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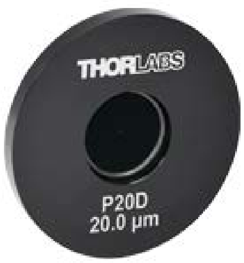
THORLABS

P25HD - May 5, 2021

Item # P25HD was discontinued on May 5, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

CIRCULAR PRECISION PINHOLES, STAINLESS STEEL FOILS

- Pinhole Sizes from Ø1 µm to Ø1 mm
- Stainless Steel Foils in Ø1/2" or Ø1" Aluminum Housings
- Blackened for Increased Absorbance on Both Sides



P20D
Ø20 µm Pinhole
Ø1" Housing

P5HD
Ø5 µm Pinhole
Ø1/2" Housing

P600D
Ø600 µm Pinhole
Ø1" Housing

P100HD
100 µm Pinhole
Ø1/2" Housing

Hide Overview

OVERVIEW

Features

- Precision Pinholes in Stainless Steel Foils Mounted in Aluminum Housings
  - Ø5 µm to Ø1 mm Pinholes Available with Ø1/2" Housing
  - Ø1 µm to Ø1 mm Pinholes Available with Ø1" Housing
- Blackened for Increased Absorbance on Both Sides

Single, mounted, precision pinholes offer small optical apertures for applications such as alignment, beam conditioning, and imaging. The pinholes offered here use blackened stainless steels foils, are available from Ø1 µm to Ø1 mm, and are mounted in Ø1/2" or Ø1" black-anodized-aluminum housings. We also offer pinholes with a variety of other foil materials; see the table to the right for options.

Click to Enlarge
P5D Pinhole Mounted in SM1ZM Zoom Housing and ST1XY-D XY Translator

Apertures Selection Guide
Single Precision Pinholes
Circular in Stainless Steel Foils
Circular in Tungsten Foils
Circular in Gold-Plated Copper Foils
Square in Stainless Steel Foils
Pinhole Wheels
Manual
Motorized
Pinhole Spatial Filter
Slits
Annular Apertures
Alignment Tools

For many applications, such as holography, spatial intensity variations in the laser beam are unacceptable. Using precision pinholes in conjunction with positioning and focusing equipment such as our KT310(/M) Spatial Filter System creates a "noise" filter, effectively stripping variations in intensity out of a Gaussian beam. Please see the *Tutorial* tab for more information on spatial filters.

Precision Pinhole Options
Thorlabs' precision pinholes are available with an assortment of fabrication materials and coatings. The choice of a particular size and material should depend on the application. Low-power applications may benefit more from the absorbance of blackened stainless steel foils, while high-power applications may need the high damage threshold and reflectivity of gold-plated copper foils or the high melting point and lower reflectivity of our tungsten foils. Please see the *Material Properties* tab for more information.

In addition to single pinholes, Thorlabs also offers pinhole wheels that contain 16 radially-spaced pinholes that are lithographically etched onto a chrome-plated fused silica substrate. These wheels allow the user to test multiple pinhole sizes within a setup.

If you do not see what you need among our stock pinhole offerings, it is possible to special order pinholes that are fabricated from different substrate materials, have different pinhole sizes, incorporate multiple holes in one foil, or provide different pinhole configurations. Customized pinhole housings are also available. Please contact Tech Support to discuss your specific needs.

Hide Foil Materials

FOIL MATERIALS

Precision Pinholes and Slits

Thorlabs offers precision pinholes with blackened stainless steel, tungsten, or gold-plated copper foils. Our pinholes with stainless steel foils are blackened on both sides for increased absorbance and are available from stock in circles from Ø1 µm to Ø1 mm and squares from 100 µm x 100 µm to 1 mm x 1 mm. Our pinholes with tungsten foils are uncoated and available with pinhole diameters from 5 µm to 2 mm. Lastly, our pinholes with gold-plated copper foils, plated with gold on one side and black-oxide coated on the reverse, are offered in 10 µm, 25 µm, or 50 µm diameters. We also offer slits in blackened stainless steel foils from stock with slit widths from 5 to 200 µm.

