Laser Protective Eyewear Guide

Use of Laser Protective Eyewear

According to the directives from the Ministry of Health, Labor and Welfare [On Measures to Prevent Injury from Laser Radiation], laser protective eyewear appropriate for the laser type is required in laser controlled areas of the Class 3R laser equipments that emit lasers at wavelengths other than 400 to 700nm, as well as Class 3B and Class 4 laser equipments as safety and preventive measures.

Selection of Laser Protective Eyewear

(1) Confirm laser output wavelengths.
(2) Confirm laser output.
For CW output: Output power
For pulse: Energy per pulse, pulse duration, pulse recurrence frequency, etc.
(3) Calculate MPE (maximum permissible exposure).
(4) Determine the maximum exposure duration.
(5) Calculate the maximum radiation exposure value.
(6) Calculate the required optical density.
(7) (Confirm whether it is required to see beams in case of visible lasers.)
(8) (Select the shape of protective eyewear (whether users will wear prescription glasses).)

What Is MPE (Maximum Permissible Exposure)

The MPE is the value that indicates a safety level for the human body, and defined as 1/10 of the strength of laser output at which probability of causing hazard is 50%.
Although the MPE is determined by two axes, wavelength and exposure time, attention is required since the MPE value is given as power density (W/m^2) or energy density (J/m^2) per unit surface area.
This area is based on the limiting aperture size, and the value varies according to the wavelength, eye or skin, exposure time and other conditions, considering hazard types.

What Is OD Value (Optical Density)

Optical transmission is generally indicated by transmittance (%).
It is commonly expressed in percentage, and indicated by logarithm. That is the OD value (optical density).
Optical density (OD) is the attenuation rate of incident light that passes through the optical filter, in this case laser protective eyewear, and calculated with the following formula.

$$OD(\lambda) = \mathrm{Log}_{10}(PI(\lambda)/PT(\lambda)) = -\log_{10}T(\lambda)$$

(PI: Incidence PT: Transmission T: Transmittance of characteristic wavelength)

∗The larger the OD value, the larger the attenuation rate of incident light, thus providing higher protective function.
∗If the OD value increases, then the transmittance decreases.

Optical Density (OD value)	Transmittance	Attenuation Rate	Protective Function
0	100%	0	Weak ↓ High
1	10%	1/10	
2	1%	1/100	
3	0.1%	1/1000	
4	0.01%	1/10000	
5	0.001%	1/100000	
6	0.0001%	1/1000000	
7	0.00001%	1/10000000	
8	0.000001%	1/100000000	
9	0.0000001%	1/1000000000	
10	0.00000001%	1/10000000000	

Differences in Usage of Complete Absorption Type, Multi-wavelength Compatible Type and Partially Transmitting Type

Complete absorption type
Normally, you cannot see visible laser light because the optical density (OD) is set to high.

Multi-wavelength compatible type
Appropriate for work involving multiple wavelengths.

Partially transmitting type for maintenance
Appropriate for maintenance involving 100mW or less (OD 1 – 2), and 10W or less (OD 4). Use this type for checking optical paths or adjusting optical axes.

Reinforced glass (complete absorption) type
Optical density (OD) and damage threshold are high enough to prevent damage from direct beam exposure.

YL-760 model (three-way type)

This model offers improved fitting functions including angle adjustment for the gap with the face and flexible temples. Inner frames (optional) customized according to lens prescriptions are available for people who wear prescription glasses.

Reference H022

YL-717 model (over prescription glasses type)

Can be used over prescription glasses.
This model is fitted with top canopy and sides, and the angle of the front frame and the length of temples are adjustable.

Reference H023

YL-335 model (over prescription glasses type)

Can be used over prescription glasses. This model is well cushioned and comfortable to wear. (Some large glasses may not fit.)

Reference H024

YL-290 model (eyeglass shaped)

Light and compact two-lens type is easy to wear and remove.
This model features a highly protective cover frame and wide temples.

Reference H024

YL-250G model (over prescription glasses, reinforced glass type)

This model uses reinforced glass for lenses, provides high visible light transmittance, and offers improved visibility and permeability of light. Lenses also offer excellent chemical resistance.

Reference H025

YL-130 model (goggle shaped)

This model fits the face snugly, and can be worn over prescription glasses. Appropriate for use when the angle of beam or scattering light cannot be identified.

Reference H025

YL-120H model (goggle shaped)

With its laminated glass structure, this model provides high visible light transmittance and ensures safety with high damage threshold against laser.

