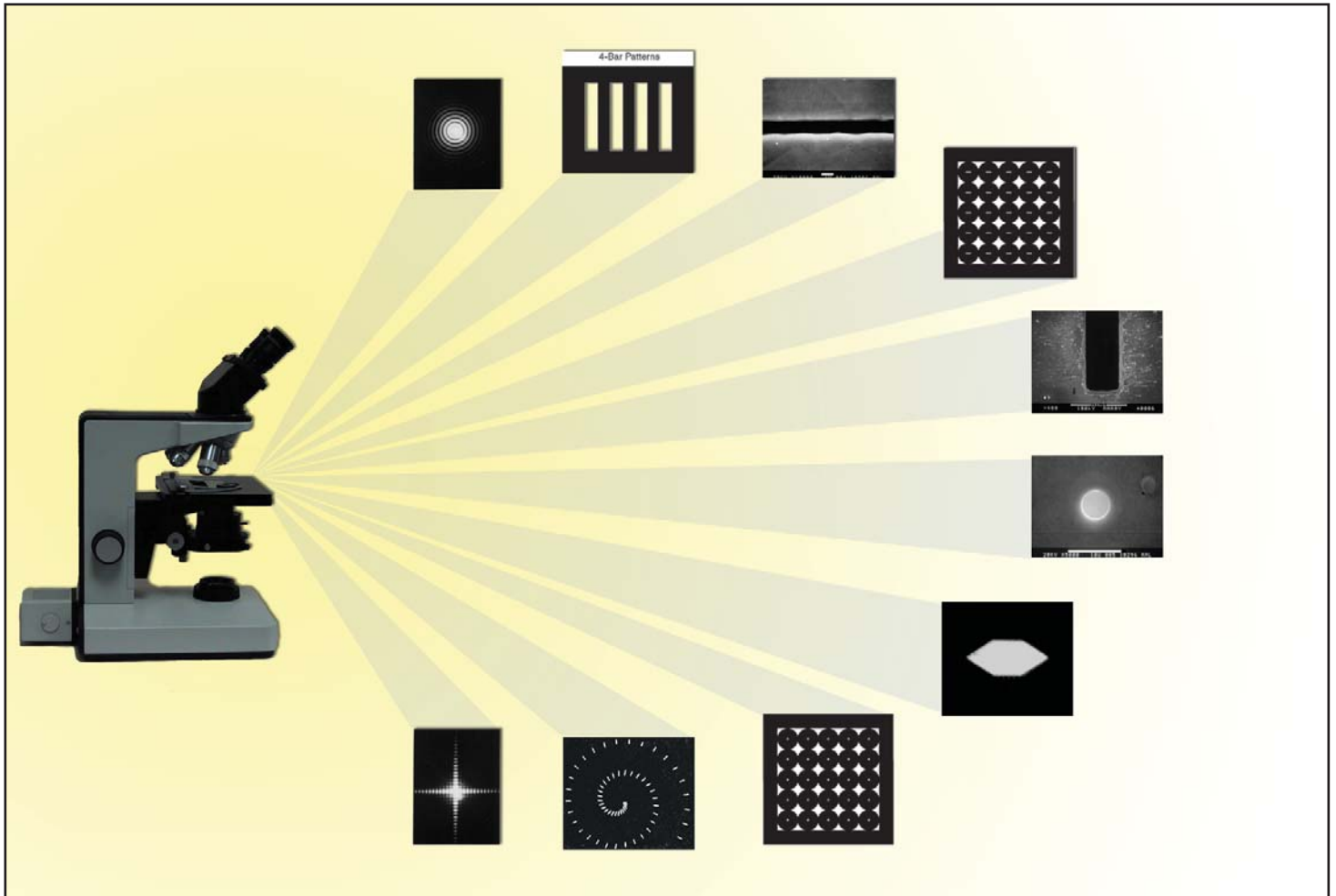




Precision Micro-Aperture Catalog

Version 2009-1



PLEASE CONTACT:
Dan Gentile

Sales Associate, National Aperture, Inc.

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PRECISION APERTURES

National Aperture is the leading manufacturer of precision micro-apertures. Our specialty is primarily in the 0.5 μ m to 1000 μ m range for round holes, with sizes up to 8,500 μ m and Slits and patterns up to 25mm square.

All aperture edges are carefully fabricated employing proprietary computerized micro-drilling, micro-slitting and micro-finishing techniques. All finished components are rigidly quality controlled before shipping. Standards are traceable to NIST.

For special needs, we have provided a choice of options at an additional cost.

Some typical applications of our apertures include:

- spatial filtering,
- high power laser light control,
- gas/liquid flow control,
- spectrometry,
- fiber optics,
- astronomy, etc.

