

## 8.1 Cube polarisers

=Customise 

Polarising beamsplitter cubes conveniently divide any beam into two polarised components. They also make excellent variable beamsplitters, particularly for sources such as lasers with polarised output, used with a half-wave plate (pp.44,45) to vary the incident polarisation state. This arrangement allows continuous variation of the split ratio over a wide range with negligible losses.

We offer cubes for both the visible and near IR ranges, both with multilayer AR coatings for maximum efficiency. Note that the polarisation purity of the transmitted beam is considerably better than the reflected beam. For even better performance see the crystal polarisers below.

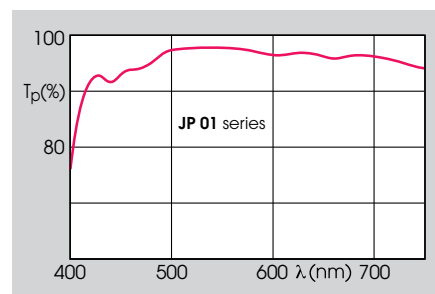
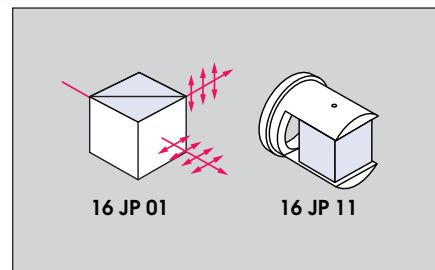
Cubes are also listed **mounted** in a flanged clevis mount (see p.59) to fit directly into our rotating holders (p.77,78), TubeMount cells (p.54) and similar mounts, whilst still allowing access to the reflected beam.

## Specification

<b>Wavelength range:</b>	
Visible	450-700nm
NIR	700-1064nm
<b>T<sub>p</sub></b>	Typ. 97%, see graph
<b>T<sub>s</sub></b>	0.2% max.*
<b>R<sub>p</sub></b>	Typ. 3% (1 - T <sub>p</sub> )
<b>R<sub>s</sub></b>	> 99%
<b>Material</b>	SF15 (699301)
<b>Dimensions</b>	±0.25mm

\*At centre of aperture. May be up to 0.5% around periphery. For NIR range, T<sub>s</sub> for 700-725nm < 1%.

Catalogue No. Visible	Catalogue No. NIR	Side (mm)
<b>Unmounted</b>		
06 JP 01	06 JP 02	6.3
10 JP 01	10 JP 02	10
16 JP 01	16 JP 02	16
25 JP 01	25 JP 02	25
<b>In mount 25mm dia.</b>		
10 JP 11	10 JP 12	10
16 JP 11	16 JP 12	16



## See also:

Non-polarising cubes [p.27](#)  
Rotating holders [p.77,78](#)

## 8.2 Crystal polarisers

The basic Glan-Taylor polarising prism gives both excellent extinction and high transmittance over a wide wavelength range. The form with side faces polished is useful as a polarising beamsplitter or for high powers.

For modest extra cost, Glan Taylors can be supplied with a single layer anti-reflection coating for any desired wavelength. Please enquire for details.

The Wollaston polarising beamsplitter, a cemented type, deviates the two polarisation components of a beam at angles ±10° from the input direction, with a small chromatic dispersion.

Most types are also offered **mounted** in flanged clevis mounts (as illustrated in 8.1

above, and see p.59); these fit directly, for instance, into our rotating holders (p.77,78) and TubeMount system (pp.53-59), whilst still allowing access to the side exit beam.

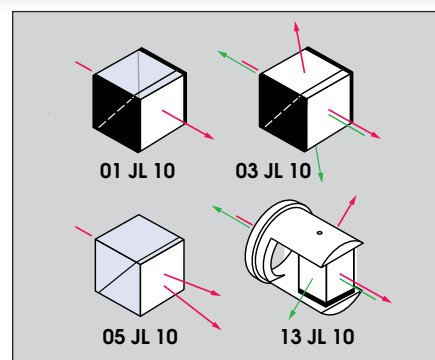
## Specification

<b>Material</b>	Calcite (CaCO <sub>3</sub> )
<b>Wavelength range</b>	350-2800nm
<b>Face flatness*</b>	λ/8

\*Manufacturer's data

## Options available

- Rochon, Glan-Thompson and other designs
- Quartz, MgF<sub>2</sub> and other materials
- Special sizes, mounts etc.
- AR coating (by special quotation)



## See also:

Graduated rotating holders [p.77,78](#)

