

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

RoHS

PFL-UV-AG-LC series are objective lenses of which magnification cover 20X, 50X and 80X. They can be used in a laser processing machines which is using 266nm and 532nm YAG pulse laser. Its glass-thickness- compensation optical design makes it possible to realize an ideal beam spot size and quality even if it was processed thorough a cover glass. These objective lenses will well match with a laser repair processing for LCD or OLED module.

- Two kinds objective lenses are available. They are designed to correct aberration depending on the thickness of cover glass. ( $t = 0.7 \text{ mm}$  and  $1.1 \text{ mm}$ )
- 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(reference):  $0.09 \text{ J/cm}^2$  (266nm),  $0.2 \text{ J/cm}^2$  (532nm)  
(Laser pulse width: 10ns, repetition frequency: 20Hz)



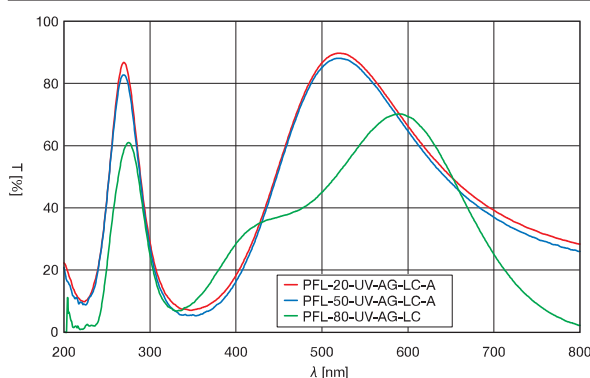
## Guide

- ▶ 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, [WEB Reference](#) [Catalog Code](#) W2012

## 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.
- ▶ When the thickness of cover glass is not same as the specified, designed specifications may not be achieved due to aberration.
- ▶ Magnification is the value when using the imaging lens  $f=200\text{mm}$ . 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.

Typical Transmittance Data T: Transmission



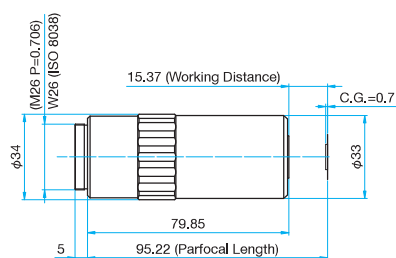
## Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working Distance W.D. [mm]	Resolution λ=550nm [μm]	Focal depth (λ=550nm) [μm]	Real field of view (Eyepiece φ24mm) [mm]	(Imaging device 1/2-inch) [mm]	Weight [kg]
PFL-20-UV-AG-LC07-A	LCD Plan UV 20x (t0.7)	20×	10	0.36	15.15	0.76	±2.1	φ1.2	0.24×0.32	0.35
PFL-20-UV-AG-LC11-A	LCD Plan UV 20x (t1.1)	20×	10	0.36	15.20	0.76	±2.1	φ1.2	0.24×0.32	0.35
PFL-50-UV-AG-LC07-A	LCD Plan UV 50x (t0.7)	50×	4	0.42	11.99	0.65	±1.6	φ0.48	0.10×0.13	0.40
PFL-50-UV-AG-LC11-A	LCD Plan UV 50x (t1.1)	50×	4	0.42	11.99	0.65	±1.6	φ0.48	0.10×0.13	0.40
PFL-80-UV-AG-LC07	LCD Plan UV 80x (t0.7)	80×	2.5	0.55	9.78	0.50	±0.9	φ0.3	0.06×0.08	0.30
PFL-80-UV-AG-LC11	LCD Plan UV 80x (t1.1)	80×	2.5	0.55	9.65	0.50	±0.9	φ0.3	0.06×0.08	0.35

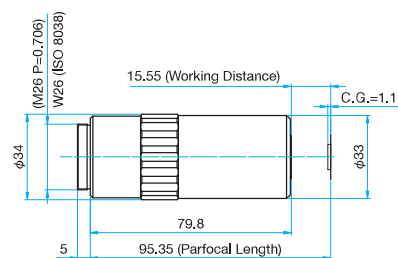
**Outline Drawing**

(in mm)

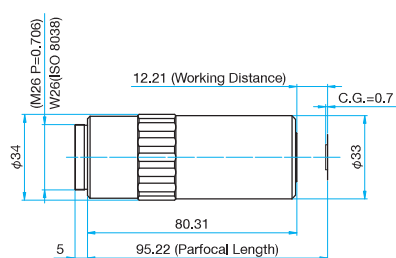
**PFL-20-UV-AG-LC07-A**



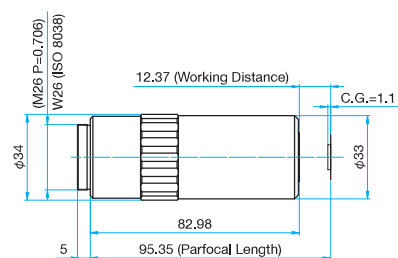
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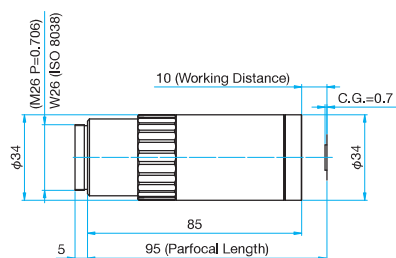
**PFL-50-UV-AG-LC07-A**