Basic types:

- Standard precision round apertures
- Standard precision air slit apertures
- High power precision round apertures
- High power precision air slit apertures
- Patterns on dielectric laser coatings

Typical materials:

- Stainless Steel
- Nickel
- Brass
- Tantalum
- Copper
- Tungsten
- Beryllium copper
- Molybdenum
- Gold
- Titanium
- Platinum

General Quality Standards:

Finish: Optical research quality,
(no burrs on interior of aperture).
< 20 μ -inch, on holes 5 μ m to 30 μ m
30 to 40 μ -inch, on holes 30 to 100 μ m
40 to 80 μ -inch on holes over 100 μ m

Round Apertures:

Roundness: Major axis - minor axis, max.
0.5 μ m on holes 1-15 μ m
1 μ m on holes 20-50 μ m
2 μ m on holes 100 μ m and up

Slit Apertures:

Edge finish: 40 μ -inch <0.0006 inch thick
60 μ -inch 0.001 inch thick
Straightness: < 0.5 μ m /mm, < 2 μ m /inch

Certification available

Pinhole positioners:

See MM-1 Accessories Data sheet

Delivery:

Immediate for in stock apertures
less than 2 weeks for standard apertures

Customer satisfaction:

UNCONDITIONALLY GUARANTEED
on all standard apertures.

Specifications:

Finish: Unblackened (see OPTIONS below)

Material: 300 series stainless steel, non-magnetic (except for HS option)

Diameter: 3/8 inch (0.375 inch max.) 9.53mm

Positional tolerance: ϕ .006 inch (0.15mm)

Thickness: 0.0005 inch (12.7 μ m) on holes 5 μ m and up

Note: Holes 0.5 μ m to 3.0 μ m and possibly up to 10 μ m include the HS option for supported ultra-thin drill region.

Catalog #	Size	Tolerance	\$ Price Each
1 - 0.5	0.5 μ m	+0.3 μ m, -0 μ m	85.00
1 - 1.0	1.0 μ m	+5 μ m, -0 μ m	65.00
1 - 2.0	2.0 μ m	\pm 0.5 μ m	48.00
1 - 3.0	3.0 μ m	\pm 0.5 μ m	48.00
1 - 5.0	5.0 μ m	\pm 1 μ m	36.00
1 - 10	10 μ m	\pm 1 μ m	36.00
1 - 15	15 μ m	\pm 1.5 μ m	28.00
1 - 20	20 μ m	\pm 2 μ m	26.00
1 - 25	25 μ m	\pm 2 μ m	26.00
1 - 30	30 μ m	\pm 2 μ m	26.00
1 - 35	35 μ m	\pm 2 μ m	26.00
1 - 40	40 μ m	\pm 3 μ m	26.00
1 - 50	50 μ m	\pm 3 μ m	26.00
1 - 75	75 μ m	\pm 3 μ m	26.00
1 - 100	100 μ m	\pm 4 μ m	26.00
1 - 150	150 μ m	\pm 6 μ m	26.00
1 - 200	200 μ m	\pm 6 μ m	26.00
1 - 300	300 μ m	\pm 8 μ m	26.00
1 - 400	400 μ m	\pm 10 μ m	24.00
1 - 500	500 μ m	\pm 10 μ m	24.00
1 - 600	600 μ m	\pm 10 μ m	24.00
1 - 700	700 μ m	\pm 10 μ m	24.00
1 - 800	800 μ m	\pm 10 μ m	24.00
1 - 900	900 μ m	\pm 10 μ m	24.00
1 - 1000	1000 μ m	\pm 10 μ m	24.00
1 - "size"	up to 7000 μ m		quote

Unlisted hole size for standard materials:

One time setup charge + price of nearest hole size

	6 μ m to 19 μ m	75.00
	20 μ m to 1000 μ m	55.00

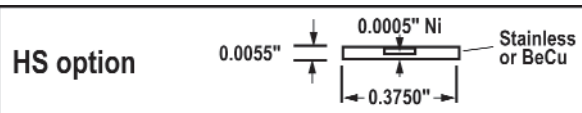
Non-standard substrate or tolerance quote

Chemical Etching quote

OPTIONS

ADD'L COST

B-1	Poly black, one side, ultra-high (98%) emissivity (on holes 5 μ m and up only)	15.00
B-2	Oxide, dull black, both sides	15.00
HS	Extra-heavy substrate, 0.005 inch (0.127mm) thick thinned down to required Ni thickness (included with 0.5 μ m - 3 μ m apertures).	20.00
	Unlisted Size	40.00

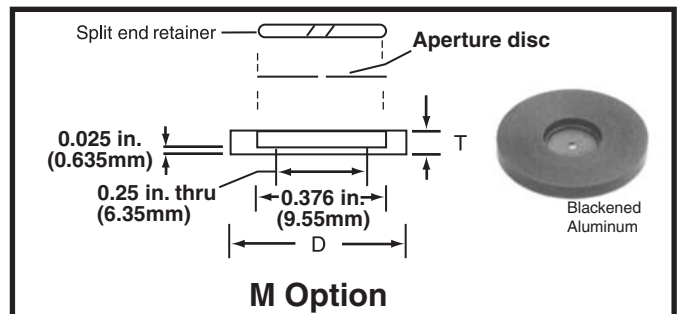


CT	Closer Tolerance; half of listed tolerance, 5 μ m to 15 μ m	45.00
	Unlisted Size	75.00
	20 μ m and up	25.00
	Unlisted Size	45.00
C	Calibrated; actual size \pm 0.5 μ m or 1%	20.00

