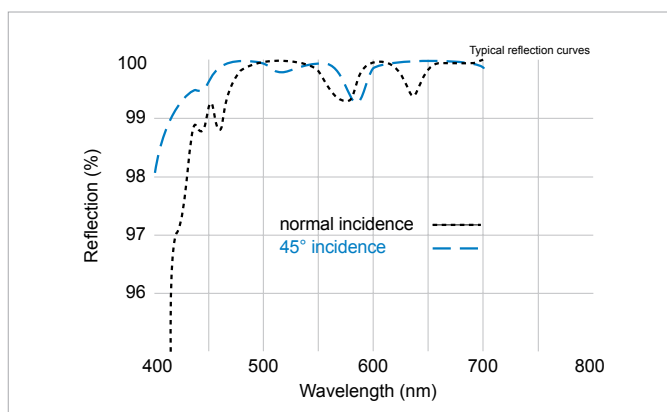
Damage Threshold: 0.4 J/cm², 10ns at 532 (typical)

MAXBRite™ coatings offer extremely high reflectance over a broad range of wavelengths. Most of the ultraviolet and visible laser wavelengths are covered by one of the two MAXBRite coating ranges.

- ▶ MAXBRite coatings operate for angles of incidence as high as 45°.
- ▶ Minimum of 98% reflectance is achieved over a wide wavelength range at angles of incidence from 0 to 45°.
- ▶ Contact CVI Laser Optics for OEM options.



MAXBRite™ coating 245 – 390nm



MAXBRite™ coating 420 – 700nm

FLAT MIRRORS WITH MAXBRITE™ BROADBAND COATINGS

UV Broadband Mirror, Round 245 - 390nm

Ø (mm)	t (mm)	Clear Aperture (mm)	PART NUMBER
25.0	6.0	22.5	MPQ-245-390-2506M

Visible Broadband Mirror, Round 420 - 700nm

25.0	6.0	22.5	MPQ-420-700-2506M
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VACUUM UV ALUMINUM MIRRORS: VUVA



Specifications

Product Code: **VUVA**

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

S1 Surface Figure: < $\lambda/10$ p-v at 633nm

S1 Surface Quality: 40-20 scratch-dig per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

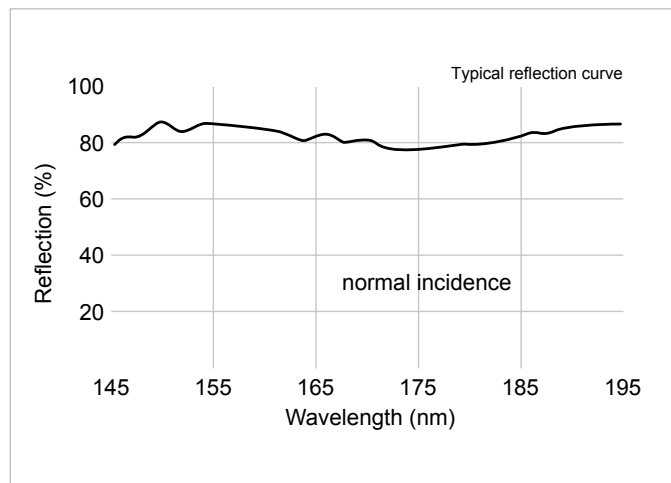
Clear Aperture: ≥ 85% of central diameter

Adhesion and Durability: Per MIL-M-13508c

Reflectance: R > 85% at 157nm by design

Based on CVI Laser Optics high density aluminum coating technology, VUVA mirrors are designed for optimized performance at 157nm. Certification of performance at wavelength is available for an additional charge. Call us for more details.

► Contact an applications engineer for OEM capabilities



Theoretical design of VUVA coating at 157nm and 0°

VACUUM UV ALUMINUM MIRRORS		
Ø (mm)	t (mm)	PART NUMBER
25.4	6.35	VUVA-PM-1025-UV
50.8	9.53	VUVA-PM-2037-UV

DEEP UV ALUMINUM MIRRORS: DUVA



Specifications

Product Code: **DUVA**

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: $\pm 0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm

S1 Surface Quality: 40-20 scratch-dig
per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

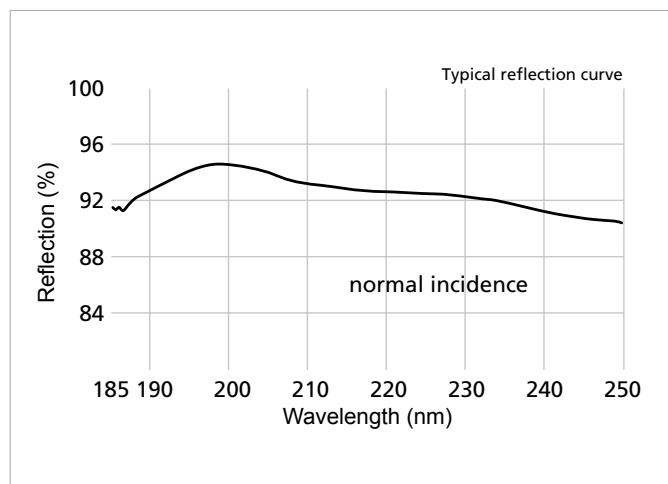
Adhesion and Durability: Per MIL-M-13508c

Reflectance:

$R > 90\%$ at 193nm, $R_{\text{avg}} \geq 85\%$ at 400 – 1200nm

Based on CVI Laser Optics high-density aluminum coating technology, broadband DUVA mirrors provide significantly higher 193nm reflectance and durability than standard UV-protected aluminum mirrors. Choose semi-custom or standard optics for your ellipsometry, spectroscopy, and semiconductor lithography or metrology applications.

► Contact an applications engineer for OEM capabilities



Reflection vs wavelength of 193nm deep UV aluminum coating at 0°

DEEP UV ALUMINUM MIRRORS		
$\varnothing$ (mm)	t (mm)	PART NUMBER
12.7	3.18	DUVA-PM-0512-UV
25.4	6.35	DUVA-PM-1025-UV
50.8	9.53	DUVA-PM-2037-UV

UV ENHANCED ALUMINUM FLAT MIRRORS: PAUV



Specifications

Product Code: **PAUV**

Substrate Material: N-BK7

Dimensional Tolerances:

Square: +0/-0.25mm

Round: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Parallelism: ≤ 5 arc minutes

Chamfer:

Ø ≤ 50.8mm: 0.35mm leg width at 45° nominal

Ø > 50.8mm: 0.85mm leg width at 45° nominal

S1 Surface Figure: < λ/10 p-v at 633nm on select substrates (see table)

S1 Surface Quality: 40-20 scratch-dig per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

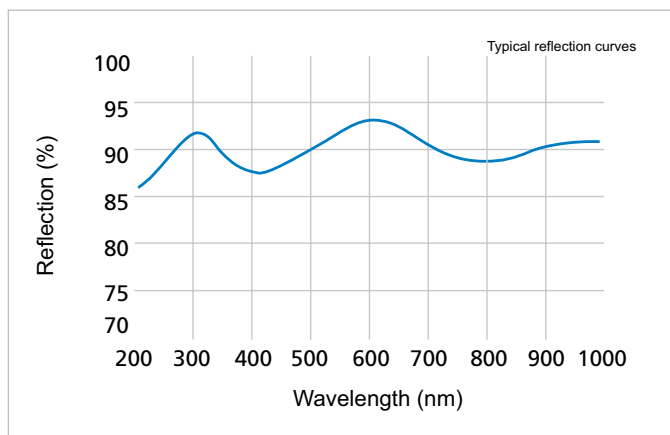
Clear Aperture: 90% of edge dimension or diameter (85% for PAUV-PM series)

Coating: UV-enhanced aluminum

Average Reflectance: ≥ 85% at 250 – 600nm

UV enhanced aluminum mirrors have an additional dielectric coating that prevents oxidation and preserves the reflectance of bare aluminum in the ultraviolet.

- ▶ Average reflectance is greater than 86% from 250 to 600nm
- ▶ Contact an applications engineer for OEM capabilities



UV enhanced aluminum coating at 0°

UV ENHANCED ALUMINUM FLAT MIRRORS						
Shape	Ø (mm)	□ (mm)	t (mm)	Clear Aperture (mm)	Surface Figure (S1)	PART NUMBER
Round	12.7	—	6.35	11.3	< λ/10	PAUV-PM-0525-C
Round	25.4	—	6.35	21.6	< λ/10	PAUV-PM-1025-C
Square	—	25.4	6.35	22.5x22.5	< λ/4	PAUV-SQM-1025-C
Round	50.8	—	10.0	45.0	< λ/10	PAUV-PM-2037-C
Square	—	50.8	9.53	45.0x45.0	< λ/4	PAUV-SQM-2037-C
Round	76.2	—	12.7	64.8	< λ/10	PAUV-PM-3050-C

PROTECTED ALUMINUM FLAT MIRRORS: PAV



Specifications

Product Code: **PAV**

Substrate Material: N-BK7

Dimensional Tolerances:

Square: $+0/-0.25\text{mm}$

Round: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Parallelism: ≤ 5 arc minutes

Chamfer:

$\varnothing \leq 50.8\text{mm}$: 0.35mm leg width at 45° nominal

$\varnothing > 50.8\text{mm}$: 0.85mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm
on select substrates

S1 Surface Quality: 40-20 scratch-dig
per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

Clear Aperture:

Round: $\geq 85\%$ of central diameter

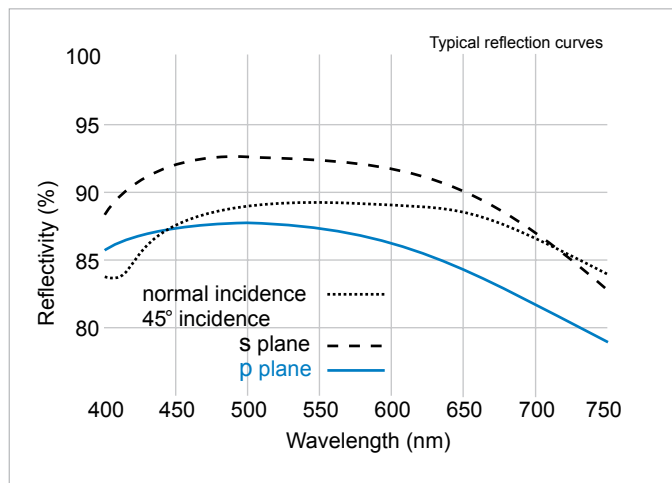
Square: $\geq 90\%$ of edge dimension

Coating: Protected aluminum

Average Reflectance: $\geq 87\%$ at 400 – 800nm

Protected aluminum is the best general-purpose metallic coating for external reflectors in the visible and near-infrared spectrum.

- ▶ Average reflectance greater than 87% from 400 to 800nm
- ▶ Contact an applications engineer for OEM capabilities



Protected aluminum coating

PROTECTED ALUMINUM FLAT MIRRORS						
Shape	Ø (mm)	□ (mm)	t (mm)	Clear Aperture (mm)	Surface Figure (S1)	PART NUMBER
Round	12.7	—	6.35	10.8	$< \lambda/10$	PAV-PM-0525-C
Round	25.4	—	6.35	21.6	$< \lambda/10$	PAV-PM-1025-C
Square	—	25.4	6.35	22.5x22.5	$< \lambda/4$	PAV-SQM-1025-C
Round	50.8	—	9.53	43.2	$< \lambda/10$	PAV-PM-2037-C
Square	—	50.8	9.53	45.0x45.0	$< \lambda/4$	PAV-SQM-2037-C
Round	76.2	—	12.7	64.8	$< \lambda/10$	PAV-PM-3050-C

ENHANCED ALUMINUM FLAT MIRRORS: EAV



Specifications

Product Code: **EAV**

Substrate Material: N-BK7

Diameter: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Parallelism: ≤ 5 arc minutes

Chamfer:

$\varnothing \leq 50.8\text{mm}$: 0.35mm leg width at 45° nominal

$\varnothing > 50.8\text{mm}$: 0.85mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm

S1 Surface Quality: 40-20 scratch-dig
per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

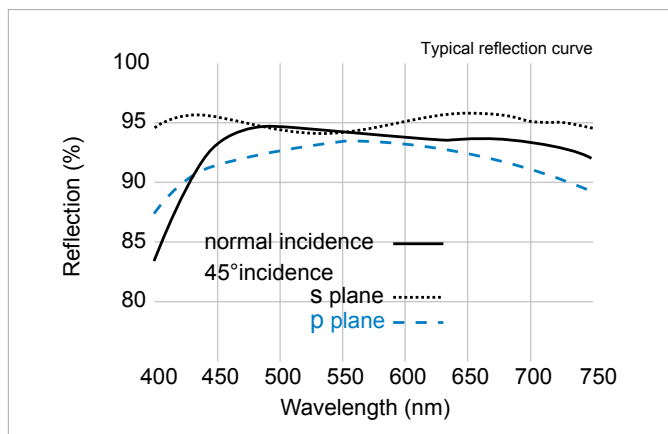
Clear Aperture: $\geq 85\%$ of central diameter

Coating: Enhanced aluminum

Average Reflectance: $\geq 92\%$ at 450–650nm

Enhanced aluminum is an aluminum coating overcoated with a durable multi-layer dielectric film which both increases reflectance throughout the visible spectrum and provides protection from the environment and handling.

- Peak reflectance is 95% with average reflectance across the visible spectrum of 92%



Enhanced aluminum coating

ENHANCED ALUMINUM FLAT MIRRORS			
$\varnothing$ (mm)	t (mm)	Clear Aperture (mm)	PART NUMBER
12.7	6.35	11.3	EAV-PM-0525-C
25.4	6.35	22.5	EAV-PM-1025-C
50.8	9.53	45.0	EAV-PM-2037-C
76.2	12.7	67.5	EAV-PM-3050-C

PROTECTED SILVER FLAT MIRRORS: PS



- ▶ Protected silver has higher reflectance than aluminum throughout the visible and near-infrared spectral region
- ▶ Minimal pulse distortion for ultrafast Ti:Sapphire lasers
- ▶ A proprietary overcoat provides increased durability
- ▶ CVI Laser Optics suggests using the drag and drop method with acetone for the cleaning of these mirrors.
- ▶ Contact an applications engineer for OEM capabilities

Specifications

Product Code: **PS**

Substrate Material: N-BK7

Dimensional Tolerances:

Square: +0/-0.25mm

Round: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Parallelism: ≤ 5 arc minutes

Chamfer:

Ø ≤ 50.8mm: 0.35mm leg width at 45° nominal

Ø > 50.8mm: 0.85mm leg width at 45° nominal

S1 Surface Figure: < λ/10 p-v at 633nm on select substrates

S1 Surface Quality: 40-20 scratch-dig per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

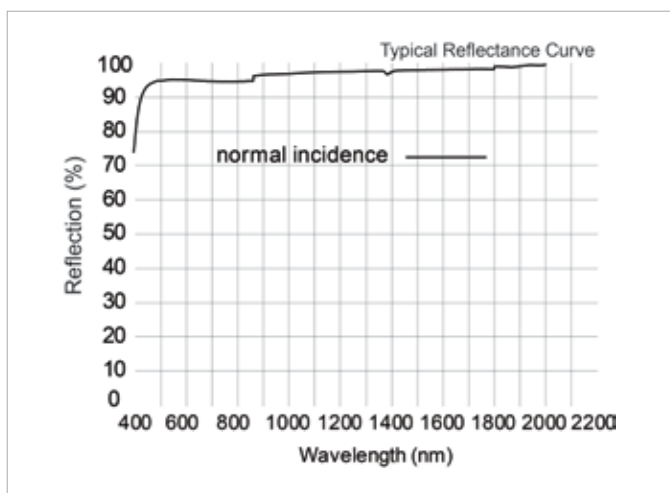
Clear Aperture:

Round: ≥ 85% of central diameter

Square: ≥ 80% of edge dimension

Coating: Protected silver

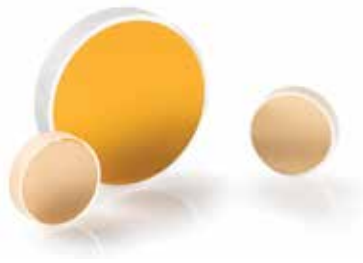
Average Reflectance: ≥ 95% at 400nm to 20μm



Protected silver coating at 0°

PROTECTED SILVER FLAT MIRRORS						
Shape	Ø (mm)	□ (mm)	t (mm)	Min. Clear Aperture (mm)	Surface Figure (S1)	PART NUMBER
Round	12.7	—	6.35	10.8	< λ/10	PS-PM-0525-C
Round	25.4	—	6.35	21.6	< λ/10	PS-PM-1025-C
Square	—	25.4	6.35	22.5x22.5	< λ/4	PS-SQM-1025-C
Round	50.8	—	9.53	43.2	< λ/10	PS-PM-2037-C
Square	—	50.8	9.53	45.0x45.0	< λ/4	PS-SQM-2037-C
Round	76.2	—	12.7	64.8	< λ/10	PS-PM-3050-C

PROTECTED GOLD FLAT MIRRORS: PG



Specifications

Product Code: **PG**

Substrate Material: N-BK7

Dimensional Tolerances:

Square: $+0/-0.25\text{mm}$

Round: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Parallelism: ≤ 5 arc minutes

Chamfer:

$\emptyset \leq 50.8\text{mm}$: 0.35mm leg width at 45° nominal

$\emptyset > 50.8\text{mm}$: 0.85mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm on select substrates

S1 Surface Quality: 40-20 scratch-dig per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

Clear Aperture:

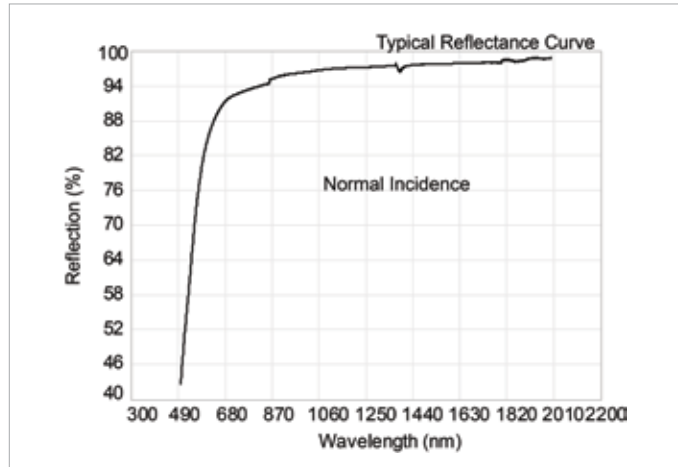
Square: $\geq 80\%$ of edge dimension

Round: $\geq 85\%$ of central diameter

Coating: Protected gold

Average Reflectance: $\geq 95.5\%$ at 650 – 1700nm,
 $\geq 98.0\%$ at 2 – 20 μm

- ▶ Protected gold combines the natural spectral performance of gold with the enhanced protection of a durable dielectric overcoat
- ▶ Protected gold provides 95.5% average reflectance from 650 to 1700nm, and over 98% average reflectance from 2 to 20 μm
- ▶ Contact an applications engineer for OEM capabilities and/or bare gold coatings



Protected gold coating at 0°

PROTECTED GOLD FLAT MIRRORS

Shape	$\emptyset$ (mm)	$\square$ (mm)	t (mm)	Clear Aperture (mm)	Surface Figure (S1)	PART NUMBER
Round	12.7	—	6.35	10.8	$< \lambda/10$	PG-PM-0525-C
Round	25.4	—	6.35	21.6	$< \lambda/10$	PG-PM-1025-C
Round	50.8	—	9.53	43.2	$< \lambda/10$	PG-PM-2037-C
Round	76.2	—	12.7	64.8	$< \lambda/10$	PG-PM-3050-C

CONVEX SPHERICAL FUSED SILICA MIRROR BLANKS: SMCX-UV



Specifications

Product Code: **SMCX-UV**

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: $\pm 0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: $< 0.05\text{mm}$

Radius Tolerance: $\pm 0.5\%$

S1 Surface Figure: $< \lambda/10$ p-v at 633nm

S1 Surface Quality: 10-5 scratch-dig
per MIL-PRF-13830b (at 100W)

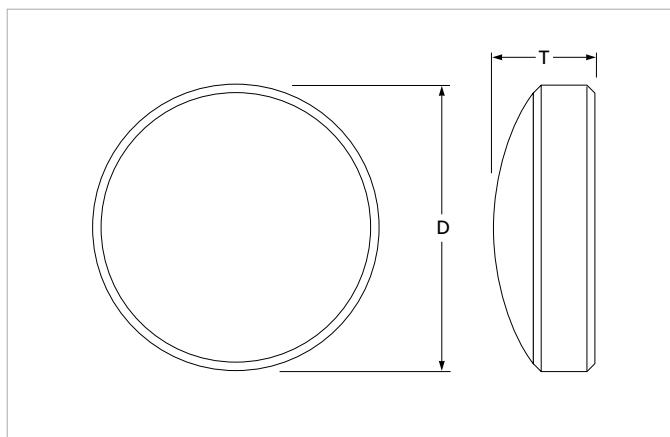
S2 Surface Figure: $< \lambda/10$ p-v at 633nm

S2 Surface Quality: 10-5 scratch-dig
per MIL-PRF-13830b (at 100W)

Clear Aperture: $\geq 85\%$ of central diameter

The fused silica plano-convex mirror substrates are polished to a 10-5, $\lambda/10$ surface on both sides, so they can be used as high reflectors, dichroic mirrors, or partial reflecting output couplers.

- ▶ All CVI Laser Optics high reflector, metal, and partial reflector coatings available
- ▶ Mirror focal length = $-r/2$
- ▶ Other dimensions and radii available in prototype and production quantities
- ▶ Tighter radius tolerance available



Convex spherical mirror blank

CONVEX FUSED SILICA SPHERICAL MIRROR BLANKS			
$\varnothing$ (mm)	t (mm)	r (m)	PART NUMBER
12.7	6.35	1.00	SMCX-0525-1.00-UV
25.4	6.35	0.30	SMCX-1025-0.30-UV
25.4	6.35	0.50	SMCX-1025-0.50-UV
25.4	6.35	1.00	SMCX-1025-1.00-UV

CONCAVE SPHERICAL FUSED SILICA / N-BK7 MIRROR BLANKS: SMCC-C, SMCC-UV



Specifications

Product Code: **SMCC-C, SMCC-UV**

Substrate Material: N-BK7 or Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Concentricity: $< 0.05\text{mm}$

Radius Tolerance:

$\pm 0.5\%$ for $r \leq 3.5\text{ m}$

$\pm 1.0\%$ for $r > 3.5\text{ m}$

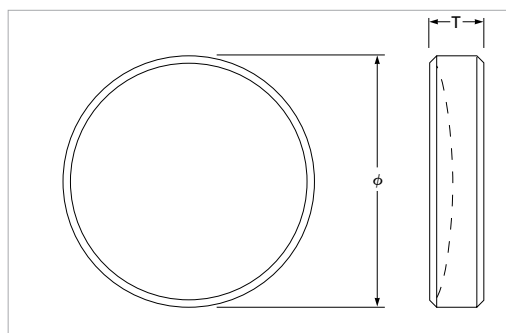
S1 Surface Figure: $< \lambda/10$ p-v at 633nm

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Figure: $< \lambda/10$ p-v at 633nm

S2 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

Clear Aperture: $\geq 85\%$ of central diameter



Concave spherical mirror blank

CONCAVE SPHERICAL MIRROR BLANKS:

Standard Grade Corning 7980 1-D (Fused Silica)

Ø (mm)	t (mm)	r (m)	PART NUMBER
12.7	6.35	0.025	SMCC-0525-0.025-UV
12.7	6.35	0.050	SMCC-0525-0.050-UV
12.7	6.35	0.075	SMCC-0525-0.075-UV
12.7	6.35	0.10	SMCC-0525-0.10-UV
12.7	6.35	0.15	SMCC-0525-0.15-UV
12.7	6.35	0.20	SMCC-0525-0.20-UV
12.7	6.35	0.25	SMCC-0525-0.25-UV
12.7	6.35	0.50	SMCC-0525-0.50-UV
12.7	6.35	1.00	SMCC-0525-1.00-UV
12.7	6.35	1.50	SMCC-0525-1.50-UV
12.7	6.35	5.00	SMCC-0525-5.00-UV
25.4	6.35	0.025	SMCC-1025-0.025-UV
25.4	6.35	0.050	SMCC-1025-0.050-UV
25.4	6.35	0.10	SMCC-1025-0.10-UV
25.4	6.35	0.15	SMCC-1025-0.15-UV
25.4	6.35	0.20	SMCC-1025-0.20-UV
25.4	6.35	0.25	SMCC-1025-0.25-UV
25.4	6.35	0.30	SMCC-1025-0.30-UV
25.4	6.35	0.50	SMCC-1025-0.50-UV
25.4	6.35	0.75	SMCC-1025-0.75-UV
25.4	6.35	1.00	SMCC-1025-1.00-UV
25.4	6.35	1.50	SMCC-1025-1.50-UV
25.4	6.35	2.00	SMCC-1025-2.00-UV
25.4	6.35	3.00	SMCC-1025-3.00-UV
25.4	6.35	5.00	SMCC-1025-5.00-UV
25.4	6.35	10.0	SMCC-1025-10.0-UV
50.8	9.53	0.50	SMCC-2037-0.50-UV
50.8	9.53	1.00	SMCC-2037-1.00-UV
50.8	9.53	1.50	SMCC-2037-1.50-UV
50.8	9.53	2.00	SMCC-2037-2.00-UV

N-BK7

Ø (mm)	t (mm)	r (m)	PART NUMBER
12.7	6.35	0.25	SMCC-0525-0.25-C
12.7	6.35	0.50	SMCC-0525-0.50-C
12.7	6.35	1.00	SMCC-0525-1.00-C
25.4	6.35	0.25	SMCC-1025-0.25-C
25.4	6.35	0.50	SMCC-1025-0.50-C
25.4	6.35	1.00	SMCC-1025-1.00-C

PLANE ROUND FUSED SILICA / N-BK7 MIRROR BLANKS: PM-UV, PM-C



Specifications

Product Code: **PM-UV, PM-C**

Substrate Material: N-BK7 or
Standard Grade Corning 7980 1-D (Fused Silica)

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge: ≤ 5 arc minutes

Chamfer:

Ø ≤ 50.8mm: 0.35mm leg width at 45° nominal

Ø > 50.8mm: 0.85mm leg width at 45° nominal

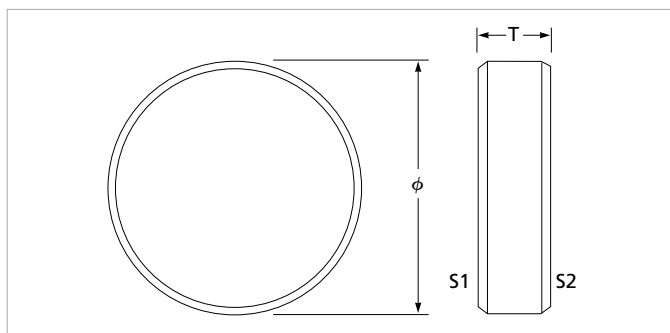
S1 Surface Figure: per table; measured p-v at 633nm

S1 Surface Quality: 10-5 scratch-dig
per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: ≥ 85% of central diameter

- ▶ All CVI Laser Optics partial reflectors, high reflectors, dichroics and metal coatings available.
- ▶ Other dimensions or materials available in production and prototype quantities



Plane round mirror blank

PLANE ROUND MIRROR BLANKS

Standard Grade Corning 7980 1-D (Fused Silica)

Ø (mm)	t (mm)	S1 Surface Figure	PART NUMBER
12.7	6.35	< λ/10	PM-0525-UV
19.1	6.35	< λ/10	PM-0725-UV
25.0	6.0	< λ/10	PM-2506M-UV
25.4	3.18	< λ/4	PM-1012-UV
25.4	6.35	< λ/10	PM-1025-UV
25.4	9.53	< λ/10	PM-1037-UV
38.1	6.35	< λ/10	PM-1525-UV
50.0	10.0	< λ/10	PM-5010M-UV
50.8	6.35	< λ/10	PM-2025-UV
50.8	9.53	< λ/10	PM-2037-UV
76.2	12.7	< λ/10	PM-3050-UV
101.6	9.53	< λ/10	PM-4037-UV
101.6	12.7	< λ/10	PM-4050-UV
152.4	25.4	< λ/10	PM-6010-UV
N-BK7			
Ø (mm)	t (mm)	S1 Surface Figure	PART NUMBER
12.7	3.18	< λ/10	PM-0512-C
12.7	6.35	< λ/10	PM-0525-C
25.0	6.0	< λ/10	PM-2506M-C
25.4	3.18	< λ/4	PM-1012-C
25.4	6.35	< λ/10	PM-1025-C
50.8	6.35	< λ/4	PM-2025-C
76.2	12.7	< λ/10	PM-3050-C

NOTE: See PW1-UV for additional options (page 94)

PLANE SQUARE FUSED SILICA / N-BK7 MIRROR BLANKS: [SQM-C](#), [SQM-UV](#)



Specifications

Product Code: [SQM-C](#), [SQM-UV](#)

Substrate Material: N-BK7 or
Standard Grade Corning 7980 1-D (Fused Silica)

Dimensional Tolerance: $\pm 0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

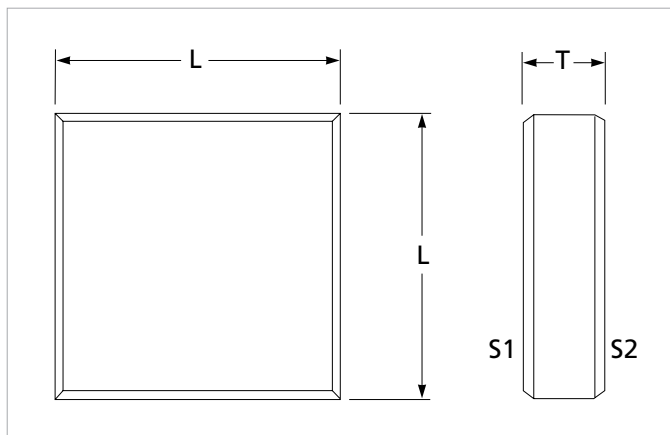
S1 Surface Figure: See table (measured p-v at 633nm)

S1 Surface Quality: 10-5 scratch-dig
per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

- ▶ Available in N-BK7 and Standard Grade Corning 7980 1-D (Fused Silica)
- ▶ All CVI Laser Optics high reflector, partials, dichroics and metal coatings available
- ▶ Other dimensions available in production and prototype quantities



Plane square mirror blank

PLANE SQUARE MIRROR BLANKS			
Standard Grade Corning 7980 1-D (Fused Silica)			
l (mm)	t (mm)	S1 Surface Figure	PART NUMBER
25.4	6.35	$< \lambda/10$	SQM-1025-UV
50.8	9.53	$< \lambda/10$	SQM-2037-UV
N-BK7			
l (mm)	t (mm)	S1 Surface Figure	PART NUMBER
25.4	6.35	$< \lambda/4$	SQM-1025-C
50.8	9.53	$< \lambda/4$	SQM-2037-C

PLANE RECTANGULAR FUSED SILICA MIRROR BLANKS: RM-UV



Specifications

Product Code: **RM-UV**

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

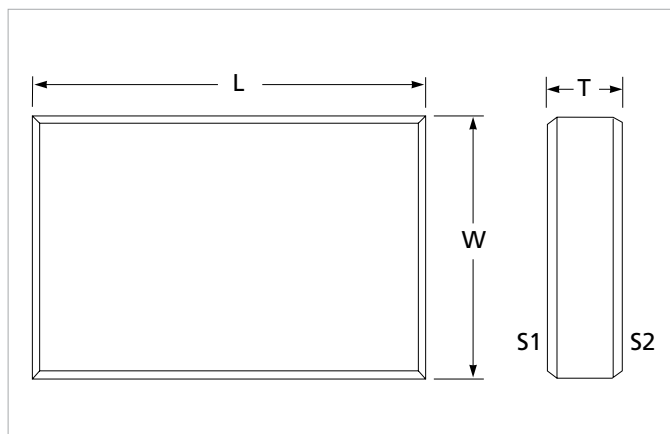
S1 Surface Figure: $< \lambda/4$ p-v at 633nm

S1 Surface Quality: 10-5 scratch-dig
per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

- ▶ Available in Standard Grade Corning 7980 1-D (Fused Silica)
- ▶ All CVI Laser Optics high reflector, partials, dichroics and metal coatings available
- ▶ Other dimensions available in production and prototype quantities



Plane rectangular mirror blank

PLANE RECTANGULAR FUSED SILICA MIRROR BLANKS			
L (mm)	w (mm)	t (mm)	PART NUMBER
20	10	6.35	RM-20.0-10.0-6.35-UV
35	20	9.53	RM-35.0-20.0-9.53-UV
40	25	9.53	RM-40.0-25.0-9.53-UV
50	30	12.7	RM-50.0-30.0-12.7-UV

Surface Figure: Peak to Valley (PV) vs Root Mean Squared (RMS)

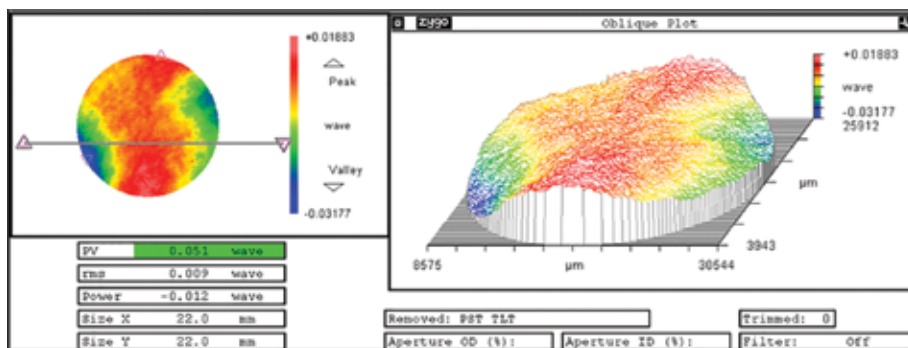
PV: The difference between the lowest point and the highest point of the optical surface.

RMS: The measurement of the clear aperture of the optical surface, then calculating the standard deviation (taking the square root of all values and squaring them).

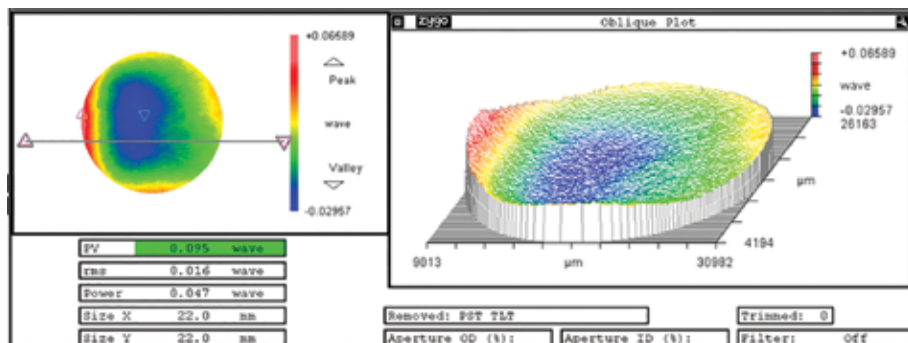
- The average PV vs RMS ratio for the combination of: Focus, Astigmatism, Coma and Spherical Aberration, is 3-5:1
- CVI Laser Optics specifies the PV error given the fact that our polishing process is such that our RMS values are significantly below $\lambda/50$ for our laser grade optics.
- CVI Laser Optics average surface roughness is between 3-5Å for laser grade optics

Consistent High Quality by a brand you can trust!

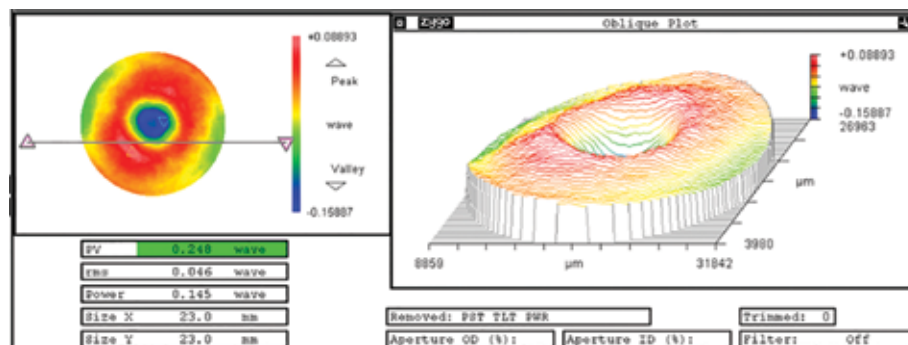
PV: $< \lambda/20$
RMS: $< \lambda/111$
Laser Grade



PV: $< \lambda/10$
RMS: $< \lambda/62$
Laser Grade



PV: $< \lambda/4$
RMS: $< \lambda/22$
Image Grade



SPHERICAL LENSES



Spherical lenses are used to focus, form images, and to collimate or expand light. They are used in almost every optical system, from high power, deep-UV lasers to low-cost condensers delivering light to a detector. Our vast selection of lens shapes, materials and lens quality options will allow you to find the right balance between performance and cost for even the most demanding application.

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Don't see exactly what you are looking for?

CVI Laser Optics specializes in prototype to volume production manufacturing!

Give us a call and we will be honored to assist you with your custom needs.

NOTES:

SELECTION GUIDE

PRODUCT TYPE	PRODUCT FEATURES	PLANO CONVEX	BICONVEX	PLANO CONCAVE	BICONCAVE
					
LASER GRADE N-BK7	<λ/10 surface figure 10-5 scratch-dig High damage threshold	PLCX-C 39	BICX-C 50	PLCC-C 46	BICC-C 52
IMAGE GRADE N-BK7	<λ/2 irregularity 60-40 scratch-dig	LPX-C 55	LDX-C 60	LPK-C 58	
LASER GRADE FUSED SILICA	<λ/10 surface figure 10-5 scratch-dig High damage threshold	PLCX-UV 35	BICX-UV 49	PLCC-UV 44	BICC-UV 51
IMAGE GRADE FUSED SILICA	<λ/4 irregularity 40-20 scratch-dig	LUP-UV 54		LUK-UV 57	
PRODUCT TYPE	PRODUCT FEATURES	PLANO CONVEX	PLANO CONCAVE	BESTFORM	ASPHERIC
					
LASER GRADE UV-GRADE CaF ₂	<λ/10 surface figure 20-10 scratch-dig Wide VUV to IR transmission High laser durability	PLCX-CFUV 42			
LASER GRADE N-SF11	<λ/10 surface figure 20-10 scratch-dig High refractive index material Reduced spherical aberration	PLCX-SF11 43	PLCC-SF11 48		
LASER GRADE POSITIVE BESTFORM FUSED SILICA	<λ/10 surface figure 10-5 scratch-dig Minimized spherical aberration and coma Smallest spot size available in singlet lens High damage threshold			BFPL-UV 53	
IMAGE GRADE ASPHERIC CONDENSER LENSES CROWN GLASS	80-50 scratch-dig High collection efficiency for lighting applications				LAG-C 61

LASER GRADE FUSED SILICA PLANO-CONVEX LENSES: PLCX-UV



Specifications

Product Code: **PLCX-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Design Wavelength: 266nm

Diameter Tolerance: +0/-0.1mm

Center Thickness Tolerance (t_c): ± 0.1 mm

Chamfer:

$\varnothing_D \geq 50.8$ mm: 0.35mm leg width at 45° nominal

$\varnothing_D \geq 50.8$ mm: 0.65mm leg width at 45° nominal

Centration:

RoC ≤ 400 mm: < 1 arc minute

RoC > 400 mm: < 3 arc minutes

Radius of Curvature (RoC) Tolerance:

RoC ≤ 1.5 m: $\pm 0.2\%$

RoC > 1.5 m: $\pm 1.0\%$

Edge: Fine Grind

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S2 Surface Flatness: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

***Anti-reflection Coating:** Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{avg} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

***Adhesion and Durability:** per MIL-C-48497a

***Damage Threshold:**

Pulsed, Narrowband: 15 J/cm², 20ns, 20Hz at 1064nm

Pulsed, Broadband: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

* Applicable for wavelengths ≥ 266 nm

With a myriad of designs, the PLCX-UV product line spans from 15mm to 10,000mm in focal length amongst three diameter options. These laser-grade quality fused silica lenses are capable of meeting the most stringent customer requirements including high power/high energy laser applications as well as ultra-low light scattering optical systems.

- ▶ Diffraction limited focusing performance for most laser applications
- ▶ Low-loss, high energy AR coatings
- ▶ Other dimensions, tolerances, specifications, and coatings available in prototype and production quantities.

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm)
PLCX-25.4-51.5-UV	248

EXAMPLE: PLCX-25.4-51.5-UV-248

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLES ON NEXT PAGE

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

CONTINUED...LASER GRADE FUSED SILICA PLANO-CONVEX LENSES: PLCX-UV

LASER GRADE FUSED SILICA PLANO-CONVEX LENSES												
	f (mm)	Ø (mm)	f/#	fb at 266nm	tc	(te)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
	15	12.7	1.4	11.67	5.00	3.51	7.50	15	15.74	16.24	16.70	PLCX-12.7-7.5-UV
	20	12.7	1.9	16.66	5.00	2.28	9.99	20	20.99	21.65	22.27	PLCX-12.7-10.0-UV
	25	12.7	2.3	21.66	5.00	1.73	12.49	25	26.24	27.06	27.84	PLCX-12.7-12.5-UV
	25	12.7	2.3	22.4	4.0	2.3	12.9	25.8	27.1	28.0	28.7	PLCX-12.7-12.9-UV
	25	25.4	1.2	16.8	12.7	2.1	12.9	25.8	27.1	28.0	28.7	PLCX-25.4-12.9-UV
	30	25.4	1.4	23.64	9.53	2.50	14.99	30	31.49	32.47	33.41	PLCX-25.4-15.0-UV
	35	25.4	1.6	29.66	8.00	2.53	17.49	35	36.73	37.88	38.97	PLCX-25.4-17.5-UV
	40	25.4	1.9	35.33	7.00	2.45	19.99	40	41.98	43.30	44.54	PLCX-25.4-20.0-UV
	45	25.4	2.1	41.00	6.00	2.07	22.49	45	47.23	48.71	50.11	PLCX-25.4-22.5-UV
	50	12.7	4.6	47.33	4.00	3.18	24.98	50	52.48	54.12	55.68	PLCX-12.7-25.0-UV
	50	25.4	2.3	45.99	6.00	2.53	24.98	50	52.48	54.12	55.68	PLCX-25.4-25.0-UV
★	51.6	12.7	4.8	50.3	2.0	1.2	25.8	51.6	54.2	56.0	57.4	PLCX-12.7-25.8-UV
★	51.6	25.4	2.4	48.1	5.3	2.0	25.8	51.6	54.2	56.0	57.4	PLCX-25.4-25.8-UV
	55	25.4	2.5	50.99	6.00	2.89	27.48	55	57.72	59.53	61.24	PLCX-25.4-27.5-UV
	60	25.4	2.8	56.66	5.00	2.18	29.98	60	62.97	64.95	66.81	PLCX-25.4-30.0-UV
	65	25.4	3.0	61.66	5.00	2.41	32.48	65	68.22	70.36	72.38	PLCX-25.4-32.5-UV
★	67.4	12.7	6.2	65.4	3.0	2.4	33.7	67.4	70.8	73.1	75.0	PLCX-12.7-33.7-UV
★	67.4	25.4	3.1	64.1	5.0	2.5	33.7	67.4	70.8	73.1	75.0	PLCX-25.4-33.7-UV
	70	25.4	3.2	66.99	4.50	2.11	34.98	70	73.47	75.77	77.95	PLCX-25.4-35.0-UV
	75	12.7	6.9	72.33	4.00	3.46	37.48	75	78.71	81.18	83.52	PLCX-12.7-37.5-UV
	75	25.4	3.5	71.99	4.50	2.28	37.48	75	78.71	81.18	83.52	PLCX-25.4-37.5-UV
★	77.2	25.4	3.6	74.84	3.6	1.5	38.60	77.2	81.1	83.8	85.8	PLCX-25.4-38.6-UV
	80	25.4	3.7	76.99	4.50	2.43	39.97	80	83.96	86.59	89.08	PLCX-25.4-40.0-UV
	85	25.4	3.9	82.33	4.00	2.06	42.47	85	89.21	92.01	94.65	PLCX-25.4-42.5-UV
	90	25.4	4.2	87.32	4.00	2.17	44.97	90	94.46	97.42	100.22	PLCX-25.4-45.0-UV
★	92.9	25.4	4.3	89.5	5.0	3.2	46.4	92.9	97.5	100.7	103.2	PLCX-25.4-46.4-UV
	95	25.4	4.4	92.32	4.00	2.27	47.47	95	99.71	102.83	105.79	PLCX-25.4-47.5-UV
	100	12.7	9.3	97.32	4.00	3.59	49.97	100	104.95	108.24	111.35	PLCX-12.7-50.0-UV
	100	25.4	4.6	97.32	4.00	2.36	49.97	100	104.95	108.24	111.35	PLCX-25.4-50.0-UV
	100	50.8	2.3	93.64	9.53	2.59	49.97	100	104.95	108.24	111.35	PLCX-50.8-50.0-UV
★	103.1	25.4	4.8	100.4	4.0	2.4	51.5	103.1	108.2	111.8	114.5	PLCX-25.4-51.5-UV
	110	25.4	5.1	107.32	4.00	2.51	54.96	110	115.45	119.07	122.49	PLCX-25.4-55.0-UV
	120	25.4	5.6	117.32	4.00	2.64	59.96	120	125.94	129.89	133.62	PLCX-25.4-60.0-UV
	125	12.7	11.6	122.32	4.00	3.68	62.46	125	131.19	135.30	139.19	PLCX-12.7-62.5-UV
	125	25.4	5.8	122.32	4.00	2.70	62.46	125	131.19	135.30	139.19	PLCX-25.4-62.5-UV
	125	50.8	2.9	118.63	9.53	4.13	62.46	125	131.19	135.30	139.19	PLCX-50.8-62.5-UV
★	128.9	25.4	6.0	126.2	4.0	2.7	64.4	128.9	135.3	139.8	143.2	PLCX-25.4-64.4-UV
	130	25.4	6.0	127.32	4.00	2.75	64.96	130	136.44	140.71	144.76	PLCX-25.4-65.0-UV
	140	25.4	6.5	137.32	4.00	2.84	69.96	140	146.93	151.54	155.90	PLCX-25.4-70.0-UV
	150	12.7	13.9	147.32	4.00	3.73	74.95	150	157.43	162.36	167.03	PLCX-12.7-75.0-UV

*Specifications for these lenses carry more relaxed dimensional tolerances and centration (Diameter Tolerance: +0/-0.25mm; Center Thickness Tolerance: ± 0.25 mm; Centricity: < 0.05 mm); However, surface quality and surface figure/flatness values are maintained as listed.

