

# Introduction

- Lasers have become almost ubiquitous in the modern world.
- We will concern ourselves with the lasers that our customers will be using.
- We will first go over a brief description of what a laser is and how it works.
- Then go into specifics about how to match our glasses up to the laser they are using.

# So what is a Laser ?

- A laser beam is created by the stimulation of a substance causing it to emit light of a single wavelength and then amplifying, focusing and directing it in one direction.
- Laser= **L**ight **A**mplification (by) **S**timulated **E**mission (of) **R**adiation
- Laser light is coherent. It is at one wavelength, moving in one direction. Think of it as being concentrated.

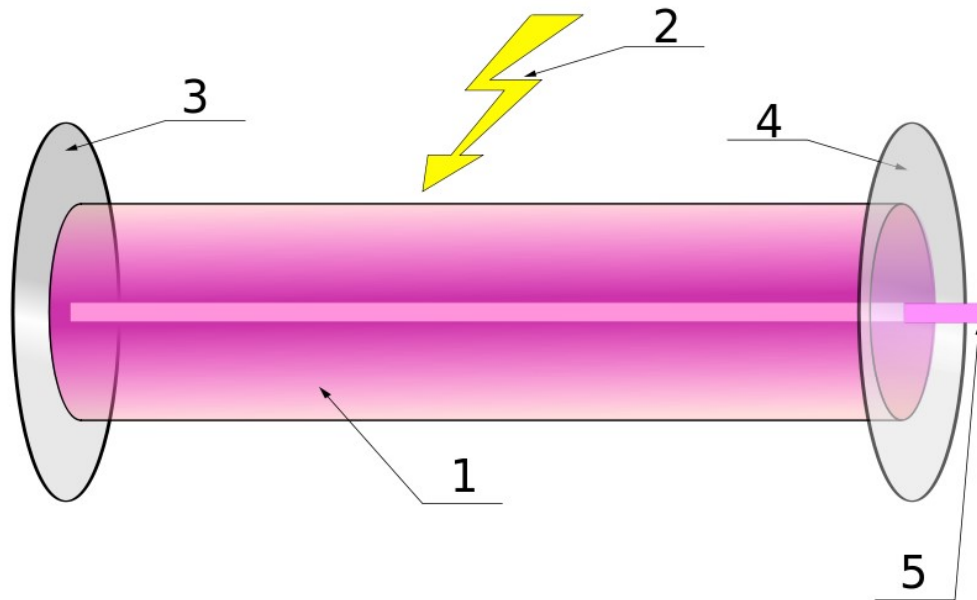
# How Safe is Safe ?

- That is why Lasers are so powerful and useful. A dollar store laser pointer, has an output many hundreds of times more powerful than a 100-Watt light Bulb!
- Even low power, “Eye Safe” lasers can cause damage, so be aware!
- Although modern lasers can be very complex, the basic design is not all that different then the first laser.

# LASER COMPONENTS

Principal components of a laser:

1. Active laser medium
2. Laser pumping energy
3. High reflector
4. **Output coupler**
5. Laser beam



TYPES of

# TYPES of LASERS

Laser gain medium and type	Operation wavelength(s)	Pump source	Applications and notes
<a href="#">Helium–neon laser</a>	632.8 nm (543.5 nm, 593.9 nm, 611.8 nm, 1.1523 μm, 1.52 μm, 3.3913 μm)	Electrical discharge	<a href="#">Interferometry</a> , <a href="#">holography</a> , <a href="#">spectroscopy</a> , <a href="#">barcode scanning</a> , alignment, optical demonstrations.
<a href="#">Argon laser</a>	454.6 nm, 488.0 nm, 514.5 nm (351 nm, 363.8, 457.9 nm, 465.8 nm, 476.5 nm, 472.7 nm, 528.7 nm, also <a href="#">frequency doubled</a> to provide 244 nm, 257 nm)	Electrical discharge	<a href="#">Retinal phototherapy</a> (for <a href="#">diabetes</a> ), <a href="#">lithography</a> , <a href="#">confocal microscopy</a> , <a href="#">spectroscopy</a> pumping other lasers.
<a href="#">Krypton laser</a>	416 nm, 530.9 nm, 568.2 nm, 647.1 nm, 676.4 nm, 752.5 nm, 799.3 nm	Electrical discharge	Scientific research, mixed with <a href="#">argon</a> to create "white-light" lasers, light shows.
<a href="#">Carbon dioxide laser</a>	10.6 μm, (9.4 μm)	Transverse (high power) or longitudinal (low power) electrical discharge	Material processing ( <a href="#">cutting</a> , <a href="#">welding</a> , etc.), <a href="#">surgery</a> , <a href="#">dental laser</a> , <a href="#">military lasers</a> .
<a href="#">Excimer laser</a>	193 nm (ArF), 248 nm (KrF), 308 nm (XeCl), 353 nm (XeF)	<a href="#">Excimer</a> recombination via electrical discharge	<a href="#">Ultraviolet lithography</a> for <a href="#">semiconductor</a> manufacturing, laser <a href="#">surgery</a> , <a href="#">LASIK</a> .
<a href="#">Ruby laser</a>	694.3 nm	Flashlamp	<a href="#">Holography</a> , <a href="#">tattoo</a> removal. The first type of visible light laser invented; May 1960.
<a href="#">Holmium YAG (Ho:YAG) laser</a>	2.1 μm	Laser diode	Tissue ablation, <a href="#">kidney stone</a> removal, <a href="#">dentistry</a> .
<a href="#">Nd:YAG laser</a>	1.064 μm, (1.32 μm)	Flashlamp, <a href="#">laser diode</a>	Material processing, <a href="#">rangefinding</a> , laser target designation, surgery, <a href="#">tattoo</a> removal, hair removal, research, pumping other lasers (combined with <a href="#">frequency doubling</a> to produce a green 532 nm beam). One of the most common high power lasers. Usually pulsed (down to fractions of a <a href="#">nanosecond</a> ), <a href="#">dental laser</a>

