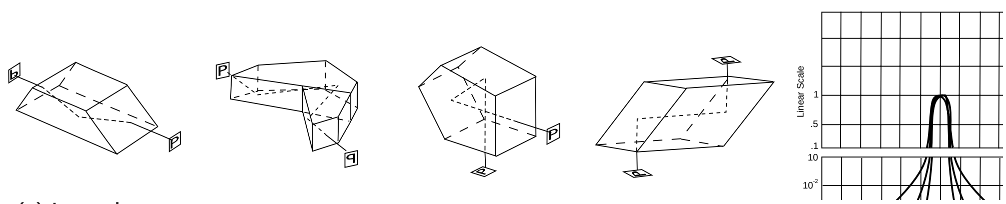
OUTPUT BEAM CHARACTERISTICS

Prisms are blocks of optical material having flat polished faces. They have no optical power and cannot act on a beam to form images. They can, however, be used to change an incident beam, which may or may not be carrying image information, in one of five ways (looking at object and image from the same direction)

(a) Inversion. The image in an incident beam emerges upside down i.e. rotated by 180° about a horizontal center line.
(b) Reversion. The image in an incident beam emerges left to right and right to left i.e. rotated by 180° about a vertical center line.
(c) Deviation. The incident beam emerges in a different direction of propagation.
(d) Displacement. The incident beam emerges in the same direction of propagation but along a different axis.
(e) Dispersion. The incident beam emerges split up into its constituent spectral components.



(a) Inversion (b) Reversion (c) Deviation (d) Displacement (e) Dispersion

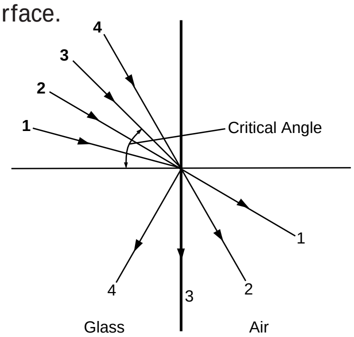
Prisms used to achieve (a) (b) (c) and (d) are known as Reflecting Prisms. The effects are caused by refraction and reflection (usually total internal reflection) at the prism faces. Prisms used to achieve (e) are known as Dispersing Prisms.

Refraction and Total Internal Reflection

A beam passing across a boundary of different refractive indices is deviated or refracted according to Snell's law of refraction, given by

$$n_1 \sin i = n_2 \sin r$$

where n_1,n_2 are the refractive indices of the two media, usually air and glass
i,r are the angles of incidence and refraction respectively measured from the normal to the surface.

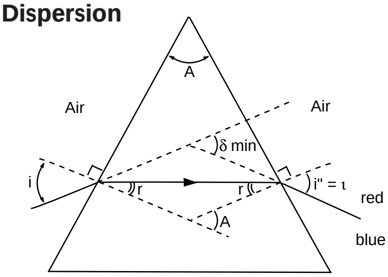


Thus every time a beam meets a prism surface (air to glass or glass to air), it is refracted. This applies for all angles of incidence except where a beam is incident inside the dense medium (glass) at an angle greater than the critical angle. This occurs when the angle of incidence is such that the refracted ray emerges parallel to the surface, i.e. angle r is 90°. Assuming the refractive indices of glass and air to be 1.5 and 1 respectively, this gives a critical angle of 41.2°. For all angles of incidence greater than the critical angle, the beam is not refracted but reflected. This phenomenon is known as total internal reflection and the beam is reflected completely without attenuation or loss. Many Reflecting Prisms employ more than one total internal reflection as an efficient means of producing the desired beam characteristics.

1
OPTICAL BENCHES, MOUNTING BASES, TABLES
COMPONENT MOUNTS
MANUAL MICRO-POSITIONERS
MOTORIZED MICRO-POSITIONERS
2
OPTICAL MATERIALS, THEORY, CLEANING
LENSES, MICROSCOPE COMPONENTS
WINDOWS, MIRRORS, BEAMSPLITTERS, COATINGS
PRISMS, POLARIZERS, APERTURES, TARGETS
OPTICAL FILTERS
3
LASERS & ACCESSORIES
LIGHT SOURCES, MONO-CHROMATORS, DETECTORS
4
OPTICAL TESTING & MEASURING INSTRUMENTS
5
TEXTBOOKS

OUTPUT BEAM CHARACTERISTICS (continued)

Dispersion



Dispersing Prisms are designed to separate a beam into its constituent spectral components. They are usually of triangular cross-section, having two refracting faces intersecting at an angle A at the apex.

Considering a monochromatic beam first, it is refracted at both surfaces and emerges deviated through an angle δ, given by

$$\delta = i + \sin^{-1}\left[(\sin A)\,(n^2 - \sin^2 i)^{1/2} - (\sin i \cos A)\right] - A$$

where n is the refractive index of the prism.

Dispersing Prisms are frequently used in the position of minimum deviation where surface reflection losses are minimized. This is where the incident and emergent angles are equal and the equation above reduces to

$$\delta_{min} = 2\sin^{-1}[n \sin (A/2)] - A$$

The angle of deviation is therefore dependent on refractive index. Since refractive index is dependent on wavelength, polychromatic beams are split up and deviated by different amounts according to their constituent wavelength components. Shorter wavelengths are ‘bent’ more i.e. a beam of white light is split into its spectral components with the blue being deviated more than the red. The degree to which the wavelengths are spread or dispersed depends on the properties of the material used. For a high degree of angular separation it is necessary to select a material with a rapid change in refractive index across the wavelengths.