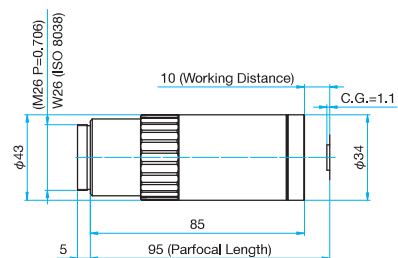
**PFL-50-UV-AG-LC11-A**



**PFL-80-UV-AG-LC07**



**PFL-80-UV-AG-LC11**



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

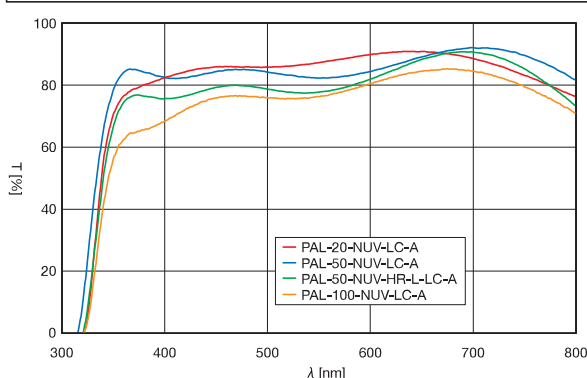
RoHS

This objective lens can be used for laser machining using pulsed laser of THG (355nm) YAG laser. Its glass-thickness- compensation optical design makes it possible to realize an ideal beam spot size and quality even if it was processed thorough a cover glass.

- Two kinds objective lenses are available. They are designed to correct aberration depending on the thickness of cover glass. (t= 0.7 mm and 1.1 mm)
- High resolution type (NA=0.65) is also available.
- With its long working infinity correction function; this objective lens can be used for a laser system and coaxial observation.
- This objective lens can be used with a pulse laser of visible light (532nm).
- Laser Damage Threshold(reference): 0.05 J/cm<sup>2</sup> (355nm), 0.1J/cm<sup>2</sup> (532nm)  
(Laser pulse width: 10ns, 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, [WEB Reference](#) [Catalog Code](#) W2012

## 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<sup>2</sup>). 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.
- ▶ When the thickness of cover glass is not same as the specified, designed specifications may not be achieved due to aberration.
- ▶ 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.

## Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working Distance W.D. [mm]	Resolution Distance W.D. (λ=550nm) [μm]	Focal depth (λ=550nm) [μm]	Real field of view (Eyepiece φ24mm) (Imaging device 1/2-inch) [mm]	Weight [kg]
PAL-20-NUV-LC07-A	LCD PlanApo NUV 20x (t0.7)	20×	10	0.40	17.35	0.69	±1.7	φ1.2 0.24×0.32	0.35
PAL-20-NUV-LC11-A	LCD PlanApo NUV 20x (t1.1)	20×	10	0.40	17.40	0.69	±1.7	φ1.2 0.24×0.32	0.35
PAL-50-NUV-LC07-A	LCD PlanApo NUV 50x (t0.7)	50×	4	0.45	15.05	0.61	±1.4	φ0.48 0.10×0.13	0.36
PAL-50-NUV-LC11-A	LCD PlanApo NUV 50x (t1.1)	50×	4	0.45	15.01	0.61	±1.4	φ0.48 0.10×0.13	0.36
PAL-50-NUV-HR-L-LC07-A	LCD PlanApo NUV HR 50x (t0.7)	50×	4	0.65	9.91	0.42	±0.7	φ0.48 0.10×0.13	0.51
PAL-50-NUV-HR-L-LC11-A	LCD PlanApo NUV HR 50x (t1.1)	50×	4	0.65	9.89	0.42	±0.7	φ0.48 0.10×0.13	0.51
PAL-100-NUV-LC07-A	LCD PlanApo NUV 100x (t0.7)	100×	2	0.50	15.00	0.48	±0.8	φ0.24 0.05×0.06	0.39
PAL-100-NUV-LC11-A	LCD PlanApo NUV 100x (t1.1)	100×	2	0.50	15.00	0.48	±0.8	φ0.24 0.05×0.06	0.39

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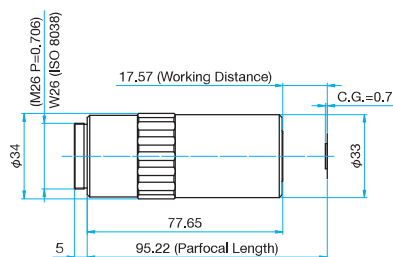
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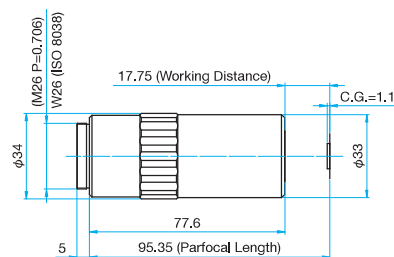
## Outline Drawing

(in mm)

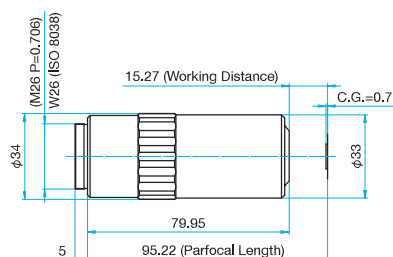
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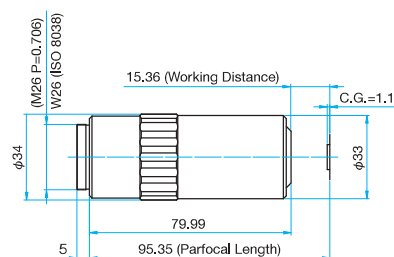
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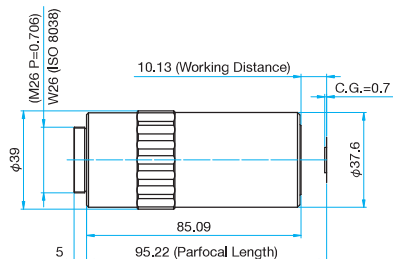
PAL-50-NUV-LC07-A



