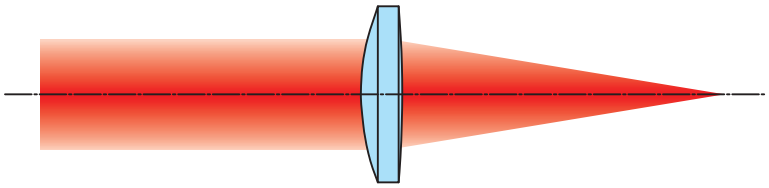

Multi-Element Optics

The lens or a combination of these lenses found in this section will have limited applications compared with single spherical lens but very high performance can be achieved in a dedicated application.

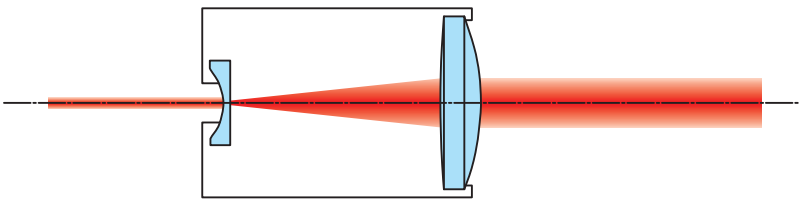
Beam Focusing

Type	Features	Applications
Achromatic Lens	Chromatic and spherical aberration is minimized. Large line-up of focal length and aperture.	Focus ability in low power lasers. Imaging system for infinity object
Focusing Lens	High laser damage threshold Spot size is minimized and near to the diffraction limit.	Lens for various laser fabrication such as laser marking, cutting and welding.
Objective Lens	Highly corrected lens with high magnification Large numerical aperture produces minimum spot size. Fully usable throughout the visible wavelength spectrum.	Microscopic imaging for the visible, ultra-violet and near infrared wavelength spectrum. Focusing a laser beam into a minimal spot. Micro-fabrication for lasers.

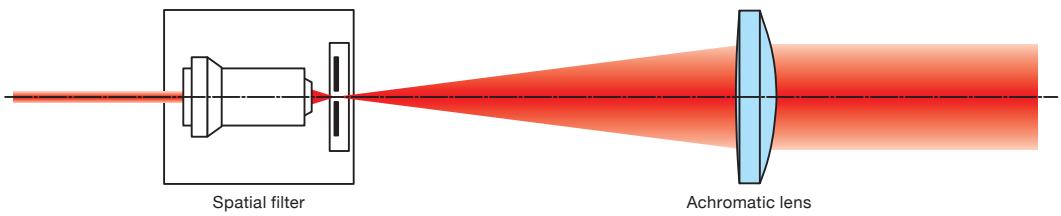


Beam Expanding

Type	Features	Applications
Beam Expander	Optimized design for minimum spherical aberration Integrated design with reduced size	Magnifying the laser aperture (for interferometer and projection) Reducing the focal spot size (by enlarging the incident laser beam diameter)
Spatial filter (objective lens) + Achromatic lens	Large choice of expansion ratios. Provides a high purified beam profile.	When using a very large collimated beam. When changing the beam aperture (with switching the achromatic lenses)



Beam expander



Spatial filter

Achromatic lens

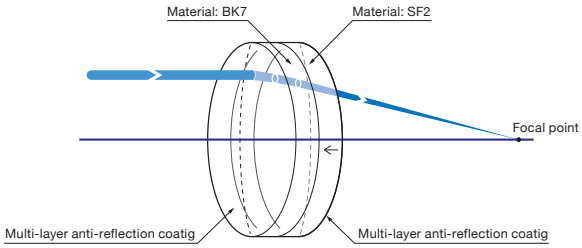
Achromatic Doublets | DLB

RoHS

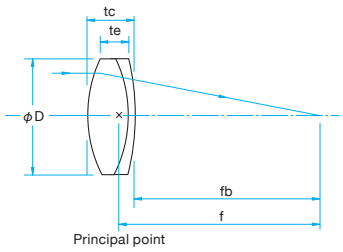
Achromatic doublets are cemented achromats made of two different lenses (Low dispersion positive from crown glass and high dispersion negative from flint glass). The difference of dispersion and shape of both lenses are designed to minimize the chromatic aberrations in blue (486.1nm), green (546.1nm) and red (656.3nm). Therefore, these lenses are able to support the entire visible wavelength spectrum.

- The spherical aberration of achromatic doublets is better than singlets and minimized at infinite conjugate ratios.
- Achromatic Doublets are coated on both surfaces with a broadband multi-layer anti-reflection coating for the visible wavelength (400 – 700nm).
- Set the positive part to the side of the incident parallel beam and put the negative part to the side of the focal point to minimize spherical aberration.
- The difference in focal length of a lens at each wave length is Chromatic aberration and is due to “dispersion of the glass”, the change in refractive index of glass accordding to wavelength. This can be corrected by combining glasses with low and high dispersions. Spherical aberration is when a ray enters a lens farther from its optical axis and has a shorter focus than a paraxial focus.

Schematic



Outline Drawing (in mm)



●Tolerance

Diameter	≦ϕ60	$\phi D^{+0}_{-0.1}$
	ϕ80	$\phi D^{+0}_{-0.15}$
	ϕ100	$\phi D^{+0}_{-0.2}$
Thickness		tc ±0.2
Focal length		±1% (546.1nm)

Specifications

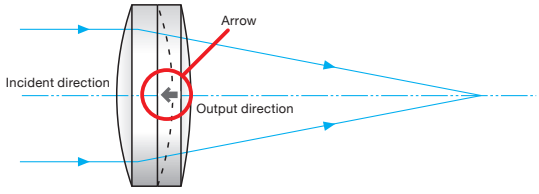
Material	BK7, SF2
Design wavelength	Blue: 486.1nm, Green: 546.1nm, Red: 656.3nm
Coating	Broadband multi-layer anti-reflection coating for the Visible
Cement	Ultraviolet Hardened Adhesive
Laser Damage Threshold	0.3J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)
Surface Quality (Scratch–Dig)	40–20
Clear aperture	90% of actual aperture

Guide

- Please contact our Sales Division for customized achromatic doublets. (Customized on size etc.)
- Please refer to our web site for the lens design data.
  WEB Reference Catalog Code W3075
- Air spaced focusing lenses are also available (NYTL/NYDL) designed for laser processing applications. Reference B181

Attention

- Set the positive part to the side of the incident parallel beam and put the negative part to the side of the focal point to minimize spherical aberration.
- The difference in focal length of a lens at each wave length is Chromatic aberration and is due to “dispersion of the glass”, the change in refractive index of glass accordding to wavelength. This can be corrected by combining glasses with low and high dispersions.
- Spherical aberration is when a ray enters a lens farther from its optical axis and has a shorter focus than a paraxial focus.
- Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.



ϕ10 – ϕ25

Part Number	Diameter ϕD [mm]	Focal length f [mm]	Edge Thickness te [mm]	Center Thickness tc [mm]	Back focal length fb [mm]	Centration [′]
DLB-10-20PM	ϕ10	20.0	5.1	6.7	16.6	<1
DLB-10-25PM	ϕ10	25.0	4.9	6.1	22.1	<1
DLB-10-30PM	ϕ10	30.1	4.7	5.7	27.4	<1
DLB-10-40PM	ϕ10	40.0	4.6	5.3	37.5	<1
DLB-10-50PM	ϕ10	50.0	4.4	5.0	47.5	<1
DLB-10-60PM	ϕ10	60.1	4.4	4.9	57.6	<1
DLB-10-70PM	ϕ10	69.9	4.3	4.7	67.3	<1
DLB-10-80PM	ϕ10	80.1	4.2	4.6	77.8	<1
DLB-10-100PM	ϕ10	100.5	4.2	4.5	98.1	<1
DLB-12.7-25PM	ϕ12.7	25.1	5.3	7.3	21.5	<1
DLB-12.7-30PM	ϕ12.7	30.0	5.2	6.8	26.7	<1
DLB-12.7-40PM	ϕ12.7	40.1	4.9	6.1	36.9	<1
DLB-12.7-50PM	ϕ12.7	50.1	4.7	5.7	47.3	<1
DLB-12.7-60PM	ϕ12.7	60.0	4.6	5.4	57.3	<1
DLB-12.7-70PM	ϕ12.7	69.9	4.5	5.2	67.5	<1
DLB-12.7-80PM	ϕ12.7	79.9	4.5	5.1	77.4	<1
DLB-12.7-100PM	ϕ12.7	100.1	4.3	4.8	97.9	<1
DLB-15-25PM	ϕ15	25.2	6.0	8.8	20.7	<1
DLB-15-30PM	ϕ15	30.1	5.7	8.0	26.0	<1
DLB-15-40PM	ϕ15	40.1	5.2	6.9	36.5	<1
DLB-15-50PM	ϕ15	50.1	5.0	6.3	47.1	<1
DLB-15-60PM	ϕ15	59.9	4.8	5.9	57.0	<1
DLB-15-70PM	ϕ15	70.2	4.8	5.7	67.4	<1
DLB-15-80PM	ϕ15	79.9	4.7	5.5	77.1	<1
DLB-15-100PM	ϕ15	100.0	4.5	5.2	97.3	<1
DLB-20-30PM	ϕ20	30.6	6.8	10.9	24.9	<1
DLB-20-40PM	ϕ20	40.1	6.2	9.2	35.3	<1
DLB-20-50PM	ϕ20	50.2	5.7	8.1	46.0	<1
DLB-20-60PM	ϕ20	60.2	5.4	7.4	56.6	<1
DLB-20-70PM	ϕ20	70.1	5.2	6.9	66.7	<1
DLB-20-80PM	ϕ20	79.9	5.1	6.6	76.6	<1
DLB-20-100PM	ϕ20	99.5	4.9	6.1	96.4	<1
DLB-20-120PM	ϕ20	120.3	4.7	5.7	117.3	<1
DLB-20-150PM	ϕ20	149.8	4.6	5.4	147.0	<1
DLB-20-170PM	ϕ20	170.0	4.6	5.3	167.2	<1
DLB-20-200PM	ϕ20	200.1	4.5	5.1	197.3	<1
DLB-20-220PM	ϕ20	220.0	4.5	5.0	216.9	<3
DLB-20-250PM	ϕ20	250.0	4.4	4.9	247.0	<3
DLB-20-300PM	ϕ20	300.0	4.3	4.7	297.1	<3
DLB-25-40PM	ϕ25	40.9	7.7	12.5	34.2	<1
DLB-25-50PM	ϕ25	50.1	7.1	10.9	44.9	<1
DLB-25-60PM	ϕ25	60.1	6.7	9.8	55.2	<1
DLB-25-70PM	ϕ25	69.9	6.3	9.0	65.3	<1
DLB-25-80PM	ϕ25	80.0	6.2	8.5	75.9	<1
DLB-25-100PM	ϕ25	100.2	5.9	7.7	96.5	<1
DLB-25-120PM	ϕ25	119.8	5.6	7.2	116.2	<1
DLB-25-150PM	ϕ25	149.6	5.5	6.7	146.2	<1
DLB-25-170PM	ϕ25	170.4	5.3	6.4	167.1	<1
DLB-25-200PM	ϕ25	200.1	5.2	6.1	197.0	<1
DLB-25-220PM	ϕ25	222.0	5.2	6.0	218.9	<1
DLB-25-250PM	ϕ25	250.8	5.1	5.8	247.7	<1
DLB-25-300PM	ϕ25	300.0	5.0	5.6	296.6	<3

Compatible Optic Mounts

LHF-10S, -15S, -20S, -25S / LHA-25

Achromatic Doublets | DLB

Catalog Code W3076

ϕ25.4 – ϕ40

Part Number	Diameter ϕD [mm]	Focal length f [mm]	Edge Thickness te [mm]	Center Thickness tc [mm]	Back focal length fb [mm]	Centration [′]
DLB-25.4-40PM	ϕ25.4	50.1	7.0	10.9	44.9	<1
DLB-25.4-50PM	ϕ25.4	50.1	7.0	10.9	44.9	<1
DLB-25.4-60PM	ϕ25.4	60.1	6.6	9.8	55.2	<1
DLB-25.4-70PM	ϕ25.4	69.9	6.2	9.0	65.3	<1
DLB-25.4-80PM	ϕ25.4	80.0	6.1	8.5	75.9	<1
DLB-25.4-100PM	ϕ25.4	100.2	5.8	7.7	96.5	<1
DLB-25.4-120PM	ϕ25.4	119.8	5.6	7.2	116.2	<1
DLB-25.4-150PM	ϕ25.4	149.6	5.4	6.7	146.2	<1
DLB-25.4-170PM	ϕ25.4	170.4	5.3	6.4	167.1	<1
DLB-25.4-200PM	ϕ25.4	200.1	5.1	6.1	197.0	<1
DLB-25.4-220PM	ϕ25.4	222.0	5.1	6.0	218.9	<1
DLB-25.4-250PM	ϕ25.4	250.8	5.0	5.8	247.7	<1
DLB-25.4-300PM	ϕ25.4	300.0	5.0	5.6	296.6	<3
DLB-30-50PM	ϕ30	50.3	8.6	14.1	43.5	<1
DLB-30-60PM	ϕ30	60.3	8.1	12.6	53.9	<1
DLB-30-70PM	ϕ30	70.8	7.7	11.5	65.0	<1
DLB-30-80PM	ϕ30	80.3	7.4	10.7	75.0	<1
DLB-30-100PM	ϕ30	100.7	6.8	9.5	96.0	<1
DLB-30-120PM	ϕ30	120.1	6.6	8.8	115.7	<1
DLB-30-150PM	ϕ30	150.0	6.3	8.1	146.0	<1
DLB-30-170PM	ϕ30	169.9	6.1	7.7	166.0	<1
DLB-30-200PM	ϕ30	200.2	6.0	7.3	196.4	<1
DLB-30-220PM	ϕ30	220.2	5.9	7.1	216.5	<1
DLB-30-250PM	ϕ30	249.7	5.8	6.9	246.1	<1
DLB-30-300PM	ϕ30	300.4	5.7	6.6	296.9	<1
DLB-30-350PM	ϕ30	350.0	5.6	6.4	346.2	<3
DLB-30-400PM	ϕ30	400.0	5.5	6.2	396.3	<3
DLB-30-450PM	ϕ30	450.0	5.5	6.1	446.5	<3
DLB-30-500PM	ϕ30	500.0	5.5	6.0	496.5	<3
DLB-40-60PM	ϕ40	60.2	11.0	19.3	50.2	<1
DLB-40-70PM	ϕ40	70.3	10.2	17.2	61.7	<1
DLB-40-80PM	ϕ40	80.2	9.7	15.8	71.8	<1
DLB-40-100PM	ϕ40	99.9	8.9	13.7	92.8	<1
DLB-40-120PM	ϕ40	120.0	8.3	12.3	113.7	<1
DLB-40-150PM	ϕ40	150.1	7.7	10.9	144.5	<1
DLB-40-170PM	ϕ40	169.7	7.5	10.3	164.5	<1
DLB-40-200PM	ϕ40	199.7	7.2	9.6	194.8	<1
DLB-40-220PM	ϕ40	220.7	7.0	9.2	216.0	<1
DLB-40-250PM	ϕ40	249.1	6.9	8.8	244.6	<1
DLB-40-300PM	ϕ40	300.5	6.7	8.3	296.1	<1
DLB-40-350PM	ϕ40	349.9	6.5	7.9	345.8	<1
DLB-40-400PM	ϕ40	399.7	6.4	7.6	395.7	<1
DLB-40-450PM	ϕ40	450.0	6.3	7.4	445.5	<3
DLB-40-500PM	ϕ40	500.0	6.3	7.2	495.6	<3