Traditionally, dispersive properties are defined in terms of Abbe numbers, often called V-values. These are related to the refractive index values at three wavelengths corresponding to the main Fraunhofer lines in the solar spectrum. V-value is defined as

$$V_d = \frac{n_d - 1}{n_F - n_c}$$

where n_d = refractive index at the Fraunhofer d line 587.6nm
n_F = refractive index at the Fraunhofer F line 486.1nm
n_C = refractive index at the Fraunhofer C line 656.3nm

Dispersive power is defined as $1/V_d$ i.e. a low V-value means high dispersive power and hence greater angular separation. The V-values for the materials used in Ealing prisms are listed below.

Material	n_d	n_F-n_C	V_d	$1/V_d$
BK7	1.517	0.0081	64.2	0.016
F2	1.620	0.0170	36.4	0.027
SF10	1.728	0.0256	28.4	0.035
Fused silica	1.458	0.0068	67.8	0.015

Angular dispersion, the angular separation of two different wavelengths, can be calculated at minimum deviation by calculating the difference in deviation for the two wavelengths. Using the equations above, the angular separation (dδ) is given by

$$d\delta = \frac{2\sin(A/2)\,dn}{\sqrt{1 - n^2 \sin^2(A/2)}} \cdot \frac{180}{\pi} \text{ degrees}$$

where n is the mean refractive index of the two wavelengths, usually $(n_F + n_C)/2$
dn is the partial dispersion, usually calculated for n_F-n_c

WAVELENGTH OF OPERATION

It is important to select prisms and coatings suitable for the wavelength range required. Detailed transmission characteristics of the materials used in Ealing prisms are shown on Pages 165-171. General details are shown below. Coating transmission curves are shown on Pages 266-268.

Material	Usable Wavelength Range (nm)
BK7	330-2100
F2	350-2200
SF10	400-2400
Fused silica	200 - see curve (Page 167)

SIZE AND FIELD OF VIEW

A prism must be selected to have an aperture which is large enough to accommodate the beam size at both the entrance and exit faces. The requirement for internal angles of incidence to be greater than the critical angle (thereby achieving total internal reflection) imposes limitations on the field of view of prisms. For example, for right angle prisms, rays should enter at an angle of less than 5.7° for BK7 and 2.5° for fused silica. For many applications this does not cause a problem. In general, a larger field of view can be obtained by using a higher refractive index glass or a fully reflecting coating, (see coatings below).

QUALITY

The tolerances to which a prism is manufactured determine the accuracy with which it will function. The angular tolerance is often of prime importance in determining prism accuracy. Ealing takes great care to specify and control the quality of its prisms. The angular and surface tolerances are specified to suit most requirements from general purpose to exacting laser applications. Ealing can also manufacture prisms to special requirements.

OPTICAL PATH LENGTH

Introducing a prism into an optical system changes the path length of a beam through the system. For a prism of refractive index n

$$\text{equivalent path length in air} = n \times \text{actual path length through the prism}$$

The effects of a change in path length need to be considered in applications such as rangefinders, stereoscopic devices, etc. Path length changes can also cause chromatic aberrations, astigmatism and displacement of the beam and focus. It is therefore important to consider these effects by correcting for and/or incorporating them where possible when designing an optical system. This is particularly true when considering incorporating prisms into an imaging system. Our technical team will be happy to advise on any specific problems.

COATINGS

Coatings are often applied to prisms for a number of reasons. Anti-reflection coatings can be applied to reduce surface reflection losses, thus improving transmission and reducing any problems from reflected radiation.

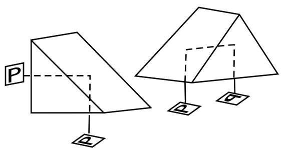
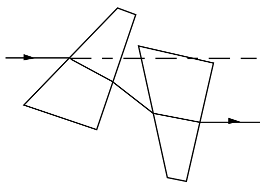
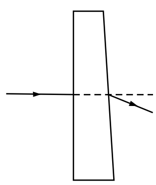
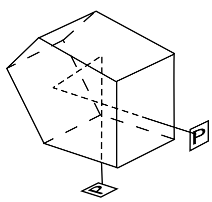
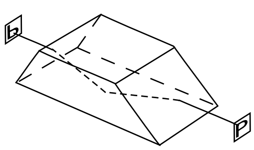
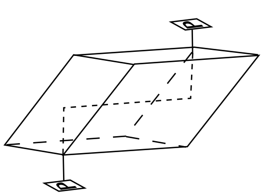
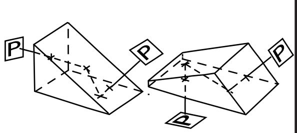
Fully reflecting coatings can be applied to the reflecting surface of prisms. Although these are less efficient than total internal reflection, they can be very useful in environments where prism surfaces cannot be kept spotlessly clean. They are also used when an acceptance angle is needed which is too large for total internal reflection. For high power applications it should be noted that the damage threshold is generally reduced by the application of a coating.