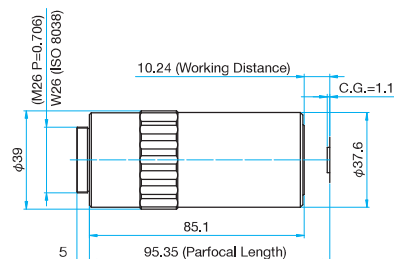
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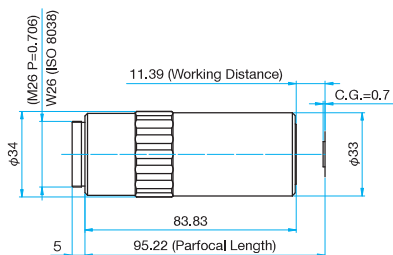
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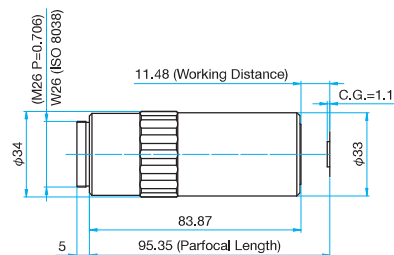
PAL-50-NUV-HR-L-LC11-A



PAL-100-NUV-LC07-A



PAL-100-NUV-LC11-A



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Glass Thickness Compensation Near Infrared Objective Lenses | PAL-NIR-LC **RoHS** Catalog Code W3465

This is a high NA infinity corrected objective lens for laser processing (femtosecond laser and fundamental of YAG laser). Its glass-thickness- compensation optical design makes it possible to realize an ideal beam spot size and quality even if it was processed thorough a cover glass.

- Two kinds objective lenses are available. They are designed to correct aberration depending on the thickness of cover glass.  
( $t = 0.7 \text{ mm}$  and  $1.1 \text{ mm}$ )
- 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 Infrared light.
- High resolution type (NA=0.65) is also available.
- This objective lens can be used with a pulse laser of visible light (532nm).
- Laser Damage Threshold(reference):  $0.1 \text{ J/cm}^2$  (532nm),  $0.2 \text{ J/cm}^2$  (1064nm)  
(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, [WEB Reference](#) [Catalog Code](#) W2012

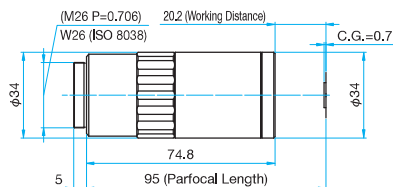
## Attention

- ▶ 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.
- ▶ When the thickness of cover glass is not same as the specified, designed specifications may not be achieved due to aberration.
- ▶ 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  $f=200\text{mm}$ . 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.

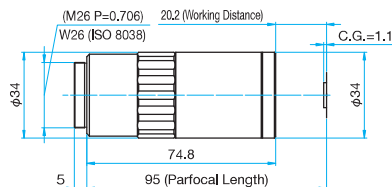
## Outline Drawing

(in mm)

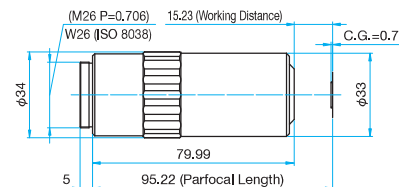
## PAL-20-NIR-LC07



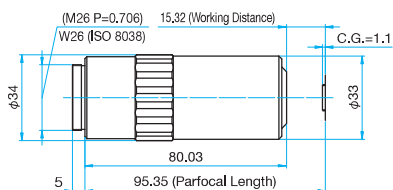
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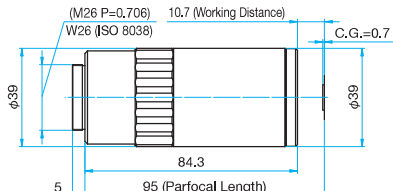
## PAL-50-NIR-L-LC07



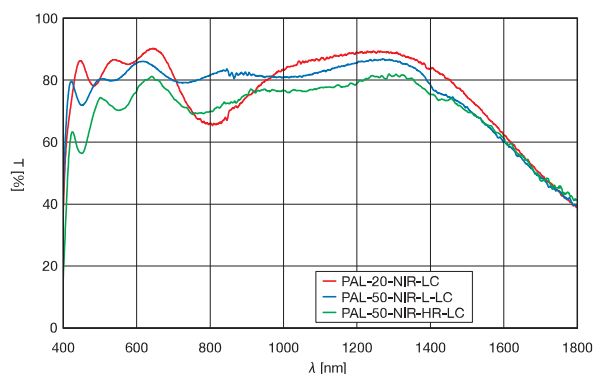
## PAL-50-NIR-L-LC11



## PAL-50-NIR-HR-LC07



## Typical Transmittance Data T: Transmission



## Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working Distance W.D. [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-NIR-LC07	LCD PlanApo NIR 10x (t0.7)	20×	10	0.40	19.98	0.69	±1.7	φ1.7	0.24×0.32	0.36
PAL-20-NIR-LC11	LCD PlanApo NIR 20x (t0.7)	20×	10	0.40	19.85	0.69	±1.7	φ1.7	0.24×0.32	0.36
PAL-50-NIR-L-LC07	LCD PlanApo NIR HR 20x (t0.7)	50×	4	0.45	15.01	0.61	±1.4	φ0.46	0.10×0.13	0.34
PAL-50-NIR-L-LC11	LCD PlanApo NIR 50x (t0.7)	50×	4	0.45	14.97	0.61	±1.4	φ0.46	0.10×0.13	0.34
PAL-50-NIR-HR-LC07	LCD PlanApo NIR HR 50x (t0.7)	50×	4	0.67	10.48	0.41	±0.6	φ0.46	0.10×0.13	0.48

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Laser Processing

This is a high NA infinity corrected objective lens for laser processing (femtosecond laser). Its glass-thickness- compensation optical design makes it possible to realize an ideal beam spot size and quality even if it was processed thorough a cover glass.