MOUNTS

ADD'L COST

M	25mm blackened aluminum mount (24.95mm x 2.54mm thick)	20.00
M-1	1 inch blackened aluminum mount (0.996 inch x 0.100 inch thick)	20.00
M-18	18mm blackened aluminum mount (18mm x 2.54mm thick)	20.00
M-0.5	0.5 inch blackened aluminum mount (0.496 inch x 0.050 inch thick)	20.00



(5 μ m and up)

Ordering information Example: 25 μ m round, black 2 sides, mounted on 25mm disc. Cat no.: **1-25+B-2+M**

Specifications:

Finish: Unblackened (see OPTIONS below)

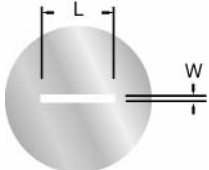
Material: 300 series stainless steel, non-magnetic (except for HS option)

Diameter: 3/8 inch (0.375 inch max.) 9.53mm

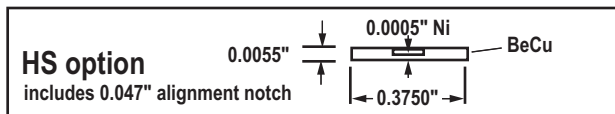
Positional tolerance: ϕ .006 inch (0.15mm)

Thickness: 0.0005 inch (12.7 μ m) on holes 5 μ m and up

Note: 3 μ m slits include a 0.005 support with a 2 μ m to 5 μ m thin Ni slit region (HS).

Catalog #	Slit Width (μ m)	Tolerance	L=3mm	L=2mm	L=1mm	
2 - 1 - L(mm)	1.0 μ m	+0.5 μ m, -0 μ m			\$250.00	
2 - 2.5 - L(mm)	2.5 μ m	+1 μ m, -0.5 μ m	\$95.00	\$85.00	\$75.00	
2 - 5 - L(mm)	5 μ m	\pm 1 μ m	\$55.00	\$48.00	\$40.00	
2 - 10 - L(mm)	10 μ m	\pm 1 μ m	\$55.00	\$48.00	\$40.00	
2 - 25 - L(mm)	25 μ m	\pm 2 μ m	\$45.00	\$40.00	\$35.00	
2 - 50 - L(mm)	50 μ m	\pm 2 μ m	\$45.00	\$40.00	\$35.00	
2 - 100 - L(mm)	100 μ m	\pm 4 μ m	\$45.00	\$40.00	\$35.00	
2 - 150 - L(mm)	150 μ m	\pm 4 μ m	\$45.00	\$40.00	\$35.00	
2 - 200 - L(mm)	200 μ m	\pm 4 μ m	\$45.00	\$40.00	\$35.00	
			Non-standard substrate or tolerance:		quote	
			Chemical Etching: (50 μ m and up \pm xxx)		quote	
			Size	Set-Up	Add'l Per Unit	
			Unlisted slit width:	6 μ m to 23 μ m	\$95.00	\$20.00
			Unlisted slit width:	24 μ m and up	\$20.00	unit price shown

OPTIONS	ADD'L COST
B-1 Poly black, one side, ultra-high (98%) emissivity (5 μ m and up only)	15.00
B-2 Oxide, dull black, both sides	15.00
HS Extra-heavy substrate, 0.005 inch (0.127mm) thick, thinned down to required Ni thickness and with 0.047 inch orientation notch. (included with 1-2 μ m slits. Maximum slit length; 5mm). Unlisted Size	40.00 40.00

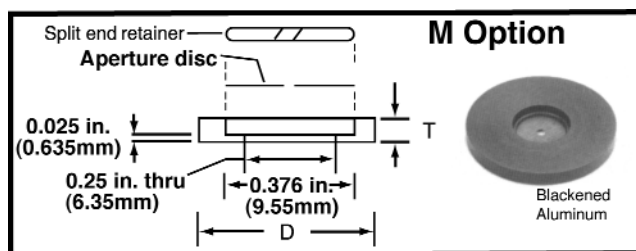


CT Closer Tolerance; half of listed tolerance, 25 μ m to 50 μ m Unlisted Size	60.00 85.00
100 μ m and up Unlisted Size	25.00 45.00
LL Longer lengths up to 100mm	quote

MOUNTS	ADD'L COST
M 25mm blackened aluminum mount (24.95mm x 2.54mm thick)	20.00
M-1 1 inch blackened aluminum mount (0.996 inch x 0.100 inch thick)	20.00
M-18 18mm blackened aluminum mount (18mm x 2.54mm thick)	20.00
M-0.5 0.5 inch blackened aluminum mount (0.496 inch x 0.050 inch thick)	20.00

CALIBRATIONS AND CERTIFICATIONS	ADD'L COST
C Calibrated; actual size \pm 1 μ m or 1% (20 μ m and up) end-center-end	45.00

Ordering information Example; 25 μ m air slit, 3mm long, black 1 side, calibrated. Cat no.: **2-25-3+B-1+C**



precision round High Power

Specifications:

Finish: Gold plated one side, flat poly black (98% emissivity) on reverse side (see OPTIONS below)
 Material: Beryllium Copper/Copper
 Diameter: 3/8 inch (0.375 inch maximum), 9.53mm
 Positional tolerance: ϕ .006 inch (0.1524mm)
 Thickness: 0.001 inch (25 μ m)

