

## A COMPLETE CATALOG OF INFRARED OPTICS



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**Spectral Systems**  
PRECISION IN OPTICS 

**Spectral Systems** is the leader in precise infrared optical components, coatings, systems integration and services from original concept through final production. Founded over thirty years ago, today we are an employee-owned company with a renewed commitment to our customer's success.

Why are customers first? The only true worth of a company is what it delivers to its customers, not the size of its profits or its facilities. Only great customer relationships! Our philosophy is "We succeed when our customers succeed." Whether supplying infrared transmission windows, infrared lenses, mirrors, Attenuated Total Reflectance (ATR) crystals, FT-IR beamsplitters, anti-reflection coatings or infrared microscopy optical elements, our goal is for you to be delighted with the quality and service provided.

The Spectral Systems difference starts with its large staff of dedicated employees. Over half of our team members have more than 15 years of optical manufacturing experience. This experience ensures your optics are made to specification every time. Even better, this experience is fully accessible for our customers. Our infrared optical system's expertise is only a phone call or email away. The Spectral Systems difference also includes our facilities located in East Fishkill, New York, and Milford, Connecticut, which are equipped with state-of-the-art polishing, coating and inspection equipment to ensure your optics are fabricated consistently and efficiently.

We have the most comprehensive capabilities to provide optical solutions for the entire infrared range, from the vacuum UV to the far-IR. No one else can cover the infrared spectrum better than Spectral Systems. We routinely work with over 16 infrared materials and have a broad range of proprietary coating solutions to meet all your needs. Before shipping your orders, we test and evaluate using the most advanced dimensional measurement equipment ensuring that you receive consistent and highest quality products.

Thank you for the opportunity to exceed your expectations. We hope you find our catalog of infrared optics to be a helpful resource. If what you need is not listed, please contact us to create custom infrared optics to your specifications.



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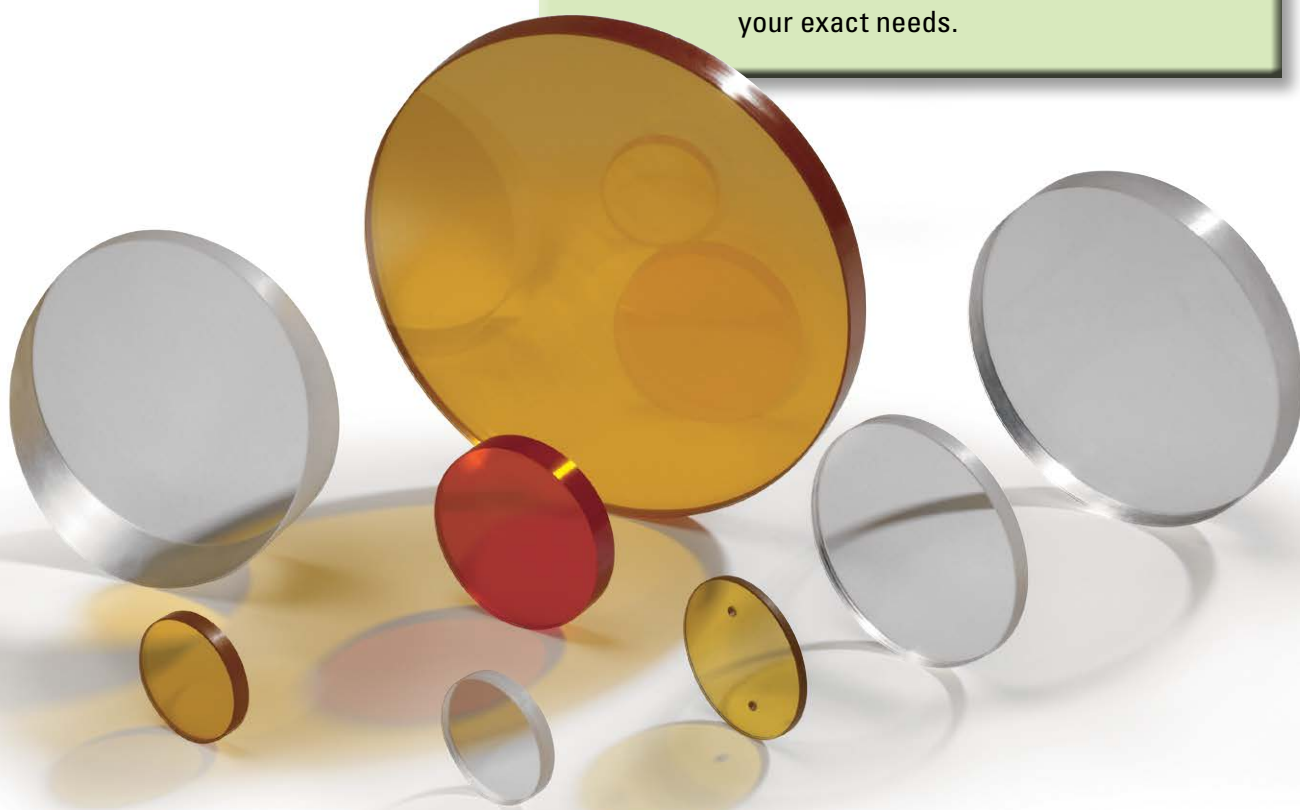


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### CUSTOM PRODUCTS

Spectral Systems offers the broadest selection of infrared optics in the industry with products ranging from infrared windows to liquid cells to infrared beamsplitters. We know that every business has its unique demands. That is why we will work with you to develop any custom product required for your exact needs.







## Infrared Sampling and Environment Containment

- Highest purity window materials for highest quality infrared spectral data
- Exceptional manufactured finish for highest performance and durability
- Anti-reflective and protective coatings available to maximize throughput and lifetime
- Wedging options available for high resolution measurements

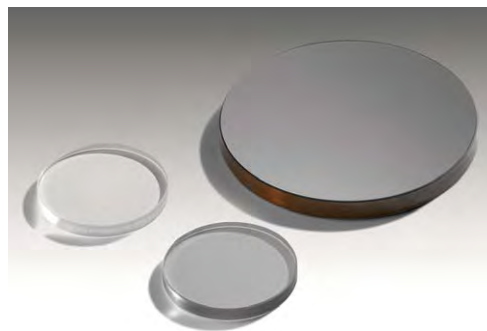
The Spectral Systems Infrared Windows are available in a wide variety of sizes, shapes and materials for measurement and operation in the infrared spectral domain.

All of our windows are manufactured of the highest quality material to provide optimum spectral quality free of stray absorbance bands. All of our windows are manufactured with maximum flatness for precision quantitative analysis and to operate leak free. Window edges are precision beveled to prevent window fracture and optimize a seal for gas or liquid sampling and for vacuum operation.

Our high quality infrared windows are a cost savings for you with reduced material replacement and more efficient measurement success rate.

### SPECIFICATIONS

Window Geometry	Disk or rectangular
Window Diameter	+0.0/-0.13 mm
Window Length, Width	±0.13 mm of stated values
Window Thickness	±0.13 mm of stated value
Window Flatness	$\lambda/5$ at 10.6 $\mu\text{m}$ (except KRS-5 and Polyethylene)
Window Edges	Precision beveled



### Specialized Coatings

Spectral Systems offer many of their infrared window materials with specialized coatings to improve performance or for special applications. Anti-reflective (AR) coatings can be applied to increase throughput of high refractive index materials. We offer broad band anti-reflective (Spectral Systems XP-BBAR™) and narrow band anti-reflective (Spectral Systems XP-NBAR™) versions. Our proprietary XP-BBAR and XP-NBAR coatings are designed to provide the highest throughput, widest and flat spectral region and exceptional durability with respect to abrasive, environmental and chemical exposures. Our XP-Halide™ or XP-Polymer™ coatings can also be applied to hygroscopic materials to specifically improve their performance in humid environments.

### Window Wedging

For some infrared sampling, it may be desirable to use a wedged window to minimize undesirable features in high resolution spectral measurements. Please ask us about your application.

## ORDERING INFORMATION – DISKS

### BaF<sub>2</sub> Disks

DESCRIPTION	PART NO.
13 × 2 mm Disk	915-3016
13 × 2 mm, 4 Pack	915-6013
15 × 2 mm Disk	915-3116
19 × 2 mm Disk	915-3216
20 × 2 mm Disk	915-3316
25 × 2 mm Disk	915-3516
25 × 2 mm, 4 Pack	915-6025
25 × 4 mm Disk	915-3616
32 × 3 mm Disk	915-3716
32 × 3 mm, 4 Pack	915-6032
32 × 3 mm Drilled Disk	915-3717
32 × 3 mm Drilled, 4 Pack	915-6033
38 × 3 mm Disk	915-3815
38 × 6 mm Disk	915-3816
41 × 3 mm Disk	915-3916
49 × 6 mm Disk	915-4016
50 × 3 mm Disk	915-4116

### CaF<sub>2</sub> Disks

DESCRIPTION	PART NO.
13 × 2 mm Disk	920-3016
13 × 2 mm, 4 Pack	920-6013
19 × 2 mm Disk	920-3216
20 × 2 mm Disk	920-3316
22 × 4 mm Disk	920-3416
25 × 2 mm Disk	920-3516
25 × 2 mm, 4 Pack	920-6025
25 × 4 mm Disk	920-3616
25 × 5 mm Disk	920-3618
32 × 3 mm Disk	920-3716
32 × 3 mm, 4 Pack	920-6032
32 × 3 mm Drilled Disk	920-3717
32 × 3 mm Drilled, 4 Pack	920-6033
38 × 3 mm Disk	920-3815
38 × 6 mm Disk	920-3816
41 × 3 mm Disk	920-3916
44 × 3 mm Disk	920-4403
49 × 6 mm Disk	920-4016
50 × 3 mm Disk	920-4116



### CdTe Disks

DESCRIPTION	PART NO.
12 × 1 mm Disk	925-1201
25 × 2 mm Disk	925-3516
38 × 2 mm Disk	925-3814
50 × 3 mm Disk	925-4116

### CsI Disks

DESCRIPTION	PART NO.
13 × 2 mm Disk	935-3016
25 × 2 mm Disk	935-3516
32 × 3 mm Disk	935-3716

### Ge Disks

DESCRIPTION	PART NO.
13 × 2 mm Disk	940-3016
19 × 2 mm Disk	940-3216
20 × 2 mm Disk	940-3316
25 × 2 mm Disk	940-3516
25 × 4 mm Disk	940-3616
32 × 3 mm Disk	940-3716
32 × 3 mm Drilled Disk	940-3717
38 × 3 mm Disk	940-3815
41 × 3 mm Disk	940-3916
50 × 3 mm Disk	940-4116