Catalogue No. Unmounted	Catalogue No. In mount 25mm dia.	Nominal aperture (mm)	Acceptance angle	Peak trans.* (%)	Extinction ratio*	Max. power* (continuous) (W/cm <sup>2</sup> )	Max. power* (pulsed) (MW/cm <sup>2</sup> )	Type
01 JL 07	–	7 x 7	±3°	~88	10 <sup>5</sup>	10	20	Glan-Taylor
01 JL 10	11 JL 10	10 x 10	±3°	~88	10 <sup>5</sup>	10	20	Glan-Taylor
03 JL 10	13 JL 10	10 x 10	±3°	~88	10 <sup>5</sup>	300	300	Glan-Taylor with side windows
05 JL 10	15 JL 10	10 x 10	±20°	~90	10 <sup>4</sup>	1	–	Wollaston, beamsplitting

\*Manufacturer's data

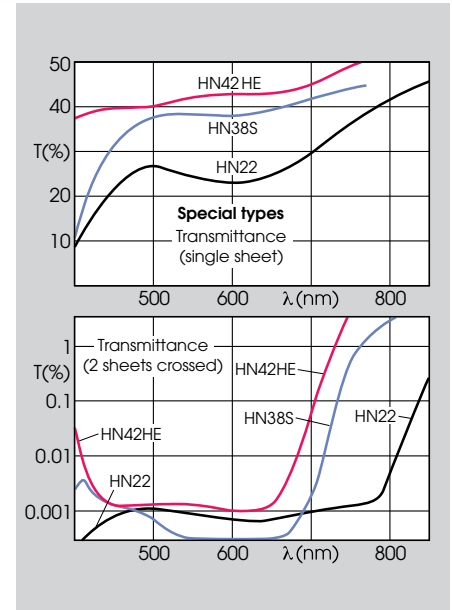
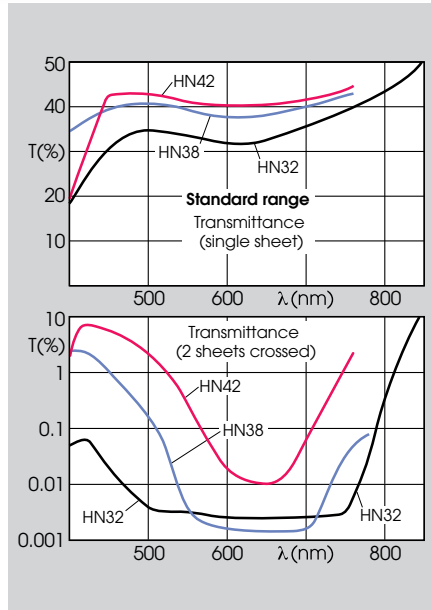
### 8.3 Sheet polarisers (visible)



The materials offered are from the former Polaroid/3M range. All are obsolescent and are being replaced by alternatives. If your application is for ongoing production, please contact us for the current situation.

However, we hold substantial stocks of many of the types. In addition to the standard grades we also offer HN38S and HN42HE, which combine very good extinction with high transmittance, at some extra cost, and HN22 which has the widest wavelength range (400-800nm): for wavelengths outside this range see p.44.

- Glass lamination for durability
- Acrylic for rigid sheets
- CAB for economy and hand cutting



#### Options available

- We offer a unique range of special services.
- Special sizes and shapes
  - Precision alignment of polarising axis ( $\pm 20'$  regularly achieved)
  - Mounting (see p.3) (circles)
  - Special glass laminating
  - Special AR coatings
  - Larger sizes available from stock sheets

#### Technical Data Sheet

Available on request

#### Specification

<b>Diameter</b>	+0, -0.25mm
<b>Length, width</b>	$\pm 0.5\text{mm}$ (<100mm) $\pm 1\text{mm}$ (100-400mm) nominal (> 400mm)
<b>AR coating</b>	Multilayer for visible
<b>Axis direction</b>	typ. $\pm 2^\circ$

Note: Rectangular sheets have axis parallel to short edge

#### Transmittance data\* (%) (uncoated)

Grade	Single	2 sheets	2 sheets at 90°	
			(nom.)	(max.)
HN42	42	34	0.5	0.9
HN38	38	29	0.05	0.1
HN32	32	20	0.005	0.01
HN22	22	10	0.0005	0.001
HN38S	38	29	0.0004	-
HN42HE	42	34	0.002	-

