American National Standard

ANSI Z136.6 – 2015

# *American National Standard for Safe Use of Lasers Outdoors*

Laser Institute of America
Laser Applications and Safety

Approved American National Standard
ANSI

**ANSI®**
Z136.6 – 2015
Revision of
ANSI Z136.6-2005

# American National Standard for Safe Use of Lasers Outdoors

**Secretariat**
**Laser Institute of America**

**Approved October 5, 2015**
**American National Standards Institute, Inc.**

**American National Standard**

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## Foreword

(This introduction is not a normative part of ANSI Z136.6-2015, *American National Standard for Safe Use of Lasers Outdoors*.)

In 1968, the American National Standards Institute (ANSI) approved the initiation of the Safe Use of Lasers Standards Project under the sponsorship of the Telephone Group.

Prior to 1985, Z136 standards were developed by ANSI Committee Z136 and submitted for approval and issuance as ANSI Z136 standards. Since 1985, Z136 standards have been developed by the ANSI Accredited Standards Committee (ASC) Z136 for Safe Use of Lasers. A copy of the procedures for development of these standards can be obtained from the secretariat, Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826, or viewed at www.z136.org.

The present scope of ASC Z136 is to protect against hazards associated with the use of lasers and optically radiating diodes.

ASC Z136 is responsible for the development and maintenance of this standard. In addition to the consensus body, ASC Z136 is composed of standards subcommittees (SSC) and technical subcommittees (TSC) involved in Z136 standards development and an editorial working group (EWG). At the time of this printing, the following standards and technical subcommittees were active:

| | |
|---|---|
| SSC-1 | Safe Use of Lasers (parent document) |
| SSC-2 | Safe Use of Lasers and LEDs in Telecommunications Applications |
| SSC-3 | Safe Use of Lasers in Health Care |
| SSC-4 | Measurements and Instrumentation |
| SSC-5 | Safe Use of Lasers in Educational Institutions |
| SSC-6 | Safe Use of Lasers Outdoors |
| SSC-7 | Eyewear and Protective Barriers |
| SSC-8 | Safe Use of Lasers in Research, Development, and Testing |
| SSC-9 | Safe Use of Lasers in Manufacturing Environments |
| SSC-10 | Safe Use of Lasers in Entertainment, Displays, and Exhibitions |
| TSC-1 | Biological Effects and Medical Surveillance |
| TSC-2 | Hazard Evaluation and Classification |
| TSC-4 | Control Measures and Training |
| TSC-5 | Non-Beam Hazards |
| TSC-7 | Analysis and Applications |
| EWG | Editorial Working Group |

The nine standards currently issued are:

ANSI Z136.1-2014, *American National Standard for Safe Use of Lasers*

ANSI Z136.2-2012, *American National Standard for Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources*

ANSI Z136.3-2011, *American National Standard for Safe Use of Lasers in Health Care*

ANSI Z136.4-2010, *American National Standard Recommended Practice for Laser Safety Measurements for Hazard Evaluation*

ANSI Z136.5-2009, *American National Standard for Safe Use of Lasers in Educational Institutions*

ANSI Z136.6-2015, *American National Standard for Safe Use of Lasers Outdoors*

ANSI Z136.7-2008, *American National Standard for Testing and Labeling of Laser Protective Equipment*

ANSI Z136.8-2012, *American National Standard for Safe Use of Lasers in Research, Development, or Testing*

ANSI Z136.9-2013, *American National Standard for Safe Use of Lasers in Manufacturing Environments*

This American National Standard provides guidance for the safe use of lasers and laser systems in an outdoor environment, including laser products that have been granted a variance or exemption from the provisions of the Federal Laser Product Performance Standard (21 CFR 1040). Products and applications covered include laser light shows, lasers used for outdoor scientific research, and military lasers. In addition to injurious levels of optical radiation, which are covered in other ANSI Z136 standards, this standard also covers possible indirect hazards such as visual interference that can be caused by exposure to visible laser radiation, particularly at night.

Development of this standard has been a collaborative effort of members of the SAE G-10 Committee, laser light show industry, DoD, FDA/CDRH, FAA, NASA, laser and laser light show manufacturers, and laser users including scientists and astronomers. This document serves as a companion to the SAE Aerospace Standard AS4970, 21 CFR 040, FAA Order 7400.2 and related FAA documents, Military Standard 1425A, and Military Handbook 828B, for determining the hazards from outdoor laser operations.

