



Optometrics

OMEGA
OPTICAL HOLDINGS

INTERFERENCE FILTERS

Narrow Bandpass Filters 334-1650 nm

Broadband Filters

Laser Line Filters

Long Pass and Short Pass Filters

FOR APPLICATIONS IN:

- Analytical Chemistry
- Physics
- Life Sciences
- Engineering
- Communications



Optometrics Corporation has, for more than forty years, designed and manufactured a broad selection of interference filters for a variety of applications in the industrial, educational and research markets.

Designing and producing interference filters is a complex procedure requiring thin-film expertise and sophisticated instrumentation.

Optometrics Corporation produces its filters in-house on customized vacuum systems, operated by a staff of experienced technicians.

We manufacture interference filters with central wavelengths from 334 nm to 1650 nm in various sizes. This allows you to select the most appropriate and economical filter that meets your optical performance criteria.

FACILITIES

Optometrics' facility in Ayer, Massachusetts contains space for offices, engineering, R&D and production. Equipment that support our broad range of capabilities includes:

- Four metal vacuum coating systems;
- Three thin-film soft coated filter vacuum coating systems;
- Two Ion-Assisted Deposition hard coat vacuum coating systems;
- Three grating ruling engines;
- Production holographic laboratory;
- R&D holographic laboratory;
- Full replication and lamination facilities;
- Full assembly, alignment and test facilities;
- Full complement of test equipment for spectral testing from the UV to the Far Infrared, for mechanical and latness testing, for humidity and environmental testing;
- Extensive marking, packaging and bar coding equipment and capabilities



PRODUCTS

Gratings

Originals and Replicated, Ruled and Holographic; Grazing Incidence, Echelles, Telecom and Transmission Gratings

Beamsplitters

Reflecting/Transmitting Beamsplitters

Optical Components

Mirrors, Lenses, Windows, Flats, Beamsplitters, Prisms

Filters

Soft Coated, Near Ultraviolet, Visible, Near Infrared, and Laser Line Filters

Infrared & Laser Products

Laser Gratings, Holographic Wire Grid Polarizers

Monochromators

Mini-Chrom Monochromators

Systems & Accessories

Plus specialized packaging, bar coding and Kanban stocking arrangements for all OEM customers.

GOALS

Optometrics goal is to provide advanced optical components and systems for use in wavelength selection applications in:

- Analytical Chemistry
- Life Sciences
- Telecom Applications
- Physics
- Education
- Space Sciences

and other applications where high quality optics are key.

In order to accomplish this, the Company has assembled state-of-the-art facilities and people to produce:

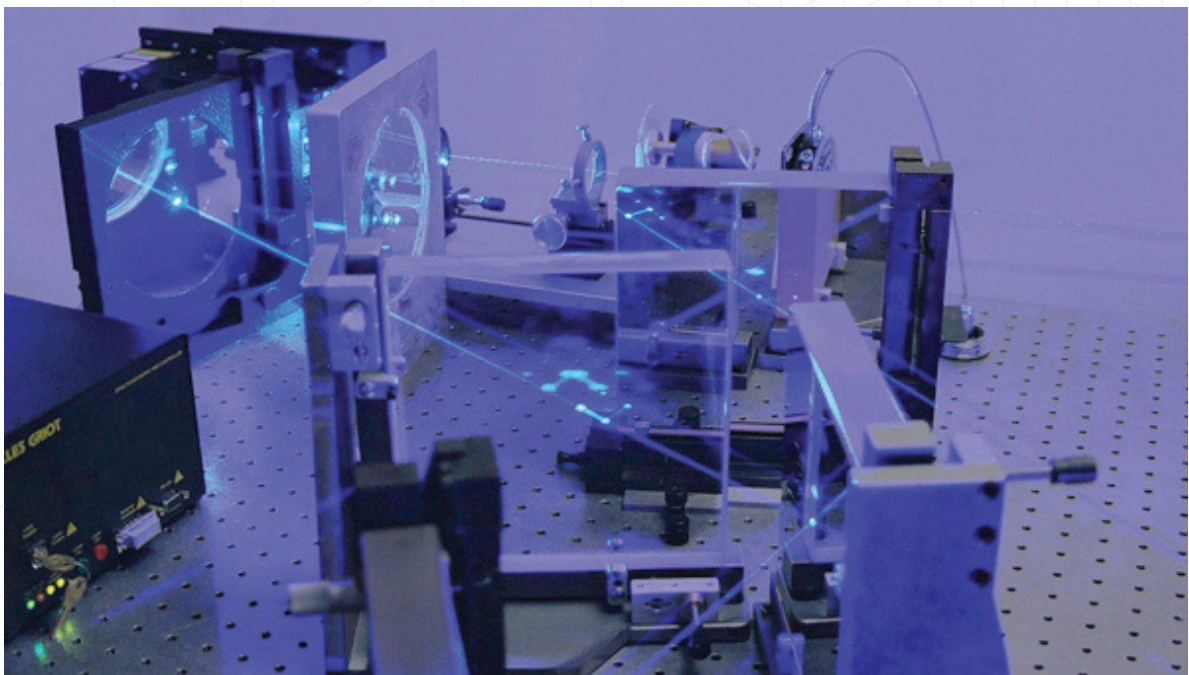
- Diffraction gratings: ruled & holographic, original & replicated, reflection and transmission
- Interference filters
- Optical components
- Laser gratings & products
- Monochromators & accessories
- Spectrophotometers
- Wire grid polarizers: ruled & holographic

OEM SERVICES

Optometrics caters, in particular, to the needs of its OEM customers by offering special services such as:

- Kanban stocking arrangements
- Custom packaging programs
- Bar coding capabilities
- Code names for complete confidentiality
- Higher level pre-aligned optical assemblies

The Company is also proud of its ability to support customers in all phases of the product development cycle



Background & Technology

INTERFERENCE FILTERS

Interference bandpass filters are relatively inexpensive wavelength selectors that allow transmission of a predetermined wavelength while rejecting or blocking other wavelengths. Interference filters are widely used in instrumentation for clinical chemistry, environmental testing, colorimetry, elemental and laser line separation, flame photometry, fluorescence, immunoassays, etc.

