



## LASER WELDING AND CUTTING SAFETY

### INTRODUCTION

A laser is a device which produces an intense, coherent, directional beam of light. The term LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. Lasers can be designed to deliver a large amount of energy to a very small area. In welding and cutting operations, this energy can heat metals quickly to very high temperatures. Much of the radiation that strikes the workpiece is reflected into the environment, creating hazards. Some laser light used in laser welding equipment is invisible, so the hazard may not be readily apparent.

### HOW LASERS WORK

Typical lasers use electricity to create the unique coherent light that is very different from ordinary non-coherent light, such as that from a light bulb. Coherent light can be tightly focused and is not diffused or scattered like ordinary light. This coherent light beam is parallel and can be focused to cut or weld metals. Laser light can be different colors of the visible light spectrum, or can be invisible when the light is ultraviolet or infrared. Lasers used for welding and cutting may be infrared, and therefore the beam may be invisible. It is very difficult to take precautions against things one cannot see. It is even more difficult to convince others to take

precautions against hazards they cannot see and may not understand.

### POTENTIAL HAZARDS

- **RADIATION** - Both visible and invisible light radiation are produced when welding or cutting. Due to the interaction with the workpiece, high levels of hazardous blue light and ultraviolet radiation (secondary radiation) are produced. This light radiation is often reflected from the workpiece into the work area. Radiation from these processes can seriously burn eyes and skin quickly and permanently. These hazards are addressed in the American National Standards Institute Z136.1 standard.
- **FIRE** - Since the laser system produces a very small spot size with high energy, the hazard of fire is present if the beam hits flammable material. Keep flammables away from the welding or cutting area. Be sure to cover and protect anything flammable in the area, since reflected radiation could start fires in unexpected places. Protect the work area.

- **FUMES AND MISTS** - Lasers easily vaporize metals. In doing so, fumes and mists are created which can present a respiratory hazard. Often the fumes and mists cannot be seen, yet they can pose a serious health hazard. Always use adequate ventilation.
- **MECHANICAL** - The optical device on the robotic arm or other beam manipulator can malfunction and send the laser beam in unintended directions. Therefore, it is essential that the work cell be shielded in conformance with standards for the laser type and class.
- **ELECTRIC SHOCK** - Since most lasers require a large amount of electrical power to accomplish specific tasks, electrical hazards are present. Conventional hazards associated with any electrical industrial power source are present. These require standard and common electrical safe practices as found in ANSI Z49.1 and in AWS Safety and Health Fact Sheet No. 5. Additionally, there are the unique electrical hazards common to lasers in general and the hazard of the individual application. Usually, the best source of safety information is provided in the instruction manual from the manufacturer of the laser system. Always read, understand, and follow the manufacturer's recommended safety procedures.
- **EYE AND SKIN DAMAGE** - Laser system eye and skin hazards are addressed in the ANSI Z136.1 standard. In many use situations, special laser eye protective devices are

required. According to the ANSI Z136.1 standard, this eyewear must be labeled with both the optical density (protective factor) and wavelength(s) for which the protection is afforded. The protective eyewear must be compatible with the manufacturer's specifications for the laser system in use, to ensure that the eyewear is suitable. In addition to the primary hazard of the laser beam, there may be a considerable eye hazard from high levels of secondary radiation. The ANSI Z136.1 standard requires that the eyes be protected from this secondary radiation in addition to the primary laser beam. A precaution must be added here-- standard safety glasses alone do not provide protection. Any laser eyewear, plain or prescription, must be labeled with the wavelength(s) of protection and the optical density at those wavelengths. In some laser systems, ultraviolet light may be leaked into the workplace. Thus the eyewear should provide primary beam protection, secondary radiation protection, and also ultraviolet protection.

## **SAFETY NEEDS**

All laser welding and cutting installations are required to have a Laser Safety Officer (LSO). The LSO is responsible for personnel protection, laser cell class conformance, and enforcement of all laser safety regulations. Be certain to follow recommendations from the laser system manufacturer. In addition, provide certified laser protective eyewear, clothing, and shields where required.

## INFORMATION SOURCES

American National Standards Institute (ANSI). *Safe Use of Lasers*, Z136.1, available from American National Standards Institute, 11 West 42nd Street, New York, NY 10036

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Laser Institute of America (LIA). *Guide for the Selection of laser Eye Protection*, available from Laser Institute of America, 12424 Research Parkway, Orlando, FL 32826.

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