Compatible Optic Mounts

LHF-25.4S, -30AS, -40AS

ϕ50 – ϕ100

Part Number	Diameter ϕD [mm]	Focal length f [mm]	Edge Thickness te [mm]	Center Thickness tc [mm]	Back focal length fb [mm]	Centration [′]
DLB-50-80PM	ϕ50	81.0	13.4	22.9	69.1	<1
DLB-50-100PM	ϕ50	100.5	12.3	19.9	90.0	<1
DLB-50-120PM	ϕ50	120.2	11.4	17.7	111.0	<1
DLB-50-150PM	ϕ50	150.7	10.5	15.5	142.8	<1
DLB-50-170PM	ϕ50	169.8	10.1	14.5	162.5	<1
DLB-50-200PM	ϕ50	200.1	9.6	13.3	193.3	<1
DLB-50-220PM	ϕ50	220.7	9.3	12.7	214.5	<1
DLB-50-250PM	ϕ50	249.4	9.1	12.1	243.4	<1
DLB-50-300PM	ϕ50	299.5	8.7	11.2	293.7	<1
DLB-50-350PM	ϕ50	350.2	8.6	10.7	344.5	<1
DLB-50-400PM	ϕ50	400.0	8.3	10.2	394.7	<1
DLB-50-450PM	ϕ50	451.5	8.3	9.9	446.2	<1
DLB-50-500PM	ϕ50	500.3	8.1	9.6	495.2	<1
DLB-50-600PM	ϕ50	599.9	8.0	9.2	594.4	<3
DLB-50-700PM	ϕ50	700.0	7.8	8.9	694.6	<3
DLB-50-800PM	ϕ50	800.0	7.7	8.6	794.9	<3
DLB-50-1000PM	ϕ50	1000.0	7.6	8.3	995.0	<3
DLB-50.8-100PM	ϕ50.8	100.5	12.1	19.9	90.0	<1
DLB-50.8-120PM	ϕ50.8	120.2	11.2	17.7	111.0	<1
DLB-50.8-150PM	ϕ50.8	150.7	10.4	15.5	142.8	<1
DLB-50.8-200PM	ϕ50.8	200.1	9.5	13.3	193.3	<1
DLB-50.8-250PM	ϕ50.8	249.4	9.0	12.1	243.4	<1
DLB-50.8-300PM	ϕ50.8	299.5	8.6	11.2	293.7	<1
DLB-50.8-400PM	ϕ50.8	400.0	8.3	10.2	394.7	<1
DLB-50.8-500PM	ϕ50.8	500.3	8.1	9.6	495.2	<1
DLB-50.8-700PM	ϕ50.8	700.0	7.8	8.9	694.6	<3
DLB-50.8-1000PM	ϕ50.8	1000.0	7.5	8.3	995.1	<3
DLB-60-170PM	ϕ60	170.8	11.4	17.7	161.9	<1
DLB-60-200PM	ϕ60	200.3	10.7	16.1	192.1	<1
DLB-60-250PM	ϕ60	250.0	10.0	14.3	242.8	<1
DLB-60-500PM	ϕ60	499.1	8.6	10.7	493.5	<1
DLB-60-600PM	ϕ60	597.9	8.3	10.1	592.6	<1
DLB-80-150PM	ϕ80	149.7	17.2	30.3	133.6	<1
DLB-80-200PM	ϕ80	200.8	14.7	24.3	188.2	<1
DLB-80-300PM	ϕ80	299.8	12.4	18.8	290.2	<1
DLB-80-500PM	ϕ80	502.6	10.7	14.5	494.9	<1
DLB-80-800PM	ϕ80	800.6	9.7	12.1	794.2	<1
DLB-100-200PM	ϕ100	200.6	21.8	37.0	181.0	<1
DLB-100-300PM	ϕ100	297.3	18.0	28.0	283.2	<1
DLB-100-500PM	ϕ100	499.6	15.2	21.1	488.8	<1
DLB-100-800PM	ϕ100	799.5	13.7	17.4	790.4	<1
DLB-100-1000PM	ϕ100	998.1	13.1	16.1	989.7	<1

Compatible Optic Mounts

LHF-50S, -50.8S, -60S, -80, -100

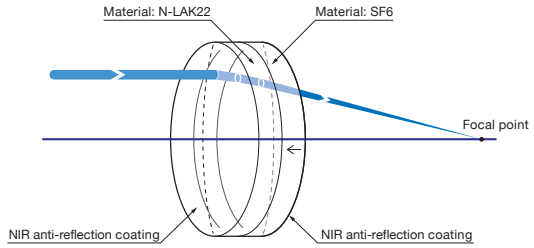
Near Infrared Achromatic Lens | DL-PNIR

RoHS | Catalog Code W3195

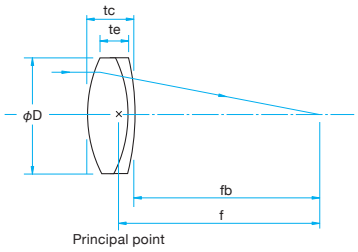
By bonding two lenses with wavelength dispersion of different refractive index the resulting component will provide reduced spherical aberration and chromatic aberration than that of a single spherical lens.
These achromatic lenses can be used as a focusing lens for YAG laser (1064nm) or LD of the near-infrared.

- The lens design is optimized so that the focal length change is minimized in the near infrared region. The focal length matches at 700nm, 880nm, 1100nm wavelengths and is optimized to minimize aberrations.
- It is suitable as a collimating lens not only because chromatic aberration but also spherical aberration is collected.

Schematic



Outline Drawing (in mm)



●Tolerance
Diameter $\phi D^{+0}_{-0.1}$
Thickness tc±0.2
Focal length ±2% (880nm)

Specifications

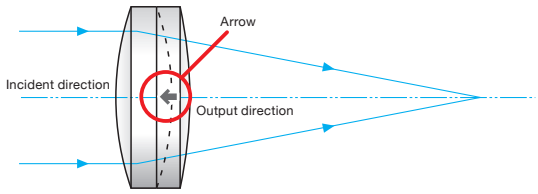
Material	N-LAK22, SF6
Design wavelength	700nm, 880nm, 1100nm
Coating	Multi-layer anti-reflection coating (700 – 1550nm)
Cement	Ultraviolet Hardened Adhesive
Laser Damage Threshold	0.3J/cm^2
Surface Quality (Scratch–Dig)	40–20
Clear aperture	90% of actual aperture

Guide

- For product other diameter size or focal lengths which are not listed on our website or in our catalog, please contact our Sales Division with your requests.
- The design and manufacture of achromatic lens of other wavelength bands are available upon requested.
- Focusing Lenses for Fiber Lasers (HFTLSQ/HFDLSQ) are also available. Reference B182

Attention

- Please use achromatic lens when focusing an image at infinity or when making parallel light from the one point of light source. It does not provide sufficient optical performance when used in such as short-range distance imaging.
- There is a direction to the incident light parallel to the achromatic lens. A surface with a small radius of curvature is allowed to be incident parallel light from a rear surface (the surface the arrow is pointing to). When it is incident parallel light from the opposite side, spherical aberration and chromatic aberration will occur and the focused spot size will increase.
- When used in the visible region, spherical aberration and chromatic aberration increases. In addition, the transmittance decreases.



Specifications

Part Number	Diameter ϕD [mm]	Focal length f [mm]	Edge Thickness te [mm]	Center Thickness tc [mm]	Back focal length fb [mm]	Centration [′]
DL-15-20PNIR	ϕ15	19.9	6.6	9.5	14.7	<3
DL-15-25PNIR	ϕ15	25.0	5.8	8.1	20.6	<3
DL-15-30PNIR	ϕ15	30.1	5.6	7.4	26.0	<3
DL-15-50PNIR	ϕ15	50.2	4.9	5.9	46.8	<3
DL-25-30PNIR	ϕ25	30.0	10.8	16.3	21.4	<3
DL-25-40PNIR	ϕ25	40.1	9.3	13.2	32.8	<3
DL-25-50PNIR	ϕ25	50.2	8.5	11.6	43.8	<3
DL-25-100PNIR	ϕ25	100.4	7.2	8.7	95.1	<3

Compatible Optic Mounts

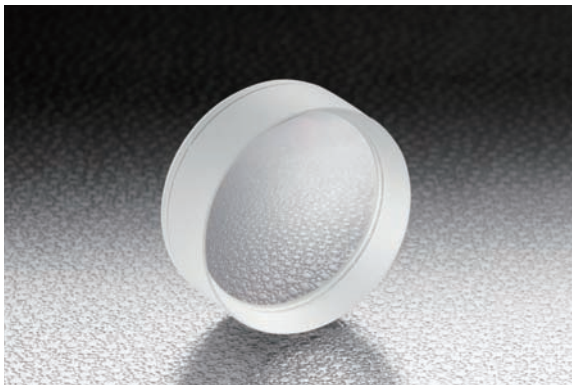
LHF-15S, -25S

Negative Achromatic Lens | DL-NM

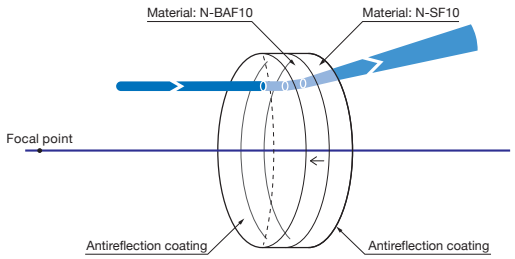
RoHS Catalog Code W3196

It is achromatic lens having a negative focal length.
By setting the concave one bonding two lenses wavelength dispersion of the refractive index is different, can be smaller than the spherical single lens and spherical aberration and chromatic aberration.

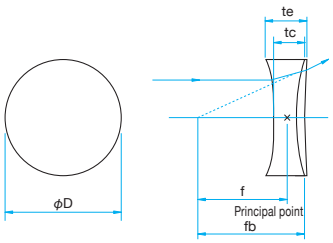
- It is optimized focal length shift is small in the visible light range, the aberration is minimized.
- It can be the beam expander of Galileo type in combination with achromatic lens with a focal length of the positive.



Schematic



Outline Drawing (in mm)



●Tolerance
Diameter $\phi D^{+0}_{-0.1}$
Thickness tc±0.2
Focal length ±2%
(546.1nm)

Specifications

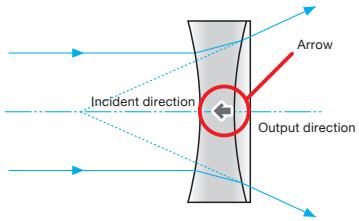
Material	N-BAF10, N-SF10
Design wavelength	486.1nm, 546.1nm, 656.3nm
Coating	Antireflection coating
Cement	Ultraviolet Hardened Adhesive
Laser Damage Threshold	0.3J/cm^2
Surface Quality (Scratch–Dig)	40–20
Clear aperture	90% of actual aperture

Guide

▶For custom focal lengths and diameter sizes not listed on-line or in our catalog please contact our Sales Division.

Attention

▶There is a direction to the incident parallel light to the achromatic lens. A surface with a small radius of curvature is allowed to be incident parallel light from a rear surface (the surface on the arrow is pointing to). When it is incident parallel light from the opposite side, spherical aberration and chromatic aberration will occur.
▶When used in the visible region, spherical aberration and chromatic aberration increases. In addition, the transmittance decreases.



Specifications

Part Number	Diameter ϕD [mm]	Focal length f [mm]	Edge Thickness te [mm]	Center Thickness tc [mm]	Back focal length fb [mm]	Centration [′]
DL-25-50NM	ϕ25	–49.94	9.3	6.7	–53.1	<3
DL-25-100NM	ϕ25	–99.94	5.9	4.6	–102.3	<3

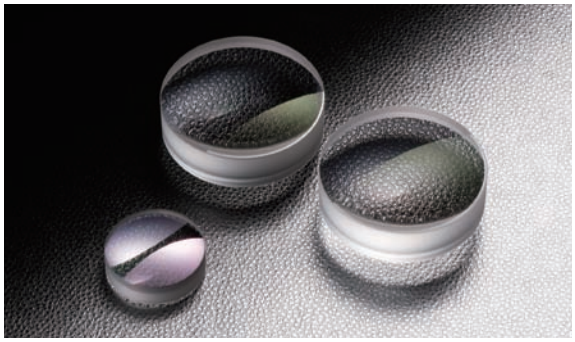
Compatible Optic Mounts

LHF-25S

Reasonable Achromatic Lens | S-DLB

RoHS Catalog Code W3197

An economic general use achromatic lens suitable for an optical system, which does not require high surface quality imaging such as a microscope lens or telescope lens.

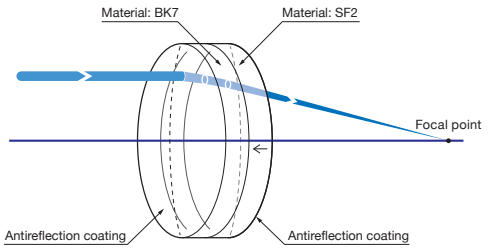


- Specification except surface quality is almost the same as DLB series. Except when used in high-precision experiment using a laser, this lens is recommended.
- It is optimized so that focal length gap is small in the visible light range and the aberration is minimized.

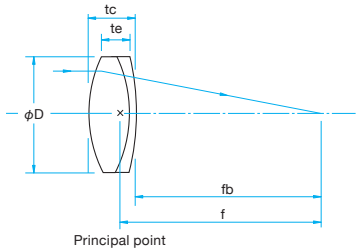
Specifications

Material	BK7, SF2
Design wavelength	Blue: 486.1nm, Green: 546.1nm, Red: 656.3nm
Centration	<3′
Cement	Ultraviolet Hardened Adhesive
Coating	Antireflection coating
Surface Quality (Scratch–Dig)	60–40
Clear aperture	90% of actual aperture
Laser Damage Threshold	0.3J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)

Schematic



Outline Drawing (in mm)

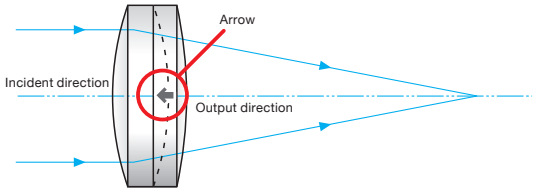


●Tolerance

Diameter<ϕ30	$\phi D^{+0}_{-0.1}$
Thickness	tc±0.2
Focal length	±1% (546.1nm)

Attention

- Achromatic lens is used when focusing an image at infinity or when making the point light source to collimated light. It does not provide sufficient optical performance when used in such as short-range imaging.
- There is a direction of the incident parallel light with achromatic lens. The radius of curvature is allowed to be incident parallel light from the side of (the surface indicated by arrows) small curvature surface. If the parallel light incidents from the opposite side, then spherical aberration and chromatic aberration occur and the focused spot size will be large.



ϕ10 – ϕ20

Part Number	Diameter ϕD [mm]	Focal length f [mm]	Edge Thickness te [mm]	Center Thickness tc [mm]	Back focal length fb [mm]
S-DLB-10-20PM	ϕ10	20.0	5.1	6.7	16.6
S-DLB-10-25PM	ϕ10	25.0	4.9	6.1	22.1
S-DLB-10-40PM	ϕ10	40.0	4.6	5.3	37.5
S-DLB-10-50PM	ϕ10	50.0	4.4	5.0	47.5
S-DLB-10-100PM	ϕ10	100.5	4.2	4.5	98.1
S-DLB-15-25PM	ϕ15	25.2	6.0	8.8	20.7
S-DLB-15-30PM	ϕ15	30.1	5.7	8.0	26.0
S-DLB-15-40PM	ϕ15	40.1	5.2	6.9	36.5
S-DLB-15-50PM	ϕ15	50.1	5.0	6.3	47.1
S-DLB-15-80PM	ϕ15	79.9	4.7	5.5	77.1
S-DLB-15-100PM	ϕ15	100.0	4.5	5.2	97.3
S-DLB-20-30PM	ϕ20	30.6	6.8	10.9	24.9
S-DLB-20-40PM	ϕ20	40.1	6.2	9.2	35.3
S-DLB-20-50PM	ϕ20	50.2	5.7	8.1	46.0
S-DLB-20-60PM	ϕ20	60.2	5.4	7.4	56.6
S-DLB-20-70PM	ϕ20	70.1	5.2	6.9	66.7
S-DLB-20-80PM	ϕ20	79.9	5.1	6.6	76.6
S-DLB-20-100PM	ϕ20	99.5	4.9	6.1	96.4
S-DLB-20-120PM	ϕ20	120.3	4.7	5.7	117.3
S-DLB-20-150PM	ϕ20	149.8	4.6	5.4	147.0
S-DLB-20-200PM	ϕ20	200.1	4.5	5.1	197.3

ϕ25 – ϕ30

Part Number	Diameter ϕD [mm]	Focal length f [mm]	Edge Thickness te [mm]	Center Thickness tc [mm]	Back focal length fb [mm]
S-DLB-25-50PM	ϕ25	50.1	7.1	10.9	44.9
S-DLB-25-70PM	ϕ25	69.9	6.3	9.0	65.3
S-DLB-25-100PM	ϕ25	100.2	5.9	7.7	96.5
S-DLB-25-120PM	ϕ25	119.8	5.6	7.2	116.2
S-DLB-25-150PM	ϕ25	149.6	5.5	6.7	146.2
S-DLB-30-60PM	ϕ30	60.3	8.1	12.6	53.9
S-DLB-30-100PM	ϕ30	100.7	6.8	9.5	96.0
S-DLB-30-120PM	ϕ30	120.1	6.6	8.8	115.7
S-DLB-30-150PM	ϕ30	150.0	6.3	8.1	146.0
S-DLB-30-200PM	ϕ30	200.2	6.0	7.3	196.4
S-DLB-30-300PM	ϕ30	300.4	5.7	6.6	296.9

Compatible Optic Mounts

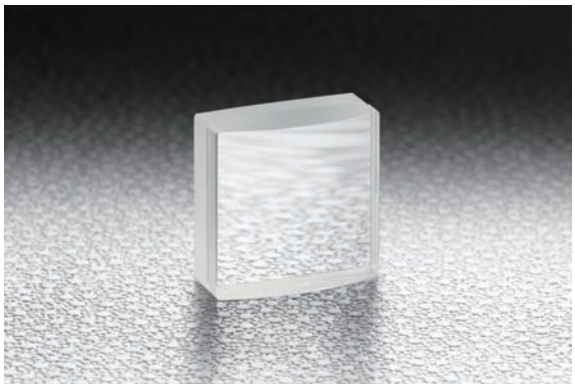
LHF-10S, -15S, -20S, -25S, -30S

Achromatic Cylindrical Lens | CDL

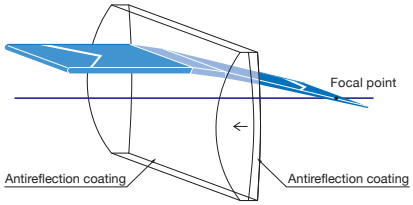
RoHS Catalog Code W3198

A cylindrical achromat is single component made by bonding two cylindrical surface lenses having different refractive indexes. The resulting achromat creates fine lines close to the theoretical limit. The cylindrical achromat is recommended if blurred lines and color bleeding is a concern when using cylindrical plano-convex lens (CLB-P).

