

Laser Safety

**Safety at Work:
Laser Safety goggles,
warning signs,
and labels**



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Safety at Work: Laser Safety Goggles

Laser safety and laser adjustment goggles

- Laser safety goggles are recommended when working with lower power lasers from laser protection class 3R and beyond, such as all visible lasers from Schäfter+Kirchhoff with up to 5 mW of output power.
- Laser safety goggles are mandatory for protection class 3B and beyond, such as all invisible infrared lasers and all visible lasers from Schäfter+Kirchhoff with more than 5 mW of output power.
- The correct handling and use of laser safety goggles protects you and your colleagues against eye injuries from hazardous laser radiation.
- A selection of CE and GS certified laser safety goggles (manufactured by LaserVision, www.lvg.com) are provided for the lasers manufactured by Schäfter+Kirchhoff.
- The type of frame is dependent upon whether glass or plastic filters are fitted. Laser safety goggles with glass filters (Order Code RX7) have a heavier frame with a facility for attaching personal spectacles, according to individual requirements. Laser safety goggles with plastic filters are lighter and can be worn over normal spectacles.
- The two distinct protective functions of either full protection goggles or alignment protection goggles need emphasizing (see box below).



Accessories - Insert for Spectacles



As an accessory for the laser protection goggles of type R01.T1A01 and R01.T1Q01, the insert RX7 for personal spectacles is available.

Order Code RX7

Laser Safety Goggles – Function and Characteristics

Protective function. Full protection goggles and alignment goggles provide different levels of safety and laser protection.

Full protection goggles, conforming to European standard EN 207, provide personal protection against laser radiation. The laser radiation is blocked and is no longer visible.

The **protection levels** (such as protection level LB..) differ in the maximum spectral transmission of the filter glasses. The EN 207 standard specifies a maximum incident laser power density (power per unit area, in W/m²) for the laser power that is allowed to irradiate the filter glass.

Alignment protection goggles, conforming to European standard EN 208, reduce the visible laser radiation (400–700 nm wavelengths) to that of the power of laser class 2 (EN 60825-1). The laser radiation remains visible, to allow alignment protection glasses to be used for adjustment tasks, while offering significant laser protection safety.

The **protection levels** (protection level RB..) describe the maximum power (watts) of a collimated laser beam that is allowed to irradiate the goggles.

Maximum power (EN 208): the maximum power of a laser beam in a specified wavelength range that is sufficiently attenuated by the alignment protection goggles (in accordance with EN 208).

Maximum transmission (EN 207): maximum transmission (minimum attenuation) in a specified wavelength range (according to EN 208).

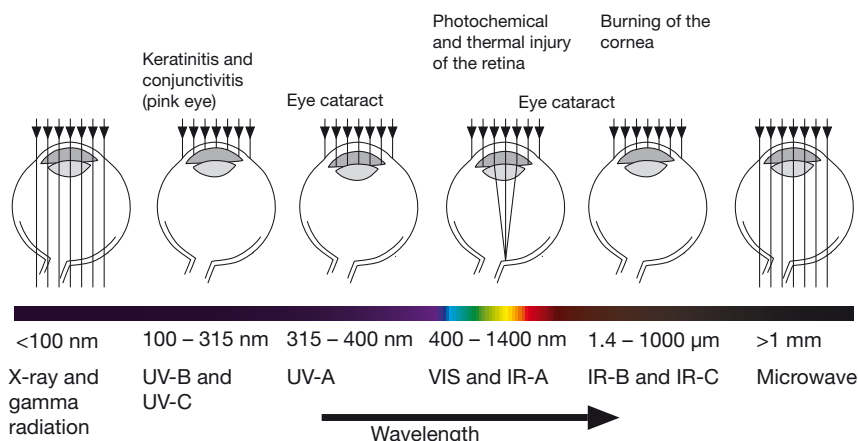
Maximum power density (EN 207): maximum power density that the filter glasses can withstand over a longer period (according to EN 207).

VLT (visible light transmission): in addition to the specified wavelengths, laser protection goggles also attenuate ambient light. The VLT is expressed as the percent transmitted daylight.

