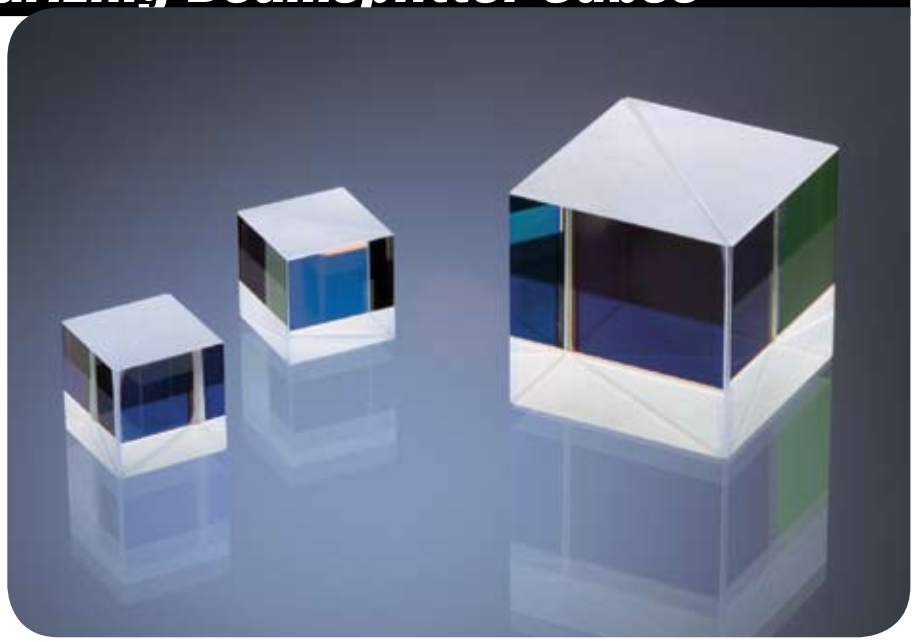
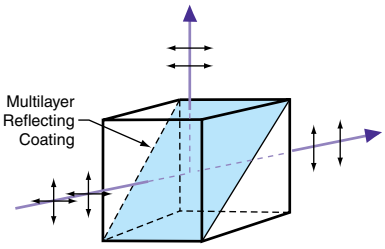
Prisms & Polarizers

Broadband Polarizing Beamsplitter Cubes

- ***Laser quality***
- ***Usable over wide wavelength ranges***





These cemented Polarizing Beamsplitter Cubes are coated to enable operation over a wide range of wavelengths.

The polarization separation is excellent with the transmitted and reflected beams at 90° to each other irrespective of wavelength.

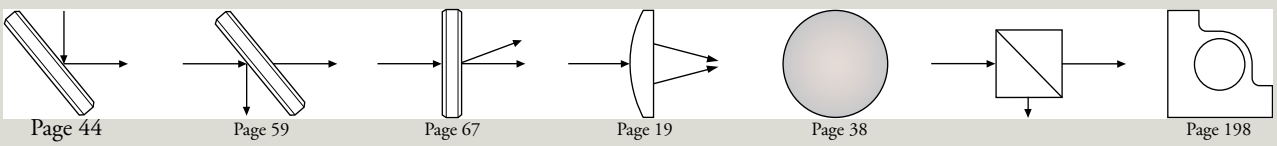
Specifications

Material: SF-2 glass
Transmission (p-polarized): >90% average
Reflection (s-polarized): >99.5% average
Transmitted wavefront: λ/4 at 633 nm
Surface quality: 20-10
Extinction ratio: >500:1
Dimensions: ±0.508 mm
Clear aperture: > 80% of cube dim.
Laser damage threshold
Pulsed (10 ns): 100 mJ/cm^2

Broadband Polarizing Beamsplitter Cubes

Wavelength Range (nm)	12.7 mm Cube		25.4 mm Cube	
	Catalog Number	Price US	Catalog Number	Price US
450-700	44-4703	$270.00	44-4711	$390.00
650-950	44-4729	$270.00	44-4737	$390.00
900-1300	44-4766	$270.00	44-4783	$390.00
1050-1620	44-4745	$270.00	44-4752	$390.00