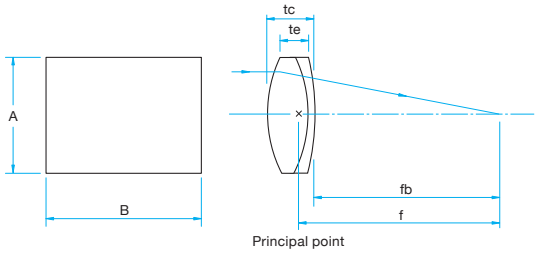
- It is designed so that difference of focusing point is reduced as much as possible in the visible light range.
- Optical adjustment is easy to do as direction of the condenser line will be parallel to the side of the diameter (B).
- It can be used as a substitute for a slit spectrograph.



Schematic



Outline Drawing (in mm)



●Tolerance

Length	$A^{+0}_{-0.2}$ $B^{+0}_{-0.2}$
Thickness	tc±0.2
Focal length	±3% (546.1nm)

Specifications

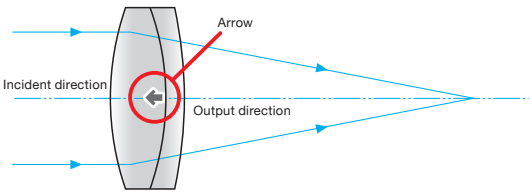
Material	N-SF5, BK7
Design wavelength	Blue: 486.1nm, Green: 546.1nm, Red: 656.3nm
Coating	Antireflection coating
Cement	Ultraviolet cure adhesive
Laser Damage Threshold	0.3J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)
Surface Quality (Scratch–Dig)	60–40
Clear aperture	Circle that internally connected to 90% of the side length

Guide

- Different focal length and diameters not mentioned on-line or in our catalog are available as a custom product upon on request.
- Cylindrical lens holder (CHA) is available for mounting the achromatic cylinder lens. WEB Reference Catalog Code W4022

Attention

- There is a direction of the incident parallel light with achromatic cylinder lens. The radius of curvature is allowed to be incident parallel light from the side of (the surface indicated by arrows) small curvature surface. If it is incident parallel light from the opposite side, condensing line will be thick.
- In the generatrix direction (B direction), there is no characteristic to reduce the effect of achromatic, reducing aberration, and for collecting light.
- If it is incident line beam source into achromatic cylindrical lens, parallel light does not come out. It will diverge in the direction of the generatrix (B direction).
- In order to focus the fine beam line, it is necessary to enter the lens a parallel beam of high quality.



Specifications

Part Number	A×B [mm]	Focal length f [mm]	Edge Thickness te [mm]	Center Thickness tc [mm]	Back focal length fb [mm]
CDL-1515-25PM	15×15	25.0	6.4	9.0	18.2
CDL-1515-50PM	15×15	50.0	4.7	6.0	46.4
CDL-1515-100PM	15×15	100.0	4.3	5.0	97.1

Compatible Optic Mounts

CHA-25

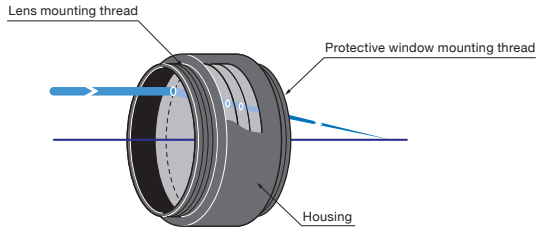
Visible Spectrum Achromats | ATL/NADL

RoHS Catalog Code W3078

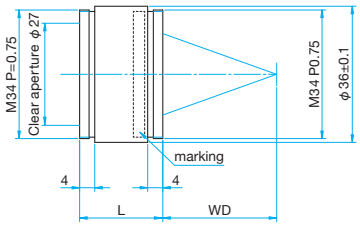
Visible spectrum achromats are air spaced achromatic triplets or doublets for lasers in the visible spectrum or white light applications.
The elements are made of crown glass of low dispersion and flint glass of high dispersion.

- These lenses have been optimized for achromatic and spherical aberrations and coma for the 3 wavelengths; blue (486.1nm), green (546.1nm) and red (656.3nm). They are coated with a broadband multi-layer anti-reflection coating for 400 – 700nm.
- Air spaced design allows high power laser applications which includes YAG second harmonic wavelength (532nm).
- The triplets with F-numbers ≧2 and doublets with F-numbers ≧3 are designed to have each spot size equal to the diffraction limited spot size and very ideal for a Gaussian input beam.

Schematic



Outline Drawing (in mm)



●Tolerance
Length L±0.2
Focal length ±2%

Specifications

Material	Crown Glass – (Air spaced) – Flint Glass
Material of frame	Aluminum Finishing: Black anodized
Design wavelength	486nm, 532nm, 656nm
Coating	Broadband multil-ayer anti-reflection coating
Acceptance angle	±1°
Laser Damage Threshold	1J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)

Guide

- Please contact our Sales Division for customized achromats. (Customized on size etc.)
- Protective lens case with rods for mirror holders is available as an option. Please contact us for further information.
- Please check the "wavelength characteristic of the focal length data" on the Web for the focal lengths of each wavelength.
  WEB Reference Catalog Code W3078

Attention

- Since the focal length and working distance of the lens is calculated at 532nm, it will change at other wavelengths due to the refractive index of the material shift.
- The F number of a lens is calculated by f (effective focal length) / De (effective clear aperture). The value represents "Brightness of the lens". The lower the value, the brighter the lens is.
- Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

Specifications

Part Number	Focal length f [mm]	Length L [mm]	Numerical aperture (NA)	Working distance (WD) [mm]
ATL-30-40PY2	40.2	22	0.34	30.1
ATL-30-50PY2	49.4	22	0.27	39.0
ATL-30-60PY2	58.9	22	0.23	49.0
NADL-30-80PY2	80.1	13	0.17	71.8
NADL-30-100PY2	99.8	13	0.14	91.9
NADL-30-150PY2	150.0	12	0.09	142.1
NADL-30-200PY2	199.8	12	0.07	193.1

Compatible Optic Mounts

LHF-M34-30

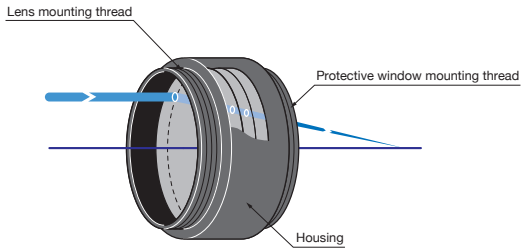
YAG Laser Focusing Lenses | NYTL/NYDL

RoHS Catalog Code W3079

YAG laser focusing lenses are air spaced triplets or doublets for YAG wavelengths. The elements are made of crown glass of lower dispersion and flint glass of higher dispersion. These lenses are optimized for spherical aberration and coma. With its spot size designed to be smaller than or equal to the diffraction limited spot size for beams at 1064nm.

- These lenses are chromatically corrected so that any HeNe guided beam or visible video monitor beam will remain focused in the same position as the YAG beam. All elements are coated with a laser-resistant narrowband multi-layer anti-reflection for YAG: 1064nm and HeNe: 633nm.
- We offer optical protective windows to prevent damage to the lens by absorbing high levels of energy from inadvertent back reflection of the incident beam. These protective windows can be easily installed to the focusing side of the lens.

Schematic



Specifications

Material	Crown Glass – (Air spaced) – Flint Glass
Material of frame	Aluminum Finishing: Black anodized
Design wavelength	1064nm, 632.8nm
Coating	Narrow band multi-layer anti-reflection coatig for 1064nm and 633nm
Acceptance angle	±1°
Laser Damage Threshold	1J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)

Guide

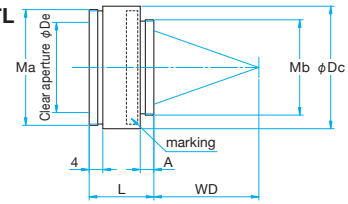
- Please contact our Sales Division for customized products. (Customized on size etc.)
- Please check the "wavelength characteristic of the focal length data" on the Web for the focal lengths of each wavelength.
  WEB Reference Catalog Code W3079

Attention

- Since the focal length and working distance of the lens is calculated at 1064nm, it will change at other wavelengths due to the refractive index of the material shift.
- The F number of a lens is calculated by f (effective focal length) / De (effective clear aperture). The value represents "Brightness of the lens". The lower the value, the brighter the lens is.
- Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

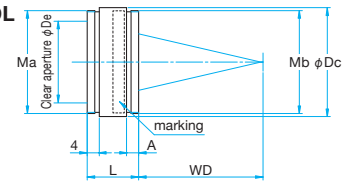
Outline Drawing (in mm)

NYTL



●Tolerance
Diameter Dc±0.1
Length L ±0.2
Focal length ±2%

NYDL



Specifications

Part Number	Maximum lens diameter φD [mm]	Focal length f [mm]	Diameter φDc [mm]	Clear aperture φDe [mm]	Length L [mm]	Lens mounting thread Ma	Protective window thread Mb	Thread length A [mm]	Numerical aperture (NA)	Working distance (WD) [mm]
NYTL-25-20PY1	φ25	20.0	φ32	φ20	22	M29 P0.75	M22 P0.75	6.0	0.50	9.0
NYTL-30-30PY1	φ30	30.0	φ36	φ27	22	M34 P0.75	M28 P0.75	6.5	0.45	19.1
NYTL-30-40PY1	φ30	40.0	φ36	φ26.5	19	M34 P0.75	M28 P0.75	4.0	0.33	30.9
NYTL-30-50PY1	φ30	50.0	φ36	φ25.5	19	M34 P0.75	M28 P0.75	3.5	0.25	41.4
NYDL-30-60PY1	φ30	59.9	φ36	φ27	17	M34 P0.75	M34 P0.75	4.0	0.23	41.1
NYDL-30-80PY1	φ30	79.9	φ36	φ27	15	M34 P0.75	M34 P0.75	4.0	0.17	67.6
NYDL-30-100PY1	φ30	100.1	φ36	φ27	14	M34 P0.75	M34 P0.75	4.0	0.14	88.4
NYDL-30-150PY1	φ30	149.3	φ36	φ27	12	M34 P0.75	M34 P0.75	4.0	0.09	140.0

Compatible Optic Mounts

LHF-M29-25, LHF-M34-30

Focusing Lenses for Fiber Lasers | HFTLSQ/HFDLSQ

RoHS Catalog Code W3080

High performance multi-element focusing lens. They are suitable for focusing and collimating solid state lasers like Yb fiber laser, YAG laser and YVO_4 laser.

- Engineered and designed to reduce the effects of thermal expansion.
- Corrected for spherical aberration and coma at 1064nm. Diffraction limited for F number ≧2 (NA≧0.25)
- AR coating optimized from 1040 – 1150nm with transmission at 633nm for pointed lasers

Specifications

Material	Synthetic fused silica
Material of frame	Aluminum Finishing: Black anodized
Design wavelength	1064nm
Coating	Broadband multil-ayer anti-reflection coating
Transmittance	>98.5% (1060 – 1080nm) >97% (1040 – 1150nm) >53% (600 – 700nm)
Laser Damage Threshold	7J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)

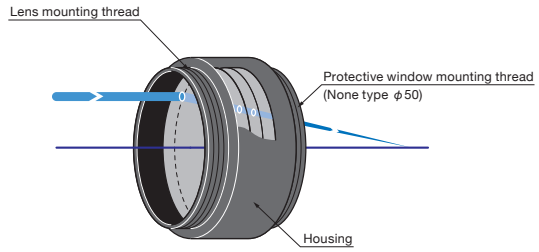
Guide

▶Please contact our Sales Division for customized products. (Customized on size etc.)

Attention

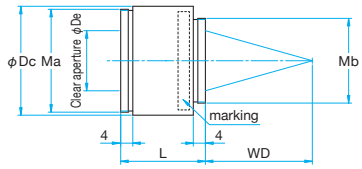
▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.
▶Protective window as an option is not Anti-reflection coated.
▶Incident a beam from the side with the screw.

Schematic



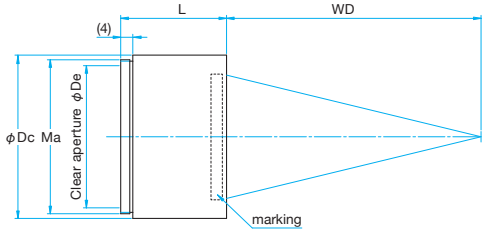
Outline Drawing (in mm)

HFTLSQ-15/HFTLSQ-20/HFTLSQ-30/HFDLSQ-30

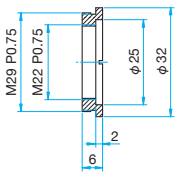


●Tolerance
Diameter Dc±0.1
Length L ±0.2
Focal length ±2%

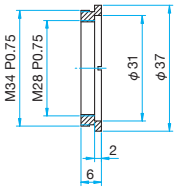
HFTLSQ-50/HFDLSQ-50



Drawing of adapter for HFTLSQ-15-20PF1



Drawing of adapter for HFTLSQ-20-30PF1



Specifications

Part Number	Focal length f [mm]	Diameter ϕDc [mm]	Clear aperture ϕDe [mm]	Length L [mm]	Lens mounting thread Ma	Protective window thread Mb	Numerical aperture (NA)	Working distance (WD) [mm]	Acceptance angle [°]
HFTLSQ-15-20PF1	20.0	ϕ24	ϕ12	16	M22 P0.75	M22 P0.75	0.30	13.7	±1.8
HFTLSQ-20-30PF1	30.3	ϕ30	ϕ17	21	M28 P0.75	M28 P0.75	0.28	22.0	±1.2
HFTLSQ-30-40PF1	40.0	ϕ36	ϕ27	31	M34 P0.75	M28 P0.75	0.34	24.9	±1
HFTLSQ-30-50PF1	50.0	ϕ36	ϕ27	28	M34 P0.75	M28 P0.75	0.27	35.4	±1
HFTLSQ-30-60PF1	60.1	ϕ36	ϕ27	23	M34 P0.75	M34 P0.75	0.22	51.4	±1
HFTLSQ-30-80PF1	80.0	ϕ36	ϕ27	23	M34 P0.75	M34 P0.75	0.17	71.7	±1
HFTLSQ-30-100PF1	100.0	ϕ36	ϕ27	23	M34 P0.75	M34 P0.75	0.14	92.7	±1
HFDLSQ-30-150PF1	150.0	ϕ36	ϕ27	18	M34 P0.75	M34 P0.75	0.09	131.0	±1
HFTLSQ-50-100PF1	99.9	ϕ54	ϕ47	35	M50.9 P0.75	—	0.24	84.2	±1
HFDLSQ-50-200PF1	199.6	ϕ54	ϕ47	23	M50.9 P0.75	—	0.12	185.7	±1
HFDLSQ-50-300PF1	300.0	ϕ54	ϕ47	23	M50.9 P0.75	—	0.08	286.2	±1

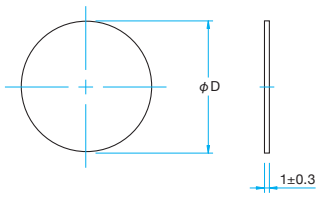
PG / PGH

- Protective windows can be attached to the focusing lens to minimize damage from laser fabrication. The protective window comes in 3 different sizes.
  Protective Window Holders (PGH)
  - Visible Spectrum Achromats
  - YAG Laser Focusing Lenses

Guide & Attention

- Since protective windows are uncoated, surface reflections will reduce transmittance to 90%.
- Anti-reflection coating for specific wavelength are available to improve trasmittance, please contact our Sales Division for assistance.
- Replace protective window if it is damaged or there is poor transmittance performance.

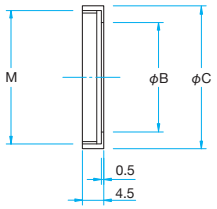
Protective Windows (Package of ten pieces)



Both sides: Uncoated

Part Number	ϕD [mm]	Protective window retainer
PG-21	ϕ21	PGH-24
PG-27	ϕ27	PGH-30
PG-33	ϕ33	PGH-36

Protective Window Holders (Retainer only)



Material: Aluminum
Finish: Black anodized

Part Number	M [mm]	ϕB [mm]	ϕC [mm]	Protective window diameter [mm]
PGH-24	M22 P0.75	ϕ18	ϕ24	ϕ21
PGH-30	M28 P0.75	ϕ23	ϕ30	ϕ27
PGH-36	M34 P0.75	ϕ29	ϕ36	ϕ33

LHF

Please select a fixed lens holder and a protective window that matches the profile of the focusing lens. (use the matrix table on the right)

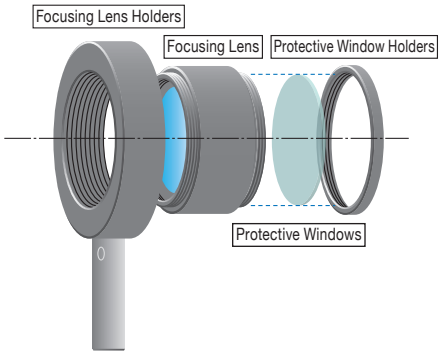
- There are two types of fixed holder for the focusing lens.