If you do not see what you need among our stock pinhole and slit offerings, it is also possible to special order pinholes and slits that are made with different foil materials, have different hole sizes and shapes, incorporate multiple holes in one foil, or provide different hole configurations. Please contact Tech Support to discuss your specific needs. For more information on the properties of the bulk materials from which the pinholes are fabricated, see the table below.

Material Properties

Depending on the application, it can be important to consider the material properties of the pinhole or slit. The material used to construct the aperture can have varying levels of melting point, density, and thermal conductivity, as detailed in the table below.

Material Properties			
Material	**300 Series Stainless Steel[a]**	**Tungsten**	**Copper[b]**
Melting Point	1390 - 1450 °C	3422 °C	1085 °C
Density	8.03 g/cm^3	19.25 g/cm^3	8.96 g/cm^3
Brinell Hardness	170 MPa	2570 MPa	878 MPa
Thermal Expansion Coefficient	16.2 (µm/m)/°C	4.5 (µm/m)/°C	16.7 (µm/m)/°C
Specific Heat @ 20 °C	485 J/(K*kg)	134 J/(K*kg)	385 J/(K*kg)
Thermal Conductivity	16.2 W/(m*K)	173 W/(m*K)	401 W/(m*K)
Thermal Diffusivity @ 300 K	3.1 mm^2/s	80 mm^2/s	111 mm^2/s

a. Stainless steel pinholes and slits are blackened on both sides to increase absorbance. The material properties will be predominantly that of bulk stainless steel.
b. Gold-plated copper pinholes have a thin coating of gold on one side of the bulk copper foil. With a beam incident on this side, reflectivity will be that of gold (96% @ 800 nm) while thermal properties will be predominantly copper-based.

Hide Tutorial

TUTORIAL

Principles of Spatial Filters

For many applications, such as holography, spatial intensity variations in the laser beam are unacceptable. Our KT310 spatial filter system is ideal for producing a clean Gaussian beam.

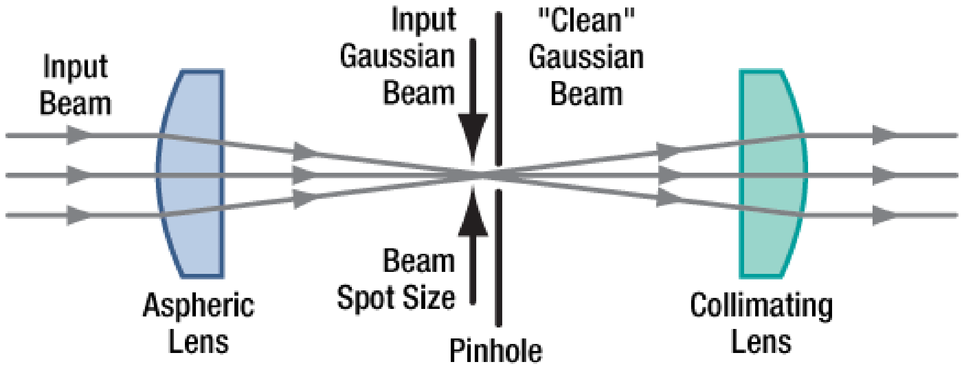


Figure 1: Spatial Filter System

The input Gaussian beam has spatially varying intensity "noise". When a beam is focused by an aspheric lens, the input beam is transformed into a central Gaussian spot (on the optical axis) and side fringes, which represent the unwanted "noise" (see Figure 2 below). The radial position of the side fringes is proportional to the spatial frequency of the "noise".

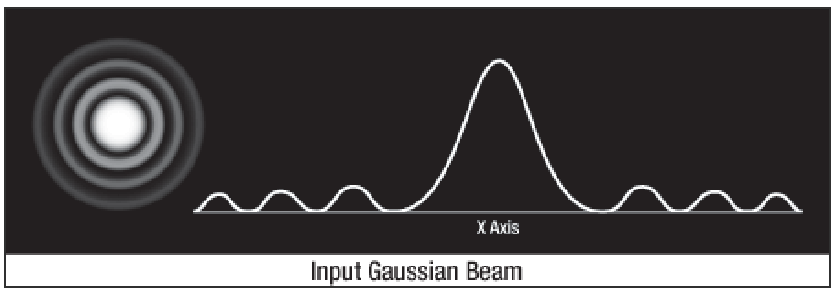


Figure 2

By centering a pinhole on a central Gaussian spot, the "clean" portion of the beam can pass while the "noise" fringes are blocked (see Figure 3 below).

