Optical filters for light sources
Standard bandpass filters

- *Wavelengths from UV-IR*
- *Narrow 10 nm bandwidth*
- *Excellent blocking outside of bandpass*
- *Measured transmission curve supplied*

About bandpass filters

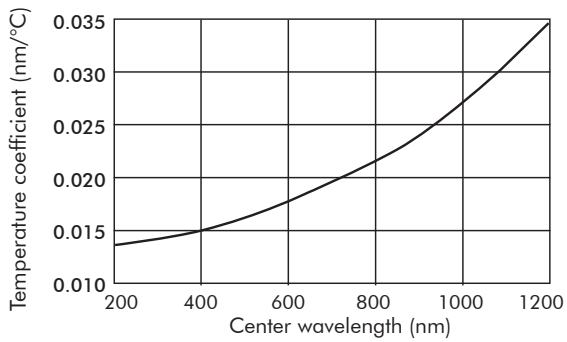
The use of bandpass filters is one of the simplest and most economical ways to transmit a well-defined band of light and to reject all other unwanted radiation. Essentially their design is a thin film Fabry-Perot interferometer formed by vacuum deposition, and consists of two reflecting stacks separated by an even-order spacer layer.

Because the Fabry-Perot filter essentially isLorentzian in shape, the cut-on and cut-off slopes are shallow and the rate of attenuation in the out-of-band blocking range is slow.

A proprietary method is used to stabilize our products to prevent drift of peak wavelength with age, and hermetically seal each filter for maximum protection against humidity. Each filter is mounted in a black anodized aluminium ring, adding further protection against chipping, scratching, and moisture penetration.

Ambient temperature

The center wavelength of a bandpass filter shifts linearily with changes in ambient temperature - up with a positive change and down with a negative change. The temperature coefficient chart below gives a good approximation of the shift in wavelength for a given temperature change.



Temperature wavelength shift coefficient

Angle of incidence

The central wavelength of the all-dielectric Fabry-Perot filter shifts lower with an increase in the incident angle. The amount of shift depends upon the incident angle and the filter's effective index (N*). This feature can be very useful in tuning a filter to the desired central wavelength. Use the formula below to determine the wavelength shift of a filter in collimated light with incident angles up to 15°.

$$\lambda_\theta = \lambda_0 \left[1 - (Ne/N^*)^2 \sin^2{}_\theta\right]^{1/2}$$

With:
- λ_θ = Wavelength at angle of incidence
- λ_0 = Wavelength at normal incidence
- Ne = Refractive index of external medium
- N* = Effective refractive index of the filter
- θ = Angle of incidence

Use of filters in converging beams

When using a filter with non-collimated light, the wavelength shift will be less than that of collimated light at the same angle. In a converging beam, the varying angles will result in broadening of the effective bandwidth and a shift of the peak to a shorter wavelength. To approximate this shift, use the same formula and divide the results by two. (This approach works in systems where the full cone angle is up to 20°.) The narrower the bandwidth the more noticeable are the effects of the angle change and the more collimated the beam needs to be.

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Optical filters for light sources
Neutral density filters

General specifications		
Diameter tolerance	+0/-0.25 mm	
Usable aperture	Size	Aperture
	25.0 mm Ø	21.0 mm Ø
	50.0 mm Ø	45.0 mm Ø
Surface quality	80 - 50 (Per MIL-PRF-13830B)	
Optical quality	Commercial instrumentation grade	
Out-of-band blocking	1 x 10^{-4} from X-ray to FIR	
Specification temp.	+23° C	
Max. survival temperature range	CW/L 214 - 380 nm	-50° C to +50° C
	CW/L 380.1 - 2400 nm	-50° C to +70° C
Humidity resistance	Per MIL-C-48497A	
Mechanical	Mounted in an anodized aluminum ring	

Incident power

No general specification can be given because of the disparate sources used with these filters. Temperature changes in excess of 5 degrees C per minute, whether environment or absorbed radiation induced, can cause cracking or delamination of filters. Most filters have a highly reflective (mirror-like) side and a darker absorptive or colored side. Always place the highly reflec - tive side towards a high intensity source. In this way the large majority of the unwanted radiation is reflected rather than absorbed and converted to heat in the filter itself. Check that the reflected radiation will not damage the source. With high power broadband incident radiation of (≥300 W) arc or halogen sources it may be necessary to use a water filter before the optical components in order to absorb excess infrared radiation.

Filters and monochromators

When should interference filters be used instead of a monochromator?

- When higher energy transmission is desired, especially with large area light sources. Depending on the size of the source and the optical system used, increases in effective transmission of 5 to 500 times are possible compared to monochromator. This is due to the aperture limitation in monochromators and the necessity to focus onto a small slit.
- When only a few wavelengths are desired: the lower cost of using filters prevails when measurement at only a few wavelengths need to be measured.

Monochromators used with interference filters

Interference filters are effective in reducing the stray light accompanying the output from a fixed wavelength grating monochromator. If a high-intensity continuous source is used, the filter should be placed between the exit slit and the detector to reduce the thermal load on the filter.

