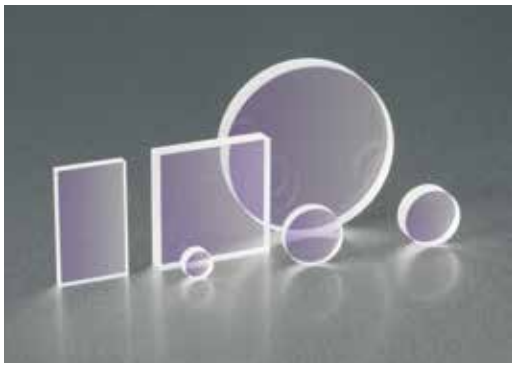
WINDOWS AND OPTICAL



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

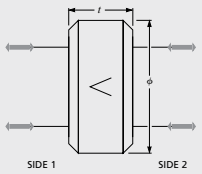
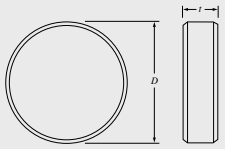
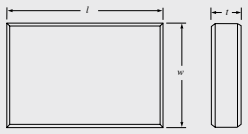
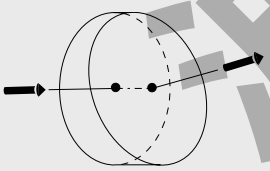
Don't see exactly what you are looking for?

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	DESCRIPTON	PAGE
ANTI-REFLECTION COATED WINDOWS: W1, W2 	Anti-reflection coated parallel windows feature low distortion, low scatter and excellent parallelism. A surface flatness of λ/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 λ/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

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 SECON

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

Specifications

Product Code: PW1

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

Diameter Tolerance: +0/–0.25mm

Thickness Tolerance: ±0.25mm

Wedge Tolerance: ≤10 arc seconds

Chamfer:
Ø ≤ 50.8mm: 0.35mm leg width 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

LASER GRADE PLANE PARALLEL WINDOW

Standard Grade Corning 7980 1-D (Fused Silica)

Ø (mm)	t (mm)	Transmitted Wavefront Error p-v at 633nm	PART NUMBER
12.7	1.0	< λ/4	PW1-0504-UV
12.7	3.175	< λ/10	PW1-0512-UV
12.7	6.35	< λ/10	PW1-0525-UV
19.1	6.35	< λ/10	PW1-0725-UV
25.0	6.0	< λ/10	PW1-2506M-UV
25.4	2.0	< λ/4	PW1-1008-UV
25.4	3.175	< λ/10	PW1-1012-UV
25.4	6.35	< λ/10	PW1-1025-UV
25.4	9.525	< λ/10	PW1-1037-UV
38.1	6.35	< λ/10	PW1-1525-UV
50.0	10.0	< λ/10	PW1-5010M-UV
50.8	6.35	< λ/10	PW1-2025-UV
50.8	9.525	< λ/10	PW1-2037-UV
76.2	12.7	< λ/10	PW1-3050-UV
101.6	12.7	< λ/10	PW1-4050-UV
152.4	25.4	< λ/10	PW1-6010-UV

N-BK7

Ø (mm)	t (mm)	Transmitted Wavefront Error p-v at 633nm	PART NUMBER
12.7	6.35	< λ/10	PW1-0525-C
25.0	6.0	< λ/10	PW1-2506M-C
25.4	6.35	< λ/10	PW1-1025-C
50.0	10.0	< λ/10	PW1-5010M-C
50.8	9.525	< λ/10	PW1-2037-C

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 λ/10 peak-to-valley at 633nm over 85% of the window's dimension.

Specifications

Product Code: RW

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

Dimensional Tolerance: +0/-0.25mm

Thickness Tolerance: ±0.25mm

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): < λ/10 p-v at 633nm

Clear Aperture: ≥85% of central 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.