\*Manufacturer's data

Catalogue No. Standard range			Catalogue No. Special types			Size (mm)	Thickness (mm)	Lamination material
HN42	HN38	HN32	HN22	HN38S	HN42HE			
<b>Glass-laminated polarisers, AR coated</b>								
42 CA 25	38 CA 25	32 CA 25	22 CA 25	05 CA 25	04 CA 25	Ø25	3 ± 0.25	B270 glass
<b>Plastic laminates, AR coated</b>								
42 VE 25	38 VE 25	32 VE 25	22 VE 25	05 VE 25	-	Ø25	0.28 ± 0.1	CAB
42 VE 106	38 VE 106	32 VE 106	22 VE 106	05 VE 106	-	Ø50		
<b>Plastic laminates, uncoated</b>								
42 CL 25	38 CL 25	32 CL 25	22 CL 25	-	-	Ø25	3.4 ± 0.75	Acrylic
42 CL 106	38 CL 106	32 CL 106	22 CL 106	-	-	Ø50		
42 CL 50	38 CL 50	32 CL 50	22 CL 50	-	-	50 x 50		
42 CL 100	38 CL 100	32 CL 100	22 CL 100	-	-	100 x 100		
42 WL 25	38 WL 25	32 WL 25	22 WL 25	05 WL 25	-	Ø25	0.75 ± 0.1	CAB (cellulose acetate butyrate) lacquered for protection
42 WL 106	38 WL 106	32 WL 106	22 WL 106	05 WL 106	-	Ø50		
42 WL 50	38 WL 50	32 WL 50	22 WL 50	05 WL 50	-	50 x 50	0.75 ± 0.1	CAB not lacquered
42 WL 100	38 WL 100	32 WL 100	22 WL 100	05 WL 100	-	100 x 100		
42 WL 160	38 WL 160	-	22 WL 160	05 WL 160	-	160 x 160	0.75 ± 0.1	
42 VL 25	38 VL 25	32 VL 25	22 VL 25	05 VL 25	04 VL 25	Ø25	0.28 ± 0.1	CAB not lacquered
-	-	-	-	-	04 VL 106	Ø50		
42 VL 50	38 VL 50	32 VL 50	22 VL 50	05 VL 50	04 VL 50	50 x 50	0.28 ± 0.1	CAB not lacquered
42 VL 100	38 VL 100	32 VL 100	22 VL 100	05 VL 100	-	100 x 100		
42 VL 160	38 VL 160	32 VL 160	-	-	-	160 x 160	0.28 ± 0.1	

†635 x 432mm



UK/Europe/Rest of world  
Sales +44 (0)1223 866120  
Technical +44 (0)1223 866130  
Fax +44 (0)1223 866125  
Email mail@comarinstruments.com

The Americas  
Sales 1 866 40 COMAR (26627)  
Technical 1 306 522 1515  
Fax 1 306 781 6006  
Email solutions@comaroptics.com

## 8.4 UV and IR sheet polarisers

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We now offer very good alternatives to the obsolescent Polaroid UV and IR materials (HNP'B and HR). All offer excellent contrast ratio and high transmission.

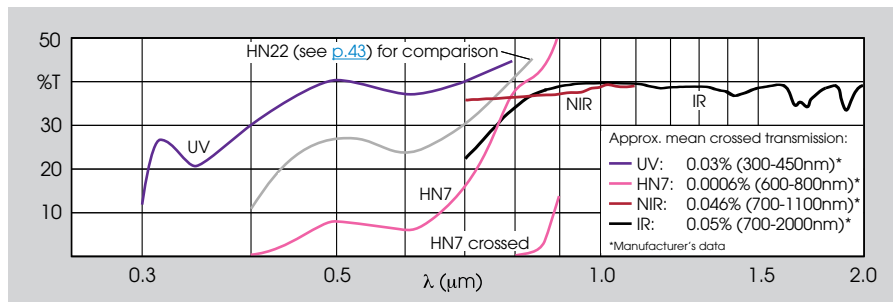
UV material for use down to 280nm.

The IR material (equivalent to the old Polaroid HR) covers 700-2000nm.

The NIR polariser has a narrower bandwidth, 700-1100nm, but is much more economical than the IR.

Finally we still have stocks of the old Polaroid HN7 which is cheap, but range-limited (600-800nm).

