Semrock Essential Performance Optical Filter Catalog

ENGINEERED FOR PERFORMANCE AND VALUE

IDEX Health & Science | Semrock Essential Performance optical filters deliver comprehensive, cost-effective solutions that align cutting-edge performance with accessible budgetary considerations. We operate under the principle that achieving optimal optical performance need not be synonymous with high cost. Explore this catalog to discover how our Essential Performance filters deliver the Semrock quality and reliability you expect, without compromising your budget.

DISCOVER WHAT'S INSIDE:

- Semrock Quality Made Affordable
- Performance Matched to Your Application
- Featuring Essential Performance Filter Families

IDEX HEALTH & SCIENCE | Semrock

Intelligent Solutions for Life®
Fluidics | Optics | Consumables | Assemblies

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Introduction to Essential Performance Optical Filters

Our commitment to providing genuinely cost-effective solutions is relevant to a wide range of professionals, including OEMs, contract optical designers, purchasing managers, buyers, and contract manufacturers, who will also appreciate the high quality that comes with a Semrock optical filter.

Not all applications require the highest-performing filters, such as those with scattered light or point detectors. This catalog guides you through our innovative BrightLine Basic™, EdgeBasic™, and Nanopede™ products — our *Essential Performance* product families.

Should our Essential Performance offerings not meet a critical requirement of your application, Semrock's High Performance products can be considered. The following table compares the relative specifications between the Essential and High Performance product families.

		TRANSMISSION	BLOCKING	EDGE STEEPNESS
ESSENTIAL PERFORMANCE PRODUCTS	BrightLine Basic™	◐	◐	◐
	EdgeBasic™	◑	◑	◐
	Nanopede™	◑	◐	◑
HIGH PERFORMANCE PRODUCTS	BrightLine®	◑	●	◑
	BrightLine® 2.0	●	●	◑
	Avant™	◐	●	●

Relative performance by product family (full circle = best).

BrightLine Basic™

Uncompromising Quality at an Unbeatable Price

For cost-conscious customers, our redesigned BrightLine Basic™ filters offer exceptional value. This product family features individual filters designed to standardized requirements with relaxed spectral specifications compared to our BrightLine®, BrightLine® 2.0, and Avant™ catalog filters. These filters are not simply "lesser" versions of our premium offerings – they are engineered specifically to meet the needs of applications where stringent specifications are less critical. By relaxing certain requirements, we are able to offer the BrightLine Basic™ filters at an incredibly competitive price point.

Key Features:

- **Exceptional Value:** BrightLine Basic™ price points make these filters an ideal option for cost-sensitive applications without sacrificing essential performance.
- **Reliable Performance:** While specifications are relaxed, BrightLine Basic™ filters still deliver reliable performance for a wide range of fluorescence imaging needs.
- **Clear Differentiation:** Standardized specifications clearly distinguish BrightLine Basic™ from BrightLine® and BrightLine® 2.0, enabling simplified selection of the right filters based on budgetary and application needs.

LEARN MORE ABOUT BRIGHTLINE BASIC™ AT IDEX-HS.COM/INFO-BRIGHTLINE

BrightLine Basic™ (Continued)

BrightLine Basic™

Center Wavelength	Passband (T_{avg} > 93%)	Blocking (OD_{avg} > 5)			Blocking (OD_{abs} > 3.5)	GMBW	FWHM	Part Number
390 nm	381 – 399 nm	300 – 366 nm	415 – 492 nm	492 – 900 nm	407 nm	18 nm	23.2 nm	FFB01-390/18-25
461 nm	440 – 481 nm	300 – 422 nm	500 – 550 nm	550 – 900 nm	490.6 nm	41 nm	45.6 nm	FFB01-461/41-25
461 nm	430 – 492 nm	300 – 381 nm	381 – 413 nm	512 – 900 nm	421.4 nm	62 nm	—	FFB01-461/62-25
465 nm	443 – 487 nm	300 – 425 nm	425 – 506 nm	506 – 900 nm	496.7 nm	44 nm	—	FFB01-465/44-25
529 nm	508 – 550 nm	300 – 440 nm	440 – 488 nm	572 – 900 nm	497.8 nm	42 nm	—	FFB01-529/42-25
531 nm	511 – 551 nm	300 – 491 nm	573 – 613 nm	613 – 900 nm	562 nm	40 nm	—	FFB01-531/40-25
535 nm	511 – 559 nm	300 – 443 nm	443 – 491 nm	581 – 900 nm	500 nm	48 nm	—	FFB01-535/48-25
537 nm	525 – 549 nm	300 – 504 nm	571 – 645 nm	645 – 900 nm	559 nm	24 nm	29.4 nm	FFB01-537/24-25
543 nm	530 – 556 nm	300 – 509 nm	578 – 640 nm	640 – 900 nm	567.1 nm	26 nm	34.6 nm	FFB01-543/26-25
555 nm	539 – 571 nm	300 – 517 nm	594 – 665 nm	665 – 900 nm	582.4 nm	32 nm	37.6 nm	FFB01-555/32-25
595 nm	576 – 613 nm	300 – 511 nm	511 – 553 nm	638 – 900 nm	564.5 nm	37 nm	—	FFB01-595/37-25
610 nm	580 – 640 nm	300 – 530 nm	530 – 557 nm	666 – 900 nm	568.4 nm	60 nm	69 nm	FFB01-610/60-25
620 nm	594 – 645 nm	300 – 525 nm	525 – 570 nm	671 – 900 nm	582.1 nm	51 nm	57.2 nm	FFB01-620/51-25
627 nm	609 – 645 nm	300 – 585 nm	671 – 726 nm	726 – 900 nm	657.9 nm	36 nm	44.9 nm	FFB01-627/36-25
640 nm	605 – 675 nm	300 – 539 nm	539 – 581 nm	702 – 900 nm	592.9 nm	70 nm	76.4 nm	FFB01-640/70-25
699 nm	672 – 726 nm	300 – 609 nm	609 – 645 nm	755 – 900 nm	658.6 nm	54 nm	63.8 nm	FFB01-699/54-25