Optometrics Corporation produces thousands of filters specified by and designed for other instrument manufacturers. If our standard filters do not conform to your requirements, Optometrics can design and manufacture filters to your performance and dimensional specifications.

FILTERS AS WAVELENGTH SELECTORS

Interference filters should be considered when the application requires a limited number of known wavelengths, when energy throughput is more critical than wavelength resolution or when cost is more important than flexibility.

The relative low cost and simple installation of interference filters makes them the preferred wavelength selector for applications such as clinical chemistry, environmental testing, laser line separation and flame photometry, where the required wavelengths are well known.

The energy throughput of an interference filter is usually much greater than can be achieved with a monochromator, where throughput is dependent on slit size, grating efficiency, input optics, etc. The entire clear aperture of an interference filter can be illuminated, resulting in high throughput and an excellent signal-to-noise ratio.

An application that requires numerous analytical wavelengths, variable resolution, far ultraviolet analysis, spectral analysis, etc., will require a prism or grating monochromator rather than interference filters. (See our *Monochromators and Modules Brochure*)

PRODUCTION

An interference filter is fabricated in 3 sections, one of which determines the central wavelength (CWL), halfbandwidth (HBW), and shape of the transmittance curve while the other two control the degree and range of blocking outside the passband. After thin film deposition is complete, the three sections are scribed, laminated, cut and mounted.

The bandpass section of an interference filter is made by repetitive vacuum deposition of thin layers of partially reflecting dielectric compounds on a glass substrate. A typical interference filter can have over fifty such layers, each one precisely controlled and evenly deposited over the preceding layer. The thickness of each layer is equal to a quarter wave ($\lambda/4$) of the filter central wavelength (λ). Alternating layers of dielectric materials with high and low refractive indices make up a stack. A half wave ($\lambda/2$) layer, or a multiple thereof, deposited between symmetric stacks, forms a spacer layer. The halfbandwidth of an interference filter is determined by the ratio of the indices of the high and low dielectric materials, the number of layers in a stack and the number of half waves in a spacer. A spacer layer and adjacent stacks form a "cavity", the basic element of an interference filter. The number of cavities in the bandpass section determines the overall shape of the transmittance curve. Most Optometrics filters are made with three cavities, resulting in filters with steep slopes, improved blocking close to the passband and relatively flat tops.

Rejection of wavelengths resulting from destructive interference is limited to within 15% of the central wavelength. Therefore, additional glass or metallic blockers must be added to reduce out-of-bandpass transmittance. Metallic blockers, which consist of layers of silver deposited on the dielectric spacer layer, reflect and absorb radiation outside the filter passband and negates higher order passbands from X-ray to the far IR. The blocking capabilities of metallic blockers are augmented in high performance filters by the addition of color glass and custom dyes that absorb UV or long wavelength radiation.

TEMPERATURE EFFECTS

The central wavelength of an interference filter can shift with increasing or decreasing temperatures. This effect, which is due primarily to the expansion or contraction of the spacer layers and the concomitant change in their refractive indices, is extremely small over normal operating ranges (≈ 0.01 nm/oC). Prolonged operation at high temperatures ($>75^{\circ}\text{C}$) will irreversibly set the central wavelength lower. Temperatures above 125°C should be avoided.

Though interference filters will function at -50°C or lower, the cooling rate should not be allowed to exceed 5°C per minute. An excessive cooling rate can cause the glass substrate to crack or the filter to delaminate due to differential thermal contraction.

SOURCE ORIENTATION

An interference filter will function with either side facing the source. It is recommended, however, that the side with the “mirror-like” reflective coating be oriented toward the source. This will minimize any thermal effect that could result from the absorption of heat by the color glass or blockers on the other side.

ANGLE OF INCIDENCE

An interference filter should be illuminated with collimated radiation normal (perpendicular) to the surface of the filter. The central wavelength will shift slightly to a lower wavelength if the illuminating radiation is not normal to the filter. A deviation of less than 3 degrees results in a negligible wavelength shift. At large deviations, the wavelength shift is significant, transmittance decreases and the shape of the passband changes.

When noncollimated radiation impinges on the filter, the result is similar to that stated above. In this case, the effect is dependent on the cone angle of the illuminating radiation. Varying the angle of incidence from normal can be used to “tune” an interference filter within a limited wavelength range.

LIFE TIME

Interference filters in the UV-VIS-NIR range are subject to environmental deterioration due to moisture penetration of the hygroscopic dielectric layers. Though the bandpass and blocking sections of interference filters are laminated with epoxy, a high humidity environment can cause delamination.

A process known as scribing results in excellent moisture protection. Scribing removes all dielectric material from the periphery of a filter, allowing a glass-to-glass epoxy seal that minimizes moisture penetration. Optometrics filters are also sealed in a metal ring, but the primary purpose of the ring is to protect the filter from physical damage, particularly the relatively soft color glass. Optometrics routinely tests its filters in a humidity chamber and Optometrics filters routinely pass MIL standard 810E aggravated test protocols.

INTEGRATED BLOCKING

Blocking refers to the degree to which transmitted radiation outside the filter passband is restricted. A blocking specification should state the wavelength range over which it is measured. Both the degree and range of blocking required are application dependent. Too little blocking will result in unacceptable stray light (high noise); too much will decrease throughput (low signal) and increase costs. Blocking is one of the most important specifications to be considered when selecting an interference filter.

Blocking is sometimes defined in “absolute” terms, which refers to the ratio of the largest peak outside the passband to the peak within the passband. Absolute blocking does not measure the total radiation (energy) outside the passband and has little meaning in spectroscopy, where all radiation outside the passband is considered stray light.