High Power

Catalog #	Size	Tolerance	\$ Price Each
3 - 5	5 μ m	\pm 1 μ m	60.00
3 - 10	10 μ m	\pm 1 μ m	60.00
3 - 15	15 μ m	\pm 1.5 μ m	60.00
3 - 25	25 μ m	\pm 2 μ m	60.00
3 - 50	50 μ m	\pm 3 μ m	60.00
3 - 100	100 μ m	\pm 4 μ m	60.00
3 - 200	200 μ m	\pm 6 μ m	60.00
3 - "size"	1100 to 7000 μ m		quote

Unlisted hole size for standard materials:

One time setup charge + price of nearest hole size

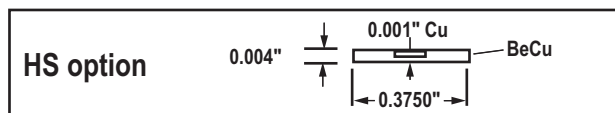
	6 μ m to 19 μ m	75.00
	20 μ m to 1000 μ m	55.00

Non-standard substrate or tolerance: quote

Chemical Etching: quote

OPTIONS ADD'L COST

HS	Extra-heavy substrate, 0.004 inch (0.1016mm) thick thinned down to 0.001 inch Cu thickness.	
	5 μ m to 15 μ m	40.00
	Unlisted Size	75.00
	20 μ m to 1000 μ m	30.00
	Unlisted Size	50.00

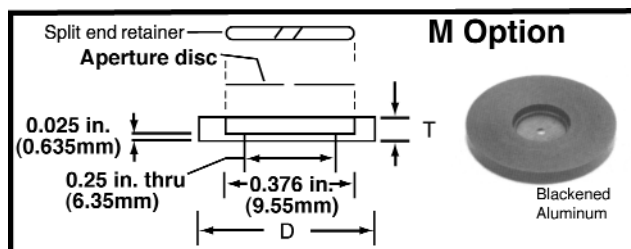


G2 Gold plated both sides quote
 Note: Listed sizes and unlisted sizes will be charged a setup and get normal delivery. Standby status for listed sizes will eliminate setup cost, but can add up to 4 weeks to delivery time.

CT	Closer Tolerance; half of listed tolerance,	
	5 μ m to 15 μ m	75.00
	Unlisted Size	95.00
	20 μ m and up	35.00
	Unlisted Size	65.00

MOUNTS ADD'L COST

M	25mm blackened aluminum mount (24.95mm x 2.54mm thick)	20.00
M-1	1 inch blackened aluminum mount (0.996 inch x 0.100 inch thick)	20.00
M-18	18mm blackened aluminum mount (18mm x 2.54mm thick)	20.00
M-0.5	0.5 inch blackened aluminum mount (0.496 inch x 0.050 inch thick)	20.00



CALIBRATIONS AND CERTIFICATIONS ADD'L COST

C	Calibrated; actual size \pm 0.5 μ m or 1% (5 μ m and up)	20.00
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Power Resistance Examples:

0.5 to 1 megawatt/mm², 75 nanosecond duration, 700nm
 1 to 2 megawatt/mm², 10 nanosecond duration, 700nm
 Note: Because of the numerous power density conditions, a test on 1 mil Cu in your direct operating environment is recommended.

Delivery: 2 weeks, standard HP Round

Ordering information Example; 25 μ m round, mounted on 25mm disc. Cat no.: **3-25+M**

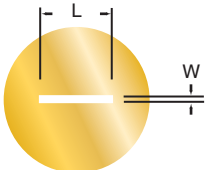
precision air slit

High Power

Specifications:

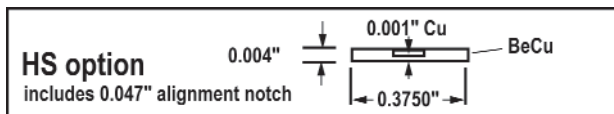
Finish: Gold plated one side, flat poly black (98% emissivity) on reverse side (see OPTIONS below)
 Material: Beryllium Copper/Copper
 Diameter: 3/8 inch (0.375 inch maximum), 9.53mm
 Positional tolerance: ϕ .006 inch (0.1524mm)
 Thickness: 0.001 inch (25 μ m)

High Power

Catalog #	Slit Width (μ m)	Tolerance	L=3mm	L=2mm	L=1mm
4 - 5 - L(mm)	5 μ m	\pm 1 μ m	\$85.00	\$75.00	\$60.00
4 - 10 - L(mm)	10 μ m	\pm 1 μ m	\$85.00	\$75.00	\$60.00
4 - 25 - L(mm)	25 μ m	\pm 2 μ m	\$75.00	\$65.00	\$50.00
4 - 50 - L(mm)	50 μ m	\pm 3 μ m	\$75.00	\$65.00	\$50.00
4 - 100 - L(mm)	100 μ m	\pm 4 μ m	\$75.00	\$65.00	\$50.00
4 - 200 - L(mm)	200 μ m	\pm 4 μ m	\$75.00	\$65.00	\$50.00
			Non-standard substrate or tolerance:		quote
			Chemical Etching: (50 μ m and up \pm xxx)		quote
Unlisted slit width:			Size	Set-Up	Add'l Per Unit
			6 μ m to 24 μ m	\$95.00	\$20.00
			25 μ m to 750 μ m	\$20.00	unit price shown

