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**Andover Corporation**

**OPTICAL COATINGS & FILTERS  
QUALITY YOU CAN TRUST**





## Why Choose Us...

As a recognized leader in the manufacture of high-quality optical filters and coatings, Andover Corporation has built an international reputation by consistently raising the bar—both for our products and for our people. We take it as a personal challenge to innovate along with our customers, designing and delivering precision solutions for use in chemical analysis, machine vision, medical diagnostics, astronomy and analyzers (air, water, and gas). Whether you need custom filters or off-the-shelf products, you have our guarantee of excellent craftsmanship, exceptional performance, and unsurpassed service with every order.

Large or small, domestic or foreign, the companies that purchase our products consistently tell us that they value the following key Andover advantages:

### **Custom Design Expertise**

Our talented and highly skilled engineers can meet your most demanding requirements for custom filters and coatings. With more than 30 years in business, we've designed products for advanced applications such as medical instrumentation, machine vision, fluorescence studies, astronomical observation, telecommunications, and space-borne and defense systems.

### **Exceptional Reliability**

Andover's filters and coatings far exceed the industry standards for quality and performance. This precision reflects the fact that Andover Corporation is one of the few optical filter manufacturers in the world to design our own state-of-the-art equipment that allows us to control the entire production process.

### **Extensive Standard Offering**

Andover maintains an inventory of over a thousand different optical filters. Bandpass, Dichroic, Edge, Heat Control, and Calibration filters are just a few of the product categories that are in stock and ready for immediate shipping.

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*Thank you for your interest in our latest catalog of products and services. We value your patronage and take great pride in responding quickly to any questions you may have, especially if you require a customized solution. If there is a filter or coating you need but don't see available, please contact us.*

*We also welcome any comments you might have about how we may better serve you.*

*-The Andover Corporation Team*

# Thank you!

## Extras Making the Difference

Unlike most optical filter and coating manufacturers, we supply exact spectral curves and digital data with most orders at no additional charge, saving you the cost of incoming quality control. We'll even help you reduce inventory by shipping your order only when you require it.



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## Andover Corporation

Andover Corporation was established in 1976 with the purpose of designing and manufacturing high-quality optical filters and coatings. As the company grows, our focus remains on quality. Our current facility spans 44,000 square feet on 17 acres of land in Salem, NH.

Our facility is custom-designed and state-of-the-art, and includes automated coating, glass polishing, and fabrication equipment. Our testing capabilities are extensive, comprising of both automated spectrophotometers for broadband spectral measurements, and ultra-high-resolution spectrophotometers for narrowband measurements. Our optical metrology lab features a custom-designed, computer-controlled tunable interferometer to measure transmitted wavefronts beyond the capabilities of a traditional laser interferometer.

We manufacture filters and coatings for a wide variety of applications; including medical instrumentation, fluorescence studies, machine vision, astronomical observation, telecommunications, space-borne systems and defense systems.



## Frequently Asked Questions

- **How do you distinguish between an image quality and a commercial quality filter?**

Image quality filters are ideal for applications that require high resolution, such as astronomical observations. To make these products, we polish high-quality optical glass to ensure the substrate is extremely flat and parallel, and then apply anti-reflective coatings on the external surfaces to reduce ghost images and maximize energy throughput. Commercial quality filters have the same spectral characteristics as image quality filters, however they are designed for use in instruments rather than imaging applications.
- **What do I need to do to maintain my filters in good condition?**

We recommend cleaning your filters about every three months. If the environment is particularly dusty or you often shift the filters between applications, more regular cleaning may be warranted. We suggest that you apply acetone, methanol, or alcohol to a soft tissue and then rub the filter using a circular motion.
- **Are there any particular environmental conditions to consider when using a filter?**

It's important to avoid prolonged exposure to high humidity and large temperature variations. To reduce the risk of damage due to thermal shock, we recommend a maximum operating temperature of 70°C and a maximum temperature change of 5°C per minute.
- **When placing an order, why do I need to include the operating temperature?**

The center wavelength of an interference filter shifts linearly with changes in ambient temperature. Our filter designs take this into consideration to ensure proper performance at your specific operating temperature.
- **When can I expect to receive my order?**

Standard products ship within two to three days of receipt of order.
- **Do you offer discounts on surplus stock?**

Andover offers generous price terms on our surplus inventory. Just visit our website at [www.andovercorp.com/surplus](http://www.andovercorp.com/surplus) and plug in the desired wavelength to see what's available.
- **Do you have a minimum order value / quantity?**

No minimum value or quantity required.
- **How do I send custom specifications for quoting?**

You can do this one of two ways:

  1. Email your request to [sales@andovercorp.com](mailto:sales@andovercorp.com).
  2. Fax your specifications to 603.893.6508  
Attn: Technical Sales Dept.
  3. Call toll-free: 888-893-9992

# COATING CAPABILITIES

## Coating Capabilities

Andover Corporation has the unique ability to provide a diverse range of coatings spanning a broad wavelength range on a wide variety of materials. We produce coatings for a multitude of applications, ranging from environmental monitoring to space-based astronomy. Our AS9100 certification ensures compliance with aerospace as well as military standards.

- Variety of coating technologies to suit any need
- Wavelengths from 193nm to 14 $\mu$ m
- Custom coatings on a wide variety of substrates

## Coating Technologies

Andover has at its disposal a variety of coating technologies, including magnetron sputtering, ion-assisted electron beam deposition and thermal evaporation, producing the best possible solutions for your needs. State-of-the-art, custom-designed and computer-controlled coating chambers ensure accuracy and repeatability.

## Dichroic Coatings

Andover designs and produces custom dichroic coatings for a variety of applications. Our in-house engineers can design exotic coatings to meet very stringent spectral and environmental requirements. As with all of our coatings, they can be applied to a wide variety of materials, in a myriad of shapes and sizes.

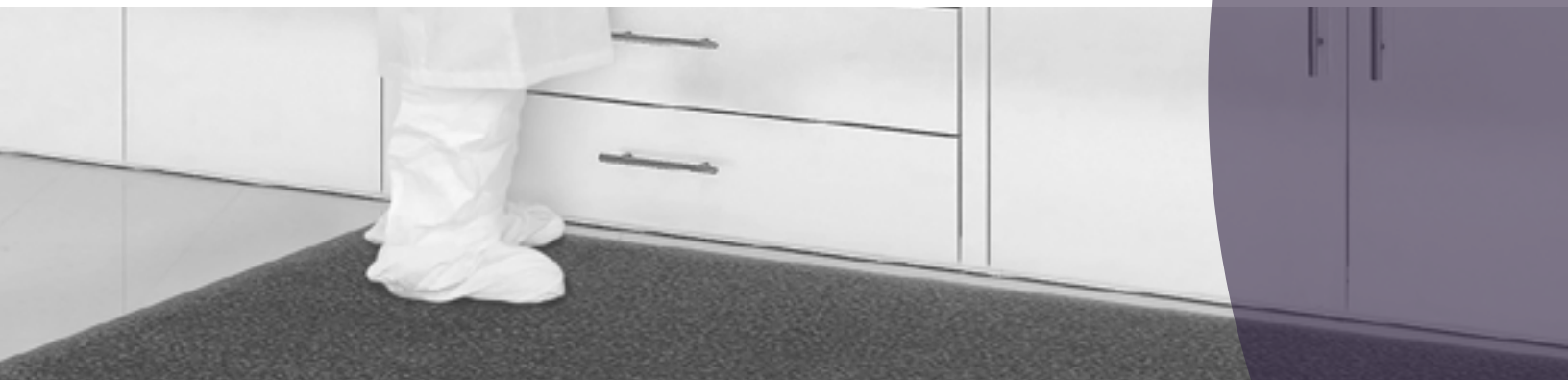
## Neutral Density Filters

Andover is a leader in flat response neutral density filters in the UV to near infrared (250nm-2000nm) and far infrared (2000-14000nm). These coatings are hard and pinhole-free. Our ND Filters exhibit industry-leading spectral neutrality over a broad wavelength range, with optical densities up to 4.0.



## Specialized Coatings

With our computer-controlled systems, we can quickly produce a variety of high-quality coatings in sizes up to 350mm with excellent repeatability using any process from thermal evaporation to magnetron sputtering.



## Anti-Reflective AR Coatings

Andover produces hard oxide AR coatings from 193nm to 14 $\mu$ m. We routinely coat customer-supplied material in all shapes and sizes: lenses, prisms, flats, domes, etc. We can coat a wide variety of materials, ranging from typical optical glass to exotic materials such as Calcium Fluoride, Zinc Sulfide and Zinc Selenide. The hard coatings not only reduce reflections to <0.1% at angles up to 50°, but also help protect optical surfaces, as the coating is more durable than the uncoated substrate.

## Bandpass Filters

We produce bandpass filters over a much broader range than any other coating firm, from 193nm to 14 $\mu$ m in wavelength. Bandwidths range from very wide, (> 10%) to extremely narrow, (< 0.02%). We can produce semi-custom bandpass filters with short lead times. We also have over 1,500 standard, off-the-shelf bandpass filters.

# CUSTOM ADVANTAGE



## Custom Advantage

While stocking over 1,500 standard filters, Andover Corporation has built a worldwide reputation for developing custom, often state-of-the-art, filters and coatings.

With our extensive engineering experience and advanced manufacturing facility, we control the entire production process to ensure that you receive only the highest-quality products, attentive service, and timely delivery.

- Fully-automated systems for excellent repeatability and rapid turnaround
- Continuously updated manufacturing processes
- Products that far exceed industry standards for quality

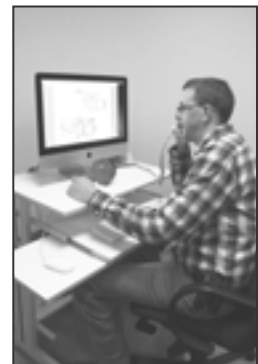
## Optical Polishing

Andover's in-house polishing facility can achieve flatness up to  $\lambda/10$  wave per inch and parallelism of 5 arc seconds or better, with a surface quality of 20/10.



## Engineering Assistance

Andover's in-house engineering staff can provide innovative assistance in optical and mechanical design, to ensure the success of your project.



## Optical Fabrication

Whether you require a filter that's 2mm or 350mm, Andover has fully automated CNC equipment to fabricate exactly what you need, at the quality you expect, and using the optical material of your choice.



## Machine Fabrication

Andover's 3-axis machining centers allow us to fabricate complex tooling quickly and accurately, greatly reducing the lead time for custom components.

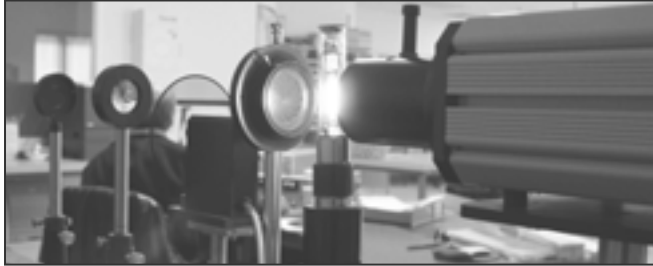




## Andover Corporation's quality testing starts with the raw material and continues through the finished product.

### Total Quality Control

To ensure total quality control, most of our equipment is either custom designed or custom constructed to our exact specifications.



Utilizing the Cary 7000 spectrophotometer, Andover is able to measure absolute specular reflection over a wide range of angles, facilitating very accurate measurements of dichroic cube beamsplitter performance, and other complex measurements.



We check all filter glass for striae, bubbles and inclusions using our tunable interferometer and custom-designed inclusion tester. These instruments detect minute defects, even in materials that do not transmit visible light.



### State-of-the-Art Testing

Our in-house environmental chambers allow us to perform routine and custom product testing at temperatures from  $-62^{\circ}\text{C}$  to over  $500^{\circ}\text{C}$ . This, along with the ability to vary humidity levels, ensures compliance with your custom specification or MIL standard.



Most interferometers rely on laser light to produce interference fringes. Many bandpass filters cannot be measured with these instruments, as they do not transmit the laser wavelength. To solve this problem, we have constructed a computerized, tunable white light interferometer that produces actual transmitted wavefront interferograms of filters at any wavelength in the range of  $350\text{nm}$ – $1100\text{nm}$ .

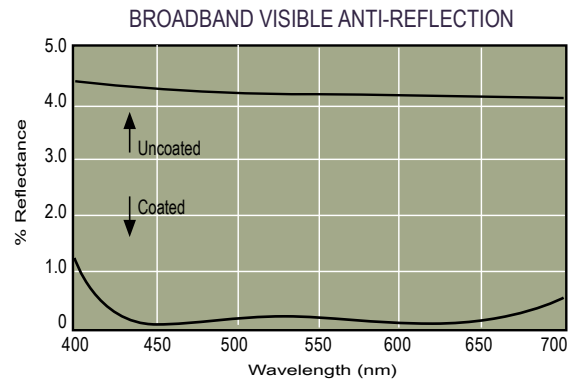
## Image Quality Filters

For demanding custom imaging requirements

Image quality filters are ideal for applications that require high resolution, such as astronomical observations, video monitoring systems, high-resolution photography, and other imaging applications. To meet these demanding requirements, Andover Corporation has developed a line of custom Image Quality (IQ) filters using high-grade optical material that is both striation and inclusion-free. The surfaces are ground and polished to a transmitted wavefront of  $\lambda/4$  per inch and parallel to 30 arc seconds or better. The internal coating positions are optimized and the exterior surfaces are anti-reflection coated to eliminate multiple images and fringe patterns, maximizing energy throughput. For very high-resolution applications, we can also provide image quality filters with a transmitted wavefront of  $\lambda/10$  and parallelism of 10 arc seconds. While commercial quality filters can have the same spectral characteristics as image quality filters, they are designed for use in instruments rather than imaging applications.

### ANTI-REFLECTIVE COATINGS

All Image Quality Filters include an anti-reflective (AR) coating. AR coatings are an effective way to limit reflections while also improving optimal system performance. Andover Corporation manufactures a variety of anti-reflective coatings designed for high efficiency, mechanical durability, and environmental stability.



All filters come with test documentation



## Success Stories

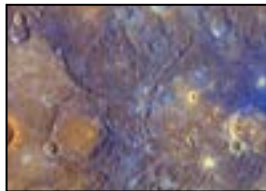
### A few examples of Andover's notable achievements

#### The Interface Region Imaging Spectrograph (IRIS)



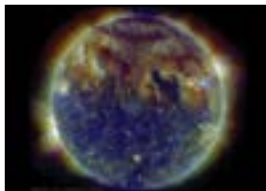
The IRIS mission is dedicated to understanding the interface between the photosphere and corona, by tracing the flow of energy and plasma through the chromosphere and transition region into the corona using spectrometry and imaging. It launched on June, 28 2013.

#### MERCURY Surface, Space ENVIRONMENT, GEOchemistry and RANGING (MESSENGER)



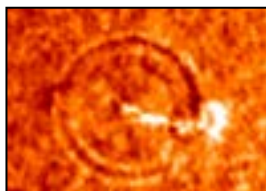
MESSENGER launched on August 3, 2004. Its mission is to analyze the surface of Mercury, to better understand our own planet. It carries seven instruments, one of which is the Mercury Dual Imaging System (MDIS), a camera with wide and narrow fields-of-view, for monochrome, color and stereo imaging.

#### The Atmospheric Imaging Assembly (AIA) for the Solar Dynamics Observatory (SDO)



SDO is designed to provide an unprecedented view of the solar corona, taking images that span at least 1.3 solar diameters in multiple wavelengths nearly simultaneously, at a resolution of about 1 arcsec and at a cadence of 10 seconds or better. These data will significantly improve our understanding of the physics behind the activity displayed by the Sun's atmosphere, which drives space weather in the heliosphere and in planetary environments.

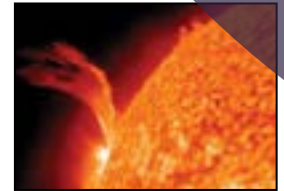
#### The Michelson Doppler Imager (MDI)



MDI is part of an international collaboration to study the interior structure and dynamics of the Sun. The MDI team was responsible for the design and fabrication, and now for the operation, of the MDI instrument on board the SOLar and Helio-spheric Observatory (SOHO) spacecraft.

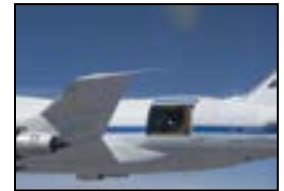
#### Helioseismic and Magnetic Imager (HMI)

The primary goal of the HMI investigation is to study the origin of solar variability and to characterize and understand the Sun's interior and the various components of magnetic activity. The HMI investigation is based on measurements obtained with the HMI instrument as part of the Solar Dynamics Observatory (SDO) mission.



#### Stratospheric Observatory for Infrared Astronomy (SOFIA)

SOFIA is the largest airborne observatory in the world, consisting of an extensively modified Boeing 747SP aircraft carrying a reflecting telescope with an effective diameter of 2.5 meters (100 inches). It is capable of making observations that are impossible for even the largest and highest ground-based telescopes.



#### The Cross-track Infrared Sounder (CrIS)

CrIS is a Michelson interferometer infrared sounder that is part of the Cross-track Infrared Microwave Sounding Suite (CrIMSS). The objective of CrIMSS is to provide global three dimensional soundings of atmospheric temperature and moisture as well as provide data on other geophysical parameters.



# ABOUT BANDPASS FILTERS



## 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. Their design is essentially 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 is Lorentzian 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. To improve the slopes and increase the attenuation in the blocking band, we introduce more cavities into the construction of our standard dielectric bandpass filters.

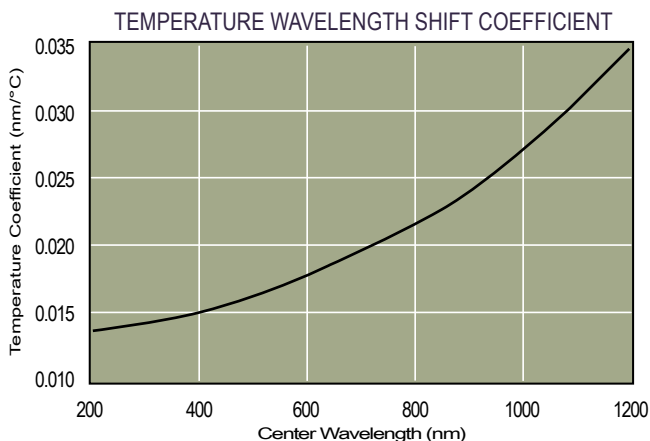
## Environmental Considerations

Ambient temperature and optical path geometry are important factors to consider in selecting or specifying bandpass filters.

### Ambient Temperature

The center wavelength of a bandpass filter shifts linearly 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.

To counter these effects, Andover has developed Temperature Controllers that help to maintain the ambient temperature of bandpass filters. (For more information see page 64 (Temperature Controller).



### Angle of Incidence

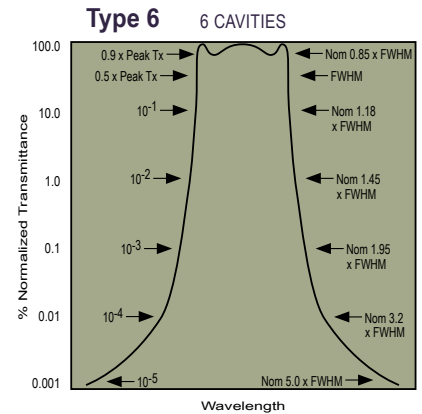
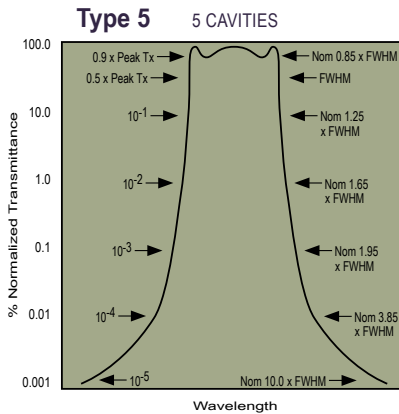
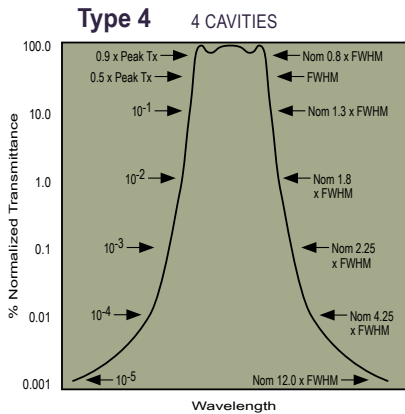
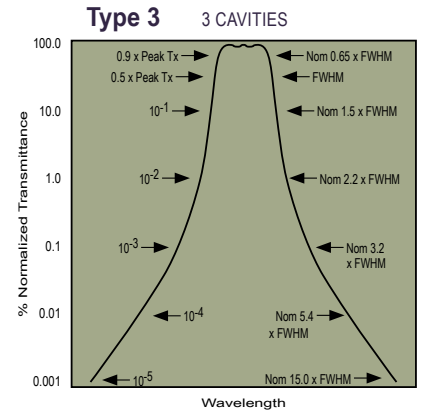
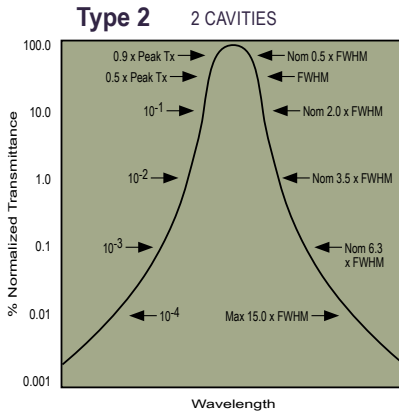
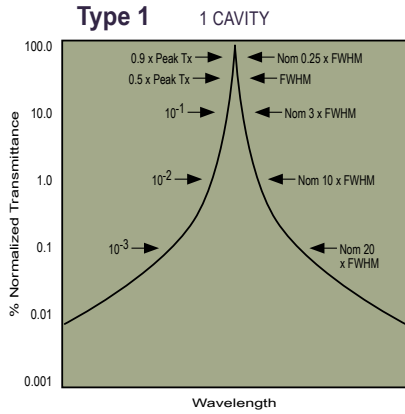
The central wavelength of the all-dielectric Fabry-Perot filter shifts lower with an increase in the incident angle. The amount of shift depends upon the incident angle and the filter's effective index ( $N^*$ ). This feature can be very useful when tuning a filter to the desired central wavelength.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

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

Where:  $\lambda_\theta$  = Wavelength at angle of incidence  
 $\lambda_0$  = Wavelength at normal incidence  
 $N_e$  = Refractive index of external medium  
 $N^*$  = Effective refractive index of the filter  
 $\theta$  = Angle of incidence

When using a filter with non-collimated light, the wavelength shift will appear somewhat less than that of collimated light at the same angle. In a cone of light, only the central ray is normal to the surface while all others are increasingly off-angle. To approximate the shift for a cone, use this same formula but use 2/3 of the max. cone angle. For example, for a  $15^\circ$  cone, use an angle of  $10^\circ$  in the above formula.

# Spectral Profiles for Andover's 10 Basic Filter Types

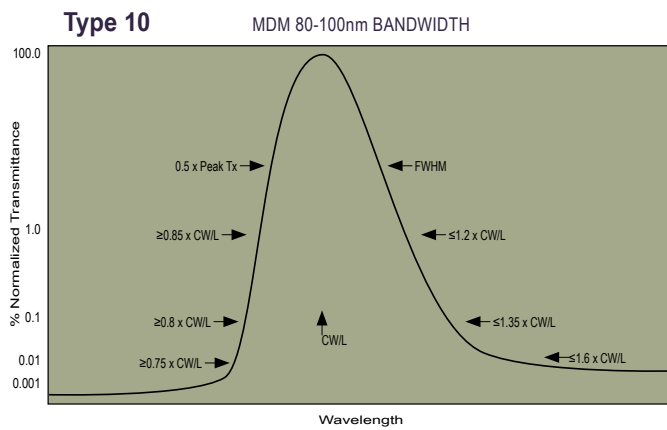
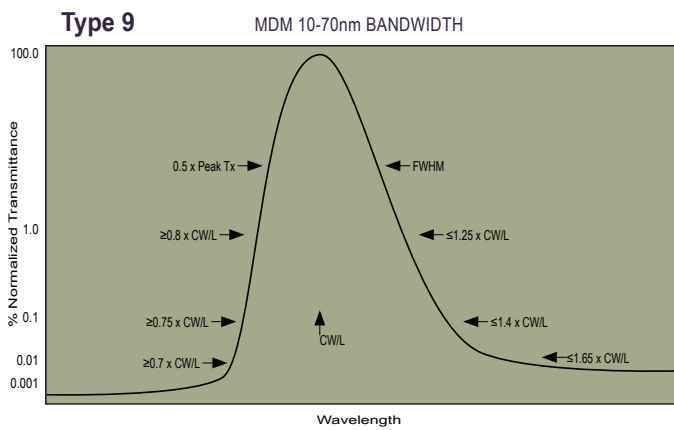
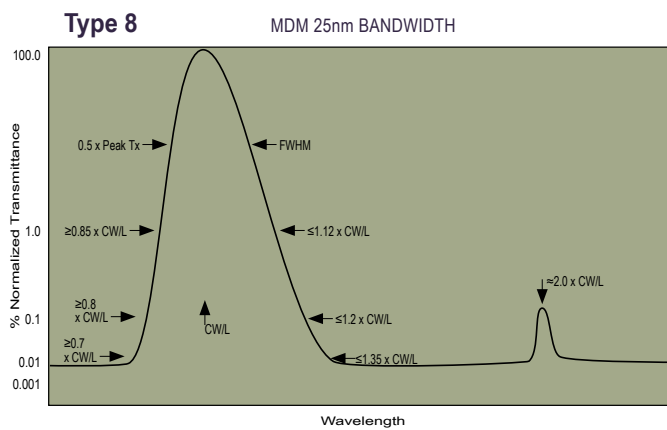
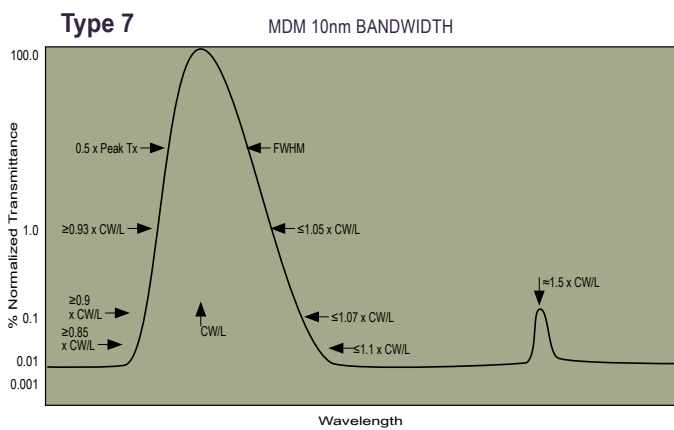


FILTER TYPES 1-6 REPRESENT UNBLOCKED FILTER PROFILES. BANDSHAPE MAY VARY DEPENDING UPON LEVEL OF ADDITIONAL BLOCKING

Normalized Transmittance of Peak (%)	Full Bandwidth Multiplier (Nominal)					
	1 Cavity	2 Cavities	3 Cavities	4 Cavities	5 Cavities	6 Cavities
90.0	0.25 nom.	0.5 nom.	0.65–0.70	0.8–0.9	0.85–0.90	0.85–0.90
10.0	2.5–3.0	1.6–2.0	1.2–1.5	1.1–1.3	1.1–1.25	1.1–1.25
1.0	8.0–10.0	2.8–3.5	1.9–2.2	1.5–1.8	1.5–1.65	1.5–1.65
0.1	15.0–20.0	5.5–6.3	2.9–3.2	2.0–2.25	2.0–2.25	2.0–2.25
0.01	undefined	10.0–15.0	4.9–5.4	3.5–4.25	3.1–3.85	2.9–3.2
0.001	undefined	undefined	10.0–15.0	9.0–12.0	8.0–10.0	4.0–5.0



MDM filters are a special type of bandpass filter utilizing dielectric layers (D) surrounded by metallic layers (M). They provide excellent throughput over a wide spectral range, while providing good out-of-band blocking.