Integrated blocking is a more useful way to define blocking. It is the ratio of the total radiation (energy) outside the passband to the total radiation within the passband. For an integrated blocking value to be meaningful, the conditions under which the filter is to be used must be known. For example, the integrated blocking value of a 340 nm filter in an optical system with a UV source and photomultiplier will be considerably better than the same filter used with a tungsten lamp and silicon photodiode. The spectral response of a UV source and PMT detector system may overlap from about 200 nm to 400 nm, with considerable energy

and detector sensitivity at 340 nm (high signal). Under these conditions, radiation detected through the filter outside the passband (stray light) is limited by both source and detector and can be easily controlled by standard blocking. If, however, the same 340 nm filter is used with another source and detector, stray light could be a problem and additional blocking may be required. The spectral response of a tungsten source and a silicon photodiode detector system may overlap from about 320 nm to 1100 nm, but with very little source energy or detector sensitivity at 340 nm (low signal). These conditions require that the filter have additional blocking to compensate for the source radiation and detector sensitivity from 400 nm to 1000 nm (ultra low noise).

Several equivalent notations are used by various manufacturers to specify blocking including absorbance, optical density, transmittance, scientific notation, rejection ratio and signal-to-noise ratio. To establish a blocking specification, Optometrics utilizes an optical system with a tungsten halogen lamp with a color temperature of 2800° K and a UV enhanced silicon photodiode. A transmittance notation is used since it is universally understood.

For spectroscopic applications, the degree of blocking should be consistent with the sample being used. Integrated blocking to 0.1%T (standard performance filter) will not cause an appreciable error with a low absorbing sample. For a highly absorbing sample ($Abs \geq 2.0$), the 0.1% stray light would be 10% of the total transmitted signal, grossly affecting the accuracy of an assay. Therefore, a high performance filter is required, where integrated blocking is 0.01%T.

CHOOSING A FILTER

Select from our extensive range of standard filters or contact Optometrics with your requirements for an OEM quotation.

TYPES OF FILTERS

Bandpass Filters

This type of interference filter finds wide application in spectral analysis, particularly those in clinical chemistry, spectral radiometry, environmental testing, laser line separation, flame photometry and color separation where the required wavelengths are well known.

Broadband Filters

Used in applications where input energy levels are low and where a wide viewing field is needed, the line of filters covers the region from 450 to 700 nm, stepped every 50 nm and each has a halfbandwidth of 80 nm.

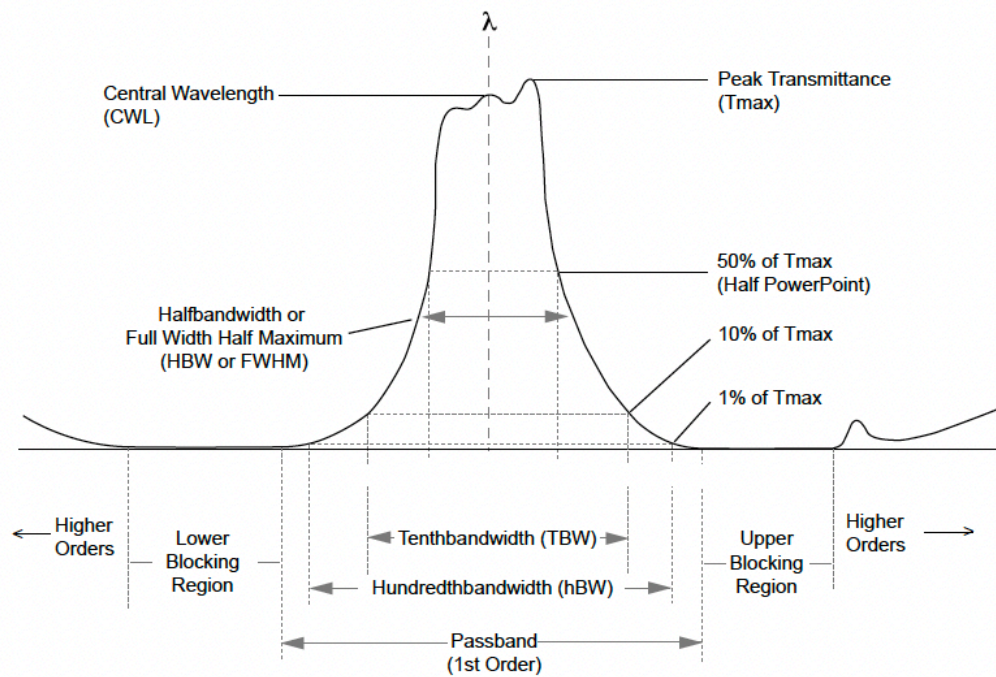
Short and Long-Pass Filters

Often called Edge filters, the transition between the 50% cut-off or cut-on rejection of these filters is quite sharp, making it much easier to separate excitation from emitted wavelengths without interfering with wavelengths of interest. They can be used as emission filters in fluorescence applications, to eliminate any unwanted radiation, in Raman spectroscopy and as order sorting filters. They are also used in laser-induced fluorescence to isolate source radiation. (See pages 17-18 for more information).

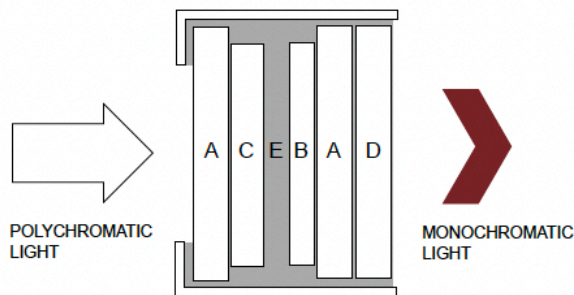
Laser Line Filters

While lasers are generally assumed to emit monochromatic light, there is often unwanted radiation that the user wishes to eliminate and Optometrics' Laser Line filters are designed for this purpose.