### Ge Disks, XP-BBAR Coated (2–14 micron)

DESCRIPTION	PART NO.
13 × 2 mm Disk	940-3016C
19 × 2 mm Disk	940-3216C
20 × 2 mm Disk	940-3316C
25 × 1 mm Disk	940-3515C
25 × 2 mm Disk	940-3516C
25 × 4 mm Disk	940-3616C
32 × 3 mm Disk	940-3716C
32 × 3 mm Drilled Disk	940-3717C
38 × 3 mm Disk	940-3815C
41 × 3 mm Disk	940-3916C
50 × 3 mm Disk	940-4116C

### Ge Disks, XP-NBAR Coated (8–12 micron)

DESCRIPTION	PART NO.
13 × 2 mm Disk	940-3016D
19 × 2 mm Disk	940-3216D
20 × 2 mm Disk	940-3316D
25 × 1 mm Disk	940-3515D
25 × 2 mm Disk	940-3516D
25 × 4 mm Disk	940-3616D
32 × 3 mm Disk	940-3716D
32 × 3 mm Drilled Disk	940-3717D
38 × 3 mm Disk	940-3815D
41 × 3 mm Disk	940-3916D
50 × 3 mm Disk	940-4116D

### IR Quartz Disks

DESCRIPTION	PART NO.
32 × 3 mm Disk	965-3716
32 × 3 mm Drilled Disk	965-3717

### KBr Disks

DESCRIPTION	PART NO.
6 × 1.5 mm Disk	945-2750
13 × 1 mm Disk	945-3015
13 × 2 mm Disk	945-3016
13 × 2 mm, 6 Pack	945-6013
18 × 1.5 mm Disk	945-3215
19 × 2 mm Disk	945-3216
20 × 2 mm Disk	945-3316
22 × 4 mm Disk	945-3416
25 × 2 mm Disk	945-3516
25 × 4 mm Disk	945-3616
25 × 4 mm, 6 Pack	945-6025
25 × 5 mm Disk	945-3618

30 × 4 mm Disk	945-3700
32 × 3 mm Disk	945-3716
32 × 3 mm, 6 Pack	945-6032
32 × 3 mm Drilled Disk	945-3717
32 × 3 mm Drilled, 6 Pack	945-6033
38 × 3 mm Disk	945-3815
38 × 6 mm Disk	945-3816
44 × 3 mm Disk	945-4403
49 × 6 mm Disk	945-4016
50 × 3 mm Disk	945-4116

### KBr Disks, XP-Halide Coated for Humidity Protection

DESCRIPTION	PART NO.
6 × 1.5 mm Disk	945-2750C
13 × 1 mm Disk	945-3015C
13 × 2 mm Disk	945-3016C
18 × 1.5 mm Disk	945-3215C
19 × 2 mm Disk	945-3216C
20 × 2 mm Disk	945-3316C
22 × 4 mm Disk	945-3416C
25 × 2 mm Disk	945-3516C
25 × 4 mm Disk	945-3616C
25 × 5 mm Disk	945-3618C
30 × 4 mm Disk	945-3700C
32 × 3 mm Disk	945-3716C
32 × 3 mm Drilled Disk	945-3717C
38 × 3 mm Disk	945-3815C
38 × 6 mm Disk	945-3816C
44 × 3 mm Disk	945-4403C
49 × 6 mm Disk	945-4016C
50 × 3 mm Disk	945-4116C

For options not shown here, please contact Spectral Systems.

### KBr Disks, XP-Polymer Coated for Humidity Protection

DESCRIPTION	PART NO.
6 × 1.5 mm Disk	945-2750P
13 × 1 mm Disk	945-3015P
13 × 2 mm Disk	945-3016P
18 × 1.5 mm Disk	945-3215P
19 × 2 mm Disk	945-3216P
20 × 2 mm Disk	945-3316P
22 × 4 mm Disk	945-3416P
25 × 2 mm Disk	945-3516P
25 × 4 mm Disk	945-3616P
25 × 5 mm Disk	945-3618P
30 × 4 mm Disk	945-3700P
32 × 3 mm Disk	945-3716P
32 × 3 mm Drilled Disk	945-3717P
38 × 3 mm Disk	945-3815P
38 × 6 mm Disk	945-3816P
44 × 3 mm Disk	945-4403P
49 × 6 mm Disk	945-4016P
50 × 3 mm Disk	945-4116P

### KBr Disks, Wedged

DESCRIPTION	PART NO.
7 × 0.9 mm Disk	945-0705W
19 × 2 mm Disk	945-3216W
25 × 4 mm Disk	945-3616W
32 × 3 mm Drilled Disk	945-3717W
32 × 3 mm Disk	945-3716W
34 × 3 mm Disk	945-3773W
41 × 3 mm Disk	945-3916W
45 × 3 mm Disk	945-3951W
56,74 × 6.35 mm Disk	945-5674W

### KRS-5 Disks

DESCRIPTION	PART NO.
32 × 3 mm Disk	950-3716
32 × 3 mm Drilled Disk	950-3717

### NaCl Disks

DESCRIPTION	PART NO.
13 × 2 mm Disk	955-3016
13 × 2 mm, 6 Pack	955-6013
19 × 2 mm Disk	955-3216
20 × 2 mm Disk	955-3316

25 × 2 mm Disk	955-3516
25 × 4 mm Disk	955-3616
25 × 4 mm, 6 Pack	955-6025
25 × 5 mm Disk	955-3618
32 × 3 mm Disk	955-3716
32 × 3 mm, 6 Pack	955-6032
32 × 3 mm Drilled Disk	955-3717
32 × 3 mm Drilled, 6 Pack	955-6033
38 × 6 mm Disk	955-3816
41 × 3 mm Disk	955-3916
49 × 6 mm Disk	955-4016
50 × 3 mm Disk	955-4116

### NaCl Disks, XP-Halide Coated for Humidity Protection

DESCRIPTION	PART NO.
13 × 2 mm Disk	955-3016C
19 × 2 mm Disk	955-3216C
20 × 2 mm Disk	955-3316C
25 × 2 mm Disk	955-3516C
25 × 4 mm Disk	955-3616C
25 × 5 mm Disk	955-3618C
32 × 3 mm Disk	955-3716C
32 × 3 mm Drilled Disk	955-3717C
38 × 6 mm Disk	955-3816C
41 × 3 mm Disk	955-3916C
49 × 6 mm Disk	955-4016C
50 × 3 mm Disk	955-4116C

### NaCl Disks, XP-Polymer Coated for Humidity Protection

DESCRIPTION	PART NO.
13 × 2 mm Disk	955-3016P
19 × 2 mm Disk	955-3216P
20 × 2 mm Disk	955-3316P
25 × 2 mm Disk	955-3516P
25 × 4 mm Disk	955-3616P
25 × 5 mm Disk	955-3618P
32 × 3 mm Disk	955-3716P
32 × 3 mm Drilled Disk	955-3717P
38 × 6 mm Disk	955-3816P
41 × 3 mm Disk	955-3916P
49 × 6 mm Disk	955-4016P
50 × 3 mm Disk	955-4116P

### Polyethylene Disks

DESCRIPTION	PART NO.
32 × 3 mm Disk	957-3716
32 × 3 mm Drilled Disk	957-3717

### Si Disks

DESCRIPTION	PART NO.
13 × 2 mm Disk	960-3016
32 × 3 mm Disk	960-3716
32 × 3 mm Drilled Disk	960-3717
38 × 6 mm Disk	960-3816

### ZnS Disks

DESCRIPTION	PART NO.
13 × 2 mm Disk	971-3016
20 × 2 mm Disk	971-3316
25 × 2 mm Disk	971-3516
32 × 3 mm Disk	971-3716
32 × 3 mm Drilled Disk	971-3717
38 × 3 mm Disk	971-3816
41 × 3 mm Disk	971-3916
49 × 3 mm Disk	971-4016
50 × 3 mm Disk	971-4116

### ZnSe Disks

DESCRIPTION	PART NO.
13 × 2 mm Disk	975-3016
13 × 2 mm, 3 Pack	975-6025
19 × 2 mm Disk	975-3216
20 × 2 mm Disk	975-3316
22 × 2 mm Disk	975-3416
25 × 2 mm Disk	975-3516
25 × 2 mm, 3 Pack	975-6025
25 × 4 mm Disk	975-3616
25 × 5 mm Disk	975-3618
32 × 3 mm Disk	975-3716
32 × 3 mm, 3 Pack	975-6032
32 × 3 mm Drilled Disk	975-3717
32 × 3 mm Drilled, 3 Pack	975-6033
38 × 3 mm Disk	975-3816
41 × 3 mm Disk	975-3916
49 × 3 mm Disk	975-4016
50 × 3 mm Disk	975-4116

### ZnSe Disks, XP-BBAR Coated (2-14 micron)

DESCRIPTION	PART NO.
13 × 2 mm Disk	975-3016C
19 × 2 mm Disk	975-3216C
20 × 2 mm Disk	975-3316C
22 × 2 mm Disk	975-3416C
25 × 2 mm Disk	975-3516C
25 × 4 mm Disk	975-3617C
25 × 5 mm Disk	975-3618C
32 × 3 mm Disk	975-3716C
32 × 3 mm Drilled Disk	975-3717C
38 × 3 mm Disk	975-3816C
41 × 3 mm Disk	975-3916C
49 × 3 mm Disk	975-4016C
50 × 3 mm Disk	975-4116C

### ZnSe Disks, Wedged, XP-BBAR Coated (2-14 micron)

DESCRIPTION	PART NO.
25 × 2 mm W20 mrad Disk	975-3519C
45 × 3 mm W6 mrad Disk	975-3920C

### ZnSe Disks, XP-NBAR Coated (8-12 micron)

DESCRIPTION	PART NO.
13 × 2 mm Disk	975-3016D
19 × 2 mm Disk	975-3216D
20 × 2 mm Disk	975-3316D
22 × 2 mm Disk	975-3416D
25 × 2 mm Disk	975-3516D
25 × 4 mm Disk	975-3617D
25 × 5 mm Disk	975-3618D
32 × 3 mm Disk	975-3716D
32 × 3 mm Drilled Disk	975-3717D
38 × 3 mm Disk	975-3816D
41 × 3 mm Disk	975-3916D
49 × 3 mm Disk	975-4016D
50 × 3 mm Disk	975-4116D



## ORDERING INFORMATION – RECTANGLES

### BaF<sub>2</sub> Rectangles

DESCRIPTION	PART NO.
30 × 15 × 4 mm Rectangle	915-5226
30 × 15 × 4 mm Drilled Rectangle	915-5227
38 × 19 × 4 mm Rectangle	915-5326
38 × 19 × 4 mm Drilled Rectangle	915-5328

### CaF<sub>2</sub> Rectangles

DESCRIPTION	PART NO.
25 × 12 × 2 mm Rectangle	920-5026
30 × 15 × 4 mm Rectangle	920-5226
30 × 15 × 4 mm Drilled Rectangle	920-5227
38 × 19 × 4 mm Rectangle	920-5326
38 × 19 × 4 mm Drilled Rectangle	920-5328