# Bandpass Filter Selection Guide

There are a number of variations of a bandpass filter's construction, and each has its advantages. Andover offers a variety of options so that you can select what is best-suited for your application.

## Standard Bandpass (Pages 14-21)

Andover's Standard Bandpass filters have been the mainstay of the industry for decades. With our proprietary stabilization and sealing method these filters will generally last for 10-20 years in the field. Their longevity, coupled with their low cost and ready availability, make these a great choice for most applications.

## High-Transmitting Bandpass (Pages 14-21)

Andover's High-Transmitting Bandpass filters are a variant of the Standard Bandpass filter line. Designed for use with PMTs and photodiodes, they employ only dielectric coatings, and have a blocking range tailored to the detector. This results in higher transmission than their fully-blocked counterparts. For your convenience, the high-transmitting bandpass filters are listed in the Standard Bandpass section, and are highlighted for easy identification.

## Semi-Custom Bandpass (Pages 26-29)

In order to make it simple for customers to custom-tailor a bandpass filter for their application, Andover offers a line of Semi-Custom bandpass filters. Their construction is similar to both the Standard Bandpass and High-Transmitting bandpass filter offerings. We offer a wide selection of wavelengths, bandwidths and sizes, and offer two blocking options.

## Hard-Coated Narrowband (Pages 22-23)

Andover offers one of the broadest ranges of hard-coated narrowband filters in the industry. Our filters feature very high transmission, and dense blocking from UV-1200nm. They are suitable for high-temperature applications.

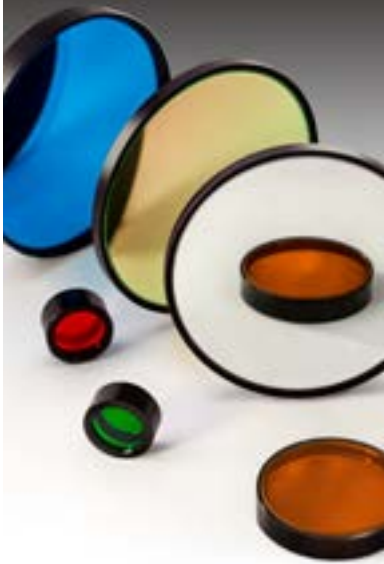
## Hard-Coated Broadband (Pages 24-25)

This line of hard, first-surface coated filters was designed to cover the standard Raman spectroscopy lines. They feature very high transmission over a broad range.

The chart below summarizes the major features of the various types of filters listed above, to aid in quickly locating the type that is best suited for your application. Please refer to the appropriate section of the catalog for more detailed information, or, if you would like advice from our technical sales staff, please contact us at [techstaff@andovercorp.com](mailto:techstaff@andovercorp.com).

Bandpass Filter Types					
Key Attributes	Standard Bandpass Filters Pages 14-21	High-Transmitting Bandpass Filters Pages 14-21	Semi-Custom Bandpass Filters Pages 26-29	Hard-Coated Narrowband Filters Pages 22-23	Hard-Coated Broadband Filters Pages 24-25
Construction	Soft-coated, laminated	Soft-coated, laminated	Soft-coated, laminated	Hard, first-surface coatings	Hard, first-surface coatings
Wavelength range	194nm - 2400nm	435.8nm - 1550nm	214nm - 2400nm	334nm - 1550nm	345nm - 785nm
Bandwidths	1nm - 100nm	10nm - 40nm	0.15nm - 80nm	10nm	80nm - 300nm
Blocking	OD4, UV-FIR	OD4, UV-800nm or 1000nm	OD4, UV-1000nm or UV-FIR	Varies by W/L	OD4, UV-1200nm
Sizes	12.5mm, 25mm and 50mm dia.	12.5mm, 25mm and 50mm dia.	12.5mm, 25mm and 50mm dia.	25mm dia.	12.5mm, 25mm and 50mm dia.
<b>Features:</b>					
Low cost	✓	✓			
Available from stock	✓	✓		✓	✓
High-Transmission		✓		✓	✓
Highly customizable			✓		
First surface coatings				✓	✓
Suitable for high temperatures				✓	✓

# STANDARD & HIGH-TRANSMITTING BANDPASS FILTERS



- Wavelengths from the ultra-violet through the infrared
- Stabilized to prevent drift of peak wavelength over time
- Hermetically sealed and protected by an anodized aluminum ring
- Transmission as high as 80%

## Standard Bandpass Filters

Andover offers one of the most extensive selections of bandpass filters in the industry, including many of the primary laser, atomic emission, biomedical, and analytical spectral lines.

We use a proprietary method 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 aluminum ring, adding further protection against chipping, scratching, and moisture penetration.

## High-Transmitting Bandpass Filters

We also offer a High-Transmitting variant of our standard bandpass filter selection. By tailoring the blocking range to match the detector, we can provide maximum possible throughput while maintaining good blocking to meet the customer's needs. Wavelengths include all popular laser, mercury, biomedical and analytical spectral lines.

## General Specifications

Diameter Tolerance:	+0/-0.25mm	
Usable Aperture:	<u>Filter Size</u>	<u>Usable Aperture</u>
	12.5mm Ø	9.0mm Ø
	25.0mm Ø	21.0mm Ø
	50.0mm Ø	45.0mm Ø
Surface Quality:	80-50 (Per MIL-PRF-13830B)	
Optical Quality:	Commercial instrumentation grade	
Out-of-Band Blocking:	1 x 10 <sup>-4</sup> avg. from X-ray to FIR	
Specification Temperature:	+23°C	
Max. Survival Temp Range:	CW/L 214-380nm	-50°C to +50°C
	CW/L 380.1-2400nm	-50°C to +70°C
Humidity Resistance:	Per MIL-C-48497A	
Mechanical:	Mounted in an anodized aluminum ring	

Optional: Mounted in threaded ring - see pg 61 for thread sizes

## Applications

Spectral Radiometry  
 Medical Diagnostics  
 Chemical Analysis  
 Colorimetry



Can't find what you need? Scan the QR code to browse our surplus product line, or email us at [sales@andovercorp.com](mailto:sales@andovercorp.com).



STANDARD & HIGH-TRANSMITTING BANDPASS FILTERS

High Trans.	Line	CWL (nm)	FWHM (nm)	Type	Min. T (%)	n*	Nom. Thk. (mm)	Blocked from UV to (nm)	Size, Shape & Part Number		
									12.5mm Ø	25mm Ø	50mm Ø
	-	193.0 ± 2.5	15 ± 3	7	12	-	3.5	FIR	193FS15-12.5	193FS15-25	193FS15-50
	-	200.0 + 3/-1	10 ± 2	7	12	-	3.5	FIR	200FS10-12.5	200FS10-25	200FS10-50
	Zn	214.0 + 3/-1	10 ± 2	7	12	-	3.5	FIR	214FS10-12.5	214FS10-25	214FS10-50
	Zn	214.0 ± 3	22 ± 4	8	20	-	3.5	FIR	214FS22-12.5	214FS22-25	214FS22-50
	-	220.0 + 3/-1	10 ± 2	7	12	-	3.5	FIR	220FS10-12.5	220FS10-25	220FS10-50
	Cd	228.0 + 3/-1	10 ± 2	7	15	-	3.5	FIR	228FS10-12.5	228FS10-25	228FS10-50
	Cd	228.0 ± 3	25 ± 5	8	20	-	3.5	FIR	228FS25-12.5	228FS25-25	228FS25-50
	Ni	232.0 + 3/-1	10 ± 2	7	15	-	3.5	FIR	232FS10-12.5	232FS10-25	232FS10-50
	Co	239.0 + 3/-1	10 ± 2	7	15	-	3.5	FIR	239FS10-12.5	239FS10-25	239FS10-50
	Co	239.0 ± 3	25 ± 5	8	20	-	3.5	FIR	239FS25-12.5	239FS25-25	239FS25-50
	HeCd Laser	248.0 + 3	10 ± 2	7	12	-	3.5	FIR	248FS10-12.5	248FS10-25	248FS10-50
	Hg	253.7 + 3/-1	10 ± 2	7	12	-	3.5	FIR	254FS10-12.5	254FS10-25	254FS10-50
	Hg	253.7 ± 3	25 ± 5	8	18	-	3.5	FIR	254FS25-12.5	254FS25-25	254FS25-50
	Hg	253.7 + 10-0	40 ± 8	9	20	-	3.5	FIR	254FS40-12.5	254FS40-25	254FS40-50
	-	260.0 + 3/-1	10 ± 2	7	12	-	3.5	FIR	260FS10-12.5	260FS10-25	260FS10-50
	Hg	265.0 + 3/-1	10 ± 2	7	12	-	3.5	FIR	265FS10-12.5	265FS10-25	265FS10-50
	Hg	265.0 ± 3	25 ± 5	8	20	-	3.5	FIR	265FS25-12.5	265FS25-25	265FS25-50
	Hg	270.0 + 3/-1	10 ± 2	7	12	-	3.5	FIR	270FS10-12.5	270FS10-25	270FS10-50
	Hg	275.0 + 3/-1	10 ± 2	7	12	-	3.5	FIR	275FS10-12.5	275FS10-25	275FS10-50
	Hg	280.0 + 3/-1	10 ± 2	7	12	-	3.5	FIR	280FS10-12.5	280FS10-25	280FS10-50
	Hg	280.0 ± 3	25 ± 5	8	20	-	3.5	FIR	280FS25-12.5	280FS25-25	280FS25-50
	Hg	289.0 + 3/-1	10 ± 2	7	15	-	3.5	FIR	289FS10-12.5	289FS10-25	289FS10-50
	Hg	296.7 + 3/-1	10 ± 2	7	15	-	3.5	FIR	297FS10-12.5	297FS10-25	297FS10-50
	-	300.0 + 3/-1	10 ± 2	7	15	-	3.5	FIR	300FS10-12.5	300FS10-25	300FS10-50
	-	300.0 ± 3	25 ± 5	8	20	-	3.5	FIR	300FS25-12.5	300FS25-25	300FS25-50
	-	300.0 + 10/-0	40 ± 8	9	20	-	3.5	FIR	300FS40-12.5	300FS40-25	300FS40-50
	Zn	307.1 + 3/-1	10 ± 2	7	15	-	3.5	FIR	307FS10-12.5	307FS10-25	307FS10-50
	Zn	307.1 ± 3	25 ± 5	8	20	-	3.5	FIR	307FS25-12.5	307FS25-25	307FS25-50
	-	310.0 + 3/-1	10 ± 2	7	15	-	3.5	FIR	310FS10-12.5	310FS10-25	310FS10-50
	Hg	313.0 + 3/-1	10 ± 2	7	15	-	3.5	FIR	313FS10-12.5	313FS10-25	313FS10-50
	Hg	313.0 ± 3	25 ± 5	8	20	-	3.5	FIR	313FS25-12.5	313FS25-25	313FS25-50
	-	320.0 + 3/-1	10 ± 2	3	25	1.45	6.9	FIR	320FS10-12.5	320FS10-25	320FS10-50
	Cd	326.1 + 0.5/-0	3 ± 0.5	2	15	1.45	6.9	FIR	326FS03-12.5	326FS03-25	326FS03-50
	Cd	326.1 + 2/-0	10 ± 2	3	25	1.45	6.9	FIR	326FS10-12.5	326FS10-25	326FS10-50
	Cd	326.1 ± 3	25 ± 5	3	25	1.45	6.4	FIR	326FS25-12.5	326FS25-25	326FS25-50
	-	330.0 + 3/-1	10 ± 2	3	25	1.45	6.9	FIR	330FS10-12.5	330FS10-25	330FS10-50
	Hg	334.0 + 2/-0	10 ± 2	3	25	1.45	6.9	FIR	334FS10-12.5	334FS10-25	334FS10-50
	N <sub>2</sub> Laser	337.1 + 0.5/-0	3 ± 0.5	2	20	1.45	6.9	FIR	337FS03-12.5	337FS03-25	337FS03-50
	N <sub>2</sub> Laser	337.1 + 2/-0	10 ± 2	3	25	1.45	8.0	FIR	337FS10-12.5	337FS10-25	337FS10-50
	biomed	340.0 + 2/-0	8 ± 2	3	35	1.45	8.0	FIR	340FS08-12.5	340FS08-25	340FS08-50
	biomed	340.0 + 3/-1	10 ± 2	3	25	1.45	6.9	FIR	340FS10-12.5	340FS10-25	340FS10-50
	biomed	340.0 ± 3	25 ± 5	3	25	1.45	5.9	FIR	340FS25-12.5	340FS25-25	340FS25-50
	NdYAG Laser	350.0 + 3/-1	10 ± 2	3	25	1.45	6.9	FIR	350FS10-12.5	350FS10-25	350FS10-50

MDM= Metal-Dielectric-Metal

STANDARD & HIGH-TRANSMITTING BANDPASS FILTERS

High Trans.	Line	CWL (nm)	FWHM (nm)	Type	Min. T (%)	n*	Nom. Thk. (mm)	Blocked from UV to (nm)	Size, Shape & Part Number		
									12.5mm Ø	25mm Ø	50mm Ø
	-	350.0 ± 3	25 ± 5	3	25	1.45	4.9	FIR	350FS25-12.5	350FS25-25	350FS25-50
	-	350.0 ± 5	40 ± 8	3	25	1.45	4.9	FIR	350FS40-12.5	350FS40-25	350FS40-50
	-	355.0 + 2/-0	10 ± 2	3	25	1.45	5.4	FIR	355FS10-12.5	355FS10-25	355FS10-50
	-	360.0 + 3/-1	10 ± 2	3	25	1.45	5.4	FIR	360FS10-12.5	360FS10-25	360FS10-50
	Hg	365.0 + 1/-0	5 ± 1	2	20	1.45	5.4	FIR	365FS05-12.5	365FS05-25	365FS05-50
✓	Hg	365.0 + 2/-0	10 ± 2	3	65	1.45	5.9	700	365FSX10-12.5	365FSX10-25	365FSX10-50
	Hg	365.0 + 2/-0	10 ± 2	3	25	1.45	5.4	FIR	365FS10-12.5	365FS10-25	365FS10-50
	Hg	365.0 ± 3	25 ± 5	3	25	1.45	5.4	FIR	365FS25-12.5	365FS25-25	365FS25-50
	Ni	370.0 + 3/-1	10 ± 2	3	25	1.45	5.4	FIR	370FS10-12.5	370FS10-25	370FS10-50
	-	380.0 + 3/-1	10 ± 2	3	25	1.45	5.9	FIR	380FS10-12.5	380FS10-25	380FS10-50
	-	390.0 + 3/-1	10 ± 2	3	35	1.45	5.9	FIR	390FS10-12.5	390FS10-25	390FS10-50
	-	400.0 + 3/-1	10 ± 2	3	45	1.45	5.9	FIR	400FS10-12.5	400FS10-25	400FS10-50
	-	400.0 ± 2	20 ± 4	3	45	1.45	5.9	FIR	400FS20-12.5	400FS20-25	400FS20-50
	-	400.0 + 10/-0	40 ± 8	3	45	1.45	5.9	FIR	400FS40-12.5	400FS40-25	400FS40-50
	-	400.0 + 20/-10	70 ± 16	10	60	-	5.9	FIR	400FS70-12.5	400FS70-25	400FS70-50
	Hg	404.7 + 1/-0	5 ± 1	2	35	1.45	5.9	FIR	405FS05-12.5	405FS05-25	405FS05-50
	Hg	404.7 + 2/-0	10 ± 2	3	45	1.45	4.9	FIR	405FS10-12.5	405FS10-25	405FS10-50
	-	410.0 + 3/-1	10 ± 2	3	45	1.45	5.9	FIR	410FS10-12.5	410FS10-25	410FS10-50
	-	415.0 + 2/-0	10 ± 2	3	45	1.45	5.9	FIR	415FS10-12.5	415FS10-25	415FS10-50
	-	420.0 + 3/-1	10 ± 2	3	45	1.45	5.9	FIR	420FS10-12.5	420FS10-25	420FS10-50
	-	430.0 + 3/-1	10 ± 2	3	45	1.45	4.9	FIR	430FS10-12.5	430FS10-25	430FS10-50
	Hg	435.8 + 1/-0	5 ± 1	2	45	1.45	5.9	FIR	436FS05-12.5	436FS05-25	436FS05-50
	Hg	435.8 + 2/-0	10 ± 2	3	45	1.45	5.9	FIR	436FS10-12.5	436FS10-25	436FS10-50
✓	Hg	435.8 + 2/-0	10 ± 2	3	70	1.45	5.9	800	436FSX10-12.5	436FSX10-25	436FSX10-50
	-	440.0 + 3/-1	10 ± 2	3	45	1.45	5.9	FIR	440FS10-12.5	440FS10-25	440FS10-50
	HeCd Laser	441.6 + 0.2/-0	1 ± 0.2	2	35	1.45	6.4	FIR	442FS02-12.5	442FS02-25	442FS02-50
	HeCd Laser	441.6 + 0.5/-0	3 ± 0.5	2	40	1.45	6.4	FIR	442FS03-12.5	442FS03-25	442FS03-50
	HeCd Laser	441.6 + 2/-0	10 ± 2	3	45	1.45	5.9	FIR	442FS10-12.5	442FS10-25	442FS10-50
✓	HeCd Laser	441.6 + 2/-0	10 ± 2	3	75	1.45	5.9	800	442FSX10-12.5	442FSX10-25	442FSX10-50
	-	450.0 + 3/-1	10 ± 2	3	45	1.45	5.9	FIR	450FS10-12.5	450FS10-25	450FS10-50
✓	-	450.0 + 3/-1	10 ± 2	3	75	1.45	5.9	800	450FSX10-12.5	450FSX10-25	450FSX10-50
	-	450.0 ± 2	20 ± 4	3	55	1.45	5.9	FIR	450FS20-12.5	450FS20-25	450FS20-50
✓	-	450.0 ± 2	20 ± 4	3	75	1.45	5.9	800	450FSX20-12.5	450FSX20-25	450FSX20-50
	-	450.0 + 10/-0	40 ± 8	3	55	1.45	5.9	FIR	450FS40-12.5	450FS40-25	450FS40-50
✓	-	450.0 + 10/-0	40 ± 8	3	75	1.45	5.9	800	450FSX40-12.5	450FSX40-25	450FSX40-50
	-	450.0 + 20/-10	80 ± 16	9	65	-	5.9	FIR	450FS80-12.5	450FS80-25	450FS80-50
	Cs	455.5 + 2/-0	10 ± 2	3	50	1.45	5.9	FIR	456FS10-12.5	456FS10-25	456FS10-50
	Arlon Laser	457.9 + 0.2/-0	1 ± 0.2	2	40	1.45	6.4	FIR	458FS02-12.5	458FS02-25	458FS02-50
	Arlon Laser	457.9 + 0.5/-0	3 ± 0.5	2	45	1.45	6.4	FIR	458FS03-12.5	458FS03-25	458FS03-50
	Arlon Laser	457.9 + 2/-0	10 ± 2	3	50	1.45	5.9	FIR	458FS10-12.5	458FS10-25	458FS10-50
✓	Arlon Laser	457.9 + 2/-0	10 ± 2	3	75	1.45	5.9	800	458FSX10-12.5	458FSX10-25	458FSX10-50
	-	460.0 + 3/-1	10 ± 2	3	50	1.45	5.9	FIR	460FS10-12.5	460FS10-25	460FS10-50
	-	470.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	470FS10-12.5	470FS10-25	470FS10-50
	-	480.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	480FS10-12.5	480FS10-25	480FS10-50

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High Trans.	Line	CWL (nm)	FWHM (nm)	Type	Min. T (%)	n*	Nom. Thk. (mm)	Blocked from UV to (nm)	Size, Shape & Part Number		
									12.5mm Ø	25mm Ø	50mm Ø
	Hb	486.1 + 2/-0	10 ± 2	3	50	2.05	5.9	FIR	486FS10-12.5	486FS10-25	486FS10-50
✓	H-beta	486.1 + 2/-0	10 ± 2	3	75	2.05	5.9	800	486FSX10-12.5	486FSX10-25	486FSX10-50
	Arlon Laser	488.0 + .2/-0	1 ± 0.2	2	45	2.05	6.4	FIR	488FS02-12.5	488FS02-25	488FS02-50
	Arlon Laser	488.0 + 0.5/-0	3 ± 0.5	2	50	2.05	6.4	FIR	488FS03-12.5	488FS03-25	488FS03-50
	Arlon Laser	488.0 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	488FS10-12.5	488FS10-25	488FS10-50
✓	Arlon Laser	488.0 + 2/-0	10 ± 2	3	75	2.05	5.9	800	488FSX10-12.5	488FSX10-25	488FSX10-50
	-	490.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	490FS10-12.5	490FS10-25	490FS10-50
	-	500.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	500FS10-12.5	500FS10-25	500FS10-50
✓	-	500.0 + 3/-1	10 ± 2	3	75	2.05	5.9	800	500FSX10-12.5	500FSX10-25	500FSX10-50
	-	500.0 ± 2	20 ± 4	3	55	2.05	5.9	FIR	500FS20-12.5	500FS20-25	500FS20-50
✓	-	500.0 ± 2	20 ± 4	3	75	2.05	5.9	800	500FSX20-12.5	500FSX20-25	500FSX20-50
	-	500.0 + 10/-0	40 ± 8	3	55	2.05	5.9	FIR	500FS40-12.5	500FS40-25	500FS40-50
✓	-	500.0 + 10/-0	40 ± 8	3	75	2.05	5.9	800	500FSX40-12.5	500FSX40-25	500FSX40-50
	-	500.0 + 20/-10	80 ± 16	9	70	-	5.9	FIR	500FS80-12.5	500FS80-25	500FS80-50
	Cd	508.5 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	508FS10-12.5	508FS10-25	508FS10-50
	-	510.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	510FS10-12.5	510FS10-25	510FS10-50
	Arlon Laser	514.5 + 0.2/-0	1 ± 0.2	2	45	2.05	6.4	FIR	515FS02-12.5	515FS02-25	515FS02-50
	Arlon Laser	514.5 + 0.5/-0	3 ± 0.5	2	50	2.05	6.4	FIR	515FS03-12.5	515FS03-25	515FS03-50
	Arlon Laser	514.5 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	515FS10-12.5	515FS10-25	515FS10-50
✓	Arlon Laser	514.5 + 2/-0	10 ± 2	3	75	2.05	5.9	1000	515FSX10-12.5	515FSX10-25	515FSX10-50
	-	520.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	520FS10-12.5	520FS10-25	520FS10-50
	-	523.0 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	523FS10-12.5	523FS10-25	523FS10-50
	-	530.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	530FS10-12.5	530FS10-25	530FS10-50
	NdYAG Laser	532.0 + 0.2/-0	1 ± 0.2	2	45	2.05	6.4	FIR	532FS02-12.5	532FS02-25	532FS02-50
	NdYAG Laser	532.0 + 0.5/-0	3 ± 0.5	2	50	2.05	6.4	FIR	532FS03-12.5	532FS03-25	532FS03-50
	NdYAG Laser	532.0 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	532FS10-12.5	532FS10-25	532FS10-50
✓	NdYAG Laser	532.0 + 2/-0	10 ± 2	3	75	2.05	5.9	1000	532FSX10-12.5	532FSX10-25	532FSX10-50
	Ti	535.0 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	535FS10-12.5	535FS10-25	535FS10-50
	-	540.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	540FS10-12.5	540FS10-25	540FS10-50
	-	543.5 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	544FS10-12.5	544FS10-25	544FS10-50
	Hg	546.1 + 1/-0	5 ± 1	2	55	1.45	5.9	FIR	546FS05-12.5	546FS05-25	546FS05-50
	Zn	546.1 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	546FS10-12.5	546FS10-25	546FS10-50
✓	Zn	546.1 + 2/-0	10 ± 2	3	75	2.05	5.9	1000	546FSX10-12.5	546FSX10-25	546FSX10-50
	-	550.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	550FS10-12.5	550FS10-25	550FS10-50
✓	-	550.0 + 3/-1	10 ± 2	3	75	2.05	5.9	1000	550FS10-12.5	550FS10-25	550FS10-50
	-	550.0 ± 2	20 ± 4	3	55	1.45	5.9	FIR	550FS20-12.5	550FS20-25	550FS20-50
✓	-	550.0 ± 2	20 ± 4	3	75	1.45	5.9	1000	550FSX20-12.5	550FSX20-25	550FSX20-50
	-	550.0 + 10/-0	40 ± 8	3	55	1.45	5.9	FIR	550FS40-12.5	550FS40-25	550FS40-50
✓	-	550.0 + 10/-0	40 ± 8	3	80	1.45	5.9	1000	550FSX40-12.5	550FSX40-25	550FSX40-50
	-	550.0 + 20/-10	80 ± 16	-	70	-	5.9	FIR	550FS80-12.5	550FS80-25	550FS80-50
	-	560.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	560FS10-12.5	560FS10-25	560FS10-50
	-	570.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	570FS10-12.5	570FS10-25	570FS10-50
	Hg	577.0 + 1/-0	5 ± 1	2	50	1.45	5.9	FIR	577FS05-12.5	577FS05-25	577FS05-50

MDM= Metal-Dielectric-Metal

STANDARD & HIGH-TRANSMITTING BANDPASS FILTERS

High Trans.	Line	CWL (nm)	FWHM (nm)	Type	Min. T (%)	n*	Nom. Thk. (mm)	Blocked from UV to (nm)	Size, Shape & Part Number		
									12.5mm Ø	25mm Ø	50mm Ø
	Hg	577.0 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	577FS10-12.5	577FS10-25	577FS10-50
✓	Hg	577.0 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	577FS10-12.5	577FS10-25	577FS10-50
	-	580.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	580FS10-12.5	580FS10-25	580FS10-50
	Na	589.3 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	589FS10-12.5	589FS10-25	589FS10-50
✓	Na	589.3 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	589FSX10-12.5	589FSX10-25	589FSX10-50
	-	590.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	590FS10-12.5	590FS10-25	590FS10-50
	-	600.0 + 3/-1	10 ± 2	2	55	2.05	5.9	FIR	600FS10-12.5	600FS10-25	600FS10-50
✓	-	600.0 + 3/-1	10 ± 2	2	80	2.05	5.9	1000	600FSX10-12.5	600FSX10-25	600FSX10-50
	-	600.0 ± 2	20 ± 4	2	55	1.45	5.9	FIR	600FS20-12.5	600FS20-25	600FS20-50
✓	-	600.0 ± 2	20 ± 4	2	80	1.45	5.9	1000	600FSX20-12.5	600FSX20-25	600FSX20-50
	-	600.0 + 10/-0	40 ± 8	3	55	2.05	5.9	FIR	600FS40-12.5	600FS40-25	600FS40-50
✓	-	600.0 + 10/-0	40 ± 8	3	80	2.05	5.9	1000	600FSX40-12.5	600FSX40-25	600FSX40-50
	-	600.0 + 20/-10	80 ± 16	9	70	-	5.9	FIR	600FS80-12.5	600FS80-25	600FS80-50
	-	610.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	610FS10-12.5	610FS10-25	610FS10-50
	-	620.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	620FS10-12.5	620FS10-25	620FS10-50
	-	630.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	630FS10-12.5	630FS10-25	630FS10-50
	HeNe Laser	632.8 + 0.2/-0	1 ± 0.2	2	50	2.05	6.4	FIR	633FS02-12.5	633FS02-25	633FS02-50
	HeNe Laser	632.8 + 0.5/-0	3 ± 0.5	2	50	2.05	6.4	FIR	633FS03-12.5	633FS03-25	633FS03-50
	HeNe Laser	632.8 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	633FS10-12.5	633FS10-25	633FS10-50
✓	HeNe Laser	632.8 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	633FSX10-12.5	633FSX10-25	633FSX10-50
	Zn	636.2 + 2/-0	10 ± 2	3	60	2.05	5.9	FIR	636FS10-12.5	636FS10-25	636FS10-50
✓	Zn	636.2 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	636FSX10-12.5	636FSX10-25	636FSX10-50
	-	640.0 + 3/-1	10 ± 2	3	60	2.05	5.9	FIR	640FS10-12.5	640FS10-25	640FS10-50
	Kr Laser	647.1 + 0.2/-0	1 ± 0.2	2	50	2.05	6.4	FIR	647FS02-12.5	647FS02-25	647FS02-50
	Kr Laser	647.1 + 0.5/-0	3 ± 0.5	2	50	2.05	6.4	FIR	647FS03-12.5	647FS03-25	647FS03-50
	Kr Laser	647.1 + 2/-0	10 ± 2	3	60	2.05	5.9	FIR	647FS10-12.5	647FS10-25	647FS10-50
✓	Kr Laser	647.1 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	647FSX10-12.5	647FSX10-25	647FSX10-50
	-	650.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	650FS10-12.5	650FS10-25	650FS10-50
✓	-	650.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1000	650FSX10-12.5	650FSX10-25	650FSX10-50
	-	650.0 ± 2	20 ± 4	3	55	2.05	5.9	FIR	650FS20-12.5	650FS20-25	650FS20-50
✓	-	650.0 ± 2	20 ± 4	3	80	2.05	5.9	1000	650FSX20-12.5	650FSX20-25	650FSX20-50
	-	650.0 + 10/-0	40 ± 8	3	50	2.05	5.9	FIR	650FS40-12.5	650FS40-25	650FS40-50
✓	-	650.0 + 10/-0	40 ± 8	3	80	2.05	5.9	1000	650FSX40-12.5	650FSX40-25	650FSX40-50
	-	650.0 + 20/-10	80 ± 16	9	70	-	5.9	FIR	650FS80-12.5	650FS80-25	650FS80-50
	Ha	656.3 + 0.2/-0	1 ± 0.2	2	45	2.05	6.4	FIR	656FS02-12.5	656FS02-25	656FS02-50
	Ha	656.3 + 0.5/-0	3 ± 0.5	2	50	2.05	6.4	FIR	656FS03-12.5	656FS03-25	656FS03-50
	Ha	656.3 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	656FS10-12.5	656FS10-25	656FS10-50
✓	Ha	656.3 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	656FSX10-12.5	656FSX10-25	656FSX10-50
	-	660.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	660FS10-12.5	660FS10-25	660FS10-50
✓	-	660.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1000	660FSX10-12.5	660FSX10-25	660FSX10-50
	-	670.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	670FS10-12.5	670FS10-25	670FS10-50
	Li	670.8 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	671FS10-12.5	671FS10-50	671FS10-50
✓	Li	670.8 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	671FSX10-12.5	671FSX10-50	671FSX10-50