Reference H025

Attention

- Do not directly look into the laser beam through laser protective eyewear.
- Do not irradiate the laser beam directly at laser protective eyewear because it may damage the eyewear.
- Do not use with incompatible lasers or wavelengths. (Even if laser names are the same, their wavelengths might be different.)
- Do not take off laser protective eyewear during work.
- Do not use as protective eyewear for welding.
- Complete absorption type eyewear is not protective equipments that completely absorb laser light. (Refer to the absorption characteristic graph.)
- Do not use products with visible light transmittance of 20% or less in a darkroom.
- Cease use of eyewear that is damaged or once it has received high laser energy.

YL-760 Model (Three-way type) | YL-760

RoHS Catalog Code W5013

Fit over prescription glasses and inner frame with prescription lenses available.

- Easy fit with adjustable angle and temples.

Guide

- Wearing laser protective eyewear over prescription glasses causes inconvenience. For convenience, optional prescription inner frames are available.
- Contact our Sales Division for the optional and custom prescriptions.

Common Specifications

Frame	Nylon elastomer
Lens	Polycarbonate (hard coated)
Specifications	Compatible with prescription glasses, adjustable angle, soft rubber temple (flexibly adjustable)
External Dimensions [mm]	(W)160×(H)58×(D)170
Weight [kg]	0.05

Function Description

■Rubber Nose Pad

Normal size

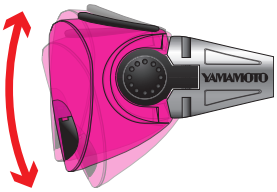
Large size

The rubber nose pad keeps eyewear from sliding to provide comfort for extended work. Together with the normal size, the large size is included as standard so that eyewear is easy to fit for women as well as people who use inner frames.

Option Inner Frame

With its simple attachment structure, the inner frame can be easily attached or taken off at the time of maintenance. It eliminates the stress of wearing protective eyewear over prescription glasses, providing comfortable work conditions.
(* Ophthalmic prescription data is required for production.)

■Angle Adjustment Function



With the angle adjustment function, it is possible to align the eyewear with the line of sight, fit it on the nose and adjust the gap with the face.

■Adjustable Earpiece

Rubber coated earpieces can be shaped into ear hook type, straight type and other shapes as desired by freely bending them.

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-760-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
YL-760-LDY1	Complete absorption	LD–YAG	800 – 810 940, 1064	7<	Green	35
YL-760-Y1	Complete absorption	YAG	1064	6<	Green	50
YL-760C-Y2	Multi-wavelength compatible type	YAG	266, 355 532 1064	10< 4< 6<	Amber	35
YL-760M-Y2	Partially transmitting for maintenance	YAG2ω	532	2<	Red	30
YL-760M-VLD	Partially transmitting for maintenance	LD	660 – 680 647, 676	2<	Blue	55

YL-717 Model (Over prescription glasses type)

YL-717 RoHS CE * With exceptions Catalog Code W5014

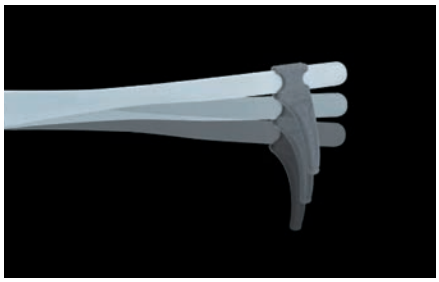
Fit comfortably over the bigger prescription glasses. Soft elastomer cushion bar. Adjustable frame angle.

- Side and top shielding for extra protection.
- Easy fit with adjustable earpiece and temples.

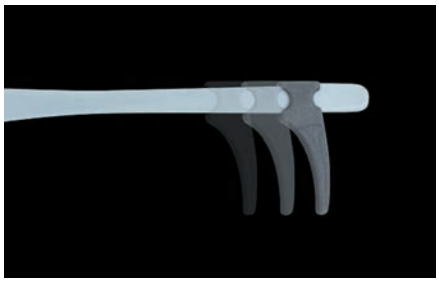
Common Specifications

Frame	Nylon elastomer
Lens	Polycarbonate (hard coated)
Specifications	Compatible with prescription glasses, elastomer cushion, adjustable temple angle
External Dimensions [mm]	(W)163×(H)65×(D)167
Weight [kg]	0.04

Function Description



Uses a newly designed straight temple. Angle of frame edge is adjustable to fit the face (three adjustment stages).