UV bandpass filters

CWL [nm]	Bandwidth [nm]	Min. peak transmission [%]	N *	Max. thickness [mm]	Part number 25 mm dia.	Part number 50 mm diam.
220.0 +3/ -0	10 ± 2	12	-	4.0	220FS10-25	220FS10-50
239.0 +3/ -0	10 ± 2	15	-	4.0	239FS10-25	239FS10-50
248.0 +3/ -0	10 ± 2	12	-	4.0	248FS10-25	248FS10-50
260.0 +3/ -0	10 ± 2	12	-	4.0	260FS10-25	260FS10-50
270.0 +3/ -0	10 ± 2	12	-	4.0	270FS10-25	270FS10-50
280.0 +3/ -0	10 ± 2	12	-	4.0	280FS10-25	280FS10-50
289.0 +3/ -0	10 ± 2	15	-	4.0	289FS10-25	289FS10-50
300.0 +3/ -0	10 ± 2	15	-	4.0	300FS10-25	300FS10-50
310.0 +3/ -0	10 ± 2	15		4.0	310FS10-25	310FS10-50
320.0 +3/ -0	10 ± 2	25	1.45	8.0	320FS10-25	320FS10-50
330.0 +3/ -0	10 ± 2	25	1.45	8.0	330FS10-25	330FS10-50
340.0 +3/ -0	10 ± 2	25	1.45	7.0	340FS10-25	340FS10-50
350.0 +3/ -0	10 ± 2	25	1.45	7.0	350FS10-25	350FS10-50
360.0 +3/ -0	10 ± 2	25	1.45	7.0	360FS10-25	360FS10-50
370.0 +3/ -0	10 ± 2	25	1.45	7.0	370FS10-25	370FS10-50
380.0 +3/ -0	10 ± 2	25	1.45	7.0	380FS10-25	380FS10-50
390.0 +3/ -0	10 ± 2	35	1.45	7.0	390FS10-25	390FS10-50

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Optical filters for light sources
Colored glass filters

VIS NIR bandpass filters						
CWL [nm]	**Bandwidth [nm]**	**Min. peak Transmission [%]**	**N ***	**Max. thickness [mm]**	**Part number 25 mm diam.**	**Part number 50 mm diam.**
400.0 +3/ -0	10 ± 2	45	1.45	7.0	400FS10-25	400FS10-50
410.0 +3/ -0	10 ± 2	45	1.45	7.0	410FS10-25	410FS10-50
420.0 +3/ -0	10 ± 2	45	1.45	7.0	420FS10-25	420FS10-50
430.0 +3/ -0	10 ± 2	45	1.45	7.0	430FS10-25	430FS10-50
440.0 +3/ -0	10 ± 2	45	1.45	7.0	440FS10-25	440FS10-50
450.0 +3/ -0	10 ± 2	45	1.45	7.0	450FS10-25	450FS10-50
460.0 +3/ -0	10 ± 2	50	1.45	7.0	460FS10-25	460FS10-50
470.0 +3/ -0	10 ± 2	50	2.05	7.0	470FS10-25	470FS10-50
480.0 +3/ -0	10 ± 2	50	2.05	7.0	480FS10-25	480FS10-50
490.0 +3/ -0	10 ± 2	55	2.05	7.0	490FS10-25	490FS10-50
500.0 +3/ -0	10 ± 2	55	2.05	7.0	500FS10-25	500FS10-50
510.0 +3/ -0	10 ± 2	55	2.05	7.0	510FS10-25	510FS10-50
520.0 +3/ -0	10 ± 2	55	2.05	7.0	520FS10-25	520FS10-50
530.0 +3/ -0	10 ± 2	55	2.05	7.0	530FS10-25	530FS10-50
540.0 +3/ -0	10 ± 2	55	2.05	7.0	540FS10-25	540FS10-50
550.0 +3/ -0	10 ± 2	55	2.05	7.0	550FS10-25	550FS10-50
560.0 +3/ -0	10 ± 2	55	2.05	7.0	560FS10-25	560FS10-50
570.0 +3/ -0	10 ± 2	55	2.05	7.0	570FS10-25	570FS10-50
580.0 +3/ -0	10 ± 2	55	2.05	7.0	580FS10-25	580FS10-50
590.0 +3/ -0	10 ± 2	55	2.05	7.0	590FS10-25	590FS10-50
600.0 +3/ -0	10 ± 2	55	2.05	7.0	600FS10-25	600FS10-50
610.0 +3/ -0	10 ± 2	55	2.05	7.0	610FS10-25	610FS10-50
620.0 +3/ -0	10 ± 2	55	2.05	7.0	620FS10-25	620FS10-50
630.0 +3/ -0	10 ± 2	55	2.05	7.0	630FS10-25	630FS10-50
640.0 +3/ -0	10 ± 2	60	2.05	7.0	640FS10-25	640FS10-50
650.0 +3/ -0	10 ± 2	55	2.05	7.0	650FS10-25	650FS10-50
660.0 +3/ -0	10 ± 2	55	2.05	7.0	660FS10-25	660FS10-50
670.0 +3/ -0	10 ± 2	55	2.05	7.0	670FS10-25	670FS10-50
680.0 +3/ -0	10 ± 2	55	2.05	7.0	680FS10-25	680FS10-50
690.0 +3/ -0	10 ± 2	55	2.05	7.0	690FS10-25	690FS10-50
700.0 +3/ -0	10 ± 2	55	2.05	7.0	700FS10-25	700FS10-50
710.0 +3/ -0	10 ± 2	55	2.05	7.0	710FS10-25	710FS10-50
720.0 +3/ -0	10 ± 2	55	2.05	7.0	720FS10-25	720FS10-50
730.0 +3/ -0	10 ± 2	50	2.05	7.0	730FS10-25	730FS10-50
750.0 +3/ -0	10 ± 2	50	2.05	7.0	750FS10-25	750FS10-50
760.0 +3/ -0	10 ± 2	50	2.05	7.0	760FS10-25	760FS10-50
770.0 +3/ -0	10 ± 2	50	2.05	7.0	770FS10-25	770FS10-50