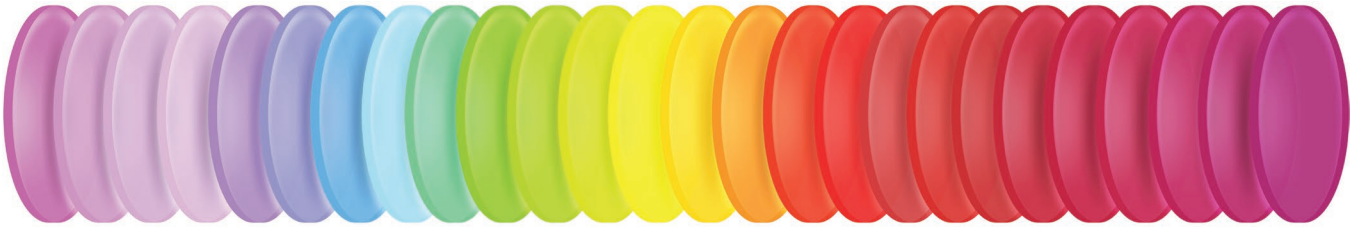
BrightLine Basic™ Sets

Our BrightLine Basic™ sets support applications utilizing the most common fluorophores at budget-friendly prices.

BrightLine Basic Sets

Designed for the following and other like fluorophores	Set Components: Exciter	Dichroic	Emitter	Part Number
BFP	FFB01-390/18-25	FF415-Di01-25x36	FFB01-461/62-25	BFP-B-Basic-000
GFP	FFB01-461/41-25	FF498-Di01-25x36	FFB01-529/42-25	GFP-A-Basic-000
FITC	FFB01-465/44-25	FF499-Di02-25x36	FFB01-535/48-25	FITC-B-Basic-000
Cy3	FFB01-531/40-25	FF564-Di01-25x36	FFB01-595/37-25	Cy3-A-Basic-000
TRITC	FFB01-537/24-25	FF564-Di02-25x36	FFB01-620/51-25	TRITC-B-Basic-000
TRITC (for use with LED light sources)	FFB01-543/26-25	FF574-Di01-25x36	FFB01-610/60-25	LED-TRITC-A-Basic-000
TxRed	FFB01-555/32-25	FF583-Di01-25x36	FFB01-640/70-25	TxRed-B-Basic-000
Cy5	FFB01-627/36-25	FF658-Di01-25x36	FFB01-699/54-25	Cy5-B-Basic-000

Nanopede™



To meet the need for precise, full-spectrum detection in spectral flow cytometry, IDEX Health & Science offers our Semrock Nanopede™ bandpass optical filter family, engineered for consistent performance across UV to NIR wavelengths.

These essential performance and cost-effective filters cover the near-UV and visible spectrum in 20 nm center wavelength increments with 20 nm FWHM spectral widths.

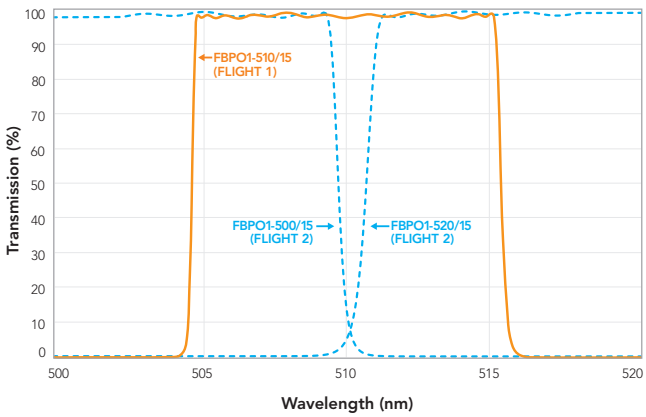


Figure 1. Zoomed-in view depicting spectral coverage of select filters from Flight 1 and Flight 2.

Moving into the NIR, the FWHM increases to 30 nm. The fifty-two filters in our Nanopede™ family have been designed with your application in mind.

Key Features:

- **Spectral Coverage:** Coverage of the spectrum in discrete steps, so you can test several configurations and define the best combinations possible.
- **OD_{avg} > 5 Blocking:** 330 to 900 nm, so you can optimize for the blocking depth and range you need.
- **Laser OD_{abs} > 5:** Maintains > OD5 at key laser wavelengths to assist in reducing light source bleed through.
- **Hard-Coated Quality:** Hard-coated for consistent performance with Semrock quality for spectral repeatability and proven reliability for your most demanding applications.
- **Compact Filters:** Available in 12.5 mm housed standard size filters with 10 mm clear aperture, providing a compact filter package. Custom sizes available for unique instrument footprints.

LEARN MORE ABOUT NANOPEDE™ AT IDEX-HS.COM/INFO-NANOPEDE

Nanopede™ Sets

Our Nanopede™ sets support complex spectral coverage across UV to NIR wavelengths at a cost-effective price.