INPUT BEAM COLLIMATION

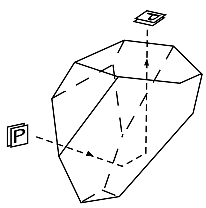
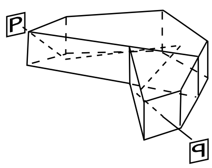
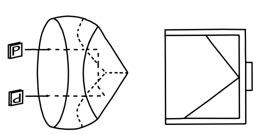
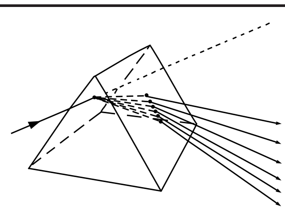
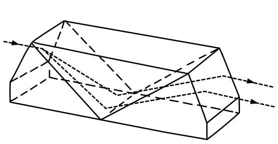
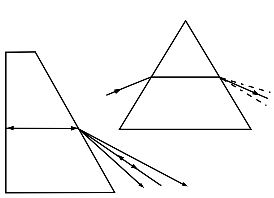
For most prisms it is generally advisable to have a collimated input beam. All beams are slightly convergent or divergent, but for most applications this is not a problem. However, where a beam is clearly convergent or divergent, aberrations are introduced, which can be significant and must be considered carefully when designing a system.

1
OPTICAL BENCHES, MOUNTING BASES, TABLES
COMPONENT MOUNTS
MANUAL MICRO-POSITIONERS
MOTORIZED MICRO-POSITIONERS
2
OPTICAL MATERIALS, THEORY, CLEANING
LENSES, MICROSCOPE COMPONENTS
WINDOWS, MIRRORS, BEAMSPLITTERS, COATINGS
PRISMS, POLARIZERS, APERTURES, TARGETS
OPTICAL FILTERS
3
LASERS & ACCESSORIES
LIGHT SOURCES, MONO-CHROMATORS, DETECTORS
4
OPTICAL TESTING & MEASURING INSTRUMENTS
5
TEXTBOOKS

SELECTING A PRISM - OVERVIEW OF THE EALING RANGE

PRODUCT RANGE		INVERSION	REVERSION	DEVIATION	DISPLACEMENT	REFLECTING/ DISPERSING	MATERIAL/ USABLE WAVELENGTH RANGE	MAX APERTURE (mm)	APPLICATIONS	PAGE NO.
RIGHT ANGLE		-	● (90° only)	90° 180°	-	Reflecting	BK 7 Fused Silica	50 50.8	Laser beam bending, Light deviation, Image erection in periscopes & telescopes, Retroreflection, Mirror substitutes	274-275
ANAMORPHIC		-	-	-	● +Beam Expansion	Reflecting	SF 11	12	Beam shaping of Laser Diodes	275
WEDGE		-	-	few degrees	-	Reflecting	BK 7	25	Laser beam steering Elimination of 2nd surface reflections	275
PENTA		-	-	90°	-	Reflecting	BK 7	30	Range-finding Surveying Alignment Cine photography	276
DOVE		●	-	-	-	Reflecting	BK 7	30	Image rotation Microfilm viewers Optical profilers	276
RHOMBOID		-	-	-	●	Reflecting	BK 7	25	Periscope systems Beam folding Stereoscopic systems Interocular adjustment	276
REFLECTION	45°60° 	-	-	45° 60°	-	Reflecting	BK 7	19	Reflection through a precisely known angle	277

SELECTING A PRISM - OVERVIEW OF THE EALING RANGE

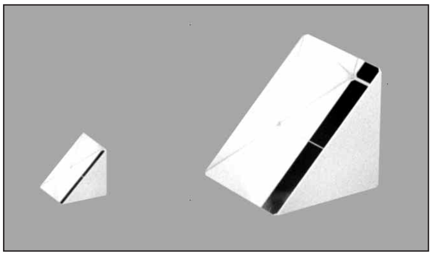
PRODUCT RANGE		INVERSION	REVERSION	DEVIATION	DISPLACEMENT	REFLECTING/ DISPERSING	MATERIAL/ USABLE WAVELENGTH RANGE	MAX APERTURE (mm)	APPLICATIONS	PAGE NO.
AMICI ROOF		●	●	90°	-	Reflecting	BK 7	21	Range-finding Terrestrial telescopes Viewing systems Medical instruments	277
REVERSION		-	●	-	-	Reflecting	BK 7	21	Image reversal without deviation	277
CORNER CUBE	solid hollow 	●	●	180°	-	Reflecting	Solid: BK 7 Hollow: mirrored	Solid: 76.2 Hollow: 125	Optical signalling, Laser interferometry, Distance & time measurements, Short pulse auto collimation, Laser anemometry	278
EQUILATERAL		-	-	●	-	Dispersing	BK 7 F 2 SF 10 Fused Silica	60	Prism spectrometers Pre-dispersers in high power systems	279
DIRECT VISION		-	-	-	-	Dispersing	420-2600nm	18	Spectral separation without deviation	279
BREWSTER/LITTROW		-	-	●	-	Dispersing	Fused Silica	25	Wavelength selection Prism spectrometers Laser cavities	280