# How to select the right Glasses

## Easy as 1, 2, 3

- 1) The most important thing to find out is the wavelength of the laser they are using.
- 2) The next consideration is the Power Level
- 3) Finally how much light they need to perform the operation they are doing with the laser.

# Wavelength

- The customer may or may not know the wavelength of their machine. It is usually given in nanometers (nm)
- If not, it should be in the manual, or inscribed on a plate mounted to the machine.
- If that is not accessible, find out what the make and model of the machine is, we can look up the wavelength online.
- In Medical Lasers, most are operating at 308nm(Excimer), 1064nm(ND/YAG), 2100nm(Holmium) or 10,600nm (CO<sub>2</sub>).
- Industrial lasers are higher power, but have more safeguards, they usually operate at either 1064nm or 10,600nm (10.6 μm)
- Often there is a wavelength of around 650nm listed. This is very often a red aiming beam that is “eye safe” so it should not be a consideration for choosing glasses.

# POWER/OD

- The next consideration is the power of the laser, this will determine what OD is required.
- Laser glasses have 2 levels of markings, the wavelength and the Optical Density.
- Optical Density is a measure of how much of a certain wavelength is blocked by the glasses.
- It is a logarithmic scale, with each step representing a tenfold increase. OD 0=100% Transmission, OD 1=10%, OD 2=1%, etc.
- Most Medical Lasers require an OD of 3 or greater.
- Most Industrial Lasers require an OD of 5 or greater.



# Optical Density

## OD to % Transmittance Conversions

OD	Transmittance	Exponential	OD	Transmittance	Exponential
0.0	100%	1.0 E+02	5.0	0.001%	1.0 E-03
1.0	10%	1.0E+01	6.0	0.0001%	1.0 E-04
2.0	1%	1.0 E	7.0	0.00001%	1.0 E-05
3.0	0.1%	1.0 E-01	8.0	0.000001%	1.0 E-06
4.0	0.01%	1.0 E-02	9.0	0.0000001%	1.0 E-07

$$OD = \log_{10} \frac{1}{T}$$

OD = Optical Density

$$T = 10^{-OD}$$

T = Transmittance (decimal)

Optical Density of a laser filter is controlled by the material that is used to make the filter itself, specific to the wavelength that is being blocked and the transmittance of visible light.

# Visible Light Transmission

- The Visible Light Transmission is also an important factor in choosing glasses.
- It is simply a percentage of how much visible light is passed through a laser filter.
- The better the **VLT**, the easier it is to see what they are working on.
- Visible Lights wavelength is about 400nm to 700nm. A very small slice of the spectrum.

# Matching filter to laser.

- We have a one page chart that shows all of our filters and their values.
- Once you find out the wavelength , and OD required, you can start to pick the right filter.
- Our KG5 filter works for many different lasers and is our biggest seller in Medical.
- The next most prevalent is the BG-42 filter.

