

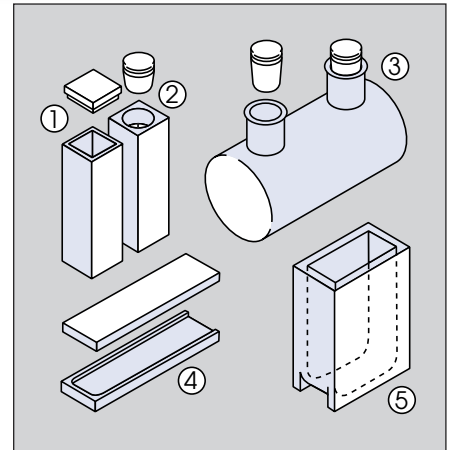
## 6.11 Cells

These cells are of fully-fused construction, containing no adhesive, and are stocked both in crown glass (for 330-2500nm) and in UV silica (for 190-2700nm). Fluorimeter cells have all five faces polished; all other cells have one pair of faces polished.

### Specification

<b>Path length:</b>	
Crown glass	±0.02mm (<10mm)* ±0.1mm (10mm)* ±0.2mm (>10mm)*
UV silica	±0.01mm*
<b>Window thickness</b>	1.25mm
<b>Flatness</b>	2λ over Ø10mm
<b>Parallelism</b>	3min.
<b>Scratch-dig</b>	20-10 (see p.2)

\*Manufacturer's data



Catalogue No. Crown glass	Catalogue No. UV silica	Path length (mm)	Ext. size (mm)	Fig.	Description
01 GT 01	21 GT 01	1	45 x 12.5	-	standard cell with lid
01 GT 10	21 GT 10	10	45 x 12.5	1	standard cell with lid
02 GT 10	22 GT 10	10	48 x 12.5	2	cell with stopper
03 GT 10	23 GT 10	10	45 x 12.5	1	fluorimeter cell
04 GT 10*	-	10	40 x 28	5	absorptiometer cell
05 GT 01	25 GT 01	1	45 x 12.5	4	demountable cell
06 GT 50	26 GT 50	50	Ø22	3	} cylindrical cells with two stoppers
06 GT 100	26 GT 100	100	Ø22	3	
07 GT 50†	27 GT 50	50	Ø50	-	cyl. cell with one stopper

\*Windows 3mm thick †Low-expansion borosilicate glass

### Options available (see p.3)

A full range of cells and accessories, including flow cells, micro and semi-micro cells, other sizes, materials and path lengths etc. available to order, often at very short notice.

## 7.1 Diffusers and screens

≡Customise  

**Anti-Newton** glass gives the weakest diffusion effect. This lightly-etched glass is used to support film in enlargers etc. without interference fringes (Newton's rings) appearing.

**Ground** glass gives a diffusion angle of about ±10° and is useful for focusing screens and for weak diffusion in illuminating systems. We list both LEBG and UV silica (see p.2 for material data).

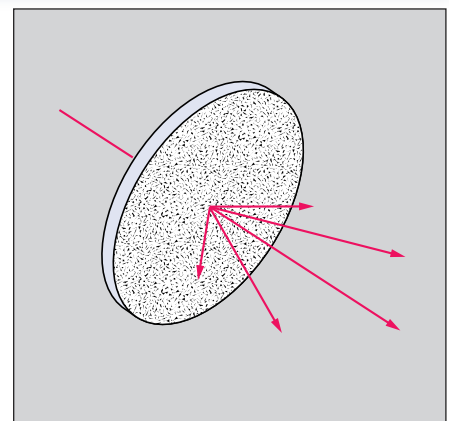
Our plastic materials have much greater diffusion, allowing an image to be back-projected on a large screen without 'hot spot', and have a grey tint to minimise reflection of ambient and scattered light. The 0.3mm PVC material, with a gain of

2.3, is normally stretched over a rigid frame, whereas the 3mm acrylic (with gain of 3) is self-supporting.

**Flashed opal** glass has a nearly Lambertian characteristic (luminance independent of viewing angle) and is used in light boxes and illumination systems where strong diffusion is needed.

### Specification

<b>Diameter</b>	+0, -0.25mm (≤63mm) +0, -0.5mm (>80mm)
<b>Length, width</b>	±0.25mm (glass) ±1mm (plastic)



### Options available (see p.3)

- Mounting (circles up to 50mm dia.)
- Special sizes at short notice
- Edging and cutting to smaller sizes
- Larger sizes available from stock sheet

Glass diffusers (3mm thick)

Catalogue No. Anti-Newton glass	Catalogue No. Ground LEBG	Catalogue No. Ground UV silica	Catalogue No. Flashed opal glass	Dimensions (mm)
-	16 DH 00	16 DS 00	-	Ø16
25 DA 00	25 DH 00	25 DS 00	25 DO 00	Ø25
-	40 DH 00	40 DS 00	40 DO 00	Ø40
50 DA 00	50 DH 00	50 DS 00†	50 DO 00	Ø50
-	63 DH 00‡	-	63 DO 00	Ø63
-	-	-	100 DO 00	Ø100
-	-	-	160 DO 00	Ø160
50 DA 50	50 DH 50	50 DS 50*	50 DO 50	50 x 50
100 DA 100	100 DH 100	-	100 DO 100	100 x 100

\*2mm thick †4mm thick ‡6mm thick

Plastic screens

Catalogue No. 0.3mm PVC	Catalogue No. 3mm acrylic	Size (mm)
100 DF 100	100 DR 100	100 x 100
160 DF 160	160 DR 160	160 x 160
250 DF 250	250 DR 250	250 x 250
400 DF 400	400 DR 400	400 x 400
600 DF 600	600 DR 600	600 x 600

## 7.2 Glass neutral filters



As the absorption takes place in the bulk of the glass, these filters are less prone to surface damage than metal-coated filters, and are also capable of handling higher powers.

The optical density is reasonably constant in the visible (400-600nm) but may be either higher or lower in the NIR depending on glass type. Transmittance figures for several IR wavelengths are given in the table; for fuller detail request our Technical Data Sheet.

### Specification

<b>Optical density</b>	±12.5% (at 546nm)
<b>Diameter</b>	+0, -0.2mm
<b>Length, width</b>	±0.2mm
<b>Thickness</b>	±0.1mm

### Options available (see p.3)

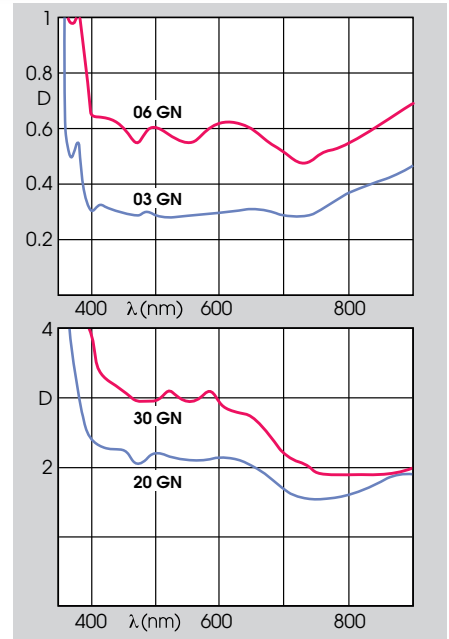
- Mounting (circles only)
- AR coating
- Edging and cutting to special sizes
- Mounting in camera filter rings (see p.80)

### Sets including storage box

<b>04 GN 00</b>	12.5mm set (13 filters)
<b>02 GN 00</b>	25mm set (13 filters)
<b>03 GN 00</b>	50 x 50mm set (12 filters)

### See also:

Light trap	p.59
Filter wheels	p.80
Storage boxes	p.3



### Density calculation

Optical density (D) is related to percentage transmittance (T) by:

$$D = -\log_{10}(T/100)$$

If several filters are used in series their densities can simply be added. Attenuation measured in dB is equal to 10 x density, e.g. density of 2 = 20dB.