Prisms - reflecting

1
OPTICAL BENCHES, MOUNTING BASES, TABLES
COMPONENT MOUNTS
MANUAL MICRO-POSITIONERS
MOTORIZED MICRO-POSITIONERS
2
OPTICAL MATERIALS, THEORY, CLEANING
LENSES, MICROSCOPE COMPONENTS
WINDOWS, MIRRORS, BEAMSPLITTERS, COATINGS
PRISMS, POLARIZERS, APERTURES, TARGETS
OPTICAL FILTERS
3
LASERS & ACCESSORIES
LIGHT SOURCES, MONO-CHROMATORS, DETECTORS
4
OPTICAL TESTING & MEASURING INSTRUMENTS
5
TEXTBOOKS

RIGHT ANGLE PRISMS

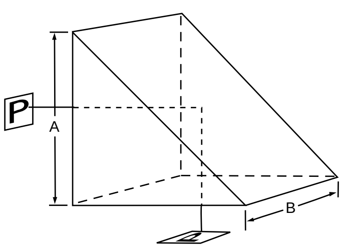
RIGHT ANGLE PRISMS



Right Angle Prisms

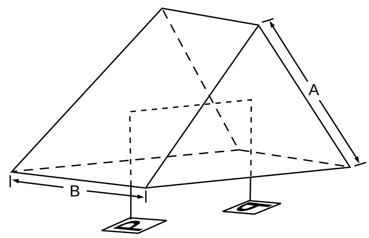
A Right Angle Prism is used to turn or deflect a beam through 90° or 180°. In either case this is achieved by total internal reflection and produces a very efficient broadband reflector.

90° DEFLECTION
For a 90° deflection the total internal reflection occurs at the hypotenuse face.



Provided that the prism surface is clean and the incident angle on the hypotenuse exceeds the critical angle, the prism will act as a very efficient broadband reflector for the visible and near infrared. The image is erect and reversed.
The main applications for this are for beam bending and for image erection in periscope and telescope systems. A Right Angle Prism is frequently used instead of a mirror since it is easier to mount and less affected by mechanical stress.

180° DEFLECTION
For a 180° deflection the Right Angle Prism is used with the hypotenuse as the entrance and exit face, with the total internal reflection occurring at the right angle faces.



The main application of this is to use it as a retroreflector provided that the plane of the incident beam includes the vertex.

Standard Right Angle Prisms

Ealing offers a wide range of sizes of Right Angle Prism in both BK7 and fused silica. For general visible and near IR work BK7 prisms are recommended. However fused silica should be selected for the UV or IR and also in thermally sensitive applications. In order to get total internal reflection the acceptance angle is fairly limited (see Page 271) and the beam should generally be collimated to avoid focal and chromatic changes. A reflective coating on the hypotenuse is sometimes advisable, particularly when a large acceptance angle is required or total cleanliness of the surface cannot be assured. Ealing offers a standard range of BK7 prisms already coated with aluminum and overcoated with black paint. Where surface losses from the other faces are a problem anti-reflection is recommended (see Page 266).

Glass Right Angle Prisms
SPECIFICATIONS

Material:	BK7
Wavelength range:	330-2100nm
Tolerances -	
dimensions:	±0.25mm
angles:	±5 arc mins
Surface finish -	
quality:	80/50
flatness:	2λ
Coating:	Al overcoated with
inconel and	
	black paint on hypotenuse

Fused Silica Right Angle Prisms
SPECIFICATIONS

Material:	UV grade fused silica
Wavelength range:	200-see curve (Page 167)
Tolerances -	
dimensions:	±0.5mm
angles:	±10 arc mins
Surface finish -	
quality:	60/40
flatness:	λ
Uncoated	

(See page 265 for standard coatings)

Suitable mounts and tables for Prisms are shown on Pages 88 and 89.

1
OPTICAL BENCHES, MOUNTING BASES, TABLES
COMPONENT MOUNTS
MANUAL MICRO-POSITIONERS
MOTORIZED MICRO-POSITIONERS
2
OPTICAL MATERIALS, THEORY, CLEANING
LENSES, MICROSCOPE COMPONENTS
WINDOWS, MIRRORS, BEAMSPLITTERS, COATINGS
PRISMS, POLARIZERS, APERTURES, TARGETS
OPTICAL FILTERS
3
LASERS & ACCESSORIES
LIGHT SOURCES, MONO-CHROMATORS, DETECTORS
4
OPTICAL TESTING & MEASURING INSTRUMENTS
5
TEXTBOOKS

Precision Laser Right Angle Prisms

Ealing offers a range of Right Angle Prisms that have been manufactured with especially high precision and from carefully-selected materials.

These prisms are ideal for use in laser applications and where very high, reproducible precision is required. Prisms are available in BK7 and fused silica, both of which have been selected for low scatter. Surface finish and angular accuracy are maintained very tightly.

Glass Precision Laser Right Angle Prisms

SPECIFICATIONS

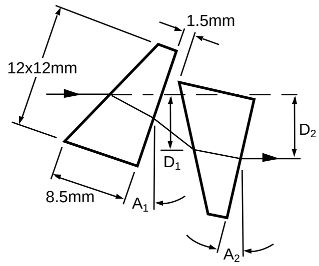
Material:	BK7
Wavelength range:	330-2100nm
Tolerances -	
dimensions:	+0/ – 0.25mm
angular deviation:	±3 mins
Surface finish -	
quality:	20/10
flatness:	λ/4
Uncoated	

Fused Silica Precision Laser Right Angle Prisms

SPECIFICATIONS

Material:	UV grade fused silica
Wavelength range:	200-see curve (Page 167)
Tolerances -	
dimensions:	+0/ – 0.25mm
angular deviation:	±3 mins
Surface finish -	
quality:	10/5
flatness:	λ/10
Uncoated	

Anamorphic Prisms



Anamorphic Prism pairs are used mainly to correct the asymmetric beam shape of a Laser Diode - from elliptical to near circular shape. This is done by expanding (or contracting) the beam in one direction only while the other direction remains unchanged.
The aspect ratio of the elliptical beam varies according to the laser diode. Magnification is controlled by the angular position of the prisms relative to the incident beam (which has already been collimated). The table below lists the linear and angular dimensions of the prisms for various magnifications.

