FIVE THINGS TO CONSIDER WHEN PICKING LASER SAFETY GLASSES
It’s essential when choosing laser safety glasses that attention be paid to picking the right pair, but it’s often hard to know where to start. Getting it right is critical for long-term eye protection, comfort, and safety.

Laser safety is a serious matter, and we only get one pair of eyes, so it’s critical to do your research and gain a thorough understanding of your safety glasses requirements. Whether it be laboratory, medical or industrial – each environment has its unique needs and care should be taken to make sure they comply with the relevant laser safety standards.

With that in mind, we’ve used our expertise and experience to write this guide on the 5 things to consider when choosing laser safety glasses:
Check your Laser Specifications

When choosing your laser safety glasses, pay careful attention to the laser products specifications. It is best done by consulting the laser operating manual or and a product expert.

Specifications include:

- **Wavelength** which is usually specified in nm (nanometers - $10^{-9}$m) or µm (micrometers - $10^{-6}$m)
- **Laser classification** which is referred to as Class 1 (I), Class 2(II), Class 2M, Class 3(III), Class 3B (IIIB), Class 3R, Class 4 (IV)

Other specifications depend if it is a pulsed or continuous (CW) laser.

- **Continuous laser**: For continuous lasers, the power is typically specified in mW (milliWatts - $10^{-3}$W), W(Watts) or kW(kilowatts - $10^{3}$W)
- **Pulsed laser**: If it is a pulsed laser then the pulse energy which is specified in Joules, pulse length in us (microseconds – $10^{-6}$s), ns (nanoseconds - $10^{-9}$s), ps (picoseconds - $10^{-12}$s) or fs (femtoseconds - $10^{-15}$s).

Take time to carefully read the operating manual before selecting the appropriate eye protection.

Picking the appropriate pair of safety glasses requires a solid understanding of the standards, specifications and the product itself – consult a product specialist if you are unsure.
2. Make Sure They Satisfy Your Lens Filter Requirements

Decide on the appropriate lens filter requirements by considering the wavelength (nm) coverage, OD (Optical Density), Damage threshold (L ratings) and Visible Light Transmission (VLT).

Right lens typically shows wavelengths covered, Optical densities OD and Visible Light Transmission

Left lens typically shows L Rating (damage threshold) Specifications and corresponding wavelengths

Some things to take into consideration:

- Make sure that the lens filters you select will reduce possible exposure of the laser below the Maximum Permissible Exposure limit (MPE)
- Consider if you need to have visibility of the laser spot for alignment purposes, which is often the case for visible red lasers. In this case, the required Optical Density will need to be calculated precisely to provide a balance between visibility and protection.
- Check the Visible Light Transmission of the filter or VLT. This is specified as a percentage and considers the response of the human eye to daylight. It gives a good indication of how light the glasses will be to look through. For example, if the VLT is less than 20% then it is best
used in a well-lit environment.

- The damage thresholds are specified in terms of L ratings and are required for eyewear in Australia and Europe. It requires that eyewear is labelled with protection levels that detail their damage thresholds, (e.g. 10600 D L5 (where L5 reflects a power density of 100 MegaWatt/m² during a 10 seconds direct hit test at 10,600nm). The recomended scale numbers are shown in the below table.

<table>
<thead>
<tr>
<th>Scale number</th>
<th>Maximum spectral transmittance at the laser wavelength</th>
<th>E_D [W/m²]</th>
<th>H_L [J/m²]</th>
<th>E_M [W/m²]</th>
<th>H_M [J/m²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB1</td>
<td>10⁻³</td>
<td>0.01</td>
<td>3 x 10⁻²</td>
<td>3 x 10¹¹</td>
<td>10²</td>
</tr>
<tr>
<td>LB2</td>
<td>10⁻²</td>
<td>0.1</td>
<td>3 x 10⁻³</td>
<td>3 x 10¹²</td>
<td>10³</td>
</tr>
<tr>
<td>LB3</td>
<td>10⁻³</td>
<td>1</td>
<td>3 x 10⁻⁴</td>
<td>3 x 10¹³</td>
<td>10⁴</td>
</tr>
<tr>
<td>LB4</td>
<td>10⁻⁴</td>
<td>10</td>
<td>3 x 10⁻⁵</td>
<td>3 x 10¹⁴</td>
<td>10⁵</td>
</tr>
<tr>
<td>LB5</td>
<td>10⁻⁵</td>
<td>10²</td>
<td>3 x 10⁻⁶</td>
<td>3 x 10¹⁵</td>
<td>10⁶</td>
</tr>
<tr>
<td>LB6</td>
<td>10⁻⁶</td>
<td>10³</td>
<td>3 x 10⁻⁷</td>
<td>3 x 10¹⁶</td>
<td>10⁷</td>
</tr>
<tr>
<td>LB7</td>
<td>10⁻⁷</td>
<td>10⁴</td>
<td>3 x 10⁻⁸</td>
<td>3 x 10¹⁷</td>
<td>10⁸</td>
</tr>
<tr>
<td>LB8</td>
<td>10⁻⁸</td>
<td>10⁵</td>
<td>3 x 10⁻⁹</td>
<td>3 x 10¹⁸</td>
<td>10⁹</td>
</tr>
<tr>
<td>LB9</td>
<td>10⁻⁹</td>
<td>10⁶</td>
<td>3 x 10⁻¹⁰</td>
<td>3 x 10¹⁹</td>
<td>10¹⁰</td>
</tr>
<tr>
<td>LB10</td>
<td>10⁻¹⁰</td>
<td>10⁷</td>
<td>3 x 10⁻¹¹</td>
<td>3 x 10²⁰</td>
<td>10¹¹</td>
</tr>
</tbody>
</table>