Nanopede Sets	Part Number
Flight 1: The 26 Flight 1 filters below in 12.5 mm diameter, delivered in set box.	NANOPEDE-20-26-A-12.5
Flight 1: The 26 Flight 1 filters below in 25 mm diameter, delivered in set box.	NANOPEDE-20-26-A-25
Flight 2: The 26 Flight 2 filters below in 12.5 mm diameter, delivered in set box.	NANOPEDE-20S-26-A-12.5
Flight 2: The 26 Flight 2 filters below in 25 mm diameter, delivered in set box.	NANOPEDE-20S-26-A-25

Nanopede™ (Continued)

Nanopede Flight 1

Center Wavelength	Passband (T_{avg} > 93%)	Blocking (OD_{avg} > 5)		GMBW	FWHM	Part Number
UV/VIS						
340 nm	331.5 – 348.5 nm	—	354 – 900 nm	16.6 nm	20 nm	FBP01-340/17-12.5
360 nm	352 – 368 nm	330 – 346 nm	374 – 900 nm	16 nm	20 nm	FBP01-360/16-12.5
380 nm	372 – 388 nm	330 – 366 nm	394 – 900 nm	16 nm	20 nm	FBP01-380/16-12.5
400 nm	392 – 408 nm	330 – 386 nm	415 – 900 nm	16 nm	20 nm	FBP01-400/16-12.5
420 nm	412 – 428 nm	330 – 405 nm	435 – 900 nm	16 nm	20 nm	FBP01-420/16-12.5
440 nm	432 – 448 nm	330 – 425 nm	455 – 900 nm	16 nm	20 nm	FBP01-440/16-12.5
460 nm	452.5 – 467.5 nm	330 – 445 nm	475 – 900 nm	15 nm	20 nm	FBP01-460/15-12.5
480 nm	472.5 – 487.5 nm	330 – 465 nm	495 – 900 nm	15 nm	20 nm	FBP01-480/15-12.5
500 nm	492.5 – 507.5 nm	330 – 485 nm	516 – 900 nm	15 nm	20 nm	FBP01-500/15-12.5
VIS						
520 nm	512.5 – 527.5 nm	330 – 504 nm	536 – 900 nm	15 nm	20 nm	FBP01-520/15-12.5
540 nm	532.5 – 547.5 nm	330 – 524 nm	556 – 900 nm	15 nm	20 nm	FBP01-540/15-12.5
560 nm	553 – 567 nm	330 – 544 nm	576 – 900 nm	14 nm	20 nm	FBP01-560/14-12.5
580 nm	573 – 587 nm	330 – 564 nm	596 – 900 nm	14 nm	20 nm	FBP01-580/14-12.5
600 nm	593 – 607 nm	330 – 584 nm	617 – 900 nm	14 nm	20 nm	FBP01-600/14-12.5
620 nm	613 – 627 nm	330 – 603 nm	637 – 900 nm	14 nm	20 nm	FBP01-620/14-12.5
640 nm	633 – 647 nm	330 – 623 nm	657 – 900 nm	14 nm	20 nm	FBP01-640/14-12.5
660 nm	653.5 – 666.5 nm	330 – 643 nm	677 – 900 nm	13 nm	20 nm	FBP01-660/13-12.5
680 nm	673.5 – 686.5 nm	330 – 663 nm	697 – 900 nm	13 nm	20 nm	FBP01-680/13-12.5
NIR						
700 nm	693.5 – 706.5 nm	330 – 683 nm	718 – 900 nm	13 nm	20 nm	FBP01-700/13-12.5
720 nm	713.5 – 726.5 nm	330 – 702 nm	738 – 900 nm	13 nm	20 nm	FBP01-720/13-12.5
740 nm	733.5 – 746.5 nm	330 – 722 nm	758 – 900 nm	13 nm	20 nm	FBP01-740/13-12.5
765 nm	754 – 776 nm	330 – 742 nm	788 – 900 nm	22 nm	30 nm	FBP01-765/22-12.5
795 nm	784 – 806 nm	330 – 772 nm	819 – 900 nm	22 nm	30 nm	FBP01-795/22-12.5
825 nm	814 – 836 nm	330 – 801 nm	849 – 900 nm	22 nm	30 nm	FBP01-825/22-12.5
855 nm	844.5 – 865.5 nm	330 – 831 nm	879 – 900 nm	21 nm	30 nm	FBP01-855/21-12.5
885 nm	874.5 – 895.5 nm	330 – 861 nm	—	21 nm	30 nm	FBP01-885/21-12.5

Nanopede™ (Continued)