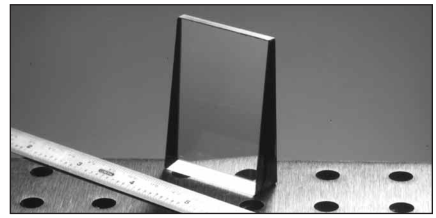
Magnification (X)	Prism angles A_1(Deg)	A_2(Deg)	Displacement D_1(mm)	D_2(mm)
2.0	21.2	6.0	5.1	5.3
3.0	30.4	0.1	6.4	6.4
4.0	35.2	–2.5	7.1	7.0
5.0	38.2	–3.9	7.6	7.4
6.0	40.4	–4.8	7.9	7.7

Ealing offers unmounted prisms in pairs. They are anti-reflection coated for use in the 650-850nm region.
Ealing can design and manufacture mounts for anamorphic prisms for use either with Ealing Laser Diodes (Pages 341-353) or customer-specified diodes.

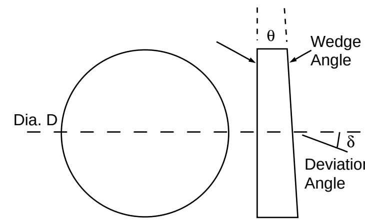
SPECIFICATIONS

Material:	SF11 glass
Wavelength range:	650-850nm
Size:	12x12x8.5mm
Tolerances -	
dimensions:	±0.1mm
angles:	<30 arc secs
Surface finish -	
quality:	60/40
flatness:	λ/8
Coating:	<0.5% per surface

Wedge Prisms



Wedge Prism



Wedge Prisms are mainly used with laser beams, either for elimination of reflections from the second surface or for beam steering.
The angle of deviation δ of a collimated laser beam through a Wedge Prism with a wedge angle θ and refractive index n is given by

$$\delta = (n-1)\,\theta$$

Wedge Prisms are often measured by their 'power' (Δ) in diopters, where 1 diopter is a deflection of 1cm at a distance of 1m from the prism.
Using two prisms of the same power in series and in close contact provides a very useful beam steerer. This is achieved by rotating the two prisms independently. A ray normal to the prisms can then be steered in any direction within a narrow cone around the undeviated path.
Ealing offers two Wedge Prisms of different powers. They are supplied uncoated - see Pages 266 and 267 if AR coatings are required.

SPECIFICATIONS

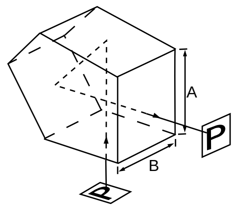
Material:	BK7 grade A fine annealed
Wavelength range:	330-2100nm
Tolerances -	
diameter:	+0/–0.10mm
angles:	±30 secs
Surface finish -	
quality:	60/40
flatness:	λ/4
Uncoated	

Prisms - reflecting

1
OPTICAL BENCHES, MOUNTING BASES, TABLES
COMPONENT MOUNTS
MANUAL MICRO-POSITIONERS
MOTORIZED MICRO-POSITIONERS
2
OPTICAL MATERIALS, THEORY, CLEANING
LENSES, MICROSCOPE COMPONENTS
WINDOWS, MIRRORS, BEAMSPLITTERS, COATINGS
PRISMS, POLARIZERS, APERTURES, TARGETS
OPTICAL FILTERS
3
LASERS & ACCESSORIES
LIGHT SOURCES, MONO-CHROMATORS, DETECTORS
4
OPTICAL TESTING & MEASURING INSTRUMENTS
5
TEXTBOOKS

PENTA / DOVE / RHOMBOID PRISMS

Penta Prisms

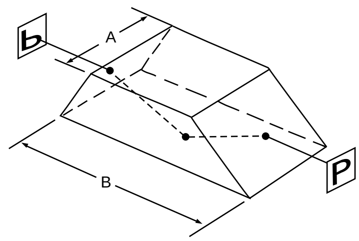


Penta Prisms deviate an incident beam through 90° without inverting or reversing it. They also show constant deviation i.e. the beam is deviated through 90° irrespective of the orientation of the prism. The accuracy of the 90° deviation is therefore only dependent on the manufacturing tolerances of the prism. These prisms are extremely useful when precise orientation of the prism is not possible and also where the path length through an instrument needs to be shortened. Typical applications include range finding, surveying, alignment and cine-photography. Ealing offers a range of sizes and a choice of two different accuracies. The reflecting faces are coated and the entrance and exit faces have an anti-reflection layer.