INTERFERENCE FILTER TERMINOLOGY

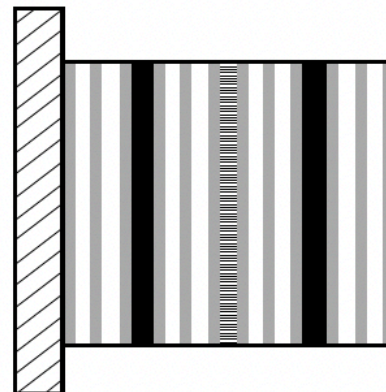


INTERFERENCE FILTER TERMINOLOGY



- A = Glass Substrate
- B = Multicavity Bandpass Section
- C = Blocker Section
- D = Color Glass
- E = Epoxy
- F = Metal Ring

TYPICAL INTERFERENCE FILTER



- Glass Substrate
- High Index Dielectric (1/4)
- Low Index Dielectric (1/4)
- Color Glass
- Epoxy

MULTI CAVITY BANDPASS SECTION

Absolute Blocking:

The ratio of the largest peak outside the passband to the peak within the passband. Expressed as an area or %T.

Absorbance:

The logarithmic function of transmittance. Sometimes used to express the degree of blocking. $A = \log(I_0/I)$.

Angle of Incidence:

The angle formed by radiation arriving (incident) at the filter surface and the perpendicular to the surface at the point of arrival.

Angstrom (Å):

Unit of length used to measure wavelengths of light. One tenth of a nanometer (nm). One Angstrom is equal to 1×10^{-10} meters.

Bandpass Filter:

See interference filter.

Bandwidth:

Specified wavelength interval of transmitted radiation.

Blocking:

The degree to which detectable radiation outside the passband is rejected. Expressed as transmittance, absorbance, optical density, scientific notation, signal-to-noise or rejection ratio. Blocking requirements are specified over a useful wavelength range.

Cavity:

Basic component of an interference filter consisting of two layers of reflective stacks separated by a spacer layer. Also known as a period.

Clear Aperture (CA):

The central, usable area of a filter through which radiation can be transmitted.

Central Wavelength (CWL):

The mean of the two wavelengths corresponding to the half power points.

Half Power Points:

Points on both sides of the passband curve of a filter, with a value 50% of the peak transmittance. Used to calculate HBW and CWL.

Half Bandwidth (HBW):

The wavelength interval of the passband measured at the half power points (50% of peak transmittance). Expressed as halfbandwidth (HBW), full width half maximum (FWHM) or half power bandwidth (HPBW).

Incident Radiation (I_0):

The radiation, usually polychromatic, that impinges on a filter.

Interference Filter:

A filter that, operating on the principles of constructive and destructive interference, transmits radiation in a discrete, narrow wavelength range while rejecting other radiation. Also known as a bandpass filter.

Integrated Blocking:

The ratio of the total transmitted radiation (energy) outside the passband to the total transmitted radiation within the passband. Integrated blocking is influenced by the source output and detector response as functions of wavelength.

Micron (μ):

Unit of length used to measure wavelengths of light. One micron is equal to 1,000 nm or 10,000 angstroms.

Nanometer (nm):

Unit of length used to measure wavelengths of light. One nanometer is equal to 1×10^{-9} meters.

Near Infrared (NIR):

Light from the region of the electromagnetic spectrum with wavelengths between (approximately) 750 nm and 3.0 μ .

Optical Density (OD):

Used to express the degree of blocking. Also known as Absorbance.

Passband:

A wavelength interval through which incident radiation is transmitted. The first order passband is at the filter design wavelength.

Peak Transmittance:

The highest transmittance value of a filter.

Peak Wavelength:

The wavelength at which a filter has its peak (highest) transmittance.

Period:

See cavity.

Rejection Ratio:

The ratio of the maximum transmittance outside the passband to the total transmittance within the passband. Signal to Noise Ratio (S/N):

The ratio of detected energy transmitted through the passband to the detected energy transmitted outside the passband. It is source and detector dependent.

Stray Light:

Unwanted energy transmitted through the filter.

Transmittance (T_x):

The ratio of the transmitted radiation to the incident radiation, expressed as a percent. $\% T = I/I_0 \times 100$.

Transmitted Radiation (I):

Radiation passing through a filter, either inside or outside the passband.

Ultra-Violet (UV):

Light from the region of the electromagnetic spectrum with wavelengths between 150 nm and 400 nm.

Visible (VIS):

Light from the region of the electromagnetic spectrum.

Optometrics Corp's standard filters are available in the wavelengths shown below. Filters vary in price depending upon wavelength and size.

CWL (nm)	APPLICATION(S)	CWL (nm)	APPLICATION(S)
334	Mercury Emission Line	589	Na, He Emission Lines
337	N Laser Line	600	BUN-Colorimetric, Serum Iron, UIBC
340	NAD/NADH, NADP/NADPH Chemistries	610	Water Analysis
365	Hg Emission Line	620	Calcium, Albumin
394	S Emission Line	632	HeNe Laser Line
400	Clinical Chemistry, Phosphate	636	Zn Emission Line
405	Hg Emission Line, Alkaline Phosphatase, Acid Phosphatase, GGT, Amylase	640	Ne Emission Line
410	H Emission Line, Cholinesterase, Silica	647	Kr Laser Line
415	Ar Emission Line, Clinical Chemistry	650	Calcium, Total Phosphates
420	Ar Emission Line, Ammonia	656	H Emission Line
430	Ar Emission Line	671	Lithium, Laser Diode
436	Hg Emission Line	676	Kr Laser Line
442	HeCd Laser Line	690	Clinical Chemistry, Hg, O ₂ Emission Lines
450	He Emission Line, Nickel, Clinical Chemistry	694	Ruby Laser
455	Cs Emission Line	730	GaAlAs Laser Diode
458	Ar Laser Line, Chloride, Copper, Hydrazine	766	Potassium
467	Xe Emission Line, Chloride	780	GaAlAs Laser Diode
470	Cd Emission Line	800	Ar Emission Line
480	Cd Emission Line	830	GaAlAs Laser Diode
486	H Emission Line	852	Cs Emission Line
488	Ar Laser Line	855	GaAlAs Laser Diode
492	Clinical Chemistry	880	GaAlAs Laser Diode
500	He Emission Line, Cholesterol, Glucose, Phenol, Triglycerides	905	GaAs Laser Diode
505	He Emission Line	940	GaAs Laser Diode
508	Cd Emission Line	1064	Nd: YAG Laser Line
510	Creatinine, Water Analysis, Iron, Co Emission Line	1100	Clinical Chemistry
515	Ar Laser Line	1150	Clinical Chemistry
520	Barium, Triglycerides, Magnesium, Uric Acid, Cholesterol	1200	Clinical Chemistry
532	Frequency Doubled, Nd: YAG Laser Line	1250	Clinical Chemistry
535	Ti Emission Line	1300	Laser Diode Cleanup
540	Total Protein, Ne Emission Line	1350	Clinical Chemistry
546	Hg Emission Line	1400	Clinical Chemistry
550	Bilirubin	1450	Clinical Chemistry
568	Kr Laser Line, Calcium	1500	Clinical Chemistry
580	Hg Emission Line, Cyanide	1550	Laser Diode Cleanup
		1600	Clinical Chemistry
		1650	Clinical Chemistry