Table B.1 — Recommended scale numbers for use of filters and eye-proectors against laser radiation.
Modes of Operation

Lasers operating at different modes have different power density characteristics and often different eyewear requirements.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Definition</th>
<th>Pulse Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Continuous Wave (cw) with consistent average power</td>
<td>greater than 0.25 second</td>
</tr>
<tr>
<td>I</td>
<td>Pulsed: short single or periodic energy emission.</td>
<td>&gt;1 µs to 0.25 s</td>
</tr>
<tr>
<td>R</td>
<td>Giant Pulsed: very short single or periodic energy emission.</td>
<td>1 µs to 1 ns</td>
</tr>
<tr>
<td>M</td>
<td>Mode Locked</td>
<td>&lt; 1 ns (pico and femtosecond)</td>
</tr>
</tbody>
</table>

Filters typically come in three types and which one you need depends on the specific requirements:

- Polymer filters are lightweight, comfortable to wear and offer the highest impact resistance. They are also the most cost-effective option. The filter material extends all the way through the filter which is often 2-3mm thick. This type of filter is the most popular and is used with all laser types and applications.

- Filter glass lenses. These are more expensive than polymer filter lenses, however, have a significantly higher (often clear) visibility, this can be important in situations that require a high degree of
visibility or colour clarity, such as in medical or telecom applications. Specialised glass filter material is used that composes the whole lens and is designed to absorb at specific wavelengths.

Dielectric coated lenses. They provide a very narrow band of wavelength protection, therefore, give a high level of visibility. The coating works by reflecting the laser wavelengths, however, because the coating is only applied to the surface, scratches can reduce the performance of the filter. Dielectric coated lenses also tend to be the most expensive option due to the involved manufacturing process.
3. Make Sure You Choose The Right Frame

As well as ensuring the correct lens is picked to protect the eyes, it’s important for the glasses to be comfortable; otherwise you may end up sore, may not use them when you should or will end up having to purchase another pair.

Style:

• **Fitover / Universal Fit:** The most popular frames are the "fitover" style as these are a universal fit that works well with or without prescription glasses underneath. Also the extra space between the eye lash and the lenses avoids smearing which often happens with the closer wrap around styles. The universal fit / fitover style have side shields which improves visibility and cuts down on obstructed viewing. The side shields also protect from peripheral laser radiation.
• **Modern / Wraparound:** The wrap-around style provides a more modern look that fits close to the eye for those that want to look good while wearing the glasses.

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**Adjustability:**

Many frames come with the option of adjustable legs and head straps which allow the frame to fit securely to various head sizes. Make sure this is an option for glasses that will be used by multiple people.

**Durability & Warranty:**

Durability is also an important consideration when choosing laser glasses as lower quality glasses may break quickly needing to be replaced.

Normally it is the frames that break first usually because the frame material is rigid/brittle or designed in a way that leaves the frame weaker such as with some of the more modern styles.

Some frames also use a more rubbery flexible material which tends to significantly improve the lifetime. The frames usually come with a 12 month or 24 month warranty. The later normally signifies a better longer lasting frame.
4. Make Sure You Choose the Right Eyewear for Patients (Medical and cosmetic applications)

If the eyewear is for use by the client / patient, then there is the option of using laser eyewear, as described above, or a total blockout eyeshield.

The option chosen will depend on the treatment and specification of the laser equipment. The blockout eye shields come in many different varieties, from reusable eye shields to disposable eye shields. Typically, blockouts can be used with a wide range of wavelengths with high levels of attenuation.

If close work needs to be done around the eyes or nose, the eyewear obstructing regions to the face that needs to treated also should be accounted for. Some eye shields allow the option of moveable nasal and side attachments, so that work can be done around these areas.

Once again careful assessment needs to be done as to who will be using the eyewear and for what purpose. Client or patient comfort is also an important consideration if they are to be wearing them for extended periods of time.

"Just want to say a big thanks for your speedy service and fantastic recommendation. The glasses you recommended, fit really well over my prescription glasses and at great price too. I've already recommended DiOptika to my colleagues."

DR HSU
Medical Director, Lumina Cosmetic Medicine
Also Make Sure You Consider

- Always check the eyewear is marked with the relevant specifications that comply with the standards of the country you are in. In Australia, New Zealand, and Europe it is a requirement that not only are the glasses marked with wavelengths and optical densities, but they are also marked with L rating damage threshold specifications. Many cheap laser glasses on the market are not properly labelled or certified – do not purchase if the glasses don’t have this information. See the image in point 2 to showing the L ratings on the glasses.

- Always check the laser glasses have the relevant wavelength and optical densities marked on them before using them with your laser. See the image in point 2 to showing the Optical density specifications on the glasses.

- When using and installing a potentially hazardous laser system, a risk assessment should be undertaken, and the proper engineering controls put in place. This should always be done by an experienced professional. Laser safety glasses are just one of the safety
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precautions when installing and using laser equipment.

- Each laser and the situation that it will be used in needs to be individually assessed to ensure appropriate safety gear is being used.

- Be aware of imitations – safety equipment and protecting the integrity of our eyesight is very important and should not be compromised at what might appear to be a cheaper version.

With the service that we have received and the assistance you have given us for our aesthetics training college, we would be delighted to continue dealing with your company and building our relationship. We will be recommending you and your team to all of our students and associates.

ANDREW CLAYTON
Administration Manager, GrayClay Medical Aesthetics Education
I hope you found that useful. If you need any help then the team at DiOptika can help with all your laser safety glasses requirements from assessing the practical application, reviewing the laser specifications and determining what lenses will be most appropriate.

And you can click here to view our large range of professional laser safety glasses that are all fully certified and compliant to Australian & New Zealand laser safety standards.