WEB Reference Catalog Code W4023

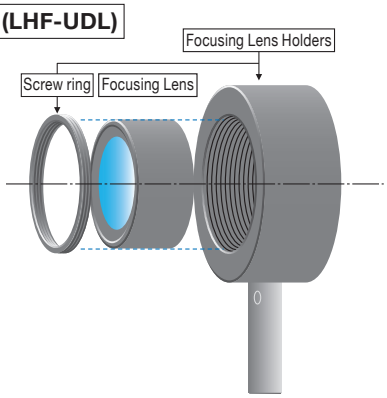
Thread Mount Type (LHF-M)
- Visible Spectrum Achromats
- YAG Laser Focusing Lenses
- Focusing Lenses for Fiber Laser
- Excimer Laser Focusing Lenses (some models)

Lens Tube Type (LHF-UDL)
- Ultraviolet Achromats

Thread Mount Type (LHF-M)



Lens Tube Type (LHF-UDL)



List of adaptive lens holder and protective window

Part Number	Protective window	Protective window retainer	Compatible Optic Mounts
Visible Spectrum Achromats			
ATL-30-40PY2	PG-33	PGH-36	LHF-M34-30
ATL-30-50PY2			
ATL-30-60PY2			
NADL-30-80PY2			
NADL-30-100PY2			
NADL-30-150PY2			
NADL-30-200PY2			
YAG Laser Focusing Lenses			
NYTL-25-20PY1	PG-21	PGH-24	LHF-M29-25
NYTL-30-30PY1	PG-27	PGH-30	LHF-M34-30
NYTL-30-40PY1			
NYTL-30-50PY1			
NYDL-30-60PY1	PG-33	PGH-36	
NYDL-30-80PY1			
NYDL-30-100PY1			
NYDL-30-150PY1			
Focusing Lenses for Fiber Laser			
HFTLSQ-15-20PF1	(PG-21)	PGH-24	exclusive adapter + LHF-M29-25
HFTLSQ-20-30PF1	(PG-27)	PGH-30	exclusive adapter + LHF-M34-30
HFTLSQ-30-40PF1			LHF-M34-30
HFTLSQ-30-50PF1			
HFTLSQ-30-60PF1	(PG-33)	PGH-36	
HFTLSQ-30-80PF1			
HFTLSQ-30-100PF1			
HFDLSQ-30-150PF1			
HFTLSQ-50-100PF1			LHF-M50.9-50
HFDLSQ-50-200PF1			
HFDLSQ-50-300PF1			
Excimer Laser Focusing Lenses			
ETL-30-40P	(PG-33)	PGH-36	LHF-M34-30
ETL-30-50P			
ETL-30-60P			
ETL-30-80P			
NEDL-30-100P			
NEDL-30-150P			
NEDL-30-200P			
EDL-50-100P			LHF-M50.9-50
EDL-50-150P			
EDL-50-200P			
EDL-50-250P			
EDL-50-300P			
Ultraviolet Achromats			
UDL-30-50P			LHF-UDL-30
UDL-30-80P			
UDL-30-100P			
NUDL-30-150P			
NUDL-30-200P			
UDL-40-80P			LHF-UDL-40
NUDL-40-100P			
NUDL-40-150P			
NUDL-40-200P			
NUDL-40-250P			
UDL-50-100P			LHF-UDL-50
NUDL-50-150P			
NUDL-50-200P			
NUDL-50-250P			
NUDL-50-300P			

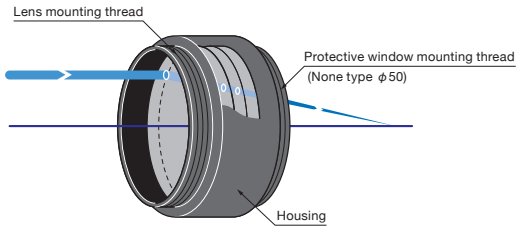
As for the protective windows enclosed in parentheses, glass material needs to be changed to synthetic fused silica as custom-made item.

Excimer Laser Focusing Lenses | ETL/EDL/NEDL RoHS Catalog Code W3082

These lenses are manufactured with a synthetic fused silica material and it has a high transmittance value in the ultra-violet wavelength of 180 – 400nm. They have excellent performance and are ideal for focusing and imaging applications. There is no adhesive or heat absorption material used to produce these lenses, as a result they show high resistance to the ultraviolet light.

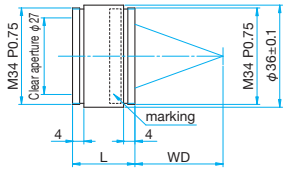
- They are made of 2 or 3 spherical lenses and they offer correction on spherical and comatic aberration.
- Standard focal lengths for Excimer laser with 248nm, 266nm and 355nm.
- NA 0.1 or below (ETL model NA 0.25) can be focused to the diffraction limit.

Schematic

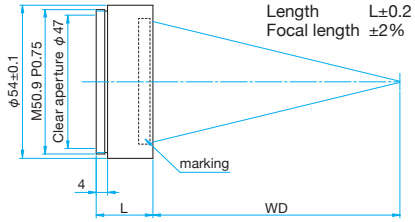


Outline Drawing (in mm)

ETL-30/NEDL-30



EDL-50



Specifications

Material	Synthetic fused silica for Excimer Laser
Material of frame	Aluminum Finishing: Black anodized
Design wavelength	248nm
Coating	Uncoated
Acceptance angle	±1°

Guide

- Products that are not listed in the table or in the catalog such as high pulse lasers or different wavelengths are available upon request, please contact our Sales Division.
- Protective Windows is sold separately. Reference B183
- For detail on focal length of each wavelength, please see our web site. WEB Reference Catalog Code W3082

Attention

- These focusing lenses are made for use to image an object located in an infinitive distance or using a point of source as a parallel light.
- The correct direction to input a parallel light is the side with barrel lettering. If the direction is wrong, the spherical aberration will be increased and the image unfocused.
- If Focusing lens is used with the designed wavelength the spherical aberration and transmission will be poor.
- Usage with high power laser or near a high temperature light source, the high heat build-up in the lens may alter the focal length. To avoid this, heat prevention is required.
- To reduce the focus spot size, ensure that the input beam diameter ($1/e^2$) is reduced to half of the effective diameter of the focus lens.
- These focusing lenses are not chromatic lenses; they are not optically corrected.
- The lenses have 4% of reflectivity per surface; therefore about 20% of loss is expected in transmission.

Specifications

Part Number	Focal length f [mm]	Length L [mm]	Numerical aperture (NA)	Working distance (WD) [mm]
ETL-30-40P	39.6	22	0.34	31.1
ETL-30-50P	49.8	22	0.27	41.6
ETL-30-60P	59.7	22	0.23	52.4
ETL-30-80P	79.8	22	0.17	73.2
NEDL-30-100P	99.9	12	0.14	94.6
NEDL-30-150P	149.3	12	0.09	144.6
NEDL-30-200P	199.3	12	0.07	194.7
EDL-50-100P	100.4	20	0.24	87.1
EDL-50-150P	149.6	20	0.16	137.9
EDL-50-200P	199.1	20	0.12	187.8
EDL-50-250P	249.0	20	0.09	238.0
EDL-50-300P	298.6	20	0.08	288.0

Compatible Optic Mounts

LHF-M34-30, LHF-M50.9-50

These lenses contain elements which have different refractive indexes and produce a high degree of correction across a bandwidth of 200 - 400nm.
They can be used as a laser focusing lens for broadband ultra-violet sources.

- NA 0.1 or below (ETL model NA 0.25) can be focused to the diffraction limit.
- No adhesive or heat absorption materials are used to produce these lenses and they show high resistance to ultra-violet light.
- These are not achromatic corrective but offers correction on spherical and comatic aberration.

Specifications

Material	Synthetic fused silica for Excimer Laser – Calcium fluoride (CaF_2)
Material of frame	Aluminum Finishing: Black anodized
Design wavelength	200nm, 308nm, 400nm
Coating	Uncoated
Acceptance angle	±1°

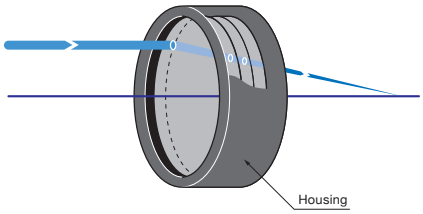
Guide

- Products that are not listed in the table or in the catalog such as high pulse lasers or different wavelengths are available upon request, please contact our Sales Division.
- We can provide catalog and custom lenses in large volume to your specifications.
- For details on focal length of each wavelength, please see details on our web site. WEB Reference Catalog Code W3083

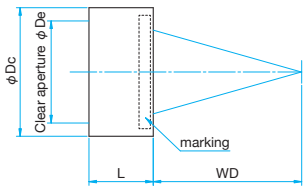
Attention

- These focusing lenses are made for use to image an object located in an infinitive distance or using a point of source as a parallel light.
- The correct direction to input a parallel light is the side with barrel lettering. If the direction is wrong, the spherical aberration will be increased and the image unfocused.
- If Focusing lens is used with the designed wavelength the spherical aberration and transmission will be poor.
- Usage with high power laser or near a high temperature light source, the high heat build-up in the lens may alter the focal length. To avoid this, heat prevention is required.
- To reduce the focus spot size, ensure that the input beam diameter ($1/e^2$) is reduced to half of the effective diameter of the focus lens.
- These focusing lenses are not chromatic lenses; they are not optically corrected.
- The lenses have 3 to 4% of reflectivity per surface; therefore about 13% of loss is expected in transmission.

Schematic



Outline Drawing (in mm)



●Tolerance
Diameter ϕDc ±0.1
Length L ±0.2
Focal length ±2%

Specifications

Part Number	Focal length f [mm]	Diameter ϕDc [mm]	Clear aperture ϕDe [mm]	Length L [mm]	Numerical aperture (NA)	Working distance (WD) [mm]
UDL-30-50P	50.4	ϕ34	ϕ27	17	0.27	39.3
UDL-30-80P	80.0	ϕ34	ϕ27	14	0.17	72.4
UDL-30-100P	100.1	ϕ34	ϕ27	13	0.14	92.5
NUDL-30-150P	151.5	ϕ34	ϕ27	16	0.09	137.1
NUDL-30-200P	200.3	ϕ34	ϕ27	16	0.07	185.2
UDL-40-80P	80.3	ϕ44	ϕ37	17	0.23	70.1
NUDL-40-100P	100.0	ϕ44	ϕ37	18	0.19	87.7
NUDL-40-150P	149.0	ϕ44	ϕ37	18	0.12	134.4
NUDL-40-200P	201.2	ϕ44	ϕ37	18	0.09	185.5
NUDL-40-250P	249.7	ϕ44	ϕ37	19	0.07	230.7
UDL-50-100P	100.8	ϕ54	ϕ47	20	0.24	89.1
NUDL-50-150P	149.7	ϕ54	ϕ47	21	0.16	136.3
NUDL-50-200P	200.0	ϕ54	ϕ47	22	0.12	179.9
NUDL-50-250P	252.4	ϕ54	ϕ47	21	0.09	233.0
NUDL-50-300P	300.9	ϕ54	ϕ47	22	0.08	278.8

Compatible Optic Mounts

LHF-UDL-30 / -40 / -50

fθ Lenses | fθ

RoHS

F-Theta Lenses are used for laser marking, bar code reader, laser micromachining and other laser applications.

- F-Theta lenses convert a rotational movement of a galvanometer mirror into a linear motion on the focal plane by using distortion effects.
- Telecentric type is also available that can be irradiated vertically to the focusing plane.
- Also available for fundamental YAG laser (1064nm), harmonic lasers (266nm, 355nm, 532nm).

Guide

- Transmittance value is a representative value only and is not guaranteed. If you have any questions, please feel free to contact our Sales Division.
- We accept orders to suit customized requirements.
- We also fabricate laser scanning systems which combine the galvanometer mirror and fθ lens as a unit.

Attention

- We do not recommend using fθ lens in an imaging system because it is designed for a scanning type optical system.
- Please position the incident pupil of the fθ lens beam into the scanning system (galvanometer mirror). If the incident pupil is not in position of the beam scanning system, the optimum focusing spot cannot be achieved because of increased aberration.

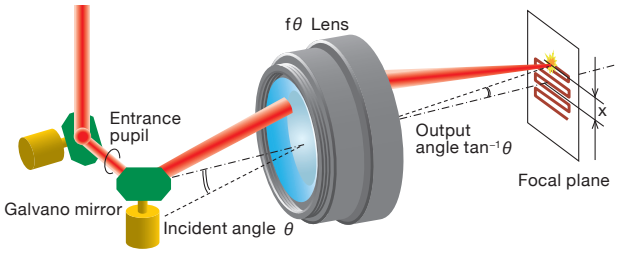
fθ Lenses dimension table

Part Number	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	ϕG (mm)	ϕH (mm)	I	ϕJ (mm)	K (mm)
fθ-100-266T	60	57.8	43	5	6	6	ϕ97	ϕ82g6	M80 P1	ϕ69	74.8
fθ-150-266T	80	73.3	65	3	6	6	ϕ122	ϕ102g6	M100 P1	ϕ89	88.3
fθ-100-355T	60	56.3	42	6	6	6	ϕ97	ϕ82g6	M80 P1	ϕ69	74.3
fθ-100-355THG	80	109.6	59	9	6	6	ϕ112	ϕ102g6	M100 P1	ϕ84	130.6
fθ-150-355T	80	72.3	64	4	6	6	ϕ122	ϕ102g6	M100 P1	ϕ89	88.3
fθ-100-532T	60	51.5	50	—	6	4	ϕ92	ϕ82g6	M80 P1	—	61.5
fθ-300-1064	39	35.9	27.3	3.7	8	—	ϕ91	—	M80 P1	ϕ76	47.6
fθ-100-1064T	60	49.5	47.5	—	6.5	6	ϕ92	ϕ82g6	M80 P1	—	62

fθ Lenses

Part Number	Design wavelength [nm]	Focal length f [mm]	Entrance pupil diameter [mm]	Scanning angle [°]	Scanning Range [mm]	Telecentric	Working distance (WD) [mm]	Transmittance (Angle of Incidence: 0°) [%]
fθ-100-266T	266	100.4	ϕ12	±15	ϕ52	○	135.9	93
fθ-150-266T	266	149.9	ϕ12	±15	ϕ78	○	205.1	93
fθ-100-355T	355	99.85	ϕ12	±15	ϕ52	○	136.1	93
fθ-100-355THG	355	100.1	ϕ14	±15	ϕ52	○	60.94	90
fθ-150-355T	355	150.2	ϕ12	±15	ϕ78	○	207.2	93
fθ-100-532T	532	100.3	ϕ12	±15	ϕ52	○	121.1	90
fθ-300-1064	1064	299.8	ϕ16	±23	ϕ240	—	361.6	95
fθ-100-1064T	1064	100.3	ϕ12	±15	ϕ52	○	123.1	95

Schematic

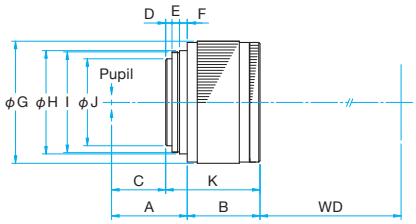


By using the f theta lens, it is possible to be moved a laser light spot in constant speed linear motion on the focal plane by scanning the mirrors such as galvanometer scanner mirrors.
The f theta lens enables this by the effect of distortion.
Mathmatically it is expressed as following;
focal length = "f", ideal image height = "y", the angle of scanned = "θ"
therefore, $y = f\theta$.
In the normal single lens, the ideal image height "y" is represented by "$y = f \tan\theta$".
Characteristics of both are the same in a small angle range. However, the difference is greater angle increases.