Broadband Laser Optics



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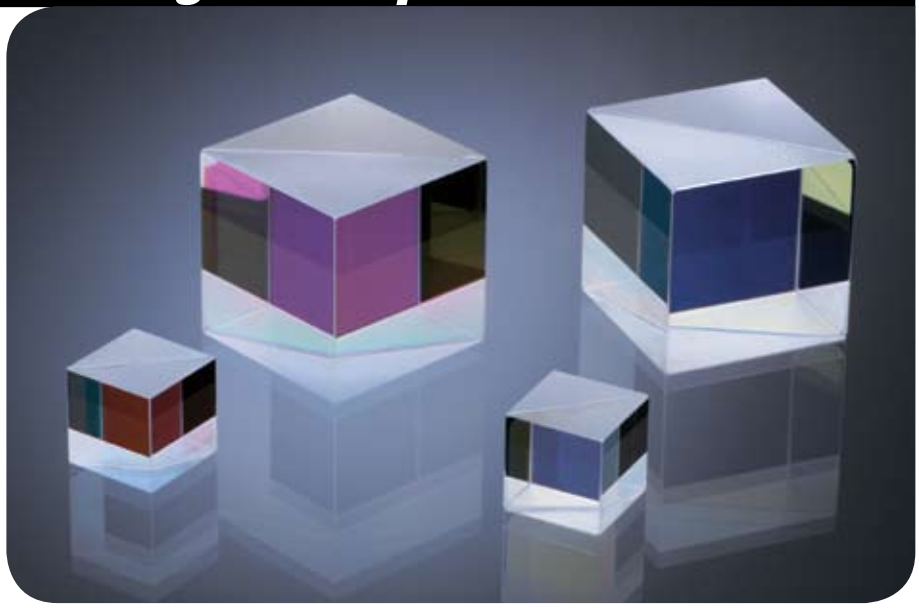
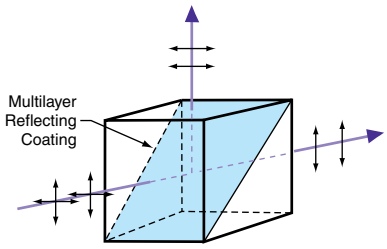
Narrowband Polarizing Beamsplitter Cubes

- *Laser quality*
- *Common laser wavelengths*





Narrowband polarizing beamsplitter cubes split the polarization states of an incoming beam. The P-polarization passes straight through the cube, while the S-polarization is reflected 90°. This split is the result of the multi-layer dielectric coating that has been placed on the internal hypotenuse surface. The entrance and exit faces have been AR coated with multi-layer coatings to maximize transmission.

Kinematic Prism Platforms

Kinematic Prism Platforms are also available.

Specifications

Material: BK7 glass
Transmission (p-polarized): >95%
Reflection (s-polarized): >99.9%
Transmitted Wavefront: λ/4 at 633nm
Surface Quality: 20-10
Extinction Ratio: 1000:1
Dimensions: ±0.508 mm
Clear Aperture: >80% of cube dim.
Laser Damage Threshold
Pulsed (10 ns): 100mJ/cm^2

Narrowband Polarizing Beamsplitter Cubes

Wavelength (nm)	12.7 mm Cube		25.4 mm Cube	
	Catalog Number	Price US	Catalog Number	Price US
488	44-4380	$190.00	44-4398	$270.00
514.5	44-4406	$190.00	44-4414	$270.00
532	44-4422	$190.00	44-4430	$270.00
632.8	44-4448	$190.00	44-4455	$270.00
670	44-4489	$190.00	44-4497	$270.00
780	44-4505	$190.00	44-4513	$270.00
808	44-4521	$190.00	44-4539	$270.00
830	44-4547	$190.00	44-4554	$270.00
850	44-4562	$190.00	44-4570	$270.00
1064	44-4588	$190.00	44-4596	$270.00
1319	44-4604	$190.00	44-4612	$270.00
1550	44-4620	$190.00	44-4638	$270.00

Calcite Polarizers

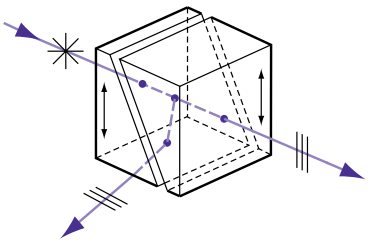
- ***Broadband linear polarizers***
- ***High extinction ratio***
- ***Laser quality***

Calcite Polarizers are laser quality, linear polarizers. They can be used over a broad wavelength region, making them suitable for multiple applications. Calcite Polarizers consist of two prisms made of a high birefringent calcite material. The internal interface between the prisms is cut at brewster's angle. This design allows for linear polarization of the incoming light with a high extinction ratio over a very wide wavelength region.