SPECIFICATIONS

Material:	BK7
Wavelength range:	330-2100nm
Beam deviation -	
standard:	90°±5'
precision:	90°±3"
Dimensional tolerances -	
standard:	+0/–0.1mm
precision:	A=±0.3mm, B=+0/–0.13mm
Surface quality -	
standard:	60/40
precision:	80/50
Surface flatness -	
standard:	λ/2
precision:	1-4λ, to DIN spec 58158
Reflective coating:	Al overcoated - inconel & black paint on reflecting surfaces only
AR coating:	Broadband AR coating

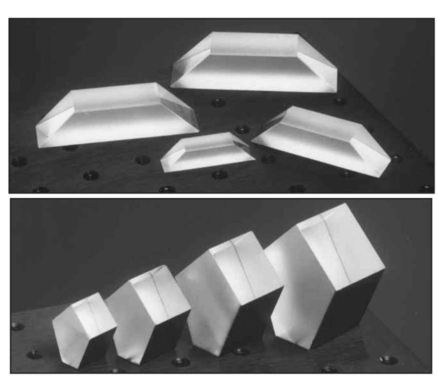
Dove Prisms



Dove Prisms are a truncated form of right angle prism which use total internal reflection to produce an image which emerges without deviation but is inverted. The main application for these prisms is as image rotators. Rotating the prism about an optical axis results in the image rotating at double the angular velocity of the prism. It is very important that the incident beam is collimated. In addition the large reflecting face must be kept very clean and the prism should not be rested on this face.
Ealing Dove Prisms are broadband AR coated on the entrance and exit faces for maximum transmission.

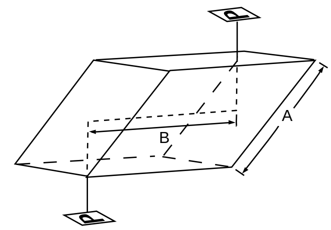
SPECIFICATIONS

Material:	BK7
Wavelength range:	330-2100nm
Tolerances -	
dimensions:	±0.2mm
angles:	±5 arc mins
Surface finish -	
quality:	80/50
flatness:	λ
Coating:	Broadband AR coating



Dove Prisms (top) and Penta Prisms

Rhomboid Prisms



Rhomboid Prisms are used primarily for controlling and redirecting the optical path without affecting the image orientation. They are particularly useful for displacing an optical center line (e.g. in a periscope system). Other applications include beam folding (e.g. adjustment of the interocular distance in binoculars), stereoscopic systems and systems which include articulation. Ealing offers a standard range of Rhomboid Prisms. The inclined reflecting faces are manufactured to the high degree of accuracy required for most applications. Entrance and exit faces are AR coated.

SPECIFICATIONS

Material:	BK7
Wavelength range:	330-2100nm
Tolerances -	
dimensions:	±0.15mm
angles:	3 arc mins
Surface finish -	
flatness:	2λ
Coating:	Broadband AR coating

See Pages 88 and 89 for the standard range of Ealing Prism Mounts and Tables.

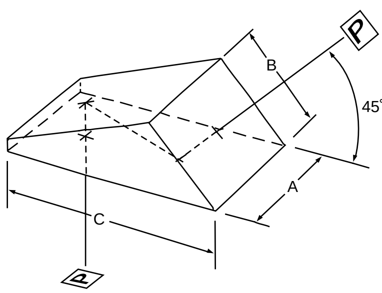
45°, 60° Reflection Prisms

Reflection Prisms are a convenient and reliable means of deflecting a beam through a precisely-known angle.
Ealing offers prisms for 45° and 60° deviation both uncoated and coated with broadband reflective and AR coatings.

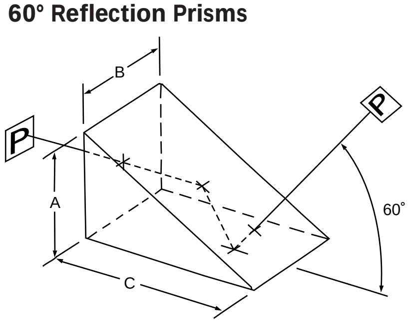
SPECIFICATIONS

Material:	BK7
Wavelength range:	310-2100nm
Tolerances -	
dimensions:	±0.2mm
angles:	±5 arc mins
Surface finish -	
quality:	60/40
flatness:	1-4λ, to DIN spec 58158
Coating:	Al and SiO_2 on larger reflecting face
	Broadband AR on entrance and exit faces