Nanopede Flight 2

Center Wavelength	Passband (T_{avg} > 93%)	Blocking (OD_{avg} > 5)		GMBW	FWHM	Part Number
UV/VIS						
350 nm	341.5 – 358.5 nm	330 – 336 nm	364 – 900 nm	17 nm	20 nm	FBP01-350/17-12.5
370 nm	362 – 378 nm	330 – 356 nm	384 – 900 nm	16 nm	20 nm	FBP01-370/16-12.5
390 nm	382 – 398 nm	330 – 376 nm	404 – 900 nm	17 nm	20 nm	FBP01-390/16-12.5
410 nm	402 – 418 nm	330 – 395 nm	425 – 900 nm	16 nm	20 nm	FBP01-410/16-12.5
430 nm	422 – 438 nm	330 – 415 nm	455 – 900 nm	16 nm	20 nm	FBP01-430/16-12.5
450 nm	442 – 458 nm	330 – 435 nm	465 – 900 nm	16 nm	20 nm	FBP01-450/16-12.5
470 nm	462.5 – 477.5 nm	330 – 455 nm	485 – 900 nm	15 nm	20 nm	FBP01-470/15-12.5
490 nm	482.5 – 497.5 nm	330 – 475 nm	505 – 900 nm	15 nm	20 nm	FBP01-490/15-12.5
510 nm	502.5 – 517.5 nm	330 – 494 nm	526 – 900 nm	15 nm	20 nm	FBP01-510/15-12.5
VIS						
530 nm	522.5 – 537.5 nm	330 – 514 nm	546 – 900 nm	15 nm	20 nm	FBP01-530/15-12.5
550 nm	542.5 – 557.5 nm	330 – 534 nm	566 – 900 nm	15 nm	20 nm	FBP01-550/15-12.5
570 nm	563 – 577 nm	330 – 554 nm	586 – 900 nm	14 nm	20 nm	FBP01-570/14-12.5
590 nm	583 – 597 nm	330 – 574 nm	606 – 900 nm	14 nm	20 nm	FBP01-590/14-12.5
610 nm	603 – 617 nm	330 – 593 nm	627 – 900 nm	14 nm	20 nm	FBP01-610/14-12.5
630 nm	623 – 637 nm	330 – 613 nm	647 – 900 nm	14 nm	20 nm	FBP01-630/14-12.5
650 nm	643 – 657 nm	330 – 633 nm	667 – 900 nm	14 nm	20 nm	FBP01-650/14-12.5
670 nm	663.5 – 676.5 nm	330 – 653 nm	687 – 900 nm	13 nm	20 nm	FBP01-670/13-12.5
690 nm	683.5 – 696.5 nm	330 – 673 nm	707 – 900 nm	13 nm	20 nm	FBP01-690/13-12.5
NIR						
710 nm	703.5 – 716.5 nm	330 – 692 nm	728 – 900 nm	13 nm	20 nm	FBP01-710/13-12.5
730 nm	723.5 – 736.5 nm	330 – 712 nm	748 – 900 nm	13 nm	20 nm	FBP01-730/13-12.5
750 nm	743.5 – 756.5 nm	330 – 732 nm	768 – 900 nm	13 nm	20 nm	FBP01-750/13-12.5
775 nm	764 – 786 nm	330 – 752 nm	798 – 900 nm	22 nm	30 nm	FBP01-775/22-12.5
805 nm	794 – 816 nm	330 – 782 nm	829 – 900 nm	22 nm	30 nm	FBP01-805/22-12.5
835 nm	824 – 846 nm	330 – 811 nm	859 – 900 nm	22 nm	30 nm	FBP01-835/22-12.5
865 nm	854.5 – 875.5 nm	330 – 841 nm	889 – 900 nm	21 nm	30 nm	FBP01-865/21-12.5
895 nm	884.5 – 905.5 nm	330 – 871 nm	—	21 nm	30 nm	FBP01-895/21-12.5

Nanopede™ (Continued)

Nanopede Flights 3 & 4

Center Wavelength	Passband (T_{avg} > 93%)	Blocking (OD_{avg} > 5)		OD_{abs}>5	GMBW	FWHM	Part Number
UV/VIS							
355 nm	332 – 378 nm	384 – 900 nm	—	405, 445, 488, 532, 633 nm	46 nm	50 nm	FBP01-355/46-12.5
380 nm	357 – 403 nm	330 – 351 nm	410 - 900 nm	445, 488, 532, 663	46 nm	50 nm	FBP01-380/46-12.5
405 nm	382 – 428 nm	330 – 376 nm	435 - 900 nm	445, 488, 532, 663	46 nm	50 nm	FBP01-405/46-12.5
430 nm	407 – 453 nm	330 – 400 nm	460 - 900 nm	488, 532, 633 nm	46 nm	50 nm	FBP01-430/46-12.5
455 nm	432.5 – 477.5 nm	330 – 426 nm	485 - 900 nm	405, 532, 633 nm	45 nm	50 nm	FBP01-455/45-12.5
480 nm	457.5 – 502.5 nm	330 – 450 nm	511 - 900 nm	405, 532, 633 nm	45 nm	50 nm	FBP01-480/45-12.5
VIS							
505 nm	482.5 – 527.5 nm	330 – 475 nm	536 - 900 nm	405, 445, 633 nm	45 nm	50 nm	FBP01-505/45-12.5
530 nm	507.5 – 552.5 nm	330 – 499 nm	561 - 900 nm	405, 445, 488, 633 nm	45 nm	50 nm	FBP01-530/45-12.5
555 nm	533 – 577 nm	330 – 525 nm	637 - 900 nm	405, 445, 488, 532 nm	44 nm	50 nm	FBP01-555/44-12.5
580 nm	558 – 602 nm	330 – 549 nm	612 - 900 nm	405, 445, 488, 532, 633 nm	44 nm	50 nm	FBP01-580/44-12.5
605 nm	583 – 627 nm	330 – 574 nm	637 – 900 nm	405, 445, 488, 532 nm	44 nm	50 nm	FBP01-605/44-12.5
630 nm	608 – 652 nm	330 – 598 nm	662 – 900 nm	405, 445, 488, 532 nm	44 nm	50 nm	FBP01-630/44-12.5
655 nm	633.5 – 676.5 nm	330 – 623 nm	687 – 900 nm	405, 445, 488, 532 nm	43 nm	50 nm	FBP01-655/43-12.5
680 nm	658.5 – 701.5 nm	330 – 648 nm	713 – 900 nm	405, 445, 488, 532, 633 nm	43 nm	50 nm	FBP01-680/43-12.5
705 nm	683.5 – 726.5 nm	330 – 673 nm	738 – 900 nm	405, 445, 488, 532, 633 nm	43 nm	50 nm	FBP01-705/43-12.5
730 nm	708.5 – 751.5 nm	330 – 697 nm	763 – 900 nm	405, 445, 488, 532, 633 nm	43 nm	50 nm	FBP01-730/43-12.5
NIR							
755 nm	734 – 776 nm	330 – 722 nm	788 – 900 nm	405, 445, 488, 532, 633 nm	42 nm	50 nm	FBP01-755/42-12.5
780 nm	759 – 801 nm	330 – 747 nm	814 – 900 nm	405, 445, 488, 532, 633 nm	42 nm	50 nm	FBP01-780/42-12.5
805 nm	784 – 826 nm	330 – 772 nm	839 – 900 nm	405, 445, 488, 532, 633 nm	42 nm	50 nm	FBP01-805/42-12.5
830 nm	809 – 851 nm	330 – 796 nm	864 – 900 nm	405, 445, 488, 532, 633 nm	42 nm	50 nm	FBP01-830/42-12.5
855 nm	834.5 – 875.5 nm	330 – 821 nm	889 – 900 nm	405, 445, 488, 532, 633, 785 nm	41 nm	50 nm	FBP01-855/41-12.5
880 nm	859.5 - 900.5 nm	330 - 846 nm	—	405, 445, 488, 532, 633, 785 nm	41 nm	50 nm	FBP01-880/41-12.5