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Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50 x 50mm	Density 546nm	Transmittance (%)						Thickness (mm)	Glass type
				546nm	700nm	780nm	850nm	1060nm	1500nm		
01 GN 12	01 GN 25	-	0.1	79	80	78	75	69	77	0.6	NG11
02 GN 12	02 GN 25	02 GN 50	0.2	63	64	60	54	43	59	1.4	NG11
03 GN 12	03 GN 25	03 GN 50	0.3	50	52	46	39	27	44	2.3	NG11
04 GN 12	04 GN 25	04 GN 50	0.4	40	42	35	28	17	34	3.2	NG11
05 GN 12	05 GN 25	05 GN 50	0.5	32	33	27	20	11	26	4.1	NG11
06 GN 12	06 GN 25	06 GN 50	0.6	25	31	30	24	15	32	2.3	NG5
08 GN 12	08 GN 25	08 GN 50	0.8	16	21	20	15	8.2	22	3.1	NG5
10 GN 12	10 GN 25	10 GN 50	1.0	10	14	13	9.4	4.3	15	3.9	NG5
15 GN 12	15 GN 25	15 GN 50	1.5	3.2	5.3	6.7	4.6	2.7	11	2.9	NG4
20 GN 12	20 GN 25	20 GN 50	2	1	2.0	2.7	1.6	0.79	5.5	3.8	NG4
25 GN 12	25 GN 25	25 GN 50	2.5	0.32	1.4	2.5	2.5	1.2	9.8	2.4	NG3
30 GN 12	30 GN 25	30 GN 50	3	0.1	0.60	1.2	1.2	0.51	6.2	2.9	NG3
40 GN 12	40 GN 25	40 GN 50	4	0.01	0.11	0.29	0.29	0.087	2.5	3.9	NG3

## 7.3 Gelatin and polyester neutral filters



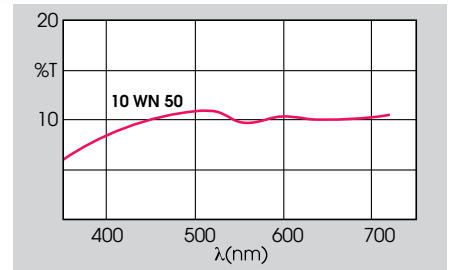
These filters offer accurate achromatic attenuation and are sufficiently thin (0.1mm) not to alter appreciably the state of focus of a system. The gelatin filters, although lacquered for protection, are of course easily damaged by moisture or heat and care is needed in handling.

Much more robust and easy to clean are the Wratten 2 polyester filters manufactured to the same standard as the gelatin filters.

### Specification

<b>Dimensions</b>	
WN	50 x 50 x 0.1mm
WS	75 x 75mm
<b>Density</b>	±5%
(measured in diffuse light to ANSI PH2.19-1959)	

Catalogue No. gelatine	Catalogue No. polyester	Dens.	Trans. (%)
01 WN 50	01 WS 75	0.1	79
02 WN 50	02 WS 75	0.2	63
03 WN 50	03 WS 75	0.3	50
04 WN 50	04 WS 75	0.4	40
05 WN 50	05 WS 75	0.5	32
06 WN 50	06 WS 75	0.6	25
07 WN 50	07 WS 75	0.7	20
08 WN 50	08 WS 75	0.8	16
09 WN 50	09 WS 75	0.9	13
10 WN 50	10 WS 75	1.0	10
15 WN 50	-	1.5	3.2
20 WN 50	20 WS 75	2.0	1.0
30 WN 50	30 WS 75	3.0	0.1
40 WN 50	40 WS 75	4.0	0.01



- Inexpensive and accurate
- Low scatter
- Neutral 450-720nm
- Easily cut to size

### Sets at special price

<b>01 WN 00</b>	Complete set (14 filters)
<b>01 WS 00</b>	Complete set (13 filters)



Stock items:  
-too big?  
-too small?  
-quite different?

try:



Stock optics  
reduced in size  
as needed



Larger sizes  
available from  
stock sheets



Metal parts  
machined  
as required

Customise - See page 1 for more detail

## 7.4 Metallic neutral filters

Customise

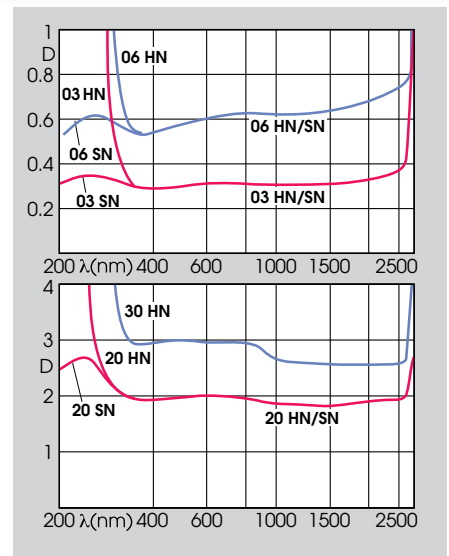
These filters consist of a thin layer of nickel-chromium alloy vacuum-deposited on a glass substrate. This gives excellent neutrality and very accurate attenuation. About half the rejected light is absorbed and the remainder reflected, so these filters can also be used as beamsplitters. Our Visible/IR range have low-expansion borosilicate glass substrates and cover the range 350-2500nm.

Our UV range are on synthetic fused silica and extend the useful range down to about 170nm. Note that the density of all filters is specified at 550nm, but in the UV it can be up to 40% higher – see curves.

All filters are supplied with a copy transmittance scan taken on a filter from the same production run.