- They are designed to correct aberration depending on the thickness of cover glass. ( $t=0.7\text{mm}$ )
- 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 Infrared light.
- This objective lens can be used with a pulse laser of visible light (532nm).
- Laser Damage Threshold(reference):  $0.1/\text{cm}^2$  (532nm),  $0.15 \text{ J}/\text{cm}^2$  (780nm)  
(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, [WEB Reference](#) [Catalog Code](#) W2012

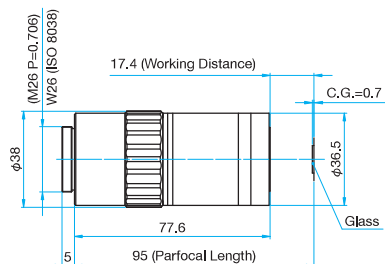
#### Attention

- ▶ 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.
- ▶ When the thickness of cover glass is not same as the specified, designed specifications may not be achieved due to aberration.
- ▶ 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  $f=200\text{mm}$ . 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.

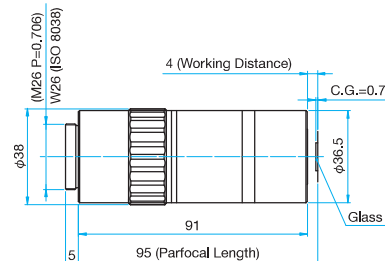
#### Outline Drawing

(in mm)

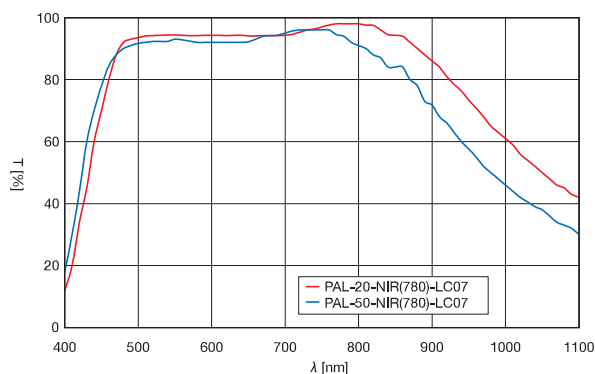
##### PAL-20-NIR(780)-LC07



##### PAL-50-NIR(780)-LC07



#### Typical Transmittance Data T: Transmission



#### Specifications

Part Number	Item name	Magnification	Focal length f [mm]	Numerical aperture NA	Working Distance W.D. [mm]	Resolution λ=550nm [μm]	Focal depth (λ=550nm) [μm]	Real field of view (Eyepiece φ24mm) [mm]	(Imaging device 1/2-inch) [mm]	Weight [kg]
PAL-20-NIR(780)-LC07	LCD PlanApo NIR(780) 20x (t0.7)	20×	10	0.45	17.2	0.6	±1.4	φ1.2	0.24×0.32	0.34
PAL-50-NIR(780)-LC07	LCD PlanApo NIR(780) 50x (t0.7)	50×	4	0.80	3.8	0.3	±0.4	φ0.46	0.10×0.13	0.44

# Objective Lenses | Others

Infinity corrected objective lenses without glass thickness correction are available.

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## 3-Wavelengths Objective Lens | PFL-UV/NUV-AG

Catalog Code W3460



- For bright field observation and laser processing
- Infinity corrected Objective Lenses
- It can be used for 266nm / 355nm / 532nm
- Magnification 10x, 20x, 50x
- Air-Gap-type design for high power laser.
- Laser Damage Threshold (For reference only)  
(Laser pulse width 10ns, repetition frequency 20Hz)  
0.09 J/cm<sup>2</sup> (266nm), 0.1 J/cm<sup>2</sup> (355nm), 0.2 J/cm<sup>2</sup> (532nm)

## Ultra-violet Objective Lenses | PFL-UV-AG

Catalog Code W3459



- For bright field observation and laser processing
- Infinity corrected Objective Lenses
- It can be used for 266nm / 532nm
- Magnification 10x, 20x, 50x, 80x
- Air-Gap-type design for high power laser.
- Laser Damage Threshold (For reference only)  
(Laser pulse width 10ns, repetition frequency 20Hz)  
0.09 J/cm<sup>2</sup> (266nm), 0.2 J/cm<sup>2</sup> (532nm)

## Near Ultra-violet Objective Lenses | PAL-NUV

Catalog Code W3458



- For bright field observation and laser processing
- Infinity corrected Objective Lenses
- It can be used for 355nm
- Magnification 20x, 50x, 100x
- Plan-Apochromat design.
- Laser Damage Threshold (For reference only)  
(Laser pulse width 10ns, repetition frequency 20Hz)  
0.05 J/cm<sup>2</sup> (355nm), 0.1 J/cm<sup>2</sup> (532nm)

## Infrared (NIR) Objective Lenses | PAL-NIR

Catalog Code W3457



- For bright field observation and laser processing
- Infinity corrected Objective Lenses
- It can be used for 770nm - 790nm / 1064nm
- Magnification 10x, 20x, 50x
- Plan-Apochromat design.
- Laser Damage Threshold (For reference only)  
(Laser pulse width 10ns, repetition frequency 20Hz)  
0.1 J/cm<sup>2</sup> (532nm), 0.2 J/cm<sup>2</sup> (1064 nm)

## Long Working Distance Objective Lenses | EPL/EPL

Catalog Code W3086



- For bright field observation
- Infinity corrected Objective Lenses
- Parfocal Length 45mm
- Compatible with visible wavelength
- Plan-Achromat design.
- Magnification 5x, 10x, 20x, 50x, 100x

## 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	<input type="checkbox"/> Yes: by Date <input type="checkbox"/> 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		<input type="checkbox"/> YES ( $\theta < \quad^\circ$ ) <input type="checkbox"/> NO			
Object - Image Distance		mm			
Working distance W.D.		mm			
Flange back		mm			
Spot Size ( $1/e^2$ )		$\mu\text{m}$			
Resolution		$\mu\text{m}$			
Real field of View (Imaging device)		mm, (		inch)	
Mounting screw thread		mm,		mm Pitch	
External dimensions		mm			
Adjustable diaphragm		<input type="checkbox"/> Requirement <input type="checkbox"/> Not requirement			
Coaxial illumination		<input type="checkbox"/> Requirement <input type="checkbox"/> Not requirement			
Specifications of Light Source Used	Divergence angle				
	Beam size	mm			
	M <sup>2</sup>				
	Power or Energy	W			
		J			
	Pulse width	S			
	Repetition frequency	Hz			

Sigma Koki Co., Ltd.