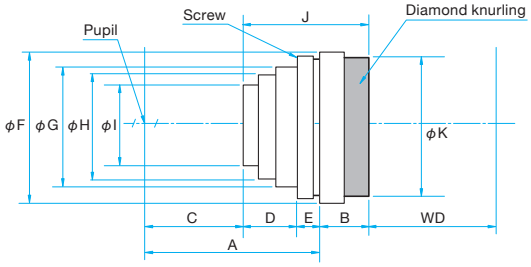
Outline Drawing

(in mm)

fθ Lenses



fθ Lenses for YAG (fθ-L/fθ-B/fθ-270-1064)



fθ Lenses for YAG dimension table

Part Number	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	ϕF (mm)	ϕG (mm)	ϕH (mm)	ϕI (mm)	J (mm)	ϕK (mm)	Screw
fθ-100-532L	53.3	17.8	22.5	22.8	8	ϕ89	ϕ80	ϕ72	ϕ60	48.6	ϕ83	M85 P1
fθ-100-1064L	53.3	17	20	25.3	8	ϕ87	ϕ80	ϕ69	ϕ57	50.3	ϕ83	M85 P1
fθ-150-1064B	63	19.8	26.8	28	8.2	ϕ87	ϕ80	ϕ74.5	ϕ64	56	ϕ86	M85 P1
fθ-220-1064L	59.8	21.1	32.1	19.7	8	ϕ97	ϕ80	—	ϕ68	48.8	ϕ97	M85 P1
fθ-270-1064	59.7	33.5	26.0	24.7	9	ϕ106	ϕ74	—	ϕ64	67.2	ϕ106	M85 P1

fθ Lenses for YAG

Part Number	Design wavelength [nm]	Focal length f [mm]	Entrance pupil diameter [mm]	Scanning angle [°]	Scanning Range [mm]	Telecentric	Working distance (WD) [mm]	Transmittance [%]
fθ-100-532L	532	100.2	ϕ12	±22.9	ϕ80	—	114.7	>95
fθ-100-1064L	1064	99.93	ϕ12	±22.9	ϕ80	—	109.6	>95
fθ-150-1064B	1064	152.1	ϕ15	±24.0	ϕ127.4	—	168.6	>95
fθ-220-1064L	1064	220.0	ϕ12	±24.0	ϕ184	—	254.2	>95
fθ-270-1064	1064	273.0	ϕ15	±24.13	ϕ230	—	318.9	>95

3-Wavelengths Objective Lenses | PFL-UV/NUV-AG RoHS Catalog Code W3460

This objective lens can be used for laser machining using pulsed laser of SHG (532nm), THG (355nm), and FHG (266nm) YAG laser. Objective lense provides high transmittance at three harmonic wavelengths of YAG.

- With its long working distance and corrected field curvature, its natural observation image is obtained to the periphery of viewing the field.
- It is the long working infinity correction function that is used to introduce a laser system and coaxial observation.
- It allows observation of the sample with visible light (400 – 500nm).
- Laser Damage Threshold (Typical) 0.09 J/cm^2 (266nm), 0.1J/cm^2 (355nm), 0.2J/cm^2 (532nm)
  (Laser pulse width 10ns, repetition frequency 20Hz)

Guide

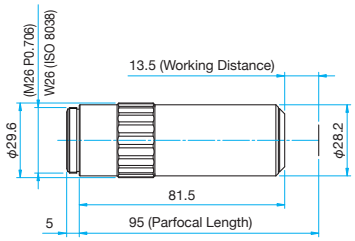
- Available fixed objective lens holder (LHO-26).
  WEB Reference Catalog Code W4024
- When the objective lens is fixed to a 2 axis holder, please consult our Sales Division.
- For laser processing, we offer a dichoric block (DIMC) and for laser unit with coaxial illumination and observation (OUCI-2).
  WEB Reference Catalog Code W2041

Attention

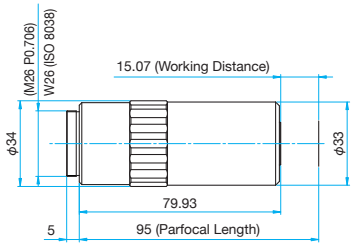
- When an objective lens is used in laser processing, use the diameter of the incident beam to extend to a size of half the pupil diameter (1/e^2). A small light spot cannot be achieved when the incident beam is too narrow. Please note if there is a laser energy density increase, there will be a high possibility of damage to the objective lens.
- The surface of an objective lens can be contaminated by debris during processing. To avoid this, please have sufficient working distance (WD) and insert a thin protective glass on the objective.
- Magnification is the value when using the imaging lens f=200mm. When used in a microscope lens barrel from other manufacturers there may be different magnifications. The actual magnification should be calculated from the ratio of the focal length of the objective lens and the focal length of the imaging lens to verify the focal length of the imaging lens barrel to be used.

Outline Drawing (in mm)

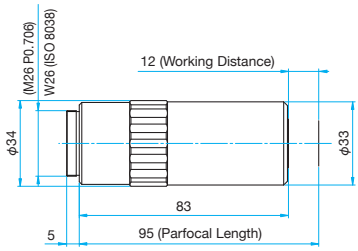
PFL-10-UV/NUV-AG



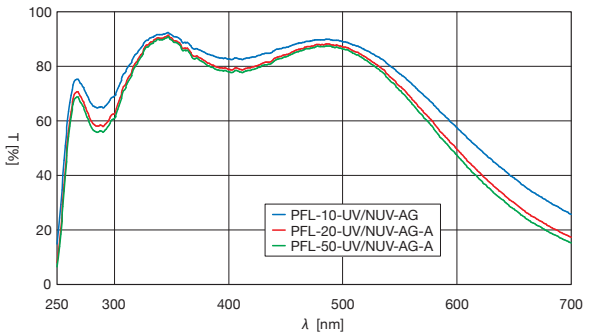
PFL-20-UV/NUV-AG-A



PFL-50-UV/NUV-AG-A



Typical Transmittance Data T: Transmission



Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working distance WD [mm]	Resolution (λ=550nm) [μm]	Focal depth (λ=550nm) [μm]	Real field of view (Eyepiece ϕ24mm) [mm]	Real field of view (Imaging device 1/2-inch) [mm]	Weight [kg]
PFL-10-UV/NUV-AG	MPlan UV/NUV 10x	10x	20	0.20	13.5	1.40	±6.9	ϕ2.4	0.48×0.64	0.30
PFL-20-UV/NUV-AG-A	MPlan UV/NUV 20x	20x	10	0.36	15.07	0.76	±2.1	ϕ1.2	0.24×0.32	0.35
PFL-50-UV/NUV-AG-A	MPlan UV/NUV 50x	50x	4	0.42	12.0	0.65	±1.6	ϕ0.48	0.10×0.13	0.41

Compatible Optic Mounts

LHO-26

Ultra-violet Objective Lenses | PFL-UV-AG

RoHS Catalog Code W3459

This objective lens can be used for laser machining using pulsed laser of SHG (532nm) YAG laser and FHG (266nm) YAG. Chromatic aberration is suppressed in both the visible and UV laser wavelength, achieving a high transmittance.

- With its long working distance and field curvature corrected, its natural observation image is obtained to the periphery of the visual field.
- It is the long working infinity correction function that is used to introduce a laser system and coaxial observation.
- It is also used for the observation of ultra-violet light.
- Laser Damage Threshold (Typical) 0.09 J/cm^2 (266nm), 0.2J/cm^2 (532nm)
  (Laser pulse width 10ns, repetition frequency 20Hz)

Guide

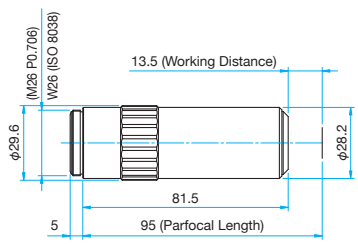
- Available fixed objective lens holder (LHO-26).
  WEB Reference Catalog Code W4024
- When the objective lens is fixed to a 2 axis holder, please consult our Sales Division.
- For laser processing, we offer a dichoric block (DIMC) and for laser unit with coaxial illumination and observation (OUCI-2).
  WEB Reference Catalog Code W2041

Attention

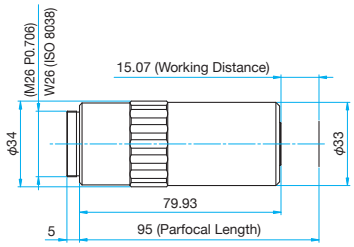
- When an objective lens is used in laser processing, use the diameter of the incident beam to extend to a size of half the pupil diameter (1/e^2). A small light spot cannot be achieved when the incident beam is too narrow. Please note if there is a laser energy density increase, there will be a high possibility of damage to the objective lens.
- The surface of an objective lens can be contaminated by debris during processing. To avoid this, please have sufficient working distance (WD) and insert a thin protective glass on the objective.
- Magnification is the value when using the imaging lens f=200mm. When used in a microscope lens barrel from other manufacturers there may be different magnifications. The actual magnification should be calculated from the ratio of the focal length of the objective lens and the focal length of the imaging lens to verify the focal length of the imaging lens barrel to be used.

Outline Drawing (in mm)

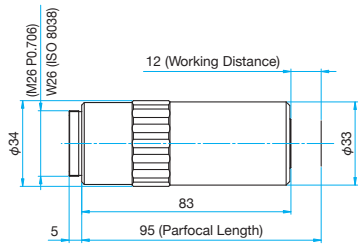
PFL-10-UV-AG



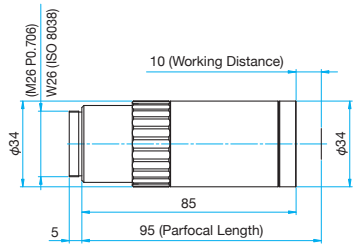
PFL-20-UV-AG-A



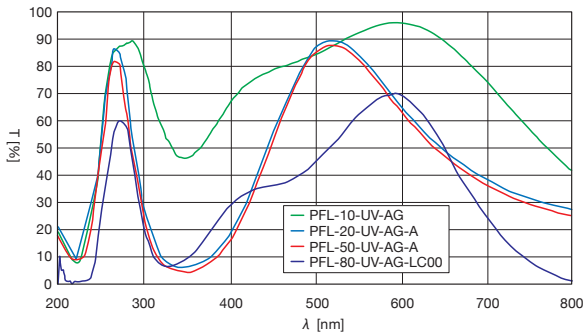
PFL-50-UV-AG-A



PFL-80-UV-AG-LC00



Typical Transmittance Data T: Transmission



Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working distance WD [mm]	Resolution (λ=550nm) [μm]	Focal depth (λ=550nm) [μm]	Real field of view (Eyepiece φ24mm) [mm]	Real field of view (Imaging device 1/2-inch) [mm]	Weight [kg]
PFL-10-UV-AG	MPlan UV 10x	10x	20	0.20	13.5	1.4	±6.9	φ2.4	0.48×0.64	0.30
PFL-20-UV-AG-A	MPlan UV 20x	20x	10	0.36	15.07	0.76	±2.1	φ1.2	0.24×0.32	0.35
PFL-50-UV-AG-A	MPlan UV 50x	50x	4	0.42	12.0	0.65	±1.6	φ0.48	0.10×0.13	0.41
PFL-80-UV-AG-LC00	MPlan UV 80x	80x	2.5	0.55	10.0	0.50	±0.9	φ0.30	0.06×0.18	0.35

Compatible Optic Mounts

LHO-26

Near Ultra-violet (NUV) Objective Lenses | PAL-NUV RoHS Catalog Code W3458

This objective lens can be used for laser machining using pulsed laser of THG (355nm) YAG laser. Chromatic aberration is suppressed in both the visible and UV laser wavelength, achieving a high transmittance.

- With its long working distance and field curvature corrected, its natural observation image is obtained to the periphery of the visual field.
- With its long working infinity correction function; this objective lens can be used for a laser system and coaxial observation.
- It is also used for the observation of near ultra-violet light.
- This objective lens can be used with a pulse laser of visible light (532nm).
- Laser Damage Threshold (Typical) 0.05J/cm^2 (355nm), 0.1J/cm^2 (532nm)
  (Laser pulse width 10ns, repetition frequency 20Hz)

Guide

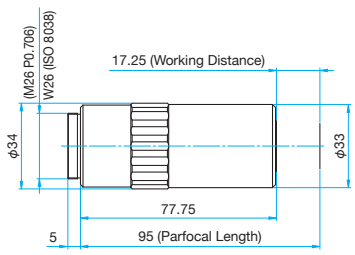
- Available fixed objective lens holder (LHO-26).
  WEB Reference Catalog Code W4024
- When the objective lens is fixed to a 2 axis holder, please consult our Sales Division.
- For laser processing, we offer a dichoric block (DIMC) and for laser unit with coaxial illumination and observation (OUCI-2).
  WEB Reference Catalog Code W2041

Attention

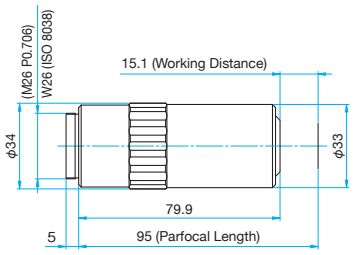
- When an objective lens is used in laser processing, use the diameter of the incident beam to extend to a size of half the pupil diameter (1/e^2). A small light spot cannot be achieved when the incident beam is too narrow. Please note if there is a laser energy density increase, there will be a high possibility of damage to the objective lens.
- The surface of an objective lens can be contaminated by debris during processing. To avoid this, please have sufficient working distance (WD) and insert a thin protective glass on the objective.
- Magnification is the value when using the imaging lens f=200mm. When used in a microscope lens barrel from other manufacturers there may be different magnifications. The actual magnification should be calculated from the ratio of the focal length of the objective lens and the focal length of the imaging lens to verify the focal length of the imaging lens barrel to be used.

Outline Drawing (in mm)

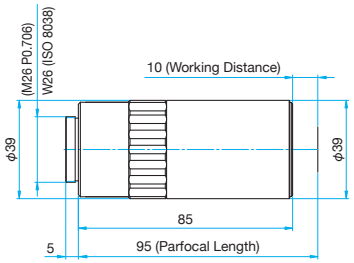
PAL-20-NUV-A



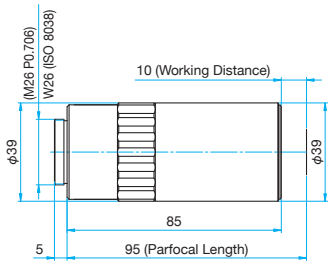
PAL-50-NUV-A



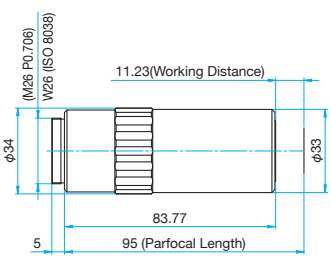
PAL-50-NUV-HR-L



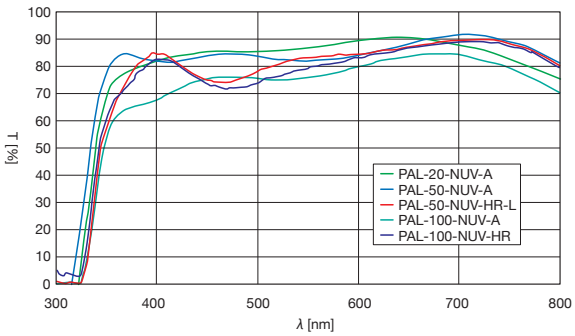
PAL-100-NUV-HR



PAL-100-NUV-A



Typical Transmittance Data T: Transmission



Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working distance WD [mm]	Resolution (λ=550nm) [μm]	Focal depth (λ=550nm) [μm]	Real field of view (Eyepiece ϕ24mm) [mm]	Real field of view (Imaging device 1/2-inch) [mm]	Weight [kg]
PAL-20-NUV-A	MPlanApo NUV 20x	20x	10	0.40	17.25	0.69	±1.7	ϕ1.2	0.24×0.32	0.35
PAL-50-NUV-A	MPlanApo NUV 50x	50x	4	0.45	15.1	0.61	±1.4	ϕ0.48	0.10×0.13	0.36
PAL-50-NUV-HR-L	MPlanApo NUV HR 50x	50x	4	0.65	10.0	0.42	±0.65	ϕ0.48	0.10×0.13	0.51
PAL-100-NUV-A	MPlanApo NUV 100x	100x	2	0.57	11.23	0.48	±0.8	ϕ0.24	0.05×0.06	0.38
PAL-100-NUV-HR	MPlanApo NUV HR 100x	100x	2	0.70	10.0	0.39	±0.6	ϕ0.24	0.05×0.06	0.53

Compatible Optic Mounts

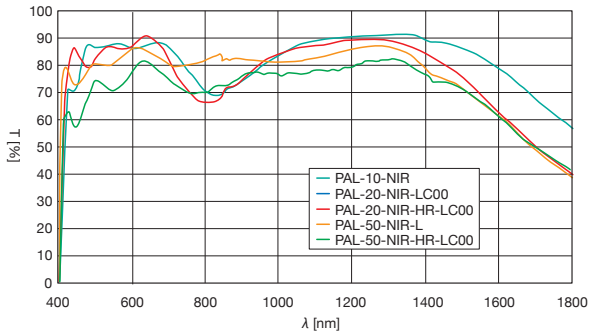
LHO-26

Infrared (NIR) Objective Lenses | PAL-NIR

This is a high NA infinity corrected objective lens for laser processing (femtosecond laser and fundamental of YAG laser). You can also observe the laser beam coaxially with a laser processed surface that is designed to reduce the aberration of the visible wavelength.