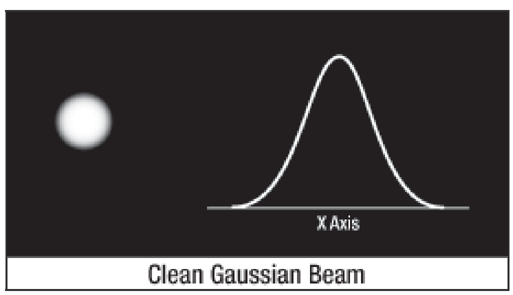


Figure 3

The diffraction-limited spot size at the 99% contour is given by:

$$D = \frac{\lambda f}{r}$$

where λ = wavelength, f=focal length and r = input beam radius at the $1/e^2$ point.

Choosing the Correct Optics and Pinhole for Your Spatial Filter System

The correct optics and pinhole for your application depend on the input wavelength, source beam diameter, and desired exit beam diameter.

For example, suppose that you are using a 650 nm diode laser source that has a diameter ($1/e^2$) of 1.2 mm and want your beam exiting the spatial filter system to be about 4.4 mm in diameter. Based on these parameters, the C560TME-B mounted aspheric lens would be an appropriate choice for the input side of spatial filter system because it is designed for use at 650 nm, and its clear aperture measures 5.1 mm, which is large enough to accommodate the entire diameter of the laser source.

The equation for diffraction limited spot size at the 99% contour is given above, and for this example, λ = (650 x 10^{-9} m), f = 13.86 mm for the C560TM-B, and r = 0.6 mm. Substitution yields

$$D = \frac{(650\ x\ 10^{-9}\ m)(13.86\ mm)}{0.6\ mm} \approx 15\ \mu m$$

Diffraction-Limited Spot Size (650 nm source, Ø1.2 mm beam)

The pinhole should be chosen so that it is approximately 30% larger than *D*. If the pinhole is too small, the beam will be clipped, but if it is too large, more than the TEM_{00} mode will get through the pinhole. Therefore, for this example, the pinhole should ideally be 19.5 microns. Hence, we would recommend the mounted pinhole P20D, which has a pinhole size of 20 µm. Parameters that can be changed to alter the beam waist diameter, and thus the pinhole size required, include changing the input beam diameter and focal length of focusing lens. Decreasing the input beam diameter will increase the beam waist diameter. Using a longer focal length focusing lens will also increase the beam waist diameter.

Finally, we need to choose the optic on the output side of the spatial filter so that the collimated beam's diameter is the desired 4.4 mm. To determine the correct focal length for the lens, consider the following diagram in Figure 4, which is not drawn to scale. From the triangle on the left-hand side, the angle is determined to be approximately 2.48°. Using this same angle for the triangle on the right-hand side, the focal length for the plano-convex lens should be approximately 50 mm.

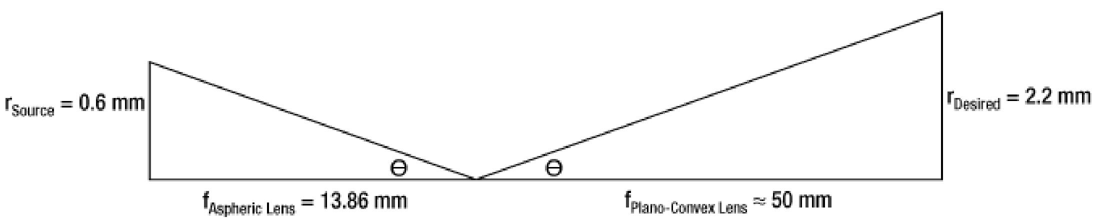


Figure 4: Beam Expansion Example

For this focal length, we recommend the LA1131-B plano-convex lens [with f = 50 mm at the design wavelength (λ = 633 nm), this is still a good approximation for f at the source wavelength (λ = 650 nm)].

Note: The beam expansion equals the focal length of the output side divided by the focal length of the input side.