LASER GRADE FUSED SILICA PLANO-CONVEX LENSES												
	f (mm)	Ø (mm)	f/#	f _b at 266nm	t _c	(t _e)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
	150	25.4	6.9	147.32	4.00	2.92	74.95	150	157.43	162.36	167.03	PLCX-25.4-75.0-UV
	150	50.8	3.5	143.63	9.53	5.09	74.95	150	157.43	162.36	167.03	PLCX-50.8-75.0-UV
*	154.7	12.7	14.3	153.2	2.3	2.0	77.3	154.7	162.4	167.8	171.9	PLCX-12.7-77.3-UV
*	154.7	25.4	7.2	152.0	4.0	2.9	77.3	154.7	162.4	167.8	171.9	PLCX-25.4-77.3-UV
*	154.7	50.8	3.6	150.0	7.0	2.7	77.3	154.7	162.4	167.8	171.9	PLCX-50.8-77.3-UV
	160	25.4	7.4	157.32	4.00	2.98	79.95	160	167.92	173.19	178.17	PLCX-25.4-80.0-UV
	170	25.4	7.9	167.32	4.00	3.05	84.95	170	178.42	184.01	189.30	PLCX-25.4-85.0-UV
	175	25.4	8.1	172.32	4.00	3.07	87.44	175	183.67	189.42	194.87	PLCX-25.4-87.4-UV
	175	50.8	4.1	170.75	6.35	2.58	87.44	175	183.67	189.42	194.87	PLCX-50.8-87.4-UV
	180	25.4	8.3	177.32	4.00	3.10	89.94	180	188.91	194.84	200.44	PLCX-25.4-89.9-UV
	190	25.4	8.8	187.32	4.00	3.15	94.94	190	199.41	205.66	211.57	PLCX-25.4-94.9-UV
	200	12.7	18.5	197.31	4.00	3.80	99.94	200	209.91	216.48	222.71	PLCX-12.7-99.9-UV
	200	25.4	9.3	197.31	4.00	3.19	99.94	200	209.91	216.48	222.71	PLCX-25.4-99.9-UV
	200	50.8	4.6	195.75	6.35	3.07	99.94	200	209.91	216.48	222.71	PLCX-50.8-99.9-UV
*	206.0	12.7	19.1	203.4	4.0	3.8	103.0	206.1	216.4	223.6	229.1	PLCX-12.7-103.0-UV
*	206.0	25.4	9.5	203.4	4.0	3.2	103.0	206.1	216.4	223.6	229.1	PLCX-25.4-103.0-UV
*	206.0	50.8	4.8	201.8	6.4	3.2	103.0	206.1	216.4	223.6	229.1	PLCX-50.8-103.0-UV
	250	12.7	23.2	247.31	4.00	3.84	124.92	250	262.38	270.60	278.38	PLCX-12.7-124.9-UV
	250	25.4	11.6	247.31	4.00	3.35	124.92	250	262.38	270.60	278.38	PLCX-25.4-124.9-UV
	250	50.8	5.8	245.74	6.35	3.74	124.92	250	262.38	270.60	278.38	PLCX-50.8-124.9-UV
	300	25.4	13.9	297.31	4.00	3.46	149.90	300	314.86	324.73	334.06	PLCX-25.4-149.9-UV
	300	50.8	6.9	295.74	6.35	4.18	149.90	300	314.86	324.73	334.06	PLCX-50.8-149.9-UV
*	309.2	25.4	14.3	306.5	4.0	3.5	154.5	309.2	324.5	335.4	343.6	PLCX-25.4-154.5-UV
	350	25.4	16.2	347.30	4.00	3.54	174.89	350	367.33	378.85	389.74	PLCX-25.4-174.9-UV
	350	50.8	8.1	345.73	6.35	4.50	174.89	350	367.33	378.85	389.74	PLCX-50.8-174.9-UV
*	360.8	25.4	16.7	358.1	4.0	3.6	180.3	360.8	378.7	391.3	401.0	PLCX-25.4-180.3-UV
*	360.8	50.8	8.4	356.5	6.4	4.6	180.3	360.8	378.7	391.3	401.0	PLCX-50.8-180.3-UV
	400	25.4	18.5	397.30	4.00	3.60	199.87	400	419.81	432.97	445.41	PLCX-25.4-199.9-UV
	400	50.8	9.3	395.73	6.35	4.73	199.87	400	419.81	432.97	445.41	PLCX-50.8-199.9-UV
*	412.3	25.4	19.1	409.6	4.0	3.6	206.0	412.3	432.7	447.1	458.2	PLCX-25.4-206.0-UV
*	412.3	50.8	9.5	408.0	6.4	4.8	206.0	412.3	432.7	447.1	458.2	PLCX-50.8-206.0-UV
	500	25.4	23.2	497.29	4.00	3.68	249.84	500	524.76	541.21	556.77	PLCX-25.4-249.8-UV
	500	50.8	11.6	495.72	6.35	5.06	249.84	500	524.76	541.21	556.77	PLCX-50.8-249.8-UV
*	515.3	25.4	23.9	512.6	4.0	3.4	257.5	515.3	540.9	558.9	572.7	PLCX-25.4-257.5-UV
*	515.3	50.8	11.9	511.0	6.4	5.1	257.5	515.3	540.9	558.9	572.7	PLCX-50.8-257.5-UV
	600	25.4	27.8	597.28	4.00	3.73	299.81	600	629.72	649.45	668.12	PLCX-25.4-299.8-UV
	600	50.8	13.9	595.71	6.35	5.27	299.81	600	629.72	649.45	668.12	PLCX-50.8-299.8-UV
	700	25.4	32.4	697.27	4.00	3.77	349.78	700	734.67	757.69	779.48	PLCX-25.4-349.8-UV
	700	50.8	16.2	695.70	6.35	5.43	349.78	700	734.67	757.69	779.48	PLCX-50.8-349.8-UV
*	721.7	25.4	33.4	718.3	4.0	3.8	360.6	721.7	757.4	782.7	802.0	PLCX-25.4-360.6-UV

*Specifications for these lenses carry more relaxed dimensional tolerances and centration (Diameter Tolerance +0/-0.25mm; Center Thickness Tolerance: ±0.25mm; Centricity: <0.05mm); However, surface quality and surface figure/flatness values are maintained as listed.

continued on next page

CONTINUED...LASER GRADE FUSED SILICA PLANO-CONVEX LENSES: PLCX-UV

LASER GRADE FUSED SILICA PLANO-CONVEX LENSES												
	f (mm)	Ø (mm)	f/#	fb at 266nm	tc	(te)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
	800	25.4	37.1	797.26	4.00	3.80	399.74	800	839.62	865.93	890.83	PLCX-25.4-399.7-UV
	800	50.8	18.5	795.69	6.35	5.54	399.74	800	839.62	865.93	890.83	PLCX-50.8-399.7-UV
	900	25.4	41.7	897.25	4.00	3.82	449.71	900	944.57	974.18	1002.18	PLCX-25.4-449.7-UV
	900	50.8	20.8	895.69	6.35	5.63	449.71	900	944.57	974.18	1002.18	PLCX-50.8-449.7-UV
	1000	25.4	46.3	997.24	4.00	3.84	499.68	1000	1049.53	1082.42	1113.54	PLCX-25.4-499.7-UV
	1000	50.8	23.2	995.68	6.35	5.70	499.68	1000	1049.53	1082.42	1113.54	PLCX-50.8-499.7-UV
*	1030.9	25.4	47.7	1028.1	4.0	3.8	515.1	1030.9	1082.0	1118.1	1145.6	PLCX-25.4-515.1-UV
*	1030.9	50.8	23.9	1026.5	6.4	5.8	515.1	1030.9	1082.0	1118.1	1145.6	PLCX-50.8-515.1-UV
	1500	25.4	69.5	1497.20	4.00	3.89	749.52	1500	1574.29	1623.63	1670.30	PLCX-25.4-749.5-UV
	1500	50.8	34.7	1495.63	6.35	5.92	749.52	1500	1574.29	1623.63	1670.30	PLCX-50.8-749.5-UV
	2000	25.4	92.6	1997.15	4.00	3.92	999.36	2000	2099.05	2147.48	2244.85	PLCX-25.4-999.4-UV
	2000	50.8	46.3	1995.59	6.35	6.03	999.36	2000	2099.05	2147.48	2244.85	PLCX-50.8-999.4-UV
*	2062.0	25.4	95.5	2058.9	4.0	3.9	1030.2	2061.7	2164.0	2236.1	2291.2	PLCX-25.4-1030.2-UV
*	2062.0	50.8	47.7	2057.3	6.4	6.1	1030.2	2061.7	2164.0	2236.1	2291.2	PLCX-50.8-1030.2-UV
	3000	25.4	139.0	2997.06	4.00	3.95	1499.04	3000	3148.58	3221.22	3367.28	PLCX-25.4-1499.0-UV
	3000	50.8	69.5	2995.50	6.35	6.13	1499.04	3000	3148.58	3221.22	3367.28	PLCX-50.8-1499.0-UV
	4000	25.4	185.3	3996.98	4.00	3.96	1998.72	4000	4198.11	4294.96	4489.71	PLCX-25.4-1998.7-UV
	4000	50.8	92.6	3995.41	6.35	6.19	1998.72	4000	4198.11	4294.96	4489.71	PLCX-50.8-1998.7-UV
	5000	25.4	231.6	4996.89	4.00	3.97	2498.40	5000	5247.64	5368.70	5612.13	PLCX-25.4-2498.4-UV
	5000	50.8	115.8	4995.32	6.35	6.22	2498.40	5000	5247.64	5368.70	5612.13	PLCX-50.8-2498.4-UV
	7500	25.4	347.4	7496.66	4.00	3.98	3747.60	7500	7871.46	8053.06	8418.20	PLCX-25.4-3747.6-UV
	10000	25.4	463.2	9996.44	4.00	3.98	4996.80	10000	10495.27	10737.41	11224.27	PLCX-25.4-4996.8-UV

*Specifications for these lenses carry more relaxed dimensional tolerances and centration (Diameter Tolerance +0/-0.25mm; Center Thickness Tolerance: ±0.25mm; Centricity: <0.05mm); However, surface quality and surface figure/flatness values are maintained as listed.

LASER GRADE N-BK7 PLANO-CONVEX LENSES: PLCX-C



Specifications

Product Code: **PLCX-C**

Optical Material: N-BK7

Diameter Tolerance: $+0/-0.25\text{mm}$

Center Thickness Tolerance (t_c): $\pm 0.25\text{mm}$

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: $\leq 0.05\text{mm}$

Radius of Curvature (RoC) Tolerance:

RoC $\leq 1.5\text{m}$: $\pm 0.5\%$

RoC $> 1.5\text{m}$: $\pm 2.0\%$

Surface Figure: $< \lambda/10$ p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{\text{avg}} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold:

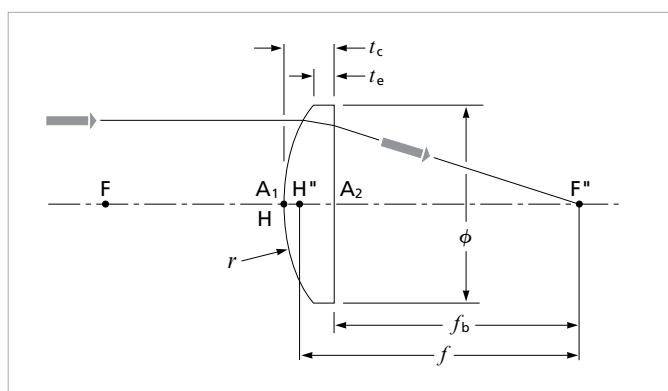
Pulsed, Narrowband: 15 J/cm², 20ns, 20 at 1064nm

Pulsed, Broadband: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

With many designs, the PLCX-C product spans focal length from 15mm all the way to 10 m. These laser quality N-BK7 lenses can meet the most stringent customer requirements including high power / high energy laser applications as well as ultra low light scattering optical systems.

- ▶ Large selection of diameters and curvatures for all types of focusing requirements
- ▶ Laser quality: $< \lambda/10$ surface figure, 10-5 surface quality
- ▶ Low-loss, high-energy AR coatings
- ▶ Other dimensions and focal lengths available in prototype and production quantities



Plano-convex lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm); for uncoated leave blank
PLCX-25.4-12.9-C	532
EXAMPLE: PLCX-25.4-12.9-C- 532	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLES ON NEXT PAGE

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

400	633	800	1050-1600
415-700	633-1064	1030	1064/532
532	700-900	1064	1550

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

CONTINUED...LASER GRADE N-BK7 PLANO-CONVEX LENSES: PLCX-C

LASER GRADE N-BK7 PLANO-CONVEX LENSES											
f (mm)	$\varnothing$ (mm)	$f/\#$	f_e (mm)	t_c (mm)	t_e (mm)	r (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	f @ 1319nm	PRODUCT CODE
15.0	8.0	2.2	12.9	3.1	2.0	7.7	14.8	14.9	15.2	15.3	PLCX-8.0-7.7-C
20.0	12.0	2.0	17.4	3.9	2.0	10.3	19.8	20.0	20.3	20.5	PLCX-12.0-10.3-C
22.0	18.0	1.4	18.0	6.0	1.5	11.3	21.8	21.9	22.3	22.4	PLCX-18.0-11.3-C
25.0	10.0	2.9	22.4	4.0	3.0	12.9	24.8	25.0	25.5	25.6	PLCX-10.0-12.9-C
25.0	12.7	2.3	22.4	4.0	2.3	12.9	24.8	25.0	25.5	25.6	PLCX-12.7-12.9-C
25.0	25.4	1.2	16.6	12.7	2.1	12.9	24.8	25.0	25.5	25.6	PLCX-25.4-12.9-C
35.0	10.0	4.1	33.5	2.2	1.5	18.0	34.7	34.9	35.5	35.8	PLCX-10.0-18.0-C
35.0	25.4	1.6	30.2	7.2	2.0	18.0	34.7	34.9	35.5	35.8	PLCX-25.4-18.0-C
40.0	10.0	4.7	38.3	2.6	2.0	20.6	39.7	40.0	40.7	40.9	PLCX-10.0-20.6-C
40.0	25.4	1.9	36.5	5.3	0.9	20.6	39.7	40.0	40.7	40.9	PLCX-25.4-20.6-C
50.0	10.0	5.9	48.7	2.0	1.5	25.8	49.7	50.1	50.9	51.2	PLCX-10.0-25.8-C
50.0	12.7	4.6	48.7	2.0	1.2	25.8	49.7	50.1	50.9	51.2	PLCX-12.7-25.8-C
50.0	25.4	2.3	46.5	5.3	2.0	25.8	49.7	50.1	50.9	51.2	PLCX-25.4-25.8-C
60.0	8.0	8.8	58.6	2.1	1.8	30.9	59.5	60.0	61.0	61.4	PLCX-8.0-30.9-C
60.0	15.0	4.7	58.6	2.1	1.2	30.9	59.5	60.0	61.0	61.4	PLCX-15.0-30.9-C
60.0	25.4	2.8	57.2	4.2	1.5	30.9	59.5	60.0	61.0	61.4	PLCX-25.4-30.9-C
70.0	25.4	3.2	67.0	4.5	2.2	36.1	69.5	70.1	71.3	71.7	PLCX-25.4-36.1-C
75.0	8.0	11.0	73.7	2.0	1.8	38.6	74.3	74.9	76.2	76.7	PLCX-8.0-38.6-C
75.0	15.0	5.9	73.7	2.0	1.3	38.6	74.3	74.9	76.2	76.7	PLCX-15.0-38.6-C
75.0	25.4	3.5	71.6	5.2	3.0	38.6	74.3	74.9	76.2	76.7	PLCX-25.4-38.6-C
75.0	50.8	1.7	67.4	11.5	2.0	38.6	74.3	74.9	76.2	76.7	PLCX-50.8-38.6-C
100.0	10.0	11.8	98.3	2.5	2.3	51.5	99.1	100.0	101.7	102.3	PLCX-10.0-51.5-C
100.0	25.4	4.6	97.4	4.0	2.4	51.5	99.1	100.0	101.7	102.3	PLCX-25.4-51.5-C
100.0	50.8	2.3	93.4	10.0	3.3	51.5	99.1	100.0	101.7	102.3	PLCX-50.8-51.5-C
125.0	25.4	5.8	122.4	4.0	2.7	64.4	124.0	125.0	127.1	127.9	PLCX-25.4-64.4-C
125.0	38.1	3.9	121.4	5.5	2.6	64.4	124.0	125.0	127.1	127.9	PLCX-38.1-64.4-C
127.0	50.8	2.9	121.7	8.0	2.9	65.4	125.9	127.0	129.1	129.9	PLCX-50.8-65.4-C
150.0	10.0	17.6	148.7	1.9	1.7	77.3	148.8	150.1	152.6	153.5	PLCX-10.0-77.3-C
150.0	25.4	6.9	147.4	4.0	2.9	77.3	148.8	150.1	152.6	153.5	PLCX-25.4-77.3-C
150.0	38.1	4.6	146.7	5.0	2.6	77.3	148.8	150.1	152.6	153.5	PLCX-38.1-77.3-C
150.0	50.8	3.5	145.4	7.0	2.7	77.3	148.8	150.1	152.6	153.5	PLCX-50.8-77.3-C
170.0	25.0	8.0	167.3	4.1	3.2	87.6	168.6	170.1	172.9	174.0	PLCX-25.0-87.6-C
200.0	10.0	23.5	198.5	2.3	2.2	103.0	198.3	200.0	203.3	204.6	PLCX-10.0-103.0-C
200.0	25.4	9.3	197.4	4.0	3.2	103.0	198.3	200.0	203.3	204.6	PLCX-25.4-103.0-C
200.0	38.1	6.2	196.6	5.1	3.3	103.0	198.3	200.0	203.3	204.6	PLCX-38.1-103.0-C
200.0	50.8	4.6	195.8	6.4	3.2	103.0	198.3	200.0	203.3	204.6	PLCX-50.8-103.0-C
250.0	25.4	11.6	247.4	4.0	3.4	128.8	247.9	250.1	254.2	255.8	PLCX-25.4-128.8-C
250.0	38.1	7.7	247.0	4.5	3.1	128.8	247.9	250.1	254.2	255.8	PLCX-38.1-128.8-C
250.0	50.8	5.8	245.8	6.4	3.9	128.8	247.9	250.1	254.2	255.8	PLCX-50.8-128.8-C
300.0	25.4	13.9	297.4	4.0	3.5	154.5	297.4	299.9	305.0	306.9	PLCX-25.4-154.5-C
300.0	50.0	7.1	296.0	6.0	4.0	154.5	297.4	300.0	305.0	306.9	PLCX-50.0-154.5-C

LASER GRADE N-BK7 PLANO-CONVEX LENSES											
f (mm)	$\varnothing$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	t_e (mm)	r (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	f @ 1319nm	PRODUCT CODE
350.0	25.4	16.2	347.4	4.0	3.6	180.3	347.1	350.0	355.9	358.1	PLCX-25.4-180.3-C
350.0	38.1	10.8	346.7	5.0	4.0	180.3	347.1	350.0	355.9	358.1	PLCX-38.1-180.3-C
350.0	50.8	8.1	345.8	6.4	4.6	180.3	347.1	350.0	355.9	358.1	PLCX-50.8-180.3-C
400.0	25.4	18.5	397.3	4.1	3.7	206.0	396.6	399.9	406.6	409.2	PLCX-25.4-206.0-C
400.0	38.1	12.4	396.7	5.0	4.1	206.7	397.9	401.3	408.0	410.6	PLCX-38.1-206.7-C
500.0	25.4	23.2	497.4	4.0	3.7	257.5	495.7	499.9	508.3	511.5	PLCX-25.4-257.5-C
500.0	38.1	15.4	496.7	5.0	4.3	257.5	495.7	499.9	508.3	511.5	PLCX-38.1-257.5-C
500.0	50.8	11.6	495.8	6.4	5.1	257.5	495.7	499.9	508.3	511.5	PLCX-50.8-257.5-C
600.0	25.4	27.8	597.4	4.0	3.7	309.1	595.0	600.1	610.1	614.0	PLCX-25.4-309.1-C
600.0	50.8	13.9	595.8	6.4	5.4	309.1	595.0	600.1	610.1	614.0	PLCX-50.8-309.1-C
700.0	25.4	32.4	697.4	4.0	3.8	360.6	694.2	700.1	711.8	716.2	PLCX-25.4-360.6-C
750.0	25.4	34.7	747.4	4.0	3.8	386.3	743.6	750.0	762.5	767.3	PLCX-25.4-386.3-C
750.0	50.8	17.4	745.8	6.4	5.6	386.3	743.6	750.0	762.5	767.3	PLCX-50.8-386.3-C
800.0	25.4	37.1	797.4	4.0	3.8	412.1	793.3	800.1	813.4	818.5	PLCX-25.4-412.1-C
800.0	50.8	18.5	795.8	6.4	5.6	412.1	793.3	800.1	813.4	818.5	PLCX-50.8-412.1-C
900.0	25.4	41.7	897.2	4.2	4.0	463.5	892.3	899.8	914.9	920.6	PLCX-25.4-463.5-C
900.0	50.8	20.8	895.8	6.4	5.7	463.5	892.3	899.8	914.9	920.6	PLCX-50.8-463.5-C
1000.0	25.4	46.3	997.4	4.0	3.8	515.1	991.6	1000.0	1016.7	1023.1	PLCX-25.4-515.1-C
1000.0	50.8	23.2	995.8	6.4	5.8	515.1	991.6	1000.0	1016.7	1023.1	PLCX-50.8-515.1-C
1500.0	25.4	69.5	1497.4	4.0	3.9	772.6	1487.3	1499.9	1525.0	1534.6	PLCX-25.4-772.6-C
1500.0	50.8	34.7	1495.8	6.3	5.9	772.6	1487.3	1499.9	1525.0	1534.6	PLCX-50.8-772.6-C
2000.0	25.4	92.6	1997.4	4.0	3.9	1030.2	1983.2	2000.0	2033.4	2045.8	PLCX-25.4-1030.2-C
2000.0	50.8	46.3	1995.8	6.4	6.1	1030.2	1983.2	2000.0	2033.4	2045.8	PLCX-50.8-1030.2-C
3000.0	25.4	139.0	2997.4	4.0	3.9	1545.0	2974.2	2999.5	3049.5	3068.8	PLCX-25.4-1545.0-C
4000.0	25.4	185.3	3997.4	4.0	4.0	2060.0	3965.6	3999.3	4066.0	4091.7	PLCX-25.4-2060.0-C
5000.0	25.4	231.6	4997.4	4.0	4.0	2575.0	4957.0	4999.1	5082.6	5114.6	PLCX-25.4-2575.0-C
7500.0	25.4	347.4	7497.4	4.0	3.9	3863.0	7436.4	7499.7	7624.8	7672.9	PLCX-25.4-3863.0-C
10000.0	25.4	463.2	9997.4	4.0	4.0	5151.0	9915.8	10000.2	10167.1	10231.2	PLCX-25.4-5151.0-C

UV GRADE CAF₂ PLANO-CONVEX LENSES: PLCX-CFUV



Specifications

Prodcut Code: **PLCX-CFUV**

Optical Material: UV-grade CaF₂, Random Axis

Diameter Tolerance: +0/-0.25mm

Center Thickness Tolerance (t_c): ± 0.25 mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: ≤ 0.05 mm

Radius of Curvature (RoC) Tolerance: $\pm 0.5\%$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure: $< \lambda/10$ p-v at 633nm before coating

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

Damage Threshold: 1 J/cm², 8ns pulse at 248nm

UV-grade calcium fluoride offers a very wide transmission ranging from 150nm to 8 μ m, with excellent ultraviolet transmittance. The high laser durability of CaF₂ makes it the material of choice for use in excimer laser optics.

- ▶ Short UV beam focusing with minimum fluorescence
- ▶ Suitable for both UV and NIR applications
- ▶ Low loss, high energy AR coatings
- ▶ Other dimensions and focal lengths available in prototype and production quantities

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm); for uncoated leave blank
PLCX-25.4-118.0-CFUV	193

EXAMPLE: PLCX-25.4-118.0-CFUV - 193

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	266	415-700
248	355	633-1064
248-355	355-532	1050-1600

Please see page T-31 for Anti-Reflective Coating Traces.

UV GRADE CAF₂ PLANO-CONVEX LENSES

f (mm)	$\varnothing$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	r (mm)	f @ 193nm	f @ 212nm	f @ 248nm	f @ 308nm	PRODUCT CODE
25.0	12.7	2.3	22.4	3.8	11.9	23.6	24.4	25.3	26.2	PLCX-12.7-11.9-CFUV
50.0	25.4	2.3	45.4	6.7	23.6	47.0	48.5	50.4	52.1	PLCX-25.4-23.6-CFUV
75.0	25.4	3.5	71.3	5.4	35.0	69.8	72.1	74.8	77.3	PLCX-25.4-35.0-CFUV
100.0	25.4	4.6	96.7	4.8	46.4	92.5	95.6	99.1	102.5	PLCX-25.4-46.4-CFUV
150.0	25.4	6.9	147.1	4.2	70.6	140.8	145.4	150.9	156.0	PLCX-25.4-70.6-CFUV
200.0	25.4	9.3	197.3	3.9	93.2	185.9	192.0	199.2	206.0	PLCX-25.4-93.2-CFUV
250.0	25.4	11.6	247.5	3.7	118.0	235.2	243.0	252.1	260.7	PLCX-25.4-118.0-CFUV
500.0	25.4	23.2	497.8	3.3	231.8	462.2	477.4	495.3	512.2	PLCX-25.4-231.8-CFUV

LASER GRADE N-SF11 PLANO-CONVEX LENSES: PLCX-SF11



Specifications

Product Code: **PLCX-SF11**

Optical Material: Schott N-SF11

Diameter Tolerance: $\pm 0.25\text{mm}$

Center Thickness (t_c): $\pm 0.25\text{mm}$

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: $\leq 0.05\text{mm}$

Radius of Curvature (RoC) Tolerance: $\pm 0.5\%$

Surface Figure: $< \lambda/10$ p-v at 633nm before coating

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{\text{avg}} \leq 0.75\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold: 4 J/cm², 20ns, 20Hz at 1064nm

N-SF11 glass is a high refractive index material used to provide more optical power with less curvature. Singlet lenses made from N-SF11 exhibit reduced spherical aberration and achieve diffraction limited performances at lower focal ratios than N-BK7 and fused silica plano-convex lenses.

- ▶ High refractive index material
- ▶ $< \lambda/10$ surface figure, 20-10 surface quality
- ▶ Low loss, high energy AR coatings
- ▶ Other dimensions and focal lengths available in prototype and production quantities

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
PLCX-15.0-19.1-SF11	1550

EXAMPLE: PLCX-15.0-19.1-SF11 - 1550

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

415-700	633-1064	1064	1550
532	800	1050-1600	
633	1030	1064/532	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-SF11 PLANO-CONVEX LENSES

f (mm)	$\emptyset$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	r (mm)	$f@780\text{nm}$	$f@800\text{nm}$	$f@1300\text{nm}$	$f@1550\text{nm}$	PRODUCT CODE
25.0	15.0	2.0	22.9	2.3	19.1	24.7	25.0	25.5	25.6	PLCX-15.0-19.1-SF11
50.0	25.4	2.3	47.9	1.6	38.1	49.2	49.8	50.9	51.2	PLCX-25.4-38.1-SF11
76.0	25.4	3.5	73.9	2.4	58.2	75.1	76.1	77.7	78.1	PLCX-25.4-58.2-SF11
175.0	25.4	8.1	172.9	3.2	134.1	173.1	175.4	179.0	180.1	PLCX-25.4-134.1-SF11

LASER GRADE FUSED SILICA PLANO-CONCAVE LENSES: **PLCC-UV**

Specifications

Product Code: **PLCC-UV****Optical Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm**Center Thickness Tolerance (tc):** ±0.25mm**Chamfer:** 0.35mm leg width at 45° nominal**Concentricity:** ≤ 0.05mm**Radius of Curvature (RoC) Tolerance:** ±0.5%**Surface Figure:** < λ/10 p-v at 633nm before coating**Surface Quality:** 10-5 scratch-dig per MIL-PRF-13830b**Clear Aperture (CA):** ≥ 85% of central diameter**Anti-reflection Coating:** Wavelength user specified**Narrowband:** R ≤ 0.25% per surface**Broadband:** Ravg ≤ 0.5% per surface**Dualband:** R ≤ 0.3% at 1064, R ≤ 0.6% at 532 per surface**Damage Threshold:****Pulsed Narrowband:** 15 J/cm², 20ns, 20Hz at 1064nm**Pulsed Broadband:** 10 J/cm², 20ns, 20Hz at 1064nm**cw:** 1 MW/cm² at 1064nm

- ▶ Diverging lens for beam expansion
- ▶ Laser quality: < λ/10 surface figure, 10-5 surface quality
- ▶ Low-loss high-energy AR coatings

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
PLCC-25.4-25.8-UV	355
EXAMPLE: PLCC-25.4-25.8-UV - 355	

CHOOSE FROM THE OPTIONS BELOW.**1. PRODUCT CODE - SEE TABLE BELOW****2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank**

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE FUSED SILICA PLANO-CONCAVE LENSES

f (mm)	Ø (mm)	f/#	f _b (mm)	t _c (mm)	t _s (mm)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
-20.0	10.0	-2.4	-21.4	2.0	3.3	10.3	-20.6	-21.6	-22.4	-22.9	PLCC-10.0-10.3-UV
-22.0	12.7	-2.0	-23.4	2.1	4.1	11.2	-22.4	-23.5	-24.3	-24.9	PLCC-12.7-11.2-UV
-25.0	10.0	-2.9	-26.4	2.0	3.0	12.9	-25.8	-27.1	-28.0	-28.7	PLCC-10.0-12.9-UV
-25.0	15.0	-2.0	-26.4	2.0	4.4	12.9	-25.8	-27.1	-28.0	-28.7	PLCC-15.0-12.9-UV
-25.0	25.4	-1.2	-26.4	2.0	11.9	13.1	-26.2	-27.5	-28.4	-29.1	PLCC-25.4-13.1-UV
-40.0	19.1	-2.5	-41.3	2.0	4.3	20.6	-41.2	-43.3	-44.7	-45.8	PLCC-19.1-20.6-UV
-40.0	25.4	-1.9	-41.4	2.0	6.7	19.6	-39.2	-41.2	-42.5	-43.6	PLCC-25.4-19.6-UV
-50.0	12.7	-4.6	-51.3	2.0	2.8	25.8	-51.6	-54.2	-56.0	-57.4	PLCC-12.7-25.8-UV
-50.0	15.0	-3.9	-51.4	2.0	3.1	25.8	-51.6	-54.2	-56.0	-57.4	PLCC-15.0-25.8-UV
-50.0	25.4	-2.3	-52.1	3.0	6.3	25.8	-51.6	-54.2	-56.0	-57.4	PLCC-25.4-25.8-UV
-75.0	15.0	-5.9	-76.3	2.0	2.7	38.6	-77.2	-81.1	-83.8	-85.8	PLCC-15.0-38.6-UV
-75.0	25.4	-3.5	-76.4	2.0	4.1	38.6	-77.2	-81.1	-83.8	-85.8	PLCC-25.4-38.6-UV
-100.0	15.0	-7.8	-101.4	2.0	2.5	51.5	-103.1	-108.2	-111.8	-114.5	PLCC-15.0-51.5-UV
-100.0	25.4	-4.6	-101.4	2.0	3.6	51.5	-103.1	-108.2	-111.8	-114.5	PLCC-25.4-51.5-UV

LASER GRADE FUSED SILICA PLANO-CONCAVE LENSES											
f (mm)	$\emptyset$ (mm)	$f/\#$	f_g (mm)	t_c (mm)	t_e (mm)	r (mm)	$f @ 266\text{nm}$	$f @ 355\text{nm}$	$f @ 532\text{nm}$	$f @ 1064\text{nm}$	PRODUCT CODE
-100.0	50.8	-2.3	-101.3	2.0	8.7	51.5	-103.1	-108.2	-111.8	-114.5	PLCC-50.8-51.5-UV
-125.0	15.0	-9.8	-126.4	2.0	2.4	64.4	-128.9	-135.3	-139.8	-143.2	PLCC-15.0-64.4-UV
-125.0	25.4	-5.8	-126.4	2.0	3.3	64.4	-128.9	-135.3	-139.8	-143.2	PLCC-25.4-64.4-UV
-150.0	15.0	-11.8	-151.5	2.3	2.7	77.3	-154.7	-162.4	-167.8	-171.9	PLCC-15.0-77.3-UV
-150.0	25.4	-6.9	-152.1	3.1	4.2	77.3	-154.7	-162.4	-167.8	-171.9	PLCC-25.4-77.3-UV
-150.0	50.8	-3.5	-153.1	4.5	8.8	77.3	-154.7	-162.4	-167.8	-171.9	PLCC-50.8-77.3-UV
-200.0	25.4	-9.3	-202.3	3.4	4.2	103.0	-206.1	-216.4	-223.6	-229.1	PLCC-25.4-103.0-UV
-200.0	50.8	-4.6	-203.3	4.8	8.0	103.0	-206.1	-216.4	-223.6	-229.1	PLCC-50.8-103.0-UV
-250.0	25.4	-11.6	-252.5	3.6	4.2	128.8	-257.8	-270.3	-279.6	-286.5	PLCC-25.4-128.8-UV
-250.0	50.8	45.8	-253.8	5.5	8.0	128.8	-257.8	-270.3	-279.6	-286.5	PLCC-50.8-128.8-UV
-300.0	25.4	413.9	-301.4	2.0	2.5	154.5	-309.2	-324.5	-335.4	-343.6	PLCC-25.4-154.5-UV
-300.0	50.8	46.9	-304.3	6.2	8.3	154.5	-309.2	-324.5	-335.4	-343.6	PLCC-50.8-154.5-UV
-350.0	25.4	416.2	-351.4	2.0	2.4	180.3	-360.8	-378.7	-391.3	-401.0	PLCC-25.4-180.3-UV
-350.0	50.8	48.1	-354.3	6.2	8.0	180.3	-360.8	-378.7	-391.3	-401.0	PLCC-50.8-180.3-UV
-400.0	25.4	-18.5	-401.4	2.0	2.4	206.6	-413.5	-434.0	-448.4	-459.5	PLCC-25.4-206.6-UV
-500.0	25.4	-23.2	-503.0	4.3	4.6	257.5	-515.3	-540.9	-558.9	-572.7	PLCC-25.4-257.5-UV
-500.0	50.8	-11.6	-504.8	7.0	8.3	257.5	-515.3	-540.9	-558.9	-572.7	PLCC-50.8-257.5-UV
-600.0	25.4	-27.8	-602.7	3.9	4.2	309.1	-618.6	-649.3	-670.9	-687.5	PLCC-25.4-309.1-UV
-1000.0	25.4	-46.3	-1001.4	2.0	2.2	515.1	-1030.9	-1082.0	-1118.1	-1145.6	PLCC-25.4-515.1-UV
-1000.0	50.8	-23.2	-1004.3	6.4	7.0	515.1	-1030.9	-1082.0	-1118.1	-1145.6	PLCC-50.8-515.1-UV
-1500.0	25.4	-69.5	-1501.4	2.0	2.1	772.6	-1546.2	-1622.9	-1677.0	-1718.3	PLCC-25.4-772.6-UV
-1500.0	50.8	-34.7	-1504.2	6.4	6.8	772.6	-1546.2	-1622.9	-1677.0	-1718.3	PLCC-50.8-772.6-UV

LASER GRADE N-BK7 PLANO-CONCAVE LENSES: PLCC-C



Specifications

Product Code: **PLCC-C**

Optical Material: N-BK7

Diameter Tolerance: $+0/-0.25\text{mm}$ Center Thickness Tolerance (t_c): $\pm 0.25\text{mm}$

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: $\leq 0.05\text{mm}$ Radius of Curvature (RoC) Tolerance: $\pm 0.5\%$ Surface Figure: $< \lambda/10$ p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

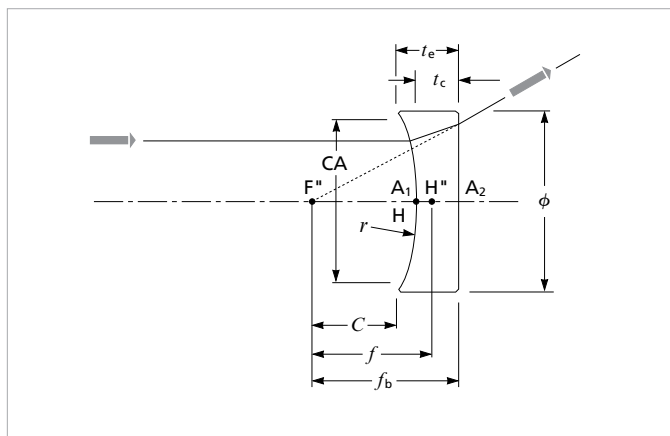
Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surfaceBroadband: $R_{\text{avg}} \leq 0.5\%$ per surfaceDualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold:

Pulsed, Narrowband: 15 J/cm², 20ns, 20Hz at 1064nmPulsed, Broadband: 10 J/cm², 20ns, 20Hz at 1064nmcw: 1 MW/cm² at 1064nm

- ▶ Diverging lens for beam expansion
- ▶ Laser quality: $< \lambda/10$ surface figure, 10-5 surface quality
- ▶ Low-loss high-energy AR coatings



Laser quality plano-concave lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
PLCC-25.4-25.8-C	633

EXAMPLE: PLCC-25.4-25.8-C - 633

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE ON RIGHT

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

400	633	800	1050-1600
415-700	633-1064	1030	1064/532
532	700-900	1064	1550

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-BK7 PLANO-CONCAVE LENSES											
f (mm)	$\varnothing$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	t_s (mm)	r (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	f @ 1319nm	PRODUCT CODE
-20.0	10.0	-2.4	-21.4	2.0	3.3	10.3	-19.8	-20.0	-20.3	-20.5	PLCC-10.0-10.3-C
-25.0	10.0	-2.9	-26.4	2.0	3.0	12.9	-24.8	-25.0	-25.5	-25.6	PLCC-10.0-12.9-C
-25.0	15.0	-2.0	-26.4	2.0	4.4	12.9	-24.8	-25.0	-25.5	-25.6	PLCC-15.0-12.9-C
-30.0	12.7	-2.8	-31.4	2.0	3.3	15.5	-29.8	-30.1	-30.6	-30.8	PLCC-12.7-15.5-C
-30.0	25.4	-1.4	-31.4	2.0	8.6	15.5	-29.8	-30.1	-30.6	-30.8	PLCC-25.4-15.5-C
-38.0	25.4	-1.8	-39.4	2.0	6.7	19.6	-37.7	-38.1	-38.7	-38.9	PLCC-25.4-19.6-C
-50.0	10.0	-5.9	-51.4	2.0	2.5	25.8	-49.7	-50.1	-50.9	-51.2	PLCC-10.0-25.8-C
-50.0	12.7	-4.6	-51.4	2.0	2.8	25.8	-49.7	-50.1	-50.9	-51.2	PLCC-12.7-25.8-C
-50.0	25.4	-2.3	-52.1	3.0	6.3	25.8	-49.7	-50.1	-50.9	-51.2	PLCC-25.4-25.8-C
-75.0	15.0	-5.9	-76.4	2.0	2.7	38.6	-74.3	-74.9	-76.2	-76.7	PLCC-15.0-38.6-C
-75.0	25.4	-3.5	-77.1	3.0	5.1	38.6	-74.3	-74.9	-76.2	-76.7	PLCC-25.4-38.6-C
-100.0	15.0	-7.8	-101.4	2.0	2.5	51.5	-99.1	-100.0	-101.7	-102.3	PLCC-15.0-51.5-C
-100.0	25.4	-4.6	-101.8	2.6	4.2	51.5	-99.1	-100.0	-101.7	-102.3	PLCC-25.4-51.5-C
-100.0	50.8	-2.3	-101.4	2.0	8.7	51.5	-99.1	-100.0	-101.7	-102.3	PLCC-50.8-51.5-C
-125.0	10.0	-14.7	-126.4	2.0	2.2	64.4	-124.0	-125.0	-127.1	-127.9	PLCC-10.0-64.4-C
-125.0	25.4	-5.8	-127.0	2.9	4.2	64.4	-124.0	-125.0	-127.1	-127.9	PLCC-25.4-64.4-C
-150.0	15.0	-11.8	-151.6	2.3	2.7	77.3	-148.8	-150.1	-152.6	-153.5	PLCC-15.0-77.3-C
-150.0	25.4	-6.9	-152.1	3.1	4.2	77.3	-148.8	-150.1	-152.6	-153.5	PLCC-25.4-77.3-C
-176.0	25.4	-8.2	-178.3	3.3	4.2	90.8	-174.8	-176.3	-179.2	-180.4	PLCC-25.4-90.8-C
-200.0	25.4	-9.3	-202.3	3.4	4.2	103.0	-198.3	-200.0	-203.3	-204.6	PLCC-25.4-103.0-C
-200.0	50.8	-4.6	-203.3	4.8	8.0	103.0	-198.3	-200.0	-203.3	-204.6	PLCC-50.8-103.0-C
-250.0	25.4	-11.6	-252.7	4.0	4.6	128.8	-247.9	-250.1	-254.2	-255.8	PLCC-25.4-128.8-C
-250.0	50.8	-5.8	-254.1	6.0	8.5	128.8	-247.9	-250.1	-254.2	-255.8	PLCC-50.8-128.8-C
-500.0	25.4	-23.2	-502.7	3.9	4.2	257.5	-495.7	-499.9	-508.3	-511.5	PLCC-25.4-257.5-C
-500.0	50.8	-11.6	-504.8	7.0	8.3	257.5	-495.7	-499.9	-508.3	-511.5	PLCC-50.8-257.5-C
-600.0	25.4	-27.8	-602.7	3.9	4.2	309.1	-595.0	-600.1	-610.1	-614.0	PLCC-25.4-309.1-C

LASER GRADE N-SF11 PLANO-CONCAVE LENSES: PLCC-SF11



Specifications

Product Code: **PLCC-SF11**

Optical Material: Schott N-SF11

Diameter Tolerance: $+0/-0.25\text{mm}$ Center Thickness Tolerance (t_c): $\pm 0.25\text{mm}$ Chamfer: 0.35mm leg width at 45° nominalConcentricity: $\leq 0.05\text{mm}$ Radius of Curvature (RoC) Tolerance: $\pm 0.5\%$ Surface Figure: $< \lambda/10$ p-v at 633nm before coating

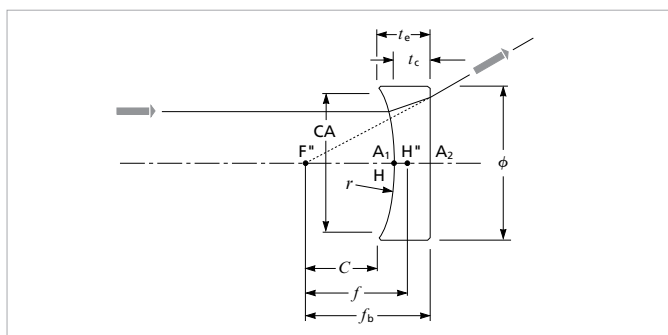
Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surfaceBroadband: $R_{\text{avg}} \leq 0.75\%$ per surfaceDualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surfaceDamage Threshold: 4 J/cm², 20ns, 20Hz at 1064nm

- ▶ Diverging lens for beam expansion
- ▶ High refractive index material providing more optical power with less curvature
- ▶ $< \lambda/10$ surface figure, 20-10 surface quality
- ▶ Low-loss high-energy AR coatings



Laser quality plano-concave lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
PLCC-10.0-7.7-SF11	1064
EXAMPLE: PLCC-10.0-7.7-SF11 - 1064	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

415-700	633-1064	1064	1550
532	800	1050-1600	
633	1030	1064/532	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-SF11 PLANO-CONCAVE LENSES

f (mm)	Ø (mm)	f/#	f _b (mm)	t _c (mm)	r (mm)	f @ 780nm	f @ 800nm	f @ 1300nm	f @ 1550nm	PRODUCT CODE
-10.0	10.0	-1.2	-11.1	3.8	7.7	-9.9	-10.1	-10.3	-10.3	PLCC-10.0-7.7-SF11
-15.0	10.0	-1.8	-16.1	3.1	11.5	-14.8	-15.0	-15.4	-15.4	PLCC-10.0-11.5-SF11
-100.0	25.4	-4.6	-101.1	3.1	76.3	-98.5	-99.8	-101.9	-102.5	PLCC-25.4-76.3-SF11
-150.0	25.4	-6.9	-151.1	2.7	114.6	-148.0	-149.9	-153.0	-153.9	PLCC-25.4-114.6-SF11

LASER GRADE FUSED SILICA BICONVEX LENSES: BICX-UV



Specifications

Product Code: **BICX-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Center Thickness Tolerance (t_c): ± 0.25 mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: ≤ 0.05 mm

Radius of Curvature (RoC) Tolerance: $\pm 0.5\%$

Surface Figure: $< \lambda/10$ p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{avg} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold:

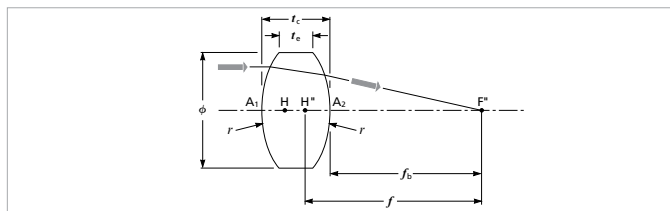
Pulsed, Narrowband: 15 J/cm², 20ns, 20Hz at 1064nm

Pulsed, Broadband: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

Spherical biconvex lenses are equiconvex: (i.e. $r_1 = r_2$). Other dimensions and focal lengths are available for OEM applications.