General Catalog 02

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Laser Processing

This objective lens can be used for laser machining using pulsed laser of SHG (532nm), THG (355nm), and FHG (266nm) YAG laser. Objective lens 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<sup>2</sup> (266nm), 0.1J/cm<sup>2</sup> (355nm), 0.2J/cm<sup>2</sup> (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

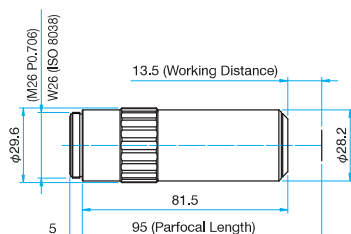
## Attention

- ▶ 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<sup>2</sup>). 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.

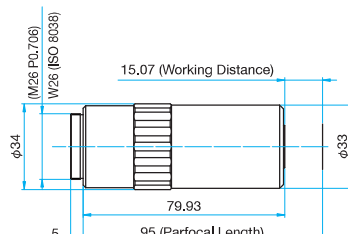
## Outline Drawing

(in mm)

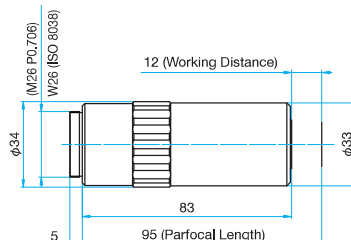
### PFL-10-UV/NUV-AG



### PFL-20-UV/NUV-AG-A

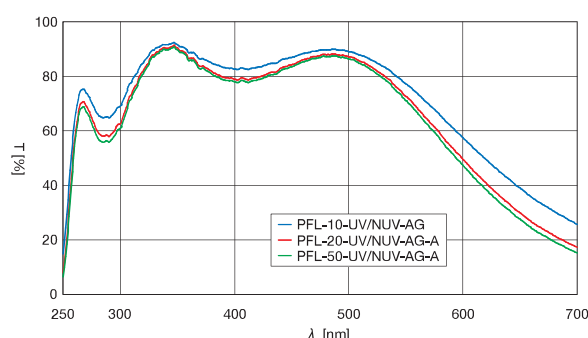


### PFL-50-UV/NUV-AG-A



## 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]	(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

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Objectives

Expanders

Others

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<sup>2</sup> (266nm), 0.2J/cm<sup>2</sup> (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

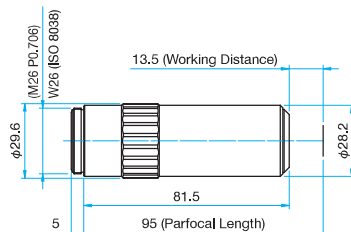
## Attention

- ▶ 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  $f=200\text{mm}$ . 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.

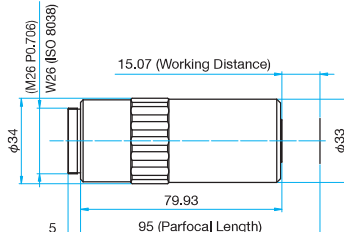
## Outline Drawing

(in mm)

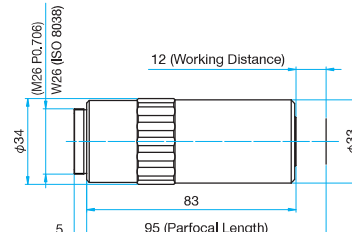
PFL-10-UV-AG



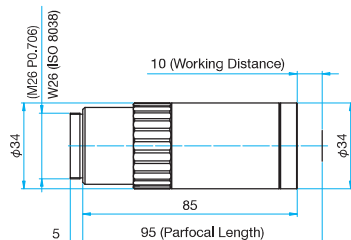
PFL-20-UV-AG-A



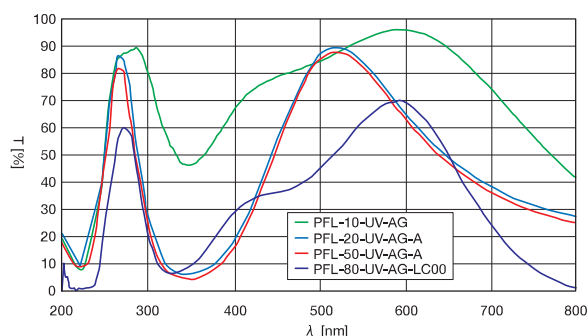
PFL-50-UV-AG-A



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 (Eye-piece φ24mm) [mm]	(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

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<sup>2</sup> (355nm), 0.1J/cm<sup>2</sup> (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

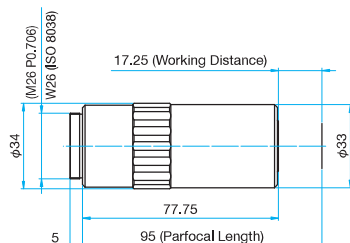
#### Attention

- ▶ 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<sup>2</sup>). 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.