OPTIONS ADD'L COST

HS	Extra-heavy substrate, 0.004 inch (0.1016mm) thick thinned down to 0.001 inch Cu thickness.	
	5 μ m to 20 μ m	65.00
	Unlisted Size	75.00
	25 μ m to 750 μ m	45.00
	Unlisted Size	50.00



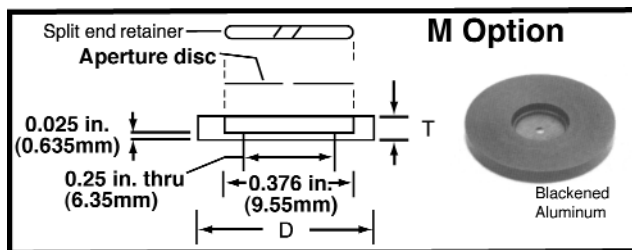
G2	Gold plated both sides	15.00
CT	Closer Tolerance; half of listed tolerance, 25 μ m to 50 μ m	85.00
	Unlisted Size	95.00
	100 μ m to 1000 μ m	35.00
	Unlisted Size	65.00
LL	Longer lengths up to 100mm	quote

Power Resistance Examples:

0.5 to 1 megawatt/mm², 75 nanosecond duration, 700nm
 1 to 2 megawatt/mm², 10 nanosecond duration, 700nm
 Note: Because of the numerous power density conditions, a test on 1 mil Cu in your direct operating environment is recommended.

MOUNTS ADD'L COST

M	25mm blackened aluminum mount (24.95mm x 2.54mm thick)	20.00
M-1	1 inch blackened aluminum mount (0.996 inch x 0.100 inch thick)	20.00
M-18	18mm blackened aluminum mount (18mm x 2.54mm thick)	20.00
M-0.5	0.5 inch blackened aluminum mount (0.496 inch x 0.050 inch thick)	20.00



CALIBRATIONS AND CERTIFICATIONS ADD'L COST

C	Calibrated; actual size \pm 1 μ m or 1% (25 μ m and up, end-center-end)	65.00
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Ordering information Example; 25 μ m air slit 3mm long (4-25), calibrated (C)
 The part number would be **4-25-3+C**

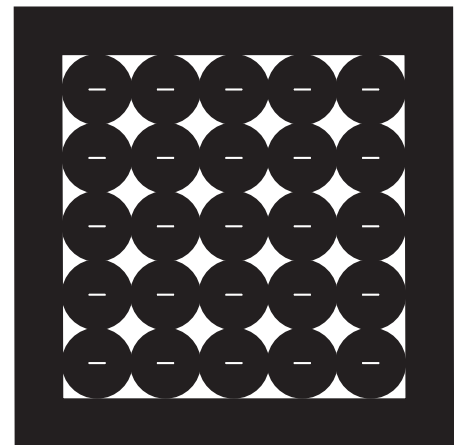
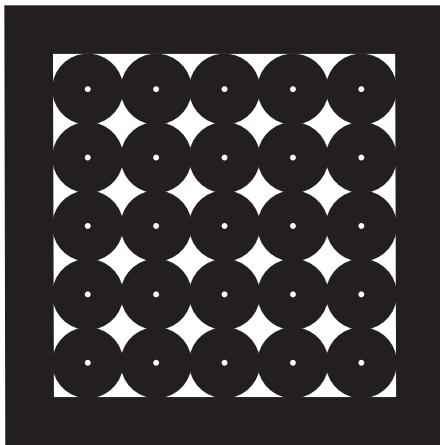
High Quality Palletized Precision APERTURES

New

Pinholes



Slits



Custom and Stock Palettes

- Highly competitive on **pricing** and **quality** with Lithography and Etching
- **Volume** pricing on 100 pc. quantity and up
- Low NRE charges
- Features easily modifiable (post NRE)
- Highly competitive **delivery**
- Top quality feature interior **finish**
- Tolerances down to $\pm 2\mu\text{m}$ and better
(1/5 to 1/10 the tolerances and edge finish of conventional laser machining)

High Quality Spatial Filter APERTURES

FITS MOST STANDARD SPATIAL FILTERS

Specifications

Substrate:

Material: 300 series stainless steel, non-magnetic

Substrate Diameter: 3/8 inch (0.375inch) 9.53mm

Thickness: 0.0005 inch (12.7 μ m)

Finish: Black both sides

Mount:

Thickness: 0.1 inch

Diameter: 1 inch

Positional Tolerance: ϕ .006 inch (0.1524mm)



Catalog #	Size (μ m)	Tolerance	Price Ea. \$
SP-5	5.0 μ m	\pm 1 μ m	63.00
SP-10	10 μ m	\pm 1 μ m	60.00
SP-15	15 μ m	\pm 1.5 μ m	59.00
SP-25	25 μ m	\pm 2 μ m	59.00
SP-35	35 μ m	\pm 2 μ m	59.00
SP-50	50 μ m	\pm 3 μ m	59.00
SP-75	75 μ m	\pm 3 μ m	59.00
SP-100	100 μ m	\pm 4 μ m	59.00
SP-150	150 μ m	\pm 6 μ m	59.00
SP-200	200 μ m	\pm 6 μ m	59.00