Catalogue No.	Material	Wavelength range (nm)	Size (mm)	Thickness (mm)
01 WL 25	UV	280-450+	25 x 25	0.15
01 WL 104	UV	280-450+	Ø25	0.15
01 WL 50	UV	280-450+	50 x 50	0.15
02 WL 25	HN7	800-860	Ø25	0.38
02 WL 50	HN7	800-860	50 x 50	0.38
02 WL 100	HN7	800-860	100 x 100	0.38
06 WL 25	IR	800-2000	25 x 25	0.38
06 WL 104	IR	800-2000	Ø25	0.38
06 WL 50	IR	800-2000	50 x 50	0.38
07 WL 25	NIR	700-1100	25 x 25	0.13
07 WL 104	NIR	700-1100	Ø25	0.13
07 WL 50	NIR	700-1100	50 x 50	0.13



### Options available

- Special sizes
- Mounting (circles)
- Glass laminating

### Technical Data Sheet

Available on request

## 8.5 Circular polarisers

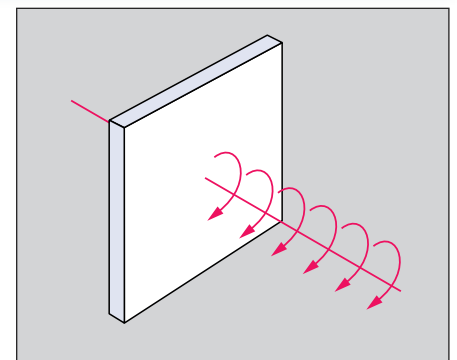
≡Customise

Polaroid circular polariser HNC37 consists of a linear polariser laminated to a quarter-wave plate. Its commonest use is to block specular reflections from displays. The matt non-glare finish helps to suppress reflections from the polariser itself, but can

only be used where the polariser is very close to the display.

The original HNC37 is no longer manufactured, but is being replaced by equivalent material from other sources.

Catalogue No. 50 x 50mm	Catalogue No. 100 x 100mm	Catalogue No. 160 x 160mm	Thickness (mm)	Lamination	Finish
10 WO 50	10 WO 100	10 WO 160	0.8	CAB	clear
11 WO 50	11 WO 100	11 WO 160	0.8	CAB	non-glare
10 CO 50	10 CO 100	10 CO 160	3.4	acrylic	clear
11 CO 50	11 CO 100	11 CO 160	3.4	acrylic	non-glare



## 8.6 Achromatic retarders

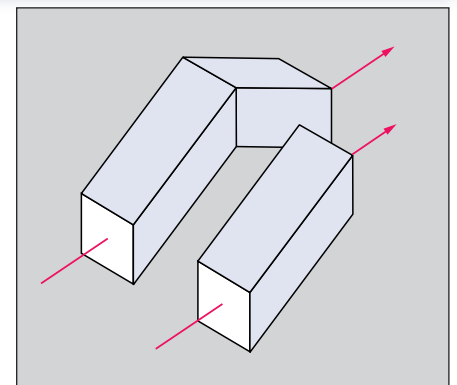
≡Customise

The Fresnel rhomb is unique among retarders in giving a fractional-wave retardation nearly independent of wavelength, the variation due to change of index with wavelength being less than ±1% through the visible (450-700nm) and within ±4% throughout the range of transparency (350-2500nm). The variation with angle is also small (less than ±6% over ±5°) and spurious stress birefringence is reduced by use of a fine-annealed grade of glass. The single (quarter-wave) rhomb gives an output parallel to the input but laterally displaced. The double (half-wave) rhomb has input and output coaxial.

### Specification

Aperture	16 x 16mm
Lateral offset (single rhomb)	21.6mm
Angles	55°20' ± 5'
Material	BK7 (see p.2)

Catalogue No.	Type	Length (mm)
01 JR 16	single (λ/4)	31.3
02 JR 16	double (λ/2)	62.6



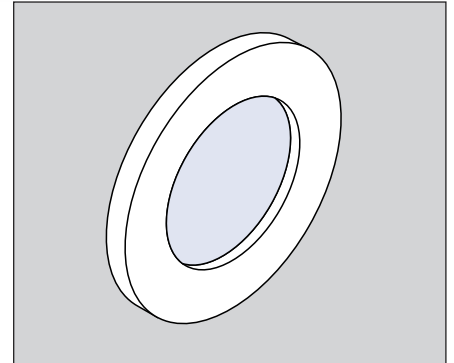
## 8.7 Quartz retarders

These V-AR coated quarter-wave and half-wave plates are suitable for high powers, having negligible absorption and very high transmittance. The low-order single-plate design minimises angle and wavelength dependence whilst avoiding the very high cost of double-plate zero-order retarders.