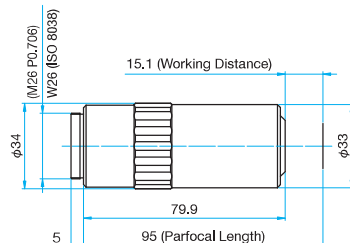
#### Outline Drawing

(in mm)

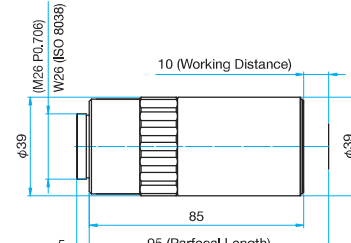
PAL-20-NUV-A



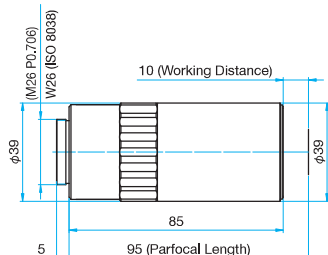
PAL-50-NUV-A



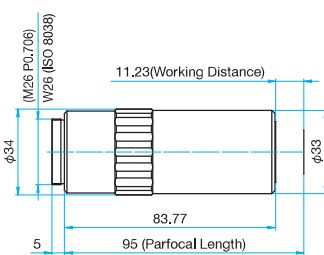
PAL-50-NUV-HR-L



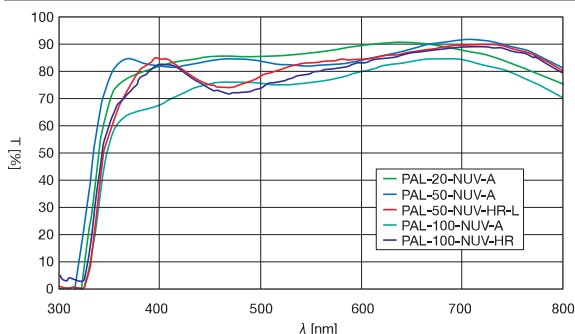
PAL-100-NUV-HR



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]	1/2-inch (Imaging device) [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

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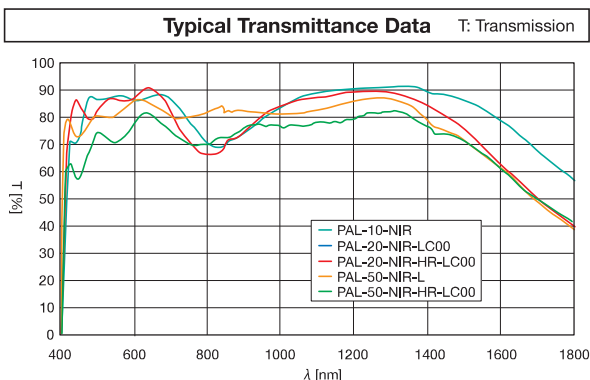
Objectives

Expanders

Others

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 ( $t=1.8\text{mm}$ ). 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  $0.1\text{J}/\text{cm}^2$  at 532nm,  $0.2\text{J}/\text{cm}^2$  at 1064nm (reference). (Laser pulse width 10nSec, 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

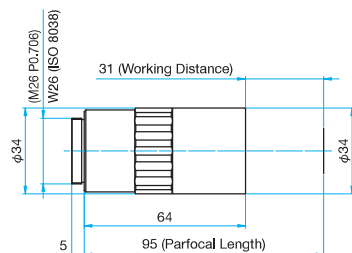
- ▶ When an objective lens is used in laser processing, use the diameter of the incident beam to extend to a size of half the pupil diameter ( $1/e^2$ ). A small light spot cannot be achieved when the incident beam is too narrow. Please note if there is a laser energy density increase, there will be 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.
- ▶ 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  $f=200\text{mm}$ . 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 ( $\lambda=550\text{nm}$ ) [ $\mu\text{m}$ ]	Focal depth ( $\lambda=550\text{nm}$ ) [ $\mu\text{m}$ ]	Real field of view (Eyepiece $\phi 24\text{mm}$ ) [mm]	Weight [kg]
PAL-10-NIR	MPlanApo NIR 10x	10x	20	0.30	31.0	0.92	$\pm 3.1$	$\phi 2.4$ 0.48×0.64	0.30
PAL-20-NIR-LC00	MPlanApo NIR 20x	20x	10	0.40	20.2	0.69	$\pm 1.7$	$\phi 1.2$ 0.24×0.32	0.36
PAL-20-NIR-HR-LC00	MPlanApo NIR HR 20x	20x	10	0.45	20.0	0.61	$\pm 1.4$	$\phi 1.2$ 0.24×0.32	0.42
PAL-50-NIR-L	MPlanApo NIR 50x	50x	4	0.45	15.1	0.61	$\pm 1.4$	$\phi 0.48$ 0.10×0.13	0.34
PAL-50-NIR-HR-LC00	MPlanApo NIR HR 50x	50x	4	0.67	10.0	0.41	$\pm 0.61$	$\phi 0.48$ 0.10×0.13	0.48

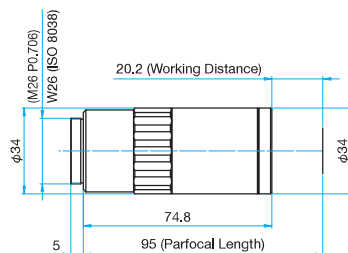
## Outline Drawing

(in mm)

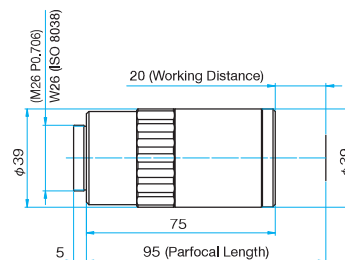
### PAL-10-NIR



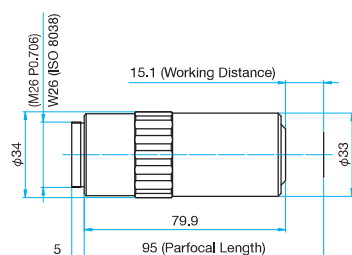
### PAL-20-NIR-LC00



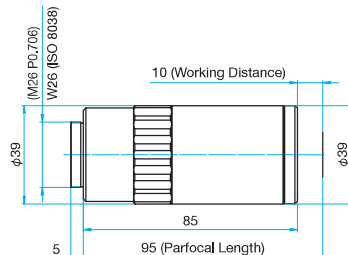
### PAL-20-NIR-HR-LC00



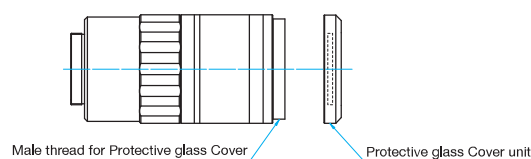
### PAL-50-NIR-L



### PAL-50-NIR-HR-LC00



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



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## Long Working Distance Objective Lenses