SPATIAL FILTER HIGH POWER PINHOLES

Specifications

Substrate:

Material: Copper

Substrate Diameter: 3/8 inch (0.375inch) 9.53mm

Thickness: 0.001 inch (25.4 μ m)

Finish: Black one side,
Gold one side

Mount:

Thickness: 0.1 inch

Diameter: 1 inch

Positional Tolerance: ϕ .006 inch (0.1524mm)



Catalog #	Size (μ m)	Tolerance	Price Ea. \$
SPHP-5	5.0 μ m	\pm 1 μ m	85.00
SPHP-10	10 μ m	\pm 1 μ m	85.00
SPHP-15	15 μ m	\pm 1.5 μ m	85.00
SPHP-50	50 μ m	\pm 3 μ m	80.00
SPHP-100	100 μ m	\pm 4 μ m	80.00
SPHP-150	150 μ m	\pm 6 μ m	74.00
SPHP-200	200 μ m	\pm 6 μ m	74.00

SPATIAL FILTERS FIXED SLITS

Specifications

Substrate:

Material: 300 series stainless steel, non-magnetic

Substrate Diameter: 3/8 inch (0.375inch) 9.53mm

Thickness: 0.0005 inch (12.7 μ m)

Finish: Black both sides

Mount:

Thickness: 0.1 inch

Diameter: 1 inch

Positional Tolerance: ϕ .006 inch (0.1524mm)



Catalog #	Size (μ m)	Tolerance	Price Ea. \$
SS-5	5.0 μ m	\pm 1 μ m	75.00
SS-10	10 μ m	\pm 1 μ m	75.00
SS-15	15 μ m	\pm 1.5 μ m	75.00
SS-25	25 μ m	\pm 2 μ m	72.00
SS-50	50 μ m	\pm 3 μ m	72.00
SS-100	100 μ m	\pm 4 μ m	69.00
SS-200	200 μ m	\pm 4 μ m	69.00

We are the manufacturer

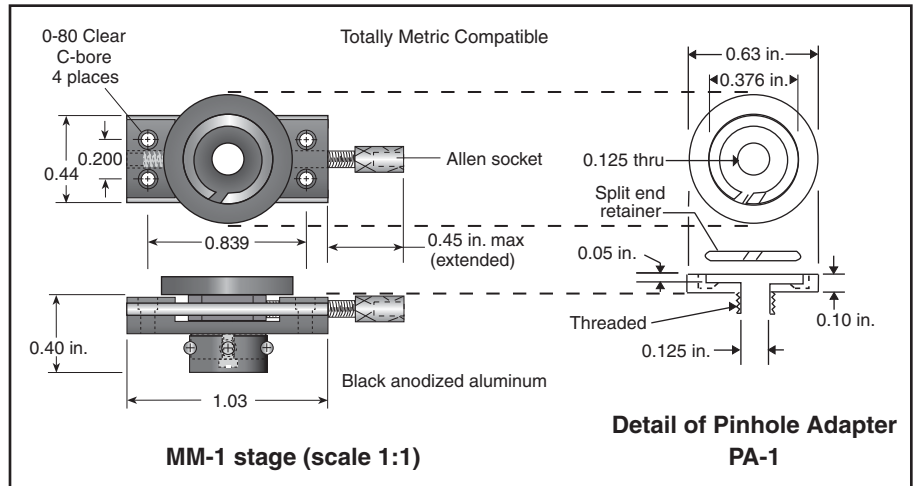
Accessories

Model MM-1XY/PA

The pinhole (aperture) positioner is a composite of the MM-1 MicroMini™ stage and the PA-1 pinhole adapter.

Specifications:

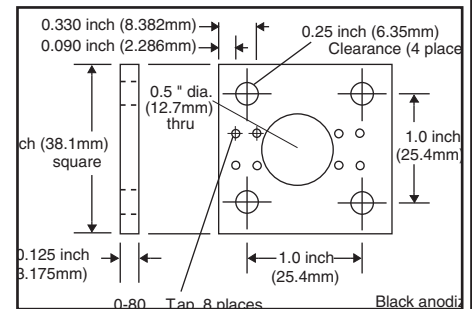
Travel:	0.125 inch, X and Y
Screw Pitch:	80 TPI
Sensitivity:	0.5μ
Backlash:	0
Wobble:	0 (no ball bearings)
Thermal Stability:	15° to 75°C
Weight:	8g



Accessories

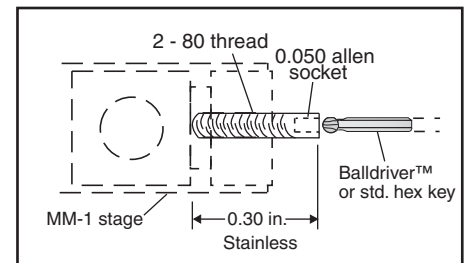
AP4-1 Adapter Plate

A multi-position mounting plate to interface with standard optical tables and accessories, or to stabilize free-standing stages.