- For 1:1 imaging applications, beam expanders, and beam relay applications
- Laser quality: $< \lambda/10$ surface figure, 10-5 surface quality
- Low-loss, high-energy AR coatings



Bi-convex lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
BICX-25.4-154.0-UV	355
EXAMPLE: BICX-25.4-154.0-UV - 355	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank			
193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

LASER GRADE FUSED SILICA BICONVEX LENSES

f (mm)	ϕ (mm)	$f/\#$	f_o (mm)	t_c (mm)	t_e (mm)	r (mm)	$f @ 266$ nm	$f @ 355$ nm	$f @ 532$ nm	$f @ 1064$ nm	PRODUCT CODE
15.0	12.7	1.4	13.0	5.9	2.9	14.4	15.5	16.2	16.7	17.1	BICX-12.7-14.4-UV
25.0	25.4	1.2	21.5	10.0	2.7	23.9	25.7	26.9	27.8	28.4	BICX-25.4-23.9-UV
50.0	25.4	2.3	48.3	5.1	1.9	50.6	51.5	54.0	55.8	57.2	BICX-25.4-50.6-UV
60.0	25.4	2.8	58.5	4.5	1.8	61.0	61.8	64.8	67.0	68.6	BICX-25.4-61.0-UV
65.0	25.4	3.0	63.0	6.0	3.5	64.4	65.5	68.7	70.9	72.7	BICX-25.4-64.4-UV
75.0	25.4	3.5	73.7	4.1	2.0	76.6	77.3	81.2	83.8	85.9	BICX-25.4-76.6-UV
100.0	25.4	4.6	98.6	4.2	2.6	102.4	103.2	108.1	111.9	114.5	BICX-25.4-102.4-UV
125.0	25.4	5.8	123.6	4.2	2.9	128.2	129.0	135.2	139.9	143.1	BICX-25.4-128.2-UV
125.0	50.8	2.9	122.7	7.2	2.1	127.5	128.8	135.1	139.6	143.0	BICX-50.8-127.5-UV
150.0	25.4	6.9	148.6	4.2	3.0	154.0	154.8	162.2	167.9	171.7	BICX-25.4-154.0-UV
200.0	25.4	9.3	198.6	4.2	3.4	205.6	206.4	216.4	223.9	229.1	BICX-25.4-205.6-UV
200.0	50.8	4.6	197.3	8.4	5.2	205.2	206.7	216.4	224.1	229.1	BICX-50.8-205.2-UV

LASER GRADE N-BK7 BICONVEX LENSES: BICX-C



Specifications

Product Code: **BICX-C**

Optical Material: N-BK7

Diameter Tolerance: +0/-0.25mm

Center Thickness Tolerance (t_c): ± 0.25 mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: ≤ 0.05 mmRadius of Curvature (RoC) Tolerance: $\pm 0.5\%$ Surface Figure: $< \lambda/10$ p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surfaceBroadband: $R_{avg} \leq 0.5\%$ per surfaceDualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold:

Pulsed, Narrowband: 15 J/cm², 20ns, 20Hz at 1064nmPulsed, Broadband: 10 J/cm², 20ns, 20Hz at 1064nmcw: 1 MW/cm² at 1064nm

Spherical biconvex lenses are equiconvex: (i.e. $r_1 = r_2$). Other dimensions and focal lengths are available for OEM applications.

- For 1:1 imaging and relay applications
- Laser quality: $< \lambda/10$ surface figure, 10-5 surface quality
- Low-loss, high-energy AR coatings

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
BICX-25.4-102.4-C	1064

EXAMPLE: BICX-25.4-102.4-C - 1064

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLES BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

400	633	800	1050-1600
415-700	633-1064	1030	1064/532
532	700-900	1064	1550

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-BK7 BICONVEX LENSES

f (mm)	Ø (mm)	f/#	f_b (mm)	t_c (mm)	t_s (mm)	r (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	f @ 1319nm	PRODUCT CODE
20.0	15.0	1.6	18.3	4.9	1.9	19.7	19.8	20.0	20.3	20.4	BICX-15.0-19.7-C
25.0	12.7	2.3	23.9	3.3	1.7	25.2	24.8	25.0	25.4	25.6	BICX-12.7-25.2-C
25.0	25.4	1.2	21.4	10.0	2.7	23.9	24.8	25.0	25.4	25.2	BICX-25.4-23.9-C
40.0	25.0	1.9	38.0	5.9	1.9	40.2	39.7	40.0	40.7	40.9	BICX-25.0-40.2-C
50.0	25.4	2.3	48.3	5.1	1.9	50.6	49.6	50.0	50.8	51.1	BICX-25.4-50.6-C
50.0	50.8	1.2	44.9	14.6	0.4	48.9	49.6	50.0	50.8	51.1	BICX-50.8-48.9-C
75.0	25.4	3.5	73.6	4.1	2.0	76.6	74.4	75.0	76.3	76.7	BICX-25.4-76.6-C
100.0	25.4	4.6	98.6	4.2	2.6	102.4	99.3	100.1	101.8	102.1	BICX-25.4-102.4-C
150.0	25.4	6.9	148.6	4.2	3.2	154.0	148.9	150.2	152.7	153.6	BICX-25.4-154.0-C
150.0	50.8	3.5	147.2	8.3	4.2	153.4	148.8	150.0	152.5	153.5	BICX-50.8-153.4-C
200.0	25.4	9.3	198.6	4.2	3.4	205.6	198.5	200.2	203.5	204.8	BICX-25.4-205.6-C
250.0	25.4	11.6	248.6	4.2	3.6	257.1	247.9	250.0	254.2	256.7	BICX-25.4-257.1-C
300.0	25.4	13.9	298.7	4.0	3.5	308.5	297.3	299.8	304.8	307.1	BICX-25.4-308.5-C
300.0	50.8	6.9	297.2	8.3	6.3	308.5	297.6	300.2	305.2	307.8	BICX-50.8-308.5-C
400.0	50.8	9.3	397.7	7.0	5.4	411.5	396.7	400.0	406.7	409.1	BICX-50.8-411.5-C
500.0	50.8	11.6	497.7	7.0	5.7	514.6	495.9	500.1	508.4	511.5	BICX-50.8-514.6-C

LASER GRADE FUSED SILICA BICONCAVE LENSES: BICC-UV



Specifications

Product Code: **BICC-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Center Thickness Tolerance (t_c): ± 0.25 mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: ≤ 0.05 mm

Radius of Curvature (RoC) Tolerance: $\pm 0.5\%$

Surface Figure: $< \lambda/10$ p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{avg} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold:

Pulsed, Narrowband: 15 J/cm², 20ns, 20Hz at 1064nm

Pulsed, Broadband: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

Spherical biconcave lenses are equiconcave: (i.e. $r_1 = r_2$). Other dimensions and focal lengths are available for OEM applications.

- ▶ UV-grade fused-silica equiconcave singlet lenses
- ▶ Laser grade: $< \lambda/10$ surface figure, 10-5 surface quality
- ▶ High-energy, single-wavelength and broadband AR coatings

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
BICC-25.4-206.4-UV	248
EXAMPLE: BICC-25.4-206.4-UV - 248	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank			
193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE FUSED SILICA BICONCAVE LENSES

f (mm)	$\emptyset$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	r (mm)	f @ 266nm	f @ 355nm	f @ 532nm	f @ 1064nm	PRODUCT CODE
-20.0	19.1	-1.2	-20.7	6.6	20.9	-20.6	-21.6	-22.3	-22.9	BICC-19.1-20.9-UV
-25.0	25.4	-1.2	-25.7	8.6	26.1	-25.8	-27.1	-28.0	-28.7	BICC-25.4-26.1-UV
-50.0	25.4	-2.3	-50.7	5.2	51.8	-51.5	-54.1	-55.9	-57.3	BICC-25.4-51.8-UV
-50.0	50.0	-1.2	-50.7	14.9	51.8	-51.5	-54.1	-55.9	-57.3	BICC-50.0-51.8-UV
-75.0	25.4	-3.5	-75.7	4.1	77.6	-76.7	-81.2	-83.2	-85.9	BICC-25.4-77.6-UV
-100.0	25.4	-4.6	-100.9	4.2	103.4	-103.0	-108.1	-111.8	-114.5	BICC-25.4-103.4-UV
-150.0	25.4	-6.9	-151.1	4.2	154.9	-154.5	-162.1	-167.6	-171.7	BICC-25.4-154.9-UV
-150.0	50.8	-3.5	-150.7	6.2	154.9	-154.5	-162.7	-167.8	-172.3	BICC-50.8-154.9-UV
-200.0	25.4	-9.3	-200.7	2.8	206.4	-206.2	-216.4	-223.7	-229.2	BICC-25.4-206.4-UV

LASER GRADE N-BK7 BICONCAVE LENSES: BICC-C



Specifications

Product Code: BICC-C

Optical Material: N-BK7

Diameter Tolerance: $+0/-0.25\text{mm}$ Center Thickness Tolerance (t_c): $\pm 0.25\text{mm}$

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: $\leq 0.05\text{mm}$ Radius of Curvature (RoC) Tolerance: $\pm 0.5\%$ Surface Figure: $< \lambda/10$ p-v at 633nm before coating

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

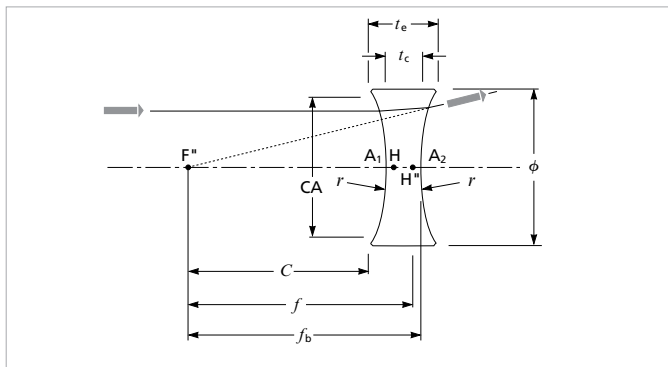
Narrowband: $R \leq 0.25\%$ per surfaceBroadband: $R_{\text{avg}} \leq 0.5\%$ per surfaceDualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold:

Pulsed, Narrowband: 15 J/cm², 20ns, 20Hz at 1064nmPulsed, Broadband: 10 J/cm², 20ns, 20Hz at 1064nmcw: 1 MW/cm² at 1064nmSpherical biconcave lenses are equiconcave: $r_1 = r_2$.

Other dimensions and focal lengths are available for OEM applications. Contact CVI Laser Optics for pricing and delivery.

- ▶ Laser quality: $< \lambda/10$ surface figure, 10-5 surface quality
- ▶ High energy, single wavelength and broadband AR coatings



Laser quality bi-concave lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
BICC-25.4-103.4-C	633
EXAMPLE: BICC-25.4-103.4-C - 633	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

400	633	800	1050-1600
415-700	633-1064	1030	1064/532
532	700-900	1064	1550

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-BK7 BICONCAVE LENSES

f (mm)	Ø (mm)	f/#	f _b (mm)	t _c (mm)	t _e (mm)	r (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	f @ 1319nm	PRODUCT CODE
-5.0	5.0	-1.2	-5.7	2.0	3.2	5.5	-5.0	-5.0	-5.1	-5.1	BICC-5.0-5.5-C
-10.0	12.7	-0.9	-10.7	2.0	6.1	10.8	-10.1	-10.2	-10.3	-10.4	BICC-12.7-10.8-C
-12.0	12.0	-1.2	-12.7	2.0	5.0	12.7	-11.9	-12.0	-12.2	-12.3	BICC-12.0-12.7-C
-20.0	20.0	-1.2	-20.5	1.0	6.1	20.9	-20.0	-20.1	-20.5	-20.4	BICC-20.0-20.9-C
-25.0	25.0	-1.2	-25.7	2.1	8.4	26.4	-25.1	-25.3	-25.7	-25.9	BICC-25.0-26.4-C
-100.0	25.4	-4.6	-100.9	2.6	4.2	103.4	-99.1	-99.9	-101.6	-102.3	BICC-25.4-103.4-C
-150.0	25.4	-6.9	-151.1	3.2	4.2	154.9	-148.6	-149.8	-152.3	-153.3	BICC-25.4-154.9-C

LASER GRADE POSITIVE BESTFORM LENSES: BFPL-UV



Specifications

Product Code: **BFPL-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Center Thickness Tolerance (t_c): ± 0.25 mm

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: ≤ 0.05 mm

Radius of Curvature (RoC) Tolerance: $\pm 0.5\%$

Surface Figure: $< \lambda/10$ p-v at 633nm before coating;
after coating on select substrates

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 85\%$ of central diameter

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{avg} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold:

Pulsed, Narrowband: 15 J/cm², 20ns, 20Hz at 1064nm

Pulsed, Broadband: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

Bestform lenses are biconvex lenses designed and manufactured to minimize coma and spherical aberrations by optimizing both radii of curvature. Positive bestform lenses are of exceptional performance and provide the smallest spot size available in a singlet lens per optimization of both spherical surfaces.

- ▶ Smallest spot size available in a singlet lens
- ▶ Low-loss, high-damage-threshold AR coatings

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
BFPL-25.4-75.0-UV	355

EXAMPLE: BFPL-25.4-75.0-UV - 355

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE POSITIVE BESTFORM LENSES

Standard Grade Corning 7980 1-D (Fused Silica)

f (mm)	Ø (mm)	f @ 532nm	f @ 633nm	f @ 1064nm	Input Diameter (mm)	Spot Size (µm)	t _c (mm)	PRODUCT CODE
25.0	12.7	25.4	26.6	27.5	3.0	2.9	2.3	BFPL-12.7-25.0-UV
50.0	25.4	52.2	54.8	56.6	5.5	4.2	0.8	BFPL-25.4-50.0-UV
75.0	25.4	77.0	80.8	83.5	7.5	4.9	1.9	BFPL-25.4-75.0-UV
100.0	25.4	104.8	110.0	113.6	9.5	5.3	2.4	BFPL-25.4-100.0-UV
125.0	25.4	128.5	134.9	139.4	11.5	6.3	2.7	BFPL-25.4-125.0-UV
150.0	25.4	153.0	160.6	166.0	13.0	6.4	2.9	BFPL-25.4-150.0-UV
200.0	25.4	206.2	216.4	223.6	16.0	6.6	3.2	BFPL-25.4-200.0-UV

IMAGE GRADE FUSED SILICA PLANO-CONVEX LENSES: LUP-UV



Specifications

Product Code: **LUP-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: $+0/-0.10\text{mm}$

Center Thickness Tolerance (t_c): $\pm 0.2\text{mm}$

Chamfer: $0.05 - 0.20\text{mm}$ at 45° nominal

Centration: ≤ 3 arc minutes

Paraxial Focal Length: $f \pm 1\%$

Surface Irregularity: $< \lambda/4$ p-v at 633nm per surface before coating

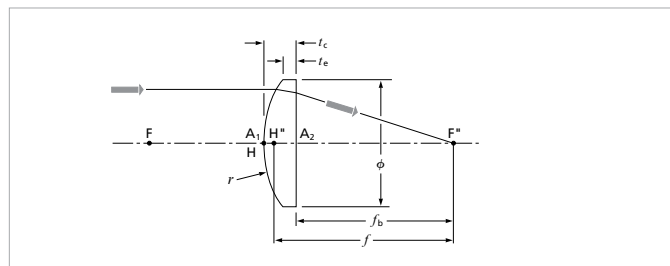
Surface Quality: 40-20 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 90\%$ of central diameter

Design Wavelength: 404.7nm

Anti-reflection Coating: Wavelength user specified

The LUP product covers a wide range of focal lengths from 15mm to 1 m. These image grade plano-convex fused silica lenses are an economical alternative to laser grade lenses which are recommended for more demanding applications.



Plano-convex lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm); for uncoated leave blank
LUP-12.5-11.7-UV	1064
EXAMPLE: LUP-12.5-11.7-UV - 532	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

248-355	355-532	415-700	1064
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IMAGE GRADE FUSED SILICA PLANO-CONVEX LENSES

f (mm)	$\varnothing$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	t_e (mm)	r (mm)	PRODUCT CODE
15.0	12.5	1.3	10.9	6.0	2.2	7.0	LUP-12.5-7.0-UV
20.0	12.5	1.8	16.6	5.0	2.6	9.4	LUP-12.5-9.4-UV
25.0	12.5	2.2	21.9	4.5	2.7	11.7	LUP-12.5-11.7-UV
30.0	12.5	2.7	27.3	4.0	2.5	14.1	LUP-12.5-14.1-UV
40.0	12.5	3.6	37.6	3.5	2.4	18.8	LUP-12.5-18.8-UV
50.0	25.0	2.2	45.2	7.0	3.4	23.5	LUP-25.0-23.5-UV
75.0	12.5	6.7	72.6	3.5	2.9	35.2	LUP-12.5-35.2-UV
75.0	25.0	3.3	70.9	6.0	3.7	35.2	LUP-25.0-35.2-UV
100.0	12.5	8.9	97.6	3.5	3.1	47.0	LUP-12.5-47.0-UV
100.0	25.0	4.4	96.6	5.0	3.3	47.0	LUP-25.0-47.0-UV
125.0	12.5	11.1	122.6	3.5	3.2	58.7	LUP-12.5-58.7-UV
125.0	25.0	5.6	121.6	5.0	3.7	58.7	LUP-25.0-58.7-UV
150.0	25.0	6.7	146.9	4.5	3.4	70.4	LUP-25.0-70.4-UV
200.0	25.0	8.9	196.9	4.5	3.7	93.9	LUP-25.0-93.9-UV
250.0	25.0	11.1	247.3	4.0	3.3	117.4	LUP-25.0-117.4-UV
300.0	25.0	13.3	297.3	4.0	3.4	140.9	LUP-25.0-140.9-UV
500.0	25.0	22.2	497.3	4.0	3.7	234.8	LUP-25.0-234.8-UV
1000.0	25.0	44.4	997.3	4.0	3.8	469.6	LUP-25.0-469.6-UV

IMAGE GRADE N-BK7 PLANO-CONVEX LENSES: LPX-C



Specifications

Product Code: **LPX-C**

Optical Material: N-BK7

Diameter Tolerance: $+0/-0.1\text{mm}$

Center Thickness Tolerance (t_c): $\pm 0.2\text{mm}$

Chamfer: 0.10-0.50mm at 45° nominal

Centration: ≤ 3 arc minutes

Paraxial Focal Length: $f \pm 2\%$ ($\pm 5\%$ for the LPX-4.0-3.1-C)

Surface Irregularity: $< \lambda/2$ p-v at 633nm per surface before coating

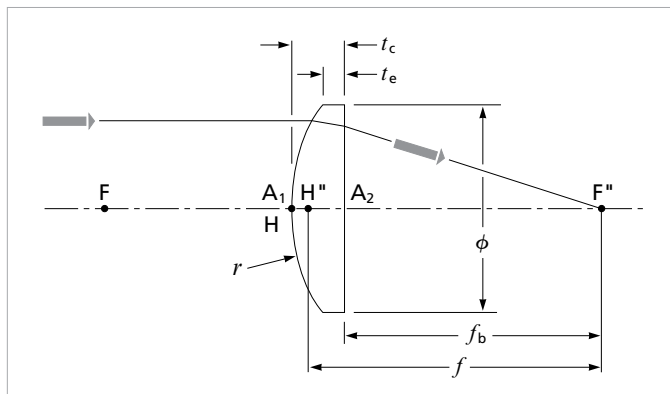
Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 90\%$ of central diameter

Design Wavelength: 546.1nm

Anti-reflection Coating: Wavelength user specified

The LPX product covers an extensive range of diameters in both metric and imperial sizes as well as focal length from 8mm to 500mm. These image grade plano-convex N-BK7 lenses can be used in a wide range of applications though not recommended for high power lasers.



Plano-convex lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm); for uncoated leave blank
LPX-25.0-25.9-C	415-700

EXAMPLE: LPX-25.0-25.9-C - 415-700

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE ON NEXT PAGE

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

415-700

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

CONTINUED...IMAGE GRADE N-BK7 PLANO-CONVEX LENSES: LPX-C

IMAGE GRADE N-BK7 PLANO-CONVEX LENSES							
f (mm)	$\varnothing$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	t_e (mm)	r (mm)	PRODUCT CODE
8.0	4.0	2.2	6.4	2.5	2.0	4.2	LPX-4.0-4.2-C
10.0	5.0	2.2	8.3	2.6	2.0	5.2	LPX-5.0-5.2-C
10.0	8.0	1.4	7.4	3.9	2.0	5.2	LPX-8.0-5.2-C
15.0	8.0	2.1	13.0	3.1	2.0	7.8	LPX-8.0-7.8-C
15.0	10.0	1.7	12.5	3.8	2.0	7.8	LPX-10.0-7.8-C
18.0	8.0	2.5	16.1	2.9	2.0	9.3	LPX-8.0-9.3-C
25.0	14.0	2.0	22.4	4.0	2.0	13.0	LPX-14.0-13.0-C
25.4	25.4	1.1	17.9	11.4	1.7	13.2	LPX-25.4-13.2-C
30.0	12.5	2.7	27.4	4.0	2.7	15.6	LPX-12.5-15.6-C
31.7	25.4	1.4	26.5	7.9	1.9	16.4	LPX-25.4-16.4-C
35.0	20.0	1.9	32.2	4.2	1.2	18.2	LPX-20.0-18.2-C
35.0	30.0	1.3	28.5	9.9	2.0	18.2	LPX-30.0-18.2-C
40.0	12.5	3.6	37.7	3.5	2.5	20.7	LPX-12.5-20.7-C
40.0	15.0	3.0	37.4	4.0	2.6	20.7	LPX-15.0-20.7-C
40.0	20.0	2.2	37.0	4.5	1.9	20.7	LPX-20.0-20.7-C
40.0	25.0	1.9	36.0	6.0	1.8	20.7	LPX-25.0-20.7-C
40.0	30.0	1.5	34.5	8.4	2.0	20.7	LPX-30.0-20.7-C
50.0	12.5	4.4	47.7	3.5	2.7	25.9	LPX-12.5-25.9-C
50.0	20.0	2.8	47.4	4.0	2.0	25.9	LPX-20.0-25.9-C
50.0	25.0	2.2	46.3	5.7	2.5	25.9	LPX-25.0-25.9-C
50.8	25.4	2.2	47.4	5.2	1.9	26.4	LPX-25.4-26.4-C
75.0	12.5	6.7	72.7	3.5	3.0	38.9	LPX-12.5-38.9-C
75.0	25.0	3.3	72.4	4.0	1.9	38.9	LPX-25.0-38.9-C
76.2	25.4	3.3	73.5	4.1	2.0	39.5	LPX-25.4-39.5-C
80.0	15.0	5.9	78.2	2.7	2.0	41.5	LPX-15.0-41.5-C
100.0	12.5	8.9	98.0	3.0	2.6	51.9	LPX-12.5-51.9-C
100.0	25.0	4.4	97.4	4.0	2.5	51.9	LPX-25.0-51.9-C
125.0	12.5	11.1	123.0	3.0	2.7	64.8	LPX-12.5-64.8-C
150.0	25.0	6.7	147.4	4.0	3.0	77.8	LPX-25.0-77.8-C
200.0	12.5	17.8	198.0	3.0	2.8	103.7	LPX-12.5-103.7-C
200.0	25.0	8.9	197.4	4.0	3.2	103.7	LPX-25.0-103.7-C
250.0	12.5	22.2	248.0	3.0	2.9	129.7	LPX-12.5-129.7-C
250.0	25.0	11.1	247.4	4.0	3.4	129.7	LPX-25.0-129.7-C
250.0	50.0	5.6	247.1	4.4	2.0	129.7	LPX-50.0-129.7-C
300.0	25.0	13.3	298.0	3.0	2.5	155.6	LPX-25.0-155.6-C
400.0	25.0	17.8	398.4	2.4	2.0	207.5	LPX-25.0-207.5-C
500.0	25.0	22.2	498.5	2.3	2.0	259.4	LPX-25.0-259.4-C

IMAGE GRADE FUSED SILICA PLANO-CONCAVE LENSES: LUK-UV



UV-grade synthetic fused silica lenses extend transmission to below 200nm and have superior thermal and mechanical characteristics.

The LUK product line covers the focal length range from -10mm to -350mm with the most common diameters. These image grade plano-concave fused silica lenses are an economical alternative to laser grade lenses which are recommended for more demanding applications.

Specifications

Product Code: **LUK-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: $+0/-0.10\text{mm}$

Center Thickness Tolerance (t_c): $\pm 0.2\text{mm}$

Chamfer: $0.05 - 0.20\text{mm}$ at 45° nominal

Flat Annulus Width (Δ): $0.5 +0/-0.25\text{mm}$

Centration: ≤ 3 arc minutes

Paraxial Focal Length: $f \pm 1\%$

Surface Irregularity: $< \lambda/4$ p-v at 633nm per surface before coating

Surface Quality: 40-20 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\emptyset - 2\Delta$

Design Wavelength: 404.7nm

Anti-reflection Coating: Wavelength user specified

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
LUK-12.5-7.0-UV	355-532
EXAMPLE: LUK-12.5-7.0-UV - 355-532	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

248-355	355-532	415-700	1064
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Please see page T-31 for Anti-Reflective Coating Traces.

IMAGE GRADE FUSED SILICA PLANO-CONCAVE LENSES							
f (mm)	$\emptyset$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	t_e (mm)	r (mm)	PRODUCT CODE
-10.0	6.3	-2.1	-11.4	2.0	2.8	4.7	LUK-6.3-4.7-UV
-12.5	6.3	-2.6	-13.9	2.0	2.6	5.9	LUK-6.3-5.9-UV
-15.0	12.5	-1.4	-16.4	2.0	5.0	7.0	LUK-12.5-7.0-UV
-25.0	12.5	-2.4	-26.7	2.5	4.0	11.7	LUK-12.5-11.7-UV
-30.0	12.5	-2.9	-32.0	3.0	4.2	14.1	LUK-12.5-14.1-UV
-37.5	25.0	-1.7	-40.9	5.0	9.7	17.6	LUK-25.0-17.6-UV
-50.0	25.0	-2.3	-53.4	5.0	8.3	23.5	LUK-25.0-23.5-UV
-75.0	25.0	-3.5	-78.4	5.0	7.1	35.2	LUK-25.0-35.2-UV
-100.0	12.5	-9.7	-102.7	4.0	4.4	47.0	LUK-12.5-47.0-UV
-100.0	25.0	-4.6	-103.4	5.0	6.6	47.0	LUK-25.0-47.0-UV
-125.0	25.0	-5.8	-128.4	5.0	6.2	58.7	LUK-25.0-58.7-UV
-150.0	25.0	-6.9	-153.4	5.0	6.0	70.4	LUK-25.0-70.4-UV
-250.0	25.0	-11.6	-254.1	6.0	6.6	117.4	LUK-25.0-117.4-UV
-350.0	25.0	-16.2	-354.1	6.0	6.4	164.4	LUK-25.0-164.4-UV

For the definition of the flat annulus width, see the standard plano-concave lens diagram page 286.

IMAGE GRADE N-BK7 PLANO-CONCAVE LENSES: LPK-C



Specifications

Product Code: LPK-C

Optical Material: N-BK7

Diameter Tolerance: $+0/-0.10\text{mm}$ Center Thickness Tolerance (t_c): $\pm 0.2\text{mm}$ Chamfer: $0.05 - 0.20\text{mm}$ at 45° nominalFlat Annulus Width (Δ): 0.2mm for $\phi \leq 40\text{mm}$, 0.4mm for $\phi > 40\text{mm}$ ($+0/-70\%$)Centration: ≤ 3 arc minutesParaxial Focal Length: $f \pm 2\%$ Surface Irregularity: $< \lambda/2$ p-v at 633nm per surface before coating

Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

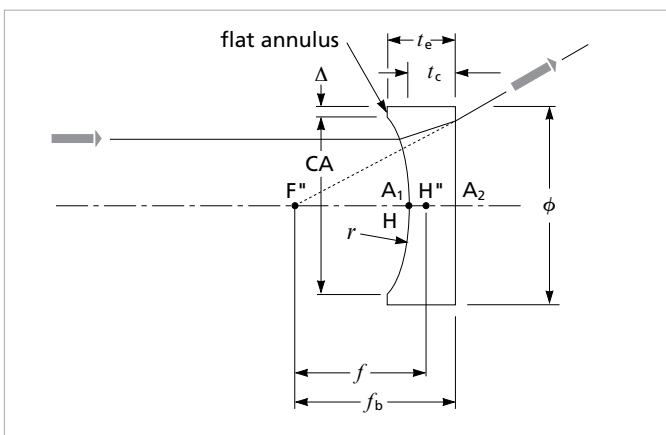
Clear Aperture (CA): $\phi - 2\Delta$ Design Wavelength: 546.1nm

Anti-reflection Coating: Wavelength user specified

Plano-concave lenses have one flat and one concave surface. They have a negative focal length and are often used to expand light or to increase focal lengths in optical systems.

Plano-concave glass lenses made from N-BK7 exhibit excellent transmissive properties from below 400nm to above $1\text{ }\mu\text{m}$.

These image grade plano-concave N-BK7 lenses can be used in a wide range of applications though not recommended for high power lasers or when high wavefront quality is required.



Standard plano-concave lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
LPK-12.5-6.5-C	415-700

EXAMPLE: LPK-12.5-6.5-C - 415-700

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE ON NEXT PAGE

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

415-700	633-1064	1064
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Please see page T-31 for Anti-Reflective Coating Traces.

IMAGE GRADE N-BK7 PLANO-CONCAVE LENSES

f (mm)	$\varnothing$ (mm)	$f/\#$	f_b (mm)	t_e (mm)	r (mm)	PRODUCT CODE
-12.5	12.5	-1.0	-13.8	6.2	6.5	LPK-12.5-6.5-C
-15.0	8.0	-1.9	-16.3	3.0	7.8	LPK-8.0-7.8-C
-15.0	12.5	-1.2	-16.3	4.9	7.8	LPK-12.5-7.8-C
-20.0	10.0	-2.0	-21.3	3.2	10.4	LPK-10.0-10.4-C
-20.0	12.5	-1.6	-21.3	4.0	10.4	LPK-12.5-10.4-C
-25.0	12.5	-2.0	-26.3	3.5	13.0	LPK-12.5-13.0-C
-25.0	25.0	-1.0	-26.3	10.9	13.0	LPK-25.0-13.0-C
-50.0	12.5	-4.0	-51.3	2.7	25.9	LPK-12.5-25.9-C
-50.0	25.0	-2.0	-51.3	4.6	25.9	LPK-25.0-25.9-C
-75.0	12.5	-6.0	-76.3	2.5	38.9	LPK-12.5-38.9-C
-75.0	25.0	-3.0	-76.3	4.0	38.9	LPK-25.0-38.9-C
-100.0	12.5	-8.0	-101.3	2.4	51.9	LPK-12.5-51.9-C
-100.0	25.0	-4.0	-101.3	3.5	51.9	LPK-25.0-51.9-C
-150.0	12.5	-12.0	-151.5	2.5	77.8	LPK-12.5-77.8-C
-150.0	25.0	-6.0	-151.3	3.0	77.8	LPK-25.0-77.8-C
-200.0	25.0	-8.0	-201.3	2.7	103.7	LPK-25.0-103.7-C
-250.0	25.0	-10.0	-251.3	2.6	129.7	LPK-25.0-129.7-C
-300.0	25.0	-12.0	-301.3	2.5	155.6	LPK-25.0-155.6-C
-500.0	25.0	-20.0	-501.3	2.3	259.4	LPK-25.0-259.4-C
-700.0	25.0	-28.0	-701.3	2.2	363.1	LPK-25.0-363.1-C
-1000.0	25.0	-40.0	-1001.3	2.2	518.7	LPK-25.0-518.7-C

IMAGE GRADE N-BK7 BICONVEX LENSES: LDX-C



Specifications

Product Code: LDX-C

Optical Material: N-BK7

Diameter Tolerance: +0/-0.10mm

Center Thickness Tolerance (t_c): ± 0.2 mm

Chamfer: 0.25 – 0.50mm at 45° nominal

Centration: ≤ 3 arc minutesParaxial Focal Length: $f \pm 2\%$ ($\pm 4\%$ for LDX-5.0-4.3-C)Surface Irregularity: $< \lambda/2$ p-v at 633nm before coating (applies to any 25mm diameter within CA for $\varnothing > 25$ mm)

Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

Clear Aperture (CA): $\geq 90\%$ of central diameter

Design Wavelength: 546.1nm

Anti-reflection Coating: Wavelength user specified

Biconvex or equi-convex lenses have two convex surfaces with identical radii. They have positive focal lengths and form both real and virtual images.

They are recommended for virtual imaging of real objects and for positive conjugate ratios from approximately 0.2 to 5 (values are wavelength sensitive). Due to the symmetry, aberrations such as coma, distortion, and chromatic aberration almost exactly cancel out at unit conjugate ratio. Aberrations increase as conjugate ratios depart from unity.

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
LDX-10.0-9.5-C	415-700

EXAMPLE: LDX-10.0-9.5-C - 415-700

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

415-700	633-1064
---------	----------

Please see page T-31 for Anti-Reflective Coating Traces.

IMAGE GRADE N-BK7 BICONVEX LENSES

f (mm)	$\varnothing$ (mm)	$f/\#$	f_b (mm)	t_c (mm)	t_s (mm)	r (mm)	PRODUCT CODE
4.5	5.0	0.9	3.8	2.0	0.4	4.3	LDX-5.0-4.3-C
7.0	5.0	1.4	5.9	3.0	2.0	6.7	LDX-5.0-6.7-C
10.0	5.0	2.0	9.1	2.6	2.0	9.9	LDX-5.0-9.9-C
10.0	10.0	1.0	8.3	4.8	1.9	9.5	LDX-10.0-9.5-C
15.0	14.5	1.0	12.9	5.9	2.0	14.5	LDX-14.5-14.5-C
20.0	15.0	1.3	18.3	4.9	2.0	19.9	LDX-15.0-19.9-C
20.0	25.0	0.8	15.6	11.8	2.1	18.5	LDX-25.0-18.5-C
25.0	25.0	1.0	21.9	8.9	2.0	24.3	LDX-25.0-24.3-C
30.0	30.0	1.0	26.4	10.3	2.0	29.3	LDX-30.0-29.3-C
38.1	38.1	1.1	33.8	12.4	1.9	37.3	LDX-38.1-37.3-C
40.0	50.0	0.8	31.9	22.2	2.9	37.3	LDX-50-37.3-C
50.0	25.0	2.0	48.3	5.1	2.0	51.0	LDX-25.0-51.0-C
50.0	50.0	1.0	44.5	15.8	2.1	49.0	LDX-50.0-49.0-C
75.0	25.0	3.0	73.7	4.0	2.0	77.1	LDX-25.0-77.1-C
75.0	50.0	1.5	71.1	11.5	3.0	75.8	LDX-50.0-75.8-C
88.9	25.4	3.9	87.6	3.8	2.0	91.6	LDX-25.4-91.6-C

ASPHERIC GLASS CONDENSER LENSES: LAG-C



Specifications

Product Code: **LAG-C**

Optical Material: Optical grade crown glass

Diameter Tolerance: $\pm 0.4\text{mm}$

Center Thickness Tolerance (t_c): $\pm 7\%$ down to $\pm 0.5\text{mm}$

Paraxial Focal Length: $f \pm 7\%$

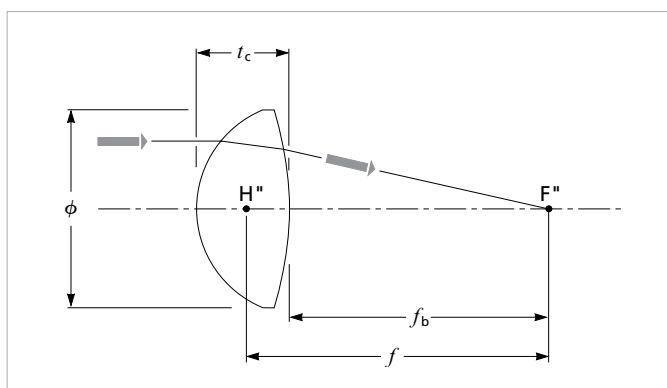
Surface Quality: Aspheric side precision molded, 80-50 scratch-dig. Flat or spherical side felt polished, 80-50 scratch-dig per MIL-PRF-13830b

Maximum Service Temperature: 177°C (350°F)

Anti-reflection Coating: Optional Single-layer MgF_2 (400-700nm)

Aspheric lenses provide better performance by reducing aberrations when used in low f-number, high-throughput applications. These lenses have one aspheric surface. The second surface is flat or spherical-convex.

- ▶ A flat second surface minimizes aberration.
- ▶ A spherical-convex second surface provides the lowest f-number and highest transmission because equal deviation of marginal rays is most closely approached.
- ▶ Only single-layer MgF_2 (SLMF-400-700) coatings are recommended for these lenses owing to the steep curvature of the aspheric surface.



Aspheric glass condenser lenses

Single vs Multi-layer Coatings

While MgF_2 does not offer the same performance as multi-layer coatings, there are special circumstances where it is preferred. On lenses with very steep surfaces, such as our LAG series aspherics, MgF_2 will actually perform better near the edge of the lens. This is because the performance of a coating shifts with angle of incidence; the shifted MgF_2 will never be worse than an uncoated lens, but at very high angles, a multi-layer coating can actually be shifted to a region where its performance is worse than if there were no coating at all.

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
LAG-18.0-12.0-C	SLMF-400-700

EXAMPLE: LAG-18.0-12.0-C - SLMF-400-700

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE ON NEXT PAGE

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

SLMF-400-700

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

ASPHERIC GLASS CONDENSER LENSES						
f (mm)	$\varnothing$ (mm)	$f/\#$	NAS Shape*	t_c (mm)	f_b (mm)	PRODUCT CODE
8.5	12.0	0.71	CX	5.5	5.8	LAG-12.0-8.5-C
12.0	15.0	0.80	P	5.5	8.4	LAG-15.0-12.0-C
12.0	17.0	0.71	P	8.0	6.7	LAG-17.0-12.0-C
12.0	18.0	0.67	CX	8.8	6.9	LAG-18.0-12.0-C
15.5	18.0	0.86	P	7.0	10.9	LAG-18.0-15.5-C
17.0	19.0	0.89	P	7.0	12.4	LAG-19.0-17.0-C
18.0	24.0	0.75	P	10.0	11.4	LAG-24.0-18.0-C
23.5	32.5	0.72	CX	13.5	15.1	LAG-32.5-23.5-C
25.0	32.5	0.77	P	13.0	16.5	LAG-32.5-25.0-C
26.5	30.0	0.88	P	11.0	19.3	LAG-30.0-26.5-C
29.5	40.0	0.74	CX	15.5	20.9	LAG-40.0-29.5-C
34.5	38.0	0.91	P	12.0	26.6	LAG-38.0-34.5-C
35.0	35.0	1.00	P	11.5	27.4	LAG-35.0-35.0-C
39.0	60.0	0.65	CX	27.5	25.0	LAG-60.0-39.0-C
50.0	75.0	0.67	P	29.1	31.2	LAG-75.0-50.0-C
53.0	65.0	0.82	P	23.5	37.6	LAG-65.0-53.0-C

*Shape of non aspheric side (NAS) is plano (P), or convex (CX)

APPLICATION NOTE

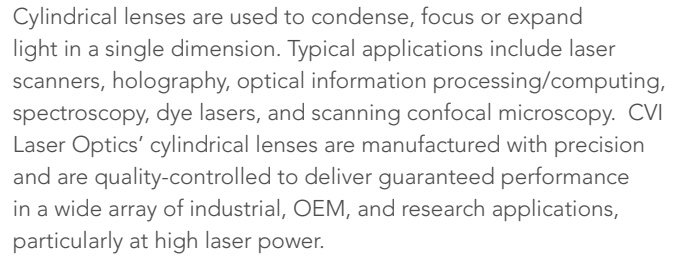
Aspheric Glass Condenser Lenses

The aspheric lens is designed to have a much shorter focal length than can be attained with a spherical glass lens of equal diameter and spherical aberration. These lenses have only one aspheric surface; the other surface is either plano, or spherical convex. A correctly formed aspheric lens surface cancels spherical aberration, or it reduces both spherical aberration and coma to insignificance, in which case the system is said to be aplanatic. Thus, more energy can be concentrated into a smaller area, such as the entrance pupil of a projection lens system or the sensitive area of a detector. Without the aspheric surface, marginal rays (which enter or exit the lens near its edge) may be severely aberrated and fail to illuminate the desired target. The aspheric surface puts marginal rays on target and allows the potential collecting area of the system to be fully utilized at f-numbers as low as 0.65.

Aspheric lenses are ideal for low f-number, high throughput applications, particularly where elements are adjacent to the light source, as in condensing, projecting, and illuminating systems. Other applications include optical communications equipment; smoke, fire

(turbulence), and intrusion alarms; pollution monitors; and chemical vapor alarms. They should be considered whenever highly efficient use of either sources or detectors is important, or whenever space is limited and short focal lengths or low f-numbers are advantageous. The schematic drawing of a typical projection system shows an aspheric lens used in combination with a plano-convex spherical lens. The aspheric surface faces the long conjugate (in this case, away from the source), making ray deviations at two surfaces nearly equal. This minimizes reflection loss. For this orientation, the aspheric surface contour minimizes the aberration of combined aspheric and plano-convex lenses, concentrating maximum power into the projection lens entrance pupil. Lens combination conjugate ratios can be adjusted, with aberration minimized, by changing the focal length of the spherical plano-convex element. For ratios near unity, the planoconvex lens should be replaced by a second aspheric element, oriented so that the aspheric surfaces face each other. For ratios much less than unity, the position of the aspheric and plano lenses should be interchanged.

Mirrors Spherical lenses Cylindrical lenses Multielement lenses Waveplates Windows and Optical Flats Beamsplitters Polarization Components Ultrafast Components Prisms Filters



Don't see exactly what you are looking for?

Give us a call and we will be honored to assist you with your custom needs.