For optimal performance, a large-diameter aspheric lens can be used in place of a plano-convex lens if the necessary focal length on the output side is 20 mm (see AL2520-A, AL2520-B, AL2520-C). These lenses are 25 mm in diameter and can be held in place using the supplied SM1RR Retaining Ring.

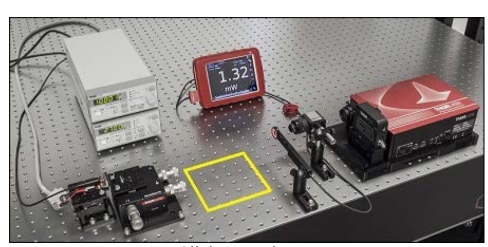
Hide Lab Facts

LAB FACTS

Comparison of Circularization Techniques for Elliptical Beams

Lab Facts

Click for Full Lab Facts Summary



Click to Enlarge

Figure 1: The beam circularization systems were placed in the area of the experimental setup highlighted by the yellow rectangle.

Edge-emitting laser diodes emit elliptical beams as a consequence of the rectangular cross sections of their emission apertures. The component of the beam corresponding to the narrower dimension of the aperture has a greater divergence angle than the orthogonal beam component. As one component diverges more rapidly than the other, the beam shape is elliptical rather than circular.

Elliptical beam shapes can be undesirable, as the spot size of the focused beam is larger than if the beam were circular, and as larger spot sizes have lower irradiances (power per area). Techniques for circularizing an elliptical beam include those based on a pair of cylindrical lenses, an anamorphic prism pair, or a spatial filter. This work investigated all three approaches. The characteristics of the circularized beams were evaluated by performing M^2 measurements, wavefront measurements, and measuring the transmitted power.


Click to Enlarge
Figure 2: Cylindrical Lens Pair System


Click to Enlarge
Figure 3: Anamorphic Prism Pair System


Click to Enlarge
Figure 4: Spatial Filter System

While it was demonstrated that each circularization technique improves the circularity of the elliptical input beam, each technique was shown to provide a different balance of circularization, beam quality, and transmitted power. The results of this work, which are documented in this Lab Fact, indicate that an application's specific requirements will determine which is the best circularization technique to choose.

Experimental Design and Setup

The experimental setup is shown in Figure 1. The elliptically-shaped, collimated beam of a temperature-stabilized 670 nm laser diode was input to each of our circularization systems shown in Figures 2 through 4. Collimation results in a low-divergence beam, but it does not affect the beam shape. Each system was based on one of the following:

- LJ1874L2-A and LJ1638L1-A Plano-Convex Convex Cylindrical Lenses (Figure 2)
- PS873-A Unmounted Anamorphic Prism Pair (Figure 3)
- KT310 Spatial Filter System with P5S Ø5 µm Pinhole (Figure 4)

The beam circularization systems, shown to the right, were placed, one at a time, in the vacant spot in the setup highlighted by the yellow rectangle. With this arrangement, it was possible to use the same experimental conditions when evaluating each circularization technique, which allowed the performance of each to be directly compared with the others. This experimental constraint required the use of fixturing that was not optimally compact, as well as the use of an unmounted anamorphic prism pair, instead of a more convenient mounted and pre-aligned anamorphic prism pair.

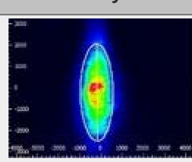
The characteristics of the beams output by the different circularization systems were evaluated by making measurements using a power meter, a wavefront sensor, and an M^2 system. In the image of the experimental setup, all of these systems are shown on the right side of the table for illustrative purposes; they were used one at a time. The power meter was used to determine how much the beam circularization system attenuated the intensity of the input laser beam. The wavefront sensor provided a way to measure the abberations of the output beam. The M^2 system measurement describes the resemblence of the output beam to a Gaussian beam. Ideally, the circularization systems would not attenuate or abberate the laser beam, and they would output a perfectly Gaussian beam.