### Specification

<b>Retardance</b>	±0.005λ
<b>Transmittance</b>	>99.5%
<b>Aperture</b>	13mm
<b>Mount dia.</b>	25mm
<b>Quartz thickness</b>	0.2-0.3mm
<b>Orders of retardance</b>	2-4

Catalogue No. λ/4 plate	Catalogue No. λ/2 plate	Wavelength (nm)
129 GR 04	257 GR 02	514.5
133 GR 04	266 GR 02	532
158 GR 04	316 GR 02	632.8
266 GR 04	532 GR 02	1064



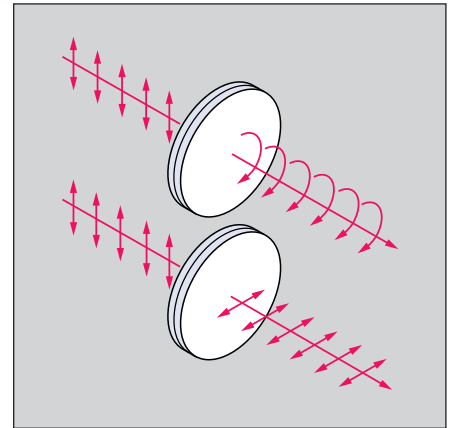
## 8.8 Mica retarders

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The natural cleavage of mica allows accurate zero-order retarders to be made at much lower cost than in quartz. The mica is laminated between glass plates for ease of handling.

The quarter-wave plate converts linear to circular polarisation and is often used with a linear polariser to form an isolator, blocking light reflected from surfaces beyond. The half-wave plate changes the

direction of linear polarisation; with a polarising beamsplitter cube or prism (see p.42) it forms a useful variable-ratio beamsplitter. Mica retarders, being zero-order, can be used over a fairly broad wavelength range; e.g. a 5% change of wavelength results in only 0.6% transmittance of light of incorrect polarisation – see box for calculation.



### Specification

<b>Retardation tolerance:</b>	
Quarter-wave	±0.01λ
Half-wave	±0.02λ
<b>Diameter</b>	25mm +0, -0.2mm
<b>Thickness</b>	3mm ±0.25mm
<b>AR coating</b>	All laminating plates are AR coated for the relevant wavelength

Catalogue No. λ/4 plate	Catalogue No. λ/2 plate	Wavelength (nm)
110 CM 25	221 CM 25	442
122 CM 25	244 CM 25	488
129 CM 25	257 CM 25	515
133 CM 25	267 CM 25	532
136 CM 25	272 CM 25	543
147 CM 25	295 CM 25	589
158 CM 25	316 CM 25	633
167 CM 25	335 CM 25	670
195 CM 25	390 CM 25	780
208 CM 25	415 CM 25	830
266 CM 25	532 CM 25	1064
378 CM 25	755 CM 25	1510

### Options available

- Special wavelengths (usually at no extra cost)
- Special sizes and thickness
- Full-wave and other retardations
- Unlaminated mica
- Mounting (all items, see p.3)
- Edging to special sizes

### Technical notes

- The spurious transmittance of a quarter-wave plate in double passage as an isolator, or of a half-wave plate as a 90° rotator, is given by:

$$\sin^2 \left( \frac{\pi \Delta \lambda}{2\lambda} \right)$$

where Δλ is the difference between the actual wavelength λ and that for which the retardance is a true half or quarter wave.

- The path-difference (retardance expressed in nm) of mica is nearly constant with

wavelength, so that e.g. a quarter-wave plate for 1064nm has 266nm path-difference and is also a half-wave plate at 532nm.

- The birefringence of mica is about 0.0054, so an unlaminate quarter-wave plate for 532nm is about 25μm thick.
- Tilt of a plate can be used to tune retardance either upwards or downwards, according as the rotation is about the fast or slow axis. The effect is approximately quadratic with angle, a 10° tilt causing about 9% change in retardance.

## 8.9 Plastic retarders

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Plastic retarders are an inexpensive alternative to mica or quartz and are available in large sizes. Quarter wave retarder (140 WR) is 0.4mm thick, and half wave retarder (280 WR) is 0.8mm thick.

Catalogue No. 50 x 50mm	Catalogue No. 100 x 100mm	Catalogue No. 150 x 150mm	Catalogue No. 305 x 305mm	Retardance (nm)	Description
140 WR 50	140 WR 100	140 WR 150	140 WR 305	140 ± 20	visible λ/4
280 WR 50	280 WR 100	280 WR 150	280 WR 305	280 ± 40	visible λ/2