SELECTION GUIDE

PRODUCT TYPE	SURFACE QUALITY	WAVELENGTH RANGE	OPERATING CONDITIONS	PAGE
Plano-Convex Cylindrical Lenses				
LASER GRADE FUSED SILICA RECTANGULAR: RCX-UV	20-10	193 – 2100nm	High Energy Lasers, 10 J/cm ² , 20ns, 20Hz at 1064nm	65
LASER GRADE N-BK7 SQUARE: SCX-C	20-10	380 – 2100nm	High Energy Lasers, 10 J/cm ² , 20ns, 20Hz at 1064nm	66
LASER GRADE FUSED SILICA SQUARE: SCX-UV	20-10	193 – 2100nm	High Energy Lasers, 10 J/cm ² , 20ns, 20Hz at 1064nm	67
LASER GRADE FUSED SILICA ROUND: CLCX-UV	20-10	193 – 2100nm	High Energy Lasers, 10 J/cm ² , 20ns, 20Hz at 1064nm	69
Plano-Concave Cylindrical Lenses				
LASER GRADE FUSED SILICA RECTANGULAR: RCC-UV	20-10	193 – 2100nm	High Energy Lasers, 10 J/cm ² , 20ns, 20Hz at 1064nm	70
LASER GRADE N-BK7 SQUARE: SCC-C	20-10	380 – 2100nm	High Energy Lasers, 10 J/cm ² , 20ns, 20Hz at 1064nm	71
LASER GRADE FUSED SILICA SQUARE: SCC-UV	20-10	193 – 2100nm	High Energy Lasers, 10 J/cm ² , 20ns, 20Hz at 1064nm	72
LASER GRADE FUSED SILICA ROUND: CLCC-UV	20-10	193 – 2100nm	High Energy Lasers, 10 J/cm ² , 20ns, 20Hz at 1064nm	73

LASER GRADE FUSED SILICA RECTANGULAR CYLINDRICAL PLANO-CONVEX LENSES: RCX-UV



Specifications

Product Code: **RCX-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Design Wavelength: 248nm

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: $\pm 0.25\text{mm}$

Radius of Curvature Tolerance: $\pm 0.5\%$

Chamfer: 0.35mm leg width at 45° nominal

Wedge: ≤ 3 arc minutes

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure:

Cylindrical side: $< 1.0 \lambda$ (y-axis),

$< 1.0 \lambda/\text{cm}$ (x-axis), p-v at 633nm

Plano side: $< \lambda/4$ p-v at 633nm

Clear Aperture (CA): $\geq 85\%$ of central dimension

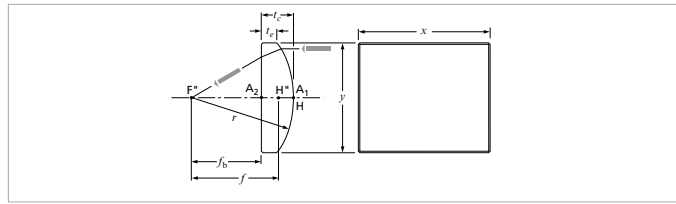
Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{\text{avg}} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold: 10 J/cm², 20ns, 20Hz at 1064nm



Rectangular cylindrical plano-convex lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
RCX-40.0-25.4-30.5-UV	193
EXAMPLE: RCX-40.0-25.4-30.5-UV - 193	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank			
193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

LASER GRADE FUSED SILICA RECTANGULAR CYLINDRICAL PLANO-CONVEX LENSES

f (mm)	x (mm)	y (mm)	r (mm)	t _c (mm)	t _e (mm)	f/#	f _b (mm)	PRODUCT CODE
12.7	12.7	6.4	6.5	3.0	2.2	2.3	10.8	RCX-12.7-6.4-6.5-UV
20.0	12.7	6.4	10.2	3.0	2.5	3.7	18.1	RCX-12.7-6.4-10.2-UV
25.0	25.4	12.7	12.7	5.0	3.3	2.3	21.8	RCX-25.4-12.7-12.7-UV
30.0	40.0	25.4	15.3	11.0	4.2	1.4	23.0	RCX-40.0-25.4-15.3-UV
40.0	25.0	15.0	20.3	5.0	3.6	3.1	36.8	RCX-25.0-15.0-20.3-UV
40.0	40.0	20.0	20.3	6.0	3.4	2.4	36.2	RCX-40.0-20.0-20.3-UV
50.0	40.0	25.4	25.4	9.0	5.6	2.3	44.2	RCX-40.0-25.4-25.4-UV
60.0	40.0	25.4	30.5	7.0	4.2	2.8	55.5	RCX-40.0-25.4-30.5-UV
75.0	40.0	25.4	38.1	5.0	2.8	3.5	71.8	RCX-40.0-25.4-38.1-UV
100.0	40.0	25.4	50.9	5.0	3.4	4.6	96.8	RCX-40.0-25.4-50.9-UV
125.0	40.0	25.4	63.6	5.0	3.7	5.8	121.8	RCX-40.0-25.4-63.6-UV
150.0	40.0	25.4	76.3	5.0	3.9	6.9	146.8	RCX-40.0-25.4-76.3-UV
200.0	30.0	20.0	101.7	5.0	4.5	11.8	196.8	RCX-30.0-20.0-101.7-UV
200.0	40.0	25.4	101.7	5.0	4.2	9.3	196.8	RCX-40.0-25.4-101.7-UV
250.0	30.0	20.0	127.1	5.0	4.6	14.7	246.8	RCX-30.0-20.0-127.1-UV
250.0	40.0	25.4	127.1	5.0	4.4	11.6	246.8	RCX-40.0-25.4-127.1-UV
300.0	40.0	25.4	152.6	5.0	4.5	13.9	296.8	RCX-40.0-25.4-152.6-UV
400.0	40.0	25.4	203.4	5.0	4.6	18.5	396.8	RCX-40.0-25.4-203.4-UV
500.0	40.0	25.4	254.3	5.0	4.7	23.2	496.8	RCX-40.0-25.4-254.3-UV
750.0	40.0	25.4	381.4	5.0	4.8	34.7	746.8	RCX-40.0-25.4-381.4-UV
1000.0	40.0	25.4	508.6	5.0	4.8	46.3	996.8	RCX-40.0-25.4-508.6-UV

LASER GRADE N-BK7 SQUARE CYLINDRICAL
PLANO-CONVEX LENSES: [SCX-C](#)



Specifications

Product Code: SCX-C

Optical Material: N-BK7

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: $\pm 0.25\text{mm}$

Radius of Curvature Tolerance: $\pm 0.5\%$

Chamfer: 0.35mm leg width at 45° nominal

Wedge: ≤ 3 arc minutes

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure:

Cylindrical side: $< 1.0 \lambda$ (y-axis),

$< 1.0 \lambda/\text{cm}$ (x-axis), p-v at 633nm

Plano side: $< \lambda/4$ p-v at 633nm

Clear Aperture (CA): $\geq 85\%$ of central dimension

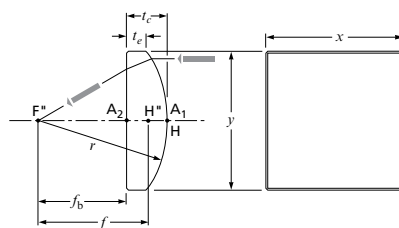
Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{avg} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold: 10 J/cm², 20ns, 20Hz at 1064nm



Square cylindrical plano-convex lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
SCX-50.8-152.6-C	1064

EXAMPLE: SCX-50.8-152.6-C - 1064

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

400	633	800	1050-1600
415-700	633-1064	1030	1064/532
532	700-900	1064	1550

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-BK7 SQUARE CYLINDRICAL PLANO-CONVEX LENSES

f (mm)	$x = y$ (mm)	r (mm)	t_c (mm)	t_s (mm)	$f/\#$	f_b (mm)	PRODUCT CODE
50.0	25.4	25.4	9.0	5.6	2.3	44.1	SCX-25.4-25.4-C
60.0	20.0	30.5	5.0	3.3	3.5	56.7	SCX-20.0-30.5-C
75.0	20.0	38.1	5.0	3.7	4.4	71.7	SCX-20.0-38.1-C
100.0	20.0	50.9	5.0	4.0	5.9	96.7	SCX-20.0-50.9-C
100.0	50.8	50.9	10.0	3.2	2.3	93.4	SCX-50.8-50.9-C
125.0	25.4	63.6	5.0	3.7	5.8	121.7	SCX-25.4-63.6-C
150.0	20.0	76.3	5.0	4.3	8.8	146.7	SCX-20.0-76.3-C
150.0	25.4	76.3	5.0	3.9	6.9	146.7	SCX-25.4-76.3-C
200.0	25.4	101.7	5.0	4.2	9.3	196.7	SCX-25.4-101.7-C
250.0	25.4	127.1	5.0	4.4	11.6	246.7	SCX-25.4-127.1-C
300.0	25.4	152.6	5.0	4.5	13.9	296.7	SCX-25.4-152.6-C
300.0	50.8	152.6	6.4	4.2	6.9	295.8	SCX-50.8-152.6-C
400.0	20.0	203.4	5.0	4.7	23.5	396.7	SCX-20.0-203.4-C
500.0	20.0	254.3	5.0	4.8	29.4	496.7	SCX-20.0-254.3-C
500.0	50.8	254.3	6.4	5.1	11.6	495.8	SCX-50.8-254.3-C
750.0	50.8	381.4	6.4	5.5	17.4	745.8	SCX-50.8-381.4-C
2000.0	50.8	1000.0	6.4	6.0	46.3	1995.8	SCX-50.8-1000.0-C
10000.0	50.8	5000.0	6.4	6.3	231.6	9995.8	SCX-50.8-5000.0-C

LASER GRADE FUSED SILICA SQUARE CYLINDRICAL PLANO-CONVEX LENSES: SCX-UV



Specifications

Product Code: **SCX-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Design Wavelength: 248nm

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: $\pm 0.25\text{mm}$

Radius of Curvature Tolerance: $\pm 0.5\%$

Chamfer: 0.35mm leg width at 45° nominal

Wedge: ≤ 3 arc minutes

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure:

Cylindrical side: $< 1.0 \lambda$ (y-axis),

$< 1.0 \lambda/\text{cm}$ (x-axis), p-v at 633nm

Plano side: $< \lambda/4$ p-v at 633nm

Clear Aperture (CA): $\geq 85\%$ of central dimension

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

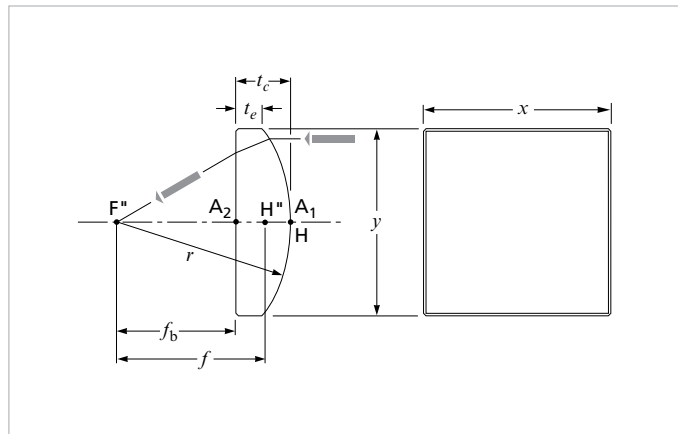
Broadband: $R_{\text{avg}} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold: 10 J/cm², 20ns, 20Hz at 1064nm

Other focal lengths and dimensions available.
Contact us for pricing and delivery details.

- ▶ UV laser-line focusing
- ▶ Anamorphic beam shaping and laser projection
- ▶ Illumination of detector arrays
- ▶ Low loss, high energy AR coatings



Square cylindrical plano-convex lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
SCX-50.8-152.6-UV	1064
EXAMPLE: SCX-50.8-152.6-UV - 1064	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE ON NEXT PAGE

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

continued on next page

LASER GRADE FUSED SILICA SQUARE CYLINDRICAL PLANO-CONVEX LENSES: SCX-UV

LASER GRADE FUSED SILICA SQUARE CYLINDRICAL PLANO-CONVEX LENSES							
f (mm)	$x = y$ (mm)	r (mm)	t_c (mm)	t_e (mm)	$f/\#$	f_e (mm)	PRODUCT CODE
25.0	20.0	12.7	8.0	3.1	1.5	19.9	SCX-20.0-12.7-UV
40.0	15.0	20.3	5.0	3.6	3.1	36.8	SCX-15.0-20.3-UV
40.0	25.4	20.3	9.0	4.5	1.9	34.2	SCX-25.4-20.3-UV
50.0	25.4	25.4	9.0	5.6	2.3	44.2	SCX-25.4-25.4-UV
50.0	30.0	25.4	9.0	4.1	2.0	44.2	SCX-30.0-25.4-UV
60.0	25.4	30.5	7.0	4.2	2.8	55.5	SCX-25.4-30.5-UV
75.0	25.4	38.1	5.0	2.8	3.5	71.8	SCX-25.4-38.1-UV
75.0	30.0	38.1	7.0	3.9	2.9	70.5	SCX-30.0-38.1-UV
75.0	50.8	38.1	12.7	3.0	1.7	66.9	SCX-50.8-38.1-UV
100.0	20.0	50.9	5.0	4.0	5.9	96.8	SCX-20.0-50.9-UV
100.0	25.4	50.9	5.0	3.4	4.6	96.8	SCX-25.4-50.9-UV
100.0	50.8	50.9	10.0	3.2	2.3	93.6	SCX-50.8-50.9-UV
125.0	20.0	63.6	5.0	4.2	7.4	121.8	SCX-20.0-63.6-UV
125.0	25.4	63.6	5.0	3.7	5.8	121.8	SCX-25.4-63.6-UV
125.0	50.8	63.6	8.5	3.2	2.9	119.6	SCX-50.8-63.6-UV
150.0	20.0	76.3	5.0	4.3	8.8	146.8	SCX-20.0-76.3-UV
150.0	25.4	76.3	5.0	3.9	6.9	146.8	SCX-25.4-76.3-UV
150.0	50.8	76.3	8.0	3.6	3.5	144.9	SCX-50.8-76.3-UV
200.0	25.4	101.7	5.0	4.2	9.3	196.8	SCX-25.4-101.7-UV
200.0	50.8	101.7	6.4	3.1	4.6	195.9	SCX-50.8-101.7-UV
250.0	20.0	127.1	5.0	4.6	14.7	246.8	SCX-20.0-127.1-UV
250.0	25.4	127.1	5.0	4.4	11.6	246.8	SCX-25.4-127.1-UV
250.0	50.8	127.1	6.4	3.8	5.8	245.9	SCX-50.8-127.1-UV
300.0	25.4	152.6	5.0	4.5	13.9	296.8	SCX-25.4-152.6-UV
300.0	50.8	152.6	6.4	4.2	6.9	295.9	SCX-50.8-152.6-UV
400.0	20.0	203.4	5.0	4.7	23.5	396.8	SCX-20.0-203.4-UV
400.0	50.8	203.4	6.4	4.8	9.3	395.9	SCX-50.8-203.4-UV
500.0	20.0	254.3	5.0	4.8	29.4	496.8	SCX-20.0-254.3-UV
500.0	25.4	254.3	5.0	4.7	23.2	496.8	SCX-25.4-254.3-UV
500.0	50.8	254.3	6.4	5.1	11.6	495.9	SCX-50.8-254.3-UV
750.0	25.4	381.4	5.0	4.8	34.7	746.8	SCX-25.4-381.4-UV
750.0	50.8	381.4	6.4	5.5	17.4	745.9	SCX-50.8-381.4-UV
1000.0	20.0	508.6	5.0	4.9	58.8	996.8	SCX-20.0-508.6-UV
1000.0	25.4	508.6	5.0	4.8	46.3	996.8	SCX-25.4-508.6-UV
1000.0	50.8	508.6	6.4	5.7	23.2	995.9	SCX-50.8-508.6-UV
2000.0	50.8	1000.0	6.4	6.0	46.3	1995.9	SCX-50.8-1000.0-UV
10000.0	50.8	5000.0	6.4	6.3	231.6	9995.9	SCX-50.8-5000.0-UV

LASER GRADE FUSED SILICA ROUND CYLINDRICAL PLANO-CONVEX LENSES: CLCX-UV



Specifications

Product Code: **CLCX-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Design Wavelength: 248nm

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: ± 0.25 mm

Radius of Curvature Tolerance: $\pm 0.5\%$

Chamfer: 0.35mm leg width at 45° nominal

Wedge: ≤ 3 arc minutes

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure:

Cylindrical side: $< 1.0 \lambda$ (y-axis),

$< 1.0 \lambda/\text{cm}$ (x-axis), p-v at 633nm

Plano side: $< \lambda/4$ p-v at 633nm

Clear Aperture (CA): $\geq 85\%$ of central dimension

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

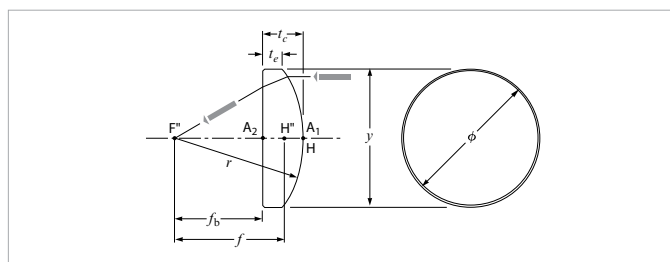
Broadband: $R_{\text{avg}} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold: 10 J/cm², 20ns, 20Hz at 1064nm

Other focal lengths and dimensions available. Contact us for pricing and delivery details.

- Anamorphic beam shaping and laser projection
- Illumination of detector arrays
- Low loss, high energy AR coatings



Round cylindrical plano-convex lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
CLCX-25.4-25.4-UV	193
EXAMPLE: CLCX-25.4-25.4-UV - 193	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE FUSED SILICA ROUND CYLINDRICAL PLANO-CONVEX LENSES

f (mm)	Ø (mm)	r (mm)	t _c (mm)	t _s (mm)	f/#	f _b (mm)	PRODUCT CODE
30.0	25.4	15.3	11.0	4.2	1.4	23.0	CLCX-25.4-15.3-UV
50.0	25.4	25.4	7.4	4.0	2.3	45.3	CLCX-25.4-25.4-UV
60.0	25.4	30.5	7.0	4.2	2.8	55.5	CLCX-25.4-30.5-UV
75.0	25.4	38.1	6.2	4.0	3.5	71.0	CLCX-25.4-38.1-UV
100.0	25.4	50.9	5.6	4.0	4.6	96.4	CLCX-25.4-50.9-UV
100.0	50.8	50.9	10.0	3.2	2.3	93.6	CLCX-50.8-50.9-UV
150.0	25.4	76.3	5.1	4.0	6.9	146.7	CLCX-25.4-76.3-UV
150.0	50.8	76.3	8.0	3.6	3.5	144.9	CLCX-50.8-76.3-UV

LASER GRADE FUSED SILICA RECTANGULAR CYLINDRICAL PLANO-CONCAVE LENSES: RCC-UV



Specifications

Product Code: **RCC-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Design Wavelength: 248nm

Dimensional Tolerance: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Radius of Curvature Tolerance: $\pm 0.5\%$

Chamfer: 0.35mm leg width at 45° nominal

Wedge: ≤ 3 arc minutes

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure:

Cylindrical side: $< 1.0 \lambda$ (y-axis),

$< 1.0 \lambda/\text{cm}$ (x-axis), p-v at 633nm

Plano side: $< \lambda/4$ p-v at 633nm

Clear Aperture (CA): $\geq 85\%$ of central dimension

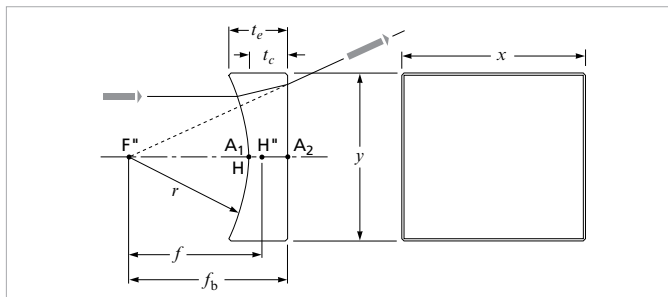
Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{\text{avg}} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold: 10 J/cm², 20ns, 20Hz at 1064nm



Laser grade rectangular cylindrical plano-concave lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
RCC-40.0-25.4-25.4-UV	633
EXAMPLE: RCC-40.0-25.4-25.4-UV - 633	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank			
193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE FUSED SILICA RECTANGULAR CYLINDRICAL PLANO-CONCAVE LENSES

f (mm)	x (mm)	y (mm)	r (mm)	t _c (mm)	t _e (mm)	f/#	f _b (mm)	PRODUCT CODE
-10.0	12.7	6.4	5.1	2.0	3.0	-1.8	-11.3	RCC-12.7-6.4-5.1-UV
-12.7	12.7	6.4	6.5	4.0	4.8	-2.3	-15.3	RCC-12.7-6.4-6.5-UV
-20.0	25.0	15.0	10.2	2.8	6.0	-1.6	-21.8	RCC-25.0-15.0-10.2-UV
-25.0	40.0	20.0	12.7	4.2	9.0	-1.5	-27.7	RCC-40.0-20.0-12.7-UV
-30.0	25.0	15.0	15.3	3.1	5.0	-2.4	-32.0	RCC-25.0-15.0-15.3-UV
-40.0	40.0	25.4	20.3	4.6	9.0	-1.9	-42.9	RCC-40.0-25.4-20.3-UV
-50.0	40.0	25.4	25.4	5.0	8.4	-2.3	-53.2	RCC-40.0-25.4-25.4-UV
-75.0	40.0	25.4	38.1	5.0	7.2	-3.5	-78.2	RCC-40.0-25.4-38.1-UV
-100.0	40.0	25.4	50.9	5.0	6.6	-4.6	-103.2	RCC-40.0-25.4-50.9-UV
-200.0	40.0	25.4	101.7	5.0	5.8	-9.3	-203.2	RCC-40.0-25.4-101.7-UV
-250.0	40.0	25.4	127.1	5.0	5.6	-11.6	-253.2	RCC-40.0-25.4-127.1-UV
-300.0	40.0	25.4	152.6	5.0	5.5	-13.9	-303.2	RCC-40.0-25.4-152.6-UV
-400.0	40.0	25.4	203.4	5.0	5.4	-18.5	-403.2	RCC-40.0-25.4-203.4-UV
-500.0	40.0	25.4	254.3	5.0	5.3	-23.2	-503.2	RCC-40.0-25.4-254.3-UV
-1000.0	40.0	25.4	508.6	5.0	5.2	-46.3	-1003.2	RCC-40.0-25.4-508.6-UV

LASER GRADE N-BK7 SQUARE CYLINDRICAL PLANO-CONCAVE LENSES: SCC-C



Specifications

Product Code: **SCC-C**

Optical Material: N-BK7

Dimensional Tolerance: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Radius of Curvature Tolerance: $\pm 0.5\%$

Chamfer: 0.35mm leg width at 45° nominal

Wedge: ≤ 3 arc minutes

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure:

Cylindrical side: $< 1.0 \lambda$ (y-axis),

$< 1.0 \lambda/\text{cm}$ (x-axis), p-v at 633nm

Plano side: $< \lambda/4$ p-v at 633nm

Clear Aperture (CA): $\geq 85\%$ of central dimension

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

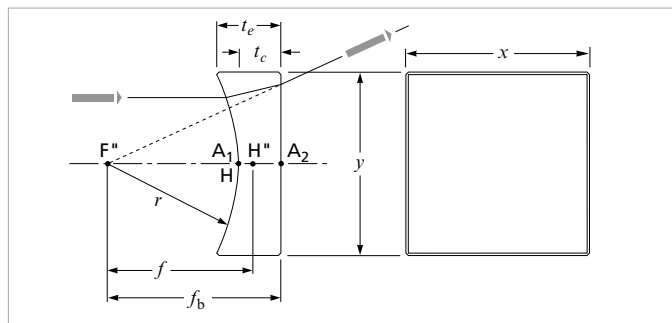
Broadband: $R_{\text{avg}} \leq 0.5\%$ per surface

Dualband: $R \leq 0.3\%$ at 1064, $R \leq 0.6\%$ at 532 per surface

Damage Threshold: 10 J/cm², 20ns, 20Hz at 1064nm

Other focal lengths and dimensions available. Contact us for pricing and delivery details.

- Anamorphic beam shaping and laser projection
- Illumination of detector arrays
- Low loss, high energy AR coatings



Laser grade square cylindrical plano-concave lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
SCC-50.8-50.9-C	800
EXAMPLE: SCC-50.8-50.9-C - 800	

CHOOSE FROM THE OPTIONS BELOW TO BUILD YOUR PART

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

400	633	800	1050-1600
415-700	633-1064	1030	1064/532
532	700-900	1064	1550

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE N-BK7 SQUARE CYLINDRICAL PLANO-CONCAVE LENSES

f (mm)	$x = y$ (mm)	r (mm)	t_c (mm)	t_e (mm)	$f/\#$	f_b (mm)	PRODUCT CODE
-30.0	20.0	15.3	4.3	8.0	-1.8	-32.8	SCC-20.0-15.3-C
-60.0	25.4	30.5	4.3	7.0	-2.8	-62.8	SCC-25.4-30.5-C
-75.0	50.8	38.1	8.0	17.6	-1.7	-80.3	SCC-50.8-38.1-C
-100.0	50.8	50.9	8.0	14.7	-2.3	-105.3	SCC-50.8-50.9-C
-250.0	50.8	127.1	6.0	8.5	-5.8	-254.0	SCC-50.8-127.1-C
-400.0	20.0	203.4	3.8	4.0	-23.5	-402.5	SCC-20.0-203.4-C
-500.0	20.0	254.3	3.9	4.0	-29.4	-502.6	SCC-20.0-254.3-C
-500.0	50.8	254.3	6.0	7.3	-11.6	-504.0	SCC-50.8-254.3-C
-1000.0	20.0	508.6	3.9	4.0	-58.8	-1002.6	SCC-20.0-508.6-C

LASER GRADE FUSED SILICA SQUARE CYLINDRICAL PLANO-CONCAVE LENSES: SCC-UV



Specifications

Product Code: **SCC-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Design Wavelength: 248nm

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Radius of Curvature Tolerance: ±0.5%

Chamfer: 0.35mm leg width at 45° nominal

Wedge: ≤ 3 arc minutes

Surface Figure: Cylindrical side: < 1.0 λ (y-axis),

< 1.0 λ/cm (x-axis), p-v at 633nm

Plano side: < λ/4 p-v at 633nm

Clear Aperture (CA): ≥ 85% of central dimension

Damage Threshold: 10 J/cm², 20ns, 20Hz at 1064nm

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
SCC-25.4-152.6-UV	355
EXAMPLE: SCC-25.4-152.6-UV - 355	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE FUSED SILICA SQUARE CYLINDRICAL PLANO-CONCAVE LENSES

f (mm)	x = y (mm)	r (mm)	t _c (mm)	t _e (mm)	f/#	f _b (mm)	PRODUCT CODE
-20.0	15.0	10.2	2.8	6.0	-1.6	-21.9	SCC-15.0-10.2-UV
-25.0	12.7	12.7	3.7	5.4	-2.3	-27.5	SCC-12.7-12.7-UV
-40.0	25.4	20.3	4.6	9.0	-1.9	-42.9	SCC-25.4-20.3-UV
-50.0	25.4	25.4	5.0	8.4	-2.3	-53.2	SCC-25.4-25.4-UV
-60.0	25.4	30.5	4.3	7.0	-2.8	-62.8	SCC-25.4-30.5-UV
-75.0	25.4	38.1	5.0	7.2	-3.5	-78.2	SCC-25.4-38.1-UV
-100.0	25.4	50.9	5.0	6.6	-4.6	-103.2	SCC-25.4-50.9-UV
-100.0	50.8	50.9	8.0	14.7	-2.3	-105.1	SCC-50.8-50.9-UV
-125.0	25.4	63.6	5.0	6.3	-5.8	-128.2	SCC-25.4-63.6-UV
-150.0	20.0	76.3	3.4	4.0	-8.8	-152.2	SCC-20.0-76.3-UV
-200.0	25.4	101.7	5.0	5.8	-9.3	-203.2	SCC-25.4-101.7-UV
-250.0	25.4	127.1	5.0	5.6	-11.6	-253.2	SCC-25.4-127.1-UV
-300.0	25.4	152.6	5.0	5.5	-13.9	-303.2	SCC-25.4-152.6-UV
-500.0	25.4	254.3	5.0	5.3	-23.2	-503.2	SCC-25.4-254.3-UV
-500.0	50.8	254.3	6.0	7.3	-11.6	-503.8	SCC-50.8-254.3-UV
-750.0	25.4	381.4	5.0	5.2	-34.7	-753.2	SCC-25.4-381.4-UV
-750.0	50.8	381.4	6.0	6.8	-17.4	-753.8	SCC-50.8-381.4-UV
-1000.0	25.4	508.6	5.0	5.2	-46.3	-1003.2	SCC-25.4-508.6-UV
-1000.0	50.8	508.6	6.0	6.6	-23.2	-1003.8	SCC-50.8-508.6-UV
-2000.0	50.8	1000.0	6.0	6.3	-46.3	-2003.8	SCC-50.8-1000.0-UV
-10000.0	50.8	5000.0	6.0	6.1	-231.6	-10003.8	SCC-50.8-5000.0-UV

LASER GRADE FUSED SILICA ROUND CYLINDRICAL PLANO-CONCAVE LENSES: CLCC-UV



Specifications

Product Code: **CLCC-UV**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Design Wavelength: 248nm

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Radius of Curvature Tolerance: ±0.5%

Chamfer: 0.35mm leg width at 45° nominal

Wedge: ≤ 3 arc minutes

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Figure

Cylindrical side: < 1.0 λ (y-axis),

< 1.0 λ/cm (x-axis), p-v at 633nm

Plano side: < λ/4 p-v at 633nm

Clear Aperture (CA): ≥ 85% of central dimension

Anti-reflection Coating: Wavelength user specified

Narrowband: R ≤ 0.25% per surface

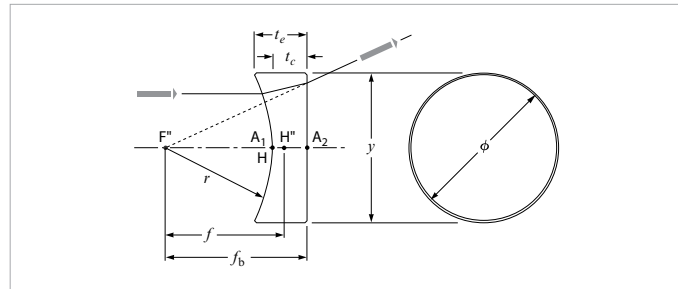
Broadband: R_{avg} ≤ 0.5% per surface

Dualband: R ≤ 0.3% at 1064, R ≤ 0.6% at 532 per surface

Damage Threshold: 10 J/cm², 20ns, 20Hz at 1064nm

Other focal lengths and dimensions available. Contact us for pricing and delivery details.

- ▶ Anamorphic beam shaping and laser projection
- ▶ Illumination of detector arrays
- ▶ Low loss, high energy AR coatings



Laser grade round cylindrical plano-concave lens

BUILD YOUR PART NUMBER

STEP-1	STEP-2
PRODUCT CODE	WAVELENGTH OF AR COATING (nm) for uncoated leave blank
CLCC-25.4-38.1-UV	193
EXAMPLE: CLCC-25.4-38.1-UV - 193	

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	355-532	633-1064	1050-1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

Please see page T-31 for Anti-Reflective Coating Traces.

LASER GRADE FUSED SILICA ROUND CYLINDRICAL PLANO-CONCAVE LENSES

f (mm)	Ø (mm)	r (mm)	t _c (mm)	t _e (mm)	f/#	f _b (mm)	PRODUCT CODE
-25.0	20.0	12.7	4.2	9.1	-1.5	-27.7	CLCC-20.0-12.7-UV
-40.0	25.4	20.3	4.6	9.1	-1.9	-43.1	CLCC-25.4-20.3-UV
-50.0	25.4	25.4	5.0	8.4	-2.3	-53.2	CLCC-25.4-25.4-UV
-75.0	25.4	38.1	5.0	7.2	-3.5	-78.2	CLCC-25.4-38.1-UV
-150.0	25.4	76.3	5.0	6.1	-6.9	-153.2	CLCC-25.4-76.3-UV

OEM Optical Mechanical Sub Assembly

CVI Laser Optics has supported the following markets with precision optical assemblies for over 40 years. We specialize in vertical integration of optical component manufacturing and mechanical system integration to provide a plug and play optical box for your OEM needs. Experience with optical systems ranging from deep UV to NIR.

Semiconductor • Industrial • Defense • Medical

- 10,000+ square feet of clean room environment for optical assembly
- Experience duplicating customers' acceptable test procedure to ensure functionality
- Over 40 years of optics experience
- Quick ramp up for OEM volumes
- Various laser wavelength testing capabilities
- Electrical and actuator integration with firmware testing capabilities
- In house environmental testing capabilities for optical components

Please give us a call and we will be honored to assist you with your custom OEM system integration needs.

CVI Laser Optics specializes in
prototype to volume production manufacturing!

SELECTION GUIDE

PRODUCT TYPE	SURFACE QUALITY	SURFACE ACCURACY	OPERATING CONDITION	PAGE
Achromats (Chromatism, Spherical Aberration and Coma Correction)				
CEMENTED DOUBLETS LASER-GRADE: LAL	20-10	$\lambda/2$ to $\lambda/4$ at 546.1nm	Visible Low Energy	77
CEMENTED DOUBLETS IMAGE-GRADE: LAO	60-40	$\lambda/2$ to $\lambda/4$ at 633nm	Visible Low Energy	78

PRODUCT TYPE	SURFACE QUALITY	TWD	F/#	OPERATING CONDITION	PAGE
Aplanats (Spherical Aberration and Coma Correction)					
HIGH ENERGY/UV LASER DOUBLETS Fused silica, air-spaced: LAPQ	10-5	$\lambda/4$ at 248nm	f/5	UV & High Energy VIS/NIR range User Specified AR High Energy	80
IMAGE GRADE DIODE LASER DOUBLETS: LAI	60-40	$\lambda/5$ at 830nm	f/3.8 to f/2.5	780 – 1550nm User Specified AR Low Energy	81

LASER-GRADE VISIBLE CEMENTED ACHROMATS: LAL



Specifications

Product Code: **LAL**

Optical Materials: N-BAK4 and N-SF10 (or equivalent)

Design Wavelengths: 486.1nm (blue), 589.0nm (yellow), and 656.3nm (red)

Clear Aperture (CA): $\geq 90\%$ of central diameter

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Surface Irregularity:

$f/\phi < 3.0$: $< \lambda/2$ p-v over CA at 546.1nm

$f/\phi \geq 3.0$: $< \lambda/4$ p-v over CA at 546.1nm

Paraxial Focal Length: $f \pm 1\%$ at 589.0nm

Diameter Tolerance: $+0/-0.15\text{mm}$

Center Thickness Tolerance: $\pm 0.25\text{mm}$

Chamfer: 0.25 – 0.50mm at max FW at $45^\circ \pm 15^\circ$

Centration: ≤ 3 arc minutes

Cement: Ultraviolet-cured synthetic polyester

Maximum Storage Temperature: 90°C (cement limitation)

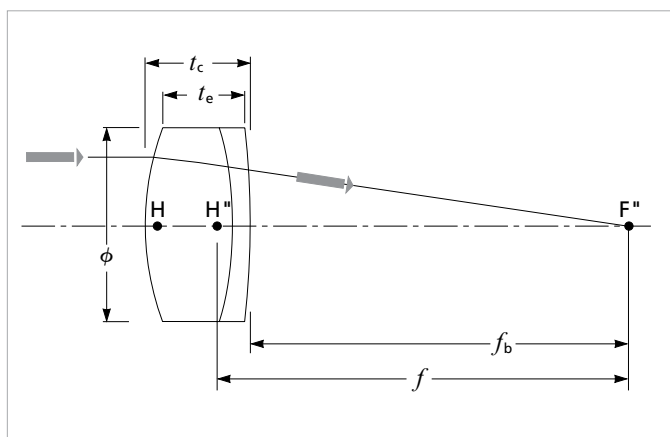
Correct Orientation: The most steeply curved (shortest radius) surface should face the infinite conjugate

Anti-reflection Coating:

$R_{\text{avg}} \leq 0.5\%$ per surface, 415 – 700nm

Laser-grade achromat lenses are manufactured to tighter focal length tolerances and have better surface quality than the LAO Series.

- ▶ Optimized for infinite conjugate ratio
- ▶ Designed for excellent paraxial performance
- ▶ Chromatism correction, with minimal spherical aberration and coma
- ▶ Recommended for use in manipulating and focusing of low-to moderate-power laser beams
- ▶ 20-10 scratch-dig surface quality to reduce scatter and stray light reflections
- ▶ Lead-free crown and flint glasses
- ▶ Broadband 415 – 700nm AR coating included



Laser-grade visible cemented achromats

LASER-GRADE VISIBLE CEMENTED ACHROMAT

f (mm)	ϕ (mm)	$f/\#$	t_c (mm)	t_e (mm)	f_b (mm)	PART NUMBER
15.0	7.5	2.2	4.8	3.7	12.7	LAL-15.0-7.5
20.0	10.0	2.2	5.9	4.5	17.2	LAL-20.0-10.0
40.0	15.0	3.0	7.0	5.4	36.8	LAL-40.0-15.0

IMAGE GRADE CEMENTED ACHROMATS 400 – 700nm: LAO



Specifications

Product Code: **LAO**

Optical Materials: N-BAK4, N-SF10, N-BK7, N-SF5, N-SF8, N-BAK1, or N-SK11 glass (or equivalent)

Design Wavelengths: 480.0nm (blue), 546.1nm (green), 643.8nm (red)

Clear Aperture (CA): $\geq 90\%$ of central diameter

Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

Surface Irregularity

$f/\phi < 3.0$: $< \lambda/2$ p-v at 633nm

$f/\phi \geq 3.0$: $< \lambda/4$ p-v at 633nm

Paraxial Focal Length: $\pm 2\%$ at 546.1nm

Diameter Tolerance: $+0/-0.15$ mm

Center Thickness Tolerance: ± 0.25 mm

Centration: ≤ 3 arc minutes

Chamfer: 0.25 – 0.50mm max FW at $45^\circ \pm 15^\circ$

Cement: Ultraviolet-cured synthetic polyester

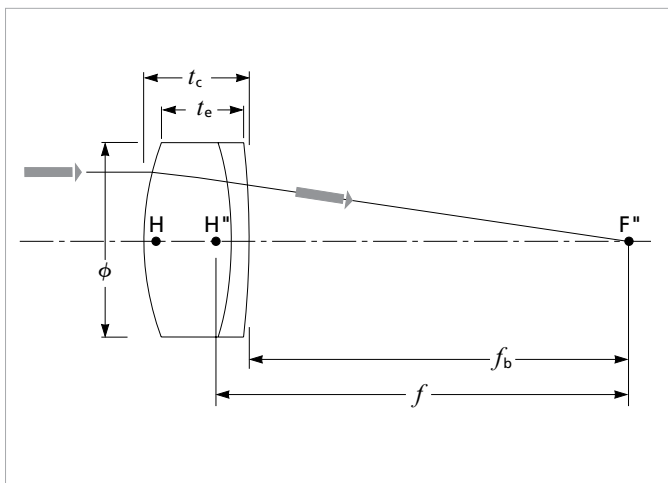
Maximum Storage Temperature: 90°C (cement limitation)

Correct Orientation: The most steeply curved (shortest radius) surface should face the infinite conjugate

Anti-reflection Coating: Single layer MgF_2 (400 – 700nm)

These achromats are available in a wide range of focal lengths ranging from 20 to 600mm. The design is balanced for correction of aberrations, particularly chromatic, spherical, and coma, to provide a superior yet affordable alternative to singlet lenses. These achromatic doublets are useful for broadband applications across the visible wavelength range. They are also ideal for use in monochromatic applications at f-numbers where singlets struggle due to spherical aberration, particularly for low power laser beam manipulation.

- ▶ Optimized for minimum chromatism, spherical aberration and coma
- ▶ Lead-free crown and flint glasses
- ▶ Broadband single layer MgF_2 coating included



Standard 400 – 700nm cemented achromats

400 – 700nm IMAGE GRADE CEMENTED ACHROMATS

f (mm)	$\varnothing$ (mm)	$f/\#$	t_c (mm)	t_e (mm)	f_b (mm)	PART NUMBER
20.0	12.5	1.8	7.0	4.7	16.2	LAO-20.0-12.5
25.0	8.0	3.5	5.1	4.4	22.6	LAO-25.0-8.0
30.0	12.5	2.7	5.3	3.9	27.3	LAO-30.0-12.5
31.1	17.5	2.0	8.9	6.1	26.7	LAO-31.1-17.5
37.5	25.0	1.7	15.0	10.1	29.4	LAO-37.5-25.0
44.0	14.0	3.5	5.2	4.0	41.4	LAO-44.0-14.0
50.0	12.5	4.4	5.0	4.1	47.6	LAO-50.0-12.5
50.0	18.0	3.1	6.0	4.2	46.9	LAO-50.0-18.0
60.0	18.0	3.7	5.2	3.7	57.6	LAO-60.0-18.0
60.0	30.0	2.2	12.5	8.4	53.5	LAO-60.0-30.0
65.0	25.0	2.9	8.0	5.3	60.6	LAO-65.0-25.0
73.0	17.0	4.8	5.2	4.1	70.5	LAO-73.0-17.0
75.0	25.0	3.3	7.0	4.7	71.5	LAO-75.0-25.0
80.0	18.0	4.9	5.2	4.1	77.5	LAO-80.0-18.0
80.0	31.5	2.8	9.5	6.1	75.2	LAO-80.0-31.5
90.0	19.0	5.3	5.5	4.4	87.3	LAO-90.0-19.0
90.0	25.0	4.0	6.5	4.4	86.9	LAO-90.0-25.0
100.0	26.5	4.2	6.8	4.9	96.5	LAO-100.0-26.5
100.0	30.0	3.7	8.7	6.3	95.5	LAO-100.0-30.0
100.0	31.5	3.5	8.7	6.3	95.5	LAO-100.0-31.5
120.0	24.0	5.6	5.5	4.2	117.4	LAO-120.0-24.0
120.0	30.0	4.4	10.7	8.4	115.3	LAO-120.0-30.0
120.0	40.0	3.3	11.2	7.6	114.3	LAO-120.0-40.0
140.0	30.0	5.2	9.0	7.1	136.0	LAO-140.0-30.0
148.0	19.0	8.7	4.6	4.0	145.7	LAO-148.0-19.0
150.0	25.0	6.7	6.2	5.1	146.7	LAO-150.0-25.0
150.0	50.0	3.3	12.5	7.9	143.0	LAO-150.0-50.0
160.0	30.0	5.9	6.5	5.0	156.9	LAO-160.0-30.0
175.0	25.0	7.8	5.5	4.4	172.4	LAO-175.0-25.0
180.0	30.0	6.7	8.1	6.6	176.6	LAO-180.0-30.0
200.0	25.0	8.9	6.5	5.6	197.1	LAO-200.0-25.0
250.0	25.0	11.1	6.3	5.6	247.3	LAO-250.0-25.0
250.0	30.0	9.3	7.2	6.3	246.5	LAO-250.0-30.0
300.0	25.0	13.3	5.5	4.9	297.7	LAO-300.0-25.0
300.0	50.0	6.7	14.7	12.5	293.2	LAO-300.0-50.0
350.0	25.0	15.6	5.5	5.0	347.8	LAO-350.0-25.0
400.0	50.0	8.9	11.0	9.1	396.0	LAO-400.0-50.0
500.0	50.0	11.1	10.0	8.5	494.8	LAO-500.0-50.0
600.0	50.0	13.3	10.0	8.8	595.7	LAO-600.0-50.0

HIGH-ENERGY/UV LASER APLANATS: LAPQ



Specifications

Product Code: **LAPQ**

Optical Material: Standard Grade Corning 7980 1-D (Fused Silica)

Design Wavelength: 248nm

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Housing Dimensional Tolerances: $\pm 0.13\text{mm}$

Transmitted Wavefront Distortion: $< \lambda/4$ p-v over 95% of clear aperture at 248nm

Anti-reflection Coating: Wavelength user specified

Narrowband: $R \leq 0.25\%$ per surface

Broadband: $R_{\text{avg}} \leq 0.5\%$ per surface

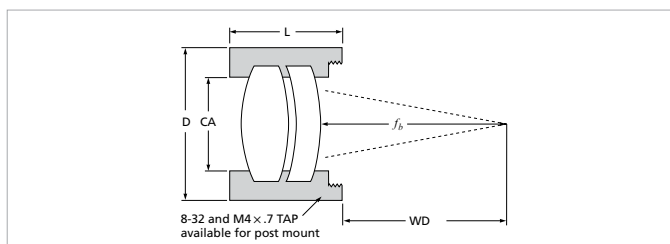
Damage Threshold

Narrowband: 15 J/cm², 20ns, 20Hz @ 1064nm

Broadband: 10 J/cm², 20ns, 20Hz @ 1064nm

Also used as excimer focusing lenses, aplanats are corrected for spherical aberration and coma. Its air-spaced fused silica design provides for significantly higher energy damage threshold performance. Parts are marked with an arrow on the barrel that points to the collimated light side.

- ▶ Beam handling, interferometers, material ablation & cutting systems
- ▶ Air-spaced fused silica design for high energy or UV applications
- ▶ Diffraction limited performance for a single wavelength
- ▶ Mounts easily onto post with 8-32 and M4 x 0.7 tap



LAPQ positive high energy/UV laser aplanat in post mount housing

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3
PRODUCT CODE	WAVELENGTH OF AR COATING (NM)	DEFAULTED POST MOUNT
LAPQ-50.0-10.0	248	PM
EXAMPLE: LAPQ-50.0-10.0 - 248 - PM		

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE - SEE TABLE BELOW

2. WAVELENGTH OF AR COATING (nm)

248	355	532	1064
-----	-----	-----	------

3. POST MOUNT

PM (DEFAULTED)

Please see page T-31 for Anti-Reflective Coating Traces.

HIGH-ENERGY/UV LASER APLANATS

f (mm)	WD (mm)	f_b (mm)	f (mm) at 1064nm	WD (mm) at 1064nm	f_b (mm) at 1064nm	D (mm)	L (mm)	CA (mm)	PRODUCT CODE
50.0	42.5	47.3	56.4	48.9	53.7	50.8	10.2	10.0	LAPQ-50.0-10.0
250.0	222.5	230.3	282.6	254.5	273.0	76.2	25.4	50.0	LAPQ-250.0-50.0

IMAGE GRADE DIODE LASER GLASS DOUBLET: LAI



Specifications

Product Code: **LAI**

Optical Materials: N-SK11 and N-SF5 (or equivalent)

Design Wavelength: 830nm

Wavelength Range: 780 – 1550nm

Diameter Tolerance: +0/-0.15mm

Center Thickness Tolerance: ± 0.25 mm

Paraxial Focal Length: $\pm 2\%$ at 632.8nm

Chamfer: 0.25 – 0.50mm max face width at $45^\circ \pm 15^\circ$

Centration: ≤ 4 arc minutes

Clear Aperture (CA): $\geq 90\%$ of central diameter

Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Distortion: $< \lambda/5$ p-v at 830nm over clear aperture

Cement: Ultraviolet-cured synthetic polyester

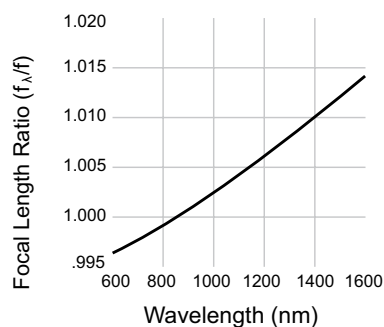
Maximum Storage Temperature: 90°C (cement limitation)

Anti-reflection Coating: Optional

APPLICATION NOTE

Focus vs Wavelength

These diode laser doublets are not achromats. Pure chromatic aberration (variation of the focal length with wavelength) has been left uncorrected to provide greater freedoms in other corrections. When used with monochromatic diode lasers this causes no aberration contribution, but means that systems will have to be refocused for use at different diode laser wavelengths.



Focal length of diode laser glass doublets as a function of wavelength

IMAGE GRADE DIODE LASER GLASS DOUBLET

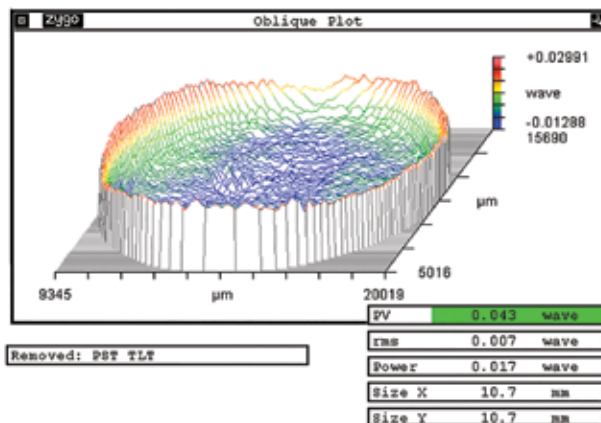
f (mm)	$\varnothing$ (mm)	f_{1550} (mm)	f_b (mm)	f_b 1550 (mm)	t_c (mm)	t_c (mm)	$f/\#$	AR Coating Wavelengths (nm)	PART NUMBER
25.0	10.0	25.3	22.4	22.8	5.0	3.9	2.5	Uncoated	LAI-25.0-10.0
25.0	10.0	25.3	22.4	22.8	5.0	3.9	2.5	780-850	LAI-25.0-10.0-HE-780-850
40.0	15.0	40.5	37.2	37.8	5.5	4.0	2.7	Uncoated	LAI-40.0-15.0
40.0	15.0	40.5	37.2	37.8	5.5	4.0	2.7	780-850	LAI-40.0-15.0-HE-780-850
40.0	15.0	40.5	37.2	37.8	5.5	4.0	2.7	1550	LAI-40.0-15.0-1550
60.0	20.0	60.8	56.7	57.4	6.5	4.7	3.0	Uncoated	LAI-60.0-20.0
80.0	25.0	81.0	75.6	76.6	8.5	6.4	3.2	Uncoated	LAI-80.0-25.0
80.0	25.0	81.0	75.6	76.6	8.5	6.4	3.2	780-850	LAI-80.0-25.0-HE-780-850
100.0	30.0	101.3	94.8	96.1	10.0	7.6	3.3	Uncoated	LAI-100.0-30.0
145.0	40.0	146.8	138.5	140.4	12.5	9.5	3.6	Uncoated	LAI-145.0-40.0
190.0	50.0	192.4	183.0	185.5	13.5	10.0	3.8	Uncoated	LAI-190.0-50.0
190.0	50.0	192.4	183.0	185.5	13.5	10.0	3.8	1550	LAI-190.0-50.0-1550

Leader in Custom, Complex, and Intricate Waveplate Manufacturing

CVI Laser Optics plays host to a vast selection of custom and catalog waveplates that are manufactured to maintain the most stringent of specifications.