EdgeBasic™

EdgeBasic™ long-wave pass and short-wave pass filters offer a superb combination of performance and value in Raman spectroscopy and fluorescence applications. These filters are ideal for specific Raman applications that do not require measurement of the narrowest Raman shifts, yet demand exceptional laser-line blocking and high transmission over a range of Raman lines.

LEARN MORE ABOUT BRIGHTLINE BASIC™ AT IDEX-HS.COM/INFO-EDGEBASIC

Key Features:

- **Deep laser-line blocking:** For maximum laser rejection (OD > 6).
- **Extended short-wavelength blocking:** For high-fidelity fluorescence imaging.
- **High signal transmission:** To detect the weakest signals (> 98% typical).

EdgeBasic™ Long Wave Pass

λ Nominal Laser Wavelength	Laser Wavelength Range λ short	λ long	Passband (T_{avg} > 93%)	Part Number
325 nm	325.0 nm	325.0 nm	334.1 – 900 nm	BLP01-325R-25
355 nm	355.0 nm	355.0 nm	364.9 – 900 nm	BLP01-355R-25
363.8 nm	363.8 nm	363.8 nm	374.0 – 900 nm	BLP01-364R-25
405 nm	400.0 nm	410.0 nm	421.5 – 900 nm	BLP01-405R-25
441.6 nm	441.6 nm	441.6 nm	454.0 – 900 nm	BLP01-442R-25
457.9 nm	439.0 nm	457.9 nm	470.7 – 900 nm	BLP01-458R-25
473 nm	473.0 nm	473.0 nm	486.2 – 900 nm	BLP01-473R-25
488 nm	486.0 nm	491.0 nm	504.7 – 900 nm	BLP01-488R-25
514.5 nm	505.0 nm	515.0 nm	529.4 – 900 nm	BLP01-514R-25
532 nm	532.0 nm	532.0 nm	546.9 – 900 nm	BLP01-532R-25
561.4 nm	561.4 nm	561.4 nm	577.1 – 900 nm	BLP02-561R-25
568.2 nm	561.4 nm	568.2 nm	584.1 – 900 nm	BLP01-568R-25
594 nm	593.5 nm	594.3 nm	610.9 – 900 nm	BLP01-594R-25
632.8 nm	632.8 nm	632.8 nm	650.5 – 1200 nm	BLP01-633R-25
635 nm	632.8 nm	642.0 nm	660.0 – 1200 nm	BLP01-635R-25
647.1 nm	647.1 nm	647.1 nm	665.2 – 1200 nm	BLP01-647R-25
664 nm	664.0 nm	664.0 nm	682.6 – 1200 nm	BLP01-664R-25
785 nm	780.0 nm	790.0 nm	812.1 – 1200 nm	BLP01-785R-25
808 nm	808.0 nm	808.0 nm	830.6 – 1600 nm	BLP01-808R-25
830 nm	830.0 nm	830.0 nm	853.2 – 1600 nm	BLP01-830R-25
980 nm	980.0 nm	980.0 nm	1007.4 – 1600 nm	BLP01-980R-25
1064 nm	1064.0 nm	1064.0 nm	1093.8 – 1600 nm	BLP01-1064R-25
1319 nm	1319.0 nm	1319.0 nm	1355.9 – 2000 nm	BLP02-1319R-25
1550 mm	1550.0 nm	1550.0 nm	1593.4 – 2000 nm	BLP01-1550R-25

EdgeBasic™ Short Wave Pass

λ Nominal Laser Wavelength	Laser Wavelength Range λ short	λ long	Passband (T_{avg} > 93%)	Part Number
532 nm	532.0 nm	532.0 nm	350.0 – 517.1 nm	BSP01-532R-25
632.8 nm	632.8 nm	647.1 nm	350.0 – 615.1 nm	BSP01-633R-25
785 nm	780.0 nm	790.0 nm	350.0 – 758.2 nm	BSP01-785R-25

PRODUCT NOTE

Essential Performance Fundamentals

Many filter types exist, including widely used off-the-shelf varieties and custom optical filters designed for specific applications. Each filter offers unique properties to exert precise light control. Some of the most common types are depicted in Figure 2. While each filter type has a unique spectral response, there exist common spectral and physical specifications across all filter types.

