

Purchasing Safe Lasers

HSE Guide

Lasers or equipment containing lasers come in many shapes, sizes and forms. They are commonly used in industries and research environment. There are laws, regulations and safety standards in place to ensure the hazards associated with each laser system are controlled. However, not all countries have applicable laws and regulations, related to the manufacture and use of laser systems. In this case, the choice to follow specific safety standards is of prime importance to ensure safe practices.

Laws, Regulations and Standards

Manufacturers of laser devices must often comply with the various countries' regulations in order to be allowed to sell their products in those countries. For example, in the United States (US), the Center for Devices and Radiological Health (CDRH) is a bureau established under the jurisdiction of the U.S. Federal Food and Drug Administration (FDA). It has fallen upon the CDRH to regulate manufactured laser products to increase safety standards and protect the public. This regulation is known as the Federal Laser Product Performance Standard (FLPPS)^[1]. It is commonly acknowledged as 21CFR sections 1040.10 and 1040.11. All laser products entering the US market place must comply with these regulations. According 21CFR, laser products are classified into categories depending on the level of hazard they present. There are also requirements for equipment labelling, hazard control measures, etc.

Outside of the US, the requirement for laser-based product entry into the global marketplace is mainly compliance with the International Electrotechnical Commission standard^[2] (IEC 60825-1). The objectives of IEC 60825-1 includes: a system of classification of the laser according to the hazard to skin and eye; requirements for manufacturer information; labels, instructions, hazard control measures, etc. In Japan, in order to prevent injury to users of laser products, a Japanese Industrial Standard called the Radiation Safety Standards for Laser Products (JIS C 6802), has been established. This is very similar to the corresponding IEC 60825-1 standard.

In Saudi Arabia, there is no established regulations pertaining to laser equipment. So at KAUST, it has

been decided that the laser products purchased must comply with either the US FLPPS (or 21 CFR 1040) regulations or the IEC 60825-1 standard.

What to look for when purchasing a laser?

Laser equipment, especially small lasers, are often the source of observed non-compliance at KAUST; i.e. these lasers meet neither US nor IEC 60825-1 requirements.

It is recommended to purchase lasers from a known manufacturer rather than from one of the large online retail service (e.g. Amazon, AliExpress, etc.). When selecting the laser you should check the following:

- The manufacturer should mention in writing (on the manual or warning labels) that the device complies with either 21CFR 1040 or IEC 60825-1.
- The laser Class should be given explicitly.
- A detailed data sheet or specification should be available providing information regarding the emitted wavelength, maximum output power, etc.
- Warning labels should comply with 21CFR 1040 or IEC 60825-1 (Figure 1 and Figure 2).
- It is always better if the manufacturer or seller display pictures of the device so you can check the overall protective housing and ensure that all the electronics are also enclosed.
- Ensure the laser aperture label is present.
- Check that the device is also [CE marked](#).



Figure 1. Example of warning label compliant with the American standard (highlighted).

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Figure 2. Example of warning label compliant with the European standard (highlighted).

Figures 3 to 5 are examples of some non-compliant lasers that were purchased at KAUST. These lasers did not meet the US (21 CFR 1040) or IEC 60825-1 standards and were therefore banned from use.

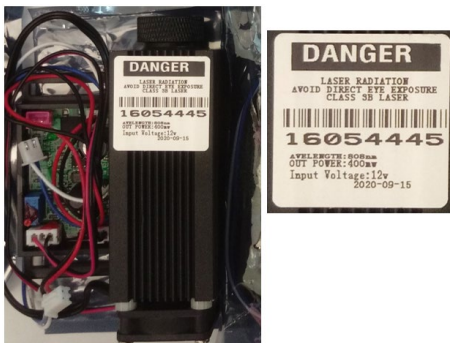


Figure 3. Diode lasers non-compliant with the standards. There is no laser warning labels, no indication where the laser aperture is. Nowhere on the device there is reference to the US or IEC standards. When checking the manufacturer's webpage it was not possible to obtain the data sheet or specifications for these laser diodes. In addition, the electronic circuit is all open which indicates poor manufacturing.

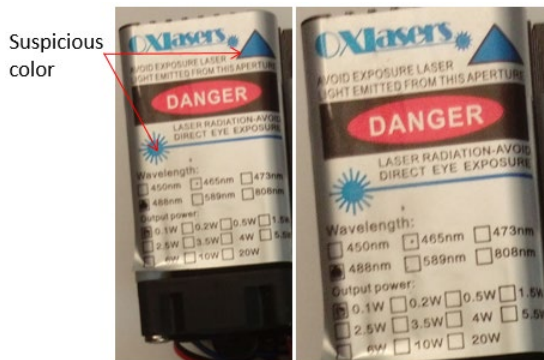
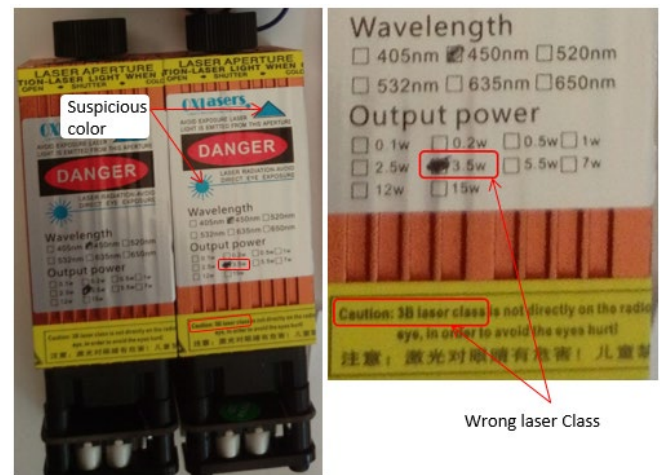


Figure 4. Diode lasers non-compliant with the standards. The color of the warning sign is already different to that of the standards (the blue color is already suspicious), nowhere on the device there is reference to the US or IEC standards or the laser class. When checking the manufacturer webpage it was not possible to obtain the data sheet or specifications for these laser diodes.



Wrong laser Class

Figure 4. Diode lasers non-compliant with the standards. The color of the warning sign is already different to that of the standards (the blue color is already suspicious), nowhere on the device there is reference to the US or IEC standards. When checking the laser classification of the laser the stated laser class was wrong (maximum output is 3.5 W at 450 nm this should be a Class 4 laser but it indicated Class 3B). When checking the manufacturer's webpage it was not possible to obtain the data sheet or specifications for these laser diodes.

Finally, users should be familiar with the purchase process at KAUST. Purchase of laser devices with a cost exceeding \$20,000 (including shipping fees) should be done via [ASEPC](#) (Academic Space, Equipment and Planning Committee) and the laser purchase will be reviewed by the Laser Safety Specialist. For laser devices of value less than \$20,000, the user can simply raise a shopping cart. However, it is highly recommended that the Laser Safety Specialist is contacted (hse@kaust.edu.sa) before the order is raised to ensure compliance with the standards. For more information please consult the [Laser Safety Webpage](#).

References

- [1] Federal Laser Product Performance Standard (FLPPS), (updated April 2020)
<https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?FR=1040.10>
- [2] IEC 60825-1, (updated December 2017)
<https://www.vde-verlag.de/iec-standards/225704/iec-60825-1-2014-ish1-2017.html>