OD (optical density): logarithmic scale for the attenuation of radiation at a specified wavelength. The OD at wavelength λ is defined as:

$$OD(\lambda) = -\log_{10} \tau(\lambda)$$

Type of Eye Damage caused by Radiation

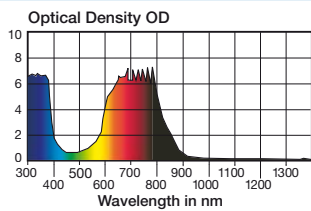


Laser Safety Goggles

**Full Protection Goggles
DIN EN 207**



VLT = 10%

Order Code F18.P1H03.1001

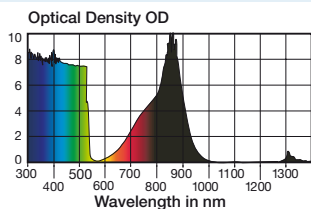
Usable Range					
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Transmission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Full	610 - 630	LB3	10 ⁻³	10 ⁴ W/m ²	-
Full	630 - 660	LB4	10 ⁻⁴	10 ⁵ W/m ²	-
Full	660 - 710	LB5	10 ⁻⁵	10 ⁶ W/m ²	-
Full	710 - 730	LB4	10 ⁻⁴	10 ⁵ W/m ²	-
Full	730 - 790	LB5	10 ⁻⁵	10 ⁶ W/m ²	-

Full protection goggles for cw lasers in the 600 - 800 nm wavelength range

**Full Protection Goggles
DIN EN 207**



VLT = 30%

Order Code F18.P1L02.1001

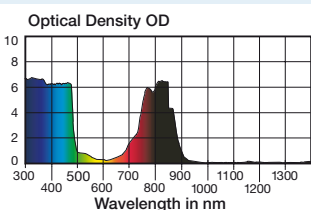
Usable Range					
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Transmission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Full	315 - 532	LB6	10 ⁻⁶	10 ⁷ W/m ²	-

Full protection goggles for cw lasers in the 315 - 532 nm wavelength range

**Full and Alignment
Protection Goggles
DIN EN 207 / DIN EN 207**



VLT = 42%

Order Code F18.P1H02.1001

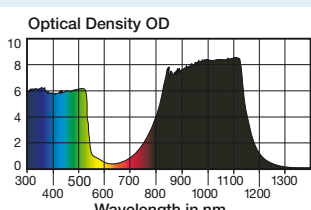
Usable Range					
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Transmission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Alignment	660 - 675	RB2	-	-	100 mW
Full	700 - 820	LB5	10 ⁻⁵	10 ⁶ W/m ²	-

Alignment protection goggles are for lasers in the 660 - 675 nm wavelength range
Full protection goggles for the 700 - 820 nm wavelength range

**Full and Alignment
Protection Goggles
DIN EN 208/DIN EN 207**



VLT = 35%

Order Code F18.P1H01.1001

Usable Range					
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Transmission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Full	770 - 800	LB4	10 ⁻⁴	10 ⁵ W/m ²	-
Full	800 - 1100	LB5	10 ⁻⁵	10 ⁶ W/m ²	-

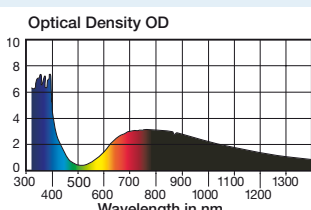
Full protection goggles for lasers in the 770 - 1100 nm wavelength range

Laser Alignment Goggles

**Full Protection Goggles
DIN EN 207**



VLT = 25%

Order Code R01.T1A02

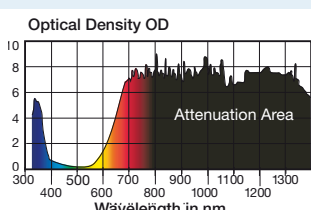
Usable Range					
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Transmission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Alignment	630 - 690	RB2	-	-	100 mW

Alignment protection goggles for cw lasers in the 630 - 690 nm wavelength range

**Full Protection Goggles
DIN EN 207**



VLT = 35%

Order Code R01.T1Q01

Usable Range					
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Transmission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Full	690 - 1320	LB5	10 ⁻⁵	10 ⁶ W/m ²	-
Full	1320 - 1550	LB2	10 ⁻²	10 ³ W/m ²	-

All-round goggles as full protection for cw lasers in the 690 - 1500 nm wavelength range

Please Note Typical density curves for the respective filters are shown for information only and are not guaranteed values. Only the protection levels (RB.. or LB..) are guaranteed by Schäfer+Kirchhoff.