A fluorescence filter set, such as those used in fluorescence microscopy, consists of an excitation bandpass filter, a dichroic mirror, and an emission bandpass filter. Filter sets are designed to work together to achieve optimal brightness, contrast, or both for particular fluorophores. Our BrightLine Basic™ family is a set of such filters optimized for popular fluorophores.

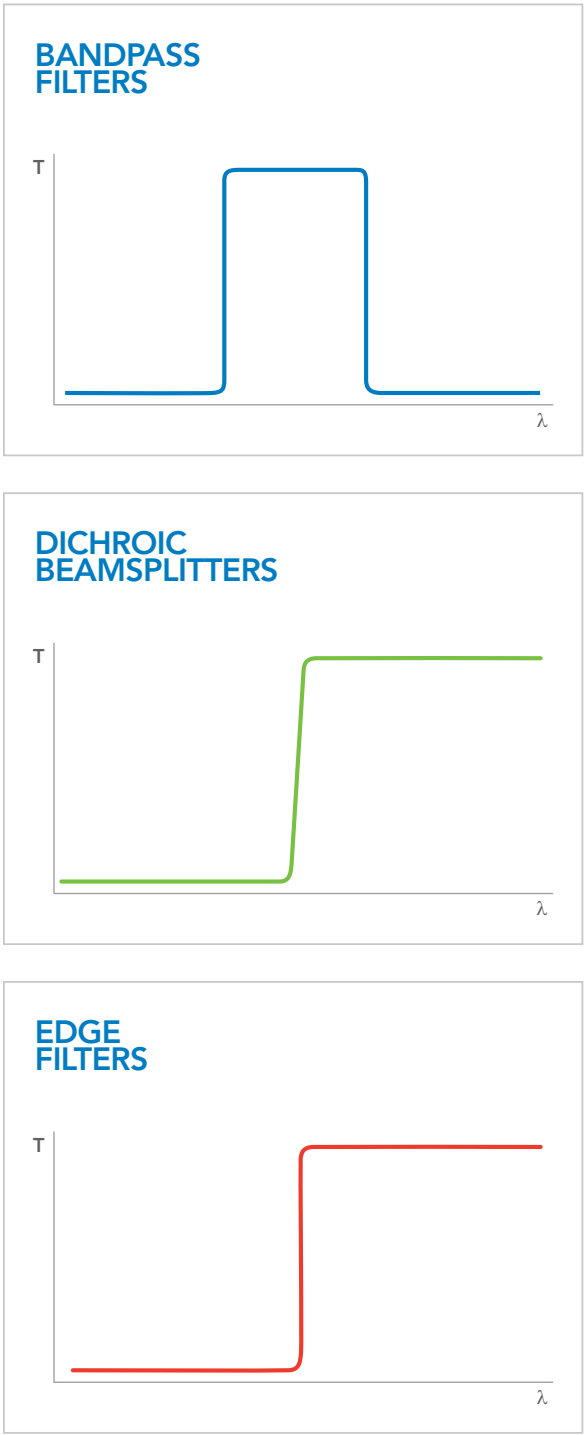


Figure 2. Common optical filter types.

TECHNICAL NOTE

Spectral Specifications

Spectral requirements are the main cost drivers for a given filter. As specifications become more stringent – wider wavelength regions, higher specification values, steeper edges – the coating design requires the deposition of a higher number of coating layers. As the number of coating layers increases, the time required in the coating chamber increases, directly increasing costs. Selectively determining which specifications require higher performance levels controls a filter's final cost. At times, one may place many spectral requirements on a filter without considering the spectral characteristics of other system components. Specifying filter performance outside the operation range of the application or instrument should be avoided. To determine which specifications require a higher level of performance (e.g., deeper OD blocking or higher transmission), one should consider the following:

- Blocking levels at specific wavelengths or wavelength regions.
- Spectrum of the light source.
- Responsivity of the detector or camera.
- Transmission or blocking of other optical components in the system.

Transmission

Usually specified as a percentage of incident light, transmission is the portion of light passing through the filter without being absorbed or reflected. Transmission is calculated as:

$$T\% = 100 * (I_T / I_O)$$

I_T = Intensity transmitted through the filter

I_O = Intensity incident on the filter

Nanopede™, BrightLine®, BrightLine Basic™, and Avant™ filter families are specified as T_{avg}>93% over the passband for bandpass filters and over the transmission region for the dichroics. BrightLine® 2.0 is specified as T_{avg}>95% over the passband for bandpass filters and over the transmission region for the dichroics.

Transmission may be specified as an absolute specification (T_{abs}) or an average specification (T_{avg}). T_{abs} requires the filter's transmission to never fall below the T% specification across the wavelength range. T_{avg} allows the filter's transmission to fall below the T% specification as long as the average T% value across the wavelength range is maintained. An absolute specification may reduce the filter's production yield and thus increase costs.