MDM= Metal-Dielectric-Metal

STANDARD & HIGH-TRANSMITTING BANDPASS FILTERS

High Trans.	Line	CWL (nm)	FWHM (nm)	Type	Min. T (%)	n*	Nom. Thk. (mm)	Blocked from UV to (nm)	Size, Shape & Part Number		
									12.5mm Ø	25mm Ø	50mm Ø
	Laser Diode	675.8 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	675FS10-12.5	675FS10-25	675FS10-50
	-	675.0 ± 2	20 ± 4	3	55	2.05	5.9	FIR	675FS20-12.5	675FS20-25	675FS20-50
	-	680.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	680FS10-12.5	680FS10-25	680FS10-50
	-	690.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	690FS10-12.5	690FS10-25	690FS10-50
	Ruby Laser	694.3 + 0.2/-0	1 ± 0.2	3	45	2.05	6.4	FIR	694FS02-12.5	694FS02-25	694FS02-50
	Ruby Laser	694.3 + 0.5/-0	3 ± 0.5	2	50	2.05	6.4	FIR	694FS03-12.5	694FS03-25	694FS03-50
	Ruby Laser	694.3 + 2/-0	10 ± 2	3	55	2.05	5.9	FIR	694FS10-12.5	694FS10-25	694FS10-50
✓	Ruby Laser	694.3 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	694FSX10-12.5	694FSX10-25	694FSX10-50
	-	700.0 + 3/-1	10 ± 2	3	55	2.05	5.9	FIR	700FS10-12.5	700FS10-25	700FS10-50
✓	-	700.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1000	700FSX10-12.5	700FSX10-25	700FSX0-50
	-	700.0 ± 2	20 ± 4	3	55	2.05	5.9	FIR	700FS20-12.5	700FS20-25	700FS20-50
✓	-	700.0 ± 2	20 ± 4	3	80	2.05	5.9	1000	700FSX20-12.5	700FSX20-25	700FSX20-50
	-	700.0 + 10/-0	40 ± 8	3	50	2.05	5.9	FIR	700FS40-12.5	700FS40-25	700FS40-50
✓	-	700.0 + 10/-0	40 ± 8	3	80	2.05	5.9	1000	700FSX40-12.5	700FSX40-25	700FSX40-50
	-	700.0 + 20/-10	80 ± 16	9	65	-	5.9	FIR	700FS80-12.5	700FS80-25	700FS80-50
	-	710.0 + 3/-1	10 ± 2	3	55	-	5.9	FIR	710FS10-12.5	710FS10-25	710FS10-50
	-	720.0 + 3/-1	10 ± 2	3	55	-	5.9	FIR	720FS10-12.5	720FS10-25	720FS10-50
	-	730.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	730FS10-12.5	730FS10-25	730FS10-50
	-	740.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	740FS10-12.5	740FS10-25	740FS10-50
	-	750.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	750FS10-12.5	750FS10-25	750FS10-50
✓	-	750.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1000	750FSX10-12.5	750FSX10-25	750FSX10-50
	-	750.0 ± 2	20 ± 4	3	50	2.05	5.9	FIR	750FS20-12.5	750FS20-25	750FS20-50
✓	-	750.0 ± 2	20 ± 4	3	80	2.05	5.9	1000	750FSX20-12.5	750FSX20-25	750FSX20-50
	-	750.0 + 10/-0	40 ± 8	3	40	2.05	5.9	FIR	750FS40-12.5	750FS40-25	750FS40-50
✓	-	750.0 + 10/-0	40 ± 8	3	80	2.05	5.9	1000	750FSX40-12.5	750FSX40-25	750FSX40-50
	-	750.0 + 20/-10	100 ± 20	9	65	-	5.9	FIR	750FS00-12.5	750FS00-25	750FS00-50
	-	760.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	760FS10-12.5	760FS10-25	760FS10-50
	K	766.5 + 2/-0	10 ± 2	3	50	2.05	5.9	FIR	766FS10-12.5	766FS10-25	766FS10-50
✓	K	766.5 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	766FSX10-12.5	766FSX10-25	766FSX10-50
	-	770.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	770FS10-12.5	770FS10-25	770FS10-50
	Rb	780.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	780FS10-12.5	780FS10-25	780FS10-50
✓	Rb	780.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1000	780FSX10-12.5	780FSX10-25	780FSX10-50
	Laser Diode	780.0 ± 2	20 ± 4	3	50	2.05	5.9	FIR	780FS20-12.5	780FS20-25	780FS20-50
	-	790.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	790FS10-12.5	790FS10-25	790FS10-50
	Rb	794.7 + 2/-0	10 ± 2	3	50	2.05	5.9	FIR	795FS10-12.5	795FS10-25	795FS10-50
✓	Rb	794.7 + 2/-0	10 ± 2	3	80	2.05	5.9	1000	795FSX10-12.5	795FSX10-25	795FSX10-50
	-	800.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	800FS10-12.5	800FS10-25	800FS10-50
✓	-	800.0 + 3/-1	10 ± 2	3	50	2.05	5.9	1200	800FSX10-12.5	800FSX10-25	800FSX10-50
	-	800.0 ± 2	20 ± 4	3	50	2.05	5.9	FIR	800FS20-12.5	800FS20-25	800FS20-50
✓	-	800.0 ± 2	20 ± 4	3	80	2.05	5.9	1200	800FSX20-12.5	800FSX20-25	800FSX20-50
	-	800.0 + 10/-0	40 ± 8	3	50	2.05	5.9	FIR	800FS40-12.5	800FS40-25	800FS40-50
✓	-	800.0 + 10/-0	40 ± 8	3	80	2.05	5.9	1200	800FSX40-12.5	800FSX40-25	800FSX40-50
	-	800.0 + 20/-10	100 ± 20	9	65	-	5.9	FIR	800FS00-12.5	800FS00-25	800FS00-50

MDM= Metal-Dielectric-Metal

STANDARD & HIGH-TRANSMITTING BANDPASS FILTERS

High Trans.	Line	CWL (nm)	FWHM (nm)	Type	Min. T (%)	n*	Nom. Thk. (mm)	Blocked from UV to (nm)	Size, Shape & Part Number		
									12.5mm Ø	25mm Ø	50mm Ø
	Laser Diode	810.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	810FS10-12.5	810FS10-25	810FS10-50
✓	Laser Diode	810.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1200	810FSX10-12.5	810FSX10-25	810FSX10-50
	Laser Diode	810.0 ± 2	20 ± 4	3	50	2.05	5.9	FIR	810FS20-12.5	810FS20-25	810FS20-50
✓	Laser Diode	810.0 ± 2	20 ± 4	3	80	2.05	5.9	1200	810FSX20-12.5	810FSX20-25	810FSX20-50
	-	820.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	820FS10-12.5	820FS10-25	820FS10-50
	GaAlAs Laser	830.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIN	830FS10-12.5	830FS10-25	830FS10-50
✓	GaAlAs Laser	830.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1200	830FSX10-12.5	830FSX10-25	830FSX10-50
	Laser Diode	830.0 ± 2	20 ± 4	3	50	2.05	5.9	FIR	830FS20-12.5	830FS20-25	830FS20-50
✓	Laser Diode	830.0 ± 2	20 ± 4	3	80	2.05	5.9	1200	830FSX20-12.5	830FSX20-25	830FSX20-50
	-	840.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	840FS10-12.5	840FS10-25	840FS10-50
	-	850.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	850FS10-12.5	850FS10-25	850FS10-50
✓	-	850.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1200	850FSX10-12.5	850FSX10-25	850FSX10-50
	-	850.0 ± 2	20 ± 4	3	50	2.05	5.9	FIR	850FS20-12.5	850FS20-25	850FS20-50
✓	-	850.0 ± 2	20 ± 4	3	80	2.05	5.9	1200	850FSX20-12.5	850FSX20-25	850FSX20-50
	-	850.0 + 10/-0	40 ± 8	3	50	2.05	5.9	FIR	850FS40-12.5	850FS40-25	850FS40-50
✓	-	850.0 + 10/-0	40 ± 8	3	80	2.05	5.9	1200	850FSX40-12.5	850FSX40-25	850FSX40-50
	-	850.0 + 20/-10	100 ± 20	9	65	-	5.9	FIR	850FS00-12.5	850FS00-25	850FS00-50
	-	860.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	860FS10-12.5	860FS10-25	860FS10-50
	-	870.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	870FS10-12.5	870FS10-25	870FS10-50
	-	880.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	880FS10-12.5	880FS10-25	880FS10-50
	-	890.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	890FS10-12.5	890FS10-25	890FS10-50
	-	900.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	900FS10-12.5	900FS10-25	900FS10-50
✓	-	900.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1200	900FSX10-12.5	900FSX10-25	900FSX10-50
	-	900.0 ± 2	20 ± 4	3	50	2.05	5.9	FIR	900FS20-12.5	900FS20-25	900FS20-50
✓	-	900.0 ± 2	20 ± 4	3	80	2.05	5.9	1200	900FSX20-12.5	900FSX20-25	900FSX20-50
	-	900.0 + 10/-0	40 ± 8	3	50	2.05	5.9	FIR	900FS40-12.5	900FS40-25	900FS40-50
✓	-	900.0 + 10/-0	40 ± 8	3	80	2.05	5.9	1200	900FSX40-12.5	900FSX40-25	900FSX40-50
	-	900.0 + 20/-10	100 ± 20	9	60	-	5.9	FIR	900FS00-12.5	900FS00-25	900FS00-50
	GaAs	905.0 + 0.2/-0	1 ± 0.2	2	45	2.05	6.4	FIR	905FS02-12.5	905FS02-25	905FS02-50
	GaAs	905.0 + 0.5/-0	3 ± 0.5	2	45	2.05	6.4	FIR	905FS03-12.5	905FS03-25	905FS03-50
	GaAs	905.0 + 2/-0	10 ± 0.2	3	50	2.05	5.9	FIR	905FS10-12.5	905FS10-25	905FS10-50
✓	-	905.0 + 2/-0	10 ± 0.2	3	80	2.05	5.9	1200	905FSX10-12.5	905FSX10-25	905FSX10-50
	-	910.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	910FS10-12.5	910FS10-25	910FS10-50
	-	920.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	920FS10-12.5	920FS10-25	920FS10-50
	-	930.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	930FS10-12.5	930FS10-25	930FS10-50
	-	940.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	940FS10-12.5	940FS10-25	940FS10-50
	-	950.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	950FS10-12.5	950FS10-25	950FS10-50
✓	-	950.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1200	950FSX10-12.5	950FSX10-25	950FSX10-50
	-	950.0 ± 2	20 ± 4	3	50	2.05	5.9	FIR	950FS20-12.5	950FS20-25	950FS20-50
✓	-	950.0 ± 2	20 ± 4	3	50	2.05	5.9	1200	950FSX20-12.5	950FSX20-25	950FSX20-50
	-	950.0 + 10/-0	40 ± 8	3	50	1.45	5.9	FIR	950FS40-12.5	950FS40-25	950FS40-50
✓	-	950.0 + 10/-0	40 ± 8	3	80	1.45	5.9	1200	950FSX40-12.5	950FSX40-25	950FS4X0-50
	-	950.0 + 20/-10	100 ± 20	9	60	-	5.9	FIR	950FS00-12.5	950FS00-25	950FS00-50

MDM= Metal-Dielectric-Metal

STANDARD & HIGH-TRANSMITTING BANDPASS FILTERS

High Trans.	Line	CWL (nm)	FWHM (nm)	Type	Min. T (%)	n*	Nom. Thk. (mm)	Blocked from UV to (nm)	Size, Shape & Part Number		
									12.5mm Ø	25mm Ø	50mm Ø
-	-	960.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	960FS10-12.5	960FS10-25	960FS10-50
-	-	970.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	970FS10-12.5	970FS10-50	970FS10-50
-	-	980.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	980FS10-12.5	980FS10-25	980FS10-50
-	-	990.0 + 3/-1	10 ± 2	3	50	2.05	5.9	FIR	990FS10-12.5	990FS10-25	990FS10-50
-	-	1000.0 + 3/-1	10 ± 2	3	45	2.05	5.9	FIR	100FS10-12.5	100FS10-25	100FS10-50
✓	-	1000.0 + 3/-1	10 ± 2	3	80	2.05	5.9	1300	100FSX10-12.5	100FSX10-25	100FSX10-50
-	Hg	1000.0 ± 2	20 ± 4	3	45	2.05	5.9	FIR	100FS20-12.5	100FS20-25	100FS20-50
✓	Hg	1000.0 ± 2	20 ± 4	3	80	2.05	5.9	1300	100FSX20-12.5	100FSX20-25	100FSX20-50
-	-	1000.0 + 10/-0	40 ± 8	3	45	1.45	5.9	FIR	100FS40-12.5	100FS40-25	100FS40-50
✓	-	1000.0 + 10/-0	40 ± 8	3	80	1.45	5.9	1300	100FSX40-12.5	100FSX40-25	100FSX40-50
-	-	1000.0 + 20/-10	100 ± 20	9	60	-	5.9	FIR	100FS00-12.5	100FS00-25	100FS00-50
-	Hg	1014.0 + 2/-0	10 ± 2	3	45	2.05	6.9	FIR	014FS10-12.5	014FS10-25	014FS10-50
-	-	1046.0 + 2/-0	10 ± 2	3	45	2.05	6.9	FIR	046FS10-12.5	046FS10-25	046FS10-50
✓	-	1046.0 + 2/-0	10 ± 2	3	75	2.05	6.9	1300	046FS10-12.5	046FS10-25	046FS10-50
-	-	1050.0 + 3/-1	10 ± 2	3	45	2.05	6.9	FIR	050FS10-12.5	050FS10-25	050FS10-50
-	Nd Laser	1064.0 + 0.2/-0	1 ± 0.2	2	40	2.05	6.9	FIR	064FS02-12.5	064FS02-25	064FS02-50
-	NdYAG Laser	1064.0 + 0.5/-0	3 ± 0.5	2	45	2.05	6.9	FIR	064FS03-12.5	064FS03-25	064FS03-50
-	NdYAG Laser	1064.0 + 2/-0	10 ± 2	3	40	2.05	6.9	FIR	064FS10-12.5	064FS10-25	064FS10-50
-	-	1100.0 + 3/-1	10 ± 2	3	40	2.05	6.9	FIR	110FS10-12.5	110FS10-25	110FS10-50
-	-	1150.0 + 3/-1	10 ± 2	3	35	2.05	6.9	FIR	115FS10-12.5	115FS10-25	115FS10-50
-	-	1200.0 + 3/-1	10 ± 2	2	35	2.05	6.9	FIR	120FS10-12.5	120FS10-25	120FS10-50
-	-	1250.0 + 3/-1	10 ± 2	2	35	2.05	7.9	FIR	125FS10-12.5	125FS10-25	125FS10-50
-	-	1300.0 + 3/-1	10 ± 2	2	35	2.05	7.9	FIR	130FS10-12.5	130FS10-25	130FS10-50
-	-	1300.0 ± 3	20 ± 5	3	35	2.05	7.9	FIR	130FS20-12.5	130FS20-25	130FS20-50
-	-	1350.0 + 3/-1	10 ± 2	2	35	2.05	7.9	FIR	135FS10-12.5	135FS10-25	135FS10-50
-	-	1400.0 + 3/-1	10 ± 2	2	30	2.05	7.9	FIR	140FS10-12.5	140FS10-25	140FS10-50
-	-	1450.0 + 3/-1	10 ± 2	2	30	2.05	7.9	FIR	145FS10-12.5	145FS10-25	145FS10-50
-	-	1500.0 + 3/-1	10 ± 2	2	30	2.05	7.9	FIR	150FS10-12.5	150FS10-25	150FS10-50
✓	-	1500.0 + 3/-1	10 ± 2	2	70	2.05	7.9	2400	150FSX10-12.5	150FSX10-25	150FSX10-50
-	-	1500.0 ± 3	20 ± 5	3	30	2.05	7.9	FIR	150FS20-12.5	150FS20-25	150FS20-50
✓	-	1500.0 ± 3	20 ± 5	3	70	2.05	7.9	2400	150FSX20-12.5	150FSX20-25	150FSX20-50
-	-	1550.0 + 3/-1	10 ± 2	2	30	2.05	7.9	FIR	155FS10-12.5	155FS10-25	155FS10-50
✓	-	1550.0 + 3/-1	10 ± 2	2	70	2.05	7.9	2400	155FSX10-12.5	155FSX10-25	155FSX10-50
-	-	1550.0 ± 3	20 ± 5	3	30	2.05	7.9	FIR	155FS20-12.5	155FS20-25	155FS20-50
✓	-	1550.0 ± 3	20 ± 5	3	70	2.05	7.9	2400	155FSX20-12.5	155FSX20-25	155FSX20-50
-	Methane	1665.0 + 3/-1	10 ± 2	2	30	2.05	7.9	FIR	167FS10-12.5	167FS10-25	167FS10-50
-	-	1665.0 ± 3	20 ± 5	3	30	2.05	7.9	FIR	167FS20-12.5	167FS20-25	167FS20-50

MDM= Metal-Dielectric-Metal

# HARD-COATED NARROWBAND FILTERS



## Hard-Coated Narrowband Filters

Our first-surface, hard-coat narrowband filters employ plasma-deposited, hard-oxide coatings on Borosilicate Glass and do not utilize any absorbing filter glasses, making them suitable for high temperature applications. They provide a steep transition from a high, peak transmission to OD4 blocking. Available at wavelengths from 334nm to 1550nm, including all major laser lines and atomic emission lines. All filters are mounted in black anodized aluminum rings to provide protection and easy identification. Please contact our technical sales department for pricing and delivery.

- Hard, durable, first-surface coatings
- Suitable for high-temperature applications

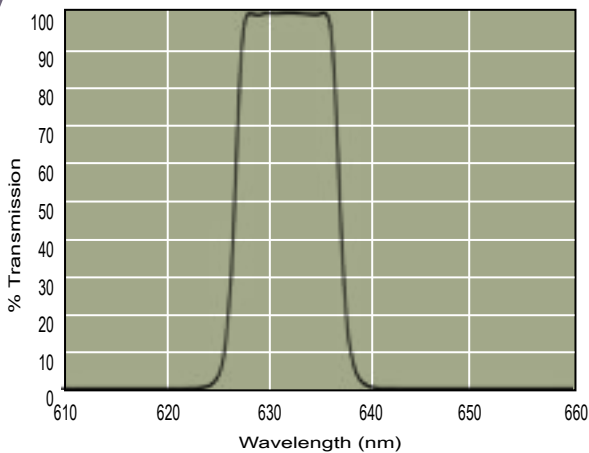
## General Specifications

Thickness:	5.0 ± 0.1mm
Size Tolerance:	+ 0.0mm / -0.1mm
Minimum Clear Aperture:	21mm dia.
Substrate Material:	Borosilicate Glass
Flatness:	3-5 waves
Surface Quality:	60 - 40 per MIL-C-48497A
Humidity and Abrasion:	Per MIL-C-675A
Durability:	Per MIL-C-48497A
Operating Temperature:	-50°C to +200°C
Mechanical:	Mounted in black anodized aluminum

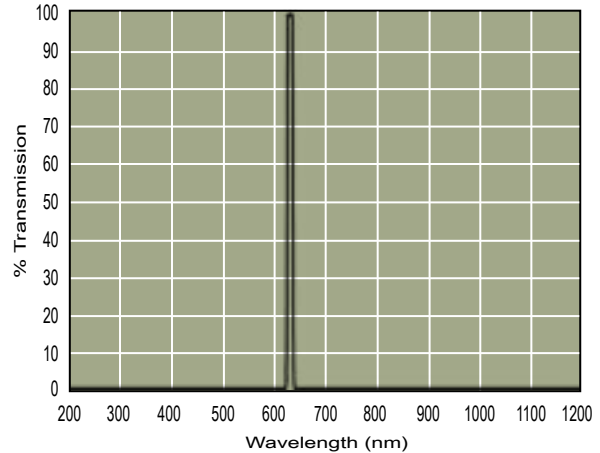
## Applications

Machine Vision  
Biotech Instrumentation  
Medical Devices

632nm Narrowband - 632HC10-25



632nm Narrowband - 632HC10-25





## HARD COATED NARROWBAND FILTERS

CWL (nm)	FWHM (nm)	Min Trans (%)	OD4 (avg.) Blocking @	Part Number
				25mm Ø
334	10	90	200-1200nm	334HC10-25
337	10	90	200-1200nm	337HC10-25
340	10	90	200-1200nm	340HC10-25
365	10	90	200-1200nm	365HC10-25
375	10	90	200-1200nm	375HC10-25
394	10	90	200-1200nm	394HC10-25
400	10	90	200-1200nm	400HC10-25
405	10	90	200-1200nm	405HC10-25
420	10	90	200-1200nm	420HC10-25
430	10	90	200-1200nm	430HC10-25
436	10	90	200-1200nm	436HC10-25
440	10	90	200-1200nm	440HC10-25
442	10	90	200-1200nm	442HC10-25
455	10	90	200-1200nm	455HC10-25
458	10	90	200-1200nm	458HC10-25
460	10	90	200-1200nm	460HC10-25
470	10	90	200-1200nm	470HC10-25
480	10	90	200-1200nm	480HC10-25
486	10	90	200-1200nm	486HC10-25
488	10	90	200-1200nm	488HC10-25
492	10	90	200-1200nm	492HC10-25
500	10	90	200-1200nm	500HC10-25
508	10	90	200-1200nm	508HC10-25
510	10	90	200-1200nm	510HC10-25
515	10	90	200-1200nm	515HC10-25
520	10	90	200-1200nm	520HC10-25
532	10	90	200-1200nm	532HC10-25
535	10	90	200-1200nm	535HC10-25
540	10	90	200-1200nm	540HC10-25
546	10	90	200-1200nm	546HC10-25
550	10	90	200-1200nm	550HC10-25
560	10	90	200-1200nm	560HC10-25
568	10	90	200-1200nm	568HC10-25
580	10	90	200-1200nm	580HC10-25
589	10	90	200-1200nm	589HC10-25
594	10	90	200-1200nm	594HC10-25
600	10	90	200-1200nm	600HC10-25
610	10	90	200-1200nm	610HC10-25
620	10	90	200-1200nm	620HC10-25
632	10	90	200-1200nm	632HC10-25
636	10	90	200-1200nm	636HC10-25
640	10	90	200-1200nm	640HC10-25

CWL (nm)	FWHM (nm)	Min Trans (%)	OD4 (avg.) Blocking @	Part Number
				25mm Ø
647	10	90	200-1200nm	647HC10-25
650	10	90	200-1200nm	650HC10-25
656	10	90	200-1200nm	656HC10-25
660	10	90	200-1200nm	660HC10-25
671	10	90	200-1200nm	671HC10-25
676	10	90	200-1200nm	676HC10-25
680	10	90	200-1200nm	680HC10-25
685	10	90	200-1200nm	685HC10-25
690	10	90	200-1200nm	690HC10-25
700	10	90	200-1200nm	700HC10-25
730	10	90	200-1200nm	730HC10-25
750	10	90	200-1200nm	750HC10-25
766	10	90	200-1200nm	766HC10-25
770	10	90	200-1200nm	770HC10-25
780	10	90	200-1200nm	780HC10-25
785	10	90	200-1200nm	785HC10-25
800	10	90	200-1200nm	800HC10-25
810	10	90	200-1200nm	810HC10-25
830	10	90	200-1200nm	830HC10-25
850	10	90	200-1200nm	850HC10-25
852	10	90	200-1200nm	852HC10-25
880	10	90	200-1200nm	880HC10-25
905	10	90	200-1200nm	905HC10-25
940	10	90	200-1200nm	940HC10-25
950	10	90	200-1200nm	950HC10-25
980	10	90	200-1200nm	980HC10-25
1064	10	90	200-1200nm	1064HC10-25
1550	10	90	200-1800nm	1550HC10-25

# HARD-COATED BROADBAND FILTERS

## Hard-Coated Broadband Filters

Our first-surface, hard coat broadband filters employ magnetron sputtered, hard-oxide coatings deposited on Borosilicate Glass and do not utilize any absorbing filter glasses, making them suitable for high temperature applications. They provide a steep transition from a high, peak transmission to OD4 blocking. Available at standard Raman wavelengths: 488, 514, 532, 633, 785nm. We offer three standard sizes, with custom sizes available on request.