Newly Released Catalog Waveplate Selection

- Includes Laser Grade Crystal Quartz Multiple Order (QWPM) and Compound Zero Order Waveplates (QWPO) (Optically Contacted and Air-Spaced)
- Utilizes Advanced Plasma Source (APS) coatings
- Increase transmission per surface
- Increased durability against environmental factors such as humidity and abrasion
- Guaranteed to function with a retardation tolerance attuned to wavelength optimization
- Inventory options spanning from UV (193nm) to NIR (1550nm)
- CVI Laser Grade Surface Quality (10-5 Scratch-Dig per MIL-PRF-13830b) at 100W per surface
- Transmitted Wavefront Distortion (TWD) < L/10 p-v at 633nm over specified CA



Looking for the atypical or bizarre? CVI Laser Optics carries years of experience in custom waveplate manufacturing to meet the most demanding of applications.

Custom Waveplate Capability

- Low Order and True Zero Order Waveplates (wavelength dependent)
- Custom Designed and Assembled Optical Mounting and/or Housing (Metal or Glass)
- Transmitted Wavefront Distortion (TWD) < L/20 p-v at 633nm over specified CA
- Custom Shaped Waveplates, Axial Alignments, and Retardations
- Expansive in House Metrology for any required documentation

**CVI Laser Optics specializes in
prototype to volume production manufacturing!**

Give us a call and we will be honored to assist you
with your custom needs.

NOTES:

SELECTION GUIDE

PRODUCT TYPE	EFFECT ON POLARIZATION	TYPICAL BANDWIDTH	RETARDATION TOLERANCE	PRODUCT FEATURES	PAGE
LASER GRADE MULTIPLE-ORDER WAVEPLATES, Crystal Quartz: QWPM	$\lambda/2$ or $\lambda/4$ retardation	< 1nm at 532nm (for $\lambda/100$)	see page 86	Best for specific wavelengths & stable temperature Available either unmounted or ring-mounted Retardation vs. AOI performance better than compound zero order waveplates	86
LASER GRADE ZERO-ORDER COMPOUND WAVEPLATES, CRYSTAL QUARTZ: QWPO	$\lambda/2$ or $\lambda/4$ retardation	30nm at 800nm (for $\lambda/100$)	see page 88	Increased spectral bandwidth performance Good thermal stability Optically contacted (unmounted or ring-mounted) and air-spaced versions available	88
LASER GRADE DUAL-WAVELENGTH WAVEPLATES, CRYSTAL QUARTZ: QWPD	Retards one wavelength $\lambda/2$, leaves other unchanged	< 1nm at 532/1064nm	$\lambda/100$ at both wavelengths	Best for specific wavelengths & temperatures Available either unmounted or ring-mounted	85
POLARIZATION ROTATOR, CRYSTAL QUARTZ: RT	Rotates linear polarization by 90°	Single λ , but rotation varies smoothly with wavelength	$\pm 0.5^\circ$ rotation tolerance	No alignment required; used at normal incidence Slight temperature dependency (Narrowband) performance	90

LASER GRADE DUAL-WAVELENGTH WAVEPLATES: QWPD



Specifications

Product Code: **QWPD**

Optical Material: Laser Grade Crystal Quartz

Diameter: 12.7 +0/-0.25mm (unmounted)

25.4 ±0.127mm (mounted)

Transmitted Wavefront: $\leq \lambda/10$ p-v at 633nm

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Retardation Tolerance:

$< \lambda/100$ at both wavelengths at 23° C

Clear Aperture: $\geq 85\%$ of diameter for the unmounted waveplates

Anti-reflection Coating: per surface, see table

Damage Threshold: 10 J/cm², 20ns, 20Hz; 1 MW/cm² cw at 1064nm

Dual-wavelength waveplates are used in a number of applications to enable selective processing of particular wavelengths. One common application is separation of different wavelengths with a polarizing beamsplitter by rotating the polarization of one wavelength by 90° ($\lambda/2$ retardation), while leaving the other unchanged. This frequently occurs in nonlinear doubling or tripling laser sources such as Nd:YAG (1064/532/355/266).

The QWPD waveplates use a multiple-order design in which the retardation specifications are met for both wavelengths. This results in a relatively high order waveplate, making them best suited for use only over narrow bandwidth and operating temperature range.

- ▶ Precise polarization control for dual wavelength sources
- ▶ Readily available for Nd:YAG and harmonics
- ▶ Best performance over a low temperature and narrow wavelength range
- ▶ Ask about OEM opportunities for other sizes and wavelength retardation combinations

LASER GRADE DUAL-WAVELENGTH WAVEPLATES

Wavelength 1 (nm)	Wavelength 1 AR Coating	Wavelength 2 (nm)	Wavelength 2 AR Coating	PART NUMBER
355	R < 0.5%	532	R < 0.5%	QWPD-355-2-532-1-05
355	R < 1.3%	1064	R < 0.5%	QWPD-355-2-1064-1-05
532	R < 0.6%	1064	R < 0.3%	QWPD-532-2-1064-1-05
1064	R < 0.3%	532	R < 0.6%	QWPD-1064-2-532-1-05

If you need the waveplate ring mounted, please add '-R10' at the end of the Part Number. The ring mount diameter is 25.4mm. Please refer to page 87 for the dimensions of the ring mount for 12.7mm diameter waveplates.

LASER GRADE MULTIPLE-ORDER QUARTZ WAVEPLATES: QWPM



CVI Laser Optics precision multiple-order QWPM waveplates are high performance and high energy retarders for single wavelength applications. If your application has a working temperature range of greater than $\pm 3^{\circ}\text{C}$, we suggest the QWPO zero-order waveplates.

Ask about OEM opportunities for other wavelengths, retardations, sizes, and/or mounting options. Low order and/or near true zero order options may also be available

Specifications

Product Code: **QWPM**

Optical Material: Laser Grade Crystal Quartz

Mount Material: Aluminum 6061-T6; Black Anodized

Diameter Tolerance: $+0/-0.25\text{mm}$ (unmounted)
 $\pm 0.127\text{mm}$ (ring mounted)

Optical Thickness: 0.4 - 1.0mm nominal

Retardation Tolerance: Refer to table below

Transmitted Wavefront Error (TWE): $< \lambda/10$ p-v at 633nm

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture: $\geq 85\%$ of diameter for unmounted waveplates (see Mount CA on next page)

***Anti-reflection Coating:** $R \leq 0.2\%$ per surface

Adhesion and Durability: Per MIL-C-48497a, MIL-C-675c

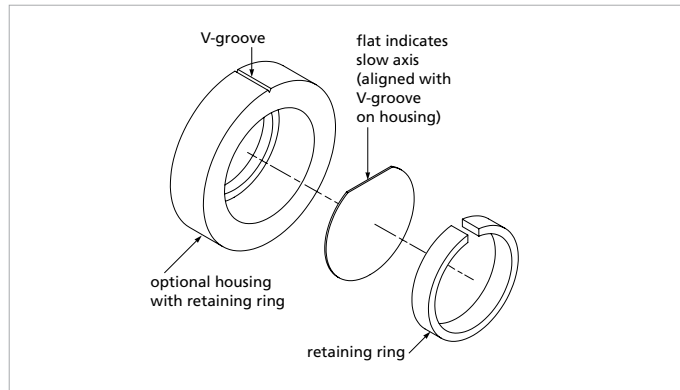
Damage Threshold:

17.5 J/cm², 20ns, 20Hz at 1064nm

10 J/cm², 20ns, 20Hz at 532nm

10 J/cm², 20ns, 20Hz at 355nm

2.5 J/cm², 10ns, 20Hz at 266nm



QWPM-series multiple-order waveplates with ring mount

RETARDATION TOLERANCE	
λ	Achievable Retardation Tolerance at 23°C
1064nm	$\leq 1/850$
800nm	$\leq 1/700$
532nm	$\leq 1/450$
400nm	$\leq 1/350$
355nm	$\leq 1/300$
266nm	$\leq 1/200$

*Applicable for wavelengths $\geq 266\text{nm}$

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4	STEP-5
PRODUCT CODE	WAVELENGTH	WAVEPLATE DIAMETER CODE	RETARDATION CODE	RING-MOUNT CODE
QWPM	1064	10	2	R15

EXAMPLE: QWPM-1064-10-2-R15

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

QWPM

2. WAVELENGTH (nm)

select from table
to the right

3. WAVEPLATE DIAMETER CODE

select from table
to the right

4. RETARDATION CODE

Retardation in Waves

2

0.500

4

0.250

5. RING-MOUNT CODE (optional)

* select from table below

QWPM WAVELENGTHS & SIZES OFFERINGS

Wavelength	Waveplate Diameter Code					
	05	08	10	12	15	20
193*	•		•			
244**	•					
248**			•			
266	•		•			
355	•	•	•	•		
400	•		•			
488			•			
515		•				
527	•					
532	•	•	•	•	•	
633	•		•			
670	•		•			
780	•		•			
800			•			
1030	•	•	•			•
1053	•		•		•	•
1064	•	•	•		•	•
1550	•		•			

* 193 nm waveplates with 0.5" diameter are available in $\lambda/2$ retardation only ** 244 nm and 248 nm waveplates are available in $\lambda/2$ retardation only

LASER GRADE WAVEPLATE DIAMETERS AND PROTECTIVE RING MOUNTS

Waveplate Diameter Code	Waveplate Diameter [mm (in.)]	Optional Ring Mount Code	Ring Mount CA (in. min)	Ring Mount OD (± 0.005 in.)	Ring Mount Thickness (± 0.005 in)
05	(0.500)	R10	0.425	1.000	0.250
08	20.0	R10	0.590	1.000	0.250
10	(1.000)	R15	0.850	1.500	0.250
12	30.0	R15	1.000	1.500	0.250
15	(1.500)	R20	1.275	2.000	0.250
20	(2.000)	R30	1.700	3.000	0.250

* Leave blank to designate waveplate without ring mount

LASER GRADE ZERO-ORDER QUARTZ WAVEPLATES: QWPO



Specifications

Product Code: QWPO

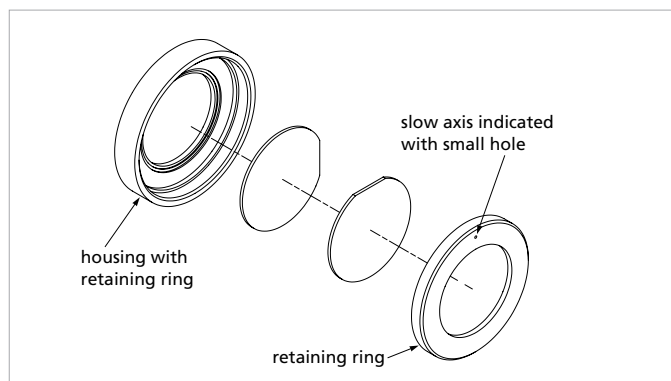
Optical Material: Laser Grade Crystal Quartz**Mount Material:** Aluminum 6061-T6; Black Anodized**Mounting/Contacting Options:** optically contacted without a mount, contacted and ring mounted, or air spaced and ring mounted**Diameter Tolerance:** +0/-0.25mm (unmounted), $\varnothing \pm 0.127$ mm (ring mounted)**Optical Thickness:** 1.0-3.0mm nominal**Retardation Tolerance:** Refer to table below.**Transmitted Wavefront:** $\leq \lambda/10$ p-v at 633nm**Surface Quality:** 10-5 scratch-dig per MIL-PRF-13830b**Clear Aperture:** $\geq 85\%$ of diameter for unmounted waveplates***Anti-reflection Coating:** $R \leq 0.2\%$ per surface**Adhesion and Durability:** per MIL-C-48497a, MIL-C-675c**Damage Threshold:**17.5 J/cm², 20ns, 20Hz at 1064nm10 J/cm², 20ns, 20Hz at 532nm10 J/cm², 20ns, 20Hz at 355nm2.5 J/cm², 10ns, 20Hz at 266nm

Zero-order waveplates are the preferred solution for applications with a temperature range of greater than $\pm 3^\circ\text{C}$ or a wavelength range greater than 2nm. Their increased bandwidth and excellent thermal stability are due to their compound construction, allowing the temperature effects of the single components to cancel each other out, while the difference in phase retardation between the single components results in true zero order retardation. They provide retardations that are a single submultiple of 2π in phase.

CVI Laser Optics offers QWPO zero-order waveplates in three different options: optically contacted sans mount, contacted and ring mounted, or air spaced and ring mounted.

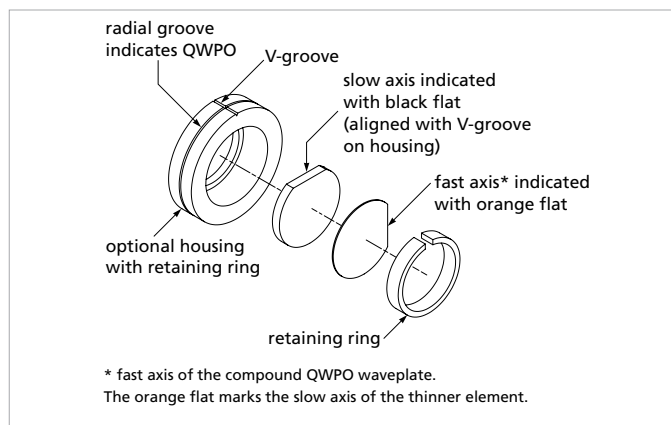
While unmounted, optically contacted waveplates can easily provide larger usable apertures; however, high UV energies can separate optically contacted waveplates. Therefore, CVI Laser Optics recommends air-spaced zero-order waveplates for wavelengths shorter than or equal to 248nm and repetition rates higher than 1 KHz.

Ask about OEM opportunities for other wavelengths, retardations, sizes, and/or mounting options.



QWPO-series zero-order quartz waveplate air-spaced assembly

RETARDATION TOLERANCE	
λ	Achievable Retardation Tolerance at 23°C
1064nm	$\leq 1/850$
800nm	$\leq 1/700$
532nm	$\leq 1/450$
400nm	$\leq 1/350$
355nm	$\leq 1/300$
266nm	$\leq 1/200$

*Applicable for wavelengths ≥ 266 nm

QWPO-series zero-order quartz waveplate with ring mount

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4	STEP-5
PRODUCT CODE	WAVELENGTH	WAVEPLATE DIAMETER CODE	RETARDATION CODE	RING-MOUNT CODE
QWPO	532	10	2	R15
EXAMPLE: QWP0-532-10-2-R15				

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

QWPO

2. WAVELENGTH (nm)

select from options table to the left

3. WAVEPLATE DIAMETER CODE

select from options table to the right

4. RETARDATION CODE

Retardation in Waves

2

0.500

4

0.250

5. RING-MOUNT CODE (optional)

select from table below

QWPO WAVELENGTHS & SIZES OFFERINGS

Wavelength	Waveplate Diameter Code					
	05	08	10	12	15	20
193*			•			
244**	•					
248**		•				
266	•		•			
355	•	•	•	•		
400	•		•			
488			•			
515		•				
532	•	•	•	•	•	
633	•		•			
670			•			
780	•		•		•	
800	•	•	•		•	•
850	•		•			
1030	•	•	•			•
1047**	•					
1053	•		•		•	•
1064	•	•	•		•	•
1550	•		•			

* 193nm and 244nm zero-order waveplates are provided in air-spaced configuration as standard, in order to maximize laser damage threshold performance. Call an applications engineer to special order contacted configurations for these wavelengths. **244nm, 248nm and 1047nm products are provided with $\lambda/2$ retardation only

LASER GRADE WAVEPLATE DIAMETERS AND PROTECTIVE RING MOUNTS

Waveplate Diameter Code	Waveplate Diameter [mm (in.)]	Contacted Waveplates Optional Ring Mount Code	Air-spaced Waveplates Ring-Mount Code	Ring Mount CA (in. min)	Ring Mount OD (± 0.005 in.)	Ring Mount Thickness (± 0.005 in.)
05	(0.500)	R10	AS10	0.425	1.000	0.250
08	20.0	R10	AS10	0.590	1.000	0.250
10	(1.000)	R15	AS15	0.850	1.500	0.250
12	30.0	R15	AS15	1.000	1.500	0.250
15	(1.500)	R20	AS20	1.275	2.000	0.250
20	(2.000)	R30	AS30	1.700	3.000	0.250

90° POLARIZATION ROTATORS: RT



Specifications

Product Code: **RT**

Optical Material: Laser Grade Crystal Quartz

Diameter Tolerance: +0/-0.25mm

Rotation Tolerance: $\pm 0.5^\circ$

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture: $\geq 85\%$ of diameter

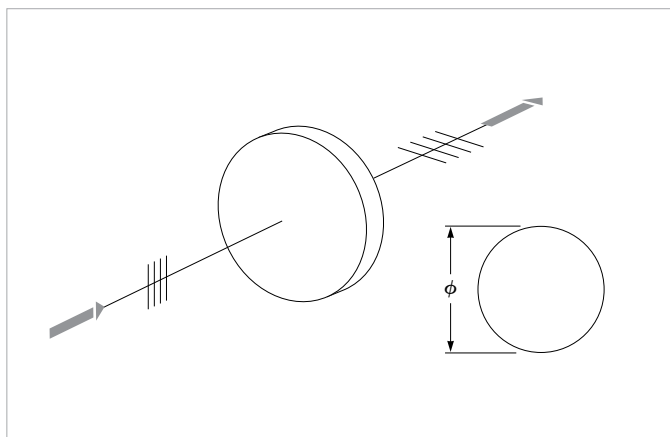
Damage Threshold: 10 J/cm², 20ns, 20Hz;
1 MW/cm² cw at 1064nm

Anti-reflection Coating: $R \leq 0.25\%$ per surface

These rotators carry the outstanding feature that their rotation is not dependent on their alignment. They are simply placed in the beam at normal incidence compared to their waveplate counterparts and do not require angular adjustment.

Crystalline quartz rotators, based on circular birefringence, are very convenient, high-damage-threshold devices. They are useful over a narrow bandwidth centered at the design wavelength with only slight temperature dependence. Custom options are available.

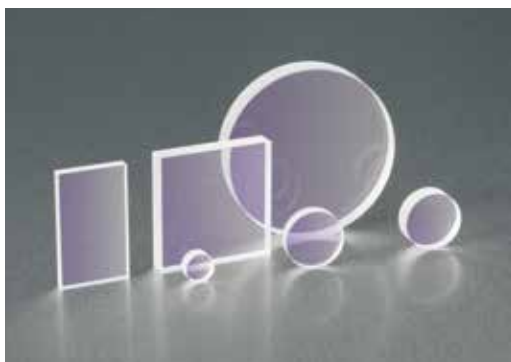
- ▶ Alignment-insensitive single wavelength rotator
- ▶ Based on optical activity of crystal quartz
- ▶ Light reflected back will revert to original configuration



RT polarization rotators

90° POLARIZATION ROTATORS

Wavelength (nm)	Ø (mm)	Nominal Thickness (mm)	Rotation	Transmitted Wavefront Error p-v @ 633nm	PART NUMBER
1064	25.4	14.3	90°	$< \lambda/6$	RT-10-1064-90



CVI Laser Optics manufactures a wide variety of optical windows. When you need to separate one optical environment from another, sample, split or steer a beam, we have a window that will meet your needs. By offering a wide selection of AR coatings with high laser damage thresholds to shapes and wedge options, our windows will reliably deliver the exact optical performance your application requires.

SELECTION GUIDE	92
ANTI-REFLECTION COATED WINDOWS	93
PLANE PARALLEL WINDOWS	94
RECTANGULAR WINDOWS	95
WEDGE WINDOWS	96

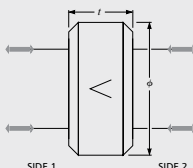
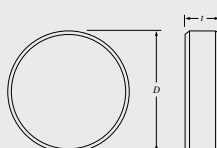
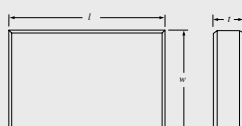
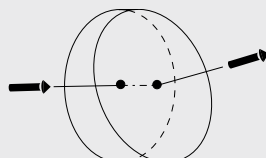
Don't see exactly what you are looking for?

CVI Laser Optics specializes in
prototype to volume production manufacturing!

Give us a call and we will be honored to assist you with your custom needs.

NOTES:

SELECTION GUIDE

PRODUCT TYPE	DESCRIPTION	PAGE
ANTI-REFLECTION COATED WINDOWS: W1 , W2 	Anti-reflection coated parallel windows feature low distortion, low scatter and excellent parallelism. A surface flatness of $\lambda/10$ and scratch-dig of 10-5 offer high beam control for demanding laser applications.	93
PLANE PARALLEL LASER GRADE WINDOWS: PW1 	PW1 windows are polished on two sides, with a wedge of ≤ 10 arc seconds, and are manufactured to handle high power applications. They form the foundation for several coated products, such as W1, W2, beamsplitters, output couplers, harmonic separators, dichroic mirrors, and partial reflectors.	94
RECTANGULAR WINDOWS: RW 	RW series rectangular windows are designed for a wide variety of laser window and beamsplitting applications. Typical transmitted wavefront error is less than $\lambda/10$ peak-to-valley at 633nm over 85% of the window's dimension.	95
WEDGE WINDOWS: IF , LW 	Wedge windows or prisms deviate an incident beam at a precise angle. Two wedge prisms of equal power can be combined to create a beam-steering apparatus that can place a beam anywhere within a cone defined by the deviation angle.	96

ANTI-REFLECTION COATED LASER WINDOWS: W1, W2



Specifications

Product Code: **W1, W2**

Material: Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge Tolerance: ≤ 10 arc sec or 30±5 arc min

Chamfer:

Ø ≤ 50.8mm: 0.35mm leg width at 45° nominal

Ø > 50.8mm: 0.85mm leg width at 45° nominal

Transmitted Wavefront Error (TWE): < λ/10 p-v at 633nm

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture: ≥85% of central diameter

Arrow on barrel points to side one.

Angle of Incidence: 0°

****Adhesion and Durability:** Per MIL-C-48497a

****Anti-reflection Coating: Single Wavelength:**

R ≤ 0.25% per surface at 0°

****Anti-reflection Coating: Broadband:**

R_{avg} ≤ 0.5% per surface at 0°

Anti-reflection Coating: Dual Wavelength:

R ≤ 0.3% at 1064nm at 0°

R ≤ 0.6% at 532nm at 0°

Damage Threshold Pulsed:

Single wavelength: 15 J/cm², 20ns, 20Hz at 1064nm

Broadband: 10 J/cm², 20ns, 20Hz at 1064nm

Dual wavelength: 5 J/cm², 20ns, 20Hz at 532nm,

10 J/cm², 20ns, 20Hz at 1064nm

Damage Threshold Continuous Wave:

1 MW/cm² at 1064nm

* Interferometer Windows (30 minute wedge) and Large Wedge Windows (≥1.0°) that have one surface anti-reflection coated will have the normal incidence surface coated as standard. If you require the wedge surface coated, please add the extension "-WEDGE". An example would be part description W1-IF-1025-UV-1064-45UNP-WEDGE.

**Applicable for wavelengths ≥ 266nm

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4	STEP-5	STEP-6
PRODUCT CODE	WEDGE	SIZE CODE	SUBSTRATE MATERIAL	AR COATING (nm)	AOI
W1	PW1	1025	UV	1064	0

EXAMPLE: W1 - PW1 - 1025 - UV - 1064 - 0

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

W1	Window, one surface AR coated *
W2	Window, two surfaces AR coated

2. WEDGE

PW1	<10 arc seconds
IF	30 arc minutes ± 5 arc minutes

3. SIZE CODE	DIAMETER (mm)	THICKNESS (mm)***	STANDARD OPTIONS
0512	12.7	3.175	Flat and Wedge
0525	12.7	6.35	Flat and Wedge
0725	19.05	6.35	Flat Only
2506M	25.0	6.0	Flat Only
1004	25.4	1.0	Flat Only
1012	25.4	3.175	Flat and Wedge
1025	25.4	6.35	Flat and Wedge
1525	38.1	6.35	Flat Only
5010M	50.0	10.0	Flat Only
2025	50.8	6.35	Flat and Wedge
2037	50.8	9.525	Flat and Wedge
3050	76.2	12.7	Flat Only
4050	101.6	12.7	Flat Only

***For wedges, thickness specifies the thick end.

4. SUBSTRATE MATERIAL

UV	Fused Silica
-----------	--------------

5. WAVELENGTH OF AR COATING (nm); for uncoated leave blank

193	355-532	633-1064	1050 - 1600
248	400	700-900	1064/532
248-355	415-700	800	1550
266	532	1030	
355	633	1064	

6. ANGLE OF INCIDENCE IN DEGREES

0	0 degrees (normal incidence)
----------	------------------------------

LASER GRADE PLANE PARALLEL WINDOWS, ≤ 10 ARC SECONDS: PW1

Specifications

Product Code: PW1

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)
or N-BK7Diameter Tolerance: $+0/-0.25\text{mm}$ Thickness Tolerance: $\pm 0.25\text{mm}$ Wedge Tolerance: ≤ 10 arc seconds

Chamfer:

 $\varnothing \leq 50.8\text{mm}$: 0.35mm leg width at 45° nominal $\varnothing > 50.8\text{mm}$: 0.85mm leg width at 45° nominal

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/10$ p-v at 633nmClear Aperture: $\geq 85\%$ of central diameter

PW1 windows are polished on two sides, with a wedge of ≤ 10 arc seconds and are manufactured to handle high power applications. They form the foundation for several coated products, such as, beamsplitters, output couplers, harmonic separators, dichroic mirrors, and partial reflectors.

- ▶ Extremely parallel wedge
- ▶ ≤ 10 seconds of arc
- ▶ Minimal angular deviation of transmitted beam
- ▶ Minimum misalignment errors when window is repeatedly inserted and removed

LASER GRADE PLANE PARALLEL WINDOW			
Standard Grade Corning 7980 1-D (Fused Silica)			
$\varnothing$ (mm)	t (mm)	Transmitted Wavefront Error p-v at 633nm	PART NUMBER
12.7	1.0	$< \lambda/4$	PW1-0504-UV
12.7	3.175	$< \lambda/10$	PW1-0512-UV
12.7	6.35	$< \lambda/10$	PW1-0525-UV
19.1	6.35	$< \lambda/10$	PW1-0725-UV
25.0	6.0	$< \lambda/10$	PW1-2506M-UV
25.4	2.0	$< \lambda/4$	PW1-1008-UV
25.4	3.175	$< \lambda/10$	PW1-1012-UV
25.4	6.35	$< \lambda/10$	PW1-1025-UV
25.4	9.525	$< \lambda/10$	PW1-1037-UV
38.1	6.35	$< \lambda/10$	PW1-1525-UV
50.0	10.0	$< \lambda/10$	PW1-5010M-UV
50.8	6.35	$< \lambda/10$	PW1-2025-UV
50.8	9.525	$< \lambda/10$	PW1-2037-UV
76.2	12.7	$< \lambda/10$	PW1-3050-UV
101.6	12.7	$< \lambda/10$	PW1-4050-UV
152.4	25.4	$< \lambda/10$	PW1-6010-UV
N-BK7			
$\varnothing$ (mm)	t (mm)	Transmitted Wavefront Error p-v at 633nm	PART NUMBER
12.7	6.35	$< \lambda/10$	PW1-0525-C
25.0	6.0	$< \lambda/10$	PW1-2506M-C
25.4	6.35	$< \lambda/10$	PW1-1025-C
50.0	10.0	$< \lambda/10$	PW1-5010M-C
50.8	9.525	$< \lambda/10$	PW1-2037-C

LASER GRADE RECTANGULAR WINDOWS: RW



Specifications

Product Code: **RW**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)
or N-BK7

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: ± 0.25 mm

Wedge Tolerance: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/10$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

RW series rectangular windows are designed for a wide variety of laser window and beamsplitting applications. All CVI Laser Optics dielectric and metal coatings can be deposited on RW series rectangular windows. Typical transmitted wavefront error is less than $\lambda/10$ peak-to-valley at 633nm over 85% of the window's dimension.

LASER GRADE RECTANGULAR WINDOWS			
Standard Grade Corning 7980 1-D (Fused Silica)			
l (mm)	w (mm)	t (mm)	PART NUMBER
28.6	14.3	3.2	RW-28.6-14.3-3.18-UV
40.0	30.0	5.0	RW-40.0-30.0-5.00-UV
N-BK7			
l (mm)	w (mm)	t (mm)	PART NUMBER
28.6	14.3	3.2	RW-28.6-14.3-3.18-C
40.0	30.0	5.0	RW-40.0-30.0-5.00-C

To apply an AR coating on any of the RW products refer to page 93 and replace Steps 2,3,4 with any of the product codes listed above.

INTERFEROMETRIC FLATS: IF



Specifications

Product Code: **IF**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)
or N-BK7

Diameter Tolerance: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge Tolerance: 30 ± 5 arc minutes

Chamfer: $\varnothing \leq 50.8\text{mm}$: leg width 0.35mm at 45° nominal
 $\varnothing > 50.8\text{mm}$: 0.85mm leg width at 45° nominal

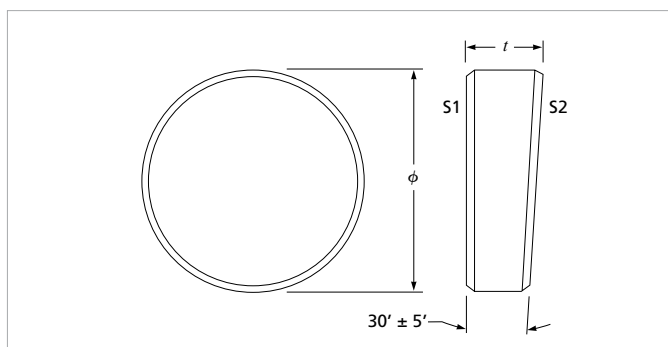
Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/10$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central diameter

IF is an uncoated window substrate, polished on two sides, with a wedge of 30 ± 5 arc minutes. Therefore, they form the foundation for several coated products, such as W1, W2, beamsplitters, output couplers, harmonic separators, dichroic mirrors, and partial reflectors.

- ▶ 30-minute wedge minimizes interference effects between surfaces
- ▶ Reflected beams from both surfaces separately usable
- ▶ Output coupler, beamsplitter, or beam sampling substrate
- ▶ $< \lambda/10$ transmitted wavefront, 10-5 surface quality



Interferometer flats have an arrow marked at the thickest edge and points towards side 1 (S1). Side 1 (S1) is at normal incidence and side 2 (S2) is the wedge surface.

INTERFEROMETER FLATS		
Standard Grade Corning 7980 1-D (Fused Silica)		
Ø (mm)	* t (mm)	PART NUMBER
12.7	3.18	IF-0512-UV
12.7	6.35	IF-0525-UV
19.1	6.35	IF-0725-UV
25.4	3.18	IF-1012-UV
25.4	6.35	IF-1025-UV
50.8	6.35	IF-2025-UV
50.8	9.53	IF-2037-UV
76.2	12.7	IF-3050-UV
101.6	12.7	IF-4050-UV
N-BK7		
Ø (mm)	* t (mm)	PART NUMBER
12.7	6.35	IF-0525-C
25.4	6.35	IF-1025-C

* Thick end of wedge

LARGE WEDGE WINDOWS: LW



Specifications

Product Code: **LW**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)
or N-BK7

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge Tolerance: ±6 arc minutes

Chamfer: Ø ≤ 50.8mm: leg width 0.35mm at 45° nominal
Ø > 50.8mm: 0.85mm leg width at 45° nominal

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): < λ/10 p-v at 633nm

Clear Aperture: ≥85% of central diameter

Large wedge windows are laser quality windows manufactured with wedges of 1° or 3°. These larger wedges prevent interference by stray back reflection and have several applications in beam steering.

- ▶ All CVI Laser Optics low loss, high energy AR coatings available
- ▶ Other dimension, wedge or material options available for OEM applications

LARGE WEDGE WINDOWS			
Standard Grade Corning 7980 1-D (Fused Silica)			
Ø	* t (mm)	Wedge α	PART NUMBER
25.4	9.53	1°	LW-1-1037-UV
50.8	9.53	1°	LW-1-2037-UV
25.4	9.53	3°	LW-3-1037-UV
50.8	9.53	3°	LW-3-2037-UV
76.2	12.7	3°	LW-3-3050-UV
N-BK7			
Ø	* t (mm)	Wedge α	PART NUMBER
25.4	9.53	1°	LW-1-1037-C
50.8	9.53	1°	LW-1-2037-C
25.4	9.53	3°	LW-3-1037-C
50.8	9.53	3°	LW-3-2037-C

*Thick end of wedge

To apply an AR coating on any of the RW products refer to page 93 and replace Steps 2,3,4 with any of the product codes listed above.

Using Large Wedge Windows

For small angles of incidence, the deviation of a ray incident on a wedged window with wedge angle α is

$$\theta_d = \frac{\eta_s}{\eta_a} \alpha$$

The first reflected ray is misaligned from the initial axis by an angle defined by

$$\theta_r = \frac{2\eta_s \alpha}{\eta_a}$$

If $\eta_a = 1$, then $\theta_r = 2\eta_s \alpha$.

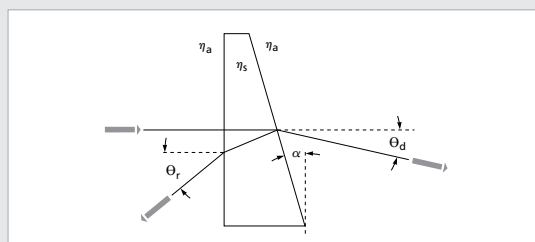


Figure 1. Deviation and reflection of beam by a wedged window of wedge α

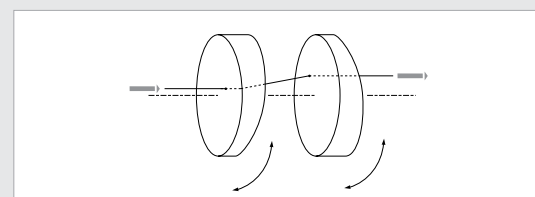


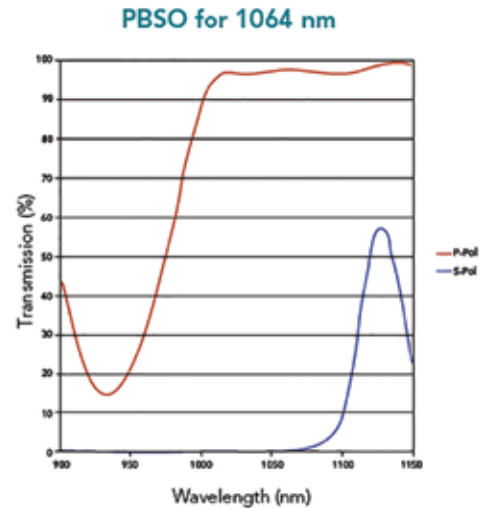
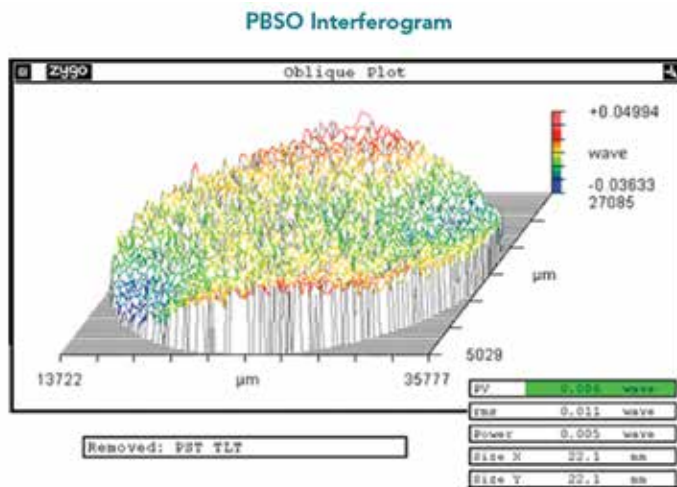
Figure 2. A beamsteering wedge formed from two wedged prisms

High Energy, High Extinction Plate and Cube Polarizers

CVI Laser Optics utilizes various coating technologies (Advanced Plasma Source, and Ion Beam Sputtering) and adhesive-free assembly techniques to enable the production of high performance polarizers. This results in laser damage and environmentally unsusceptible optics with high P-polarization versus S-polarization extinction ratio.

Newly Improved Optically Contacted Laser Line Polarizing Cube Beamsplitter

- Catalog Product Code: PBSO (see page 113)
- Increased laser damage threshold ($>30\text{J}/\text{cm}^2$, 20ns, 20Hz at 1064nm typical) and TP:TS extinction ($>750:1$ typical) of polarizing coating on hypotenuse face
- Increased durability against environmental factors such as humidity and abrasion
- Optically contacted
 - Adhesive free within clear aperture.
 - No index change, CTE mismatch, or environmental susceptibility concerns
- Optimized for Nd:YAG Wavelength and associated harmonics (1064nm, 532nm, 355nm, 266nm)
- CVI Laser Grade Surface Quality (10-5 Scratch-Dig per MIL-PRF-13830b) at 100W per surface
- Transmitted Wavefront Distortion (TWD) $< \text{L}/10$ p-v at 633nm over specified CA



Custom Polarizer Capability

- Brewster Plate Polarizers (56° AOI), Low Dispersion Plate Polarizers (72° AOI), Beam Path Accommodating Plate Polarizers (45° AOI), and Anything in Between from UV-NIR
- High Performing Laser Line and Broadband Polarizer Coatings
- Adhesive-Free Bonding Techniques for Polarizer Assemblies
- Custom Material, Substrates, Prisms, and Dimensional Features as Required
- Custom Designed and Assembled Optical Mounting and/or Housing (Metal or Glass)
- Transmitted Wavefront Distortion (TWD) $< \text{L}/20$ p-v at 633nm over Specified CA
- Expansive In-House Metrology for any Required Documentation

SELECTION GUIDE

PRODUCT TYPE	WAVELENGTHS	OPERATING CONDITIONS	PERFORMANCE	PAGE
Plate Beamsplitters				
HIGH ENERGY PLATE BEAMSPLITTERS: BS1	Center Wavelengths from 193 – 2100nm	10 J/cm ² , 20ns, 20Hz at 1064nm 1 MW/cm ² at 1064nm	R dependent on selected value	102
BROADBAND BEAMSPLITTERS: BBS	Wavelength Range 458 – 529nm, 488 – 694nm, 650 – 1100nm, or 1200 – 1500nm	10 mJ/cm ² , 20ns, 20Hz at 1064nm	$R_{\text{unp}} = 50\% \pm 15\%$	104
STANDARD VISIBLE PLATE BEAMSPLITTERS: BTF	Center Wavelengths from 425 – 750nm	1 J/cm ² , 20ns, 20Hz at 532nm	Nominal R/T ratio: 30/70, 50/50 or 70/30	105
HIGH ENERGY HARMONIC SEPARATORS: BSR	Harmonics for Nd:YAG, Argon and Ti:Sapphire lasers	10 J/cm ² , 20ns, 20Hz at 1064nm 1 MW/cm ² at 1064nm	Primary wavelength R Secondary wavelength T	106
LONG WAVE PASS DICHROIC BEAMSPLITTERS: LWP	Center wavelength options: 266nm, 248nm, 532nm, 633nm, 670nm, 780nm and 1064nm	10 J/cm ² , 20ns, 20Hz at 1064nm 1 MW/cm ² at 1064nm	Primary wavelength R Secondary wavelength T	108
SHORT WAVE PASS DICHROIC BEAMSPLITTERS: SWP	Center wavelength options: 633nm, 780nm, 800nm, 1064nm, and 1550nm	10 J/cm ² , 20ns, 20Hz at 1064nm 1 MW/cm ² at 1064nm	Primary wavelength R Secondary wavelength T	109
LASER LINE NON-POLARIZING PLATE BEAMSPLITTERS: BSNP	Center Wavelengths: 532nm, or 1064nm	3 J/cm ² , 10ns, 20Hz at 1064nm	$ R_s - R_p , T_s - T_p < 5\%$	110

SELECTION GUIDE

PRODUCT TYPE	WAVELENGTHS	OPERATING CONDI- TIONS	PERFORMANCE	PAGE
Cube Beamsplitters				
UV LASER LINE POLARIZING CUBE BEAMSPLITTERS: UPBS	Center wavelength options: 355nm, 405nm	10 mJ/cm ² , 20ns, 20Hz at 266nm 10 W/cm ² at 266nm	Extinction: $T_p/T_s > 100:1$	111
LASER LINE POLARIZING CUBE BEAMSPLITTERS: PBS	Center wavelength options: 532nm, 633nm, 670nm, 780nm, 532nm, 633nm, 670nm, 780nm, 1047nm, 1064nm and 1550nm	1 J/cm ² , 20ns, 20Hz at 1064nm 100 W/cm ² at 1064nm	Extinction: $T_p/T_s > 1000:1$	112
HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS: PBSO	Center wavelength options: 266nm, 355nm, 532nm and 1064nm	25 J/cm ² , 20ns, 20Hz at 1064nm 1 MW/cm ² at 1064nm	$\lambda = 532\text{nm}$ or 1064nm: $T_p/T_s = 500:1$ $\lambda < 500\text{nm}$: $T_p/T_s = 250:1$	113
ION-BEAM SPUTTERED HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS: PBSI	Center wavelength options: 355nm, 532nm and 1064nm	10 J/cm ² , 20ns, 20Hz at 1064nm 1 MW/cm ² at 1064nm	$\lambda < 1064\text{nm}$: $T_p/T_s = 1000:1$ $\lambda < 532\text{nm}$: $T_p/T_s = 750:1$ $\lambda < 355\text{nm}$: $T_p/T_s = 500:1$	114
BROADBAND POLARIZING CUBE BEAMSPLITTERS: PBSH	450 – 700nm, 450 – 1300nm, 450 – 2000 or 670 – 980nm	500 mJ/cm ² , 20ns, 20Hz at 515nm 100 W/cm ² at 515nm	Extinction: $T_p/T_s > 500:1$	115
BROADBAND HYBRID CUBE BEAMSPLITTERS, VISIBLE: BSC	450 – 700nm	500 mJ/cm ² , 20ns, 20Hz at 515nm 100 W/cm ² at 515nm	45% $\pm$ 6%	116
Beamsplitter Assembly				
HIGH ENERGY CONTINUOUSLY VARIABLE BEAMSPLITTER: ABSO	Standard wavelegnth options: 266nm, 355nm, 532nm and 1064nm	5 J/cm ² , 20ns, 20Hz at 1064nm	Variable Transmission Range 1% – 95% 1MW/cm ² at 1064nm	117

LASER GRADE HIGH ENERGY PLATE BEAMSPLITTERS: BS1



Specifications

Product Code: **BS1**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Wedge: ≤5 arc min

Chamfer: 0.35mm leg width at 45° nominal

Surface Figure: < $\lambda/10$ p-v at 633nm before coating;
after coating on select substrates

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture: ≥85% of central diameter

Angle of Incidence: 45°

Adhesion and Durability: Per MIL-C-48497a

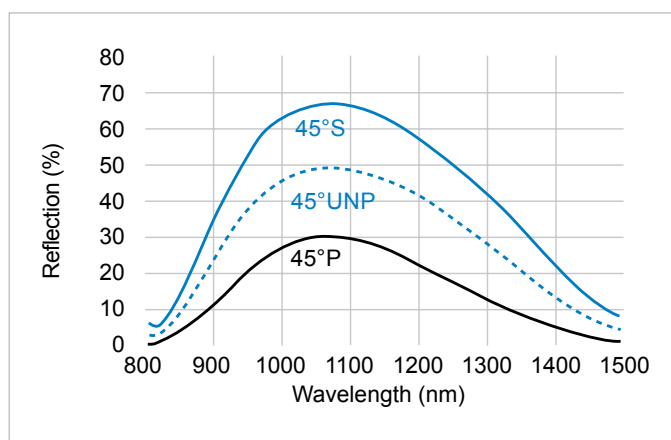
Damage Threshold:

Pulsed: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

CVI Laser Optics high energy plate beamsplitters are used to separate a laser beam into two separate beams or to combine beams at right angles to each other. The front surface of the beamsplitter reflects a portion of the incoming beam. The BS1 beamsplitters exhibit almost no absorption and are designed specifically for 45° at the wavelength and polarization being used. Standard substrates have an antireflection coating on the second surface and a wedge of less than five arc minutes. The beamsplitter coating can be done on any CVI Laser Optics wedged or plane parallel substrate to meet your OEM application requirements. For pick-off beam samplers, see product code W1. For normal incidence beamsplitters, see product code PR1.

- ▶ Ultrahard, high-damage-threshold coatings are available for wavelengths from 193nm to 2100nm
- ▶ Internally reflected ghost images are minimized by an antireflection coating on the rear surface



BS1-1064-50-45UNP high energy plate beamsplitter

Please see page T-38 for Surface 2 Anti-Reflective Coating Traces.