This standard provides acceptable levels of irradiation in particular defined zones of navigable airspace in order to minimize visual interference to aircrews. These zones were created to reduce illumination levels of aircrews during critical phases of flight, primarily during takeoff and

landing, in response to numerous incidents of aircraft illuminations that have occurred during the past several years. These defined levels of irradiation may also apply to operators of vehicles other than aircraft. As more powerful commercial off the shelf lasers have become available, the threat to aircraft and other vehicles from illumination by a laser has increased. For visible laser exposure, indirect hazards due to hampered vision have been demonstrated at levels below the levels that would cause permanent eye injury.

This standard has been published as part of the American National Standard Z136 series. The basic document is *American National Standard for Safe Use of Lasers*, ANSI Z136.1. In general, this standard may be used independently of ANSI Z136.1. Instances where additional guidance contained in ANSI Z136.1 is required are noted in this document.

It is expected that this standard will be periodically revised as new information and experience in the use of lasers are gained. Future revisions may have modified content and the use of the most current document is highly recommended.

While there is considerable compatibility among existing laser safety standards, some requirements differ among state, federal, and international standards. These differences may have an effect on the particulars of the applicable control measures.

Occasionally questions may arise regarding the meaning or intent of portions of this standard as it relates to specific applications. When the need for an interpretation is brought to the attention of the secretariat, the secretariat will initiate action to prepare an appropriate response. Since ANSI Z136 standards represent a consensus of concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason, the secretariat is not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration. Requests for interpretations and suggestions for improvements of the standard are welcome. They should be sent to ASC Z136 Secretariat, Laser Institute of America, 13501 Ingenuity Drive, Suite 128, Orlando, FL 32826.

This standard was developed by Standards Subcommittee 6 (SSC-6) “Safe Use of Lasers Outdoors” and approved by ANSI Accredited Standards Committee (ASC) Z136 for Safe Use of Lasers. Committee approval of the standard does not necessarily imply that all members voted for its approval.

Robert Thomas, Committee Chair
Sheldon Zimmerman, Committee Vice-Chair
Ben Edwards, Committee Secretary

## Notice

(This notice is not a normative part of ANSI Z136.6-2015, *American National Standard for Safe Use of Lasers Outdoors.*)

Z136 standards and recommended practices are developed through a consensus standards development process approved by the American National Standards Institute. The process brings together volunteers representing varied viewpoints and interests to achieve consensus on laser safety related issues. As secretariat to ASC Z136, the Laser Institute of America (LIA) administers the process and provides financial and clerical support to the committee.

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**Participants** At the time it approved this standard, ASC Z136 had the following members:

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| Altos Photonics, Inc. | Lucian Hand |
| American Academy of Dermatology | Ray Jalian |
| American College of Obstetricians & Gynecologists | Ira Horowitz |
| American Dental Association | Harvey Wigdor |
| American Glaucoma Society | Michael Berlin |
| American Industrial Hygiene Association | R. Timothy Hitchcock |
| American Society for Laser Medicine & Surgery | David Sliney<br>Patti Owens (Alt) |
| American Society of Safety Engineers | Thomas V. Fleming<br>Walter Nickens (Alt) |
| American Veterinary Medical Association | Kenneth Sullins |
| American Welding Society | Mark McLear |
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| Association of Surgical Technologists | Kevin Frey |
| Buffalo Filter | Daniel Palmerton |
| Camden County College | Fred Seeber |
| Daniel Laser Safety | Paul Daniel, Jr. |
| Federal Aviation Administration (FAA) | Ricky Chitwood |
| Fort Hays State University | C.D. Clark III |
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| Institute of Electrical and Electronics Engineers (SCC-39) | Ron Petersen |
| International Imaging Industry Association (I3A) | Joseph Greco |
| International Laser Display Association (ILDA) | Patrick Murphy |
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| Power Technology, Inc. | William Burgess |
| Rockwell Laser Industries | William Ertle |
| SLAC National Accelerator Laboratory | Michael Woods |
| Solta Medical Inc. | George Frangineas |
| TASC, Inc. | Edward Early |
| Underwriters Laboratories, Inc. | Peter Boden |
| University of Chicago, School of Dentistry | Michael D. Colvard |
| University of Texas, Southwestern Medical Center | John Hoopman |
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| U.S. Department of Labor, Occupational Safety & Health Administration | Jeffrey Lodwick |
| U.S. Department of the Air Force, Air Force Research Laboratory | Benjamin Rockwell<br>Robert Thomas (Alt) |
| U.S. Department of the Air Force, Surgeon General's Office | Edward Kelly<br>Bret Rogers (Alt) |
| U.S. Department of the Army, Army Public Health Center (APHC) | Jeffrey Pfoutz<br>Penelope Galoff (Alt) |
| U.S. Department of the Army, Army Institute of Surgical Research | Bruce Stuck |
| U.S. Department of the Navy, Naval Air Systems Command | James Sheehy |
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The various subcommittees that participated in developing this standard had the following members:

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