- Hard, durable, first-surface coatings
- Suitable for high-temperature applications
- Available from stock

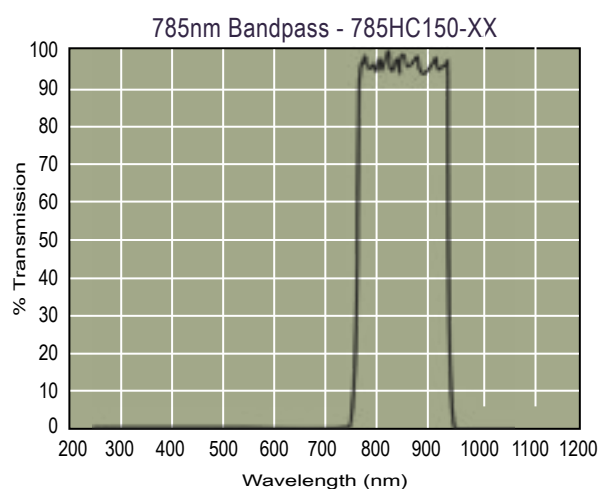
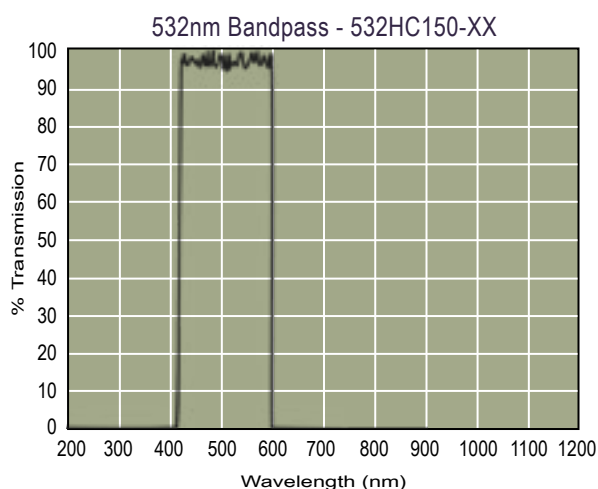
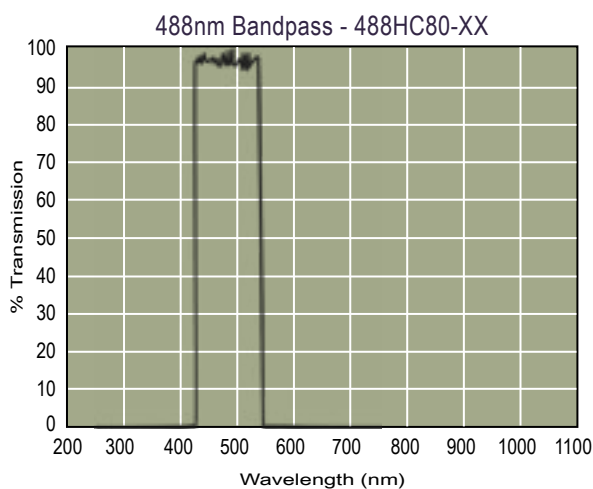
## Applications

Machine Vision  
Biotech Instrumentation  
Medical Devices

## General Specifications

Thickness:	3.0 ± 0.25mm
Size Tolerance:	+ 0.0mm / -0.2mm
Minimum Clear Aperture:	85% of outside dimension
Substrate Material:	Borosilicate Glass (345nm filter utilizes Fused Silica)
Flatness:	3 – 5 waves
Surface Quality:	60 – 40 per MIL-C-48497A
Humidity and Abrasion:	Per MIL-C-675A
Durability:	Per MIL-C-48497A
Operating Temperature:	-50°C to +200°C
Mechanical:	Unmounted

Optional: Mounted in threaded ring - see pg 61 for thread sizes



#### HARD-COATED BANDPASS FILTERS

Line	CWL (nm)	FWHM (nm)	Transmission (%)	OD4 (avg.) Blocking @	Size, Shape & Part Number		
					12.5mm Ø	25mm Ø	50mm Ø
Argon Laser	345	80 ± 8.0	≥ 60	200-650nm	345HC80-12.5	345HC80-25	345HC80-50
Argon Laser	441.6	150 ± 15.0	≥ 80	200-750nm	442HC150-12.5	442HC150-25	442HC150-50
NaYAG	470.	100 ± 10.0	85-92	200-750nm	470HC100-12.5	470HC100-25	470HC100-50
Argon Laser	488	80 ± 8.0	85-92	200-750nm	488HC80-12.5	488HC80-25	488HC80-50
Argon Laser	514.5	90 ± 9.0	85-92	200-800nm	515HC90-12.5	515HC90-25	515HC90-50
NaYAG	532	150 ± 15.0	85-92	200-900nm	532HC150-12.5	532HC150-25	532HC150-50
LED	550	300 ± 30.0	85-92	200-900nm	550HC300-12.5	550HC300-25	550HC300-50
HeNe Laser	632.8	90 ± 9.0	85-92	200-900nm	633HC90-12.5	633HC90-25	633HC90-50
Ti:Sapphire	785	170 ± 17.0	85-92	200-1100nm	785HC170-12.5	785HC170-25	785HC170-50

# SEMI-CUSTOM BANDPASS FILTERS



- Wavelengths from the visible through infrared
- Bandwidths from 0.15nm to 80nm
- Short lead times

## General Specifications

Reference page 14

## Semi-Custom Bandpass Filters

Thanks to a large inventory of components, Andover Corporation can fabricate and deliver higher-performance commercial quality bandpass filters to your specifications in as soon as 5-10 days from receipt of order. To specify your semi-custom filter, follow the steps in the table header below.

All other features are predetermined by these three choices. The out-of-band blocking of these filters is  $1 \times 10^{-4}$  within the defined spectral range. Optional threaded rings are available, and image quality versions are also available. Please contact our technical sales department for pricing and delivery.

### SEMI-CUSTOM BANDPASS FILTERS

STEP 1 Select Bandwidth, Filter Type and CW/L			STEP 2 Select Blocking Range				STEP 3 Select Size and Corresponding Part Number		
Bandwidth (FWHM) (nm)	Cavities/ Filter Type	CW/L Range (nm)	CW/L Tolerance (nm)	Min. T (%)			Size, Shape & Part Number		
				When Blocked To 1μ	FIR	n*	12.5mm Ø	25mm Ø	50mm Ø
0.15 ± 0.05	1/1	450.0–550.0	+ 0.1/-0	40	30	1.45	001FC10-12.5	001FC10-25	001FC10-50
	1/1	550.1–750.0	+ 0.1/-0	45	40	1.45	001FC12-12.5	001FC12-25	001FC12-50
0.20 ± 0.05	1/1	450.0–550.0	+ 0.1/-0	45	35	1.45/2.05	002FC10-12.5	002FC10-25	002FC10-50
	1/1	550.1–750.0	+ 0.1/-0	45	35	2.05	002FC12-12.5	002FC12-25	002FC12-50
0.30 ± 0.10	2/2	450.0–550.0	+ 0.1/-0	35	25	1.45	003FC10-12.5	003FC10-25	003FC10-50
	2/2	550.1–750.0	+ 0.1/-0	40	35	2.05	003FC12-12.5	003FC12-25	003FC12-50
0.30 - 0.40	3/3	550.0–750.0	+ 0.1/-0	35	30	2.05	004FC12-12.5	004FC12-25	004FC12-50
0.50 ± 0.10	2/2	450.0–550.0	+ 0.1/-0	40	30	1.45/2.05	005FC10-12.5	005FC10-25	005FC10-50
	2/2	550.1–750.0	+ 0.1/-0	45	35	2.05	005FC12-12.5	005FC12-25	005FC12-50
0.60 ± 0.10	2/2	430.0–480.0	± 0.1	40	35	1.45	006FC08-12.5	006FC08-25	006FC08-50
	2/2	480.1–550.0	± 0.1	45	35	2.05	006FC10-12.5	006FC10-25	006FC10-50
	2/2	550.1–750.0	± 0.1	45	25	2.05	006FC12-12.5	006FC12-25	006FC12-50
0.50 - 0.80	3/3	480.0–550.0	± 0.1	40	30	2.05	007FC10-12.5	007FC10-25	007FC10-50
	3/3	550.1–750.0	± 0.1	45	35	2.05	007FC12-12.5	007FC12-25	007FC12-50
	3/3	750.1–950.0	± 0.1	45	35	2.05	007FC14-12.5	007FC14-25	007FC14-50
0.80 ± 0.20	2/2	430.0–480.0	+ 0.2/-0	45	40	1.45	008FC08-12.5	008FC08-25	008FC08-50
	2/2	480.1–550.0	+ 0.2/-0	45	40	2.05	008FC10-12.5	008FC10-25	008FC10-50
	2/2	550.1–750.0	+ 0.2/-0	50	45	2.05	008FC12-12.5	008FC12-25	008FC12-50
	2/2	750.1–950.0	+ 0.2/-0	50	45	2.05	008FC14-12.5	008FC14-25	008FC14-50
	2/2	950.1–1100.0	+ 0.2/-0	50	40	2.05	008FC16-12.5	008FC16-25	008FC16-50

## SEMI-CUSTOM BANDPASS FILTERS

STEP 1 Select Bandwidth, Filter Type and CW/L			STEP 2 Select Blocking Range				STEP 3 Select Size and Corresponding Part Number		
Bandwidth (FWHM) (nm)	Cavities/ Filter Type	CW/L Range (nm)	CW/L Tolerance (nm)	Min. T (%)		n*	Size, Shape & Part Number		
				When Blocked To 1μ	FIR		12.5mm Ø	25mm Ø	50mm Ø
1.0 ± 0.2	2/2	340.0–385.0	+ 0.2/-0	-	8	1.45	010FC04-12.5	010FC04-25	010FC04-50
	2/2	385.1–395.0	+ 0.2/-0	15	10	1.45	010FC05-12.5	010FC05-25	010FC05-50
	2/2	395.1–430.0	+ 0.2/-0	20	15	1.45	010FC06-12.5	010FC06-25	010FC06-50
	2/2	430.1–480.0	+ 0.2/-0	40	35	1.45/2.05	010FC08-12.5	010FC08-25	010FC08-50
	2/2	480.1–550.0	+ 0.2/-0	50	40	2.05	010FC10-12.5	010FC10-25	010FC10-50
	2/2	550.1–750.0	+ 0.2/-0	55	45	2.05	010FC12-12.5	010FC12-25	010FC12-50
	2/2	750.1–950.0	+ 0.2/-0	55	45	2.05	010FC14-12.5	010FC14-25	010FC14-50
	2/2	950.1–1100.0	+ 0.2/-0	55	40	2.05	010FC16-12.5	010FC16-25	010FC16-50
1.0 ± 0.2	3/3	480.0–550.0	+ 0.2/-0	50	35	1.45/2.05	010FC35-12.5	010FC35-25	010FC35-50
	3/3	550.1–750.0	+ 0.2/-0	55	40	2.05	010FC36-12.5	010FC36-25	010FC36-50
	3/3	750.1–950.0	+ 0.2/-0	55	40	2.05	010FC37-12.5	010FC37-25	010FC37-50
	3/3	950.1–1100.0	+ 0.2/-0	50	35	2.05	010FC38-12.5	010FC38-25	010FC38-50
1.5 ± 0.3	2/2	250.0–320.0	+ 0.3/-0	-	6	1.45	015FC02-12.5	015FC02-25	015FC02-50
	2/2	320.1–387.0	+ 0.3/-0	-	10	1.45	015FC04-12.5	015FC04-25	015FC04-50
	2/2	387.1–430.0	+ 0.3/-0	20	10	1.45	015FC06-12.5	015FC06-25	015FC06-50
	2/2	430.1–480.0	+ 0.3/-0	40	30	1.45/2.05	015FC08-12.5	015FC08-25	015FC08-50
	2/2	480.1–550.0	+ 0.3/-0	55	50	2.05	015FC10-12.5	015FC10-25	015FC10-50
	2/2	550.1–750.0	+ 0.3/-0	55	50	2.05	015FC12-12.5	015FC12-25	015FC12-50
	2/2	750.1–950.0	+ 0.3/-0	55	50	2.05	015FC14-12.5	015FC14-25	015FC14-50
	2/2	950.1–1100.0	+ 0.3/-0	65	50	2.05	015FC16-12.5	015FC16-25	015FC16-50
2.0 ± 0.5	2/2	240.0–320.0	+ 0.5/-0	-	6	1.45	020FC02-12.5	020FC02-25	020FC02-50
	2/2	320.1–387.0	+ 0.5/-0	-	10	1.45	020FC04-12.5	020FC04-25	020FC04-50
	2/2	387.1–430.0	+ 0.4/-0	30	25	1.45	020FC06-12.5	020FC06-25	020FC06-50
	2/2	430.1–480.0	+ 0.4/-0	50	45	1.45/2.05	020FC08-12.5	020FC08-25	020FC08-50
	2/2	480.1–550.0	+ 0.4/-0	55	50	2.05	020FC10-12.5	020FC10-25	020FC10-50
	2/2	550.1–750.0	+ 0.4/-0	55	50	2.05	020FC12-12.5	020FC12-25	020FC12-50
	2/2	750.1–950.0	+ 0.4/-0	65	50	2.05	020FC14-12.5	020FC14-25	020FC14-50
	2/2	950.1–1100.0	+ 0.4/-0	55	45	2.05	020FC16-12.5	020FC16-25	020FC16-50
2.0 ± 0.5	3/3	430.0–480.0	+ 0.4/-0	50	40	1.45/2.05	020FC34-12.5	020FC34-25	020FC34-50
	3/3	480.1–550.0	+ 0.4/-0	55	45	2.05	020FC35-12.5	020FC35-25	020FC35-50
	3/3	550.1–750.0	+ 0.4/-0	55	45	2.05	020FC36-12.5	020FC36-25	020FC36-50
	3/3	750.1–950.0	+ 0.4/-0	60	50	2.05	020FC37-12.5	020FC37-25	020FC37-50
	3/3	950.1–1100.0	+ 0.4/-0	65	45	2.05	020FC38-12.5	020FC38-25	020FC38-50
3.0 ± 0.5	2/2	240.0–320.0	+ 0.5/-0	-	8	1.45	030FC02-12.5	030FC02-25	030FC02-50
	2/2	320.1–387.0	+ 0.5/-0	-	10	1.45	030FC04-12.5	030FC04-25	030FC04-50
	2/2	387.1–430.0	+ 0.5/-0	40	25	1.45	030FC06-12.5	030FC06-25	030FC06-50
	2/2	430.1–480.0	+ 0.5/-0	45	35	1.45/2.05	030FC08-12.5	030FC08-25	030FC08-50
	2/2	480.1–550.0	+ 0.5/-0	55	50	2.05	030FC10-12.5	030FC10-25	030FC10-50
	2/2	550.1–750.0	+ 0.5/-0	55	50	2.05	030FC12-12.5	030FC12-25	030FC12-50
	2/2	750.1–950.0	+ 0.5/-0	55	50	2.05	030FC14-12.5	030FC14-25	030FC14-50
	2/2	950.1–1100.0	+ 0.5/-0	65	50	2.05	030FC16-12.5	030FC16-25	030FC16-50

SEMI-CUSTOM BANDPASS FILTERS

STEP 1 Select Bandwidth, Filter Type and CW/L			STEP 2 Select Blocking Range				STEP 3 Select Size and Corresponding Part Number		
Bandwidth (FWHM) (nm)	Cavities/ Filter Type	CW/L Range (nm)	CW/L Tolerance (nm)	Min. T (%) When Blocked To			Size, Shape & Part Number		
				1μ	FIR	n*	12.5mm Ø	25mm Ø	50mm Ø
3.0 ± 0.5	3/3	430.0–480.0	+ 0.5/-0	50	40	1.45/2.05	030FC34-12.5	030FC34-25	030FC34-50
	3/3	480.1–550.0	+ 0.5/-0	55	45	2.05	030FC35-12.5	030FC35-25	030FC35-50
	3/3	550.1–750.0	+ 0.5/-0	55	45	2.05	030FC36-12.5	030FC36-25	030FC36-50
	3/3	750.1–950.0	+ 0.5/-0	60	50	2.05	030FC37-12.5	030FC37-25	030FC37-50
	3/3	950.1–1100.0	+ 0.5/-0	55	45	2.05	030FC38-12.5	030FC38-25	030FC38-50
5.0 ± 1.0	2/2	240.0–320.0	+ 1/-0	-	8	1.45	050FC02-12.5	050FC02-25	050FC02-50
	2/2	320.1–385.0	+ 1/-0	-	25	1.45	050FC04-12.5	050FC04-25	050FC04-50
	2/2	385.1–480.0	+ 1/-0	45	35	1.45/2.05	050FC06-12.5	050FC06-25	050FC06-50
	2/2	480.1–550.0	+ 1/-0	55	50	2.05	050FC10-12.5	050FC10-25	050FC10-50
	2/2	550.1–750.0	+ 1/-0	55	50	2.05	050FC12-12.5	050FC12-25	050FC12-50
	2/2	750.1–950.0	+ 1/-0	60 <sup>a</sup>	45	2.05	050FC14-12.5	050FC14-25	050FC14-50
	2/2	950.1–1100.0	+ 1/-0	65 <sup>b</sup>	45	2.05	050FC16-12.5	050FC16-25	050FC16-50
	2/2	1100.1–1300.0	+ 1/-0	55 <sup>c</sup>	40	2.05	050FC18-12.5	050FC18-25	050FC18-50
	2/2	1300.1–1550.0	+ 1/-0	50 <sup>d</sup>	35	2.05	050FC19-12.5	050FC19-25	050FC19-50
2/2	1550.1–2000.0	+ 1/-0	50 <sup>e</sup>	-	2.05	050FC20-12.5	050FC20-25	050FC20-50	
5.0 ± 1.0	3/3	400.0–430.0	+ 1/-0	45	40	1.45	050FC33-12.5	050FC33-25	050FC33-50
	3/3	430.1–460.0	+ 1/-0	55	40	1.45	050FC34-12.5	050FC34-25	050FC34-50
	3/3	460.1–550.0	+ 1/-0	55	45	1.45/2.05	050FC35-12.5	050FC35-25	050FC35-50
	3/3	550.1–750.0	+ 1/-0	55	45	2.05	050FC36-12.5	050FC36-25	050FC36-50
	3/3	750.1–950.0	+ 1/-0	60 <sup>a</sup>	45	2.05	050FC37-12.5	050FC37-25	050FC37-50
	3/3	950.1–1100.0	+ 1/-0	55 <sup>b</sup>	40	2.05	050FC38-12.5	050FC38-25	050FC38-50
	3/3	1100.1–1300.0	+ 1/-0	50 <sup>c</sup>	35	2.05	050FC39-12.5	050FC39-25	050FC39-50
5.0 ± 1.0	4/4	460.0–550.0	+ 1/-0	60	50	1.45/2.05	050FC45-12.5	050FC45-25	050FC45-50
	4/4	550.1–750.0	+ 1/-0	60	50	2.05	050FC46-12.5	050FC46-25	050FC46-50
	4/4	750.1–950.0	+ 1/-0	55 <sup>a</sup>	45	2.05	050FC47-12.5	050FC47-25	050FC47-50
	4/4	950.1–1100.0	+ 1/-0	55 <sup>b</sup>	40	2.05	050FC48-12.5	050FC48-25	050FC48-50
10.0 ± 2.0	MDM/7	214.0–250.0	+ 2/-0	-	12	--	100FC00-12.5	100FC00-25	100FC00-50
	MDM/7	250.1–320.0	+ 2/-0	-	15	--	100FC02-12.5	100FC02-25	100FC02-50
	3/3	320.1–385.0	+ 2/-0	-	25	--	100FC32-12.5	100FC32-25	100FC32-50
	3/3	385.1–430.0	+ 2/-0	50	40	1.45	100FC33-12.5	100FC33-25	100FC33-50
	3/3	430.1–480.0	+ 2/-0	60	50	1.45/2.05	100FC34-12.5	100FC34-25	100FC34-50
	3/3	480.1–550.0	+ 2/-0	70	55	2.05	100FC35-12.5	100FC35-25	100FC35-50
	3/3	550.1–750.0	+ 2/-0	70	55	2.05	100FC36-12.5	100FC36-25	100FC36-50
	3/3	750.1–950.0	+ 2/-0	70 <sup>a</sup>	45	2.05	100FC37-12.5	100FC37-25	100FC37-50
	3/3	950.1–1100.0	+ 2/-0	70 <sup>b</sup>	45	2.05	100FC38-12.5	100FC38-25	100FC38-50
	3/3	1100.1–1300.0	+ 2/-0	70 <sup>c</sup>	35	2.05	100FC39-12.5	100FC39-25	100FC39-50
	2/2	1300.1–1550.0	+ 2/-0	70 <sup>d</sup>	35	2.05	100FC40-12.5	100FC40-25	100FC40-50
	2/2	1550.1–2400.0	+ 2/-0	60 <sup>e</sup>	-	2.05	100FC41-12.5	100FC41-25	100FC41-50

a= Blocking to 1200nm b= Blocking to 1300nm c= Blocking to 1550nm d= Blocking to 2400nm e= Blocking to 3200nm

SEMI-CUSTOM BANDPASS FILTERS

STEP 1 Select Bandwidth, Filter Type and CW/L			STEP 2 Select Blocking Range				STEP 3 Select Size and Corresponding Part Number		
Bandwidth (FWHM) (nm)	Cavities/ Filter Type	CW/L Range (nm)	CW/L Tolerance (nm)	Min. T (%)		n*	Size, Shape & Part Number		
				When Blocked To 1μ	FIR		12.5mm Ø	25mm Ø	50mm Ø
10.0 ± 2.0	4/4	460.0–550.0	+ 2/-0	60	45	1.45/2.05	100FC45-12.5	100FC45-25	100FC45-50
	4/4	550.1–750.0	+ 2/-0	60	45	2.05	100FC46-12.5	100FC46-25	100FC46-50
	4/4	750.1–950.0	+ 2/-0	70 <sup>a</sup>	50	2.05	100FC47-12.5	100FC47-25	100FC47-50
	4/4	950.1–1100.0	+ 2/-0	70 <sup>b</sup>	45	2.05	100FC48-12.5	100FC48-25	100FC48-50
	4/4	1100.1–1300.0	+ 2/-0	70 <sup>c</sup>	30	2.05	100FC49-12.5	100FC49-25	100FC49-50
20.0 ± 4.0	MDM/8	214.0–250.0	± 2.5	–	12	–	200FC00-12.5	200FC00-25	200FC00-50
	MDM/8	250.1–320.0	± 2.5	–	15	–	200FC02-12.5	200FC02-25	200FC02-50
	5/5	320.1–400.0	± 2.5	–	30	1.45	200FC32-12.5	200FC32-25	200FC32-50
20.0 ± 4.0	3/3	400.1–480.0	± 2.0	50	45	1.45	200FC33-12.5	200FC33-25	200FC33-50
	3/3	480.1–550.0	± 2.0	65	50	1.45	200FC35-12.5	200FC35-25	200FC35-50
	3/3	550.1–750.0	± 2.0	70	50	1.45/2.05	200FC36-12.5	200FC36-25	200FC36-50
	3/3	750.1–950.0	± 2.0	70 <sup>a</sup>	50	2.05	200FC37-12.5	200FC37-25	200FC37-50
	3/3	950.1–1100.0	± 2.0	70 <sup>b</sup>	50	2.05	200FC38-12.5	200FC38-25	200FC38-50
	3/3	1100.1–1300.0	± 2.0	70 <sup>c</sup>	30	2.05	200FC39-12.5	200FC39-25	200FC39-50
	3/3	1300.1–1550.0	± 2.0	70 <sup>d</sup>	30	2.05	200FC40-12.5	200FC40-25	200FC40-50
	3/3	1550.1–2400.0	± 2.0	60 <sup>e</sup>	30	2.05	200FC41-12.5	200FC41-25	200FC41-50
20.0 ± 4.0	4/4	480.0–550.0	± 2.0	65	45	1.45	200FC45-12.5	200FC45-25	200FC45-50
	4/4	550.1–750.0	± 2.0	70	50	1.45/2.05	200FC46-12.5	200FC46-25	200FC46-50
	4/4	750.1–950.0	± 2.0	70 <sup>a</sup>	50	2.05	200FC47-12.5	200FC47-25	200FC47-50
	4/4	950.1–1100.0	± 2.0	70 <sup>b</sup>	40	2.05	200FC48-12.5	200FC48-25	200FC48-50
40.0 ± 10.0	MDM/8	230.0–250.0	± 5.0	–	15	–	400FC00-12.5	400FC00-25	400FC00-50
	MDM/8	250.1–320.0	± 5.0	–	20	–	400FC02-12.5	400FC02-25	400FC02-50
	5/5	320.1–399.9	± 5.0	–	30	1.45	400FC52-12.5	400FC52-25	400FC52-50
50.0 ± 10.0	5/5	400.0–460.0	± 5.0	60	45	1.45	500FC53-12.5	500FC53-25	500FC53-50
	5/5	460.1–520.1	± 5.0	70	50	1.45	500FC54-12.5	500FC54-25	500FC54-50
	4/4	520.1–750.1	± 5.0	70	50	2.05	500FC46-12.5	500FC46-25	500FC46-50
	4/4	750.1–900.0	± 5.0	75 <sup>a</sup>	50	2.05	500FC47-12.5	500FC47-25	500FC47-50
	3/3	900.1–1100.0	± 5.0	75 <sup>b</sup>	45	2.05	500FC38-12.5	500FC38-25	500FC38-50
	3/3	1100.1–1300.0	± 5.0	70 <sup>c</sup>	35	2.05	500FC39-12.5	500FC39-25	500FC39-50
	3/3	1300.1–1550.0	± 5.0	70 <sup>d</sup>	30	2.05	500FC40-12.5	500FC40-25	500FC40-50
	3/3	1550.1–2400.0	± 5.0	70 <sup>e</sup>	–	2.05	500FC41-12.5	500FC41-25	500FC41-50
60.0 ± 10.0	5/5	340.0-399.0	± 6.0	–	30	1.45	600FC52-12.5	600FC52-25	600FC52-50
80.0 ± 20.0	5/5	460.0–750.0	± 10.0	75	–	1.45	800FC55-12.5	800FC55-25	800FC55-50
	4/4	750.1–900.0	± 10.0	75 <sup>a</sup>	–	1.45	800FC47-12.5	800FC47-25	800FC47-50
	4/4	900.1–1100.0	± 10.0	70 <sup>b</sup>	–	2.05	800FC48-12.5	800FC48-25	800FC48-50
	4/4	1100.1–1300.0	± 10.0	70 <sup>c</sup>	–	2.05	800FC49-12.5	800FC49-25	800FC49-50
	4/4	1300.1–1550.0	± 10.0	70 <sup>d</sup>	–	2.05	800FC50-12.5	800FC50-25	800FC50-50
	4/4	1550.1–2400.0	± 10.0	70 <sup>e</sup>	–	2.05	800FC51-12.5	800FC51-25	800FC51-50

a= Blocking to 1200nm b= Blocking to 1300nm c= Blocking to 1550nm d= Blocking to 2400nm e= Blocking to 3200nm

# ASTRONOMY UBVRI FILTERS

## Astronomy UBVRI Filters

Andover Corporation offers two sets of UBVRI filters—the Johnson/Bessel and the Kron/Cousins types—as standard items. These wideband filters isolate and measure large specific bands of light emitted by astronomical objects. Both types have the same ultraviolet, blue and visible filters but different red and infrared filters. The Johnson/Bessel type is better suited for use with a photomultiplier tube, while the Kron/Cousins type is better suited for use with a Silicon CCD.

- Options for professionals and amateurs alike
- Ideal for photometric calibration

Custom UBVRI filters are available in your choice of size and spectral characteristics. Please contact our technical sales department for a quotation.