### Sets including storage box

01 HN 00	Visible/IR 25mm dia. set (13 filters)
02 HN 00	Visible/IR 50 x 50mm set (13 filters)
01 SN 00	UV 25mm dia. set (11 filters)
02 SN 00	UV 50 x 50mm set (11 filters)



Catalogue No. Visible/IR Ø25 x 2mm	Catalogue No. Visible/IR 50 x 50 x 2mm	Catalogue No. UV Ø25 x 2mm	Catalogue No. UV 50 x 50 x 2mm	Density (550nm)	Transmittance (550nm) (%)
003 HN 25	003 HN 50	003 SN 25	003 SN 50	0.03*	93
01 HN 25	01 HN 50	01 SN 25	01 SN 50	0.1 ± 0.015	79
02 HN 25	02 HN 50	02 SN 25	02 SN 50	0.2 ± 0.015	63
03 HN 25	03 HN 50	03 SN 25	03 SN 50	0.3 ± 0.015	50
04 HN 25	04 HN 50	04 SN 25	04 SN 50	0.4 ± 0.015	40
05 HN 25	05 HN 50	05 SN 25	05 SN 50	0.5 ± 0.015	32
06 HN 25	06 HN 50	06 SN 25	06 SN 50	0.6 ± 0.015	25
08 HN 25	08 HN 50	08 SN 25	08 SN 50	0.8 ± 0.015	16
10 HN 25	10 HN 50	10 SN 25	10 SN 50	1.0 ± 0.015	10
15 HN 25	15 HN 50	15 SN 25	15 SN 50	1.5 ± 0.02	3.2
20 HN 25	20 HN 50	20 SN 25	20 SN 50	2.0 ± 0.03	1.0
30 HN 25	30 HN 50	-	-	3.0 ± 0.06	0.1
40 HN 25	40 HN 50	-	-	4.0 ± 0.12	0.01

\* Uncoated substrate

### Options available (see p.3)

- Mounting (25mm dia. only)
- All filters can be cut down or edged to special sizes
- Mounting in camera filter rings (see p.80)

### Technical data available

Set of transmittance curves for all filter types

## 7.5 Variable neutral filters

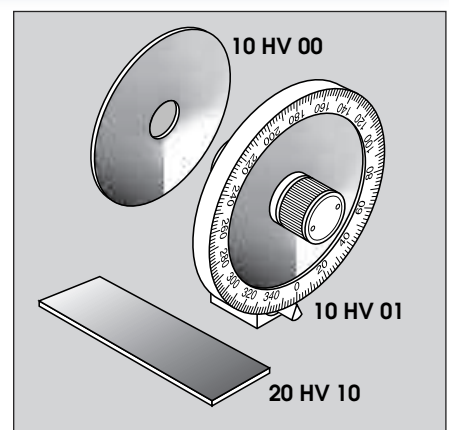
Customise

These filters have a precisely-graduated Ni-Cr-Fe coating and can be used as variable attenuators or as variable beamsplitters. A combination of two filters with opposite orientation gives uniform density over larger apertures.

The circular filters have density varying with angle, allowing adjustment by simple rotation. Both surfaces have multilayer AR coatings. We offer both unmounted discs

and complete assemblies with scale graduated in degrees and M6 thread to take standard posts (p.74).

An economical alternative is the rectangular linear filter with density increasing along the length. This has a multilayer-AR coated rear face and a small wedge (15') across the width to reduce multiple reflections.



Catalogue No. Unmounted	Catalogue No. Complete assembly	Maximum density
<b>Circular filters</b>		
10 HV 00	10 HV 01	1
15 HV 00	15 HV 01	1.5
20 HV 00	20 HV 01	2
30 HV 00	30 HV 01	3
<b>Linear filter</b>		
20 HV 10	-	2

### Dimensions (mm)

#### Unmounted circular filters:

Diameter	50 ± 0.25
Thickness	1.5 ± 0.2
Hole dia.	8 ± 0.25
Coated area	Ø46 x 300°

#### Circular filter assemblies:

Overall dia.	52
Aperture	Ø12 - Ø42

#### Linear filter:

Dimensions	76.2 x 25.4 x 2
Coated length*	~56

\*First 20mm (approx.) of length uncoated

### Specification

#### Density (633nm):

Circular*	±5% of max. value
Linear*	±8% of max. value

#### Material

BK7 (see p.2)

\*Manufacturer's data

7.6 Glass colour filters



Solid glass filters, mostly from Schott materials, are listed in two sizes. These boast excellent blocking characteristics - especially the long-pass types.

Most types are additionally stocked in polished plates about 165mm square permitting large 'specials' to be cut at

short notice via our *Customise* service.

Our **540 GB** photopic filters are a laminated construction and are designed to adapt the spectral response of silicon detectors or cameras to approximate that of the human eye.

**Technical Data Sheets**

Available for each filter; please specify type

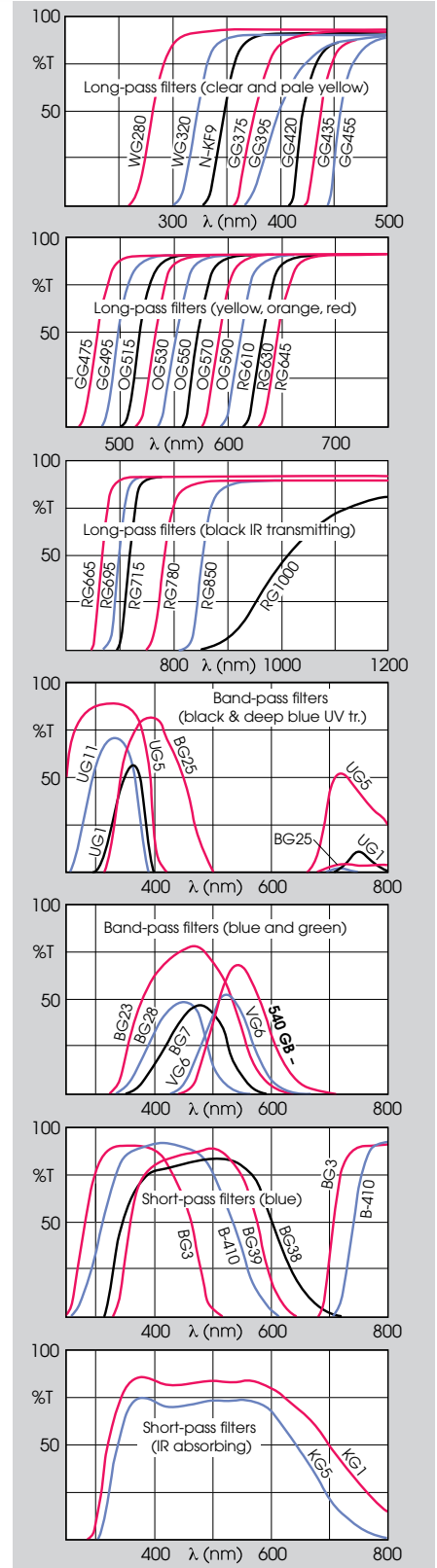
**Options available (see p.3)**

- Mounting (circles)
- Edging and cutting special sizes
- Mounting in camera filter rings (see p.80)
- AR coating

**Specification**

**Material** Schott glass  
**Diameter** +0, -0.2mm  
**Length/width** ±0.2mm  
**Thickness** ±0.2mm  
 Note: Wavelength listed in table is transition wavelength (T = Tmax/2) for long-pass and short-pass filters, and peak for band-pass filters