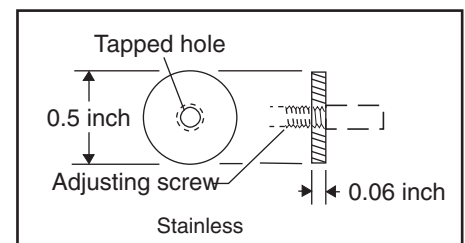
SS-1 Headless Adjusting Screw

This custom designed lead screw replaces the standard thumb screw. It provides full linear travel, while reducing the overall length of the stage by 0.4 inches.



TG-1 Thumb Grip

This knurled 1/2 inch diameter adjustment ring provides increased sensitivity. The TG-1 can be added to the standard MM-1 adjusting screw and may alternately be used as a locking nut.



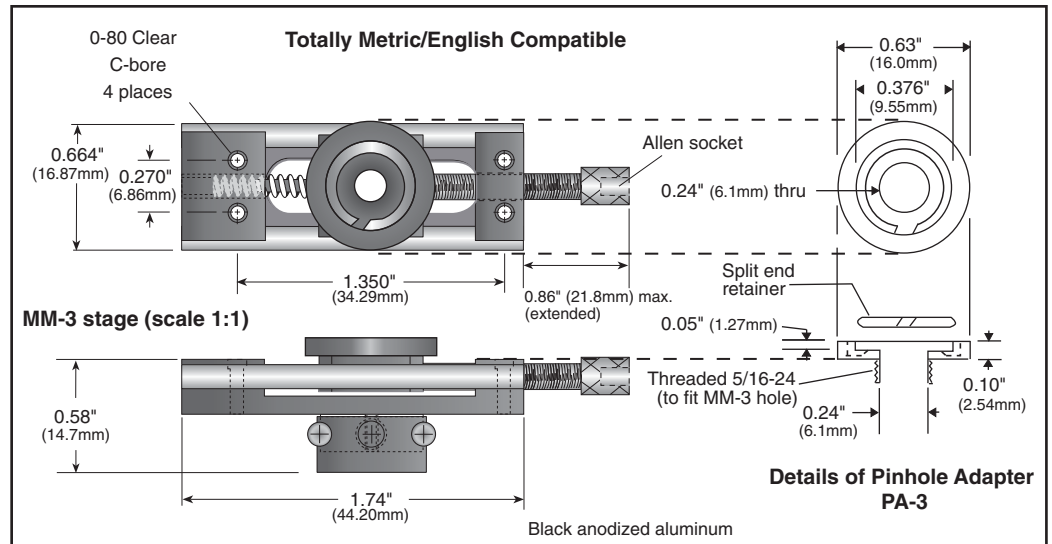
Accessories

Model MM-3XY/PA

The pinhole (aperture) positioner is a composite of the MM-3 MicroMini™ stage and the PA-1 pinhole adapter.

Specifications:

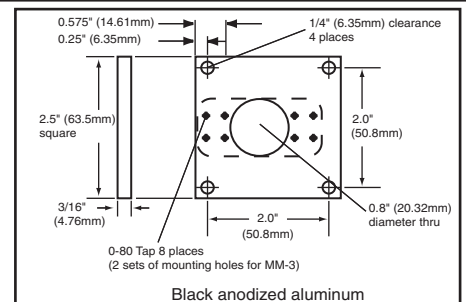
Travel:	0.125 inch, X and Y
Screw Pitch:	80 TPI
Sensitivity:	0.5μ
Backlash:	0
Wobble:	0 (no ball bearings)
Thermal Stability:	15° to 75°C
Weight:	8g



Accessories

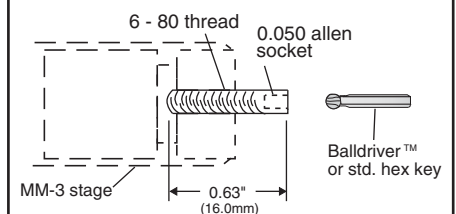
AP4-3 Adapter Plate

A multi-position mounting plate to interface with standard optical tables and accessories, or to stabilize free-standing stages.



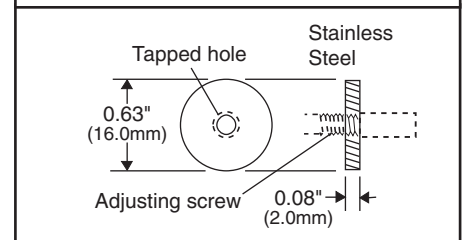
SS-3 Headless Adjusting Screw

This custom designed stainless lead screw replaces the standard thumb screw, and provides full linear travel while reducing the overall length of the stage by 0.5 inches.



TG-3 Thumb Grip

The knurled 5/8 inch diameter adjustment ring provides increased sensitivity. The TG-3 can be added to the standard MM-3 adjusting screw and may alternately be used as a locking nut.



Air Apertures on Reflective Surfaces to Optical Tolerances - *Custom Only*

Flatness:

to 1/4 wave per inch (25.μm), with consideration for thickness requirements at immediate aperture area

Reflectivity:

Optical metal mirror quality

Materials:

- Copper
- Stavex (stainless steel)
- etc.