## General Specifications

Size Tolerance:	+0/-0.25mm
Glass Thickness:	5.0mm +/-0.1mm
Bevels:	Break all sharp edges
Coating Durability:	Per MIL-C-48497A moderate abrasion
Construction:	Schott glass substrates (ground and polished) laminated with index-matching epoxy






## OPTICAL SPECIFICATIONS

Transmitted Wavefront:	1/4 wave or better per 25mm
Parallelism:	30 arc seconds or better
Surface Quality:	60/40 or better per MIL-C-675
Optical Quality:	Image Quality
AR Coatings:	Exterior surfaces (appropriate to the filter passband)

## JOHNSON / BESSEL FILTER SPECIFICATIONS

					
Nominal CW/L:	365nm	440nm	520nm	630nm	900nm
Nominal FWHM:	60nm	100nm	90nm	120nm	300nm
Nominal Transmission:	> 50%	> 55%	> 70%	> 70%	> 70%

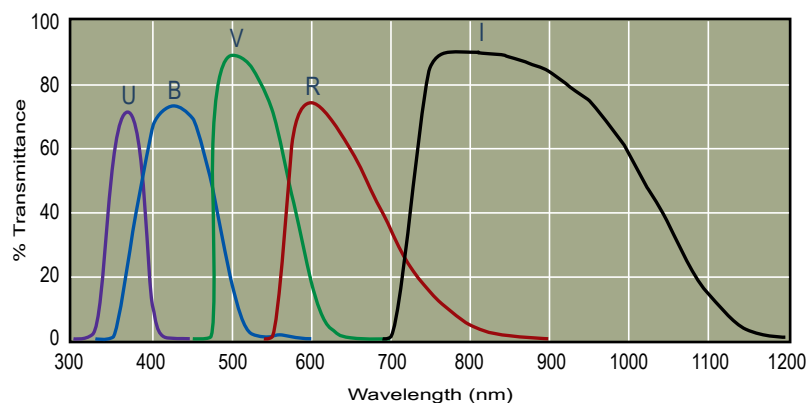
## KRON / COUSINS FILTER SPECIFICATIONS

					
Nominal CW/L:	365nm	440nm	520nm	760nm	800nm
Nominal FWHM:	60nm	100nm	90nm	250nm	150nm
Nominal Transmission:	> 50%	> 55%	> 70%	> 70%	> 70%



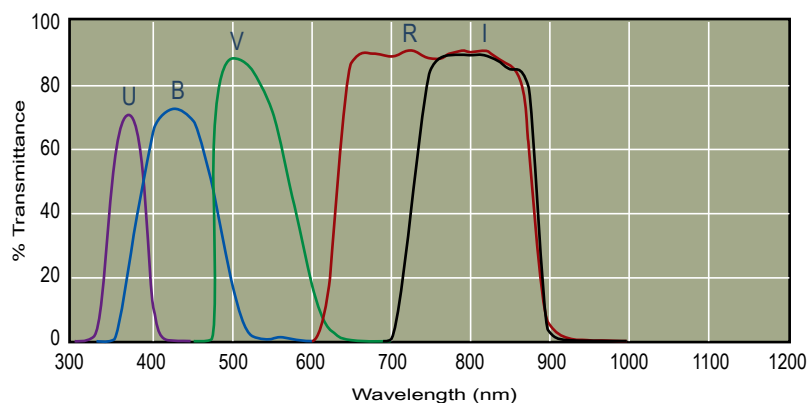
## JOHNSON/BESSEL UBVR I FILTERS

Type	Size, Shape & Part Number & Type				
	25mm Ø	50mm Ø	50mm SQ	(Mounted) 31mm Ø	(Mounted) 50mm Ø
Ultraviolet	JOHN-U-25	JOHN-U-50	JOHN-U-50S	JOHN-U-31M	JOHN-U-50M
Blue	JOHN-B-25	JOHN-B-50	JOHN-B-50S	JOHN-B-31M	JOHN-B-50M
Visible	JOHN-V-25	JOHN-V-50	JOHN-V-50S	JOHN-V-31M	JOHN-V-50M
Red	JOHN-R-25	JOHN-R-50	JOHN-R-50S	JOHN-R-31M	JOHN-R-50M
Infrared	JOHN-I-25	JOHN-I-50	JOHN-I-50S	JOHN-I-31M	JOHN-I-50M
5 Piece Sets	JOHN-FA-25	JOHN-FA-50	JOHN-FA-50S	JOHN-FA-31M	JOHN-FA-50M



## KRON/COUSINS UBVR I FILTERS

Type	Size, Shape & Part Number & Type				
	25mm Ø	50mm Ø	50mm SQ	(Mounted) 31mm Ø	(Mounted) 50mm Ø
Ultraviolet	KRON-U-25	KRON-U-50	KRON-U-50S	KRON-U-31M	KRON-U-50M
Blue	KRON-B-25	KRON-B-50	KRON-B-50S	KRON-B-31M	KRON-B-50M
Visible	KRON-V-25	KRON-V-50	KRON-V-50S	KRON-V-31M	KRON-V-50M
Red	KRON-R-25	KRON-R-50	KRON-R-50S	KRON-R-31M	KRON-R-50M
Infrared	KRON-I-25	KRON-I-50	KRON-I-50S	KRON-I-31M	KRON-I-50M
5 Piece Sets	KRON-FA-25	KRON-FA-50	KRON-FA-50S	KRON-FA-31M	KRON-FA-50M



# METALLIC NEUTRAL DENSITY FILTERS

## Metallic ND Coated

Metallic-coated neutral density (ND) filters obtain their optical density from a metal alloy coating on a substrate appropriate for the wavelength region of interest. Unlike the all-dielectric or absorption type, the metallic type ND filter employs a combination of absorption and reflection to reduce the intensity of light. While able to withstand more incident power than the absorptive type, metallic ND filters are suitable only for low-energy pulsed applications. (Note: If used in series, these filters should be tilted to avoid multiple reflections and any reduction of density).

- Provides attenuation with greater linearity over a wide spectral range
- Reduces thermal effects in low-power laser applications
- Soda lime glass, fused silica and custom substrates available
- Delivers superior durability
- Infrared NDs also available - see pg. 54 for details

## General

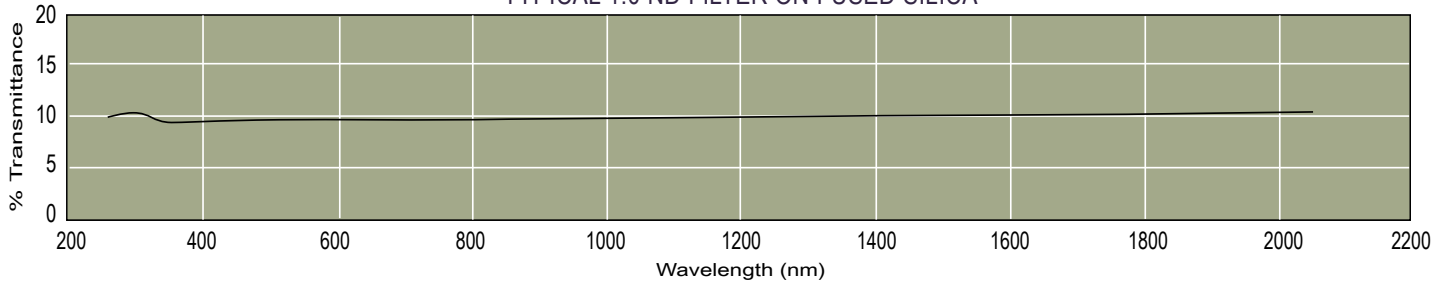
## Applications

Thickness:	1.5 ±0.5mm	<div style="border: 1px solid black; padding: 5px;">                     Calibration                      Attenuation                      Low-Power Lasers                      Scientific Measurements and Research                      Machine Vision and Other Imaging Applications                 </div>
Dimensional Tolerances:	+0/-0.2mm	
Clear Aperture:	90% of outside dimension	
Surface Quality:	80/50 per MIL-O-13830B	
Coating Adherence:	Per MIL-M-13508C	
Humidity:	Per MIL-STD-810F	
Max. Operating Temperature:	+100°C	
Substrate Materials:	Glass (350–2000nm region) or fused silica (250–2000nm region)	
Optical Quality:	Glass: Flatness of 3–5 waves per inch and parallelism of 3 arc minutes or better. Fused Silica: Flatness of $\lambda/4$ per inch and parallelism of 30 arc seconds or better.	
Mechanical:	Unmounted	
Optional: Mounted in threaded ring - see pg 61 for thread sizes		

## METALLIC NEUTRAL DENSITY SPECIFICATIONS

Optical Density	Nominal Transmission (%)	Transmission Deviation From Nominal (%)		
		250-400nm	400-800nm	800-2000nm
0.10	79.4	± 9.0	± 3.0	± 9.0
0.15	70.8	± 8.0	± 3.0	± 8.0
0.20	63.0	± 6.0	± 2.0	± 6.0
0.30	50.0	± 5.0	± 2.0	± 5.0
0.40	39.8	± 4.0	± 1.5	± 4.0
0.50	31.6	± 4.0	± 1.5	± 4.0
0.60	25.0	± 4.0	± 1.5	± 4.0
0.70	20.0	± 4.0	± 1.5	± 4.0
0.80	15.5	± 4.0	± 1.5	± 4.0
0.90	12.6	± 3.5	± 1.0	± 3.5
1.00	10.0	± 3.5	± 1.0	± 3.5
1.30	5.0	± 3.0	± 1.0	± 3.0
1.50	3.2	± 1.5	± 0.5	± 1.5
2.00	1.0	± 0.5	± 0.2	± 0.5
2.50	0.32	± 0.15	± 0.07	± 0.15
3.00	0.10	± 0.06	± 0.05	± 0.1 (nominal)
4.00	0.01	± 0.008	+ 0.01/-0.008	± 0.01 (nominal)

TYPICAL 1.0 ND FILTER ON FUSED SILICA



VISIBLE/NEAR INFRARED REGION (Glass Substrate, 350–2000nm)

Optical Density	Nominal Transmission (%)	Size, Shape & Part Number			
		12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
0.10	79.4	010FN52-12.5	010FN52-25	010FN52-50	010FN52-50S
0.15	70.8	015FN52-12.5	015FN52-25	015FN52-50	015FN52-50S
0.20	63.0	020FN52-12.5	020FN52-25	020FN52-50	020FN52-50S
0.30	50.0	030FN52-12.5	030FN52-25	030FN52-50	030FN52-50S
0.40	39.8	040FN52-12.5	040FN52-25	040FN52-50	040FN52-50S
0.50	31.6	050FN52-12.5	050FN52-25	050FN52-50	050FN52-50S
0.60	25.0	060FN52-12.5	060FN52-25	060FN52-50	060FN52-50S
0.70	20.0	070FN52-12.5	070FN52-25	070FN52-50	070FN52-50S
0.80	15.5	080FN52-12.5	080FN52-25	080FN52-50	080FN52-50S
0.90	12.6	090FN52-12.5	090FN52-25	090FN52-50	090FN52-50S
1.00	10.0	100FN52-12.5	100FN52-25	100FN52-50	100FN52-50S
1.30	5.0	130FN52-12.5	130FN52-25	130FN52-50	130FN52-50S
1.50	3.2	150FN52-12.5	150FN52-25	150FN52-50	150FN52-50S
2.00	1.0	200FN52-12.5	200FN52-25	200FN52-50	200FN52-50S
2.50	0.32	250FN52-12.5	250FN52-25	250FN52-50	250FN52-50S
3.00	0.10	300FN52-12.5	300FN52-25	300FN52-50	300FN52-50S
4.00	0.01	400FN52-12.5	400FN52-25	400FN52-50	400FN52-50S

For sets see pg 35; Infrared NDs also available - see pg 54 for details

ULTRAVIOLET/VISIBLE/NEAR INFRARED REGION (Fused Silica, 250–2000nm)

Optical Density	Nominal Transmission (%)	Size, Shape & Part Number			
		12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
0.10	79.4	010FN46-12.5	010FN46-25	010FN46-50	010FN46-50S
0.15	70.8	015FN46-12.5	015FN46-25	015FN46-50	015FN46-50S
0.20	63.0	020FN46-12.5	020FN46-25	020FN46-50	020FN46-50S
0.30	50.0	030FN46-12.5	030FN46-25	030FN46-50	030FN46-50S
0.40	39.8	040FN46-12.5	040FN46-25	040FN46-50	040FN46-50S
0.50	31.6	050FN46-12.5	050FN46-25	050FN46-50	050FN46-50S
0.60	25.0	060FN46-12.5	060FN46-25	060FN46-50	060FN46-50S
0.70	20.0	070FN46-12.5	070FN46-25	070FN46-50	070FN46-50S
0.80	15.5	080FN46-12.5	080FN46-25	080FN46-50	080FN46-50S
0.90	12.6	090FN46-12.5	090FN46-25	090FN46-50	090FN46-50S
1.00	10.0	100FN46-12.5	100FN46-25	100FN46-50	100FN46-50S
1.30	5.0	130FN46-12.5	130FN46-25	130FN46-50	130FN46-50S
1.50	3.2	150FN46-12.5	150FN46-25	150FN46-50	150FN46-50S
2.00	1.0	200FN46-12.5	200FN46-25	200FN46-50	200FN46-50S
2.50	0.32	250FN46-12.5	250FN46-25	250FN46-50	250FN46-50S
3.00	0.10	300FN46-12.5	300FN46-25	300FN46-50	300FN46-50S
4.00	0.01	400FN46-12.5	400FN46-25	400FN46-50	400FN46-50S

# ABSORPTIVE NEUTRAL DENSITY FILTERS



## Absorptive ND Filters

With their ability to minimize back-reflections and scattered light, absorptive neutral density (ND) filters are ideal for calibration. In contrast to the metallic type, absorption-type filters achieve their optical density by absorbing light within the substrate. For this reason, thickness is a key determinant of opacity. Given their absorbing quality, these filters are suitable for low-power applications only.

Infrared NDs also available - see pg 54 for details

- Sets provide a uniform series of filters for adjusting illumination
- Custom substrate materials and dimensions available

## General Specifications

Thickness:	5.0mm (maximum)
Dimensional Tolerance:	+0.0/-0.25mm
Clear Aperture:	90% of outside dimension
Surface Quality:	80/50 per MIL-0-13830B
Max. Operating Temperature:	+100°C
Substrate Material:	Schott absorption glass
Spectral Range:	400–700nm
Optical Quality:	Flatness of $\lambda/4$ per inch and parallelism of 30 arc seconds or better
Mechanical:	Unmounted

Optional: Mounted in threaded ring - see pg 61 for thread sizes

## Applications

Photomicrography  
Machine Vision  
Calibration  
Photography  
Scientific Measurements and Research

Optical Density	Nominal Transmission (%)	Density Tolerance @ 550nm (%)	Thickness (mm)	Size, Shape & Part Number	
				25mm Ø	50mm SQ
0.10	79.5	± 20.00	4.95	010ABND-25	010ABND-50S
0.20	63.0	± 10.00	1.52	020ABND-25	020ABND-50S
0.30	50.0	± 10.00	2.84	030ABND-25	030ABND-50S
0.40	39.8	± 10.00	3.78	040ABND-25	040ABND-50S
0.50	31.6	± 10.00	2.11	050ABND-25	050ABND-50S
0.60	25.0	± 10.00	2.54	060ABND-25	060ABND-50S
0.70	20.0	± 10.00	2.95	070ABND-25	070ABND-50S
0.80	15.8	± 10.00	3.38	080ABND-25	080ABND-50S
0.90	12.6	± 10.00	1.75	090ABND-25	090ABND-50S
1.00	10.0	± 10.00	1.96	100ABND-25	100ABND-50S
1.50	3.2	± 10.00	2.90	150ABND-25	150ABND-50S
2.00	1.0	± 10.00	2.06	200ABND-25	200ABND-50S
3.00	0.10	± 10.00	2.92	300ABND-25	300ABND-50S
4.00	0.01	± 10.00	2.82	400ABND-25	400ABND-50S

# NEUTRAL DENSITY SETS



## Neutral Density Sets

For your convenience, standard and user-defined neutral density filter sets are available and come with a quality hardwood case for secure storage.

### METALLIC-COATED SETS

Andover's metallic-coated neutral density filter sets feature both round and square filters in your choice of four sizes and two substrates.

7 Piece Set	Size, Shape & Part Number				
	Substrate	12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
	Glass	128FA52-12.5	128FA52-25	128FA52-50	128FA52-50S
Fused Silica	130FA46-12.5	130FA46-25	130FA46-50	130FA46-50S	

Includes seven filters with optical densities ranging from 0.10 to 4.00, in your choice of four set sizes, and in either glass or fused silica substrates.

17 Piece Set	Size, Shape & Part Number				
	Substrate	12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
	Glass	132FA52-12.5	132FA52-25	132FA52-50	132FA52-50S
Fused Silica	134FA46-12.5	134FA46-25	130FA46-50	134FA46-50S	

Includes seventeen filters with optical densities ranging from 0.10 to 4.00, in your choice of four set sizes, and in either glass or fused silica substrates.

### ABSORPTIVE SETS

Andover's absorptive neutral density filter sets provide a choice of either round or square filters

7 Piece Set	Size, Shape & Part Number	
	25mm Ø	50mm SQ
	135FAND-25	135FAND-50S

Includes seven filters with optical densities ranging from 0.10 to 4.00.

14 Piece Set	Size, Shape & Part Number	
	25mm Ø	50mm SQ
	136FAND-25	136FAND-50S

Includes fourteen filters with optical densities ranging from 0.10 to 4.00.

# HEAT CONTROL FILTERS



## Heat Control Filters

A combination of hot and cold mirrors can essentially eliminate 99% of the radiation generated by high-power illumination systems. The cold mirror, mounted at a 45° angle of incidence, transmits much of the heat while reflecting the visible light. The hot mirror, mounted perpendicular to the light beam, reflects the remaining heat while transmitting 90% of the visible light.

- Cold mirrors transmit near-IR and reflect visible light
- Hot mirrors reflect near-IR and transmit visible light
- Together, they effectively cool high-power illumination systems

## General Specifications

Thickness:	3.0mm ±0.5mm (6.0mm ±0.5mm for IR Suppressing)
Size Tolerance:	+0.0mm/-0.5mm
Min. Clear Aperture:	95% of outside dimension
Substrate Material:	Borosilicate glass
Flatness:	5–10 waves per 25mm
Parallelism:	3 arc minutes or better
Surface Quality:	80/50 per MIL-O-13830
Humidity and Abrasion:	Per MIL-C-675A
Max. Operating Temperature:	+200°C (+100°C for IR suppressing)
Mechanical:	Unmounted

Optional: Mounted in threaded ring - see pg 61 for thread sizes

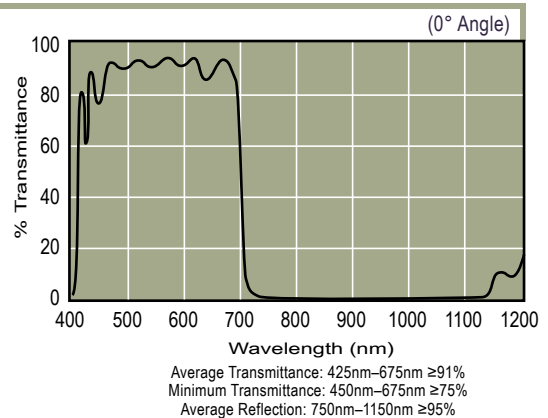
## Applications

Projection Systems  
 Photocopiers  
 Surgical and Dental Lighting  
 Film and Photographic Apparatus  
 Illumination Systems  
 Scientific Instruments

## Hot Mirrors

Hot mirrors are heat-reflecting filters designed to transmit visible wavelengths and reflect near-infrared heat-generating wavelengths. Andover's hot mirrors have hard, first-surface dielectric coatings that meet or exceed the humidity and abrasion specifications listed above. The coatings are deposited onto a low-expansion material such as borosilicate glass to prevent cracking or crazing from high heat applications.

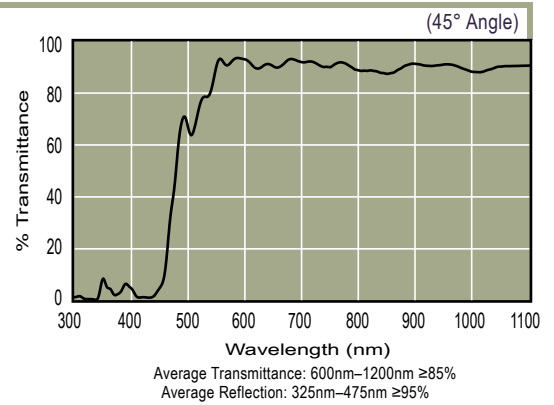
Size, Shape & Part Number		
25mm Ø	50mm Ø	50mm SQ
775FW82-25	775FW82-50	775FW82-50S



## Ultraviolet Cold Mirrors

Ultraviolet mirrors differ slightly from the standard cold mirror in that they reflect the ultraviolet and transmit the visible and infrared. They are excellent for applications that call for separating the ultraviolet from the visible and near infrared.

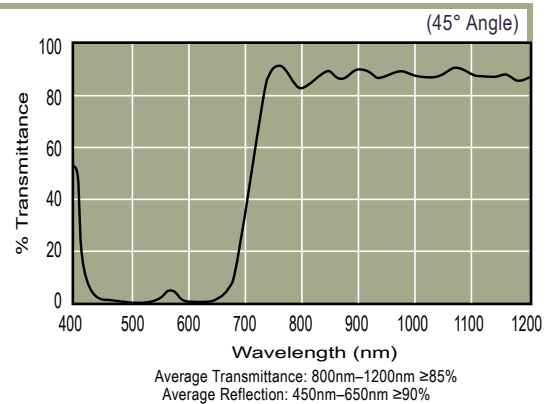
Size, Shape & Part Number		
25mm Ø	50mm Ø	50mm SQ
375FV86-25	375FV86-50	375FV86-50S



## Cold Mirrors

Cold mirrors are heat-transmitting filters designed to reflect visible wavelengths and transmit near-infrared wavelengths. Andover's cold mirrors have first-surface coatings that are deposited onto a low-expansion material such as borosilicate glass.

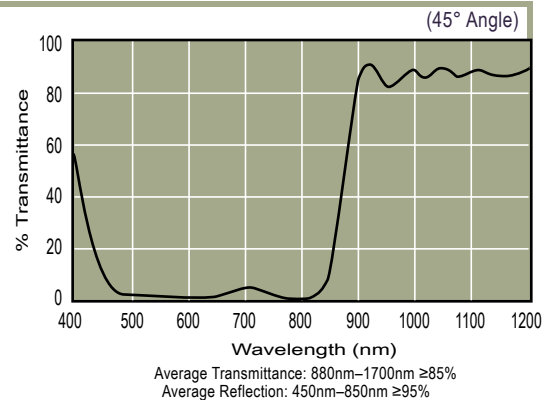
Size, Shape & Part Number		
25mm Ø	50mm Ø	50mm SQ
645FK84-25	645FK84-50	645FK84-50S



## 850nm Cold Mirrors

This version of the cold mirror is identical to the standard cold mirror, but with the reflection range extended to 850nm. It has excellent transmission throughout the NIR region.

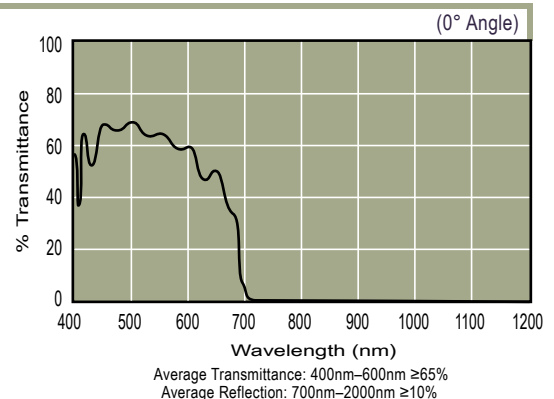
Size, Shape & Part Number		
25mm Ø	50mm Ø	50mm SQ
850FK84-25	850FK84-50	850FK84-50S



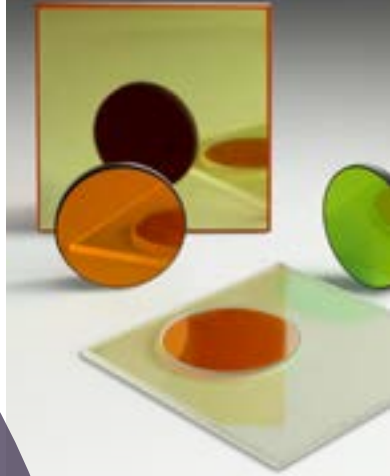
## Infrared Suppressing Filters

These filters extend the blocking of standard hot mirrors across the infrared range using a combination of reflection from the dielectric stack and absorption from an infrared absorbing filter glass. Because of this absorption factor, these filters are suitable only in low-power applications with a maximum filter temperature of 100°C.

Size, Shape & Part Number		
25mm Ø	50mm Ø	50mm SQ
800FB72-25	800FB72-50	800FB72-50S



# DICHROIC FILTERS



## Dichroic Filters

Far more durable than dyed plastic or gel-coated types, dichroic glass filters have a hard dielectric film created by thin layers of metallic oxides. These color separation filters are designed to isolate certain regions of the visible spectrum, reflecting rather than absorbing unwanted frequencies. As a result, they not only produce pure, intense color but also withstand the heat and UV energy from high-power light sources. Commonly used as light balancing filters in color enlargers and photocopiers, dichroic filters are suitable for any application that requires separating the incident light into two or more light beams.

- Useful for redirecting a particular band of light
- Spectrally stable at changing temperatures and humidity
- Available in custom designs, colors, angles of incidence, substrates, dimensions, and coatings

## General Specifications

Thickness:	1.0mm ±0.25mm
Size Tolerance:	+0.0mm/-0.25mm
Min. Clear Aperture:	95% of outside dimension
Substrate Material:	Soda lime glass
Flatness:	3–5 waves per 25mm
Parallelism:	3 arc minutes or better
Surface Quality:	80/50 per MIL-C-48497A
Humidity and Abrasion:	Per MIL-C-48497A
Max. Operating Temperature:	+200°C
Mechanical:	Unmounted

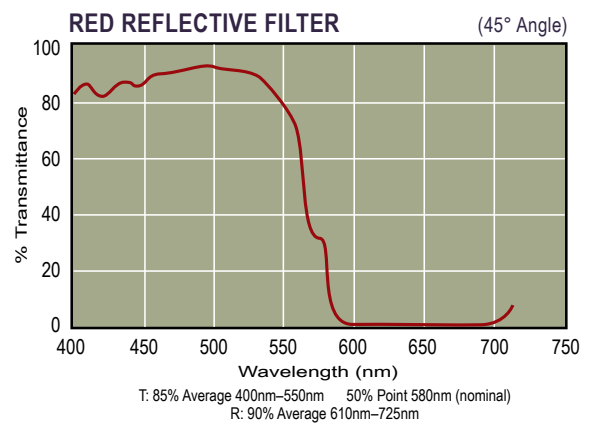
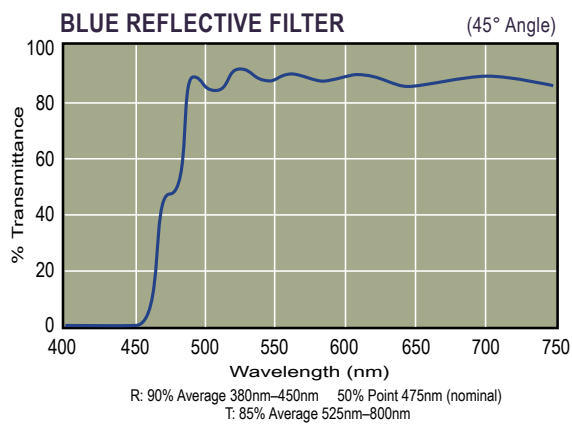
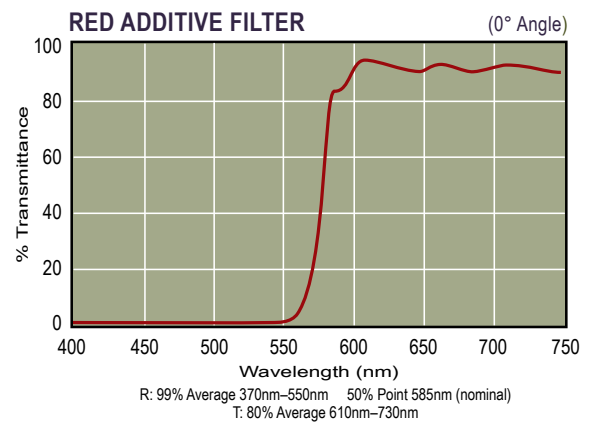
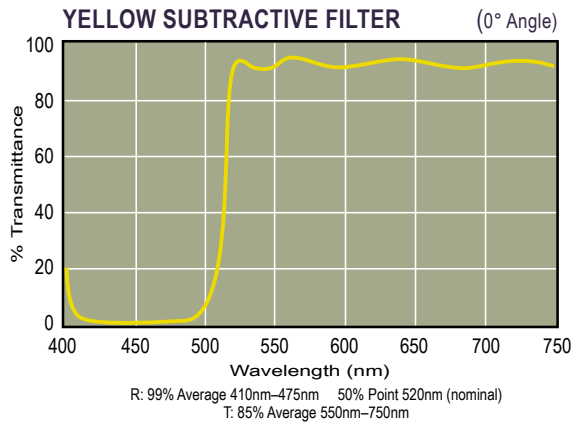
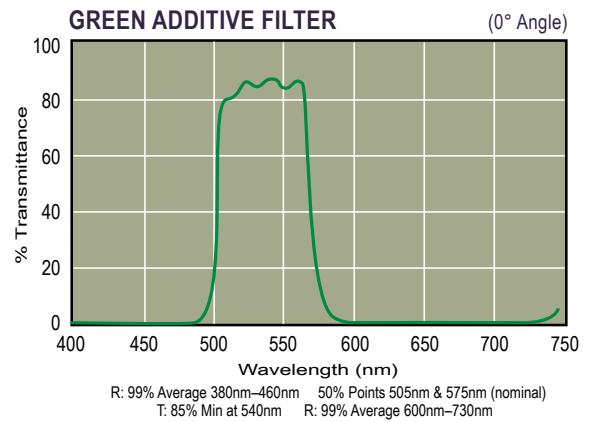
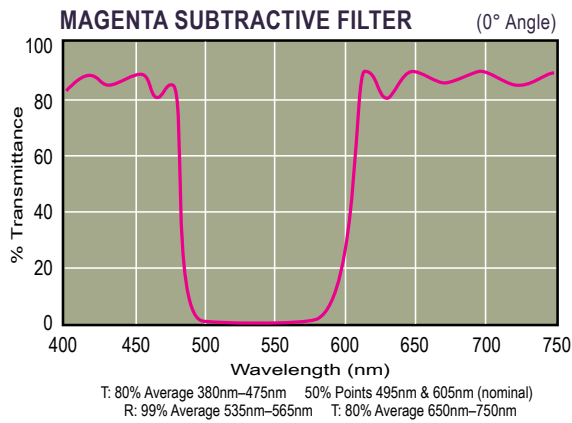
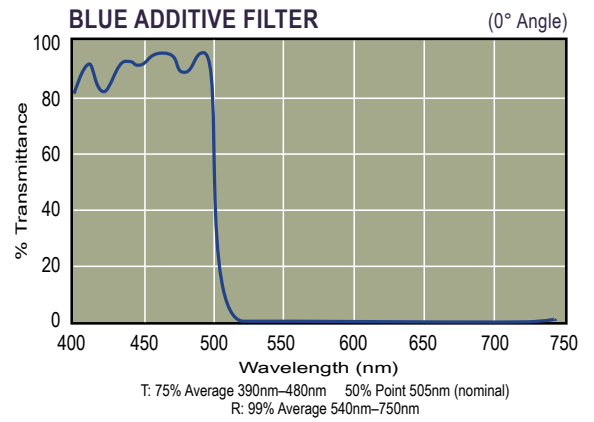
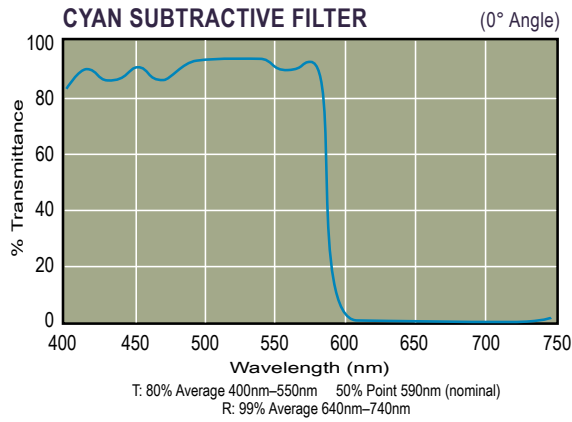
Optional: Mounted in threaded ring - see pg 61 for thread sizes

## Applications

Fluorescence Microscopy  
 UV-VIS Irradiation  
 Camera Imaging  
 Stage Lighting  
 Architectural Lighting  
 Projection Displays  
 Color Enlargers  
 Photocopiers

Type	Color	Size, Shape & Part Number		
		25mm Ø	50mm Ø	50mm SQ
Subtractive	Cyan	590FD24-25	590FD24-50	590FD24-50S
	Magenta	550FD26-25	550FD26-50	550FD26-50S
	Yellow	520FD22-25	520FD24-50	520FD22-50S
Additive	Blue	505FD64-25	505FD64-50	505FD64-50S
	Green	540FD66-25	540FD66-50	540FD66-50S
	Red	585FD62-25	585FD62-50	585FD62-50S
Reflective	Blue	475FD68-25	475FD68-50	475FD68-50S
	Red	580FD70-25	580FD70-50	580FD70-50S





# Standard Dichroic Filter Sets

Excellent for color process work, Andover's select dichroic filter sets come in two configurations. Each set is accompanied by complete spectral curve data sheets and shipped in a protective storage case.