LASER GRADE HIGH ENERGY PLATE BEAMSPLITTERS

266nm						
Wavelength (nm)	Reflection (%)	Tolerances (%)	Polarization	Ø (mm)	t (mm)	PART NUMBER
266	50	±4.0	P	25.4	3.175	BS1-266-50-1012-45P
266	50	±4.0	UNP	25.4	3.175	BS1-266-50-1012-45UNP
266	50	±4.0	UNP	50.8	6.35	BS1-266-50-2025-45UNP
266	50	±4.0	S	25.4	3.175	BS1-266-50-1012-45S
355nm						
Wavelength (nm)	Reflection (%)	Tolerances (%)	Polarization	Ø (mm)	t (mm)	PART NUMBER
355	50	±4.0	P	25.4	3.175	BS1-355-50-1012-45P
355	50	±4.0	P	50.8	6.35	BS1-355-50-2025-45P
355	50	±4.0	UNP	25.4	3.175	BS1-355-50-1012-45UNP
355	50	±4.0	S	25.4	3.175	BS1-355-50-1012-45S
355	99	±0.5	P	25.4	3.175	BS1-355-99-1012-45P

LASER GRADE HIGH ENERGY PLATE BEAMSPLITTERS

532nm

Wavelength (nm)	Reflection (%)	Tolerances (%)	Polarization	Ø (mm)	t (mm)	PART NUMBER
532	50	±4.0	P	25.4	3.175	BS1-532-50-1012-45P
532	50	±4.0	P	50.8	6.35	BS1-532-50-2025-45P
532	50	±4.0	UNP	25.4	3.175	BS1-532-50-1012-45UNP
532	50	±4.0	UNP	50.8	6.35	BS1-532-50-2025-45UNP
532	50	±4.0	S	25.4	3.175	BS1-532-50-1012-45S
532	50	±4.0	S	50.8	6.35	BS1-532-50-2025-45S
532	99	±0.5	P	25.4	3.175	BS1-532-99-1012-45P

800nm

Wavelength (nm)	Reflection (%)	Tolerances (%)	Polarization	Ø (mm)	t (mm)	PART NUMBER
800	10	±4.0	P	25.4	3.175	BS1-800-10-1012-45P
800	10	±4.0	S	25.4	3.175	BS1-800-10-1012-45S
800	10	±4.0	P	50.8	6.35	BS1-800-10-2025-45P
800	30	±4.0	P	25.4	3.175	BS1-800-30-1012-45P
800	50	±4.0	P	25.4	3.175	BS1-800-50-1012-45P
800	50	±4.0	P	50.8	6.35	BS1-800-50-2025-45P
800	50	±4.0	S	25.4	3.175	BS1-800-50-1012-45S
800	50	±4.0	S	50.8	6.35	BS1-800-50-2025-45S
800	70	±4.0	P	25.4	3.175	BS1-800-70-1012-45P
800	70	±4.0	P	50.8	6.35	BS1-800-70-2025-45P
800	80	±4.0	P	25.4	3.175	BS1-800-80-1012-45P
800	90	±3.0	P	25.4	3.175	BS1-800-90-1012-45P
800	90	±3.0	P	50.8	6.35	BS1-800-90-2025-45P
800	95	±2.0	P	25.4	3.175	BS1-800-95-1012-45P
800	98	±1.0	P	25.4	3.175	BS1-800-98-1012-45P
800	99	±0.5	P	25.4	3.175	BS1-800-99-1012-45P

1064nm

Wavelength (nm)	Reflection (%)	Tolerances (%)	Polarization	Ø (mm)	t (mm)	PART NUMBER
1064	10	±4.0	UNP	25.4	3.175	BS1-1064-10-1012-45UNP
1064	10	±4.0	UNP	50.8	6.35	BS1-1064-10-2025-45UNP
1064	50	±4.0	P	25.4	3.175	BS1-1064-50-1012-45P
1064	50	±4.0	P	50.8	6.35	BS1-1064-50-2025-45P
1064	50	±4.0	UNP	25.4	3.175	BS1-1064-50-1012-45UNP
1064	50	±4.0	UNP	50.8	6.35	BS1-1064-50-2025-45UNP
1064	50	±4.0	S	25.4	3.175	BS1-1064-50-1012-45S
1064	50	±4.0	S	50.8	6.35	BS1-1064-50-2025-45S
1064	95	±2.0	UNP	50.8	6.35	BS1-1064-95-2025-45UNP
1064	98	±1.0	UNP	50.8	6.35	BS1-1064-98-2025-45UNP
1064	99	±0.5	UNP	50.8	6.35	BS1-1064-99-2025-45UNP

LASER GRADE BROADBAND BEAMSPLITTERS: BBS



Specifications

Product Code: **BBS**

Optical Material: N-BK7

Diameter Tolerance: +0/-0.25mm

Thickness: 6.35mm ±0.25mm

Wedge: ≤5 arc min

Chamfer: 0.35mm leg width at 45° nominal

Surface Figure: < λ/10 p-v at 633nm before coating;
after coating on select substrates

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Adhesion and Durability: Per MIL-C-48497a

Reflection: $R_{unp} = 50\% \pm 15\%$

Clear Aperture: ≥85% of central diameter

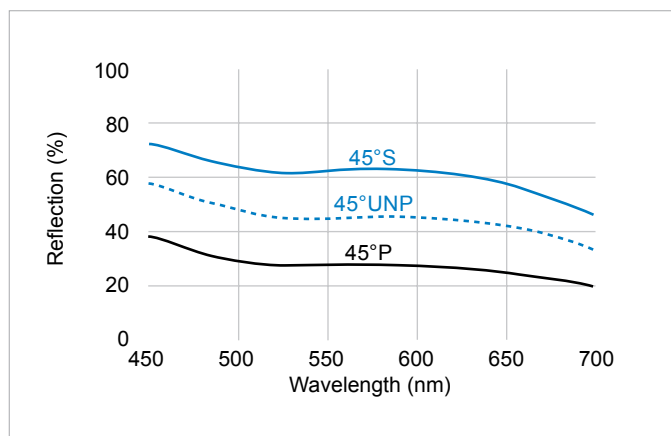
Coating on S2: Low-reflection BBAR coating
(see page T-31)

Damage Threshold:

100 mJ/cm², 20ns, 20Hz at 1064nm

BBS beamsplitter plates can be used to either split or combine a laser beam with a broad bandwidth or multiple beams in the same optical path within a specified wavelength range.

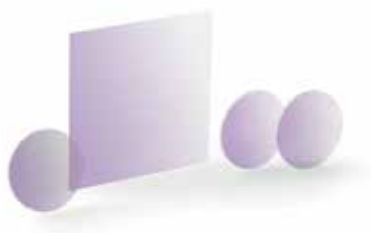
- ▶ Near 50/50 laser splitting for UNP light
- ▶ Low reflection BBAR coating on back surface (S2)
- ▶ For cw and low-energy pulsed laser applications



Broadband dielectric beamsplitter for 488 – 694nm

LASER GRADE BROADBAND BEAMSPLITTERS		
Wavelength Range (nm)	Ø (mm)	PART NUMBER
488 – 694	25.4	BBS-488-694-1025-45
488 – 694	50.8	BBS-488-694-2025-45
650 – 1100	25.4	BBS-650-1100-1025-45
650 – 1100	50.8	BBS-650-1100-2025-45

IMAGE GRADE VISIBLE PLATE BEAMSPLITTERS: BTF



Specifications

Product Code: **BTF**

Material: Optical grade crown glass

Dimensional Tolerances:

Square: $A \pm 0.2\text{mm}$,

Round: $A +0/-0.15\text{mm}$

Thickness: $1.0 \pm 0.2\text{mm}$

Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b; edges beveled

Parallelism: < 5 arc minutes

Clear Aperture: 90% of dimension A

Transmitted Wavefront Error (TWE): $\leq 2 \lambda$ p-v at 633nm

R/T Tolerance at 45°:

$\pm 5\%$ (50nm from center wavelength range)

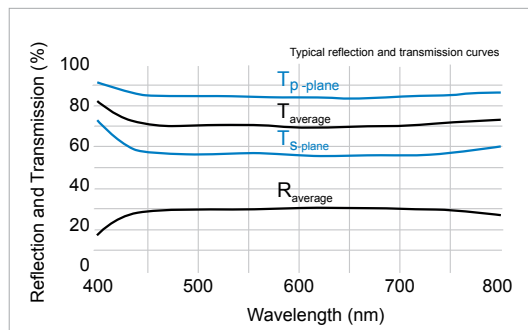
$\pm 10\%$ (outside of $\pm 50\text{nm}$ from center wavelength range)

Coating:

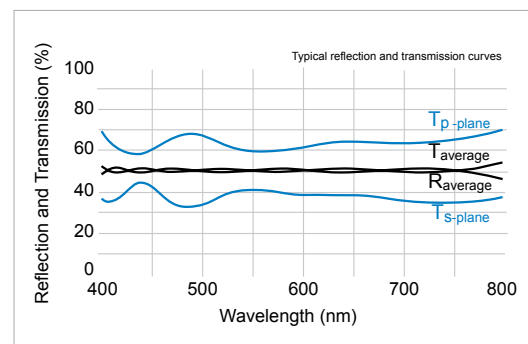
1st Surface: All-dielectric partial reflection coating for 45°, surface marked with a dot

2nd Surface: $R_{\text{avg}} \leq 1.5\%$ at 45°, UNP

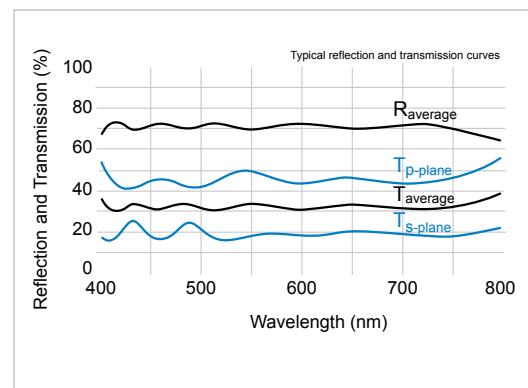
Angle of Incidence: 45°



30/70 plate beamsplitter for visible wavelengths



50/50 plate beamsplitter for visible wavelengths



70/30 plate beamsplitter for visible wavelengths

IMAGE GRADE PLATE BEAMSPLITTERS				
Visible				
A (mm)	Shape	Nominal R/T Ratio	Clear Aperture at 45°(mm)	PART NUMBER
25	Round	30/70	15.9x22.5	BTF-VIS-30-2501M-C
25	Round	50/50	15.9x22.5	BTF-VIS-50-2501M-C
25	Round	70/30	15.9x22.5	BTF-VIS-70-2501M-C
50	Square	30/70	31.8x45.0	BTF-VIS-30-SQW-5001M-C
50	Square	50/50	31.8x45.0	BTF-VIS-50-SQW-5001M-C
50	Square	70/30	31.8x45.0	BTF-VIS-70-SQW-5001M-C

LASER GRADE HIGH ENERGY HARMONIC SEPARATORS: BSR



Specifications

Product Code: **BSR**

Optical Material: If λ_1 or $\lambda_2 < 450\text{nm}$: Standard Grade Corning 7980 1-D (Fused Silica), If λ_1 or $\lambda_2 \geq 450\text{nm}$: N-BK7

Diameter Tolerance: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge: ≤ 5 arc min

Chamfer: 0.35mm leg width at 45° nominal

Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Anti-reflection Coating: $R \leq 0.75\%$ (45° UNP) (see page T-31)

Adhesion and Durability: Per MIL-C-48497a

Angle of Incidence: 45°

Damage Threshold:

Pulsed:

10 J/cm², 20ns, 20Hz for reflection at 1064nm,

4 J/cm², 20ns, 20Hz; for reflection at 532nm,

4 J/cm², 20ns, 20Hz for transmission at 1064nm

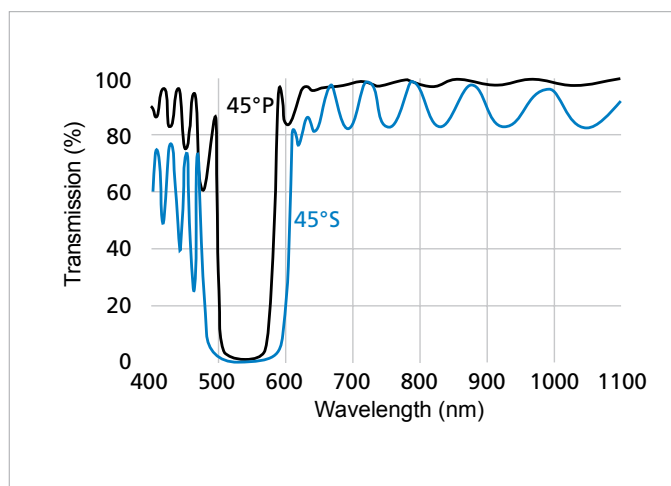
cw: 1 MW/cm² at 1064nm and 532nm

High energy harmonic separators are used to reflect a laser's primary or harmonic wavelength while transmitting another. Our standard High Energy Harmonic Separators are designed for the Nd:YAG and Ti:Sapphire laser systems. These beamsplitters are coated on the front surface with a high energy dichroic coating designed to reflect the wavelength of interest $\geq 99.5\%$ and transmit another wavelength $\geq 90\%$. A high energy antireflection coating is applied to the rear surface of the harmonic separator at the transmitted wavelength.

A typical example would be our BSR-51-1025 high energy harmonic separator, which reflects the second Nd:YAG harmonic of 532nm, and transmits the primary 1064nm wavelength.

For other OEM beamsplitter options or applications please contact CVI Laser Optics for assistance.

- ▶ Isolates Nd:YAG and Nd:YLF harmonics
- ▶ 2nd, 3rd, and 4th harmonic separation; 5th harmonic separation available as custom
- ▶ Characterization of collagen orientation in human dermis by two-dimensional second-harmonic-generation polarimetry
- ▶ 45° dichroic beamsplitters
- ▶ High energy all dielectric coating design, AR coated on side 2



BSR-51-1025 high energy harmonic separator

Visit cvilaseroptics.com for additional traces.

LASER GRADE HIGH ENERGY HARMONIC SEPARATORS

Reflect 266nm, Transmit 532nm and 1064nm — AR Coating Optimized for 532nm

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	$\varnothing$ (mm)	t (mm)	PART NUMBER
266	532/1064	99.5	90	532	25.4	6.35	BSR-25-1025

Reflect 266nm, Transmit 532nm and 1064nm — AR Coating Optimized for 1064nm

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	$\varnothing$ (mm)	t (mm)	PART NUMBER
266	532/1064	99.5	90	1064	25.4	6.35	BSR-21-1025

Reflect 355nm, Transmit 532nm and 1064nm — AR Coating Optimized for 532nm

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	$\varnothing$ (mm)	t (mm)	PART NUMBER
355	532/1064	99.5	90	532	12.7	6.35	BSR-35-0525
355	532/1064	99.5	90	532	25.4	6.35	BSR-35-1025

Reflect 355nm, Transmit 532nm and 1064nm — AR Coating Optimized for 1064nm

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	$\varnothing$ (mm)	t (mm)	PART NUMBER
355	532/1064	99.5	90	1064	25.4	6.35	BSR-31-1025
355	532/1064	99.5	90	1064	50.8	6.35	BSR-31-2025

Reflect 400nm, Transmit 800nm — AR Coating Optimized for 800nm

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	$\varnothing$ (mm)	t (mm)	PART NUMBER
400	800	99.5	90	800	25.4	6.35	BSR-48-1025
400	800	99.5	90	800	50.8	6.35	BSR-48-2025

Reflect 532nm, Transmit 1064nm — AR Coating Optimized for 1064nm

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	$\varnothing$ (mm)	t (mm)	PART NUMBER
532	1064	99.5	90	1064	12.7	6.35	BSR-51-0525
532	1064	99.5	90	1064	25.4	6.35	BSR-51-1025
532	1064	99.5	90	1064	50.8	6.35	BSR-51-2025

Reflect 800nm, Transmit 400nm — AR Coating Optimized for 400nm

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	$\varnothing$ (mm)	t (mm)	PART NUMBER
800	400	99.5	90	400	25.4	6.35	BSR-84-1025
800	400	99.5	90	400	50.8	6.35	BSR-84-2025

Reflect 1064nm, Transmit 532nm — AR Coating Optimized for 532nm

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	$\varnothing$ (mm)	t (mm)	PART NUMBER
1064	532	99.5	90	532	12.7	6.35	BSR-15-0525
1064	532	99.5	90	532	25.4	6.35	BSR-15-1025
1064	532	99.5	90	532	50.8	6.35	BSR-15-2025

LASER GRADE LONG WAVE PASS DICHROIC BEAMSPLITTERS: LWP



Specifications

Product Code: **LWP**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge: ≤5 arc min

Chamfer: 0.35mm leg width at 45° nominal

Surface Figure: < λ/10 p-v at 633nm before coating;
after coating on select substrates

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture: ≥85% of central dimension

Anti-reflection Coating:

$R_p \leq 0.75\%$ at 45°

$R_{unp} \leq 1.0\%$ at 45°

$R_s \leq 1.3\%$ at 45°

Adhesion and Durability: Per MIL-C-48497a

Reflection: $R \geq 99.0\%$ for unpolarized light

Average Transmission: >85% in long wave pass to
approximately 2200nm

Damage Threshold:

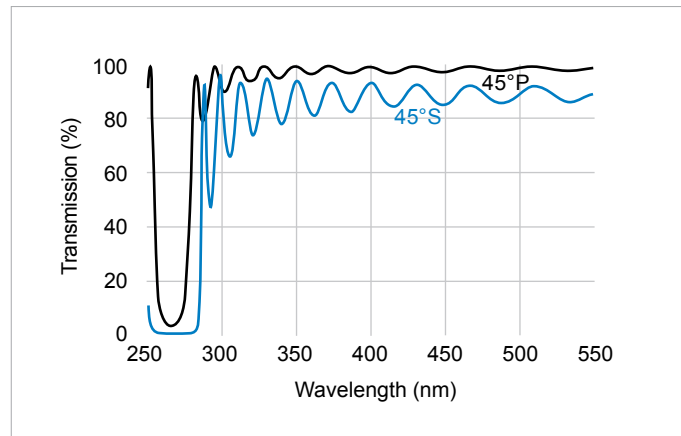
Pulsed: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

Long wave pass dichroic beamsplitters exhibit high transmission for a long wavelength band, high damage thresholds, and high reflectivity for a shorter band of wavelengths.

Reflectivity bandwidth is limited by coating design, incidence angle, and polarization.

- ▶ Reflectance is centered for 45° *p*-polarization to assure optimal reflectance center wavelength
- ▶ Any polarization can be used; however, to maximize efficiency, reflect 45° *s*-polarized and transmit 45° *p*-polarized
- ▶ Fluorescence microscopy
- ▶ Optical parametric generation
- ▶ Contact CVI Laser Optics for OEM capabilities



Long wave pass dichroic beamsplitter at 45° incidence angle

Visit cvilaseroptics.com for additional traces.

LASER GRADE LONG WAVE PASS DICHROIC BEAMSPLITTERS

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	Ø (mm)	t (mm)	PART NUMBER
266	400	≥99.0	≥85.0	400	25.4	3.175	LWP-45-RP266-TU400-PW1-1012-UV
266	400	≥99.0	≥85.0	400	50.8	6.35	LWP-45-RP266-TU400-PW1-2025-UV
266	800	≥99.0	≥85.0	800	25.4	3.175	LWP-45-RP266-TU800-PW1-1012-UV
266	800	≥99.0	≥85.0	800	50.8	6.35	LWP-45-RP266-TU800-PW1-2025-UV
266	1064/532	≥99.0	≥85.0	1064/532	25.4	3.175	LWP-45-RP266-TU1064/532-PW1-1012-UV
266	355 – 532	≥99.0	≥85.0	355 – 532	25.4	3.175	LWP-45-RP266-TU355-532-PW1-1012-UV
532	633 – 1064	≥99.0	≥85.0	633 – 1064	25.4	3.175	LWP-45-RP532-TU633-1064-PW1-1012-UV
532	633 – 1064	≥99.0	≥85.0	633 – 1064	50.8	6.35	LWP-45-RP532-TU633-1064-PW1-2025-UV
633	800	≥85.0	≥90	800	25.4	3.175	LWP-45-RP633-TU800-PW1-1012-UV
670	800	≥99.0	≥85.0	800	25.4	3.175	LWP-45-RP670-TU800-PW1-1012-UV
780	1550	≥99.0	≥85.0	1550	25.4	3.175	LWP-45-RP780-TU1550-PW1-1012-UV
1064	1550	≥99.0	≥85.0	1550	25.4	3.175	LWP-45-RP1064-TU1550-PW1-1012-UV

LASER GRADE SHORT WAVE PASS DICHOIC BEAMSPLITTERS: SWP



Specifications

Product Code: **SWP**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge: ≤5 arc min

Chamfer: 0.35mm leg width at 45° nominal

Surface Figure: < λ/10 p-v at 633nm before coating;
after coating on select substrates

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture: ≥85% of central dimension

Anti-reflection Coating:

$R \leq 0.75\%$ at 0°

$R_p \leq 1.0\%$ at 45°

$R_{unp} \leq 0.75\%$ at 45°

$R_s \leq 1.3\%$ at 45°

Adhesion and Durability: Per MIL-C-48497a

Reflection: $R \geq 99.0\%$ for Unpolarized light

Average Transmission: >80% in short wave pass

Damage Threshold:

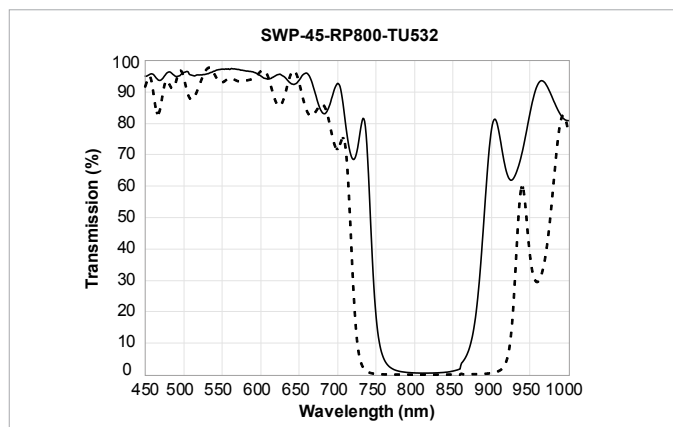
Pulsed: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

Short wave pass dichroic beamsplitters exhibit high transmission for a short wavelength band, high damage thresholds, and high reflectivity for a longer band of wavelengths.

Reflectivity bandwidth is limited by coating design, incidence angle, and polarization. For high energy laser applications, specify pulse energy, pulse duration, repetition rate, and beam diameter.

- ▶ Reflectance is centered for 45° *p*-polarization to assure optimal reflectance center wavelength
- ▶ Any polarization can be used; however, to maximize efficiency, reflect 45° *s*-polarized and transmit 45° *p*-polarized
- ▶ 0° options also available
- ▶ Optical parametric generation; fluorescence microscopy
- ▶ Contact CVI Laser Optics for OEM capabilities



Short wave pass dichroic beamsplitter at 45° incidence angle

P-POL: — UNP: - - - S-POL: — 0°: ····

Visit cvilaseroptics.com for additional traces.

LASER GRADE SHORT WAVE PASS DICHOIC BEAMSPLITTERS

Reflected Wavelength (nm)	Transmitted Wavelength Range (nm)	Unpolarized Reflection (%)	Unpolarized Transmission (%)	Antireflection Coating λ	Ø (mm)	t (mm)	PART NUMBER
633	355 – 532	≥ 99.0	≥ 80	355 – 532	25.4	3.175	SWP-45-RP633-TU355-532-PW1-1012-UV
780	415 – 700	≥ 99.0	≥ 80	415 – 700	25.4	3.175	SWP-45-RP780-TU415-700-PW1-1012-UV
* 800	532	≥ 99.0	≥ 80	532.0	25.4	3.175	SWP-0-R800-T532-PW1-1012-UV
800	532	≥ 99.0	≥ 80	532.0	25.4	3.175	SWP-45-RP800-TU532-PW1-1012-UV
800	532	≥ 99.0	≥ 80	532.0	50.8	6.35	SWP-45-RP800-TU532-PW1-2025-UV
* 1064	415 – 700	≥ 99.0	≥ 80	415 – 700	25.4	3.175	SWP-0-R1064-T415-700-PW1-1012-UV
1064	415 – 700	≥ 99.0	≥ 80	415 – 700	12.7	3.175	SWP-45-RP1064-TU415-700-PW1-0512-UV
1064	415 – 700	≥ 99.0	≥ 80	415 – 700	25.4	3.175	SWP-45-RP1064-TU415-700-PW1-1012-UV
1064	415 – 700	≥ 99.0	≥ 80	415 – 700	50.8	6.35	SWP-45-RP1064-TU415-700-PW1-2025-UV
* 1064	700 – 900	≥ 99.0	≥ 80	700 – 900	25.4	3.175	SWP-0-R1064-T700-900-PW1-1012-UV
1064	700 – 900	≥ 99.0	≥ 80	700 – 900	25.4	3.175	SWP-45-RP1064-TU700-900-PW1-1012-UV
1550	780	≥ 99.0	≥ 80	780.0	25.4	3.175	SWP-45-RP1550-TU780-PW1-1012-UV

* Angle of incidence is 0° for these options.

LASER LINE NON-POLARIZING PLATE BEAMSPLITTERS: BSNP



Specifications

Product Code: **BSNP**

Optical Material: N-BK7

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: $\pm 0.25\text{mm}$

Clear Aperture: $\geq 85\%$ of central dimension

Transmitted Wavefront Error (TWE): $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Angle of Incidence: 45°

Adhesion and Durability: Per MIL-C-48497a

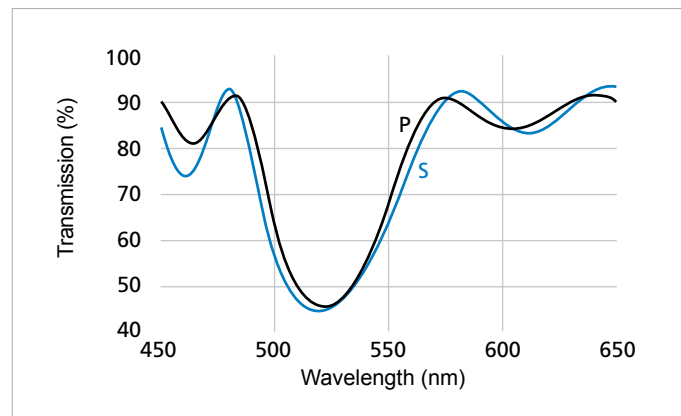
$|R_s - R_p|, |T_s - T_p|: < 5\%$

Damage Threshold: 3 J/cm^2 , 10ns pulse at 1064nm

CVI Laser Optics all dielectric 45° non-polarizing plate beamsplitters divide laser energy while preserving input polarization in reflected and transmitted beams. With 3 J/cm^2 damage threshold, these non-polarizing beamsplitter plates are especially useful for high energy applications where cemented beamsplitter cubes may fail.

Plate beamsplitters are thinner and lighter than cube beamsplitters. This may be required in some applications where there is not enough room for a cube.

- ▶ Near 50% reflection
- ▶ $|R_s - R_p| < 5\%$
- ▶ Damage threshold $> 3 \text{ J/cm}^2$
- ▶ Cement free
- ▶ Contact CVI Laser Optics for your OEM requirements



BSNP-532-50-1025 non-polarizing plate beamsplitter

LASER LINE NON-POLARIZING PLATE BEAMSPLITTERS			
Wavelength (nm)	Ø (mm)	Reflection (%)	PART NUMBER
532	25.4	50±5%	BSNP-532-50-1025
532	50.8	50±5%	BSNP-532-50-2025
1064	25.4	50±5%	BSNP-1064-50-1025
1064	50.8	50±5%	BSNP-1064-50-2025

UV LASER LINE POLARIZING CUBE BEAMSPLITTERS: UPBS



Specifications

Product Code: **UPBS**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Edge Dimension Tolerance (A): $\pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Field of View: $\pm 2^\circ$ typical

Anti-reflection Coating: $R \leq 0.25\%$, all entrance and exit surfaces

Extinction Ratio: $T_p/T_s > 100:1$

Transmission Efficiency: $T_p > 90.0\%$

Reflection Efficiency: $R_s > 99.0\%$

Damage Threshold:

Pulsed: 10 mJ/cm^2 , 20ns, 20Hz at 266nm

cw: 10 W/cm^2 at 266nm

These polarizing cube beamsplitters are made from fused silica to optimize UV performance.

To avoid damage when using a laser, be sure to orient the cube so that the beam enters through the prism marked with the dot.

- ▶ Fused-silica cube polarizers for doubled argon, tripled Nd:YAG, quadrupled Nd:YAG, and UV excimer lasers
- ▶ For use with fluences less than 10 mJ/cm^2
- ▶ Index matching optical adhesive assembly (low absorbing, high UV transmission)
- ▶ Contact CVI Laser Optics for alternate wavelengths, dimensions, or other specification changes for OEM applications

UV LASER LINE POLARIZING CUBE BEAMSPLITTERS

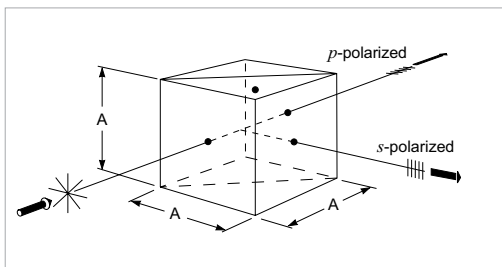
12.7mm Cube

Wavelength (nm)	PART NUMBER
355	UPBS-355-050
405	UPBS-405-050

25.4mm Cube

Wavelength (nm)	PART NUMBER
355	UPBS-355-100
405	UPBS-405-100

Visit cvilaseroptics.com for additional traces.



UPBS UV laser line polarizing beamsplitter cubes

LASER LINE POLARIZING CUBE BEAMSPLITTERS: PBS



Specifications

Product Code: **PBS**

Optical Material: N-BK7

Edge Dimension Tolerance (A): $\pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE):

$< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Field of View: $\pm 3^\circ$

Anti-reflection Coating: $R \leq 0.25\%$ per surface

Extinction Ratio: $T_p/T_s > 1000:1$

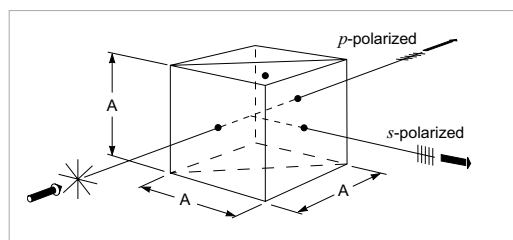
Transmission Efficiency: $T_p > 95\%$

Reflection Efficiency: $R_s > 99.9\%$

Damage Threshold:

Pulsed: 1 J/cm^2 , 20ns, 20Hz at 1064nm

cw: 100 W/cm^2 at 515nm



PBS laser line polarizing beamsplitter cubes

Polarizing beamsplitter cubes are used to split a laser beam into two orthogonally polarized components; p-polarization is transmitted straight through while s-polarization is reflected at 90° .

To avoid damage when using a high power laser, be sure to orient the cube so that the beam enters through the prism face marked with the dot.

- Projection systems, signal monitoring, color separation and recombination, optical coupling
- Fewer ghost images than plate beamsplitters
- Index matching optical adhesive assembly (low absorbing, high VIS/NIR transmission)
- $T_p/T_s > 1000:1$ extinction ratio

LASER LINE POLARIZING CUBE BEAMSPLITTERS

12.7mm Cube

Wavelength (nm)	PART NUMBER
532	PBS-532-050
780	PBS-780-050
800	PBS-800-050
810	PBS-810-050
830	PBS-830-050
850	PBS-850-050
1030	PBS-1030-050
1064	PBS-1064-050
1550	PBS-1550-050

25.4mm Cube

Wavelength (nm)	PART NUMBER
532	PBS-532-100
780	PBS-780-100
800	PBS-800-100
1064	PBS-1064-100

Please see page T-38 for coating traces.

HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS: PBO



CVI Laser Optics' high-energy, polarizing cube coatings are designed for optimal extinction ratio (T_p/T_s) and laser damage threshold. Via optical contacting, the cube remains free of adhesive within the clear aperture, preventing any environmental and spectral anomalies that can be attributed by said adhesive. For applications requiring higher transmission efficiency (i.e. $T_p > 98.0\%$), a reduction in extinction ratio can be applied.

- ▶ Adhesive free; optically contacted
- ▶ High laser damage threshold
- ▶ 750:1 extinction ratio typical

Specifications

Product Code: **PBO**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Edge Dimension Tolerance: $A \pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Beam Deviation: < 5 arc minutes

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Anti-reflection Coating:

$R \leq 0.25\%$, all entrance and exit surfaces

Extinction Ratio:

$\lambda > 500\text{nm}$: $T_p/T_s > 500:1$; $> 750:1$ typical

$\lambda \leq 500\text{nm}$: $T_p/T_s > 250:1$; $> 500:1$ typical

Transmission Efficiency:

$T_p > 95\%$

Reflection Efficiency:

$\lambda > 500\text{nm}$ $R_s > 99.5\%$

$\lambda \leq 500\text{nm}$ $R_s > 99.0\%$

Damage Threshold:

Pulsed:

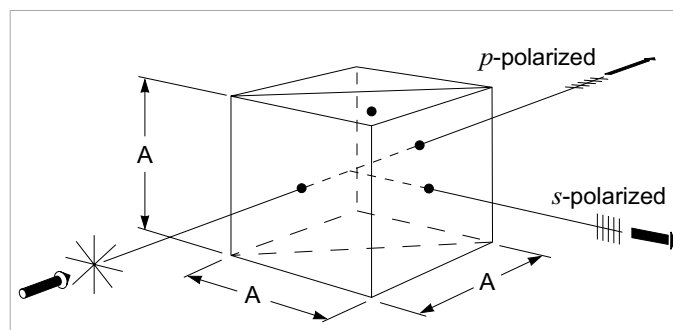
25 J/cm², 20ns, 20Hz at 1064nm

15 J/cm², 20ns, 20Hz at 532nm

3 J/cm², 20ns, 20Hz at 355nm

2 J/cm², 20ns, 20Hz at 266nm

cw: 1 MW/cm² at 1064nm

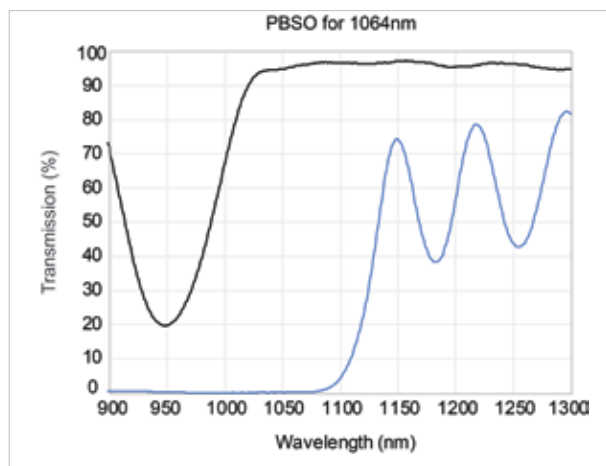
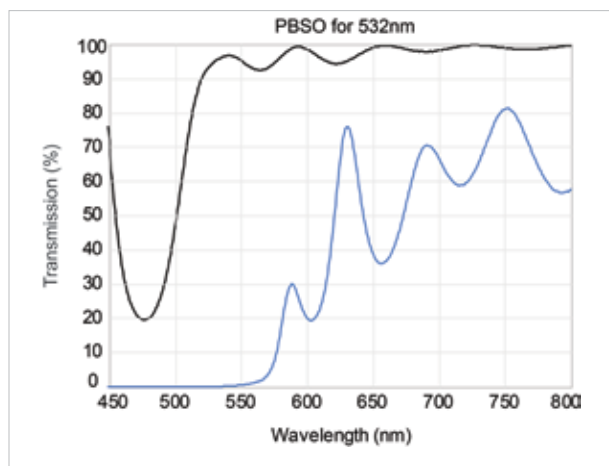


PBO high energy laser line polarizing beamsplitter cubes

HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS

Wavelength (nm)	PART NUMBER	
	12.7mm Cube	25.4mm Cube
266	PBSO-266-050	PBSO-266-100
355	PBSO-355-050	PBSO-355-100
532	PBSO-532-050	PBSO-532-100
1064	PBSO-1064-050	PBSO-1064-100

Please see page T-38 for coating traces.



P-POL: — UNP: - - - - S-POL: — 0°: ·····

ION BEAM SPUTTERED HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS: PBSI



Specifications

Product Code: **PBSI**

Optical Material:

Standard Grade Corning 7980 0-A (Fused Silica)

Edge Dimension Tolerance (A): $\pm 0.25\text{mm}$

Transmitted Beam Deviation: < 3 arc minutes

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

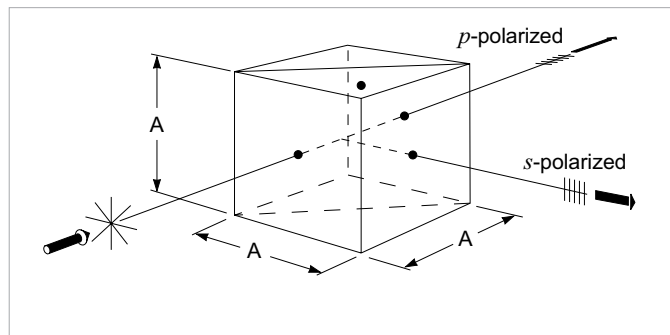
Reflected Wavefront Error (RWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Anti-reflection Coating: $R \leq 0.20\%$, all entrance and exit surfaces

Call us for more information on custom polarizers and beamsplitter cube designs

- ▶ High energy laser line polarizer cube
- ▶ Reflected and transmitted beams separated by 90°



PBSI ion beam sputtered high energy laser line polarizing beamsplitter cubes

ION BEAM SPUTTERED HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS

Wavelength (nm)	T_{p-pol}	Extinction Ratio T_p/T_s	Damage Threshold	PART NUMBER
355	$> 95.0\%$	$> 500:1$	$2 \text{ J/cm}^2 @ 355\text{nm}$	PBSI-355-050
532	$> 96.0\%$	$> 750:1$	$4 \text{ J/cm}^2 @ 532\text{nm}$	PBSI-532-050
1064	$> 97.0\%$	$> 1000:1$	$10 \text{ J/cm}^2 @ 1064\text{nm}$	PBSI-1064-050

Visit cvilaseroptics.com for traces.

VISIBLE AND NEAR-IR BROADBAND POLARIZING CUBE BEAMSPLITTERS: PBSH



Specifications

Product Code: **PBSH**

Optical Material: Schott N-SF2 glass

Edge Dimension Tolerance (A): $\pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Field of View: $\pm 2.5^\circ$

Anti-reflection Coating: See table

Extinction Ratio: $T_p/T_s > 500:1$

Transmission Efficiency (T_p avg): $> 90\%$

Reflection Efficiency: $R_s > 99.5\%$ average

Clear Aperture: $\geq 85\%$ of central dimension

Damage Threshold:

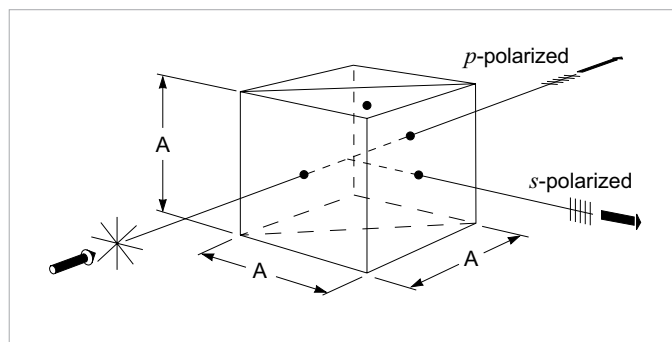
Pulsed: 500 mJ/cm^2 , 20ns, 20Hz at 515nm

cw: 100 W/cm^2 at 515nm

These broadband polarizing beamsplitter cubes are made from N-SF2 glass to improve broadband performance. A multi-layer anti-reflective coating is applied to each face of the beamsplitter to ensure maximum transmission efficiency.

To avoid damage when using a laser, be sure to orient the cube so that the beam enters through the prism marked with the dot.

- ▶ Broadband performance
- ▶ Reflected and transmitted beams separated by 90°
- ▶ Optical adhesive assembly
- ▶ Contact CVI Laser Optics for OEM opportunities for other wavelengths or dimensions



PBSH broadband polarizing cube beamsplitters

VISIBLE AND NEAR-IR BROADBAND POLARIZING CUBE BEAMSPLITTER

12.7mm Cube

Wavelength Range (nm)	R_{avg} (per surface)	PART NUMBER
450 – 700	$< 0.5\%$	PBSH-450-700-050
450 – 1300	$< 2.5\%$	PBSH-450-1300-050
450 – 2000	$< 3.0\%$	PBSH-450-2000-050
670 – 980	$< 0.5\%$	PBSH-670-980-050

25.4mm Cube

Wavelength Range (nm)	R_{avg} (per surface)	PART NUMBER
450 – 700	$< 0.5\%$	PBSH-450-700-100
450 – 1300	$< 2.5\%$	PBSH-450-1300-100
450 – 2000	$< 3.0\%$	PBSH-450-2000-100

Please see page T-38 for coating traces.

BROADBAND HYBRID CUBE BEAMSPLITTERS: BSC



Specifications

Product Code: **BSC**

Material: N-BK7

Edge Dimensions: $A \pm 0.3\text{mm}$

Transmission: $45\% \pm 6\%$

Surface Flatness: $< \lambda/2$ at 633nm per surface within clear aperture

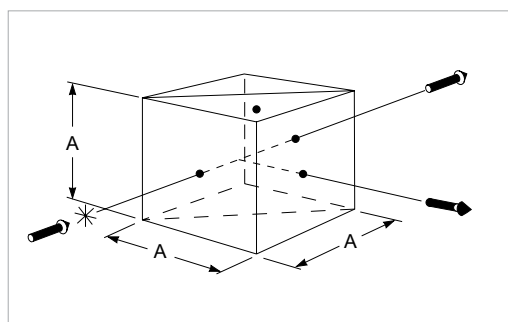
Clear Aperture: 90% of central area

Transmitted Beam Deviation: < 10 arc minutes

Surface Quality: 60-40 scratch-dig per MIL-PRF-13830b

Absorption: $< 10\%$

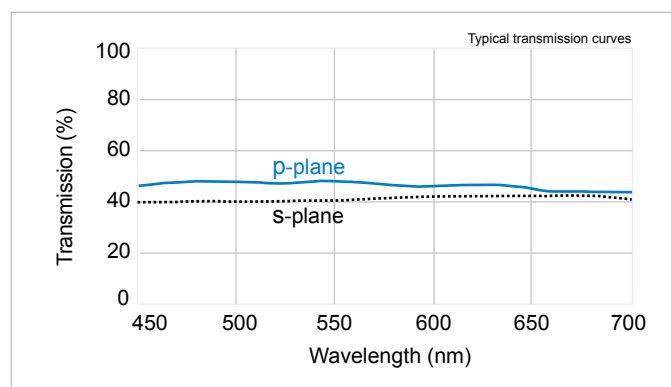
Coating: HEBBAR™ anti-reflection coating (entrance and exit faces) see page T-32



BSC broadband polarizing cube beamsplitters

Cube beamsplitters are recommended for use with collimated or nearly collimated light. Convergent or divergent beams will contribute unwanted spherical aberration to an optical system. Cube beamsplitters consist of matched pairs of right angle prisms cemented together. The hypotenuse of one prism has a partial reflecting coating. A black dot on the ground side of the prism indicates which prism has the partial reflector on the hypotenuse. The incident beam must enter the prism containing the partial reflector first.

- ▶ A hybrid metal dielectric coating exhibits moderate absorption with little polarization sensitivity
- ▶ These beamsplitters are fairly insensitive to changes in angle of incidence
- ▶ Optical adhesive contact
- ▶ Performance is relatively flat across a large spectral band
- ▶ Other wavelength ranges available



Broadband hybrid cube beamsplitter for 450 – 700nm

BROADBAND HYBRID CUBE BEAMSPLITTERS

Wavelength Range (nm)	A (mm)	CA (mm)	PART NUMBER
450 – 700	25.4	22.9x22.9 min	BSC-450-700-100

HIGH ENERGY CONTINUOUSLY VARIABLE BEAMSPLITTERS: ABSO



Specifications

Product Code: **ABSO**

Optical Material: Crystal Quartz and Standard Grade Corning 7980 1-D (Fused Silica)

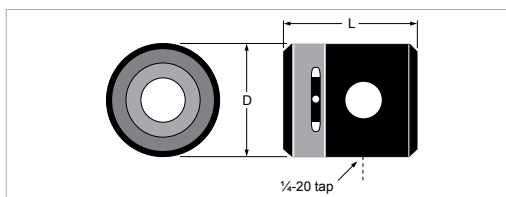
Housing Material: Black-Anodized Aluminum, 1/4-20 thread

Anti-reflection Coating: $R \leq 0.25\%$ on all entrance and exit surfaces

Transmission Range: 1%–95%

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

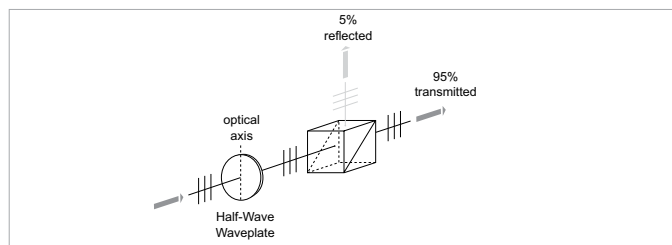
Damage Threshold: 5 J/cm², 20ns, 20Hz at 1064nm



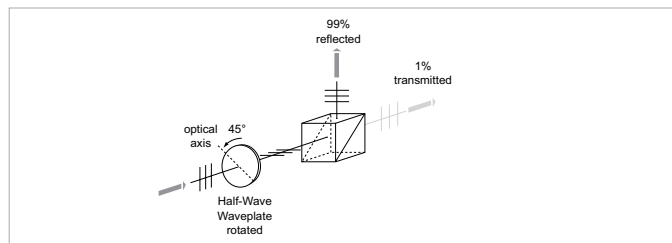
Housing for ABSO continuously variable beamsplitters

Continuously variable attenuation of linearly polarized light is achieved with a multiorder rotatable half-waveplate followed by a polarizing beamsplitter cube. The s-polarized light is reflected at 90° while p-polarized light is transmitted straight through the assembly. The amount of transmitted light depends on the alignment of the waveplate and can be manually adjusted from 1 to 95%.