EPL/EPL

RoHS

Catalog Code W3086

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Others

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

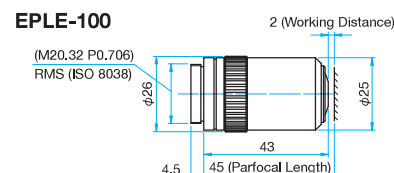
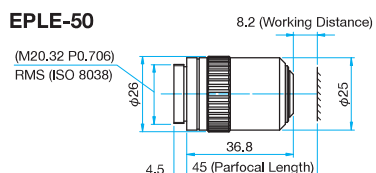
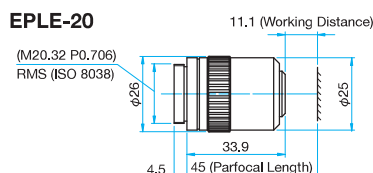
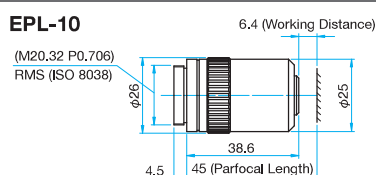
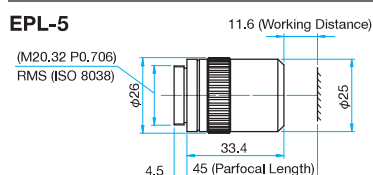
- ▶ Available fixed objective lens holder (LHO-20.32).
- ▶ When the objective lens is fixed to a 2 axis holder, please consult our Sales Division.
- ▶ For laser processing, we offer a dichoric block (DIMC) and for laser unit with coaxial illumination and observation (OUCI-2).

## 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  $f=200\text{mm}$ . 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)

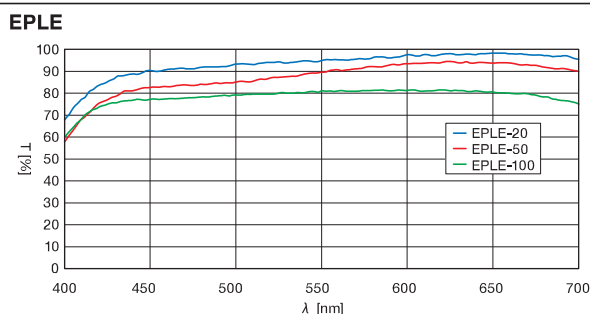
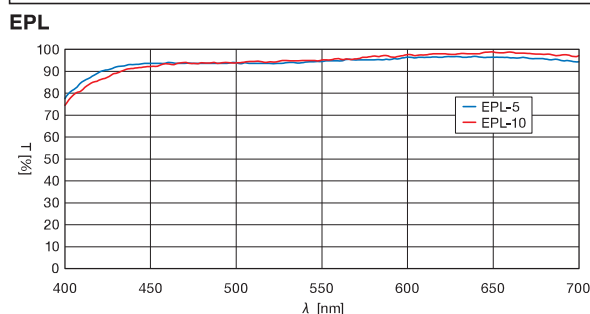


## Specifications

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)	(Imaging device 1/2-inch)	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
EPL-20	20	0.40	11.1	10	0.7	±1.7	φ8.0	φ1.2	0.24×0.32	0.085
EPL-50	50	0.55	8.2	4	0.5	±0.9	φ4.4	φ0.48	0.10×0.13	0.095
EPL-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



## Compatible Optic Mounts

LHO-26

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

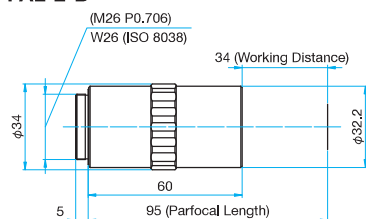
## Attention

- ▶ 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  $f=200\text{mm}$ . 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.

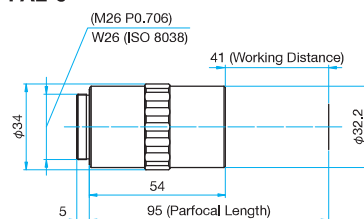
## Outline Drawing

(in mm)