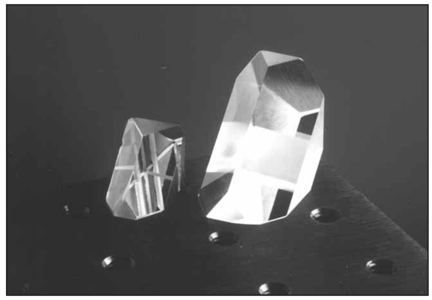
45° Reflection Prisms



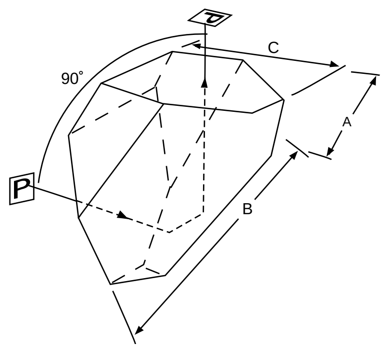
60° Reflection Prisms



Amici Roof Prisms



Amici Roof Prisms

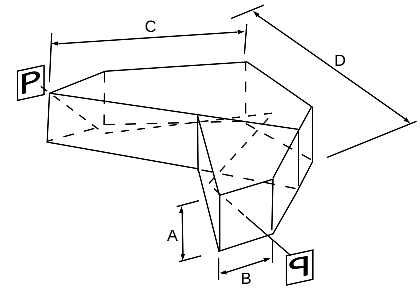


Amici Roof Prisms are right angle prisms where the hypotenuse is replaced by a totally internally reflecting roof. The image is both inverted and reversed and is also deflected through 90°. Common applications for Roof Prisms include rangefinders, terrestrial telescopes, viewing systems and medical instruments.
Cleanliness and quality of the roof faces are very important. Ealing offers Roof Prisms with the roof angle tightly controlled for accurate applications. For wide field applications it may be advisable to coat the roof faces with a fully reflective coating. (See Pages 267-268).

SPECIFICATIONS

Material:	BK7
Wavelength range:	310-2100nm
Roof angle -	
standard:	1 arc min
precision:	6 arc secs
Uncoated	

Reversion Prism

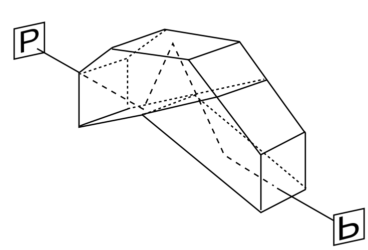


This prism is an Abbe-Konig type of Reversion Prism made up of two elements cemented together. It is sometimes known as a K prism. Used as above, the image remains the same, i.e. erect and undeviated except for a complete reversal. This prism may be used in converging and diverging beams as well as those that are collimated.

SPECIFICATIONS

Material:	BK7
Aperture:	21mm
Dimensional tolerances -	
A:	22mm ±0.13mm
B:	21mm
C:	40mm ±0.3mm
D:	69.2mm ±0.3mm
Max deviation error:	10 arc mins
Coating:	Broadband AR coated

* Note also that this prism may be used in the following configuration to invert rather than revert the image.



Prisms - reflecting

CORNER CUBE PRISMS

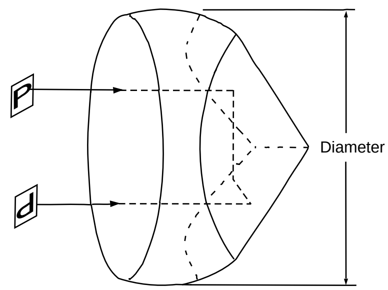
Solid Corner Cubes

These solid glass retroreflective mirrors are of tetrahedral construction producing three total internal reflections. This design is such that an incident ray is reflected back on itself, regardless of the orientation of the prism, the accuracy of the reflection being dependent only on manufacturing tolerances. The image is inverted and reversed. Common applications include optical signalling, laser interferometry and a variety of distance and time measurements.

Ealing offers a range of Solid Corner Cubes with different accuracies. They are available with a circular aperture for individual use or with hexagonal faces for combining together to form a larger reflecting surface.

It is often advisable to anti-reflection coat Corner Cubes to avoid ghost reflections from the front face, although this tends to restrict the usable spectral range. (For coatings see Pages 262-268).

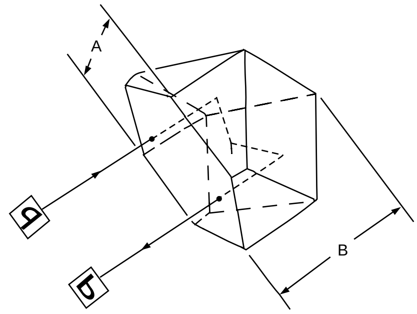
Circular Corner Cubes



SPECIFICATIONS

Material:	BK7
Wavelength range:	310-2100nm
Beam deviation:	3 arc secs
Dimensional tolerances:	+0/ –0.1mm
Surface finish -	
quality:	60/40
flatness:	λ/8
Uncoated	

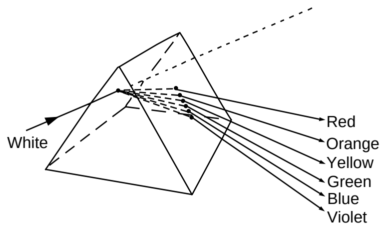
Hexagonal Corner Cubes



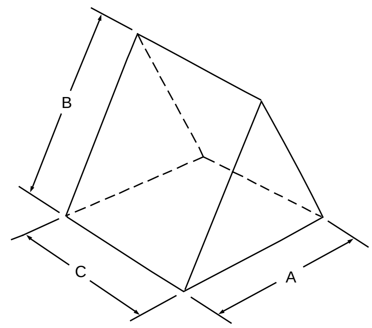
SPECIFICATIONS

Material:	BK7
Wavelength range:	310-2100nm
Beam deviation -	
standard:	1 arc min
precision:	20 arc secs
Dimensional tolerances:	±0.3mm
Surface finish -	
quality:	80/50
flatness:	1-4λ, to DIN spec 58158
Uncoated	