## COLOR SUBTRACTIVE

<b>3 Piece Set</b>	Size, Shape & Part Number		
	25mm Ø	50mm Ø	50mm SQ
	126FA46-25	126FA46-50	126FA46-50S

Includes Cyan, Magenta and Yellow filters in your choice of three sizes.

**Cyan**

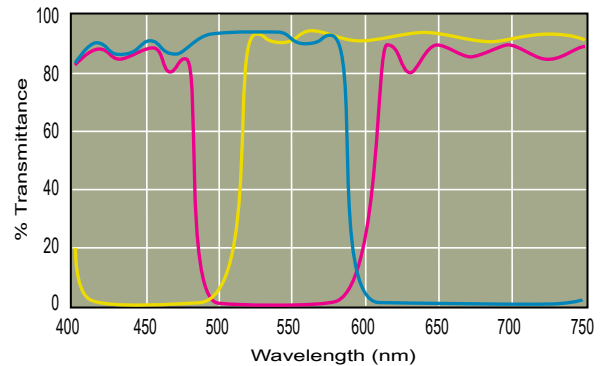
T: 80% Average 400nm–550nm  
R: 99% Average 640nm–740nm  
50% Point 590nm (nominal)

**Magenta**

T: 80% Average 380nm–475nm  
R: 99% Average 535nm–565nm  
T: 80% Average 650nm–750nm  
50% Points 495nm & 605nm (nominal)

**Yellow**

R: 99% Average 410nm–475nm  
T: 85% Average 550nm–750nm  
50% Cut-on 520nm (nominal)



## COLOR ADDITIVE

<b>3 Piece Set</b>	Size, Shape & Part Number		
	25mm Ø	50mm Ø	50mm SQ
	126FA44-25	126FA44-50	126FA44-50S

Includes Blue, Green and Red filters in your choice of three sizes.

**Blue**

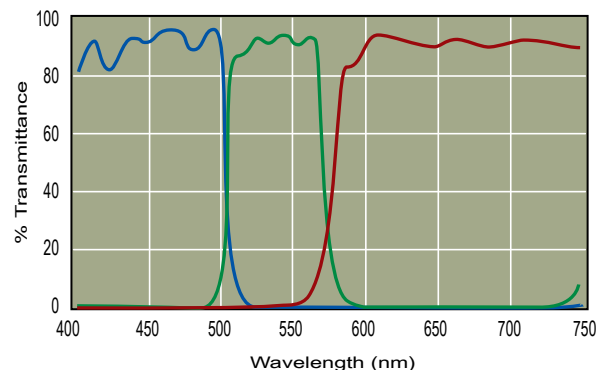
T: 80% Average 390nm–480nm  
R: 99% Average 540nm–750nm  
50% Point 505nm (nominal)

**Green**

R: 99% Average 380nm–460nm  
T: 85% Minimum at 540nm  
R: 99% Average 600nm–730nm  
50% Points 505nm & 575nm (nominal)

**Red**

R: 1% Average 370nm–550nm  
T: 85% Average 610nm–730nm  
50% Cut-on 585nm (nominal)





**USER-DEFINED DICHOIC FILTER SETS**

User-Defined Sets	Size, Shape & Number		
	25mm Ø	50mm Ø	50mm Sq.
3-Piece Set	000FS03-25	000FS03-50	000FS03-50S
6-Piece Set	000FS06-25	000FS06-50	000FS06-50S
8-Piece Set	000FS08-25	000FS08-50	000FS08-50S

# EDGE FILTERS

## Edge Filters

Often referred to as long wave pass (LWP) and short wave pass (SWP) filters, edge filters provide a well-defined transition between reflecting and transmitting regions. Essentially a modified quarter-wave stack, the filters use interference effects rather than absorption to isolate their spectral bands. Because edge filters will shift shorter with an increase in the angle of incidence, they are a good choice for fine-tuning the cut-on/cut-off wavelength. With their durable, first-surface dielectric coatings, Andover's edge filters are built to withstand the normal cleaning and handling required by any high-quality optical component.

- Provide sharp separation between transmission and reflection
- Provide steeper transition than color glass filters
- Offer coverage over the 300-1000nm range

## General Specifications

Thickness:	4.0mm maximum
Size Tolerance:	+0.0mm/-0.5mm
Min. Clear Aperture:	85% of outside dimension
Substrate Material:	Glass (Note: BK-7 or Borofloat available as an option for higher Tx)
Flatness:	3-5 waves per 25mm
Surface Quality:	80/50 per MIL-C-48497A
Humidity and Abrasion:	Per MIL-C-675A
Operating Temperature:	-50°C to +200°C
Cut-on/cut-off Slopes:	6% maximum (11% for 300nm filter)
Cut-on/cut-off Tolerance:	±10nm from 400nm - 1000nm ±5nm from 300nm - 375nm
Mechanical:	Unmounted

Optional: Mounted in threaded ring - see pg 61 for thread sizes

### TRANSMISSION

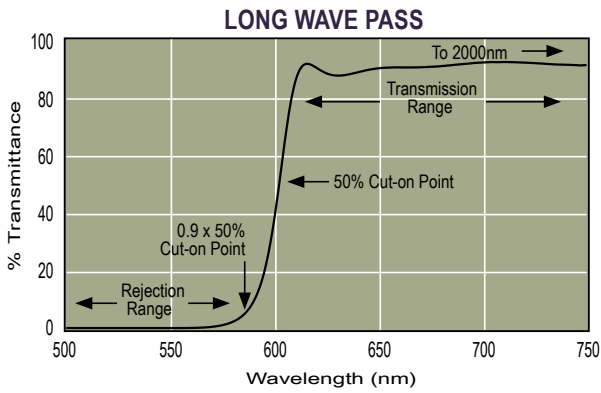
Long Wave Pass:	85% average from the 50% cut-on point to 2000nm
Short Wave Pass:	400 - 450nm 85% average from the 50% cut-on point to 0.75 x the 50% cut-off point 500 - 1000nm 85% average from the 50% cut-on point to 0.75 x the 50% cut-off point (Note: With the exception of the 400nm filter, all SWP filters will drop off in transmission at wavelengths under 425nm.)

### REJECTION

Long Wave Pass:	99% or greater from 0.9 x the 50% point to the ultraviolet
Short Wave Pass:	99% or greater from 1.07 x the 50% point to 1.25 x the 50% point
Effective Index of Refraction (n*)	1.7 (approximately)

## Applications

Fluorescence  
Photometry  
Color Enhancement  
and Combining

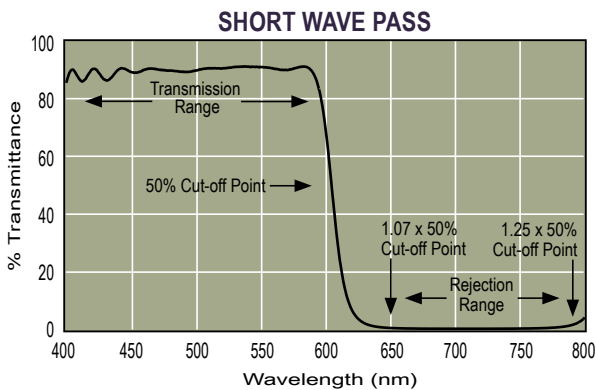


### VISIBLE

50% Point	Size, Shape & Part Number			
	12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
300nm	300FH90-12.5	300FH90-25	300FH90-50	300FH90-50S
325nm	325FH90-12.5	325FH90-25	325FH90-50	325FH90-50S
350nm	350FH90-12.5	350FH90-25	350FH90-50	350FH90-50S
375nm	375FH90-12.5	375FH90-25	375FH90-50	375FH90-50S
400nm	400FH90-12.5	400FH90-25	400FH90-50	400FH90-50S
450nm	450FH90-12.5	450FH90-25	450FH90-50	450FH90-50S
500nm	500FH90-12.5	500FH90-25	500FH90-50	500FH90-50S
550nm	550FH90-12.5	550FH90-25	550FH90-50	550FH90-50S
600nm	600FH90-12.5	600FH90-25	600FH90-50	600FH90-50S
650nm	650FH90-12.5	650FH90-25	650FH90-50	650FH90-50S
700nm	700FH90-12.5	700FH90-25	700FH90-50	700FH90-50S

### NEAR INFRARED

50% Point	Size, Shape & Part Number			
	12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
750nm	750FH90-12.5	750FH90-25	750FH90-50	750FH90-50S
800nm	800FH90-12.5	800FH90-25	800FH90-50	800FH90-50S
850nm	850FH90-12.5	850FH90-25	850FH90-50	850FH90-50S
900nm	900FH90-12.5	900FH90-25	900FH90-50	900FH90-50S
950nm	950FH90-12.5	950FH90-25	950FH90-50	950FH90-50S
1000nm	100FH90-12.5	100FH90-25	100FH90-50	100FH90-50S



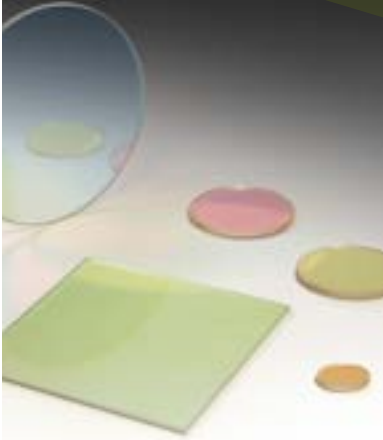
### VISIBLE

50% Point	Size, Shape & Part Number			
	12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
400nm	400FL07-12.5	400FL07-25	400FL07-50	400FL07-50S
450nm	450FL07-12.5	450FL07-25	450FL07-50	450FL07-50S
500nm	500FL07-12.5	500FL07-25	500FL07-50	500FL07-50S
550nm	550FL07-12.5	550FL07-25	550FL07-50	550FL07-50S
600nm	600FL07-12.5	600FL07-25	600FL07-50	600FL07-50S
650nm	650FL07-12.5	650FL07-25	650FL07-50	650FL07-50S
700nm	700FL07-12.5	700FL07-25	700FL07-50	700FL07-50S

### NEAR INFRARED

50% Point	Size, Shape & Part Number			
	12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
750nm	750FL07-12.5	750FL07-25	750FL07-50	750FL07-50S
800nm	800FL07-12.5	800FL07-25	800FL07-50	800FL07-50S
850nm	850FL07-12.5	850FL07-25	850FL07-50	850FL07-50S
900nm	900FL07-12.5	900FL07-25	900FL07-50	900FL07-50S
950nm	950FL07-12.5	950FL07-25	950FL07-50	950FL07-50S
1000nm	100FL07-12.5	100FL07-25	100FL07-50	100FL07-50S

# STEEP-EDGE LONGPASS FILTERS



## Steep-Edge Longpass Filters

Our steep-edge long pass filters employ magnetron sputtered hard oxide coatings to yield deep rejection and a sharp transition to very high transmission. The coatings are deposited on precision polished Fused Silica substrates, and do not employ any absorbing filter glasses, making them suitable for high-temperature applications. They are offered in three standard sizes, with custom sizes available on request.

- Provide very steep ( $\leq 1\%$ ) cut-on slopes
- Suitable for high-temperature applications
- Can be cut or machined to smaller sizes

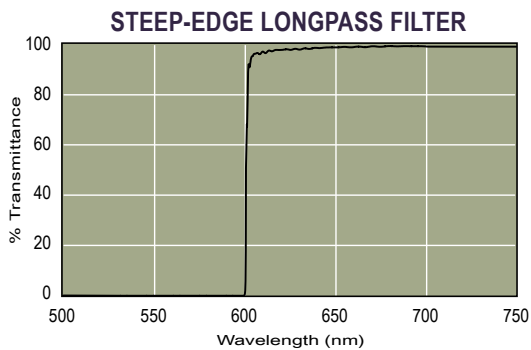
## General Specifications

Thickness:	1.5 ± 0.25mm
Size Tolerance:	+0.0mm/-0.2mm
Min. Clear Aperture:	85% of outside dimension
Substrate Material:	UV Grade Fused Silica
Flatness:	≤ 1/4 wave/inch TWF
Surface Quality:	60-40 per MIL-C-48497A
Humidity and Abrasion:	Per MIL-C-675A
Durability:	Per MIL-C-48497A
Operating Temperature:	-50°C to +200°C
Transmission:	≥ 91% average
Rejection:	≥ OD 4.0
Cut-on Slope:	1% maximum
Cut-on Tolerance:	± 1%
Mechanical:	Unmounted

Optional: Mounted in threaded ring - see pg 61 for thread sizes

## Applications

Fluorescence  
Photometry  
Color Enhancement and  
Combining Laser studies



50% Point	Rejection Band	Transmission Band	Size, Shape & Part Number			
			12.5mm Ø	25mm Ø	50mm Ø	50mm SQ
325nm	200-315nm	355-660nm	325SC01-12.5	325SC01-25	325SC01-50	325SC01-50S
350nm	200-340nm	360-700nm	350SC01-12.5	350SC01-25	350SC01-50	350SC01-50S
375nm	200-365nm	385-750nm	375SC01-12.5	375SC01-25	375SC01-50	375SC01-50S
400nm	200-390nm	408-800nm	400SC01-12.5	400SC01-25	400SC01-50	400SC01-50S
450nm	200-440nm	458-900nm	450SC01-12.5	450SC01-25	450SC01-50	450SC01-50S
500nm	200-490nm	508-1000nm	500SC01-12.5	500SC01-25	500SC01-50	500SC01-50S
550nm	200-539nm	560-1100nm	550SC01-12.5	550SC01-25	550SC01-50	550SC01-50S
600nm	200-588nm	610-1200nm	600SC01-12.5	600SC01-25	600SC01-50	600SC01-50S
650nm	200-637nm	660-1300nm	650SC01-12.5	650SC01-25	650SC01-50	650SC01-50S
700nm	200-686nm	710-1400nm	700SC01-12.5	700SC01-25	700SC01-50	700SC01-50S

# INFRARED FILTERS & COATINGS

## WINDOWS & SUBSTRATES

### Infrared Windows & Substrates

Andover stocks a variety of optical-quality infrared-transmitting substrates. All substrates are optically polished. AR coatings are also available; see next page for details.

For convenience, we offer the windows in two standard sizes: 25mm and 50mm dia. In addition, we can produce custom sizes and shapes. Contact our technical sales department for a quotation.

- High optical quality
- Available from stock
- Custom sizes available

### Applications

- Thermal Imaging
- Weapons Systems
- Detector Windows
- IR Photography

### General Specifications

Thickness:	1.0 ± 0.2mm
Diameter Tolerance:	+0/-0.1mm
Surface Quality:	60/40 per MIL-C-48497A
CTE:	Coefficient of Thermal Expansion (see tables)

Threaded ring mounting available - see pg 61 for thread sizes

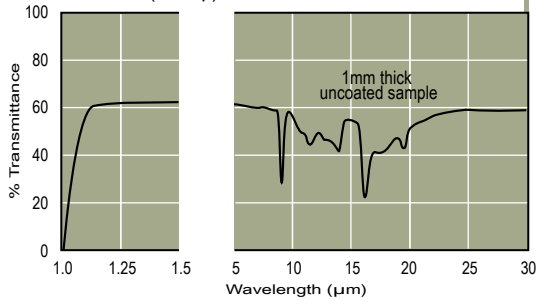
Substrate Material	Size, Shape & Part Number	
	25mm Ø	50mm Ø
Silicon (Si)	IRWS100-25	IRWS100-50
Germanium (Ge)	IRWS200-25	IRWS200-50
Sapphire (Al <sub>2</sub> O <sub>3</sub> )	IRWS300-25	IRWS300-50
Water-Free Fused Silica (SiO <sub>2</sub> )	IRWS400-25	IRWS400-50
Calcium Fluoride (CaF <sub>2</sub> )	IRWS500-25	IRWS500-50
Zinc Selenide (ZnSe)	IRWS600-25	IRWS600-50



### SILICON

Silicon (Si) is an economical choice for many IR applications.

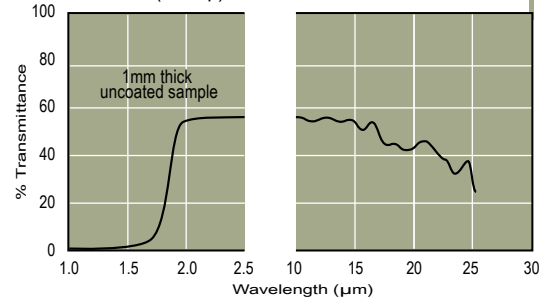
Refractive index: 3.43 at 3.0 $\mu$ m  
 CTE ( $10^{-6}/^{\circ}$ C): 4.15  
 Hardness (Knoop): 820



### GERMANIUM

Germanium (Ge) is widely used for lenses and windows in the Mid-IR region.

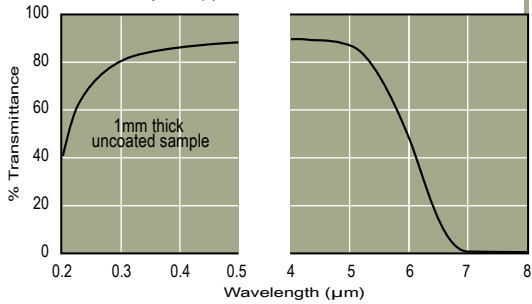
Refractive index: 4.00 at 10.6 $\mu$ m  
 CTE ( $10^{-6}/^{\circ}$ C): 5.7  
 Hardness (Knoop): 692



### SAPPHIRE

Sapphire ( $Al_2O_3$ ) is transparent over a wide range, and has excellent mechanical strength.

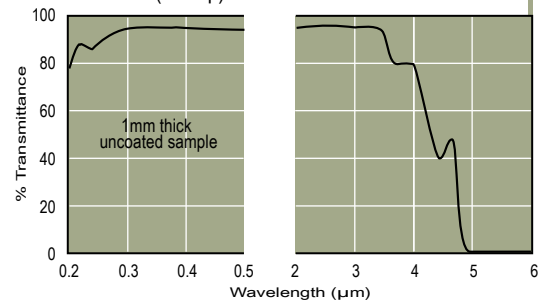
Refractive index: 1.737 at 2.0 $\mu$ m  
 CTE ( $10^{-6}/^{\circ}$ C): 7.7  
 Hardness (Knoop): 1920



### WATER-FREE FUSED SILICA

WF Fused silica ( $SiO_2$ ) has excellent transmission in VIS and near IR and exhibits minimal fluorescence.

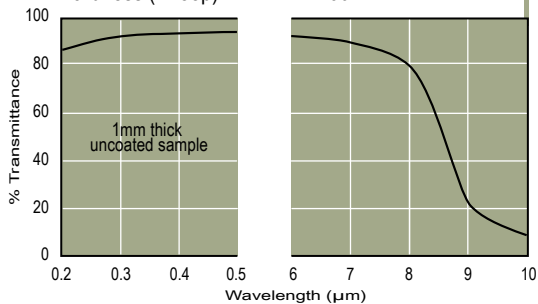
Refractive index: 1.45 at 1.0 $\mu$ m  
 CTE ( $10^{-6}/^{\circ}$ C): 0.55  
 Hardness (Knoop): 741



### CALCIUM FLUORIDE

Calcium Fluoride ( $CaF_2$ ) has good transmission from the UV to the Mid-IR.

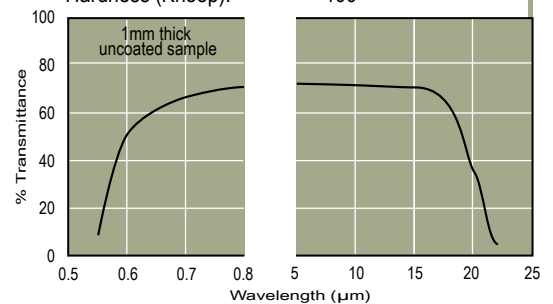
Refractive index: 1.40 at 5.0 $\mu$ m  
 CTE ( $10^{-6}/^{\circ}$ C): 18.9  
 Hardness (Knoop): 160



### ZINC SELENIDE

Zinc Selenide ( $ZnSe$ ) is widely used for lenses and windows in the Mid-IR region.

Refractive index: 2.40 at 10.6 $\mu$ m  
 CTE ( $10^{-6}/^{\circ}$ C): 7.6  
 Hardness (Knoop): 100



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# INFRARED FILTERS & COATINGS

## BROADBAND ANTI-REFLECTIVE (AR) COATINGS ON IR SUBSTRATES

### Broadband AR Coatings on IR Substrates

Andover produces a non-radioactive dielectric multilayer coating designed to reduce the reflection of Germanium, Silicon, and other substrates in the infrared. Reflection is reduced from 36% per surface to less than 1% per surface.

Constructed of hard, durable first-surface dielectric coatings on optical-quality germanium substrates, these filters will withstand cleaning and handling associated with any high-quality optical component.

For convenience, we offer filters in two standard sizes: 25mm and 50mm dia. In addition, we offer custom sizes and shapes, as well as custom optical characteristics. Contact our technical sales department for a quotation.

- Reduces reflection from 36% to 1% per surface
- Constructed of hard, durable, non-radioactive materials
- Meets MIL-C-48497

### General Specifications

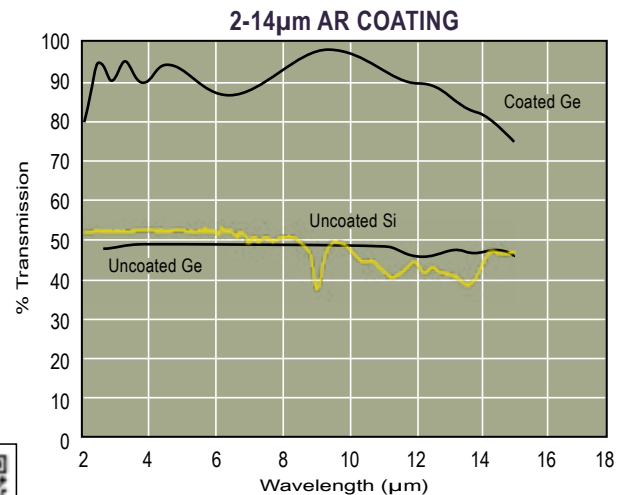
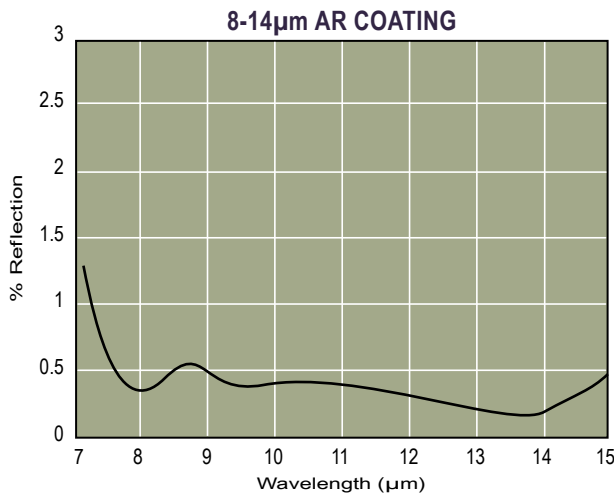
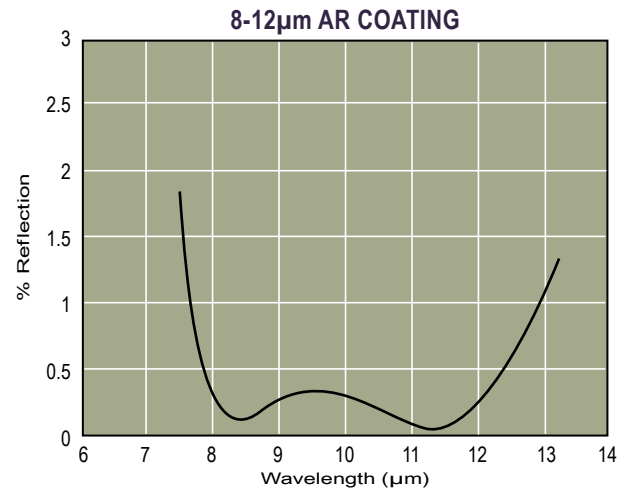
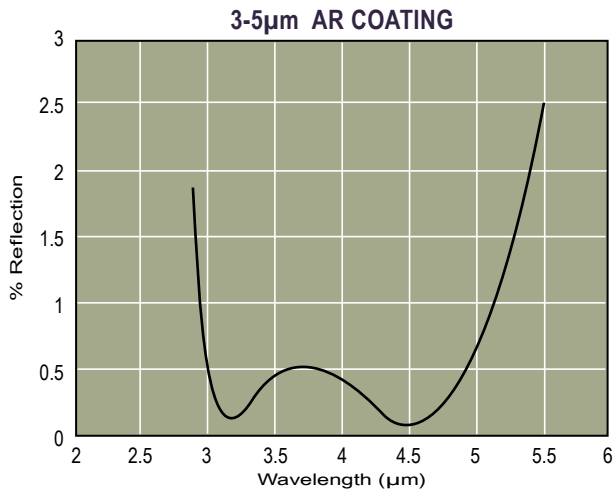
Thickness:	1.0 ±.2mm
Diameter Tolerance:	+0/-.1mm
Min. Clear Aperture:	90% of outside dimension
Substrate Material:	Germanium or Silicon (other substrates available)
Flatness:	2 waves at 632.8nm
Parallelism:	<10 arc minutes
Surface Quality:	80/50 per MIL-C-48497A
Coating Quality:	80/50 per MIL-C-48497A
24-hour humidity:	per MIL-C-48497A
Moderate Abrasion:	per MIL-C-48497A
Adhesion:	per MIL-C-48497A
Operating Temperature:	-62°C to +71°C
Mechanical:	Unmounted

Optional: Mounted in threaded ring - see pg 61 for thread sizes

### Applications

Thermal Imaging  
Weapons Systems  
Detector Windows  
Dewar Windows

AR Coating	Size, Shape & Part Number	
	25mm Ø	50mm Ø
2-14 μm coated Germanium Window	GEBBAR-2-14-25	GEBBAR-2-14-50
3-5 μm coated Germanium Window	GEBBAR-3-5-25	GEBBAR-3-5-50
8-12 μm coated Germanium Window	GEBBAR-8-12-25	GEBBAR-8-12-50
8-14 μm coated Germanium Window	GEBBAR-8-14-25	GEBBAR-8-14-50
2-14 μm coated Silicon Window	SIBBAR-2-14-25	SIBBAR-2-14-50
3-5 μm coated Silicon Window	SIBBAR-3-5-25	SIBBAR-3-5-50
8-12 μm coated Silicon Window	SIBBAR-8-12-25	SIBBAR-8-12-50
8-14 μm coated Silicon Window	SIBBAR-8-14-25	SIBBAR-8-14-50



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# INFRARED FILTERS & COATINGS

## STANDARD LONG WAVE PASS FILTERS

### Standard Long Wave Pass Filters

Long wave pass filters provide a sharp cut-off below a particular wavelength. Often used for order sorting, they isolate broad regions of the spectrum, simultaneously providing high transmission of desired energy, and deep rejection of unwanted energy.