### Ge Rectangles

DESCRIPTION	PART NO.
30 × 15 × 4 mm Rectangle	940-5226
30 × 15 × 4 mm Drilled Rectangle	940-5227
38 × 19 × 4 mm Rectangle	940-5326
38 × 19 × 4 mm Drilled Rectangle	940-5328

### KBr Rectangles

DESCRIPTION	PART NO.
25 × 25 × 4 mm Rectangle	945-5126
30 × 15 × 4 mm Rectangle	945-5226
30 × 15 × 4 mm Drilled Rectangle	945-5227
38 × 19 × 4 mm Rectangle	945-5326
38 × 19 × 4 mm Drilled Rectangle	945-5328

### KBr Rectangles, XP-Halide Coated for Humidity Protection

DESCRIPTION	PART NO.
25 × 25 × 4 mm Rectangle	945-5126C
30 × 15 × 4 mm Rectangle	945-5226C
30 × 15 × 4 mm Drilled Rectangle	945-5227C
38 × 19 × 4 mm Rectangle	945-5326C
38 × 19 × 4 mm Drilled Rectangle	945-5328C

### KBr Rectangles, XP-Polymer Coated for Humidity Protection

DESCRIPTION	PART NO.
25 × 25 × 4 mm Rectangle	945-5126P
30 × 15 × 4 mm Rectangle	945-5226P
30 × 15 × 4 mm Drilled Rectangle	945-5227P
38 × 19 × 4 mm Rectangle	945-5326P
38 × 19 × 4 mm Drilled Rectangle	945-5328P

### NaCl Rectangles

DESCRIPTION	PART NO.
25 × 12 × 2 mm Rectangle	955-5026
30 × 15 × 4 mm Rectangle	955-5226
30 × 15 × 4 mm Drilled Rectangle	955-5227
38 × 19 × 4 mm Rectangle	955-5326
38 × 19 × 4 mm Drilled Rectangle	955-5328
41 × 23 × 6 mm Rectangle	955-5426

### NaCl Rectangles, XP-Halide Coated for Humidity Protection

DESCRIPTION	PART NO.
25 × 12 × 2 mm Rectangle	955-5026C
30 × 15 × 4 mm Rectangle	955-5226C
30 × 15 × 4 mm Drilled Rectangle	955-5227C
38 × 19 × 4 mm Rectangle	955-5326C
38 × 19 × 4 mm Drilled Rectangle	955-5328C
41 × 23 × 6 mm Rectangle	955-5426C

### NaCl Rectangles, XP-Polymer Coated for Humidity Protection

DESCRIPTION	PART NO.
25 × 12 × 2 mm Rectangle	955-5026P
30 × 15 × 4 mm Rectangle	955-5226P
30 × 15 × 4 mm Drilled Rectangle	955-5227P
38 × 19 × 4 mm Rectangle	955-5326P
38 × 19 × 4 mm Drilled Rectangle	955-5328P
41 × 23 × 6 mm Rectangle	955-5426P

### ZnSe Rectangles

DESCRIPTION	PART NO.
30 × 15 × 2 mm Rectangle	975-5226
30 × 15 × 2 mm Drilled Rectangle	975-5227
38 × 19 × 2 mm Rectangle	975-5326
38 × 19 × 2 mm Drilled Rectangle	975-5328

For options not shown here, please contact Spectral Systems.

# SUPER-SEALED LIQUID CELLS



## Optimized Reproducibility in Quantitative Analysis

- Precision fixed sampling pathlength
- Proprietary seal technology for leak free operation
- Complete window material offerings for your sample types
- Rectangular plate design to fit your FT-IR spectrometer
- Individually serialized to aide in record keeping
- Optional factory calibration for your convenience and method certainty

The Spectral Systems Super-Sealed™ Liquid Cells are designed and manufactured for precision quantitative analysis and maximum reproducibility. The fixed pathlength of the Super-Sealed Cell eliminates potential variability due to reassembly of a demountable liquid cell. The proprietary seal technology used in our Super-Sealed Liquid Cells provides for leak free operation, exceptional durability and maximum productivity.

The cell mount for the Super-Sealed Liquid Cells is the standard 2.0" × 3.0" to fit your FT-IR spectrometer. All Super-Sealed Liquid Cells are manufactured with Luer Lock fill ports for convenient sample filling and cell cleaning.

The Super-Sealed Liquid Cells are available with your selection of sampling pathlength and window materials. Window materials used in the Super-Sealed Liquid Cells are of the highest quality composition and maximum flatness for precision quantitative analysis. For special applications we offer our

Spectral Systems XP-BBAR coating for our Super-Sealed Liquid Cells to increase IR throughput of high refractive index window materials. We can also manufacture these cells with wedged windows for improved performance in high resolution spectral measurements. Please contact us for details.

For your convenience we offer factory calibration of any of our Super-Sealed Liquid Cells.

## SPECIFICATIONS

Plate Geometry	Rectangular
Plate Dimensions	2.0" W × 3.0" H
IR Beam Port Geometry	Circular
IR Beam Port Diameter	13 mm
Nominal Pathlength	±10% guaranteed
Calibrated Pathlength	Optional
Seal Type	Proprietary, leak free
Fill Port Type	Luer Lock
Window Flatness	λ/5 at 10.6 micron (Except KRS-5, Ten Wave at 633 nm)

## ORDERING INFORMATION

### Super-Sealed Liquid Cells

PATHLENGTH (MM) VOLUME (ML)	0.015 0.005	0.025 0.009	0.050 0.018	0.100 0.036	0.150 0.054	0.200 0.072	0.500 0.18	1.000 0.36	5.000 1.8	10.000 3.6
BaF <sub>2</sub>	097-15-001	097-15-002	097-15-003	097-15-004	097-15-005	097-15-006	097-15-007	097-15-008	097-15-009	097-15-000
CaF <sub>2</sub>	097-16-001	097-16-002	097-16-003	097-16-004	097-16-005	097-16-006	097-16-007	097-16-008	097-16-009	097-16-000
CsI	097-17-001	097-17-002	097-17-003	097-17-004	097-17-005	097-17-006	097-17-007	097-17-008	097-17-009	097-17-000
KBr	097-18-001	097-18-002	097-18-003	097-18-004	097-18-005	097-18-006	097-18-007	097-18-008	097-18-009	097-18-000
KRS-5	097-19-001	097-19-002	097-19-003	097-19-004	097-19-005	097-19-006	097-19-007	097-19-008	097-19-009	097-19-000
NaCl	097-20-001	097-20-002	097-20-003	097-20-004	097-20-005	097-20-006	097-20-007	097-20-008	097-20-009	097-20-000
IR Quartz	097-21-001	097-21-002	097-21-003	097-21-004	097-21-005	097-21-006	097-21-007	097-21-008	097-21-009	097-21-000
ZnSe	097-22-001	097-22-002	097-22-003	097-22-004	097-22-005	097-22-006	097-22-007	097-22-008	097-22-009	097-22-000
ZnS	097-23-001	097-23-002	097-23-003	097-23-004	097-23-005	097-23-006	097-23-007	097-23-008	097-23-009	097-23-000

Super-Sealed Liquid Cells include Teflon® stoppers to complete the seal of your sample within the cell.

### Super-Sealed Liquid Cells Calibration

DESCRIPTION	PART NO.
Calibration of Liquid Cell	097-00-000

Please order 1 each of this part number for each cell to be calibrated.

### Replacement Parts for Super-Sealed Liquid Cells

DESCRIPTION	PART NO.
Teflon Stoppers (12 each)	097-3711

For other options for Super-Sealed Liquid Cells, please contact Spectral Systems.



Also available in rectangular port version – optimized for dispersive spectrophotometers. Please contact us for detail.



# FREE-STANDING SEALED LIQUID CELLS



## Flexible Mounting and Reproducibility in Quantitative Analysis

- Precision fixed sampling pathlength
- Proprietary seal technology for leak free operation
- Versions optimized for your applications
- Mounts in your holder or optional Demountable Liquid Cell

The Spectral Systems Free-Standing Sealed Liquid Cells are designed for flexible mounting in a variety of cell holders including the Free-Standing Liquid Cell Holder. Fill port versions available are Luer Lock or tubular. The Spectral Systems Horizon-Fill™ Liquid Cell is designed with horizontal Luer Lock ports for easy liquid sample fill. The Spectral Systems Veri-Fill™ Liquid Cell is designed with vertical Luer Lock ports recommended for very low viscosity liquid samples. And, the Spectral Systems Trans-Flow™ Liquid Cell is designed with integrated tubular fill ports – optimum for continuous flow sampling. Our proprietary sealing technology provides for leak free operation, exceptional durability and maximum productivity.

The Free-Standing Sealed Liquid Cells are available with your choice of sampling pathlength and window materials. Window materials used in the Free-Standing Sealed Liquid Cells are of the highest quality composition and maximum flatness for precision quantitative analysis.

We recommend selection of our Free-Standing Liquid Cell Holder for ease of mounting these cells in your spectrometers. For your convenience, we offer factory calibration of any of our Free-Standing Sealed Liquid Cells.

### SPECIFICATIONS

Cell Geometry	Circular
Cell Diameter	32 mm
IR Beam Port Geometry	Circular
IR Beam Port Diameter	13 mm
Nominal Pathlength	±10%
Seal Type	Proprietary, leak free
Fill Port Type	Luer Lock or tubular (1/8" OD)
Window Flatness	λ/5 at 10.6 micron (Except KRS-5)

## ORDERING INFORMATION

### Free-Standing Liquid Cell Holder

DESCRIPTION	PART NO.
Free-Standing Liquid Cell Holder	097-3700

*Free-Standing Liquid Cell Holder includes holder and protective rear gasket.*



**Horizon-Fill Liquid Cell used with our Free-Standing Liquid Cell Holder**

### Horizon-Fill, Sealed Liquid Cells

PATHLENGTH (MM) VOLUME (ML)	0.015 0.005	0.025 0.009	0.050 0.018	0.100 0.036	0.150 0.054	0.200 0.072	0.500 0.18	1.000 0.36	5.000 1.8	10.000 3.6
BaF <sub>2</sub>	097-35-001	097-35-002	097-35-003	097-35-004	097-35-005	097-35-006	097-35-007	097-35-008	097-35-009	097-35-000
CaF <sub>2</sub>	097-36-001	097-36-002	097-36-003	097-36-004	097-36-005	097-36-006	097-36-007	097-36-008	097-36-009	097-36-000
CsI	097-37-001	097-37-002	097-37-003	097-37-004	097-37-005	097-37-006	097-37-007	097-37-008	097-37-009	097-37-000
IR Quartz	097-41-001	097-41-002	097-41-003	097-41-004	097-41-005	097-41-006	097-41-007	097-41-008	097-41-009	097-41-000
KBr	097-38-001	097-38-002	097-38-003	097-38-004	097-38-005	097-38-006	097-38-007	097-38-008	097-38-009	097-38-000
KRS-5	097-39-001	097-39-002	097-39-003	097-39-004	097-39-005	097-39-006	097-39-007	097-39-008	097-39-009	097-39-000
NaCl	097-40-001	097-40-002	097-40-003	097-40-004	097-40-005	097-40-006	097-40-007	097-40-008	097-40-009	097-40-000
ZnSe	097-42-001	097-42-002	097-42-003	097-42-004	097-42-005	097-42-006	097-42-007	097-42-008	097-42-009	097-42-000
ZnS	097-43-001	097-43-002	097-43-003	097-43-004	097-43-005	097-43-006	097-43-007	097-43-008	097-43-009	097-43-000