Ealing offers five different types of calcite polarizers, each with their own unique advantages. Care should be taken to select the best one for the application at hand based on the lasers' power density, wavelength, and required acceptance angle. All Calcite polarizers are supplied cemented in a slotted black anodized aluminum cylinder, which can be mounted with polarizers mounts.

Glan Laser Polarizers

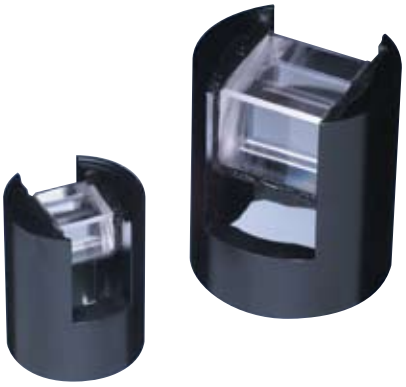
- ***Ideal for high power lasers***
- ***Low beam divergence***



Glan Laser polarizers are intended for use with high power laser beams. Their many applications include intra-cavity gain switching, beam combination, pulse extraction and feedback elimination. Glan Laser Polarizers are air spaced, and have side windows to enable rejected beams to escape, thus avoiding damage due to excess heating. Care must be taken to terminate the rejected beams, though.

Glan Laser Polarizers

Catalog Number	Clear Aperture (mm)	Price US
43-6741	10.0	$775.00
43-6766	15.0	$1,175.00
43-6774	20.0	$1,935.00



Specifications

Material: Laser grade calcite
Wavelength Range: 220-2800 nm
Peak Transmission: 88%
Extinction Ratio: 10^5
Beam Deviation: <3 arcmin
Flatness: λ/8 at 589 nm
Surface Quality: 20-10
Field Angle: 8°

Mount Dimensions	Diameter (mm)	Length (mm)
10 mm Aperture:	25.4	32.0
15 mm Aperture:	31.8	38.0
20 mm Aperture:	38.1	44.0

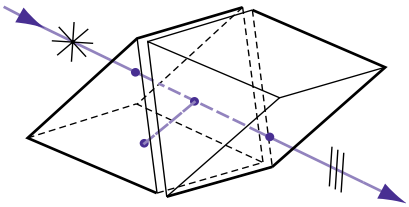
Dimensions Tolerance: ±0.1mm
Laser Damage Threshold
CW: 100 W/cm²
Pulsed (1ns): 300 MW/cm²

Calcite Polarizer Mounts

Calcite Polarizer Mounts are also available.

High Transmission Glan Laser Polarizers

- *Ideal for high power lasers*
- *High transmission*



These Glan Laser polarizers are designed as high power, high transmission linear polarizers. All entrance and exit surfaces are at Brewster's angle, resulting in a maximum transmission of the p-polarized incoming light. Note that although the High Transmission Glan Laser Polarizer will work over an 8° field angle, in order to achieve 98% transmission it is necessary to strike the entrance surface at Brewster's angle.

Specifications

Material: Laser grade calcite
Wavelength range: 220-2800 nm
P-polarized Transmission: 98%
Extinction Ratio: 10^5
Flatness: λ/8 at 589 nm
Surface Quality: 20-10
Field Angle: 8°
Beam Displacement
10mm Aperture: 5 mm
15mm Aperture: 7.5 mm

Mount Dimensions	Diameter (mm)	Length (mm)
10mm Aperture:	25.4	32.0
12mm Aperture:	25.4	34.0
15mm Aperture:	31.8	38.0

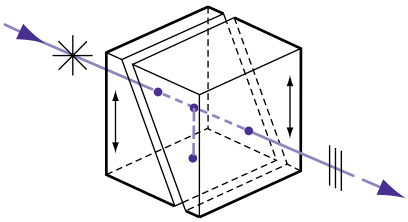
Dimensions Tolerance: ±0.1mm
Laser Damage Threshold
CW: 100 W/cm²
Pulsed (1ns): 300 MW/cm²

High Transmission Glan Laser Polarizers

Catalog Number	Clear Aperture (mm)	Price US
43-6782	10.0	$936.00
43-6808	15.0	$1,365.00

Glan Taylor Polarizers

- *Useful with low or medium power lasers*



These Glan Taylor Polarizers are ideal for low and medium power applications where the rejected beam is not required. They do not have any escape windows and are assembled with fine ground, black glass cemented to the calcite prisms for efficient absorption of the rejected beam.