- With its long working distance and field curvature corrected, its natural observation image is obtained to the periphery of the visual field.
- It is the long working infinity correction function that is used to introduce a laser system and coaxial observation.
- It is also used for the observation of infrared light.
- PAL-20-NIR-LC00/PAL-20-NIR-HR-LC00/PAL-50-NIR-HR-LC00 include protective glass unit (t=1.8mm). The protective glass will help protect the objective lens from debris spattering and scattered by laser processing. The protective glass unit can be replaced.
- These variety of objective lens can be used with a pulse laser of visible light such as 532nm. The damage threshold of each lens is 0.1J/cm^2 at 532nm, 0.2J/cm^2 at 1064nm (reference). (Laser pulse width 10nSec, repetition frequency 20Hz)

Typical Transmittance Data T: Transmission



Guide

- Available fixed objective lens holder (LHO-26).
  WEB Reference Catalog Code W4024
- When the objective lens is fixed to a 2 axis holder, please consult our Sales Division.
- For laser processing, we offer a dichoric block (DIMC) and for laser unit with coaxial illumination and observation (OUCI-2).
  WEB Reference Catalog Code W2041

Attention

- When an objective lens is used in laser processing, use the diameter of the incident beam to extend to a size of half the pupil diameter (1/e^2). A small light spot cannot be achieved when the incident beam is too narrow. Please note if there is a laser energy density increase, there will be a high possibility of damage to the objective lens.
- The surface of an objective lens can be contaminated by debris during processing. To avoid this, please have sufficient working distance (WD) and insert a thin protective glass on the objective.
- If the incident laser beam femtosecond is below 100fs, there is a possibility that the pulse width will spread.
- Magnification is the value when using the imaging lens f=200mm. When used in a microscope lens barrel from other manufacturers there may be different magnifications. The actual magnification should be calculated from the ratio of the focal length of the objective lens and the focal length of the imaging lens to verify the focal length of the imaging lens barrel to be used.
- PAL-20-NIR-HR-LC00/PAL-50-NIR-HR-LC00 is designed in consideration of the thickness of including protective glass. If user removes the protective glass, the objective will not meet the performance specifications noted.

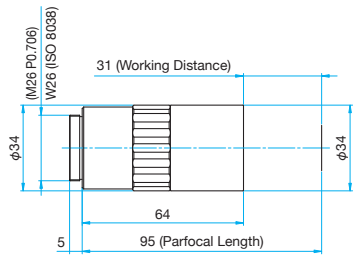
Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working distance WD [mm]	Resolution (λ=550nm) [μm]	Focal depth (λ=550nm) [μm]	Real field of view (Eyepiece φ24mm) [mm]	Real field of view (Imaging device 1/2-inch) [mm]	Weight [kg]
PAL-10-NIR	MPlanApo NIR 10x	10x	20	0.30	31.0	0.92	±3.1	φ2.4	0.48×0.64	0.30
PAL-20-NIR-LC00	MPlanApo NIR 20x	20x	10	0.40	20.2	0.69	±1.7	φ1.2	0.24×0.32	0.36
PAL-20-NIR-HR-LC00	MPlanApo NIR HR 20x	20x	10	0.45	20.0	0.61	±1.4	φ1.2	0.24×0.32	0.42
PAL-50-NIR-L	MPlanApo NIR 50x	50x	4	0.45	15.1	0.61	±1.4	φ0.48	0.10×0.13	0.34
PAL-50-NIR-HR-LC00	MPlanApo NIR HR 50x	50x	4	0.67	10.0	0.41	±0.61	φ0.48	0.10×0.13	0.48

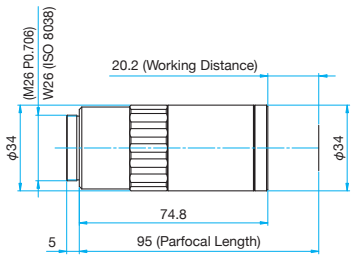
Outline Drawing

(in mm)

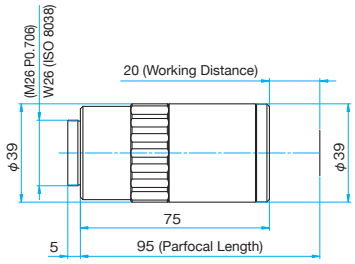
PAL-10-NIR



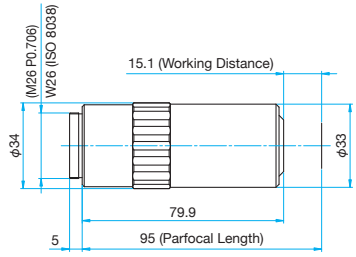
PAL-20-NIR-LC00



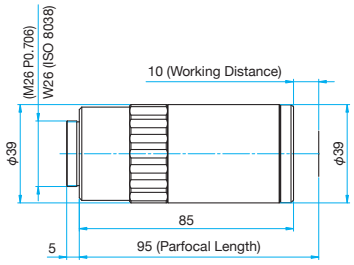
PAL-20-NIR-HR-LC00



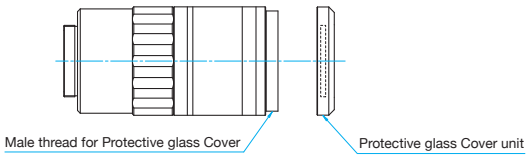
PAL-50-NIR-L



PAL-50-NIR-HR-LC00



How to replace the protective glass unit of PAL-20-NIR-HR-LC00/PAL-50-NIR-HR-LC00



Compatible Optic Mounts

LHO-26

Long Working Distance Objective Lenses | EPL/EPLE

RoHS | Catalog Code W3086

With its long working infinity correction function; this objective lens can be used for a laser system and coaxial observation.
The objective will allow user to focus a visible laser or microscopic observation of objects from a distance.

- Chromatic aberration is corrected in the visible range (400 – 700nm).
- Two types of parfocal distance are available, 45mm and 90mm.
- This parfocal 95mm lens has a long working distance and a corrected field curvature. Its natural observation image is obtained to the periphery of the visual field.
- It is possible to improve the response speed in the driving mechanism of the 45mm parfocal objective lens (SFS-OBL/SFAI-OBL); with a lightweight auto focusing solution.

Guide

- Available fixed objective lens holder (LHO-20.32).
  WEB Reference Catalog Code W4024
- When the objective lens is fixed to a 2 axis holder, please consult our Sales Division.
- For laser processing, we offer a dichoric block (DIMC) and for laser unit with coaxial illumination and observation (OUCI-2).
  WEB Reference Catalog Code W2041

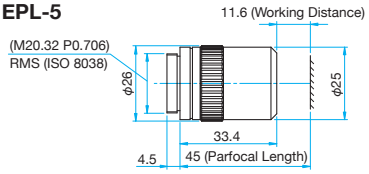
Attention

- When an objective lens is used in laser processing, use the diameter of the incident beam to extend to a size of half the pupil diameter ($1/e^2$). A small light spot cannot be achieved when the incident beam is too narrow.
  Please note if there is a laser energy density increase, there will be a high possibility of damage to the objective lens.
- The surface of an objective lens can be contaminated by debris during processing. To avoid this, please have sufficient working distance (WD) and insert a thin protective glass on the objective.
- Magnification is the value when using the imaging lens f=200mm. When used in a microscope lens barrel from other manufacturers there may be different magnifications. The actual magnification should be calculated from the ratio of the focal length of the objective lens and the focal length of the imaging lens to verify the focal length of the imaging lens barrel to be used.

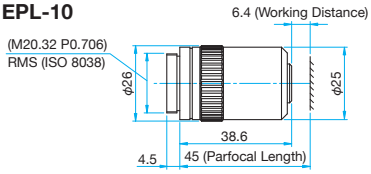
Outline Drawing

(in mm)

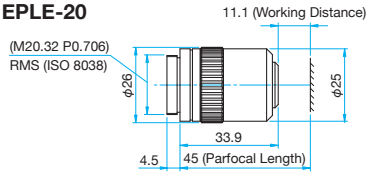
EPL-5



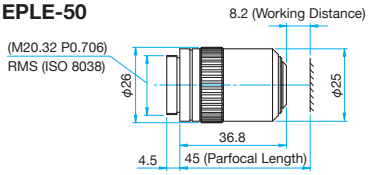
EPL-10



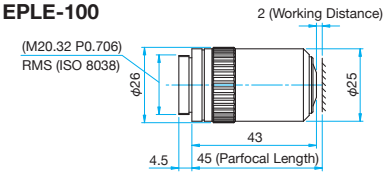
EPLE-20



EPLE-50



EPLE-100



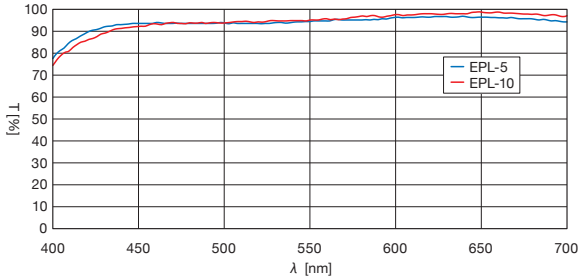
Specifications

Part Number	Magnification	Numerical aperture (NA)	Working distance (WD) [mm]	Focal length f [mm]	Resolution [μm]	Focal depth [μm]	Pupil diameter [mm]	Real field of view (Eyepiece φ24mm) [mm]	Real field of view (Imaging device 1/2-inch) [mm]	Weight [kg]
EPL-5	5	0.13	11.6	40	2.1	±16.3	φ10.4	φ4.8	0.96×1.28	0.085
EPL-10	10	0.30	6.4	20	0.9	±3.1	φ12.0	φ2.4	0.48×0.64	0.085
EPLE-20	20	0.40	11.1	10	0.7	±1.7	φ8.0	φ1.2	0.24×0.32	0.085
EPLE-50	50	0.55	8.2	4	0.5	±0.9	φ4.4	φ0.48	0.10×0.13	0.095
EPLE-100	100	0.80	2.0	2	0.3	±0.4	φ3.2	φ0.24	0.05×0.06	0.105

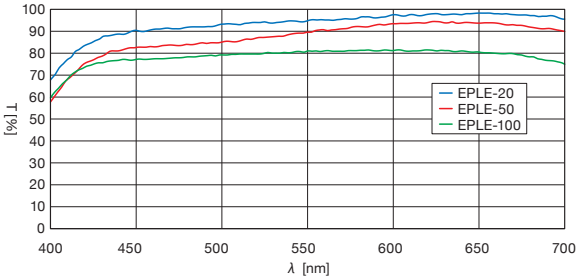
Typical Transmittance Data

T: Transmission

EPL



EPLE



Compatible Optic Mounts

LHO-26

Long Working Distance Objective Lenses | PAL/PAL-L RoHS Catalog Code W3456

The long working distance objective lens infinity correction function and par focal length 95mm can be used for a laser system and coaxial observation. The objective will allow user to focus a visible laser or microscopic observation of objects from a distance.

- Chromatic aberration is corrected in the visible range (400 – 700nm).
- PAL/PAL-L has a long working distance and a corrected field curvature. Its natural observation image is obtained to the periphery of the visual field.

Guide

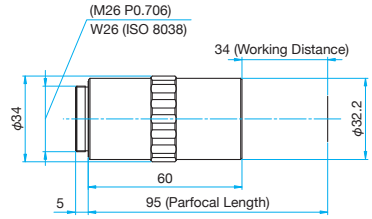
- Available fixed objective lens holder (LHO-26).
  WEB Reference Catalog Code W4024
- When the objective lens is fixed to a 2 axis holder, please consult our Sales Division.
- For laser processing, we offer a dichoric block (DIMC) and for laser unit with coaxial illumination and observation (OUCI-2).
  WEB Reference Catalog Code W2041

Attention

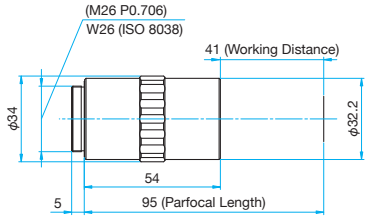
- When an objective lens is used in laser processing, use the diameter of the incident beam to extend to a size of half the pupil diameter ($1/e^2$). A small light spot cannot be achieved when the incident beam is too narrow. Please note if there is a laser energy density increase, there will be a high possibility of damage to the objective lens.
- The surface of an objective lens can be contaminated by debris during processing. To avoid this, please have sufficient working distance (WD) and insert a thin protective glass on the objective.
- Magnification is the value when using the imaging lens f=200mm. When used in a microscope lens barrel from other manufacturers there may be different magnifications. The actual magnification should be calculated from the ratio of the focal length of the objective lens and the focal length of the imaging lens to verify the focal length of the imaging lens barrel to be used.

Outline Drawing (in mm)

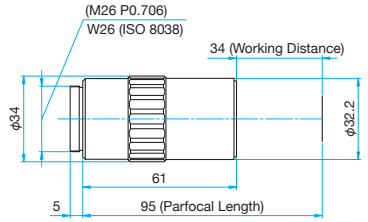
PAL-2-B



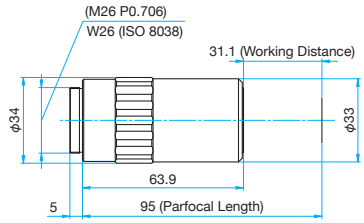
PAL-5



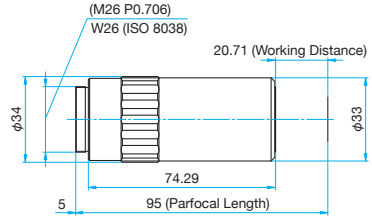
PAL-10-A



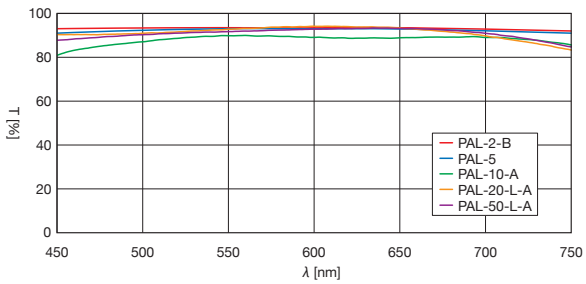
PAL-20-L-A



PAL-50-L-A



Typical Transmittance Data T: Transmission



Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working distance WD [mm]	Resolution (λ=550nm) [μm]	Focal depth (λ=550nm) [μm]	Real field of view (Eyepiece ϕ24mm) [mm]	Real field of view (Imaging device 1/2-inch) [mm]	Weight [kg]
PAL-2-B	MPlanApo 2x	2x	100	0.055	34.0	5	91	ϕ12	2.4×3.2	0.25
PAL-5	MPlanApo 5x	5x	40	0.14	41.0	2	14	ϕ4.8	0.96×1.28	0.24
PAL-10-A	MPlanApo 10x	10x	20	0.3	34.0	0.92	3.1	ϕ2.4	0.48×0.64	0.24
PAL-20-L-A	MPlanApo SL20x	20x	10	0.3	31.1	0.92	3.1	ϕ1.2	0.24×0.32	0.28
PAL-50-L-A	MPlanApo SL50x	50x	4	0.42	20.7	0.65	1.6	ϕ0.48	0.10×0.13	0.31

Microscope Objectives | OBL

RoHS Catalog Code W3085

These objectives are educational microscope objectives. They are to the JIS standard (Japanese Industry Standard), have Short focal length, high NA and are fit for beam divergent use.

- Full color correction throughout the visible wavelength.
- The OBL-40 and OBL-60 have a built-in spring in the tip of the objective lens.
- These objective lenses are finite.
- To mount it to a microscope, a finite 160mm adaptor is required.
- The distance from the attachment face of the objective lens to the image is 150mm.

Guide

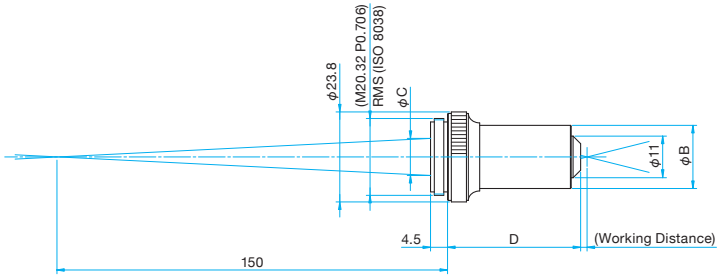
- Use a special filter (SFB) to correct the wave front distortion.
  WEB Reference Catalog Code W4036
- Objective holder (LHO) is available for these objective lenses.
  WEB Reference Catalog Code W4024
- Cross holder (TAT) is now available.
  WEB Reference Catalog Code W4038

Attention

- Do not use objectives with high power laser.
- The objective lenses are finite and are not to be used with infinite lens barrel or poor images will result.
- To be used only in the visible wavelength range.

Outline Drawing

(in mm)



Specifications

Part Number	Magnification	Length D [mm]	Barrel diameter ϕB [mm]	Pupil diameter ϕC [mm]	Focal length f [mm]	NA	Working distance (WD) [mm]	Weight [kg]
OBL-10	10	30.5	ϕ16.7	ϕ8.3	16.6	0.25	5.5	0.05
OBL-20	20	35.2	ϕ16.7	ϕ7.1	9.0	0.40	1.7	0.05
OBL-40	40	36.4	ϕ19.7	ϕ5.8	4.5	0.65	0.6	0.06
OBL-60	60	36.7	ϕ19.7	ϕ4.9	2.91	0.85	0.3	0.07

Compatible Optic Mounts

LHO-20.32, -20.32A / TAT-18OA + TAT16RO

Reflective Microscope Objectives Lenses | OBLR RoHS Catalog Code W3090

These reflective Microscope objective lenses are optimized for chromatic aberration over a bandwidth of 350nm to 7um. They are mainly used in microscope-spectrometry and failure analysis in the semiconductor industry.