Constructed of hard, durable first-surface dielectric coatings on optical-quality IR-transmitting substrates, these filters will withstand normal cleaning and handling associated with any high-quality optical component.

For convenience, we offer the filters in two standard sizes: 25mm and 50mm dia. In addition, we offer custom sizes and shapes, as well as custom optical characteristics. Contact our technical sales department for a quotation.

- Useful for isolating broad spectral regions
- Constructed of hard, durable first-surface coatings
- Available in standard and custom wavelengths

### General Specifications

Thickness:	1.0±0.2mm
Diameter Tolerance:	+0/-0.1mm
Min. Clear Aperture:	90% of outside dimension
Substrate Material:	Silicon or Germanium
Flatness:	3-5 waves at cut-on W/L
24-hour Humidity:	per MIL-C-48497A
Operating Temperature:	-62°C to +71°C
Parallelism:	<10 arc minutes
Transmission (Ave):	>85% from 1.05 x cut-on to 2.0 x cut-on
Rejection (Ave):	<0.1%
Slope:	<7% (12% for 1.05µm filter)

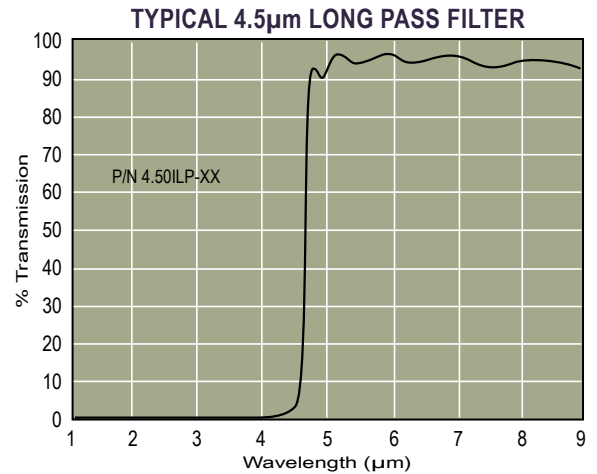
Optional: Mounted in threaded ring - see pg 61 for thread sizes

### Applications

Order Sorting  
FTIR Spectroscopy  
Thermal Imaging

## STANDARD LONG PASS FILTERS

5% point cut-on W/L	Size, Shape & Part Number		
	12.5mm Ø	25mm Ø	50mm Ø
1.05µm ± 0.04µm	1.05ILP-12.5	1.05ILP-25	1.05ILP-50
1.65µm ± 0.07µm	1.65ILP-12.5	1.65ILP-25	1.65ILP-50
2.40µm ± 0.09µm	2.40ILP-12.5	2.40ILP-25	2.40ILP-50
3.60µm ± 0.14µm	3.60ILP-12.5	3.60ILP-25	3.60ILP-50
4.50µm ± 0.18µm	4.50ILP-12.5	4.50ILP-25	4.50ILP-50
6.00µm ± 0.24µm	6.00ILP-12.5	6.00ILP-25	6.00ILP-50
7.30µm ± 0.29µm	7.30ILP-12.5	7.30ILP-25	7.30ILP-50



## Custom IR Long Wave Pass Filters

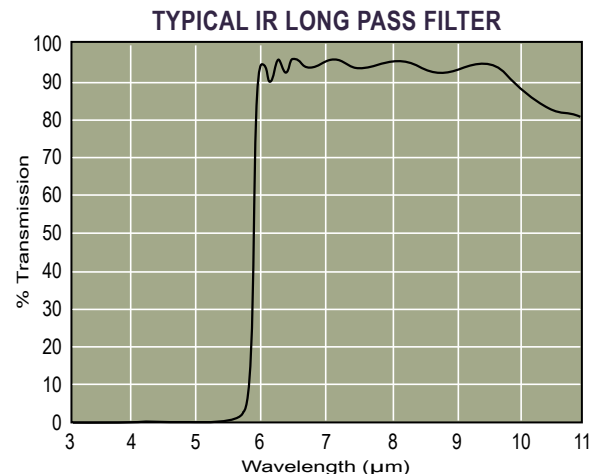
Andover can design and fabricate long pass and short pass filters to suit your particular requirements. Every phase of the process is performed in-house, including thin-film coating design, mechanical design, substrate fabrication and coating, inspection, and environmental testing.

We can coat a variety of substrate materials, including Germanium, Sapphire, Silicon, Zinc Sulfide, and Zinc Selenide.

Contact us for a quotation, whether it is for prototype quantities, or production quantities.

## CUSTOM LONG PASS FILTERS

5% point cut-on W/L	Size, Shape & Part Number		
	12.5mm Ø	25mm Ø	50mm Ø
1.0µm - 2.1µm	IRLWP08-12.5	IRLWP08-25	IRLWP08-50
2.2µm - 5.0µm	IRLWP10-12.5	IRLWP10-25	IRLWP10-50
5.1µm - 7.0µm	IRLWP12-12.5	IRLWP12-25	IRLWP12-50
7.1µm - 11.0µm	IRLWP14-12.5	IRLWP14-25	IRLWP14-50



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# INFRARED FILTERS & COATINGS

## STANDARD IR BANDPASS FILTERS

### Standard IR Bandpass Filters

Bandpass filters isolate specific regions of the spectrum, simultaneously providing high transmission of desired energy, and deep rejection of unwanted energy. Available in wide or narrow bandwidths, they can be tailored to suit your specific requirements.

Constructed of hard, durable first-surface dielectric coatings on optical-quality, IR-transmitting substrates, these filters will withstand normal cleaning and handling associated with any high-quality optical component.

Our standard IR bandpass filters are 25mm in diameter. However, we can produce custom sizes and shapes, as well as custom optical characteristics. Contact our technical sales department for a quotation.

- Useful for isolating narrow spectral regions
- Constructed of hard, durable first-surface coatings
- Available in standard and custom wavelengths up to 14 $\mu$ m

### General Specifications

Diameter Tolerance:	+0/-0.1mm
Min. Clear Aperture	90% of outside diameter
Transmission (Typ.):	75% min, 90% typical
Blocking:	T < 0.1% Average to 30 $\mu$ m
24-hour Humidity:	per MIL-C-48497A
Moderate Abrasion:	per MIL-C-48497A
Adhesion:	per MIL-C-48497A

Optional: Mounted in threaded ring - see pg 61 for thread sizes

### Applications

Environmental  
Monitoring  
Security Systems  
FLIR Systems  
Avionics

### STANDARD IR GAS ANALYSIS BANDPASS FILTERS

Gas	Center W/L	Bandwidth	Blocking	Part Number
Water Vapor	2.70 $\pm$ .03 $\mu$ m	110 $\pm$ 30nm	UV to 30 $\mu$ m	2.70GA05-25
	2.95 $\pm$ .03 $\mu$ m	110 $\pm$ 30nm	UV to 30 $\mu$ m	2.95GA05-25
Methane and Ethanol	3.46 $\pm$ .04 $\mu$ m	140 $\pm$ 30nm	UV to 30 $\mu$ m	3.46GA05-25
Formaldehyde	3.60 $\pm$ .04 $\mu$ m	140 $\pm$ 30nm	UV to 30 $\mu$ m	3.60GA05-25
SWIR	4.00 $\pm$ .20 $\mu$ m	2000 $\pm$ 200nm	UV to 7 $\mu$ m	4.00GA20-25
CO <sub>2</sub>	4.26 $\pm$ .04 $\mu$ m	120 $\pm$ 30nm	UV to 30 $\mu$ m	4.26GA05-25
CO	4.67 $\pm$ .05 $\mu$ m	150 $\pm$ 30nm	UV to 30 $\mu$ m	4.70GA05-25
NO	5.30 $\pm$ .05 $\mu$ m	420 $\pm$ 50nm	UV to 30 $\mu$ m	5.30GA05-25
FIR Broadband	10.0 $\pm$ .30 $\mu$ m	4000 $\pm$ 500nm	UV to 17 $\mu$ m	10.00GA40-25
CO <sub>2</sub>	10.6 $\pm$ .10 $\mu$ m	1500 $\pm$ 100nm	UV to 16.5 $\mu$ m	10.60GA15-25

# Custom IR Bandpass Filters

Andover can design and fabricate custom bandpass filters to suit your particular requirements. Every phase of the process is performed in-house, including thin-film coating design, mechanical design, substrate fabrication and polishing, coating, inspection, and environmental testing.

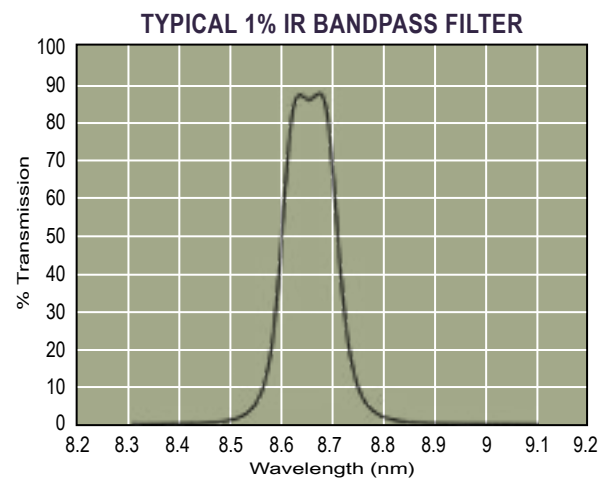
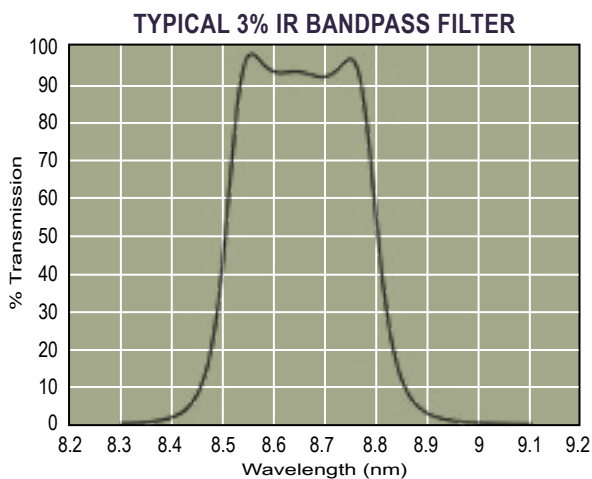
For ease of selection, we have created a matrix of typical wavelength ranges and bandwidths which are readily manufacturable. Simply specify the wavelength and bandwidth within the range, and select the appropriate part number.

If there is not a suitable filter in the table, please contact us. We can coat a variety of substrate materials, including Germanium, Sapphire, Silicon, Calcium Fluoride, Zinc Sulfide, and Zinc Selenide. Contact us for a quotation, whether it is for prototype quantities, or production quantities.

## CUSTOM IR BANDPASS FILTERS

Substrate	CW/L Range (nm)	FWHM (%)	Transmission (%)	Blocking	Part Numbers
Sapphire	2500nm-5300nm	1-3	70	UV to 30nm	IRFC10-25
	2500nm-5300nm	3-10	75	UV to 30nm	IRFC12-25
	2500nm-5300nm	10-14	80	UV to 30nm	IRFC14-25
Germanium	7500nm-9500nm	3-8	75	UV to CW/Lx1.65	IRFC16-25
	7500nm-9500nm	8-14	80	UV to CW/Lx1.65	IRFC18-25
	9500nm-11000nm	3-8	75	UV to CW/Lx1.65	IRFC20-25
	9500nm-11000nm	8-14	80	UV to CW/Lx1.65	IRFC22-25
	7500nm-9500nm	3-8	80	7500 to 13500nm	IRFC24-25
	7500nm-9500nm	8-14	85	7500 to 13500nm	IRFC26-25
	9500nm-12000nm	3-8	80	7500 to 13500nm	IRFC28-25
	9500nm-12000nm	8-14	80	7500 to 13500nm	IRFC30-25

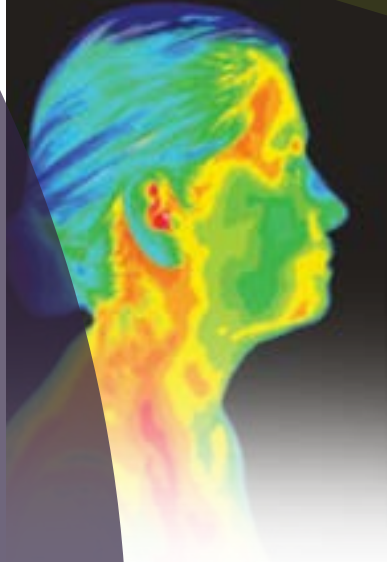
Custom spectral and physical properties available upon request



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# INFRARED FILTERS & COATINGS

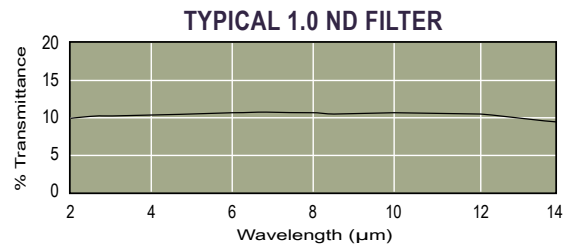
## NEUTRAL DENSITY FILTERS



### IR Neutral Density Filters

Metallic-coated infrared neutral density (ND) filters obtain their optical density from a metal alloy coating on a Germanium substrate. Unlike the all-dielectric or absorption type, the metallic type ND filter employs a combination of absorption and reflection to reduce the intensity of light.

- Provides attenuation with greater linearity over a wide spectral range
- Delivers superior durability
- Custom substrates available



### General Specifications

Wavelength Range:	2.0µm - 14.0µm
Dimensional Tolerances:	±0.2mm
Thickness:	1.0mm
Clear Aperture:	90% of outside dimension
Surface Quality:	80/50 per MIL-0-13830B
Coating Quality:	80/50 per MIL-0-13830B
Coating Adherence:	Per MIL-M-13508C
Humidity:	Per MIL-STD-810F
Substrate Material:	Germanium
Optical Quality:	Flatness of 3-5 waves per inch and parallelism of 10 arc minutes or better
Mechanical:	Unmounted

Optional: Mounted in threaded ring - see pg 61 for thread sizes

### Applications

- Thermal Imaging
- Medical Imaging
- IR Test Bench
- IR Photography

### CUSTOM IR NEUTRAL DENSITY FILTER SPECIFICATIONS

Optical Density	Nominal Transmittance (%)	Max Deviation From Nom. (%)	Size, Shape & Part Number	
			25mm Ø	50mm Ø
0.3	50.12	± 4.0	030FNIR-25	030FNIR-50
0.5	31.62	± 2.0	050FNIR-25	050FNIR-50
0.6	25.00	± 2.0	060FNIR-25	060FNIR-50
0.9	12.60	± 1.5	090FNIR-25	090FNIR-50
1.0	10.00	± 1.5	100FNIR-25	100FNIR-50
1.3	5.00	± 1.25	130FNIR-25	130FNIR-50
1.5	3.20	± 0.7	150FNIR-25	150FNIR-50
2.0	1.00	± 0.25	200FNIR-25	200FNIR-50
3.0	0.10	+ .08 / -0.05	300FNIR-25	300FNIR-50
Set of nine filters (includes storage box)			FNIR-SET-25	FNIR-SET-50



# CUSTOM IR COATINGS

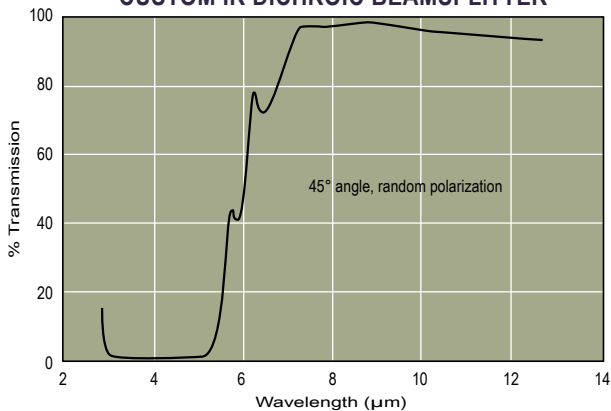


## Custom IR Coatings

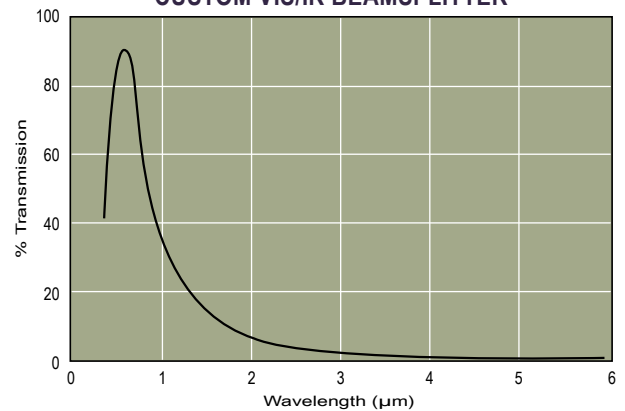
Andover Corporation offers optical coatings for the long wave infrared band, on substrate materials such as Germanium, Zinc Selenide, Zinc Sulfide, Silicon and Sapphire. Coating types include AR, bandpass, long and short pass, dichroic, and more. Andover can also design infrared coatings to function as dichroics, reflecting one region while allowing the transmittance of another. While generally operating at  $0^\circ$  or  $45^\circ$ , the coatings can be optimized for any particular angle or range of angles of incidence. Also available are custom dichroics that transmit visible while simultaneously reflecting far infrared light.

*Computer-controlled dicing saw that produces extremely precise and chip-free parts.*

**CUSTOM IR DICHROIC BEAMSPLITTER**



**CUSTOM VIS/IR BEAMSPLITTER**



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# COLORED GLASS FILTERS



## Colored Glass Filters

Colored glass filters are unique in their ability to transmit a very broad band of light. The long wave pass type, often used as order/wavelength sorting filters, transmit the longer wavelengths and absorb the shorter wavelengths. The bandpass type, useful for enhancing the signal-to-noise ratio of illumination systems, transmits a broad band of energy while blocking the shorter and longer wavelengths. As with all optical components, colored glass filters should not be exposed to high temperatures or sharp temperature changes.

- Fabricated from high-quality optical filter glass
- Excellent color consistency as well as sharp contrast
- Both surfaces precision polished
- Options span ultraviolet to infrared region

## General Specifications

Optical Thickness:	3mm $\pm$ 0.5mm
Mechanical Thickness:	Add 0.8mm for ring mount
Size Tolerance:	+0.00/-0.25mm
Surface Quality:	80/50 per MIL-M-13508
Max. Operating Temperature:	+100°C
Transmitted Wavefront (TWF):	1/4 wave per inch
Parallelism:	30 arc seconds or better
Spectral Data:	Stated as internal transmittance
Mechanical:	Mounted (except for 165mm sq.)

Optional: Mounted in threaded ring - see pg 61 for thread sizes

Note: Corners are cropped on all 165mm sq. parts unless otherwise requested.

## Applications

Machine Vision  
Astronomy  
Electronic Instrumentation  
Calibration  
Medical Devices

## Three Class Types

### BANDPASS TYPE

Ultraviolet Transmitting  
Blue and Blue - Green

### HEAT ABSORBING TYPE

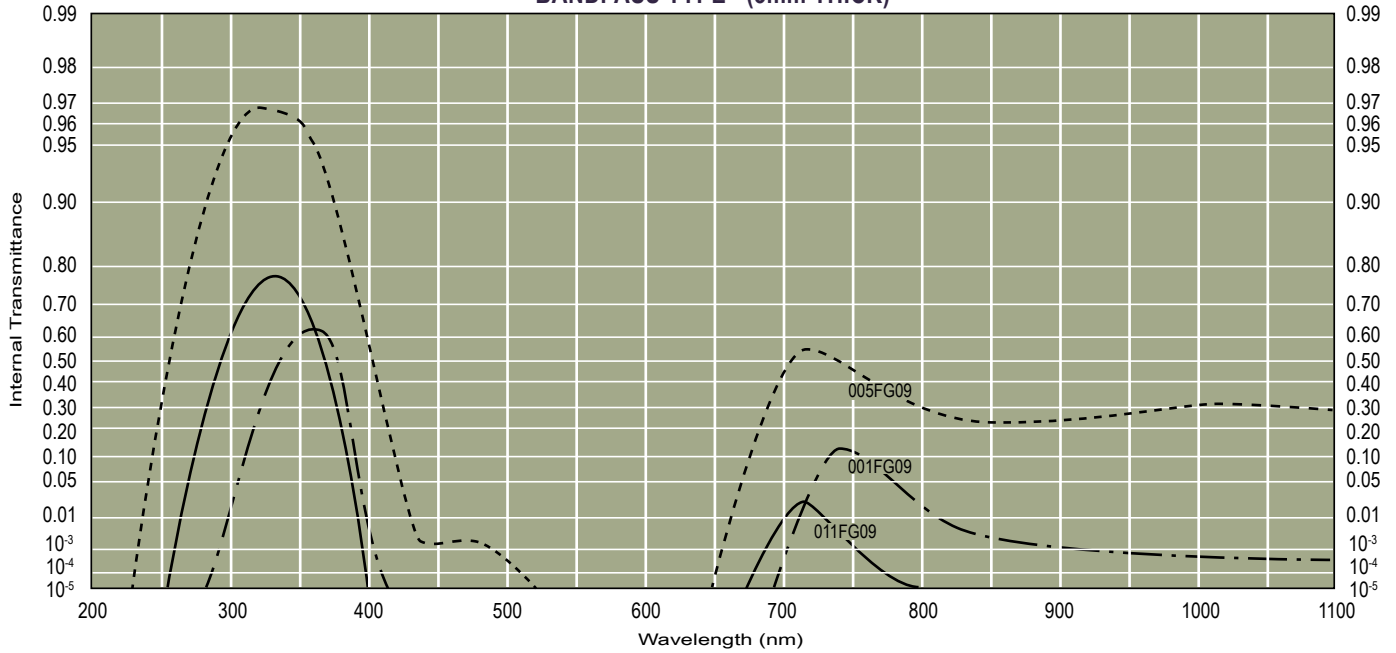
Infrared Absorbing

### LONG WAVE PASS TYPE

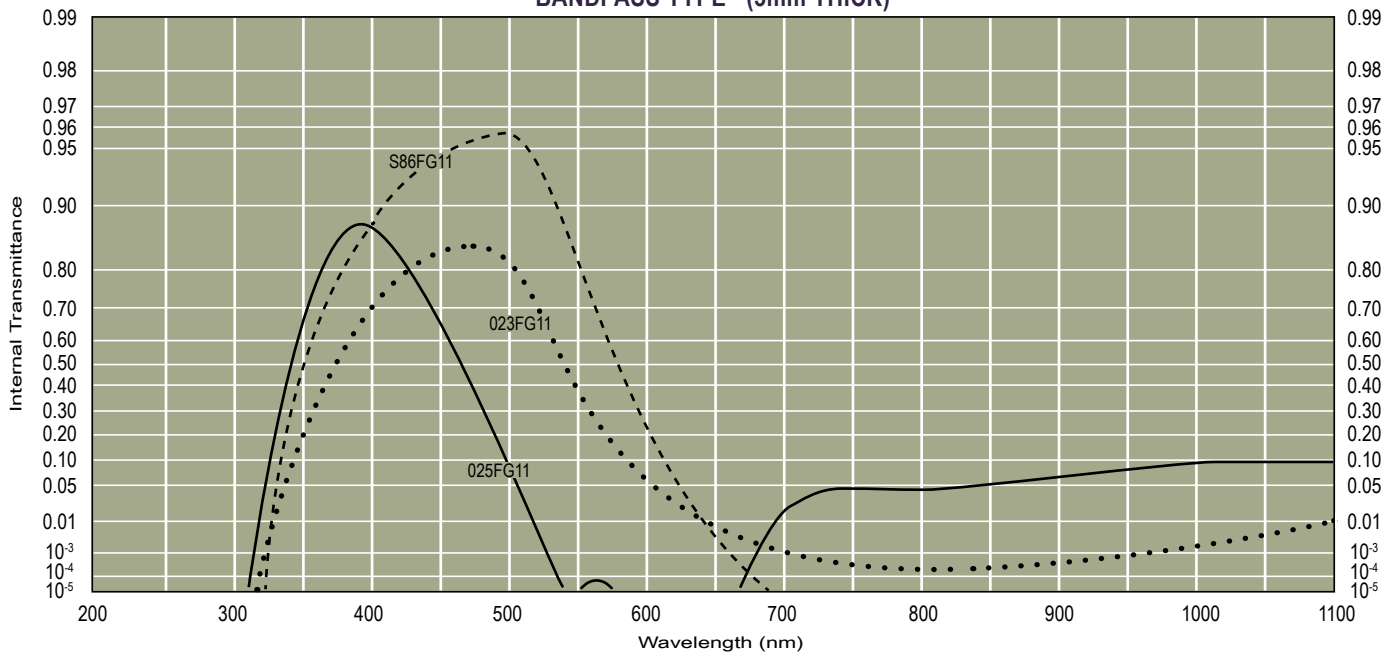
Near Infrared Transmitting  
Yellow  
Orange  
Red

We check all filter glass for striae, bubbles, and inclusions using our tunable interferometer and custom-designed inclusion tester. These instruments detect minute defects, even in materials that do not transmit visible light.