Catalogue No. 25mm dia.	Catalogue No. 50 x 50mm	Glass type	Thick. (mm)	Wave-length (nm)	Description
<b>Long-pass filters</b>					
280 GY 25	280 GY 50	WG280	2	280	} colourless filters transmitting visible and some UV
315 GY 25	315 GY 50	WG320	2	315	
340 GY 25*	341 GY 50	N-KF9	3	341	
375 GY 25	375 GY 50	GG375	3	375	} colourless UV-absorbing
395 GY 25	395 GY 50	GG395	3	395	
420 GY 25	420 GY 50	GG420	3	420	} very pale yellow
435 GY 25	435 GY 50	GG435	3	435	
455 GY 25	455 GY 50	GG455	3	455	pale yellow
475 GY 25	475 GY 50	GG475	3	475	yellow
495 GY 25	495 GY 50	GG495	3	495	yellow
515 GY 25	515 GY 50	OG515	3	515	deep yellow
530 GY 25	530 GY 50	OG530	3	530	yellow-orange
550 GY 25	550 GY 50	OG550	3	550	orange
570 GY 25	570 GY 50	OG570	3	570	orange-red
590 GY 25	590 GY 50	OG590	3	590	bright red
610 GY 25	610 GY 50	RG610	3	610	red
630 GY 25	630 GY 50	RG630	3	630	deep red
645 GY 25	645 GY 50	RG645	3	645	very deep red
665 GY 25	665 GY 50	RG665	3	665	} extreme red/IR transmitting
695 GY 25	695 GY 50	RG695	3	695	
715 GY 25	715 GY 50	RG715	3	715	} black filters passing IR from the stated wavelength to 2.7µm
780 GY 25	780 GY 50	RG780	3	780	
850 GY 25	850 GY 50	RG850	3	850	
1000 GY 25	1000 GY 50	RG1000	3	1000	
<b>Band-pass filters</b>					
320 GB 25	320 GB 50	UG5	3	320	} black UV-transmitting
330 GB 25	330 GB 50	UG11	3	330	
360 GB 25	360 GB 50	UG1	3	360	} deep blue
390 GB 25	390 GB 50	BG25	3	390	
445 GB 25	445 GB 50	BG28	3	445	blue
465 GB 25	465 GB 50	BG23	3	465	bright blue
475 GB 25	475 GB 50	BG7	3	475	blue
520 GB 25	520 GB 50	VG6	3	520	green
540 GB 25	540 GB 50	-	5	540	photopic (eye response)
<b>Short-pass filters</b>					
465 GK 25	465 GK 50	BG3	1	465	deep blue, UV-transmitting
538 GK 25	538 GK 50	B-410‡	2.5	538	bright blue, UV-transmitting
575 GK 25	575 GK 50	BG39	3	575	pale blue, strongly absorbs red/NIR
610 GK 25	610 GK 50	BG38	3	610	pale blue, absorbs red/NIR
668 GK 25	668 GK 50	KG5	3	668	IR-absorbing
716 GK 25	716 GK 50	KG1	3	716	IR-absorbing, toughened §



**See also:**

- Neutral glass filters [p.34](#)
- More heat filters [p.38](#)
- Storage boxes [p.3](#)

\* 25mm dia. is in similar Hoya type UV-34, 340nm cut-off, 2.5mm thick. ‡ Hoya § See [p.38](#) for full range of heat filters

7



**Stock items:**  
 -too big?  
 -too small?  
 -quite different?

try:



**Customise** - See [page 1](#) for more detail





### 7.7 Gelatin and polyester colour filters

≡Customise

The well-known Wratten gelatin filters, an industry standard for many years, are now being replaced by 'Wratten 2' filters. These are manufactured in polyester and are much more robust, but are still made to the same spectral standard.

We are introducing them as they become available, distinguishing them from the original catalogue number by changing the letter pairs from **WY** and **WB** to **KY** and **KB** respectively.

We also offer a low-cost range of polyester filters which are rough equivalents of the Wratten range.

#### Specification

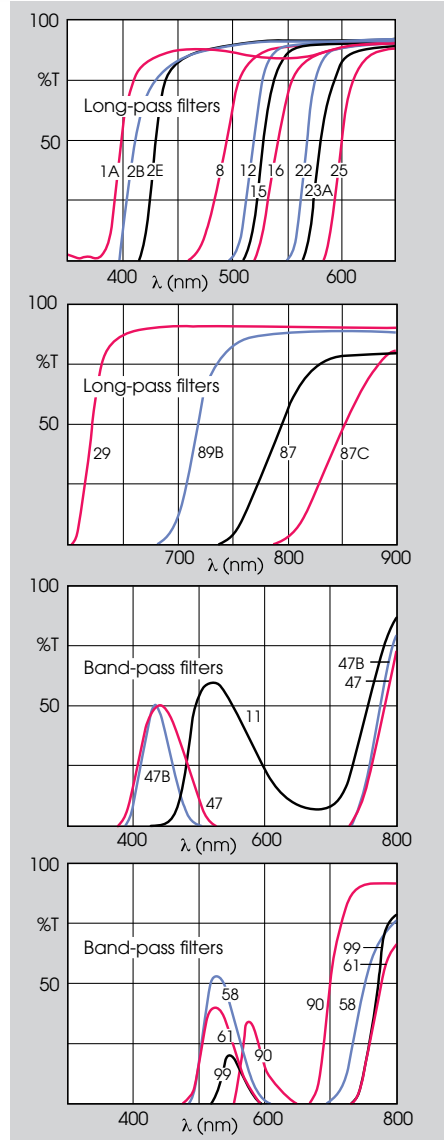
**Dimensions** 75 x 75 x 0.1mm  
**Transmittance** See curves

Note: Wavelength listed is transition wavelength (T = 50%) for long-pass and peak for band-pass types. Data and curves are based on Wratten data; for exact curves for polyester see Technical Data Sheets.

#### Technical Data Sheets

Available for each filter; please specify type

Catalogue No. 'Wratten' gelatin	Catalogue No. Polyester	Wratten No.	Wavelength (nm)	Description
<b>Long-pass filters</b>				
-	<b>395 CY 75</b>	1A	395	pale pink UV-absorbing (skylight)
<b>411 WY 75</b>	<b>411 CY 75</b>	2B	411	pale yellow UV-absorbing
<b>430 WY 75</b>	-	2E	430	pale yellow UV-absorbing
<b>494 WY 75</b>	<b>494 CY 75</b>	8	494	yellow
<b>519 WY 75</b>	<b>519 CY 75</b>	12	519	deep yellow (minus blue)
<b>528 WY 75</b>	<b>528 CY 75</b>	15	528	deep yellow
<b>540 WY 75</b>	<b>540 CY 75</b>	16	540	yellow-orange
<b>568 WY 75</b>	-	22	568	deep orange
-	<b>581 CY 75</b>	23A	581	orange-red
<b>600 WY 75</b>	<b>600 CY 75</b>	25	600	tricolour red
<b>622 WY 75</b>	-	29	622	narrow-cut tricolour red
<b>717 WY 75</b>	-	89B	717	black filters passing IR from the stated wavelength to 2.7µm
<b>794 WY 75</b>	<b>794 CY 75</b>	87	794	
<b>852 WY 75</b>	-	87C	852	
<b>Band-pass filters</b>				
<b>432 WB 75</b>	<b>432 CB 75</b>	47B	432	narrow-cut tricolour blue
<b>440 WB 75</b>	-	47	440	tricolour blue
<b>516 WB 75</b>	<b>516 CB 75</b>	11	516	yellowish green
<b>525 WB 75</b>	-	61	525	narrow-cut tricolour green
<b>527 WB 75</b>	<b>527 CB 75</b>	58	527	tricolour green
<b>547 WB 75</b>	-	99	547	dark green
<b>575 WB 75</b>	-	90	575	dark amber monochromat



### 7.8 Acrylic filters

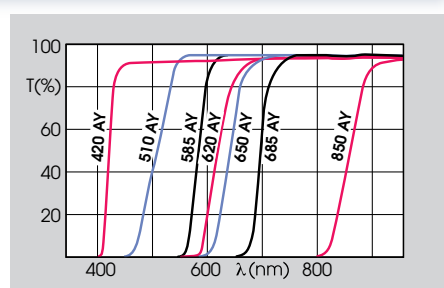
≡Customise

These robust and inexpensive long-pass filters are available in large sheets. The UV blocking type is often used for protection from photochemical damage. The IR black filters are used to cover IR transmitters or receivers to hide them from view and block unwanted ambient light.