Essential Specifications Summary to Limit Costs

- T_{avg} specifications have a better yield than T_{abs} specifications

TECHNICAL NOTE

Spectral Specifications (Continued)

Blocking

Blocking is defined as the wavelength range over which minimal transmission is desired. Often, transmission is a small value, thus, better described as a logarithmic blocking value. Blocking is measured in units of Optical Density (OD), defined as:

$$OD = -\text{Log}_{10}(T)$$

T = Intensity transmitted through the filter, expressed as a value between 0 and 1.

Deeper OD blocking translates as lower transmission – OD1 = 10% transmission, whereas OD6 = 0.0001% transmission (one photon in a million passes through the filter).

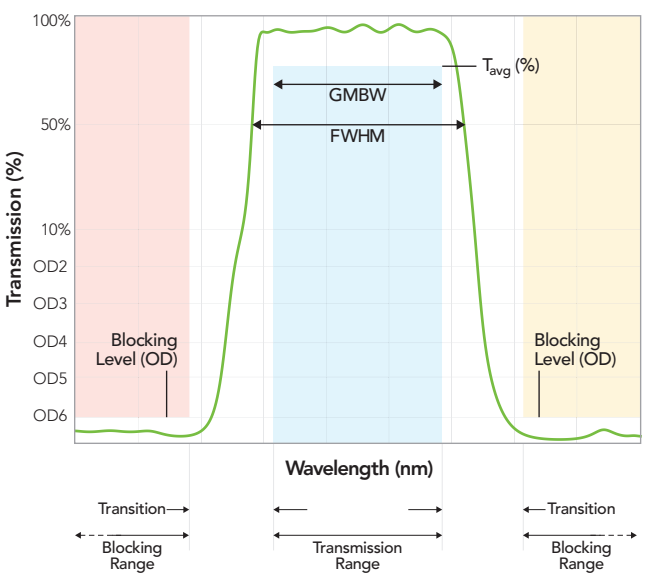


Figure 3. Diagram depicting filter specifications versus filter spectral response.

When considering transmission and blocking, the wavelength range and specification value should be optimized as much as possible. As wavelength ranges and specification values increase, additional coating layers are required, thereby increasing production costs. Nanopede™ and BrightLine Basic™ specify blocking to 900 nm, whereas BrightLine® 2.0 and Avant™ provide blocking to 1100 nm. Higher levels of transmission (≳95%) or blocking (≳OD6) over wide wavelength ranges should be specified only as necessary.

Essential Specifications Summary to Limit Costs

- OD_{avg} has a better yield than OD_{abs} – only use OD_{abs} as needed by the system.
- Analyze the depth of blocking; deeper OD means more coating layers. Consider OD5 in critical wavelength regions and OD3 in non-critical regions.
- Consider the breadth of blocking; blocking further from the passband increases coating layers. For example, examine detector responsivity in the near IR.

Reflection

When a filter operates at a non-normal angle of incidence (AOI), one may consider reflection instead of transmission, particularly for high AOIs such as dichroics at 45 degrees. Reflection is typically defined as:

$$R = 1 - T - A$$

For most filters, absorption is negligible and is considered = 0. Absorption should be considered in the UV wavelength region where substrate material absorption increases.

Higher reflection specifications require more coating layers on both sides of the filter. The second side coating is typically an AR coating. Additionally, the reflection specification's wavelength range affects the number of required coating layers. Determine the light source's emission spectrum and limit the reflection specification to the appropriate wavelength region(s).

Essential Specifications Summary to Limit Costs

- R_{avg} specifications have a better yield than R_{abs} specifications.
- Limit the breadth of reflection to the regions of interest in the system. Broader reflection requires more coating layers.

TECHNICAL NOTE

Spectral Specifications (Continued)

Transition Width and Edge Steepness

Transition width is the maximum allowed spectral width between the laser line (where OD > 6) and the 50% transmission wavelength. Transition width can be thought of as the "goal posts" between which the actual filter spectral response must fall.

Edge steepness is the actual spectral steepness of a filter, measured from the highest wavelength exhibiting OD6 blocking to the 50% transmission wavelength. A filter's edge steepness is greater than (steeper) than the transition width specification.

The following diagram shows the relationship between transition width and edge steepness (Figure 4):

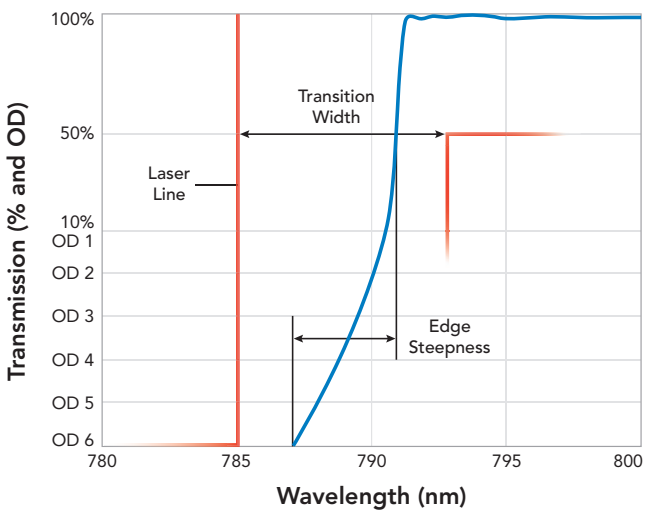


Figure 4. Transition width and edge steepness.