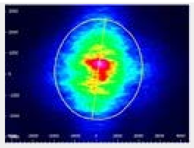
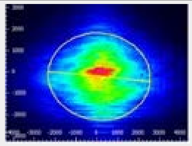
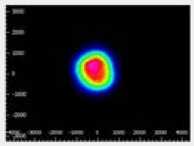
Edge-emitting laser diodes also emit astigmatic beams, and it can be desirable to force the displaced focal points of the orthogonal beam components to overlap. Of the three circularization techniques investigated in this work, only the cylindrical lens pair can also compensate for astigmatism. The displacement between the focal spots of the orthogonal beam components were measured for each circularization technique. In the case of the cylindrical lens pair, their configuration was tuned to minimize the astigmatism in the laser beam. The astigmatism was reported as a normalized quantity.

Experimental Results

The experimental results are summarized in the following table, in which the green cells identify the best result in each category. Each circularization approach has its benefits. The best circularization technique for an application is determined by the system's requirements for beam quality, transmitted optical power, and setup constraints.

Spatial filtering significantly improved the circularity and quality of the beam, but the beam had low transmitted power. The cylindrical lens pair provided a well-circularized beam and balanced circularization and beam quality with transmitted power. In addition, the cylindrical lens pair compensated for much of the beam's astigmatism. The circularity of the beam provided by the anamorphic prism pair compared well to that of the cylindrical lens pair. The beam output from the prisms had better M^2 values and less wavefront error than the cylindrical lenses, but the transmitted power was lower.

Method	Beam Intensity Profile	Circularity[a]	M^2 Values	RMS Wavefront	Transmitted Power	Normalized Astigmatism[b]
Collimated Source Output (No Circularization Technique)	 Click to Enlarge Scale in Microns	0.36	X Axis: 1.28 Y Axis: 1.63	0.17	Not Applicable	0.67
Cylindrical Lens Pair		0.84	X Axis: 1.90	0.30	91%	0.06

	 Click to Enlarge Scale in Microns		Y Axis: 1.93			
Anamorphic Prism Pair	 Click to Enlarge Scale in Microns	0.82	X Axis: 1.60 Y Axis: 1.46	0.16	80%	1.25
Spatial Filter	 Click to Enlarge Scale in Microns	0.93	X Axis: 1.05 Y Axis: 1.10	0.10	34%	0.36

a. Circularity=d_{minor}/d_{major}, where d_{minor} and d_{major} are minor and major diameters of fitted ellipse (1/e intensity) and Circularity = 1 indicates a perfectly circular beam.
b. Normalized astigmatism is the difference in the waist positions of the two orthogonal components of the beam, divided by the Raleigh length of the beam component with the smaller waist.

Components used in each circularization system were chosen to allow the same experimental setup be used for all experiments. This had the desired effect of allowing the results of all circularization techniques to be directly compared; however, optimizing the setup for a circularization technique could have improved its performance. The mounts used for the collimating lens and the anamorphic prism pair enabled easy manipulation and integration into this experimental system. It is possible that using smaller mounts would improve results by allowing the members of each pair to be more precisely positioned with respect to one another. In addition, using made-to-order cylindrical lenses with customized focal lengths may have improved the results of the cylindrical lens pair circularization system. All results may have been affected by the use of the beam profiler software algorithm to determine the beam radii used in the circularity calculation.

Additional Information

Some information describing selection and configuration procedures for several components used in this experimental work can be accessed by clicking the following hyperlinks:

- Mounting Laser Diodes
- Driving a Laser Diode
- Selecting a Collimating Lens
- Aspheric Lenses
- Spatial Filters

Hide Apertures Selection Guide

APERTURES SELECTION GUIDE

Apertures Selection Guide			
Aperture Type	**Representative Image (Click to Enlarge)**	**Description**	**Aperture Sizes Available from Stock[a]**
Single Precision		Circular Pinholes in Stainless Steel Foils	Ø1 µm to Ø1 mm
		Circular Pinholes in Tungsten Foils	Ø5 µm to Ø2 mm