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CWL [nm]	**Bandwidth [nm]**	**Min. peak transmission [%]**	**N ***	**Max. thickness [mm]**	**Part number 25 mm diam.**	**Part number 50 mm diam.**
780.0 +3/ -0	10 ± 2	50	2.05	7.0	780FS10-25	780FS10-50
790.0 +3/ -0	10 ± 2	50	2.05	7.0	790FS10-25	790FS10-50
800.0 +3/ -0	10 ± 2	50	2.05	7.0	800FS10-25	800FS10-50
810.0 +3/ -0	10 ± 2	50	2.05	7.0	810FS10-25	810FS10-50
820.0 +3/ -0	10 ± 2	50	2.05	7.0	820FS10-25	820FS10-50
830.0 +3/ -0	10 ± 2	50	2.05	7.0	830FS10-25	830FS10-50
840.0 +3/ -0	10 ± 2	50	2.05	7.0	840FS10-25	840FS10-50
850.0 +3/ -0	10 ± 2	50	2.05	7.0	850FS10-25	850FS10-50
860.0 +3/ -0	10 ± 2	50	2.05	7.0	860FS10-25	860FS10-50
870.0 +3/ -0	10 ± 2	50	2.05	7.0	870FS10-25	870FS10-50
880.0 +3/ -0	10 ± 2	50	2.05	7.0	880FS10-25	880FS10-50
890.0 +3/ -0	10 ± 2	50	2.05	7.0	890FS10-25	890FS10-50
900.0 +3/ -0	10 ± 2	50	2.05	7.0	900FS10-25	900FS10-50
910.0 +3/ -0	10 ± 2	50	2.05	7.0	910FS10-25	910FS10-50
920.0 +3/ -0	10 ± 2	50	2.05	7.0	920FS10-25	920FS10-50
930.0 +3/ -0	10 ± 2	50	2.05	7.0	930FS10-25	930FS10-50
940.0 +3/ -0	10 ± 2	50	2.05	7.0	940FS10-25	940FS10-50
950.0 +3/ -0	10 ± 2	50	2.05	7.0	950FS10-25	950FS10-50
960.0 +3/ -0	10 ± 2	50	2.05	7.0	960FS10-25	960FS10-50
970.0 +3/ -0	10 ± 2	50	2.05	7.0	970FS10-25	970FS10-50
980.0 +3/ -0	10 ± 2	50	2.05	7.0	980FS10-25	980FS10-50
990.0 +3/ -0	10 ± 2	50	2.05	7.0	990FS10-25	990FS10-50
1000.0 +3/ -0	10 ± 2	45	2.05	8.5	100FS10-25	100FS10-50
1050.0 +3/ -0	10 ± 2	45	2.05	8.5	050FS10-25	050FS10-50
1100.0 +3/ -0	10 ± 2	40	2.05	8.5	110FS10-25	110FS10-50
1150.0 +3/ -0	10 ± 2	40	2.05	8.5	115FS10-25	115FS10-50
1200.0 +3/ -0	10 ± 2	35	2.05	8.5	120FS10-25	120FS10-50
1250.0 +3/ -0	10 ± 2	35	2.05	8.5	125FS10-25	125FS10-50
1300.0 +3/ -0	10 ± 2	35	2.05	8.5	130FS10-25	130FS10-50
1350.0 +3/ -0	10 ± 2	35	2.05	8.5	135FS10-25	135FS10-50
1400.0 +3/ -0	10 ± 2	30	2.05	8.5	140FS10-25	140FS10-50
1500.0 +3/ -0	10 ± 2	30	2.05	8.5	150FS10-25	150FS10-50
1550.0 +3/ -0	10 ± 2	30	2.05	8,5	155FS10-25	155FS10-50

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