**BANDPASS TYPE (3mm THICK)**

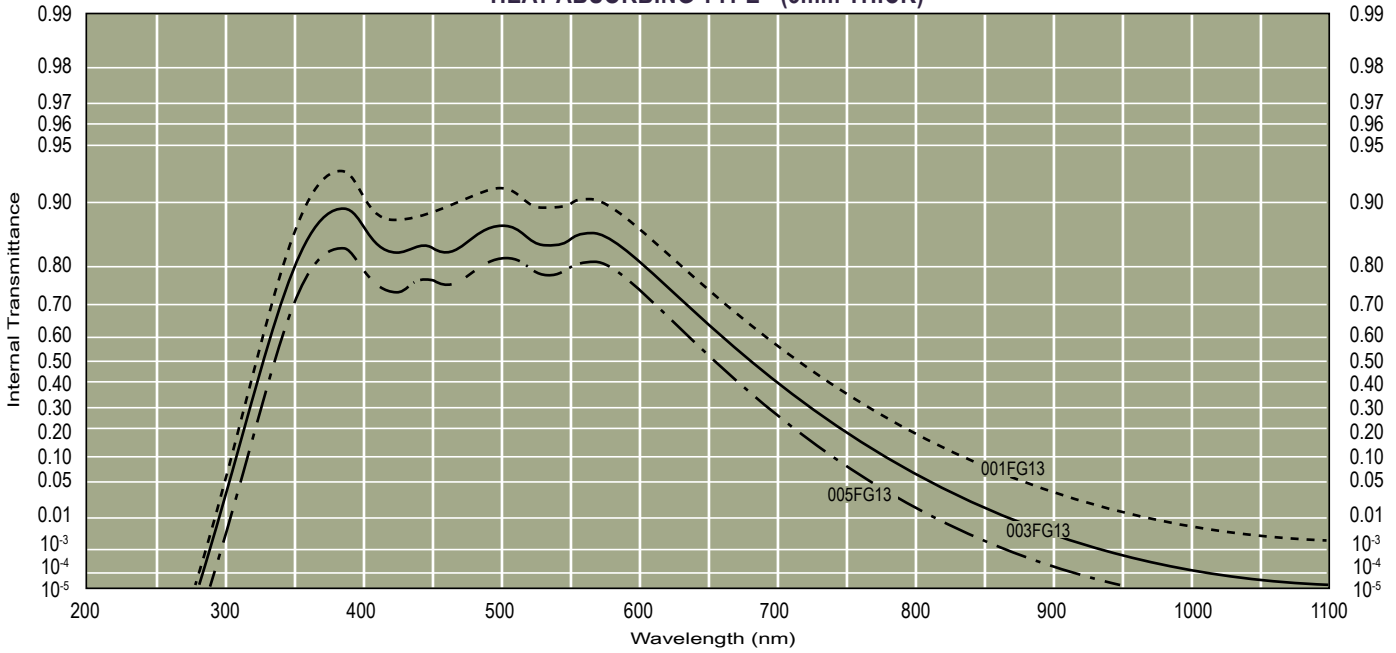


**BANDPASS TYPE (3mm THICK)**



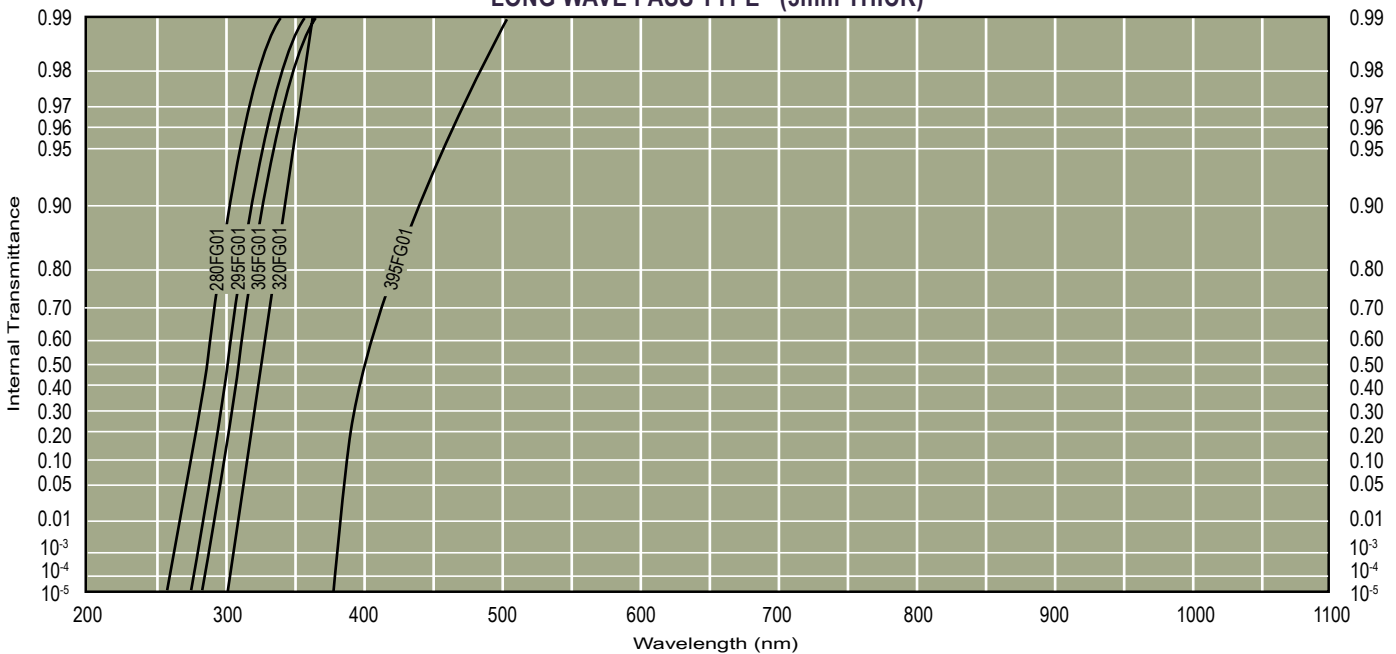
Glass Type	Size, Shape & Part Number			
	25mm Ø	50mm Ø	50mm SQ	165mm SQ
UV Transmitting	001FG09-25	001FG09-50	001FG09-50S	001FG09-165S
	005FG09-25	005FG09-50	005FG09-50S	005FG09-165S
	011FG09-25	011FG09-50	011FG09-50S	011FG09-165S
Blue glass	023FG11-25	023FG11-50	023FG11-50S	023FG11-165S
	025FG11-25	025FG11-50	025FG11-50S	025FG11-165S
	S86FG11-25	S86FG11-50	S86FG11-50S	S86FG11-165S

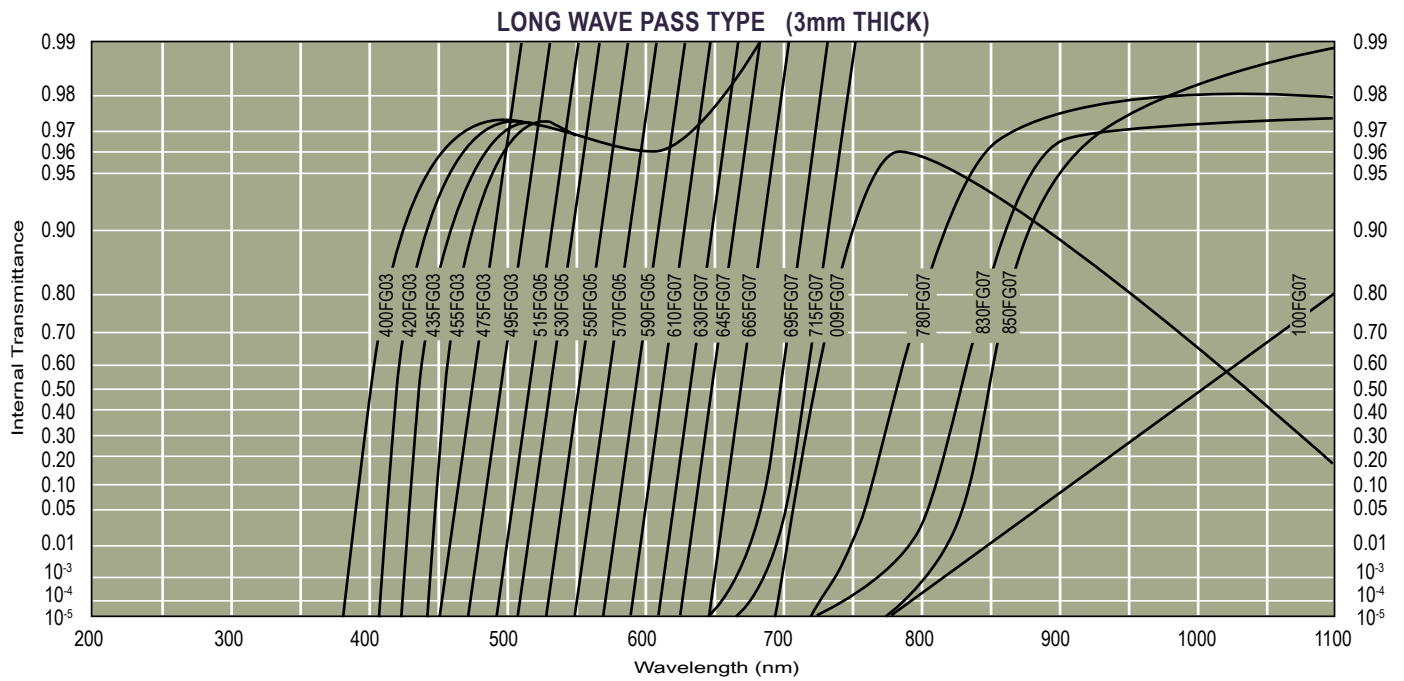
### HEAT ABSORBING TYPE (3mm THICK)



Glass Type	Size, Shape & Part Number			
	25mm Ø	50mm Ø	50mm SQ	165mm SQ
Heat Absorbing	001FG13-25	001FG13-50	001FG13-50S	001FG13-165S
	003FG13-25	003FG13-50	003FG13-50S	003FG13-165S
	005FG13-25	005FG13-50	005FG13-50S	005FG13-165S
White Glass	280FG01-25	280FG01-50	280FG01-50S	280FG01-165S
	295FG01-25	295FG01-50	295FG01-50S	295FG01-165S
	305FG01-25	305FG01-50	305FG01-50S	305FG01-165S
	320FG01-25	320FG01-50	320FG01-50S	320FG01-165S
Green Glass	395FG03-25	395FG03-50	395FG03-50S	395FG03-165S

### LONG WAVE PASS TYPE (3mm THICK)





Glass Type	Size, Shape & Part Number			
	25mm Ø	50mm Ø	50mm SQ	165mm SQ
Green Glass	400FG03-25	400FG03-50	400FG03-50S	400FG03-165S
	420FG03-25	420FG03-50	420FG03-50S	420FG03-165S
	435FG03-25	435FG03-50	435FG03-50S	435FG03-165S
	455FG03-25	455FG03-50	455FG03-50S	455FG03-165S
	475FG03-25	475FG03-50	475FG03-50S	475FG03-165S
	495FG03-25	495FG03-50	495FG03-50S	495FG03-165S
Orange Glass	515FG05-25	515FG05-50	515FG05-50S	515FG05-165S
	530FG05-25	530FG05-50	530FG05-50S	530FG05-165S
	550FG05-25	550FG05-50	550FG05-50S	550FG05-165S
	570FG05-25	570FG05-50	570FG05-50S	570FG05-165S
	590FG05-25	590FG05-50	590FG05-50S	590FG05-165S
Red Glass	610FG07-25	610FG07-50	610FG07-50S	610FG07-165S
	630FG07-25	630FG07-50	630FG07-50S	630FG07-165S
	645FG07-25	645FG07-50	645FG07-50S	645FG07-165S
	665FG07-25	665FG07-50	665FG07-50S	665FG07-165S
	695FG07-25	695FG07-50	695FG07-50S	695FG07-165S
	715FG07-25	715FG07-50	715FG07-50S	715FG07-165S
IR Transmitting	009FG07-25	009FG07-50	009FG07-50S	009FG07-165S
	780FG07-25	780FG07-50	780FG07-50S	780FG07-165S
	830FG07-25	830FG07-50	830FG07-50S	830FG07-165S
	850FG07-25	850FG07-50	850FG07-50S	850FG07-165S
	100FG07-25	100FG07-50	100FG07-50S	100FG07-165S

# CALIBRATION FILTER SETS



- Spectrophotometric glass filters for verifying transmittance and absorbance scales
- Calibration standards traceable to NIST
- Shipped in a durable aluminum storage case

## Calibration Filter Sets

Andover offers two filter sets for verifying the transmittance and absorbance scales of visible absorption spectrophotometers with maximum bandwidths of 2.2nm and 6.5nm. Made of uncoated Schott NG-4 and NG-5 glass, the filters are polished over the central 5mm x 20mm area to a transmitted wavefront of 1/4 wave or better at 633nm, with a parallelism of 30 arc seconds or better. The transmission value of each filter is measured on a spectrophotometer calibrated with standards directly traceable to the National Institute of Standards and Technology (NIST).

## General Specifications

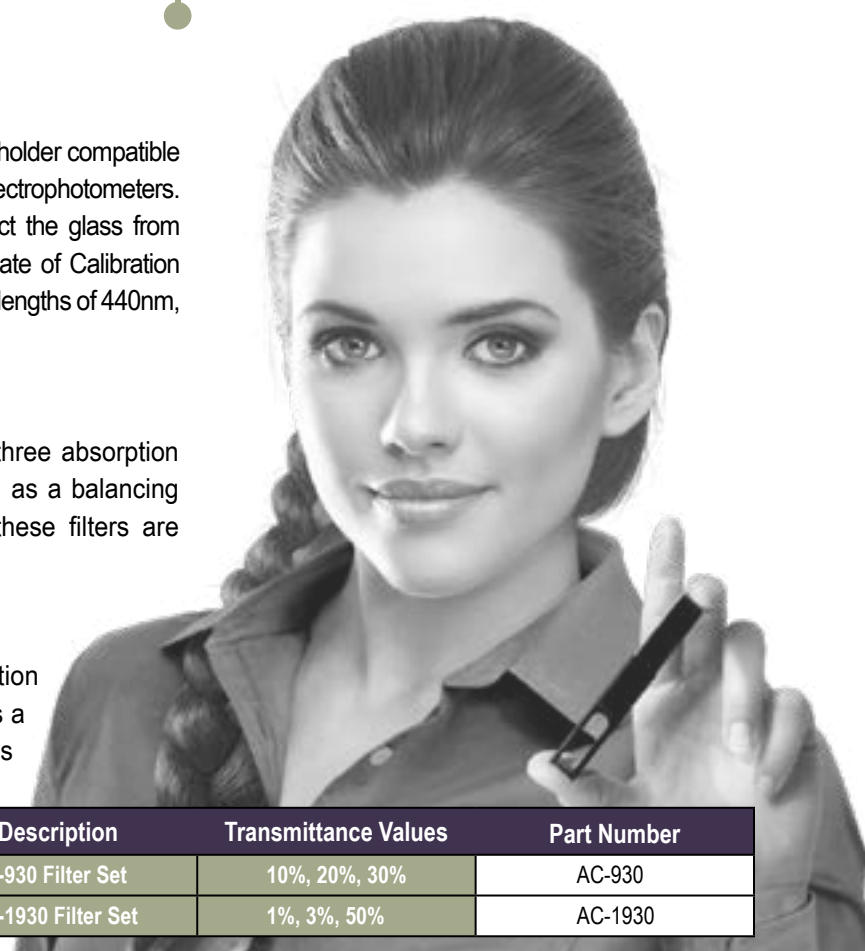
Each filter is mounted in a black anodized aluminum holder compatible with the 1cm cuvette holder supplied with most spectrophotometers. Individual filters have removable shutters to protect the glass from damage. Every filter set is shipped with a Certificate of Calibration stating the transmission value of each filter at wavelengths of 440nm, 465nm, 546.1nm, 590nm and 635nm.

### AC-930 Filter Set

The AC-930 calibration filter set consists of three absorption glass filters and one blank holder to be used as a balancing filter. The nominal transmittance values of these filters are 10%, 20%, and 30%.

### AC-1930 Filter Set

The AC-1930 filter set consists of three absorption glass filters and one blank holder to be used as a balancing filter. The nominal transmittance values of these filters are 1%, 3%, and 50%.



Description	Transmittance Values	Part Number
AC-930 Filter Set	10%, 20%, 30%	AC-930
AC-1930 Filter Set	1%, 3%, 50%	AC-1930

## Recertification Service

Each calibration filter set is certified for two years. At the end of that period, sets should be returned to Andover Corporation in their original shipping box for cleaning and recertification. Please contact the sales department at (888) 893-9992 for pricing and lead time, before returning your filter set.

# THREADED FILTER RINGS



- Industry-standard sizes
- Adaptable to most of our standard products
- Laser-engraved identification

## Threaded Filter Rings

In addition to our standard rings, Andover offers a variety of threaded ring mounts. Standard sizes and thread pitches enable the user to securely attach the filter to equipment. Please contact our technical sales department to discuss your requirements.



### THREADED RING SIZES AVAILABLE

Thread size (mm)	OD (mm)	Clear aperture (mm)	Part Number
M27.0 x 0.5	29.5	23	RING-M27
M30.5 x 0.5	32.5	26.5	RING-M30.5
M37.0 x 0.75	39	32	RING-M37
M40.5 x 0.5	42	36.5	RING-M40.5
M46.0 x 0.75	48.5	41	RING-M46
M49.0 x 0.75	51.5	44	RING-M49
M52.0 x 0.75	54	47	RING-M52

# MOTORIZED FILTER WHEEL



## Motorized Filter Wheel

Filter wheels are used in a host of applications, including color CCD photography, fluorescence microscopy, and photometry. Two 4" diameter wheels are available: a six-position 25mm filter wheel and a twelve-position 12.5mm filter wheel.

- Motorized or Manual
- Local or Remote Control
- Accepts 12.5mm and 25mm diameter filters
- Labeled filter positions
- Base and post mountable
- Programmable filter sequences
- Very small footprint suitable for tight space requirements

## Applications

Color CCD Photography  
Fluorescence Microscopy  
Photometry



## General Specifications

Interfaces included:

Serial:	RS - 232
USB:	USB 2.0
Manual:	Push button switches
Mounting:	1/4-20 & #8-32 (M6 & M4)
Size:	5.0" x 4.49" x 1.85"

## PROGRAMMING AND REMOTE CONTROL

Automation of filter sequences is available through the USB 2.0 or serial (RS - 232 interface) using LabVIEW software for both Mac and Windows platforms. A simple command language facilitates retrieving filter status and making filter selections. The unit comes with the controller, filter housing, filter wheel, a 5 VDC power supply and threaded retaining rings to hold the optics in place.



## Remote or Manual Operation

Filter selection can be made manually from push buttons on the unit, or remotely from either a USB 2.0 or serial (RS - 232) interface.

## Interchangeable Filter Wheels

The 4" diameter wheel is easily changed, allowing quick conversions between applications. Additional wheels are available.



### MOTORIZED FILTER WHEEL

Description	Size & Part Number	
	12-Position / 12.5mm	6-Position / 25mm
Motorized filter wheel	FW-MOT-12.5	FW-MOT-25
Extra wheel only	FW-12.5	FW-25

### MANUAL FILTER WHEEL

Description	Size & Part Number	
	12-Position / 12.5mm	6-Position / 25mm
Manual filter wheel	FW-MAN-12.5	FW-MAN-25



# TEMPERATURE CONTROLLER

## Temperature Controller

The performance of very narrow bandwidth interference filters can suffer significantly due to changes in ambient temperature. The regulated temperature controller provides protection against the influences of fluctuating ambient temperatures, and provides a means of tuning the center wavelength to an exact value.

Andover's temperature controllers are extremely stable, and regulate over a broad range (30° to 60°C).

All temperature controllers include an assembly kit which enables the user to install their own filters in the controller, if desired. The assembly kit includes optical-quality BK-7 or Fused Silica windows which are A/R coated in a user-selectable range.

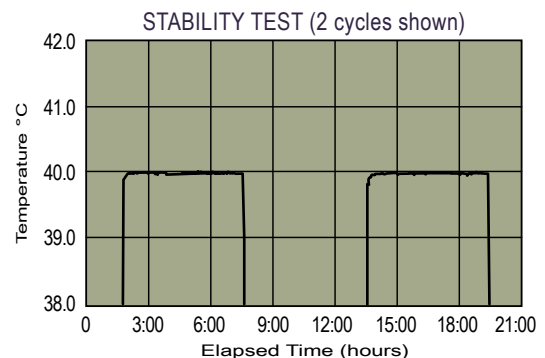
Shipped in a sturdy, reusable weatherproof case, all of our temperature controllers include a universal power adaptor, which will operate from 110 to 220 volts, 50–60 Hz, and include plugs for US, UK, Australia, and Europe.

- Provides added control over ambient temperatures
- Effective for conducting outdoor experiments
- Custom sizes and temperature ranges also available
- Provides stability with varying ambient temperatures
- Our Temperature Controllers are subjected to a 120 hour stability test.
- Calibration of wavelength tuning with temperature setting is available

## General Specifications

Regulation Accuracy:	+/-0.25°C
Ambient Temperature Range:	0-30°C
Min. Regulated Temperature:	30°C
Max. Regulated Temperature:	60°C
Power Requirements:	110-220VAC, 50-60Hz, 1.0A
Filter Size:	50mm or 75mm diameter

Custom adapters for smaller sizes available at a nominal charge.



## ORDERING:

To ensure you have the appropriate filter oven and controller that best suits your needs, please follow steps 1 and 2.

### Step 1

Select temperature controller size

Temperature Controller	Part Number
50mm	101FRDC01-50
75mm	101FRDC01-75

### Step 2

Select the assembly kit that best suits your needs

AR Coating W/L Range	Part Number
300nm to 450nm	101FRDC01-KIT
450nm to 700nm	101FRDC02-KIT
700nm to 1200nm	101FRDC03-KIT
1200nm to 1600nm	101FRDC04-KIT



The assembly kits include the necessary hardware to mount a filter into the filter oven, as well as instructions for assembly. The windows supplied are broadband anti-reflective (AR) coated over the specified wavelength range for an average reflectance of  $\leq 0.5\%$  per surface. The substrate material is either Schott BK-7 or Fused Silica, as appropriate, and polished to a  $1/4$  wave flatness, with a parallelism of 30 arc seconds or better.

# EPOLITE FH-5313 EPOXY

## Epolite FH- 5313 Epoxy

Fuller Epolite FH-5313 is a 100% solid, room-temperature curing, optically clear, electrical grade epoxy. Proven to be a superior bonding agent for ferrite pot cures, this system is designed for continuous operation at temperatures up to 200°F. Resin and hardener are sold individually or in kits, and in pre-measured A-Paks.

- Ideal for bonding a variety of substrates and potting electronic assemblies
- Excellent chemical resistance, and mechanical strength



### EPOXY

Type	Weight & Content	Part Number
Pre-measured A-Pak	5.2 grams Resin, .8 grams Hardener	FH-5313A-A-PAK
Resin & Hardener Kit	16oz. Resin, 2oz. Hardener & 6 Droppers	FH-5313A-KIT
Resin Only	16oz. 64oz. 128oz.	FH-5313A-RESIN/16 FH-5313A-RESIN/64 FH-5313A-RESIN/128
Hardener Only	2oz. 8oz. 16oz.	FH-5313A-HARD/2 FH-5313A-HARD/8 FH-5313A-HARD/16

## Certified results from an independent testing lab

### GENERAL PROPERTIES

	VALUE	TEST METHOD
Specific Gravity	1.17	ASTM-D-792-00
Hardness, Shore D	81	ASTM-D-2240-04e1
Strength		
Tensile	7,940 psi	ASTM-D-683.03
Shear	782 psi	ASTM-D-1002-01
Compressive	15,440 psi	ASTM-D-695-02a
Flexural	13,860 psi	ASTM-D-790-03
Coefficient of Linear Thermal Expansion	93.5 ppm/°C	ASTM-E-831-03
Mixed Viscosity	1,970 cP	MIL-STD-883E
Pot Life Minutes at 77°F	30	ERF 13-70
Cure Schedule Hours at 77°F	12	
Cure Schedule Hours at 150°F	1	
Mix Ratio by Weight (A:B)	100:15	

### ELECTRICAL PROPERTIES

Dielectric Strength	2,128 volts/mil	ASTM-D-149-97a
Dielectric Constant @100 Hz	4.06	ASTM-D-150.98
Dissipation Factor @100 Hz	0.001	ASTM-D-150.98
Volume Resistivity, ohm/cm	8.4 x 10 <sup>14</sup>	ASTM-D-257.99

### CHEMICAL RESISTANCE

Isopropyl Alcohol		
Weight Change	0.15%	ASTM-D-543.95
Thickness Change	0.902%	ASTM-D-543.95
Jet A		
Weight Change	0.055%	ASTM-D-543.95
Thickness Change	0.519%	ASTM-D-543.95

### OUTGASSING PROPERTIES

Total Mass Loss	0.56%	ASTM-E-595-03e2
Collected Volatile Condensable Material	<0.01%	ASTM-E-595-03e2
Water Vapor Regain	0.29%	ASTM-E-595-03e2

# GLOSSARY

<b>A</b>	AR Coating	Anti-reflective coating that reduces the surface reflection of an optic	<b>F</b>	Fabry-Perot Filter	Dielectric filter construction based on the Fabry-Perot interferometer. Consists of two reflective stacks separated by an even-ordered spacer	
	Absorptance	The ratio of absorbed to incident radiation		FIR	Far Infrared (wavelengths from 6 $\mu$ m to 30 $\mu$ m)	
<b>B</b>	BW	Bandwidth	<b>H</b>	FWHM	Full width at half maximum or the bandwidth of the filter	
	Bandpass Filter	A filter that transmits a specific band of energy and rejects all other energy at higher and lower wavelengths		Hot Mirror	A filter that reflects the near infrared energy (heat) and transmits the visible energy	
	Bandwidth	The spectral width of a filter measured at half of the peak transmission; also referred to as full width at half maximum (FWHM)		<b>I</b>	Image Quality	A filter designed for use in imaging applications
	Blocking Range	The spectral range of unwanted radiation			Index of Refraction	The ratio of the velocity of light in a vacuum to the velocity of light in a refractive material
<b>C</b>	Cavity	An internal structure of a band-pass filter, consisting of two reflecting stacks of dielectric material separated by an even-ordered spacer. The number of cavities determines the shape of the passband	Interferometer	An instrument that measures the accuracy of an optical element utilizing interference phenomena based on the wave characteristics of light		
	Center Wavelength	The wavelength coinciding with the midpoint of the passband	IR	Infrared Spectrum (wavelengths from 2.5 $\mu$ m to 30 $\mu$ m)		
	Cold Mirror	A filter which reflects the visible energy and transmits the near infrared energy	<b>L</b>	Long Pass Filter	A filter which transmits the longer wavelengths and rejects the shorter wavelengths	
	Commercial Quality	A filter designed for use in non-imaging instrumentation applications				
	CWL	Center wavelength				

<b>M</b>	MDM	Metal-Dielectric-Metal	<b>S</b>	Short Pass Filter	A filter that transmits the shorter wavelengths and rejects the longer wavelengths
	MWIR	Midwave Infrared Spectrum (2.6 $\mu$ m to 6.0 $\mu$ m)		Spectrophotometer	An instrument that measures intensity of light at varying wavelengths
<b>N</b>	N*	The effective refractive index of the filter	SWIR	Shortwave Infrared Spectrum (1.5 $\mu$ m to 3.0 $\mu$ m)	
	ND Filter	A neutral density filter that transmits a specific amount of energy equally over all wavelengths			
	NIR	Near Infrared Spectrum (wavelengths from 750nm to 1.5 $\mu$ m )	<b>T</b>	T or Tx Transmittance	Transmittance Transmittance is the fraction of incident light which passes through a filter
<b>P</b>	Passband	The band of energy that is transmitted (passed) by the filter	<b>U</b>	UV	Ultraviolet spectrum, typically defined as the (wavelengths from 200-400nm)
	Polarization	A process or state in which rays of light exhibit different properties in different directions, especially the state in which all vibration takes place in one plane	<b>V</b>	VIS	Visible spectrum (wavelengths from 400nm to 750nm)
<b>R</b>	R/T ratio	The ratio of reflectance to transmittance			
	Reflectance	The ratio of the total amount of radiation reflected by a surface to the total amount of radiation incident on the surface			
	Refractive Index	The ratio of the velocity of light in a vacuum to the velocity of light in a refractive material			

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