#### Specification

**Diameter** +0, -0.2mm  
**Length, width** ±0.5mm (50mm)  
±1mm (400mm)  
**Thickness** ±0.2mm

Catalogue No. 25mm dia.	Catalogue No. 50 x 50 mm	Catalogue No. 400 x 400 mm	TWL (T = 50%) (nm)	Thick. (mm)	Description
<b>420 AY 25</b>	<b>420 AY 50</b>	<b>420 AY 400</b>	420	1	clear UV blocking
<b>510 AY 25</b>	<b>510 AY 50</b>	<b>510 AY 400</b>	510	1	yellow
<b>585 AY 25</b>	<b>585 AY 50</b>	<b>585 AY 400</b>	585	1	light red
<b>620 AY 25</b>	<b>620 AY 50</b>	<b>620 AY 400</b>	620	1	red
<b>650 AY 25</b>	<b>650 AY 50</b>	<b>650 AY 400</b>	650	1	dark red
<b>685 AY 25</b>	<b>685 AY 50</b>	<b>685 AY 400</b>	685	1	black IR trans.
<b>850 AY 25</b>	<b>850 AY 50</b>	<b>850 AY 400</b>	850	1	black IR trans.



#### Options available (see p.3)

- Mounting in camera filter rings (see p.80)
- Edging and cutting special sizes

## 7.9 Heat-control optics

≡Customise

Heat filters absorb unwanted IR. Hot and cold mirrors, at some extra cost, divide much more sharply between IR and visible and can handle more power. Hot mirrors reflect IR and transmit visible, whilst cold mirrors reflect visible and transmit IR.

For further specification detail request a Technical Data Sheet.

### Specification

<b>Diameter</b>	+0, -0.2mm
<b>Length, width</b>	±0.2mm
<b>Thickness</b>	±0.25mm
<b>Heat filters:</b>	
Material	Schott KG1, toughened
<b>Hot mirrors:</b>	
Transmittance (0°)*	>88% (425-675nm) typical 94%
Reflectance (0°)*	>95% (760-1150nm)
Substrate	LEBG float (see p.2)
<b>Cold mirrors:</b>	
Reflectance (45°)*	>90% (425-650nm)
Transmittance (45°)*	>90% (800-1200nm)
Substrate	LEBG float (see p.2)

\*Average over wavelength regions stated

### Catalogue No. Dimensions (mm)

#### Heat filters

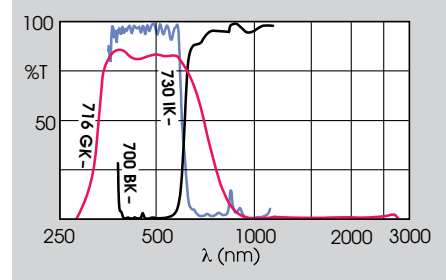
716 GK 25	Ø25 x 3
716 GK 105	Ø40 x 3
716 GK 106	Ø50 x 3
716 GK 40	40 x 40 x 3
716 GK 50	50 x 50 x 3
716 GK 63	63 x 63 x 3

#### Hot mirrors (0°)

730 IK 25	Ø25 x 3
730 IK 105	Ø40 x 3
730 IK 106	Ø50 x 3
730 IK 40	40 x 40 x 3
730 IK 50	50 x 50 x 3
730 IK 63	63 x 63 x 3
730 IK 80	80 x 80 x 3

#### Cold mirrors (45°)

700 BK 16	25 x 16 x 3
700 BK 25	40 x 25 x 3
700 BK 40	63 x 40 x 3
700 BK 63	100 x 63 x 3
700 BK 100	160 x 100 x 3



### Options available (see p.3)

- Mounting (circular items)
- Edging and cutting special sizes
- Special sizes
- Mounting in camera filter rings (see p.80)
- Larger sizes available from stock sheets

### See also:

Other short-pass filters [p.36](#)

7

## 7.10 Dichroic filters (0°)

≡Customise

These filters consist of thin-film dielectric coatings on glass with sharp transitions between the transmitted and reflected bands. Having negligible absorption they are suitable for high powers and do not show the strong fluorescence of certain glass filters.

Where strong blocking is needed, however, glass filters (p.36) or bandpass interference filters (pp.39-41) are recommended.

Data are given for normal incidence; if used at 45° the shift towards shorter wavelengths is about 35-50nm.

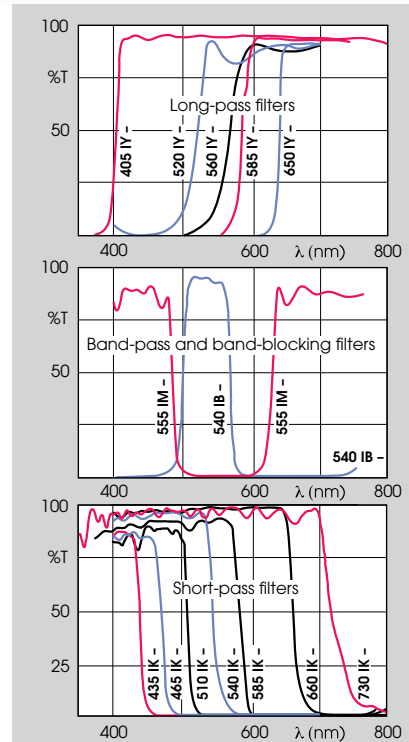
### New range now available

Comprehensive new range of dichroic filters now stocked including greatly increased choice of long-pass, short-pass, band pass and band block types.

[Click here for full information.](#)

Catalogue No. 25mm dia.	Catalogue No. 50 x 50mm	TWL* (T=50%) (nm)	Passband (nm)	Block band (nm)	Thick. (mm)	Description
<b>Long-pass filters</b>						
405 IY 25	405 IY 50	405	420-760	300-380	1	UV block.
520 IY 25	520 IY 50	520	545-760	400-480	1	yellow
560 IY 25	560 IY 50	560	585-760	425-525	1	orange
585 IY 25	585 IY 50	590	615-760	400-540	1	red
650 IY 25	650 IY 50	650	680-760	400-595	1	deep red
<b>Band-pass filters</b>						
540 IB 25	540 IB 50	{505 575}	530-550	{380-460 600-730}	1	green
<b>Short-pass filters</b>						
435 IK 25	435 IK 50	435	390-415	475-710	1	violet
465 IK 25	465 IK 50	465	400-440	500-740	1	deep blue
510 IK 25	510 IK 50	510	400-490	550-700	1	blue
540 IK 25	540 IK 50	540	400-510	580-700	1	light blue
585 IK 25	585 IK 50	585	420-565	630-760	1	cyan
660 IK 25	660 IK 50	660	400-640	690-1000	1	IR block.
730 IK 25	730 IK 50	730	425-675	750-1150	3	hot mirror †
<b>Band-blocking filters</b>						
555 IM 25	555 IM 50	{485 630}	{400-460 650-730}	530-560	1	magenta

\* Transition wavelength † For full range of hot mirrors see 7.9 above



### Specification

<b>Diameter</b>	+0, -0.2mm
<b>Length, width</b>	±0.25mm
<b>Thickness</b>	±0.2mm
<b>Transmittance</b>	Request data sheet

### 7.11 Dichroic beamsplitters (45°)

Customise

These are similar to the dichroic filters above but are used at 45°, so separating two spectral regions to be used or detected simultaneously. Applications include separation of laser wavelengths, fluorescence microscopy and tricolour separation. The UV mirrors allow UV to be isolated without expensive transmitting materials.