Specifications

Material: Optical grade calcite
Wavelength range: 220-2800 nm
Peak transmission: 88%
Extinction ratio: 10^5
Beam deviation: <3 arcmin
Flatness: λ/8 at 589 nm
Surface quality: 20-10
Field angle: 8°

Mount Dimensions	Diameter (mm)	Length (mm)
10mm Aperture:	25.4	32.0
15mm Aperture:	31.8	38.0
20mm Aperture:	38.1	44.0

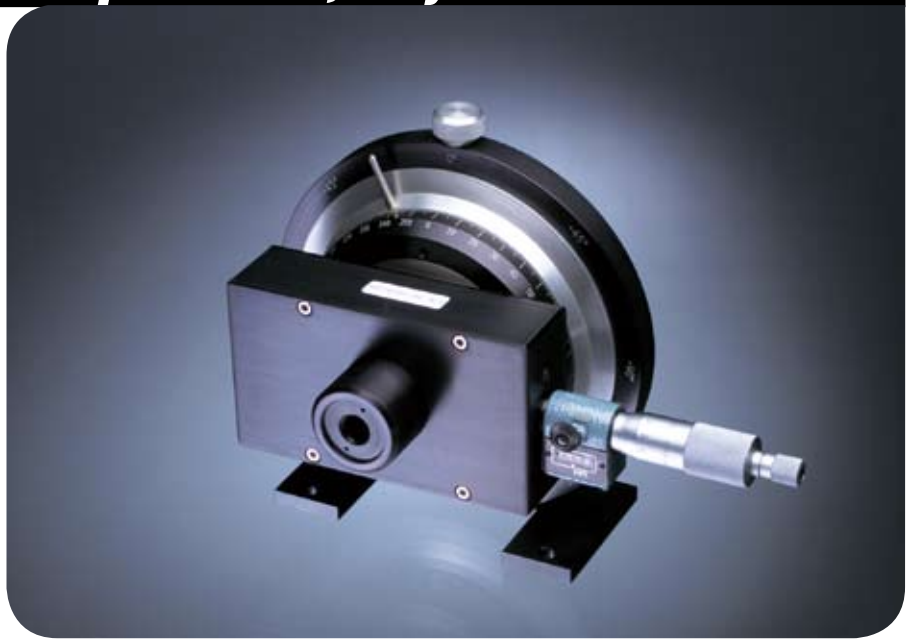
Dimensions Tolerance: ±0.1mm
Laser Damage Threshold
CW: 10 W/cm²
Pulsed (1ns): 20 MW/cm²

Glan Taylor Polarizers

Catalog Number	Clear Aperture (mm)	Price US
43-6824	10.0	$695.00
43-6840	15.0	$1,095.00
43-6857	20.0	$1,859.00

Soleil-Babinet Compensator, Adjustable Retarder

- ***An instrument for precise determination of retardation***



A Soleil-Babinet Compensator functions as an adjustable zero order retarder over the wavelength range 200-2700 nm. It allows complete analysis and selection of the state of polarization of a beam and can be used for inspection and comparative work.

The Ealing Soleil-Babinet Compensator consists of two crystalline quartz wedges with their optic axes parallel and at 45° to the polarization direction of the input beam. One wedge is fixed and the other, which is attached to a crystalline quartz compensating block with its axis at 90° to the wedge, is adjustable by a micrometer screw. This adjustment changes the path difference through the instrument and hence the retardation.

It can be used to select a uniform phase difference between the extraordinary and ordinary rays of 0-2π. As a result incident elliptically or circularly polarized light can be converted into linearly polarized light by introducing the appropriate compensation. Conversely any desired polarization form can be obtained by pre-setting the appropriate values.

The Soleil-Babinet Compensator is mounted conveniently on a precision ballbearing indexing head which has a fixed outer circumference graduated 0°, 180°, +45°, +90°, +135°, -45°, -90° and -135°. The inner circumference is rotatable through 360° and has indicator marks at one degree increments with each 10° being labelled. The outer circumference has a knurled locking screw for absolute fixing. A 1/4-20 tapped hole is located at the 180° mark for post mounting. The micrometer adjustment screw has a four-place digital readout. The fifth place can be interpolated from alignment marks on the micrometer barrel. All Compensators are supplied in wooden instrument cases with instruction manual and calibration data.