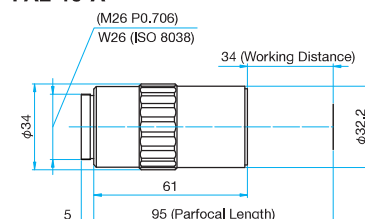
### PAL-2-B



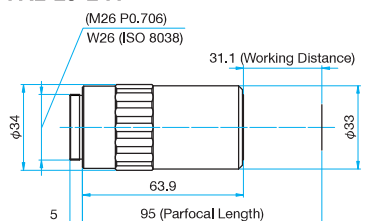
### PAL-5



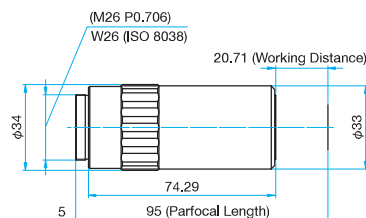
### PAL-10-A



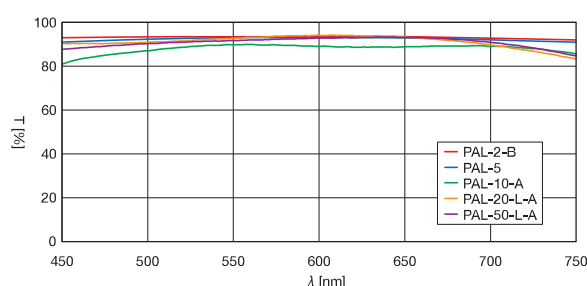
### PAL-20-L-A



### 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 ( $\lambda=550\text{nm}$ ) [ $\mu\text{m}$ ]	Focal depth ( $\lambda=550\text{nm}$ ) [ $\mu\text{m}$ ]	Real field of view (Eyepiece $\phi 24\text{mm}$ ) [mm]	(Imaging device 1/2-inch) [mm]	Weight [kg]
PAL-2-B	MPlanApo 2x	2x	100	0.055	34.0	5	91	$\phi 12$	$2.4 \times 3.2$	0.25
PAL-5	MPlanApo 5x	5x	40	0.14	41.0	2	14	$\phi 4.8$	$0.96 \times 1.28$	0.24
PAL-10-A	MPlanApo 10x	10x	20	0.3	34.0	0.92	3.1	$\phi 2.4$	$0.48 \times 0.64$	0.24
PAL-20-L-A	MPlanApo SL20x	20x	10	0.3	31.1	0.92	3.1	$\phi 1.2$	$0.24 \times 0.32$	0.28
PAL-50-L-A	MPlanApo SL50x	50x	4	0.42	20.7	0.65	1.6	$\phi 0.48$	$0.10 \times 0.13$	0.31

# Microscope Objectives | OBL

RoHS

Catalog  
Code

W3085

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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

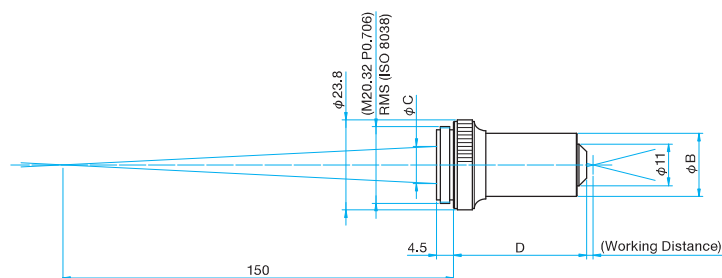
- ▶ Use a special filter (SFB) to correct the wave front distortion.  
WEB Reference Catalog Code W4036
- ▶ Objective holder (LHO) is available for these objective lenses.  
WEB Reference Catalog Code W4024
- ▶ Cross holder (TAT) is now available.  
WEB Reference Catalog Code W4038

## 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 $\phi B$ [mm]	Pupil diameter $\phi C$ [mm]	Focal length f [mm]	NA	Working distance (WD) [mm]	Weight [kg]
OBL-10	10	30.5	$\phi 16.7$	$\phi 8.3$	16.6	0.25	5.5	0.05
OBL-20	20	35.2	$\phi 16.7$	$\phi 7.1$	9.0	0.40	1.7	0.05
OBL-40	40	36.4	$\phi 19.7$	$\phi 5.8$	4.5	0.65	0.6	0.06
OBL-60	60	36.7	$\phi 19.7$	$\phi 4.9$	2.91	0.85	0.3	0.07

## Compatible Optic Mounts

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





# Glass Thickness Corrected Objective Lenses | Others

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

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## 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  $t=0.7\text{mm}$  or  $1.1\text{mm}$ .
- magnification 20x, 50x, 80x
- Air Gap type compatible with high-energy
- Laser Damage Threshold (For reference only)  
(Laser pulse width 10ns, repetition frequency 20Hz)  
 $0.09\text{ J/cm}^2$  (266nm)  
 $0.2\text{ J/cm}^2$  (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  $t=0.7\text{mm}$  or  $1.1\text{mm}$ .
- magnification 20x, 50x, 100x
- With Plan-Apochromat
- Laser Damage Threshold (For reference only)  
(Laser pulse width 10ns, repetition frequency 20Hz)  
 $0.05\text{ J/cm}^2$  (355nm)  
 $0.1\text{ J/cm}^2$  (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  $t=0.7\text{mm}$  or  $1.1\text{mm}$ .
- Magnification 20x, 50x
- Laser Damage Threshold (For reference only)  
(Laser pulse width 10ns, repetition frequency 20Hz)  
 $0.1\text{ J/cm}^2$  (532nm)  
 $0.2\text{ J/cm}^2$  (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  $t=0.7\text{mm}$
- Magnification 20x, 50x
- Laser Damage Threshold (For reference only)  
(Laser pulse width 10ns, repetition frequency 20Hz)  
 $0.1\text{ J/cm}^2$  (532nm)  
 $0.15\text{ J/cm}^2$  (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	<input type="checkbox"/> Yes: by Date <input type="checkbox"/> 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		<input type="checkbox"/> YES ( $\theta < \quad^\circ$ ) <input type="checkbox"/> NO			
Object - Image Distance		mm			
Working distance W.D.		mm			
Flange back		mm			
Spot Size ( $1/e^2$ )		$\mu\text{m}$			
Resolution		$\mu\text{m}$			
Real field of View (Imaging device)		mm, (		inch)	
Mounting screw thread		mm,		mm Pitch	
External dimensions		mm			
Adjustable diaphragm		<input type="checkbox"/> Requirement		<input type="checkbox"/> Not requirement	
Coaxial illumination		<input type="checkbox"/> Requirement		<input type="checkbox"/> Not requirement	
Specifications of Light Source Used	Divergence angle				
	Beam size	mm			
	M <sup>2</sup>				
	Power or Energy	W			
		J			
		Pulse width	S		
Repetition frequency		Hz			

Sigma Koki Co., Ltd.

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