Newly designed locking rubber ear-piece for improved fit.

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
CE YL-717-EX	Complete absorption	EXCIMER	190 – 380	10<	Clear	85
YL-717-AR(45)	Complete absorption	Ar	488, 515	10<	Orange	45
CE YL-717-Y2	Complete absorption	YAG2ω	532	10<	Red	16
YL-717-DYE	Complete absorption	DYE	590 – 598	6<	Blue	20
CE YL-717-HN	Complete absorption	He-Ne	633	5<	Blue	25
CE YL-717-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
CE YL-717-Fiber	Complete absorption	NIR	810 – 1100	7<	Green	35
CE YL-717-Y1(50)	Complete absorption	YAG	1064	6<	Green	50
YL-717-CO2	Complete absorption	CO_2	10600	5<	Green	60
CE YL-717C-LD2	Complete absorption/multi-wavelength	LD	740 – 840 920 – 1160	6 6<	Green	4
YL-717C-Y1	Complete absorption/multi-wavelength	YAG	266, 355 532 1064	10< 2< 6<	Amber	35
CE YL-717C-Y2	Complete absorption/multi-wavelength	YAG	266, 355 532 1064	10< 4< 6<	Amber	30
YL-717C-Y3	Complete absorption/multi-wavelength	YAG	266, 355 532 1064	10< 7< 6<	Amber	25
YL-717M-AR	Partially transmitting, OD2	Ar	488, 515	3< 2<	Orange	57
CE YL-717M-Y2	Partially transmitting, OD2	YAG2ω	532	2<	Red	30
YL-717M-HN	Partially transmitting, OD2	He-Ne	628, 633, 635	2<	Blue	47
CE YL-717M-VLD	Partially transmitting, OD2	LD	660 – 680 647, 676	2<	Blue	55
YL-717A-AR	Partially transmitting, OD4	Ar	488, 515	4<	Orange	50
CE YL-717A-Y2	Partially transmitting, OD4	YAG2ω	532	4<	Red	25

YL-335 Model (Over prescription glasses type)
YL-290 Model (Eyeglass shaped)

YL-335
YL-290

YL-335

RoHS Catalog Code W5015

Provide high transmittance and visibility. Wide temples and soft nose pad.

- Excellent resistance to breaking and scratches.

Common Specifications	
Frame	Polycarbonate elastomer
Lens	Polycarbonate (hard coated)
Specifications	Compatible with prescription glasses, wide temple, soft nose pad, flexible temple
External Dimensions [mm]	(W)158×(H)65×(D)168
Weight [kg]	0.05

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-335-EX/He-Cd	Complete absorption	EXCIMER	193 – 442	10<	Yellow	75
YL-335-Y2	Complete absorption	YAG2ω	532	10<	Red	16
YL-335-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
YL-335-LDY1	Complete absorption	LD–YAG	800 – 810 940, 1064	7<	Green	35
YL-335-Y1(50)	Complete absorption	YAG	1064	6<	Green	50
YL-335-CO2-CLA	Complete absorption	CO_2	10600	6<	Clear	85
YL-335M-BLD	Partially transmitting, OD2	LD	405	3<	Clear	85
YL-335M-AR	Partially transmitting, OD2	Ar	515	2<	Orange	57
YL-335M-Y2	Partially transmitting, OD2	YAG2ω	532	2<	Red	30
YL-335M-HN	Partially transmitting, OD2	He-Ne	628, 633, 635	2<	Blue	47
YL-335M-VLD	Partially transmitting, OD2	LD	660 – 680	2<	Blue	55
YL-335M-LD2	Partially transmitting, OD2	LD	635 – 780	0.5 – 1<	Blue	58
YL-335M-RGB	Partially transmitting, OD2	RGB-LED	457, 532, 633	2<	Purple	8
YL-335C-Y2	Complete absorption multi-wavelength	YAG	266, 355 532 1064	10 4 6<	Amber	35

YL-290

RoHS Catalog Code W5016

Light and comfort with easy wearing semi-straight temples.

- Appropriate for use when identifying angle of beam and scattering light.
- Optional parts (fasteners for adjustment and hard cases) for use in clean room are available.