Specifications

Materials
Optics: Laser quality crystalline quartz
Housing: Non-magnetic metal

Diameter: 152.4 mm

Clear Aperture: 10 mm

Thickness: 105.3 mm
(compensator and mount)

Dimensions Tolerance: ±0.25 mm

Optical Center: 75.2 mm
(bottom to optical center line)

Maximum Height: 243.5 mm
(micrometer fully extended)

Wavefront Distortion: <λ/4 at 633 nm

Wavelength Range: 200-2700 nm

Retardation Range:
320 nm = 0 to 2λ
633 nm = 0 to 1λ
1230 nm = 0 to λ/2
2500 nm = 0 to λ/4

Readout: 4 place digital;
fifth place interpolated

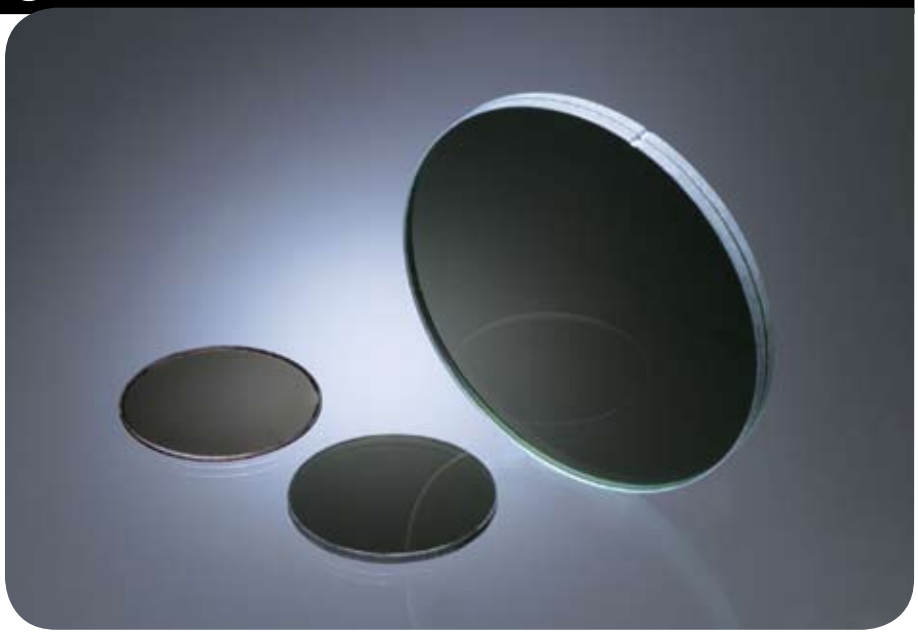
Resolution: 0.001λ
(0 to 25,000 on digital readout)

Temperature Range: 0°C to 70°C

Soleil-Babinet Compensator — Adjustable Retarder

Catalog Number	Price US
34-5918	$3,450.00

Sheet Polarizers



- ***Ideal for broadband applications***
- ***Cost effective***

For low power applications Sheet Polarizers can often provide a simple cost effective solution.

Unpolarized light passing through a Sheet Polarizer emerges as linearly polarized light. Sheet Polarizers are often used in pairs. When the two polarizers have their axes aligned transmission is at a maximum. When the axes are orthogonal to each other transmission is nearly zero. For intermediate positions the transmission is given by the equation:

$I = I_{max} \cos^2\theta$
where θ = angle between the axes of the polarizers.

Ealing offers Sheet Polarizers for the visible, ultraviolet and infrared spectrums.

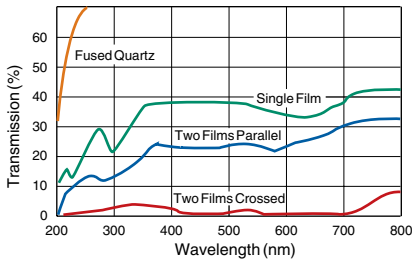
Sheet Polarizers are not suitable for high power use. Their main applications are for production and analysis of polarized radiation, and the elimination of unwanted beams.