*Free-Standing Sealed Liquid Cells include Teflon stoppers to complete the seal of your sample within the cell.*



Veri-Fill Liquid Cell used with our Free-Standing Liquid Cell Holder

## Veri-Fill, Sealed Liquid Cells

PATHLENGTH (MM) VOLUME (ML)	0.015 0.005	0.025 0.009	0.050 0.018	0.100 0.036	0.150 0.054	0.200 0.072	0.500 0.18	1.000 0.36	5.000 1.8	10.000 3.6
BaF <sub>2</sub>	097-25-001	097-25-002	097-25-003	097-25-004	097-25-005	097-25-006	097-25-007	097-25-008	097-25-009	097-25-000
CaF <sub>2</sub>	097-26-001	097-26-002	097-26-003	097-26-004	097-26-005	097-26-006	097-26-007	097-26-008	097-26-009	097-26-000
CsI	097-27-001	097-27-002	097-27-003	097-27-004	097-27-005	097-27-006	097-27-007	097-27-008	097-27-009	097-27-000
IR Quartz	097-31-001	097-31-002	097-31-003	097-31-004	097-31-005	097-31-006	097-31-007	097-31-008	097-31-009	097-31-000
KBr	097-28-001	097-28-002	097-28-003	097-28-004	097-28-005	097-28-006	097-28-007	097-28-008	097-28-009	097-28-000
KRS-5	097-29-001	097-29-002	097-29-003	097-29-004	097-29-005	097-29-006	097-29-007	097-29-008	097-29-009	097-29-000
NaCl	097-30-001	097-30-002	097-30-003	097-30-004	097-30-005	097-30-006	097-30-007	097-30-008	097-30-009	097-30-000
ZnSe	097-32-001	097-32-002	097-32-003	097-32-004	097-32-005	097-32-006	097-32-007	097-32-008	097-32-009	097-32-000
ZnS	097-33-001	097-33-002	097-33-003	097-33-004	097-33-005	097-33-006	097-33-007	097-33-008	097-33-009	097-33-000

Free-Standing Sealed Liquid Cells include Teflon stoppers to complete the seal of your sample within the cell.



## Trans-Flow, Sealed Liquid Cells

PATHLENGTH (MM) VOLUME (ML)	0.015 0.005	0.025 0.009	0.050 0.018	0.100 0.036	0.150 0.054	0.200 0.072	0.500 0.18	1.000 0.36	5.000 1.8	10.000 3.6
BaF <sub>2</sub>	097-45-001	097-45-002	097-45-003	097-45-004	097-45-005	097-45-006	097-45-007	097-45-008	097-45-009	097-45-000
CaF <sub>2</sub>	097-46-001	097-46-002	097-46-003	097-46-004	097-46-005	097-46-006	097-46-007	097-46-008	097-46-009	097-46-000
CsI	097-47-001	097-47-002	097-47-003	097-47-004	097-47-005	097-47-006	097-47-007	097-47-008	097-47-009	097-47-000
IR Quartz	097-51-001	097-51-002	097-51-003	097-51-004	097-51-005	097-51-006	097-51-007	097-51-008	097-51-009	097-51-000
KBr	097-48-001	097-48-002	097-48-003	097-48-004	097-48-005	097-48-006	097-48-007	097-48-008	097-48-009	097-48-000
KRS-5	097-49-001	097-49-002	097-49-003	097-49-004	097-49-005	097-49-006	097-49-007	097-49-008	097-49-009	097-49-000
NaCl	097-50-001	097-50-002	097-50-003	097-50-004	097-50-005	097-50-006	097-50-007	097-50-008	097-50-009	097-50-000
ZnSe	097-52-001	097-52-002	097-52-003	097-52-004	097-52-005	097-52-006	097-52-007	097-52-008	097-52-009	097-52-000
ZnS	097-53-001	097-53-002	097-53-003	097-53-004	097-53-005	097-53-006	097-53-007	097-53-008	097-53-009	097-53-000

Free-Standing Sealed Liquid Cells include Teflon stoppers to complete the seal of your sample within the cell.

## Free-Standing Sealed Liquid Cells Calibration

DESCRIPTION	PART NO.
Calibration of Liquid Cell	097-00-000

Please order 1 each of this part number for each cell to be calibrated.

## Replacement Parts for Free-Standing Sealed Liquid Cells

DESCRIPTION	PART NO.
Teflon Stoppers (12 each)	097-3711

For other options for Free-Standing Sealed Liquid Cells, please contact Spectral Systems.

# DEMOUNTABLE LIQUID CELLS



## SPECIFICATIONS

Plate Geometry	Rectangular
Plate Dimensions	2.0" W × 3.0" H
IR Beam Port Dimension	9.5 × 21 mm
Spacer Thickness, mm	0.015, 0.025, 0.050, 0.10, 0.20, 0.50, 1.0
Nominal Pathlength	Spacer thickness
Seal Type	Friction/Teflon
Fill Port Type	Luer Lock
Window Dimensions	32 × 3.0 mm circular
Window Flatness	$\lambda/5$ at 10.6 micron (except KRS-5 and Polyethylene)

## Maximum Sampling Pathlength Flexibility

- Easy spacer change for flexible sampling pathlength
- Complete selection of window materials for all sample types
- Standard rectangular slide mount configuration to fit your FT-IR spectrometer

The Spectral Systems Demountable Liquid Cell is an ideal accessory for the analysis of liquids when a wide range of component concentrations is encountered and when the sample type varies frequently. The pathlength of the analysis is defined by your choice of spacer included with the accessory. Spacers are composed of Teflon which is inert and compatible with all sample types.

Spectral Systems offers a complete selection of window materials for analysis in the mid-, near- and far-infrared spectral regions and to provide compatibility with organic and aqueous solvents. All windows offered for our Demountable Liquid Cell are edge rounded and finished for exceptional durability and improved seal.

## ORDERING INFORMATION

### Demountable Liquid Cell

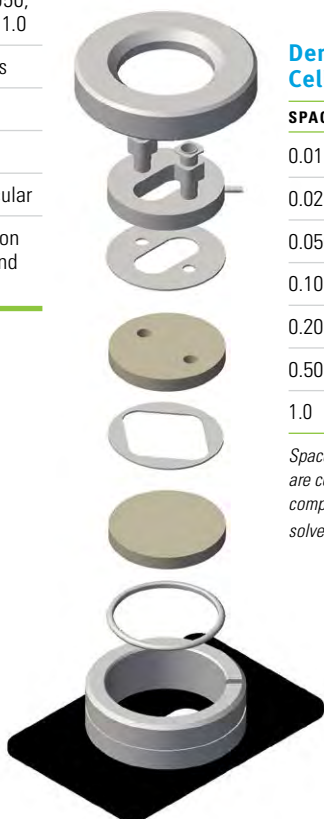
DESCRIPTION	PART NO.
Demountable Liquid Cell	097-3710

*Demountable Liquid Cell includes cell holder, needle plate, o-ring, gaskets, complete set of spacers (2 each of each thickness) and Teflon stoppers. Please select a drilled and undrilled window to complete the accessory.*

### Demountable Liquid Cell Spacers

SPACER THICKNESS	PART NO.
0.015	097-3713
0.025	097-3714
0.050	097-3715
0.10	097-3716
0.20	097-3717
0.50	097-3718
1.0	097-3719

*Spacers include 12 each. Spacers are composed of Teflon which is compatible with organic and aqueous solvents.*



### Demountable Liquid Cell Windows

WINDOW MATERIAL	UNDRILLED PART NO.	DRILLED PART NO.
BaF <sub>2</sub>	915-3716	915-3717
CaF <sub>2</sub>	920-3716	920-3717
CsI	935-3716	935-3717
Ge	940-3716	940-3717
IR-Quartz	965-3716	965-3717
KBr	945-3716	945-3717
KRS-5	950-3716	950-3717
NaCl	955-3716	955-3717
Polyethylene	957-3716	957-3717
Si	960-3716	960-3717
ZnSe	975-3716	975-3717
ZnS	971-3716	971-3717

*Minimum 1 each undrilled and drilled window are required to complete the Demountable Liquid Cell. For window material characteristics and further detail, please refer to the Spectral Systems Properties.*

### Replacement Parts for Demountable Liquid Cell

DESCRIPTION	PART NO.
Teflon Stoppers (12 each)	097-3711
Teflon Gaskets (12 each)	097-3712
Teflon O-Rings (12 each)	097-3737
Aluminum O-Rings (12 each)	097-3723
Needle Plate	097-3727

# PROPERTIES OF MATERIALS FOR SPECTROSCOPY

Material	SWL cm <sup>-1</sup>	LWL cm <sup>-1</sup>	RI	S/D	Flatness	Pe Atm	Restrahlen cm <sup>-1</sup>	Density g/cc	Solubility g/100 g	Melting Point °C	Hardness kg/mm <sup>2</sup>
AgBr	22,000	255 292	2.22@10	80/50	5	0.56	88	6.5	1.2E-05	432	7
AgCl	24,500	353 404	1.90@10	80/50	5	0.56	123	5.6	5.2E-02	457	10
Al <sub>2</sub> O <sub>3</sub>	40,000	1608 1834	1.76@0.6 1.77@0.6	40/20	1/2	6.1	741	4.0	0	2040	1370
AMTIR	11,000	593 625	2.50@10	80/50	1	0.27		4.4	0	370	170
BaF <sub>2</sub>	66,600*	691 782	1.45@5	40/20	1/20	0.56	213	4.9	0.17	1280	82
CaF <sub>2</sub>	79,500*	896 1025	1.40@5	40/20	1/20	0.77	286	3.2	0.0017	1360	158
CdTe	17,000	313 340	2.67@10	80/50	1	0.08		6.2	0	1092	56
Cleartran™	22,000	690 722	2.20@10	40/20	1/20	2.2	328	4.1	0	1830	240
CsI	42,000	172	1.73@10	80/50	1/10	0.12	69	4.5	44	621	1
Diamond	30,000	<2	2.41@0.6	20/10	1	10.9	None	3.5	0	550 <sup>lb</sup>	5700
Ge	5500	432 574	4.00@10	60/40	1/8	1.0	None	5.3	0	936	780
KBr	48,800	345 388	1.52@10	60/40	1/20	0.02	129	2.8	53	730	6
KCl	55,600	385 439	1.45@10	60/40	1/20	0.05	158	2.0	35	776	7
KRS-5	17,900	204 232	2.37@10	60/40	1/1	0.56	74	7.4	0.05	414.5	40
LiF	96,150*	1105 1286	1.39@0.5	40/20	1/10	0.23	400	2.6	0.27	870	105
MgF <sub>2</sub>	90,900*	1271 1457	1.38@0.5 1.39@0.5	40/20	1/20	1.0	500	3.2	0.0002	1255	415
NaCl	52,600	457 584	1.49@10	40/20	1/20	0.05	200	2.2	36	801	18
Si	8900	624 969	3.41@10	60/40	1/8	1.8	None	2.3	0	1420	1150
SiO <sub>2</sub>	50,000*	2315 2677	1.53@1	40/20	1/20	4.2		2.6	0	1713	460
ZnS	17,000	690 722	2.20@10	40/20	1/20	1.5	328	4.1	0	1830	240
ZnSe	15,000	461 508	2.40@10	40/20	1/20	1.2	219	5.3	0	1526	120
ZrO <sub>2</sub>	40,000	1431	2.13@1	60/40	1/8	1.1		5.9	0	2700	1250





