HAZARDS OF LASER WELDERS, CUTTERS, HEAT TREATERS AND PUNCH PRESSES

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An OSHA Cooperative Program

Laser Institute of America
Laser Applications and Safety

FACT SHEET

WHERE? LASER MATERIALS PROCESSING

The use of high-power lasers for industrial cutting and welding is widespread in the industrial community. Lasers are used in welding, cutting, heat treaters and punch presses. Normal industrial safety practices may not be adequate for these devices. Users may need to identify additional potential hazards and develop appropriate precautions.

WHAT ARE THE OPTICAL RADIATION HAZARDS?

The potential optical radiation health hazards include: serious eye and skin damage from direct exposure to the beam, laser reflections, secondary emissions from the work-piece incandescence, and plasma.

All of these hazards can exceed personnel viewing exposure standards. Most industrial lasers are far infrared (IR-C) carbon-dioxide lasers and near-infrared (IR-A) neodymium-YAG lasers. The IR-C lasers pose hazards to the cornea of the eye and to the skin; whereas, the IR-A lasers pose a potential retinal burn hazard and thermal skin burn hazard. Secondary emissions viewed through filtered view-ports do not pose a potential for retinal injury within the normal aversion response time for the eye. Potentially hazardous actinic ultraviolet emissions are absorbed by the view-port window.

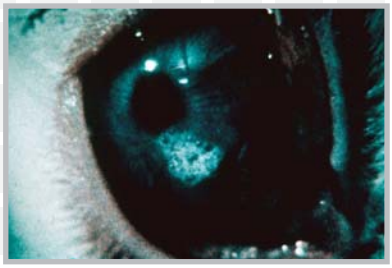
Retinal Injury

ENCLOSED INDUSTRIAL LASER SYSTEMS

Many industrial laser systems are safely “enclosed” and consist of three parts:

- The actual laser component.
- A light pipe which carries the laser beam.
- An interlocked work enclosure where the beam acts on a work-piece.

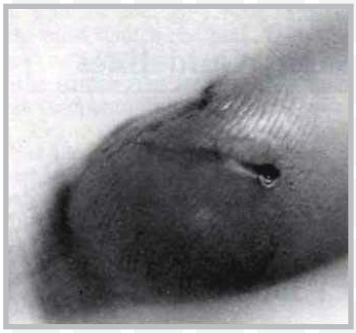
Each component encloses the beam so that personnel cannot gain ready access. Such systems are classified from a hazard standpoint by the American National Standard Institute (ANSI) Z136.1 (Reference 1) as a Class 1 safe laser system. Personnel are not at any significant risk to primary beam exposure from a Class 1 laser system except during a malfunction, service, or beam alignment. Service or beam alignment procedures require development of safety standing operating procedures (SOPs). Only trained personnel should perform these SOPs.



Corneal Injury

ANSI CLASS 4 UNENCLOSED INDUSTRIAL LASER SYSTEMS

Many laser cutters and punch presses often are not entirely enclosed. A small gap may exist (e.g., where sheet metal can be inserted). Such unenclosed laser systems are normally classified technically from a hazard stand-point by the ANSI Standard as Class 4 or high-power laser system. The ANSI Standard recommends locating Class 4 lasers in a separate closed room. Studies by the Laser/Optical Radiation Program (LORP), U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), indicates that potentially harmful laser emissions do not usually escape at the gap in a laser press. Measurements are needed to confirm this for each installation of covers for each laser wavelength and work situation.



Skin Injury

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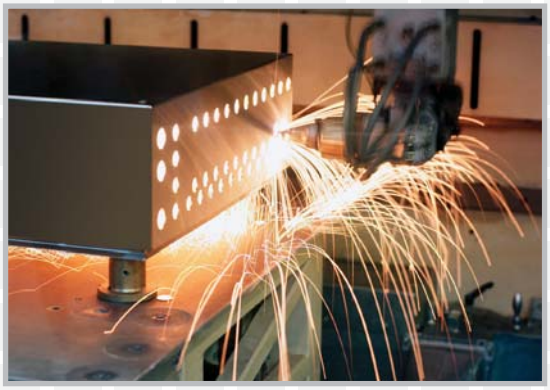
ASSOCIATED HAZARDS

Other associated hazards are addressed in ANSI B11.21 (Reference 2). Some ancillary hazards are high voltage, toxic materials, and vapors. Ventilation for toxic materials could be necessary in the work area to control airborne contaminants as prescribed by an industrial hygienist. Also, high power lasers are often guided with a coaxial, low-power visible laser for alignment. Most alignment lasers do not pose a significant health hazard and are Class 3R and Class 2.

CONTROL MEASURES

Industrial laser systems sold in the U.S. are required to comply with the safety design features of the Federal standard for laser products contained in 21 CFR 1040 (Reference 3). While these standards assume safety for Class 1 products, the user must provide safe operation for Class 4 laser systems. Users should periodically inspect all laser system components (e.g., mirrors, view-port windows, light pipe, etc.) for signs of laser beam damage and remove a damaged system from service until it is repaired. Scratched or damaged view-port windows should only be replaced with appropriate materials such as polycarbonate shielding. Personnel required to view laser welding operations through unfiltered view-port windows may need to wear electric arc welding eye protection which affords a comfortable viewing brightness of any secondary emissions such as plasma.



Laser Cutting

CONCLUSIONS

While industrial lasers are normally considered safe for use, personnel must remain alert to potentially hazardous conditions and take appropriate action.

REFERENCES

1. ANSI Z136.1-2007, American National Standard for the Safe Use of Lasers, Orlando, Laser Institute of America.

2. ANSI B11.21-2006, Machine Tools - Safety Requirements for Machine Tools Using Lasers for Processing Materials. New York, ANSI.

3. 21 Code of Federal Regulations, Part 1040.10, Performance Standards for Light-Emitting Products, 1996.