Equilateral Prisms



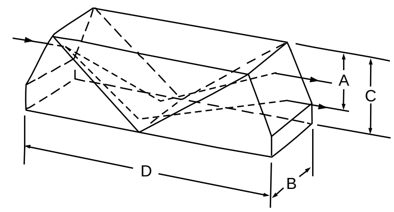
Equilateral Prisms are used routinely as dispersing elements where spectral separation is required. They provide superior brightness (lower stray light) than diffraction gratings, have greater power handling capabilities and avoid possible confusion when trying to interpret overlapping spectral orders. However, it must be remembered that dispersion is non-linear with wavelength and that surface reflection losses may affect throughput. Ealing offers Equilateral Prisms in four materials designed to suit a wide variety of dispersion, wavelength, surface reflection and cost requirements. In general, a higher refractive index material produces greater angular separation. However it should be noted that high index flint glasses are more fragile than BK7 and can be subject to staining. They also exhibit higher reflection losses, which may be important for s-polarized or un-polarized beams but can be improved by AR coating the entrance and exit faces (see Pages 266 and 267).



SPECIFICATIONS

Material and wavelength range:	
BK7	330-2100nm
F2	350-2200nm
SF10	400-2400nm
fused silica	200-see curve (Page 167)
Refractive index:	
BK7	n_d=1.517
	n_F- n_C=0.0081
F2	n_d=1.620
	n_F- n_C=0.0170
SF10	n_d=1.728
	n_F-n_C=0.0256
fused silica	n_d=1.458
	n_F-n_C=0.0068
Angular dispersion:	
BK7	0°42'37"
F2	1°40'45"
SF10	2°58'25"
fused silica	0°34'01"
Tolerances -	
dimensions:	±0.5mm
angles:	±5 arc mins
Surface finish -	
quality:	80/50
flatness:	2λ per 25.4mm
Uncoated	
(see Page 265 for standard coatings)	

Direct Vision Prisms



These Amici-type Direct Vision Prisms are constructed from three components cemented together. The outer elements are crown glass and the center one is made from flint glass. They are used as dispersing elements where spectral separation is required without any additional deviation of the beam.

SPECIFICATIONS

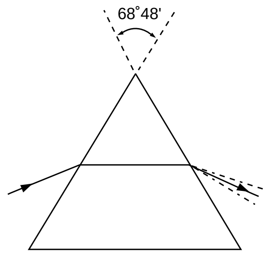
Angular dispersion:	4° 35'
Wavelength range:	420–2600nm
Tolerances -	
dimensions	
A,B:	±0.2mm
C:	±0.13mm
D:	±0.5mm
Uncoated	

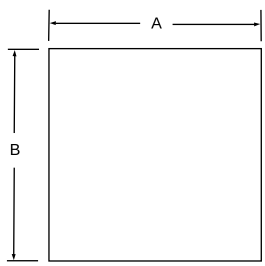
Standard Prism Mounts are shown on Pages 88 and 89. Please inquire for special mounting requirements.

Prisms - dispersing

BREWSTER / LITTROW PRISMS

Brewster Prisms





Brewster Prisms are designed to have an apex angle such that a p-polarized ray incident at Brewster's angle will pass through the prism parallel to the base at minimum deviation, and exit also at Brewster's angle. In this case surface reflection losses are negligible and Brewster Prisms are often used in situations where surface reflection losses cannot be tolerated.

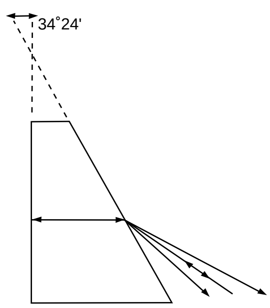
Brewster Prisms are also frequently used to select a single wavelength from a multi-wavelength laser. Tuning is accomplished by tilting the prism.

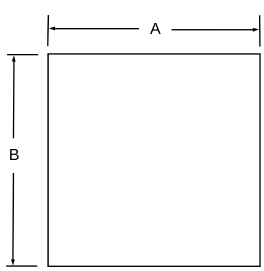
These prisms have very low surface reflection losses (>10^{-6}) over the range 350-650nm and are usable from 350-2500nm.

SPECIFICATIONS

Material:	UV grade fused silica
Refractive index:	n_d=1.458
	n_F-n_C=0.0068
Angular dispersion:	0°47'46"
Wavelength range:	350-2500nm
for low reflections:	350-650nm
Tolerances -	
dimensions:	±0.5mm
apex angle:	±5 arc mins
Surface -	
finish:	scatter free
flatness:	λ/20
Uncoated	

Littrow Prisms





Littrow Prisms are of the same design as Brewster prisms but cut in half vertically from the apex to the base.

They are normally used in a laser cavity or prism spectrometer to select a particular wavelength. In general, the beam is incident on the hypotenuse and is reflected back from the rear surface. It exits from the hypotenuse dispersed into its constituent wavelength components. Tuning is accomplished by tilting.

Ealing Littrow Prisms are supplied uncoated but should be coated for normal operation with a minimum reflectance multilayer dielectric coating (see Pages 266-267).

SPECIFICATIONS

Material:	UV grade fused silica
Refractive index:	n_d=1.458
	n_F-n_C=0.0068
Angular dispersion:	0° 13'40"
Wavelength range:	350-2500nm
Tolerances -	
dimensions:	±0.5mm
apex angle:	±5 arc mins
Surface -	
finish:	scatter free
flatness:	λ/20
Uncoated	