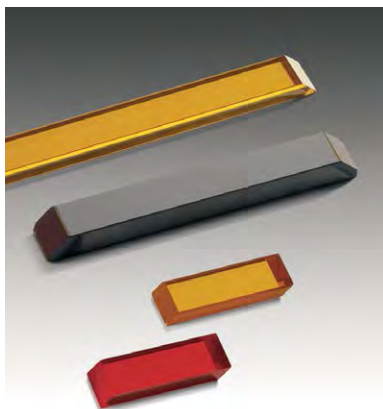
Material	Comments	BBAR Coat	Hard Coat
AgBr	Insoluble in water, slightly soluble in sodium hydroxide and some amines. Migrates into base metals. Will blacken under UV radiation. Cold flows and should not be used above 200 °C.	No	No
AgCl	Insoluble in water, slightly soluble in sodium hydroxide and some amines. Migrates into base metals. Will blacken under UV radiation. Cold flows and should not be used above 200 °C.	No	No
Al <sub>2</sub> O <sub>3</sub>	GRAS. Resistant to strong acids and bases. Birefringent. Very durable and may be used at high temperatures.	Yes 1.05	No
AMTIR	Amorphous material. A chalcogenide glass, which, although relatively hard, is also brittle. Insoluble in water and resistant to acids. It is attacked by alkalis.	Yes 1.3	Yes 2
BaF <sub>2</sub>	Hard material suitable for high pressure applications. Extremely vulnerable to thermal shock. Very slightly soluble in water. Attacked by ammonium hydroxide, ammonium salts, complex agents such as EDTA, and acids.	No	Yes 3
CaF <sub>2</sub>	Very hard material similar to BaF <sub>2</sub> , but almost insoluble in water and less vulnerable to thermal shock. Attacked by nitric acid and strong hydroxides, ammonium salts, and complexing agents such as EDTA. Very desirable for near-IR applications as it has no OH absorption bands.	No	Yes 3
CdTe	Hard but very brittle material. Insoluble in water. Attacked by nitric acid.	Yes 1.35	Yes 2
Cleartran	GRAS. A clear form of ZnS. Properties similar to ZnS.	Yes 1.25	Yes 2
CsI	Soft and hygroscopic. Generally only used for its extended far-IR transmission. Should only be exposed to anhydrous solvents. Never use with alcohols or aqueous solutions. A hard optical coating can be used to provide some protection. In powdered form it can be used to make pellets. Keep stored in a dessicator or heated cabinet.	No	Yes 6
Diamond	GRAS. Hard and chemically resistant. Often used in very high pressure applications. High cost limits size to a few mm. Has a characteristic lattice absorption doublet between 1800 and 2700 cm <sup>-1</sup> .	Yes 1.25	No
Ge	Hard and brittle. Semiconductor material with low band gap energy. Free electron absorption becomes important at temperatures above about 60 °C and it can become totally opaque at temperatures above 100 °C. Attacked by sulfuric acid and aqua regia. When used as a window it has high reflection losses which can be significantly reduced with BBAR coatings. Used as an ATR prism when low penetration depth is desired.	Yes 2.0	Yes 2
KBr	The most popular IR material. Hygroscopic and can only be used with anhydrous solvents, glycerol or alcohols. Withstands thermal and mechanical shock well. A protective coating can improve its resistance to humidity. Keep stored in a dessicator or heated cabinet.	No	Yes 4
KCl	Hygroscopic and can only be used with anhydrous solvents, glycerol or alcohols. Withstands thermal and mechanical shock fairly well. A protective coating can improve its resistance to humidity. When AR coated can be used as a low cost CO <sub>2</sub> laser window. Keep stored in a dessicator or heated cabinet.	No	Yes 4
KRS-5	Extremely toxic, even with skin contact. KRS-5 should only be handled with protective gloves or finger cots. A relatively soft material, it cold flows and deforms under pressure. This is enhanced at temperatures above 200 °C. It should only be polished by well-trained professionals. Good chemical resistance.	Yes 1.2	Yes 2
LiF	Slightly soluble in water. Hard and brittle. Sensitive to thermal shock. Should not be used above 400 °C.	No	Yes 2
MgF <sub>2</sub>	Almost insoluble in water. Can be used at fairly high pressure. Slightly sensitive to thermal shock. Birefringent. Should not be used above 500 °C.	No	Yes 2
NaCl	Harder and less hygroscopic than KBr but can only be used with anhydrous solvents, glycerol or alcohols. Withstands thermal and mechanical shock fairly well. A protective coating can improve its resistance to humidity. Keep stored in a dessicator or heated cabinet.	No	Yes 4
Si	Hard material and resistant to most chemicals except for strong acids. Withstands thermal shock. Has a strong phonon absorption band at 590-630 cm <sup>-1</sup> . Transmits well at wavenumbers lower than this and well into the far-IR. BBAR coatings are available for the mid-IR region.	Yes 1.7	No
SiO <sub>2</sub>	GRAS. Resistant to acids and alkalis. Used in the near-IR. Most forms of SiO <sub>2</sub> have OH absorption bands.	Yes 1.05	No
ZnS	GRAS. Relatively hard material and resistant to thermal and mechanical shock. Insoluble in water but can be attacked by strong acids and bases.	Yes 1.25	Yes 2
ZnSe	Hard and brittle. Attacked by strong acids and bases. Resistance can be improved with the use of a hard coating. The most popular material for ATR applications. When AR coated, can be used as CO <sub>2</sub> laser window.	Yes 1.35	Yes 4
ZrO <sub>2</sub>	Hard material with good resistance to chemicals. Cannot be used at high temperatures as a phase change occurs at 1000 °C.	Yes 1.2	Yes 2

#### NOTES

1. SWL – Highest wavenumber for which transmission is greater than 50% for 1 mm thickness.
2. LWL – Lowest wavenumber for which transmission is greater than 50% for 1 mm thickness and 4 mm thickness.
3. RI – Refractive Index at the indicated wavelength in microns.
4. S/D – Scratch and Dig surface polish achievable with normal polishing techniques. High quality UV-Vis optics are usually 20/10 and IR optics 40/20. Each level is approximately 2 times worse than the lower numbers.
5. Flatness – Routine polishing can yield flatness as measured in wavelengths of 6328Å (HeNe laser).
6. GRAS – US FDA Generally Recognized As Safe. May be used to measure food products.
7. \* – UV grade material required to achieve this limit.
8. Pe – Yield strength in atmospheres for a 25 mm × 1 mm thick window with a safety factor of 4. To calculate the thickness required for a given pressure:  

$$T/D = 0.034 \sqrt{P/Pe}$$

T – Window Thickness  
D – Window Diameter  
P – Pressure
9. Restrahlen – Frequencies at which the materials exhibit high resonance reflection. Apparent in reflection measurements.
10. BBAR Coat – Multilayer coating on material to increase energy transmission and/or reduce interference fringing. Number is the approximate gain in signal per window or lens.
11. Hard Coat – Coating to increase abrasion resistance and/or humidity and chemical resistance. Number is the approximate relative increase in abrasion, humidity or chemical resistance.
12. fp – Flash Point.



## Crystals for Optimized Infrared Sampling

- Beamsplitter grade material purity to eliminate undesirable absorbance bands
- Precision cut and finish for exceptional durability
- Available coatings to optimize throughput and performance
- Customized dimensions and coatings to enhance your ATR applications

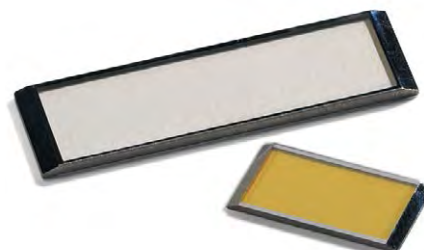
Attenuated Total Reflection (ATR) has become the sampling technique of choice in a high percentage of the applications of FT-IR as it generally reduces or eliminates sample preparation. Spectral Systems is the largest supplier of ATR optical elements, supplying product of the highest quality and durability.

Our ATR crystal manufacturing process starts with exceptional material purity to eliminate undesirable features in your spectral data. Then we cut and shape the ATR crystals with exceptional flatness for high throughput and measurement accuracy. Finally our ATR crystals are precision edge beveled to provide durability and effective mounting seal.

Many of our ATR crystal offerings are not listed in this catalog as they are proprietary to the instrument and accessory manufacturers. We are pleased to provide specific crystal designs for your measurements – please contact us.

### SPECIFICATIONS

ATR Crystal Geometries	Trapezoidal, Parallelogram, Other
Crystal Flatness	$\lambda/4$ at 10.6 micron (except KRS-5)
Crystal Edges	Beveled



## Specialized Optical Coatings

Spectral Systems have developed special optical coatings for ATR elements to further enhance their performance in spectroscopic applications.

- Our proprietary broad band anti-reflective (Spectral Systems XP-BBAR) coatings on the entrance and exit surfaces of the ATR element to enhance the energy throughput. For many elements, our XP-BBAR coating can more than double the throughput with a corresponding improvement in quantitation or detection limits.
- Protective coatings on the sampling surfaces to improve the resistance to acids and bases or abrasion and thus extend the lifetime of the ATR element.
- Coatings on the sampling surface to reduce the penetration depth as a function of wavenumber.
- Enhanced reflection coatings can be used to improve the reflectivity of areas where high reflectivity is desired.
- Coatings on portions of the ATR element so that it might be soldered into the mounting structure.
- Coatings to eliminate unwanted absorption due to contact with an area of the ATR element outside the sampling region.