The degree of polarization is virtually independent of the incident angle. This allows them to be used with highly convergent or divergent beams and still produce uniform polarization.

UV-Visible Linear Polarizers

- ***Useful for 200-800 nm***
- ***UV fused silica substrate***

Providing excellent linear polarization from 200-800 nm in a single special coating, these polarizers are mounted on UV quality, fused silica. The coated surface is delicate and care should be taken while handling or cleaning. Normal cleaning solvents should not be used. For best results only clean with blown air. The coating is neutral green in color. Maximum survival temperature is 95°C. Polarization and transmission characteristics do not deteriorate with time or long exposure to UV, visible, or IR irradiation. Thickness is nominally 1.6 mm.



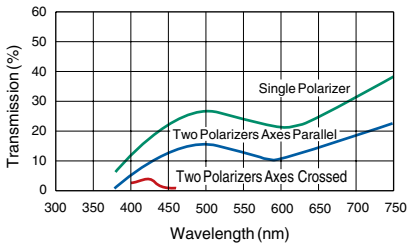
UV-Visible Linear Polarizers

Catalog Number	Diameter (mm)	Price US
23-2520	25.4	$407.00
23-2363	50.8	$620.00
22-9039	101.6	$1,554.00

Visible Linear Polarizers

- *Usable over 350-750 nm*
- *Ideal for broadband applications*

These sheet polarizers are designed for 350-750 nm. Total luminous transmittance is 22% for white light; total integrated transmission for two crossed polarizers is 0.05%. The polarizing sheet is sandwiched between two optically ground and polished pieces of glass. Polarization and transmission characteristics are stable with time and prolonged visible irradiation. High intensity ultraviolet or infrared irradiation will degrade both the polarizing properties and total transmission of the unit. Recommended temperature extremes are -60°C and +80°C. Maximum survival temperature is 90°C. High relative humidity will tend to cause a separation of the glass sandwich and should be avoided.



Visible Linear Polarizers

Catalog Number	Diameter (mm)	Thickness (mm)	Price US
23-5671	50.8	3.2	$280.00
22-9062	101.6	7.2	$357.00

Waveplates

- ***Quarter and half waveplates***
- ***Zero or multiple order available***

Applications for Half Waveplates include rotating the plane of polarization (e.g. in a laser), electro-optic modulation and as a variable ratio beamsplitter (when used in conjunction with a polarizing cube).

Waveplates are made from materials which exhibit birefringence. The velocities of the extraordinary and ordinary rays through the birefringent material vary inversely with their refractive indices. For the case of crystal quartz the extraordinary beam has a higher refractive index and therefore a slower velocity. For this reason its direction is known as the 'slow' axis. Likewise, the direction of the ordinary beam is known as the 'fast' axis and is indicated by the marked lines on the mount.

The difference in velocities gives rise to a phase difference when the two beams recombine. In the case of an incident linearly polarized beam this is given by

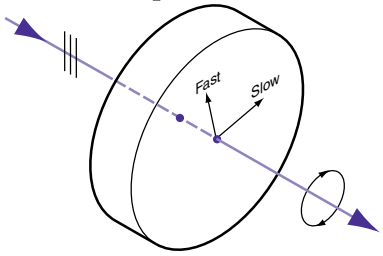
$$\theta = \pm \frac{2\varpi d (n_e - n_o)}{\lambda}$$

where:

θ =	phase difference
d =	thickness of waveplate in mm
n_e, n_o =	refractive indices of extraordinary and ordinary rays respectively
λ =	wavelength in nm

At any specific wavelength the phase difference is governed by the thickness of the retarder. Quarter and Half Waveplates are two specific cases of this.

Quarter Waveplate



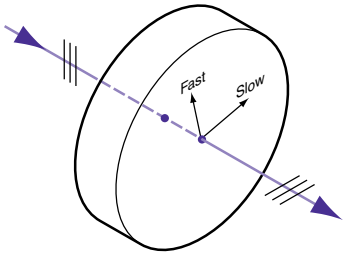
A Quarter Waveplate is used to convert linearly polarized beams into circularly polarized beams (and vice versa).

The construction of a Quarter Waveplate is such that the fast axis, indicated by the marked line, lies in the surface at 45° to the input polarization. The input beam is resolved into two components of equal amplitude, but each with a different velocity.