- Adjustable for use with various types of microscope tubes with focal length ranging from 80mm to infinite
- The reflection mirror is strengthened with aluminium coating and MgF_2 protective layer.
- The RMS(M20.32 P0.706) mounting thread conforms to JIS standard and is compatible with all major microscope tubes.
- The focus point and image size of visible, UV and IR wavelengths shows no difference and precise matching of the images is possible.

Guide

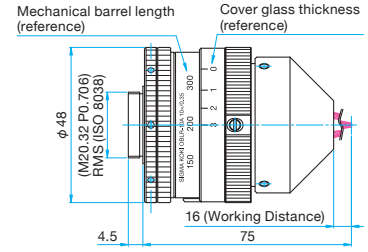
- There is no protective layer in aluminium coating for the vacuum ultra-violet spectrum and gold layer coating for near infrared is available as an option.
- An adapter for the objective lens turret is available (OBRLR-AMT). Check with our International Sales Division or your microscope manufacturer for compatibility and the use of reflective microscope objective lenses.
- Specific holder for microscope objective lenses (LHO-20.32) is available. WEB Reference Catalog Code W4024

Attention

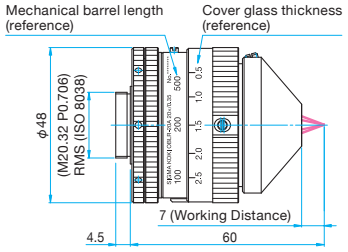
- These objectives are not to be used for laser processing due to light axis shielding of the reflective mirror.
- There are microscopes that cannot be used with a turret.
- The cover glass is not mobile. Use the adjustable correction collar to adjust the focal length and the cover glass thickness.
- The center reflective mirror shields the center of the light axis. For direct light experiments, a low intense light in the center is expected.
- The light intensity loss if expected to be around 45%. (The center mirror shielding 36% and the aluminum reflectivity 90%)

Outline Drawing (in mm)

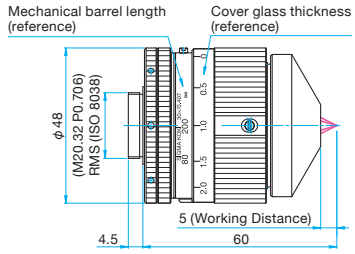
OBLR-10A



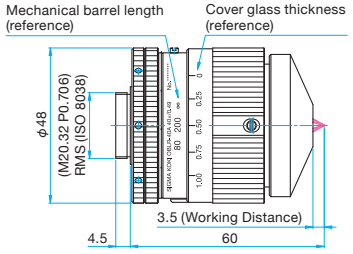
OBLR-20A



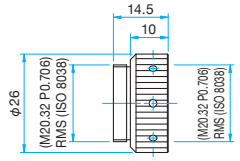
OBLR-30A



OBLR-40A



Objective Lens Adapter



Part Number	OBLR-AMT

Specifications

Part Number	Magnification	Wavelength Range	Focal length f [mm]	Numerical aperture (NA)	Field of view [mm]	Working distance (WD) [mm]	Mechanical tube length [mm]	Shielding ratio [%]
OBLR-10A	10	350nm – 7μm	19.9	0.2	ϕ1.0	16	80 – ∞ (Variable)	about 36
OBLR-20A	20	350nm – 7μm	10.0	0.35	ϕ0.5	7	80 – ∞ (Variable)	about 36
OBLR-30A	30	350nm – 7μm	6.7	0.41	ϕ0.34	5	80 – ∞ (Variable)	about 36
OBLR-40A	40	350nm – 7μm	5.0	0.49	ϕ0.25	3.5	80 – ∞ (Variable)	about 36

Compatible Optic Mounts

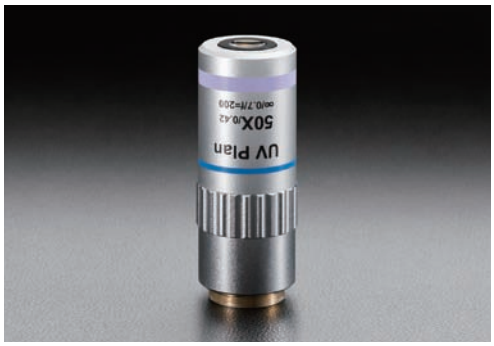
LHO-20.32

Glass Thickness Corrected Objective Lenses | Others

You can check our WEB catalog for the objective lenses that are not listed in the catalog.

Glass Thickness Corrected Ultra-violet Objective Lenses | PFL-UV-AG-LC

Catalog Code W3463



- For bright field observation and laser processing
- Infinity corrected objective lens
- It can be used for 266nm/532nm.
- Glass thickness is corrected to t=0.7mm or 1.1mm.
- magnification 20x,50x,80x
- Air Gap type compatible with high-energy
- Laser Damage Threshold (For reference only)
  (Laser pulse width 10ns, repetition frequency 20Hz)
  0.09 J/cm^2 (266nm)
  0.2J/cm^2 (532nm)

Glass Thickness Corrected Near Ultra-violet Objective Lenses | PAL-NUV-LC

Catalog Code W4364

- For bright field observation and laser processing
- Infinity corrected objective lens
- It can be used for 355nm
- Glass thickness is corrected to t=0.7mm or 1.1mm.
- magnification 20x,50x,100x
- With Plan-Apochromat
- Laser Damage Threshold (For reference only)
  (Laser pulse width 10ns, repetition frequency 20Hz)
  0.05 J/cm^2 (355nm)
  0.1 J/cm^2 (532nm)

Glass Thickness Corrected Infrared Objective Lenses | PAL-NIR-LC

Catalog Code W4365

- For bright field observation and laser processing
- Infinity corrected objective lens
- It can be used for 1064nm
- Glass thickness is corrected to t=0.7mm or 1.1mm.
- Magnification 20x,50x
- Laser Damage Threshold (For reference only)
  (Laser pulse width 10ns, repetition frequency 20Hz)
  0.1 J/cm^2 (532nm)
  0.2 J/cm^2 (1064 nm)

Glass Thickness Corrected Infrared Objective Lenses | PAL-NIR (780)

Catalog Code W4366

- Infinity corrected objective lens
- It can be used for 780nm
- Glass thickness is corrected to t=0.7mm
- Magnification 20x,50x
- Laser Damage Threshold (For reference only)
  (Laser pulse width 10ns, repetition frequency 20Hz)
  0.1 J/cm^2 (532nm)
  0.15 J/cm^2 (780nm)

Contact sheet for Custom-made Objective Lenses ■Estimation ■Order

Date

☐ To: Sigma Koki Co., Ltd. **FAX +81-3-5638-6550**

Affiliation (Organization Name)					
Department		Name			
TEL		FAX		E-mail	
Country/Address					
Name & Designation					(Tentative name is okay)
Drawing Number		Estimate	☐ Yes: by Date		☐ No
Desired Delivery Date		Budget			JP Yen

Intention Please fill in as concrete as possible.		
Design wavelength		nm
Focal length		mm
Acceptance angle		°
Magnification		
NA		
Distortion		
Telecentric	☐ YES (θ< °) ☐ NO	
Object - Image Distance		mm
Working distance W.D.		mm
Flange back		mm
Spot Size ($1/e^2$)		μm
Resolution		μm
Real field of View (Imaging device)	mm, (	inch)
Mounting screw thread	mm,	mm Pitch
External dimensions		mm
Adjustable diaphragm	☐Requirement ☐Not requirement	
Coaxial illumination	☐Requirement ☐Not requirement	

Specifications of Light Source Used	Divergence angle		
	Beam size		mm
	M^2		
	Power or Energy		W
			J
		Pulse width	S
		Repetition frequency	Hz

Sigma Koki Co., Ltd.

General Catalog 02

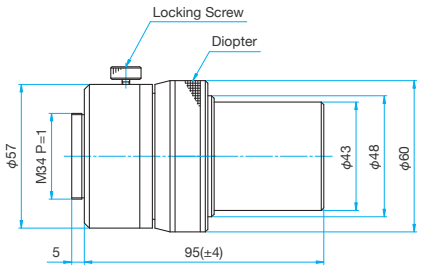
High Power Laser Beam Expander | BEHP

RoHS Catalog Code W3200

**These laser beam expanders are designed for use with a high-power laser.
Fine adjustment of the collimator is available with the diopter correction function.
The lens design takes into account the wavefront aberration, so it can be used in an optical system with high precision, such as a laser interferometer or laser processing.**

- The optical system of the beam expander utilizes an air gap configuration that does not use an adhesive bonding of lens.
- By turning the diopter ring that is attached to the center of the beam expander, you can make variable beams such as a focused beam, collimated beam, and a divergent beam. It is used when you want to vary the position of the beam waist and where precision collimation adjustment is necessary.

Outline Drawing (in mm)



Specifications

Lens Material	Synthetic fused silica
Configuration of lens	2 group 4plates Galilean
Acceptance range of incident angle	±1°
Coating	Antireflection coating (Design wavelength: 633nm)
A range of the length of lens barrel	±5mm

Guide

- We also can provide a holder for our laser beam expander (KLH-BE) for the fine adjustment with tilt angle and to secure the beam expander. WEB Reference Catalog Code W4147
- It is also available to provide beam expander of wavelength other than products on-line and in our catalog and achromatic in two wavelengths or more.

Attention

- It is not possible to create a collimated light obtained by reducing the beam diameter using in the opposite direction a beam expander. In this case, please use the appropriate optical system by determining the position of the beam waist and divergence angle of the laser beam.

Specifications

Primary material: Aluminum
Finish: Black Anodized

Part Number	Design wavelength [nm]	Beam magnification	Input Clear aperture [mm]	Laser Damage Threshold* [J/cm²]
BEHP-3-266	266	3	ϕ10	2
BEHP-5-266	266	5	ϕ6	2
BEHP-10-266	266	10	ϕ3	2
BEHP-3-355	355	3	ϕ10	4
BEHP-5-355	355	5	ϕ6	4
BEHP-10-355	355	10	ϕ3	4
BEHP-3-532	532	3	ϕ10	5
BEHP-5-532	532	5	ϕ6	5
BEHP-10-532	532	10	ϕ3	5
BEHP-3-1064	1064	3	ϕ10	7
BEHP-5-1064	1064	5	ϕ6	7
BEHP-10-1064	1064	10	ϕ3	7

* Laser pulse width 10ns, repetition frequency 20Hz

Compatible Optic Mounts

KLH-BE-M34H

High-Power Zoom Laser Beam Expander | BEZHP RoHS Catalog Code W3201

It is capable of 1× to 3× times changing high-power zoom Laser beam expander.
Fine adjustment of the collimator is available with diopter correction function.
It can be used in an optical system with high precision, such as a laser interferometer and processing by the lens design that takes into account the wavefront aberration.

- The optical design of the beam expander is an air gap configuration that does not use an adhesive to bond the lenses. This allows the beam expander to be used with a high-power laser. By the Galileo type lens configuration, it reduces the number of aberration correction lens, and enables the shorter overall length of the beam expander.
- By turning the diopter ring that is attached to the center of the beam expander, you can make variable beams such as the focused beam, collimated beam, and the divergent beam. It is used when you want to vary the position of the beam waist and if strict collimation adjustment is necessary.

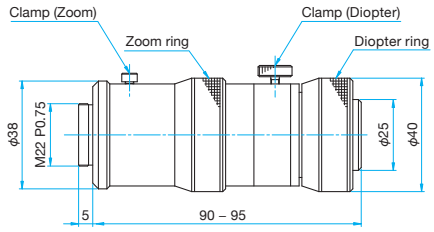
Guide

- We provide the laser beam expander holders (KLH-BE) for optical-axis adjustment of the laser beam expander.
  WEB Reference Catalog Code W4147
- We can also provide a beam expander for wavelengths not listed on-line or in our catalog, please contact our Sales Division with your request.

Attention

- It is not possible to create a collimated light obtained by reducing the beam diameter using in the opposite direction a beam expander. In this case, please use the appropriate optical system by determining the position of the beam waist and divergence angle of the laser beam.

Outline Drawing (in mm)



Specifications

Primary material: Aluminum
Finish: Black Anodized

Part Number	Variable magnification	Design wavelength [nm]	Input Clear aperture [mm]	Laser Damage Threshold* [J/cm^2]	Coating	Material	Weight [kg]
BEZHP-1/3-532	1 – 3	532	ϕ5	5.0	Antireflection coating	Synthetic fused silica	0.3

* Laser pulse width 10ns, repetition frequency 20Hz

Compatible Optic Mounts

KLH-BE-M22H

Laser Beam Expanders With diopter correction function | BE/LBED RoHS

**This is an optical system for expanding a small collimated laser beam to a larger one.
Fine adjustment of the collimator is available using the diopter correction function.
You can use in a high precision optical system like an interferometer or laser processing with lens designed for wave from aberration.**

- The beam expander optical system is air-space with no bonded lenses and can be used for high powered laser applications.
- With the Galilean type lens configuration, it reduces the number of aberration corrections and shortens the length of the beam expander.
- By turning the diopter ring on the beam expander, you can have a varied collimated beam with beam divergence on the focused beam. A beam waist or an accurate adjustment of the collimation is required.
- There is a wide variety with different magnification and wavelengths to choose from.
- With the different types of BE-V and LBED visible lasers, can be attached to a He-Ne (05-LHP) lasers with an adapter (included).

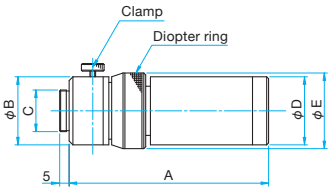
Guide

- We provide the laser beam expander holders (KLH-BE) for optical-axis adjustment of the laser beam expander.
  WEB Reference Catalog Code W4147
- We can also fabricate achromatic beam expanders with multiple wave lengths other than those found in on-line and in our catalog, call our Sales Division for more information.
- Fabrication of beam expander for high-energy pulsed laser is also available. Reference B200

Attention

- By using in the opposite direction, it will not create a reduceduction in diameter of the collimated beam. Please use the appropriate optical system by determining the position of the beam waist and the divergence angle of the laser beam.

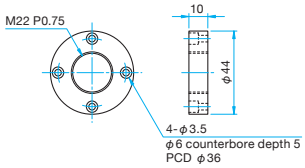
Outline Drawing (in mm)



Accessories for visible light (BE-V/LBED)

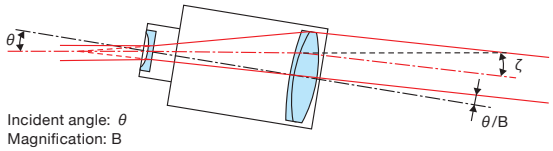
Connection adapters for He-Ne laser

#4-40UNC、L=3/8...4 screws



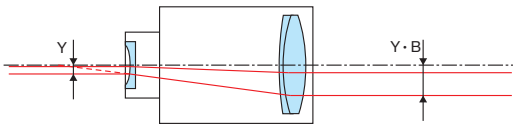
■For adjustment of the laser beam expander

If the incident beam is inclined to the optical axis of the laser beam expander, a larger collimated light is emitted from the direction of the incident beam is inclined.
Therefore, it is necessary to precisely align the optical axis of the beam expander for the incident beam.