With the exception of KRS-5, these coatings can be applied to all commonly used materials for ATR elements. Please contact us if you have an ATR sampling problem which might be solved with these coatings.

## ORDERING INFORMATION

### AMTIR™ ATR Crystals

DESCRIPTION	PART NO.
50 × 20 × 2 mm 45° Trapezoid	230-7942
80 × 10 × 3 mm 45° Trap, Aluminized TROUGH	230-0592
80 × 10 × 3 mm 60° Trap, Aluminized TROUGH	230-0594

### Germanium ATR Crystals

DESCRIPTION	PART NO.
50 × 10 × 1 mm 45° Trapezoid	240-7542
50 × 10 × 2 mm 45° Trapezoid	240-7632
50 × 10 × 2 mm 45° Parallelogram	240-7642
50 × 10 × 3 mm 45° Trapezoid	240-7742
50 × 10 × 3 mm 45° Parallelogram	240-7732
50 × 20 × 1 mm 45° Trapezoid	240-7842
50 × 20 × 2 mm 45° Trapezoid	240-7942
50 × 20 × 2 mm 45° Parallelogram	240-7932
50 × 20 × 2 mm 60° Trapezoid	240-7943
50 × 20 × 3 mm 45° Parallelogram	240-8032
56 × 10 × 4 mm 45° Trapezoid XP-BBAR	240-5604C
56 × 10 × 4 mm 60° Trapezoid XP-BBAR	240-5660C
80 × 10 × 2 mm 45° Trapezoid XP-BBAR	240-8102C
80 × 10 × 3 mm 45° Trap, Aluminized FLAT	240-0512
80 × 10 × 3 mm 60° Trap, Aluminized FLAT	240-0514
80 × 10 × 3 mm 30° Trap, Aluminized TROUGH	240-0563
80 × 10 × 3 mm 45° Trap, Aluminized TROUGH	240-0562
80 × 10 × 3 mm 60° Trap, Aluminized TROUGH	240-0564
55 × 5 × 3 mm 45° Aluminized FLAT	240-0612
55 × 5 × 3 mm 45° Aluminized TROUGH	240-0662

### KRS-5 ATR Crystals

DESCRIPTION	PART NO.
50 × 10 × 3 mm 45° Parallelogram	250-7732
50 × 20 × 2 mm 45° Trapezoid	250-7942
50 × 20 × 3 mm 45° Trapezoid	250-8042

### Si ATR Crystals

DESCRIPTION	PART NO.
50 × 10 × 2 mm 45° Trapezoid	260-7642
50 × 10 × 2 mm 45° Parallelogram	260-7632
50 × 10 × 3 mm 45° Trapezoid	260-7742
50 × 10 × 3 mm 45° Parallelogram	260-7732
50 × 10 × 3 mm 60° Parallelogram	260-7733
50 × 20 × 2 mm 45° Trapezoid	260-7942
50 × 20 × 3 mm 45° Trapezoid	260-8042
50 × 20 × 3 mm 45° Parallelogram	260-8032
56 × 10 × 4 mm 45° Trapezoid	260-5604
80 × 10 × 4 mm 45° Trapezoid	260-8004
80 × 10 × 4 mm 45° Aluminized TROUGH	260-0595

### ZnS ATR Crystals

DESCRIPTION	PART NO.
50 × 20 × 2 mm 45° Trapezoid	271-7942
80 × 10 × 3 mm 30° Aluminized TROUGH	271-0583
80 × 10 × 3 mm 55° Aluminized TROUGH	271-0586

### ZnSe ATR Crystals

DESCRIPTION	PART NO.
25 × 10 × 3 mm 45° Parallelogram	275-6932
50 × 10 × 1 mm 45° Trapezoid	275-7542
50 × 10 × 2 mm 45° Trapezoid	275-7642
50 × 10 × 2 mm 45° Parallelogram	275-7632
50 × 10 × 3 mm 30° Parallelogram	275-7731
50 × 10 × 3 mm 45° Trapezoid	275-7732
50 × 10 × 3 mm 45° Parallelogram	275-7742
50 × 10 × 3 mm 60° Parallelogram	275-7733
50 × 20 × 2 mm 45° Trapezoid	275-7942
50 × 20 × 2 mm 45° Parallelogram	275-7932
50 × 20 × 2 mm 60° Trapezoid	275-7943
50 × 20 × 3 mm 45° Trapezoid	275-8042
50 × 20 × 3 mm 45° Parallelogram	275-8032
60 × 10 × 3.75 mm 45° Trapezoid	275-6010
72 × 10 × 6 mm 45° Trapezoid, XP-BBAR	275-0330
76 × 6 × 6 mm 45° Trapezoid, XP-BBAR	275-0310
80 × 10 × 4 mm 45° Trapezoid, XP-BBAR	275-8004C
80 × 10 × 3 mm 40° Trap, Aluminized FLAT	275-0501
80 × 10 × 3 mm 45° Trap, Aluminized FLAT	275-0502
80 × 10 × 3 mm 60° Trap, Aluminized FLAT	275-0504
80 × 10 × 3 mm 40° Trap, Aluminized TROUGH	275-0551
80 × 10 × 3 mm 45° Trap, Aluminized TROUGH	275-0552
80 × 10 × 3 mm 55° Trap, Aluminized TROUGH	275-0556
80 × 10 × 3 mm 60° Trap, Aluminized TROUGH	275-0554
80 × 10 × 3 mm 70° Trap, Aluminized TROUGH	275-0557
55 × 5 × 3 mm 45° Aluminized FLAT	275-0602
55 × 5 × 3 mm 45° Aluminized TROUGH	275-0652

If you have a specific ATR crystal requirement and or coating need, please contact us.



### Optimized Focus of the Infrared Beam

- Reflective, refractive, spherical and aspherical versions available
- Manufactured of highest quality materials for exceptional spectral integrity
- Customized designs to maximize your infrared performance
- Available proprietary coatings for optimum throughput and durability

Spectral Systems is a world leader in supplying spherical and aspherical custom optics for infrared spectroscopy, infrared imaging, and infrared warning, surveillance, and tracking systems. We use diamond turning and conventional techniques using a variety of infrared reflective and refractive materials.

Our off axis reflective paraboloids and ellipsoids can be used to focus energy in broad spectral range applications. These reflective optical elements are manufactured to proprietary specifications for our customers and are therefore not included in this catalog. Our breadth of experience with design and manufacture of reflective optical elements can help you optimize your systems – please contact us to discuss your applications.

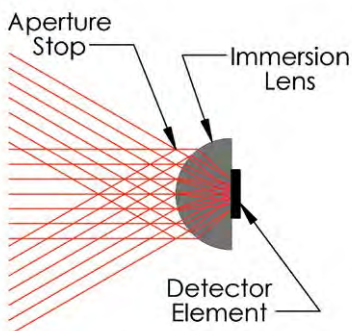
For refractive optical elements, we list here optical elements you can use for proof of concept in the design of your infrared systems. High refractive index materials are often used for lenses in the infrared and our proprietary Spectral Systems XP-BBAR coatings will provide maximum available energy throughput. This throughput advantage is particularly gained with infrared microscopy lenses.



## Hemispherical Immersion Lenses

Immersion lenses are used to increase the numerical aperture or throughput of an optical system in non-focusing applications, i.e., systems where the radiation is not focused. The flat side of the lens is placed in contact with the detector. In this application, the energy on the detector is theoretically increased by a factor equal to the refractive index of the lens material. This gain is very large in the infrared because of the high refractive index of the infrared materials. The lens should be coated with our XP-BBAR to achieve this theoretical gain.

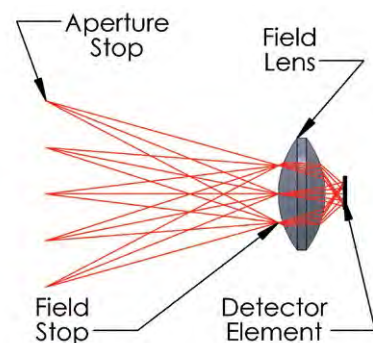
The major application of this lens in spectroscopic applications is in total reflectance measurements using an integrating sphere. Here the signal to noise ratio can be improved by a factor of 4 or more.



Application for Spectral Systems Immersion Lens

## Field Lenses

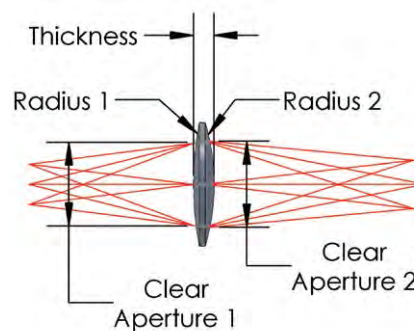
Field lenses are usually small lenses used to focus the beam of radiation onto the infrared detector. They can also make the response of the system more uniform over the field of view (FOV). If the lens is small it can be placed inside the dewar holding a mercury cadmium telluride (MCT) or other cooled detector. It can then also reduce background noise from radiation outside the spectral region of interest.



Application for Spectral Systems Field Lens

## Medium Focus Medium Speed Lenses

These lenses are used in remote sensing spectroscopic measurements as wide field of view telescopic objectives or in laboratory spectrometers as sample compartment focusing lenses. They frequently are used in place of mirrors to reduce the overall size of the spectrometer.