GENERAL SPECIFICATIONS

Central Wavelength Tolerances

10 nm Bandpass Filters.....	± 2 nm
Broadband Filters.....	± 15 nm
NIR Bandpass Filters.....	Varies by wavelength

Halfbandwidth

10 nm Bandpass Filters.....	10 nm ± 2 nm
12 nm NIR Bandpass Filters.....	12 nm ± 2.4 nm
Broadband Filters.....	80 nm ± 25 nm

Blocking Range

334-1100 nm.....	Xray to 1200 nm
1150-1200 nm.....	200-1350 nm
1250-1350 nm.....	200-1500 nm
1400-1650 nm.....	200-1800 nm

Integrated Blocking:

Standard 10 nm Bandpass and	
Broadband Filters.....	$\leq 0.1\%$
NIR Bandpass Filters.....	$\leq 0.01\%$

Transmittance

Standard Bandpass Filters:	
334 nm to 365 nm.....	$\geq 25\%$
394 nm to 400 nm.....	$\geq 30\%$
405 nm to 442 nm.....	$\geq 40\%$
450 nm to 647 nm.....	$\geq 45\%$
650 nm to 1064 nm.....	$\geq 50\%$
1100 nm to 1550 nm	$\geq 70\%$
1600 nm to 1650 nm.....	$\geq 65\%$
Broadband Filters.....	$\geq 55\%$

Standard Sizes

Diameters.....	12.5 and 25.0 mm
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Dimensional Tolerances

12.5 mm dia.	+0.0/-0.2 mm
25 mm dia.	+0.01/-0.1 mm

Minimum Clear Aperture

12.5 mm dia.	9.0 mm
25.0 mm dia.	21.0 mm
Mounting.....	Black anodized metal ring
Thickness.....	7.5 mm +0.0/-0.2 mm

BANDPASS FILTERS

This type of interference filter finds wide application in spectral analysis, particularly those in clinical chemistry, spectral radiometry, environmental testing, laser line separation, flame photometry and color separation where the required wavelengths are well known.

10NM BANDPASS FILTERS • 334 TO 1064 NM

CWL (nm)	12.5 mm Dia.	25.0 mm Dia.
334	2-3341	2-3342
337	2-3371	2-3372
340	2-3401	2-3402
365	2-3651	2-3652
394	2-3941	2-3942
400	2-4001	2-4002
405	2-4051	2-4052
410	2-4101	2-4102
415	2-4151	2-4152
420	2-4201	2-4202
430	2-4301	2-4302
436	2-4361	2-4362
442	2-4421	2-4422
450	2-4501	2-4502
455	2-4551	2-4552
458	2-4581	2-4582
467	2-4671	2-4672
470	2-4701	2-4702
480	2-4801	2-4802
486	2-4861	2-4862
488	2-4881	2-4882
492	2-4921	2-4922
500	2-5001	2-5002
505	2-5051	2-5052
508	2-5081	2-5082
510	2-5101	2-5102
515	2-5151	2-5152
520	2-5201	2-5202
532	2-5321	2-5322
535	2-5351	2-5352
540	2-5401	2-5402

CWL (nm)	12.5 mm Dia.	25.0 mm Dia.
546	2-5461	2-5462
550	2-5501	2-5502
568	2-5681	2-5682
580	2-5801	2-5802
589	2-5891	2-5892
600	2-6001	2-6002
610	2-6101	2-6102
620	2-6201	2-6202
632	2-6321	2-6322
636	2-6361	2-6362
640	2-6401	2-6402
647	2-6471	2-6472
650	2-6501	2-6502
656	2-6561	2-6562
671	2-6711	2-6712
676	2-6761	2-6762
690	2-6901	2-6902
694	2-6941	2-6942
730	2-7301	2-7302
766	2-7661	2-7662
780	2-7801	2-7802
800	2-8001	2-8002
830	2-8301	2-8302
852	2-8521	2-8522
855	2-8551	2-8552
880	2-8801	2-8802
905	2-9051	2-9052
940	2-9401	2-9402
1064	2-1061	2-1062

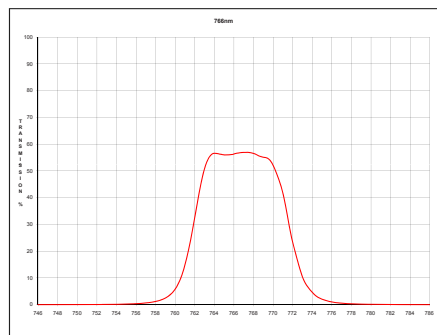
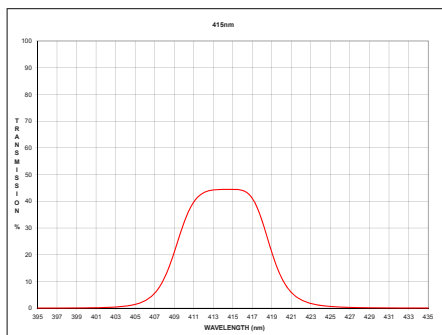
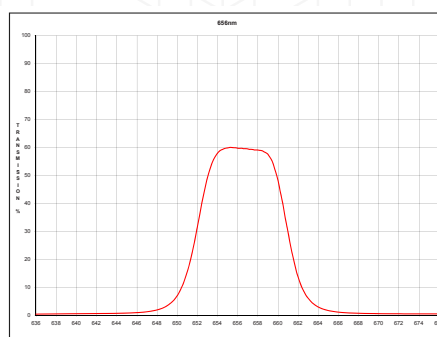
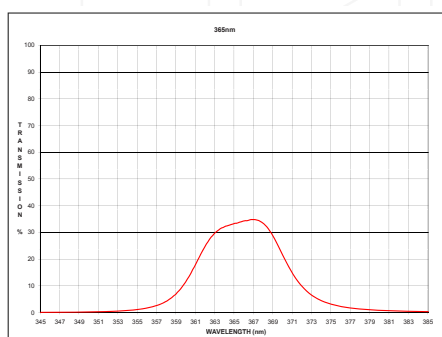
BANDPASS FILTERS