- ▶ ABSO utilizes high powered cubes that are optically contacted
- ▶ Applications include: variable laser sampling, holography, interferometry, light entanglement, and variable ratio beamsplitting
- ▶ RoHS compliant
- ▶ Convenient 1/4-20 tapped thread for mounting



Orientation of waveplate for maximum p-polarized transmission



Orientation of waveplate for minimum p-polarized transmission

HIGH ENERGY CONTINUOUSLY VARIABLE BEAMSPLITTERS

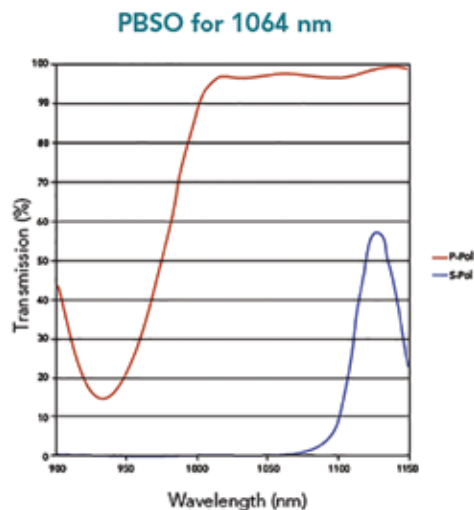
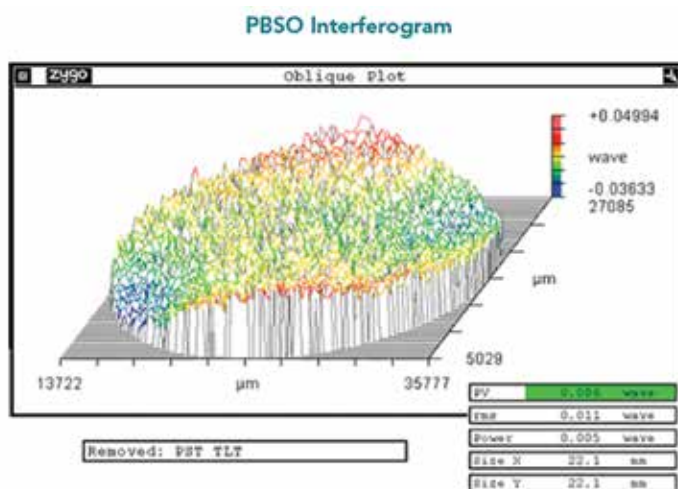
Wavelength (nm)	Clear Aperture (mm)	Housing Diameter (D)mm	Housing Length (L)mm	PART NUMBER
266	6.35	25.4	33.0	ABSO-6.35-266
355	6.35	25.4	33.0	ABSO-6.35-355
532	6.35	25.4	33.0	ABSO-6.35-532
1064	6.35	25.4	33.0	ABSO-6.35-1064
266	12.7	50.8	48.3	ABSO-12.7-266
355	12.7	50.8	48.3	ABSO-12.7-355
532	12.7	50.8	48.3	ABSO-12.7-532
1064	12.7	50.8	48.3	ABSO-12.7-1064

High Energy, High Extinction Plate and Cube Polarizers

CVI Laser Optics utilizes various coating technologies (Advanced Plasma Source, and Ion Beam Sputtering) and adhesive-free assembly techniques to enable the production of high performance polarizers. This results in laser damage and environmentally unsusceptible optics with high P-polarization versus S-polarization extinction ratio.

Newly Improved Optically Contacted Laser Line Polarizing Cube Beamsplitter

- Catalog Product Code: PBSO (see page 113)
- Increased laser damage threshold ($>30\text{J}/\text{cm}^2$, 20ns, 20Hz at 1064nm typical) and TP:TS extinction ($>750:1$ typical) of polarizing coating on hypotenuse face
- Increased durability against environmental factors such as humidity and abrasion
- Optically contacted
 - Adhesive free within clear aperture.
 - No index change, CTE mismatch, or environmental susceptibility concerns
- Optimized for Nd:YAG Wavelength and associated harmonics (1064nm, 532nm, 355nm, 266nm)
- CVI Laser Grade Surface Quality (10-5 Scratch-Dig per MIL-PRF-13830b) at 100W per surface
- Transmitted Wavefront Distortion (TWD) $< \text{L}/10$ p-v at 633nm over specified CA



Custom Polarizer Capability

- Brewster Plate Polarizers (56° AOI), Low Dispersion Plate Polarizers (72° AOI), Beam Path Accommodating Plate Polarizers (45° AOI), and Anything in Between from UV-NIR
- High Performing Laser Line and Broadband Polarizer Coatings
- Adhesive-Free Bonding Techniques for Polarizer Assemblies
- Custom Material, Substrates, Prisms, and Dimensional Features as Required
- Custom Designed and Assembled Optical Mounting and/or Housing (Metal or Glass)
- Transmitted Wavefront Distortion (TWD) $< \text{L}/20$ p-v at 633nm over Specified CA
- Expansive In-House Metrology for any Required Documentation

CVI Laser Optics specializes in
prototype to volume production manufacturing!

SELECTION GUIDE

DIAGRAM	PRODUCT TYPE	OPERATION CONDITIONS	EXTINCTION RATIO TP/TS	POLARIZATION BANDWIDTH	TRANSMISSION EFFICIENCY	PAGE
Polarizing Cube Beamsplitters						
	UV LASER-LINE: UPBS	10 mJ/cm ² , 20ns, 20Hz; 10 W/cm ² cw at 266nm	100:1	5nm at 257nm	90%	122
	LASER-LINE: PBS	1 J/cm ² , 20ns, 20Hz at 1064nm; 100 W/cm ² cw at 515nm	1000:1	25nm at 515nm	95%	123
	HIGH-ENERGY LASER-LINE: PBSO	25 J/cm ² , 20ns, 20Hz; 1 MW/cm ² cw at 1064nm	500:1 at 1064nm	5–10nm at 1064nm	95%	124
	ION BEAM SPUTTERED: PBSI	10 J/cm ² , 20ns, 20Hz; 1 MW/cm ² cw at 1064nm	1,000:1 at 1064nm	5–10nm at 1064nm	97%	126
	BROADBAND: PBSh	500 mJ/cm ² , 20ns, 20Hz; 100 W/cm ² cw at 515nm	500:1	>250nm at 532nm	90%	127
	HIGH-ENERGY BROADBAND: PBSK	5 J/cm ² , 20ns, 20Hz; 1 MW/cm ² cw at 1064nm	1,000:1 at 1064nm	140nm at 532nm	92% at 800nm	128
Thin-Film Plate Polarizers						
	THIN-FILM PLATE POLARIZERS 56°: TFP	20 J/cm ² , 20ns, 20Hz; 1 MW/cm ² cw at 1064nm	200:1 at 1064nm	5nm at 1064nm	95% at 1064nm	129
	ION BEAM SPUTTERED 45°: TFPN	10 J/cm ² , 20ns, 20Hz; 1 MW/cm ² cw at 1064nm	500:1 at 1064nm	6–8nm at 1064nm	97% at 1064nm	130

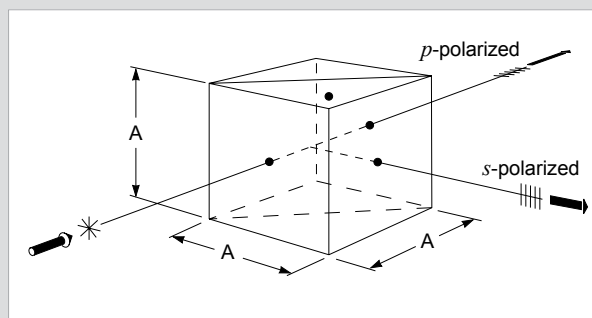
POLARIZING CUBE BEAMSPLITTERS

APPLICATION NOTE

Polarizing cube beamsplitters separate polarization components of an incident beam into two highly polarized output beams separated by a 90° angle. The beam that passes straight through the cube is linearly *p*-polarized with the electric field vector parallel to the plane of incidence. The beam that emerges from the cube at right angles to the incident beam is linearly *s*-polarized with the electric field vector orthogonal to the plane of incidence.

When using a polarizing cube beamsplitter, remember:

- ▶ For polychromatic beam-combining applications, the two incoming beams must have properly oriented polarization states. This can be achieved by using a CVI Laser Optics half-wave plate (refer to QWPM or QWPO) to rotate the polarization state of the beam.
- ▶ Only collimated beams of light can be used.
- ▶ Light should be incident on the beamsplitter coating (hypotenuse surface) at an angle of $45^\circ \pm 2^\circ$.



Polarizing cube beamsplitters

UV LASER LINE POLARIZING CUBE BEAMSPLITTERS: UPBS



Specifications

Product Code: **UPBS**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Edge Dimension Tolerance (A): $\pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Field of View: $\pm 2^\circ$ typical

Anti-reflection Coating: $R \leq 0.25\%$, all entrance and exit surfaces

Extinction Ratio: $T_p/T_s > 100:1$

Transmission Efficiency: $T_p > 90.0\%$

Reflection Efficiency: $R_s > 99.0\%$

Damage Threshold:

Pulsed: 10 mJ/cm^2 , 20ns, 20Hz at 266nm

cw: 10 W/cm^2 at 266nm

These polarizing cube beamsplitters are made from fused silica to optimize UV performance.

To avoid damage when using a laser, be sure to orient the cube so that the beam enters through the prism marked with the dot.

- ▶ Fused-silica cube polarizers for doubled argon, tripled Nd:YAG, quadrupled Nd:YAG, and UV excimer lasers
- ▶ For use with fluences less than 10 mJ/cm^2
- ▶ Index matching optical adhesive assembly (low absorbing, high UV transmission)
- ▶ Contact CVI Laser Optics for alternate wavelengths, dimensions, or other specification changes for OEM applications

UV LASER LINE POLARIZING CUBE BEAMSPLITTERS

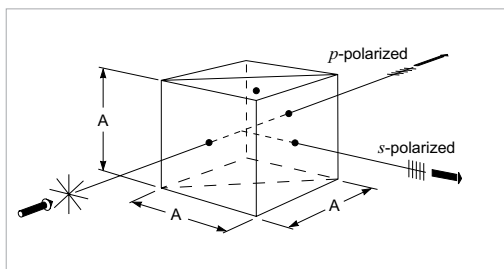
12.7mm Cube

Wavelength (nm)	PART NUMBER
355	UPBS-355-050
405	UPBS-405-050

25.4mm Cube

Wavelength (nm)	PART NUMBER
355	UPBS-355-100
405	UPBS-405-100

Please see page T-38 for coating traces.



UPBS UV laser line polarizing beamsplitter cubes

LASER LINE POLARIZING CUBE BEAMSPLITTERS: PBS



Specifications

Product Code: **PBS**

Optical Material: N-BK7

Edge Dimension Tolerance (A): $\pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE):

$< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Field of View: $\pm 3^\circ$

Anti-reflection Coating: $R \leq 0.25\%$ per surface

Extinction Ratio: $T_p/T_s > 1000:1$

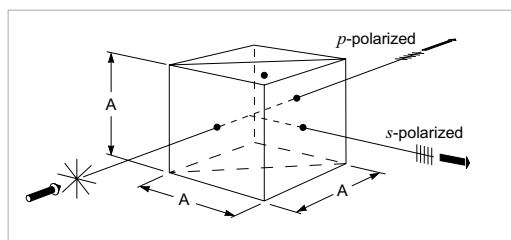
Transmission Efficiency: $T_p > 95\%$

Reflection Efficiency: $R_s > 99.9\%$

Damage Threshold:

Pulsed: 1 J/cm^2 , 20ns, 20Hz at 1064nm

cw: 100 W/cm^2 at 515nm



PBS laser line polarizing beamsplitter cubes

Polarizing beamsplitter cubes are used to split a laser beam into two orthogonally polarized components; p-polarization is transmitted straight through while s-polarization is reflected at 90° .

To avoid damage when using a high power laser, be sure to orient the cube so that the beam enters through the prism face marked with the dot.

- ▶ Projection systems, signal monitoring, color separation and recombination, optical coupling
- ▶ Fewer ghost images than plate beamsplitters
- ▶ Index matching optical adhesive assembly (low absorbing, high VIS/NIR transmission)
- ▶ 1000:1 extinction ratio

LASER LINE POLARIZING CUBE BEAMSPLITTERS

12.7mm Cube

Wavelength (nm)	PART NUMBER
532	PBS-532-050
780	PBS-780-050
800	PBS-800-050
810	PBS-810-050
830	PBS-830-050
850	PBS-850-050
1030	PBS-1030-050
1064	PBS-1064-050
1550	PBS-1550-050

25.4mm Cube

Wavelength (nm)	PART NUMBER
532	PBS-532-100
780	PBS-780-100
800	PBS-800-100
1064	PBS-1064-100

Please see page T-38 for coating traces.

HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS: **PBSO**

Specifications

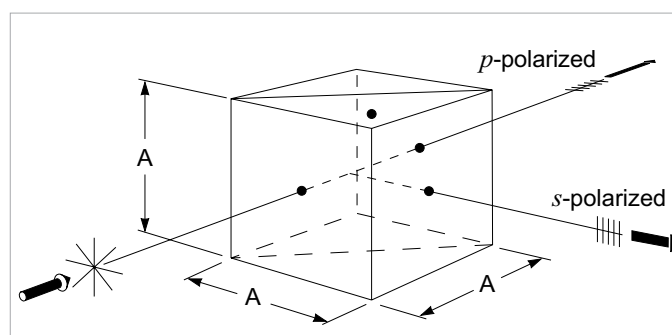
Product Code: **PBSO****Optical Material:**

Standard Grade Corning 7980 1-D (Fused Silica)

Edge Dimension Tolerance: $A \pm 0.25\text{mm}$ **Surface Quality:** 20-10 scratch-dig per MIL-PRF-13830b**Transmitted Beam Deviation:** < 5 arc minutes**Transmitted Wavefront Error (TWE):** $< \lambda/4$ p-v at 633nm**Clear Aperture:** $\geq 85\%$ of central dimension**Anti-reflection Coating:** $R \leq 0.25\%$, all entrance and exit surfaces**Extinction Ratio:** $\lambda > 500\text{nm}$: $T_p/T_s > 500:1$; $> 750:1$ typical $\lambda \leq 500\text{nm}$: $T_p/T_s > 250:1$; $> 500:1$ typical**Transmission Efficiency:** $T_p > 95\%$ **Reflection Efficiency:** $\lambda > 500\text{nm}$ $R_s > 99.5\%$ $\lambda \leq 500\text{nm}$ $R_s > 99.0\%$ **Damage Threshold:****Pulsed:**25 J/cm², 20ns, 20Hz at 1064nm15 J/cm², 20ns, 20Hz at 532nm3 J/cm², 20ns, 20Hz at 355nm2 J/cm², 20ns, 20Hz at 266nm**cw:** 1 MW/cm² at 1064nm

CVI Laser Optics' high-energy, polarizing cube coatings are designed for optimal extinction ratio (T_p/T_s) and laser damage threshold. Via optical contacting, the cube remains free of adhesive within the clear aperture, preventing any environmental and spectral anomalies that can be attributed by said adhesive. For applications requiring higher transmission efficiency (i.e. $T_p > 98.0\%$), a reduction in extinction ratio can be applied.

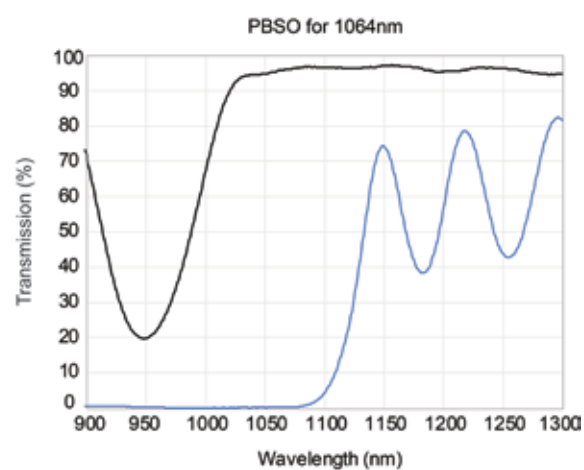
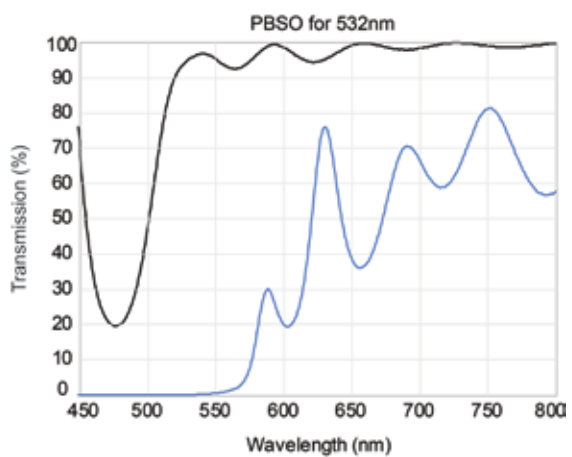
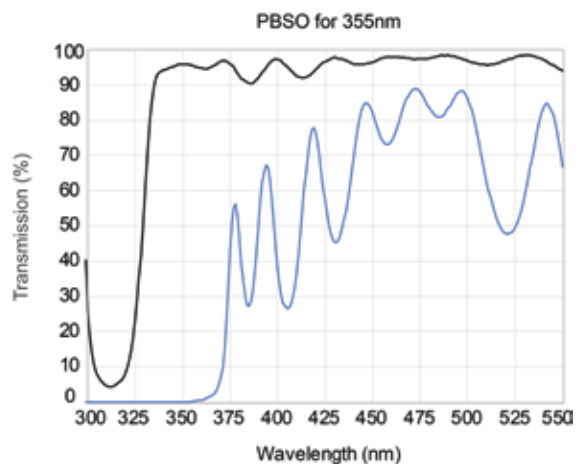
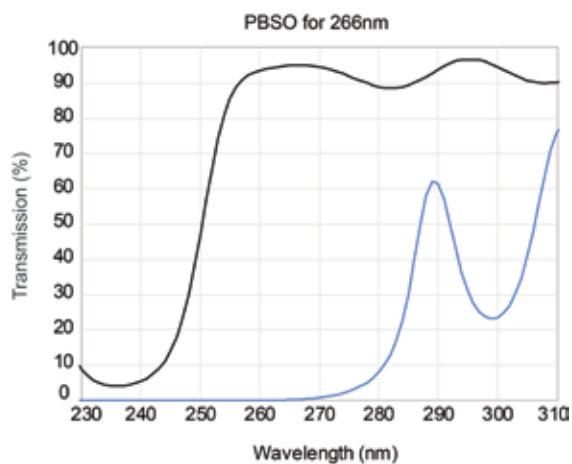
- ▶ Adhesive free; optically contacted
- ▶ High laser damage threshold
- ▶ 750:1 extinction ratio typical



PBSO high energy laser line polarizing beamsplitter cubes

HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS

Wavelength (nm)	PART NUMBER	
	12.7mm Cube	25.4mm Cube
266	PBSO-266-050	PBSO-266-100
355	PBSO-355-050	PBSO-355-100
532	PBSO-532-050	PBSO-532-100
1064	PBSO-1064-050	PBSO-1064-100



P-POL: — UNP: - - - - S-POL: — 0°: ·····

ION BEAM SPUTTERED HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS: PBSI



Specifications

Product Code: **PBSI**

Optical Material:

Standard Grade Corning 7980 0-A (Fused Silica)

Edge Dimension Tolerance (A): $\pm 0.25\text{mm}$

Transmitted Beam Deviation: < 3 arc minutes

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

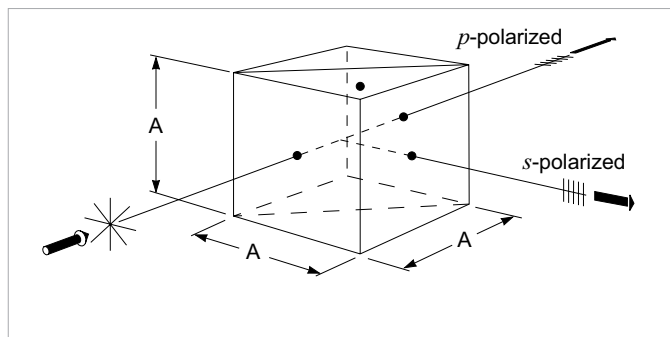
Reflected Wavefront Error (RWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Anti-reflection Coating: $R \leq 0.20\%$, all entrance and exit surfaces

Call us for more information on custom polarizers and beamsplitter cube designs

- ▶ High energy laser line polarizer cube
- ▶ Reflected and transmitted beams separated by 90°



PBSI ion beam sputtered high energy laser line polarizing beamsplitter cubes

ION BEAM SPUTTERED HIGH ENERGY LASER LINE POLARIZING CUBE BEAMSPLITTERS

Wavelength (nm)	T_{p-pol}	Extinction Ratio T_p/T_s	Damage Threshold	PART NUMBER
355	$> 95.0\%$	$> 500:1$	2 J/cm ² @ 355nm	PBSI-355-050
532	$> 96.0\%$	$> 750:1$	4 J/cm ² @ 532nm	PBSI-532-050
1064	$> 97.0\%$	$> 1000:1$	10 J/cm ² @ 1064nm	PBSI-1064-050

Visit cvilaseroptics.com for traces..

VISIBLE AND NEAR-IR BROADBAND POLARIZING CUBE BEAMSPLITTERS: PBSH



Specifications

Product Code: **PBSH**

Optical Material: Schott N-SF2 glass

Edge Dimension Tolerance (A): $\pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Field of View: $\pm 2.5^\circ$

Anti-reflection Coating: See table

Extinction Ratio: $T_p/T_s > 500:1$

Transmission Efficiency (T_p avg): $> 90\%$

Reflection Efficiency: $R_s > 99.5\%$ average

Clear Aperture: $\geq 85\%$ of central dimension

Damage Threshold:

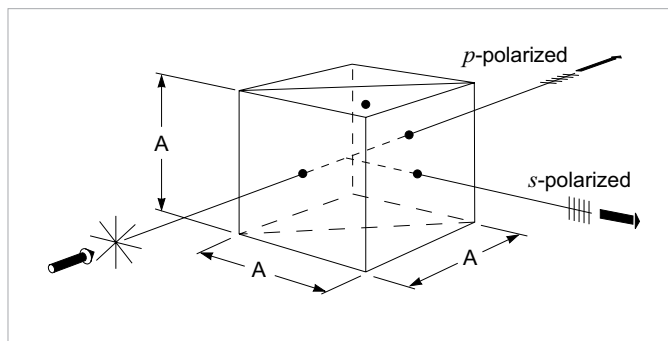
Pulsed: 500 mJ/cm^2 , 20ns, 20Hz at 515nm

cw: 100 W/cm^2 at 515nm

These broadband polarizing beamsplitter cubes are made from N-SF2 glass to improve broadband performance. A multi-layer anti-reflective coating is applied to each face of the beamsplitter to ensure maximum transmission efficiency.

To avoid damage when using a laser, be sure to orient the cube so that the beam enters through the prism marked with the dot.

- ▶ Broadband performance
- ▶ Reflected and transmitted beams separated by 90°
- ▶ Optical adhesive assembly
- ▶ Contact CVI Laser Optics for OEM opportunities for other wavelengths or dimensions



PBSH broadband polarizing cube beamsplitters

VISIBLE AND NEAR-IR BROADBAND POLARIZING CUBE BEAMSPLITTER

12.7mm Cube

Wavelength Range (nm)	R_{avg} (per surface)	PART NUMBER
450 – 700	$< 0.5\%$	PBSH-450-700-050
450 – 1300	$< 2.5\%$	PBSH-450-1300-050
450 – 2000	$< 3.0\%$	PBSH-450-2000-050
670 – 980	$< 0.5\%$	PBSH-670-980-050

25.4mm Cube

Wavelength Range (nm)	R_{avg} (per surface)	PART NUMBER
450 – 700	$< 0.5\%$	PBSH-450-700-100
450 – 1300	$< 2.5\%$	PBSH-450-1300-100
450 – 2000	$< 3.0\%$	PBSH-450-2000-100

Please see page T-38 for coating traces.

HIGH ENERGY BROADBAND POLARIZING CUBE BEAMSPLITTERS: PBSK



Specifications

Product Code: PBSK

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Edge Dimension Tolerance (X,Y): $\pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nmClear Aperture: $\geq 85\%$ of central dimensionExtinction Ratio: $T_p/T_s > 1000:1$

Anti-reflection Coating:

 $R_{\text{avg}} \leq 0.50\%$, all entrance and exit surfaces

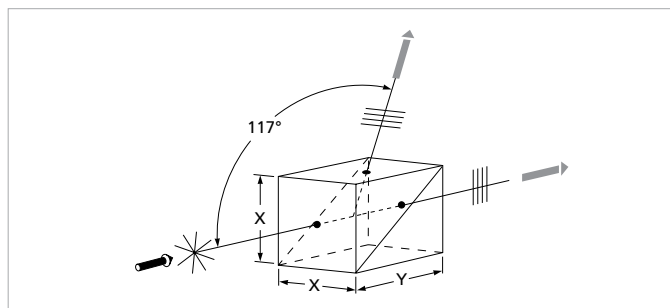
Damage Threshold:

Pulsed: 5 J/cm^2 , 20ns, 20Hz at 1064nmcw: 1 MW/cm^2 at 1064nm

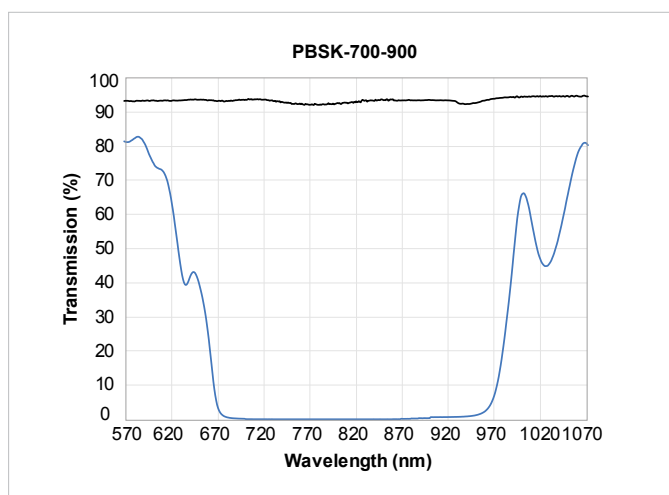
An alternative to calcite and Brewster angle polarizers, the PBSK is an optimal solution for high-energy broadband or multi-line systems. Unlike cemented cube polarizers, the PBSK is optically contacted, coated with all-dielectric materials and manufactured from fused silica to ensure high transmission and high damage threshold.

To avoid damage when using a high power laser, be sure to orient the cube so that the beam enters through the prism marked with the dot.

- Designed for Pulse Lengths $> 15 \text{ fs}$
- Contact CVI Laser Optics for other designs between 230nm and 2100nm



PBSK high-energy broadband polarizing beamsplitter cubes



P-POL: — UNP: - - - - S-POL: — 0°: ·····

HIGH ENERGY BROADBAND POLARIZING CUBE BEAMSPLITTERS

X x Y (mm)	PART NUMBER
12.7x17.5	PBSK-700-900-050
15.4x35.3	PBSK-700-900-100

THIN-FILM PLATE POLARIZERS, 56°: TFP



Specifications

Product Code: **TFP**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ± 0.25 mm

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Surface Figure: $< \lambda/10$ at 633nm before coating on select substrates

Transmitted Wavefront Error (TWE): $< \lambda/8$ p-v at 633nm

Transmission Efficiency: $\lambda \geq 527$ nm: 95%, $\lambda = 355$ nm: 90%, $\lambda = 248$ nm or 266nm: 85%

Tp/Ts,:

$\lambda \geq 527$ nm: 200:1 $\lambda = 248$ nm, 266nm and 355nm: 100:1

Clear Aperture: $\geq 85\%$ of central diameter

Damage Threshold:

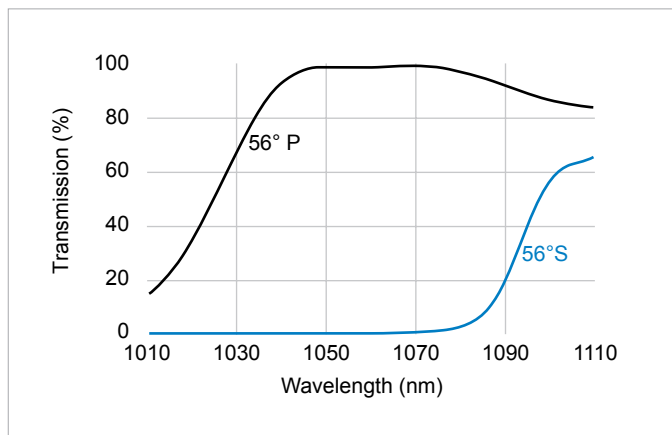
Pulsed: 20 J/cm², 20ns, 20Hz at 1064nm

cw: 1 MW/cm² at 1064nm

Angle of Incidence: 56° $\pm 3^\circ$

TFP thin-film plate polarizers are the best choice when maximum laser damage resistance is necessary. Typically, thin film polarizers are used for fluences greater than 500 mJ/cm², where calcite air-spaced polarizers exhibit long-term tracking and cemented polarizers cannot be used at all. Applications for the TFP include usage as an intracavity Q-switch hold-off polarizer, and, in conjunction with a half-wave plate, as an extracavity attenuator for an Nd:YAG laser fundamental and its harmonics. To maximize transmission, users must make a provision in their mechanical setup for the necessary angular tuning. Note that the losses at the uncoated second surface are insignificant at 83° from Brewster's angle.

- ▶ High damage threshold Brewster-angle polarizer, >20 J/cm²
- ▶ Angle tuning suggested to achieve maximum transmission
- ▶ Contact CVI Laser Optics for alternate wavelengths, dimensions and OEM capabilities



Transmission vs wavelength of TFP series 1064-nm thin film polarizer

THIN-FILM PLATE POLARIZERS 56°			
Center Wavelength (nm)	Dimensions (mm)	t (mm)	PART NUMBER
355	Ø 25.4	6.35	TFP-355-PW-1025-UV
355	Ø 50.8	6.35	TFP-355-PW-2025-UV
355	28.6x14.3	3.18	TFP-355-RW-28.6-14.3-3.2-UV
527	28.6x14.3	3.18	TFP-527-RW-28.6-14.3-3.2-UV
532	Ø 25.4	6.35	TFP-532-PW-1025-UV
532	Ø 50.8	6.35	TFP-532-PW-2025-UV
532	28.6x14.3	3.18	TFP-532-RW-28.6-14.3-3.2-UV
1053	28.6x14.3	3.18	TFP-1053-RW-28.6-14.3-3.2-UV
1064	Ø 25.4	6.35	TFP-1064-PW-1025-UV
1064	Ø 50.8	6.35	TFP-1064-PW-2025-UV
1064	28.6x14.3	3.18	TFP-1064-RW-28.6-14.3-3.2-UV

Please see page T-38 for coating traces.

ION BEAM SPUTTERED THIN-FILM PLATE POLARIZERS, 45°: TFPN



Specifications

Product Code: TFPN

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter: 25.4mm +0/-0.25mm

Thickness: 6.35mm ±0.25mm

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): < $\lambda/8$ p-v at 633nm

Clear Aperture: ≥ 85% of central diameter

Transmission Efficiency: $\lambda=1064\text{nm}$: $T_p > 97\%$, $\lambda=532\text{nm}$: $T_p > 96\%$ T_p/T_s : >500:1

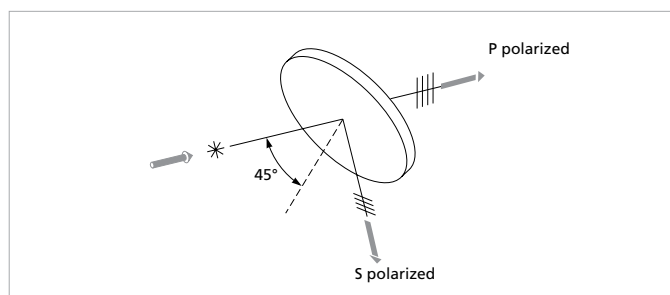
Damage Threshold:

Pulsed: 10 J/cm², 20ns, 20Hz at 1064nmcw: 1 MW/cm² at 1064nm

Angle of Incidence: 45°

TFPN thin-film plate polarizers are an ideal choice when both high laser damage threshold and a 90° reflection angle are necessary. Unlike Brewster angle polarizers which work at an angle of incidence of 56°, the TFPN plate polarizer works at 45°. Consequently, the reflected and transmitted beams are separated by 90° and orthogonally polarized, just like a cube polarizer.

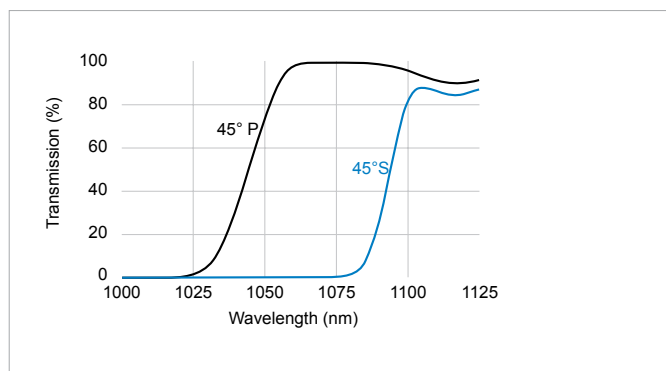
- ▶ High-energy laser line polarizer
- ▶ Reflected and transmitted beams separated by 90°
- ▶ No angle tuning required
- ▶ RoHS compliant
- ▶ Contact CVI Laser Optics for other wavelengths and sizes



TFPN 45° thin film plate polarizers

ION BEAM SPUTTERED THIN-FILM PLATE POLARIZERS, 45°

Wavelength (nm)	PART NUMBER
532	TFPN-532-PW-1025-UV
1064	TFPN-1064-PW-1025-UV



Transmission versus wavelength of TFPN series 1064nm thin film plate polarizers

CVI Laser Optics specializes in
prototype to volume production manufacturing!

NOTES:

SELECTION GUIDE

PRODUCT TYPE	OPERATING CONDITIONS	WAVE-LENGTHS	ANGLE OF INCI-DENCE	PERFORMANCE	PAGE
BROADBAND TI:SAPPHIRE MIRRORS: TLMW	0.35 J/cm ² , 50 psec, 50Hz at 800nm	720 – 900nm	0° or 45°	R > 99.0% for 720 – 900nm Broadband design with ultra low GDD	133
HIGH POWER TI:SAPPHIRE MIRRORS: TLMB	0.46 J/cm ² , 50 fsec, 50Hz at 800nm	740 – 860nm	0° or 45°	R > 99.0% for 740 – 860nm Broadband design with ultra low GDD	134
TUNABLE LASER LINE MIRRORS: TLM1	0.55 J/cm ² , 50 fsec, 50Hz at 800nm	From 190nm to 2100nm	0° or 45°	R > 99.5% at 355nm ≤ λ ≤ 2100nm; High Power design with low GDD	135
TUNABLE BROADBAND MIRRORS: TLM2	0.28 J/cm ² , 50 fsec, 50Hz at 800nm	450 – 2100nm	0° or 45°	R > 99.5% at 450nm ≤ λ ≤ 2100nm; Low Power design with ultralow GDD	136
ND:YAG 532NM LASER MIRRORS: Y2	20 J/cm ² , 20ns, 20Hz at 1064nm	532nm	0° or 45°	R > 99.9% at 0° incidence R > 99.8% at 45°, UNP	137
ND:YAG 1064NM LASER MIRRORS: Y1	25 J/cm ² , 20ns, 20Hz at 1064nm	1064nm	0° or 45°	R > 99.9% at 0° incidence R > 99.8% at 45°, UNP	137
PROTECTED SILVER METAL COATED MIRRORS: PS	~ 0.21 J/cm ² , 50 fsec, 50Hz at 800nm	400 – 20,000nm	0° – 45°	R _{avg} ≥ 95% (400nm to 20 μm)	138
PROTECTED GOLD METAL COATED MIRRORS: PG	~ 2 J/cm ² , 10ns, 10Hz at 1064 n	650 – 20,000nm	0° – 45°	R _{avg} ≥ 95.5% (650nm to 20 μm)	139
FEMTOSECOND BEAMSPLITTERS: FABS	~ 0.5 to 1 J/cm ² , 20ns, 20Hz at 1064nm	400nm, 800nm Custom	45°	Broadband all-dielectric R/T ratio 50:50	140
HIGH ENERGY BROADBAND POLARIZING CUBE BEAMSPLITTERS: PBSK	5 J/cm ² , 20ns, 20Hz; 1 MW/cm ² cw at 1064nm	248 – 308nm, 460 – 600nm, 700 – 900nm, 950 – 1230nm	0° - Incident and reflected beams separated by 117°	T _p > 92% at 800nm Extinction Ratio T _p /T _s > 103:1 Polarization bandwidth 140nm at 532nm	141

BROADBAND TI:SAPPHIRE MIRRORS: TLMW



Specifications

Product Code: **TLMW**

Substrate Material: N-BK7

Diameter: 25.4mm +0/-0.25mm

Thickness: 6.35mm ± 0.25 mm

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

Center Wavelength: 800nm

Angle of Incidence: 0° or 45° options

Reflectance:

0°: $R \geq 99.0\%$ from 720 - 900nm

45°: $R \geq 99.0\%$ from 720 - 900nm, UNP

Damage Threshold:

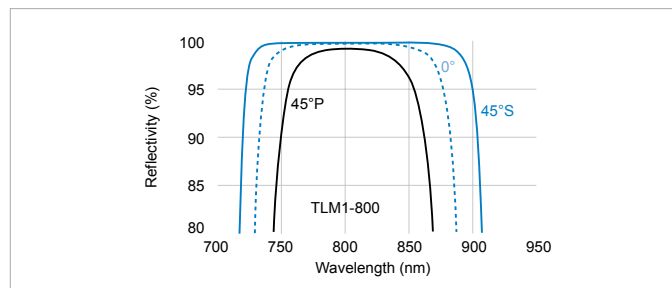
Pulsed: 0.35 J/cm², 50 fsec, 50Hz at 800nm

Bandwidth Tolerance: +0/-10% typical

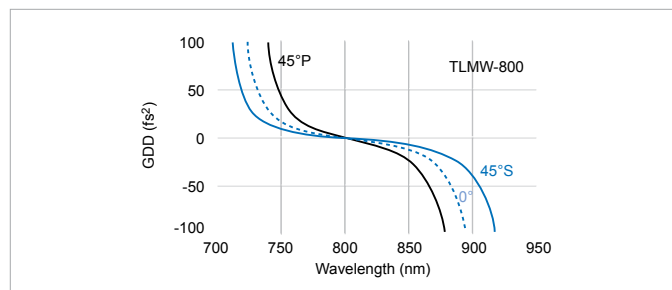
Adhesion and Durability: Per MIL-C-48497a

The TLMW mirrors was specially designed to achieve a wider bandwidth (720 - 900nm) than our premier TLMB Ti:Sapphire mirror while maintaining high reflectivity, low dispersion and high damage threshold. These mirrors are designed for 800nm Ti:Sapphire laser applications with pulse lengths as low as 15 femtoseconds.

- ▶ Designed for Pulse Lengths > 15 fs
- ▶ Ultrahard coatings with LDT 1 J/cm², 180 fsec at 800nm
- ▶ High reflectivity: 720 - 900nm for 0° or 45° UNP
- ▶ Contact CVI Laser Optics for a range of custom options



Reflectivity vs wavelength of TLMW-800 broadband laser mirror showing 0° and 45° angle of incidence designs



Group delay dispersion vs wavelength of TLMW narrowband laser mirror showing 0° and 45° angle of incidence designs

BROADBAND TI; SAPPHIRE MIRRORS:

Incidence Angle	PART NUMBER
0°	TLMW-800-0-1025
45°	TLMW-800-45-1025

HIGH POWER TI:SAPPHIRE MIRRORS: TLMB



Product Code: **TLMB**

Substrate Material: N-BK7

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ± 0.25 mm

Wedge: ≤ 5 arc minutes

Chamfer:

$\varnothing \leq 50.8$ mm: 0.35mm leg width at 45° nominal

$\varnothing > 50.8$ mm: 0.85mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm
(after coating)

S1 Surface Quality: 10-5 scratch-dig
per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: $\geq 85\%$ of central diameter

Angle of Incidence: 0° or 45° options

Center Wavelength: 800nm

Reflectance: $R > 99.0\%$ from 740 – 860nm for 0° or 45° UNP

Adhesion and Durability: Per MIL-C-48497a,
Insoluble in lab solvents.

Damage Threshold:

Pulsed: 0.46 J/cm^2 , 50 fsec, 50Hz at 800nm

These mirrors are available upon special request for all Ti:Sapphire laser-related center wavelengths.

- Designed for Pulse Lengths > 30 fs
- Broadband design with ultralow group velocity dispersion (GVD)
- High reflectivity: 740 – 860nm for 0° or 45° Unpolarized

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4
PRODUCT CODE	WAVELENGTH	ANGLE OF INCIDENCE	SIZE CODE
TLMB	800	45	1025

EXAMPLE: TLMB-800-45-1025

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

TLMB

2. WAVELENGTH (nm)

800

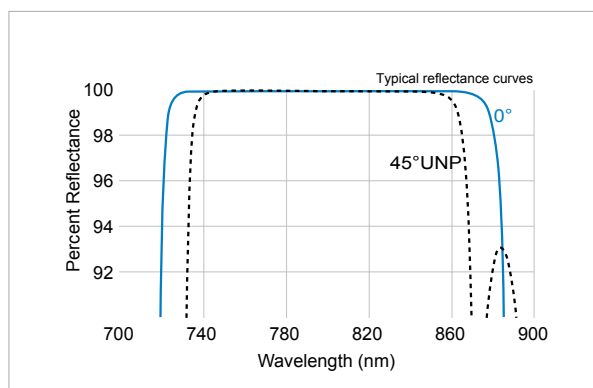
3. ANGLE OF INCIDENCE in Degrees

0	0 degrees (normal incidence)
45	45 degrees

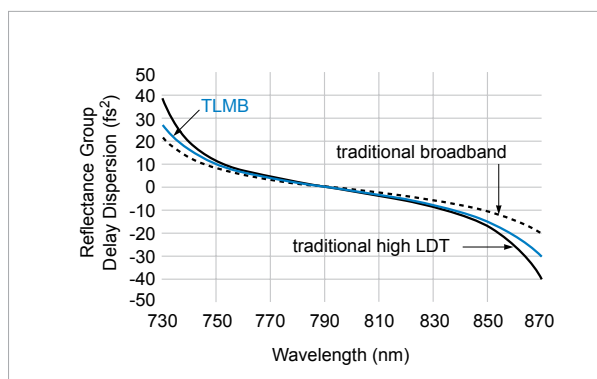
4. SIZE CODE

SIZE CODE	DIAMETER (mm)	THICKNESS (mm)
2506M	25.0	6.0
1025	25.4	6.35
5010M*	50.0	10.0
2037	50.8	9.53
3050*	76.2	12.7
4050*	101.6	12.7

* Only available at 45° AOI



TLMB-800 Ti:Sapphire broadband mirror showing 0° and 45° angle of incidence designs



A comparison of group delay dispersion vs wavelength of traditional broadband, traditional high laser damage threshold, and the CVI Laser Optics TLMB ultrafast mirror

TUNABLE LASER LINE MIRRORS: TLM1



Specifications

Product Code: **TLM1**

Substrate Material:

$\lambda < 450\text{nm}$: Standard Grade Corning 7980 1-D (Fused Silica)

$\lambda > 450\text{nm}$: N-BK7

Diameter Tolerance: $\pm 0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge: ≤ 5 arc minutes

Chamfer:

$\emptyset \leq 50.8\text{mm}$: 0.35mm leg width at 45° nominal
 $\emptyset > 50.8\text{mm}$: 0.85mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Concentricity: $\leq 0.05\text{mm}$ (spherical substrates only)

Radius Tolerance: $\pm 0.5\%$ (spherical substrates only)

Clear Aperture: $\geq 85\%$ of central diameter

Angle of Incidence: 0° or 45° options

Adhesion and Durability: Per MIL-C-48497a

Reflectance:

$R \geq 99.0\%$ at 0°

$R \geq 98.5\%$ at 45°, P-Pol

$R \geq 99.0\%$ at 45°, UNP

$R \geq 99.5\%$ at 45°, S-Pol

Damage Threshold:

Pulsed:

20 J/cm², 20ns, 20Hz at 1064nm

0.55 J/cm², 50 fsec, 50Hz at 800nm

5.0 J/cm², 10ns, 20Hz at 532nm

3.0 J/cm², 7ns, 20Hz at 266nm

Continuous Wave: 10 MW/cm² at 1064nm

Center Wavelength Tolerance: $\pm 3\%$

TYPICAL BANDWIDTH FOR TLM1 MIRRORS

Center Wave-length (nm)	R>99% 0°	R>99% 45°S	R> 98% 45°P
200	10*	12*	—
400-405	50	64	31
780	85	109	61
800	88	110	62
1030	99	123	74
1550	124	154	94

* R > 97.0%

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4	STEP-5
PRODUCT CODE	CENTER WAVELENGTH	ANGLE OF INCIDENCE	SIZE CODE	RADII OPTIONS
TLM1	800	0	1025	1.00CC
EXAMPLE: TLM1-800-0-1025-1.00CC				

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

TLM1

2. CENTER WAVELENGTH (nm)

200	400-405	780	800	1030	1550
-----	---------	-----	-----	------	------

3. ANGLE OF INCIDENCE in Degrees

0	0 degrees (normal incidence)
45	45 degrees

4. FLAT SIZE CODE

	Diameter (mm)	Thickness (mm)	Standard Options
0525	12.7	6.35	Flat or Radius
0725	19.1	6.35	Flat Only
1025	25.4	6.35	Flat or Radius
2037	50.8	9.53	Flat Only
3050	76.2	12.7	Flat Only
4050	101.6	12.7	Flat Only

5. RADIUS OF CURVATURE (m)

SIZE CODE	Diameter (mm)	RADII OPTIONS (m), cc = concave		RADII OPTIONS (m), cx = convex
0525	12.7	0.10CC	0.75CC	
		0.25CC	1.00CC	
		0.50CC		
1025	25.4	0.10CC	1.50CC	0.30CX
		0.25CC	2.00CC	0.50CX
		0.50CC	3.00CC	1.00CX
		0.75CC	5.00CC	
		1.00CC	10.00CC	

For Nd:YAG/Nd:YLF wavelengths see page 11

For ArF and KrF wavelengths see page 9

Please see page T-28 for High Reflection Coating Traces.