INTERFEROMETWER FLATS: IF

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
- < λ/10 transmitted wavefront, 10-5 surface quality

Specifications

Product Code: IF

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

Diameter Tolerance: +0/–0.25mm

Thickness Tolerance: ±0.25mm

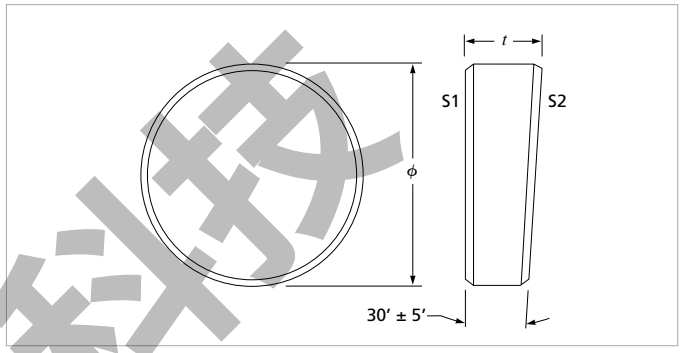
Wedge Tolerance: 30 ±5 arc minutes

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



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 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

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			
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 $\theta_r = 2\eta_s\alpha$.

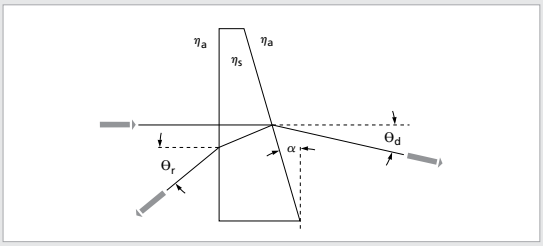


Figure 1. Deviation and reflection of beam by a wedged window of wedge α

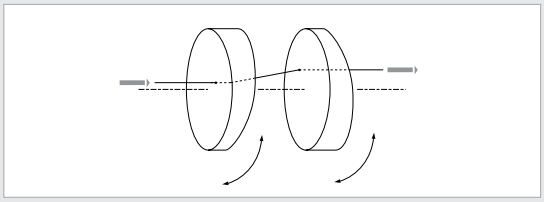


Figure 2. A beamsteering wedge formed from two wedged prisms

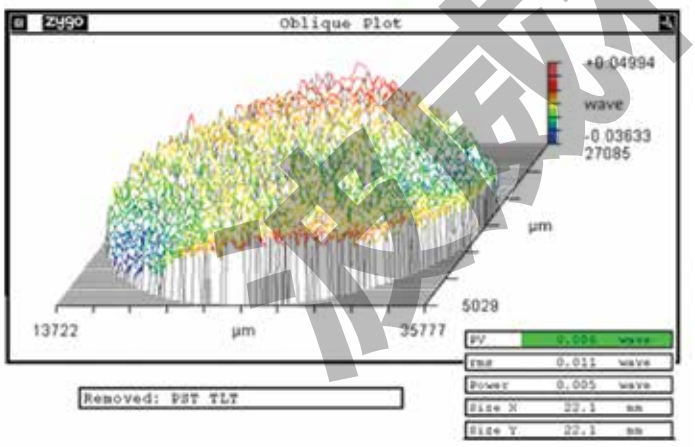
High Energy, High Extinction Plate and C rs

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.

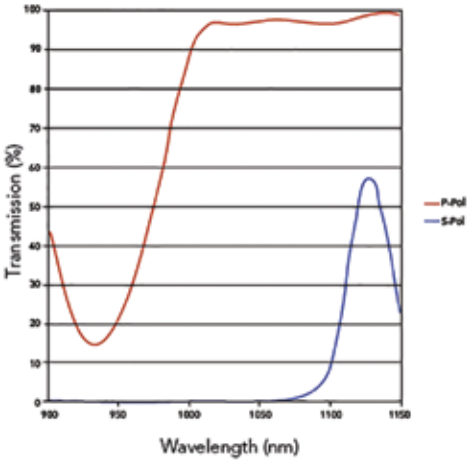
Newly Improved Optically Contacted Laser Line Polarizing Cube Beamsplitter

- Catalog Product Code: PBSO (see page 113)
- Increased laser damage threshold (>30J/cm2, 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) < L/10 p-v at 633nm over specified CA

PBSO Interferogram



PBSO for 1064 nm



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) < L/20 p-v at 633nm over Specified CA
- Expansive In-House Metrology for any Required Documentation