Pinholes[a]		Circular Pinholes in Gold-Plated Copper Foils	Ø10 to Ø50 µm
		Square Pinholes in Stainless Steel Foils	100 µm to 1000 mm Square
Slits[a]		3 mm Long Slits in Stainless Steel Foils	Slit Widths: 5 to 200 µm
Annular Apertures		Annular Aperture Obstruction Targets on Quartz Substrates with Chrome Masks	Ø300 µm or Ø2 mm Pinholes with ε Ratios[b] of 0.85, Ø1 mm Pinholes with ε Ratios[b] of 0.05 0.1, or 0.85
Pinhole Wheels		Manual, Mounted or Unmounted, Chrome-Plated Fused Silica Disks with Lithographically Etched Pinholes	Each Disk has 16 Pinholes from Ø25 µm to Ø2 mm and Four Annular Apertures (Ø100 µm Hole, 50 µm Obstruction)
		Motorized Pinhole Wheels with Chrome-Plated Glass Disks with Lithographically Etched Pinholes	Each Disk has 16 Pinholes from Ø25 µm to Ø2 mm and Four Annular Apertures (Ø100 µm Hole, 50 µm Obstruction)

a. Single precision pinholes and slits can be special ordered with different aperture sizes, foil materials, shapes, and hole distributions than those offered from stock. Please contact Tech Support with inquiries.
b. Ratio of the Obstruction Diameter to the Pinhole Diameter

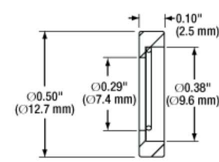
Hide Pinholes, Stainless Steel Foils, Ø1/2" Housings

Pinholes, Stainless Steel Foils, Ø1/2" Housings

- Precision Pinholes from Ø5 µm to Ø1 mm
- Stainless Steel Foils are Black-Nickel Coated on Both Sides for Increased Absorbance
- Black-Anodized Aluminum Housings with 1/2" (12.7 mm) Outer Diameters

These mounted precision pinholes are available with pinhole diameters from 5 µm to 1 mm. They are fabricated from stainless steel foils that are black-nickel coated on both sides. The pinholes are mounted in a Ø1/2" (12.7 mm), 0.10" (2.5 mm) thick aluminum housing that is black anodized. The housings are engraved with the pinhole item # and the size of the pinhole.

The foils can be taken out of their housings by removing the retaining ring using small tweezers or pliers; use care as the foil is very thin (50 µm).



Click to Enlarge
Dimensions for Mounted Stainless Steel Pinholes in Ø1/2" (12.7 mm) Housing


Click to Enlarge
Rear of Mounted Pinhole

Item #	Pinhole Diameter	Diameter Tolerance	Circularity	Foil Thickness	Foil Material	Housing Material
P5HD[a]	5 µm	±1 µm	>90%	50 µm	300 Series Stainless Steel, Black-Nickel Coated	6061-T6 Aluminum
P10HD[a]	10 µm					
P25HD[a]	25 µm	±2 µm	≥95%			
P50HD[a]	50 µm	±3 µm				
P100HD[a]	100 µm	±4 µm				
P200HD[a]	200 µm	±6 µm				

P500HD[a]	500 µm	±10 µm				
P1000HD[a]	1000 µm					

a. Upon request, this item is available with an item-specific test report at an additional cost. Please contact Tech Support for details and lead times.

Part Number	Description	Price	Availability
P5HD	**Ø1/2" (12.7 mm) Mounted Pinhole, 5 ± 1 µm Pinhole Diameter, Stainless Steel**	**$79.04**	**Today**
P10HD	**Ø1/2" (12.7 mm) Mounted Pinhole, 10 ± 1 µm Pinhole Diameter, Stainless Steel**	**$79.04**	**Today**
P25HD	**Ø1/2" (12.7 mm) Mounted Pinhole, 25 ± 2 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P50HD	**Ø1/2" (12.7 mm) Mounted Pinhole, 50 ± 3 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P100HD	**Ø1/2" (12.7 mm) Mounted Pinhole, 100 ± 4 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P200HD	**Ø1/2" (12.7 mm) Mounted Pinhole, 200 ± 6 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P500HD	**Ø1/2" (12.7 mm) Mounted Pinhole, 500 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P1000HD	**Ø1/2" (12.7 mm) Mounted Pinhole, 1000 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**

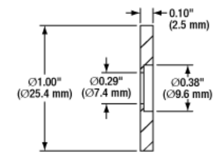
Hide Pinholes, Stainless Steel Foils, Ø1" Housings

Pinholes, Stainless Steel Foils, Ø1" Housings

- Precision Pinholes from Ø1 µm to Ø1 mm
- Stainless Steel Foils are Blackened on Both Sides for Increased Absorbance
  - P1H and P2H: Black-Oxide Coated
  - All Other Sizes: Black-Nickel Coated
- Black-Anodized Aluminum Housings with 1" Outer Diameters

These mounted precision pinholes are available with pinhole diameters from 1 µm to 1 mm. They are fabricated from stainless steel foils that are blackened on both sides. The pinholes are mounted in a Ø1", 0.10" (2.5 mm) thick aluminum disk housing that is black anodized. The housings are engraved with the pinhole item # and the size of the pinhole.