Incident angle: θ
Magnification: B
Deviation angle of beam: ζ = θ − θ/B

If the center of the incident beam is translated from the optical axis of the laser beam expander, the emission is emitted with enlarged and magnified amounts of deviation of the incident beam. For this reason, if you need the expanded beam with no chipping or deformation, the incident beam must be strictly in accordance with the center of the optical axis.
We recommend the laser beam expander holder (KLH-BE) to adjust the beam expanders tilt and the center of the optical axis.
WEB Reference Catalog Code W4147



Compatible Optic Mounts

KLH-BE-M22H, M34H

Specifications

Primary material: Aluminum
Finish: Black Anodized

Part Number	Design wavelength [nm]	Expansion ratio	Input aperture (MAX) [mm]	Barrel length A [mm]	ϕB [mm]	Mounting thread C	ϕD [mm]	Diameter ϕE [mm]	Laser Damage Threshold* [J/cm²]	Weight [kg]
BE-2-266	266	2.0	ϕ15.5	72.0±4	ϕ57	M34 P1	ϕ48	ϕ60	1.4	0.3
BE-3-266	266	3.0	ϕ10.5	79.5±4	ϕ57	M34 P1	ϕ48	ϕ60	1.4	0.3
BE-4-266	266	4.0	ϕ9.0	90.5±4	ϕ57	M34 P1	ϕ48	ϕ60	1.4	0.3
BE-5-266	266	5.0	ϕ7.0	119.5±4	ϕ57	M34 P1	ϕ48	ϕ60	1.4	0.4
BE-7.5-266	266	7.5	ϕ4.5	129.0±4	ϕ57	M34 P1	ϕ48	ϕ60	1.4	0.4
BE-10-266	266	10.0	ϕ3.5	173.0±4	ϕ57	M34 P1	ϕ48	ϕ60	1.4	0.4
BE-2-355	355	2.0	ϕ15.5	75.0±4	ϕ57	M34 P1	ϕ48	ϕ60	2	0.3
BE-3-355	355	3.0	ϕ10.5	83.0±4	ϕ57	M34 P1	ϕ48	ϕ60	2	0.3
BE-4-355	355	4.0	ϕ9.0	94.5±4	ϕ57	M34 P1	ϕ48	ϕ60	2	0.3
BE-5-355	355	5.0	ϕ7.0	125.0±4	ϕ57	M34 P1	ϕ48	ϕ60	2	0.4
BE-7.5-355	355	7.5	ϕ4.5	134.5±4	ϕ57	M34 P1	ϕ48	ϕ60	2	0.4
BE-10-355	355	10.0	ϕ3.5	181.0±4	ϕ57	M34 P1	ϕ48	ϕ60	2	0.5
BE-2-V	400 – 700	2.0	ϕ6.0	42.0^{+3}_{-2}	ϕ36	M22 P0.75	ϕ26	ϕ40	4	0.12
LBED-3	400 – 700	3.0	ϕ5.4	42.0^{+3}_{-2}	ϕ36	M22 P0.75	ϕ26	ϕ40	4	0.12
BE-4.1-V	400 – 700	4.1	ϕ4.1	62.0±3	ϕ36	M22 P0.75	ϕ26	ϕ40	4	0.13
LBED-5	400 – 700	5.0	ϕ3.2	50.5±3	ϕ36	M22 P0.75	ϕ26	ϕ40	4	0.12
BE-6-V	400 – 700	6.0	ϕ4.3	102.0±3	ϕ36	M22 P0.75	ϕ36	ϕ40	4	0.17
BE-7.6-V	400 – 700	7.6	ϕ3.4	80.0±3	ϕ36	M22 P0.75	ϕ36	ϕ40	4	0.15
BE-8.4-V	400 – 700	8.4	ϕ3.1	89.5±3	ϕ36	M22 P0.75	ϕ36	ϕ40	4	0.16
LBED-10	440 – 700	10.0	ϕ2.6	109.5±3	ϕ36	M22 P0.75	ϕ36	ϕ40	4	0.18
BE-12.6-V	450 – 700	12.6	ϕ2.1	138.0±3	ϕ36	M22 P0.75	ϕ36	ϕ40	4	0.2
BE-14.3-V	460 – 700	14.3	ϕ1.8	158.5±3	ϕ36	M22 P0.75	ϕ36	ϕ40	4	0.2
BE-16.8-V	480 – 700	16.8	ϕ2.1	190.0±3	ϕ36	M22 P0.75	ϕ46	ϕ40	4	0.3
BE-18.5-V	500 – 700	18.5	ϕ1.9	211.0±3	ϕ36	M22 P0.75	ϕ46	ϕ40	4	0.3
BE-21-V	510 – 700	21.0	ϕ1.7	241.0±3	ϕ36	M22 P0.75	ϕ46	ϕ40	4	0.3
BE-1.5-LD	780 – 830	1.5	ϕ16.1	51.0^{+4}_{-2}	ϕ57	M34 P1	ϕ48	ϕ60	4	0.3
BE-2-LD	780 – 830	2.0	ϕ15.3	53.0±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.3
BE-3-LD	780 – 830	3.0	ϕ10.1	64.0±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.3
BE-4-LD	780 – 830	4.0	ϕ8.9	95.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.3
BE-5-LD	780 – 830	5.0	ϕ7.2	125.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.4
BE-7.5-LD	780 – 830	7.5	ϕ4.7	135.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.4
BE-10-LD	780 – 830	10.0	ϕ3.6	186.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.5
BE-1.5-1064	1064	1.5	ϕ16.0	52.0^{+4}_{-3}	ϕ57	M34 P1	ϕ48	ϕ60	4	0.3
LBED-2Y	1064	2.0	ϕ15.1	49.0^{+4}_{-0}	ϕ57	M34 P1	ϕ48	ϕ60	4	0.3
LBED-3Y	1064	3.0	ϕ10.2	64.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.3
LBED-4Y	1064	4.0	ϕ8.6	93.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.3
BE-5.3-1064	1064	5.3	ϕ6.8	127.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.4
BE-7-1064	1064	7.0	ϕ5.1	179.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.5
BE-10-1064	1064	10.0	ϕ3.6	188.5±4	ϕ57	M34 P1	ϕ48	ϕ60	4	0.5

* Laser pulse width 10ns, repetition frequency 20Hz

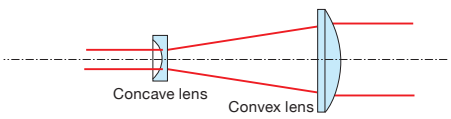
Lens configuration

Beam expander is divided into two main types depending on the configuration of the lens.

Galilean type

Combination of convex and concave type

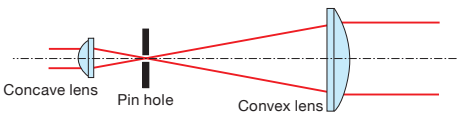
Features.
- Can shorten the overall length of the beam expander.
- High performance with small number of lenses.
- Usable with high powered lasers.



Keplerian type

Uses two convex lenses. (It is not used for this product.)

Features.
- You can insert a pin hole in the expander.
- You can obtain a clean Gaussian beam emitted by the effect of the pinhole spatial filter.



Note: Do not use with high energy lasers
It can cause a spark in the focal point of the laser causing the transmitted wave front to collapse.

Diopter and diopter correction function

By using the diopter correction function, it is available to adjust the divergent light beam to the parallel beam.
If it is necessary to use exact optical laser system, recommended to use the beam expander with diopter correction function.
And if the parallel light beam incident into the beam expander, the light would be emitted in expanded beam.
However, since most laser is slightly divergent, the beam will not be emitted by parallel beam.
In addition, parallel light emitted from the beam expander will be shifted in various factors. Such as LD (laser diode) which has a possibility that wavelength will change, and by the changes of the temperature.

Laser Beam Expanders | LBE

RoHS Catalog Code W3092

Beam expanders are useful laser accessories when the beam diameter must be increased. However, their main function is to decrease the divergence of the laser beams which are to be projected over long distances. These precision beam expanders have been designed for use with HeNe lasers but they can be used for any laser working in the visible part of the spectrum (400 – 700nm).

- Laser beam expanders designed to use with high powered lasers that are made of lenses attached together without using glue (air-gap).
- These beam expanders are light weight and short bodied and because they are Galileo type design, they have little aberration and correction.
- The visible type can be mounted directly to any He-Ne laser.

Guide

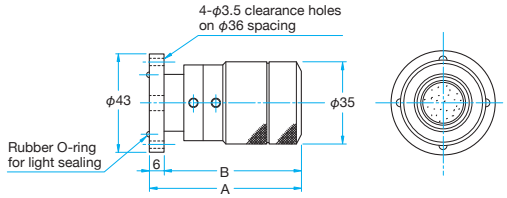
- For wavelength or magnification which is not shown on-line or in the catalog, please ask our Sales Division.
- We provide the laser beam expander holders (KLH-BE) for optical-axis adjustment of the laser beam expander.
  WEB Reference Catalog Code W4147

Attention

- Make sure that the beam expander is well aligned with the laser light axis. If the beam expander is inclining, the output light will also be inclined.
- It is not possible to obtain a decreased beam diameter by using the beam expander on the opposite side. Use it properly to obtain an adequate optical solution.
- The light may not be collimated when it become divergent or convergent.

Outline Drawing (in mm)

#4-40UNC, L=3/8…4



Typical Laser for He-Ne (400 – 700nm)

Primary material: Aluminum
Finish: Black Anodized

Part Number	Expansion ratio	Barrel length A [mm]	B [mm]	Input aperture [mm]	Laser Damage Threshold* [J/cm²]	Weight [kg]
LBE-3	3	62.9	56.9	ϕ3.8	4	0.12
LBE-5	5	61.9	55.9	ϕ2.7	4	0.12
LBE-10	10	127.9	121.9	ϕ1.7	4	0.18

* Laser pulse width 10ns, repetition frequency 20Hz

Typical Laser for LD (780 – 830nm)

Primary material: Aluminum
Finish: Black Anodized

Part Number	Expansion ratio	Barrel length A [mm]	B [mm]	Input aperture [mm]	Laser Damage Threshold* [J/cm²]	Weight [kg]
LBE-3L	3	63.3	57.3	ϕ3.8	4	0.12
LBE-5L	5	62.3	56.3	ϕ2.7	4	0.12
LBE-10L	10	127.9	122.8	ϕ1.7	4	0.18

* Laser pulse width 10ns, repetition frequency 20Hz

Typical Laser for YAG (1064nm)

Primary material: Aluminum
Finish: Black Anodized

Part Number	Expansion ratio	Barrel length A [mm]	B [mm]	Input aperture [mm]	Laser Damage Threshold* [J/cm²]	Weight [kg]
LBE-3Y	3	63.73	57.8	ϕ3.8	4	0.12
LBE-5Y	5	62.7	57.8	ϕ2.7	4	0.12
LBE-10Y	10	128.9	123.8	ϕ1.7	4	0.18

* Laser pulse width 10ns, repetition frequency 20Hz

Compatible Optic Mounts

KLH-BE-M22H

Contact sheet for Laser Beam Expanders ■Estimation ■Order

Date

☐ To: Sigma Koki Co., Ltd. **FAX +81-3-5638-6550**

Affiliation (Organization Name)					
Department			Name		
TEL		FAX		E-mail	
Country/Address					
Name & Designation	(Tentative name is okay)				
Drawing Number			Estimate	☐ Yes: by Date	☐ No
Desired Delivery Date			Budget	JP Yen	

Intention		Outline and Dimensions * Please enter your rough shape and dimensions.
Quantity		Other
Wavelenght Used	λ = nm	* Write more detailed specifications here. (Rough illustration is acceptable.)
Divergence angle of beam	F = mrad	
Beam incident diameter	mm	
Magnification of afocal		
Transmitted wavefront	λ /	
Type of lens	☐ Galilean type ☐ Keplerian type	

Sigma Koki Co., Ltd.

General Catalog 02

fθ Lenses for CO_2 Lasers | fθ-10600

RoHS | Catalog Code W3203

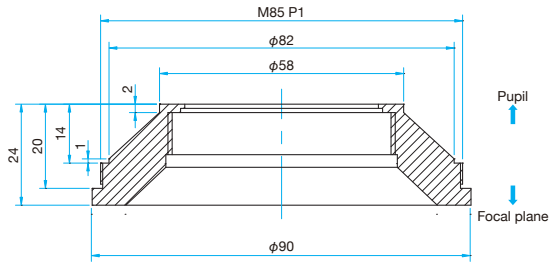
The f theta lens for CO_2 laser is made by a single lens of zinc selenide (ZnSe). These are used in the laser marking systems.

- It is compact and lightweight because it is composed of a single lens.
- The design and use are processed to an optimum shape of various aberrations becomes smaller.
- There are wide variety of the lineup that scan area is 50mm to 300mm.

Specifications

Material	Zinc selenide (ZnSe)
Design wavelength	10.6μm
Entrance pupil diameter	ϕ12mm
Scanning angle	±12.5°
Distance to lens from pupil	25mm
Coating	Dielectric multi-layer coating

Outline Drawing (in mm)



Guide

▶We also offer f theta lens in other than CO_2 laser wavelength of 10.6μm. Reference B186

Attention

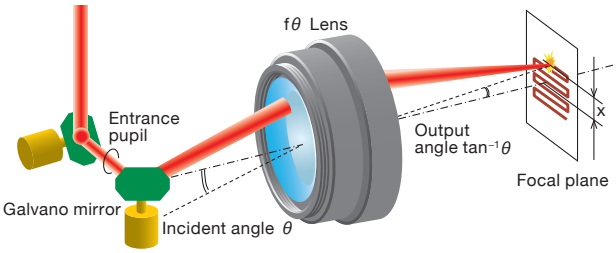
▶Hydrogen selenium is harmful when it comes to contact with strong acids! Do not immerse the lens in hydrochloric or sulphuric acid.

▶When light is condensed on the surface of ZnSe, the high power laser beam may produce toxic gases due to the thermal decomposition.
In addition, a large amount of gas and powder occurs when the ZnSe lens is damaged by the laser thermal runaway. In case of the ZnSe lens is damaged by any chance, DO NOT handle the lens with your bare hands. Collect the debris and be careful not to inhale the powder and steam generated.

▶It is not recommended to use the f theta lens for the optical imaging system because it is designed for the scanning system.

▶Please place in accordance with the position of the entrance pupil of the fθ lens beam scanning system (galvanometer mirror).
If the incident pupil is not in position of the beam scanning system, the optimum focusing spot cannot be achieved because the aberration will increase.

Schematic



By using the f theta lens, it is possible to be moved a laser light spot in constant speed linear motion on the focal plane by scanning the mirrors such as galvanometer scanner mirrors.
The f theta lens enables this by the effect of distortion.
Mathmatically it is expressed as following;
focal length = "f", ideal image height = "y", the angle of scanned = "θ"
therefore, y = fθ.
In the normal single lens, the ideal image height "y" is represented by "y = f tanθ".
Characteristics of both are the same in a small angle range. However, the difference is greater angle increases.

Specifications

Part Number	Focal length f [mm]	Scanning Range [mm]	WD [mm]
fθ-75-10600	75	50×50	57.8
fθ-100-10600	100	70×70	85.8
fθ-150-10600	150	110×110	139.0
fθ-200-10600	200	140×140	181.2
fθ-250-10600	250	175×175	232.7
fθ-300-10600	300	210×210	283.6
fθ-340-10600	340	250×250	344.7
fθ-400-10600	400	300×300	414.5

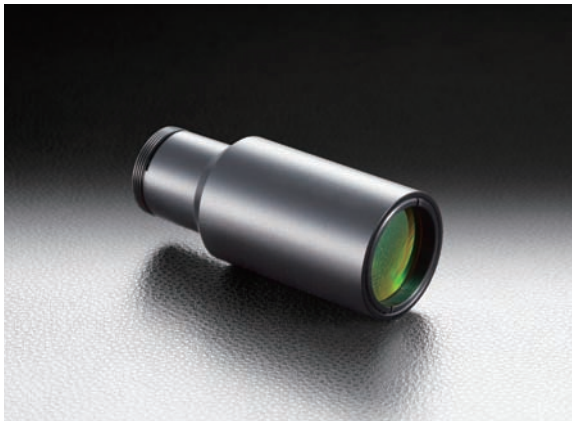
Important: Treatment of ZnSe optics

Important: Treatment of ZnSe optics
ZnSe (Zinc selenide) is Poisonous and Deleterious Substances classified as legal, Depending on the specifications, the certificate of delivery may be required acquisition of Poisonous and Deleterious Substances.
In addition, ZnSe Optics disposal after use is prohibited.
When lenses that are no longer needed, please return them to us.
However, it is only in our products. The above is a case in Japan and please ask your local sales contact about requirements outside Japan.

Laser Beam Expanders for CO_2 Lasers | BE-10600 RoHS Catalog Code W3204

This is a beam expander for CO_2 Laser (wavelength : 10.6μm) made of zinc selenide (ZnSe) lens. It will be used in laser marking system and so on.

- Diopter correction function is provided, customer can fine-tune the collimated beam.
- Because it is a beam expander type of the Galilean, it is compact and has good aberration characteristics.
- Since the lens of zinc selenide has an anti-reflection coating, loss of light intensity is kept low.



Specifications

Material	Zinc selenide (ZnSe)
Design wavelength	10.6μm
Coating	Dielectric multi-layer coating
Transmittance	>98.5%

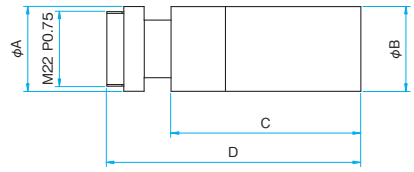
Guide

- Beam expanders other than for CO_2 laser (10.6μm) are available. Reference B200
- We provide the laser beam expander holders (KLH-BE) for optical-axis adjustment of the laser beam expander. WEB Reference Catalog Code W4147

Attention

- It is not possible to obtain a decreased beam diameter by using the beam expander on the opposite side. Use it properly to obtain an adequate optical solution.
- Make sure that the beam expander is well aligned with the laser light axis. If the beam expander is inclining, the output light will also be inclined.

Outline Drawing (in mm)



Part Number	ϕA [mm]	ϕB [mm]	C [mm]	D [mm]
BE-10600-3	ϕ25	ϕ25	50	65
BE-10600-4	ϕ25	ϕ25	55	75
BE-10600-5	ϕ30	ϕ30	58	78

Specifications

Part Number	Expansion ratio	Input aperture (MAX) [mm]	Output Clear aperture [mm]	Diameter [mm]
BE-10600-3	3	ϕ4	ϕ12	ϕ25
BE-10600-4	4	ϕ4	ϕ16	ϕ25
BE-10600-5	5	ϕ4	ϕ20	ϕ30

Important: Treatment of ZnSe optics

Important: Treatment of ZnSe optics
ZnSe (Zinc selenide) is Poisonous and Deleterious Substances classified as legal, Depending on the specifications, the certificate of delivery may be required acquisition of Poisonous and Deleterious Substances.
In addition, ZnSe Optics disposal after use is prohibited.
When lenses that are no longer needed, please return them to us.
However, it is only in our products. The above is a case in Japan and please ask your local sales contact about requirements outside Japan.

Compatible Optic Mounts

KLH-BE-M22H