Our newest NIR wavelength filters are ring mounted, have blocking to OD4 over a broad range and transmit from 65-75%. They should be considered for applications that require a limited number of known wavelengths, when energy throughput is more critical than wavelength resolution or when cost is more important than flexibility.

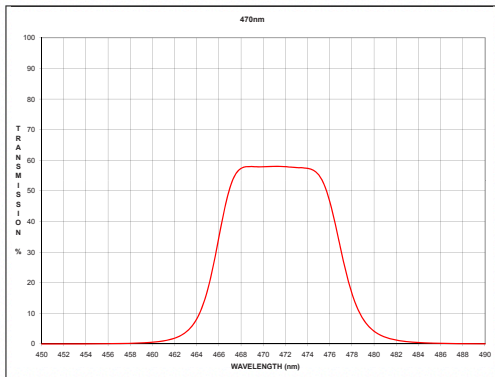
NIR BANDPASS FILTERS (1000-1650 nm)

CWL (nm)	CWL TOL. (nm)	HBW (nm)	12.5 mm DIA.	25.0 mm DIA.
1000	± 2	10	2-1004	2-1005
1050	± 2	10	2-1054	2-1055
1100	± 2	10	2-1104	2-1105
1150	+ 4, - 0	10	2-1154	2-1155
1200	± 2	10	2-1214	2-1215
1250	± 2	10	2-1264	2-1265
1300	± 2.4	12	2-1314	2-1315
1350	± 2.4	12	2-1364	2-1365
1400	± 2.4	12	2-1404	2-1405
1450	± 2.4	12	2-1454	2-1455
1500	± 2.4	12	2-1504	2-1505
1550	± 2.4	12	2-1554	2-1555
1600	± 2.4	12	2-1604	2-1605
1650	± 2.4	12	2-1654	2-1655

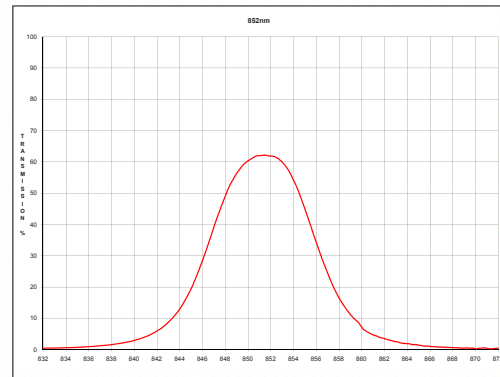
TYPICAL TRANSMISSION CURVES - BANDPASS FILTERS



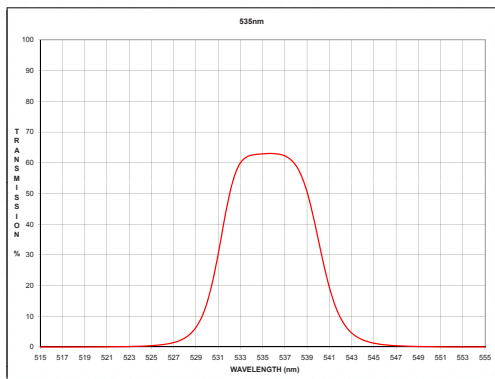
TYPICAL TRANSMISSION CURVES - BANDPASS FILTERS (CONT.)