TUNABLE BROADBAND MIRRORS: TLM2



Specifications

Product Code: **TLM2**

Substrate Material: N-BK7

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ± 0.25 mm

Wedge: ≤ 5 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: ≤ 0.05 mm (spherical substrates only)

Radius Tolerance: $\pm 0.5\%$ (spherical substrates only)

S1 Surface Figure: $< \lambda/10$ p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Adhesion and Durability: Per MIL-C-48497a

Clear Aperture: $\geq 85\%$ of central diameter

Center Wavelength: 780nm, 800nm, or 1030nm

Reflectance: Please refer to the typical bandwidth tables

Angle of Incidence: 45° only

Damage Threshold:

Pulsed:

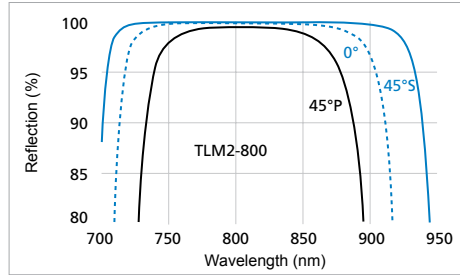
0.28 J/cm², 50 fsec, 50Hz at 800nm

0.50 J/cm², 20ns, 20Hz at 1064nm

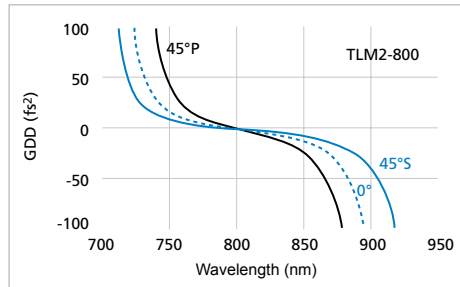
Center Wavelength Tolerance: $\pm 3\%$

Designed for Pulse Lengths: > 30 fs

The TLM2 mirrors are specially designed to achieve high reflectivity and low dispersion for cw oscillators and low-fluence pulses. These mirrors can be coated for any angle of incidence from 0° to 60° and any center wavelength between 450nm and 2100nm for OEM applications. For 45° tuning mirror applications involving very short pulses or very broad bandwidths. Using s - polarization minimizes pulse distortion and maximizes average reflectivity.



Reflectivity vs wavelength of TLM2-800 broadband laser mirror showing 0° and 45° angle of incidence designs



Group delay dispersion vs wavelength of TLM2-800 broadband laser mirror showing 0° and 45° angle of incidence designs

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4
PRODUCT CODE	WAVELENGTH	ANGLE OF INCIDENCE	SIZE CODE
TLM2	800	45	1025

EXAMPLE: TLM2-800-45-1025

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

TLM2

2. WAVELENGTH (nm)

800

1030

3. ANGLE OF INCIDENCE in Degrees

45

45 degrees

4. SIZE CODE

0525

DIAMETER (mm)

12.7

THICKNESS (mm)

6.35

1025

25.4

6.35

TYPICAL BANDWIDTH FOR TLM2 MIRRORS

Center Wave-length (nm)	R > 99% 0°	R > 99.5% S	R > 99% 45° P
800	156	197	76
1030	180	230	80

HIGH POWER Nd:YAG / Nd:YLF LASER MIRRORS: Y1, Y2



Specifications

Product Code: **Y1, Y2**

Substrate Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Wedge: ≤5 arc minutes (flat substrates only)

Chamfer: 0.35mm leg width at 45° nominal

Concentricity: ±0.05mm (spherical substrates only)

Radius Tolerance: ±0.5% (spherical substrates only)

S1 Surface Figure: < λ/10 p-v at 633nm before coating; after coating on select substrates

S1 Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b (at 100W)

S2 Surface Quality: Commercial polish

Clear Aperture: ≥85% of central diameter

Angle of Incidence: 0° or 45° options

Reflectance:

R ≥ 99.9% at 0°

R ≥ 99.6% at 45°, P-Pol

R ≥ 99.8% at 45°, UNP

R ≥ 99.9% at 45°, S-Pol

Adhesion and Durability: Per MIL-C-675c and MIL-C-48497a

Damage Threshold:

Pulsed:

25 J/cm², 20ns, 20Hz at 1064nm

20 J/cm², 20ns, 20Hz at 532nm

cw: 10 MW/cm² at 1064nm

USABLE BANDWIDTH (R_{AVG} ≥ 99.0%):

Y1	1020 - 1100nm
Y2	510 - 560nm

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4
PRODUCT CODE	SIZE CODE	ANGLE OF INCIDENCE	RADII OPTIONS
Y1	1025	0	1.00CC
EXAMPLE: Y1-1025-0-1.00CC			

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE	LASER TYPE	WAVELENGTH (nm)
Y1	Nd:YAG/Nd:YLF	1047-1064
Y2	Nd:YAG/Nd:YLF second harmonic	523-532

2. SIZE CODE	DIAMETER (mm)	THICKNESS (mm)
0525	12.7	6.35
1025	25.4	6.35
1537	38.1	9.53
2037	50.8	9.53
3050	76.2	12.7
4050	101.6	12.7

3. ANGLE OF INCIDENCE	in Degrees
0	0 degrees (normal incidence)
45	45 degrees

4. RADIUS OF CURVATURE (m)				
SIZE CODE	Diameter (mm)	RADII OPTIONS (m), cc = concave		RADII OPTIONS (m), cx = convex
0525	12.7	0.10CC	0.75CC	
		0.25CC	1.00CC	
		0.50CC		
1025	25.4	0.10CC	1.50CC	0.30CX
		0.25CC	2.00CC	0.50CX
		0.50CC	3.00CC	1.00CX
		0.75CC	5.00CC	
		1.00CC	10.00CC	

Please see page T-26 for High Reflection Coating Traces.

PROTECTED SILVER FLAT MIRRORS: PS



- ▶ Protected silver has higher reflectance than aluminum throughout the visible and near-infrared spectral region
- ▶ Minimal pulse distortion for ultrafast Ti:Sapphire lasers
- ▶ A proprietary overcoat provides increased durability
- ▶ CVI Laser Optics suggests using the drag and drop method with acetone for the cleaning of these mirrors.
- ▶ Contact an applications engineer for OEM capabilities

Specifications

Product Code: **PS**

Substrate Material: N-BK7

Dimensional Tolerances:

Square: +0/-0.25mm

Round: +0/-0.25mm

Thickness Tolerance: ±0.25mm

Parallelism: ≤5 arc minutes

Chamfer:

Ø ≤ 50.8mm: 0.35mm leg width at 45° nominal

Ø > 50.8mm: 0.85mm leg width at 45° nominal

S1 Surface Figure: < λ/10 p-v at 633nm on select substrates

S1 Surface Quality: 40-20 scratch-dig per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

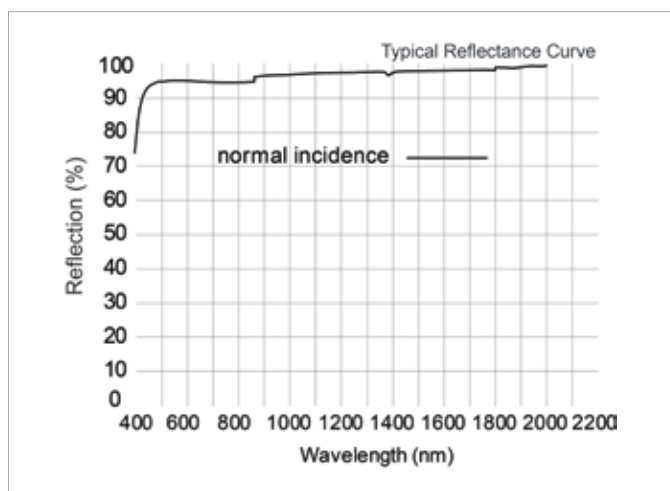
Clear Aperture:

Round: ≥85% of central diameter

Square: ≥80% of edge dimension

Coating: Protected silver

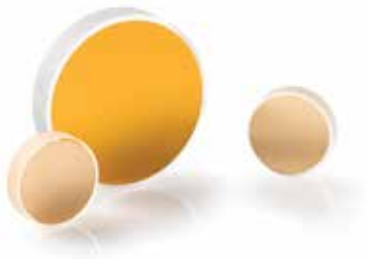
Average Reflectance: ≥95% at 400nm to 20μm



Protected silver coating at 0°

PROTECTED SILVER FLAT MIRRORS						
Shape	Ø (mm)	□ (mm)	t (mm)	Min. Clear Aperture (mm)	Surface Figure (S1)	PART NUMBER
Round	12.7	—	6.35	10.8	< λ/10	PS-PM-0525-C
Round	25.4	—	6.35	21.6	< λ/10	PS-PM-1025-C
Square	—	25.4	6.35	22.5x22.5	< λ/4	PS-SQM-1025-C
Round	50.8	—	9.53	43.2	< λ/10	PS-PM-2037-C
Square	—	50.8	9.53	45.0x45.0	< λ/4	PS-SQM-2037-C
Round	76.2	—	12.7	64.8	< λ/10	PS-PM-3050-C

PROTECTED GOLD FLAT MIRRORS: PG



Specifications

Product Code: **PG**

Substrate Material: N-BK7

Dimensional Tolerances:

Square: $+0/-0.25\text{mm}$

Round: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Parallelism: ≤ 5 arc minutes

Chamfer:

$\varnothing \leq 50.8\text{mm}$: 0.35mm leg width at 45° nominal

$\varnothing > 50.8\text{mm}$: 0.85mm leg width at 45° nominal

S1 Surface Figure: $< \lambda/10$ p-v at 633nm on select substrates

S1 Surface Quality: 40-20 scratch-dig per MIL-PRF-13830b

S2 Surface Quality: Commercial polish

Clear Aperture:

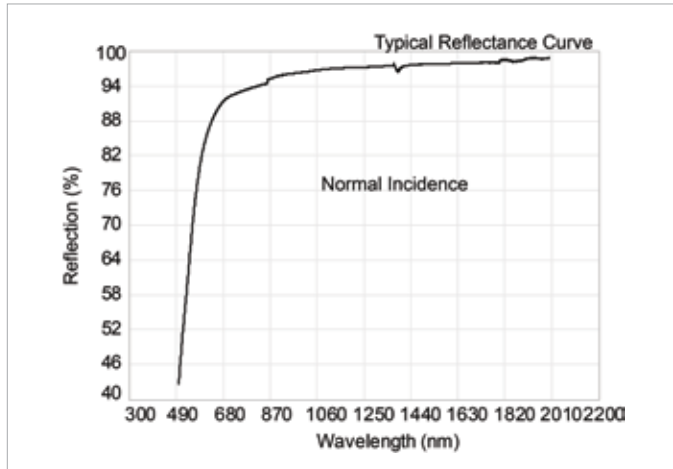
Square: $\geq 80\%$ of edge dimension

Round: $\geq 85\%$ of central diameter

Coating: Protected gold

Average Reflectance: $\geq 95.5\%$ at 650 – 1700nm,
 $\geq 98.0\%$ at 2 – 20 μm

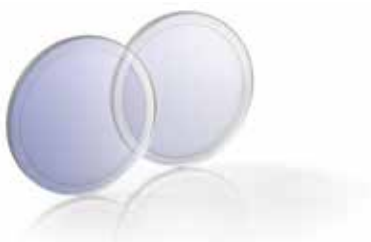
- ▶ Protected gold combines the natural spectral performance of gold with the enhanced protection of a durable dielectric overcoat
- ▶ Protected gold provides 95.5% average reflectance from 650 to 1700nm, and over 98% average reflectance from 2 to 20 μm
- ▶ Contact an applications engineer for OEM capabilities and/or bare gold coatings



Protected gold coating at 0°

PROTECTED GOLD FLAT MIRRORS						
Shape	$\varnothing$ (mm)	$\square$ (mm)	t (mm)	Clear Aperture (mm)	Surface Figure (S1)	PART NUMBER
Round	12.7	—	6.35	10.8	$< \lambda/10$	PG-PM-0525-C
Round	25.4	—	6.35	21.6	$< \lambda/10$	PG-PM-1025-C
Round	50.8	—	9.53	43.2	$< \lambda/10$	PG-PM-2037-C
Round	76.2	—	12.7	64.8	$< \lambda/10$	PG-PM-3050-C

FEMTOSECOND BEAMSPLITTER: FABS



Specifications

Product Code: **FABS**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Diameter: 25.4mm +0/-0.25mm

Thickness: 1.0mm ±0.25mm

Wedge Tolerance: ≤10 arc sec

Chamfer: 0.35mm leg width at 45° nominal

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Surface Figure: < $\lambda/10$ p-v at 633nm before coating;
after coating on select substrates

Clear Aperture: ≥85% of central diameter

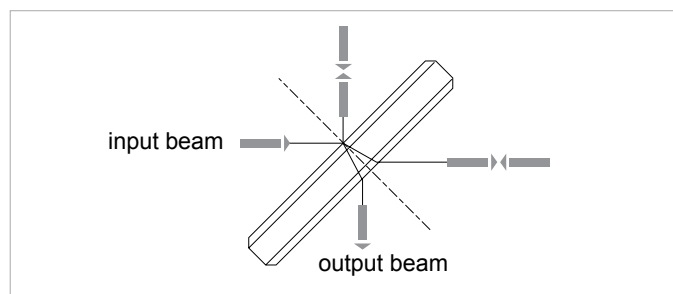
Transmission: [1-R] first surface

Angle of Incidence: 45°

Polarization: Specify s- or p-polarization.

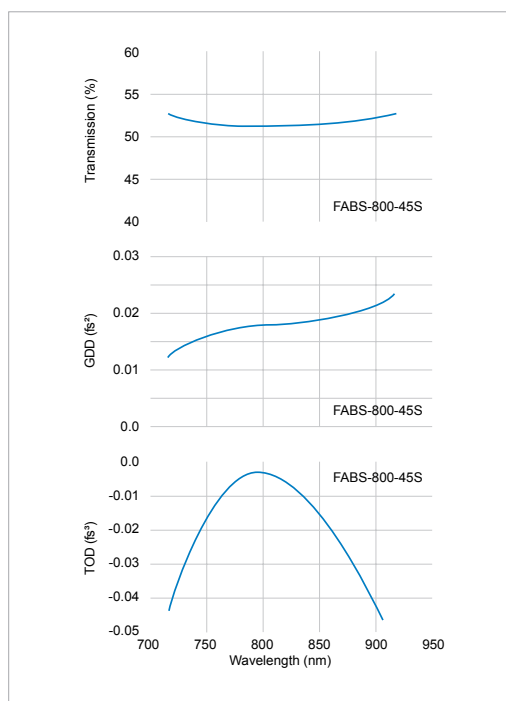
Femtosecond autocorrelator beamsplitters are broadband, 50% all-dielectric beamsplitters. They are useful in many types of pump-probe experiments and in the construction of anti-resonant ring configurations. They are essentially lossless and extremely durable. Both are advantages over partially reflecting metal coatings.

As with virtually all dielectric coated optics, the s-polarized version is broader than p-polarized. CVI Laser Optics can produce FABS in other than 50:50 with excellent phase characteristics.

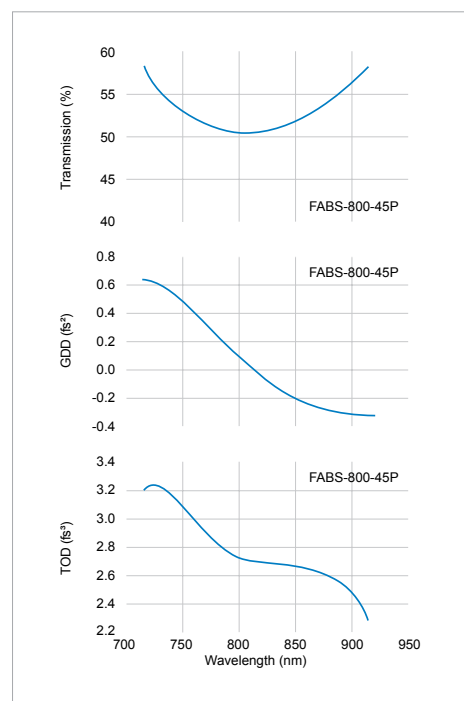


FEMTOSECOND BEAMSPLITTERS

Wavelength (nm)	Polarization	PART NUMBER
790.0	P	FABS-790-45P-PW1-1004-UV
790.0	S	FABS-790-45S-PW1-1004-UV
800.0	P	FABS-800-45P-PW1-1004-UV
800.0	S	FABS-800-45S-PW1-1004-UV
1550.0	S	FABS-1550-45S-PW1-1004-UV



S-Polarized



P-Polarized

HIGH ENERGY BROADBAND POLARIZING CUBE BEAMSPLITTERS: PBSK



Specifications

Product Code: **PBSK**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)

Edge Dimension Tolerance (X,Y): $\pm 0.25\text{mm}$

Surface Quality: 20-10 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/4$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central dimension

Extinction Ratio: $T_p/T_s > 1000:1$

Anti-reflection Coating:

$R_{\text{avg}} \leq 0.50\%$, all entrance and exit surfaces

Damage Threshold:

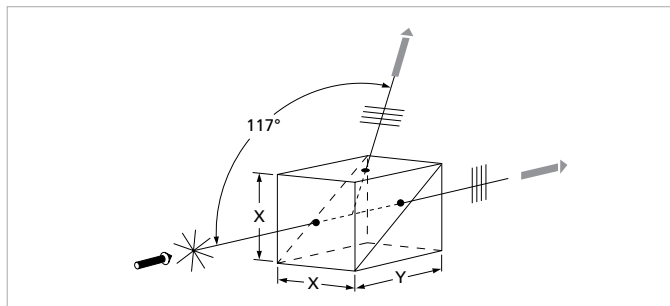
Pulsed: 5 J/cm^2 , 20ns, 20 Hz at 1064nm

cw: 1 MW/cm^2 at 1064nm

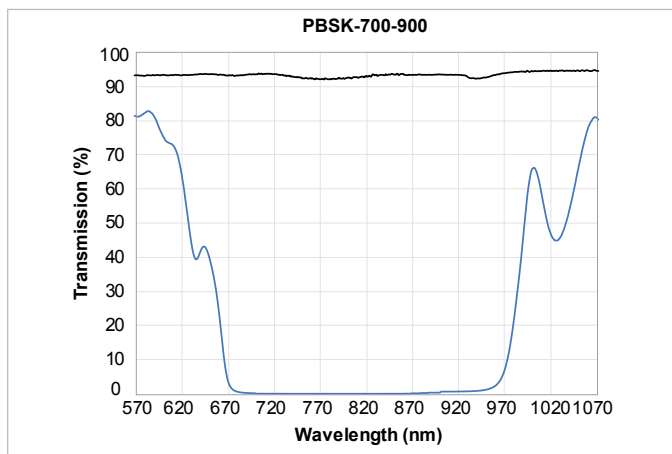
An alternative to calcite and Brewster angle polarizers, the PBSK is an optimal solution for high-energy broadband or multi-line systems. Unlike cemented cube polarizers, the PBSK is optically contacted, coated with all-dielectric materials and manufactured from fused silica to ensure high transmission and high damage threshold.

To avoid damage when using a high power laser, be sure to orient the cube so that the beam enters through the prism marked with the dot.

- Designed for Pulse Lengths $> 15 \text{ fs}$
- Contact CVI Laser Optics for other designs between 230nm and 2100nm



PBSK high-energy broadband polarizing beamsplitter cubes



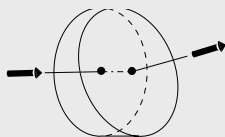
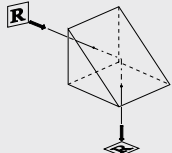
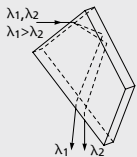
P-POL: — UNP: - - - S-POL: — 0°: ···

HIGH ENERGY BROADBAND POLARIZING CUBE BEAMSPLITTERS

X x Y (mm)	PART NUMBER
12.7x17.5	PBSK-700-900-050
15.4x35.3	PBSK-700-900-100

CVI Laser Optics specializes in
prototype to volume production manufacturing!

SELECTION GUIDE

PRODUCT TYPE	DESCRIPTION	PAGE
WEDGE WINDOWS/PRISMS: LW-C,LW-UV 	Wedge windows or prisms deviate an incident beam at a precise angle. Two wedge prisms of equal power can be combined to create a beam-steering apparatus that can place a beam anywhere within a cone defined by the deviation angle.	145
RIGHT-ANGLE PRISMS: RAP-C, RAP-UV, P90-C, P90-UV, P180-C, P180-UV 	Right-angle prisms bend the image by 90° and invert the image. Right-angle prisms may also be used to retroreflect a collimated beam (bend the image 180°).	146
PELLIN BROCA PRISMS: PLBC 	In a Pellin Broca prism, light enters the right-angle prism normal to one of its faces, is turned exactly 90°, is presented to the second “half” dispersing prism in minimum deviation, and hence exits the Pellin Broca prism deviated at exactly 90° to its initial direction. This is what is meant by calling the Pellin Broca prism a “constant deviation prism”.	148

LARGE WEDGE WINDOWS: LW



Specifications

Product Code: **LW**

Optical Material:

Standard Grade Corning 7980 1-D (Fused Silica)
or N-BK7

Diameter Tolerance: $+0/-0.25\text{mm}$

Thickness Tolerance: $\pm 0.25\text{mm}$

Wedge Tolerance: ± 6 minutes

Chamfer: $\emptyset \leq 50.8\text{mm}$: leg width 0.35mm at 45° nominal
 $\emptyset > 50.8\text{mm}$: 0.85mm leg width at 45° nominal

Surface Quality: 10-5 scratch-dig per MIL-PRF-13830b

Transmitted Wavefront Error (TWE): $< \lambda/10$ p-v at 633nm

Clear Aperture: $\geq 85\%$ of central diameter

Large wedge windows are laser quality windows manufactured with wedges of 1° or 3° . These larger wedges prevent interference by stray back reflection and have several applications in beam steering.

- ▶ All CVI Laser Optics low loss, high energy AR coatings available
- ▶ Other dimension, wedge or material options available for OEM applications

LARGE WEDGE WINDOWS			
Standard Grade Corning 7980 1-D (Fused Silica)			
$\emptyset$	* t (mm)	Wedge α	PART NUMBER
25.4	9.53	1°	LW-1-1037-UV
50.8	9.53	1°	LW-1-2037-UV
25.4	9.53	3°	LW-3-1037-UV
50.8	9.53	3°	LW-3-2037-UV
76.2	12.7	3°	LW-3-3050-UV
N-BK7			
$\emptyset$	* t (mm)	Wedge α	PART NUMBER
25.4	9.53	1°	LW-1-1037-C
50.8	9.53	1°	LW-1-2037-C
25.4	9.53	3°	LW-3-1037-C
50.8	9.53	3°	LW-3-2037-C

*Thick end of wedge

To apply an AR coating on any of the RW products refer to page 93 and replace Steps 2,3,4 with any of the product codes listed above.

Using Large Wedge Windows

For small angles of incidence, the deviation of a ray incident on a wedged window with wedge angle α is

$$\theta_d = \frac{\eta_s}{\eta_a} \alpha$$

The first reflected ray is misaligned from the initial axis by an angle defined by

$$\theta_r = \frac{2\eta_s \alpha}{\eta_a}$$

If $\eta_a = 1$, then $\theta_r = 2\eta_s \alpha$.

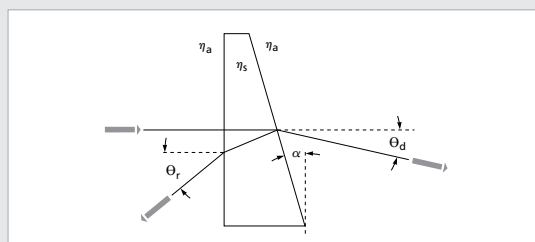


Figure 1. Deviation and reflection of beam by a wedged window of wedge α

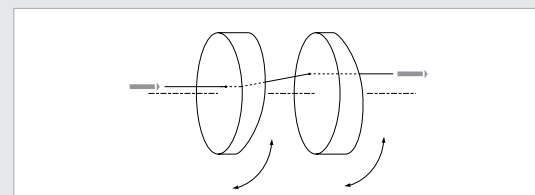


Figure 2. A beamsteering wedge formed from two wedged prisms

RIGHT-ANGLE PRISMS: RAP-C, RAP-UV



Specifications

Product Code: **RAP-C, RAP-UV**

Optical Material: N-BK7 or Standard Grade Corning 7980 1-D (Fused Silica)

Dimensional Tolerance: +0/-0.25mm

Angular Deviation: ± 3 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

Surface Quality: Per MIL-PRF-13830b; see table

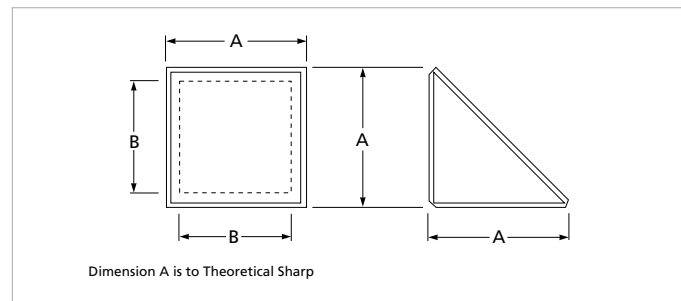
Surface Figure:

N-BK7: $< \lambda/4$ p-v at 633nm before coating

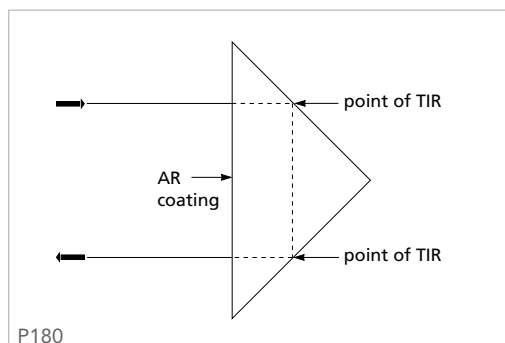
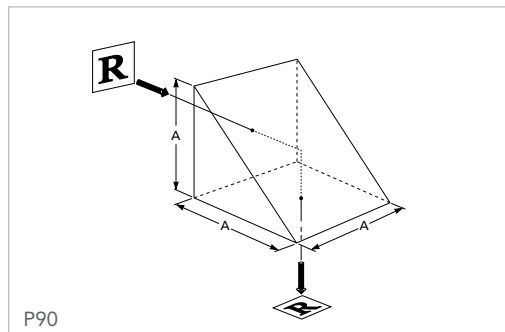
Fused Silica: $< \lambda/10$ p-v at 633nm before coating

Right angle prisms (RAP) are most commonly used for image rotation, redirection of light, and as components for both polarizing and non-polarizing beamsplitter cubes. Because of their simple 45°-45°-90° design and high-quality surface polish, they can be used as high energy 90° bending prisms or 180° folding prisms. They can be anti-reflection coated in these applications to increase overall transmission, or metal coated for use as external turning mirrors.

- Contact CVI Laser Optics for other dimensions or material options for OEM applications



Uncoated right-angle prisms



RIGHT-ANGLE PRISMS

N-BK7

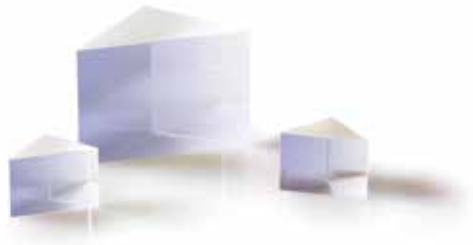
*Surface Figure	Surface Quality	A (mm)	Clear Aperture B (mm) min.	PART NUMBER
$< \lambda/4$	20-10	5.0	3.0	RAP-020-C
$< \lambda/4$	20-10	10.0	8.0	RAP-040-C
$< \lambda/4$	20-10	12.7	10.8	RAP-050-C
$< \lambda/4$	20-10	15.0	12.8	RAP-060-C
$< \lambda/4$	20-10	20.0	17.0	RAP-080-C
$< \lambda/4$	20-10	25.4	21.6	RAP-100-C
$< \lambda/2$	60-40	40.0	36.0	RAP-157-C

Standard Grade Corning 7980 1-D (Fused Silica)

*Surface Figure	Surface Quality	A (mm)	Clear Aperture B (mm) min	PART NUMBER
$< \lambda/10$	10-5	10.0	8.0	RAP-040-UV
$< \lambda/10$	10-5	12.7	10.8	RAP-050-UV
$< \lambda/10$	10-5	25.0	21.0	RAP-090-UV
$< \lambda/10$	10-5	25.4	21.6	RAP-100-UV

* Measured p-v at 633nm

PRECISION RIGHT-ANGLE BENDING & FOLDING PRISMS: P90-C, P90-UV, P180-C, P180-UV



Specifications

Product Code: **P90-C, P90-UV, P180-C, P180-UV**

Optical Material: N-BK7 or Standard Grade Corning 7980 1-D (Fused Silica)

Dimensional Tolerance: +0/-0.25mm

Angular Deviation: ± 3 arc minutes

Chamfer: 0.35mm leg width at 45° nominal

Surface Figure:

N-BK7: $< \lambda/4$ p-v at 633nm before coating

Fused Silica: $< \lambda/10$ p-v at 633nm before coating

Surface Quality:

N-BK7: 20-10 scratch-dig per MIL-PRF-13830b

Fused Silica: 10-5 scratch-dig per MIL-PRF-13830b

Clear Aperture: $\geq 85\%$ of central dimension

Anti-reflection Coating:

Single wavelength: $R \leq 0.25\%$ per surface

Broadband: $R_{avg} \leq 0.50\%$ per surface

Adhesion and Durability: Per MIL-C-48497a

Damage Threshold:

Pulsed: 10 J/cm², 20ns, 20Hz at 1064nm

cw: 10 MW/cm² at 1064nm

P90 right-angle bending prisms utilize the inherent total internal reflection (TIR) at the hypotenuse to invert the image and achieve a 90° change in direction. P180 right-angle folding prisms utilize the inherent total internal reflection at the leg faces to achieve a 180° change in direction (i.e., retroreflection). Antireflection coatings are applied to maximize the overall throughput and reduce any back-reflection.

- ▶ Use P90 series 90° bending prisms as broadband, high energy 90° reflectors: CVI Laser Optics high energy AR and BBAR coatings can be applied to legs
- ▶ Use P180 series 180° folding prisms as broadband, high-energy retroreflectors: CVI Laser Optics high energy AR and BBAR coatings can be applied to hypotenuse
- ▶ Aluminized hypotenuse with black overcoat, other dimensions or wavelengths available for OEM applications

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3	STEP-4
PRODUCT CODE	SIZE CODE	AR COATING WAVELENGTH (nm)	MATERIAL CODE
P90	050	1064	C

EXAMPLE: P90 - 050 - 1025 - C

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE

P90	90° bending prism
P180	180° folding prism

2. SIZE CODE DIMENSION A (mm) (Theoretical Sharp)

050	12.7
100	25.4

3. WAVELENGTH OF AR COATING (nm)

193*	266*	532	1064
248*	355*	633	1050-1600
248-355*	415-700	632-1064	1500

4. MATERIAL CODE

MATERIAL CODE	MATERIAL
C	N-BK7
UV	Standard Grade Corning 7980 1-D (Fused Silica)

Please see page T-31 for Anti-reflection Coating Traces.

*Only available in Standard Grade Corning 7980 1-D (Fused Silica).

PELLIN BROCA PRISMS: PLBC



Specifications

Product Code: **PLBC**

Optical Material: Heraeus Suprasil 1 or Crystal Quartz

Dimensional Tolerance: $\pm 0/-0.25\text{mm}$

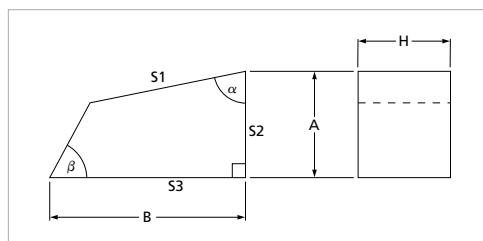
Angular Deviation: $\alpha: \pm 30 \text{ arc min}$ $\beta: \pm 2^\circ$

Chamfer: 0.35mm leg width at 45° nominal

Surface Figure: $< \lambda/10$ p-v at 633nm

Surface Quality: 10-5 scratch-dig on three polished surfaces per MIL-PRF-13830b

Clear Aperture: $\geq 85\%$ of central dimension



PLBC Pellin Broca prism

In a Pellin Broca prism, an ordinary dispersing prism is split in half along the bisector of the apex angle. Using a right-angle prism, the two halves are joined to create a dispersing prism with an internal right angle bend obtained by total internal reflection. See Figure 1.

A simple dispersing prism always deviates the longer wavelength less than the shorter wavelength. In a Pellin Broca prism, whether the longer wavelength is deviated more or less depends on the orientation of the prism. This is an important consideration when designing a high power Pellin Broca beam separator. This is illustrated in Figures 2 and Figures 3.

- Ideal for 90° wavelength deviation or beam separation
- Suprasil 1 for 180 to 240nm region
- Crystal quartz is specifically designed for high power Q-switched 266nm laser pulses above fluence levels of 50 mJ/cm^2

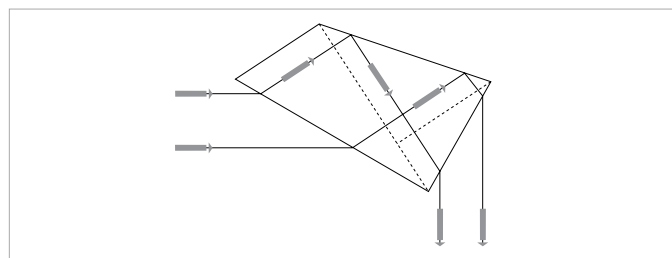


Figure 1. One of the wavelengths deviates by exactly 90° to its initial direction

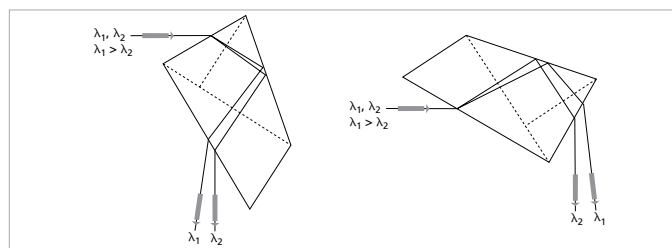


Figure 2. Whether the longer wavelength is deviated more or less depends on the orientation of the prism.

PELLIN BROCA PRISMS

Optical Material	A (mm)	B (mm)	H (mm)	Clear Aperture (mm)	α	PART NUMBER
Suprasil 1	11.0	20.0	6.4	5.0	79.5°	PLBC-5.0-79.5-SS
Crystal Quartz	23.5	40.0	12.7	10.0	77.2°	PLBC-10.0-77.2-CQ



Our suite of optical filters includes both interference filters and neutral density filters that enable its user to attenuate light at a specific wavelength or over a wavelength range. Drawing on an assembled combination of color glass, metallic films, and dielectric coatings, our portfolio of interference filters include both narrow and wide bandpass filters balancing transmission and full width half max (FWHM) over ultraviolet (UV), visible, and near-infrared (NIR) wavelengths. Neutral density filters are offered at an assortment of different optical density ranges; combined with fused silica, they are rather multifaceted in that they can simultaneously function from the UV to NIR.

SELECTION GUIDE	150
INTERFERENCE FILTERS	151
NEUTRAL DENSITY FILTERS	153

Don't see exactly what you are looking for?

CVI Laser Optics specializes in
prototype to volume production manufacturing!

Give us a call and we will be honored to assist you with your custom needs.

NOTES:

SELECTION GUIDE

DIAGRAM	PRODUCT TYPE	FWHM	TRANSMISSION (%)	BLOCKING OPTICAL DENSITY	APPLICATIONS	PAGE
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Transmission Filters

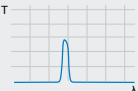
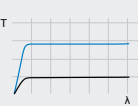
	INTERFERENCE FILTERS: F-UV, F-VIS, F-NIR	1.5 – 70nm depending on CWL	12–70 (peak) depending on CWL	3 - 4	Laser-line clean-up	151
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DIAGRAM	PRODUCT TYPE	TRANSMISSION (%)	BLOCKING OPTICAL DENSITY	APPLICATIONS	PAGE
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Neutral Density and Specialty Filters

	METALLIC NEUTRAL DENSITY FILTERS: NDQ, FSQ	0.01 – 79.43	0.1 - 4.0	Broadband attenuation	153
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BANDPASS INTERFERENCE FILTERS, UV & VISIBLE (355 – 749NM): F-UV, F-VIS



Specifications

Product Code: **F-UV, F-VIS**

Bandpass Interference Filters: Visible (355 - 749nm)

Diameter Tolerance: +0/-0.25mm

Thickness Tolerance: 6.35mm (nominal)

Surface Figure: Commercial Polish

Surface Quality: 80-50 scratch-dig
per MIL-PRF-13830b

Center Wavelength: $\lambda_c \pm 0.2 \times \text{FWHM}$

Bandwidth Tolerance: $\text{FWHM} \pm 20\%$

Blocking Minimum: x-ray to 1200nm

Clear Aperture: $\varnothing = 12.5\text{mm}$: 9.0mm, $\varnothing = 25.0\text{mm}$:
21.0mm, $\varnothing = 50.0\text{mm}$: 45.0mm

Mounting: Black-anodized aluminum ring

- ▶ Out of band rejection of Optical Density (OD) ≥ 4 average and $\geq \text{OD } 3$ absolute
- ▶ Custom options are available for center wavelength, bandwidth, optical blocking, and size
- ▶ Unmounted option also available

Visit cvilaseroptics.com for additional traces.

BANDPASS INTERFERENCE FILTERS, VISIBLE (355 - 749nm)

λ_c (nm)	FWHM (nm)	Minimum T_{peak} (%)	25.0 (mm)
355	10 ± 2	25	F10-355.0-4-25.0M
400	10 ± 2	25	F10-400.0-4-25.0M
400	40 ± 8.0	35	F40-400.0-4-25.0M
405	10 ± 2	30	F10-405.0-4-25.0M
420	10 ± 2	40	F10-420.0-4-25.0M
430	10 ± 2	40	F10-430.0-4-25.0M
435.8	10 ± 2	40	F10-435.8-4-25.0M
450	10 ± 2	45	F10-450.0-4-25.0M
450	40 ± 8.0	45	F40-450.0-4-25.0M
470	10 ± 2	45	F10-470.0-4-25.0M
500	10 ± 2	45	F10-500.0-4-25.0M
510	10 ± 2	45	F10-510.0-4-25.0M
514.5	10 ± 2	50	F10-514.5-4-25.0M
527	10 ± 2	45	F10-527.0-4-25.0M
532	1.5 ± 0.3	30	F1.5-532.0-4-25.0M
532	3 ± 0.6	35	F03-532.0-4-25.0M
532	10 ± 2	45	F10-532.0-4-25.0M
550	40 ± 8.0	50	F40-550.0-4-25.0M
550	70 ± 14.0	60	F70-550.0-4-25.0M
560	10 ± 2	50	F10-560.0-4-25.0M
570	10 ± 2	50	F10-570.0-4-25.0M
577	10 ± 2	50	F10-577.0-4-25.0M
580	10 ± 2	50	F10-580.0-4-25.0M
589.6	1.5 ± 0.3	35	F1.5-589.6-4-25.0M
600	10 ± 2	50	F10-600.0-4-25.0M
600	40 ± 8.0	50	F40-600.0-4-25.0M
630	10 ± 2	50	F10-630.0-4-25.0M
632.8	10 ± 2	50	F10-632.8-4-25.0M
635	10 ± 2	50	F10-635.0-4-25.0M
650	40 ± 8.0	50	F40-650.0-4-25.0M
656.2	1.5 ± 0.3	35	F1.5-656.2-4-25.0M
656.2	10 ± 2	50	F10-656.2-4-25.0M
660	10 ± 2	50	F10-660.0-4-25.0M
670	10 ± 2	50	F10-670.0-4-25.0M
700	10 ± 2	50	F10-700.0-4-25.0M
700	40 ± 8.0	50	F40-700.0-4-25.0M

BANDPASS INTERFERENCE FILTERS, NEAR IR (701 – 1200nm): F-NIR



- ▶ Out of band rejection of Optical Density (OD) ≥ 4 average and $\geq$ OD 3 absolute
- ▶ Custom options are available for center wavelength, bandwidth, optical blocking, and size
- ▶ Contact an applications engineer for more information on custom parts

Visit cvilaseroptics.com for additional traces.

Specifications

Product Code: **F-NIR**

Bandpass Interference Filters: Near IR (750 - 1200nm)

Diameter Tolerance: $\pm 0/-0.25$ mm

Thickness Tolerance: 6.35mm (nominal)

Surface Figure: Commercial Polish

Surface Quality: 80-50 scratch-dig per MIL-PRF-13830b

Center Wavelength: $\lambda_c \pm 0.2 \times \text{FWHM}$

Bandwidth Tolerance: FWHM $\pm 20\%$

Blocking Minimum: x-ray to 3500+nm

Clear Aperture: $\varnothing=12.5$ mm: 9.0mm, $\varnothing=25.0$ mm: 21.0mm, $\varnothing=50.0$ mm: 45.0mm

Mounting: Black-anodized aluminum ring

BANDPASS INTERFERENCE FILTERS, NEAR IR (750 - 1200nm)

λ_c (nm)	FWHM (nm)	Minimum T_{peak} (%)	25.0 (mm)
750	40 ± 8	.0 50	F40-750.0-4-25.0M
780	10 ± 2	50	F10-780.0-4-25.0M
785	10 ± 2	50	F10-785.0-4-25.0M
794.7	1.5 ± 0.3	35	F1.5-794.7-4-25.0M
794.7	3 ± 0.6	40	F03-794.7-4-25.0M
800	10 ± 2	45	F10-800.0-4-25.0M
800	40 ± 8	60	F40-800.0-4-25.0M
830	10 ± 2	50	F10-830.0-4-25.0M
850	10 ± 2	50	F10-850.0-4-25.0M
850	40 ± 8	50	F40-850.0-4-25.0M
900	10 ± 2	45	F10-900.0-4-25.0M
950	10 ± 2	45	F10-950.0-4-25.0M
950	40 ± 8.0	45	F40-950.0-4-25.0M
1000	10 ± 2	45	F10-1000.0-4-25.0M
1064	3 ± 0.6	40	F03-1064.0-4-25.0M
1064	10 ± 2	50	F10-1064.0-4-25.0M
1200	10 ± 2	40	F10-1200.0-4-25.0M

METALLIC NEUTRAL DENSITY FILTERS: **NDQ**



Specifications

Product Code: **NDQ**

Material: Standard Grade Corning 7980 1-F or equivalent (Fused Silica)

Dimension Tolerance: $\pm 0.2\text{mm}$

Diameter Tolerance: $\pm 0/-0.25\text{mm}$

Thickness Tolerance: $2.0 \pm 0.2\text{mm}$

Surface Quality: 80-50 scratch-dig per MIL-PRF-13830b

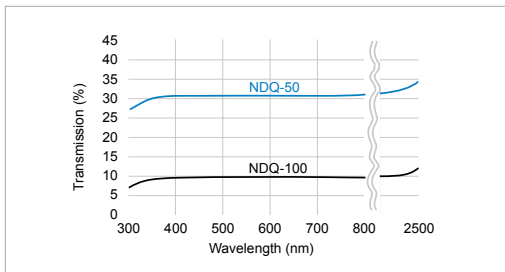
Surface Flatness: $< 3\lambda$ p-v at 633nm per 25mm

Density Tolerance: $\pm 5\%$ of optical density at 546nm

Accuracy of Spectrophotometer Curves: Between 200nm and 700nm $\pm 1\%$ of full scale

Parallelism: < 3 arc minutes

Clear Aperture: $> 85\%$



Transmission vs. wavelength for NDQ-50 and NDQ-100 metallic neutral density filters

CVI Laser Optics metallic neutral density filters attenuate light through a combination of reflection and absorption. The alloy Inconel® creates a spectral-density curve that is flatter over a wider range than the curves of most pure metals and therefore allows the relative spectral distribution to be maintained.

- Uniform light attenuation over a broad spectrum
- Operational temperature range: -73°C to $+150^{\circ}\text{C}$
- Typical Laser Damage Threshold ≤ 25 Watts/cm²
- Ideal for wide aperture applications

BUILD YOUR PART NUMBER

STEP-1	STEP-2	STEP-3
PRODUCT CODE	OPTICAL DENSITY CODE	SIZE CODE
NDQ	100	50.0 X 50.0 M
EXAMPLE: NDQ-100-50.0 X 50.0 M		

CHOOSE FROM THE OPTIONS BELOW.

1. PRODUCT CODE	SUBSTRATE MATERIAL
NDQ	Fused Silica

2. OPTICAL DENSITY CODE	OPTICAL DENSITY	~ % T
10	0.10	79.4
20	0.20	63.1
30	0.30	50.1
40	0.40	39.8
50	0.50	31.6
60	0.60	25.1
70	0.70	20.0
80	0.80	15.8
90	0.90	12.6
100	1.00	10.0
150	1.50	3.2
200	2.00	1.0
300	3.00	0.1
400	4.00	0.01

3. SIZE CODE	SIZE
0.50	12.7mm
25.0 M	25.0mm
1.00	25.4mm
50.0 X 50.0 M	50.0mm x 50.0mm

Visit cvilaseroptics.com for additional traces.

METALLIC NEUTRAL DENSITY FILTER SETS: FSQ



- ▶ CVI Laser Optics offers a selection of metallic ND filter sets to provide a broad range of filter options.
- ▶ Filters include individual density curves and wooden storage box

Specifications

Product Code: **FSQ**

Optical Material:

Standard Grade Corning 7980 (Fused Silica)

Density Tolerance: $\pm 5\%$ of optical density at 546nm,
 ± 0.02 density for density > 1.0

Thickness: $2.0 \pm 0.2\text{mm}$

Surface Flatness: $< 3 \lambda$ p-v at 633nm per 25mm

Surface Quality: 80-50 scratch-dig per MIL-PRF-13830b

METALLIC NEUTRAL DENSITY FILTER SETS:

Standard Grade Corning 7980 (Fused Silica)			
Size (mm)	Number of Elements	Included Optical Densities (at 550nm)	PART NUMBER
□50.0 x 50	7	0.03*, 0.1, 0.3, 0.5, 1.0, 2.0, 3.0	FSQ-50.0X50.0M

* This includes a blank substrate of N-BK7 ($D_0=0.0376$) or fused silica ($D_0=0.0309$), as appropriate.