Applications for Quarter Waveplates include creating circular polarization from linear or linear polarization from circular, ellipsometry, optical pumping, suppressing unwanted reflections (when used in conjunction with a polarizer) and optical isolation (when used with a Polarizing Beamsplitter Cube.)

Half Waveplates

The thickness of a Half Waveplate is such that the phase difference



is ϖ (zero order) or 3ϖ, 5ϖ, 7ϖ, etc (multiple orders). A linearly polarized beam incident on a Half Waveplate emerges as a linearly polarized beam but rotated such that its angle to the optic axis is twice that of the incident beam. It is usual to have the fast axis lying in the surface of the retarder at 45° to the input polarization. The Half Waveplate therefore introduces a 90° rotation of the plane of polarization.

Zero Order Waveplates

Ealing Zero Order Waveplates are the preferred type of waveplate. They are not as sensitive to changes in temperature, wavelength, angle of incidence or collimation. A wavelength shift of 15 nm will result in approximately a 1% retardation change. They are supplied in a 25.4 nm mount.

Specifications

Material: Crystalline quartz
Retardation: ±0.005λ
Wavefront Distortion: λ/8
AR Coating: <0.25%R per surface
Diameter: 25.4 +0.0 -0.15 mm
Aperture: 15 mm
Thickness: 8 +0.0 -0.25 mm
Laser Damage Threshold: 500 MW/cm²

Zero Order Waveplates

Wavelength (nm)	Quarter Waveplate		Half Waveplate	
	Catalog Number	Price US	Catalog Number	Price US
248	45-7564	$372.00	45-7788	$372.00
266	45-7572	$372.00	45-7796	$372.00
308	45-7580	$372.00	45-7804	$372.00
355	45-7598	$372.00	45-7812	$372.00
488	45-7606	$372.00	45-7820	$372.00
514	45-7614	$372.00	45-7838	$372.00
532	45-7622	$372.00	45-7846	$372.00
633	45-7648	$372.00	45-7861	$372.00
670	45-7663	$372.00	45-7887	$372.00
780	45-7697	$372.00	45-7911	$372.00
808	45-7705	$372.00	45-7929	$372.00
820	45-7713	$372.00	45-7937	$372.00
830	45-7721	$372.00	45-7945	$372.00
850	45-7739	$372.00	45-7952	$372.00
905	45-7747	$372.00	45-7960	$372.00
1064	45-7754	$372.00	45-7978	$372.00
1300	45-7762	$372.00	45-7986	$372.00
1550	45-7770	$372.00	45-7994	$372.00

Multiple Order Waveplates

Ealing Multiple Order Waveplates are available in a range of laser-line wavelenths, mounted in a 25.4 mm diameter mount. Multiple Order Waveplates are sensitive to changes in temperature, angle or incidence and degree of collimation. They are intended for use at the design wavelength only. If used at a different wavelength, a retardation change of 10% occurs for every 0.2 nm deviation.

Specifications

Material: Crystalline quartz
Retardation: ±0.005λ
Wavefront Distortion: λ/8
AR Coating: <0.25%R per surface
Diameter: 25.4 +0.0 -0.15 mm
Aperture: 15 mm
Thickness: 8 +0.0 -0.25 mm
Laser Damage Threshold: 500 MW/cm²

Multiple Order Waveplates

Wavelength (nm)	Quarter Waveplate		Half Waveplate	
	Catalog Number	Price US	Catalog Number	Price US
248	45-6848	$305.00	45-7200	$305.00
266	45-6855	$305.00	45-7069	$305.00
308	45-6863	$305.00	45-7077	$305.00
355	45-6871	$305.00	45-7085	$305.00
488	45-6889	$305.00	45-7093	$305.00
514	45-6897	$305.00	45-7101	$305.00
532	45-6905	$305.00	45-7119	$305.00
633	45-6921	$305.00	45-7135	$305.00
670	45-6947	$305.00	45-7150	$305.00
780	45-6970	$305.00	45-7184	$305.00
808	45-6988	$305.00	45-7192	$305.00
820	45-7002	$305.00	45-7218	$305.00
830	45-7010	$305.00	45-7226	$305.00
850	45-7016	$305.00	45-7234	$305.00
905	45-7044	$305.00	45-7259	$305.00
1064	45-7028	$305.00	45-7238	$305.00
1300	45-7036	$305.00	45-7242	$305.00
1550	45-7048	$305.00	45-7262	$305.00