The foils can be taken out of their housings by removing the retaining ring or spring using small tweezers or pliers; use care as the foil is very thin (50 µm).



Click to Enlarge
Dimensions for Mounted Stainless Steel Pinholes in Ø1" Housing

Click to Enlarge
Microscope Image of Precision Pinhole

Click to Enlarge
Rear of Mounted Pinhole

Item #	Pinhole Diameter	Diameter Tolerance	Circularity	Foil Thickness	Foil Material	Housing Material
P1H	1 µm	+0.25 / -0.10 µm	≥85%		300 Series Stainless Steel, Black-Oxide Coated	
P2H	2 µm	±0.25 µm				
P5D[a]	5 µm	±1 µm	>90%			
P10D[a]	10 µm					
P15D[a]	15 µm	±1.5 µm				
P20D[a]	20 µm	±2 µm				
P25D[a]	25 µm					
P30D[a]	30 µm					
P40D[a]	40 µm	±3 µm				
P50D[a]	50 µm					
P75D[a]	75 µm					

P100D[a]	100 µm	±4 µm	≥95%	50 µm	300 Series Stainless Steel, Black-Nickel Coated	6061-T6 Aluminum
P150D[a]	150 µm	±6 µm				
P200D[a]	200 µm					
P300D[a]	300 µm	±8 µm				
P400D[a]	400 µm	±10 µm				
P500D[a]	500 µm					
P600D[a]	600 µm					
P700D[a]	700 µm					
P800D[a]	800 µm					
P900D	900 µm					
P1000D[a]	1000 µm					

a. Upon request, this item is available with an item-specific test report at an additional cost. Please contact Tech Support for details and lead times.

Part Number	Description	Price	Availability
P1H	**Ø1" Mounted Pinhole, 1 +0.25 / -0.10 µm Pinhole Diameter, Stainless Steel**	**$132.61**	**Today**
P2H	**Ø1" Mounted Pinhole, 2 ± 0.25 µm Pinhole Diameter, Stainless Steel**	**$132.61**	**Today**
P5D	**Ø1" Mounted Pinhole, 5 ± 1 µm Pinhole Diameter, Stainless Steel**	**$79.04**	**Today**
P10D	**Ø1" Mounted Pinhole, 10 ± 1 µm Pinhole Diameter, Stainless Steel**	**$79.04**	**Today**
P15D	**Ø1" Mounted Pinhole, 15 ± 1.5 µm Pinhole Diameter, Stainless Steel**	**$79.04**	**Today**
P20D	**Ø1" Mounted Pinhole, 20 ± 2 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P25D	**Ø1" Mounted Pinhole, 25 ± 2 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P30D	**Ø1" Mounted Pinhole, 30 ± 2 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P40D	**Ø1" Mounted Pinhole, 40 ± 3 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P50D	**Ø1" Mounted Pinhole, 50 ± 3 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P75D	**Ø1" Mounted Pinhole, 75 ± 3 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P100D	**Ø1" Mounted Pinhole, 100 ± 4 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P150D	**Ø1" Mounted Pinhole, 150 ± 6 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P200D	**Ø1" Mounted Pinhole, 200 ± 6 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P300D	**Ø1" Mounted Pinhole, 300 ± 8 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P400D	**Ø1" Mounted Pinhole, 400 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P500D	**Ø1" Mounted Pinhole, 500 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P600D	**Ø1" Mounted Pinhole, 600 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P700D	**Ø1" Mounted Pinhole, 700 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P800D	**Ø1" Mounted Pinhole, 800 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P900D	**Ø1" Mounted Pinhole, 900 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**
P1000D	**Ø1" Mounted Pinhole, 1000 ± 10 µm Pinhole Diameter, Stainless Steel**	**$71.62**	**Today**