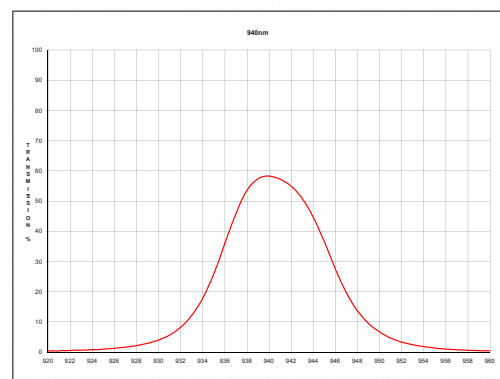
470 nm



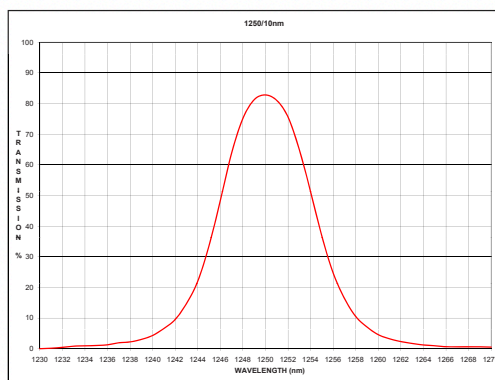
852 nm



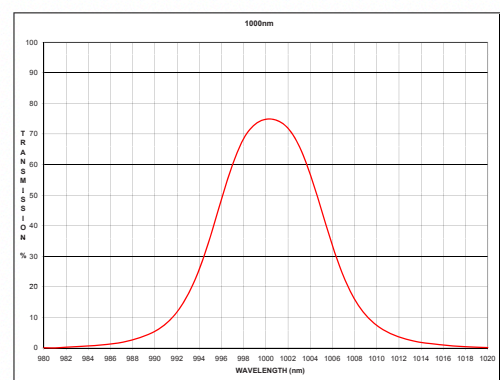
535 nm



940 nm



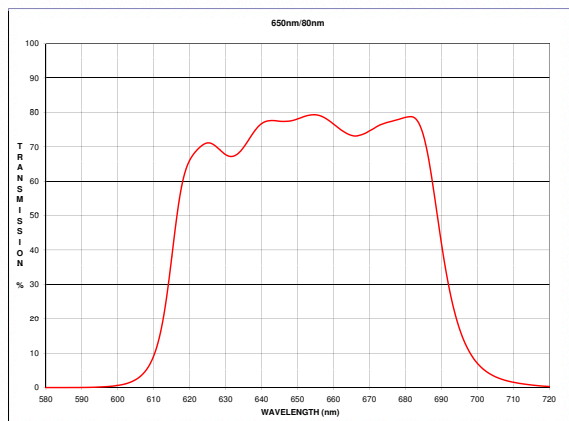
1250 nm



1000 nm

BROADBAND FILTERS

This line of interference filters covers the region from 450 to 700 nm, stepped every 50 nm and each has a halfbandwidth of 80 nm. Broadband filters are useful in applications where input energy levels are low and where a wide viewing field is needed.



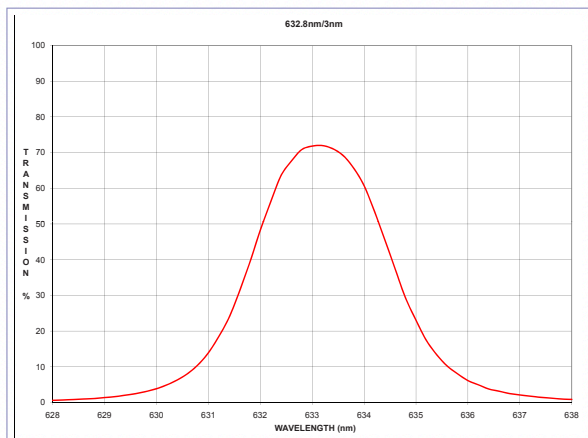
650nm/80nm

BROADBAND • 80NM HBW, STEPPED EVERY 50nm FROM 450 - 700nm

CWL (nm)	12.5 mm Dia.	25.0 mm Dia.
450	2-4521	2-4523
500	2-5021	2-5023
550	2-5521	2-5523
600	2-6021	2-6023
650	2-6521	2-6523
700	2-7021	2-7023

LASER LINE FILTERS

Laser line filters are designed to isolate laser lines. Standard filters are manufactured for use with Cadmium, Argon, YAG and He-Ne lasers and are available in 12.5 mm and 25 mm diameter sizes.



632.8nm/3nm

GENERAL SPECIFICATIONS

Diameter Tolerance +0.0/-0.2 mm

Thickness 7.5 ± 0.1 mm

Surface Quality 80-50

Clear Aperture

12.5 mm diameter..... >9.0 mm

25.0 mm diameter..... >21.0 mm

Operating Temp. -20°C to +75°C

LASER LINE FILTERS

Laser Line	CWL (nm)	CWL TOL. (nm)	HBW (nm)	HBW TOL. (nm)	Tx min %	12.5 mm diameter	25 mm diameter	Blocking OD \geq
Argon	488	+ 0.7/-0.4	3	± 0.7	35	2-4887	2-4888	4.0
Argon	488	± 2	10	± 2	45	2-4897	2-4898	3.0
Argon	514.5	+ 0.7/-0.4	3	± 0.7	35	2-5147	2-5148	4.0
Argon	514.5	± 2	10	± 2	45	2-5157	2-5158	3.0
Argon	532	+ 0.7/-0.4	3	± 0.7	35	2-5327	2-5328	4.0
Nd:YAG	532	± 2	10	± 2	45	2-5337	2-5338	3.0
HeNe	632.8	+ 0.7/-0.4	3	± 0.7	35	2-6327	2-6328	4.0
HeNe	632.8	± 2	10	± 2	45	2-6337	2-6338	3.0
Krypton	647.1	± 2	10	± 2	45	2-6477	2-6478	3.0
Diode	671	± 2	10	± 2	50	2-6707	2-6708	3.0
Diode	780	± 2	10	± 2	50	2-7807	2-7808	3.0
Diode	830	± 2	10	± 2	50	2-8307	2-8308	3.0
Diode	850	± 3.0	10	± 2.5	50	2-8507	2-8508	4.0
Diode	880	± 2	10	± 2	50	2-8807	2-8808	3.0
Diode	880	± 15	50	± 15	55	2-8817	2-8818	3.0
Diode	880	± 10	70	± 8	70	2-8827	2-8828	4.0
Diode	905	± 5	25	± 5	70	2-9067	2-9068	4.0
Nd:YAG	1064	± 0.6	3	± 0.6	55	2-1067	2-1068	4.0
Nd:YAG	1064	± 2	10	± 2	50	2-1077	2-1078	3.0
Diode	1300	± 6	30	± 6	70	2-1317	2-1308	4.0
Diode	1550	± 2.5	12	± 2.5	70	2-1557	2-1558	4.0
Diode	1550	± 6	30	± 6	70	2-1567	2-1568	4.0

EDGE FILTERS

A Long Pass or Long Wave Pass filter ("LP") is one that transmits at longer wavelengths and rejects shorter wavelengths. A Short Pass or Short Wave Pass filter ("SP") is a filter that transmits at shorter wavelengths and rejects longer wavelengths. By design, the transition in both LP and SP filters between the 50% cut-off or cut-on to rejection is quite sharp. This makes it much easier to separate excitation from emitted wavelengths without interfering with wavelengths of interest. LP and SP filters are useful in applications where spectral noise reduction is important or for isolating a particular region of the spectrum. They can be used as emission filters in fluorescence applications, to eliminate any unwanted radiation, in spectroscopy, and as order sorting filters, as well as in astronomical applications. They are also used in laser-induced fluorescence to isolate source radiation.