Application for Spectral Systems Medium Focus Medium Speed Lens

## ORDERING INFORMATION

### Hemispherical Immersion Lenses

DESCRIPTION	PART NO.
6 mm diameter, R = 3 mm, ZnSe, XP-BBAR coated	998-0060C
10 mm diameter, R = 5 mm, ZnSe, XP-BBAR coated	998-0100C

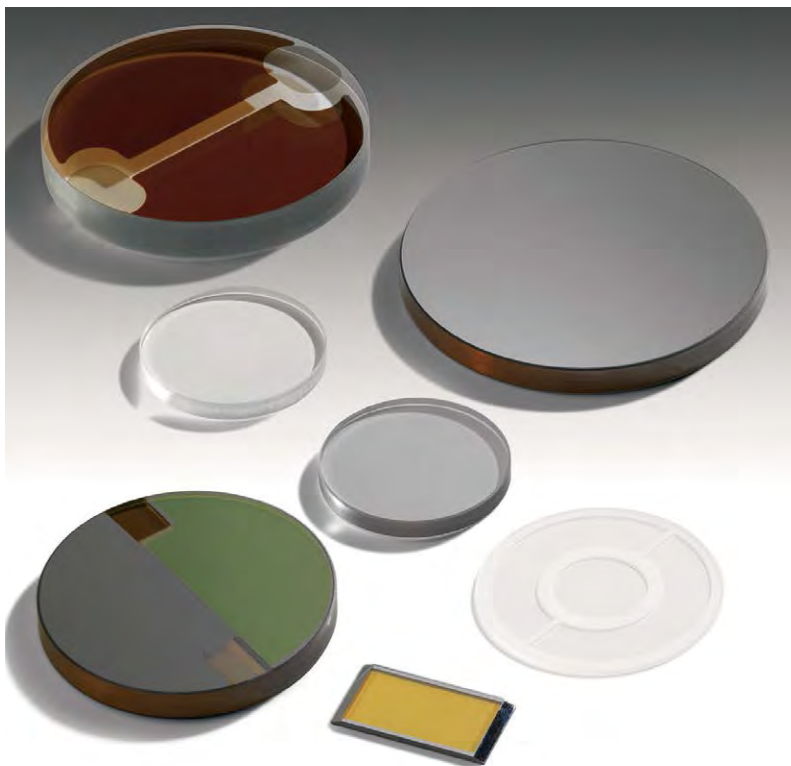
### Field Lenses

DESCRIPTION	PART NO.
6.35 mm diameter, F#1, ZnSe, XP-BBAR coated	575-0635C
12.7 mm diameter, F#1, ZnSe, XP-BBAR coated	575-1201C
25.4 mm diameter, F#1, ZnSe, XP-BBAR coated	575-2501C
12.7 mm diameter, F#1, Ge, XP-BBAR coated	540-1201C
25.4 mm diameter, F#1, Ge, XP-BBAR coated	540-2501C

### Medium Focus Medium Speed Lenses

DESCRIPTION	PART NO.
12.7 mm diameter, F#3, ZnSe, XP-BBAR coated	575-1236C
25.4 mm diameter, F#3, ZnSe, XP-BBAR coated	575-2503C
12.7 mm diameter, F#3, Ge, XP-BBAR coated	540-1236C
25.4 mm diameter, F#3, Ge, XP-BBAR coated	540-2503C
50 mm diameter, 2.35" EFL, BaF <sub>2</sub>	515-0235C
40 mm diameter, 4.88" EFL, BaF <sub>2</sub>	515-0488C
50 mm diameter, 2.35" EFL, KBr, protective coated	545-0235C
40 mm diameter, 4.88" EFL, KBr, protective coated	545-0488C

For infrared optical elements not included in this list, please contact Spectral Systems.



## Enhancing Performance of Infrared Optical Elements

- Comprehensive coatings for the infrared optical industry
- Widest infrared spectral range and highest throughput
- Protective and solderable options
- Designed specifically for infrared optical performance

Spectral Systems is the technical and commercial leader in the field of infrared optical coatings for spectroscopy. Our coating products and services provide a complete offering of performance enhancement for refractive and reflective infrared optical elements. Our proprietary coatings have been developed and enhanced over the 30 plus years of our existence. We continue to offer the highest performance coatings in the infrared optical industry.

All of Spectral Systems' optical coatings are designed specifically for the infrared spectral region of choice. This provides you with maximum throughput, durability and highest spectral integrity free of material artifacts.

Our infrared optical coatings are exceptional. Spectral Systems have developed the XP-BBAR (broad-band anti-reflective) and XP-NBAR (narrow-band anti-reflective) coatings to provide the highest IR throughput over the widest infrared spectral range available in the infrared optical industry. This spectral range provides you with the widest and most complete infrared information and performance.

### Generally our coatings can be grouped into six categories

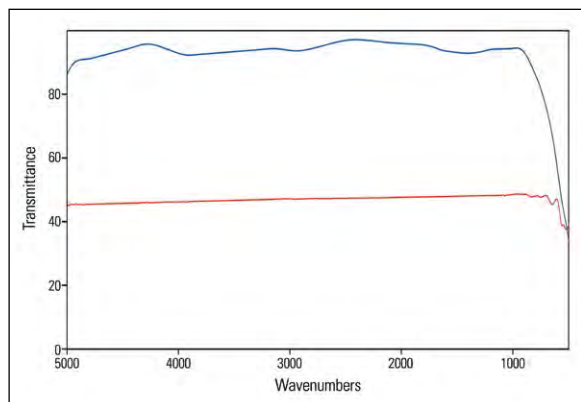
<b>Beamsplitter Coatings</b>	Provide transmission and reflection of the incident IR beam.
<b>Anti-Reflective Coatings</b>	Improve throughput especially for higher refractive index materials such as zinc selenide and germanium.
<b>Bandpass Coatings</b>	Provide a specific spectral range of transmission for optimum performance in a defined spectral region.
<b>Reflective Coatings</b>	Improve reflectivity of optical elements such as bare aluminum within a selected spectral region.
<b>Protective Coatings</b>	Prevent or reduce degradation of optical elements from exposure to elevated humidity or abrasive contact.
<b>Connective Coatings</b>	Improve or enable melding of optical elements such as making a refractive optical element solderable to a metal plate.

Spectral Systems is the largest and most comprehensive supplier of infrared beamsplitters world-wide. Our Photon Pro™ beamsplitter coatings are uniquely developed for highest throughput, flat frequency response and highest spectral purity while providing the desired transmission/reflection split of the infrared beam.

Working closely with our customers over our long history has enabled us to develop and optimize protective coatings exceptional for use with infrared optical elements. Our XP-Halide and XP-Polymer coatings provide high performance and superior protection from high humidity environments. Our CERAMSpec™ coating is designed to minimize abrasion from physical contact.

Often it is desirable to use two different optical coatings on one optical element. An example of this combined use would be layering our XP-BBAR coating with our abrasion coating on the faces of an ATR crystal to maximize throughput and to minimize the expected wear from sample contact.

Many companies can offer coatings for products. Spectral Systems offers the highest performance coatings for the infrared optical industry.



**Transmission spectra of a germanium (Ge) window with and without Spectral Systems XP-BBAR coating**

The following list of part numbers includes many of the unique coatings we offer our customers. Many of our offerings are not listed here since they require specific design for your application. If your requirement is not described here, please call us for additional and/or customized offerings.

## ORDERING INFORMATION

### Anti-Reflective Coatings

DESCRIPTION	PART NO.
Al <sub>2</sub> O <sub>3</sub> XP-NBAR, 0.8–2.5 μm	999-5398
AMTIR XP-BBAR, 2–20 μm	999-0002
CdTe XP-BBAR, 1.8–20 μm	999-1113
Diamond XP-BBAR, 1.6–20 μm	999-1814
Quartz XP-NBAR, 0.8–1.1 μm	999-2706
Ge XP-NBAR, 3.8–10 μm	999-0208
Ge XP-NBAR, 2–5 μm	999-0900
Ge XP-NBAR, 7–14 μm	999-9101
Ge XP-BBAR, 2.5–20 μm	999-9017
Si XP-NBAR, 2–5 μm	999-0869
ZnS (Cleartran) XP-BBAR, 2–14 μm	999-0212
ZnSe XP-BBAR, 1.1–20 μm	999-0110
ZnSe XP-BBAR, 1.6–20 μm	999-0160
ZnSe XP-BBAR, 2–14 μm	999-0100
ZnSe XP-NBAR, 7–14 μm	999-9147
ZnSe XP-NBAR, 8–12 μm	999-9174
ZnSe XP-NBAR, 0.6–1 μm	999-9046

### Beamsplitter Coatings

DESCRIPTION	PART NO.
BaF <sub>2</sub> Photon Pro 2–12 μm	999-9434
CaF <sub>2</sub> Photon Pro 0.8–10 μm	999-9050
CaF <sub>2</sub> Photon Pro 0.6–8 μm	999-9004
CsI Photon Pro 2–50 μm	999-9012
CsI Photon Pro 2–40 μm	999-9018
KBr Photon Pro, 1–25 μm	999-0157
KBr Photon Pro, 2–25 μm	999-1378
KBr Photon Pro, 1–28 μm	999-6571
KBr Photon Pro, 1.5–25 μm	999-9045
KBr Photon Pro, 2–28 μm	999-8379
KBr Photon Pro, 2–28 μm	999-9066
KBr Photon Pro, 0.6–1.0 μm	999-6790
Quartz Photon Pro, 0.6–3.6 μm	999-9130
ZnSe Photon Pro, 2–20 μm	999-9016
ZnSe Photon Pro, 0.6–1 μm	999-9048

### Protective Coatings

DESCRIPTION	PART NO.
CERAMSpec	999-0400
KBr XP-Halide, 0.4–28 μm	999-0200B
XP-Polymer	999-1360

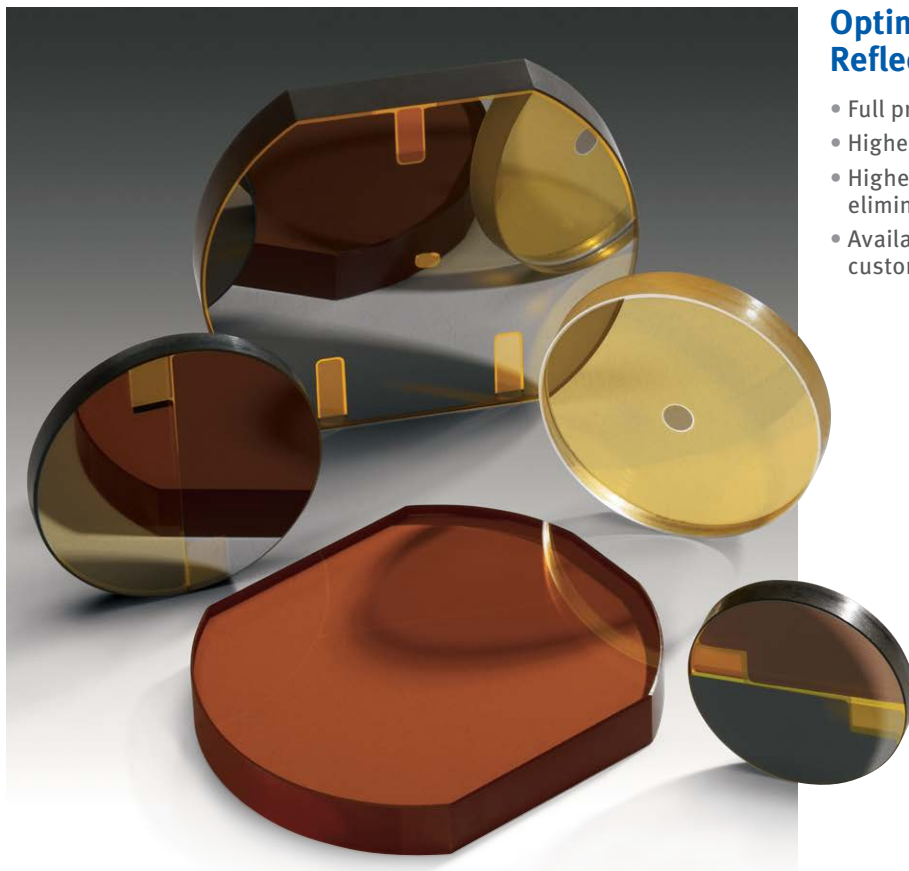
### Reflective Mirror Coatings

DESCRIPTION	PART NO.
Aluminum Front Face Reflector	999-0300
Gold Front Face Reflector	999-9010