#### Specification

**Dimensions** ±0.25mm  
For full specification request a Technical Data Sheet.

#### New range now available

Comprehensive new range of dichroic filters now stocked including greatly increased choice of long-pass, short-pass, band pass and band block types.

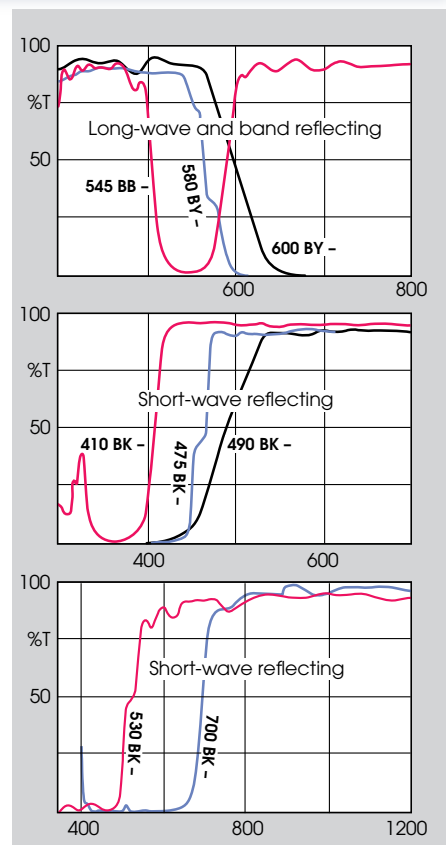
[Click here for full information.](#)

#### Options available (see p.3)

- Edging and cutting special sizes
- Mounting in camera filter rings (see p.80)
- Larger sizes available from stock sheets

Catalogue No. 25 x 16mm	Catalogue No. 40 x 25mm	TWL* (T=50%) (nm)	Trans. band (nm)	Refl. band (nm)	Thick. (mm)	Description (Reflected light)
<b>Long-wave reflecting</b>						
580 BY 16	580 BY 25	580	400-550	610-725	1	red
600 BY 16	600 BY 25	600	400-560	640-760	1	red
<b>Band reflecting</b>						
545 BB 16	545 BB 25	{500}{590}	{400-480}{620-760}	520-560	1	green
<b>Short-wave reflecting</b>						
410 BK 16	410 BK 25	410	440-700	340-390	1	UV
475 BK 16	475 BK 25	475	525-800	380-450	1	blue
490 BK 16	490 BK 25	490	520-760	400-450	1	blue
530 BK 16	530 BK 25	530	600-1200	325-475	3	UV/blue
700 BK 16	700 BK 25	700	800-1200	425-650	3	visible†

\* Transition wavelength † For full range of cold mirrors see p.38



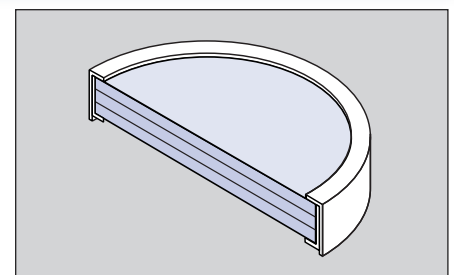
### 7.12 Interference filters

Customise

These filters consist of an all-dielectric Fabry-Perot coating, prepared – along with other coatings for additional blocking – on large sheets of glass, which are then cemented to form a solid stack. Individual filters are then cut and mounted in nested rings, providing a labyrinth epoxy edge seal which greatly extends their life. Filter life, however, is not indefinite and filters should be stored with desiccant to prevent damage to the hydrophilic coatings. Each filter is marked with catalogue number and batch code and supplied with a copy scan from its production batch.

Uses include laser signal discrimination, line selection, colorimetry and fluorimetry. Although not originally designed for imaging, they are often so used, but please note that the various reflective surfaces in each filter are not precisely parallel and multiple reflections of bright objects in the field of view may be troublesome.

Filters used with high flux must have the more reflective side towards the incoming light.



#### See also:

Storage boxes [p.3](#)

#### Dimensions

**Diameter** +0, -0.3mm  
**Thickness** 5-6mm  
**Clear aperture:**  
12.5mm dia. 8.6mm  
25mm dia. 19mm  
50mm dia. 44mm

#### Options available (see p.3)

- Mounting in camera filter rings (see p.80)

#### Specification

Range	IN	IL (<1100nm)	IL (≥1100nm)	IH	IU	IW
<b>CWL Tolerance (nm)</b>	+0.8,-0.5	±2.5	±3.5	±2.5	±6	±8
<b>HBW tolerance (nm)</b>	±0.8	±2.5	±3.5	±2.5	±6	±9
<b>Bandwidth ratios*:</b>						
10%BW/HBW	1.74	1.35	1.74	1.35	1.13	1.05
1%BW/HBW	3.21	1.99	3.21	1.99	1.30	1.18
0.1%BW/HBW	6.09	2.92	6.09	2.92	1.60	1.36
0.01%BW/HBW	12.68	4.41	12.68	4.41	2.04	1.69
<b>Blocking type and specification</b>	Induced transmittance filter 10 <sup>-4</sup> absolute, 200-3500nm+			Dielectric stacks: 10 <sup>-4</sup> ave., 10 <sup>-3</sup> abs., x-ray to 1150nm		
<b>No of cavities (min)</b>	2	3	2	3	5	7

\* Manufacturers data. A few items may have more cavities than standard, hence lower ratios.

† Some filters have 5 cavities, see extra - broadband range on p.41. Filters with 5 cavities will have the same bandwidth ratios as the broadband range.

## 7.12 Interference filters (continued)

Customise

### Interference filter glossary

**Bandwidth (HBW, FWHM):** Width of the pass-band; specifically, the difference between the two wavelengths at which the transmittance is half the peak value. Similarly, 10% bandwidth (10%BW) is measured between points where T = 10% of the peak, etc.

**Blocking:** Rejection of energy outside the pass-band. Absolute blocking is the transmittance level not exceeded at any point in the specified wavelength range. Average blocking is a value averaged over the range.

**Cavity:** The basic element from which a filter is constructed, consisting of two reflective coating stacks with a spacer layer between. Our standard range are based on a series of three cavities, all deposited as a single stack of layers. Wider-band filters have more cavities and therefore a squarer shape of passband.