These requirements can be specified in wavelength (e.g., 6 nm), percent of the laser wavelength (e.g., 1% of 633 nm), or in wavenumbers (cm^{-1}). Tighter transition widths and steeper edges increase the number of coating layers, with the tightest transitions and steepest edges requiring thick coatings.

IDEX Health & Science | Semrock offers three types of edge filters. EdgeBasic™ filters are identified by their 50% transmission wavelength. Their edge steepness is targeted to be 1.5% of this wavelength. RazorEdge® and Verona™ edge filters are typically used with laser sources and are specified with respect to the laser wavelength. The edge steepness of the RazorEdge® and Verona™ filters is 0.5% and 0.2% of the laser wavelength, respectively.

Edge steepness for bandpass filters is measured from OD3.5 to the transmission region. In Figure 5, the edge steepness increases as requirements move from essential specifications to premium specifications. BrightLine Basic™ has the least steep edge, while Avant™ has the steepest edge. BrightLine® 2.0 strikes a balance between edge steepness, price, and performance.

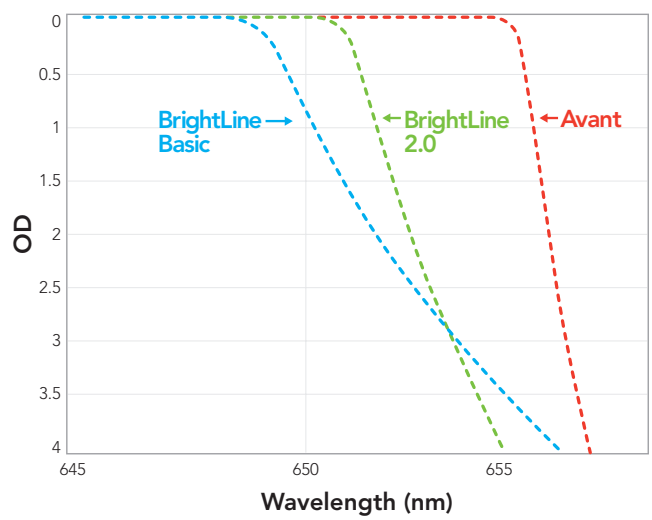


Figure 5. Bandpass edge steepness comparison.

Essential Specifications Summary to Limit Costs

- Wider transition widths reduce coating layers. Consider ≳2.5% of the wavelength of interest.
- Wider edge steepness reduces coating layers. Consider ≳1.5% of the wavelength of interest.
- For paired bandpass filters, widen the edge steepness on the non-critical edge to further reduce coating layers (≳2%).

TECHNICAL NOTE

Spectral Specifications (Continued)

Cosmetic Specifications

Scratches (S) and digs (D) are commonly specified together and noted as S/D. S specifies the maximum allowable scratch width in microns. D specifies the maximum allowable size of holes, bubbles, and other defects. Digs are specified in units of 10 microns - a dig specification of 40 equates to an imperfection of 400 microns in diameter. Scratch and dig specifications only apply within the clear aperture of the filter.

A standard S/D specification is 60/40, which is acceptable for most imaging applications. Relaxing the S/D to 80/50 increases production yields and reduces production costs; this cosmetic specification may be acceptable for non-imaging applications. The Nanopede filter family has 80/50 S/D, which tends to be acceptable for scattered light and point detectors, while all other Semrock product families meet 60/40 S/D.

Essential Specifications Summary to Limit Costs

- Consider the impact of looser cosmetic specifications on your system to increase yield, especially for filters with a large clear aperture (≳ 40 mm dimension).

Conclusion

At IDEX Health & Science, our mission is to assist customers through collaborative partnerships. As specification experts, we guide projects from concept to production, handle system upgrades, and accommodate non-standard packaging. Our focus is always on finding optimal solutions for your specific needs. The iterative process of optimizing specifications for application performance, while minimizing costs, involves input from various teams, including customers, sales engineers, optical engineers, quality assurance, and logistics.

These new Essential Performance product families demonstrate our commitment to customized solutions with strict cost control, and prove that our rapid prototyping capabilities and agile manufacturing processes deliver custom-designed filters at best-in-class lead times with exceptional economic value.

Our BrightLine Basic™, EdgeBasic™, and Nanopede™ product families embody our commitment to delivering *Essential Performance* with filters that meet the necessary technical requirements without the unnecessary costs associated with over-specifying. By focusing on the *critical* spectral and physical specifications, we've created a portfolio that maintains the Semrock quality and reliability you expect, but at budget-friendly prices. We encourage you to use the insights in this catalog to strategically select or specify the optimal optical solution, ensuring you receive best-in-class value and performance that is matched to your application and budget.

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Semrock

Semrock, Inc. manufactures optical filters that set the standard for the life science and analytical instrumentation industries, as well as optical filters and mirrors for laser and optical systems. OEM filters are manufactured in volume using thin-film sputtering and proprietary volume manufacturing technology. All Semrock products carry a ten-year warranty.

Founded in September 2000, Semrock is based in Rochester, New York, a well-known world center for optics, and has sales offices throughout the United States. In October 2008 Semrock became a unit of IDEX Corporation.

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All prices are domestic USD and subject to change without notice. Check our website for current pricing and availability.

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Orders received for catalog products will be reviewed for best possible delivery date within 48 hours. Domestic orders are shipped UPS Ground or 2-day, unless otherwise requested. We also accept customers' shipping account numbers for direct carrier billing.

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