FEATURES

- Long Pass filters every 50 nm from 500 nm to 1500 nm
- Short Pass filters every 50 nm from 450 nm to 1000 nm
- Ring mounted
- Scribed and sealed for moisture protection
- Use in combination for custom filtering
- Fine tune cut-on or cut-off wavelengths by changing angle of incidence

GENERAL SPECIFICATIONS

Dimensions & Tolerances

25.4 mm diameter.....+0.00, -0.2 mm

Thickness..... ≤ 6.3 mm

Clear Aperture

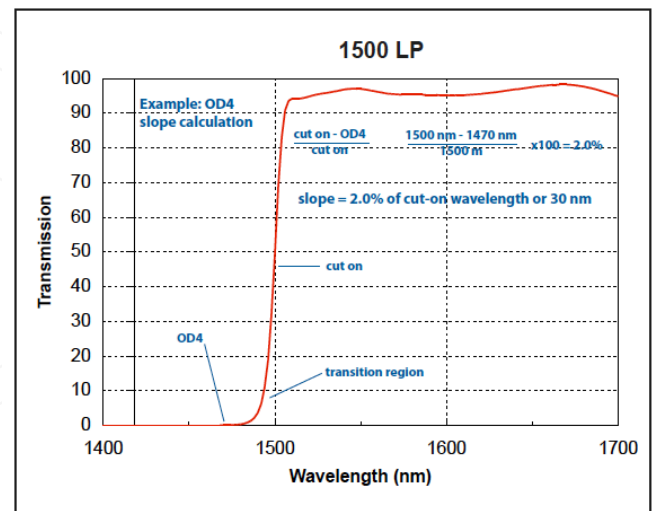
25.4 mm diameter..... ≥ 21.0 mm

Mounting.....Black anodized aluminum ring

Scratch/Dig.....80/50 per Mil-O-13830A

Substrate material.....Borofloat

Operating temperature range.....-20° C to 75° C



EDGE FILTERS

Transmission Region.....Cut-on λ to 2200 nm minimum

Maximum Peak Transmission

500-700 nm.....80%

750-1000 nm.....75%

>1000 nm.....70%

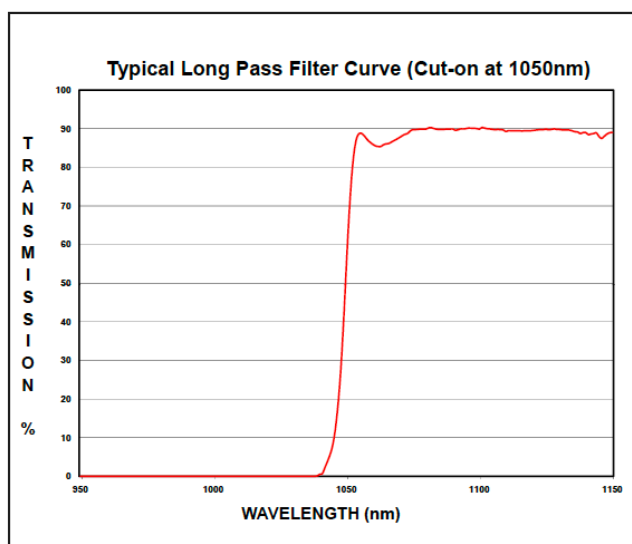
Cut-On Tolerance (@ 50% of peak)

≤ 750 nm..... ± 3 nm

> 750 nm..... ± 15 nm

Rejection..... $\geq 0.01\%$ absolute 200 nm to cut-on

Cut-On Slope.....3%, OD=0.3 to OD=4.0



50% Cut-on Wavelength (nm)	25.4 mm Dia. (Mounted)
500	2-0850
550	2-0851
600	2-0852
650	2-0853
700	2-0854
750	2-0855
800	2-0856
850	2-0857
900	2-0858
950	2-0859
1000	2-0860
1050	2-0861
1100	2-0862
1150	2-0863
1200	2-0864
1250	2-0865
1300	2-0866
1350	2-0867
1400	2-0868
1450	2-0869
1500	2-0870

SHORT PASS FILTERS

Transmission Region.....Cut-off λ to 400 nm or $0.7\lambda_c$
(whichever is the higher)

Maximum Peak Transmission

< 500 nm.....70%

≥ 550 nm.....80%

Cut-On Tolerance ($\Delta\lambda$ @ 50% of peak)

≤ 750 nm..... ± 3 nm

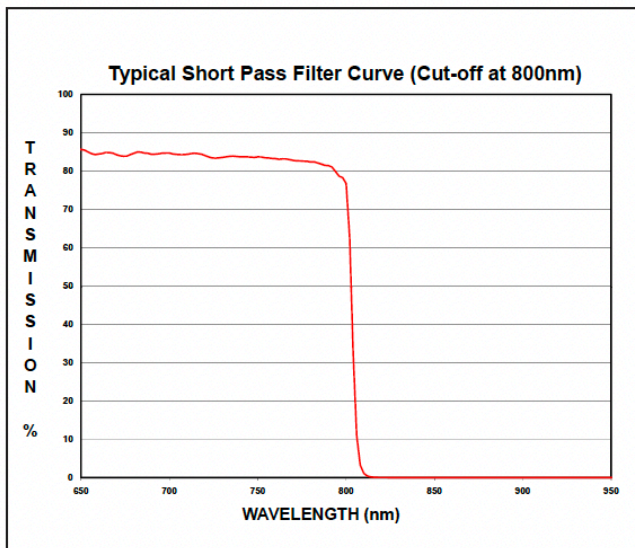
> 750 nm..... ± 15 nm

Rejection..... $\geq 0.01\%$ absolute, 0.0001% avg.
(≥ 1.3 times cut-off λ)

Cut-On Slope.....3%, OD=0.3 to OD=4.0

50% Cut-on Wavelength (nm)	25.4 mm Dia. (Mounted)
450	2-0800
500	2-0801
550	2-0802
600	2-0803
650	2-0804
700	2-0805
750	2-0806
800	2-0807
850	2-0808
900	2-0809
950	2-0810
1000	2-0811

Custom OEM Filter Specifications Provided Upon Request





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