Part Number	Type of Laser	RANGE OD VALUES ARE IN (PARENTHESES)	Lens Color	VLT% *	PRICE *1			NOTES
					GLASSES	FITOVERS	GOGGLES	
LS-KG5^	Homium.YAG,Co2	870-950(4),950-1000(5),1000-1550(7),1150-2750(4),2800-11,000(6)	CLEAR	90	210	ARE \$10	245	
LS-KG5+^	High Power Hom,YAG	870-950(6),950-1000(9),1000-1550(10),1150-2750(6),2800-11,000(8)	CLEAR	90	310		355	
LS-AD	Alexandrite Diode	730-855nm(5),755-830nm(7)	PINK	32.6	165	LESS	165	
LS-BG38^	Alx.Did. Hi Light Xmsn	632nm(2),650-690(3)nm,690-1000nm(6)	BLUE	55.5	205	THAN	240	
LS-BG42^	Alx.Did. Hi Light Xms	700-1200nm(7)	BLUE	52.5	250	GLASSES	285	
LS-BGKG	DIO,Co2,NdYag,Erb,H	200-310(7),615-633(1-2),664-690(3-4),690-719(5-6),	CLEAR	85	439		459	
LS-BGKG	Holm,NIR	720-1500(7),1501-1600(6),2100-2350(4),2800-5200(5)	CLEAR	85	439		459	
LS-DH83	Diode, Excimer,UV	190-400(7),532(7),910-1070(6),850-1075(5),808-850(4)	BROWN	33	225		260	
LS-DIO	DIODE	600-900nm(6)	GREEN	27.9	145		180	
LS-D680	UV,Excimer,InGas,Dio	190-420(6),660-780(2),745-1115(3),800-904(5),905-1075(6),10.6µ(6)	GREEN	64	219		259	
LS-D81	DIODE 810nm	800-830nm (5)	YEL/GRN	68	110	#	135	
LS-D98	Alex Diode	800-980nm(5)	GREEN	50	145		185	
LS-DYH	Diode,YAG Harmonic	190-534nm(5),830-1090nm(5),1064(7)	AMBER	28	265		300	
LS-DIFU	Argon,Ruby,Dio,YAG	190-540nm(7),630-650nm(2),650-690nm(3),690-710nm(6),710-1200nm(7),1064(5)	Brown	21	499		549	
LS-W570^	UV,Excimer,AKP,CO2	190-536nm(6),5000-10,600(6)	ORANGE	80	249		279	
LS-YAG	YAG	190-380nm(5),1064nm(7),900-1070nm(5)	GREEN	58.7	165	#	200	
LS-YAGD	YAG Double Harmncs	190-534nm(5),910-1070nm(6)	BROWN	26.2	210		245	
LS-YHAD	M.W.YAG/Alx Did	190-534nm(5),730-1090nm(5),1064nm(7+)	AMBER	10.6	265		300	
LS-Y97	Alexandrite,Diode,YAG	725-1120nm(7), 10,600nm(6)	GREEN	21	225		260	
LS-AKP	Argon/KTP	190-532nm(5),5000-11000nm(6)	ORANGE	46.4	100	# FOR ALL	135	
LS-CD2^	Co2/Eximer	190-370nm(5),10600nm(6)	CLEAR	82	40	# FILTERS	75	
LS-SFP	Dye (CE Approved)	190-390nm(7),589-600nm(5),5902-597nm(6)	PURPLE	27.2	189	#	224	
LS-RBY	RUBY	680-710nm(4),690-700nm(7)	TEAL	33.8	150		185	
LS-S806^	Vbeam,Dye,VBeam2	591-597(4),592-596(5),570-595(6),571-594(7),735-755(7),795-810(7)	PURPLE	71	349		NA	
LS-CR39^	Co2/Erbium	190-340nm(7),2760-3470nm(7),5000-11000nm(7)	CLEAR	85	159		175	
LS-BG3^	Dye,Diode,HeNe,Ruby	513-680nm (6), 576-668nm(7)	BLUE	14	249.99		274.99	
LS-IPL^	Intense Pulse Light	550-1100nm(1.5),620-1050nm(3)	GREEN	9	130		165	
LS-IPLB	Intense Pulse Light	IPL USE ONLY	BROWN	15	55	#	85	
LS-G15	Broadband Alignment	400-667 (1), 668-700(0.5)	GRAY	17	234		254	
LS-AA	Argon Alignment	480-532nm(2,3),470-555nm(1.5)	RED	34	90	PRICING	125	
LS-HENE	HEliumNEon Alignmt	190-380nm(5),633nm(2)	BLUE	36.6	90		125	
SPECIALS		GLASS FILTERS (^) CAN BE MADE PRESCRIPTION./OD CAN BE INCREASED. ALSO 2 FILTERS CAN BE COMBINED TO INCREASE WAVELENGTHS BLOCKED -CALL FOR PRICING AND APPLICATIONS						
		* Visible Light Transmission						
		*1 Standard Frames See website for Economy Frames						
		# Available in 282 Frame						

# Care and Cleaning Instructions

- Laser glasses should always be worn while the laser is in use. When not being used, take care to not rest them on the lenses as this may scratch them. Best to store on a flat surface with the curved parts of the temples facing up.
- **STORAGE:** Glasses should be stored in protective case when not in use. Normal room temperature and low relative humidity is ideal.
- **CLEANING/DISINFECTING:** In general high heat should not be used as it will damage frames and coatings. Never use ammonia or chlorine-based cleaners. Do not auto-clave. Do not use circular motions whilst cleaning as it can damage applied coatings.
- Cleaning with commercially available alcohol-based lens wipes is acceptable. Or use an anti-bacterial detergent or hand soap with no microbeads or grit added. Gently rub lenses and frames in straight lines under clear running water to rinse with. This will also facilitate disinfection of the lenses and frames. Dry with a soft lint free cloth.
- **MAINTENANCE:** Examine eyewear frequently. If lenses become pitted, chipped or in other ways damaged cease use immediately and contact your distributor for instructions. End user maintenance limited to tightening of hinge screws.

# Summary

- Laser Glasses are critical for the use of lasers.
- Getting the right glasses is easy if you take it step by step.
- They are a great addition to your offerings
- We are always available to support you if you have questions or need something special for your customers.