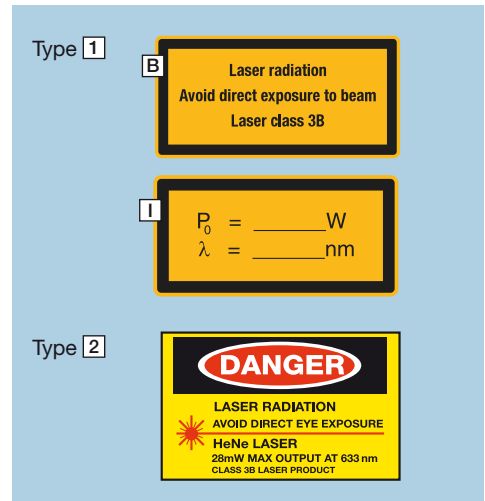
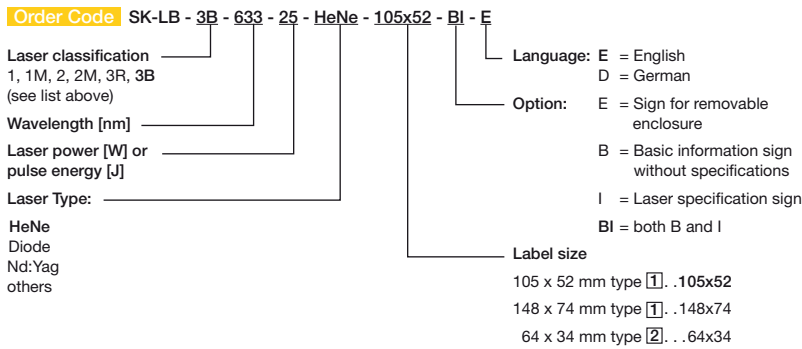
Laser Safety: Warning Triangle Laser Labels

row	Image	Size	Order Code
1		Triangle 10 mm	SK-LB-T1
2		Triangle 46 mm	SK-LB-T2
3		Triangle 92 mm	SK-LB-T3
4		Triangle 185 mm	SK-LB-T4



Laser Safety: Laser Classification Labels

Order Options for Laser Labels



Laser Safety

To be in accordance with DIN IEC 60825-1:2007, every laser system must be labelled with a warning triangle. Additionally, all lasers must be labelled with additional warning information specific to the laser class:

- Class 1:** " CLASS 1 LASER PRODUCT "
- Class 1M:** " LASER RADIATION, DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS, CLASS 1M LASER PRODUCT "
- Class 2:** " LASER RADIATION, DO NOT STARE INTO BEAM, CLASS 2 LASER PRODUCT "
- Class 2M:** " LASER RADIATION, DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS, CLASS 2M LASER PRODUCT "
- Class 3R:** " LASER RADIATION, AVOID DIRECT EYE EXPOSURE, CLASS 3R LASER PRODUCT "
- Class 3B:** " LASER RADIATION, AVOID EXPOSURE TO THE BEAM, CLASS 3B LASER PRODUCT "
- Class 4:** " LASER RADIATION, AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION, CLASS 4 LASER PRODUCT "

Furthermore, all lasers of class 2 to 4 must exhibit a warning that lists the laser specifications, including the laser source, the wavelength and the laser power or pulse energy.

If the laser is enclosed but the housing can be opened then the housing must also be labelled with a warning triangle and the requisite information about the laser class, as listed below:

- Class 1:** The laser is safe for any form of measurement task and the maximum permitted exposure (MPE) cannot be exceeded. Enclosed high power laser systems, with an integrated automatic shutdown system on opening of the enclosure, are also included in this laser class.
- Class 1M:** As for class 1, except when magnifying optics such as microscopes and telescopes are used: safety limits may be exceeded and class 3 dangers may be possible.
- Class 2:** Visible laser light (400–700 nm) with <1 mW continuous wave (CW) and/or <0.25 s exposure time (with an energy limit according to the standard) is considered to be safe. Radiation either side of the 400–700 nm range is considered to be class 1.
- Class 2M:** As for class 2, except when magnifying optics such as microscopes and telescopes are used.
- Class 3R:** If handled carefully, the laser is considered safe because only a low risk of injury exists. Visible CW lasers in Class 3R are limited to 5 mW. For other wavelengths and for pulsed lasers, other limits apply.
- Class 3B:** Direct exposure is hazardous for the eye, but diffuse reflections such as from paper are not harmful. The limits apply to wavelengths and to operation mode (as for CW and pulsed lasers). Laser safety goggles are absolutely required when a direct view of the laser beam is at all possible. Class 3B lasers must be equipped with an isolating key switch and a safety interlock.
- Class 4:** Every type of laser beyond class 3B.