

Why Optimizing VLT* May Not Be Optimal

*VLT = Visible Light Transmission



What is VLT (Visible Light Transmission) ?

- “Undoubtedly, VLT and fit are the two most compelling features in the use or aversion to use of the laser eyewear.”
- “Simply stated, VLT is the mean average percentage of the entire visible spectrum as weighted for blue spectral responsiveness, which is *not* being filtered by these same lenses.”
- “Repeatedly, experience has indicated that the higher the VLT , the higher the likelihood of eyewear usage and consequently laser eyewear safety compliance.”
- *Laser Safety, Tools and Training*, Ken Barat, ed., 2009

Two Types of VLT: Photopic (PLT) and Scotopic (SLT)

Photopic Luminous Transmittance

- VLT in “day” conditions
- “Luminous Transmittance of a filter weighted by the spectral sensitivity of the day-adapted eye.” (ANSI Z136.7)

Scotopic Luminous Transmittance

- VLT in “dusk” conditions.
- “Luminous Transmittance of a filter weighted by the spectral sensitivity of the night-adapted eye.” (ANSI Z136.7)

Comparing Photopic and Scotopic Sensitivities

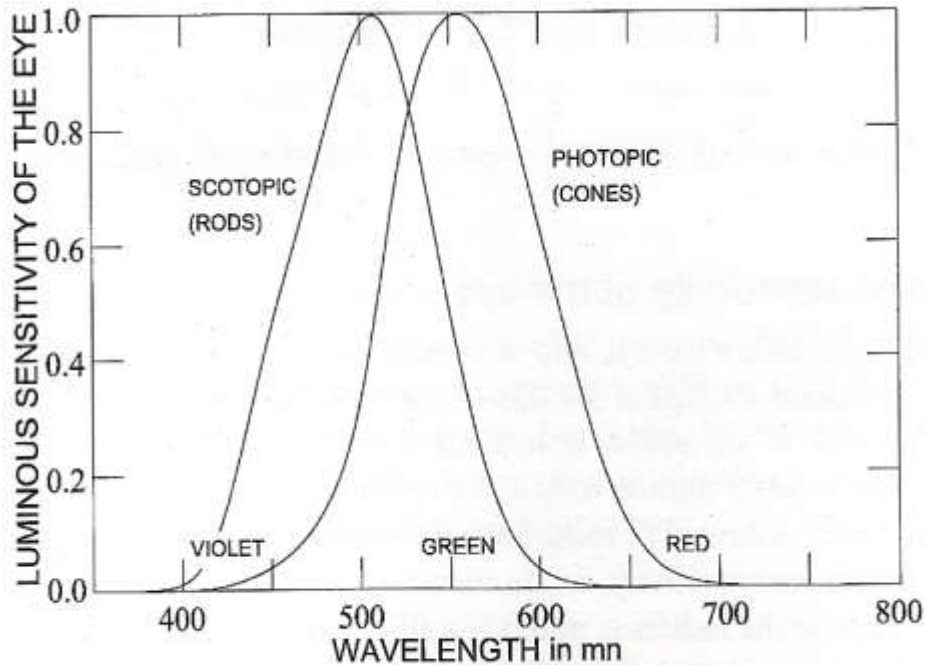


Figure 1.9 Luminous sensitivities of the photopic and scotopic eye.

EXAMPLE RESULT
(using source D65)

Typical Polycarbonate Laser
Eyewear for Nd:Yag and KTP

VLT = 25%

SLT = 22%

PLT = 25%

Match the Light Source to the Application

Illuminant	Description	Notes
A	Flash Environment	Active
B	Noon Sunlight	Discontinued
C	Average Daylight	Discontinued
D65	Average Daylight	Active, Replaced “C”

Higher luminous transmission may not be optimal in several applications.

- “Flash” Environments
 - ✓ Laser welding
 - ✓ Medical/Surgical
- “Color Recognition” Environments
 - ✓ Medical/Surgical
 - ✓ Cockpit LEDs
 - ✓ Work Areas & Computer Use
- Some Laser Alignment Situations
- Outdoor Laser Use

Example 1: YAG Laser Welding

Kentek Case: 2888

Situation: Operator of YAG welder complains of headache and eye strain; has difficulty aligning the arc

Product: OD7+ @ 1064nm and VLT 60% (typical high-powered Nd:Yag polycarbonate filter)

Solution: Offered OD7+ @1064 in polycarbonate with Shade 3 and additional blue light protection. VLT ~10%.

Example 2: Multiple Lasers

Kentek Case: 2545

Situation: Medical laboratory experimenting with multiple low power lasers and a range of pigments.

Product: Multiple products, all high VLT

Solution: Offered custom product, single filter with VLT ~12%. Also integrated neutral density technology to shift color recognition and improve overall visibility.

Vision can be enhanced by technology!

Example 3: Photobleaching

Kentek Case: 3847

Situation: Lab environment with high power, short pulse, diode laser at 800nm +/-.

Product: High VLT filter glass, BG-39 with VLT ~50%.

Solution: Replaced eyewear with BG-42, similar OD level, VLT ~38%, to account for high potential for filter saturation and photobleaching.

Concluding Thoughts

Higher VLT is a great place to start.

If staff are not using eyewear, interview and probe to find out why.

- Look at the whole environment.
- What needs to be seen?
- What other hazards or annoyances are present?

Consider using multiple pairs of eyewear for individual users or projects.

Or...for a few dollars more, have a custom product built for your application.

Ultraviolet, visible and infrared regions of the electromagnetic spectrum

Spectral region	Range of wavelength	Subregion
Ultraviolet	200-280nm	UV-C
	280-315nm	UV-B
	315-380nm	UV-A
Visible	380-430nm	Violet
	430-500nm	Blue
	500-520nm	Cyan
	520-565nm	Green
	465-580nm	Yellow
	580-625nm	Orange
	625-740nm	Red
Infrared	1400-10,600	Far IR

P = Photopic Vision

P+S = Mesopic Vision = Photopic Vision + Scotopic Vision

S = Scotopic Vision

	Light Condition	Illuminance
P	Direct sunlight	100,000-130,000 lux
P	Full daylight, indirect sunlight	10,000-20,000 lux
P	Overcast day	1,000 lux
P	Clear sunrise or sunset	500 lux
P	Indoor office	200-400 lux
P	Very dark day	100 lux
P	Hallway	80 lux
P	Twilight	10 lux
P	Pure Photopic Vision	3.4 lux
P+S	Candle at 1 meter	1 lux
P+S	Deep twilight	1 lux
P+S	Full moon overhead at tropical latitudes	1 lux
P+S	Full moon on clear night	0.27 lux
S	Pure Scotopic vision	0.034 lux
S	First or Last Quarter Moon, overhead	0.027 lux
S	Quarter moon	0.01 lux
S	Starlight	0.001 lux
S	Starlight on overcast night	0.0001 lux
S	Threshold of Scotopic vision	0.00001 lux