Common Specifications	
Frame	Nylon
Lens	Polycarbonate (hard coated)
Specifications	Round frame, wide temple
External Dimensions [mm]	(W)138×(H)39×(D)155
Weight [kg]	0.03

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-290-EX/He-Cd	Complete absorption	EXCIMER, He-Cd	193 – 442	10<	Yellow	75
YL-290-Y2	Complete absorption	YAG2ω	532	10<	Red	16
YL-290-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
YL-290-Y1(50)	Complete absorption	YAG	1064	6<	Green	50
YL-290M-Y2	Partially transmitting, OD2	YAG2ω	532	2<	Red	30
YL-290M-VLD	Partially transmitting, OD2	LD	660 – 680 647, 676	2<	Blue	55
YL-290C-Y2	Complete absorption multi-wavelength	YAG	266, 355 532 1064	10 4 6<	Amber	35

YL-250G Model (Over prescription glasses, reinforced glass type)
YL-130 Model (Goggle shaped)/YL-120H Model (Goggle shaped, reinforced glass type)

YL-250G

RoHS CE * With exceptions Catalog Code W5017

Provide high transmittance and visibility.

High damage threshold.
- Excellent resistance to breaking and scratches.

Common Specifications	
Frame	Nylon
Lens	Reinforced glass
Specifications	Compatible with prescription glasses
External Dimensions [mm]	(W)155×(H)57×(D)141
Weight [kg]	0.07

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-250G-3Y	Reinforced glass type	Nd-YAG:OD3(3Y)	780	0.8<	Green	80
			980	3<		
			1064	3<		
			1310, 1550	2<		
			2100, 2940	2<		
CE YL-250G-5Y	Reinforced glass type	Nd-YAG:OD5(5Y)	1064	5<	Green	74
			2100, 2940	3.5<		
YL-250G-7Y	Reinforced glass type	Nd-YAG:OD7(7Y)	1064	7<	Green	69
			2100, 2940	5<		

YL-130

RoHS CE * With exceptions Catalog Code W5018

Google design for complete protection and fit over prescription glasses.

- Hardened glasses and anti-fog coating.
- Optional parts for supporting use in clean room (fasteners for adjustment, with hard cases) are available. WEB Reference

Common Specifications	
Frame	PP elastomer
Lens	Polycarbonate (anti-fog hard coated)
Specifications	Compatible with prescription glasses (some glasses do not fit)
External Dimensions [mm]	(W)192×(H)83×(D)92
Weight [kg]	0.09

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-130-EX	Complete absorption	EXCIMER	190 – 380	10<	Clear	85
YL-130-Y2	Complete absorption	YAG2ω	532	10<	Red	16
YL-130-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
YL-130-Y1(50)	Complete absorption	YAG	1064	6<	Green	50
YL-130C-Y2	Complete absorption multi-wavelength	YAG	266, 355	10<	Amber	35
			532	4<		
			1064	6<		
YL-130M-Y2	Partially transmitting, OD2	YAG2ω	532	2<	Red	30
YL-130M-VLD	Partially transmitting, OD2	LD	660 – 680	2<	Blue	55
			647, 676			

YL-120H

RoHS CE Catalog Code W5019

Provide high transmittance and visibility.
Both frame and lens have high damage threshold.

Guide

▶Damage threshold stands for the value of laser power when the lenses and frame start to have damages in case of receiving direct laser beam.

Common Specifications	
Frame	Special laminating resin
Lens	Special laminating glass
Specifications	Compatible with prescription glasses
External Dimensions [mm]	(W)160×(H)80×(D)73
Weight [kg]	0.16

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
CE YL-120H-Y1	Reinforced glass type	YAG	1064, 1320	7<	Green	67
			1060			
			1319.5			
CE YL-120H-CO2	Reinforced glass type	CO_2	10600	10<	Clear	86
			193, 248, 308			

*1 Damage threshold: Value indicating the degree of power at which damage occurs if laser light is irradiated.

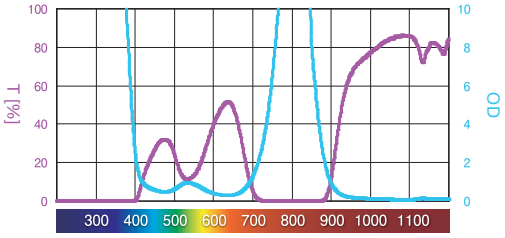
Laser Protective Eyewear Filter Spectra | Filter Spectra

Complete absorption type

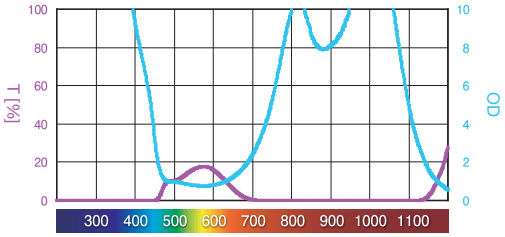
Normally, you cannot see visible laser light because the optical density is set to high.