*For options not shown here, please contact Spectral Systems.*

## Optimized Transmission and Reflection of the Infrared Beam

- Full product offerings from vacuum UV to the far-IR
- Highest performance designs for each spectral region
- Highest quality components and coatings to eliminate undesirable spectral features
- Available design and manufacturing service to customize your applications

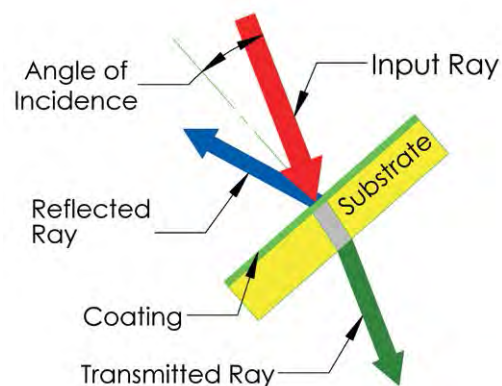


### SPECIFICATIONS

Materials	KBr, Csl, CaF <sub>2</sub> , Infrasil™, BK-7, ZnSe, Mylar, Si
Extreme Flatness	KBr, CaF <sub>2</sub> , Infrasil, BK-7, ZnSe: $\lambda/20$ P.V. at 633 nm Csl: $\lambda/10$ P.V. at 633 nm Si: $\lambda/8$ P.V. at 633 nm Mylar: $5\lambda$ P.V. at 633 nm
Extreme Parallelism	$\pm 0.1$ arc seconds (most materials)
Wedge Applications	$\pm 2$ arc seconds (as required)
Coatings	Visible: 350–800 nm, 50/50%, $\pm 15\%$ T/R Near-IR: 1000–5000 nm, 50/50%, $\pm 15\%$ T/R Mid-IR: 5000–25000 nm, 50/50%, $\pm 20\%$ T/R Far-IR: 10000–50000 nm, 50/50%, $\pm 35\%$ T/R

Spectral Systems is the world's leading supplier of FT-IR beamsplitter components and sub-assemblies. We provide the market with a full range of optical components, standard coatings and engineering support for new designs and can contribute our technical knowledge toward the development of your instrument. Our beamsplitters are used in instruments produced to compete in the markets of hazardous materials, environmental control, process control and material recognition on the manufacturing floor. Spectral Systems possess vast knowledge of the critical parameters of beamsplitter design and manufacture. We are capable of taking a beamsplitter design and making improvements desirable for your unique application. Our knowledge of infrared materials purity, flatness requirements, angular tolerances, matching of compensators and the phase and amplitude response when compensated and the critical completing features of our specialty coatings all will complement your design. Spectral Systems Photon Pro infrared beamsplitters are the culmination of our experience and knowledge providing the finest quality product in the industry.

Generally the infrared beamsplitter is designed to simultaneously transmit and reflect 50% of the incident beam between two optical elements. In the case of an interferometer within a FT-IR, the optical elements are represented by a fixed and a moving mirror. The design of the beamsplitter must take into account many factors including dimensions, desired substrate and spectral range, incident beam angle and requirements for durability.



Reflected and transmitted rays from the infrared beamsplitter



Research and development services are available through our process engineering staff to solve some of the more common problems such as fringing, chirping and insufficiently broad spectral coverage necessary in the mid-IR to far-IR spectral regions.

Most of our beamsplitter designs have flat response through their spectral coverage. This ensures that the beamsplitter does not contribute to overall instrument instability.

Our long history and experience in the design and manufacture of infrared beamsplitters allows us to provide the highest level of support and service to you. Our beamsplitters are used in handheld spectrometers, laboratory FT-IRs, military interferometers, dedicated analysis instruments and high resolution spectrometers worldwide. Most of the beamsplitters we manufacture are proprietary designs for our customers. Within these pages we list generic versions of infrared beamsplitters available from Spectral Systems. Please contact us to discuss your beamsplitter requirements.

## ORDERING INFORMATION

### Photon Pro CaF<sub>2</sub> Beamsplitters

DESCRIPTION	PART NO.
25 × 2 mm, 0.6–8.0 μm	920-3516H
32 × 3 mm, 0.8–9.0 μm	920-3716H
50 × 6 mm, 0.6–8.0 μm	920-0506H
57.15 × 6 mm, 0.8–9.0 μm	920-5716H

### Photon Pro KBr Beamsplitters

DESCRIPTION	PART NO.
25 × 2 mm, 2–28 μm	945-3516H
32 × 3 mm, 1–25 μm	945-3716H
50 × 6 mm, 2–28 μm	945-0506H
57.15 × 6 mm, 2–28 μm	945-5716H
57.15 × 8 mm, 1–25 μm	945-5718H
69.85 × 8 mm, 1–25 μm	945-6908H
72 × 10 mm, 2–28 μm	945-7210H

### Photon Pro ZnSe Beamsplitters

DESCRIPTION	PART NO.
25 × 2 mm, 2–20 μm	975-3516H
30 × 3 mm, 7–14 μm	975-0303H
32 × 3 mm, 7–14 μm	975-3716H
50 × 3 mm, 2–20 μm	975-4116H
69.85 × 8 mm, 2–20 μm	975-6985H



## Broad list of applications we cover with our beamsplitters

### Mid-IR Commercial

For commercial applications with FT-IR spectrometers, the substrate of choice has always been KBr. This choice has defined the long wavelength limit (25 μm) for the specification of the spectrometers and they cover at least the range of fundamental vibrations of molecules, usually to 2.5 μm. These fundamental vibrations are usually strongly absorbing and specific to the molecular structure. Therefore, commercial applications are often identifications and/or detection of molecular species. Even though the spectrometers are commonly used in a “pseudo” ratio mode, it is desirable, if not essential to minimize the spectral structure on the beamsplitter performance while achieving the near 50% beam splitting for optimum sensitivity. Therefore the beamsplitter should be maximally flat, non-absorbing and broad band at 50% transmission/reflection.

### Mid-IR Military, Environmental

The spectral performance of FT-IR systems for military and environmental applications is determined by the location of the atmospheric transmission windows of 3–5 μm, traditionally called mid-IR and the 8–12 μm window called the far-IR. Military and environmental applications generally require a more durable substrate than KBr and CaF<sub>2</sub> and anti-reflective (AR) coated ZnSe substrates are generally specified for the mid-IR region. As in the commercial applications, sensitivity is important and the beamsplitters for this application should be about 50% transmission/reflection over this region.

### Near-IR Commercial

Most near-IR commercial applications involve quantification by measuring the overtone and combination bands of the fundamental vibrations found in the mid-IR. Since these bands are much weaker than the fundamental vibrations, sample preparation becomes easier and accurate quantification is possible. It becomes very important to minimize spectral features in the spectrometer. As a result CaF<sub>2</sub> substrates are often preferred since they have none of the adsorbed OH impurities found in all SiO<sub>2</sub>/quartz substrates.

### Far-IR Commercial

The fundamental vibrations of many molecules can occur at wavelengths beyond the limit of KBr transmission. Analysis, identification and detection of many compounds such as organometallics and polymers can optimally be done at longer wavelengths. In addition, if extended to sufficiently long wavelengths, FT-IR/far-IR can overlap the exciting new Terahertz spectroscopy systems. Csl can be used to extend the spectrometer range to 50 μm. However, beyond that range either uncoated Si substrates or coated pellicles of Mylar or other non-absorbing polymers are used.

### Far-IR Military, Environmental

For requirements of durability beamsplitter substrates of AR coated ZnSe are predominantly used.

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# SPECTRAL SYSTEMS ORDERING INFORMATION

## How do I place an order for a standard catalog item?

Standard catalog items can be ordered in several convenient ways, including sending a purchase order by mail, fax, or email. Orders can also be taken by phone. If you have not ordered from us before, we also accept VISA or MasterCard credit cards to expedite delivery of phone orders. If you have ordered from us before, credit terms for payment in NET 30 days from shipment can be established. Although a fee applies, International payment via wire transfer is available. There is no minimum order requirement. Please use this contact information when placing an order:

Spectral Systems  
35 Corporate Park Drive  
Hopewell Junction, NY 12533  
  
Phone: 845.896.2200  
Fax: 845.896.2203  
Email: [info@spectral-systems.com](mailto:info@spectral-systems.com)  
**[www.spectral-systems.com](http://www.spectral-systems.com)**

## How do I place an order for a custom optical item?

To order a custom item, please contact us by email, phone or fax with a description of your custom need and any specifications or drawings that may best describe your requirement. Within 24 hours of your request, we will respond with any clarifying questions. A formal quotation will be provided as soon as possible describing the custom item with a part number, price and estimated delivery. Quotations are valid for 90 days.

*Custom orders cannot be placed from our website.*

## When can I expect my order to be delivered?

Many catalog items are in stock and immediately available to ship to you within 24 hours of placing the order. Spectral Systems will contact you within one business day if the requested item is not in stock and confirm the delivery time for your order. Unless specified otherwise, orders will ship UPS Ground within the United States and Canada and via UPS Red for international destinations. Shipping costs will be added to your invoice or we provide the option for you to have the shipping cost billed directly to your carrier of choice by providing us your account number.

## If I need to return a Spectral Systems product, what should I do?

Please contact Spectral Systems: by email at [info@spectral-systems.com](mailto:info@spectral-systems.com) or by phone at 845.896.2200 to receive your Return Material Authorization (RMA) number.

An RMA number is needed to return any products for credit, exchange, warranty or repair services. All returns should be addressed to:

Spectral Systems  
Attn: RMA # \_\_\_\_\_  
35 Corporate Park Drive  
Hopewell Junction, NY 12533

## When I order a product from Spectral Systems, is satisfaction guaranteed?

Yes. The Spectral Systems promise is that the products in our catalog will meet or exceed our published specifications and be free from defects in material and workmanship for a period of 30 days from the date of shipment. If you are not satisfied, please contact us right away, get an RMA number and ship the defective product to our attention. We will promptly repair or replace the product at no charge within the warranty period.

## How can I get help if I have a technical question about infrared optics?

The Spectral Systems team is dedicated to providing the best technical assistance available regarding your infrared optical needs. Please contact us via phone, fax or email with your questions. Our regular business hours are 8 a.m. to 5 p.m. Eastern Standard Time, Monday through Friday.

At Spectral Systems, our mission is to exceed our customer's expectations. We hope we have made it easy for you to order the infrared optics just right for your needs. If you have any questions or concerns, please don't hesitate to contact us and thank you for the opportunity to work with you.

**Note:** Complete Terms and Conditions are supplied at time of order acknowledgement. They also are available in advance on request. Prices on our published price list and website are subject to change at any time.

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**Kokyo**

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