**Centre wavelength (CWL):** The wavelength midway between the half-power points which define bandwidth (see above).

**Transmittance (T):** The guaranteed minimum value of the peak transmittance of the filter (not necessarily occurring at the centre wavelength)

### Technical notes

- To estimate the transmittance near the passband, use the bandwidth ratios given on p.39: e.g. **340 IL 12** has HBW = 10; for **IL** range 1%BW/HBW = 1.99, so 1%BW = 19.9; i.e. transmittance will be 1% of peak (about 0.3% absolute) at  $340 \pm (19.9/2)$ , i.e. about 330nm and 350nm.

- For light incident at an angle the centre wavelength  $\lambda_0$  will shift to:

$$\lambda(\theta) = \lambda_0 (1 - k \sin^2\theta)$$

where k is approximately 0.24 for **IW** filters and 0.11 for all others.

- The CWL shifts towards longer wavelengths with increasing temperature, at about 0.01nm/K

### Specification

See p.32

### Boxed filter sets

Sets are supplied complete with a wooden storage box, at a discount on the individual filter prices. Items included in sets are marked in the tables.

**01 IL 12** 12.5mm } 10nm bandwidth UV/  
**01 IL 25** 25mm } visible sets (10 filters)  
**01 IL 50** 50mm }

**02 IL 12** 12.5mm } 10-18nm bandwidth  
**02 IL 25** 25mm } IR sets (10 filters)

**01 IU 12** 12.5mm } 40nm bandwidth  
**01 IU 25** 25mm } sets (10 filters)  
**01 IU 50** 50mm }

**01 IW 12** 12.5mm } 65-75nm bandwidth  
**01 IW 25** 25mm } sets (10 filters)

**Custom sets:** Order 10 or more different interference filters in the same size and we will supply a wooden storage box (see p.3) free of charge.

Narrowband range (3nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
488 IN 12	488 IN 25	488	3	35
515 IN 12	515 IN 25	514.5	3	35
532 IN 12	532 IN 25	532	3	35
546 IN 12	546 IN 25	546.1	3	40
568 IN 12	568 IN 25	568.2	3	40
578 IN 12	578 IN 25	577.7	3	40
589 IN 12	589 IN 25	589.6	3	40
633 IN 12	633 IN 25	632.8	3	40
670 IN 12	670 IN 25	670	3	40

Standard range (10nm bandwidth) continued

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
520 IL 12*	520 IL 25*	520 IL 50*	520	10	50
530 IL 12	530 IL 25	530 IL 50	530	10	50
532 IL 12	532 IL 25	-	532	10	50
532 IH 12	532 IH 25	532 IH 50	532	10	75
540 IL 12	540 IL 25	540 IL 50	540	10	50
543 IL 12	543 IL 25	-	543	10	50
546 IL 12	546 IL 25	546 IL 50	546.1	10	50
550 IL 12*	550 IL 25*	550 IL 50*	550	10	50
560 IL 12	560 IL 25	560 IL 50	560	10	50
570 IL 12*	570 IL 25*	570 IL 50*	570	10	50
578 IL 12	578 IL 25	-	577.7	10	50
580 IL 12	580 IL 25	-	580	10	50
589 IL 12	589 IL 25	-	589.6	10	50
590 IL 12	590 IL 25	590 IL 50	590	10	50
600 IL 12*	600 IL 25*	600 IL 50*	600	10	50
610 IL 12	610 IL 25	610 IL 50	610	10	50
620 IL 12	620 IL 25	620 IL 50	620	10	50
630 IL 12	630 IL 25	630 IL 50	630	10	50
633 IL 12	633 IL 25	-	632.8	10	50
633 IH 12	633 IH 25	633 IH 50	632.8	10	75
636 IL 12	636 IL 25	-	636	10	50
640 IL 12	640 IL 25	640 IL 50	640	10	50
645 IL 12	645 IL 25	-	645	10	50
650 IL 12*	650 IL 25*	650 IL 50*	650	10	50
656 IL 12	656 IL 25	656 IL 50	656.3	10	50
660 IL 12	660 IL 25	660 IL 50	660	10	50
670 IL 12	670 IL 25	-	670	10	50
670 IH 12	670 IH 25	670 IH 50	670	10	75
675 IH 12	675 IH 25	-	675	10	75
680 IL 12	680 IL 25	680 IL 50	680	10	50
685 IH 12	685 IH 25	685 IH 50	685	10	75
690 IL 12	690 IL 25	690 IL 50	690	10	50
694 IL 12	694 IL 25	-	694.3	10	50
700 IL 12*	700 IL 25*	700 IL 50*	700	10	50
710 IL 12	710 IL 25	-	710	10	50

Standard range (10nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
340 IL 12*	340 IL 25*	340 IL 50*	340	10	30
365 IL 12	365 IL 25	365 IL 50	365	10	30
380 IL 12	380 IL 25	380 IL 50	380	10	30
390 IL 12	390 IL 25	-	390	10	33
400 IL 12*	400 IL 25*	400 IL 50*	400	10	33
405 IL 12	405 IL 25	-	405	10	35
410 IL 12	410 IL 25	410 IL 50	410	10	43
420 IL 12	420 IL 25	420 IL 50	420	10	45
430 IL 12	430 IL 25	430 IL 50	430	10	45
436 IL 12	436 IL 25	436 IL 50	435.8	10	45
440 IL 12	400 IL 25	440 IL 50	440	10	45
450 IL 12*	450 IL 25*	450 IL 50*	450	10	45
458 IL 12	458 IL 25	458 IL 50	457.9	10	45
460 IL 12	460 IL 25	-	460	10	45
470 IL 12	470 IL 25	470 IL 50	470	10	45
480 IL 12	480 IL 25	480 IL 50	480	10	45
488 IL 12	488 IL 25	-	488	10	45
488 IH 12	488 IH 25	488 IH 50	488	10	70
490 IL 12	490 IL 25	490 IL 50	490	10	45
500 IL 12*	500 IL 25*	500 IL 50*	500	10	50
510 IL 12	510 IL 25	510 IL 50	510	10	50
515 IL 12	515 IL 25	-	514.5	10	50
515 IH 12	515 IH 25	515 IH 50	514.5	10	70

\*Included in set (see box above)



Stock items:  
-too big?  
-too small?  
-quite different?

try:



Stock optics  
reduced in size  
as needed



Larger sizes  
available from  
stock sheets



Metal parts  
machined  
as required

Customise - See page 1 for more detail



### 7.12 Interference filters (continued)



Standard IR range (10-18nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
720 IL 12	720 IL 25	720	10	50
730 IL 12	730 IL 25	730	10	50
740 IL 12	740 IL 25	740	10	50
750 IL 12*	750 IL 25*	750	10	50
760 IL 12	760 IL 25	760	10	50
770 IL 12	770 IL 25	770	10	50
775 IH 12	775 IH 25	775	10	75
780 IL 12*	780 IL 25*	780	10	50
780 IH 12	780 IH 25	780	10	75
785 IH 12	785 IH 25	785	10	75
790 IL 12	790 IL 25	790	10	50
800 IL 12*	800 IL 25*	800	10	50
810 IL 12	810 IL 25	810	10	45
820 IL 12	820 IL 25	820	10	45
820 IH 12	820 IH 25	820	10	75
825 IH 12	825 IH 25	825	10	75
830 IL 12	830 IL 25	830	10	45
830 IH 12	830 IH 25	830	10	75
835 IH 12	835 IH 25	835	10	75
840 IL 12	840 IL 25	840	10	45
850 IL 12*	850 IL 25*	850	10	45
860 IL 12	860 IL 25	860	10	45
870 IL 12	870 IL 25	870	10	45
880 IL 12	880 IL 25	880	10	45
885 IH 12	885 IH 25	885	10	75
890 IL 12	890 IL 25	890	10	45
900 IL 12*	900 IL 25*	900	10	45
900 IH 12	900 IH 25	900	10	75
905 IL 12	905 IL 25	905	10	50
905 IH 12	905 IH 25	905	10	75
910 IL 12	910 IL 25	910	10	50
910 IH 12	910 IH 25	910	10	75
920 IL 12	920 IL 25	920	10	50
930 IL 12	930 IL 25	930	10	50
940 IL 12	940 IL 25	940	10	50
950 IL 12*	950 IL 25*	950	10	50
960 IL 12	960 IL 25	960	10	50
970 IL 12	970 IL 25	970	10	50
980 IL 12	980 IL 25	980	10	45
990 IL 12	990 IL 25	990	10	50
1000 IL 12*	1000 IL 25*	1000	15/14 <sup>¶</sup>	50
1020 IL 12	1020 IL 25	1020	15/14 <sup>¶</sup>	50
1040 IL 12	1040 IL 25	1040	15	50
1050 IL 12	1050 IL 25	1050	15/14 <sup>¶</sup>	47
1064 IL 12*	1064 IL 25*	1064	16	50
1064 IH 12†	1064 IH 25†	1064	10	75
1080 IL 12	1080 IL 25	1080	15/14 <sup>¶</sup>	45
1100 IL 12*	1100 IL 25*	1100	16.5/14 <sup>¶</sup>	45
1120 IL 12	1120 IL 25	1120	17.5	45
1140 IL 12	1140 IL 25	1140	17.5/14 <sup>¶</sup>	45
1160 IL 12	1160 IL 25	1160	18/11 <sup>¶</sup>	45
1180 IL 12	1180 IL 25	1180	11	45
1200 IL 12*	1200 IL 25*	1200	11	45
1220 IL 12	1220 IL 25	1220	11	45
1240 IL 12	1240 IL 25	1240	11.5/11 <sup>¶</sup>	45
1260 IL 12	1260 IL 25	1260	12/11 <sup>¶</sup>	45
1280 IL 12	1280 IL 25	1280	12/11 <sup>¶</sup>	45
1300 IL 12	1300 IL 25	1300	12	45
1320 IL 12	1320 IL 25	1320	12.5/12 <sup>¶</sup>	45
1340 IL 12	1340 IL 25	1340	13/12 <sup>¶</sup>	45
1360 IL 12	1360 IL 25	1360	13/12 <sup>¶</sup>	45
1380 IL 12	1380 IL 25	1380	13.5/12 <sup>¶</sup>	45

Standard IR range (10-18nm bandwidth) continued

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
1400 IL 12	1400 IL 25	1400	14/12 <sup>¶</sup>	40
1420 IL 12	1420 IL 25	1420	14/12 <sup>¶</sup>	40
1440 IL 12	1440 IL 25	1440	14/12 <sup>¶</sup>	40
1460 IL 12	1460 IL 25	1460	14/12 <sup>¶</sup>	40
1480 IL 12	1480 IL 25	1480	15/12 <sup>¶</sup>	40
1500 IL 12	1500 IL 25	1500	15/14 <sup>¶</sup>	40
1520 IL 12	1520 IL 25	1520	15/13 <sup>¶</sup>	40
1540 IL 12	1540 IL 25	1540	15/13 <sup>¶</sup>	40
1560 IL 12	1560 IL 25	1560	15/13 <sup>¶</sup>	40
1580 IL 12	1580 IL 25	1580	16/13 <sup>¶</sup>	40
1600 IL 12	1600 IL 25	1600	16/13 <sup>¶</sup>	40
1620 IL 12	1620 IL 25	1620	16/13 <sup>¶</sup>	40
1640 IL 12	1640 IL 25	1640	16/13 <sup>¶</sup>	40
1660 IL 12	1660 IL 25	1660	14/13 <sup>¶</sup>	40
1680 IL 12	1680 IL 25	1680	14	40
1700 IL 12	1700 IL 25	1700	15	40
1800 IL 12	1800 IL 25	1800	17/15 <sup>¶</sup>	40
1900 IL 12	1900 IL 25	1900	16	35
2000 IL 12	2000 IL 25	2000	17	35

Broadband range (22-40nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
400 IU 12*	400 IU 25*	400 IU 50*	400	40	45
450 IU 12*	450 IU 25*	450 IU 50*	450	40	60
500 IU 12*	500 IU 25*	500 IU 50*	500	40	70
550 IU 12*	550 IU 25*	550 IU 50*	550	40	75
570 IU 12	570 IU 25	-	570	40	75
600 IU 12*	600 IU 25*	600 IU 50*	600	40	75
633 IU 12	633 IU 25	633 IU 50	632.8	40	75
650 IU 12*	650 IU 25*	650 IU 50*	650	40	75
660 IU 12	660 IU 25	-	660	40	75
670 IU 12*	670 IU 25*	670 IU 50*	670	40	75
678 IH 12†	678 IH 25†	678 IH 50†	678	22	75
700 IU 12*	700 IU 25*	700 IU 50*	700	40	75
730 IU 12	730 IU 25	730 IU 50	730	30	75
750 IU 12*	750 IU 25*	750 IU 50*	750	40	75
780 IU 12	780 IU 25	780 IU 50	780	30	75
830 IU 12	830 IU 25	830 IU 50	830	40	75
850 IU 12*	850 IU 25*	850 IU 50*	850	40	75
905 IU 12	905 IU 25	-	905	40	75

\*Included in set (see box p.40)

†Special design; bandwidth ratios do not apply

Extra-broadband range (65-75nm bandwidth)

Catalogue No. 12.5mm dia.	Catalogue No. 25mm dia.	Catalogue No. 50mm dia.	CWL (nm)	HBW (nm)	T(typ.) (%)
500 IW 12*	500 IW 25*	500 IW 50	500	70	70
550 IW 12*	550 IW 25*	550 IW 50	550	70	75
600 IW 12*	600 IW 25*	600 IW 50	600	65	75
650 IW 12*	650 IW 25*	650 IW 50	650	75	75
670 IW 12	670 IW 25	670 IW 50	670	75	75
700 IW 12*	700 IW 25*	-	700	70	75
750 IW 12*†	750 IW 25*†	-	750	60	75
800 IW 12*†	800 IW 25*†	800 IW 50	800	65	75
820 IW 12	820 IW 25	-	820	75	75
850 IW 12*†	850 IW 25*†	850 IW 50	850	70	75
880 IW 12†	880 IW 25†	-	880	70	75
900 IW 12*†	900 IW 25*†	-	900	60	75
940 IW 12	940 IW 25	-	940	60	75
950 IW 12*	950 IW 25*	-	950	65	75

\*Included in set (see box p.40) †Blocked to 1250nm

\*Included in set (see box p.40). †5 cavities

¶Undergoing redesign with narrower bandwidth. If exact bandwidth critical please enquire for specification of current stock