T: Transmittance

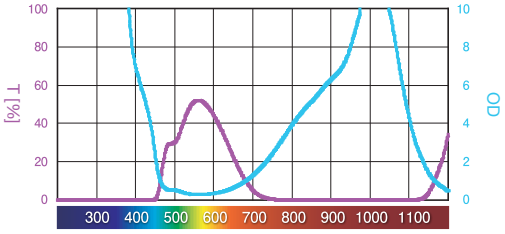
Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290	
Lens Type	ALEXANDRITE	
Color	Pink	
Visible Light Transmittance	30%	
Optical Density [OD]		
ALEXANDRITE	755nm	6<
LD	750 – 850nm	4 – 10<
	800nm	10<
	750 – 850nm	4<



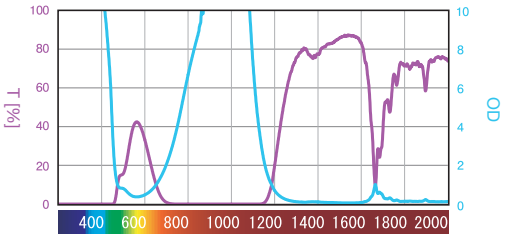
Frame Type	YL-335 YL-760	
Lens Type	LD–YAG	
Color	Green	
Visible Light Transmittance	35%	
Optical Density [OD]		
FIBER LASER	800 – 1080nm	6<
YAG	1064nm	7<
LD	800 – 810nm	7<
	940nm	7<



Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290	
Lens Type	YAG	
Color	Green	
Visible Light Transmittance	50%	
Optical Density [OD]		
Nd-YLF	1047nm 1053nm	6<
YAG	1064nm	6<



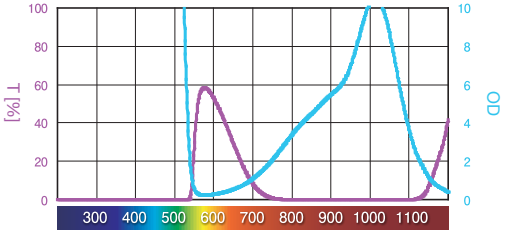
Frame Type	YL-717	
Lens Type	NIR Fiber	
Color	Green	
Visible Light Transmittance	35%	
Optical Density [OD]		
CO_2	810 – 1100nm	7<



Multi-wavelength compatible type

One filter handles multiple wavelengths of laser.

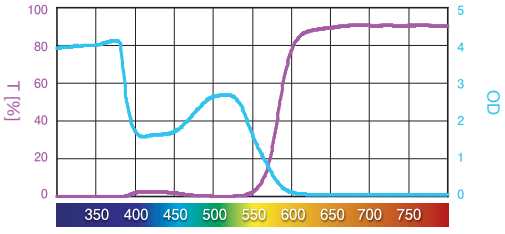
Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290	
Lens Type	C-YAG2	
Color	Amber	
Visible Light Transmittance	40%	
Optical Density [OD]		
YAG	226nm	10<
	355nm	10<
	532nm	4<
	1064nm	6<



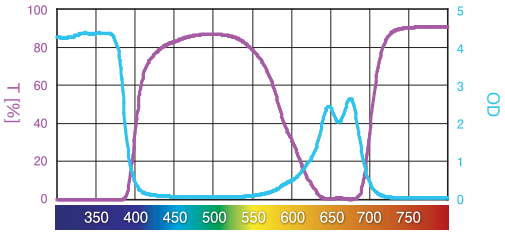
1/100 attenuation partially transmitting type for maintenance

For maintenance for 100mW or less (optical density 1 – 2).
Use this type for checking optical paths or adjusting optical axes.

Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290	
Lens Type	M-YAG2ω	
Color	Red	
Visible Light Transmittance	30%	
Optical Density [OD]		
YAG2ω	532nm	2<



Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290	
Lens Type	M-VLD	
Color	Blue	
Visible Light Transmittance	55%	
Optical Density [OD]		
LD	660 – 680nm	2<
Kr	647.1nm	2<
	676.4nm	2<



* Note that the graphs of optical density show measured values, not guaranteed values.