Thickness:

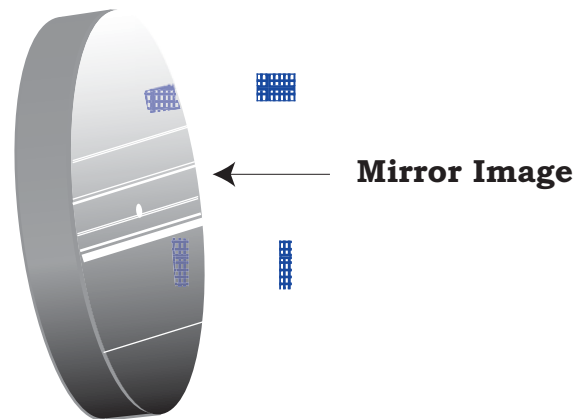
as required for flatness, minimum

Coatings:

- Gold
- Silver
- Dichroic
- SiO
- etc.

Applications:

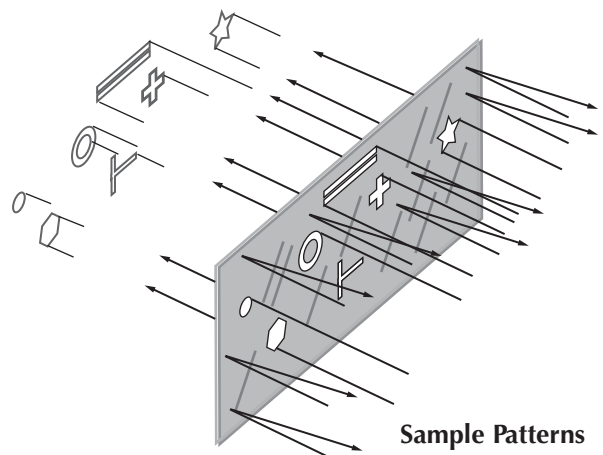
- Astronomy; ground based and space applications
- Imaging
- etc.



Clear Patterns, Reticles, Apertures on high power dielectric laser reflector coatings

For applications requiring transparency and/or power resistance greater than achievable with opaque (metallic, etc.) surfaces this process creates patterns on dichroic reflectors with selective transparency.

- Wavelength:** Per standard high power dielectric coating, visible and near visible
- Reflectivity:** 20% to 98%, based on requirement
- Incidence:** 0° - 90°, per specification
- Power resistance:** 2 - 8 Megawatts/mm², pulsed
- Pattern definition:** < 1 μm (semiconductor pattern quality)
- Material:** Glass, fused silica, etc.
- Dimensions:** Up to 6 inch (1.524mm) thickness, 0.04 inch (1.016mm) - 0.09 inch (2.286mm)
- Pattern generation:** Per customer or National Aperture, Inc. via AutoCad™
- Pricing:** Quote



Typical materials:

- Stainless steel
- Brass
- Copper
- Beryllium copper
- Gold
- Nickel
- Tantalum
- Tungsten
- Molybdenum
- Titanium
- Platinum
- etc.

Suggested materials (unless otherwise required):

For best quality and cost;
300 series stainless steel 0.001 inch thick or under.

Gas, Liquid, Material FLOW Oriented:

Leak test grade;

The emphasis normally on roundness is replaced by orifice area specification to improve cost effectiveness. To optimize quality, materials should be kept as thin as allowable. 302 stainless steel is suggested unless otherwise required.

Metered Flow;

Same as Leak Test above

Dies (wire polymer), Jets (liquid or gas);

Up to 0.010 inch diameter x 0.010 inch deep

X-ray shielding, selective:

Typical materials are tantalum, tungsten and platinum

Special Micro Patterns:

Round, square, rectangular, slit, arc, hexagon, octagon, annular, etc. and combinations of patterns or arraysper quote

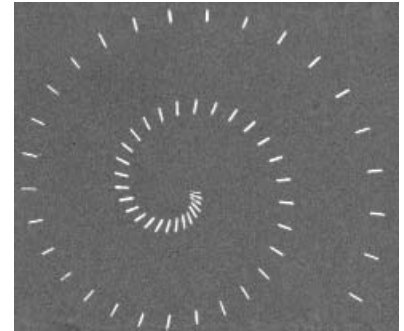
Four-Bar Patterns:

Standard or 302 stainless steel 0.0005 in. x 0.375 in., or copper 0.001 in.
Up to 5mm square; not including applicable air slit options\$85.00
Up to 0.750 in., any workable materialper quote

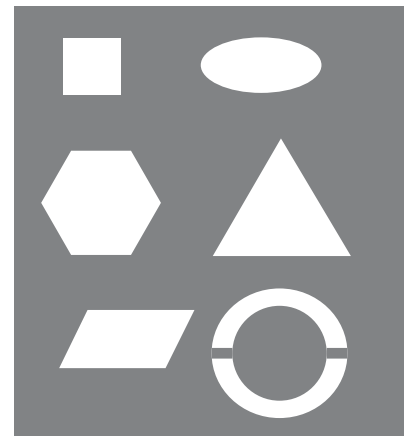
SEM photos:

per feature\$95.00
per additional shot/angle\$25.00
(Not to be used for calibration or measurement.)

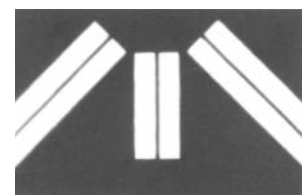
Quality projection samples are available at minimal or no cost.



Spiral Slits



Shapes



Slits